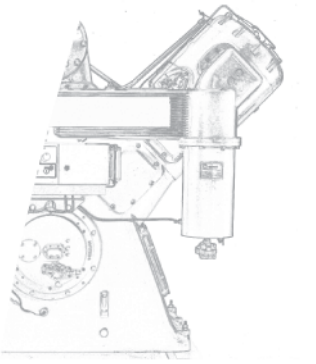
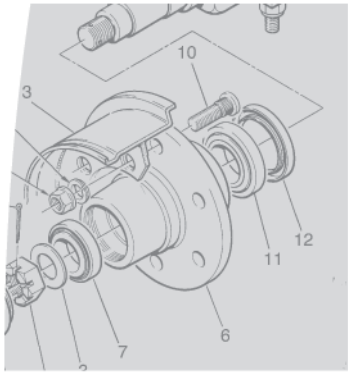
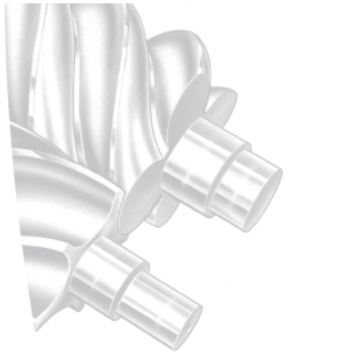




Operating instructions

# DELCOS 3100 electronics with base load selection circuit for stationary, speed-controlled screw compressors (LRS-Serie)

Valid from software edition SD31R2.0x

GB Issue April 2006 Ident. no.: 100 01 0400 / 01

Subject to revision that refers to technical progress.
Valid from software edition SD31R2.0x

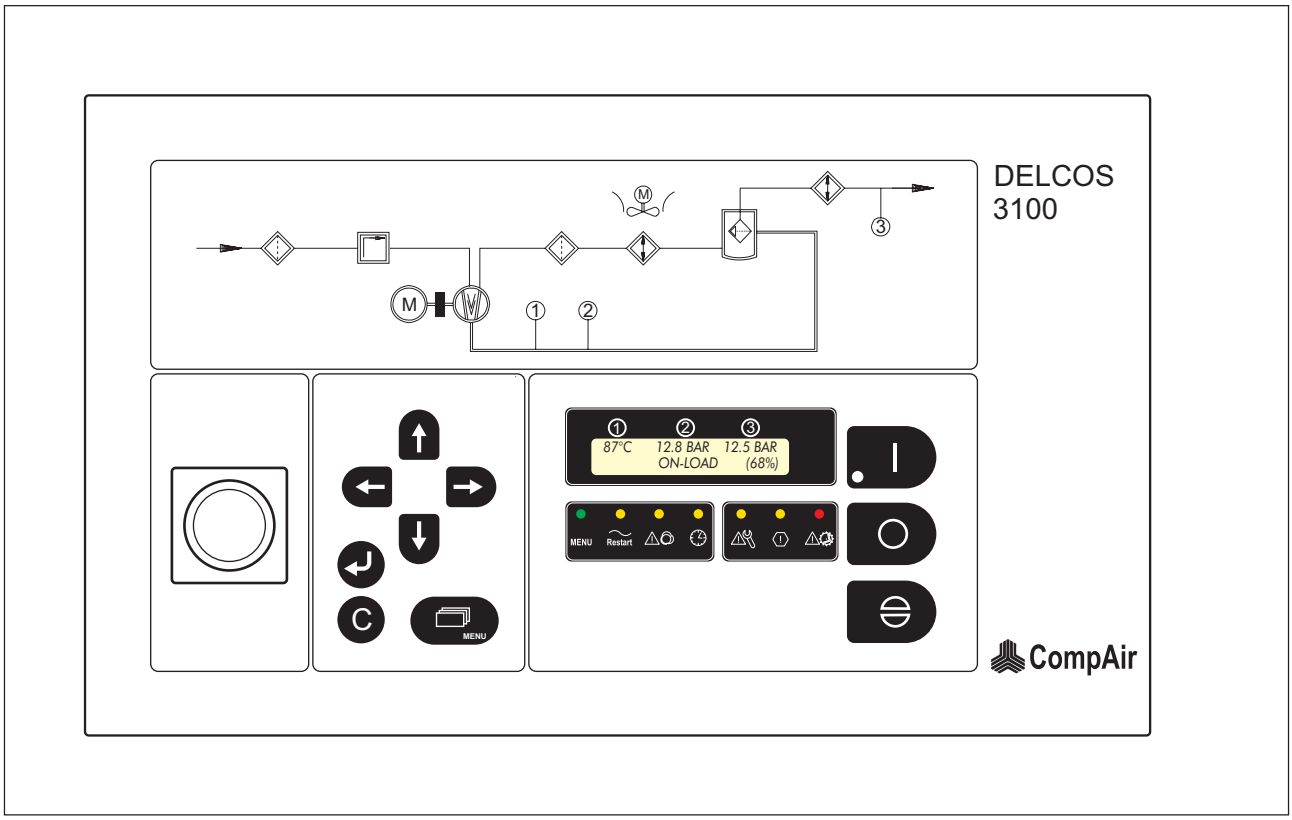



Fig. 1

## 1.1 Operating elements

### 1.1.1 Keyboard

=> Switches the system on

=> Switches the system off

=> Acknowledgement key
=> in the menu: Input mode interrupted (previous value is restored)

Clear text field: => 1st line: Indication of final temperature/final compression pressure/line pressure
=> 2nd line: Status display (operating mode)

=> Opens/closes the menu

=> Input of an access code which protects various menu items

=> In the menu: scrolling upwards
In the input mode: changing of parameters

=> In the menu: scrolling downwards
In the input mode: changing of parameters

=> One column to the left in the menu

=> One column to the right in the menu

=> Inputs are to be changed or acknowledged

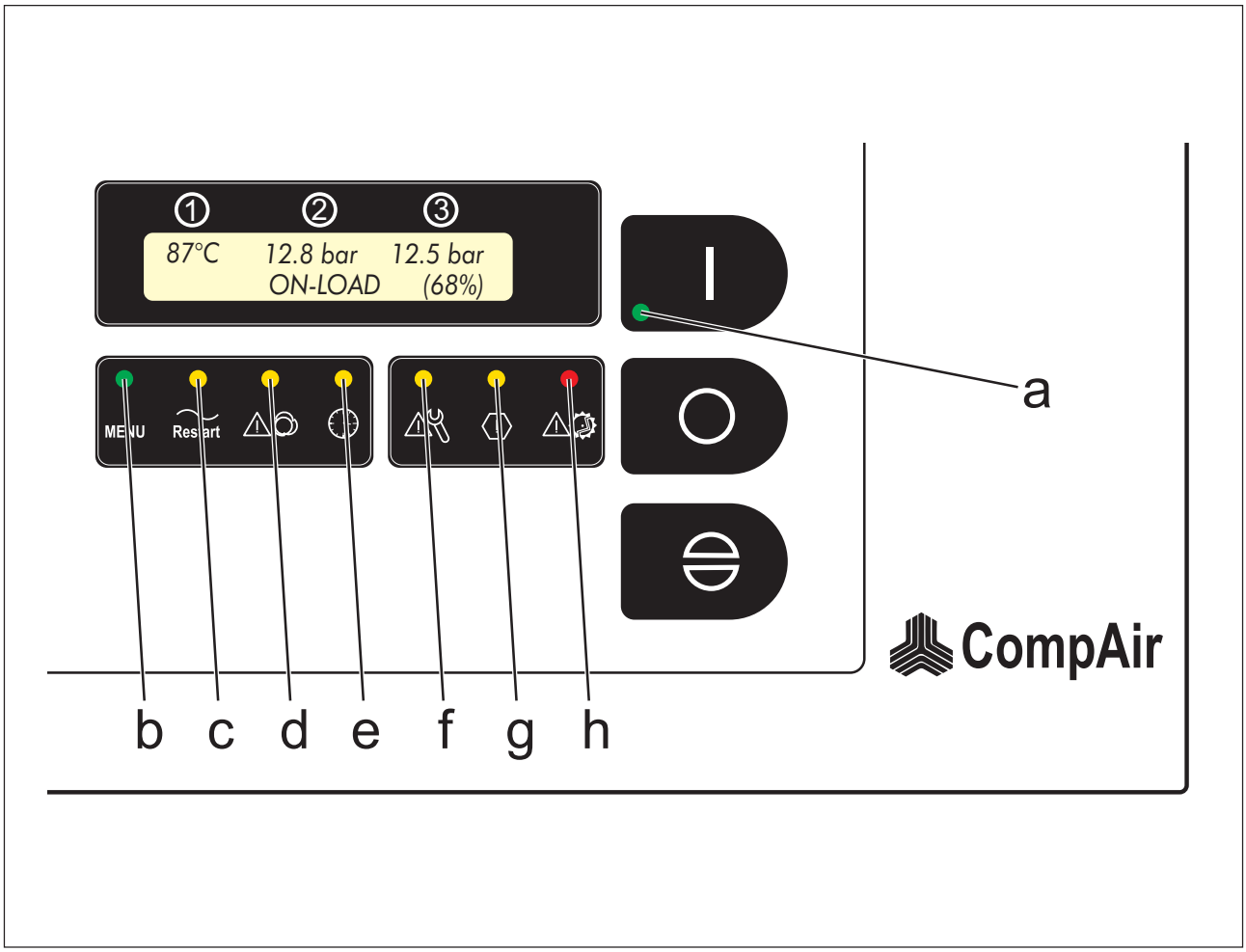



Fig. 2

### 1.1.2 Light emitting diodes

**Operating messages:**

LED a => flashing: The system is in the stand-by mode, i.e. the motor can start up automatically at any time.

on: The drive motor is running

LED b => The operator is within the menu

LED c => Automatic restart is switched ON

LED d => flashing: Remote control, remote off

on: Remote control, remote on

LED e => flashing: In timer control mode Compressor OFF

on: In timer control mode Compressor ON

**Messages:**

LED f => Maintenance interval elapsed

LED g => Warning

LED h => Collective fault

If LED f, g or LED h light up, a message will appear in the clear text field. Determine the cause of failure, warning or maintenance as described in the following chapters - 1.3.4 to 1.3.9.

### 1.1.3 Language selection

DELCOS 3100 is provided in 17 languages. You can change from one language to the other by pressing keys ↵ and ⊖ simultaneously. The internationally valid, national symbols show the current configuration.

*Note*

*The change-over of language is not possible within the menu status (LED b => OFF).*

*In the English display variant you can select °C, bar or °F,PSI.*

### 1.1.4 Clear text field - Line 1

Under normal operating conditions, the display shows the following system values in line 1 of the clear text field:

| | | | |
|---|---|---|---|
| 1 | => | Final temperature | (Sensor R2), |
| 2 | => | Final compression pressure | (Sensor B2) |
| 3 | => | Line pressure | (Sensor B1) |

In the case of incorrect transmission from a sensor, the actual value cannot be determined and displayed. The display shows: - - - - as well as a corresponding message in the second line: FAULT SENSOR ....

#### Final temperature display

This display indicates the final compression temperature.

If the temperature is too high, the temperature display flashes.

#### Final compression pressure display

This display indicates the final compression pressure (see above).

If the system pressure/final compression pressure is too high, the display flashes (see above).

#### Line pressure display

This indicates the actual mains pressure.

### 1.1.5 Clear text field - Line 2 status display

The 2nd line of the clear text field shows the relevant status of the machine, which can be overwritten permanently in the case of faults or cyclically in the case of warnings or maintenance.

