GEA Grasso
Refrigeration Division

Grasso System Control GSC DuoPack Units and Chiller with screw compressors

User Manual

FOREWORD

Introduction

Grasso has been producing refrigerating compressors and compressor units for a wide range of different applications for several decades.

A new compressor control has been developed for universal use based on our many years' operational experience.

The compressor control, type "GSC" (**G**rasso **S**ystem **C**ontrol) is a highly modern programmable controller, which is based on the Simatic C7-633 system.

The GSC is suitable for controlling and monitoring our company's compressors.

Explanation of the abbreviations used

The following abbreviations are used in this manual.

Abbreviation	Description
GSC	"**G**rasso **S**ystem **C**ontrol" Type designation of the Grasso standard compressor control
CP	"**C**ommunication **p**rocessor"
CPU	"**C**entral **p**rocessing **u**nit"
DP	"**D**ecentralised **p**eriphery"
Eco	"**Eco**nomizer"
EPROM	"**E**rasable **p**rogrammable **r**ead-**o**nly **m**emory"
Ext.	"**Ext**ernal"
HDT	"**H**ermetically sealed **d**ifferential **t**ransformer"
RF	„**Ref**rigerant"
RF-separator	"**Ref**rigerant separator"
LED	"**L**ight-**e**mitting **d**iode"
MAX	"**Max**imum"
MIN	"**Min**imum"
MPI	„**M**ulti **P**oint **I**nterface" Siemens internal, interface with multi-point capability on the GSC, used for communication between several controls.
MRES	„**M**emory **Res**et"
SV	„**S**olenoid **v**alve"
LVS	"**L**ow **V**oltage **s**witchgear" – switchgear with power contactors for compressor motor, oil pump and oil heating
OP	"**O**perator **p**anel" control and display device
PG	"**Prog**ramming device"
PLC	"**P**rogrammable **l**ogic **c**ontroller"
Slide-Seq	"Primary **slide** position in the **seq**uencing control"
Slide Pos	"Primary **slide pos**ition"
P & ID	"**P**ipe and **i**nstrumentation **d**iagram"
SC	"**S**crew **C**ompressor"
SCP	"**S**crew **C**ompressor **P**ackage"
SC-Type	"**S**crew **C**ompressor **Type**"

General drawings

This drawing shows the general configuration of a screw compressor unit type “Large“. The supplied model can deviate from this.

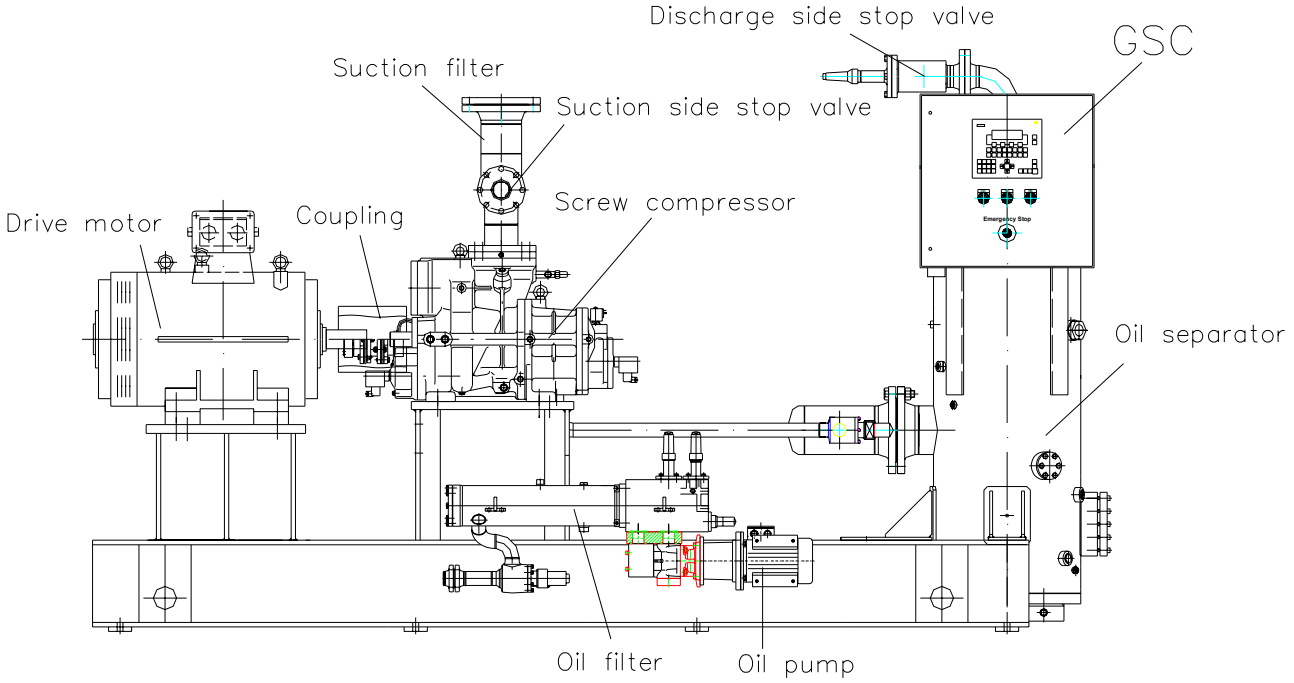


Figure 0.1: View of screw compressor unit, type Grasso SP duo Medium

General P & ID

This diagram is intended to give a general overview of the measuring points provided. The supplied unit may deviate from this diagram.

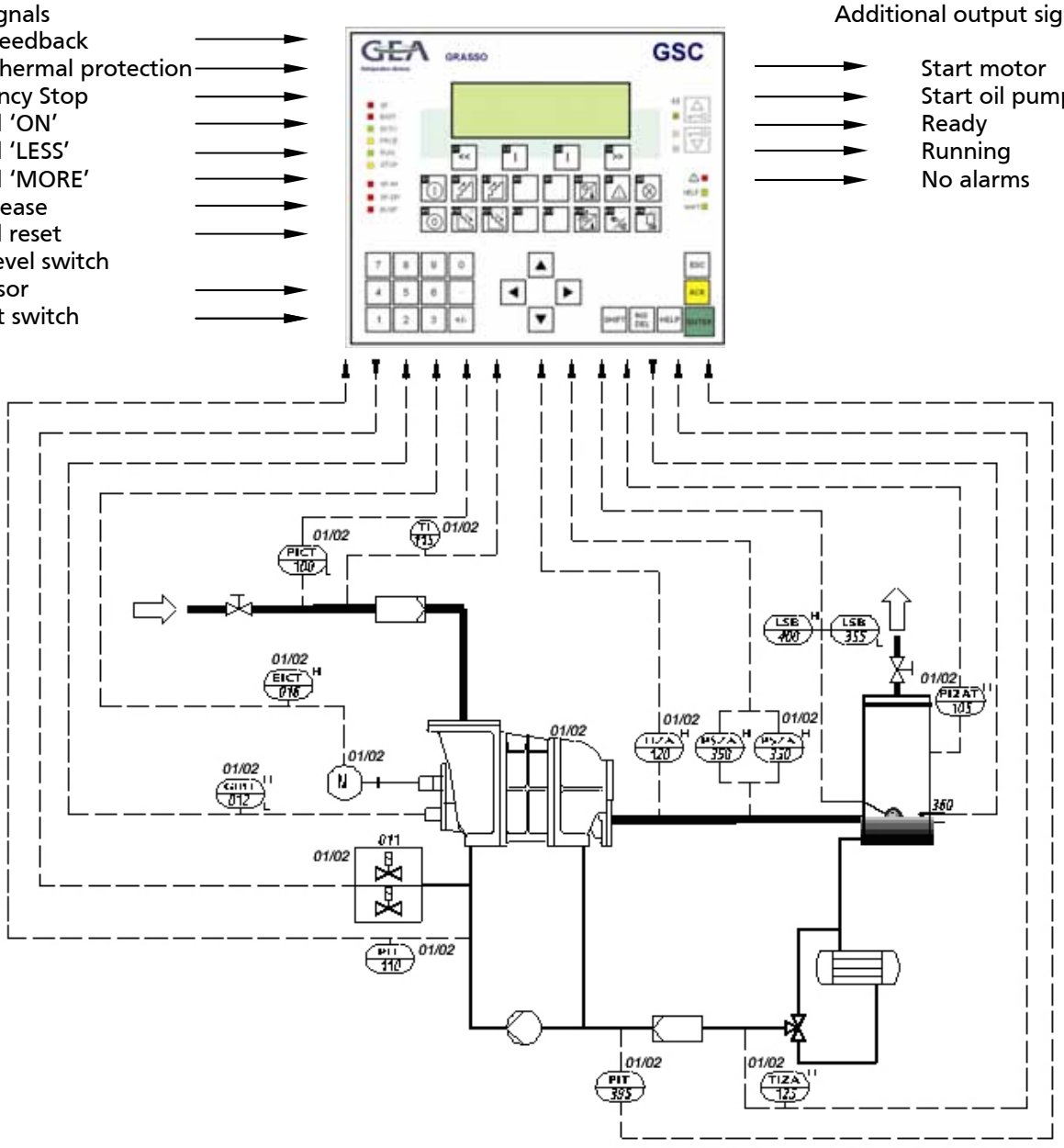
MAIN SWITCHGEAR CABINET

Input signals
Motor feedback
Motor thermal protection
Emergency Stop
External 'ON'
External 'LESS'
External 'MORE'
Start release
External reset
Liquid level switch
Gas sensor
Setpoint switch

MAIN SWITCHGEAR CABINET

Additional output signals

Start motor
Start oil pump
Ready
Running
No alarms



Pos.	Explanation
011	Capacity control solenoids
012	Capacity slide position sensor
016	Motor current sensor
100	Suction pressure sensor
105	Discharge pressure sensor
110	Oil pressure sensor
115	Suction temperature sensor

Pos.	Explanation
120	Discharge temperature sensor
125	Oil temperature sensor
350	HP switch KP7 ABS
355	Minimum oil level switch
360	Oil heater
395	Oil pressure after filter sensor
400	Maximum oil level switch
01	Compressor 1
02	Compressor 2

Figure 0.2: P & ID

1

1 DESCRIPTION OF THE GRASSO SYSTEM CONTROL

1.1 Grasso System Control - General

The GSC consists of the control unit with operator keypad and display unit, indicator lights for “Running”, “Warning” and “Alarm”, emergency stop button, output relays etc.

The standard GSC is directly mounted on the compressor package unit. However, the GSC can also be located in a control centre.

The GSC performs the following functions:

- Display of all physical and technical parameters - e.g. pressure, temperature, motor current, capacity, number of hours run, operating mode and status signals.
- Automatic start up and shut down of the compressor unit and capacity regulation dependent on the suction pressure or an external temperature.
- Monitoring of all operating parameters.
- Compressor capacity limitation, in case the discharge pressure, suction pressure, secondary refrigerant temperature or motor current limits are approached.
- Alarm memory with date and time.
- Wire failure detection of analogue input signals.
- Password protection for preventing unauthorised access to parameters.
- Program memory on EPROM.
- Control of the compressor unit by a master controller via potential free contacts.
- MPI or Profibus-DP communication with a master controller.
- Sequence control of max. 5 compressor package units via MPI.

1.1.1 View

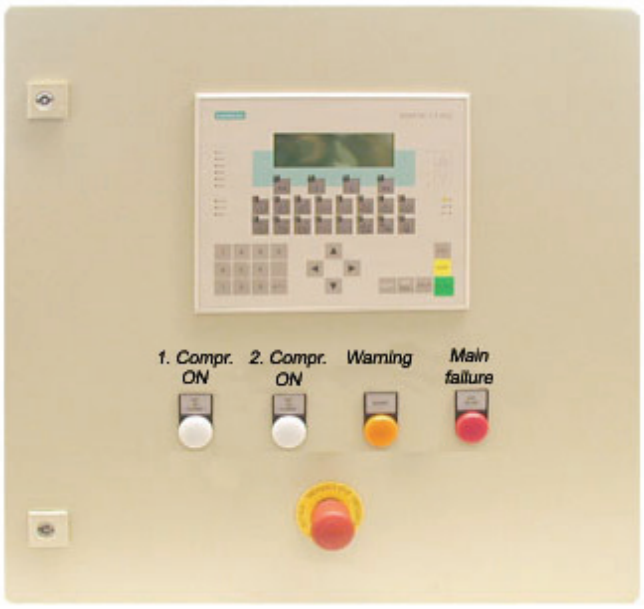
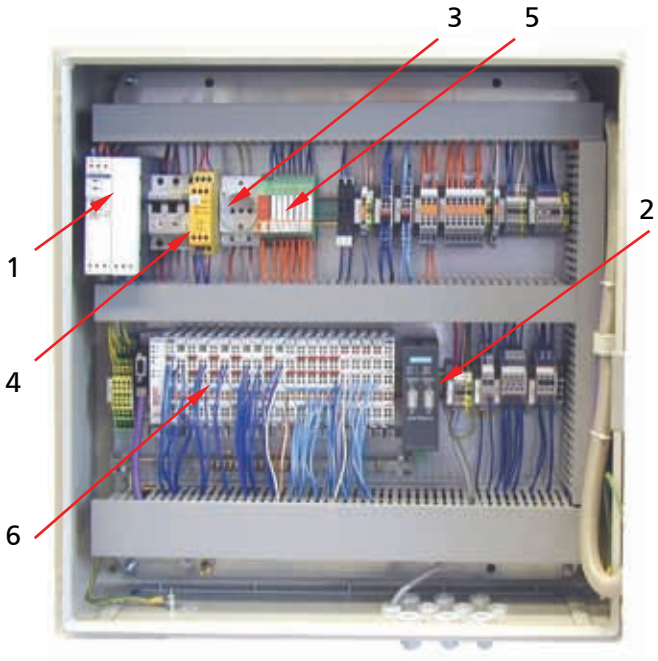


Figure 1.1: View of outside of switchgear cabinet



1 Power supply
2 Profibus DP/DP-coppler
3 Socket-outlet for service
4 Emergency stop relay
5 Relays
6 Bus Terminal

Figure 1.2: View of inside of switchgear cabinet

1.1.2 Lamps/ Push buttons

☞ White indicator light (Running)

This indicator lamp flashes slowly when the compressor unit is in the "Ready" state.

This lamp flashes quickly during start up of the compressor.

Once the compressor has started, the light becomes steady.

This lamp flashes quickly during the shut down operation, until the compressor drive motor is switched off.

☞ Yellow indicator light (Warning)

This lamp flashes if an operating condition reaches a preset value (Warning /Pre-alarm).

Detection of this warning can be acknowledged at the operator panel. Warnings are automatically reset after the cause has gone.

The flashing light changes over to a steady light.

This indicator light switches off again when the operating conditions are back to normal.

☞ Red indicator light (Alarm)

This lamp flashes if an operating condition exceeds its permitted value, the machine shuts down on alarm.

This state is signalled by a red flashing light. After the alarm has been acknowledged at the operator panel, this flashing light changes over to a steady light, as long as the alarm condition remains.

Once the cause of the alarm has been corrected, this indicator light switches off (after it has been acknowledged).

☞ Emergency stop button

This red button can be used to switch the compressor unit off at any time in case of an emergency. The operator terminal controls remain functional.

1.2 Operator terminal

The operator terminal is the interface between the operator and the control unit.

All switching, operating and control actions are carried out via this operator terminal.

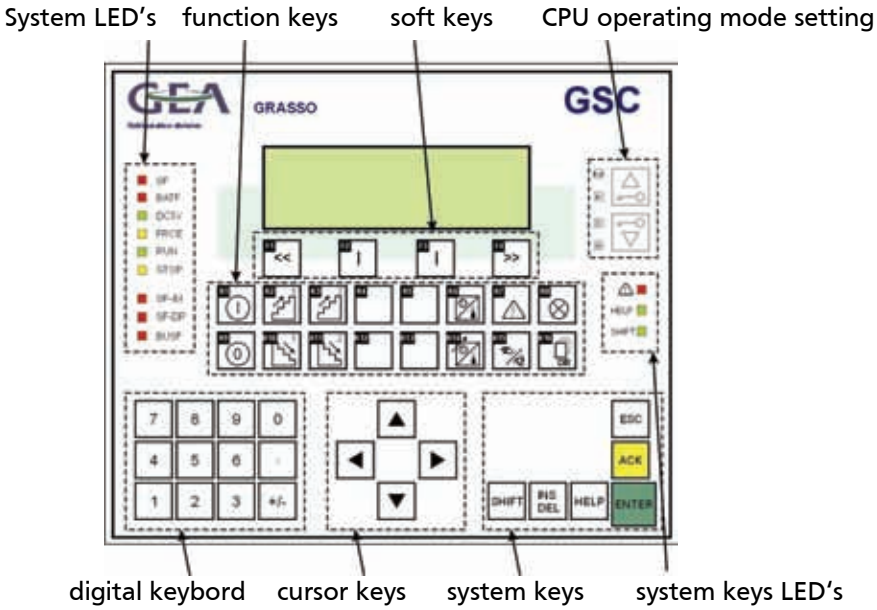
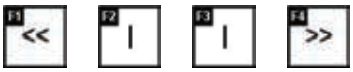
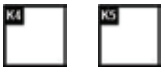


Figure 1.3: GSC operator terminal

☞ For detailed explanation of the system LEDs see Chapter 4.1

1.2.1 Key assignment

Key	Function
	**Change** to the next display window F2, F3 Go to the **menu item** described in the text display directly above
	**Switch on** the compressor unit, **start enabled**
	**Start 1st compressor** (Press key for 5 sec. in operation mode "Manual"). **Increase capacity of 1st compressor** (In case of manual capacity control only)
	**Start 2nd compressor** (Press key for 5 sec. in operation mode "Manual"). **Increase capacity of 2nd compressor** (In case of manual capacity control only)
	No function
	Call up **display of actual values**
	Call up **alarm signals**
	**Lamp test**
	**Switch off** the compressor unit, **start disabled**
	**Stop 1st compressor** (Press key for 5 sec. in operation mode "Manual"). **Reduce capacity of 1st compressor** (In case of manual capacity control only)
	**Stop 2nd compressor** (Press key for 5 sec. in operation mode "Manual"). **Reduce capacity of 2nd compressor** (In case of manual capacity control only)
	No function
	Call up **controls** – settings
	Call up **operating mode** setting
	Call up the **menu overview**
ESC	**Return** or cancel input
ACK	**Acknowledge**, reset failure and warning
ENTER	**Confirm input**
HELP	Press the button once for display of a **help text**. In some screens two levels of help are available by pressing the button twice.
SHIFT	**Switch over** to the 2nd keyboard level
	**Cursor keys**

☞ Functions for F1...F4 keys

These functions are only available if the symbols can be seen in the display.

F1 <<	**Back** to previous display
F2 | F3 |	Go to the **menu item** described
F4 >>	**Move** to next display

☞ Standard function of the shift keys

SHIFT + ▲ or ▼	Change between the possible **selections (1st or 2nd compressor)**
SHIFT + +/-	Alter the **display contrast**

☞ Special function of the shift key

SHIFT + K6	Change to the **"Status display"**
SHIFT + K8	Change to the **"Language selection"** or **"Contrast menu"**
SHIFT + X13	Change to the **"Digital inputs / outputs display"**
SHIFT + X14	Change to the **"Transfer"** menu. Attention: stop with ESC
SHIFT + X15	Change to the **"Password"** menu
SHIFT + X16 DIR	Change to the **"Date, Time"** menu

1.2.2 Menu structure

1.2.2.1 Password level

The access rights within the menu structure are protected by different passwords.

The operator is asked to enter a password when they try to enter a command.

The password consists of a 4-figure number.

Each password level has a different number allocated to it.

The passwords for Levels 1 to 8 can be freely allocated by the user.

The password for the highest password level 9 is specified by Grasso on delivery and cannot be subsequently changed.

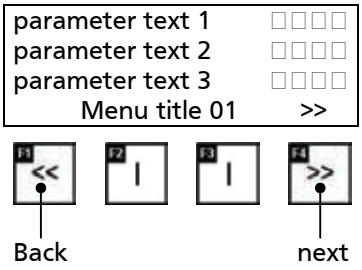
If a password is entered and then no key is used for a longer period (approx. 10 mins), the operator panel automatically logs out from the password level.

☞ **The following password levels have been allocated:**

Password level **1**	Operator level	Change to the set point values possible.
Password level **2**	Only for authorised persons	Changes to all limiting values/timers possible – in addition to Level 1
Password level **9**	Service level	Changes in the configuration menu possible – in addition to level 2

1.2.2.2 General image format

The image format is identical in all the images.

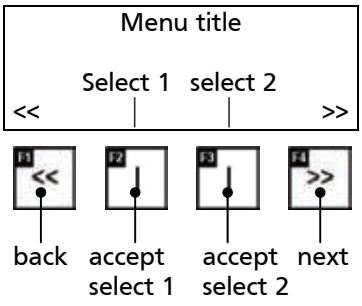


Depending on the menu, the actual or set point values are displayed in the 3 top rows.

The names of the selected menu and of the selected compressor (1st or 2nd) are displayed again in the lowest row.

The double arrows F1 << or F4 >> mean that you can move to the previous menu display F1 << or the next menu display F4 >> by pressing the key under this symbol.

If a menu is selected in which further branches are possible, the image format is as follows:



The current image name is displayed in the top row.

The keys under the symbols F1 << and F4 >> are used to return to the previous menu display F1 << or to the next menu display F4 >>, and thus to further possible selections.

The described function is selected using the F2 and F3 keys under the symbols.

1.2.3 Call up table of contents

To get to the table of contents, press the  key. A list of the available menus is then displayed.

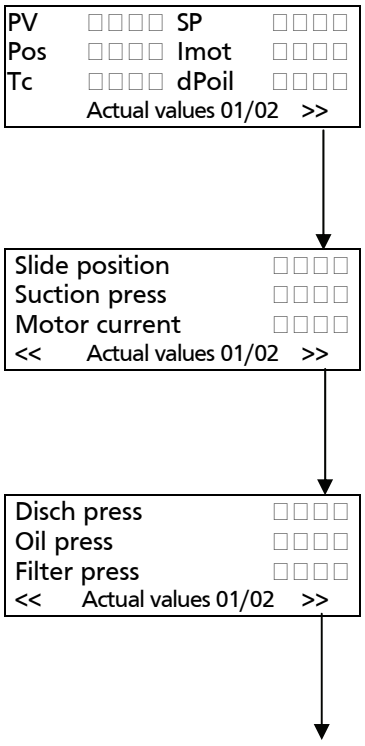
Number	Title	Help text HELP
05	Actual values	Display of all unit's actual values
10	Control settings	Display and set up of all control parameters
15	Operating modes	Selection of operation mode
20	Limit values	Set up of alarm, warning and limitation parameters
25	Alarms	Display of current and previous alarms
30	Timer settings	Set up of timers
35	Unit Options	Selection of unit option menus
50	Configuration	Enter: - Compressor type - Scaling of the sensors - Refrigerant used - With/without economiser - etc
90	Main system menu	

To get to these menus, position the cursor on the menu name (using the ▲ or ▼ key) and confirm with the ENTER key.

Parameter changes in menu 20, 30, 35, 50 can cause serious damage to the screw compressor unit or chiller!

1.2.3.1 Actual values menu

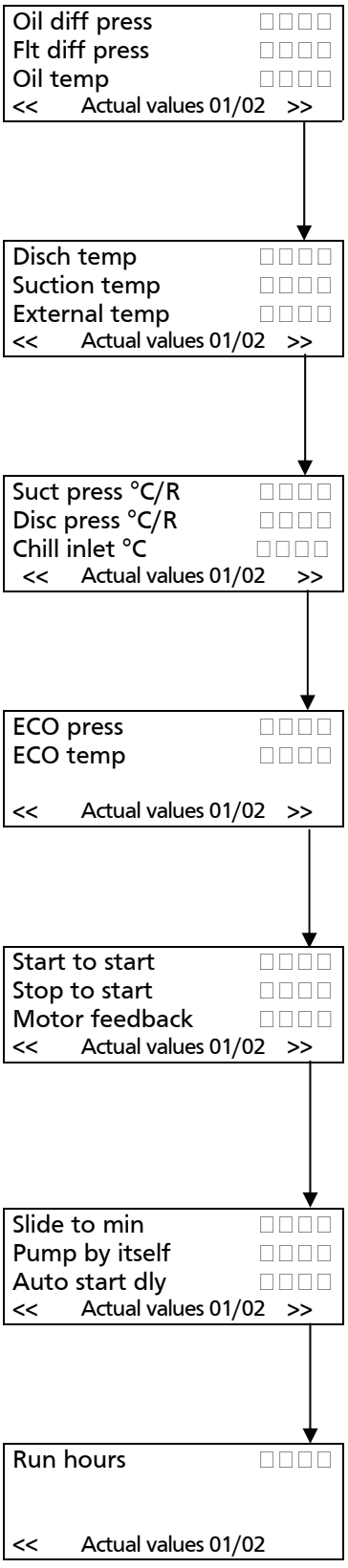
05 Actual values



PV: Process Variable, display in °C/R (pressure) or °C (temp)
SP: Set Point display in °C / °C/R
Pos: Capacity slide position in %
Imot: Motor current in A
Tc: Discharge pressure in °C/R
dPoil: Differential oil pressure in bar

Slide position: %
Suction press: bar (a)
Motor current: A

Discharge pressure: bar (a)
Oil pressure: bar (a)
Oil filter pressure: bar (a)



Oil diff press: Value calculated from the oil pressure minus discharge pressure in bar

Flt diff press: Value calculated from the discharge pressure minus the oil filter pressure in bar

Oil temp: in °C

Discharge temp: °C

Suction temp: °C

External temp: External temperature. If unit is configured for chiller, this value is the chiller outlet temperature in °C

Suct press °C/R: Suction pressure displayed as temperature

Disc press °C/R: Discharge pressure displayed as temperature

Chill inlet °C: Chiller inlet temperature in °C

ECO press: Economiser pressure in bar (a)

ECO temp: Economiser temperature in °C

Start to start: Remaining time between two starts of the compressor drive motor in secs.

Stop to start: Remaining time between stop and next start of the compressor drive motor in secs

Motor feedback: Remaining time for motor running feedback signal from compressor drive motor starter.

Slide to min: Remaining time for capacity slide to return to its minimum position after stopping the compressor.

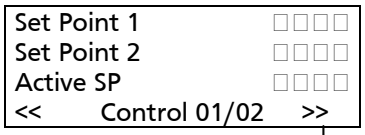
Pump by itself: Remaining time the oil pump can run by itself without initialising an oil drain.

Auto start dly: Remaining time for automatic start delay.

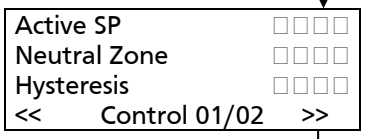
Run hours: Number of operating hours.

1.2.3.2 Control settings menu

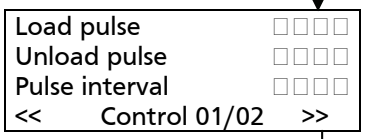
10 Control settings



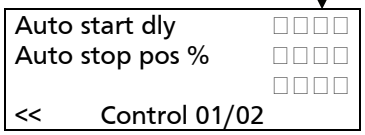
Set Point 1: First Set Point for the controlled parameter °C
Set Point 2: Second Set Point for the controlled parameter °C
Active SP: Active Set Point in °C
2 different set point values can be entered. The switchover takes place due to a potential free contact. The active set point value is displayed.



Active SP: Active set point in °C
Neutral Zone: Neutral zone of the automatic capacity regulation in K
Hysteresis: Hysteresis of the automatic capacity regulation in K.



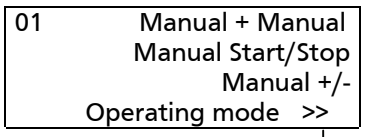
Load pulse: Length of pulse to load compressor in secs
Unload pulse: Length of pulse to unload compressor in secs
Pulse interval: Interval between pulses to load or unload the compressor in secs.



Auto start dly: Length of delay in sec before automatic start up.
Auto stop pos %: Compressor stops when capacity slide (%) is below this position in automatic control.

1.2.3.3 Operating mode menu

15 Operating modes

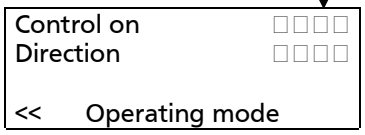


Switchover operating modes

Select the operating mode using SHIFT and ▲ or ▼.

Confirm selection with ENTER

Example shown is operating mode type 01 – Manual stop start and manual capacity control (Please refer to section 2.1)



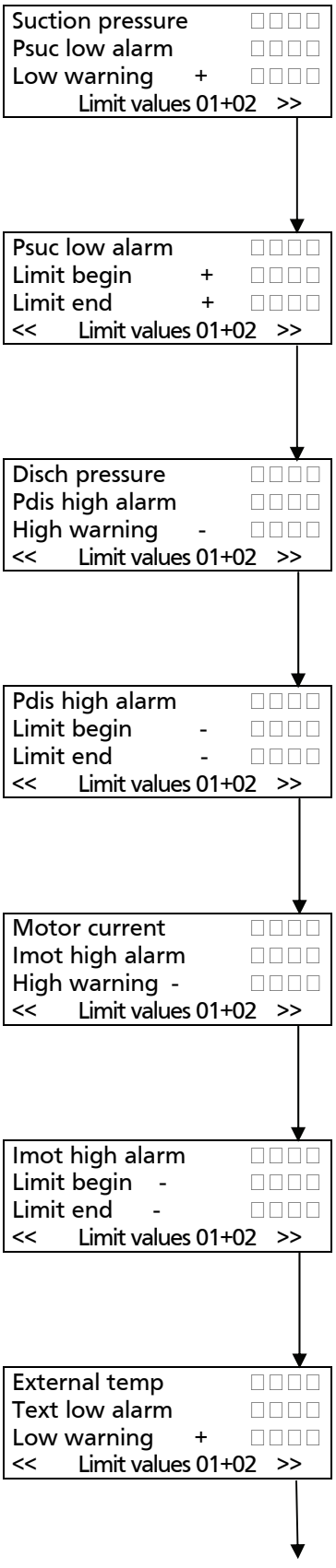
Control on: Choose between “Press” and “Temp”
Direction: Choose between “Cooling” and “Heating”

Select the operating mode using SHIFT and ▲ or ▼.

