

# QUICK START GUIDE:

Customer:	
Installation:	
Name, Date:	

## FrigoSoft® X.7: Refrigeration Software

- FS 1.7 activated: **Basic Pressure Control**

View Level	OPERATOR	Operator, End Customer	Monitoring operation	None
Language	TECHNICIAN	Refrigeration technician	Refrigeration Contractor, Installer	Yes
Run Wizard?	ENGINEER	Trained engineer	Special optimization, hotline support	Superuser
	ENGLISH	English, French, German, Spanish, Italian, Dutch, Turkish, L7, L8, L9,		None
	See Page 11: NO / YES	Resetting to factory settings, loading firmware and application		Yes

OPERATION

FrigoPack FU+ 11	BM-1
23 A 400 V	
1.9.1	
123.456.789.012	

First 16 characters configurable (see p. 6)

Alternatives depending on Option Modules fitted:	Operating Mode
+TOV BM-1 EM-1 EM-2 EM-3 EM-4 ISES ... ..	
Rating of Power Module	
Firmware	
IP address	

DIAGNOSTICS
OPERATION
REFRIGERATION SETUP

### Menu OPERATION of operating observation parameters: Users

- Compressor rack:
- Variable-speed Compressor (VsC):
- Digital inputs and outputs:
- Frequency Inverter:
- Condenser:
- Performance:
- Digital inputs and outputs:
- Refrigerant:
- Variable-speed Compressor (VsC):
- Assistance:
- Language:

02:ted_Rack_tcd Y.Y °C YY.Y °C	03:pe_Rack_pc Y.Y bar YY.Y bar	04:ted_Rack_tcm Diff Y.Y K Y.Y K	06:Spd_VsC_Power YYYY/min YYY kW	08:Start_Sl-Lm-Cc-Cp YYYY YYYY YYYY	09:VsC ELECTRICAL Y.Y Hz Y.Y A	10:tc-bub_CND tc-dew YY.Y °C YY.Y °C	11:delta_COND_setpnt YY.Y K YY.Y °C	12:VfG_COND_tamb YYY % YY.Y °C	16:Elec Power_Energy YY.Y kW YY.Y kWh	20:OUTPUTS_DIG_INPUTS YYYY YYYY YYYY YYYY	33/43:ted_tcm Flt Stp YYY.Y °C YYY.Y °C	25:REFRIGERANT <14:R134a	60:COMPRESSOR <16 2CES-4Y	0:OPERATION OPERATION-Automatic
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Type	Value	Explanation	Further information
Calculated values	___ °C ___ °C	Saturated gas temperatures (dew): Evaporating and Condensing	1.1
Measured values	___ bar ___ bar	Gas pressures: Suction and Discharge gas	1
Deviations	___ K ___ K	Temp. Deviations from setpoints: Evaporating and Condensing	
Internal value	___ /min ___ kW	Motor: Speed, Electrical power	2.0
Status values	XXXX XXXX XXX 1 XXXX XXXX XXX 2 XXXX XXXX XXX 4	Right: Sequnc_Limits_CpctyCntrl_Cmpr Left: ARS AtmptsLeft Time to start VFSc1 VFSc2 VFSc3 Compre sors running Gray-Code: 0.F	1.2
Capacity Control:	XXXX XXXX X CXX	Active limits	
Sequencing State	XXXX XXXX YXXX XXXX XYYY XXXX	0 1 2 3 4 5 6 7 8 9 A B C D E Time to next start in s	
Auto Restart: Remaining Attempts	YYYY XXXX XXXX	Swap: Remaining time (self extending)	
Measured values	___ Hz ___ A	Variable-speed Compressor, Motor Frequency and Current	
Calculated values	___ °C ___ °C	Condenser: Condensing Temperatures, bubble_dew	1.4
Measured values	___ K ___ °C	Floating control with ambient temperat.: Setpoints: (tc - tamb) (tcb + tcd)/2	
Measured value	___ % ___ °C	Air-cooled Condenser: Variab.-speed fan Group_Ambient temp.	
Calculated values	___ kW ___ kWh	Compressor Rack: Electrical power and energy	1.5
Status values		Digital outputs and inputs: Bitstrings grouped in nibbles	1.6
Input values	___ °C ___ °C	Floating setpoints in °C: ted(33: 31..32)_tcm(43: 41..42)	2.1
Selected value		Refrigerant (SD-MC card or BEST with PC) Selection in: FIRST SETUP ,P. 6	0.1
Selected value		Compressor (SD-MC card or BEST with PC) Selection in: FIRST SETUP ,P. 6	0.2
Internal value		Information on Operating condition	1.9
Setting		Language Setting	

Abbreviations:	
VsC:	Variable-speed Compressor
FsC:	Fixed-speed Compressor
VfSc:	Variable- / Fixed-speed Compressor
VfG:	Variable-speed fan group (Condenser / Dry cooler)
=	YY.Y % : Measured value depending on operating point
→	FFF : Factory default value depending on frame size and rated power

Password for Refrigeration Personnel  
Factory setup: R134a Medium Temperature

**IMPORTANT:**

The parameters in this menu are only applicable as follows:

FrigoSoft 1.7: Basic control of suction and evaporating temperatures:

All the following parameters are relevant.

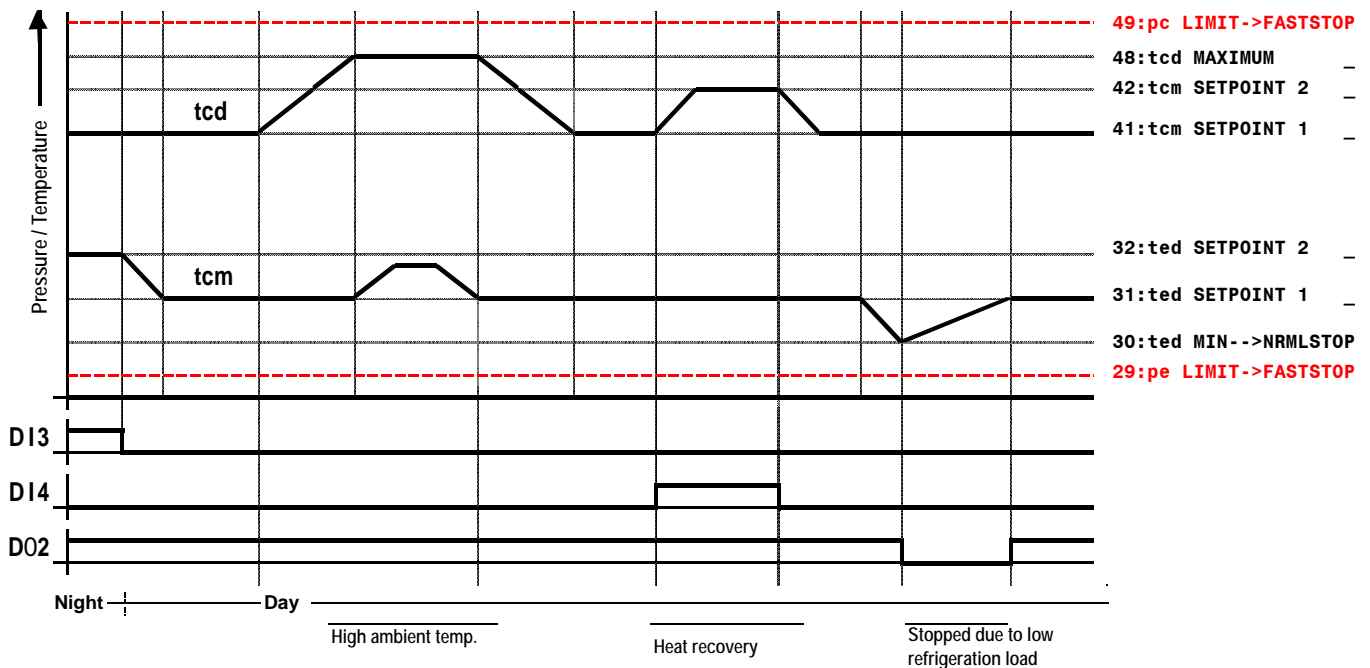
Settings

REFRIGERATION SETUP

Modifying

Menu REFRIGERATION SETUP for refrigeration settings:		
Type	Explanation	Further information
Setting	Compensation for relative pressure: Modify if >= 1000 m altitude	
Limit value	Low Suction-Pressure limit: Fast Stop with trip Set to minimum operating pressure of compressor (usually 0.1 bar). Must not to be used as a safety device.	3.1
Limit value	Evaporating Temperature (dewpoint): Normal Stop as "Pump Down limit"	
Setting 1	Evaporating Temperature (dew point): Setpoint 1 (lower value) If this value is changed then parameters 30: 32 and 39: can be modified accordingly if the green '1'-key alone is pressed longer than 10 s: (30==> 31: -5 K; 32==>31 +5 K; 39==>31 +10 K).	3.2
Setting 2	Evaporating Temperature (dew point): Setpoint 2 (higher value)	
Setting 2	Evaporating Temperature (dew point): Maximum for setpoint control	3.3
Refer to the following parameter on page 4: <b>99: OPERATING MODE</b>		
Setting	Condensing Temperature (mid point): Setpoint 1 (lower value)	4.2
Setting	Condensing Temperature (mid point): Setpoint 2 (higher value)	
Limit value	Condensing Temperature (dew point), max.: Compr. Capacity will be reduced above this value	4.3
Setting	Discharge Pressure: Fast Stop with trip Set to just below maximum operating pressure of compressor. Must not to be used as a safety device.	
Password for Refrigeration Personnel		
Password for Refrigeration Personnel		

**Explanation of adjustable operating pressures:**



REFRIGERATION SETUP  
**COMPRESSOR SETUP**  
 SPECIAL ADJUSTMENTS

Menu COMPRESSOR SETUP for setting compressor operation:  
 Refrigeration Personnel

Type	Explanation	Further information
Value		

Settings

Variable-speed Compressor (VsC):

Limits:

Resonance avoidance:

Time settings:

Fixed-speed Compressor (FsC):

Time settings:

Commissioning:

Modifying

61:VsC CURRENT MAX  
0.0 A

62:VsC FREQUENCY MAX  
65.0 Hz

64:VsC FREQUENCY MIN  
25.0 Hz

65:VsC MOTOR NO POLES  
4

66:VsC SKIP FREQ1 MIN  
25.0 Hz

67:VsC SKIP FREQ1 MAX  
25.0 Hz

68:VsC SKIP FREQ2 MIN  
25.0 Hz

69:VsC SKIP FREQ2 MAX  
25.0 Hz

70:VsC tinhibit TIME  
300 s

71:VsC tlubrcn TIME  
4 s

72:VsC thld fmin TIME  
10 s

74:VsC tmon fmin TIME  
300 s

80:Fsc PRIORITY CNTRL  
0000001

81:Fsc ton DELAY  
120 s

82:Fsc toff DELAY  
10 s

86:FORCE ACTION +/-  
Y YYYY

Setting	Explanation	Further information
Setting	VsC Motor current max	5.1

CAN ONLY BE CHANGED IF FRIGOPACK FU+ STOPPED FIRST  
 Factory preset to maximum continuous Refrigeration Current until a compressor is selected, see page 6/7

Setting	Explanation	Further information
Setting	VsC Motor frequency max.: Max. settable value: Dt1, page 4	

Setting	Explanation	Further information
Setting	VsC Motor frequency min.: Min. settable value: Dt2, page 4	

Setting	Explanation	Further information
Setting	VsC Motor: No. of poles: 2, 4, 6, 8	

Setting	Explanation	Further information
Setting	VsC Resonance Avoid., Skip freq 1 min: 10.0..65.0 Hz *	5.2

Setting	Explanation	Further information
Setting	VsC Resonance Avoid., Skip freq 1 max: 10.0..65.0 Hz *	

Setting	Explanation	Further information
Setting	VsC Resonance Avoid., Skip freq 2 min: 10.0..65.0 Hz *	

Setting	Explanation	Further information
Setting	VsC Resonance Avoid., Skip freq 2 max: 10.0..65.0 Hz *	

\* Limited to fmin..fmax and range of next band.  
 Set to 0.0 Hz when not in use.

Setting	Explanation	Further information
Setting	VsC Restart Inhibit Time after VsC start: 20..1200 s	5.3

Setting	Explanation	Further information
Setting	VsC Oil Lubrication Pulse time: 0..100 s	

Setting	Explanation	Further information
Setting	VsC Start Hold Time (at fmin): 0..120 s	

Setting	Explanation	Further information
Setting	VsC Monitoring time at fmin: 0..1800 s	

Setting	Explanation	Further information
Setting	FsC9,8,7,6,5,4,3,2: Priority: 0: not available	6.0

Compressors with identical priorities >= 1 will be automatically swapped after the time set by the following parameter on page 4:

**Dt7**

FsC1 and FsC2 if both set to E or F will be interpreted as a special swop between VFsc1 and VFsc2.

F: Operation with DI3 and DI4 as enables for VFsc1 or VFsc2 respectively.

Setting	Explanation	Further information
Setting	FsC, Switch-on delay +: 1 ... 1000 s	

Setting	Explanation	Further information
Setting	FsC, Switch-off delay -: 1 ... 100 s	

Commissioning	Explanation	Further information
Commissioning	Stage Controller force: Left: Force input; Left: Status	1.7

Password for Refrigeration Personnel

COMPRESSOR SETUP

Settings

Units:

Operating Mode:

Controllers:

Control Mode:

SD MC Card:

Modifying

**<CONTROL**

90:VsC Voltage/Freq	8.00 V/Hz
91:ted CONTROLLER P-GN	5.0
92:tcm CONTROLLER P-GN	20
93:CND VFG SPEED MIN	20 %
94:CND VFG SPEED MAX	100 %
95:ted LIMITER P-GN	25
97:START BULGE	2.0%
98:UNITS	bar, °C
99:OPERATING MODE	C000

Type	Explanation	Further information
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Sub-Menu <CONTROL of Optimizing Parameters

Setting	Ratio of Voltage to Frequency, usually: 8.00: 400 V/50 Hz // 4.62: 230 V/50 Hz / 400 V/87 Hz	7.1
Caution: Only set to the indicated values for standard motors.		
Setting	ted Controller, Proportional gain: 1.0 ... 25.0	7.2
Setting	tcm Controller, Proportional gain: 1.0 ... 25.0	
Setting	Condenser, Var.-speed fan Group, min. speed: 0.0 ... 100.0 %	
Setting	Condenser, Var.-speed fan Group, max. speed: 50.0 ... 150.0 %	
Setting	pc Limiter, Proportional gain: 10 ... 250	
Setting	Optimization of starting torque: 0.0 ... 5.0 %	7.4
Only change after reference to our Applications Department		
Setting	Selectable units: bar, °C, K; psi, °F, °R; bar, °F, °R	7.5
Setting	Defines Operating Mode: Input as hexadecimal	7.6
Setpoints	XXX1 Setpoints ted1..ted2 (EM-1..3 connected)	
DI3: ted1 / ted2	XXX2 Setpoints tedmax..ted1/ted2 (EM-1..3 connected)	
Terminal X13.4	XXX3 Setpoints ted2..ted1 (EM-1..3 connected)	
	XXX4 Test Setpoint ted = -100 °C	
Setpoints	XX1X Setpoints tcm1..tcm2 (BM1/2 fitted)	
DI14: tcm1 / tcm2	XX3X Floating Condensing Temperature	
Terminal X12.1	XX4X Test Setpoint tcm = +100 °C	
Special functionality	X1XX Activate Capacity Controller	
	X2XX Activate GRAY Code	
	X4XX Stop at fmin after 74:VsC tmon fmin	
	1XXX Trip reset: DI1 (0->1) / 0XXX->1XXX	
	2XXX Allow slow stop ramp	
	0XXX Relay Ready: Safety OK	
	4XXX DO1 & DI1 (Control Switch)	
	8XXX & not inhibited	
	CXXX & pe < 39:pe MAXIMUM	

**<DATA**

Dt0	70.0 Hz
Dt1	25.0 Hz
Dt7	1200 s
Dt8	DCBA1028

Sub-Menu <DATA of Special Parameters

Setting	VsC: Motor Frequency max. settable 15.0 ... 120.0 Hz	8.1
Setting	VsC: Motor Frequency min. settable 15.0 ... 120.0 Hz	
DI0 and DI1 can only be changed in the config mode with inverter stopped. Reset for operation by pressing the red 'O' key.		
Setting	Compressor swop after this time with rack: 0 s: none; 60 s ... 65535 s swop	
Setting	Activations: Functional and Outputs: FFFFFFFF ... 00000000	8.3
	XXXX XXX1 Activate Capacity Controller	8.3.1
	XXXX XXX2 Activate extended current limit	
	XXXX XXX4 Activate pc transmitter monitoring	
	XXXX XXX 8 Activate envelope frequency-range limiting	
	XXXX XX1X Activate inverter motor heating	
	XXXX XX 2X Activate Autotune if there is a failed start	
	XXXX XX4X View Level OPERATOR: Extend menus	
	XXXX XX8X Activate Serial Communication	
	XXXX 0 0XX 0: 0..+10 V Variable-speed fan Group	8.3.3
	XXXX 1 1XX 1: 0..+10 V Frequency (10 V = fmax)	
	XXXX 2 2XX 2: 0..+10 V Hot-Gas Bypass control	
	XXXX 3 3XX 3: Monitor fmin (see 74:VsC tmon fmin TIME)	
	XXXX 4 4XX 4: Inhibit Sump Heater	
	XXXX 5 5XX 5: More Condens. capacity required (cascade)	
	XXXX 6 6XX 6: Maintenance recommended	
	XXXX 7 7XX 7: Connect supply filter trap	
	XXXX 8 8XX 8: Activate Capacity Control (CC)	
	XXXX 9 9XX 9: Compressor turning / Start lubrication	
	AAA A AAXX A: Activate Compressor VFsC1	
	BB B BBXX B: Activate Compressor VFsC2 / FsC2	
	C C C CCXX C: Activate Compressor FsC3	
	D D D D DXX D: Activate Compressor FsC4	
	E E E E EXX E: Activate Expansion Valve	
	F F F F FXX F: Activate Start Unloader and VFsC1	
Setting	SD-MC (Secure Data Memory Card): Revision Designation	8.4

IO05	IO04	IO3	IO2	A02	A01	Settings
Logic outputs with A01, A02 (special ext. relays)						

Password for Refrigeration Personnel

**<SPECIALS**

Sub-Menu <SPECIALS of Expert Parameters

Only change after reference to our Applications Department

Pressure transmitters

Sp0  
**XX22**

Setting	Pressure transmitter measurement ranges: pc, pe (ratiometric), pc, pe (4...20 mA)
4...20 mA	XXX1 -1.0 ... 9.0 bar XXX2 <b>-0.5 ... 7.0 bar (preferred)</b> XXX3 0.0 ... 25.0 bar
4...20 mA	XX1X 0.0 ... 25.0 bar XX2X <b>0.0 ... 30.0 bar (preferred)</b> XX3X 0.0 ... 40.0 bar XX4X 0.0 ... 60.0 bar XX5X 0 ... 100 bar XX6X 0 ... 160 bar

9.0

Speed Setpoint Conditioning

Sp1  
**0064**

Setting	Lubricating / Force Frequency: 0064 = 50.0 Hz
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9.1

Limiter Gains

Sp2  
**8CC4**

Setting	Discharge Temperature: P Gain, Limit (25.12 91.20 °C)
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9.2-6

Sp3  
**8C1E**

Setting	Lubrication: P gain, Overpress. +1.0 bar (25.12 2.0-1.0 bar)
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Sp4  
**8C46**

Setting	Suction-gas Superheat limiter: P gain, ts - ted (25.12 5.01 K)
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Sp5  
**8C46**

Setting	Discharge-gas Superheat limiter: P gain, td - tcd (25.12 5.01 K)
---------	---

Sp6  
**8C46**

Setting	Lubrication Overheat limiter: P gain, tl - ted (25.12 5.01 K)
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Further Resonance Avoidance

Sp7  
**FFFF**

Setting	Further Skip Frequency 3: Frequency, Band
---------	--

9.7-8

Sp8  
**FFFF**

Setting	Further Skip Frequency 4: Frequency, Band
---------	--

Sequential Control

Sp9  
**1050**

Setting	RHVAC Sequencing Logic: Start Delay1: 0.1 s, Start Delay2: 0.01 s
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9.9-A

Capacity Controller

SpA  
**648C**

Setting	Rack control: Controller: I time constant (0.1 s), P gain,
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9.B

SpB  
**9F46**

Setting	Capacity control: Reserve, Hot-Gas Bypass gain
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9.B

SpC  
**F897**

Setting	Capacity Control: Min. OFF-time (s), Max. ON time (s)
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9.C