The status displays listed below have the following meaning:

**READY TO START**

The unit is ready to start, but is yet switched off

**WARNING START WITH**

alternating with

**PRESSURE REQUIREMENT**

The unit has been switched on (stand-by); a line pressure requirement is missing !

**WARNING START AFTER**

alternating with

**... DE-PRESSURISE**

The unit has been switched on (stand-by); the final compression pressure is still above the start-up protection value.

**WARNING START WITH**

alternating with

**... TIMER CONTROL**

The unit has been switched on in the "timer control" operating mode (stand-by). The enable signal from the timer is not yet available.

**WARNING START BY ...**

alternating with

**... REMOTE OPERATION**

The remote control operating mode is activated. The start-up takes place with the REMOTE ON signal.

**WARNING START IN ##s**

alternating with

**... AFTER POWER LOSS**

Restart with time delay in xxx seconds as a result of "AUTO RESTART" after power failure

**CAUTION: START IN xx MIN ...**

alternating with

**... AFTER DRYER PRE-RUN**

The unit was switched on (stand-by); the dryer is still in the pre-run time. The start-up will place when this time has elapsed.

**MOTOR START PHASE**

Motor starts up

*Note*

*With SPEED REGULATION = ON, the status line shows the volume delivered in the operational states of the off-load and on-load mode. If the base load selection circuit is active, the total volume delivered can be displayed additionally.*

The delivered volume can be displayed
- as a percentage value of the individual machine
- as value of the individual machine
- as value of the complete station (not possible with [BASE LOAD SELECT OPERATION OFF])

To change the contents in brackets, scroll through the individual items and make the changes by means of the arrow keys.

- Percentage value for the individual machine

**OFF-LOAD ( 0%) 123s**

The machine is running in the off-load mode at minimum speed and will be shut down in 123 seconds.

**ON-LOAD (40%)**

The machine is running with 40% output in the on-load mode.

- Value for the individual machine

**OFF-LOAD (V = 0.0) 123s**

The machine is running in the off-load mode at minimum speed and will be shut down in 123 seconds.

**ON-LOAD (V = 4.9)**

The machine is running in the on-load mode. It delivers 4.9 m³/min. (see 1.3.1.3)

**ON-LOAD (V = 294)**

As before, but unit of the delivered volume = m³/h. (see 1.3.1.3)

- Value for the complete station

**OFF-LOAD (ΣV = 23.0) 123s**

The machine is running in the off-load mode at minimum speed and will be shut down in 123 seconds.
The active slave compressors deliver a total volume of 23 m³/min (see 1.3.1.3).

**ON-LOAD (ΣV = 27.9)**

The machine is running in the on-load mode. The total volume delivered is 27.9 m³/min. (see 1.3.1.3)

**ON-LOAD (ΣV = 1674)**

Like before, but unit of the delivered volume = m³/h. (see 1.3.1.3)

*Note*

*With SPEED REGULATION = OFF or in the by-pass mode (option), flashing symbols "(Max)" or "(Byp)" are displayed instead of the delivered volume.*

**OFF-LOAD (MAX) 123s**

The machine is running in the off-load mode at maximum speed, while SPEED REGULATION is switched OFF, and will be shut down in 123 seconds.

**ON-LOAD (MAX)**

The machine is in the on-load mode while SPEED REGULATION is switched OFF.

**OFF-LOAD (BYP) 123s**

The machine is running off load in the by-pass mode (option) and will be shut down in 123 seconds.

**ON-LOAD (BYP)**

The machine is running on load in the by-pass mode (option).

*Note*

If the RUN-ON TIMER (e.g. 123s) is not displayed while the machine is in the off-load mode, CONTINOUS OPERATION was activated instead of AUTOMATIC OPERATION (compressor shuts down automatically after the RUN-ON TIMER.

**RUN ON TIMER ###s**

The unit is in the run-on time and stops after yyy seconds (standby)

**FAULT: <FAULT MESSAGE>**

Shutdown due to fault

**WARNING: <WARNING MESSAGE>**

If a warning is present, the status text will appear for 3 seconds

*Note*

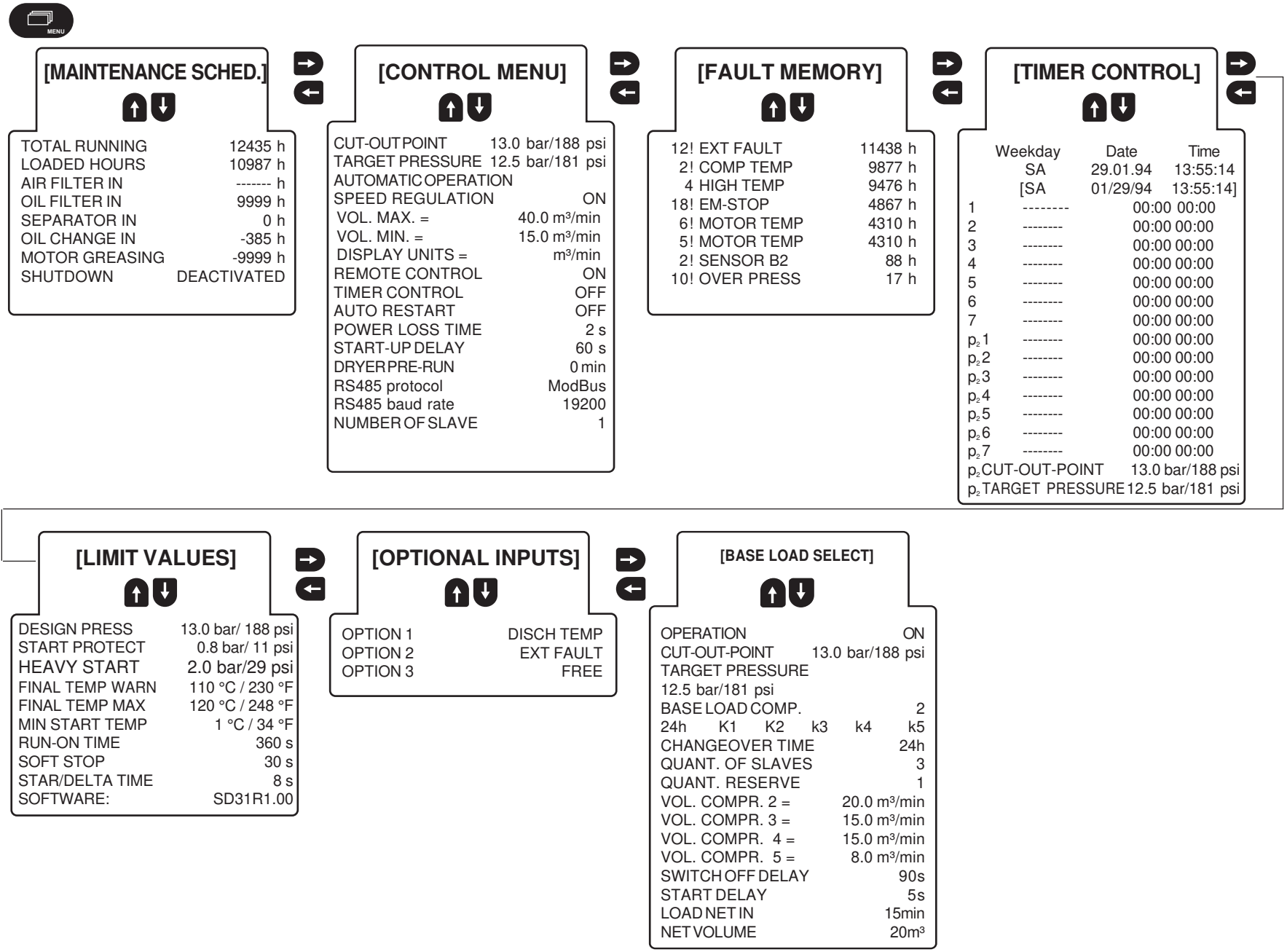
*For explanations regarding fault and warning messages, see the fault memory table, 1.4.*

**MAINTENANCE ELAPSED**

If a maintenance interval has elapsed, the status text is not generally overwritten - as is the case with faults - but is displayed additionally every 12 seconds for 3 seconds.

*Note*

*For explanations regarding the individual maintenance intervals, see chapter 1.5.*


MENU
[MAINTENANCE SCHED.]
TOTAL RUNNING 12435 h
LOADED HOURS 10987 h
AIR FILTER IN ------- h
OIL FILTER IN 9999 h
SEPARATOR IN 0 h
OIL CHANGE IN -385 h
MOTOR GREASING -9999 h
SHUTDOWN DEACTIVATED
[CONTROL MENU]
CUT-OUT POINT 13.0 bar/188 psi
TARGET PRESSURE 12.5 bar/181 psi
AUTOMATIC OPERATION
SPEED REGULATION ON
VOL. MAX. = 40.0 m³/min
VOL. MIN. = 15.0 m³/min
DISPLAY UNITS = m³/min
REMOTE CONTROL ON
TIMER CONTROL OFF
AUTO RESTART OFF
POWER LOSS TIME 2 s
START-UP DELAY 60 s
DRYER PRE-RUN 0 min
RS485 protocol ModBus
RS485 baud rate 19200
NUMBER OF SLAVE 1
[FAULT MEMORY]
12! EXT FAULT 11438 h
2! COMP TEMP 9877 h
4 HIGH TEMP 9476 h
18! EM-STOP 4867 h
6! MOTOR TEMP 4310 h
5! MOTOR TEMP 4310 h
2! SENSOR B2 88 h
10! OVER PRESS 17 h
[TIMER CONTROL]
Weekday Date Time
SA 29.01.94 13:55:14
[SA 01/29/94 13:55:14]
1 -------- 00:00 00:00
2 -------- 00:00 00:00
3 -------- 00:00 00:00
4 -------- 00:00 00:00
5 -------- 00:00 00:00
6 -------- 00:00 00:00
7 -------- 00:00 00:00
p2 1 -------- 00:00 00:00
p2 2 -------- 00:00 00:00
p2 3 -------- 00:00 00:00
p2 4 -------- 00:00 00:00
p2 5 -------- 00:00 00:00
p2 6 -------- 00:00 00:00
p2 7 -------- 00:00 00:00
p2 CUT-OUT-POINT 13.0 bar/188 psi
p2 TARGET PRESSURE 12.5 bar/181 psi
[LIMIT VALUES]
DESIGN PRESS 13.0 bar/ 188 psi
START PROTECT 0.8 bar/ 11 psi
HEAVY START 2.0 bar/29 psi
FINAL TEMP WARN 110 °C / 230 °F
FINAL TEMP MAX 120 °C / 248 °F
MIN START TEMP 1 °C / 34 °F
RUN-ON TIME 360 s
SOFT STOP 30 s
STAR/DELTA TIME 8 s
SOFTWARE: SD31R1.00
[OPTIONAL INPUTS]
OPTION 1 DISCH TEMP
OPTION 2 EXT FAULT
OPTION 3 FREE
[BASE LOAD SELECT]
OPERATION ON
CUT-OUT-POINT 13.0 bar/188 psi
TARGET PRESSURE
12.5 bar/181 psi
BASE LOAD COMP. 2
24h K1 K2 k3 k4 k5
CHANGEOVER TIME 24h
QUANT. OF SLAVES 3
QUANT. RESERVE 1
VOL. COMPR. 2 = 20.0 m³/min
VOL. COMPR. 3 = 15.0 m³/min
VOL. COMPR. 4 = 15.0 m³/min
VOL. COMPR. 5 = 8.0 m³/min
SWITCH OFF DELAY 90s
START DELAY 5s
LOAD NET IN 15min
NET VOLUME 20m³

## Re 1.2 Menu structure DELCOS 3100

Menu guidance is provided in the 2nd line of the clear text field.