Confirm selection with ENTER

1.2.3.4 Limit values menu

20 Limit values



Suction pressure: Actual suction pressure in bar (a)
Psuc low alarm: Alarm limit for minimum suction pressure in bar (a)
Low warning: Enter the warning value as an offset to the alarm value in bar

Psuc low alarm: Alarm limit for minimum suction pressure in bar (a)
Limit begin: Begin the suction pressure limitation - enter value as an offset to the alarm value in bar
Limit end: End the suction pressure limitation - enter value as an offset to the alarm value in bar

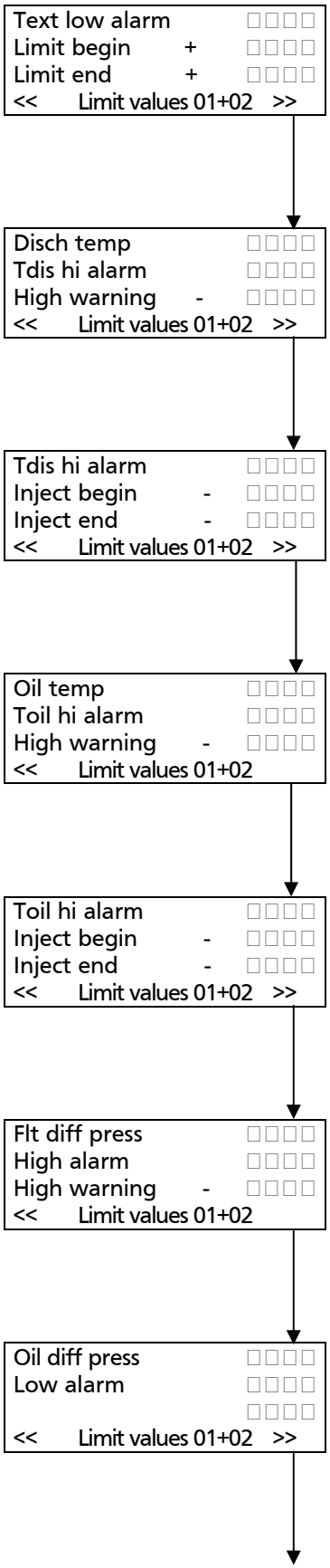
Disch pressure: Actual discharge pressure in bar (a)
Pdis high alarm: Alarm limit for maximum discharge pressure in bar (a)
High warning: Enter the warning value as an offset to the alarm value in bar

Pdis high alarm: Alarm limit for maximum discharge pressure in bar (a)
Limit begin: Begin the discharge pressure limitation - enter value as an offset to the alarm value in bar
Limit end: End the discharge pressure limitation - enter value as an offset to the alarm value in bar

Motor current: Actual motor current in A
Alarm (max): Alarm limit for maximum motor current in A
Warning: Enter the warning value as an offset to the alarm value in A

Imot high alarm: Alarm limit for maximum current in A
Limit begin: Begin the motor current limitation - enter value as an offset to the alarm value in A
Limit end: End of the - motor current limitation enter value as an offset to the alarm value in A

External temp.: Actual external temperature in °C
Text low alarm: Alarm limit for minimum external temperature in °C
Low warning: Enter the warning value as an offset to the alarm value in K



Text low alarm: Alarm limit for minimum external temperature in °C
Limit begin: Begin the temperature limitation - enter value as an offset to the alarm value in K
Limit end: End the temperature limitation - enter value as an offset to the alarm value in K

Disch temp.: Actual discharge temperature in °C
Tdis hi alarm: Alarm limit for maximum discharge temperature in °C
High warning: Enter the warning value as an offset to the alarm value in K

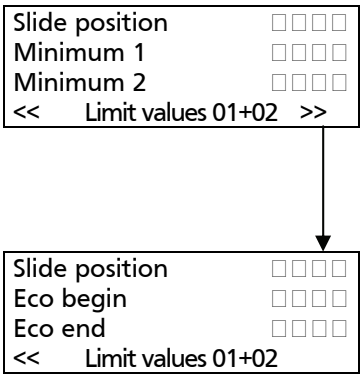
Tdis hi alarm: Alarm limit for maximum discharge temperature in °C
Inject begin: Begin injection cooling (if mounted) - enter value as an offset to the alarm value in K
Inject end: End injection cooling (if mounted) – enter value as an offset to the alarm value in K

Oil temp: Actual oil temperature in °C
Toil hi alarm: Alarm limit for maximum oil temperature in °C
High warning: Enter the warning value as an offset to the alarm value in K

Toil hi alarm: Display the alarm limit in °C
Inject begin: Begin injection cooling (if mounted) - enter value as an offset to the alarm value in K
Inject end: End injection cooling (if mounted)– enter value as an offset to the alarm value in K

Flt diff press: Actual oil filter differential pressure in bar
High alarm: Alarm limit for maximum pressure differential in bar
High warning: Enter the warning value as an offset to the alarm value in bar

Oil diff press.: Actual oil differential pressure in bar
Low alarm: Alarm limit for minimum pressure differential in bar

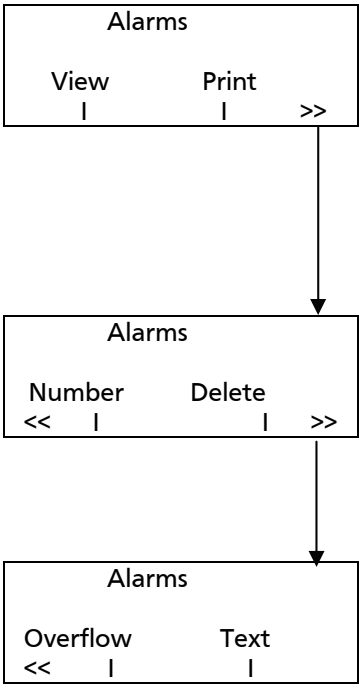


Slide position: Actual slide position in %
Minimum 1: Minimum slide position for starting / stopping in %
Minimum 2: 2nd minimum slide position for starting in %
(only for compressor type Small and Medium)

Slide position: Actual slide position in %
Eco begin: Open economiser solenoid at this slide position
Eco end: Close economiser solenoid at this slide position

1.2.3.5 Alarm menu

25 Alarms



View: The alarm number, date, time and status of the alarmare displayed. Status 'K' is logged when the alarm first occurs, 'Q' when the alarm is acknowledged and 'G' when the alarm condition has been cleared.
If the cursor is pointing to the alarm number, the alarm text can be displayed by pressing the ▶ key.

Print: Not used.

Number: Displays how many alarms have been stored and how many are still active.

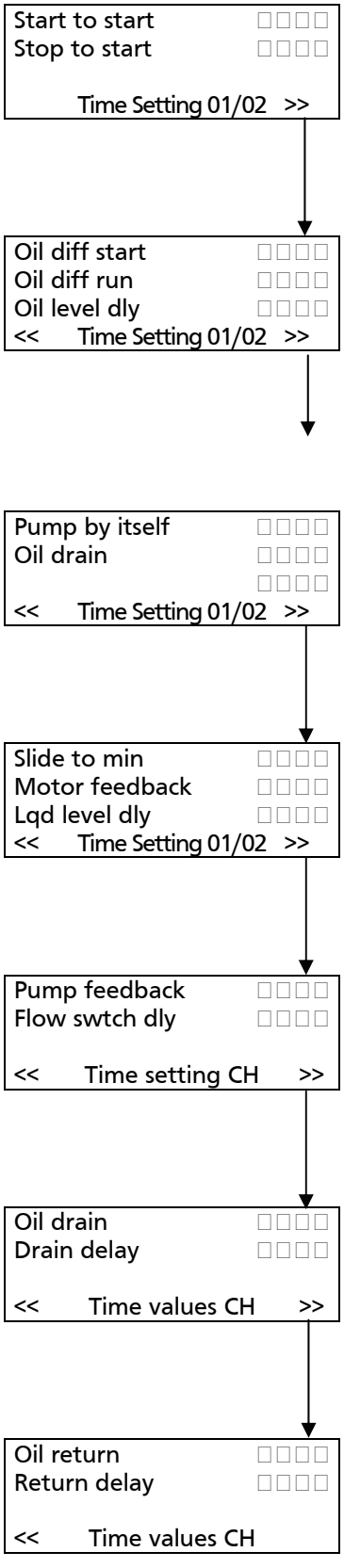
Delete: All the alarm signals stored in the buffer can be deleted.

Overflow: When switched off it enables a new alarm message to be displayed even if the fault buffer is full.

Text: Display of all possible alarm messages with alarm number (see section 6 for details of possible alarms)

1.2.3.6 Timer Settings menu

30 Timer Settings



Start to start: Delay between two starts of the compressor in secs.
Stop to start: Delay between stop and next start in secs.

Oil diff start: Oil pressure alarm delay during start up in secs.
Oil diff run: Oil pressure alarm delay during running in secs.
Oil level dly: Low oil level alarm delay in secs.

Pump by itself: Maximum time the oil pump may run by itself without initialising an oil drain in secs.
Oil drain: Compressor oil drain time if 'Pump by itself expires' in secs.

Slide to min: Maximum time for slide to return to its minimum position after compressor stops in sec. (Large series only)
Motor feedback: After start output – maximum time to allow feedback signal from start equipment in secs.
Lqd level dly: High liquid level alarm delay in secs.

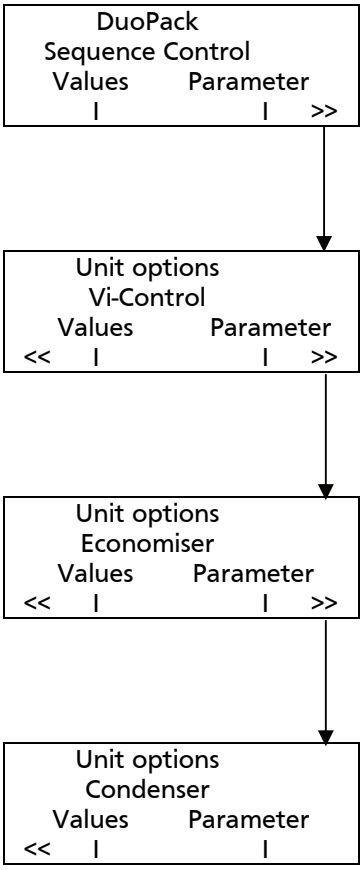
Pump feedback: Maximum time between pump start output and feedback signal from start equipment in secs.
Flow swtch dly: No secondary refrigerant flow alarm delay in secs.

Oil drain: Time period during which oil is drained from the evaporator in secs.
Drain delay: Delay following oil drain.

Oil return: Time period during which oil is returned to the compressor in sec.
Return delay: Delay following oil return in sec.

1.2.3.7 Unit options menu

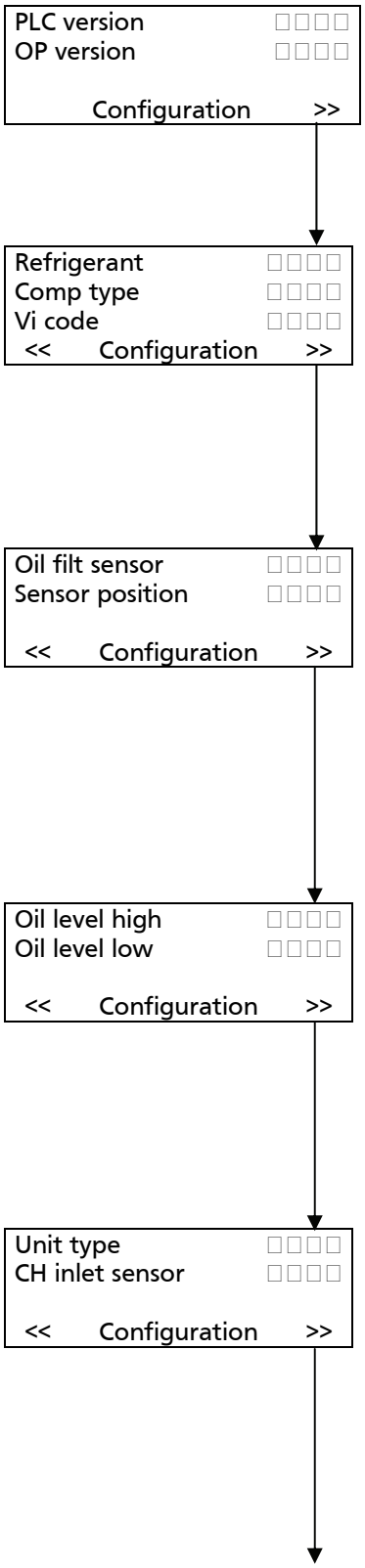
35 Unit Options



Values:	Jump to display of sequence control values
Parameter:	Jump to sequence control parameters
Actual value:	Jump to display of Vi values
Parameter:	Jump to Vi parameters
Actual value:	Jump to display of economiser values.
Parameters:	Jump to economiser solenoid control parameters.
Values:	Jump to condensor values.
Parameter:	Jump to condensor parameters.

1.2.3.8 Configuration menu

50 Configuration



PLC version: Display of the PLC program version used.
OP version: Display of the operater panel version used

Refrigerant: Select R717, R22, R134a, R404a, R290,R507 or R1270
Compressor type: Select the compressor type C up to XD
Vi-code: Select fixed, 51, 52 or 53

Select using SHIFT and ▲ or ▼

Confirm the selection with ENTER

Oil filter sensor: Select Yes or No
Sensor position: Select 395 or 495 (These numbers are position numbers referred to on the P & ID drawing supplied with the compressor unit).

Select using SHIFT and ▲ or ▼

Confirm the selection with ENTER

Oil level high: Select "Yes" if sensor mounted, otherwise "No"
Oil level low: Select "Yes" if sensor mounted, otherwise "No"

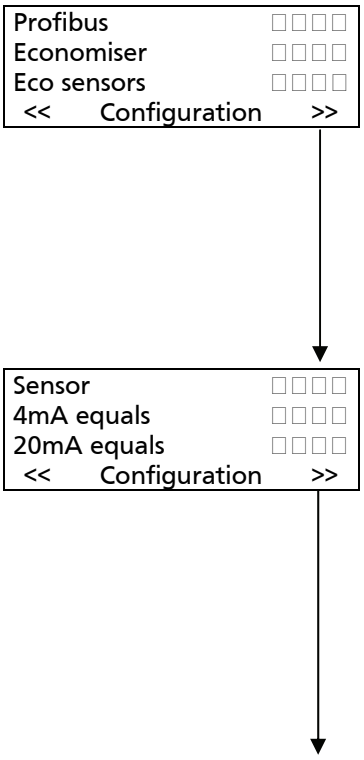
Select using SHIFT and ▲ or ▼

Confirm the selection with ENTER

Unit type: Select Package, FX Chiller or DX Chiller
CH inlet sensor: Select "Yes" if sensor mounted, otherwise "No"

Select using SHIFT and ▲ or ▼.

Confirm the selection with ENTER



Profibus: Select "Yes" if mounted, otherwise "No"

Economiser: Select "With" and "Without"

Eco sensors: Select "Yes" if mounted, otherwise "No"

Select using SHIFT and ▲ or ▼.

Confirm the selection with ENTER.

Sensor: Select the sensor type e.g. "motor current", external setpoint", "suction pressure", "discharge pressure", etc.

4mA equals: Start of measuring range of the sensor selected e.g. 0 bar or –60 °C

20mA equals: End of measuring range of the sensor selected e.g. 21 bar or +140 °C

Select using SHIFT and ▲ or ▼.

Confirm the selection with ENTER.

Accept: Store the set configuration in the main memory (program works with the new values, but these are not yet saved in the EPROM.

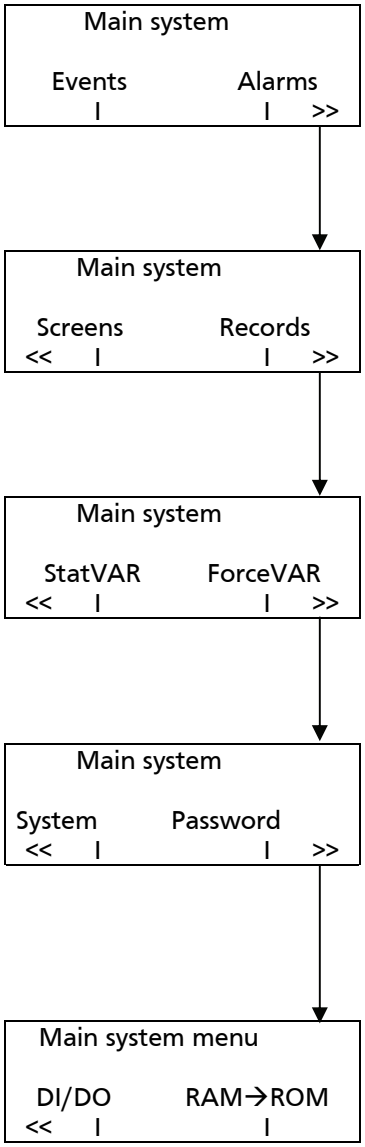
Save: Saves the set configuration in the EPROM.

For configuration settings to take effect you must choose both accept and save before escaping from this menu.

With save the configuration data is stored on the EPROM. This procedure can be performed when the PLC is in RUN only (see 4.3.) Otherwise the following system message is displayed: $369 S7 command error 20.

1.2.3.9 Main system Menu

90 Main system



Events:	Further submenus: “View”, “Print”, “Number”, “Delete”, “Overflow”, “Text”
Alarms:	Further submenus: “View”, “Print”, “Number”, “Delete”, “Overflow”, “Text”
Screens:	Further submenus: “Edit”, “Print”
Records:	Further sub menus: “Edit”, “Print”, “Carry”
StatVAR:	Status variables, control variables (values) can be displayed in this menu
ContrVAR:	Control variables, control variables (values) can be altered in this in menu
System:	Further sub- menus: “OPMode”, “DispMsg”, “SysMsg”, “Language”, “Dat/Time”, “Printer”, “IF1”, “IF2”
Password:	Further sub menus: “Login”, “Logout”, “Edit”
DI/DO:	Display the control input and output assignments
RAM→ROM:	Copies the contents of the main memory to the EPROM (only possible if PLC is in “Stop”)

1.3 Status display

To get to the status display, press the ESC key several times, or press the SHIFT key and then  .

This display shows all of the information shown in the first actual values screen plus the status of the compressor unit.

PV	□□□□	SP	□□□□
Pos	□□□□	Imot	□□□□
Tc	□□□□	Dpoil	□□□□
Operating status			

PV: Process Value, display in °C/R (pressure) or °C (temp)
SP: Set Point display in °C / °C/R
Pos: Capacity slide position in %
Imot: Motor current in A
Tc: Discharge pressure in °C/R
dPoil: Differential oil pressure in bar
Operating status: eg Running, Off, Slide to min, Motor in Star etc.

The operating status provides information about the compressor unit.

The following status messages are possible:

Initialisation	Initialisation of the controller after swithing on the power supply or after saving the configuration (save, RAM → ROM)
Start to start 01/02	Start delay between two starts is active.
Oil drain 01/02	Oil drain delay is active, the oil pump has run too long by itself. (Minimum slide position has not been reached during start or stop procedure)
Standby 01/02	Compressor unit ready for switching on, but one or more starting conditions are still not fulfilled e.g. process variable still below set point
External start 01/02	The controller is waiting for an external signal to enable the start of the unit.
Slide to min 01/02	Starting procedure commenced, slide moving towards minimum position.
Starting 01/02	Compressor motor has been started, and the running feedback signal from the starter panel has not yet been received.
Running 01/02	Running feedback signal from the starter panel has been received. Unit in operation.
Limit suct press 01/02	A capacity limitation is active (suction pressure too low), capacity control solenoid to reduce capacity is opened.
Limit disch press 01/02	A capacity limitation is active (discharge pressure too high), capacity control solenoid to reduce capacity is opened.
Limit mot current 01/02	A capacity limitation is active (motor current too high), capacity control solenoid to reduce capacity is opened.
Limit ext temp 01/02	A capacity limitation is active (external temperature too low), capacity control solenoid to reduce capacity is opened.
Limit oil temp 01/02	A temperature limitation is active (oil temperature too high), refrigerant injection is enabled (optional).
Stopping 01/02	The compressor unit has received a shutdown command, the capacity slide is moved towards its minimum position
Compressor off 01/02	The compressor is switched off
Stop to start 01/02	Start delay between stop and next start is active
Failure 01/02	A failure has occurred, which is still active.
italic writing	Text display flashes
Normal writing	Text display is static

The overall status of the compressor unit is displayed with the LEDs in  and  .

Key	Colour	Status	Explanation
	Green	Flashing	The Grasso SPduo has received a start request. One compressor may start.
	Green	Continuous light	One compressor is running.
 + 	None	OFF	The Grasso SPduo is switched off, there is an alarm active. The alarm light on the cabinet is active.
	Red	Continuous light	The Grasso SPduo is switched off.

2

MENU 15 „OPERATION MODES“

Control via GSC buttons

0	Service	Oil pump by itself		
1	Manual + Manual	manual	-	Stop/Start control
		manual +/–	-	Capacity control
2	Manual + Auto	manual	-	Stop/Start control
		auto +/–	-	Capacity control
3	Auto + Auto	auto	-	Stop/Start control
		auto +/–	-	Capacity control

Control via digital/analogue signals

4	Remote + HW (cont)	External	-	Stop/Start control
		Ext continuous +/–	-	Capacity control
5	Remote + HW (pulse)	External	-	Stop/Start control
		Ext pulses +/–	-	Capacity control
6	Remote + HW-Loc.SP	External	-	Stop/Start control
		Local set point	-	Capacity control
7	Remote + HW-Rem.SP	External	-	Stop/Start control
		Remote set point	-	Capacity control

Control via Network

8	Remote + Net (cont)	Network	-	Stop/Start control
		Net continuous +/–	-	Capacity control
9	Remote + Net (pulse)	Network	-	Stop/Start control
		Net pulse +/–	-	Capacity control
10	Remote + Net-Loc. SP	Network	-	Stop/Start control
		Local set point	-	Capacity control
11	Remote + Net-Net SP	Network	-	Stop/Start control
		Network set point	-	Capacity control

2. CONTROL SEQUENCE

2.1 Overview of the operating modes

Operation modes			Signal for...	
	Name	**Explanation**	**Start/Stop**	**Capacity +/-**
0	Service	Oil pump by itself Compressor motor blocked		
1	Manual + Manual	Manual control via OP	Manual	Manual
2	Manual + Auto	Manual Start/Stop via OP and full automatic local capacity control	Manual	Auto
3	Auto + Auto	Full automatic Start/Stop and local capacity control	Auto	Auto
4	Remote + HW (cont)	Start/stop and capacity demand via digital contacts (Hardware) from a remote Master controller. The GSC derives from the continuous +/- signals the pulses for controlling the slide position (indirect).	External	External continuous
5	Remote + HW (pulse)	Start/stop and capacity demand via digital contacts (Hardware) from a remote Master controller. The Master also generates the +/- signals as pulses for controlling the slide position directly.	External	External pulses
6	Remote + HW-Loc.SP	Start/stop via digital contacts (Hardware) from a remote Master controller. The capacity control is based on the local set point (OP).	External	Local set point
7	Remote + HW-Rem.SP	Start/stop via digital contacts (Hardware) from a remote Master controller. The capacity control is based on the remote set point (analogue input).	External	Remote set point
8	Remote + Net (cont)	Start/stop and capacity demand via network (MPI or Profibus-DP) from a remote Master controller. The GSC derives from the continuous +/- signals the pulses for controlling the slide position (indirect).	Network	Network continuous
9	Remote + Net (pulse)	Start/stop and capacity demand via network (MPI or Profibus-DP) from a remote Master controller. The Master also generates the +/- signals as pulses for controlling the slide position directly.	Network	Network pulses
10	Remote + Net-Loc.SP	Start/stop via network (MPI or Profibus-DP) from a remote Master controller. The capacity control is based on the local set point (OP).	Network	Local set point
11	Remote + Net-Net.SP	Start/stop via network (MPI or Profibus-DP) from a remote Master controller. The capacity control is based on a remote set point that is sent via the network also.	Network	Network set point

2.2 Explanation of symbols and characters used

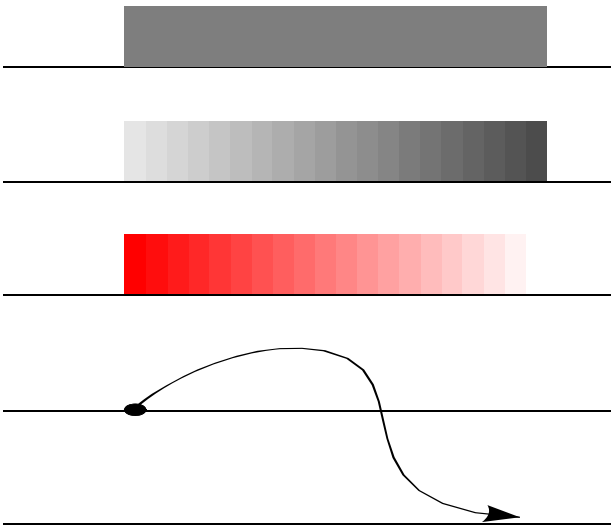
Progression of a signal with time or information

Progression of a signal with time or information, the pre-event history is *irrelevant*

Progression of a signal with time or information, the future is *irrelevant*

Time at which a cause or condition begins (in text "• if..")

Effect
(in text „→ then..")



2.3 General starting conditions

The following conditions have to be fulfilled to begin start up of the compressor unit:

- **If** Start command, eg 'External on' input equals 1 for operating mode 6

  and
- **If** the 'Start to start' timer is not active

  and
- **If** the 'Stop to start' timer is not active

  and
- **If** the 'Oil drain' timer is not active (only applies to Large compressors)

  and
- **If** the digital input "start release" equals 1

  and
- **If** No alarms are active

→ **Then** the starting conditions are fulfilled

2.3.1 Start to start timer (anti- recycle timer)

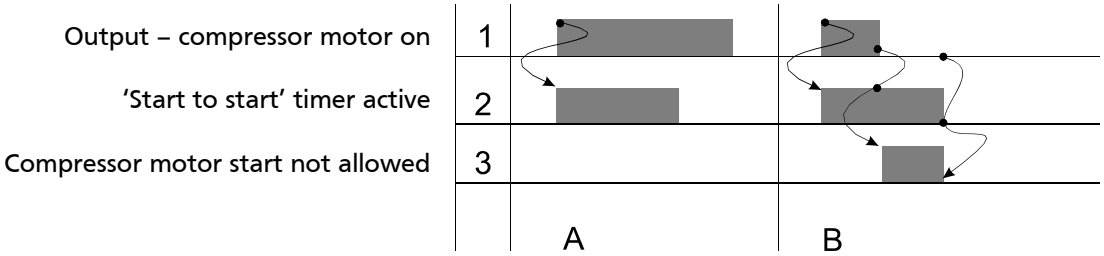
As electric motors are particularly highly loaded during the start up process, it is important to comply with the manufacturer's requirements regarding the allowed number of start per hour.

These include protection for maintaining the thermal and mechanical loading within limits.

The 'Start to start' timer fulfils the following function:

- Limitation of the number of starts per unit time.

The permissible number of starts per hour is based on the motor manufacturer's values for the operating mode and insulation class.



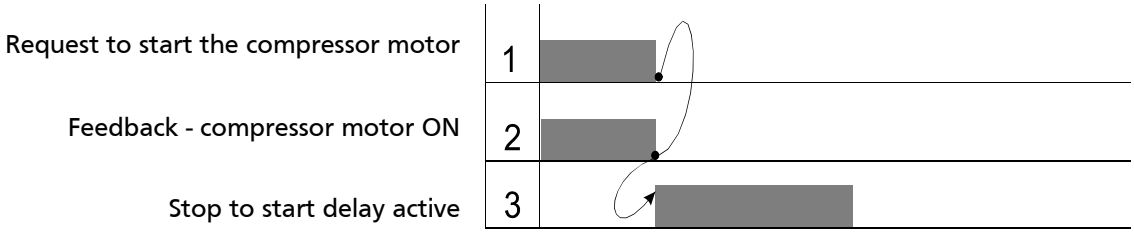
Case A: The compressor motor ran longer than the 'Start to start' timer, next start allowed immediately.

Case B: The compressor motor ran less than the 'Start to start' timer, the next start is not allowed until the remaining 'Start to start' time has expired.

2.3.2 Stop to start timer

A minimum time difference is required between a stop and the next start of the compressor motor.

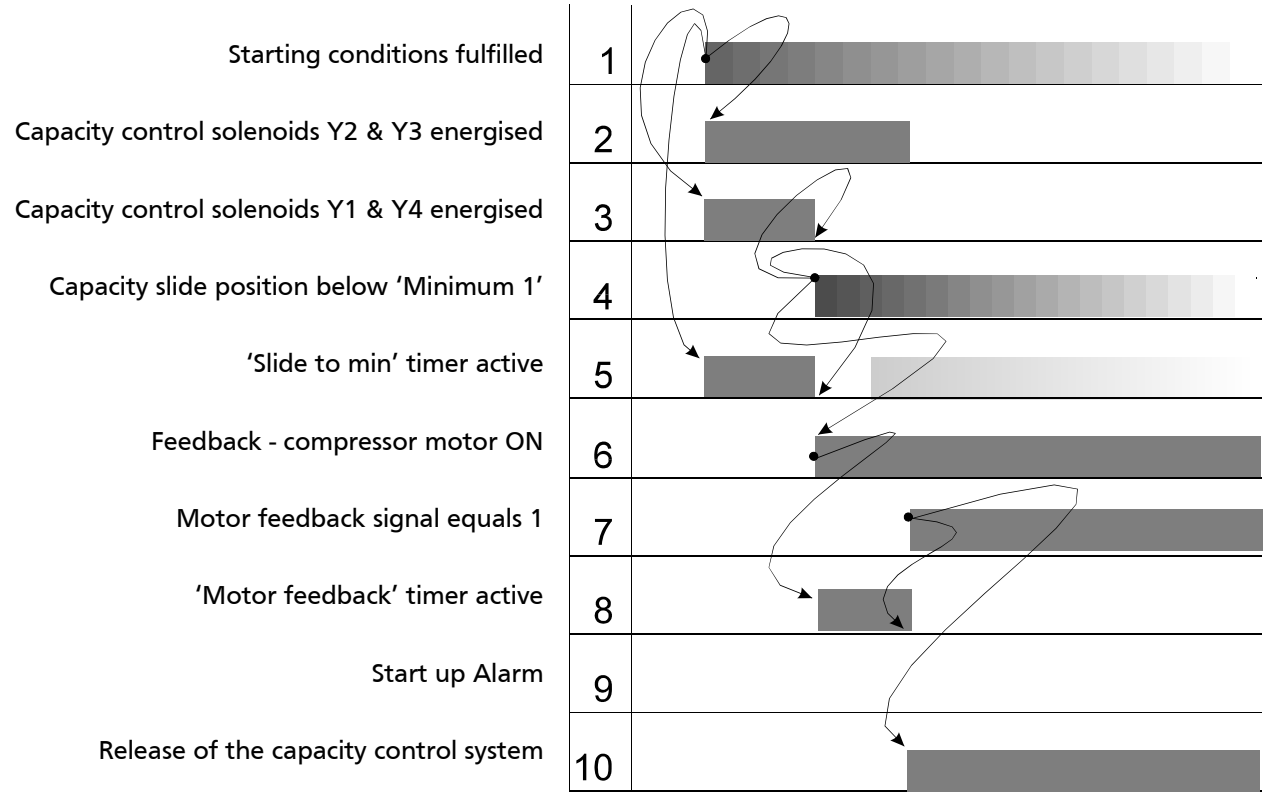
At the same time, the switching device contacts have to open correctly for the compressor motor time!