Current Profile

SpD  
**B4DC**

Setting	Max. Current as a function of speed: fmax in %, fmin in 10%
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9.D

Other settings

SpE  
**8C8C**

Setting	te, tc Controllers, I time constants: tctc, tetc
---------	---

9.E

Low Ambient Start

SpF  
**0000**

Setting	Low-Ambient Start (LAS): tmin (- °C), TBD
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9.F

External Energy Meter

SpG  
**0000**

Setting	External Energy Meter: Pulse in kW
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9.G

External input Harmonic Filter

SpH  
**0000**

Setting	External input harmonic filter: Activate trap connect
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9.H

Other settings

SpI  
**3FFA**

Setting	LOCAL_Energy Saving_ Flux reduction_Flux characteristic
Base Voltage:	XXXA [F..A.: Max(110 %)..Normal(100%)..Min(80%)
Energy Saving,	
- Max Volt. Reduction:	XXFX F.: 0: None(100%)..Min(70%)
- Min. acting freq.:	XFX 0. F: fmin +(0..15 Hz)
LOCAL Automatic,	0XXX 0.1 Hz / s
Sweep rate:	1XXX 0.2 Hz / s 2XXX 0.5 Hz / s 3XXX <b>1 Hz / s</b> 4XXX 2 Hz / s 5XXX 5 Hz / s 6XXX 10 Hz / s

9.I

Resetting values

SpJ  
**0000**

Setting	Reset of various settings
Reset Values shown in Menu	XXX0 No reset XXX1 <b>CONTROL SCREEN</b>   Installation Name
DIAGNOSTICS:	XXX2 <b>DIAGNOSTICS</b>   VsC equiv. 50 Hz time
	XXX3 <b>DIAGNOSTICS</b>   Fan equiv. 40 °C time
	XXX4 <b>FAULTS / WARN</b>   Trips Accumulated Primes

9.J

Modifying

Modifying

Password for Refrigeration Personnel

Password for Refrigeration Personnel with FrigoPack FU+ Training required

SPECIAL ADJUSTMENTS

Select data from the SD-MC card

SD-MC:Data Select  
 <0:Selection disabled


Read data from the SD-MC card


SD-MC:Data Read  
 <14:R134aHFC  
 <Long\_Selectin\_List

Value	Explanation	Further
Settings:	One of the following must be activated	0.1, 0.2
<0:Selection disabled	Selection not activated (normal condition)	
<1:Refrigerant	Refrigerant selection	
<2:VFsc Manufacturer	Manufacturer selection	
<3:VFsc Type	Compressor Type selection	
<4:VFsc Cylinders	Compressor number of cylinders	
<5:Supply Voltage	Electrical Supply Voltage	
<6:VFsc Compressor	Compressor selection	

Measured value	Read selected data from SD-MC card
	Selected compressor

**KEYS FOR SELECTION:**

 Select next data set (short tip >= 0.5 s)

 Select previous data set (short tip >= 0.5 s)

**IMPORTANT:**

Requirement for Selection:

- SD-MC memory card with valid authorized data plugged into SD slot of the FU+ Refrigeration Inverter:
- The selection parameter SD Data\_Selection must be set to:

**<0:Selection disabled**  
after selection for normal operation

Selectable data from the SD-MC card

SD-MC: Secure Digital - Memory Card

FrigoPack EC / FrigoSoft 4.7: Option

FrigoPack E / FrigoSoft 1.7/ Standard  
 FrigoPack / FrigoSoft 2.7:

**REFRIGERANT selection:**

<1:Refrigerant	R134a, R14, R22, R23, R32, R134a, R152a, R170, R227ea, R236fa, R245fa, R290, R404A, R407A, R407C, R407F, R410A, R417A, R417B, R422A, R422D, R427A, R434A, R437A, R438A, R442A, R442A, R448A, R449A, R507A, R508A, R508B, R513A,	R600, R600a, R717, R723, R744, R1150, R1234yf, R1234ze, R1270
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**Vsc Compressor Manufacturer:**

<2:VFsc Manufacturer	<20:noname <21:BITZER <22:CARLYLE <23:DANFOSS	<24:DORIN <25:EMERSON <26:FRASCOLD <27:FRIGOPOL	<28:GEA-Bock <29:HANBELL <2A:HITACHI <2B:J&EHALL	<2C:LGE <2D:SANYO <2E:TECUMSEH <2F:other
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**Vsc Compressor Types:**

<3:VFsc Type	<30:notype <31:RecipHermetic <32:RecipSemihermc <33:Recip2-stage	<34:Recipopen <35:ScrewHermetic <36:ScrewSemihermc <37:ScrewCompact	<38:ScrewOpen <39:Scroll <3A:Reserve
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**Vsc Number of cylinders with reciprocating compressors:**

<4:VFsc Cylinders	<40:Nocylinders <41:1 cylinder <42:2 cylinders <43:3 cylinders	<44:4 cylinders - <46:6 cylinders -	<48:8 cylinders - <4A:10 cylinders - <4C:12 cylinders - <4F:(15+ cylinders)
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**Supply Voltage at 50/60 Hz:**

<5:Supply Voltage	<50:notdefined <51:50Hz200V <52:50Hz230V <53:50Hz400V	<54:50Hz420V <55:50Hz500V <56:50Hz690V <57:50Hztdv	<58:60Hz200V <59:60Hz208V <5A:60Hz230V <5B:60Hz380V	<5C:60Hz460V <5D:60Hz575V <5E:60Hz660V <5F:other
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**Vsc COMPRESSOR selection:**

<6:VFsc Compressor	<No_Data_selected_
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Real Time Clock:

Time and Date  
 2015/07/04 16:08:51

Setting	Set Time and Date of RTC if module A FU+ CM-1 fitted	0.3
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Language:

Language  
 ENGLISH

Setting	Set Language	0.4
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Units:

98:UNITS  
 bar, °C

Setting	Selectable units: bar, °C, K; psi, °F, °R; bar, °F, °R	7.5
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Installation ID:

Installation Name  
 VARIPACK\_FU+  
 FrigoPack\_FU+

Setting	Welcome text in Control Menu: 16 settable characters:	0.5
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# Setting-up step by step

Starting condition:

SD-MC:Data Select  
<0:Selection disabl

SD-MC:Data Read

## 1: REFRIGERANT:

Set Refrigerant selection mode:



SD-MC:Data Select  
<1:Refrigerant

*Modify as follows if necessary:*  
- After 1 s on release: +1 Refrigerant

Select Refrigerant:

SD-MC:Data Read  
<14:R134aHFC

- After 1 s on release: -1 Refrigerant

2a..d: Compressor pre-selections:

2a. Set Manufacturer selection mode:



SD-MC:Data Select  
<2:VFsc Manufacturer

*Modify if necessary:*  
- After 1 s on release: +1 Manufacturer

Select manufacturer:

SD-MC:Data Read  
<21:BITZER

- After 1 s on release: -1 Manufacturer

2b. Set Type selection mode:



SD-MC:Data Select  
<3:VFsc Type

*Modify if necessary:*  
- After 1 s on release: +1 Type

Select Type:

SD-MC:Data Read  
<32:RecipSemihermtc

- After 1 s on release: -1 Type

2c. Set no of cylinders (0 for screw or scroll):



SD-MC:Data Select  
<4:VFsc Cylinders

*Modify if necessary:*  
- After 1 s on release: +1 Cylinder

Select no.:

SD-MC:Data Read  
<44:4 cylinders

- After 1 s on release: -1 Cylinder

2d. Set Supply voltage:



SD-MC:Data Select  
<5:Supply Voltage

*Modify if necessary:*  
- After 1 s on release: +1 Voltage

Select supply voltage:

SD-MC:Data Read  
<53:50Hz400V

- After 1 s on release: -1 Voltage

## 2: COMPRESSOR:

Set Compressor selection mode:



SD-MC:Data Select  
<6:VFsc Compressor

*Select compressor:*  
- After 1 s on release: +1 Compressor

Select compressor:

SD-MC:Data Read  
<Long\_Selectin\_List

- After 1 s on release: -1 Compressor

**VERY IMPORTANT:**  
Reset after completion of steps 1 and 2a...2d:

Reset to starting position:



SD-MC:Data Select  
<0:Selection disabl

Alternative: Wait 60 s, then automatic reset:

Indication:

SD-MC:Data Read

## VERIFICATION OF SETTINGS:

Select menu:  
Verify settings:

OPERATION

25:REFRIGERANT  
<14:R134a HFC

60:COMPRESSOR  
<6 2CES-4Y

Example compressor

Settings

**First Trip** NONE

**Active 1 - 32** XXXXXXXX

**Active 33 - 64** 000000XX

**Warnings 1 - 32** XXXXXXXX

**Warnings 33 - 64** 000000XX

**Recent Trips[ ]** >>

**Recent Trips[0]**

**Recent Trips[1]** NONE

**Recent Trips[2]** NONE

**Recent Trips[3]** NONE

**Recent Trips[3]** NONE

**Recent Trips[5]** NONE

**Recent Trips[6]** NONE

**Recent Trips[7]** NONE

**Recent Trips[8]** NONE

**Recent Trips[9]**

**Recent Trip Times[ ]** >>

**Recent Trip Times[0]** YYYYYYYY s

**Recent Trip Times[1]** YYYYYYYY s

**Recent Trip Times[2]** YYYYYYYY s

**Recent Trip Times[3]** YYYYYYYY s

**Recent Trip Times[4]** YYYYYYYY s

**Recent Trip Times[5]** YYYYYYYY s

**Recent Trip Times[6]** YYYYYYYY s

**Recent Trip Times[7]** YYYYYYYY s

**Recent Trip Times[8]** YYYYYYYY s

**Recent Trip Times[9]** YYYYYYYY s

**Control Board Up Time** YYYYYYYY s

**AR Restarts remaining** YY

**AR Time remaining** YYYYYY.Y s

**COMMON TRIPS** YY

Type	Value	Explanation	Further information
Measured value		Trip which caused shut down	10.0
Measured value		Code of active trips (hexadecimal)	
Measured value		Code of active trips (hexadecimal)	
Measured value		Code of active warnings (hexadecimal)	
Measured value		Code of active+ warnings (hexadecimal)	
Menu		Recent Trips Times (last 10)	
Measured value		Recent Trip 1 (latest)	
Measured value		Recent Trip 2	
Measured value		Recent Trip 3	
Measured value		Recent Trip 4	
Measured value		Recent Trip 4	
Measured value		Recent Trip 6	
Measured value		Recent Trip 7	
Measured value		Recent Trip 8	
Measured value		Recent Trip 9	
Measured value		Recent Trip 10 (oldest)	
Menu		Recent Trips Times (last 10)	
Measured value	_____ s		
Measured value	_____ s		
Measured value	_____ s		
Measured value	_____ s		
Measured value	_____ s		
Measured value	_____ s		
Measured value	_____ s		
Measured value	_____ s		
Measured value	_____ s		
Measured value	_____ s	Control board powered-up time in s (used to time-stamp trips if no RTC)	
Measured value	_____	Autorestarts remaining	
Measured value	_____ s	Autorestart time remaining until next start attempt	
Measured value	_____	Accumulation of trip prime numbers	



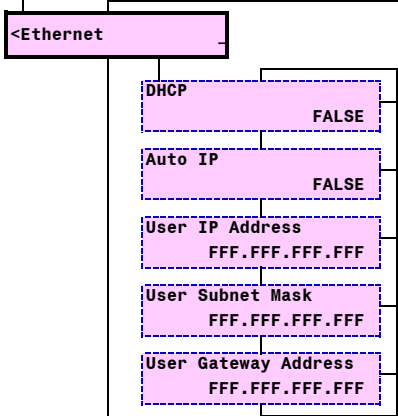
# Trips, Diagnosis, Fault Finding

ELECTRICAL  
→  
←  
REFRIGERATION

Trip Message	Possible Cause	Hints for Fault Finding	Remedies
<b>01 OVER VOLTAGE</b>	<ul style="list-style-type: none"> <li>Voltage of supply too high</li> <li>Compressor motor defect</li> </ul>	<ul style="list-style-type: none"> <li>Measure and document three input voltages</li> <li>Test Compressor motor. Disconnect cables from the Refrigeration Inverter. Connect direct to the input supply through a suitable motor circuit breaker. Monitor if compressor runs normally by verifying current taken agrees with compressor software data.</li> <li>Measure resistance of motor winding and compare with manufacturer's data</li> <li>Disconnect Refrigeration Inverter and check winding insulation between phases and to earth</li> <li>Check wiring of control circuit and compare function with recommendations</li> </ul>	<ul style="list-style-type: none"> <li>Rectify cause of any high voltage</li> <li>Replace compressor motor</li> <li>Modify wiring</li> </ul>
<b>02 UNDER VOLTAGE</b>  <b>04 STACK FAULT</b>  <b>21 PHASE FAIL</b>  <b>22 VDC RIPPLE</b>	<ul style="list-style-type: none"> <li>Voltage of supply too low</li> <li>Phase of supply voltage missing</li> <li>Isolating contactor not controlled correctly</li> <li>Compressor motor defect</li> <li>Refrigeration Inverter faulty</li> <li>Incorrect motor connection</li> </ul>	<ul style="list-style-type: none"> <li>Measure and document three input voltages</li> <li>Check wiring of control circuit and compare function with recommendations</li> <li>Test Compressor motor. Disconnect cables from the Refrigeration Inverter. Connect direct to the input supply through a suitable motor circuit breaker. Monitor if compressor runs normally by verifying current taken agrees with compressor software data.</li> <li>Measure resistance of motor winding and compare with manufacturer's data</li> <li>Disconnect Refrigeration Inverter and check winding insulation between phases and to earth</li> <li>Remove motor cable connections to Refrigeration Inverter</li> <li>Check if operation of Refrigeration Inverter without a motor connected is possible</li> <li>Test operation with a small test motor</li> <li>Check wiring to motor terminals (choice of star/delta, part winding etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Rectify cause of any low voltage</li> <li>Modify wiring</li> <li>Replace compressor motor</li> <li>Replace Refrigeration Inverter</li> <li>Modify wiring</li> </ul>
<b>08 INVERSE TIME</b>  <b>09 MOTOR I2T</b>  <b>14 START FAILED</b>	<ul style="list-style-type: none"> <li>Compressor start aborted</li> </ul>	<ul style="list-style-type: none"> <li>Liquid refrigerant in compressor?</li> <li>Defect compressor</li> <li>Incorrect size of Refrigeration Inverter or motor connected in delta instead of star</li> </ul>	<ul style="list-style-type: none"> <li>Contact Supplier for advice</li> </ul>
<b>27 STO ACTIVE</b>	<ul style="list-style-type: none"> <li>Safety device in safety circuit tripped</li> <li>Safety relay or contactor not controlled correctly</li> <li>Wiring fault in safety circuit</li> <li>DC 24 V control voltage missing</li> </ul>	<ul style="list-style-type: none"> <li>Check safety circuits. Possibly missing supply voltage at a monitoring device.</li> <li>Check wiring of control circuit and compare function with recommendations</li> <li>Check DC 24 V control voltage at Refrigeration Inverter</li> <li>Short circuit with DC 24 V control voltage ?</li> </ul>	<ul style="list-style-type: none"> <li>Reset if necessary</li> <li>Verify wiring</li> <li>Modify wiring</li> <li>Verify wiring</li> </ul>
<b>33 TRANSMITTER PRESSR</b>	<ul style="list-style-type: none"> <li>Suction-pressure transmitter not connected or connections swapped</li> <li>Transmitter for suction pressure faulty</li> </ul>	<ul style="list-style-type: none"> <li>Check if blue LED at the input of the Basic Module lights</li> <li>Check if blue LED at the input of the Basic Module lights</li> <li>Ratiometric Types: Check connections</li> </ul>	<ul style="list-style-type: none"> <li>Verify correct connection to transducer for suction pressure. Exchange leads if necessary</li> <li>Replace faulty pressure transmitter</li> </ul>
<b>34 PRESS RANGE EXCEED</b>	<ul style="list-style-type: none"> <li>Pressure outside range or unsuitable pressure transmitter fitted</li> </ul>	<ul style="list-style-type: none"> <li>Verify Pressure Transmitter</li> </ul>	<ul style="list-style-type: none"> <li>Exchange Pressure Transmitter or correct wiring</li> </ul>
<b>35 DISCH TEMP TOO HGH</b>	<ul style="list-style-type: none"> <li>Discharge-gas temperature too high</li> </ul>	<ul style="list-style-type: none"> <li>Suction-gas superheat too high</li> <li>Damaged compressor valves or leaking gasket</li> <li>Unsuitable refrigerant</li> </ul>	<ul style="list-style-type: none"> <li>Investigate refrigeration components</li> </ul>
<b>36 SUPERHEATS TOO LOW</b>	<ul style="list-style-type: none"> <li>Suction and Discharge-Gas superheats too low</li> </ul>	<ul style="list-style-type: none"> <li>Problem with an expansion valve</li> <li>Liquid in suction line</li> </ul>	<ul style="list-style-type: none"> <li>Investigate refrigeration components</li> </ul>
<b>37 LUBRC TEMP TOO LOW</b>	<ul style="list-style-type: none"> <li>Lubricant Overtemperature too low</li> </ul>	<ul style="list-style-type: none"> <li>Suction-gas superheat too low</li> <li>Liquid in suction line</li> <li>Sump heater not used, not connected correctly or faulty</li> </ul>	<ul style="list-style-type: none"> <li>Investigate refrigeration components</li> </ul>
<b>38 LUBRC PRES TOO LOW</b>	<ul style="list-style-type: none"> <li>Low lubricant pressure</li> </ul>	<ul style="list-style-type: none"> <li>Lubricant migration</li> <li>Problem with refrigeration piping</li> </ul>	<ul style="list-style-type: none"> <li>Investigate refrigeration circuit</li> </ul>
<b>39 EXT MODULE FAULT</b>	<ul style="list-style-type: none"> <li>External Module or cable fault</li> </ul>	<ul style="list-style-type: none"> <li>Verify wiring</li> </ul>	<ul style="list-style-type: none"> <li>Correct wiring</li> </ul>
<b>40 MAINTENANCE NECESS</b>	<ul style="list-style-type: none"> <li>Proactive Maintenance due</li> </ul>	<ul style="list-style-type: none"> <li>Investigate Maintenance parameters in the menu DIAGNOSTICS</li> </ul>	<ul style="list-style-type: none"> <li>Organize parts required and plan maintenance</li> </ul>
<b>?? OTHER TRIP</b>	<ul style="list-style-type: none"> <li>Other</li> </ul>	<ul style="list-style-type: none"> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>Contact supplier for advice</li> </ul>

Menu COMMUNICATION for setting up Communications:  
 Trained Refrigeration Personnel

Settings  
 Ethernet:



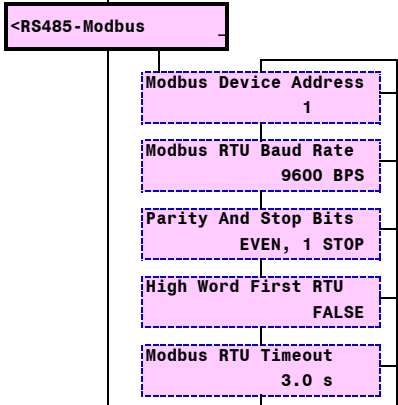
Type	Value	Explanation	Further information
------	-------	-------------	---------------------

Ethernet local area network

Setting	Value	Explanation
DHCP	FALSE	Ethernet local area network
Auto IP	FALSE	Automatic IP generation
User IP Address	FFF.FFF.FFF.FFF	User set IP address
User Subnet Mask	FFF.FFF.FFF.FFF	User set Subnet Mask
User Gateway Address	FFF.FFF.FFF.FFF	User set Gateway Address

12.1

RS485 Modbus RTU:

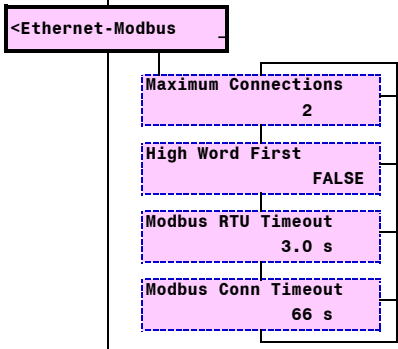


Modbus RTU RS485 if Module A FU+ CM-1 fitted

Setting	Value	Explanation
Modbus Device Address	1	Address 1..247
Modbus RTU Baud Rate	9600 BPS	Baud Rate 1200..115200 BPS
Parity And Stop Bits	EVEN, 1 STOP	Parity and Stop Bits
High Word First RTU	FALSE	High-word first (word order in Protocol) for 32-Bit interrogations
Modbus RTU Timeout	3.0 s	No activity Timeout (Watchdog) 0.0 .. 65.0 s

12.2

Ethernet Modbus:



Modbus over Ethernet

Setting	Value	Explanation
Maximum Connections	2	Maximum number of connections
High Word First	FALSE	High-word first (word order in Protocol) for 32-Bit interrogations
Modbus RTU Timeout	3.0 s	No Modbus RTU activity Timeout 0.0 .. 65.0 s
Modbus Conn Timeout	66 s	No Ethernet Fieldbus activity 0 .. 100000 s

12.2

Menu 'Run Wizard?' to reset to factory defaults:  
 Trained Refrigeration Personnel

Type	Value	Explanation	Further information
------	-------	-------------	---------------------

Setting	Value	Explanation
Reset to defaults	FALSE	Reset to factory defaults
Set to TRUE followed by pressing the central blue key 4 times		

13.1

**CAUTION: Reset ALL settings to factory defaults:  
 USE WITH GREAT CARE**

Reset to factory settings:

Modifying

Password for Refrigeration Personnel

Diagnostics

Sequencing and Limits:

2090\_578\_2091

SEQUENCING STATES	
YY	Y

STARTS --- ENABLES ---	
YYYY	YYYY

LIMITING CONDITIONS	
YYYY	YYYY

Relative Rack Capacity (volume flow):

Electrical Values:

Temperatures:

Power Module:

Control Module:

Compressor:

Maintenance :

Keypad FU+ PROG required for Diagnosis:

Avg_Rack-Power_Actl	YYY.Y %	Y.YYY %
---------------------	---------	---------

DC LINK	MOTOR	
YYY V	YYYY V	

BASE FRQ	POWER	
YY.Y Hz	YYY.Y kW	

Cntrl Mod1_Heat Sink	YY.Y °C	YY.Y °C
----------------------	---------	---------

Power Stack Fitted	YYYYYYYYYYYYYYY
--------------------	-----------------

Stack Serial No	YYYYYYYYYYYYYYY
-----------------	-----------------

HV SMPS Up Time	YYYYYYYYYYY s
-----------------	---------------

HV Power On Count	YYYYYYYYYYYYYYY
-------------------	-----------------

Control Module Serial	YYYYYYYYYYYYYYY
-----------------------	-----------------

Control Board Up Time	YYYYYYYYYYY s
-----------------------	---------------

VsC Serial Number	YYYYYYYYYYYYYYY
-------------------	-----------------

Motor Run Time	YYYYYYYYYYY s
----------------	---------------

Motor start count	YYYYYYYYYYY
-------------------	-------------

VsC equiv 50 Hz time	YYYYYYYYYYY s
----------------------	---------------

Fan equiv 40 °C time	YYYYYYYYYYY s
----------------------	---------------



Type	Explanation	Further information
------	-------------	---------------------

Internal value	Modbus over Ethernet
Left:	Right:
0:Stppd Rdy to Start	0:NOT READY TO SWITCH ON
1:Start Delay	1:SWITCH ON DISABLED
2:Autotuning	2:READY TO SWITCH ON
3:Aligning	3:SWITCHED ON
4:Prefluxing	4:OPERATION ENABLED
5:Starting	5:QUICKSTOP ACTIVE
6:Lubricating	6:FAULT REACTION ACTIVE
7:Hold at fmin	7:FAULTED
8:Normal_operation	
9:Stopping	
10:Stopped, Inhibited	
11:Compressor_Heating	
12:Local_operation	
13:Serial_communicatns	

Internal value	Logical conditions:
XXXX XXXX XXXX xxx1	Safety Circuit (STO) Not active (OK)
XXXX XXXX XXXX xx1X	Refrigeration Inverter Enabled (fault free)
XXXX XXXX XXXX x1XX	External Module EM1..3 Enable or not present
XXXX XXXX XXXX 1XXX	ISESCO Enable or not present
XXXX XXXX xxx1 XXXX	pe >= pe min limit Suction pressure
XXXX XXXX xx1X XXXX	ted > ted min Evaporating temperature
XXXX XXXX x1XX XXXX	tod < tod max Discharge temp
XXXX XXXX 1XXX XXXX	pc << pc max limit Exhaust gas pressure
XXXX XXXX XXXX XXXX	DI1 Start input
XXXX xx1X XXXX XXXX	ted > ted setpoint/ Force Controller start / DI2
XXXX x1XX XXXX XXXX	External Module EM1..3 Module start
XXXX 1XXX XXXX XXXX	Isesco start Isesco start
xxx1 XXXX XXXX XXXX	External Start Signal AI1 or AI2 > 0.0 V
xx1X XXXX XXXX XXXX	Compr. Swop active Swop time >= 0 s

Internal value	Logical conditions:
XXXX XXXX XXXX xxx1	tod >= tod max Condensing Temperature
XXXX XXXX XXXX xx1X	lcmp >= lcmp max Current
XXXX XXXX XXXX x1XX	LAS, RAS Low Ambient Start
XXXX XXXX XXXX 1XXX	Reserve Reserve
XXXX XXXX xxx1 XXXX	td Discharge gas temperature limiting
XXXX XXXX xx1X XXXX	pl Lubrication Differential pressure
XXXX XXXX x1XX XXXX	ts Suction Gas Superheat
XXXX XXXX 1XXX XXXX	td Discharge gas Superheat
XXXX XXXX XXXX XXXX	il Lubrication Overheat

Measured value	Compressor Rack, Relative Capacity:	11.2
_____%	30(long) / 7 day(short) average and Actual	
Calculated values	DC Link and motor voltages	
____V	____V	
Calculated value	Actual Base Frequency _ Motor power	
____Hz	____kW	

Measured value	Heatsink and Control Module Temperatures	11.3
____°C	____°C	

Measured value	Power Size Code	11.4
____		

Measured value	Stack Serial Number	
____		

Measured value	Switched-Mode Power Supply ON time in s	
____s		

Measured values	Number of times the supply has been connected	
____		

Measured values	Control Board Serial Number	11.7
____		

Measured value	Control board powered-up time in s	
____%		

Measured values	VsC Compressor Serial Number	11.5
____		

Measured values	Compressor ON time in s	
____s		

Measured values	Number of motor starts	
____		

Measured values	VsC Compr. Equiv. 50 Hz remaining operation	11.6
____s		

Measured values	Fan equivalent 40 °C remaining operation (for planned exchange of fans)	
____s		

**Password for Refrigeration Personnel**  
**Password for Refrigeration Personnel with FrigoPack FU+ Training req**

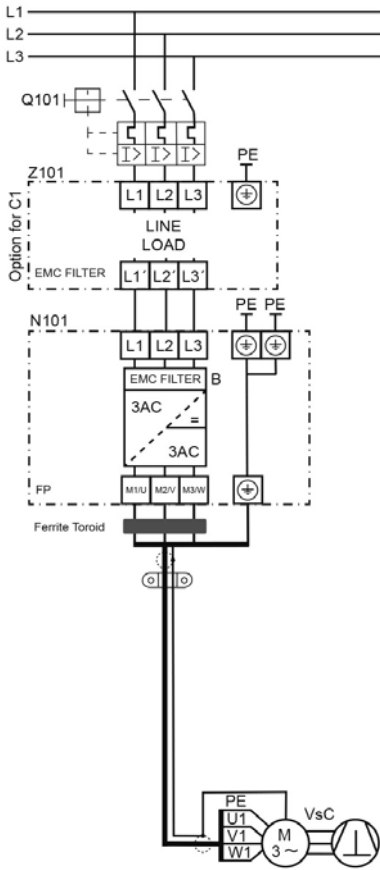
Light	Explanation
OFF	Stopping
OFF	Stopped
ON	Running
Flashing	Auto Start
Flashing	Not Operational
Green then Red Flashing	Tripped / Fault

Übersetzung?

# POWER SECTION

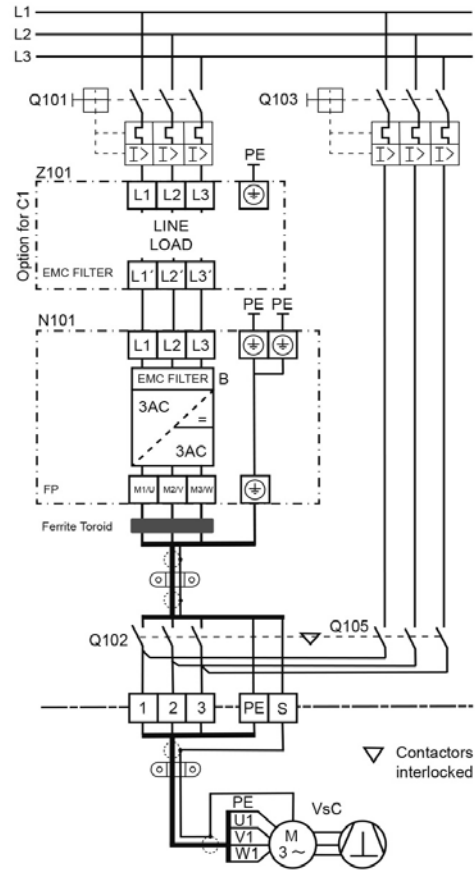
## Power connections

QSG12841.1



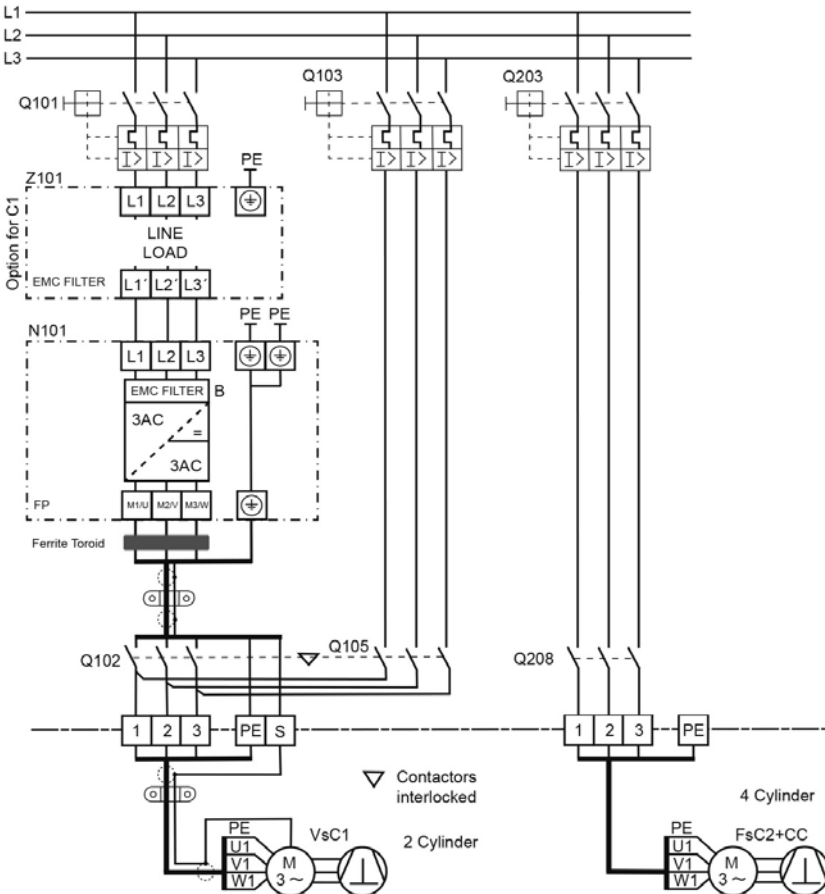
Settings: 80:Fsc PRIORITY CNTRL 00000000 (See page 3)  
Dt8: DCBA1028 (See page 4)

Single compressor (basic connection)



Settings: 80:Fsc PRIORITY CNTRL 00000000 (Siehe Seite 3)  
Dt8: DCBA1028

Single compressor with bypass for emergency operation

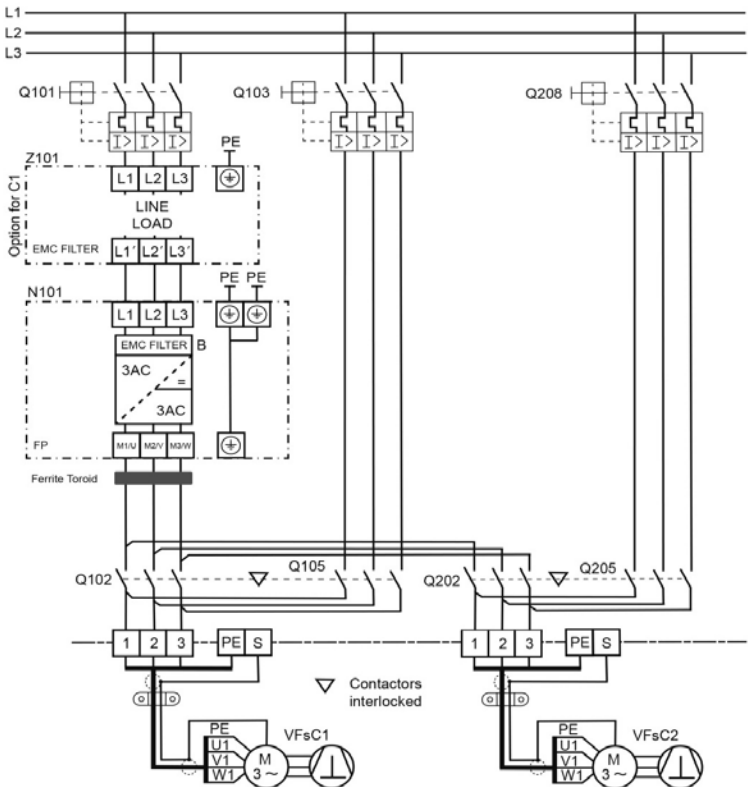


Settings: 80:Fsc PRIORITY CNTRL 00000000 (See page 3)  
Dt8: DCBA8028 (See page 4)

Variable-speed compressor with second larger compressor with Capacity Control

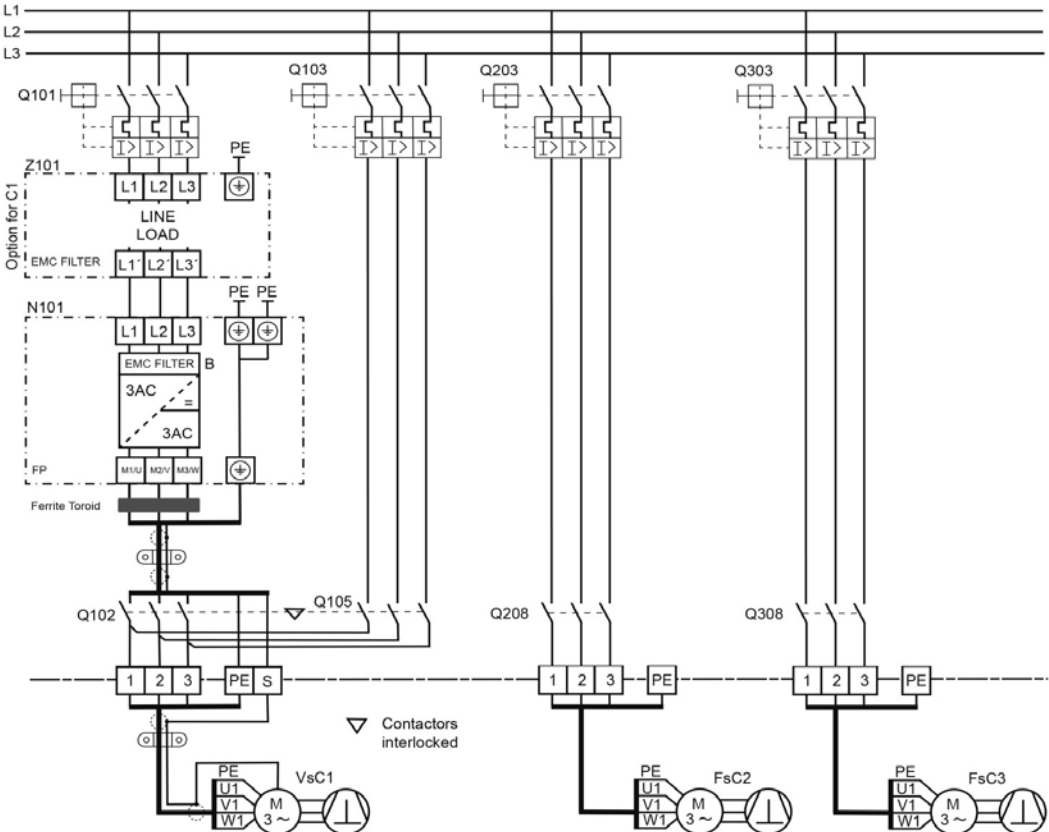
Accessory required: A FU+ DC12V RL/11

POWER SECTION



**80:Fsc PRIORITY CNTRL** 000000EE / 000000FF  
**Dt8:** DCBA1028

**Two compressors, each with bypass and swopping**



**Three compressors, two Fixed-speed Compressors with swopping**

**80:Fsc PRIORITY CNTRL:** 00000011  
**Dt8:** DCBA1028

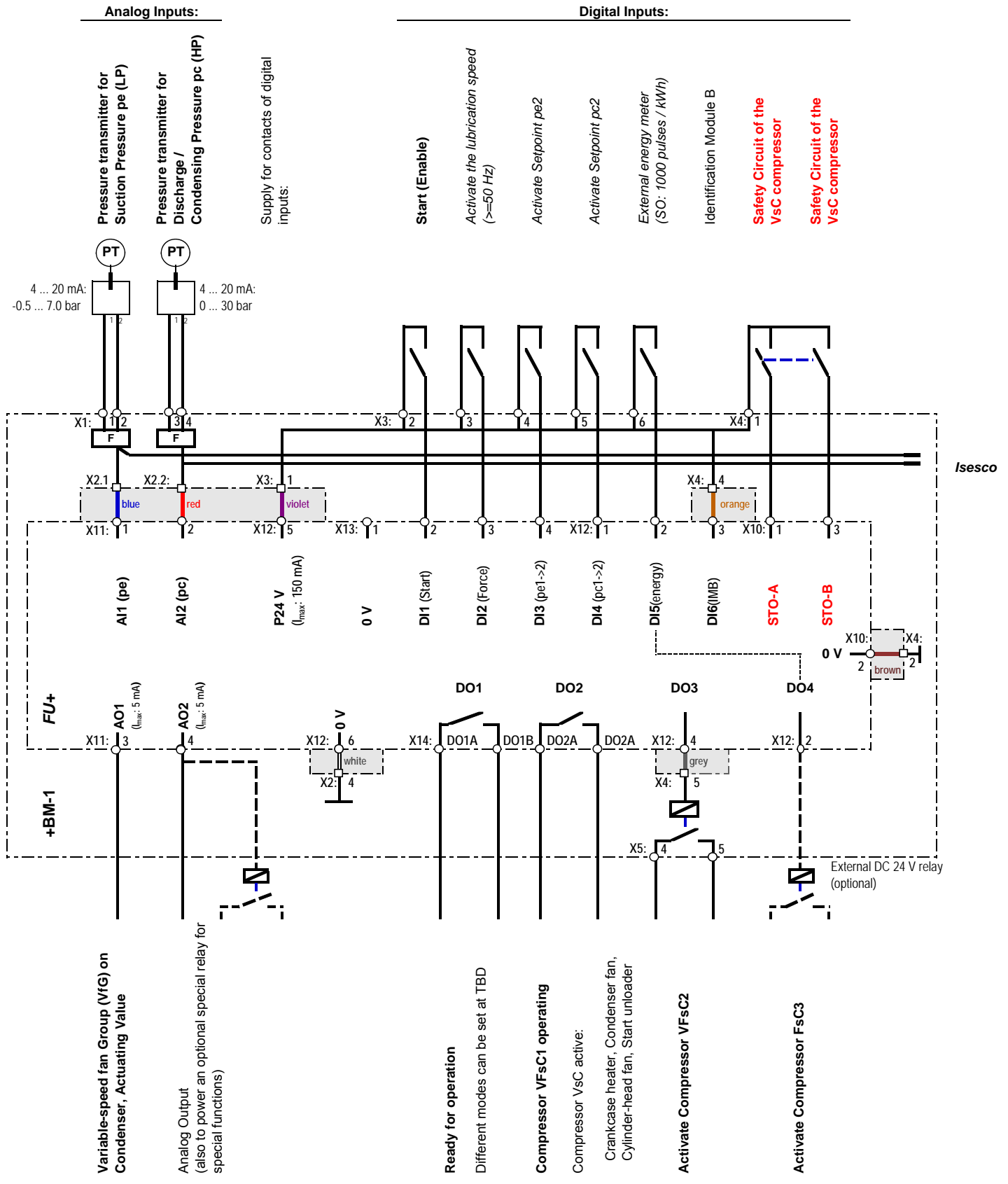
Various other configurations are possible, please enquire

**Power terminals**

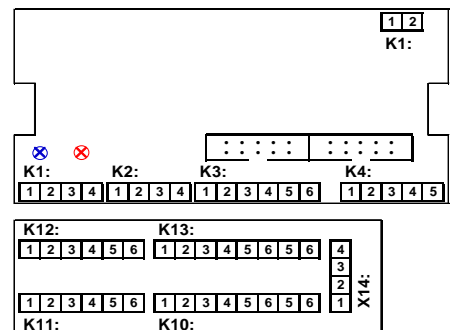
Terminal / Designation	Signal / Function	Explanation	Further information
PE	Protective Earth connection 1 to supply	- Observe all safety and EMC requirements	7.7.1
L1	Three phases of voltage supply	- Ensure that supply voltage agrees with data on name plate	7.7.1
L2			
L3			
PE	Protective Earth connection 2 to supply	- Observe all safety and EMC requirements	6.7
M1/U	Motor of Variable-speed Compressor	- Through interlocked isolating contactor if required	7.7.1/ 7.7.2
M2/V			
M3/W			
PE	Protective earth connection to compressor motor		7.7.2

# CONTROL SECTION

## Control connections with internal Pressure Control



- VfG:** Variable-speed fan group (Condenser / Dry cooler)
- VFSc1:** Variable-speed Compressor 1 (also used as a Fixed-speed Compressor in some connections)
- VFSc2:** Fixed-speed Compressor 2 (also used as a Variable-speed Compressor in some connections)



## Terminal List for control functions with internal Pressure Control

Terminal / Designation		Signal / Function	Explanation	Further information
BM-1: X1.1 / 2	AI1	<b>Analog Input:</b> <b>Pressure transmitter for Suction Pressure pe (LP)</b> 4...20 mA: -0.5 ... 7.0 bar 0 mA: Fault	- Must be used - Suitable pressure transducer: - A REFR-P-TRANSD-LP7+PL - Connections: 1-->X1.1, 2-->X1.2	
BM-1: X1.3 / 4	AI2	<b>Analog Input:</b> <b>Pressure transmitter for Discharge / Condensing</b> 20 mA: 0 ... 30 bar 0 mA: Fault	- Optional use - Suitable pressure transducer: - A REF-P-TRANSD-HP30+PL Connections: 1-->X1.3, 2-->X1.4	
X11.5	P10 V	Universal Analog Output (5 mA max. load)	- Do not use	
X11.6	N10 V	Universal Analog Output (5 mA max. load)	- Do not use	
X12.5	+24 V	Supply for contacts of digital inputs	- Not available	
BM-1: X3.1 / X13.2	DI1	<b>Digital Input:</b> <b>Start (Enable)</b> Start +24 V: Controlled stop 0 V: Controlled stop	- Must be used:  - Load: 3.3 kΩ, 7.3 mA	
BM-1: X3.2/ X13.3	DI2	<b>Digital Input:</b> <b>Activate Lubrication Speed (50 Hz)</b> +24 V: Lubrication speed 0 V: Normal operation	- Optional use  - Load: 3.3 kΩ, 7.3 mA	
BM-1: X3.3/ X13.4	DI3	<b>Digital Input:</b> <b>Activate Setpoint pe2</b> +24 V: Setpoint pe2 0 V: No action	- Optional use  - Load: 3.3 kΩ, 7.3 mA	
BM-1: X3.4/ X12.1	DI4	<b>Digital Input:</b> <b>Activate Setpoint pc2</b> +24 V: Setpoint pc2 0 V: No action	- Optional use  - Load: 3.3 kΩ, 7.3 mA	
BM-1: X3.5/ X12.2	DI5	<b>Digital Input:</b> <b>Pulses from Energy Meter</b> +24 V: Pulse 0 V: Not activated	- Optional use  - Load: 3.3 kΩ, 7.3 mA	
X12.3	DI6	<b>Digital Input:</b> <b>Identification Module B (&gt;=50 Hz)</b> +24 V: IMB Coding (mark) 0 V: IMB Coding (space)	- Must be used: - Connect to Basic Module 1, terminal tbd  - Load: 3.3 kΩ, 7.3 mA	
X10.1	STO-A	<b>Digital Input:</b> <b>Not Safe Torque Off, Channel A (&gt;=50 Hz)</b> +24 V: Operation Enable 0 V: Safe Stop	- Must be used: - Enable from contact pair of safety relay - Active if Channel B simultaneously activated - Load: 3.3 kΩ, 7.3 mA	
X10.2	0 V	<b>Ground for Safe Torque Off</b>	- Must be used	
X10.3	STO-B	<b>Digital Input:</b> <b>Not Safe Torque Off, Channel B (&gt;=50 Hz)</b> +24 V: Operation Enable 0 V: Safe Stop	- Must be used: - Enable from contact pair of safety relay - Active if Channel A simultaneously activated - Load: 3.3 kΩ, 7.3 mA	
X14: DO1A / DO1B	DOUT1	<b>Relay Output:</b> <b>"Ready" (without fault)</b> Closed: Ready (no fault) Open: No supply, fault or alarm	- Ready (no fault): - Function depends on the following setting: SPECIAL ADJUSTMENTS _   DATA   Dt1 - Max load: AC 230 V / 250 VA	
X14: DO2A / DO2B	DOUT2	<b>Relay Output with alternative functionality:</b> <b>- Single compressor:</b> - VsC1 Operating / <b>- 1, 3 or more compressors without swop:</b> - VsC1 Operating Closed: Operation / Activate Open: Stop, Deactivated	- To control auxiliaries such as: Crankcase heater, Condenser fan, Start unloader / - Activate VFSc1  - Max load: AC 230 V / 250 VA	
BM-1: X5:1 / X5:2	DOUT3	<b>Relay Output with alternative functionality:</b> <b>- 1, 3 or more compressors:</b> - Activate Compressor FsC2 <b>- 2 compressors with swop:</b> - VFSc2 Operating Closed: Operation / Activate Open: Stop, Deactivated	- Activate FsC2  - Activate VFSc2  - Max load: AC 230 V / 250 VA	
BM-1: X13:2	DOUT4	<b>Relay Output with alternative functionality:</b> <b>- 1, 3 or more compressors:</b> - Activate Compressor FsC3 Closed: Operation / Activate Open: Stop, Deactivated	- Activate FsC3  - External relay DC 24 V required  - Max load: AC 230 V / 250 VA	
X11.3	AO1	<b>Analog Output with alternative functionality:</b> <b>VfG Condenser fan, actuating value</b> 0...+10 V: 0.0 ... 100.00 %	Function depends on the following setting: <b>SPECIAL ADJUSTMENTS _   Dt8</b> - Max load: 5 mA	
X11.4	AO2	<b>Analog Output with alternative functionality:</b> <b>P10 V</b> 0...+10 V: 0.0 ... 100.00 %	Function depends on the following setting: <b>SPECIAL ADJUSTMENTS _   Dt8</b> - Max load: 5 mA	

**VsC:** Variable-speed Compressor  
**FsC:** Fixed-speed Compressor  
**VFSc:** Variable- / Fixed-speed Compressor

**VfG:** Variable-speed fan group  
 (Condenser / Dry cooler)

# Control and Safety Circuits

## Safety Requirements

The regulations for refrigeration equipment reference the safety standard EN 60204-1 (Safety of machinery - Electrical equipment of machines - Part 1 General requirements).

It is established and proven practice that safety circuits (including pressure-limiting devices) are processed by electromechanical devices such as relays or contactors.

It is not permissible to use standard software-based automation controls (such as PLCs) as these are not functionally fail-safe or a software error can result in dangerous operating conditions.

In an emergency (such as a pressure-limit reached) the Stop Category 0 (immediate removal of power) is appropriate.

Contactors interruption in the energy supply to the compressor is a proven circuit technique for the immediate and safe stopping of compressor motors in an emergency condition.

The integrated Safe Torque-Off (STO) function of this Refrigeration Inverter may be used as an alternative method provided that a bypass contactor is not used. With correct installation a Safety Integrity Level of SIL3 can be achieved.

A typical safety circuit would normally consist of the following:

- Essential safety-relevant devices such as approved over-pressure switches
- Optional devices such as low-pressure switches, oil pressure or level monitoring controls

The safety circuit should terminate at a safety relay with two normally-open contacts wired as follows:

- Two individual or a single common connection from P24 V from the Refrigeration Inverter to the supply side of these two contacts.
- Two independent normally-open contacts dedicated to the the Safe-Torque Off function of the refrigeration inverter wired to inputs STO-A and STO-B

The previously described standards and recommendations are general guidelines for the safety-relevant design of the installation.

However it is the installer or contractor's responsibility to assess the risk of each installation and to ensure that all safety measures are appropriate and functional.

## Functional recommendations

A control switch should be provided with the following functionality:

- Middle position: **OFF**            Controlled STOP of the compressor or compressor rack
- Right position: **AUTO**        AUTOMATIC controlled operation
- Left position: **MAN**         MANUAL test or emergency operation without activation of the Refrigeration Inverter

The normal automatic stopping and starting of the compressor should only be by using the AUTOMATIC (start) command at Digital Input DI1 of the Refrigeration Inverter.

Opening contactors in the input or output of the Refrigeration Inverter during operation must not be used for normal starting or stopping of the compressor as this will stress the Refrigeration Inverter and reduce the working life.

To ensure correct monitoring and fault logging the operating commands should be separate from the safety circuit.

The MANUAL mode of operation should preferably make use of a pump-down pressure switch to enable controlled operation.

It is recommended that control circuit automatically reverts to MANUAL operation if the FrigoPack Refrigeration Inverter is not available. This condition should be signaled to a supervising or warning system.

If in a fault condition no compressor is available, then a means of stopping the evaporation is recommended to minimize the risk of liquid in the suction line should be provided.

## Example of suitable safety and control circuits

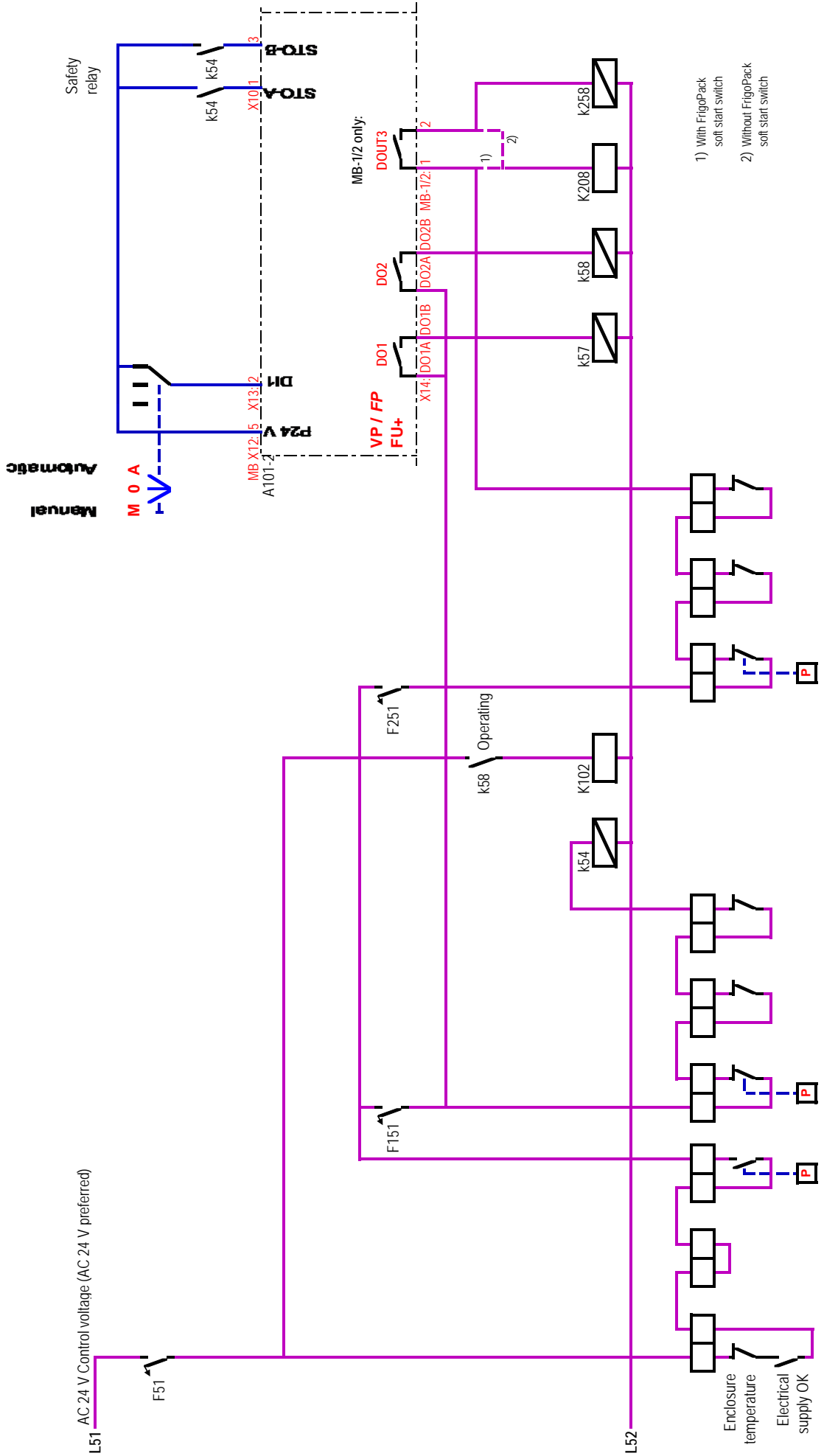
The following simplified overview of the safety and control wiring of a typical system only includes the wiring for AUTOMATIC operation.

Standard suggestions for the safety and control wiring with these features are available on request.

Please enquire at your supplier for assistance with the planning of complex systems or systems with special requirements.



# SAFETY CIRCUIT



1) With FrigoPack soft start switch  
2) Without FrigoPack soft start switch

°C, Electrical safety	External safety	Suction pressure	High pressure	Lubrication	Motor temp.	Safety relay	Safety contactor	High pressure	Lubrication	Motor temp.	Relay Ready	Relay Operating	Motor Contactor	
Safety: Compressor rack											Ready and Operation: Variable-speed Compressor 1 (VsC1)		Operation: Fixed-speed Compressor 2 (F-sC2)	
Safety: Verdrichter veränderbarer Drehzahl 1 (VsC1)											Safety: Fixed-speed Compressor 2 (F-sC2)			

## CONTROL SECTION

# FIRST-TIME POWER UP

Mounting and electrical safety:

Ensure that all recommendations in the Product Manual have been adhered to.

UL compliance where appropriate:

Ensure that all recommendations in the Product Manual for UL compliance have been adhered to.

EMC compliance:

Ensure that all recommendations in the Product Manual for EMC compliance have been adhered to.

View Level:

There are three basic view levels selectable in the Wizard (see page 1):

**OPERATOR:**

Available without restriction as it is not possible to change any settings at this level.

**TECHNICIAN:**

For refrigeration-trained and authorized persons (Password 8670). This level is sufficient for normal commissioning.

**ENGINEER:**

Special applications and usage (special Super-User password).

Language:

The language selection is only relevant when the 4-line Graphic Key Pad is fitted to the inverter

The following languages can be selected (see page 1):

- English, German
- (French, Spanish and Italian in preparation)

Refrigeration application:

The following refrigeration applications are automatically selected by fitting the correct Basic Module (auto-detection) :

**FrigoSoft® 1.7:** Upper module for pressure transmitters: BM-1 (4 ... 20 mA).

Optional External Modules:  
CM-1, EM-6/7.

Pressure transmitters:

This refrigeration application is designed for use with the following pressure transducers:

Industry-Standard 4 ... 20 mA relative (gauge) pressure transmitters:

- pe: -0.5 ... 7.0 bar (-7.25...101.53 psig) A REFR-P-SENSOR-LP7	- pc: 0...30 bar (0.0...101.5 psig) A REFR-P-SENSOR-HP30
--	--

BITZER-Standard ratiometric absolute pressure transmitters and

- pe: 0.0 ... 13.79 bara (0.0...200.0 psia) 34731401	- pc: 0.324...35.487 bara (14.7 ... 514.7 psig) 34731402
Cable 6.6 m: 34411553	34411553
Kit: 2x Transmitters + cables, Module BM-2: 34797201	-----

Pressure transmitters alone:  
Cable 6.6 m:  
Kit: 2x Transmitters + cables, Module BM-2:

**WARNING: Only use approved pressure transmitters**

Recommended basic commissioning steps:

- Verify that the power circuit corresponds to the suggestions on the previous pages 12/13
- In particular ensure that an interlocked isolating contactor is fitted between the Refrigeration Inverter and the compressor if a parallel bypass connection is used.
- Verify that the control circuit corresponds to the suggestions on the previous pages 14...16.
- In particular ensure that two isolated contacts of the safety relay are connected to the Safe Torque Off inputs of FrigoPack: STO-A (Terminal X10.1) / STOP-B (Terminal X10.3) X10:1&3
- Remove Start Command: DIN1: X13:2.
- Connect main power supply.
- Verify that the blue LED for Suction Pressure near terminals BM-1: 1 & 2 lights. If not, then check that the wiring to the pressure transmitter is correct
- If a discharge-pressure transmitter is used, then verify that the red LED near terminals BM-1: 3 & 4 for the discharge pressure lights. If not, then check that the wiring
- Measure the pressures with a refrigeration pressure gauge. Verify that the pressure indicated at parameters 03:pe\_\_\_ VsC\_pc\_PRESS agree with these external measurements.

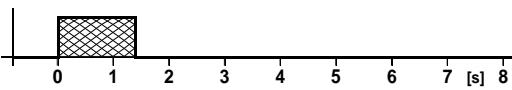
Recommended basic commissioning steps:

- Set the Refrigerant at the following parameter:  
 FIRST SETUP \_ | SD-MC:Data Select \_ |  
 <1:Refrigerant \_  
 as described in detail on pages 6,7
- Set the Compressor at the following parameter:  
 FIRST SETUP \_ | SD-MC:Data Select \_ |  
 <2:VFsc Manufacturer \_  
 <3:VFsc Type \_  
 <4:VFsc Cylinders \_  
 <5:Supply Voltage \_  
 <6:VFsc Compressor \_  
 as described in detail on pages 6,7
- Reset to the following starting position (VERY IMPORTANT) :  
 FIRST SETUP \_ | SD-MC:Data Select \_ |  
 <0:Selection disabld

MULTI-FUNCTIONAL SPECIAL KEYS "1" & "0"

Further information tbd

Timed Operation: | Key: | Action: | Amount:



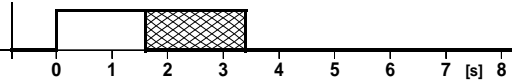
➔ Increase speed in LOCAL: +1 Hz  
 Reset Inhibit Timer:

➔ SD FIRST-TIME SETUP setup mode (page 6,7):  
 Next set of data.



➔ Reduce speed in LOCAL: -1 Hz  
 Reset trip:

➔ SD FIRST-TIME SETUP setup mode (page 6,7):  
 Previous set of data.

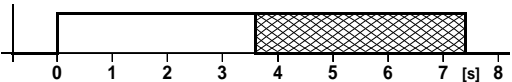


➔ Increase speed in LOCAL: +5 Hz



➔ Reduce speed in LOCAL: -5 Hz

Stop and LOCAL reset on reaching fmin  
 Restart will occur automatically when the inhibit time is expired  
 Retains floc 60 s after switching to AUTOMATIC,  
 otherwise revert to floc = fmin



Stop and LOCAL reset: 0 Hz

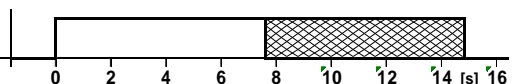


Start LOCAL operation: fmin  
 With Digital Input DI2, 50 Hz  
 Set LOCAL frequency:

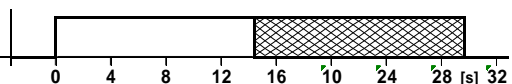


Repeat two key activation:  
 0: OPERATION | STARTING-Local

Set LOCAL test ramp: 1 Hz ↑↓ / 2 s



➔ Modify evaporating temperature setpoints to correspond to:  
 31:ted SETPOINT 1 \_ (see page 2).



➔➔ Reset values: Refer to SPECIALS | SpJ on page 5:

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Manufacturer	Agent / Partner	Customer	Installation	Name, Date
KIMO RHVAC Controls Ltd German Branch Hüttendorfer Weg 60 D-90768 Fürth, Germany <a href="http://www.frigokimo.com">www.frigokimo.com</a>				