In order to enter the individual menus press the key.

You can move between the individual menu branches by using the (left) and (right) keys.

By using the (up) and (down) keys you can call up parameters within the individual menu branches.

The menus cannot be scrolled horizontally or vertically, i.e. they are limited.

Before changing any parameter, the input of a code may be required, see chapter 1.2.8.

Two minutes after the last key operation, the menu is quit automatically.

The values shown in the menus below and in the overview on page 10 are merely examples!

***Danger***

***When parameters are changed in the stand-by mode, the unit can start up at any time.***

### 1.2.1 Menu [MAINTENANCE SCHED.]

Move to the menu point [MAINTENANCE SCHED.] using the keys and . Here, you can call up the individual parameters with the keys and .

The following parameter inputs are saved under the menu heading [MAINTENANCE SCHED.], and the following values could be displayed:

| | |
|---|---|
| TOTAL RUNNING | 12435 h |
| LOADED HOURS | 10987 h |
| AIR FILTER IN | ----- h |
| OIL FILTER IN | 9999 h |
| SEPARATOR IN | 0 h |
| OIL CHANGE IN | - 385 h |
| MOTOR GREASING | - 9999 h |
| SHUTDOWN | DEACTIVATED |

*Note*

*Fur further information, see chapter 1.5 Maintenance intervals.*

Two minutes after the last key operation, the menu is quit automatically.

### 1.2.2 Menu [CONTROL MENU]

Move to the [CONTROL MENU] using keys and . Here, you can call up the individual parameters with the keys and .

The following parameter inputs are stored under the menu title [CONTROL MENU], and the following values could be displayed :

| | |
|---|---|
| CUT-OUT POINT | 13.0 bar/188 psi |
| TARGET PRESSURE | 12.5 bar/181 psi |
| AUTOMATIC OPERATION | ON |
| SPEED REGULATION | |
| VOL. MAX. = | 40.0 m³/min |
| VOL. MIN. = | 15.0 m³/min |
| DISPLAY UNITS = | m³/min |
| REMOTE CONTROL | ON |
| TIMER CONTROL | OFF |
| AUTO RESTART | OFF |
| POWER LOSS TIME | 2 s |
| START-UP DELAY | 60 s |
| DRYER PRE-RUN | 0 min |
| RS485 protocol | ModBus |
| RS485 baud rate | 19200 |
| NUMBER OF SLAVE | 1 |

*Note*

*For further information, see chapter 1.6 Operating modes.*

Two minutes after the last key operation, the menu is quit automatically.

### 1.2.3 Menu [FAULT MEMORY]

Move to the [FAULT MEMORY] menu using keys and . Here, you can call up the individual entries with the keys and .

Fault messages are stored in the [FAULT MEMORY] as follows:

| | | |
|---|---|---|
| 12! | EXT FAULT | 11438 h |
| 2! | COMP TEMP | 9877 h |
| 4 | HIGH TEMP | 9476 h |
| 18! | EM-STOP | 4867 h |
| 6! | MOTOR TEMP | 4310 h |
| 5! | MOTOR TEMP | 4310 h |
| 2! | SENSOR B2 | 88 h |
| 10! | OVER PRESS | 17 h |

Shutdowns (faults) are identified with an "!", whereas for warnings the "!" is not displayed.

*Note*

*For further information, see chapter 1.3.13 FAULT MEMORY.*

Two minutes after the last key operation, the menu is quit automatically.

### 1.2.4 Menu [LIMIT VALUES]

Move to the menu [LIMIT VALUES] using keys ← and →. Here, you can call up the individual parameters with the keys ↑ and ↓ .

The following parameter inputs are, for example, stored under the menu heading [LIMIT VALUES]:

| | |
|---|---|
| DESIGN PRESS | 13.0 bar/ 188 psi |
| START PROTECT | 0.8 bar/ 11 psi |
| HEAVY START | 2.0 bar/29 psi |
| FINAL TEMP WARN | 110 °C / 230 °F |
| FINAL TEMP MAX | 120 °C / 248 °F |
| MIN START TEMP | 1 °C / 34 °F |
| RUN-ON TIME | 360 s |
| SOFT STOP | 30 s |
| STAR/DELTA TIME | 8 s |
| SOFTWARE: | SD31R1.00 |

*Note*

*Factory-set limit values cannot be changed by the operator (see also chapter 1.2.8.).*

Two minutes after the last key operation, the menu is quit automatically.

### 1.2.5 Menu [OPTIONAL INPUTS]

The menu heading [OPTIONAL INPUTS] is provided in the form of optional software. You can have the individual additional monitoring features optionally installed.

Move to the [OPTIONAL INPUTS] menu using keys ← and →. Here, you can allocate three reserve inputs. You simply have to state, which monitoring function has been assigned to which input. Inputs, which are identified as [FREE], are not activated/monitored.

You can call up the individual parameters using keys ↑ and ↓.

One allocation from the following list can be selected for each input:

| Selection | Criterion applied |
|---|---|
| BEKOMAT FAULT | Fault |
| BEKOMAT WARN | Warning |
| DRYER WARNING | Warning |
| DRYER FAULT | Fault |
| OIL PRESS | Fault |
| OIL LEVEL | Warning |
| EXT FAULT | Fault |
| EXT WARNING | Warning |
| OIL TEMP | Warning |
| DISCH TEMP | Warning |
| ROT /BELTS | Fault |
| OPERATE_B1 | See chapter 1.6.3 |
| MOT. LUB. SYSTEM | Warning |
| FREE | No action |

Example:

| | |
|---|---|
| Input 1: | DISCH TEMP |
| Input 2: | EXT FAULT |
| Input 3: | FREE |

Two minutes after the last key operation, the menu is quit automatically.

### 1.2.6 Menu [TIMER CONTROL]

***Danger***

***During programming in the stand-by mode, the machine can start up at any time.***

The real-time clock allows you to switch the control on and off via the timer. Moreover, you can pre-select a change-over of pressure for certain times (e.g. night time reduction). The change-over of pressure is also active, when timer control is not requested [TIMER CONTROL OFF].

If the unit is to be switched on and off via the timer control, you have to activate [TIMER CONTROL ON] in the [CONTROL MENU] and put the unit into operation (switch on).

In order to set the timer or the pressure change-over, move to the menu item [TIMER] using the keys ← and →. Here, you can select/deactivate the individual parameters with the help of keys ↑ and ↓ .

#### Basic clock setting:

Example: [SA 29.01.94 13:55:14] /
[SA 01/29/94 13:55:14]

- Press key ↵, the day of the week [SA] flashes
- Re-set the day of the week using the keys ↑ and ↓
- Acknowledge the new setting by pressing key ↵

- Now the date flashes [29]
- Re-set the date using keys ↑ and ↓
- Acknowledge the new setting by pressing key ↵

The steps described above are the same for setting the month, year, hours, minutes, and seconds. When you acknowledge the new seconds setting with key ↵, the clock starts to run with this new setting.

The clock setting procedure can be interrupted at any time by pressing the ⊜ key.

## Setting of the clock timer:

There are 7 clock timer blocks available.

**Example:** Block No.2, not activated

[2_____ 00:00 00:00]

**Example:** Block No.1,

Unit ON from Monday to Friday - daily from 07:30 to 16:15 h

[1_MTWTF_ 07:30 16:15]

After having selected a timer clock block using keys ↑ and ↓ ,

**Example:** [1_____ 00:00 00:00]

- press key ↵, the day of the week will flash (Sunday), [1S_____ 00:00 00:00]
- select the required setting using keys ↑ and ↓ ,
- acknowledge the new setting by pressing key ↵.

- Then, the next day of the week will flash (Monday),
- Select the required setting using keys ↑ and ↓ ,
- acknowledge the new setting by pressing the key ↵

Repeat the procedure above for the other days of the week and the required times for switching ON and OFF.

The setting procedure of a timer clock can be interrupted at any time by pressing key ⎋. The previous setting will then be restored.

**Example 1:**

With a working time from:

Sunday 22:00 to Saturday 14:00 h,

with a break - daily - from:

12:00 to 12:30 h

the setting of the clock timer should be as follows:

[1S_____ 22:00 24:00]
[2_MTWTFS 00:00 12:00]
[3_MTWTF_ 12:30 24:00]
[4_____S 12:30 14:00]
[5_____ 00:00 00:00]
[6_____ 00:00 00:00]
[7_____ 00:00 00:00]

**Example 2:**

From:

Monday 6:00 h to Friday 22:00 h

you require a continuous compressed air supply:

[1_M_____ 06:00 24:00]
[2__TWT__ 00:00 24:00]
[3_____F__ 00:00 22:00]
[4_____ 00:00 00:00]
[5_____ 00:00 00:00]
[6_____ 00:00 00:00]
[7_____ 00:00 00:00]

## Setting of the pressure change-over

7 further timer blocks are available for switching over to a second pressure range. These are identified by symbol $p_2$.

These timer blocks can be used for determining, during which period of time the system is to be changed over to the second pressure value. The change-over to the second pressure range is effective for the current values of CUT-OUT POINT and TARGET PRESSURE

The current values of CUT-OUT POINT and TARGET PRESSURE depend on the setting of the base load selection circuit (menu [BASE LOAD SELECT]):

| **Timer block $p_2$1.. $p_2$7** | **Menu [BASE LOAD SELECT] [OPERATION OFF]** |
|---|---|
| Not active | The speed-controlled compressor operates within the pressure range set in the menu [CONTROL] |
| Active | The speed-controlled compressor operates within the second pressure range set in the menu [TIMER] |

| **Timer block $p_2$1.. $p_2$7** | **Menu [BASE LOAD SELECT] [OPERATION ON]** |
|---|---|
| Not active | All of the compressors connected to the base load selection circuit operate within the pressure range set in the menu [BASE LOAD SELECT]. |
| Active | All of the compressors connected to the base load selection circuit operate within the second pressure range set in the menu [TIMER]. |

Timer block active means:

The system time is within the time range programmed in the timer block.

During the pressure changeover the values for

[CUT-OUT POINT] and [TARGET PRESSURE]

are dispayed unchanged in the menu [CONTROL].

The times of the pressure changeover are adjusted in analogy to the timer setting.

When a timer block of pressure changeover is active, the symbol $\mathbf{p_2}$ flashes in the upper line before the indication of the current line pressure.

*Note*

*The pressure changeover feature can also be activated via an external, potential-free contact. To this end, a digital input on the base load selection module can be used.*

If no pressure changeover is requested, deactivate all timer blocks of the pressure changeover feature.

Two minutes after the last key operation, the menu is quit automatically.

### 1.2.7 Changing of values

***Danger***

***During programming in the stand-by mode, the machine can start up at any time.***

If the code (see chapter 1.2.8.) is unlocked, any value, except the [LIMIT VALUES] can be changed at any time without the code inquiry.

Move to the value to be changed using keys ← and →. Now press key ↵ in order to change to the input mode. If the code has not yet been unlocked, the code inquiry will appear. When the input mode is activated, the value will flash.

*Note*

*In the input mode, keys ← and → are inactive.*

After having entered the new value with the keys ↑ and ↓, this new value must be acknowledged by pressing key ↵. The display stops flashing, and a new menu item can be selected.

In the input mode, you can restore the original setting and at the same time exit the input mode by pressing key ⊖.

### 1.2.8 Locking/unlocking of the code

In order to avoid unauthorized programming, the settings can be protected by means of a code. The limit values, which are set in the factory, cannot be changed by the operator.