- **If** (1) Request to start the compressor motor not active anymore
→ **and** (2) no feedback compressor motor ON,
→ **Then** (3) Stop to start delay active

2.4 Start up sequence

2.4.1 Small and Medium Screw Compressor Packages



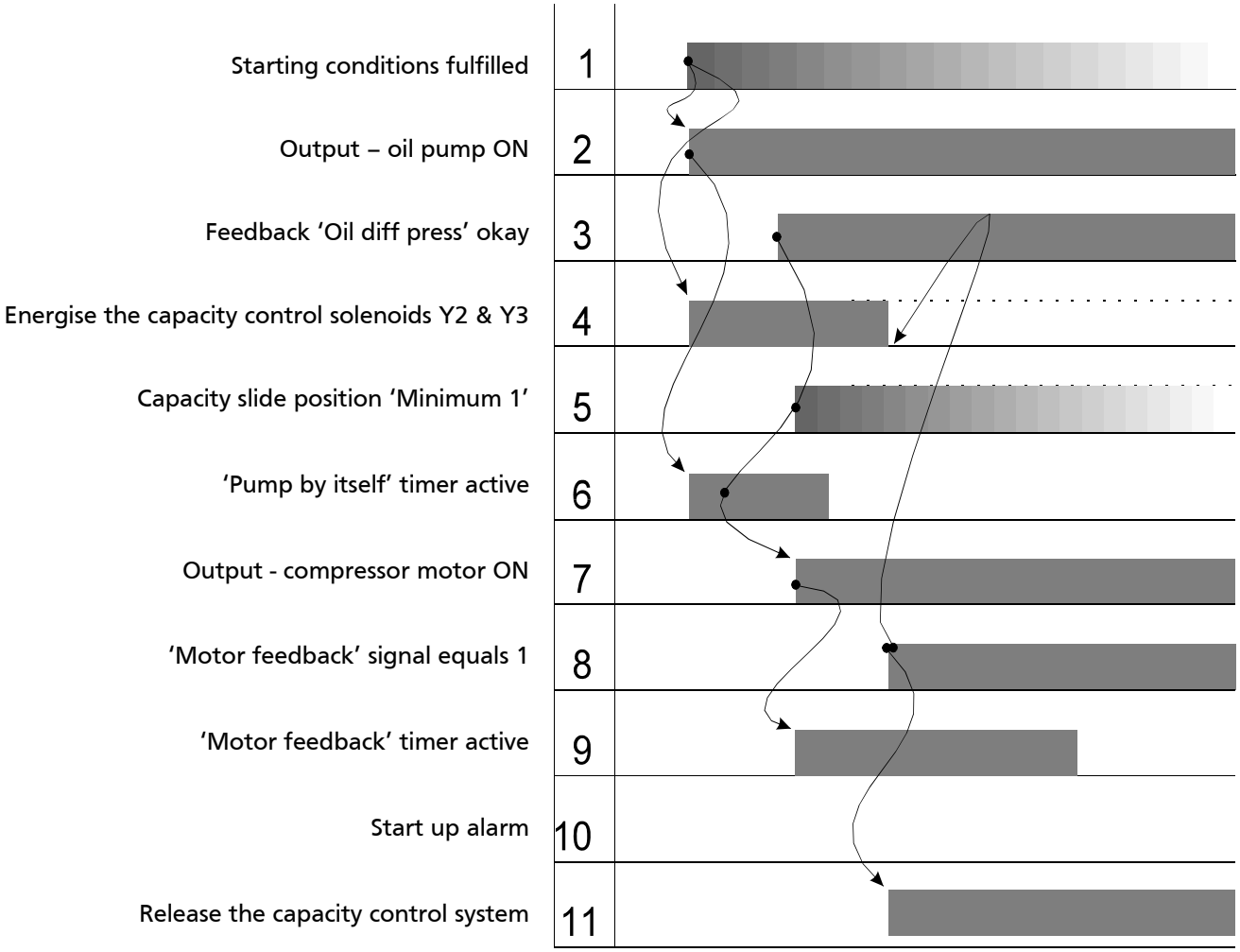
- **If** (1) Starting conditions fulfilled
→ **Then** (2) Energise the capacity control solenoids Y2 & Y3
→ **Then** (3) Energise the capacity control solenoids Y1 & Y4
→ **Then** (5) 'Slide to min' timer active

- **If** (4) Feedback - capacity slide below 'Minimum 1' position
→ **Then** (6) Output - compressor motor ON
→ **Then** (5) Reset 'Slide to min' timer
→ **Then** (3) De-energise the capacity control solenoids Y1 & Y4

- **If** (6) Output - compressor motor ON
→ **Then** (8) 'Motor feedback' timer active

- **If** (7) Motor feedback signal equals 1
→ **Then** (2) De-energise the capacity control solenoids Y2 & Y3
→ **Then** (8) Reset 'Motor feedback' timer
→ **Then** (10) Release of the capacity control system

2.4.2 Large Screw Compressor Packages



- **If** (1) Starting conditions fulfilled
→ **Then** (2) Output – oil pump ON
→ **Then** (4) Energise the capacity control solenoids Y2 & Y3

- **If** (2) Output – oil pump ON
→ **Then** (6) 'Pump by itself' timer active

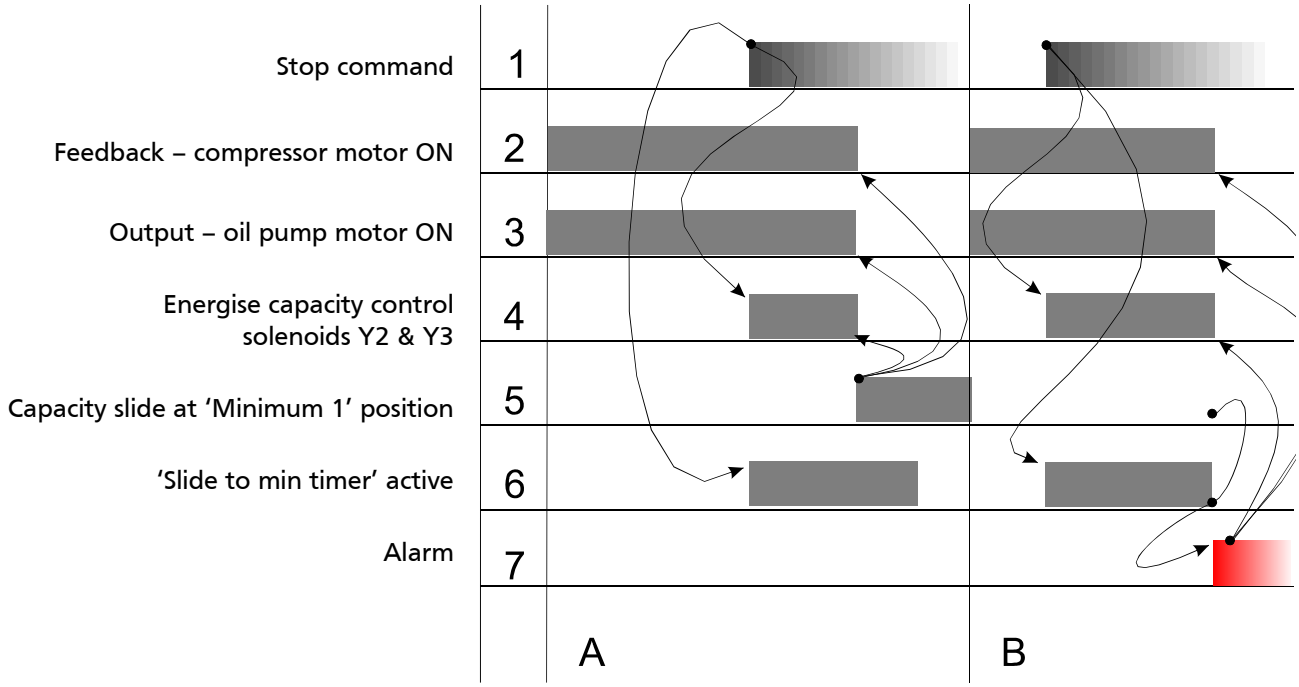
- **If** (3) Feedback 'Oil diff press' okay
  and
- **If** (5) Capacity slide position 'Minimum 1'
  and
- **If** (6) 'Pump by itself' timer not elapsed
→ **Then** (7) Output - compressor motor ON

- **If** (7) Output - compressor motor ON
→ **Then** (9) 'Motor feedback' timer active

- **If** (8) 'Motor feedback' signal equals 1
→ **Then** (4) De-energise the capacity control solenoids Y2 & Y3
→ **Then** (11) Release the capacity control system

2.5 Switch off sequence

2.5.1 Switching off sequence in the normal case and in case of slide failure



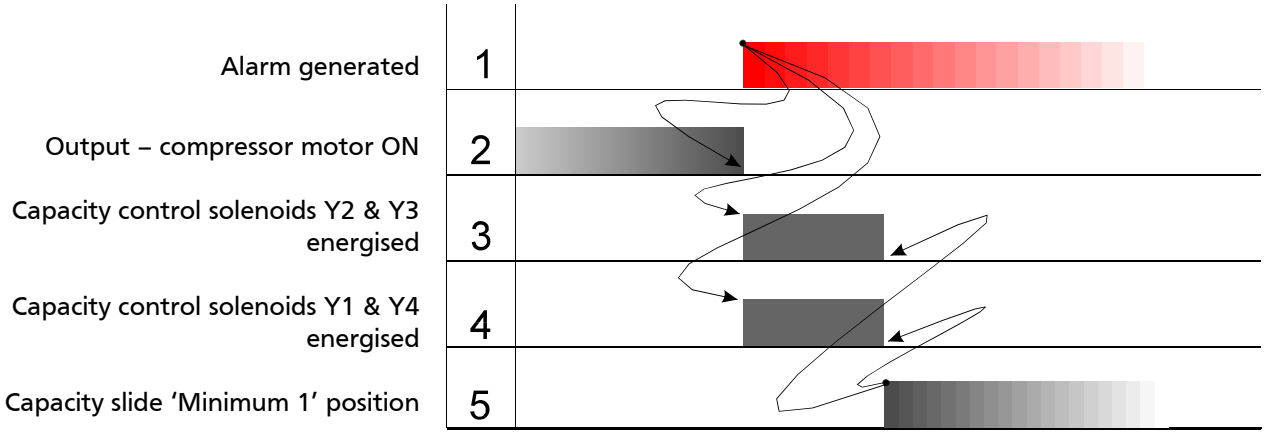
A Normal case:
Capacity slide returns to 'Minimum 1', compressor and oil pump are stopped

B Slide failure:
Capacity slide not returned to 'Minimum 1' before 'slide min timer' expired, compressor and oil pump are stopped and Alarm is generated (see 2.5.2/3)

- **If** (1) Stop command
→ **Then** (4) Energise capacity control solenoids Y2 & Y3
→ **Then** (6) 'Slide to min timer' active

- **If** (4) Energise capacity control solenoids Y2 & Y3
Or
- **If** (6) 'Slide to min timer' elapsed
and (5) Capacity slide at 'Minimum 1' position not reached
→ **Then** (7) Alarm
→ **Then** Reset the actuating signals (2), (3) and (4)

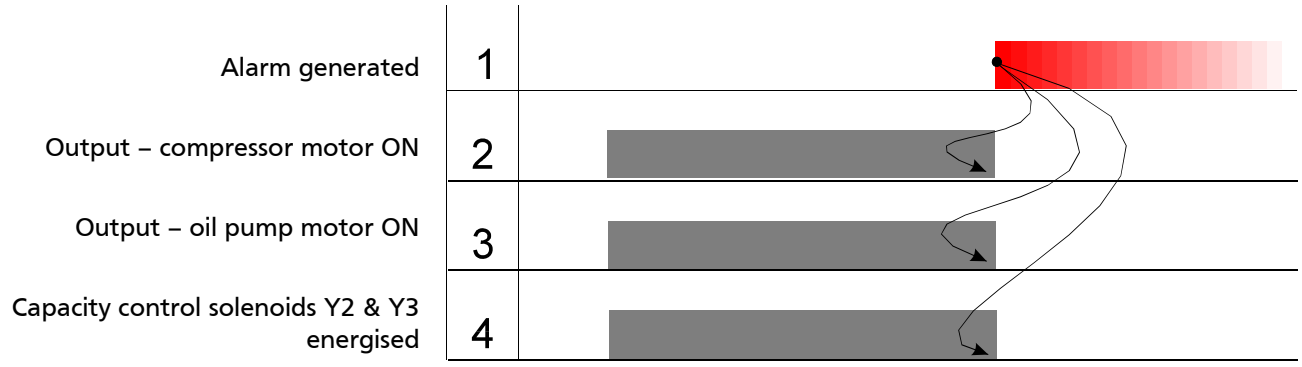
2.5.2 Switching off sequence in case of an alarm - small and medium screw compressor packages



- **If** (1) Alarm generated
→ **Then** (2) Reset output – compressor motor ON
→ **Then** (3) Capacity control solenoids Y2 & Y3 energised
→ **Then** (4) Capacity control solenoids Y1 & Y4 energised

- **If** (5) Capacity slide 'Minimum 1' position
→ **Then** (3) Capacity control solenoids Y2 & Y3 de-energised
→ **Then** (4) Capacity control solenoids Y1 & Y4 de-energised

2.5.3 Switching off sequence in case of an alarm – large screw compressor packages



- **If** (1) Alarm generated
→ **Then** (2) Reset output – compressor motor ON
→ **Then** (3) Reset output – oil pump motor ON
→ **Then** (4) Capacity control solenoids Y2 & Y3 de-energised

2.6 Compressor control

2.6.1 Capacity control

All screw compressors from Grasso are equipped with an infinitely variable capacity control system in the geometric range (0-100)%.

An external temperature or the suction pressure, can be selected as the controlled variable.

The capacity is adjusted using a hydraulically adjustable regulating capacity slide, adjustment of which results in a reduction in the effective rotor length of the compressor. The definitive length of the rotor for the compression process is thus altered.

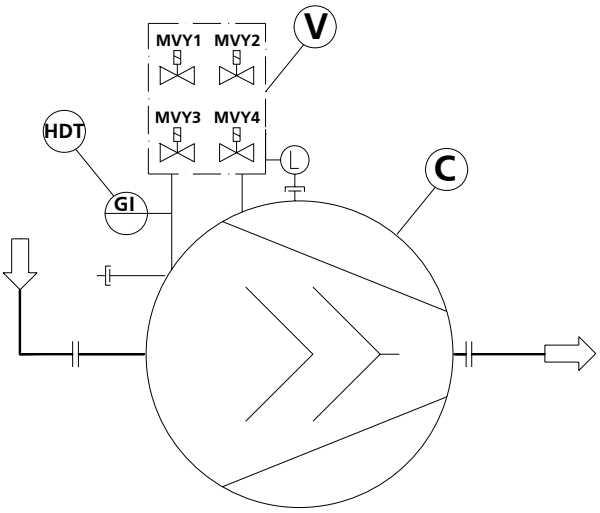
The position of the capacity slide is measured by a position sensor (HDT path sensor).

The hydraulic adjustment of the capacity slide is controlled via 4 solenoid valves, which are situated together in a block.

C.. Compressor

V.. Solenoid valve block

HDT.. Path sensor controller slider

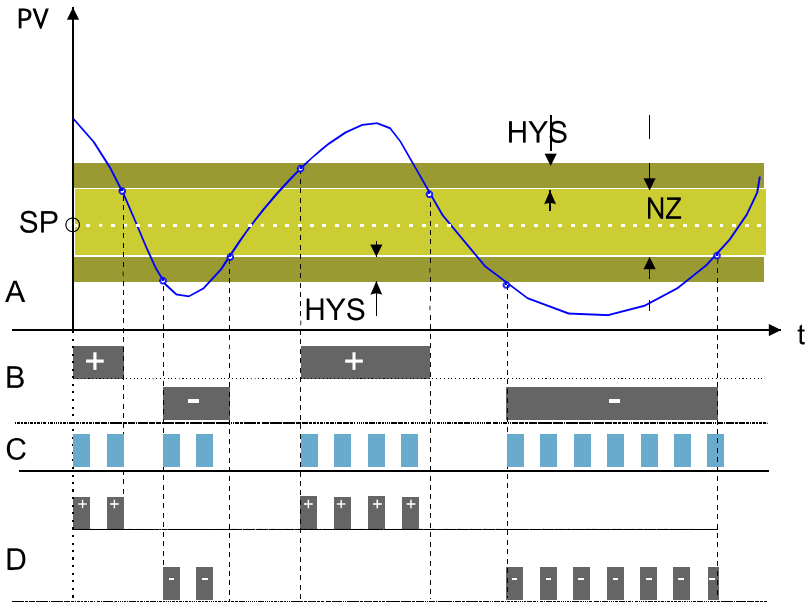


The solenoid valves for capacity adjustment are operated in pulses by the GSC control and are switched in pairs.

	Capacity +	Capacity -
Solenoid valve Y1	Energised	De-energised
Solenoid valve Y2	De-energised	Energised
Solenoid valve Y3	De-energised	Energised
Solenoid valve Y4	Energised	De-energised

2.6.2 Mode of operation of the capacity controller and of the subsequent solenoid valve pulses

PV.. Process value
SP.. Set point value
NZ.. Neutral zone
HYS... Hysteresis
A.. Time characteristic of PV
B.. Time characteristic of the 3-point controller outputs
C.. Time characteristic of the pulse generator
D.. Time characteristic of the pulsed outputs to the capacity control solenoid valves



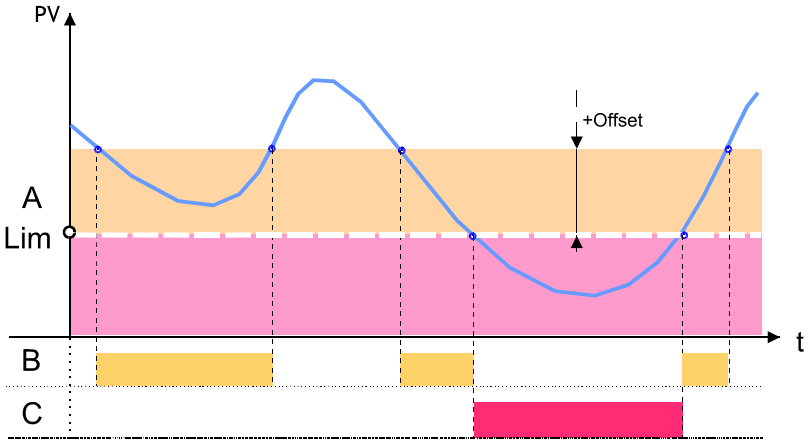
2.7 Safety control (Alarms, warnings and limitations)

The following types of alarms will activate the alarm output signal:

- Oil system alarms
- Minimum / Maximum limits reached
- Compressor and oil pump motor's start equipment alarms
- Hardware or sensor failures
- Safety timers exceeded

The formation of a limit value signal is illustrated in the following diagram.

A.. Time characteristic of the process value
B.. Warning output
C.. Alarm output
Lim.. Alarm limit of the process value
PV.. Process value
+/- Offset Warning limit

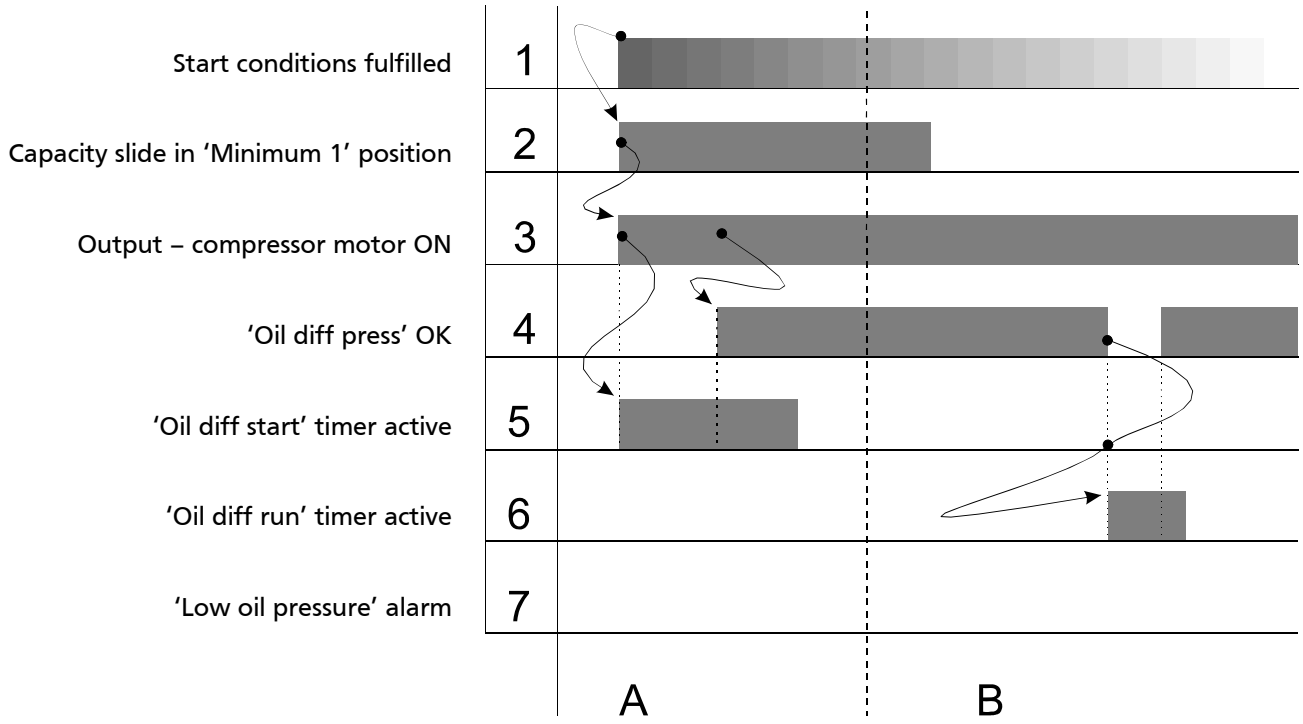


2.7.1 Oil system monitor of the small and medium screw compressor packages

The oil system monitor is responsible for monitoring the oil system. The package is switched off if alarms occur.

The difference between the oil pressure and the discharge pressure is monitored.

2.7.1.1 Switching sequence in the normal case



A During start up
B Brief lowering of the oil differential pressure during running

- **If** (2) Capacity slide in 'Minimum 1' position

→ **Then** (3) Output – compressor motor ON

- **If** (3) Output – compressor motor ON

→ **Then** (5) 'Oil diff start' timer active

- **If** (4) 'Oil diff press' not OK

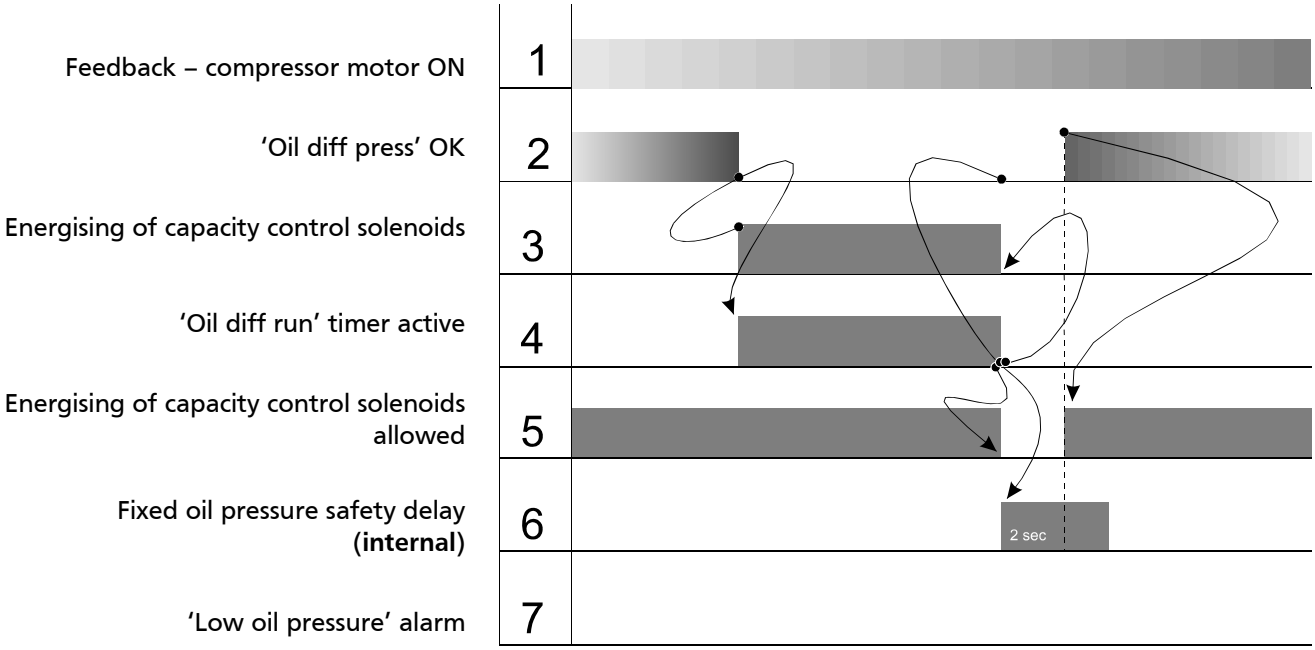
  and
- **If** (5) 'Oil diff start' timer elapsed

→ **Then** (6) 'Oil diff run' timer active

If the oil differential pressure is OK again within the appropriate delay time, there is no alarm shutdown.

2.7.1.2 Switching sequence for capacity control solenoid valves

- The configuration of the oil cycle causes the oil pressure to drop when a solenoid valve is opened!
- Actuating time monitoring is provided for the solenoid valves of the package to guarantee that the oil pressure is built up again.
- The blocking of the actuating signals only takes place in the operating condition of the package (compressor motor in delta) and during the shutdown cycle.
- A new capacity control pulse cannot be generated for a solenoid valve until the oil differential pressure has recovered.



- **If** (3) Energising of capacity control solenoids
  and
- **If** (2) 'Oil diff press' not OK

→ **Then** (4) 'Oil diff run' timer active

- **If** (4) 'Oil diff run' timer elapsed
  and
- **If** (2) 'Oil diff press' not OK

→ **Then** (6) Fixed oil pressure safety delay active

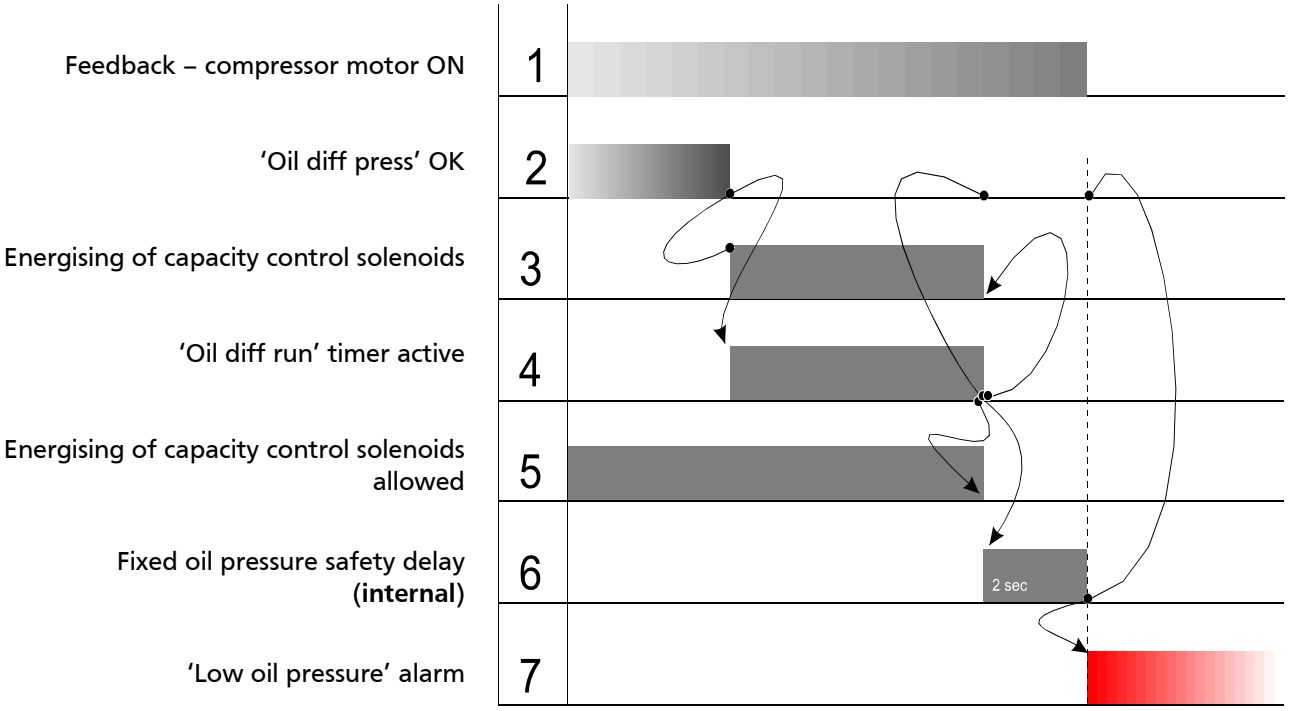
→ **Then** (3) De-energising of capacity control solenoids

- **If** (2) 'Oil diff press' OK
  and
- **If** (6) Fixed oil pressure safety delay not elapsed

→ **Then** (5) Energising of capacity control solenoids allowed

2.7.1.3 Switching sequence in case of too low oil differential pressure alarm during running

For Small and Medium compressors with internal oil pump.



