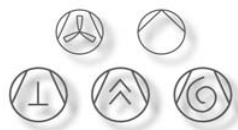
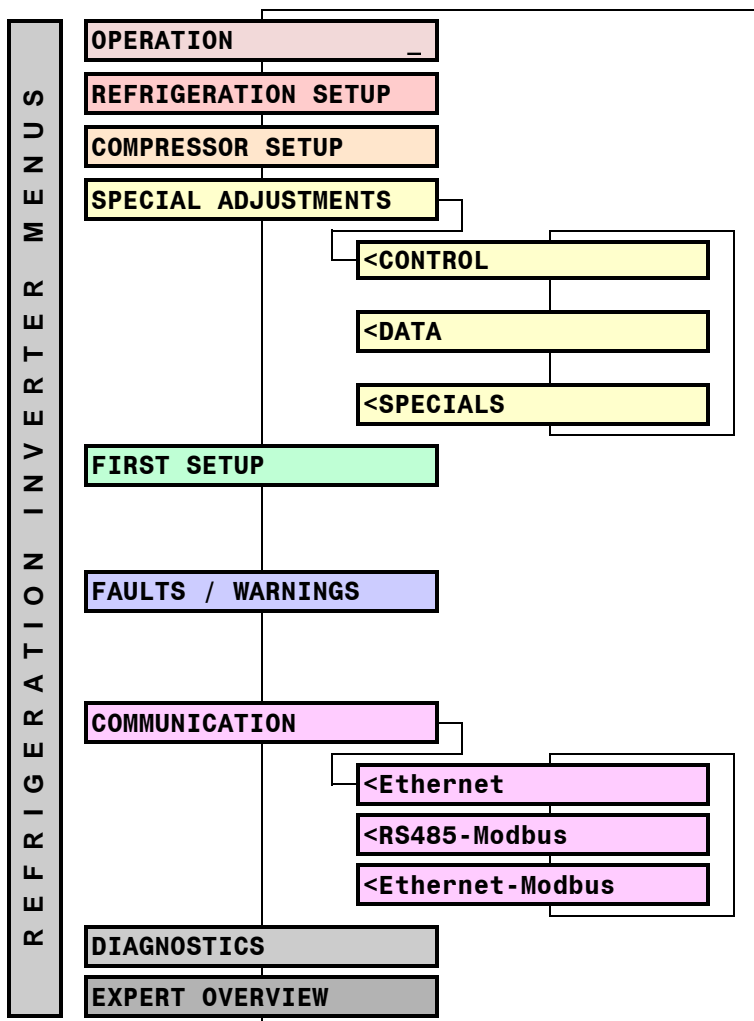




FrigoPack® FU+
A New Generation



Intelligent Refrigeration Control
Systems for Compressors,
Condensers, HVAC & Pumps



OVERVIEW OF MENUS AND INDEX

| | |
|---|-------------|
| | Page |
| | 1 |
| Main refrigeration operating parameters (observation only) | 2 |
| Refrigeration setup parameters | 3 |
| Compressor setup parameters | 4 |
| Three submenus of special adjustments | 5,6 |
| Parameters for optimizing performance and setting mode of operation | .5 |
| Further parameters for optimizing performance and setting the mode of operation | .5 |
| Parameters for special functionality | .6 |
| Refrigerant and Compressor from data on the SD-MC card | 7 |
| Time and Date, Language, Units, Installation Name | 7 |
| Faults, Warnings and last 10 Trips with time occurred | 8 |
| Trip Messages, Possible Causes, Hints for Fault Finding, Remedies | 9 |
| Communication protocols | 10 |
| Ethernet | ..10 |
| RS485 Modbus RTU | ..10 |
| Ethernet Modbus | ..10 |
| Diagnostics, monitoring values and serial numbers | 11 |
| Concentrated overview | 20 |

POWER SECTION

Power connections:

| | |
|---|------|
| - Single compressor (basic connection) | ..12 |
| - Single compressor with bypass for emergency operation | ..12 |
| - Variable-speed compressor with second larger compressor with Capacity Control | ..12 |
| - Two compressors, each with bypass and swopping (Rotation) | ..13 |
| - Three compressors, two Fixed-speed Compressors with swopping (Rotation) | ..13 |

Power Terminals

13

CONTROL SECTION

Control connections to the Refrigeration Inverter with internal pressure control

14,15

Control connections with External Control 4...20 mA or 0...+10 V

14,15

Control and Safety circuits

16,17

Key Pad

10,11

FIRST TIME POWER UP

Important information

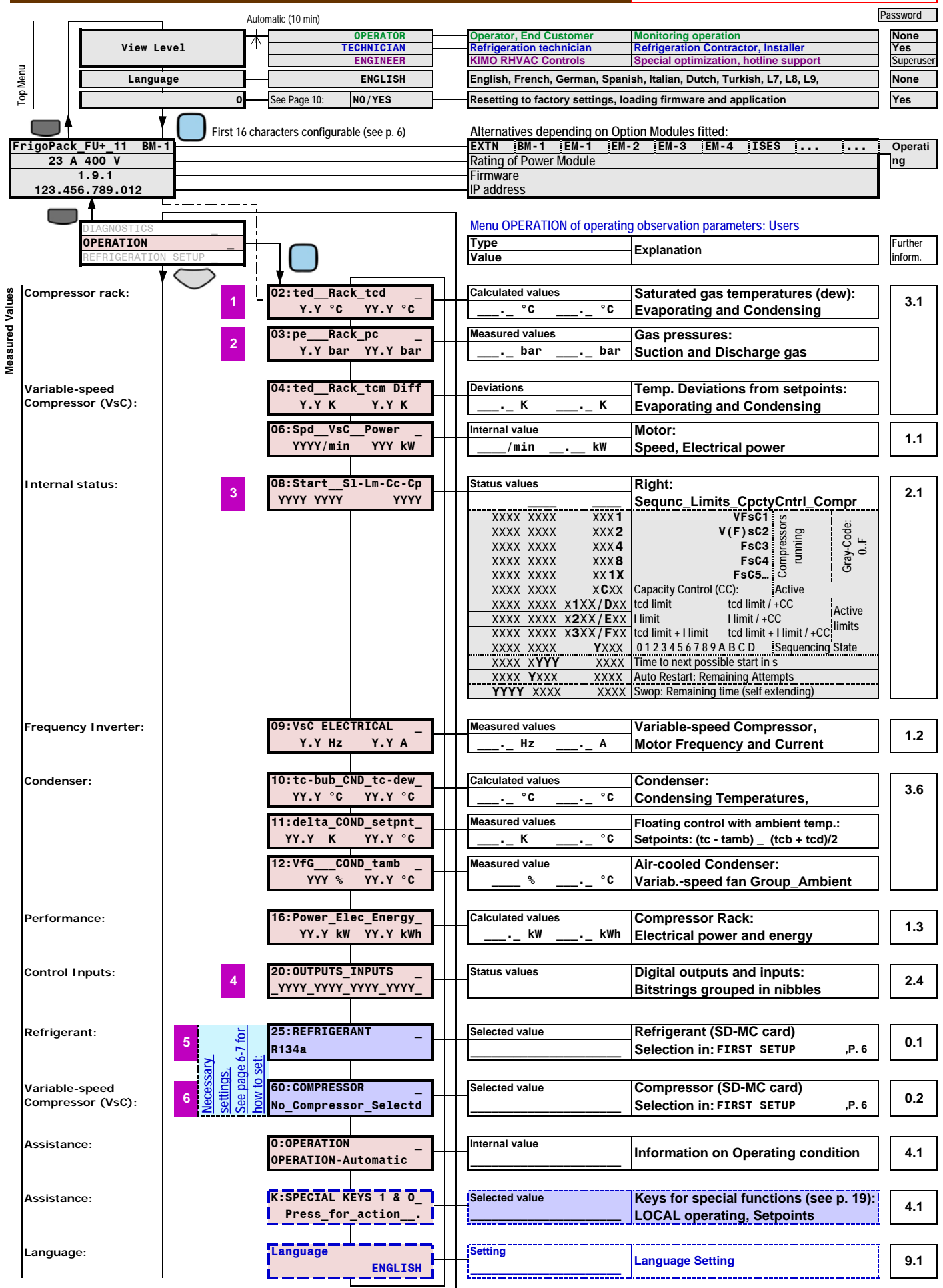
18,19

SETTING UP STEP BY STEP

20

| Manufacturer | Agent / Partner | Customer | Installation | Name, Date |
|---|-----------------|----------|--------------|------------|
| KIMO RHVAC Controls Ltd German Branch Hüttendorfer Weg 60 D-90768 Fürth, Germany www.frigokimo.com | | | | |

OPERATION



| | |
|--|-----------|
| Operator | None |
| TECHNICIAN | Yes |
| ENGINEER | Superuser |
| ENGLISH | None |
| English, French, German, Spanish, Italian, Dutch, Turkish, L7, L8, L9, | None |
| See Page 10: NO/YES | Yes |

| | | | | | | | | | |
|--|------|------|------|------|------|------|-----|-----|------------|
| Alternatives depending on Option Modules fitted: | | | | | | | | | |
| EXTN | BM-1 | EM-1 | EM-2 | EM-3 | EM-4 | ISES | ... | ... | Operati ng |
| Rating of Power Module | | | | | | | | | |
| Firmware | | | | | | | | | |
| IP address | | | | | | | | | |

| Menu OPERATION of operating observation parameters: Users | | |
|---|-------------|-----------------|
| Type | Explanation | Further inform. |
| Value | | |

| | | | | | | | |
|----------------------------------|--|---------------------------------------|--|---|-----|---------------------|-----------------|
| Measured Values | Compressor rack: | 02:ted_Rack_tcd Y.Y °C YY.Y °C | Calculated values | Saturated gas temperatures (dew): Evaporating and Condensing | 3.1 | | |
| | | 03:pe_Rack_pc Y.Y bar YY.Y bar | Measured values | Gas pressures: Suction and Discharge gas | | | |
| | Variable-speed Compressor (VsC): | 04:ted_Rack_tcm Diff Y.Y K Y.Y K | Deviations | Temp. Deviations from setpoints: Evaporating and Condensing | | | |
| | | 06:Spd_VsC_Power YYYY/min YYY kW | Internal value | Motor: Speed, Electrical power | 1.1 | | |
| | Internal status: | 08:Start_S1-Lm-Cc-Cp YYYY YYYY YYY | Status values | Right: Sequnc Limits CpctyCntrl Compr | 2.1 | | |
| | | | XXXX XXXX XXX 1 VFsC1 | V(F)sC2 | | | |
| | | | XXXX XXXX XXX 2 | FsC3 | | Compressors running | Gray-Code: 0..F |
| | | | XXXX XXXX XXX 4 | FsC4 | | | |
| | | XXXX XXXX XX 1X | FsC5... | | | | |
| | | XXXX XXXX X CXX | Capacity Control (CC): | Active | | | |
| | XXXX XXXX X1XX / DXX | tcd limit | tcd limit / +CC | Active limits | | | |
| | XXXX XXXX X2XX / EXX | l limit | l limit / +CC | | | | |
| | XXXX XXXX X3XX / FXX | tcd limit + l limit | tcd limit + l limit / +CC | | | | |
| | XXXX XXXX YXXX | 0 1 2 3 4 5 6 7 8 9 A B C D | Sequencing State | | | | |
| | XXXX XYYY XXXX | | Time to next possible start in s | | | | |
| | XXXX YXXX XXXX | | Auto Restart: Remaining Attempts | | | | |
| | YYYY XXXX XXXX | | Swop: Remaining time (self extending) | | | | |
| Frequency Inverter: | 09:VsC ELECTRICAL Y.Y Hz Y.Y A | Measured values | Variable-speed Compressor, Motor Frequency and Current | 1.2 | | | |
| Condenser: | 10:tc-bub_CND_tc-dew YY.Y °C YY.Y °C | Calculated values | Condenser: Condensing Temperatures, | 3.6 | | | |
| | 11:delta_COND_setpnt YY.Y K YY.Y °C | Measured values | Floating control with ambient temp.: Setpoints: (tc - tamb) _ (tcb + tcd)/2 | | | | |
| | 12:VfG_COND_tamb YYY % YY.Y °C | Measured value | Air-cooled Condenser: Variab.-speed fan Group_Ambient | | | | |
| Performance: | 16:Power_Elec_Energy YY.Y kW YY.Y kWh | Calculated values | Compressor Rack: Electrical power and energy | 1.3 | | | |
| Control Inputs: | 20:OUTPUTS_INPUTS _YYYY_YYYY_YYYY_YYYY_ | Status values | Digital outputs and inputs: Bitstrings grouped in nibbles | 2.4 | | | |
| Refrigerant: | 25:REFRIGERANT R134a | Selected value | Refrigerant (SD-MC card) Selection in: FIRST SETUP ,P. 6 | 0.1 | | | |
| Variable-speed Compressor (VsC): | 60:COMPRESSOR No_Compressor_Selectd | Selected value | Compressor (SD-MC card) Selection in: FIRST SETUP ,P. 6 | 0.2 | | | |
| Assistance: | 0:OPERATION OPERATION-Automatic | Internal value | Information on Operating condition | 4.1 | | | |
| Assistance: | K:SPECIAL KEYS 1 & 0 Press_for_action_. | Selected value | Keys for special functions (see p. 19): LOCAL operating, Setpoints | 4.1 | | | |
| Language: | Language ENGLISH | Setting | Language Setting | 9.1 | | | |

| | |
|----------------|---|
| 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 TECHNICIAN for Refrigeration Personnel: 8670

1 ... 10 Please report these values if there are any problems

Settings

- Altitude**
- Evaporation**
 - Low-pressure limit
 - Dew Temperatures
- Condensation**
 - Mid Temperatures
 - Dew Temperature
 - High-pressure limit

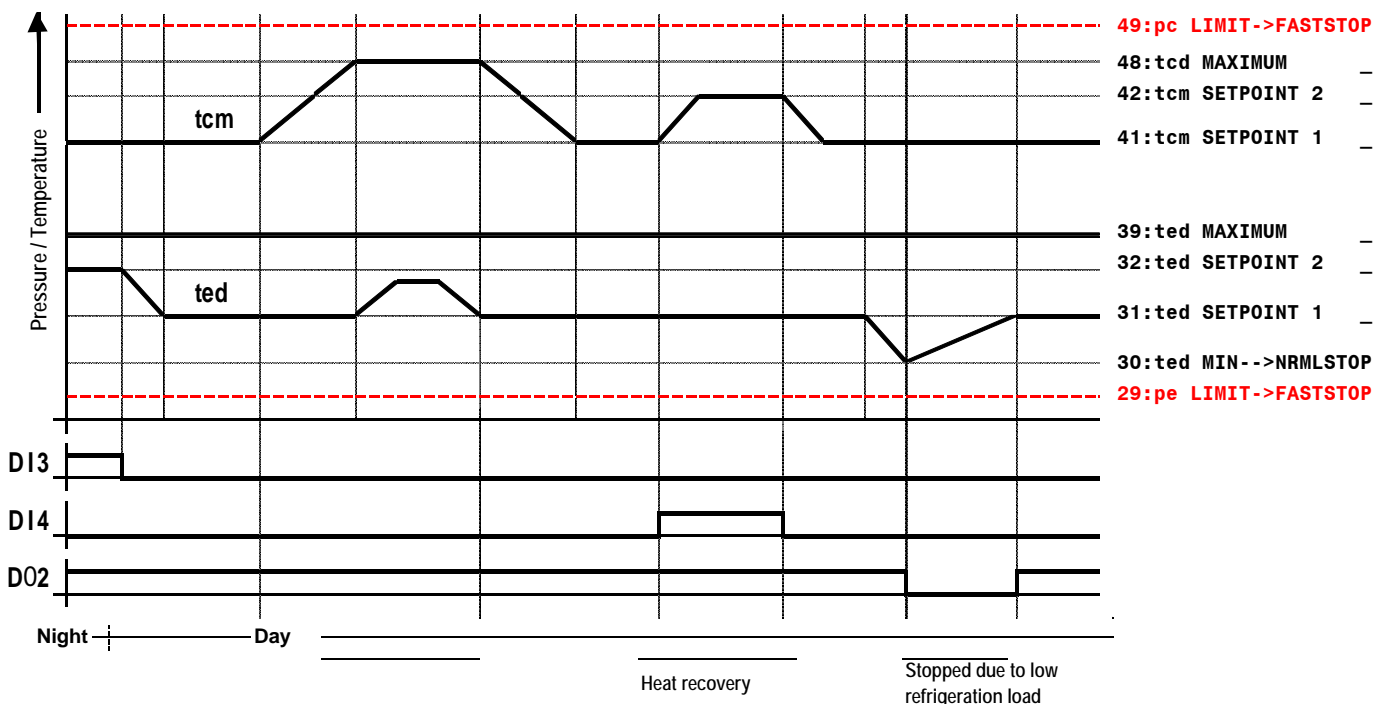
Menu REFRIGERATION SETUP for refrigeration settings:
View Level **TECHNICIAN** (for Refrigeration Personnel) only, see page 1

| Type | Value | Explanation | Further inform. |
|-------------|-------------------------------------|--|-----------------|
| Setting | 24:ALTITUDE 500 m | Compensation for relative pressure: Modify if >= 1000 m altitude | 2.4 |
| Limit value | 29:pe LIMIT->FASTSTOP 0.10 bar | 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. | 2.5 |
| Limit value | 7 30:ted MIN-->NRMLSTOP -15.0 °C | Evaporating Temperature (dew point): Normal Stop as "Pump Down" limit | |
| Setting 1 | 8 31:ted SETPOINT 1 -10.0 °C | Evaporating Temp. (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). | |
| Setting 2 | 32:ted SETPOINT 2 -5.0 °C | Evaporating Temp. (dew point): Setpoint 2 (higher value) | |
| Setting 2 | 39:ted MAXIMUM 5.0 °C | Evaporating Temp. (dew point): Maximum for setpoint control | |
| Setting | 9 41:tcm SETPOINT 1 25.0 °C | Condensing Temp. (mid point): Setpoint 1 (lower value) | 2.6 |
| Setting | 42:tcm SETPOINT 2 45.0 °C | Condensing Temp. (mid point): Setpoint 2 (higher value) | |
| Limit value | 10 48:tcd MAXIMUM 55.0 °C | Condensing Temp. (dew point), max.: Compr. Capacity reduced above here | |
| Setting | 49:pc LIMIT->FASTSTOP 30 bar | Discharge Pressure: Fast Stop with trip Set to just below maximum operating pressure of compressor. Must not to be used as a safety device. | |
| | | 99:OPERATING MODE | |
| | | Password TECHNICIAN for Refrigeration Personnel: 8670 | |
| | | Password TECHNICIAN for Refrigeration Personnel: 8670 | |

REFRIGERATION SETUP

Modifying

Explanation of adjustable operating pressures:



Menu COMPRESSOR SETUP for setting compressor operation:
View Level TECHNICIAN (for Refrigeration Personnel) only, see page 1

| Type | Explanation | Further inform. |
|-------|-------------|-----------------|
| Value | | |

REFRIGERATION SETUP
COMPRESSOR SETUP
SPECIAL ADJUSTMENTS

Settings
Variable-speed Compressor (VsC):

61:VsC CURRENT MAX
0.0 A

Configuration Setting
_____. A
VsC Motor current max
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

5.1

Limits:

62:VsC FREQUENCY MAX
65.0 Hz

Setting _____ Hz
VsC Motor frequency max.:
Max. settable value: Dt1, page 4

64:VsC FREQUENCY MIN
25.0 Hz

Setting _____ Hz
VsC Motor frequency min.:
Min. settable value: Dt2, page 4

65:VsC MOTOR NO POLES
4

Setting _____
VsC Motor:
No. of poles: 2, 4, 6, 8

Resonance avoidance:

66:VsC SKIP FREQ1 MIN
0.0 Hz

Setting _____ Hz
VsC Resonance Avoid., Skip freq 1 min:
10.0..65.0 Hz *

5.2

67:VsC SKIP FREQ1 MAX
0.0 Hz

Setting _____ Hz
VsC Resonance Avoid., Skip freq 1 max:
10.0..65.0 Hz *

68:VsC SKIP FREQ2 MIN
0.0 Hz

Setting _____ Hz
VsC Resonance Avoid., Skip freq 2 min:
10.0..65.0 Hz *

69:VsC SKIP FREQ2 MAX
0.0 Hz

Setting _____ Hz
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.

Time settings:

70:VsC tinhibit TIME
300 s

Setting _____ s
VsC Inhibit Time after VsC start:
20..1200 s

6.1

71:VsC tlubrcn TIME
4 s

Setting _____ s
VsC Oil Lubrication Pulse time:
0..100 s

72:VsC thld fmin TIME
10 s

Setting _____ s
VsC Start Hold Time (at fmin):
0..120 s

74:VsC tmon fmin TIME
300 s

Setting _____ s
VsC Monitoring time at fmin:
0..1800 s

Fixed-speed Compressor (FsC):

80:Fsc PRIORITY CNTRL
00000001

Setting _____
FsC9,8,7,6,5,4,3,2: Priority:
0: not available ... 7: Maximum
CAN ONLY BE CHANGED IF FRIGOPACK FU+ STOPPED FIRST:

5.4

Time settings:

Compressors with identical priorities >= 1 will be automatically swapped after the time set by the following parameter on page 4:
Dt7
000000EE: Special swop between VFsc1 and VFsc2, Enables: Extension Module
000000FF: Special swop between VFsc1 and VFsc2, Enables: D13 / D14
9XXXXXXX: Activate VFsc1 in bypass if there is a fault
AXXXXXXX: Enable multiplex FsC4 at D01
BXXXXXXX: Enable multiplex operation of FsC4 + Activate VFsc1 in bypass

81:Fsc ton DELAY
120 s

Setting _____ s
FsC, Switch-on delay +:
1 ... 1000 s

6.2

82:Fsc toff DELAY
10 s

Setting _____ s
FsC, Switch-off delay -:
1 ... 100 s

Commissioning:

86:FORCE ACTION +/-
Y YYY

Commissioning _____
Stage Controller force:
Left: Force input; Left: Status

5.5

Modifying

Password TECHNICIAN for Refrigeration Personnel: 8670

COMPRESSOR SETUP
SPECIAL ADJUSTMENTS
 FIRST SETUP

Menu SPECIAL ADJUSTMENTS of special parameters:
 View Level TECHNICIAN (for Refrigeration Personnel) only, see page 1

| Type | Explanation | Further inform. |
|-------|-------------|-----------------|
| Value | | |

<CONTROL

Sub-Menu <CONTROL of Optimizing Parameters

Settings

Controllers:

Units:

Operating Mode:

NEW

| | |
|------------------------|-----------|
| 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:tcd LIMITER P-GN | 25 |
| 97:START BULGE | 2.0% |

| | |
|-------------------|---------|
| 98:UNITS | bar, °C |
| 99:OPERATING MODE | D100 |

| | | |
|------------------------------|---|-----|
| Configuration 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 |
| Setting | ted Controller, Proportional gain: 1.0 ... 25.0 | |
| 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 % | |

Only change after reference to our Applications Department

| | |
|---------|---|
| Setting | Selectable units: bar, °C, K; psi, °F, °R; bar, °F, °R |
|---------|---|

| | |
|---------|---|
| Setting | Defines Operating Mode: Input as hexadecimal |
|---------|---|

| | |
|---------------|--|
| Setpoint ted: | XXX0 Setpoint ted1 / ted2 (DI3: Terminal X13.4) |
| | XXX1 Setpoint tedmax..ted1/ted2 (EM1..3 connected) |
| | XXX2 Setpoint ted1..ted2 (EM1..3 connected) |
| | XXX3 Test Setpoint ted = -100 °C |
| | XXX4 Cascade: Fast to 31:ted SETPOINT 1 |

| | |
|--------------|--|
| Setpoint tcm | XX0X Setpoints tcm1 / tcm2 (DI4: Terminal X12.1) |
| | XX1X Setpoints 0..tcm1/tcm2 (EM1..3 connected) |
| | XX2X Floating Condensing Temperature |
| | XX3X Test Setpoint tcm = +100 °C |

| | |
|-----------------------|--|
| Special functionality | X1XX Activate Capacity Controller |
| | X2XX Activate GRAY Code |
| | X4XX Stop at fmin after 74:VsC tmon fmin TIM |
| | X8XX Activate delayed Oil Injection |
| | 1XXX Trip reset: DI1 (0->1) / 0XXX->1XXX |
| | 2XXX Allow slow stop ramp |
| | 0XXX Relay Ready Safety Circuit & Enables all OK |
| | 4XXX DO1: & Not Inhibited |
| | 8XXX & DI1 (Control Switch) |
| | CXXX Sfty Crct &Enbl &DI1(Cntrl Swch) |

<DATA

Sub-Menu <DATA of Special Parameters

Only change after reference to our Applications Department

Controllers:

Control Mode:

| | |
|-----|----------|
| Dt0 | 70.0 Hz |
| Dt1 | 25.0 Hz |
| Dt7 | 1200 s |
| Dt8 | ECBAF008 |

| | | |
|------------------------------|---|-----|
| Configuration Setting | VsC: Motor Frequency max. settable 15.0 ... 120.0 Hz | 7.2 |
| Configuration Setting | VsC: Motor Frequency min. settable 15.0 ... 120.0 Hz | |

Dt0 and Dt1 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: 0 s: none; 60 s ... 65535 s swop |
|---------|--|

| | |
|---------|---|
| Setting | Activations: Functional and Outputs: FFFFFFFF ... 00000000 |
|---------|---|

| | |
|-----------|---|
| XXXX XXX0 | Activate Capacity Controller |
| XXXX XXX1 | Activate Capacity Controller |
| XXXX XXX2 | Activate extended current limit |
| XXXX XXX4 | Activate pc transmitter monitoring |
| XXXX XXX8 | Activate envelope frequency-range limiting |

| | |
|-----------|---|
| XXXX XX0X | Activate inverter motor heating |
| XXXX XX1X | Activate inverter motor heating |
| XXXX XX2X | Activate Autotune if there is a failed start |
| XXXX XX4X | View Level OPERATOR: Extend menus |
| XXXX XX8X | Activate Serial Communication |

| | |
|-----------|--------------------------------------|
| XXXX 00XX | 0: 0..+10 V Variable-speed fan Group |
| XXXX 11XX | 1: 0..+10 V Frequency (10 V = fmax) |
| XXXX 22XX | 2: 0..+10 V Hot-Gas Bypass control |

| | |
|-----------|--|
| XXXX 33XX | 3: Monitor fmin (see 74:VsC tmon fmin TIME) |
| XXXX 44XX | 4: Inhibit Sump Heater |
| XXXX 55XX | 5: More Condens. capacity required (cascade) |
| XXXX 66XX | 6: Maintenance recommended |
| XXXX 77XX | 7: Connect supply filter trap |
| XXXX 88XX | 8: Activate Capacity Control (CC) |
| XXXX 99XX | 9: Compressor turning / Start lubrication |

| | |
|-----------|--|
| AAAA AAXX | A: Activate Compressor VFsC1 |
| BBBB BBXX | B: Activate Compressor VFsC2 / FsC2 |
| CCCC CCXX | C: Activate Compressor FsC3 |
| XXXX DXXX | D: Activate Compressor FsC4 (AO2) |
| E - - - - | E: Activate Compressor FsC5 (MUX of DO1) |
| FFFF FFXF | F: Activate Expansion Valve |

| | |
|---|--|
| Selectable outputs: | |
| (DO5) | |
| (DO4) | |
| DO3 | |
| DO2 | |
| AO2 | |
| AO1 | |
| Settings | |
| Logic outputs with AO1, AO2 (special ext. relays) | |

SD MC Card:

| | |
|-----|------|
| Dt9 | _16c |
|-----|------|

| | |
|---------|--|
| Setting | SD-MC (Secure Data Memory Card): Revision Designation |
|---------|--|

Modifying

Password TECHNICIAN for Refrigeration Personnel: 8670

<SPECIALS

Sub-Menu <SPECIALS of Expert Parameters

Only change after reference to our Applications Department

7.3

Pressure transmitters

Sp0
XX22

| | | | | | | | | | | | | | | | | | | | | | |
|------------------------|--|------|----------|------|------------------|------|-------------------------|------|------------------|------|------------------|------|------------------|------|------------------|------|---------------|------|---------------|------|--|
| Setting | Pressure transmitter measurement ranges: pc, pe (4...20 mA) | | | | | | | | | | | | | | | | | | | | |
| BM-1: AI1 4...20 mA | <table border="1"> <tr><td>XXX0</td><td>Not used</td></tr> <tr><td>XXX1</td><td>-1.0 ... 9.0 bar</td></tr> <tr><td>XXX2</td><td>-0.5 ... 7.0 bar</td></tr> <tr><td>XXX3</td><td>0.0 ... 25.0 bar</td></tr> <tr><td>XXX4</td><td>0.0 ... 30.0 bar</td></tr> <tr><td>XXX5</td><td>0.0 ... 40.0 bar</td></tr> <tr><td>XXX6</td><td>0.0 ... 60.0 bar</td></tr> <tr><td>XXX7</td><td>0 ... 100 bar</td></tr> <tr><td>XXX8</td><td>0 ... 160 bar</td></tr> <tr><td>XX2X</td><td></td></tr> </table> | XXX0 | Not used | XXX1 | -1.0 ... 9.0 bar | XXX2 | -0.5 ... 7.0 bar | XXX3 | 0.0 ... 25.0 bar | XXX4 | 0.0 ... 30.0 bar | XXX5 | 0.0 ... 40.0 bar | XXX6 | 0.0 ... 60.0 bar | XXX7 | 0 ... 100 bar | XXX8 | 0 ... 160 bar | XX2X | |
| XXX0 | Not used | | | | | | | | | | | | | | | | | | | | |
| XXX1 | -1.0 ... 9.0 bar | | | | | | | | | | | | | | | | | | | | |
| XXX2 | -0.5 ... 7.0 bar | | | | | | | | | | | | | | | | | | | | |
| XXX3 | 0.0 ... 25.0 bar | | | | | | | | | | | | | | | | | | | | |
| XXX4 | 0.0 ... 30.0 bar | | | | | | | | | | | | | | | | | | | | |
| XXX5 | 0.0 ... 40.0 bar | | | | | | | | | | | | | | | | | | | | |
| XXX6 | 0.0 ... 60.0 bar | | | | | | | | | | | | | | | | | | | | |
| XXX7 | 0 ... 100 bar | | | | | | | | | | | | | | | | | | | | |
| XXX8 | 0 ... 160 bar | | | | | | | | | | | | | | | | | | | | |
| XX2X | | | | | | | | | | | | | | | | | | | | | |

Speed Setpoint Conditioning

Sp1
0064

| | |
|---------|--|
| Setting | Lubricating / Force Frequency: 0064 = 50.0 Hz |
|---------|--|

Limiter Gains

Sp2
8CC4

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

Sp3
8C1E

| | |
|---------|---|
| Setting | Lubrication: P gain, Press. +1.0 bar (25.12 2.0-1.0 bar) |
|---------|---|

Sp4
8C46

| | |
|---------|---|
| Setting | Suction-gas Superheat limiter: P gain, ts - ted (25.12 5.01 K) |
|---------|---|

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) |
|---------|--|

Further Resonance Avoidance

Sp7
FFFF

| | |
|---------|---|
| Setting | Further Skip Frequency 3: Maximum+Minimum, hexadecimal coded |
|---------|---|

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 |
|---------|--|

Capacity Controller

SpA
648C

| | |
|---------|--|
| Setting | Rack control: Controller: I time const. (0.1 s), P gain |
|---------|--|

SpB
9F46

| | |
|---------|---|
| Setting | Capacity control: Reserve, Hot-Gas Bypass gain |
|---------|---|

SpC
F897

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

Current Profile

SpD
B4DC

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

Other settings

SpE
8C8C

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

Low Ambient Start

SpF
0000

| | |
|---------|--|
| Setting | Low-Ambient Start (LAS): tmin (- °C), TBD |
|---------|--|

External Energy Meter

SpG
0000

| | |
|---------|---------------------------------------|
| Setting | External Energy Meter: Pulse in kW |
|---------|---------------------------------------|

External input Harmonic Filter

SpH
0000

| | |
|---------|--|
| Setting | External input harmonic filter: Activate trap connect |
|---------|--|

Other settings

SpI
3FFA

| | |
|------------------------|--|
| Setting | LOCAL_Energy Saving_ Flux reduction_Flux characteristic |
| Base Voltage: | XXXA F..A..0: Max(110%)..Normal(100%)..Min(80%) |
| Energy Saving, | |
| - Max Volt. Reduction: | XXFX F..0: None(100%)..Min(70%) |
| - Min. acting freq.: | XFXX 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 1 Hz / s |
| | 4XXX 2 Hz / s |
| | 5XXX 5 Hz / s |
| | 6XXX 10 Hz / s |

Resetting values

SpJ
0000

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

Limiting Ranges (night operation)

SpK
0000

| | |
|---------|--|
| Setting | Limit ranges of VfG(links) and VfG(rights). Activation when Ext. Module EM connected. |
|---------|--|

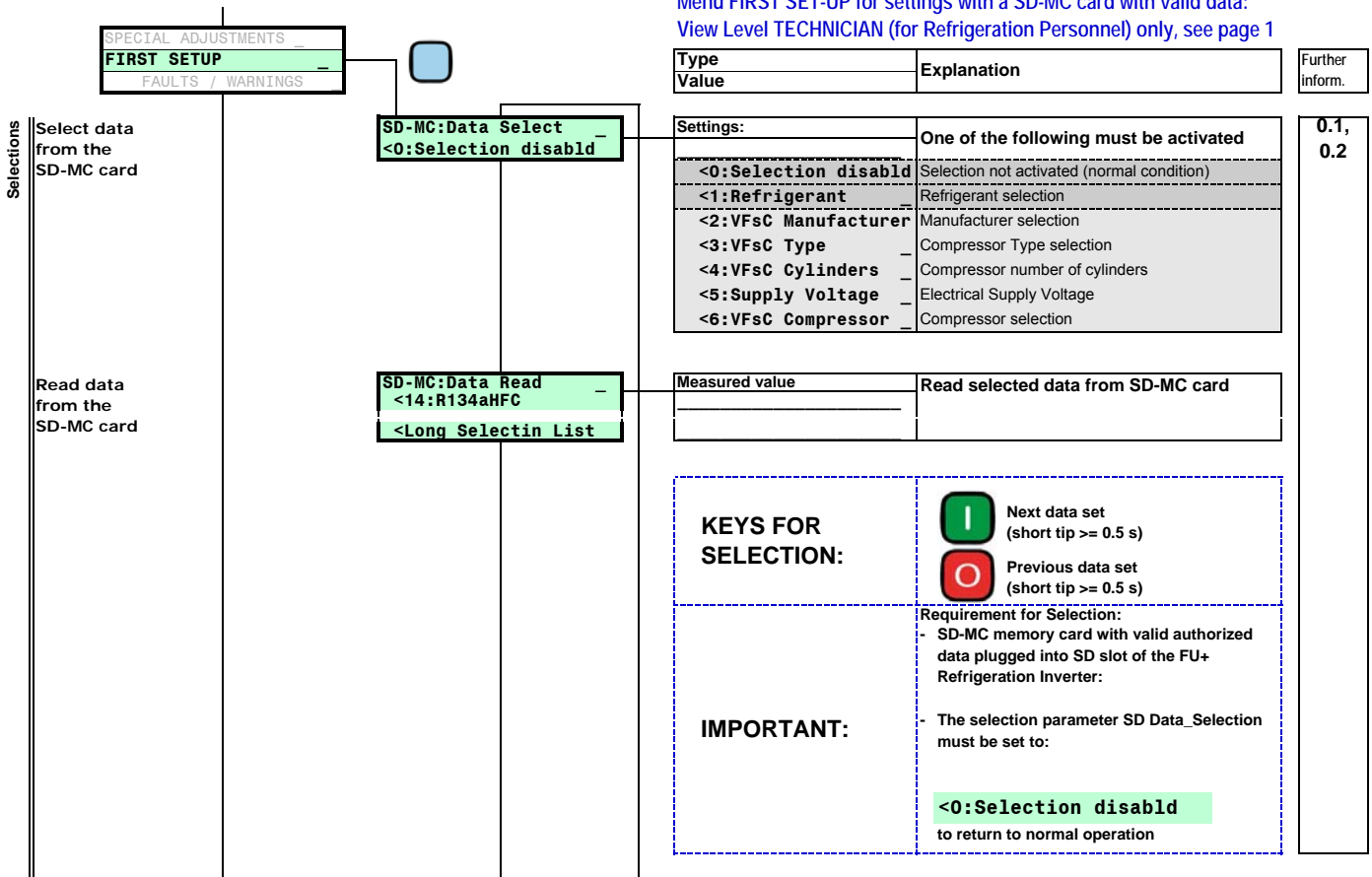
Modifying

Modifying

Password TECHNICIAN for Refrigeration Personnel: 8670

Password for Refrigeration Personnel with FrigoPack FU+ Training required

Menu FIRST SET-UP for settings with a SD-MC card with valid data:
View Level TECHNICIAN (for Refrigeration Personnel) only, see page 1



| Selectable data from the SD-MC card | | SD-MC: Secure Digital - Memory Card | |
|-------------------------------------|-------------------------------|---|---|
| FrigoSoft 1.7: Standard | | | |
| Compressor pre-selections: | REFRIGERANT selection: | 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 |
| | <20:noname | <24:DORIN | <28:GEA-Bock |
| | <21:BITZER | <25:EMERSON | <29:HANBELL |
| | <22:CARLYLE | <26:FRASCOLD | <2A:HITACHI |
| | <23:DANFOSS | <27:FRIGOPOL | <2B:J&EHALL |
| | <2C:LGE | <2D:SANYO | <2E:TECUMSEH |
| <2F:other | | | |
| <30:notype | <34:Recipopen | <38:ScrewOpen | |
| <31:RecipHermetic | <35:ScrewHermetic | <39:Scroll | |
| <32:RecipSemihermtc | <36:ScrewSemihermtc | <3A:Reserve | |
| <33:Recip2-stage | <37:ScrewCompact | | |
| <40:Nocylinders | <44:4 cylinders | <48:8 cylinders | <4C:12 cylinders |
| <41:1 cylinder | - | - | - |
| <42:2 cylinders | <46:6 cylinders | <4A:10 cylinders | - |
| <43:3 cylinders | - | - | <4F:(15+ cylinders) |
| Supply Voltage at 50/60 Hz: | <50:notdefined | <54:50Hz420V | <58:60Hz200V |
| | <51:50Hz200V | <55:50Hz500V | <59:60Hz208V |
| | <52:50Hz230V | <56:50Hz690V | <5A:60Hz230V |
| | <53:50Hz400V | <57:50HztbDV | <5B:60Hz380V |
| | | | <5C:60Hz460V |
| | | | <5D:60Hz575V |
| | | | <5E:60Hz660V |
| | | | <5F:other |
| VsC COMPRESSOR selection: | <No_Data_selected_ | | |

| | | | | | |
|-------------------|------------------|--------------------------------------|---------|---|-----|
| Selections | 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 |
| | Language: | Language ENGLISH | Setting | Set Language | 0.4 |
| | Units: | 98:UNITS bar, °C | Setting | Selectable units: bar, °C, K; psi, °F, °R; bar, °F, °R | 7.5 |
| | Installation ID: | Installation Name FrigoPack_FU+ | Setting | Welcome text in Control Menu: 16 settable characters: | 0.5 |

Settings

FIRST SETUP
FAULTS / WARNINGS
 COMMUNICATION

First Trip NONE For details

Active 1 - 32 XXXXXXXX For details

Active 33 - 64 000000XX For details

Warnings 1 - 32 XXXXXXXX For details

Warnings 33 - 64 000000XX For details

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] YYYYYYY s

Recent Trip Times[1] YYYYYYY s

Recent Trip Times[2] YYYYYYY s

Recent Trip Times[3] YYYYYYY s

Recent Trip Times[4] YYYYYYY s

Recent Trip Times[5] YYYYYYY s

Recent Trip Times[6] YYYYYYY s

Recent Trip Times[7] YYYYYYY s

Recent Trip Times[8] YYYYYYY s

Recent Trip Times[9] YYYYYYY s

Control Board Up Time YYYYYYY s

AR Restarts remaining

AR Time remaining YYYYY.Y s

COMMON TRIPS YY

All Users

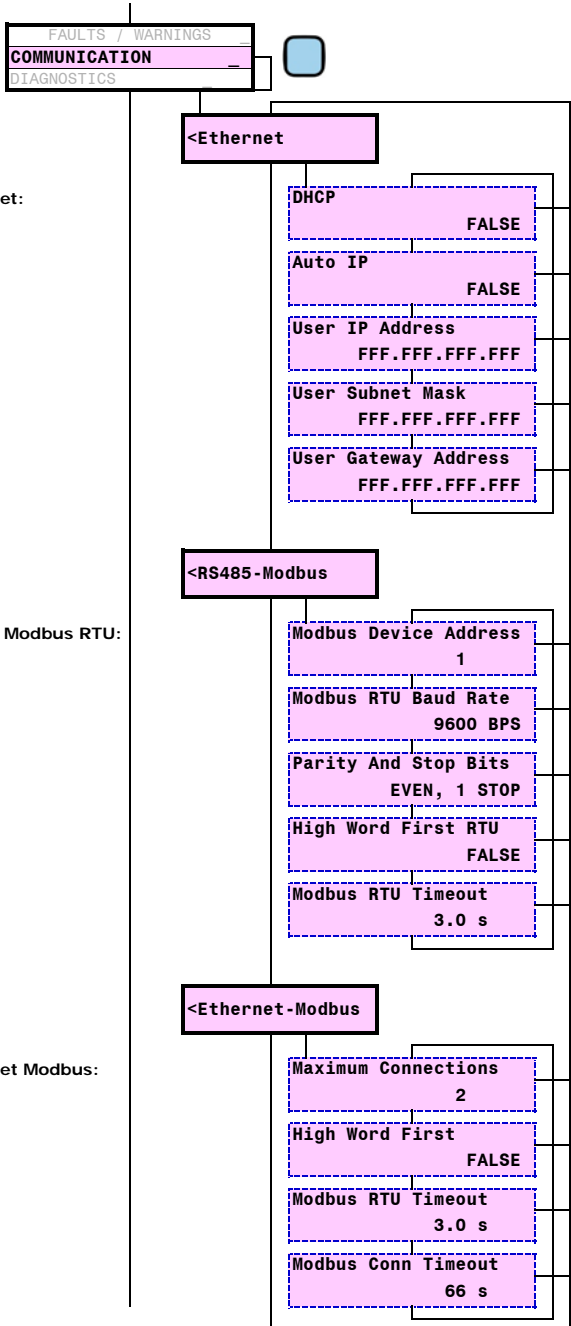
| Type Value | Explanation | Further inform. |
|----------------|---|-----------------|
| Measured value | Trip which caused shut down | 10.0 |
| Measured value | Code of active trips (hexadecimal) | |
| Measured value | Code of active trips (hexadecimal) | |
| Measured value | Code of active warnings (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 | Recent Trip Time 1 (latest) | |
| Measured value | Recent Trip Time 2 | |
| Measured value | Recent Trip Time 3 | |
| Measured value | Recent Trip Time 4 | |
| Measured value | Recent Trip Time 5 | |
| Measured value | Recent Trip Time 6 | |
| Measured value | Recent Trip Time 7 | |
| Measured value | Recent Trip Time 8 | |
| Measured value | Recent Trip Time 9 | |
| Measured value | Recent Trip Time 10 (oldest) | |
| Measured value | Control board powered-up time (to time-stamp trips if no RTC) | |
| Measured value | Autorestarts remaining | |
| Measured value | Autorestart time remaining until next start attempt | |
| Measured value | Accumulation of trip prime numbers | |

Trips, Diagnosis, Fault Finding

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

ELECTRICAL → REFRIGERATION ←

COMMUNICATION



Menu COMMUNICATION for setting up Communications:
View Level TECHNICIAN (for Refrigeration Personnel) only, see page 1

| Type | Explanation | Further inform. |
|-------|-------------|-----------------|
| Value | | |

Ethernet local area network

| Setting | Explanation | 12.1 |
|-----------------------------|-----------------------------|------|
| Ethernet local area network | Ethernet local area network | |
| Auto IP | Automatic IP generation | |
| User IP Address | User set IP address | |
| User Subnet Mask | User set Subnet Mask | |
| User Gateway Address | User set Gateway Address | |

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

| Setting | Address | 12.2 |
|-----------------------|--|------|
| Modbus Device Address | 1..247 | |
| Modbus RTU Baud Rate | 1200..115200 BPS | |
| Parity And Stop Bits | Parity and Stop Bits | |
| High Word First RTU | High-word first for 32-Bit interrogations | |
| Modbus RTU Timeout | No activity Timeout (Watchdog) 0.0 .. 65.0 s | |

Modbus over Ethernet

| Setting | Maximum number of connections | 12.2 |
|---------------------|--|------|
| Maximum Connections | Maximum number of connections | |
| High Word First | High-word first for 32-Bit interrogations | |
| Modbus RTU Timeout | No Modbus RTU activity Timeout 0.0 .. 65.0 s | |
| Modbus Conn Timeout | No Ethernet Fieldbus activity 0 .. 100000 s | |

Top Menu - Run Wizard?

Menu 'Run Wizard?' to reset to factory defaults:
View Level TECHNICIAN (for Refrigeration Personnel) only, see page 1

| Type | Explanation | Further inform. |
|-------|-------------|-----------------|
| Value | | |

Reset to factory settings:

Reset to defaults
FALSE

| Setting | Reset to factory defaults | 13.1 |
|-------------------|---------------------------|------|
| Reset to defaults | Reset to factory defaults | |

Set to TRUE followed by pressing the central blue key 4 times

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

Password TECHNICIAN for Refrigeration Personnel: 8670

Modifying

Keypad FU+ PROG:
Keys:



| Key | Navigation Mode | Edit Mode |
|-----------|----------------------------------|--|
| Softkey 1 | Previous level menu | Edit Mode |
| UP | Moves up list of parameters | Increments displayed parameter |
| DOWN | Moves down list of parameters | Increments displayed parameter |
| LEFT | Previous level menu or parameter | Selects the digit to be changed |
| RIGHT | Next level menu or parameter | Selects the digit to be changed |
| OK | Next level menu or parameter | Edit mode when a parameter is selected |
| '1' '0' | Refer to pages 7, 19 | Refer to pages 7, 19 |

Menu, Diagnostics:
Diagnostics and other Monitoring Data

Diagnostics

COMMUNICATION
DIAGNOSTICS
EXPERT OVERVIEW

Sequencing and Limits:

SEQUENCING STATES
YY _ Y

STARTS---ENABLES---
YYYY YYYY YYYY YYYY

LIMITING CONDITIONS
YYYY YYYY YYYY YYYY

Relative Rack Capacity (volume flow):

Electrical Values:

Temperatures:

Power Module:

Control Module:

Compressor:

Maintenance :

Avg_Rack_Power_Actl_
 YYY.Y % Y.YYY %

DC LINK MOTOR
 YYY V YYY V

BASE FRQ POWER
 YY.Y Hz YY.Y kW

Cntrl Modl Heat Sink
 YY.Y °C YY.Y °C

Power Stack Fitted
 YYYYYYYYYYYYYY

Stack Serial No
 YYYYYYYYYYYYYY

HV SMPS Up Time
 YYYYYYYYYY s

HV Power On Count
 YYYYYYYYYYYYYY

Control Module Serial
 YYYYYYYYYYYYYY

Control Board Up Time
 YYYYYYYYYY s

VsC Serial Number
 YYYYYYYYYYYYYY

Motor Run Time
 YYYYYYYYYY s

Motor start count
 YYYYYYYYYY

VsC equiv 50 Hz time
 YYYYYYYYYY s

Fan equiv 40 °C time
 YYYYYYYYYY s

| Type | Explanation | Further Inform. |
|------------------------|-----------------------------|-----------------|
| Internal value | Modbus over Ethernet | 11.1 |
| Left: | Right: | |
| 0:Stpdd Rly 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: |
|---------------------|--|
| | Starting, Limiting |
| 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 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 Isesco start |
| XXX1 XXXX XXXX XXXX | External Start Signal A11 or A12 > 0.0 V |
| xx1X XXXX XXXX XXXX | Compr. Swop active Swop time >= 0 s |

| Internal value | Logical conditions: |
|---------------------|---------------------------------------|
| ' | Limiting conditions |
| XXXX XXXX XXXX XXX1 | tcd >= tcd 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 |

| | | |
|----------------|--|------|
| Measured value | Compressor Rack, Relative Capacity: 30(long) / 7 day(short) average and Actual | 11.2 |
|----------------|--|------|

| | | |
|-------------------|----------------------------|--|
| Calculated values | DC Link and motor voltages | |
|-------------------|----------------------------|--|

| | | |
|------------------|-------------------------------------|--|
| Calculated value | Actual Base Frequency _ Motor power | |
|------------------|-------------------------------------|--|

| | | |
|----------------|--|------|
| Measured value | Heatsink and Control Module Temperatures | 11.3 |
|----------------|--|------|

| | | |
|----------------|-----------------|------|
| Measured value | Power Size Code | 11.4 |
|----------------|-----------------|------|

| | | |
|----------------|---------------------|--|
| Measured value | Stack Serial Number | |
|----------------|---------------------|--|

| | | |
|----------------|------------------------------------|--|
| Measured value | Switched-Mode Power Supply ON time | |
|----------------|------------------------------------|--|

| | | |
|-----------------|---|--|
| 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 | |
|-----------------|--------------------|--|

| | | |
|-----------------|------------------------|--|
| Measured values | Number of motor starts | |
|-----------------|------------------------|--|

| | | |
|-----------------|---|------|
| Measured values | VsC Compr. Equiv. 50 Hz remaining operation | 11.6 |
|-----------------|---|------|

| | | |
|-----------------|--|--|
| Measured values | Fan equivalent 40 °C remaining operation | |
|-----------------|--|--|

Password TECHNICIAN for Refrigeration Personnel with training required

Keypad FU+ PROG:
Diagnosis:

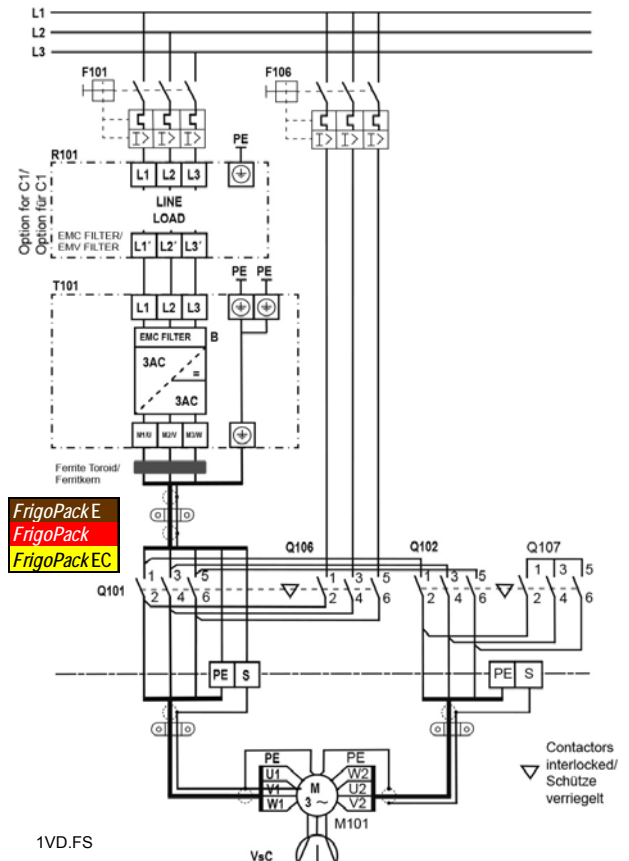
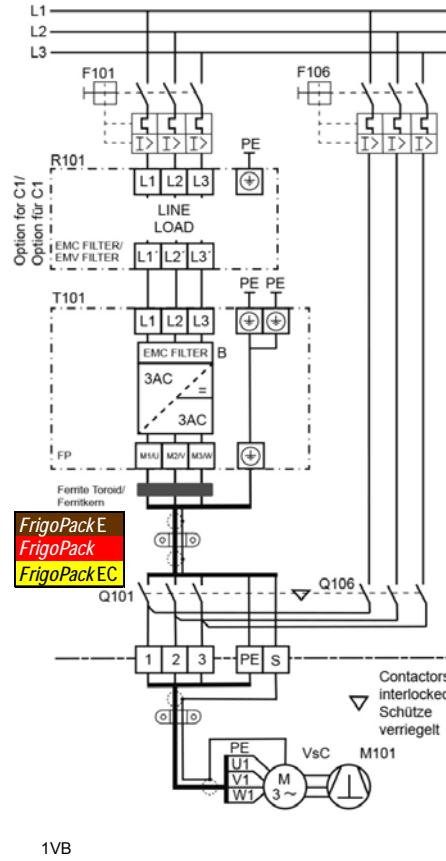
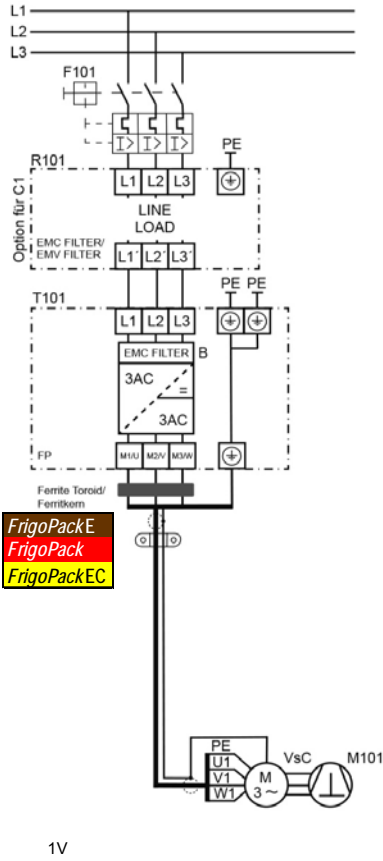


| Light State | Explanation |
|-------------------------|-----------------|
| Green | Running |
| Red | Stopped |
| Flashing Green | Auto Start |
| Flashing Red | Not Operational |
| Green then Red Flashing | Tripped / Fault |

DIAGNOSTICS

POWER SECTION

Power connections



Single compressor (basic connection)

Settings: 80:Fsc PRIORITY CNTRL
Dt8:

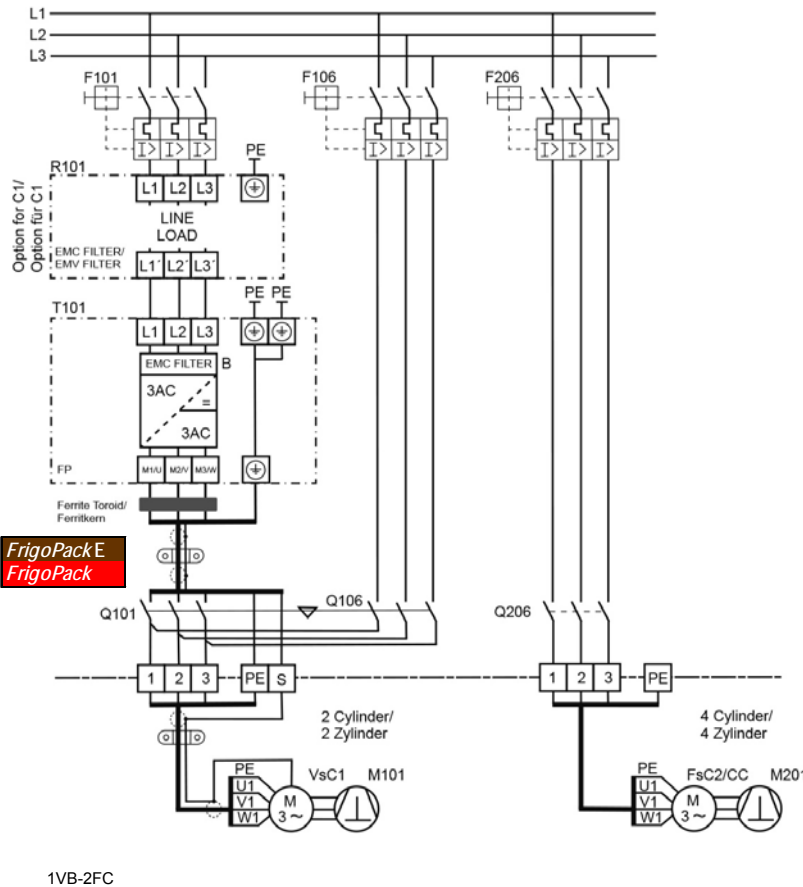
Single compressor with bypass for emergency operation

0000000 (See page 4)
ECBAF008 (See page 5)

Single compressor in DELTA with bypass in STAR for emergency operation

| Digital Control Outputs | | Place/Part |
|-------------------------|------------|------------------------|
| Relay DO1 | Ready: | FrigoPack FrigoPack |
| Relay DO2 | Operation: | VsC FrigoPack |

POWER SECTION

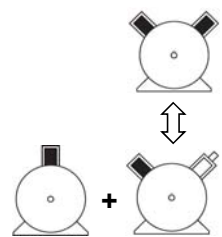


1VB-2FC

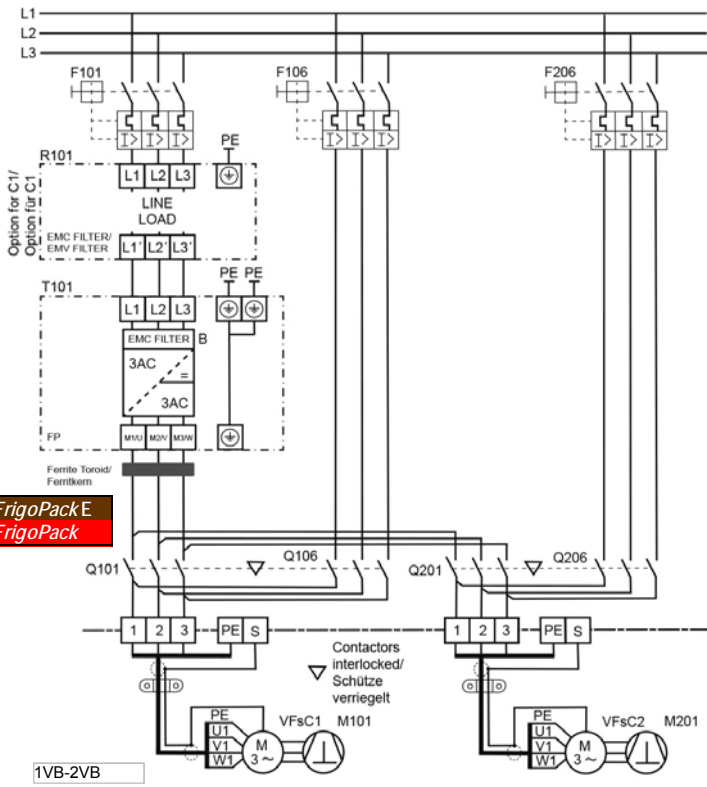
Variable-speed compressor with second larger compressor with Capacity Control

Settings: 80:Fsc PRIORITY CNTRL 00000001 (See page 4) * Accessory required:
Dt8: ECBAF008 (See page 5)

| Digital Control Outputs | | Place/Part |
|-------------------------|------------------|------------------------|
| Relay DO1 | Ready: | FrigoPack FrigoPack |
| Relay DO2 | Operation: | VsC1 FrigoPack |
| Relay DO3 | Operation: | FsC2 FrigoPack |
| Relay DO4 | Capacity Control | Extern.P24 V |
| Relay AO2 | Expansion | Ext. P12 V * |



A FU+ DC12V RL/11
(Special low coil-current relay module)
QSG31516



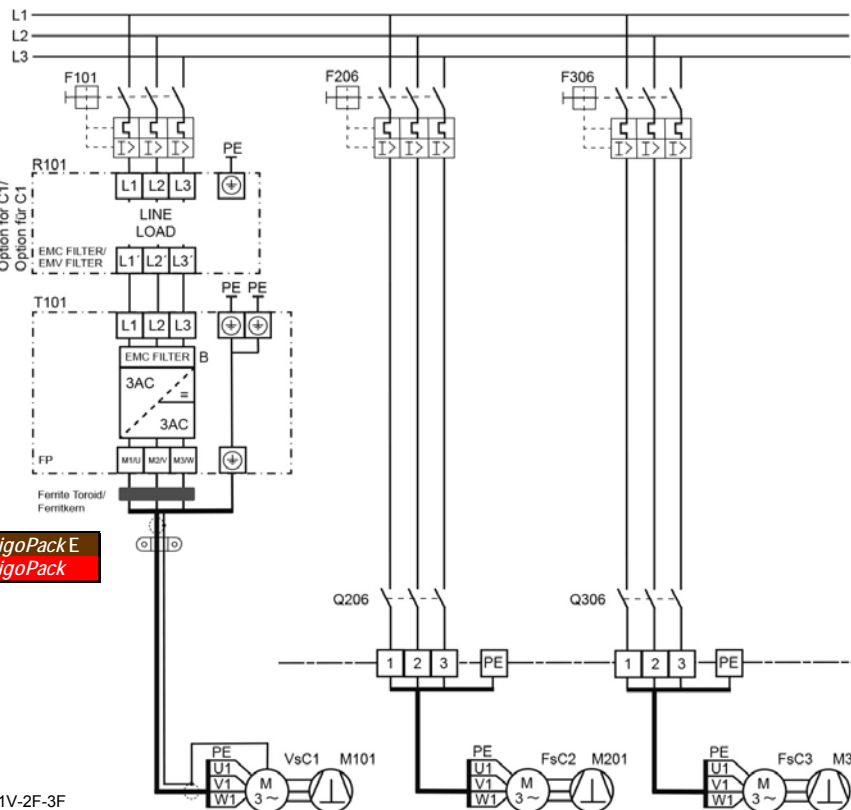
FrigoPack E
FrigoPack

| Digital Control Outputs | | | Place/Part |
|-------------------------|------------|-----------|--------------|
| Relay DO1 | Ready: | FrigoPack | FrigoPack |
| Relay DO2 | Operation: | VFSc1 | FrigoPack |
| Relay DO3 | Operation: | VFSc2 | FrigoPack |
| Relay AO2 | Expansion | | Ext. P12 V * |

Settings: 80:Fsc PRIORITY CNTRL 000000EE / (See page 4)
000000FF
Dt8: ECBAF008 (See page 5)

* **Accessory required:** A FU+ DC12V RL/11 (Special low coil-current relay module)

Two compressors, each with bypass and swopping (Rotation)



FrigoPack E
FrigoPack

| Digital Control Outputs | | | Place/Part |
|-------------------------|------------|-----------|--------------|
| Relay DO1 | Ready: | FrigoPack | FrigoPack |
| Relay DO2 | Operation: | VsC1 | FrigoPack |
| Relay DO3 | Operation: | FsC2 | FrigoPack |
| Relay DO4 | Operation: | FsC3 | Ext. P24 V |
| Relay AO2 | Expansion | | Ext. P12 V * |

Three compressors, two Fixed-speed Compressors with swopping (Rotation)

Settings: 80:Fsc PRIORITY CNTRL 00000011 (See page 4)
Dt8: ECBAF008 (See page 5)

* **Accessory required:** A FU+ DC12V RL/11 (Special low coil-current relay module)

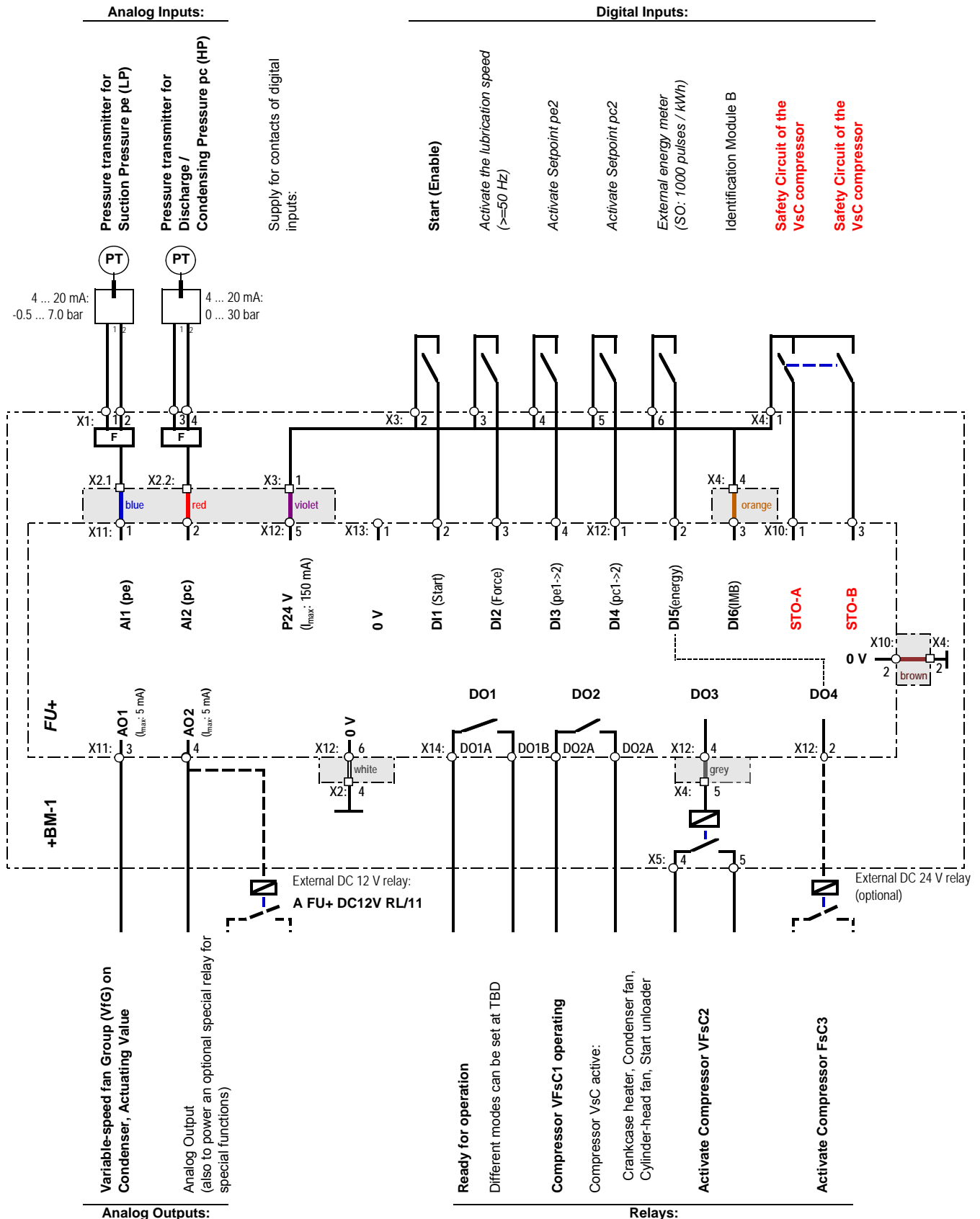
Various other configurations are possible (e.g. up to 8 compressors), please enquire.

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/ |
| M2/V | | | 7.7.2 |
| M3/W | | | |
| PE | Protective earth connection to compressor motor | | 7.7.2 |

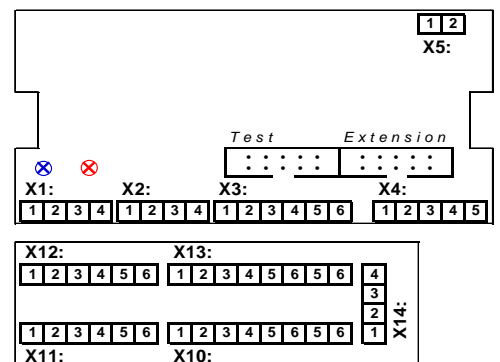
POWER SECTION

FrigoSoft 1.7 activated: Basic 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 position:



Terminal List for control functions

FrigoSoft 1.7 activated: Basic Pressure Control:

| Terminal / Designation | Signal / Function | Explanation | Further information |
|--------------------------|---|--|---------------------|
| BM-1: X1.1 / 2 | A11 Analog Input: Pressure transmitter for Suction Pressure pe (LP) 4...20 mA: -0.5 ... 7.0 bar 0 mA: Fault | - Must be used - Suitable pressure transducer: - A REF-P-TRANSD-LP7+PL - Connections: 1->X1.1, 2->X1.2 | |
| BM-1: X1.3 / 4 | A12 Analog Input: Pressure transmitter for Discharge / Condensing 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 Digital Input: Start (Enable) +24 V: Controlled stop 0 V: Start | - Must be used: - Load: 3.3 kΩ, 7.3 mA | |
| BM-1: X3.2/ X13.3 | DI2 Digital Input: Activate Lubrication Speed (50 Hz) +24 V: Lubrication speed 0 V: Normal operation | - Optional use - Load: 3.3 kΩ, 7.3 mA | |
| BM-1: X3.3/ X13.4 | DI3 Digital Input: Activate Setpoint pe2 +24 V: Setpoint pe2 0 V: No action | - Optional use - Load: 3.3 kΩ, 7.3 mA | |
| BM-1: X3.4/ X12.1 | DI4 Digital Input: Activate Setpoint pc2 +24 V: Setpoint pc2 0 V: No action | - Optional use - Load: 3.3 kΩ, 7.3 mA | |
| BM-1: X3.5/ X12.2 | DI5 Digital Input: Pulses from Energy Meter +24 V: Pulse 0 V: Not activated | - Optional use - Load: 3.3 kΩ, 7.3 mA | |
| X12.3 | DI6 Digital Input: Identification Module BM-1 (>=50 Hz) +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 Digital Input STO (Safe Torque Off), Channel A +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 Ground for Safe Torque Off | - Must be used | |
| X10.3 | STO-B Digital Input STO (Safe Torque Off), Channel 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 | DO1 Relay Output: "Ready" (without fault) 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 | DO2 Relay Output with alternative functionality: - Single compressor: - VsC1 Operating / - 1, 3 or more compressors without swop: - 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 | DO3 Relay Output with alternative functionality: - 1, 3 or more compressors: - Activate Compressor FSc2 - 2 compressors with swop: - VFSc2 Operating Closed: Operation / Activate Open: Stop, Deactivated | - Activate FSc2 - Activate VFSc2 - Max load: AC 230 V / 250 VA | |
| X13:2 | DO4 Relay Output with alternative functionality: - 1, 3 or more compressors: - 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 Analog Output with alternative functionality: VfG Condenser fan, actuating value 0...+10 V: 0.0 ... 100.00 % | Function depends on the following setting: SPECIAL ADJUSTMENTS _ Dt8 - Max load: 5 mA | |
| X11.4 | AO2 Analog Output with alternative functionality: P10 V 0...+10 V: 0.0 ... 100.00 % | Function depends on the following setting: SPECIAL ADJUSTMENTS _ Dt8 - 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 SECTION

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 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 signalled 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

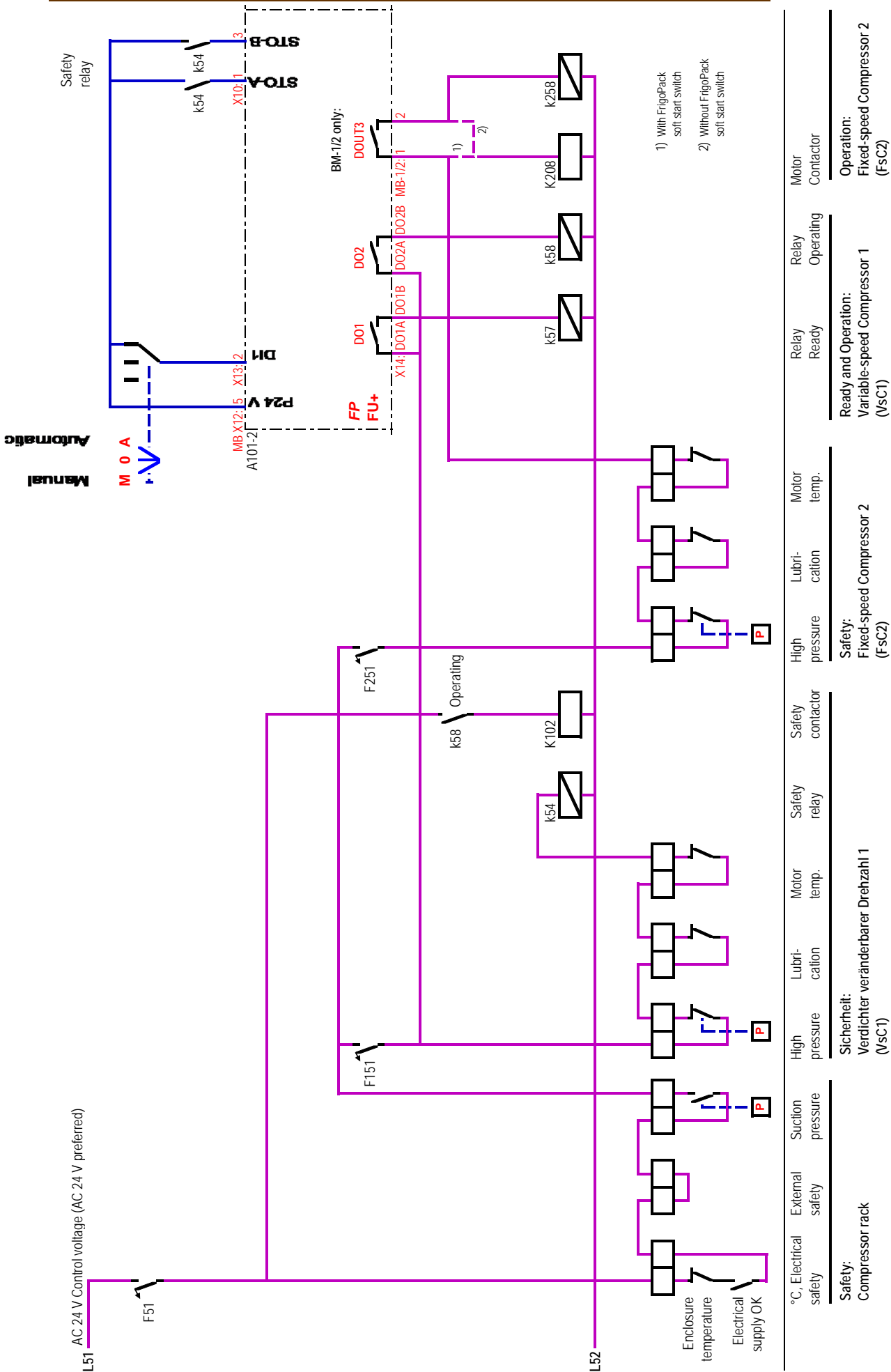
The following simplified overview of the safety and control wiring of a typical system only includes the wiring for AUTOMATIC operation.

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

FrigoSoft 1.7 activated: Basic Pressure Control:



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

| | | | | | | | | | | | | | | | | | | |
|---|--|--|---|---|---|--|--|---|--|--|---|--|---|--|---|--|---|--|
| AC 24 V Control voltage (AC 24 V preferred) | F51 | L51 | Enclosure temperature | Electrical supply OK | Suction pressure | High pressure | Lubrication | Motor temp. | Safety relay | Safety contactor | High pressure | Lubrication | Motor temp. | Variable-speed Compressor 2 (VsC2) | Fixed-speed Compressor 2 (FSc2) | | | |
| °C, Electrical safety | External safety | Suction pressure | High pressure | Lubrication | Motor temp. | Safety relay | Safety contactor | High pressure | Lubrication | Motor temp. | Variable-speed Compressor 1 (VsC1) | Fixed-speed Compressor 2 (FSc2) | Motor temp. | Motor Contactor | Relay Operating | Relay Ready | Motor Contactor | |
| Safety: Compressor rack | Sicherheit: Verdichter veränderbarer Drehzahl 1 (VsC1) | Sicherheit: Verdichter veränderbarer Drehzahl 1 (VsC1) | Safety: Fixed-speed Compressor 2 (FSc2) | Safety: Fixed-speed Compressor 2 (FSc2) | Ready and Operation: Variable-speed Compressor 1 (VsC1) | Operation: Fixed-speed Compressor 2 (FSc2) | Operation: Fixed-speed Compressor 2 (FSc2) | Ready and Operation: Variable-speed Compressor 1 (VsC1) | Operation: Fixed-speed Compressor 2 (FSc2) | Operation: Fixed-speed Compressor 2 (FSc2) | Ready and Operation: Variable-speed Compressor 1 (VsC1) | Operation: Fixed-speed Compressor 2 (FSc2) | Ready and Operation: Variable-speed Compressor 1 (VsC1) | Operation: Fixed-speed Compressor 2 (FSc2) | Ready and Operation: Variable-speed Compressor 1 (VsC1) | Operation: Fixed-speed Compressor 2 (FSc2) | Ready and Operation: Variable-speed Compressor 1 (VsC1) | Operation: Fixed-speed Compressor 2 (FSc2) |

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 preset 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 |
|--|--|

For other preset pressure ranges refer to page 6.

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.

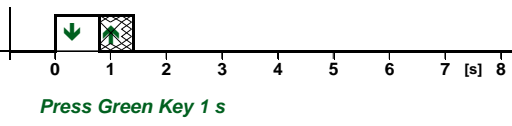
Recommended basic commissioning steps (cont.):

- 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 disabl

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

Further inform. tbd

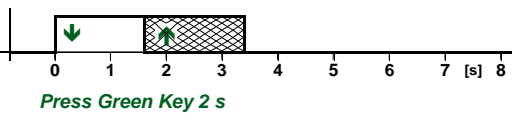
| Timed Operation: | Key: | Action: | Amount: |
|------------------|------|---------|---------|
|------------------|------|---------|---------|



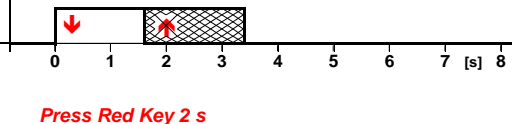
I Increase speed in LOCAL: +1 Hz
Reset Inhibit Timer:
SD FIRST-TIME SETUP setup mode (page 6,7):
Next set of data.



O Reduce speed in LOCAL: -1 Hz
Reset trip:
SD FIRST-TIME SETUP setup mode (page 6,7):
Previous set of data.



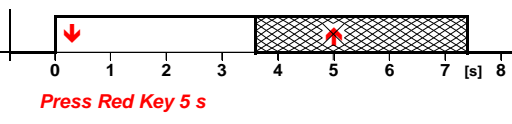
I Increase speed in LOCAL: +5 Hz



O 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

Press Green and Red Keys together 2 s and release

I + O Interrogate Application Software version:
Project: +5 s
Version: +5 s



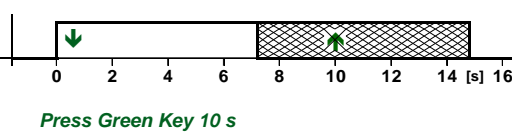
O Stop and LOCAL reset: 0 Hz

Press Green and Red Keys together 5 s and release

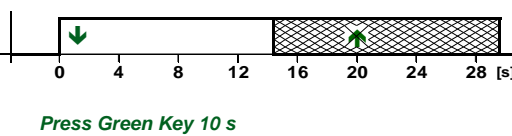
O + I Start LOCAL operation: fmin
With Digital Input DI2 activated: 50 Hz
Set LOCAL frequency as described above: fmin..fmax

Repeat two key activation:

Set LOCAL test ramping (continuous up and down): 1 Hz ↑↓ / 2 s



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



I Reset diagnostic values: Refer to SPECIALS | SpJ on page 5:

FIRST-TIME POWER UP

Setting-up step by step

Starting condition:

| | |
|----------------------|---|
| SD-MC:Data Select | - |
| <0:Selection disabld | - |
| 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
- After 1 s on release: -1 Refrigerant

Select Refrigerant:

| | |
|-----------------|---|
| SD-MC:Data Read | - |
| <14:R134aHFC | - |

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
- After 1 s on release: -1 Manufacturer

Select manufacturer:

| | |
|-----------------|---|
| SD-MC:Data Read | - |
| <21:BITZER | - |

2b. Set Type selection mode:



| | |
|-------------------|---|
| SD-MC:Data Select | - |
| <3:VFSc Type | - |

Modify if necessary:

- After 1 s on release: +1 Type
- After 1 s on release: -1 Type

Select Type:

| | |
|---------------------|---|
| SD-MC:Data Read | - |
| <32:RecipSemihermtc | - |

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
- After 1 s on release: -1 Cylinder

Select no.:

| | |
|-----------------|---|
| SD-MC:Data Read | - |
| <44:4 cylinders | - |

2d. Set Supply voltage:



| | |
|-------------------|---|
| SD-MC:Data Select | - |
| <5:Supply Voltage | - |

Modify if necessary:

- After 1 s on release: +1 Voltage
- After 1 s on release: -1 Voltage

Select supply voltage:

| | |
|-----------------|---|
| SD-MC:Data Read | - |
| <53:50Hz400V | - |

2: COMPRESSOR:

Set Compressor selection mode:



| | |
|--------------------|---|
| SD-MC:Data Select | - |
| <6:VFSc Compressor | - |

Select compressor:

- After 1 s on release: +1 Compressor
- After 1 s on release: -1 Compressor

Select compressor:

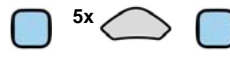
| | |
|---------------------|---|
| SD-MC:Data Read | - |
| <Long Selectin List | - |

VERY IMPORTANT:

Deactivate after completion of steps 1 and 2a...2d:

Alternative: Wait 60 s, then automatic deactivation:

Reset to starting position:



| | |
|----------------------|---|
| SD-MC:Data Select | - |
| <0:Selection disabld | - |

Indication:

| | |
|-----------------|---|
| SD-MC:Data Read | - |
|-----------------|---|

VERIFICATION OF SETTINGS:

Select menu:

| | |
|-----------|---|
| OPERATION | - |
|-----------|---|

Verify settings:

| | |
|-----------------|-----|
| 25: REFRIGERANT | - |
| <14: R134a | HFC |

| | |
|----------------|---------|
| 60: COMPRESSOR | - |
| <6 | 2CES-4Y |

Example compressor

Expert Overview

| | |
|-----------------|---|
| DIAGNOSTICS | - |
| EXPERT OVERVIEW | - |
| OPERATION | - |

| | | |
|------------------------|---------|----------|
| 04:ted_Rack_tcm Diff | Y.Y K | Y.Y K |
| 02:ted_Rack_tcd | Y.Y °C | YY.Y °C |
| 03:pe_Rack_pc | Y.Y bar | YY.Y bar |
| 0A:VsC_compressor_RACK | Y.Y Hz | XXXX |

Concentrated overview

| Type | Value | Explanation | Further inform. |
|-------------------|-----------|--|-----------------|
| Deviations | ___._ K | Temp. Deviations from setpoints: Evaporating and Condensing | 3.1 |
| Calculated values | ___._ °C | Saturated gas temperatures (dew): Evaporating and Condensing | |
| Measured values | ___._ bar | Gas pressures: Suction and Discharge gas | |
| Deviations | ___._ K | Motor Frequency_ Rack Status | |