#### Locking

If the code is to be locked, press key C. Then, the following message appears:

"CODE: UNLOCK" (for 1 second)

"CODE INPUT: 0000" (value is flashing)

If CODE: [3031] is entered, the following message will appear:

"CODE: LOCK" (for 1 second).

With a wrong code input, the following message will appear:

"CODE: UNLOCK" (for 1 second)

The program then automatically returns to the starting point.

#### Unlocking

The code can be unlocked again by:

- pressing key C or
- pressing key ↵ and by trying to change a protected value.

The code inquiry will then appear:

"CODE: LOCK" (for 1 second)

"CODE INPUT: 0000" (value is flashing)

Here, you have to enter CODE: [3031].

If the code input is correct, the following message appears:

"CODE: UNLOCK" (for 1 second)

If the input was incorrect, the following message appears:

"CODE: LOCK" (for 1 second)

The program then automatically returns to the starting point.

*Note*

*The code is not locked automatically; the operator can decide whether to implement this function or not.*

### 1.2.9 Setup code

SETUP - DELCOS 3100

| | | | |
|---|---|---|---|
| **Code 1 .** | **0001** | A. no. | 12345678 |
| **Code 2 :** | **0001** | Fab. no. | 123456/1234 |
| **Code 3 :** | **0001** | RA/XY/291194/CSD3-V01 | |

COMPAIR Drucklufttechnik

Label: Setup codes

*Note*

*The setup codes are to be found in the switch cabinet.*

In the case of a failure of the DELCOS 3100 electronics or after their replacement, the control inquires three "setup codes".
The clear text field shows:

CompAir
SETUP-CODE 1: _ _ _ _

Now, press keys ⬆ and ⬇ and enter the correct code. Acknowledge the input by pressing key ↵. Code 2 will then appear automatically. Proceed as with code 1. When code 2 has been acknowledged by pressing key ↵, code 3 will appear automatically. Proceed also here as with code 1 and code 2.

In the case of an incorrect code input, the system automatically enquires code 1 again, i.e. you have to enter all codes once again.

If you have entered all codes correctly, the machine is reset automatically to the basic setting.

**Important**

**Before the next start-up, it is vital that you check the complete settings of the DELCOS 3100 and restore the individual settings !**

**Especially in the [OPTIONAL INPUTS] menu, the optionally connected monitors have to be re-defined on the basis of the electric circuit diagram, otherwise the monitoring functions will not be available. (See chapter 1.2.5.).**

## 1.3 Commissioning

***Danger***

***When the system is in the stand-by operating mode, i.e. LED a flashes, the compressor can start up automatically at any time !***

### 1.3.1 Input of delivered volumes

For the calculation of the current volume delivered by the machine, the rated delivery values must be entered in the DELCOS 3100. In addition, the delivered volume must be known for the correct operation of the base load selection circuit.

This input is also used for calculating the output of the currently delivered volume via the analogue output.

#### 1.3.1.1 Setting of the maximum delivery volume [VOL.MAX.= ??.? m3/min]

The volume must always be entered in the unit [m³/min]. The maximum delivery volume is pre-set in the factory.
Enter the delivery volume specified on the nameplate.

#### 1.3.1.2 Setting of the minimum delivery volume [VOL.MIN.= ?.? m3/min]

The volume must always be entered in the unit [m³/min]. The minimum delivery volume is pre-set in the factory.

- Make of the converter: WEG

It is calculated from: VOL.MIN. = (delivery volume according to nameplate) x Min.speed (P133) / Max.speed (P134)

The data of Min.speed (P133) and Max.speed (P134) can be found in the parameter list of the converter.

- Make of the converter: Loher

It is calculated from: VOL.MIN. = (delivery volume according to nameplate) x $f_{min}$ / $f_{max}$.

The values for $f_{min}$ [Hz] and $f_{max}$ [Hz] can be found in the parameter list of the converter.

#### 1.3.1.3 Setting of the flow unit for the status display [DISPLAY UNITS = m3/min]

This value can be set to [m³/min] or [m³/h].

The status display shows the flow currently delivered by the machine. Since the number of characters on the LCD display is restricted, the unit shown can be pre-set. This unit is not indicated on the status display.

### 1.3.2 Starting of the unit

When the power supply is switched on, an LED test is run that must be acknowledged by pressing key before the machine starts up. Prior to setting the unit into operation by pressing the -key, faults must have been rectified and acknowledged.

The compressor cannot be started at temperatures below the permissible start temperature (see chapter 1.2.4. [LIMIT VALUES]).

If the compressed air mains does not report a requirement at the time of start-up, the unit will go into the stand-by mode - LED a flashes. The clear text field shows [WARNING START WITH] together with the corresponding message (see chapter 1.1.5 STATUS DISPLAY).

Moreover, a safety circuit (start-protection) prevents the drive motor from starting against an internal residual pressure. In this case, the compressor also goes into the stand-by mode. The compressor starts automatically, when the pressure falls below the factory-pre-set start-protection value or when the compressed air mains signals a requirement.

If the compressor is fitted with an optional integrated dryer, the value for the dryer run-up time must be programmed to a value > 0 min in the Control menu. The minimum run-up time can be found in the operating instructions of the integrated dryer.

Also in this case, the compressor is initially switched to the stand-by mode. The compressor starts automatically when the dryer run-up time has elapsed.

When the start-up is requested by pressing the key – or by a switch-on impulse of the remote control – a check is run as to whether the enable conditions for the motor are fulfilled.

If one of the following start-up conditions is missing:

- Final compression pressure below start-up protection value
- Line pressure requirement present (only in the automatic mode)
- Enable of the timer (only when timer ON)
- Dryer run-up time elapsed (for further information, see chapter „Integrated dryer“ in the operating instructions of the compressor)* the system first changes over to the stand-by mode (ON key flashes).

*) OPTION

### 1.3.3 Controller

The speed is controlled with the help of a PI-controller, which is implemented in the software and adapts the speed according to the demand for compressed air. The controller tries to maintain the line pressure to the value set for the target pressure in the [CONTROL MENU].

### 1.3.4 Operation under load/idle running

***Danger***

***When the unit is in the stand-by mode, i.e. LED a flashes, the compressor can start up automatically at any time !***

When the unit is in the stand-by mode (motor off and the display shows "WARNING START WITH... PRESSURE REQUIREMENT“) it starts, when the line pressure is < TARGET PRESSURE.

If your compressed air mains has a low or even no consumption at all for a certain period of time, the unit automatically changes over to the off-load mode.

When the pressure falls below the setpoint pressure during the run-on time of the motor, the unit changes again to the on-load mode.

When the running-on phase (idle running in the automatic operating mode) is over, the motor is switched off after the pre-selected running-on time and the compressor changes to the stand-by mode. The remaining [RUN-ON TIME] is indicated in the clear text field.

### 1.3.5 Stopping of the unit

The pressing of the -key is followed by a [SOFT STOP] of 30 seconds before the motor switches off.

### 1.3.6 Malfunction/shutdowns/power failures

In order to protect the unit, all recognized faults will result in the immediate shutdown of the system or will prevent a start-up.

These faults are displayed in the clear text field and LED h lights up. The messages are transferred to the fault memory and then signalled to the collective fault relay.

The faults have to be acknowledged (after rectification of the fault) by pressing key .

In the case of [POWER LOSS], the LED test appears as soon as voltage is again applied. This must be acknowledged at the unit by pressing key . However, in the remote control operating mode, a new REMOTE ON impulse will be sufficient to signal the acknowledgement to the [FAULT MEMORY].

### 1.3.7 Warning

Warning messages will be signalled via LED g (at the same time, the nature of the warning is indicated in the clear text field). They will not result in the shutdown of the compressor but will be transferred to the fault memory.

Ignoring warnings can result in malfunction.

### 1.3.8 Maintenance

Maintenance messages are signalled by LED f, but will not lead to a shutdown of the compressor and are also not entered into the fault log.

When a maintenance interval has elapsed, i.e. has reached 0 h (hours), the clear text field displays the message [MAINTENANCE ELAPSED]. The elapsed maintenance interval can be determined in the [MAINTENANCE SCHED.] (see 1.2.1.).

Ignoring maintenance intervals can result in malfunction (see chapter 1.5 Maintenance intervals).

### 1.3.9 Collective fault relay

A potential-free contact in the control (see electrical circuit diagram) reports malfunction of the unit.

The contact of the collective fault relay must not be loaded with more than 250 V/1 A.

### 1.3.10 Speed on message

A potential free contact of the control (see electrical circuit diagram) signals that the motor is running. The speed depends on the consumption of compressed air.

The contact may be loaded with max. 230V/4A.

### 1.3.11 Delivered flow (analogue output)

The delivered flow is signalled via the analogue-out module in channel 2. This information is of a purely computational nature and depends on the correct setting of the delivery volume of the speed-controlled compressor in the menu [CONTROL] (see chapter 1.3.1).

It must be noted that when the base load selection circuit is activated, this output does not signal the delivery volume of the speed-controlled compressor, but the delivery volume of the complete system (all compressors managed by the base load selection circuit, including the speed-controlled compressor).

Scaling when the base load selection circuit is switched off:

| Output current | corresponds to delivery volume |
|---|---|
| 4 mA | 0 |
| 20 mA | Max. delivery volume [VOL.MAX.] of the speed-controlled machine, see menu [CONTROL] |

*Note*

*An isolation amplifier must be provided directly downstream of this analogue output for electrical isolation.*

### 1.3.12 Operating/load hours counter

The operating and load hours of the unit can be called up at any time.

For this, go to the [MAINTENANCE SCHED.] menu and, from there to the menu item [TOTAL RUNNING] or [LOADED HOURS] (see chapter 1.2.1.), where you can read the current status.

*Note*

*With a replacement of the DELCOS 3100 electronics, the operating hours and load hours are lost.*

### 1.3.11 Fault memory

The fault memory includes the number, fault/warning text and the total hours count at the time when the fault/warning has occurred.

You can call further information about the state of the compressor at the time when a fault is present (so-called extended fault log).

For this, go to the [FAULT MEMORY] menu as described in chapter 1.2.3.

With faults/warnings, which have not been acknowledged, the number of the current fault/warning flashes.

Faults, i.e. shutdowns, are generally identified with an "!", whereas for warnings this "!" is not displayed.

**Example:**

E.g.: 12! MOTOR TEMP 12345 h.

Explanation:

- 12! means: The same fault "!" has occurred 12 times
- MOTOR TEMP The fault refers to the motor temperature
- 12345 h The fault occurred after 12345 operating hours

The display contains only the 8 latest messages, with the newest entry being on top of the list.

Older entries, which cannot be displayed with regard to the restricted fault memory indication space of 8 entries, are stored in the long-term memory with their corresponding number.

This means: When a fault/warning re-occurs, the relevant fault/warning message appears together with the current number of the fault/warning event and with the hour, in which the fault/warning has re-occurred.

To be able to utilize the extended fault log, proceed as follows:

1. Call the fault to be examined in the menu [FAULT]
2. By pressing key repeatedly, you can call up the states of the compressors at the time when the fault occurred in subsequent order:

- Date and time
- Status of the compressor (e.g. on load)
- Speed in %
- Final compression temperature, final compression pressure and line pressure.

Since this information is shown in line 1 of the clear text field it flashes to underline that these values do not correspond to the current state of the compressor.

## 1.4 Fault table DELCOS 3100 in the case of a fault or warning

### 1.4.1 Check list

Generally, loosened connections and plug-in connectors, defective power supplies or the non-observance of installation instructions result in a variety of faults. The fault messages displayed can therefore often be traced back to different causes.