- **If** (3) Energising of capacity control solenoids
  and
- **If** (2) 'Oil diff press' not OK

→ **Then** (4) 'Oil diff run' timer active

- **If** (4) 'Oil diff run' timer elapsed
  and
- **If** (2) 'Oil diff press' not OK

→ **Then** (6) Fixed oil pressure safety delay active

- **If** (6) Fixed oil pressure safety delay elapsed
  and
- **If** (2) 'Oil diff press' not OK

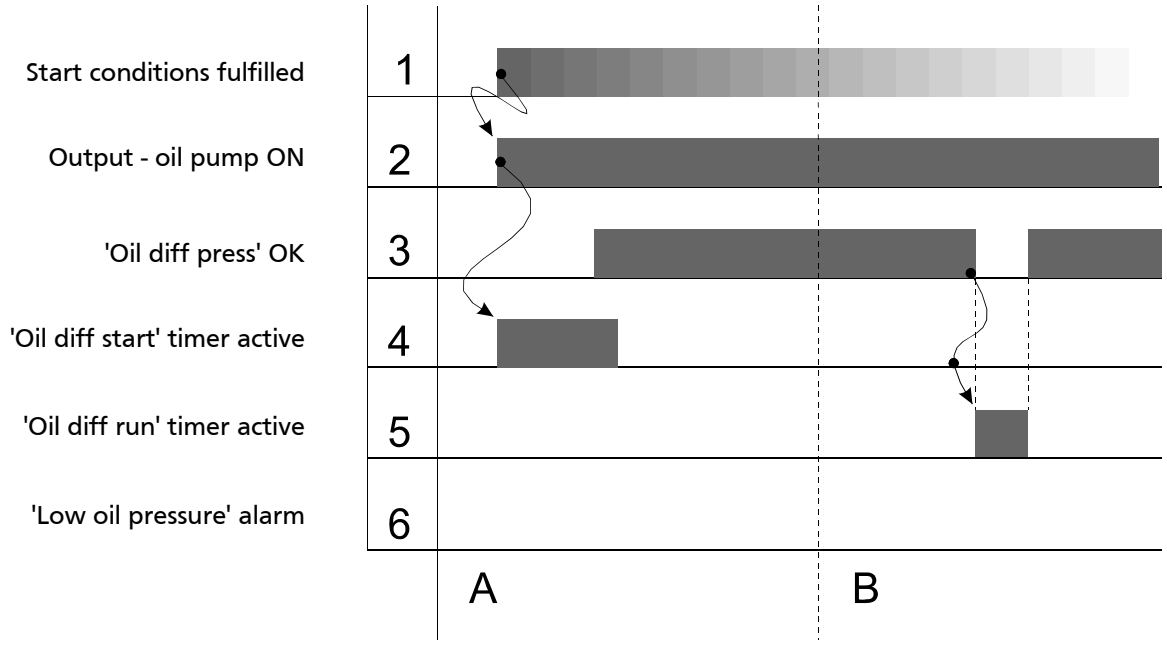
→ **Then** (7) 'Low oil pressure' alarm

2.7.2 Oil system monitor of the large screw compressor packages

The oil system monitor is responsible for monitoring the oil system. The package is switched off if alarms occur.

The difference between the oil pressure and the discharge pressure is monitored.

2.7.2.1 Switching sequence in the normal case



A.. During start up
B.. Brief lowering of the oil differential pressure during running

- **If** (1) Start conditions fulfilled

→ **Then** (2) Output - oil pump ON

- **If** (2) Output - oil pump ON

→ **Then** (4) 'Oil diff start' timer active

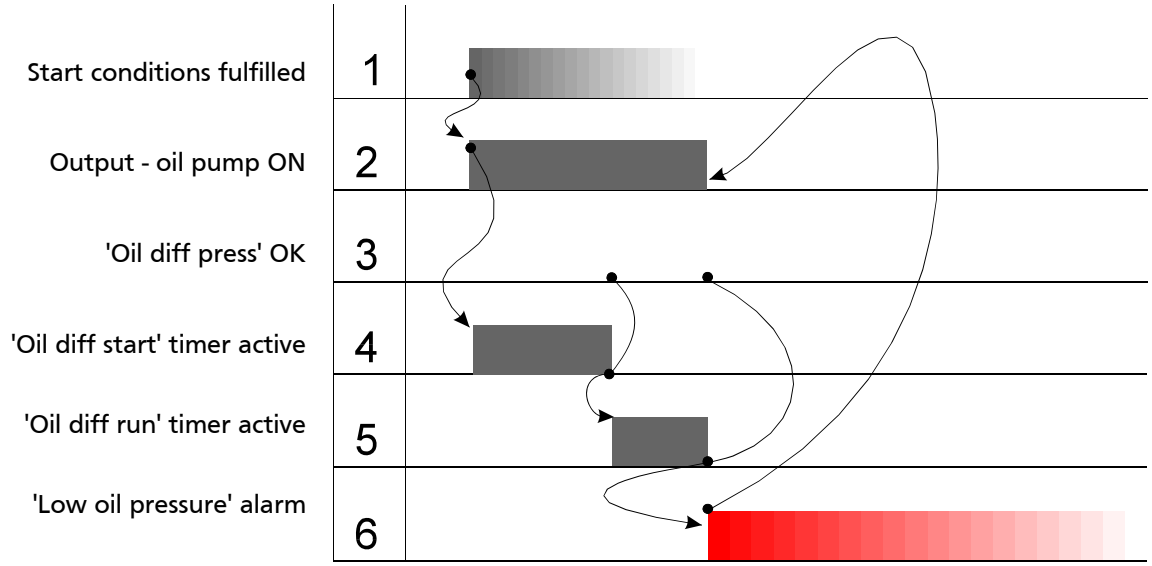
- **If** (3) 'Oil diff press' not OK

  and
- **If** (4) 'Oil diff start' timer elapsed

→ **Then** (5) 'Oil diff run' timer active

If the oil differential pressure is OK again within the appropriate delay time, there is no alarm shutdown.

2.7.2.2 Switching sequence in the case of a malfunction during the starting operation



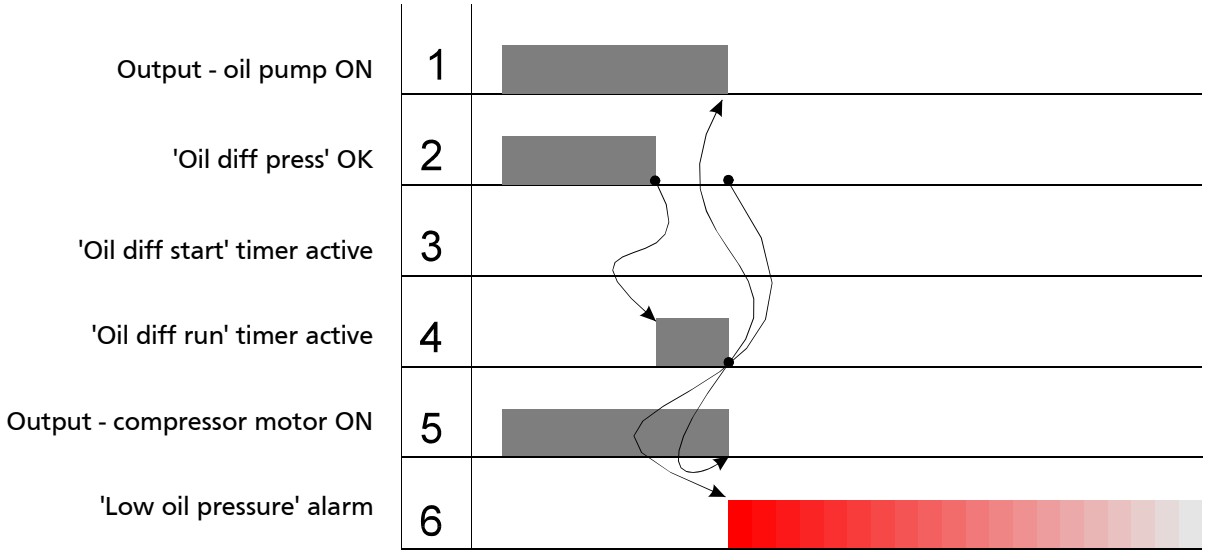
- **If** (1) Start conditions fulfilled
→ **Then** (2) Output - oil pump ON

- **If** (2) Output - oil pump ON
→ **Then** (4) 'Oil diff start' timer active

- **If** (4) 'Oil diff start' timer elapsed
  and
- **If** (3) 'Oil diff press' not OK
→ **Then** (5) 'Oil diff run' timer active

- **If** (5) 'Oil diff run' timer elapsed
  and
- **If** (3) 'Oil diff press' not OK
→ **Then** (6) 'Low oil pressure' alarm
→ **Then** (2) Reset of the output - oil pump ON

2.7.2.3 Switching sequence in the case of malfunction in the operating condition



- **If** (2) 'Oil diff press' not OK

→ **Then** (4) 'Oil diff run' timer active

- **If** (4) 'Oil diff run' timer elapsed

and

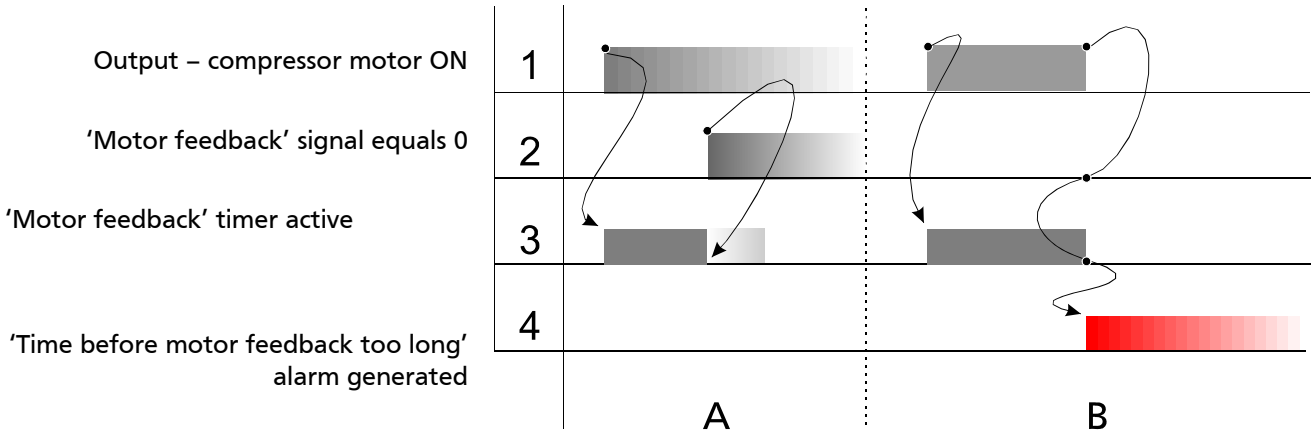
- **If** (2) 'Oil diff press' not OK

→ **Then** (6) 'Low oil pressure' alarm

→ **Then** Reset all actuating signals

2.7.3 Compressor motor alarms

2.7.3.1 'Motor feedback' alarm – start up of compressor motor takes too long



A.. During start up
B.. During the starting operation, the motor feedback signal is delayed for too long

- **If** (1) Output - compressor motor ON

→ **Then** (3) 'Motor feedback' timer active

- **If** (1) Output - compressor motor ON

and

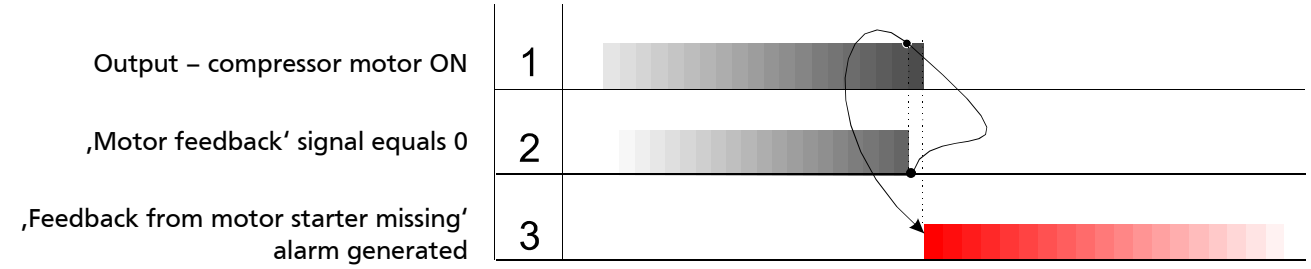
- **If** (2) 'Motor feedback' signal equals 0

and

- **If** (3) 'Motor feedback' timer elapsed

→ **Then** (4) 'Time before motor feedback too long' alarm generated

2.7.3.2 "Feedback from motor starter missing" alarm



- **If** (2) ,Motor feedback' signal equals 0

and

- **If** (1) Output - compressor motor ON

→ **Then** (3) ,Feedback from motor starter missing' alarm generated

2.7.3.3 Motor current limitation

The motor current limitation prevents overloading of the compressor drive motor. It does not become effective until the start up process has been completed.

If the motor current reaches its initial limitation value (e.g. 105% of the full load current), the capacity of the compressor is reduced by energising capacity control solenoids Y2 & Y3.

The signal dominates compared to the capacity control and is effective until the motor current has reached the end of the limitation.

The motor current limitation function is illustrated in the following diagram.

I_{mot} Motor current

V.. Capacity control solenoids Y2 & Y3 energised

b.. 'Imot – limit begin'

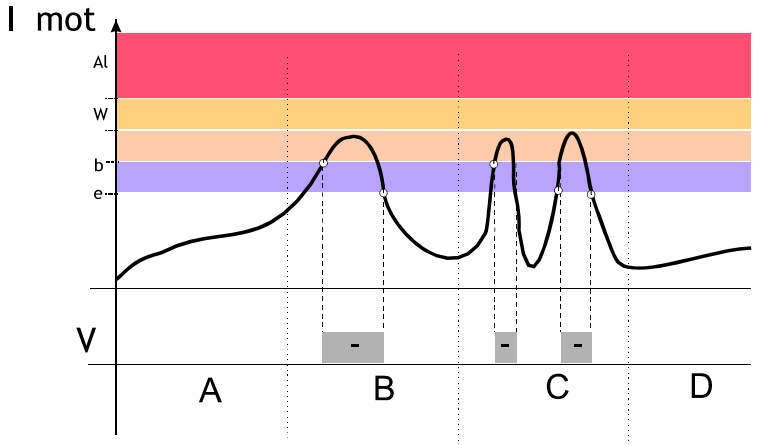
e.. 'Imot – limit end'

A.. Start up

B.. Limitation during (eg) pull down

C.. Intermittent limitation

D.. Shut down procedure (no limitation)



Imot high alarm	□□□□
Limit begin -	□□□□
Limit end -	□□□□
<< Limit values 01 >>	

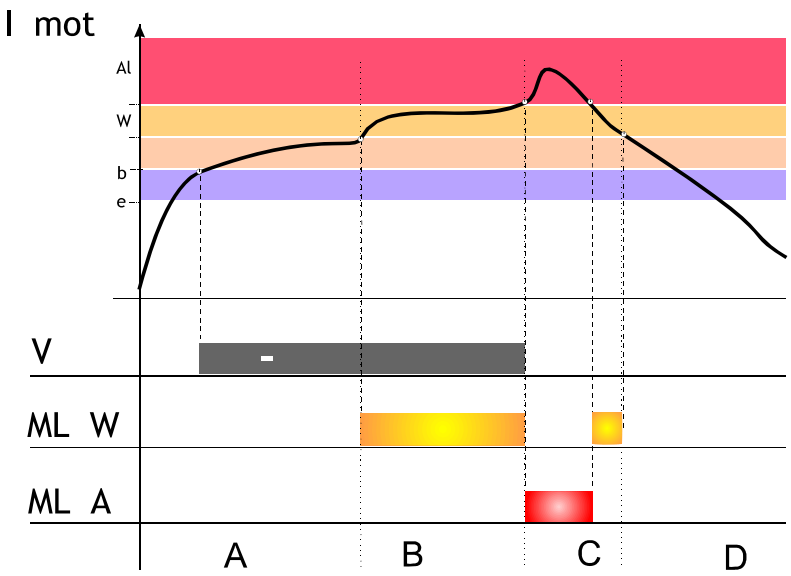
Imot high alarm: Alarm limit for maximum current in A

Limit begin: Begin the motor current limitation - enter value as an offset to the alarm value in A

Limit end: End of the - motor current limitation enter value as an offset to the alarm value in A

2.7.3.4 High motor current alarm

I mot	Motor current
b..	‚Imot – Limit begin'
e..	'Imot – Limit end'
W..	‚Imot – high warning'
Al..	'Imot – high alarm'
V..	Capacity control solenoids Y2 & Y3 energised
ML W..	Warning message
ML A..	Alarm signal
A..	‚Imot' limitation effective
B..	‚High motor current' warning
C.	‚High motor current' alarm
D..	No alarm generated



Motor current	□□□□
Imot high alarm	□□□□
High warning -	□□□□
<< Limit values 01 >>	

Motor current:	Actual motor current in A
Alarm (max):	Alarm limit for maximum motor current in A
Warning:	Enter the warning value as an offset to the alarm value in A

2.7.3.5 Low suction pressure limitation

The suction pressure limitation attempts to prevent a low suction pressure alarm. It does not become effective until the start up process has been completed.

If the suction pressure reaches its initial limitation value, the capacity of the compressor is reduced by energising capacity control solenoids Y2 & Y3.

The signal dominates compared to the capacity control is effective until the suction pressure reaches the end of the limitation. The suction pressure limitation function is illustrated in the following diagram.

P_{suc} Suction pressure

V.. Capacity control solenoids Y2 & Y3 energised

b.. 'Psuc low – limit begin'

e.. 'Psuc low – limit end'

W.. 'Psuc – low warning'

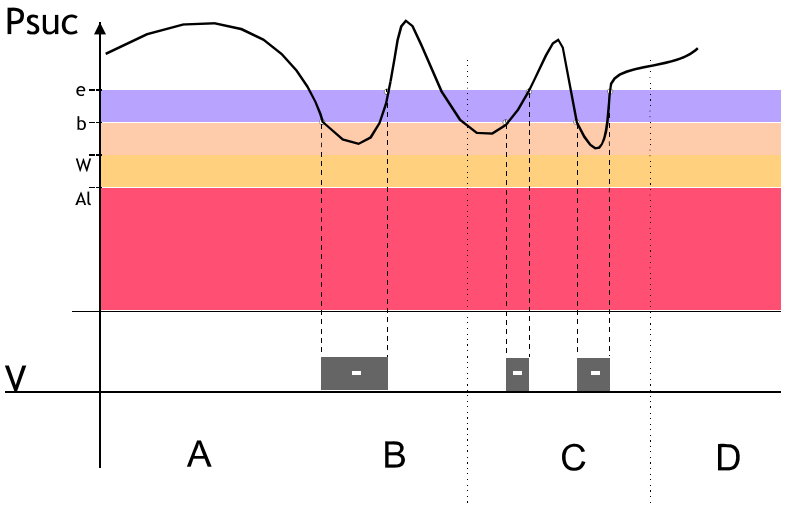
Al... 'Psuc – low alarm'

A.. Start up

B.. Short term limitation

C.. Intermittent limitation

D.. Normal operation (no limitation)



Psuc low alarm		□□□□
Limit begin	+	□□□□
Limit end	+	□□□□
<<	Limit values 01	>>

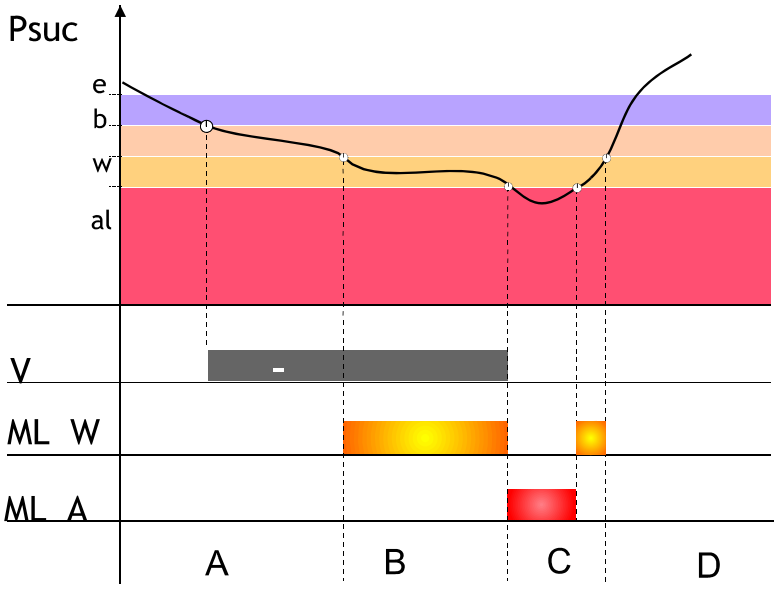
Psuc low alarm: Alarm limit for minimum suction pressure in bar (a)

Limit begin: Begin the suction pressure limitation - enter value as an offset to the alarm value in bar

Limit end: End the suction pressure limitation - enter value as an offset to the alarm value in bar

2.7.3.6 Low suction pressure alarm

P_{suc}	Suction pressure
b..	'Psuc low – limit begin'
e..	'Psuc low – limit end'
W..	'Psuc – low warning'
Al..	'Psuc – low alarm'
V..	Capacity control solenoids Y2 & Y3 energised
ML W..	Warning message
ML A..	Alarm message
A..	'Psuc' Limitation effective
B..	'Low suction pressure' warning
C..	'Low suction pressure' Alarm
D..	No alarm generated



Suction pressure	□□□□
Psuc low alarm	□□□□
Low warning +	□□□□
Limit values 01 >>	

Suction pressure: Actual suction pressure in bar (a)
Psuc low alarm: Alarm limit for minimum suction pressure in bar (a)
Low warning: Enter the warning value as an offset to the alarm value in bar

2.7.3.7 Low external temperature limitation

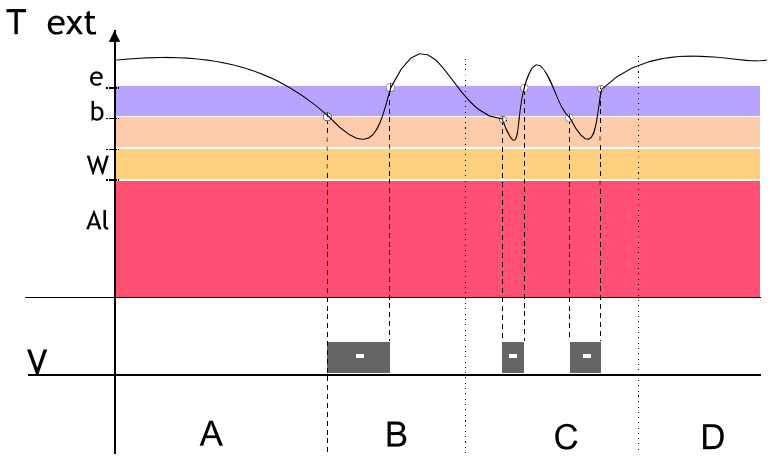
This limitation is only active if the external temperature is selected as the controlled value.

This limitation is intended to prevent the evaporator from freezing. It does not become effective until the start up process has been completed.

If the external temperature reaches its initial limitation value, the capacity of the compressor is reduced by energising capacity control solenoids Y2 & Y3.

The signal dominates compared to the capacity control and is effective until the external temperature has reached the end of the limitation. The low external temperature limitation is illustrated in the following diagram.

T_{ext}	External temperature
V..	Capacity control solenoids Y2 & Y3 energised
b..	'Text low – limit begin'
e..	'Text low – limit end'
W..	'Text – low warning'
Al..	'Text – low alarm'
A..	Start up
B..	Short term limitation
C..	Intermittent limitation
D..	Normal operation (no limitation)

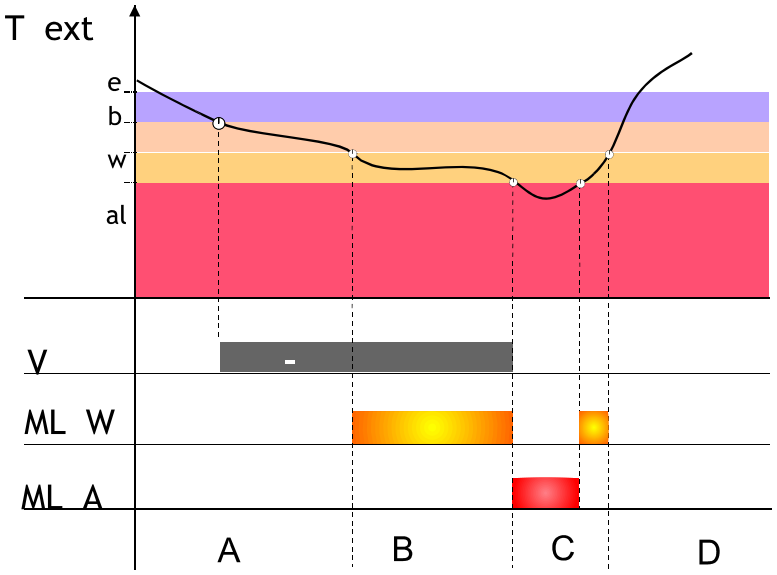


Text low alarm		□□□□
Limit begin	+	□□□□
Limit end	+	□□□□
<<	Limit values 01	>>

Text low alarm:	Alarm limit for minimum external temperature in °C
Limit begin:	Begin the temperature limitation - enter value as an offset to the alarm value in K
Limit end:	End the temperature limitation - enter value as an offset to the alarm value in K

2.7.3.8 Low external temperature alarm

T_{ext}	External temperature
b..	'Text – limit begin'
e..	'Text - limit end'
W..	'Text – low warning'
Al..	'Text – low alarm'
V..	Capacity control solenoids Y2 & Y3 energised
ML W..	Warning message
ML A..	Alarm message
A..	'Text' limitation effective
B..	'Text – low warning'
C..	'Text – low alarm'
D..	No alarm generated



External temp	□□□□
Text low alarm	□□□□
Low warning +	□□□□
<< Limit values 01 >>	

External temp.: Actual external temperature in °C
Text low alarm: Alarm limit for minimum external temperature in °C
Low warning: Enter the warning value as an offset to the alarm value in K

2.7.3.9 High discharge pressure limitation

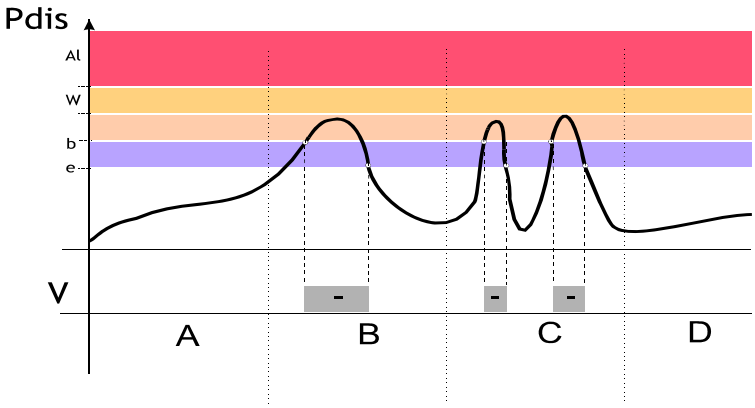
The discharge pressure limitation is intended to prevent a high discharge pressure alarm. It does not become effective until the start up process has been completed.

If the discharge pressure reaches its initial limitation value the capacity of the compressor is reduced by energising capacity control solenoids Y2 & Y3.

The signal dominates compared to the capacity control and is effective until the discharge pressure has reached the end of the limitation.

The discharge pressure limitation function is illustrated in the following diagram.

P_{dis}	Discharge pressure
V..	Capacity control solenoids Y2 & Y3 energised
b..	'Pdis – limit begin'
e..	'Pdis – limit end'
W..	'Pdis – high warning'
Al..	'Pdis – high alarm'
A..	Start up
B..	Short term limitation
C..	Intermittent limitation
D..	Shut down procedure (no limitation)

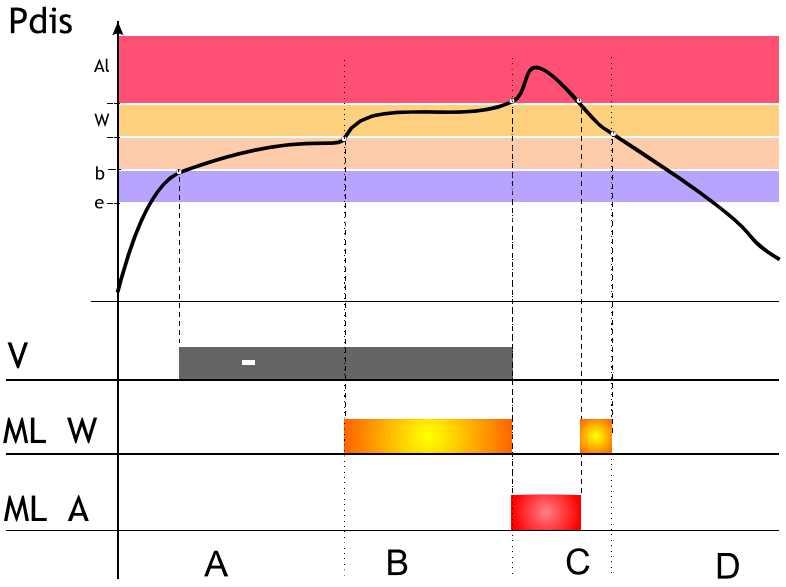


Pdis high alarm	□□□□
Limit begin	- □□□□
Limit end	- □□□□
<< Limit values 01 >>	

Pdis high alarm:	Alarm limit for maximum discharge pressure in bar (a)
Limit begin:	Begin the discharge pressure limitation - enter value as an offset to the alarm value in bar
Limit end:	End the discharge pressure limitation - enter value as an offset to the alarm value in bar

2.7.3.10 High discharge pressure alarm

P_{dis}	Discharge pressure
b..	'Imot – limit begin'
e..	'Imot – limit end'
W..	'Imot – high warning'
Al..	'Imot – high alarm'
V..	Energise capacity control solenoids Y2 & Y3
ML W..	Warning signal
ML A..	Alarm signal
A..	'Pdis' limitation effective
B..	'High discharge pressure' warning
C..	'High discharge pressure' alarm
D..	No alarm generated



Disch pressure	□□□□
Pdis high alarm	□□□□
High warning -	□□□□
<< Limit values 01 >>	

Disch pressure:	Actual discharge pressure in bar (a)
Pdis high alarm:	Alarm limit for maximum discharge pressure in bar (a)
High warning:	Enter the warning value as an offset to the alarm value in bar

2.8 Internal DuoPack Sequence control

This document describes the sequence control for a DuoPack.