For this reason, please always observe the following check list:

1. The supply voltage to the unit must always be within the permissible limits.

2. If required, the control power transformer must be adjusted to suit local nominal voltages (see electric circuit diagram).

3. The switch cabinet temperature must not exceed 55°C.

4. Without a coupling relay, the line length of retrofitted remote controls (remote on/off) must not exceed 20 m from the switch cabinet.

5. During commissioning and when carrying out maintenance work, check that all terminal screws are tightened and all connectors fit properly.

6. The power supply cabling must have a sufficient cross-section. Therefore, the installation requirements, the line length and the expected conductor temperatures must be taken into account when selecting the cable(s).

7. When retrofitting switch equipment, the power control transformers must not be "tapped" under any circumstances, since this can result in overloading.

8. Always use CompAir spare parts.

9. Never connect additional switch or measuring equipment without CompAir's prior permission.

10. Never relocate measuring transducers away from the unit.

11. In the case of queries, please have the following information on hand so that we can provide quick and specific support:

    - Type of unit / serial no.
    - Order no.
    - Circuit diagram for drawing no. and Id no.
    - Information regarding the operating conditions of the unit
    - Information regarding the accessories retrofitted by yourselves (remote controls, etc.)
    - Other subsequent modifications or attachments to the unit
    - The exact description of the fault

### 1.4.2 Table of faults/warnings

On the following pages you will find the fault table DELCOS 3100 with possible causes and remedies

| [DISPLAY] / Problem | Possible cause | Remedy |
|---|---|---|
| [FAULT POWER LOSS] | Power failure | Search for cause |
| | Voltage drop | Search for cause |
| | Cabling defective | Check, if required, repair |
| | Terminals loose/loosened | Check all connecting terminals and connectors for proper fit, if required, re-tighten |
| [FAULT EM-STOP] | Emergency stop is/was activated | Unlock |
| | Emergency stop switch defective | Check, if required, replace |
| | Cabling defective | Check, if required, repair |
| [FAULT MOTOR TEMP] | Motor has been started too frequently | Limit the number of starts per hour |
| | Insufficient motor cooling | Improve |
| | Excessive power requirement | Check, search for cause |
| | Defective power supply | Check, search for cause |
| | Motor defective | Check, if required, replace |
| | Star/delta starter defective (by-pass option) | Check, if required, repair |
| [FAULT COMP TEMP] | Final compression temperature exceeded (1) | - |
| [WARNING HIGH TEMP] | Intake temperature too high | Improve |
| | Insufficient cooling | Improve |
| | Unit is being operated with open access panels | Close access panels |
| | Oil injection quantity/temperature insufficient/excessive | Check, search for cause |
| | Wrong type of oil/viscosity | Check, if required, replace oil |
| | Temperature sensor R2 defective (Temperature | Check, if required, replace |
| [FAULT START TEMP] | Startversuch bei zu geringer Temperatur (1) | Heat compressor room |
| | Temperature sensor R2 defective (Temperature display too low) | Check, if required, replace |
| [WARNING HIGH PRESS] | Operating pressure exceeded by 1.0 bar/14 psi (1) | - |
| [FAULT OVER PRESS ] | Operating pressure exceeded by 1.5 bar/21 psi (1) | |
| | Excessive pressure losses in the unit | Check, search for cause |
| | Mains pressure switching points(4) too high | Correct |
| | External pressure requirement too high | Check remote on-load/off-load switching points |
| | Intake regulator does not close | Check, search for cause |
| | Pressure sensor B1 or B2 defective (wrong | Check, if required, replace |
| [FAULT SENSOR B1 ] | Mains pressure sensor defective | - |
| [FAULT SENSOR B2 ] | Final compression pressure sensor defective | - |
| [FAULT SENSOR R2 ] | Final compression temperature sensor defective | |
| | Pressure or temperature sensor defective | Check, if required, replace |
| | Cabling to the sensor defective | Check, if required, repair |
| [FAULT DIRECT ROT] | Wrong direction of rotation of the drive motor (see electrical circuit diagram) | Connect the phase sequence correctly |
| [FAULT MAINT PER] | Shutdown maintenance (2) activated and maintenance interval elapsed by 100 hours(2) | Carry out maintenance and re-program interval newly |

| [DISPLAY] / Problem | Possible cause | Remedy |
|---|---|---|
| [FAULT SOLENOID] | Short-circuit or cable break Solenoid valve Y1 or Y4 | Check, if required, repair or replace |
| [FAULT COOLING] | Air-cooled units: Failure of the unit's fan | |
| | Excessive resistance through intake/exhaust channels | Check, if required install auxiliary fan |
| | Wrong setting of the fan motor protective switch | Set to 110% of the nominal fan flow |
| | Fan motor defective | Check, if required, replace |
| | Water-cooled units: | |
| | Insufficient cooling water supply | |
| | Cooling water temperature too high | Improve |
| | Cooling water flow insufficient | Increase |
| | Filter clogged | Clean |
| | Cooling water solenoid valve does not open | Check, if required, replace |
| | Air in the system | Bleed |
| [FAULT: CONVERTER] | Loss of converter signal "CONVERTER READY" in operating mode [SPEED REGULATION ON/OFF]. | Check converter (air filter, internal fan).<br>If required, change over to [BY-PASS MODE] (option) (see chapter 1.6.2). |
| [FAULT: HEAVY START] | Excessive final compression pressure during motor start-up phase. | Check intake regulator for freedom from leakage. |
| [WARNING: SPEED-SIG.] | Loss of the converter signal "SETPOINT > 3.5 mA" in the operating mode [SPEED REGULATION ON/OFF]. | Cable interruption or short-circuit of the setpoint value signal to the converter.<br>MS bus module A02 failed<br>Analogue input of converter faulty. |
| [WARNING: MS BUS:A02] | Analogue output module failed. | Check power supply to the module.<br>Check fuse in the module. |
| [WARNING: MS BUS:A06] | Module failed in operating mode [SPEED REGULATION ON/OFF]. | Check power supply to the module.<br>Check fuse in the module. |
| [FAULT: BY-PASS] **(OPTION)** | Loss of signal "BY-PASS READY" in operating mode [BY-PASS] (option). | Check by-pass in the converter (see chapter 1.6.2). |
| [FAULT: FEEDBACK] **(OPTION)** | Signals "CONVERTER READY" and "BY-PASS READY" are present simultaneously. | Check wiring of signals (see chapter 1.6.2). |
| [FAULT: MS BUS:A06] **(OPTION)** | Module failed in operating mode [BY-PASS] (option). | Check power supply to the module.<br>Check fuse in the module.<br>If required, switch over to [SPEED REGULATION ON/OFF].<br>(see chapter 1.6.2) |
| [FAULT DRIVE BELT] **(OPTION)** | V-belt set defective/torn (monitored via input: ROT /BELTS (3)) | Check, if required, replace |
| [FAULT OIL PRESS] **(OPTION)** | No/insufficient oil pressure (monitored via input: OIL PRESS (3)) | Check, search for cause |
| [FAULT EXT FAULT] **(OPTION)** | Shutdown due to external fault (monitored via input: EXT FAULT(3)) | Check, search for cause |
| [Warnung: EXT. WARN.] **(OPTION)** | Warning by external device.<br>(Monitored via input: Ext. Warn. (3)) | Check, search for cause. |
| [FAULT DELCOS] | Hardware fault in DELCOS | Replace DELCOS electronics |
| [WARNING SEPARATOR] **(OPTION)** | Excessive differential pressure fine separator | Check, if required, replace fine separator |
| [WARNING AIR FILTER] **(OPTION)** | Excessive differential pressure air filter | Check, if required, replace air filter |

| **[DISPLAY] / Problem** | **Possible cause** | **Remedy** |
|---|---|---|
| [WARNING OIL FILTER] **(OPTION)** | Excessive differential pressure oil filter | Check, if required, replace oil filter |
| [WARNING OIL TEMP] **(OPTION)** | Oil injection temperature too high (monitored via input: OIL TEMP (3)) | Check, search for cause |
| [WARNING DISCH TEMP] **(OPTION)** | Excessive compressed air discharge temperature (monitored via input: DISCH TEMP (3)) | Check, search for cause |
| [WARNING OIL LEVEL] **(OPTION)** | Oil level too low (monitored via input: OIL LEVEL (3)) | Check, if required, top up oil |
| [WARNING: MOT.LUB. SYST.] **(OPTION)** | Fault in the motor lubricating system or LC unit running short. | See chapter "motor lubricating system" in the operating instructions of the compressor system. |
| [WARNING: MS BUS A06] | Relay module of Base Load Selection circuit failed | Check power supply to the module, check fuse in the module. |
| [BEKOMAT FAULT] **(OPTION)** | Connected condensate drain valve (Bekomat) defective. | Check, search for cause |
| [BEKOMAT WARN] **(OPTION)** | Connected condensate drain valve (Bekomat) defective. | Check, search for cause |
| [DRYER WARNING] **(OPTION)** | Fault of the integrated dryer. | See chapter "Integrated dryer" in the operatin instructions of the compressor unit |
| [DRYER FAULT] **(OPTION)** | Fault of the integrated dryer. | See chapter "Integrated dryer" in the operatin instructions of the compressor unit |
| [WARNING BATTERY] | The battery of the real-time clock is exhausted | Replace the real-time clock module |
| [WARNING: INPUT 1]<br>[WARNING: INPUT 2]<br>[WARNING: INPUT 3] | One of reserve inputs 1..3 was controlled, but is programmed as [FREE]. | Check according to the input assignment. (3) |
| [FAULT: POWER LOSS 20V] | 20V supply of control transformer failed. | Check control transformer and fuses. |
| Incorrect indication of flow | Flows set incorrectly. | Check max. and min. flow in the menu [CONTROL] (see chapter 1.3.1).<br>Check the flows of the BLS slaves in the menu [BASE LOAD SELECT]. |
| [COMPAIR]<br>[SETUP-CODE 1: ___?] | Hardware fault in DELCOS | DELCOS electronics has to be replaced; stopgap measure: Enter setup codes, check all settings and, if required, re-set (2)(3)(4)(5) |
| A fault/warning cannot be acknowledged | The fault/warning is still present | Search for cause and rectify |
| No display | - No voltage to the machine<br>- DELCOS control voltage (10 VAC) not applied | Fix power supply, check fuses<br>Check fuses, if required, replace |
| Pressure and temperature display failed, Display (----) | - DELCOS control voltage (20 VAC) not applied | Check fuses, if required, replace |
| Unit does not restart automatically after power failure | - Function "Automatic restart" not ctivated<br>- Power failure lasted too long (4) | Switch on (4) |
| Unit is permanently running in the idle mode without changing automatically over to the stand-by mode | - Operating mode [CONTINUOUS OPERATION] selected(4)<br>- Very short pressure requirements during the running-on phase | Select [AUTOMATIC OPERATION] |
| No compressed air supply within the set switching points (4) | - Pressure change-over p2 (5) active | - |

(1) Unit-specific setting: See menu 1.2.4. [LIMIT VALUES], page 10
(2) Individual setting: See menu 1.2.1. [MAINTENANCE SCHED.], page 9
(3) Individual setting: See menu 1.2.5. [OPTIONAL INPUTS], page 10
(4) Individual setting: See menu 1.2.2. [CONTROL MENU], page 9
(5) Individual setting: See menu 1.2.6. [TIMER CONTROL] **(OPTION)**, page 10

## 1.5 Maintenance intervals

***Danger***

***When the unit is in the stand-by mode, i.e. LED a flashes, the compressor can start up automatically at any time !***

The programming of the maintenance intervals must be tailored to your specific application conditions, since the clogging degree of the air filter depends for example on the intake conditions on site.