The normal situations are described for increasing and decreasing capacity (see diagram 1 and 2). Furthermore, the special situation is described where compressor 1 trips on an alarm and is shut off (see diagram 3). Only this situation is special because if compressor 2 trips on an alarm, the sequence is not changed.

2.8.1 GSC Parameters

DuoPack sequence control: limits (menu 35: Unit options) [1]

Minimum[2]	Minimum position in %, based on total swept volume.
Part load	Part load (med. position) in % based on total swept volume.
Maximum	Maximum position in %, based on total swept volume.
Neutral zone	Neutral zone in K. The 2nd compressor may start as soon as the process value exceeds the set point + ½ NZ.
Seq. order	Select the sequence order to use. "Auto" Sequence order based on running hours. "1 – 2" Compressor 1 will start first and stop last. "2 – 1" Compressor 2 will start first and stop last. Note: If one of both compressors is equipped with a frequency inverter a fixed sequence order is used. This compressor will always start first and stop last.
Act. seq. order	Actual active sequence

DuoPack sequence control: time settings (menu 35: Unit options)

Start delay	Start delay in sec to start the 2nd compressor after 1st has reached maximum.
Stop delay	Stop delay in sec to stop the 2nd compressor as soon as it has reached middle position (med. position) and the 1st compressor is running at middle position.
Force start dly	Monitoring time for capacity increase in sec. This time is not active if a limitation is active[3]. As soon as this time has elapsed the next step in the sequence will be forced.
Force stop dly	Monitoring time for capacity decrease in sec. This time is not active if a limitation is active. As soon as this time has elapsed the next step in the sequence will be forced.
Max. hrs. diff.	Maximum number of running hours between both compressors. As soon as the value is reached, and both compressors are running, then the sequence order will be changed automatically. If one compressor is running only and the value is reached no forced change of the sequence order will be executed. (This parameter is not active if one of both compressors is equipped with a frequency inverter.)

[1] These parameters must be set for each compressor individually. All other parameters are equal for both compressors.

[2] The minimum load position is monitored if both compressors are running only. In all other cases this value is neglected.

[3] In case of motor current limitation and 1 compressor running only the next compressor is forced to start after start delay time + fixed additional time (90 sec).

CAPACITY INCREASE (NORMAL SITUATION)

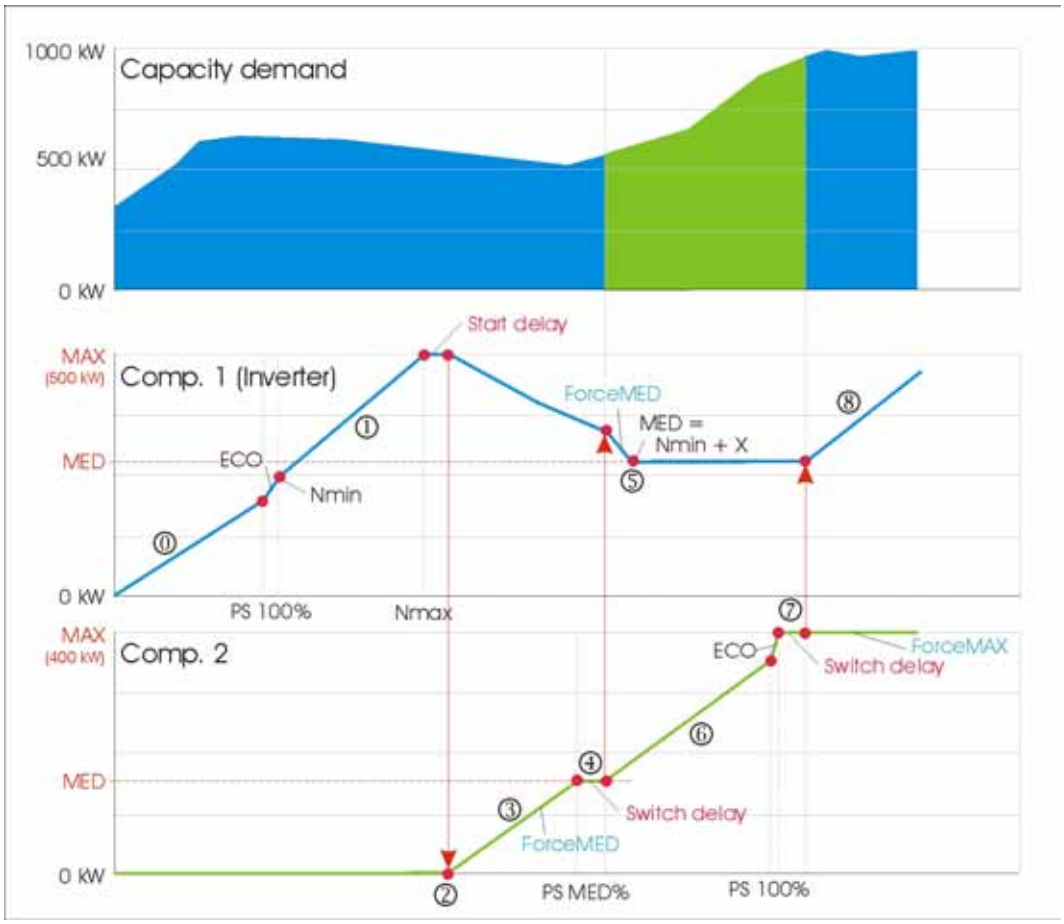


Diagram 1, Capacity increase, normal situation

0. Start compressor 1 (equipped with frequency inverter) at minimum speed and control slide up to 100%. Next activate economizer.
1. Increase compressor capacity by increasing the motor speed up to maximum speed.
2. Wait until "start delay" has elapsed and start 2nd compressor (without frequency inverter).
3. The 2nd compressor is forced to "Part load" regardless of set point and process value. During this time compressor 1 is in control.
   a. If less capacity is needed compressor 1 will reduce capacity.
   b. If more capacity is needed compressor 1 will stay at 100% with maximum speed.
4. After that compressor 2 has reached the desired "Part load" for more than "switch delay" time, compressor 1 is forced to reduce capacity (part load) and compressor 2 takes over control.
5. As soon as compressor 1 has reached the "Part load", which is within the speed control area and above the minimum speed, the capacity is fixed.
6. Compressor 2 is controlled based on set point and process value by changing the slide position
7. As soon as compressor 2 has reached 100% slide position the economizer is activated and the capacity is fixed
8. From now compressor 1 takes over capacity control. The speed can be increased or decreased (down to minimum speed) depending on the capacity demand.

CAPACITY DECREASE (NORMAL SITUATION)

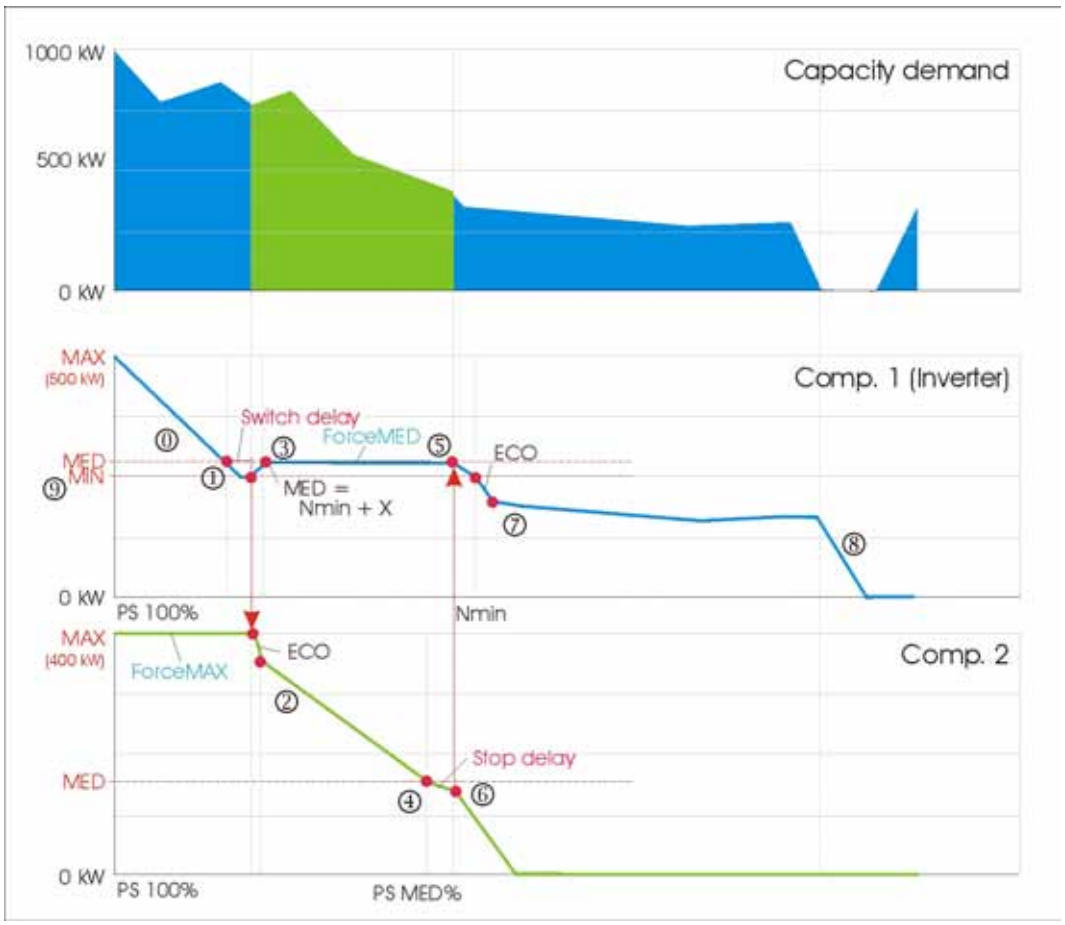


Diagram 2, Capacity decrease, normal situation

0. Compressor 1 decreases capacity by reducing motor speed
1. As soon as the “Part load” is reached (and/or below) the switch delay is set.
2. After this delay compressor 2 takes over capacity control and...
3. Compressor 1 is forced to stay at “Part load”.
4. If compressor 2 runs below “Part load” the stop delay is started
5. After the stop delay compressor 1 takes over capacity control and...
6. Compressor 2 is stopped.
7. Compressor 1 is running and controlled based on set point and process value.
8. If no capacity is needed compressor 1 is stopped also.
9. The “Minimum” parameter is valid if both compressors are running. As soon as the capacity of a running compressor is less than this value, the capacity is increased. In this way it is ensured that no compressor can run with less capacity than the “Minimum” value. Furthermore, the minimum value for the sequence control is always higher than the bushing limit for the local control. So it also ensures that the compressor keeps running.

CAPACITY INCREASE/DECREASE (SPECIAL SITUATION)

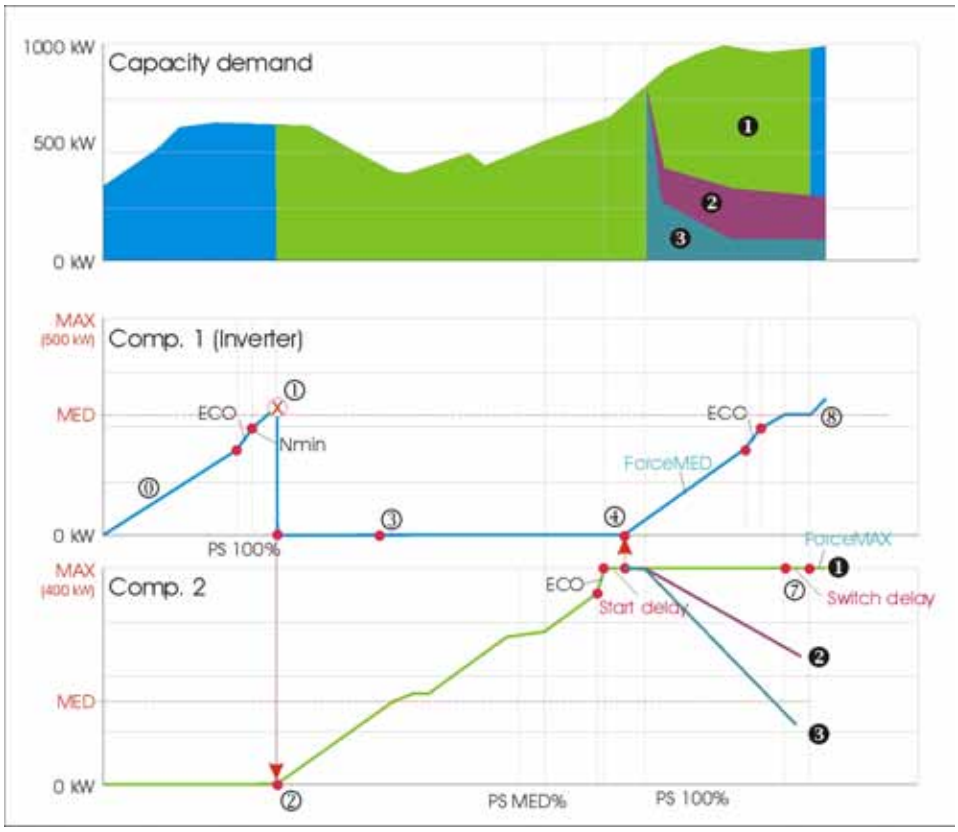


Diagram 3, Capacity increase/decrease (special situation)

0. Compressor 1 increases capacity (same as point 0. Capacity increase, normal situation)
1. Failure shut down of compressor 1
2. Compressor 2 takes over capacity control
3. Failure at compressor 1 acknowledged. Compressor 1 standby.
4. Compressor 2 reaches maximum capacity. After "Start delay" time compressor 1 is started and forced to "Part load".

From now on 3 situations can occur:

1. Capacity demand is so high that compressor 2 stays at maximum load. As soon as compressor 1 has reached the "Part load" the "switch delay" timer starts. After this time compressor 2 is forced to stay at maximum load. Compressor 1 is controlling capacity based on set point and process value. This situation equals points 7 and 8 at "capacity increase, normal situation".
2. Capacity demand decreases and compressor 2 decreases capacity during the time that compressor 1 is forced to "Part load". As long as the capacity of compressor 2 is more than the "Part load" nothing special happens. This situation is equal to points 5 and 6 of "capacity increase, normal situation" or points 2 and 3 of "capacity decrease, normal situation".
3. Capacity demand decreases dramatically and compressor 2 decreases capacity below the "Part load" (before or after compressor 1 has reached the "Part load"). In this case compressor 2 will be shut off after "stop delay" time and this situation equals points 4, 5 and 6 of "capacity decrease, normal situation".

2.8.2 Determination of the starting sequence

The screw compressors are switched on or off according to a fixed starting sequence.

The start sequence (1 → 2 or 2 → 1) is defined at the terminal (Menu 35 Duopack sequence control – limits).

If a compressor fails, another automatically takes up its function (if available).

The compressor start sequence within the sequencing control plays a major role. It determines the order in which the sequencing control logic selects the compressor for power adjustment or for switching on and off.

A start sequence canbe fixed automatically or manually.

If a parameterisable maximum difference in operating hours is exceeded and the start sequence mode is “auto”, a forced changeover in the priorities takes place. But no compressor is forced to start or stop.

2.8.3 Fault handling

Compressors under fault conditions are evaluated within the sequencing control as not being in the sequencing control mode.

If the malfunction is corrected, the corresponding compressor is automatically included back in the sequencing control (to previous position).

2.8.4 Parameterisation of the sequencing control at the operator terminal

Press 

,

Select main menu 15 “Operating modes“

Use 

and 
to select “Auto+auto” and Press 

Select main menu 35 “Options“ and Press 

.

Duopack Sequence control	
Limits	Time set.

Press 

once (Select “Limits”). The following selection appears on the display:

The following selection appears on the display:

Maximum	95
Part load	65
Minimum	35
Duopack limits	>>

Depending on the requirements, the default parameters for the plant conditions can be adjusted here.

Parameters valid for both compressors.

Press 

. The following selection appears on the display:

Neutral zone	4
Seq. order	auto
Act. seq. order	1 - 2

Press ESC key. The following selection appears on the display:

Duopack	
Sequence control	
Limits	Time set.

Press F3 | once (Select "Timer settings").

The following selection appears on the display:

Start delay	120
Stop delay	120
Time Setting 1 + 2	>>

Times valid for the 2nd (subsequent)compressor only.

Depending on the requirements, the default parameters for the plant conditions can be adjusted here.

Press F4 >> once (page forward to next image). The following selection appears on the display:

Force start dly	600
Force stop dly	600
max. hrs. diff.	99 h
<< Time Setting 1+2	

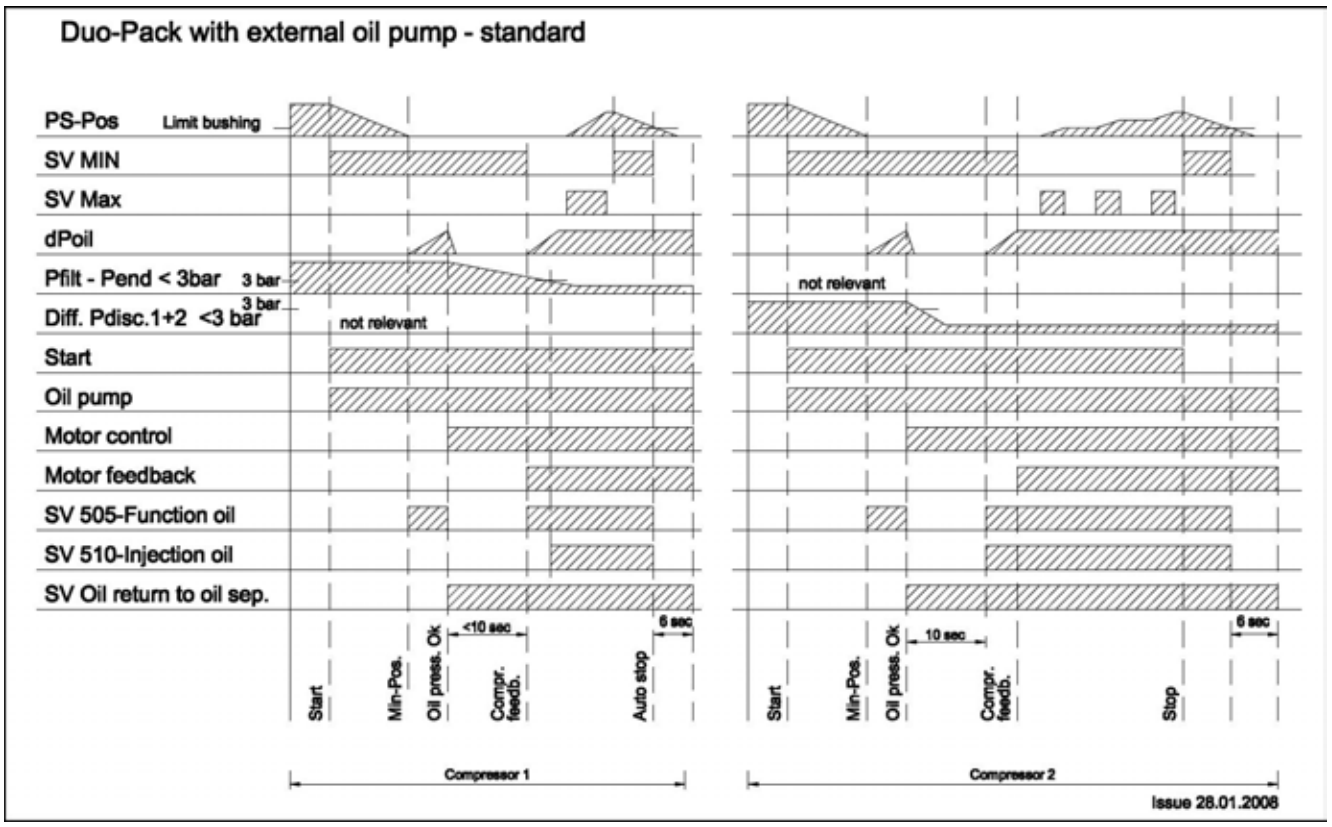
Depending on the requirements, the default parameters for the plant conditions can be adjusted here.

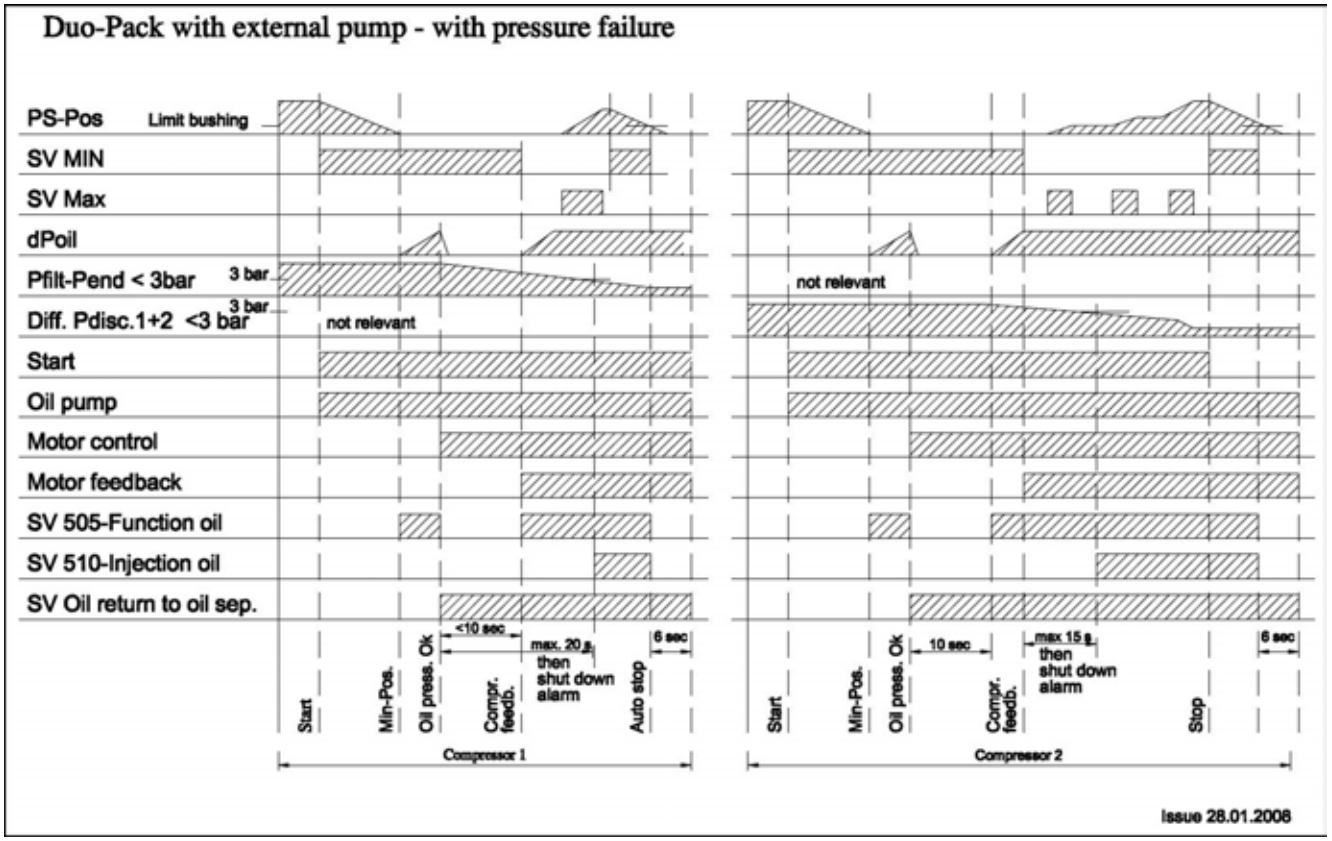
2.9 Restarting performance following power supply failure

- Following power failure, the GSC requires a short time delay for self checking.
- During this delay, the package cannot be started.
- When this timer has expired and no new alarms are present the alarm output is reset.
- If the package is in remote control, it cannot be requested to start until this timer has expired.
- If the package is in control modes 1, 2 or 3, it has to be started manually (This prevents several packages starting together).

Start to start	□□□□
Stop to start	□□□□
Time Setting 01	>>

2.10 Turn on/ Turn off solenoid valves 505.* and 510.*





2.11 Chiller functions

The GSC can also form part of a chiller package control system.

2.11.1 Start up

The start up operation of a chiller package is as follows

1. The digital outputs A 12.0 and A 12.1 are energised following a start request. The secondary refrigerant pump and the condenser system are thus released. The GSC, at digital inputs E 12.0 and E 12.1, accepts feedback signals to ensure that these systems are in operation. If no feedbacks are received within the set times, the GSC passes into a warning condition, and the package starts up.
2. The GSC monitors the secondary refrigerant flow by means of o flow switch input E12.2.Once the secondary refrigerant pump has been released to start the GSC must receive this input within the timer setting 'Flow swtch dly'. If the input is not made within this time, the GSC passes into an alarm condition, and the unit stops.

Pump feedback	□□□□
Flow swtch dly	□□□□
<< Time setting CH	>>

3. The start up procdure for the screw compressor package is not initiated until the flow in the secondary refrigerant cicruit is established.

2.11.2 Oil draining and return

The 'FX' range of chillers have an oil return from the evapaorator. The oil is returned to the comprerssor from the evaporator via 2 solenoid valves.

1. After start up of the compressor, an oil draining phase operates, the solenoid valve position number 2305 opens for the duration 'Oil drain'.
2. After the oil draining phase the timer 'Oil drain dly' operates.
3. After the oil drain delay, the oil return phase operates, the solenoid valve position number 2310 opens for the duration 'Oil return'.
4. After the oil return phase the timer 'Oil return dly' operates.

The parameters for oil draining and return are found in menu 30 'Timer settings'.

Oil return	□□□□
Return delay	□□□□
<< Time values CH	

Oil drain	□□□□
Drain delay	□□□□
<< Time values CH	>>

3

3 INITIAL START UP

3.1 Compressor, refrigerant, and sensor selection

Press 

,

Select the main menu 50 “Configuration“.

Press 

once. The following selection appears on the display:

Refrigerant	R717
Comp type	P
Vi code	Fixed
<< Configuration	>>

Line: “ Refrigerant“ select the refrigerant with the 

and 
keys.

Line: “Comp type“ select the compressor type with the 

and 
keys.

Line: “Vi code“, read off the Vi code from the compressor rating plate and select here with the 

and 
keys.

Press 

once (page down one image). The following selection appears on the display:

Oil filt sensor	yes
Sensor position	395
<< Configuration	>>

Line: “Oil filt sensor“, use the 

and 
keys to select whether an oil filter pressure sensor is used.

Line: “Sensor position?“ Use the 

and 
keys to select whether the oil filter pressure sensor is fitted at Pos. 395 or 495.

Press 

once. The following selection appears on the display:

Oil level high	no
Oil level low	no
<< Configuration	>>

Line: “Oil level high“ use the 

and 
keys to select whether an oil level sensor is installed for a too high level in the oil separator.

Line: “Oil level low“ use the 

and 
keys to select whether an oil level sensor is installed for a too low level in the oil separator.

Press 

once (page on to the next image). The following selection appears on the display:

Unit type	Package
CH inlet sensor	no
<< Configuration	>>

Line: “Unit type“ use the SHIFT and ▼ keys to select whether a compressor unit, DX chiller or an FX chiller functionality is required.

Line: “CH inlet sensor" use the SHIFT and ▼ keys to select whether a sensor is installed for the secondary refrigerant inlet temperature.

Press F4 >> once. The following selection appears on the display:

Profibus	no
Economiser	without
Eco sensor	no
<< Configuration	>>

Line: “Profibus“ use the SHIFT and ▼ keys to select whether the process data (via profibus DP) is to be transferred to a master control system. If “No“ they can only be read via the MPI bus.

Line: “Economiser“ use the SHIFT and ▼ keys to select whether an economizer is installed.

Line: “Eco sensor“ use the SHIFT and ▼ keys to select whether pressure and temperature sensors are fitted to the economizer.

Press F4 >> once. The following selection appears on the display:

Sensor	Psuc
4mA equals	0
20mA equals	70
<< Configuration 01	>>

Line: “Sensor“ use the SHIFT and ▼ keys to select the sensor to be scaled.

Line: “4mA equals“ Enter the selected sensor’s minimum value (when its output is 4 mA).

Line: “20mA equals“ Enter the selected sensor’s maximum value (when its output is 20 mA).

Press F4 >> once. The following selection appears on the display:

	Configuration	
	accept	save
	(ok)	(ok)
<<	I	I

Accept the configuration with the F2 I key.

Use the F3 I key to permanently save the configuration on the EPROM of the CPU. This procedure can be performed when the PLC is in RUN only (see 4.3.) Otherwise the following system message is displayed: $369 S7 command error 20.

3.2 Parameterise options

Press  ,

Select the main menu 35 “Unit options”. The following selection appears on the display:

```
      DuoPack
  Sequence Control
   Values    Parameter
<<    I          I    >>
```

- Use the  key to select the sequence control parameter list.
- Use the  key to select the actual values of the master and slave.

Press  once. The following selection appears on the display:

```
     Unit options
      Vi control
   Values    Parameter
<<    I          I    >>
```

- Use the  key to select the Vi parameter list.
- Use the  key to select the actual Vi values.

Press  once. The following selection appears on the display:

```
     Unit options
      Economiser
   Values    Parameter
<<    I          I    >>
```

- Use the  key to select the economiser parameter list.
- Use the  key to select the actual economiser values.

Press  once. The following selection appears on the display:

```
     Unit options
      Condenser
   Values    Parameter
<<    I          I    >>
```

- Use the  key to select the condenser parameter list.
- Use the  key to select the actual values for the condenser.
- *The actual values menu item is always quit by pressing the*  *key!*

3.3 Adjusting limiting values

Press 

,

Select the main menu 20 “Limit values“. The following selection appears on the display:

Suction press	□□□□
Psuc low alarm	□□□□
Low warning	+□□□□
Limit values 01+02	>>

Page on using the 

key.

Adjust the limit values to the suit the refrigeration plant.

3.4 Adjusting the control settings

Press 

,

Select the main menu 10 “Control settings“. The following selection appears on the display:

Set Point 1	□□□□
Set Point 2	□□□□
Active SP	□□□□
Control 01/02	>>

Page on using the 

key.

Adjust the control parameters to suit the refrigeration plant.

3.5 Check the compressor unit’s wiring

- Remove each compressor unit sensor connector from its sensor and wait for an alarm message to appear. If a ‘Broken wire’ alarm message does not appear for the disconnected sensor, then this sensor has not been configured in menu 50 ‘Configuration’.
- If the alarm message appears even though no connector has been removed, check the wiring to the sensor, or, if the sensor is not mounted, then make sure it has not been configured.

4

4 SYSTEM DESCRIPTION GSC

The system LEDs are located on the front of the GSC. These system LEDs provide information about the status of the controller.

4.1 Explanation of the system LED

The position of the system LED is given in Chapter 1.2, Fig.1.3.

Meaning of the status and error displays

Display	Meaning	Explanation
SF (red)	C7-CPU-centralised fault	**Lights up for:** - Hardware errors - Firmware errors - Programming errors - Parameterising errors - Computational errors - Time errors - Faulty internal memory storage - Battery failure or if standby supply missing for MAINS ON - Peripheral error in the internal peripheral functions Further information about the malfunction that has occured can be read out of the diagnosis memory using the PG.
BATF (red)	Battery error	**Lights up**, if battery - does not have enough voltage, - is defective, - is missing.
DC5V (green)	Voltage supply for C7	**lights up,** if the internal DC 5V supply is OK.
FRCE (yellow)	Force application	**lights up,** if a force application is active.
RUN (green)	Operating state RUN of the C7-CPU	**lights up,** if the C7 CPU application program is running. **flashes** (2Hz) during the C7 CPU start up (the STOP lamps also lights up; after the STOP lights go off, the outputs are released).
STOP (yellow)	Operating state STOP of the C7 CPU	**lights up,** if the C7 is not processing a CPU-application program. **flashes** at 1-second intervals, if C7 CPU general reset(MRES) is required.
SF-IM (red)	Switching module - centralised fault	**lights up**, if the connection between C7 and the extension rack is interrupted.
⚠ (red)	Alarm active	**lights up,** if a malfunction has been confirmed, but is still active. **flashes,** if a further malfunction has been activated.
Help (green)	Help text available	**lights up,** if a help text is available.
Shift (green)	Switch over function active	**lights up,** if the SWITCHOVER function is active.

Display elements for Profibus

SF-DP (red)	BUSF (green)	Meaning	Remedy
On	On	Bus error (physical defect)	Check the bus cable for a short circuit or breakage
		DP interface error for various baud rates in multimaster mode	Analyse diagnosis, if necessary, replan the project or correct error
On	Flashes	Station failure	Check the bus cable for correct connection, short circuit or breakage
		At least one of the allocated slaves cannot be contacted	Wait until the C7 has completed the start up, if the flashing doesn't stop, check the DP slaves and analyse diagnosis
On	Off	Missing or faulty DP project planning (event is CPU has not been parameterised as the DP master)	Analyse diagnosis, if necessary, replan the project or correct error
Off	Off	No error	

4.2 C7-CPU Selection of the operating mode

Change the C7-CPU operating mode

The CPU operating modes RUNP, RUN, STOP and MRES are selected as follows:

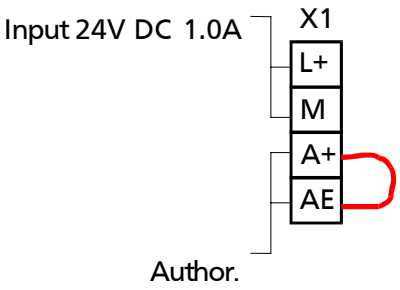
Procedure	
The status of the CPU is changed each time the key is pressed. The key must be pressed for at least 300 ms, so that the change takes place and the relevant LED lights up. To prevent uncontrolled C7 CPU operating mode changes during the control mode, the key function can be activated or deactivated via an external authorisation input. During the activated authorisation input, the operating mode selection is active and an LED displays the current CPU operating mode set. If the authorisation input is deactivated, all status LEDs are off. The authorisation input is located on the same connector as the C7 power supply.	

Figure 4.1: Bridge at the authorisation input, see Figure 5.2

4.3 Meaning of the key-operated switches

SF-DP (red)	Meaning	Remedy
RUNP (R-P)		The C7 CPU processes the application program. The program and data can: - be read out of the C7-CPU with the PG (C7 → PG) - be transferred into the C7-CPU or be amended there (PG → C7)
RUN (R)	 or 	The C7 CPU processes the application program. The programs and data can: - be read out from the C7 CPU using the PG (C7 → PG) - not be transferred to the C7 CPU or be amended there (PG → C7)
STOP (S)		The C7 CPU does not edit the application program. Programs can: - be read out of the C7 CPU using the PG (C7 → PG) - be transferred to the C7 CPU or be amended there (PG → C7) **Note:** The Operating state STOP is only valid for the C7 CPU. It does not apply for C7 OP. It is possible to continue to work with the C7 OP.
MRES (M)		**General reset** The general reset of the C7-CPU (delete memory, reload the application program from the flash memory, where a memory card has been inserted) requires a special operating sequence of the operating modes STOP and MRES: Select the operating mode STOP by pressing the DOWN key. The key must be pressed for at least 300 ms, so that the change takes place. The LED keys “S“ and the CPU status LED “STOP“ light up. Select the operating mode MRES by keeping the DOWN key pressed. The LED key “M“ lights up. Directly after the CPU status LED „STOP“ lights up for the second time, release the key for a moment and then press it again. After flashing for a short while, the status LED “STOP“ lights up again constantly. The CPU is thus in the STOP status. **Note:** If the data that the C7 OP project planning requires has been deleted during the general reset, a relevant error message appears for the C7-OP.

☞ Note: see also Item 1.2

4.4 Installation of the memory card (EPROM)

4.4.1 Description of the memory card used

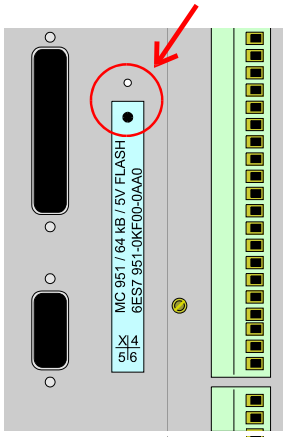
The PLC Siemens C7-633/P uses the following standard memory card:

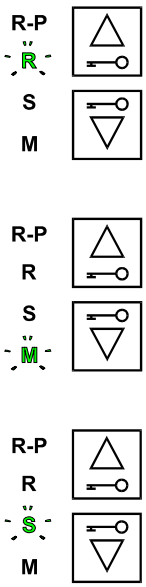
Memory card	Capacity	Technical data Daten	Ansicht
6ES7 951-0KG00-0AA0	128 kB	5V Flash 128 kByte / 8 bit	

Figure 4.2: Memory card

4.4.2 Installation of the Siemens SIMATIC C7 memory card

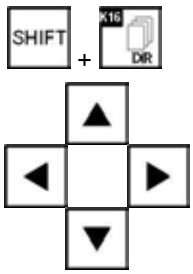
The memory card is installed by carrying out the following steps:

Step	Procedure	
1	**Turn off the power of the PLC.** This can be done by unplugging connector X1 on the PLC.	
2	**Placement of the Author. connection** Bridge connections A+ and AE on connector X1 (see Figure 4.1: Bridge at the authorisation input)	
3	**Insert the memory card** The C7-633/P PLC is equipped with a memory card slot (X6) on one of its sides (see the back of the PLC for detailed information). This slot has an identifying marking on the upper side (small opening). The memory card also has an identifying mark (black dot). These marks should be positioned at the same side when inserting the memory card, like shown in Figure 4.3: Positioning of the memory card.	 *Figure 4.3: Positioning of the memory card*
4	**Turn on the power of the PLC** This can be done by reconnecting connector X1 on the PLC. The PLC will restart. . Furthermore, on the left of the "key", a green LED will indicate the current state of the operation mode key of the PLC. During the restart the PLC will notice the memory card and this will cause the PLC to stop. The STOP-indicator of the PLC will **blink** (1Hz) yellow (Figure 4.4). Furthermore, the PLC will show message $551 "SPS-Adresse 2 nicht vorhanden" or "AS address 2 not possible".	 RUN = Operation *Figure 4.4: STOP*

Step	Procedure	
5	**Use the "key" in order to reset the memory** The next step is to reset the PLC memory, so that the new program will be uploaded from the memory card. In order to reset the memory, the PLC operation mode key state must be changed from "R" to "M". This can be done by pressing the lower "key"-button until the green LED of the "M" lights. After releasing the "key"-button, the green LED of the "S" will light indicating that the current PLC operation mode key state is STOP Furthermore, for a few seconds the STOP-indicator will blink yellow (0.5Hz). Subsequently this indicator will light yellow continuously (Figure 4.4.). Now the PLC operation mode key state "S" equals the actual PLC mode indicated by the STOP-indicator.	 *Figure 4.5: Sequence of operation mode key state indication*
6	**Change the operation mode to "RUN"** By using the upper "key"-button, the PLC operation mode can be changed into RUN (Figure 4.5). For a few seconds the RUN-indicator will blink green (0,5Hz). Subsequently this indicator will light green continuously (Figure 4.6).	 (RUN = Operation) *Figure 4.6 RUN indicator seeFigure 1.3*
7	**Remove the Author. connection** In order to disable the PLC operation mode key, the bridge between A+ and AE of connector X1 should be removed. If not removed, unauthorised personal could stop the PLC or even reset the memory of the PLC.	

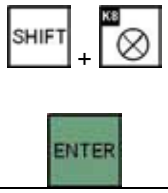
4.5 Adjusting the date/ time

The current date and time can be adjusted at the OP, e.g. to correct for summer/winter time. Any change made affects all the messages and images, in which a date/ time variable appears. The display format for the date and time is specified in the project planning and cannot be changed at the OP.

Step	Procedure	
1	The Date/Time sub-menu is called up by pressing the Shift + K16 key. Move the cursor from the date field to the time field and back again using the cursor keys. To move the cursor to the right or left within the date or time input field using the cursor keys, activate the shift lock switching so that the LED lights up. Change the weekday by entering it symbolically. The date and time are altered by entering numbers.	
2	Confirm the entry with	
3	Quit the standard image with	

4.6 Changing the language

The project planning can be loaded on the OP in up to three languages simultaneously. You can switch between the individual languages online at any time. After switching over, all the language dependent texts are displayed in the new language.

Step	Procedure	
1	Press the shift + K8 hey to select the contrast/ language sub-menu. To switch over languages, enter the password required for this action. Confirm it with ENTER.	
2	**Select the language required using a symbolic input.** The selection list only contains the languages that have been loaded onto the OP. The OP restarts and displays all language-dependent texts in the new language.	

5

5 TECHNICAL DATA

This technical data refers to the whole GSC control cabinet.

Operating voltage	100 to 240 V
Mains frequency	47 to 63 Hz
Power consumption	Maximum 300 W
Control voltage	24V DC
Type of protection	IP 54
Permissible ambient temperature (storage)	-20 to +70 °C
Permissible ambient temperature (operation)	0 to 50 °C *
Maximum air humidity	5 to 95 % at 25 °C (no moisture condensation) *
Dimensions	Width: 600 mm Depth: 210 mm Height: 600 mm
Weight	36 kg

* Additional measures required when outside these operating limits

5.1 Types of sensors used

Sensor type	Description
Pressure transducer	**Passive** electrical 2-wire measuring transducers with a output signal of 4...20 mA are used to measure all pressures.
Temperature detectors	Pt100 with top assembly sensor transmitters are used to measure temperatures. The **passive** 2-wire measuring transducers located in the connection head of the Pt 100 supply an output signal of 4 ... 20 mA.
Position sensor Type HDT	The position sensor Type HDT is an **active** pick-up, which produces an output signal of 4...20 mA.
Motor current	An **active** current signal of 4...20 mA is required to measure the power consumption of the compressor drive motor.
External set point value	An **active** or **passive** current signal of 4...20 mA is required to evaluate an external set point value.
External temperature value	An **active** or **passive** current signal of 4...20 mA is required to evaluate an external temperature value.

☞ Scaling the range limits, see Chapter 3

☞ For description of the components used, see separate documentation.

5.2 Extended data communication (interfaces)

The GSC is equipped with an MPI interface as a standard.

This interface can be used to connect up to 32 users to each other.

As this interface is an internal Siemens interface with multi-point capability, it can only be used between Siemens controls (S7).

The MPI interface can be operated with a maximum transmission speed of 187.5 kBit/s, whereby the distance between 2 adjacent users must not exceed maximum 50 m.

As an option, the GSC can also be fitted with a Profibus DP coupler (Master/Slave method).

This bus protocol is standardised and can also be interpreted by other controls.

With a Profibus, up to 128 users can be operated together with a maximum transmission speed of 12 Mbit/s, whereby the maximum total length is between 100 m and 1200 m. The maximum total length of the bus system is dependent on the number of users and the transmission speed.

☞ **The precise bus structure and the transmission and receiving data protocol are described in more detail in the "MPI and Profibus" manual.**

5.2.1 Explanation of the MPI

To set up a network with MPI, all the users must be connected to each other with a bus cable.

As the MPI interface is fed to the GSC on a 9-pin sub-D jack, suitable cable connectors are required.

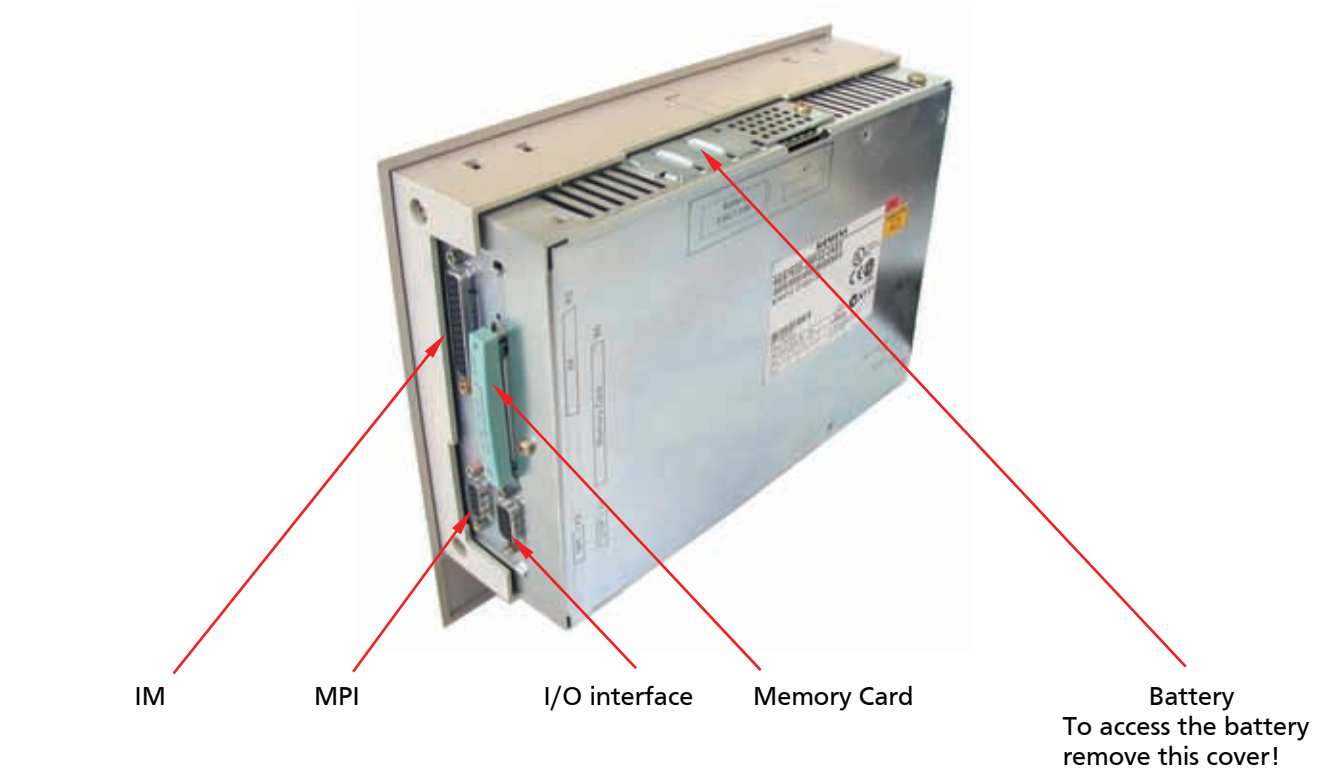


Figure 5.1: Overview of the interfaces, memory card placing and battery position

Figure 5.2: Interfaces C7-633, power supply and Author. connection

The individual users can also be fitted with a bus cable connector.

This connector is inserted directly in the bus interface (9-pin sub-D jack).

The incoming and outgoing bus cable is connected in the socket via 4 terminals. The line termination resistance integrated in the bus cable can be connected via a switch. This is required at both ends of a network.

We recommend bus cable connectors with vertical outgoing feeder cables.

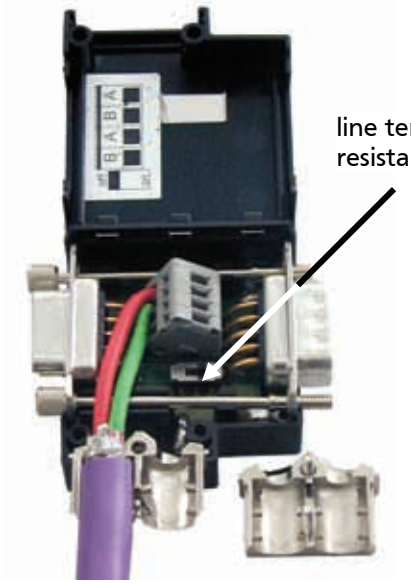


Figure 5.3: Bus cable connectors and PG junction box

A two core, double shielded bus cable is used as a connection cable between the individual bus users.

The MPI communication can be used by the customer for reading the following values out of the screw compressor package/Chiller:

- All analogue values (pressures, temperatures, slide position etc.)
- Remaining waiting times
- Active warning and alarm messages
- Status messages

Furthermore, by sending control commands over the MPI communication remote control of the screw compressor package/Chiller is possible.

5.2.2 Explanation of the Profibus

If the GSC is to be incorporated in a Profibus-DP network, this must be taken into consideration at the time of the order, as additional modules have to be installed (Profibus-DP/ DP-coppler).

The Profibus-DP/ DP-coppler consists of a 9-pin Sub-D jack at the communications processor module. Suitable cable connectors are required to connect the bus cable.

Within a Profibus network all configured stations have to be connected.

A two core, double shielded bus cable is used as a connection cable between the individual bus stations.

The stations are connected to each other analogue to the MPI Bus.

The Profibus-DP communication can be used by the customer for reading the following values out of the screw compressor package/Chiller:

- All analogue values (pressures, temperatures, slide position etc.)
- Remaining waiting times
- Active warning and alarm messages
- Status messages

Furthermore, by sending control commands over the Profibus-DP communication remote control of the screw compressor package/Chiller is possible.

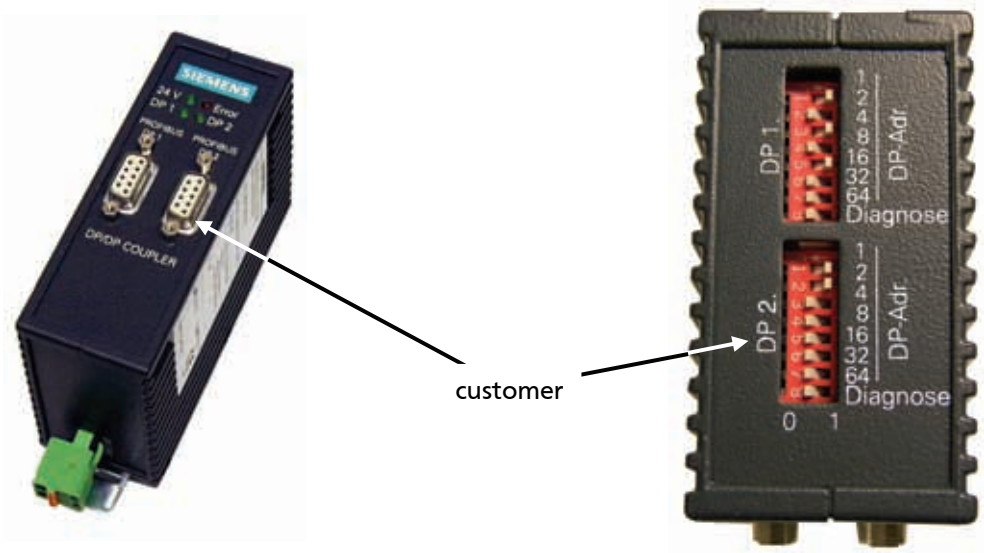


Figure 5.4: DP/DP-Coupler and the DP-address settings

The slave address for the two slaves is set independent of each other with DIP switches that are located on the top side of the device. The DP 1 address is for Grasso usage only. The default setting for the DP1 address is 21 (see figure 5.4). The customer must use the DP2 address for Profibus-DP communication, where the address can be set freely in accordiance of the customers network configuration.

☞ **Notice that the valid address range is 1 through 124 only. Other addresses are not valid within a Profibus DP network. A change of Profibus address becomes active after switching OFF/ON the coupler first. When adjusting the address, pay attention to the writing on the body of the coupler (0 and 1) and do not pay attention to the writing on the DIP switches themselfs.**

☞ **For more information see User Instruction "MPI and Profibus" and "Profibus DP/DP-coupler", available at Grasso.**

5.3 Description of the periphery modules

The periphery modules are the link between the GSC, the compressor unit, the power panel and the customer.

5.3.1 Periphery bus coupler

As link between the PLC and periphery modules a periphery bus coupler is used (see figure). The address selector must be set to address 11.

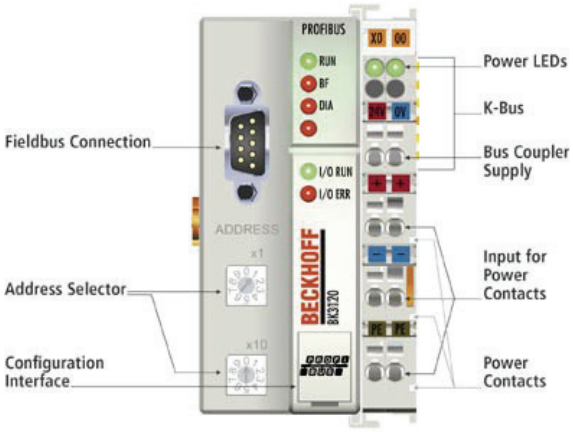


Figure 5.5: Beckhoff periphery bus coupler (BK3120)

5.3.2 Digital input terminal

The KL1408 digital input terminal acquires the binary control signals from the process level and transmits them, in an electrically isolated form, to the higher-level automation unit. Each Bus Terminal contains eight channels which indicate their signal state by means of light emitting diodes.

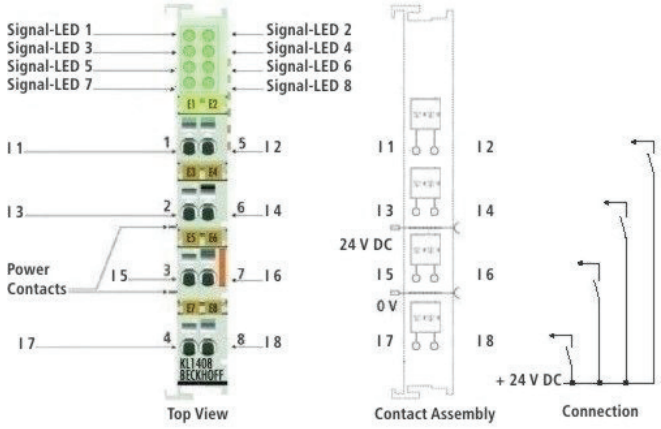


Figure 5.6: Digital input terminal with 8 channels

5.3.3 Analogue input terminals

The GSC is equipped with several types of analogue input terminals. The standard input signals use 4...20mA signals.

The KL3054 terminal is used for the 4...20mA signals. The job of the analogue input terminal with sensor supply is to supply power to measuring transducers located in the field, and to transmit analog measurement signals with electrical isolation to the automation device. The voltage for the sensors is supplied to the terminals via the power contacts. The input electronics is independent of the supply voltage of the power contacts. The "0 V rail" is the reference potential for the inputs. The RUN LEDs give an indication of the data exchange with the Bus Coupler. The error LEDs indicate an overload condition and a broken wire. The KL3054 version combins 4 channels in one housing.

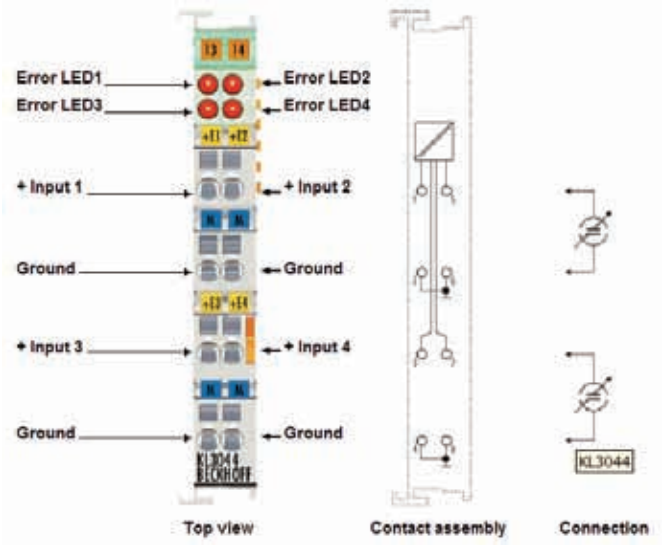


Figure 5.10: Analogue input terminals with 4 channels (4...20mA)

5.3.4 Bus end terminal

At the end of the periphery terminals a bus end terminal (KL9010) must be mounted, otherwise the periphery bus coupler detects an error and no data will be send to the PLC.

6

6.1 General

☞ **Shut down on alarms are carried out to prevent the refrigeration equipment operating outside of design limits and do not represent a defect in the controls.**

The alarm signals are divided into 2 groups:

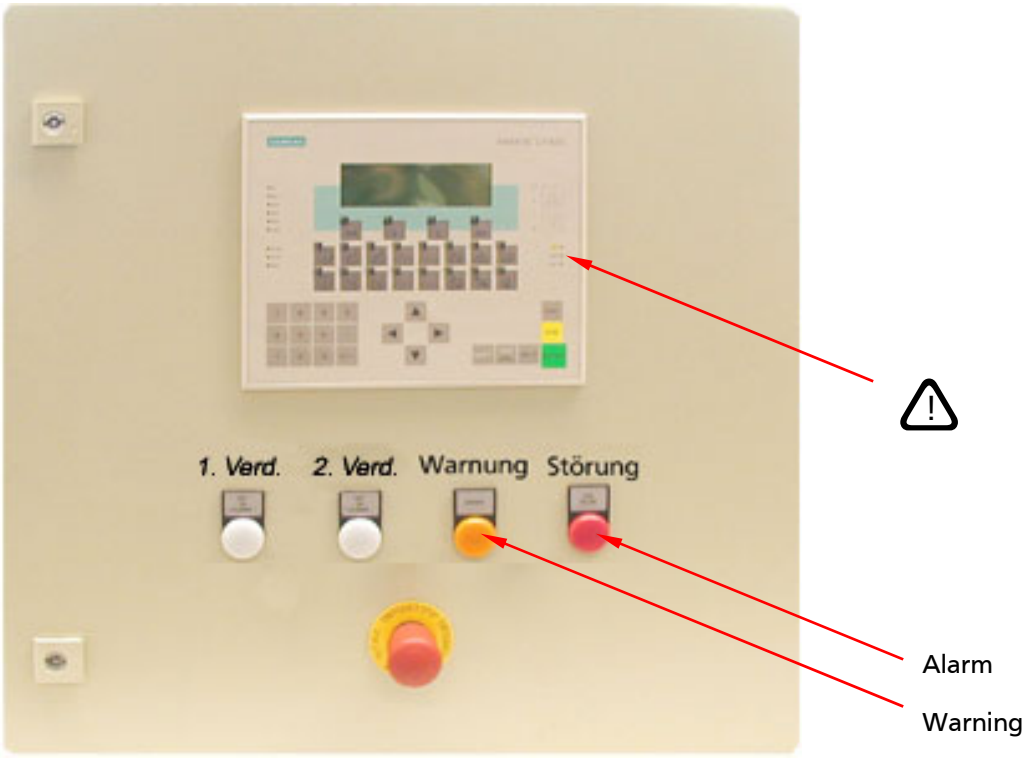


Figure 1: : Control cabinet with LED and indicator lights

6.1.1 Alarms

☞ **These cause the compressor to switch off and prevent it from automatically switching back on.**

Alarms are indicated by the indicator light (red) "Alarm", LED (red) ⚠ and text message in the display.