In the factory, the setting values for the maintenance intervals are therefore protected in the menu [MAINTENANCE SCHED], the clear text field shows - - - -.

You can set your individual maintenance intervals for air filters, oil filters, fine separators, motor greasing and oil change yourselves (see chapter 1.2.7.) and thus partly replace your maintenance book. The values for the maintenance intervals can be programmed from 0...9999 hours.

If no monitoring of the maintenance intervals is requested, program a value above 9999 hours. The display shows - - - - , i.e. this/these maintenance interval/s is/are blocked.

When the setting value has counted down to 0 hours, the message [MAINTENANCE ELAPSED] appears in the clear text field, and LED f (Maintenance) flashes simultaneously.

You should carry out the scheduled maintenance now, as improper maintenance can result in malfunctions.

The current count of the maintenance intervals can be read from the [MAINTENANCE SCHED.] menu.

It is possible to display negative, i.e. overdue maintenance intervals.

Moreover, a shutdown can be activated/deactivated for maintenance intervals, if a maintenance interval has counted down to -100 hours. If one of the intervals has reached this shutdown threshold, the shutdown is triggered off by the collective fault LED h, which acts in addition to LED f. The message [FAULT MAINT PER] is present in the fault memory as well as in the clear text field.

After having carried out the maintenance work, re-program the maintenance interval and then acknowledge - for a restart - the [FAULT MAINT PER] by pressing key ⏀.

## 1.6 Operating modes

### 1.6.1 Automatic and continuous operation

The selection of [AUTOMATIC OPERATION] or [CONTINUOUS OPERATION] is made under the [CONTROL MENU] (see chapter 1.2.7. - Changing of values).

The [AUTOMATIC OPERATION] mode is the most economic, because the control stops the compressor when no compressed air is required and restarts the unit automatically in the case of demand for compressed air.

The operating mode [CONTINUOUS OPERATION] is required in special applications only. Continuous operation prevents the stopping of the drive motor even if no compressed air is required. The operation is then continued in the idle mode. In contrast to the automatic operation, you can start the unit, although no requirement is present from the compressed air mains.

### 1.6.2 Operating modes of the motor control

The operating mode of the motor control can be set in the menu [CONTROL].

#### 1.6.2.1 SPEED REGULATION ON

This is the default setting of the machine, with which the flow is adjusted by means of the motor speed.

When the converter is ready, the signal "setpoint value > 3.5mA“ is present and no warning "WARNING MS-BUS:A02“ or "WARNING MS-BUS:A06“ is output; it is possible to change over to [SPEED REGULATION ON] in the menu. The desired speed is continuously computed and output.

If the feedback "setpoint value > 3.5mA“ is missing, the "WARNING SPEED SIG.“ is triggered and the system changes over to [SPEED REGULATION OFF].

Changing over to [SPEED REGULATION OFF] is also possible during operation.

#### 1.6.2.2 SPEED REGULATION OFF

Setting the motor speed to maximum speed. i.e. keeping the speed constant, is useful for testing purposes only.

In this operating mode the drive cannot be started, if the feedback "converter ready" is present. The maximum speed request is output to the converter, and the digital output "speed max." is used additionally to change over to maximum speed. This maximum speed is pre-programmed in the converter. On-load/off-load control of the intake regulator takes place in the standard mode, i.e. in the case of line pressure ≥ CUT-OUT POINT, the system changes over to the off-load mode, in the case of line pressure ≤ TARGET PRESSURE, the system switches to the on-load mode.

Moreover, when base load selection operation is active, care must be taken that the machine is now integrated in the base load selection circuit like a standard compressor. After a change-over, it can take the base or peak load position and rotates together with the other compressors within the BLS circuit.

If the feedback "setpoint > 3.5mA" is missing in the operating mode [SPEED REGULATION ON], the "WARNING SPEED-SIG.“ is triggered and the system changes over to [SPEED REGULATION OFF] and switches to maximum speed using the digital output "speed max.".

It is possible to change over to "SPEED REGULATION ON"] during operation, provided that all conditions are fulfilled.

### 1.6.2.3 By-pass operation (option)

A star/delta by-pass can optionally be installed in the converter cabinet. In the event of a failure of the converter, it is possible to change over to the operating mode [BY-PASS OPERATION] when the machine is switched off. The drive can then be re-started via the star/delta by-pass.

A precondition for this is that the converter does not feed back a ready signal, while the by-pass is not faulty.

The on-load/off-load mode of the intake regulator is controlled in the standard mode, i.e. in the case of a line pressure ≥ CUT-OUT POINT, the system changes over to the on-load mode, and in the case of line pressure ≤ TARGET PRESSURE to the on-load mode.

Moreover, when base load selection operation is active, care must be taken that the machine is now integrated in the base load selection circuit like a standard compressor. After a change-over, it can take the base or peak load position and rotates together with the other compressors within the BLS circuit.

Only when the machine is switched off and the signal "converter ready" is present is it possible to change over to the operating modes [SPEED REGULATION ON/OFF].

The messages "by-pass ready" and "converter ready" must not be present simultaneously. This would result in malfunction (see chapter 1.4.2, table of faults/warnings).

When the "WARNING MS-BUS:A06“ (BLS Module) is present, the signal "by-pass ready“ is invalid.

### - Changing over to by-pass operation

When the converter is faulty, DELCOS 3100 switches the machine off due to the "FAULT:CONVERTER". Provided that the by-pass signals its readiness, it is possible to change over to by-pass operation and to re-start the compressor:

- Change from [SPEED REGULATION ] to [BY-PASS OPERATION] in the menu [CONTROL]
- Exit the menu (operate menu key, so that LED b goes out)
- Acknowledge "FAULT: CONVERTER“ with the acknowledgement key
- Re-start the compressor in the by-pass mode

*Note*

*Changing over with the power contactors in the converter cabinet is delayed by some seconds by means of a time relay. After a converter fault has occurred, you have to wait for a short time.*

### - Changing over to speed control

After the converter was repaired, it is possible to switch back to the operating mode [SPEED REGULATION ] as follows:

- Switch the compressor off and wait until the motor has come to a standstill
- Activate the converter
- Change over from [BY-PASS OPERATION] to [SPEED REGULATION ON] in the menu [CONTROL]
- Exit the menu (press menu key, so that LED b goes out)
- Acknowledge "FAULT: BY-PASS" by means of the acknowledgement key
- Restart the compressor in the operating mode [SPEED REGULATION ON].

### 1.6.3 Remote control (remote ON/OFF)

**Important**

**Only potential-free contacts may be connected to the terminal strip. External voltages will result in the destruction of DELCOS 3100.**

**The distance between potential-free contacts and the terminal strip must not exceed 20 metres. If required, install coupling relays in the control cabinet.**

***Danger***

***In this operating mode, the compressor can start up automatically at any time!***

The control offers the possibility of switching the compressor on or off externally via the connection of a potential-free contact.

To activate the input "remote control ON/OFF" (terminals X3.25/X3.26) you have to select [REMOTE CONTROL ON] in the [CONTROL MENU].

- During [REMOTE CONTROL ON] LED d is on and key I and key O of the compressor are locked.
- For starting the unit, the control requires a REMOTE ON edge at the Remote ON/OFF input.
- The unit is operating as long as the remote ON/OFF input is closed.
- The unit stops when the remote ON/OFF input is opened.
- When the unit was switched on manually and the operating mode is changed over to [REMOTE CONTROL ON] it remains in operation as long as the remote ON/OFF input is closed.
- When the remote mode is switched off [REMOTE CONTROL OFF], the unit remains switched ON or OFF.

### 1.6.4 Remote control (on-load mode enable)

**Important**

**Only potential-free contacts may be connected to the terminal strip. External voltages result in the destruction of DELCOS 3100.**

**The distance between potential-free contacts and the terminal strip must not exceed 20 metres. If required, install coupling relays in the control cabinet.**

The control offers the possibility of

- interrupting the enable for the on-load/off-load control (1) of the compressor or
- connecting an external potential-free contact for remote load in series with the internal electronic pressure switch via the connection of an external potential-free contact.

Operating principle:

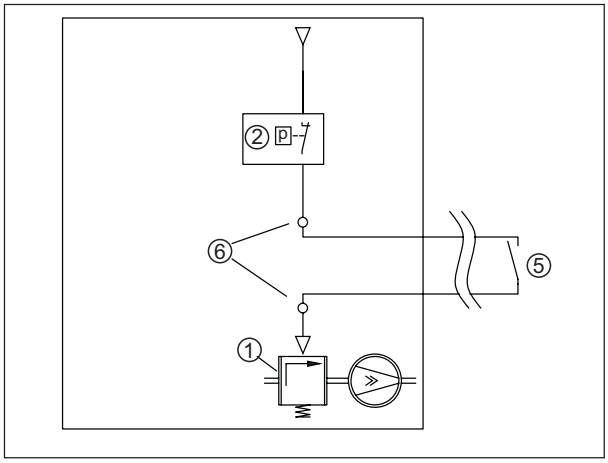



Fig. 4

Legend:

(1) On-load/off-load control of the compressor
(2) Internal electronic pressure switch; for the setting, see [CONTROL MENU]
(5) Enable switch or external potential-free contact for remote load
(6) Terminals

* During normal operation, the on-load/off-load control (1) of the compressor is controlled exclusively via the internal electronic pressure switch (2) of the unit. The switching points of the internal electronic pressure switch (2) can be programmed in the [CONTROL MENU] with the parameters [CUT-OUT POINT] and [TARGET PRESSURE].
* Program one of the three programmable inputs for the function [OPERATE_B1] in the menu [OPTIONAL INPUTS]. Due to this, the selected input with terminals (6) is now connected in series with the internal electronic pressure switch (2).
* Connect the external switch (5) to terminals (6).

Assignment of terminals (6) depending on the selected input:

| | |
|---|---|
| [OPTION 1] | Terminals X3.15/X3.18 |
| [OPTION 2] | Terminals X3.16/X3.19 |
| [OPTION 3] | Terminals X3.17/X3.20 |

*Note*

*As a result of the series connection of the two pressure switches (2) + (5) the setting of the internal electronic pressure switch (2) may have to be increased in the [CONTROL MENU].*

### 1.6.5 Remote control (pressure change-over)

**Important**

**Only potential-free contacts may be connected to the terminal strip. External voltages result in the destruction of DELCOS 3100.**

**The distance between potential-free contacts and the terminal strip must not exceed 20 metres. If required, install coupling relays in the control cabinet.**

***Danger***

***In this operating mode, the compressor can start up automatically at any time !***

The pressure change-over ca be activated via an external, potential-free contact. To this end, a digital input on the base load selection module is used.

### 1.6.6 Automatic restart after power failure

***Danger***

***In this operating mode, the compressor can start up automatically at any time !***

You can activate or deactivate [AUTO RESTART] in the [CONTROL MENU] (see chapter 1.2.2).

After a power failure, which has not taken longer than approx. 2 seconds, the compressor is automatically restarted, provided that it was switched on before the power failure occurred, i.e. it was in operation or in the stand-by mode.

Failures of a duration of more than 2 seconds trigger off the message [POWER LOSS], and [AUTO RESTART] does not take place.

The menu item [POWER LOSS TIME] (see chapter 1.2.2.) can be programmed to values between 2 to 999 seconds.

In addition, you can program a start delay of 1 to 60 seconds in order to ensure that, with stations comprising several compressors, the compressors do not start simultaneously so that the power supply mains is relieved. The clear text display will then show:

[WARNING START IN xxs].

In the remote control operating mode, remote on signal must still be applied for a restart. In the timer control operating mode, the clock timer enable signal must still be applied.

### 1.6.7 Unlimited automatic restart after power failure

The control can execute an automatic restart after a power failure of any duration.

To this end you have to read the following safety notes and enable the unlimited automatic restart by entering a code.

***Danger***

***In this operating mode, the compressor can start automatically after a power failure of any duration. Read the safety regulations that are valid for your country (e.g. EN1012-1, EN60204) to see whether you are allowed to enable an unlimited automatic restart and which precautions are to be taken for this.***

***In any case, provide warning signs on the compressor, keep the compressor room locked and instruct your personnel accordingly.***

***Install the master switch prescribed in EN60204 and provide the relevant warning signs.***

To enable the unlimited automatic restart, proceed as follows:

1. Press the code key C
2. Enter code "8888"
3. Press the enter key to confirm the code

After the enable was given, the menu item can be programmed to [POWER LOSS TIME — s] for the maximum failure time. This corresponds to an unlimited automatic restart.

To withdraw the enable enter code "8888" again.

### 1.6.8 RS485 communication

2 protocols can be used via the serial interface of DELCOS 3100. In addition, different baud rates (4800, 9600, 19200Baud) and station addresses can be selected. The settings can be made in the [CONTROL MENU].

The DELCOS protocol is used in conjunction with the CompAir Profibus Module. DELCOS 3100 can be connected to a Profibus master (e.g. PLC) via the Profibus Module.

Modbus interfaces and the associated drivers are available for nearly all programmable logic controls (PLC) and for PC visualisation software by renown manufacturers.

## 1.7 Factory pre-set limit values

This menu enables you to check the factory pre-set limit values for your unit. However, these settings cannot be changed.

Please note the following values, which are set individually to your unit:

**[LIMIT VALUES]**

| | |
|---|---|
| Design pressure | bar / psi |
| Start protection | bar / psi |
| Heavy startup | bar / psi |
| Final temp warn | °C / °F |
| Final temp max | °C / °F |
| Mi. start temp | °C / °F |
| Run-on time | s |
| Soft stop | s |
| Star/delta time | s |
| Software: | |

# 2. Base load selection circuit DELCOS 3100 L-RS

## 2.1 Overview

The base load selection circuit (BLS) can be adjusted under menu item [BASE LOAD SELECT]. The BLS is an independent part of the normal compressor control of the master. It merely requires the following information from the master:

- Current line pressure
- Setting of the timer

It is therefore irrelevant, in which status the master machine is. The master can be switched off or even faulty. Only the following events result in a failure of the BLS:

- Master without power supply
- Fault: pressure sensor
- Warning: MS-Bus: A06 (relay module for controlling the slaves failed)

The terms below are used in the following description:

| | |
|---|---|
| BLS: | Base load selection circuit |
| BLS series: | Order of compressors referred to the given line pressure switching points. |
| Slave: | Compressors K2 .. K5, which are switched to the on-load mode by a relay module. |
| Relay module A06: | Printed circuit board in the control cabinet of the master machine, which is provided with potential-free contacts for controlling the slaves and to which fault messages of the slaves can (optionally) be connected. |
| Change-over time: | Determination, how long the current base load machine is to be maintained before the BLS series changes over. Compressors K2 to K5 receive on-load/off-load commands from the master control. To this end, a relay module is provided in the master control (see electrical circuit diagram). The relay contacts must be integrated into the control of the slaves so that a picked-up relay (contact made) causes the connected compressor to change to the on-load mode. In order that the normal on-load/off-load control of the machine has no influence on BLS operation, the switching points must be changed accordingly on each slaves. |
| Remaining time: | Indication, when the change-over of compressors will take place |

## 2.2 Functional description / features

The line pressure range that is to be maintained by the base load selection circuit is defined by the setting [CUT-OUT POINT / TARGET PRESSURE] in the menu [BASE LOAD SELECT]. When the line pressure leaves this range or the demand for compressed air changes significantly, the control switches compressors on or off as required. Since the control establishes additionally, how fast the setpoint range is left, the compressors are cut in or out correspondingly slowly or fast. Further functions are described in conjunction with the individual setting options.

Features of the BLS:

- Independent operation, no failure of the station in the case of a fault or temporary deactivation of the master.
- In the case of a compressor fault, the subsequent compressors move up and the faulty compressor is reintegrated after the fault was eliminated (requires to connection of slave fault messages to the master machine).
- Status display of time remaining until change-over, on-load, off-load and fault of the compressors; the operator can call the status display additionally during normal operation without having to enter the BLS menu.
- Change-over time, remaining time and current base load series can be adjusted during operation
- Test routine (300s) and blockable change-over time (fixed BLS order)
- The change-over time is running during on-load operation of the base load unit
- With the help of parameter "LOAD NET IN XYMIN", it is possible to activate only a limited number of compressors for the classic "Monday morning start-up".
- It is possible to define reserve compressors that are not integrated in the BLS, but assigned as fixed "reserve" peak load compressors.
- Change-over of pressure possible via timer and/or external contact.
- Adjustable start-up delay (for short line pressure breakdowns)

## 2.3 Interfacing the slaves with the BLS

### 2.3.1 Load requirement

Compressors K2 to K5 receive on-load/off-load commands from relay module A06 of the BLS. A picked-up relay means on-load operation.

The relay contacts must be switched in the control of the slaves. In order that the normal on-load/off-load control of the machine has no influence on BLS operation, its setting must be changed accordingly.

### 2.3.2 Fault message

The fault messages of the slaves (K2..K5) can (optionally) be wired to existing terminals of the master relay module. A closed electric circuit means "no fault".

For compressors with DELCOS 3100 it is useful to wire back the message "operation". Otherwise, the "SWITCH OFF" function is faulty and the analogue output provides incorrect values (e.g. slave was switched off manually = not faulty => is requested and integrated into the calculation of the delivery volume).

## 2.4 Interfacing the master with the BLS

When the BLS is not switched on [OPERATION OFF] or failed [OPERATION—], the master machine (K1) is controlled on the basis of the line pressure switching points set in the menu [CONTROL].

As soon as the BLS is switched on [ON/TIMER], the master machine is coupled by the software to the BLS. On-load and off-load commands will then be provided exclusively by the BLS.

The fault message of the master (K1) is acquired internally and is therefore always available.

## 2.5 Remote control

The BLS can be switched on or off via external contacts, and the BLS or the machine itself can be switched to a second pressure range.

If the cable length between the machine and external contacts is longer than 20 m, coupling relays must be used.

### 2.5.1 Remote pressure change-over

The BLS or the machine itself [OPERATION OFF] can be forcedly changed over to the second pressure range via input E07.5 (module A06) (see chapter [TIMER CONTROL].)

While the pressure is being changed over, symbol $\mathbf{p_2}$ flashes before the indication of the current line pressure.

### 2.5.2 Remote switching off in [OPERATION ON]

The BLS can be temporarily switched off via input E07.4 (module A06).

This deactivation is not identical to manual switching off of the BLS. Only the load requirements to all machines are withdrawn. In contrast to manual switching off, the message "BLS active" is maintained.

### 2.5.3 Remote switching on in [OPERATION TIMER]

The BLS that was switched off via the timer can be force-activated via input E07.4 (module A06).

## 2.6 Overview [BASE LOAD SELECT.] menu

All of the settings in the menu can be locked/unlocked by entering the code 3031.

| | | |
|---|---|---|
| [BASE LOAD SELECT] | | {Menu header} |
| OPERATION | ON | {OFF, ON, TIMER, fault} |
| CUT-OUT-POINT | 13.0 bar | {Max. line pressure} |
| TARGET PRESSURE | 12.5 bar | {Target pressure} |
| BASE LOAD COMP. | 2 | {Current base load unit} |
| 24h K1 K2 k3 k4 k5 | | {Status line: Remaining hours and series} |
| CHANGEOVER TIME | 24h | {Setpoint time provided for the series} |
| QUANT. OF SLAVES | 3 | {For normal BLS operation} |
| QUANT. RESERVE | 1 | {As reserve for emergencies} |
| VOL. COMPR. 2 = | 20.0 m³/min | {Delivery volume of compressor 2} |
| VOL. COMPR. 3 = | 15.0 m³/min | {Delivery volume of compressor 3} |
| VOL. COMPR. 4 = | 15.0 m³/min | {Delivery volume of compressor 4} |
| VOL. COMPR. 5 = | 8.0 m³/min | {Delivery volume of compressor 5} |
| SWITCH OFF DELAY | 30s | {Waiting time until cut-out} |
| START DELAY | 5s | {Graduated start-up} |
| LOAD NET IN | 15min | {Start-up velocity} |
| NET VOLUME | 20m³ | {Line volume} |

### 2.6.1 Notes on the setting

This Base Load Selection circuit offers all possibilities of operating the compressed air system in the most effective way.

It allows smallest pressure bands with highest precision, lowest pressure level, etc. At the same time, the unnecessary activation of compressors, caused, for example, by irrelevant line pressure breakdowns over a very short period of time, is prevented.

On the other hand, certain conditions may be present, which are not optimal, but cannot be avoided (e.g. installed compressor with long start-up time). Moreover, the compressed air receiver may be too small or line losses (leakage) too great. A lot of other reasons could be listed here.

The corresponding setting of the BLS is therefore, of course, the most important point. The data should be set as correctly and realistically as possible, and the optimum setting must be gradually approached.

### 2.6.2 Data saving

The settings of the BLS are battery-backed against loss. Battery-protection is only important for the de-energised phase of the machine.

Long before the battery is no longer able to protect the data, a warning appears on the display: BATTERY. In this case, the clock module (RTC) of the electronics must soon be replaced.

When the battery is completely exhausted, that data will be lost after a power failure. In order to ensure the compressed air supply also in this case, the BLS will change over to its default values. The unit-specific data can be adjusted temporarily (only until the next power failure).

### 2.6.3 Setting [OPERATION]

Here, the BLS is switched on or off. When the BLS failed as a result of the events described before, [OPERATION —] appears on the display until the fault is rectified. In this case, it is possible to switch from [OPERATION —] back to [OPERATION OFF]. When the BLS is switched off, no load requirements are sent to the slaves.

The compressors connected to the BLS can be controlled in dependence on the [TIMER]. The BLS receives the timer information from the menu [TIMER CONTROL] of the master, which must be programmed accordingly. The timer setting is/can be used by the BLS (menu: [BASE LOAD SELECT]) and/or the machine itself (menu: [CONTROL]).

The timer LED on the operator control membrane is reserved exclusively for the machine and does therefore not signal that the BLS is timer-controlled.

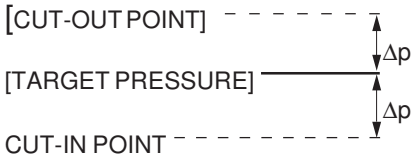
If a clock defect is recognised after a power failure, the BLS is switched back from [TIMER] to [ON]. The following message appears on the display [WARNING: BATTERY].

Since the BLS issues only on-load/off-load commands, it is assumed that all machines involved are switched on or in the stand-by mode (waiting for pressure requirement). This is also valid for the master machine itself.

### 2.6.4 Setting [CUT-OUT POINT / TARGET PRESSURE]

Line pressure range that is maintained by the BLS. The difference between cut-out point and target pressure cannot be set to a value smaller than 0.3 bar. This pressure band should not be set too small, in particular in the case of small line volumes, in order to ensure that the control operates as smoothly as possible.

The internal value for the cut-in point results from the setting of [CUT-OUT POINT] and [TARGET PRESSURE]. If the line pressure falls below the cut-in point, the BLS compressor cuts in. The CUT-IN POINT is calculated as follows:




When a pressure change-over is activated in the menu [TIMER CONTROL] or the pressure change-over is initiated via the external contact, the BLS uses the values [$\mathbf{p_2}$ CUT-OUT POINT = xx BAR] and [$\mathbf{p_2}$ TARGET PRESSURE = xx BAR] from the menu [TIMER CONTROL].

When the line pressure leaves the desired range, the compressors are switched on or off as required.

### 2.6.5 Setting [BASE LOAD COMP]

With [SPEED REGULATION ON] the speed-controlled compressor is firmly at the first position. The base load machine can therefore only be set within the range of 2..(number of BLS slaves). With [SPEED REGULATION OFF], the master machine is integrated in the BLS like a standard machine. In this case, the value can be set within the limits 1..(quant. of BLS slaves).

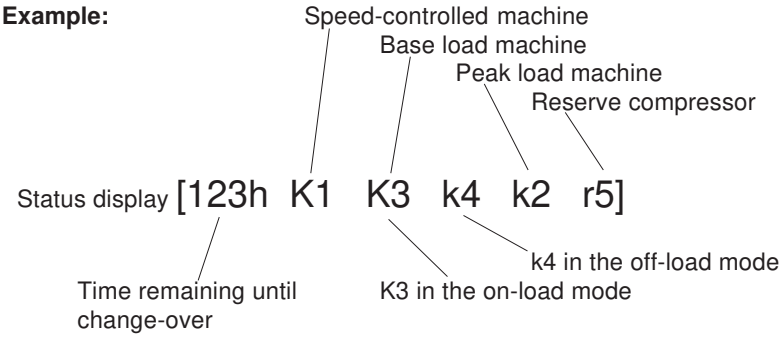
When a fault is detected on the base load unit, another compressor assumes (temporarily) the base load. The actual base load series is indicated on the status display, which is described in the following. When the fault is eliminated, the planned machine re-assumes the base load.

A change in the setting has no effect on the time remaining until the next change-over of the BLS series.

### 2.6.6 Status display of the BLS [123h K1 K3 k4 r2 r5]

The status display provides information about the current BLS order, the time remaining until the next change-over and the status of the machines (on-load/off-load/fault). The reserve machines are shown as well.

**Example:**




The time remaining until change-over can be changed within the range of 1h...change-over time in the input mode (exceptions: [CHANGE-OVER TIME 300s] or [CHANGE-OVER TIME—h] set). The change-over time is counted down as long as the base load unit is in the on-load mode.

The indication of the BLS series starts on the left with the speed-controlled machine, followed by the current base/medium/peak load machines and the reserve compressors. The following is shown:

| | |
|---|---|
| 'K2' | Compressor 2 in the on-load mode |
| 'k2' | Compressor 2 in the off-load mode |
| 'k!' | Compressor faulty and moved to the last position, the display alternates every second between 'k2' and 'k!' |

The same display structure is valid for reserve machines, however, with the letters "R/r" (instead of "K/k").

To get a quick overview of the BLS status during normal operation of the machines, you can show and hide this status diplay with the help of key ↵. Since this is possible outside the menu, the change-over time cannot be changed here. The status display is maintened for max. 60 s in the display or is overwritten by any faults/warnings that occur.

### 2.6.7 Setting [CHANGEOVER TIME]

Here, you can enter the setpoint time for the BLS series. The change-over time is counted down when the base load unit is running in the on-load mode. It stops when no compressor is requested.

The change-over time can be set within the range of 300s, 1h .. 999h, —h.

| | |
|---|---|
| 300s: | Test mode |
| 1h .. 999h: | Normal change-over time |
| —h: | No change-over; the BLS series is maintained permanently |

In the test mode (300s) or if no change-over is requested (—h), the remaining time until change-over cannot be changed in the status display.

When the change-over time is shortened, this may have an effect on the BLS change-over time. As described before, the time remaining until change-over is only displayed on the BLS status display and can be changed there.

### 2.6.8 Setting [QUANT. OF BLS SLAVES]

Here, you can set, how many slave machines apart from the master are to be included in the actual BLS circuit, i.e. exchange the base load in dependence upon the operating hours. This does not apply to reserve machines.

### 2.6.9 Setting [QUANT. OF RESERVE]

If the number of BLS slaves is less than 4, reserve machines can be defined. The reserve machines are not included in the operating hours-related BLS circuit. They are always at the last position in the series and are cut in only when required. Typical reserve machines are, for example, outdated compressors, which are operable, but should be cut in in emergency cases only.

### 2.6.10 Setting [VOL.COMP 2..5]

The delivery volume of the slave compressors can be set here. Enter the delivery volume exclusively in the unit [$m^3$/min].

### 2.6.11 Setting [SWITCH OFF DELAY]

The BLS knows all delivery volumes of the slave compressors and the current delivery volume of the speed-controlled machine. If the calculation shows that the speed-controlled compressor has a sufficient delivery volume available to assume the delivery value provided by the current peak load machine, the time set in [SWITCH OFF DELAY xy s] is counted down. The peak load machine is switched off after this period.

The peak load machine can be a slave or a reserve compressor.

We recommend that the value set here be not too short in order that the new operating point can be set after the peak load machine was cut out.

### 2.6.12 Setting [START DELAY]

The setting of the start-up delay (adjustment range 5..30s) allows a delayed reaction to line pressure breakdowns. It causes the machines to be cut in one after the other. The set value should be at least the longest star/delta time of the connected compressors.

When the pressure falls below TARGET PRESSURE, the first unit is cut in without delay.

### 2.6.13 Setting [LOAD NET IN]

[LOAD NET IN xymin] is used to start only the number of compressors, which are required to charge the line in the specified time. In this way, automatic cutting in of the entire station is prevented.

This function is not active after a power failure. In this (emergency) case, cutting in takes place as usual.

When the compressors connected to the BLS circuit are started manually [OPERATION ON], via the timer or by remote control, while the current line pressure is below TARGET PRESSURE, the compressed air line is charged in a controlled manner.

Example:

On Monday morning at 6:00 o'clock, the compressed air mains must have a pressure of 8.0bar. In order to minimise, amongst others, the reactive power requirement, as few compressors as possible should be switched on.

Solution:

The master compressor is activated by its timer at 5:45 o'clock for switching on the BLS. The BLS mode is set to "timer" and "load net" to 15 min. After 15 minutes at the latest will a line pressure of 8.0 be reached and the number of compressors cut in for this is kept to a minimum.

### 2.6.14 Setting [NET VOLUME]

To calculate the ideal control characteristics, the BLS must know the net volume of the compressed air station. Enter the sum of all receivers here. In the case of branched or large compressed air mains, an allowance for pipes should be added.

Caution:

- The correct setting of the parameter [NET VOLUME] is decisive for a satisfactory operation of the base load selection circuit!
- Setting too small (slow): In the case of significant changes in the consumption, the BLS cannot recognise within the range of TARGET PRESSURE and CUT-OUT POINT that it must preventively cut out compressors.
- Setting too high (sensitive): The BLS cuts compressors out too early within TARGET PRESSURE and CUT-OUT POINT

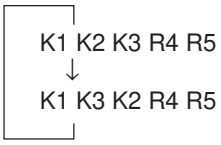
## 2.7 Change-over of BLS series

When the change-over time has elapsed, changing over to the new series takes place, and the time remaining until the next change-over is re-set to the value specified in [CHANGEOVER TIME]. The reserve compressors remain at the peak load position.

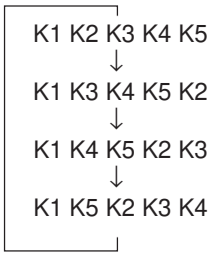
In the following example, it is assumed that the speed-controlled machine is set to [SPEED REGULATION ON] and therefore remains at the first position.

Example:

2 slave compressors
2 reserve compressors




4 BLS compressors
No reserve compressor possible




When changing over takes place, not only the line pressure switching points, but also the previous load enables are passed on.

## 2.8 Compressor fault

Faults of slaves can only be considered, if their fault message contacts are wired to the relay module.

In the event of a fault of a compressor, the latter is shifted to the last position in the series and the load enable is withdrawn. The available compressors that are not faulty move up in the series. After the fault was rectified, the compressor(s) are re-integrated in the BLS series.

Example 1: Circuit with 4 compressors, 1 reserve compressor, [BASE LOAD COMP. 3], fault of K4

| | | |
|---|---|---|
| Before the fault: | 103h K1 K3 K4 k2 r5 | {K3+K4 on load} |
| Fault of K4: | 103h K1 K3 K2 r5 k! | {K3+K2 on load} |
| After the fault: | 102h K1 K3 K4 k2 r5 | |

When the BLS series is changed over, the new BLS series is re-arranged with the available machines.

Example 2: Circuit with 4 compressors, 1 reserve compressor, [BASE LOAD COMP. 3], [CHANGEOVER TIME 250h], K4 faulty

| | | |
|---|---|---|
| Before the fault: | 14h K1 K3 K4 k2 r5 | {K3+K4 on load} |
| Fault of K4: | 14h K1 K3 K2 r5 k! | {K3+K1 on load} |
| Change-over: | 250h K1 K2 K3 r5 k! | {K4 is now the planned base load compressor, but faulty} |
| After the fault: | 217h K1 K4 K2 k3 r5 | {K4 re-integrated after the fault} |

## 2.9 Message BLS active

The slave compressors are usually provided with their own/internal pressure switch for on-load/off-load control. In conjunction with coupling relays, the message "BLS active" can be used to disconnect the slaves from their internal pressure switches, i.e. controlling takes place exclusively via the load request from the master.

Should the BLS fail, can the slave change over to its own pressure switch.

### 2.9.1 Via the output Spare-Out (option)

The function BLS active can be activated via the Spare-Out of the master using code 9348. When the BLS is active [OPERATION ON/TIMER] the relay is picked up. The relay drops out, when, due to the following events on the part of the BLS master, load enables can no longer be passed on to the machines [OPERATION OFF/—]:

1. The BLS was switched off in the menu
2. Master without power supply
3. Fault: Line pressure sensor B1
4. Warning: MS-Bus: A06 (relay module for controlling the slaves failed)

### 2.9.2 Via the BLS module

If the total number of slaves and reserve machines is less than 4, one relay on relay module A06 is free. This relay assumes the function of signalling BLS active. The Spare-Out can therefore be used for other messages.

## 2.10 Messages to the higher-level system when BLS is not activated

If the quantity of slaves + quantity reserve = 0 and the BLS operation = OFF, the relay outputs of the BLS module signal the following:

| | |
|---|---|
| Relay A06.0 | The speed-controlled machine is 100% under full load |
| Relay A06.1 | The speed-controlled machine is off load |
| Relay A06.2 | The speed-controlled machine is on load |
| Relay A06.3 | Speed regulation=switched on (not OFF or by-pass) |

## 2.11 Delivered flow (analogue output)

The delivered flow is signalled via the analogue-out module in channel 2. This information is of a purely computational nature and depends on the correct setting of the delivery volume of the speed-controlled compressor in the menu [CONTROL] (see chapter 1.3.1).

It must be noted that when the base load selection circuit is activated, this output does not signal the delivery volume of the speed-controlled compressor, but the delivery volume of the complete system (all compressors managed by the base load selection circuit, including the speed-controlled compressor).

Scaling when the base load selection circuit is switched off:

| Output current | Corresponds to delivery volume |
|---|---|
| 4 mA | 0 |
| 20 mA | Total delivery voluem of all compressors managed, including speed-controlled compressor. |

*Note*

*An isolation amplifier must be provided directly downstream of this analogue output for electrical isolation.*

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