6.1.2 Warnings

☞ **These do not cause the compressor to switch off and do not block it from being switched on.**

Warnings are signalled optically by the indicator light (amber) "Warning", LED (red) ⚠ and text message in the display.

Note: Warnings are automatically reset after the cause has gone.

6.1.3 View active alarms and warnings

The ´Status mode´is displayed by pressing the ESC key several times. The most important actual values are shown in the first three rows and in the 4th row the status message is shown.

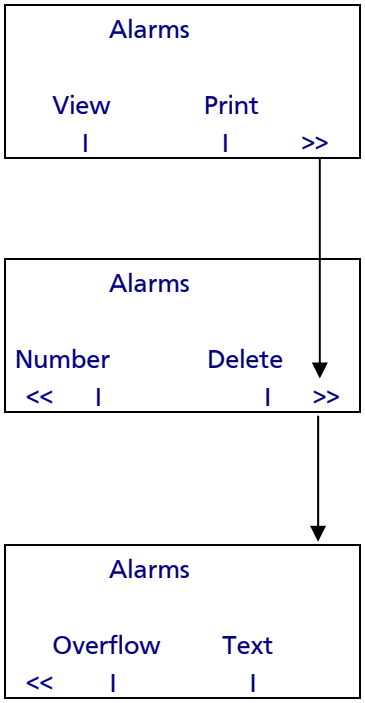
By scrolling with the cursor keys ▲ and ▼ all active alarms and warnings are displayed.

6.2 Possible text displays for alarms and warnings

6.2.1 General

The GSC produces all the alarms and warnings listed in the following section.

All the warnings and alarms are stored in a history file for possible later analysis by the operator.



View: The alarm No., date and time and status of the alarm are di
A = **A**cknowledged; **C** = **C**ome; **G** = **G**one

If the cursor is pointing to the alarm No., the alarm text can

Print: no stored function

Number: Displays how many alarms have been stored and how many are still active

Delete: All the fault signals stored in the buffer can be deleted (foll

Overflow: Enables a message to be displayed even if the fault buffer

Text: Display all possible alarm messages with alarm No.

The alarm and warning numbers are unique and are displayed in the alarm histogram.

☞ see Chapter 1.2.3.5

6.2.2 List of all alarms and warnings

☞ All alarm and warning messages of the 2nd compressor marked with „2.“!

☞ All not explained message numbers are provided as „reserve“!

Alarm histogram number (1st compressor)	OP- text	Alarm histogram number (2nd compressor)
001	Alarm 1! Broken wire suction pressure sensor	097
002	Alarm 2! Broken wire oil pressure sensor	098
003	Alarm 3! Broken wire discharge pressure sensor	099
004	Alarm 4! Broken wire discharge temperature sensor	100
005	Alarm 5! Broken wire oil temperature sensor	101
006	Alarm 6! Broken wire slide position sensor	102
007	Alarm 7! Pofibus-DP-Slave	103
009	Alarm 9! Broken wire external temperature sensor	105
010	Alarm 10! Broken wire oil filter pressure sensor	106

Alarm histogram number (1st compressor)	OP- text	Alarm histogram number (2nd compressor)
011	Alarm 11! Difference oil pressure - discharge pressure too high	107
012	Alarm 12! Motor feedback too late	108
013	Alarm 13! Start speed not reached	109
014	Alarm 14! Virtual bushing position not reached	110
017	Alarm 17! Suction pressure too low	113
019	Alarm 19! Discharge pressure is too high	115
020	Alarm 20! Discharge temperature is too high	116
021	Alarm 21! Oil temperature is too high!	117
022	Alarm 22! Slide to min time too long	118
023	Alarm 23! High motor current!	119
024	Alarm 24! Difference between both discharge pressures was too high	120
025	Alarm 25! Low external temperature	121
031	Alarm 31! Motor speed too low	127
032	Alarm 32! Motor speed too high	128
034	Alarm 34! Comp. motor or freq. ctrl protection device active	130
035	Alarm 35! Emergency switch or safety chain has responded	131
036	Alarm 36! Start procedure too long	132
037	Alarm 37! Feedback from motor starter missing!	133
038	Alarm 38! High liquid level	134
040	Alarm 40! Low oil pressure	136
041	Alarm 41! Oil filter blocked	137
042	Alarm 42! Bus-Communikation	138
043	Alarm 43! Refrigerant leak detected	139
044	Alarm 44! Flow switch secondary refrigerant circuit has responded	140
049	Warning 1! Suction pressure is too low	145
051	Warning 3! Discharge pressure is too high!	147
052	Warning 4! Discharge temperature is too high!	148
053	Warning 5! Oil temperature is too high!	149
055	Warning 7! High motor current!	151
056	Warning 8! Broken wire ext. set point sensor	152
057	Warning 9! Low external temperature!	153
059	Warning 11! Broken wire Vi-position indicator	155
060	Warning 12! Broken wire ECO-pressure	156
061	Warning 13! Broken wire ECO-temperature	157
062	Warning 14! Broken wire Chiller inlet temperature	158
063	Warning 15! Broken wire Frequency value	159
064	Warning 16! Oil separator level too high!	160
065	Warning 17! Pre-alarm oil filter	161

Alarm histogram number (1st compressor)	OP- text	Alarm histogram number (2nd compressor)
066	Warning 18! No feedback from refrigerant pump motor (Chiller only)	162
067	Warning 19! No feedback from condenser system (fans or pumps)	163
069	Warning 21! Program buffer battery empty	165
070	Warning 22! Oil separator level too low	166
071	Warning 23! Broken wire motor current transformer	167
072	Warning 24! Broken wire suction temperature sensor	168

6.3 Description and diagnosis of alarm messages

2. = Identification of alarm messages and warning massages of the 2nd compresso

Display message / Explanation	Possible cause of the alarm	Alarm clearance
Alarm 1! Broken wire suction Pressure sensor The GSC has detected a loose wire or short circuit in the suction pressure sensor (P&ID position no. 100)	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.
Alarm 2! Broken wire oil pressure sensor The GSC has detected a loose wire or short circuit in the oil pressure sensor (P&ID position no. 110).	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.
Alarm 3! Broken wire discharge pressure sensor The GSC has detected a loose wire or short circuit in the discharge pressure sensor (P&ID position no. 105).	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.
Alarm 4! Broken wire discharge Temperature sensor! The GSC has detected a loose wire or short circuit in the discharge temperature sensor (P&ID position no. 120).	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.

Display message / Explanation	Possible cause of the alarm	Alarm clearance
Alarm 5! Broken wire oil temperature sensor! The GSC has detected a loose wire or short circuit in the oil pressure sensor (P&ID position no. 125).	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.
Alarm 6! Broken wire capacity slide position sensor! The GSC has detected a loose wire or short circuit in the capacity slide sensor (P&ID position no. 011).	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.
Alarm 7! Profibus-DP-Slave! The GSC as Profibus-DP-Master has detected a failure at one of the Profibus-DP-Slaves.	The terminal connections have become loose or a wire is broken. Faulty wiring between the GSC and slave modules. The sensor is defective or in a fault state range. Faulty settings of Profibus connectors.	Check the terminal connections (master and slaves) for tightness and continuity of wiring. Check the connection of A- and B-clamp wires of Master connector with the A-/ B-clamp wires of the slaves. Replace slave-module. Profibus connectors with only one connected cable must be setted (switch the DIP-Button “ON”). Profibus connectors with two connected cables **must not** be setted (switch the DIP-Button “OFF”).
Alarm 9! Broken wire external Temperature sensor! The GSC has detected a loose wire or short circuit in the external temperature sensor.	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.
Alarm 10! Broken wire oil pressure after oil filter sensor The GSC has detected a loose wire or short circuit in the oil filter pressure sensor (P&ID position no. 395 or 495).	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.

Display message / Explanation	Possible cause of the alarm	Alarm clearance
Alarm 11! Difference: oil pressure - discharge pressure too high Remains during start up the differencial pressure between oil filter pressure (P&ID position no 395; equivalent to pressure at balance piston) and discharge pressure of the started compressor (P&ID position no 105.x; equivalent to pressure at the face end of the rotor) too high, then there is the risk that the balance piston is overloaded and therefore the compressors gets damaged. Therefor the start-up is stopped after a certain time value.	Sensors are defective. The analogue input module is defective. Faulty oil circuit design.	Check/ replace the sensors. Replace analogue module. Check/ revise the oil circuit design and/or contact Grasso service department.
Alarm 12! Motor feedback too late During starting up of the compressor motor, the GSC must receive withing a certain time the motor feedback (digital input (DI) 0.0).	The ramp time of the softstarter or the inverter does not match with the monitoring time for the motor feedback of the GSC The ramp time of the softstarter or the inverter leads to exceeded starting time of the motor. The terminal connections have become loose. Digital input module defective.	Compare and adjust the ramp time of softstarter/inverter with the timer "motor feedback" in the GSC. Adjust the ramp time of softstarter / inverter accordingly. Check the terminal connections. Replace the digital input module.
Alarm 13! Start speed not reached! In case of use of an inverter for the compressor motor the start speed (adjustable parameter) must be reached within a certain time (adjustable parameter).	The ramp time of the inverter is <u>not</u> matching the monitoring time $t_{(Start)}$ in the GSC (Menu 30) The scaling of the output for the actual RPMs of the inverter is <u>not</u> matching the corresponding scaling for the actual RPMs in the GSC (see menu 50 / configuration)	Adjust one of the timers accordingly. Adjust the scalings ranges of the inverter and the GSC accordingly.
Alarm 14! Virtual bushing position not reached! Is for a SP-Duo a virtual limitation bushing activated in the GSC (see menu 10/ figure 4), then the capacity slide must reach this "Limitation slide position" within a certain monitoring time.	Movement of capacity slide is too slow Instead of the operation with a virtual limitation bushing, the compressor is equipped with a mechanical limitation bushing.	Check if oil diifferential pressure is sufficient for a proper slide movement. The function of the virtual limitation bushing in the GSC must be deactivated (contact Grasso Service).

Display message / Explanation	Possible cause of the alarm	Alarm clearance
Alarm 17! Suction pressure too low! This alarm is activated if the suction pressure falls below the 'Psuc low alarm' limit value.	Suction pressure is too low. 'Psuc low alarm' limit is set too high. The sensor has not been correctly calibrated in the configuration menu. Sensor defective.	Remove cause of low suction pressure in the refrigeration plant. Change 'Psuc low alarm' limit to a suitable value. Enter the correct calibration value. Replace sensor.
Alarm 19! Discharge pressure too high! This alarm is activated if the discharge pressure is higher than the 'Pdis hi alarm' limit value.	Discharge pressure is too high. 'Pdis hi alarm' is set too low. The sensor has not been correctly calibrated in the configuration menu. Sensor defective.	Remove cause for the high discharge pressure in the refrigerating plant. Change 'Pdis hi alarm' to a suitable value. Enter the correct calibration value. Replace sensor.
Alarm 20! Discharge temperature too high! This alarm is activated if the discharge temperature is higher than the 'Tdis hi alarm' limit value.	Discharge temperature is too high. 'Tdis hi alarm' is set too low. The sensor has not been correctly calibrated in the configuration menu. Sensor defective	Remove the cause for the high discharge temperature. Change 'Tdis hi alarm' to a suitable value. Enter the correct calibration value. Replace sensor.
Alarm 21 Oil temperature too high! This alarm is activated if the oil temperature is higher than the 'Toil hi alarm' limit value.	Compressor oil temperature is too high. The 'Toil hi alarm' is set too low. The sensor has not been correctly calibrated in the configuration menu. Sensor defective.	Remove the cause for the high compressor oil temperature. Change the 'Toil hi alarm' to a suitable value. Enter the correct calibration value. Replace sensor.
Alarm 22! Slide to min time too long! This alarm is activated if the capacity slide does not reach its Minimum position after the strt-/stop signal within the setted time.	The 'Slide to min' timer setting parameter is too short. The capacity control solenoids for capacity reduction are not energising. Oil pressure too low. The throttle screws for adjusting the setting speed are closed.	Set the 'Slide to min' timer setting to 180 sec. Check the function of the capacity control solenoids both electrically and mechanically. Correctly set the oil pressure in accordance with the operating instructions for the compressor unit. Correctly adjust the throttle screws in accordance with the operating instructions for the compressor unit.

Display message / Explanation	Possible cause of the alarm	Alarm clearance
	The capacity slide is sticking.	Check the capacity slide / change the seal(s).
Alarm 23! High motor current This alarm is activated if the motor current is higher than the 'Imot high alarm' limit value.	Motor current too high. The 'Imot high alarm' is set too low. The sensor has not been correctly calibrated in the configuration menu. Sensor defective.	Remove cause for high motor current in the refrigerating plant. Change the 'Imot high alarm' limit to a suitable value. Enter the correct calibration value. Replace sensor.
Alarm 24! Difference between both discharge pressures was too high! During start up of the second compressor the discharge pressures (Pos. 105.1 und 105.2) of both compressors are compared. At a low pressure difference the standard start procedure is executed. A remaining high pressure difference during start up is an indication that the started compressor is not developing pressure on the compressor outlet port. To avoid overloading of the balance piston and a compressor damage the start procedure is stopped after a certain time.	Check why the discharge pressures values a differing strongly. Check if both discharge sided check valves (POS 185.1 and 185.2) are fully opened. Discharge pressure sensors might cover different metering ranges, but without any concordance with scaling ranges of the GSC.	Inspect the check valve function. Set the scaling of both discharge pressure sensors to the actual metering ranges (menu 50).
Alarm 25! Low external temperature! This alarm is activated if the external temperature is lower than the 'Text lo alarm' limit value.	External temperature too low. The 'Text lo alarm' is set too high. The sensor has not been correctly calibrated in the configuration menu External temperature too low.	Remove cause for low external temperature in the refrigerating plant. Change the 'Text lo alarm' limit to a suitable value. Enter the correct calibration value. Remove cause for low external temperature in the refrigerating plant.
Alarm 31! Motor speed too low! If a frequency inverter is used for compressor drive motor the actual motor speed must not fall below the minimum speed after start-up (menu 10, pict. 5).	Output scaling of actual frequency (speed) at frequency inverter does not communicate with GSC frequency scaling (menu 50). The values of minimum speed and starting speed are too similar.	The GSC as well as the frequency inverter must have identical ranges of scale. The minimumm difference between both values should be > 100 min^{-1}.

Display message / Explanation	Possible cause of the alarm	Alarm clearance
Alarm 34! Comp. Motor or freq. ctrl protection device active This alarm is activated if the digital input signal E 0.1 "motor OK" Equals 0.	Motor protection has tripped – contact open. The terminal connections have become loose. The wire is broken. Digital input module defective.	Investigate cause and (possibly) reset the motor protection. Check the terminal connections. Replace the wire. Replace the digital input module.
Alarm 35! Emergency switch or safety chain has responded! This alarm is activated if the input signal E 0.2 equals 0.	The discharge pressure HP switch has activated. The emergency stop button has been pressed. The terminal connections have become loose. The wire is broken. Digital input module defective.	Reset the discharge pressure switch (internal/ external reset). Reset the emergency stop button. Check the terminal connections. Replace the wire. Replace the digital input module.
Alarm 36! Start procedure too long! This alarm is activated if the feedback signal (digital input E 0.0 equals 1) from the compressor drive motor starter equipment takes longer than 'Motor feedback' time setting.	Time setting 'Motor feedback' too short.	Increase time setting 'Motor feedback' to a suitable value.
Alarm 37! Feedback from motor starter missing! This alarm is activated if the compressor is running and the input signal E 0.0 "compressor feedback" equals 0.	The feedback contactor is defective – contact open. Power failure due to tripped fuse. The terminal connections have become loose. The wire is broken. The compressor motor feedback is faulty indicated by external control device.	Replace the feedback contactor. Change fuse Check the terminal connections. Replace the wire. Check the external software.
Alarm 38! High liquid level! This alarm is activated if the input signal E 1.1 "separator liquid level" equals 0 and the 'Lqd level dly' timer has expired.	The level in the refrigerant separator is too high. The level sensor is defective. The terminal connections have become loose. The wire is broken. The time setting'Lqd level dly'is too short. Digital input module defective.	Reduce the level in the refrigerant separator. Replace the level sensor. Check the terminal connections. Replace the wire. Increase the time setting 'lqd level dly' Replace the digital input module.

Display message / Explanation	Possible cause of the alarm	Alarm clearance
Alarm 40! Low oil pressure! This alarm is activated if the difference between the oil pressure and discharge pressure is less than the 'Oil diff min' limit value and the delay time has expired.	Oil pressure is too low. The 'Oil diff min' limit value is set too high. The sensor has not been correctly calibrated in the configuration menu Sensor defective. The delay time is too short. Discharge pressure is too high.	Remove the cause for the low oil pressure at the compressor. Reduce the 'Oil diff min' limit to a suitable value. Enter the correct calibration value. Replace sensor. Increase the time setting 'Oil diff start' for the start up phase or 'Oil diff run' for the running phase. Remove the cause for the high discharge pressure at the compressor.
Alarm 41! Oil filter blocked! This alarm is activated if the difference between the discharge pressure and the Oil filter pressure is larger than the 'Filt diff press – high alarm' limit value and the time delay has expired).	Oil filter is blocked. The 'Flt diff press - hi alarm' limit value is set too low. The sensor has not been correctly calibrated in the configuration menu. Sensor defective. The delay time 'Oil diff run' or 'Oil diff start' is too short.	Replace the oil filter cartridge. Increase the alrm limit to a suitable value. Enter the correct calibration value. Replace sensor. Increase the time setting 'Oil diff run' or 'Oil diff start' to a suitable value.
Alarm 42! Bus-Communication! This alarm is activated at the slave GSC if the sequence control has been activated and the slave GSC is not connected to the master GSC via the MPI bus.	Bus-cable broken or plug-in connector defective.	Replace defective parts.
Alarm 43! Refrigerant leak detected! This alarm is activated if the input signal E 1.2 "gas sensor" equals 0.	Gas alarm system is active. The terminal connections have become loose. The wire is broken. Digital input module defective.	Reset the gas alarm system. Check the terminal connections. Replace the wire. Replace the digital input module.

Display message / Explanation	Possible cause of the alarm	Alarm clearance
Alarm 44! Flow switch secondary Refrigerant circuit has responded! This alarm is activated if the input signal E 12.2 "secondary refrigerant flow OK" equals 0 and the time setting 'Flow swtch dly' has expired.	Secondary refrigerant pump is not running. The flow sensor is defective. The terminal connections have become loose. The wire is broken. The time setting 'Flow swtch dly' is too short. Digital input module defective.	Start up the secondary refrigerant pump. Replace the flow sensor. Check the terminal connections. Replace the wire. Increase the time setting 'Flow swtch dly' to a suitable value. Replace the digital input module.

6.4 Description and diagnosis of warning messages

Warning message	Possible cause	Warning clearance
Warning 1! Suction pressure is too low! This warning is activated if the suction pressure is less than 'Psuc lo alarm' plus 'Low warning' limit values.	Suction pressure is too low. 'Psuc lo alarm' plus 'Low warning' set too high. The sensor has not been correctly calibrated in the configuration menu. Sensor defective.	Remove the cause for low suction pressure in the refrigerating plant. Change 'Psuc lo alarm' and 'Low warning' limits to suitable values. Enter the correct calibration value. Replace sensor.
Warning 3! Discharge pressure is too high! This warning is activated if the discharge pressure is higher than the 'Pdis hi alarm' minus 'High warning' limit values.	The discharge pressure is too high. 'Pdis hi alarm' minus 'High warning' set too high. The sensor has not been correctly calibrated in the configuration menu Sensor defective.	Remove the reason for the high discharge pressure in the refrigerating plant. Change 'Pdis hi alarm' and 'High warning' limits to suitable values. Enter the correct calibration value. Replace sensor.
Warning 4! Discharge temperature is too high! This warning is activated if the discharge temperature is higher than the 'Tdis hi alarm' minus 'High warning' limit values.	The compressor discharge temperature is too high. 'Tdis hi alarm' minus 'High warning' set too high. The sensor has not been correctly calibrated in the configuration menu. Sensor defective.	Remove the cause for high compressor discharge temperature in the refrigerating plant. Change 'Tdis hi alarm' and 'High warning' limits to suitable values. Enter the correct calibration value. Replace sensor.
Warning 5! Oil temperature is too high! This warning is activated if the oil temperature is higher than the 'Toil hi alarm' minus 'High warning' limit values.	The compressor oil temperature is too high. 'Toil hi alarm' minus 'High warning' set too high. The sensor has not been correctly calibrated in the configuration menu Sensor defective.	Remove the cause for high compressor oil temperature in the refrigerating plant. Change 'Toil hi alarm' and 'High warning' limits to suitable values. Enter the correct calibration value. Replace sensor.

Warning message	Possible cause	Warning clearance
Warning 7! High motor current! This warning is activated if the „Motor current" input signal does not provide at least 4mA.	No motor current sensor projected. Faulty connected motor current sensor The analogue input module is defective. Sensor defective.	Order one at Grasso immediately. Study circuit diagram. Replace analogue module. Replace sensor.
Warning 8! Broken wire ext. Set point sensor! This warning is activated if the „Ext. set point" input signal in operation mode 7 (Remote+HW ext.SW) does not provide at least 4mA.	No external set point adjustment projected. Faulty connected external set point adjustment. The analogue input module is defective.	Do never change to operation mode 7 (07 Remote+HW ext.SW)! Study circuit diagram. Replace analogue module.
Warning 9! Low external temperature! This warning is activated if the external temperature is less than 'Text lo alarm' plus 'Low warning' limit values.	External temperature is too low. 'Text lo alarm' plus 'Low warning' set too high. The sensor has not been correctly calibrated in the configuration menu Sensor defective.	Remove the cause for low external temperature in the refrigerating plant. Change 'Text lo alarm' and 'Low warning' limits to suitable values. Enter the correct calibration value. Replace sensor.
Warning 11! Broken wire Vi position sensor! The GSC has detected a loose wire or short circuit in the Vi slide sensor (P&ID position no. 052.2).	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.
Warning 12! Broken wire Eco-pressure! The GSC has detected a loose wire or short circuit in the Economiser pressure sensor.	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.

Warning message	Possible cause	Warning clearance
Warning 13! Broken wire Eco-temperature! The GSC has detected a loose wire or short circuit in the Economiser temperature sensor.	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.
Warning 14! Broken wire Chiller inlet temperature! The GSC has detected a loose wire or short circuit in the chiller inlet temperature sensor.	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.
Warning 15! Broken wire Frequency value! This warning is activated if the „Frequency value“ input signal does not provide at least 4mA while a frequency inverter operation is defined in menu 50.	No connection between inverter and GSC was projected. The actual frequency of the inverter is not assigned to any analogue output of the inverter. The inverter does not have analogue outputs to be scaled for the needed range (4...20) mA. The digital input module is defective.	Project connection and refit, if needed, an additional analogue output card in the inverter. Assign the actual frequency/RPMs to an analogue output of the inverter in the menu of the inverter. Insert a adequate anologue card in the inverter. Replace digital input module.
Warning 16! Oil separator level too high! This warning is activated if the input signal E 1.6 "high level in oil separator" equals 0 and the timer ‘Oil level dly’ has expired.	The oil level in the oil separator is too high. Level sensor is defective. The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The timer setting ‘Oil level dly’ is too short. The digital input module is defective.	Reduce the level in the oil separator. Replace the level sensor. Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Increase the timer setting ‘Oil level dly’. Replace digital input module.

Warning message	Possible cause	Warning clearance
Warning 17! Pre-alarm oil filter! This warning is activated if the difference between the discharge pressure and the Oil filter pressure is larger than the 'Filt diff press – high alarm' minus the 'high warning' limit values and the fixed time delay has expired.	Oil filter is slightly blocked. 'Flt diff press – Hi alarm' minus 'Hi warning' set too low. The sensor has not been correctly calibrated in the configuration menu Sensor defective. The timer setting 'Oil filt dly' is too short.	Change the oil filter cartridge soon. Change 'Filt diff press – hi alarm' and 'Hi warning' limits to a suitable value. Enter the correct calibration value. Replace sensor. Change the timer setting 'Oil filt dly' to a suitable value.
Warning 18! No feedback from refrigerant pump motor! (Chiller only) This warning is activated if the input signal E 12.0 'feedback secondary pump equals 0 and the timer 'pump fback dly' has expired.	The secondary pump is not running. The pump's feedback contact (relay) is defective. The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor/relay wiring. The timer setting 'Pump fback dly' is too short. The digital input module is defective.	Switch on the secondary pump. Replace the contact (relay). Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Change the timer setting 'Pump fback dly' to a suitable value. Replace digital input module.
Warning 19! No feedback from condenser system! This warning is activated if the input signal E 12.1 'feedback condenser' equals 0 and the fixed delay timer has expired.	Condenser is not running. The condensor feedback contact/ relay is defective. The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor/relay wiring. The delay time is too low. The digital input module is defective.	Switch on the condenser. Replace the contact/ relay. Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Increase the "t(KT Pump feedback)" parameter in the "time values" menu, "time values/chiller" image. Replace digital input module.
Warning 21! Program buffer battery empty! This warning is activated if the battery is empty.	Battery is empty.	Replace battery.

Warning message	Possible cause	Warning clearance
Warning 22! Oil separator level too low! This warning is activated if the input signal E 1.0 'low level in oil separator' equals 0 and the timer setting 'Oil level dly' has expired	The oil level in the oil separator is too low. The level sensor is defective. The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The timer setting 'Oil level dly' is too short. The digital input module is defective.	Increase the oil level in the oil separator. Replace the level sensor. Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Change the timer setting 'Oil level dly' to a suitable value. Replace digital input module.
Warning 23! Broken wire motor current transformer! The GSC has detected a loose wire or short circuit in the motor current sensor (pos 16).	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.
Warning 24! Broken wire suction temperature sensor! The GSC has detected a loose wire or short circuit in thesuction temperature sensor (pos 115).	The terminal connections have become loose or a wire is broken. There is a short circuit in the sensor wiring. The sensor is defective. The analogue input module is defective.	Check the terminal connections for tightness and continuity of wiring. Check where short circuit has occurred and rectify. Replace the sensor. Replace analogue module.

6.5 No alarm signal and the compressor will not start

Compressor will not start, although there is no active alarm.

Key  „ON" has been pressed and the LED K1 "ON" is flashing.

Ursache		Abhilfe
No 'start release' signal	The input ´start release´ is not closed.	Close input or install a link.
'Auto Start dly' active	The time setting 'Auto start dly' in 'control settings menu' has not yet expired.	Wait until the delay time has expired.
'Start to start' delay active	The time setting 'Start to start' in 'Timer settings' menu has not yet expired.	Wait until the delay time has expired.
PV < (SP + ½ NZ) PV= Process value SP = Set point NZ= Neutral zone		Check set point and neutral zone settings in ´Control settings´menu. **Attention!** In case of suction pressure control the set point value is entered in degrees Celsius.

7

7 ACKNOWLEDGING AND RESETTING ALARMS AND WARNINGS

7.1 Information about the status of the controls in case of an alarm/warning

The occurrence of an alarm/warning is signalled by:

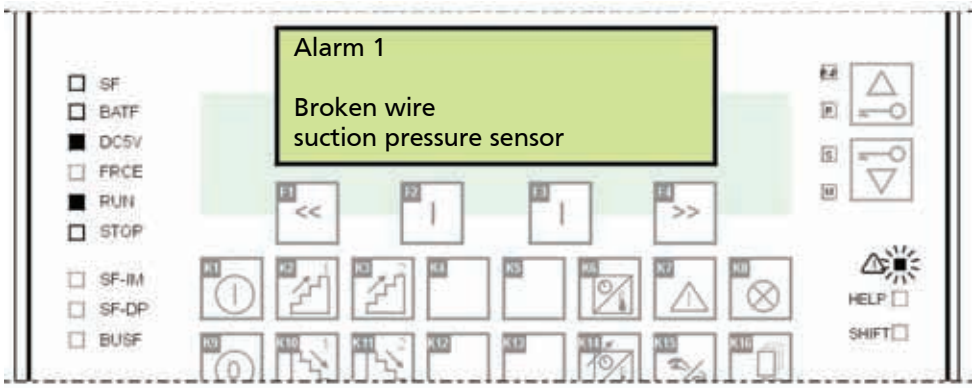
At the control cabinet:

- Signal lamp (red) 'Alarm'/ signal lamp (yellow) 'Warning'.

At the GSC display:

- An alarm message appears in the display.
- 2 = alarm message identification of the 2nd compressor
- The LED "alarm signal" flashes.
- The application program continues to run.

The "DC5V" LED and the "RUN" LED light up.



- LED not applicable
- LED off
- LED on
- LED flashes quickly

7.2 Restart following Alarms

Alarms and warnings are signalled as follows:

a. The alarm relay is de-energised (only for alarm conditions – not for warning conditions).

b. The red indicator light 'Alarm' flashes at the control cabinet for alarms, the yellow indicator light flashes for warnings.

c. System LED check (left-hand side of display).
There is no system fault if only the green LEDs "DC5V" and "RUN" are lit up, i.e., the applications program continues to run.

d. Display check
A flashing text message is visible in the display, which describes the alarm or warning that has occurred. In addition, the red LED on the right-hand of the display also flashes. All possible text messages are listed in section 6.3.2. This list includes troubleshooting and fault correction information.

e. The alarm or warning is acknowledged by pressing the alarm acknowledgement key "ACK". The flashing text message disappears.
If the cause of the alarm still exists after acknowledgement, the red alarm LED changes from a flashing light to a steady light; otherwise it goes out. The 'warning' and 'alarm' indicator lights also change over to a steady light or switch off after acknowledgement.

f. If a flashing alarm text is not displayed and the alarm LED lights up; at least one alarm or warning is still active.

g. Press ‘SHIFT’ and ‘K6’ keys to get into ‘Status display’ mode where the current status is displayed

h. By pressing the cursor key ‘down’ or the key ‘up’, you can now view the still active alarms or warnings (scroll).

i. If only warning signals are still active, the compressor can be restarted, otherwise the cause for the still active alarm messages have to be corrected before the compressor can be restarted.

j. Information about alarm clearance is explained in Item 7.3.

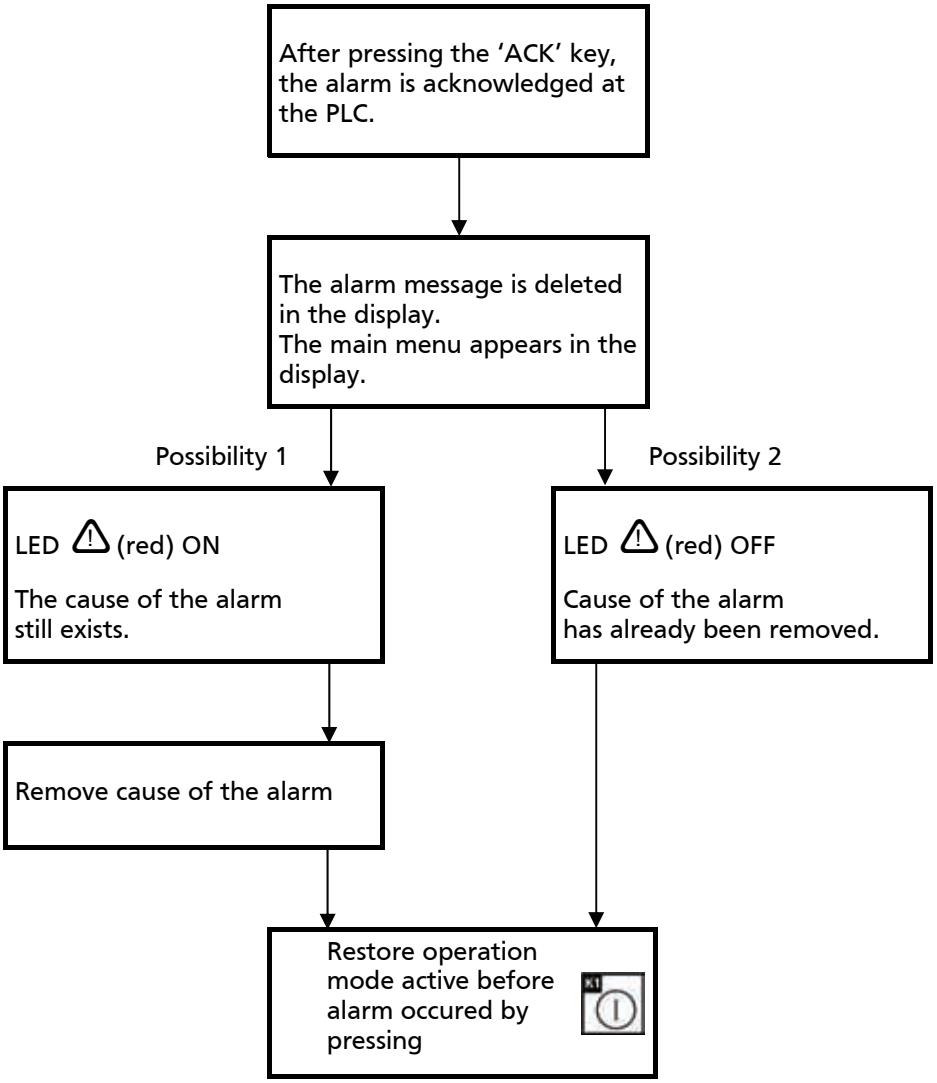
k. The last 256 alarms/warnings, saved with their time and date, can be viewed in the menu item 25 ‘Alarms’ or by calling them up directly using the 

key.

☞ **Display the signal states of digital and analogue signals in the display with the keys** 

and 

.



☞ **Attention! It is not possible to restart the compressor as long as the cause of the alarm still exists!**

Display of the cause(s) of the alarms after deleting the display on view (press the ACK key) or in the case that several alarms have occurred simultaneously:

Step	Procedure
1	Call up the 'Alarms' menu by pressing the key.
2	Select the 'View' menu item for the alarms by pressing the key. The errors that have occurred can be viewed here with the date and time at which they occur.

For more detailed explanations for reading the error messages, see Chapter 1.2.2.2.

7.3 Information from the controls in case of a system error

7.3.1 CPU

A system error is triggered by the Siemens system software, e.g. by the detection of an SPS hardware fault.

A system error is signalled by the "SE" LED.

System errors are:

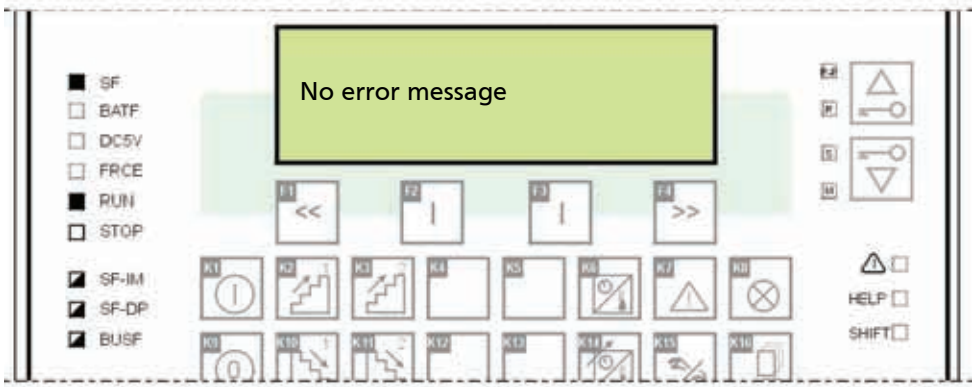
- SPS hardware faults,
- Firmware errors,
- Program errors,
- Parameterising errors,
- Computational errors,
- Time errors,
- Faulty internal memory storage,
- Battery failure or the standby supply is missing while MAINS ON,
- Peripheral error in the internal peripheral functions.

A PG or a PC with the relevant software must be used to read out the diagnostics buffer for precise determination of the errors.

☞ **There is no alarm message in the display.**

If a system error occurs, it can be signalled in one of the following possible ways:

Option 1: The "SE" and "RUN" LEDs are alight.
The application program continues to run.
The compressor is not switched off.

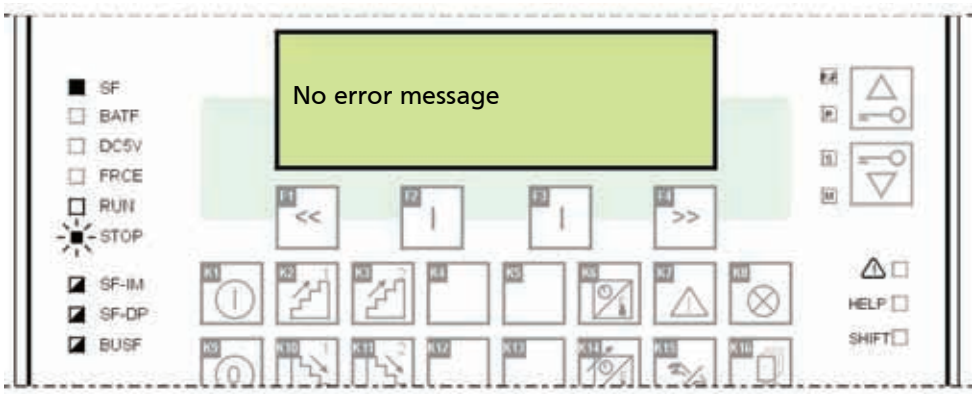


- LED irrelevant
- LED off
- LED on
- LED flashing slowly
- LED flashing quickly
- LED additional information

Option 2: The "SE" LED is alight and the "STOP" LED flashes slowly (1Hz); the "RUN" LED is off.
The application program is not running.
The compressor is switched off and the 'alarm' relay signals an alarm (relay has de-energised).

- LED irrelevant
- LED off
- LED on
- LED flashing slowly
- LED flashing quickly
- LED additional information

Option 3: The "SE" LED is alight and the "STOP" LED flashes slowly (1Hz); the "RUN" LED is off.
The application program is not running.
The compressor is switched off and the 'alarm' relay signals an alarm (relay has de-energised).

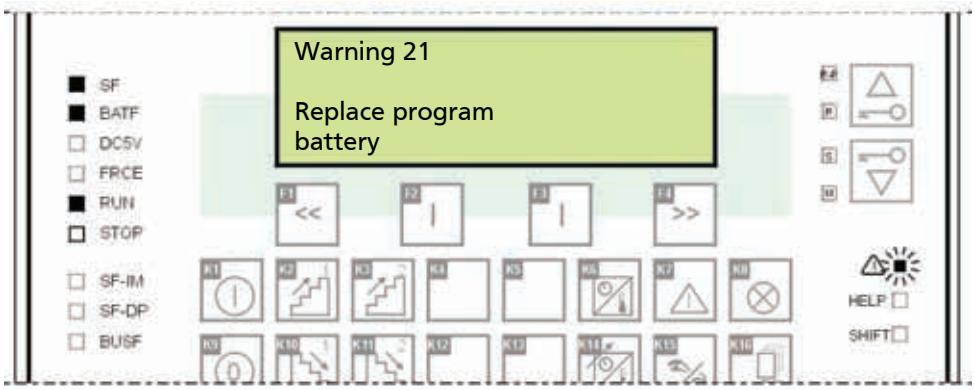


- LED irrelevant
- LED off
- LED on
- LED flashing slowly
- LED flashing quickly
- LED additional information

The flashing "STOP" LED signals that a general reset has been requested. The cause for the CPU "general reset" request can only read from the diagnostics buffer using programming device; check any peripheral modules used that have "SE" LEDs. General reset means that the main memory in the CPU is deleted and the application program is reloaded from the flash memory (EPROM). For the actions required to carry out the general reset (MRES), see Item. 4.2.

Option 4: The 'SE', 'RUN' and 'BATF' LEDs are alight. The "alarm signal" LED is flashing.
The application program continues to run;
the compressor is not switched off.
A warning message appears in the display.
2 = warning message identification of 2nd compressor

Fault: The program battery is flat.
Fault correction: Replace the battery.



- LED irrelevant
- LED off
- LED on
- LED flashing slowly
- LED flashing quickly
- LED additional information

7.3.2 Profibus DP/DP-coupler

Figure 1: Profibus DP/DP-coupler

The LEDs on the front side of the DP/DP coupler have the following meaning:

24 Volt (green)	Error (red)	DP1 (green)	DP2 (green)	Meaning
□	▫	▫	▫	No 24V supply voltage
■	▫	▫	▫	24V supply is applied and is OK
▫	□	▫	▫	Device is running; operation possible.
▫	■	▫	▫	The device is still in the initialisation phase. Grave error in device (exchange HW if necessary). Operation is not possible.
▫	▫	□	▫	No messages are running on Network 1
▫	▫	■	▫	Messages are running on the PROFIBUS DP Network 1 (w/o fault)
▫	▫	▫	□	No messages are running on Network 2
▫	▫	▫	■	Messages are running on PROFIBUS DP Network 2 (w/o fault)

□ LED off
■ LED on
▫ LED irrelevant

7.3.3 Periphery bus coupler

After switching on, the bus coupler immediately checks the connected configuration. During this “self test” all functions of the connected terminals and the communication with the input and output modules are tested. During this phase the red I/O LED flashes. Error free start-up is signalled by extinction of the red LED "I/O ERR”

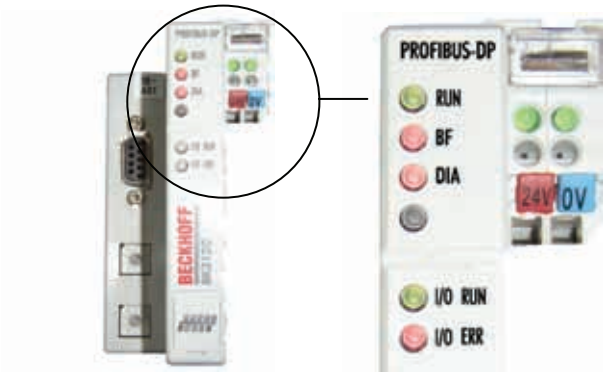


Figure 2: Periphery bus coupler with system LEDs

On the upper right-hand side of the bus coupler are two more green LEDs that indicate the voltage supply. The left-hand LED indicates the 24V supply of the bus coupler. The right-hand LED signals the supply to the power contacts.

The system LEDs on the front side of the bus coupler have the following meaning:

RUN (green)	BF (red)	DIA (red)	Meaning
■	□	□	**Operation state: RUN; inputs are read and outputs are set.**
■	■	□ or ✳	**1. Bus activity, but slave is not yet parameterised. Possible cause: no program available. 2. Bus error in which the outputs become 0.**
□	□	□	**PLC is in STOP mode; no exchange of data.**
□	■	■	**No bus activity, connection to PLC could not be established.**
□	■	□ or ✳	**Bus error, exchange of data between bus coupler and in- and output modules is stopped.**
■	□		**The LED lights up in order to indicate fault-free operation.**
□	✳ or ✳		**If the LED blinks, an error in the area of the terminals is indicated. The error code can be determined from the frequency and number of blinks.**

□ LED off
■ LED on
✳ LED flashing slowly
✳ LED flashing quickly

7.3.4 Analogue incoming terminals

The error LEDs indicate sensor faults (e.g. a broken wire or an overload) - (see chapter 5.4.4)

8

8. DAMAGE REPORT

The Grasso System Control is a high quality product.

Nevertheless, damage or malfunctions during operation cannot be completely avoided.

☞ **Please direct any questions concerning malfunctions that occur to your Grasso supplier.**

☞ **Your contact in Germany:**

Grasso GmbH Refrigeration Technology
Holzhauser Straße 165

13509 Berlin

Germany

Telephone: +49 (0)30 – 43 592 6

Fax: +49 (0)30 – 43 592 777

24 h Central Call Out Service

Telephone: +49 / 172 / 391 20 50

☞ **Your nearest contact:**

.....
.....

.....

.....

Telephone: .....

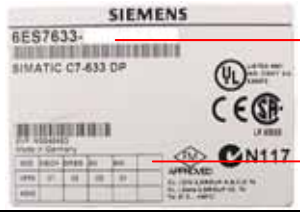
Fax: .....

24 h Central Call Out Service

Telephone: .....

☞ **Please use the fax form on the back of this page to report your damage!**

☞ **By submitting a complete damage report you ensure that the damage that has occurred can be repaired quickly.**

Address of the owner/operator:	
Type and model number of the product:	
Designation of the defective module	
Suspected cause of the damage:	
Date damage occurred:	
Operating hours of the module until damage occurred:	
Software Version: (can be called up under the menu item "Configuration")	
Manufacturer's code (see figure):	 MECH GRBG PER SW
Error message in display:	Row 1 _____ Row 2 _____ Row 3 _____ Row 4 _____

Status and Error Displays

SF -LED	OFF ☐	ON ☐	
BATF -LED	OFF ☐	ON ☐	
DC5V -LED	OFF ☐	ON ☐	
FRCE -LED	OFF ☐	ON ☐	
RUN -LED	OFF ☐	ON ☐	Flashing (2Hz) ☐
STOP -LED	OFF ☐	ON ☐	Flashing (1Hz) ☐
SF-IM -LED	OFF ☐	ON ☐	
SF-DP -LED	OFF ☐	ON ☐	
BUSF -LED	OFF ☐	ON ☐	Flashing (2Hz) ☐
⚠ -LED	OFF ☐	ON ☐	Flashing (2Hz) ☐

Functional Key LEDs

LED K1 „ON"	OFF ☐	ON ☐	Flashing ☐
LED K9 „OFF"	OFF ☐	ON ☐	

Additional Informations

- Description of the symptoms
- Owner/operator requirements

- List of parameters (see chapter 9)

9

LIST OF PARAMETERS COMPRESSOR 1

#	Title	Standard	HotKey			
5	**Actual values**		**K 06**	**ACTUAL values of compressor unit data + remaining times for timers**		
10	**Control settings**		**K 14**	**Parameters for control values**		
				Range	**Default setting**	**Project setting**
	Set Point 1	°C		-60 ... +30	6,0	
	Set Point 2	°C		-60 ... +30	6,0	
	Neutral zone	K		0,2 ... 5,0	0,3	
	Hysteresis			0,1 ... 1,0	0,1	
	Load pulse	s		1 ... 10	2	
	Unload pulse	s		1 ... 10	3	
	Pulse interval	s		5 ... 60	30	
	Auto start dly	s		10 ... 300	120	
	Auto stop pos %	%		0 ... 40	30	
15	**Operating modes**		**K 15**	**Parameters for operating modes**		
				Default setting		**Project setting**
	Operating mode			01 Manual + Manual		
	Control on			Press		
	Direction			Cooling		
20	**Limit values**		**DIR**	**Parameters for limiting values**		
				Range	**Default setting**	**Project setting**
	Suction pressure					
	Psuc low alarm	bar (a)		0,30 ... 5,00	2,00	
	Low warning	bar		0,01 ... 2,00	+ 0,50	
	Limit begin	bar		0,01 ... 2,00	+ 0,30	
	Limit end	bar		0,01 ... 2,00	+ 0,50	
	Discharge pressure					
	Pdis high alarm	bar(a)		5,0 ... 40,0	20,0	
	High warning	bar		0,1 ... 5,0	- 0,5	
	Limit begin	bar		0,1 ... 5,0	- 1,0	
	Limit end	bar		0,1 ... 5,0	- 2,0	

#	Title	Standard	HotKey			
20	Limit values		DIR	Parameters for limiting values		
				Range	Default setting	Project setting
	Motor current					
	Imot high alarm	A		10 ... 900	200	
	High warning	A		1 ... 100	- 10	
	Limit begin	A		1 ... 100	- 20	
	Limit end	A		1 ... 100	- 25	
	External temperature					
	Text low alarm	°C		-60 ... +20	2,0	
	Low warning	K		0,0 ... 10,0	+ 0,0	
	Limit begin	K		0,0 ... 10,0	+ 1,0	
	Limit end	K		0,0 ... 10,0	+ 1,5	
	Discharge temperature					
	Tdis hi alarm	°C		+30 ... +120	100,0	
	High warning	K		1,0 ... 20,0	- 5,0	
	Injection begin	K		1,0 ... 20,0	- 55,0	
	Injection end	K		1,0 ... 20,0	- 40,0	
	Oil temperature					
	Toil hi alarm	°C		+30 ... +120	70,0	
	High warning	K		1,0 ... 30,0	- 5,0	
	Injection begin	K		1,0 ... 30,0	- 10,0	
	Injection end	K		1,0 ... 30,0	- 20,0	
	Oil filter differential pressure					
	High alarm	bar		0,0 ... 5,0	3,0	
	High warning	bar		0,0 ... 3,0	- 2,0	
	Oil differential pressure					
	Low alarm	bar		-1,0 ... +4,0	2,0	
	Slide position					
	Minimum 1	%		0 ... 20	5	
	Minimum 2	%		30 ... 70	70	
	Eco begin	%		0 ... 100	70	
	Eco end	%		0 ... 100	65	

#	Title	Standard	HotKey			
30	**Time settings**		**DIR**	**Parameters for timer values**		
				Range	**Default setting**	**Project setting**
	Stop to start	s		5 ... 50	10,0	
	Start to start	s		60 ... 900	60,0	
	Oil diff start	s		0 ... 15	10,0	
	Oil diff run	s		0 ... 10	6,0	
	Oil level dly	s		0 ... 600	20,0	
	Pump by itself	s		10 ... 40	35,0	
	Oil drain	s		300 ... 900	600,0	
	Slide to min	s		60 ... 300	180,0	
	Motor feedback	s		5 ... 180	30,0	
	Lqd level dly	s		0 ... 300	10,0	
	Pump feedback	s		0 ... 60	30,0	
	Flow swtch dly	s		0 ... 30	10,0	
	Oil drain	s		5 ... 600	120,0	
	Drain delay	s		5 ... 600	100,0	
	Oil return	s		5 ... 600	30,0	
	Return delay	s		5 ... 600	100,0	
35	**Unit options**		**DIR**	**Parameters for optional values**		
				Default setting	**Project setting**	
	Vi-Control: Values + Parameter					
	Sequence Control: Value + Parameter					
	Economiser: Values + Parameter					
	DX Control: Selftuner + Control					
	Condenser: Values + Parameter					

#	Title	Standard	HotKey		
50	Configuration		DIR	Parameters for configuration values	
				Default setting	Project setting
	PLC Version			00.00.00	
	OP Version			00.00.00	
	Refrigerant			R717	
	Comp type			C	
	Vi code			Fix	
	Oil filt sensor			Yes	
	Sensor position			395	
	Oil level high			No	
	Oil level low			No	
	Unit type			Package	
	CH inlet sensor			No	
	Profibus			No	
	Economiser			Without	
	Eco sensors			No	
50	Configuration		DIR	Parameters for configuration values		
				Range	Default setting	Project setting
	Sensor scaling: Suction pressure					
	Sensor				Psuc	
	4mA equals	bar (a)		0 ... 400	0	
	20mA equals	bar (a)		0 ... 400	70	
	Sensor scaling: Oil pressure					
	Sensor				Poil	
	4mA equals	bar (a)		0 ... 40	0	
	20mA equals	bar (a)		0 ... 40	21	
	Sensor scaling: Discharge press.					
	Sensor				Pdis	
	4mA equals	bar (a)		0 ... 40	0	
	20mA equals	bar (a)		0 ... 40	21	

#	Title	Standard	HotKey			
50	Configuration		DIR	Parameters for configuration values		
				Range	Default setting	Project setting
	Sensor scaling: Discharge temp.					
	Sensor				Tdis	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Oil temperature					
	Sensor				Toil	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Slide position					
	Sensor				Slide pos	
	4mA equals	%		0 ... 100	0	
	20mA equals	%		0 ... 100	100	
	Sensor scaling: Motor current					
	Sensor				Imot	
	4mA equals	A		0 ... 999	0	
	20mA equals	A		0 ... 999	400	
	Sensor scaling: Suction temp.					
	Sensor				Tsuc	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: External temp.					
	Sensor				Text	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Oil filter pressure					
	Sensor				Pfilt	
	4mA equals	bar (a)		0 ... 40	0	
	20mA equals	bar (a)		0 ... 40	21	

#	Title	Standard	HotKey			
50	Configuration		DIR	Parameters for configuration values		
				Range	Default setting	Project setting
	Sensor scaling: Vi-position					
	Sensor				Vi pos	
	4mA equals	%		0 ... 100	0	
	20mA equals	%		0 ... 100	100	
	Sensor scaling: Eco pressure					
	Sensor				Peco	
	4mA equals	bar (a)		0 ... 40	0	
	20mA equals	bar (a)		0 ... 40	13	
	Sensor scaling: Eco temp.					
	Sensor				Teco	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Chiller inlet temp.					
	Sensor				CH in	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Condenser outlet temp.					
	Sensor				Cond out	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Condenser inlet temp.					
	Sensor				Cond in	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Configuration					
	Accept				ok	
	Save				ok	

LIST OF PARAMETERS COMPRESSOR 2

#	Title	Standard	HotKey			
5	**Actual values**		**K 06**	**ACTUAL values of compressor unit data + remaining times for timers**		
10	**Control settings**		**K 14**	**Parameters for control values**		
				Range	**Default setting**	**Project setting**
	Set Point 1	°C		-60 ... +30	6,0	
	Set Point 2	°C		-60 ... +30	6,0	
	Neutral zone	K		0,2 ... 5,0	0,3	
	Hysteresis			0,1 ... 1,0	0,1	
	Load pulse	s		1 ... 10	2	
	Unload pulse	s		1 ... 10	3	
	Pulse interval	s		5 ... 60	30	
	Auto start dly	s		10 ... 300	120	
	Auto stop pos %	%		0 ... 40	30	
15	**Operating modes**		**K 15**	**Parameters for operating modes**		
				Default setting		**Project setting**
	Operating mode			01 Manual + Manual		
	Control on			Press		
	Direction			Cooling		
20	**Limit values**		**DIR**	**Parameters for limiting values**		
				Range	**Default setting**	**Project setting**
	Suction pressure					
	Psuc low alarm	bar (a)		0,30 ... 5,00	2,00	
	Low warning	bar		0,01 ... 2,00	+ 0,50	
	Limit begin	bar		0,01 ... 2,00	+ 0,30	
	Limit end	bar		0,01 ... 2,00	+ 0,50	
	Discharge pressure					
	Pdis high alarm	bar(a)		5,0 ... 40,0	20,0	
	High warning	bar		0,1 ... 5,0	- 0,5	
	Limit begin	bar		0,1 ... 5,0	- 1,0	
	Limit end	bar		0,1 ... 5,0	- 2,0	

#	Title	Standard	HotKey			
20	Limit values		DIR	Parameters for limiting values		
				Range	Default setting	Project setting
	Motor current					
	Imot high alarm	A		10 ... 900	200	
	High warning	A		1 ... 100	- 10	
	Limit begin	A		1 ... 100	- 20	
	Limit end	A		1 ... 100	- 25	
	External temperature					
	Text low alarm	°C		-60 ... +20	2,0	
	Low warning	K		0,0 ... 10,0	+ 0,0	
	Limit begin	K		0,0 ... 10,0	+ 1,0	
	Limit end	K		0,0 ... 10,0	+ 1,5	
	Discharge temperature					
	Tdis hi alarm	°C		+30 ... +120	100,0	
	High warning	K		1,0 ... 20,0	- 5,0	
	Injection begin	K		1,0 ... 20,0	- 55,0	
	Injection end	K		1,0 ... 20,0	- 40,0	
	Oil temperature					
	Toil hi alarm	°C		+30 ... +120	70,0	
	High warning	K		1,0 ... 30,0	- 5,0	
	Injection begin	K		1,0 ... 30,0	- 10,0	
	Injection end	K		1,0 ... 30,0	- 20,0	
	Oil filter differential pressure					
	High alarm	bar		0,0 ... 5,0	3,0	
	High warning	bar		0,0 ... 3,0	- 2,0	
	Oil differential pressure					
	Low alarm	bar		-1,0 ... +4,0	2,0	
	Slide position					
	Minimum 1	%		0 ... 20	5	
	Minimum 2	%		30 ... 70	70	
	Eco begin	%		0 ... 100	70	
	Eco end	%		0 ... 100	65	

#	Title	Standard	HotKey			
30	**Time settings**		**DIR**	**Parameters for timer values**		
				Range	**Default setting**	**Project setting**
	Stop to start	s		5 ... 50	10,0	
	Start to start	s		60 ... 900	60,0	
	Oil diff start	s		0 ... 15	10,0	
	Oil diff run	s		0 ... 10	6,0	
	Oil level dly	s		0 ... 600	20,0	
	Pump by itself	s		10 ... 40	35,0	
	Oil drain	s		300 ... 900	600,0	
	Slide to min	s		60 ... 300	180,0	
	Motor feedback	s		5 ... 180	30,0	
	Lqd level dly	s		0 ... 300	10,0	
	Pump feedback	s		0 ... 60	30,0	
	Flow swtch dly	s		0 ... 30	10,0	
	Oil drain	s		5 ... 600	120,0	
	Drain delay	s		5 ... 600	100,0	
	Oil return	s		5 ... 600	30,0	
	Return delay	s		5 ... 600	100,0	
35	**Unit options**		**DIR**	**Parameters for optional values**		
				Default setting	**Project setting**	
	Vi-Control: Values + Parameter					
	Sequence Control: Value + Parameter					
	Economiser: Values + Parameter					
	DX Control: Selftuner + Control					
	Condenser: Values + Parameter					

#	Title	Standard	HotKey			
50	Configuration		DIR	Parameters for configuration values		
				Default setting	Project setting	
	PLC Version			00.00.00		
	OP Version			00.00.00		
	Refrigerant			R717		
	Comp type			C		
	Vi code			Fix		
	Oil filt sensor			Yes		
	Sensor position			395		
	Oil level high			No		
	Oil level low			No		
	Unit type			Package		
	CH inlet sensor			No		
	Profibus			No		
	Economiser			Without		
	Eco sensors			No		
50	Configuration		DIR	Parameters for configuration values		
				Range	Default setting	Project setting
	Sensor scaling: Suction pressure					
	Sensor				Psuc	
	4mA equals	bar (a)		0 ... 400	0	
	20mA equals	bar (a)		0 ... 400	70	
	Sensor scaling: Oil pressure					
	Sensor				Poil	
	4mA equals	bar (a)		0 ... 40	0	
	20mA equals	bar (a)		0 ... 40	21	
	Sensor scaling: Discharge press.					
	Sensor				Pdis	
	4mA equals	bar (a)		0 ... 40	0	
	20mA equals	bar (a)		0 ... 40	21	

#	Title	Standard	HotKey			
50	Configuration		DIR	Parameters for configuration values		
				Range	Default setting	Project setting
	Sensor scaling: Discharge temp.					
	Sensor				Tdis	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Oil temperature					
	Sensor				Toil	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Slide position					
	Sensor				Slide pos	
	4mA equals	%		0 ... 100	0	
	20mA equals	%		0 ... 100	100	
	Sensor scaling: Motor current					
	Sensor				Imot	
	4mA equals	A		0 ... 999	0	
	20mA equals	A		0 ... 999	400	
	Sensor scaling: Suction temp.					
	Sensor				Tsuc	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: External temp.					
	Sensor				Text	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Oil filter pressure					
	Sensor				Pfilt	
	4mA equals	bar (a)		0 ... 40	0	
	20mA equals	bar (a)		0 ... 40	21	

#	Title	Standard	HotKey			
50	Configuration		DIR	Parameters for configuration values		
				Range	Default setting	Project setting
	Sensor scaling: Vi-position					
	Sensor				Vi pos	
	4mA equals	%		0 ... 100	0	
	20mA equals	%		0 ... 100	100	
	Sensor scaling: Eco pressure					
	Sensor				Peco	
	4mA equals	bar (a)		0 ... 40	0	
	20mA equals	bar (a)		0 ... 40	13	
	Sensor scaling: Eco temp.					
	Sensor				Teco	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Chiller inlet temp.					
	Sensor				CH in	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Condenser outlet temp.					
	Sensor				Cond out	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Sensor scaling: Condenser inlet temp.					
	Sensor				Cond in	
	4mA equals	°C		-100 ... +200	-60	
	20mA equals	°C		-100 ... +200	140	
	Configuration					
	Accept				ok	
	Save				ok	

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TÜV CERT
DIN EN ISO 9001
Certificate: 04 100 10416
Certificate: 01 100 80114

GEA Grasso
Refrigeration Division

A company of mg technologies group

Please contact your office: