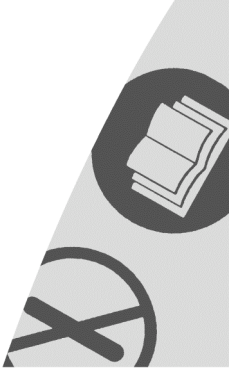
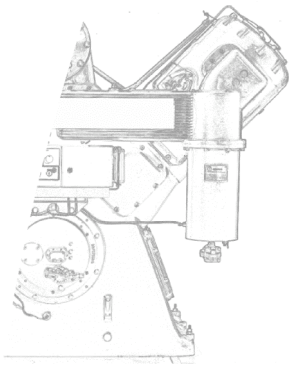
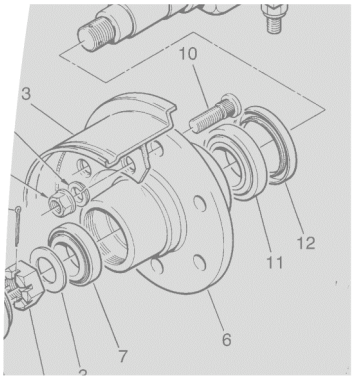
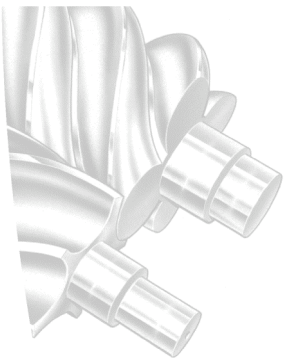
GARDNER DENVER





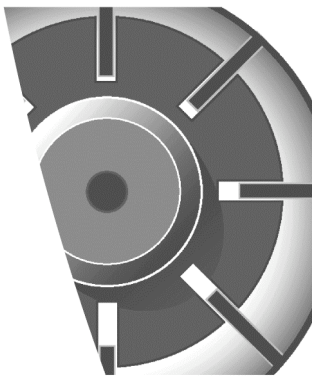


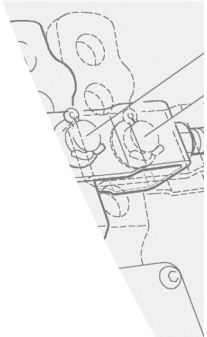


User Manual

DELCOS 3100 Controller for EnviroAire

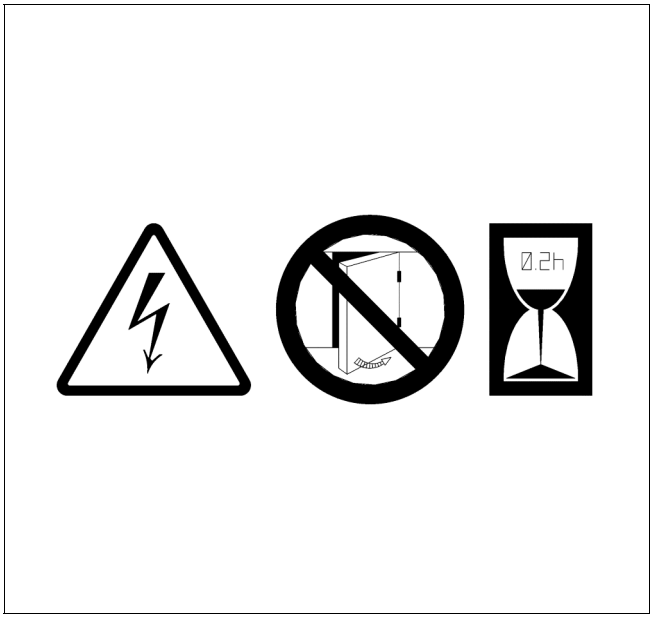
Oil-Free





GB Id. No. 100016911 / 01 - October 2009

SR version only:



Attention: Risk of electric shock from charged capacitors!

Always disconnect the system from the power supply and then wait a further 12 minutes before touching electrical components. The power capacitors take this time to discharge.

Subject to modification in the course of technical progress.

Valid from software version

Version FS	HD31V2.0x
Version SR	HD31S1.1x
Version RS	HD31R1.3x

Deutsche Basis BA 100016910 / 01

Contents

Contents

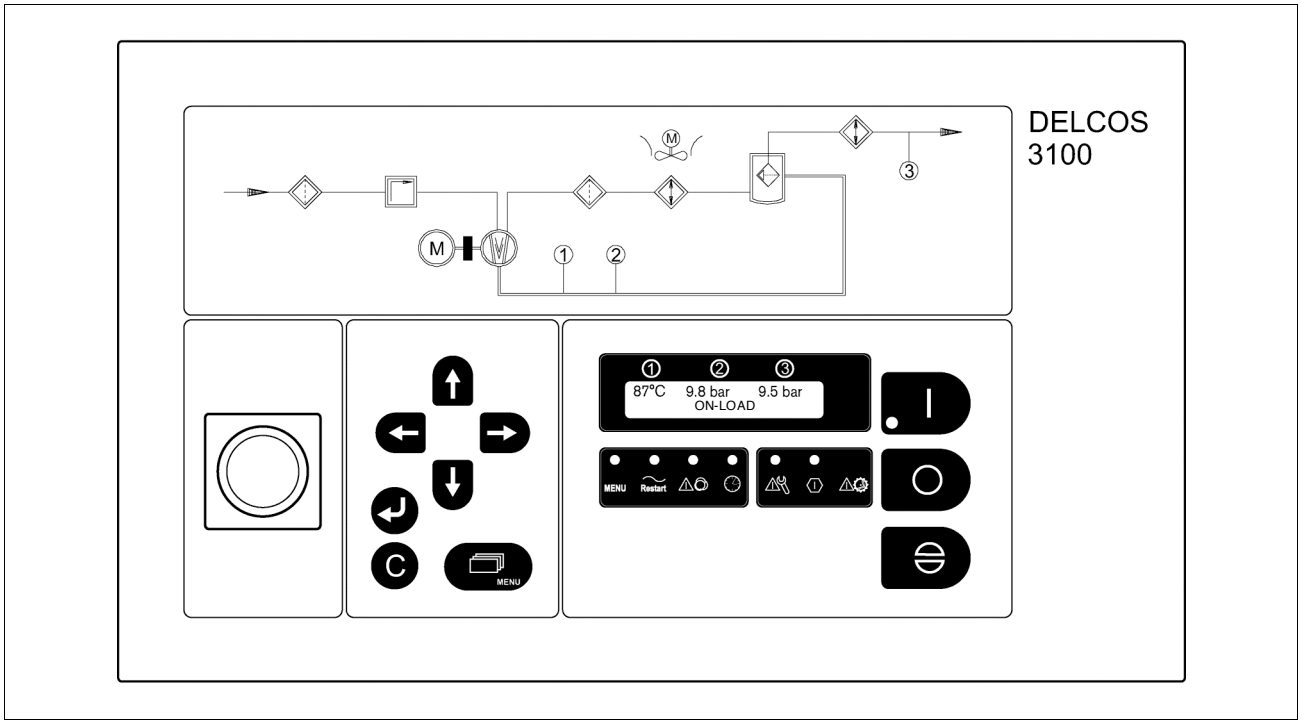


Figure 1

1.1 Foreword

This manual describes the DELCOS 3100 compressor control system in various configuration levels:

Version FS	Version for fixed-speed compressors
Version RS	Version for speed-controlled, RS-series compressors
Version SR	Version for speed-controlled compressors with SR drive (SR series)

Functions that only concern a specific version are identified FS, RS or SR.

In addition, individual versions can be equipped with further options that are not included in the standard package. These are also indicated separately.

1.2 Controls

1.2.1 Keypad

=> switches system on

=> switches system off

=> acknowledgement key

=> in the menu: cancels entry in input mode (old value is restored)

=> opens and closes the menu

=> enters an access code to protect various menu options

=> in menu: scroll up

In entry mode: change parameters

=> in menu: scroll down

In entry mode: changes parameters

=> in menu, one column to the left

=> in menu, one column to the right

=> changes or confirms entries

Plaintext field

=> 1st line: display of final temperature/ final compression pressure / network pressure

=> 2nd line: status display (operating status)

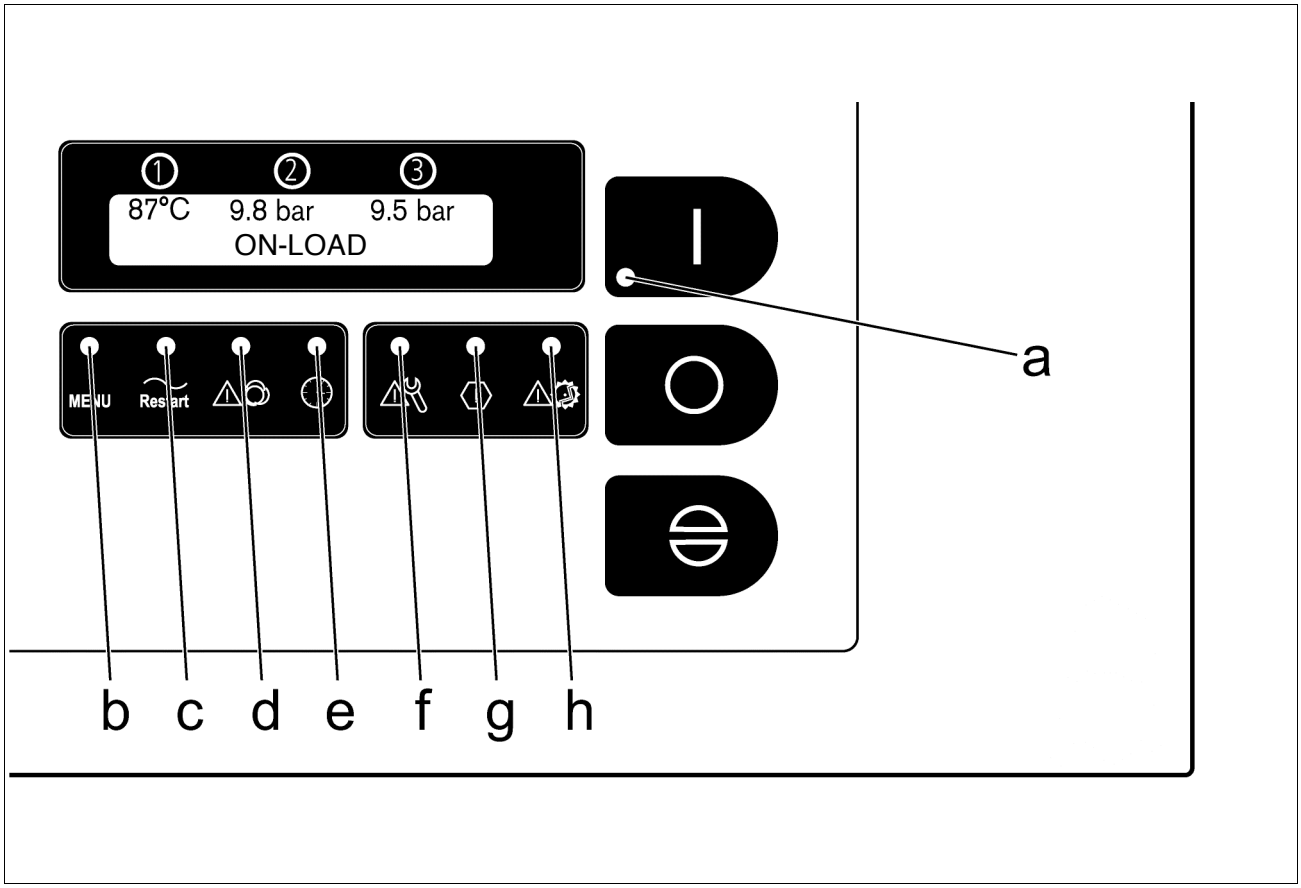


Figure 1

1.2.2 Light-emitting diodes

Operating messages:

LED a => flashing: system in standby mode, i.e. the motor can start automatically at any time

steady: drive motor is running

LED b => operator is moving within menu

LED c => automatic restart activated

LED d => flashing: remote control, remote off

steady: remote control, remote on

LED e => flashing: compressor OFF in timer mode

steady: compressor ON in timer mode

Messages:

LED f => maintenance interval expired

LED g => warning

LED h => group fault

The plaintext field shows a message when LED f, g or LED h is lit. Ascertain reason for malfunction, warning or maintenance as described below in Chapters 1.4.6 to 1.4.12.

1.2.3 Changing language

DELCOS 3100 is configured in 17 languages. To switch from one language to another, simultaneously press the ↵ and ⛁ keys. The international country identifiers show you the current configuration.

Note

Switching from one language to another is only possible outside the menu status (LED b => off)
The English-language version provides the °C, bar display option (GB) or °F, psi display option (US).

1.2.4 Plaintext field - Line 1

In normal circumstances, line 1 of the plaintext field in the display shows under:

1 => the final temperature (sensor R2)
2 => the final compression pressure (sensor B2)
3 => the network pressure (sensor B1)

of the system.

If a sensor transmits information incorrectly, the actual value cannot be determined and displayed. The display shows: [- - - -] as well as an associated message in the second line: [FAULT SENSOR…]

Final temperature display

This is where the final compression temperature is displayed.

The temperature display flashes if the temperature is too high or below the set start temperature.

Final compression pressure display

This is where the final compression pressure (see above) is displayed. The display flashes if system pressure/final compression pressure (see above) is too high.

Network pressure display

This is where the current network pressure is indicated.

1.2.5 Plaintext field – line 2, status display

The 2nd line of the plaintext field shows the machine's current status which may be permanently overwritten by faults or cyclically overwritten in the event of a warning or maintenance.

The status displays below have the following meanings:

All versions:

READY TO START
The system is ready to start but still shutdown

WARNING START WITH ... in alternation with
... PRESSURE REQUIREMENT
The system has been switched on (standby); network pressure request is still outstanding!

WARNING START BY ... in alternation with
... DE-PRESSURISE
The system has been switched on (standby), the final compression pressure is still above the start-up protection level.

WARNING START BY ... in alternation with
... TIMER CONTROL
The system has been switched on in the [TIMER CONTROL] operating mode (standby). Timer has not yet given the enable signal.

WARNING START BY ... in alternation with
...REMOTE OPERATION
Remote operation is activated. Start-up on receipt of REMOTE ON signal.

WARNING START IN xxs in alternation with
... AFTER POWER LOSS
Restart by [AUTO RESTART] after power failure with time delay of xx seconds.

WARNING START IN xxs in alternation with
... AFTER DRYER PRE-RUN
System has been switched on (standby); dryer pre-running time still in progress. Start-up after this time elapses.

MOTOR START PHASE
Motor being started

SOFT STOP TIME XXs
System is in soft stop time and stops after XX seconds (standby)

FAULT <fault text>
Shutdown in response to fault. Explanations of fault texts are provided in the fault memory table, see Chapter 1.5.

WARNING <Warning text>

If a warning is given, the status text is not – as in the case of faults – generally overwritten by this message but additionally shown every 12 seconds for 3 seconds. Explanations of the warning texts are provided in the fault memory table, see Chapter 1.5.

MAINTENANCE ELAPSED

Once a maintenance interval has elapsed, the status text is not – as in the case of faults – generally overwritten by this message but additionally shown every 12 seconds for 3 seconds. Explanations of the various maintenance intervals are provided in Chapter 1.6.

Version FS only:

OFF-LOAD

Machine is running off-load.

ON-LOAD

Machine is running on-load.

RUN-ON TIME XXs

Machine has been shutdown and stops after XX seconds.

RS Version only:

In the on-load and off-load operating statuses, the status line shows the delivery rate for SPEED REGULATION ON. If base-load sequencing is activated, it is also possible to display the total delivery rate

The delivery rate can be displayed as:

- a percentage for the specific machine
- a value for the specific machine
- a value for the overall station (not possible for [BASE LOAD SELECT. - OPERATION OFF])

  Using one of the arrow keys, you can continuously step through the contents of the brackets.

- a percentage for the specific machine (example values)

  OFF-LOAD (0%) 123s

  Machine running off-load at minimum speed and will shut down in 123 seconds.

  ON-LOAD (40%)

  Machine is running at 40% delivery rate in the on-load operating mode.

- a value for the specific machine (example values)

  OFF-LOAD (V = 0.0) 123s

  Machine is running off-load at minimum speed and will shut down in 123 seconds.

  ON-LOAD (V = 12.3)

  Machine is running on-load. The delivery rate is shown in the unit selected.

- a value for the overall station (example values)

  OFF-LOAD (ΣV = 12.3) 123s

  Machine is running off-load at minimum speed and will shut down in 123 seconds. The total delivery quantity incl. activated slave compressors is shown in the unit selected.

  ON-LOAD (ΣV = 12.3)

  Machine is running on-load. The total delivery quantity incl. activated slave compressors is shown in the unit selected.

  With SPEED REGULATION OFF or in the bypass mode (Option), the display merely shows an abbreviation (MAX) or (BYPASS) instead of the delivery rate.

  OFF-LOAD (MAX) 123s

  Machine is running off-load with deactivated speed control at maximum speed and will shut down in 123 seconds.

  ON-LOAD (MAX)

  Machine is running on-load with deactivated speed control.

  OFF-LOAD (BYPASS) 123s

  Machine is running in bypass mode (option) off-load and will shut down in 123 seconds.

  ON-LOAD (BYPASS)

  Machine in running in bypass mode (option) on-load.

Note

If there is no display of the run-on time (e.g. 123s) when the machine is off-load, the CONTINUOUS OPERATION mode will be activated instead of AUTOMATIC OPERATION (compressor shuts down automatically after run-on stop time).

SR version only:

INITIALIZATION SRD...

The compressor's supply voltage has been switched on. The control system is being initialised and is setting up communication to the SR drive.

SRD-POWERING UP... xxx VDC

The intermediate DC voltage circuit of the SR drive is being powered up. The level of voltage is xxx VDC.

In the on-load and off-load operating states, the status line shows the delivery rate in brackets. If the optional base-load sequencing is activated, it is also possible to display the total delivery rate.

The delivery rate can be displayed:

- as a value for an individual machine
- as a value for the entire station (not possible for [BASE LOAD SELECT. - OPERATION OFF])

  The contents of the brackets can be stepped through continuously using one of the arrow keys.

- a value for an individual machine (example values)

  OFF-LOAD (V = 0.0) 123s

  Machine is running off-load at minimum speed and will shut down in 123 seconds.

  ON-LOAD (V = 12.3)

  Machine is running on-load. The delivery rate is shown in the unit selected.

- a value for the entire station (example values)

  OFF-LOAD (ΣV = 12.3) 123s

  Machine is running off-load at minimum speed and will shut down in 123 seconds. The total delivery quantity incl. activated slave compressors is shown in the unit selected.

  ON-LOAD (ΣV = 12.3)

  Machine is running on-load. The total delivery quantity incl. activated slave compressors is shown in the unit selected.

- The arrow keys can additionally be used to display the drive motor's current speed:

  Examples of speed displayed:

  [_____▮___] 3690rpm

  Speed in controlled range.

  [▮_____] 690rpm

  Speed in lower controlled range, minimum speed not yet reached.

  [I◄_____] 650rpm

  Minimum speed reached.

  [_____ ►I] 4050rpm

  Maximum speed reached.

1.3 DELCOS 3100 menu structure (example values)

DELCOS 3100 FS menu structure (example values)

[MAINTENANCE SCHED.]

TOTAL RUNNING	12345 h
LOADED HOURS	10987 h
AIR FILTER IN	----- h
WATER FILTER IN	9999 h
MOTOR GREASING	9999 h
SHUTDOWN	DEACTIVATED

[CONTROL MENU]

CUT-OUT POINT	10.0 bar / 145 psi
CUT-IN POINT	9.5 bar / 138 psi
AUTOMATIC OPERATION	
REMOTE CONTROL	ON
TIMER CONTROL	OFF
AUTO RESTART	OFF
POWER LOSS TIME	2 s
START-UP DELAY	5 s
DRYER PRE-RUN	0 min
RS485-PROTOCOL	ModBus
RS485-BAUDRATE	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]

Week day	Date	Time
Saturday	29.01.2006	13:55:14
[SA	01/29/06	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
p_2 1	_____	00:00 00:00
p_2 2	_____	00:00 00:00
p_2 3	_____	00:00 00:00
p_2 4	_____	00:00 00:00
p_2 5	_____	00:00 00:00
p_2 6	_____	00:00 00:00
p_2 7	_____	00:00 00:00
p_2 CUT-OUT POINT		10.0 bar / 145 psi
p_2 CUT-IN POINT		9.5 bar / 138 psi

[LIMIT VALUES]

DESIGN PRESS	10.0 bar / 145 psi
START PROTECT	0.4 bar / 6 psi
HEAVY STARTUP	2.0 bar / 29 psi
FINAL TEMP WARN	59 °C/138 °F
FINAL TEMP MAX	65 °C/149 °F
MIN START TEMP	2 °C/ 36 °F
RUN-ON TIME	90 s
SOFT STOP	30 s
STAR/DELTA TIME	8 s
SOFTWARE:	HD31V2.00

[OPTIONAL INPUTS]

OPTION 1	DISCH TEMP
OPTION 2	EXT FAULT
OPTION 3	FREE

[BASE LOAD SELECT.] (Option)

OPERATION	OFF
CUT-OUT POINT	10.0 bar / 145 psi
CUT-IN POINT	9.5 bar / 138 psi
BASE LOAD COMP	1
123h K2 K3 K4 k5 k1	
CHANGEOVER TIME	24h
QUANT.SLAVES	4
QUANT.RESERVE	0
START DELAY	5s
LOAD NET IN	15min
VOLUME OF NET	20%

[WATER]

CHANGE CYCLE	24h
23h y8 y9 Y10	>-<
SUPPLY MAX.	150s
DRAINAGE MAX.	150s

DELCOS 3100 RS menu structure (example values)

[MAINTENANCE SCHED.]

TOTAL RUNNING	12345 h
LOADED HOURS	10987 h
AIR FILTER IN	----- h
WATER FILTER IN	9999 h
MOTOR GREASING	9999 h
SHUTDOWN	DEACTIVATED

[CONTROL MENU]

CUT-OUT POINT	10.0 bar / 145 psi
CUT-IN POINT	9.5 bar / 138 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	5 s
DRYER PRE-RUN	0 min
RS485-PROTOCOL	ModBus
RS485-BAUDRATE	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]

Week day	Date	Time
Saturday	29.01.2006	13:55:14
[SA	01/29/06	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
p_2 1	_____	00:00	00:00
p_2 2	_____	00:00	00:00
p_2 3	_____	00:00	00:00
p_2 4	_____	00:00	00:00
p_2 5	_____	00:00	00:00
p_2 6	_____	00:00	00:00
p_2 7	_____	00:00	00:00

p_2 CUT-OUT POINT	10.0 bar / 145 psi
p_2 TARGET PRESSURE	9.5 bar / 138psi

[LIMIT VALUES]

DESIGN PRESS	10.0 bar / 145 psi
START PROTECT	0.4 bar / 6 psi
HEAVY STARTUP	2.0 bar / 29 psi
FINAL TEMP WARN	59 °C/138 °F
FINAL TEMP MAX	65 °C/149 °F
MIN START TEMP	2 °C/ 36 °F
RUN-ON TIME	360 s
SOFT STOP	30 s
STAR/DELTA TIME	8 s
SOFTWARE:	HD31R2.00

[OPTIONAL INPUTS]

OPTION 1	DISCH TEMP
OPTION 2	EXT FAULT
OPTION 3	FREE

[BASE LOAD SELECT.]

OPERATION	ON
CUT-OUT POINT	10.0 bar / 145 psi
TARGET PRESSURE	9.5 bar / 138 psi
BASE LOAD COMP	2

24h	K1	K2	k3	k4	k5

CHANGEOVER TIME	24h
QUANT.SLAVES	3
QUANT.RESERVE	1
VOL.COMP2 =	20.0 m3/min
VOL.COMP3 =	15.0 m3/min
VOL.COMP4 =	15.0 m3/min
VOL.COMP5 =	8.0 m3/min
SWITCH OFF DELAY	30s
START DELAY	5s
LOAD NET IN	15min
NET VOLUME	20m3

[WATER]

CHANGE CYCLE	24h

23h	y8	y9	Y10	>-<

SUPPLY MAX.	150s
DRAINAGE MAX.	150s

DELCOS 3100 SR menu structure (example values)

[MAINTENANCE SCHED.]

TOTAL RUNNING	12345 h
LOADED HOURS	10987 h
AIR FILTER IN	----- h
WATER FILTER IN	9999 h
MOTOR GREASING	9999 h
SHUTDOWN	DEACTIVATED

[CONTROL MENU]

CUT-OUT POINT	10.0 bar / 145 psi
TARGET PRESSURE	9.5 bar / 138 psi
AUTOMATIC OPERATION	
DISPLAY UNITS =	m3/min
REMOTE CONTROL	ON
TIMER CONTROL	OFF
AUTO RESTART	OFF
POWER LOSS TIME	2 s
START-UP DELAY	5 s
DRYER PRE-RUN	0 min
RS485-PROTOCOL	ModBus
RS485-BAUDRATE	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]

Week day	Date	Time
Saturday	29.01.2006	13:55:14
[SA	01/29/06	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
p_2 1	00:00	00:00
p_2 2	00:00	00:00
p_2 3	00:00	00:00
p_2 4	00:00	00:00
p_2 5	00:00	00:00
p_2 6	00:00	00:00
p_2 7	00:00	00:00

p_2 CUT-OUT POINT 13,0 bar / 188 psi
p_2 TARGET PRESSURE12,5 bar / 181 ps

[LIMIT VALUES]

DESIGN PRESS	10.0 bar / 145 psi
START PROTECT	0,4 bar / 6 psi
EXT. LIMIT	3550 rpm
FINAL TEMP WARN	59 °C/138 °F
FINAL TEMP MAX	65 °C/149 °F
MIN START TEMP	2 °C/ 36 °F
RUN-ON TIME	20 s
SOFT STOP	30 s
VOL.MAX. =	10,0 m3/min
VOL.MIN. =	2,0 m3/min
SOFTWARE:	HD31S2.00

[OPTIONAL INPUTS]

OPTION 1	DISCH TEMP
OPTION 2	EXT FAULT
OPTION 3	FREE

[BASE LOAD SELECT.] (Option)

OPERATION	ON
CUT-OUT POINT	10.0 bar / 145 psi
TARGET PRESSURE	9.5 bar / 138 psi
BASE LOAD COMP	2
24h K1 K2 k3 k4 k5	
CHANGEOVER TIME	24h
QUANT.SLAVES	3
QUANT.RESERVE	1
VOL.COMP2 =	20.0 m3/min
VOL.COMP3 =	15.0 m3/min
VOL.COMP4 =	15.0 m3/min
VOL.COMP5 =	8.0 m3/min
SWITCH OFF DELAY	30s
START DELAY	5s
LOAD NET IN	15min
NET VOLUME	20m3

[WATER]

CHANGE CYCLE	24h
23h y8 y9 Y10	>-<
SUPPLY MAX.	150s
DRAINAGE MAX.	150s

re 1.3 Menu structure

Menu prompting takes place in the 2nd line of the plaintext field. To access the different menus, first press the key.

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

Using the (up) and (down) keys, you can retrieve/select the parameters in the various menu branches.

The menus do not scroll through horizontally and vertically, i.e. they are limited at either end.

Before you can change parameters, you may have to enter a code, see Chapter 1.3.9.

The menu closes automatically two minutes after last pressing a key

The following display values in the menus as well as the overview merely serve as examples.

Danger

The machine can start at any time when changing parameters in the standby mode.

1.3.1 [MAINTENANCE SCHED.] menu

Using the and keys, go to the [MAINTENANCE SCHED.] menu option. This is where you can then retrieve/select individual parameters using the and keys.

The following parameter entries are stored under the [MAINTENANCE SCHED.] menu heading and can also be displayed there:

TOTAL RUNNING	12345 h
LOADED HOURS	10987 h
AIR FILTER IN	----- h
WATER FILTER IN	9999 h
MOTOR GREASING	9999 h
SHUTDOWN	DEACTIVATED

Note

Further information is provided in Chapter 1.6, Maintenance Intervals.

The menu closes automatically two minutes after last pressing a key.

1.3.2 [CONTROL MENU] menu

Using the and keys, go to the [CONTROL MENU] menu option. This is where you can then retrieve/select individual parameters using the and keys.

The following parameter entries or the following values are stored under the [CONTROL MENU] menu heading and can also be displayed there:

CUT-OUT POINT	10.0 bar / 145 psi	
CUT-IN POINT	9.5 bar / 138 psi	version FS only
TARGET PRESSURE	9.5 bar/138 psi	version RS,SR only
AUTOMATIC OPERATION		
SPEED REGULATION	ON	version RS only
VOL.MAX.	10.0 m3/min	version RS only
VOL.MIN.	2.0 m3/min	version RS only
DISPLAY UNITS =	m3/min	version RS,SR only
REMOTE CONTROL	ON	
TIMER CONTROL	OFF	
AUTO RESTART	OFF	
POWER LOSS TIME	2 s	
START-UP DELAY	5 s	
DRYER PRE-RUN	0 min	
RS485-PROTOCOL	ModBus	
RS485-BAUDRATE	19200	
NUMBER OF SLAVE	1	

Note

Further information is provided in Chapter 1.7, Operating modes.

The menu closes automatically two minutes after last pressing a key.

1.3.3 [FAULT MEMORY] menu

Using the ⬅ and ➡ keys, go to the [FAULT MEMORY] menu option. This is where you can then retrieve/select individual entries using the ⬆ and ⬇ keys.

Fault messages are stored in the [FAULT MEMORY] in the following manner, e.g.

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 exclamation mark (!) whereas warnings appear without the !.

Note

Further information is provided in Chapter 1.4.12, Fault memory.

The menu closes automatically two minutes after last pressing a key.

1.3.4 [LIMIT VALUES] menu

Using the ⬅ and ➡ keys, go to the [LIMIT VALUES] menu option. This is where you can then retrieve/select individual parameters using the ⬆ and ⬇ keys.

The following parameter entries are stored under the [LIMIT VALUES] menu heading:

DESIGN PRESS	1o.0 bar / 145 psi	
START PROTECT	0.4 bar / 6 psi	
HEAVY STARTUP	2.0 bar / 29 psi	only version FS or RS
EXT. LIMIT	3550 rpm	version SR only
FINAL TEMP WARN	59 °C/138 °F	
FINAL TEMP MAX	65 °C/149 °F	
MIN START TEMP	2 °C/36 °F	
RUN-ON TIME	90 s	
SOFT STOP	30 s	
STAR/DELTA TIME	8 s	only version FS or RS
VOL.MAX. =	10.0 m3/min	version SR only
VOL.MIN. =	2.0 m3/min	version SR only
SOFTWARE:	HD31S2.00	

Note

Factory settings cannot be changed by the operator (also refer to Chapter 1.3.9).

The menu closes automatically two minutes after last pressing a key

1.3.5 [OPTIONAL INPUTS] menu

The software provides for the [OPTIONAL INPUTS] menu option. You can have the various additional monitoring functions included by way of option.

Go to the [OPTIONAL INPUTS] menu option using the ⬅ and ➡ keys. This is where you can assign three spare inputs. You merely specify which monitoring function has been connected to which input. Inputs declared as [FREE] are not edited/monitored.

You can retrieve/select individual parameters using the ⬆ and ⬇ keys.

An assignment can be selected from the following list for each input:

Selection	**Resident criterion**
FREE	Not edited
BEKOMAT FAULT	Fault
BEKOMAT WARN.	Warning
DRYER FAULT	Fault
DRYER WARNING	Warning
EXT FAULT	Fault
EXT WARNING	Warning
DISCH TEMP	Warning
OPERATE_B1	see Chapter 1.7.8
Mot.Lub.System	Warning, only version FS or RS
EXT. RPM LIMIT	SR version only, see Chap. 1.7.4

Example:

OPTION 1	DISCH TEMP
OPTION 2	EXT FAULT
OPTION 3	FREE

The menu closes automatically two minutes after last pressing a key.

1.3.6 [WATER] menu

Using the ⬅ and ➡ keys, go to the [WATER] menu option. This is where you can then retrieve/select individual parameters using the ⬆ and ⬇ keys.

The following parameter entries or following values are stored under the [WATER] menu heading:

CHANGE CYCLE	24h
23h y8 y9 Y10	>-<
SUPPLY MAX.	150s
DRAINAGE MAX.	150s

Note

Further information is provided in Chapter 1.8, Water circuit.

The menu closes automatically two minutes after last pressing a key.

1.3.7 [TIMER CONTROL] menu

Danger

The machine can start at any time when programming in standby mode.

The realtime clock allows you to switch the machine on and off by means of the timer. In addition, you can specify a pressure changeover at specific times (e.g. lower level during the night). Pressure changeover is still active even if you do not wish to operate in the timer mode [TIMER CONTROL OFF].

If the system is to be switched on/off by means of the timer, you must select [TIMER CONTROL ON] from the [CONTROL MENU] menu and, if necessary, also put the system into operation (switch on). To set the timer or pressure changeover, go to the [TIMER CONTROL] menu option using the ← and → keys. This is where you can retrieve/select individual parameters using the ↑ and ↓ keys.

Basic clock setting:

Example:

[SA 29.01.06 13:55:14] / [SA 01/29/06 13:55:14]

- Press the ↵ key, the week day [SA] flashes
- Set the day of the week using the ↑ and ↓ keys
- Press the ↵ key to confirm the new setting
- The date [29] now flashes
- Set the date using the ↑ and ↓ keys
- Press the ↵ key to confirm the new setting

These steps are repeated for setting the month, year, hours, minutes and seconds. If you confirm the seconds setting by pressing the ↵ key, the clock will start to run with the new setting.

The process for setting the clock can be cancelled at any time by pressing the ⊜ key.

Setting the timer

You are provided with 7 timer blocks.

Example

Block no. 2, not activated

[2_____ 00:00 00:00]

Example

Block no. 1, system on from Monday to Friday – each day from 07:30 to 16:15 hours

[1_MTWTF _ 07:30 16:15]

- Using the ↑ and ↓ keys, select a timer block, e.g. block no. 2 [2_____ 00:00 00:00]
- Press the ↵, the week day flashes (Sunday)
- Make the setting of your choice using the ↑ and ↓ keys
- Press the ↵ key to confirm the new setting
- The next day of the week (Monday) now flashes
- Make the setting of your choice using the ↑ and ↓ keys
- Press the ↵ key to confirm the new setting

These steps are repeated for the other weekdays and chosen on and off times.

The process for setting a timer block can be cancelled at any time by pressing the ⊜ key. The old setting is new restored.

Example 1

For a working time of:

Sunday 22:00 to Saturday 14:00 hrs,
with a daily break from 12:00 to 12:30 hrs, the timer would have to be set as follows:

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

Example 2

You require an uninterrupted supply of compressed air from:

Monday 6:00 hrs to Friday 22:00 hrs:

[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 pressure changeover

You are provided with a further 7 timer blocks for changing over to a second pressure range. These are identified by the $\mathbf{p_2}$ symbol.

These timer blocks define the periods in which the machine switches over to the second pressure level. Switching over to the second pressure range acts on the current values of CUT-OUT POINT and CUT-IN POINT in Version FS, and on the current values of CUT- POINT and TARGET PRESSURE in version RS and SR.

The current values for CUT-OUT POINT and CUT-IN POINT or TARGET PRESSURE are governed by the base-load sequencing setting (option in FS and SR version) in the [BASE LOAD SELECT.] menu.

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

Timer block $p_2$1… $p_2$7	**[BASE LOAD SELECT.] menu [OPERATION ON]**
Not active	The entire base-load sequencing system operates across the pressure range in the [BASE LOAD SELECT.] menu
Active	The entire base-load sequencing system operates across the second pressure range in the [TIMER CONTROL] menu

Timer block active means: system time is within the time range programmed in the timer block.

The values displayed for CUT-OUT POINT and CUT-IN POINT or TARGET PRESSURE in Version FS remain unchanged even while pressure is being switched over.

The procedure for setting pressure changeover time is the same as that for setting the timer.

If a pressure changeover timer block is active, the p_2 symbol flashes in front of the display of current network pressure in the top line.

Note

Pressure changeover can also be activated through an external, floating contact. In FS and RS version, this takes place through a digital input on the base-load sequencing module (a dedicated input is available for this purpose in version SR).

If no pressure changeover is required, deactivate all pressure-changeover timer blocks.

The menu closes automatically two minutes after last pressing a key

1.3.8 Changing values

Danger

The machine can start up at any time when programming in the standby mode.

If the code (see Chapter 1.3.9) is unlocked, all values, with the exception of [LIMIT VALUES], can be changed at any time without the code being requested. Using the ← and → keys, go to the value you wish to change. Now press the ↵ key to enter the input mode. If the code has still not been unlocked, it will now be requested. The value flashes when you are in the input mode.

Note

The ← and → keys are non-operational in the input mode.

After setting the new value using the ↑ and ↓ keys, it must be accepted by pressing the ↵ key. Flashing stops, and a new menu option can be selected.

Using the ⊖ key, you can restore the original setting in the input mode and, at the same time, close the input mode.

1.3.9 Locking/unlocking code

To prevent unauthorised programming, settings can be protected with a code. Factory settings cannot be changed by the operator.

Locking

The code is locked by means of the C key. After pressing the C key, the following message is displayed:

[CODE: UNLOCK] (for 1 second)
[CODE INPUT 0000] (value flashes)

Entering the code: [3031] displays the message:

[CODE: LOCK] (for 1 second).

Entering an incorrect code displays the message:

[CODE: UNLOCK] (for 1 second)

You are then automatically returned to the starting point.

Unlocking

To unlock the code again, either:

- Press the C key or
- press the ↵ key on attempting to change a protected value.

The code is then requested:

[CODE: LOCK] (for 1 second)
[CODE INPUT 0000] (value flashes)

Here, you must enter the code: [3031].

Entering the correct code displays the message:

[CODE: UNLOCK] (for 1 second)

Entering the incorrect code displays the message:

[CODE: LOCK] (for 1 second).

You are then automatically returned to the starting point.

Note

The code is not locked automatically; you yourself, as the operator, can decide to do so.

1.3.10 Setup code

SETUP - DELCOS 3100			
CODE 1 :	0001	A.-Nr.	12345678
CODE 2 :	0001	Fact. no.	123456/1234
CODE 3 :	0001	RA/XY/291194/CSD3-V01	
GARDNER DENVER			

Sign: Setup Codes

Note

You will find the setup codes in the switch cabinet.

If the DELCOS 3100 electronics malfunction or after changing them, the control system will request three setup codes. The plaintext field shows:

GARDNER DENVER
SETUP-CODE1: _ _ _ _

Press the ↑ and ↓ keys here to enter the correct code. Press the ↵ key to confirm. [CODE 2] now appears automatically. At this point, please proceed in the same as for code 1. Once code 2 has been confirmed by pressing the ↵ key, code 3 appears automatically. Here too, please proceed in the same way as for code 1 and code 2.

If you enter an incorrect code, you will automatically be asked for code 1 again, i.e. you must enter all of the codes again.

Once you have entered the codes correctly, the machine automatically assumes its basic setting.

Attention

Before starting the next time, always check all of DELCOS 3100's settings and restore your own specific settings!

In particular, you must re-instate the monitoring functions optionally connected on the basis of the electrical circuit diagram as monitoring will otherwise not be possible (see Chapter 1.3.5)

1.4 Starting up

Danger

When the system is in standby mode, i.e. LED a flashes, the compressor can start automatically at any time!

1.4.1 Entering delivery rates (version RS only)

To calculate the machine's current delivery rate, its basic delivery rate values must be entered into DELCOS 3100. It is also necessary to know the delivery rate for base-load sequencing to work correctly.

This input also serves to calculate output of the current delivery rate through the analogue output.

1.4.1.1 Setting the maximum delivery volume [VOL.MAX.]

This is always entered in the [m³/min].unit. The maximum delivery rate is factory-preset. The delivery rate entered is the one shown on the type plate.

1.4.1.2 Setting the minimum delivery volume [VOL.MIN.]

This is always entered in the [m³/min] unit. The minimum delivery rate is factory-preset.

Make of converter: WEG

$$\text{VOL.MIN.} = \frac{\text{Delivery rate acc. to type plate x min.speed (P133)}}{\text{Max.speed (P134)}}$$

Specifications on min. sped (P133) and max. speed (P134) are provided in the technical information relating to the converter.

Make of converter: Loher

$$\text{VOL.MIN.} = \frac{\text{Delivery rate according to type plate x } f_{min}}{f_{max}}$$

The specifications on f_{min} [Hz] and f_{max} [Hz] are provided in the technical information relating to the converter.

1.4.1.3 Setting the unit of volumetric flow for the status display [DISPLAY UNITS]

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

The status display shows the machine's current volumetric flow rate. As the LC display only permits a limited number of characters, the unit displayed is preset. This unit does not appear on the status display.

1.4.2 Starting the system

Switching on the power supply activates the light-emitting diode test that must be acknowledged before starting the system by pressing key. The system is started by pressing the key. Beforehand, however, all faults must be rectified and acknowledged

The compressor is unable to start at temperatures below the permissible start-up temperature (see Chapter 1.3.4 [LIMIT VALUES] menu).

If the compressed-air network reports no requirement on start-up, the system goes to standby and LED a flashes. The plaintext field reads [WARNING START BY ...] with the relevant message (see Chapter 1.2.5).

A safety circuit (start-up protection) also prevents the drive motor from starting against an internal residual pressure. Therefore, the compressor merely switches to standby in this case too. The compressor starts automatically once pressure falls below the factory-set start-up protection level or when pressure is requested by the network.

If the compressor is equipped with the integrated dryer option, it can be used by programming the value for [DRYER PRE-RUN] to a value > 0 min in the [CONTROL MENU] menu. The minimum pre-running time is shown in the operating instructions of the integrated dryer. Here as well, the compressor is initially switched to standby. The compressor starts automatically once the dryer pre-running time has elapsed.

On requesting start-up by pressing the key or on receiving a switch-on pulse from the remote control, a check is carried out to ascertain whether the conditions are given for enabling the motor

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

- Final compression pressure below start-up protection level
- Network requesting pressure (in automatic mode only)
- Timer enabled for timer ON (timer optional in Version FS)
- Dryer pre-running time elapsed. For further information, see chapter on “Integrated dryer” in the operating instructions of the compressor system (option).

The system initially goes to standby (ON key flashes).

1.4.3 Control (version RS and SR only)

Speed is controlled with the aid of a PI controller implemented in the software and is matched to the demand for compressed air. The controller tries to keep the network pressure to the value set for setpoint pressure in the [CONTROL MENU] menu

As network pressure rises, the maximum permissible speed is constantly calculated to prevent the maximum permissible motor output from being exceeded.

For example, the maximum speed at a network pressure of 6 bar will be higher than that at a network pressure of 10 bar.

1.4.4 On-load/off-load operation

Danger

If the system is on standby, i.e. LED a flashes, the compressor can start automatically at any time!

If the machine is on standby (motor shutdown and the display shows [WARNING START WITH ...pressure request]) it is started in:

version SR and RS:
when network pressure < setpoint pressure
Version FS: when network pressure < min. pressure

On leaving the factory, the [AUTOMATIC OPERATION] operating mode is set. This means: the compressor will deliver compressed air to match consumption and is shut down automatically (standby).

If, at times, no compressed air is being consumed in your network or consumption is low, the system automatically goes to of-load operation

The [RUN-ON TIME] remaining in each case is displayed in the plaintext field.

If pressure falls below setpoint pressure during the motor's run-on time (version RS and SR) or below min. network pressure (version FS), the machine returns to on-load operation.

Once the run-on phase (off-load operation in the automatic mode) has elapsed, the motor is shut down – after the specified run-on time – and the compressor goes to standby.

Cooling (ventilator/cooling water) is active for as long as the motor is running.

1.4.5 Switching the system off

After pressing the key, a 30-second [SOFT STOP] period elapses before the motor shuts down.

1.4.6 Faults/shutdown/power failures

To protect the system, any fault identified immediately shuts the machine down or prevents it from being started.

These faults appear in the plaintext field and LED h lights up. The messages are entered into the fault memory and communicate them to the group-fault relay.

Before starting (after eliminating the fault), faults must be acknowledged by pressing the key.

In the event of power failure [FAULT POWER LOSS], the light-emitting diode test is activated when power returns. This must be acknowledged on the system by pressing the key. In the remote mode, however, all that is required is a new REMOTE ON pulse with which the fault is simultaneously acknowledged in the [FAULT MEMORY].

1.4.7 Warnings

Warning messages are shown by means of LED g (the plaintext field at the same time indicates the warning concerned). However, they do not lead to the compressor being shut down and are entered in the fault memory. Ignored warnings may lead to faults.

1.4.8 Maintenance activities

Maintenance messages are indicated by means of LED f; however they do not lead to the compressor being shut down, nor are they entered in the fault memory.

Once a maintenance interval has elapsed, i.e. 0 h (hours) has been reached, the plaintext field displays the [MAINTENANCE ELAPSED] message. The maintenance interval elapsed can be ascertained from the [MAINTENANCE SCHED.] menu (see Chapter 1.3.1).

Failure to carry out maintenance activities may lead to faults (see Chapter 1.6 Maintenance intervals).

1.4.9 Group-fault relay

A floating contact in the control system (see electric circuit diagram) reports system faults.

The load applied to the group-fault relay must be no more than 250 V/1 A.

1.4.10 Speed ON message (version RS only)

A floating contact in the control system (see electric circuit diagram) reports that the motor is running. Speed in dependent on compressed-air consumption.

The load applied to the group-fault relay must be no more than 230 V/4 A.

1.4.11 Running-hours/loaded-hours counter

The systems running and loaded hours can be retrieved at any time.

To do this, go to the [MAINTENANCE SCHED.] menu and select the [TOTAL RUNNING] or [LOADED HOURS] menu option (see Chapter 1.3.1). This displays the current counter reading in each case.

Note

The running and loaded-hours readings are lost on changing the DELCOS 3100 electronics.

1.4.12 Fault memory

The fault memory contains number, fault/warning text and total hour counter reading at the time when the fault/warning occurs.

To retrieve this information, go – as described in Chapter 1.3.3 – to the [FAULT MEMORY] menu.

In the case of non-acknowledged faults/warnings, the number of faults/warnings currently active in each case flashes.

Faults, i.e. shutdowns, are always identified by !. The ! is not shown for warnings.

Example:

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

Explanation:

- 12! Means: the same ! fault has occurred a total of 12 times
- MOTOR TEMP: fault concerns motor temperature
- 12345 h: the fault occurred in the 12345th running hour

Only the last 8 messages are displayed at any one time. The newest entry appears at the top

Entries beyond the 8 messages shown in the fault memory are no longer displayed. They are, however, retained in the long-term memory – with indication of number.

This means: when the fault/warning occurs again, the fault/warning message appears with the current number of fault/warning occurrences as well as with the hour during which the fault/warning re-occurred.

In version RS, SR and FS with optional timer, it is also possible to retrieve further information on compressor status at the time of the fault ("extended" fault memory).

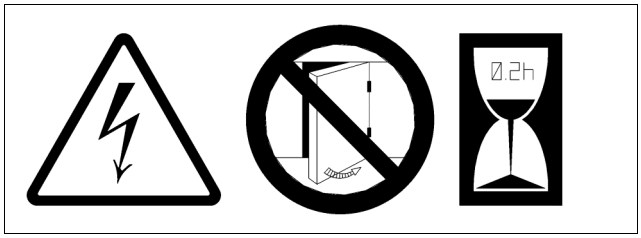
To use the function of the extended fault memory, proceed as follows:

1. From the [FAULT MEMORY] menu, select the fault under investigation.
2. By pressing the ↵ key several times, it is possible to retrieve the following compressor statuses at the time of the fault one after the other:
   - Date and time
   - Compressor status (e.g. on-load)
   - Speed (version SR only)
   - Final compression temperature, final compression pressure and network

   This information is displayed in line 1 of the plaintext field, it flashes to make clear that these values do not reflect the compressor's current status.

1.5 DELCOS 3100 fault table in the case of a fault or warning

For version SR only:



Attention

Risk of electric shock from charged capacities!

Always disconnect the system from the power supply and then wait a further 12 minutes before touching electrical components. The power capacities take this time to discharge.

1.5.1 Check-list

Loose connections, plugs, faulty power supply or failure to observe information instructions general give rise to a large number of fault displays. The faults indicated, therefore, may frequently be attributed to another cause.

Therefore, please always observe the following checklist:

1. The systems supply voltage must be within the permissible limits.
2. The control power transformer must be set to any differing local rated voltages (see electric circuit diagram
3. The control-cabinet temperature must not exceed 55 °C.
4. Without coupling relays, all subsequently installed remote controls (remote on/off) must not be taken to a distance of over 20 metres from the control cabinet.
5. On starting up and performing maintenance work, make sure that all connection screws are tight and that all plugs are firmly connected.
6. Power must be supplied with cables of adequate cross-section. When rating the cable(s), therefore, pay attention to the cable-laying method, line length and line temperatures to be expected
7. When retro-fitting switchgear, the control-power transformers must not, under any circumstances, be "tapped" as they could be overloaded.
8. Only use genuine Gardner Denver replacement parts.
9. Do not connect additional switchgear or measuring equipment without Gardner Denver’s approval.
10. Do not route measuring sensors out of the system.
11. If you have any technical queries, keep the following information to hand so that a fault can be rectified quickly and methodically:
    - System type / factory number
    - Order number
    - Circuit diagram, drawing no. and ID no.
    - Information on the system's operating conditions
    - Information on any accessories you have subsequently installed (remote controls, etc.)
    - Other subsequent modifications or attachments to the system.
    - An exact description of the fault that has occurred.

1.5.2 Faults/warnings table

On the following pages you will find the table of DELCOS 3100 faults, their possible cause and suggested remedial action.

[Display] / Problem	Possible Cause	Remedy
[FAULT POWER LOSS]	Power failure	Search for cause
	Power drop	Search for cause
	Damaged cables	Check, repairing if necessary
	Detached/loose terminals	Check all connection terminals and plugs for a tight fit, tightening if necessary
[FAULT EM-STOP]	Emergency-off is / has been actuated	Unlock
	Emergency-off switch faulty	Check, changing if necessary
	Damaged cables	Check, changing if necessary
[FAULT EM-STOP (SR)]	Absent emergency-OFF identification by SR electronics	
	Emergency-off switch faulty	Check, changing if necessary
	Damaged cables	Check, changing if necessary
[FAULT MOTOR TEMP]	Motor has been started too frequently	Limit number of starts/hour
	Inadequate motor cooling	Improve
	Power consumption too high	Check, search for cause
	Faulty power supply	Check, search for cause
	Motor faulty	Check, changing if necessary
	Star-delta starter faulty (only in FS or RS version with bypass option)	Check, repairing if necessary
[FAULT COMP TEMP]	Final compression temperature exceeded (1)	Search for cause
[WARNING HIGH TEMP]	Intake temperature too high	Improve
	Inadequate cooling	Improve
	System operated with open cladding	Close cladding
	Temperature sensors are too faulty (reading too high)	Check, changing if necessary
[FAULT START TEMP]	Start attempted at insufficient temperature (1)	Heat compressor room
	Temperature sensors R2 faulty (reading too low)	Check, changing if necessary
[WARNING HIGH PRESS]	Operating pressure exceeded by 1.0bar/14psi (1)	
[FAULT OVER PRESS]	Operating pressure exceeded by 1.5bar/21psi (1)	
	Excessive pressure losses in the system	Check, search for cause
	Network switching-point pressures (4) too high	Correct
	External pressure request too high	Remotely check on-load/off-load switching points
	Intake controller not closing (FS or RS version only)	Check, search for cause
	Pressure sensor B1 or B2 faulty (incorrect reading)	Check, changing if necessary
[FAULT SENSOR B1]	Faulty network pressure sensor	
[FAULT SENSOR B2]	Faulty final compression pressure sensor	

[Display] / Problem	Possible Cause	Remedy
[FAULT SENSOR R2]	Faulty compression temperature sensor	
	Pressure or temperature sensor faulty	Check, changing if necessary
	Damaged cabling to sensor	Check, search for cause
[FAULT DIRECT ROT]	No pressure being built up in start-up phase, e.g. because drive motor is turning in wrong direction.	Connect correct phase sequence
[FAULT ROT.LINE]	Wrong direction of rotation of the drive motor (see electrical circuit diagram)	Connect correct phase sequence
[FAULT MAINT PER]	Maintenance shutdown (2) activated and 100 hours still left in maintenance interval(2)	Carry out maintenance and re-program
[FAULT SOLENOID]	Short circuit or line break in relation to solenoid valve Y1 or Y4	Check, replacing or changing if necessary
[FAULT CONVERTER]	In version RS: failure of "converter ready" converter signal during [SPEED REGULATION ON/OFF] mode	Check converter (air filter, internal fan) If applicable, switch over to [BYPASS OPERATION] (option, see 1.7.2)
	In version SR: communication failure between DELCOS 3100 and SR drive through CAN interface	Check - SR system control voltages - SR system fuses - CAN interface wiring - If no fault can be found, notify Gardner Denver service engineer.
[FAULT HEAVY STARTUP]	Final compression pressure too high during motor start-up phase.	Check whether intake regulator tightly seals.
[WARNING SPEED-SIG.]	Failure of "set point > 3.5 mA" converter signal during [speed cont.ON/OFF] operating mode.	Line break or short circuit in relation to setpoint signal to the converter.
		MS bus module A02 failed.
		Converter analogue input faulty.
[FAULT SPEED LOW]	Permissible minimum speed not reached.	Notify Gardner Denver Service Engineer.
	Faulty connection between emergency-OFF and SR system.	Check connection of emergency-OFF at gate drive board plus J19.
[FAULT COOLING]	Air-cooled systems:	
	Failure of system fan	
	Resistances too high through delivery/discharge air channels	Check, install auxiliary fan in necessary
	Fan-motor circuit breaker incorrectly set	Set to 110% of rated fan flow
	Fan motor faulty	Check, changing if necessary
	Water-cooled systems:	
	Inadequate cooling water supply	
	Cooling-water temperature too high	Improve
	Cooling-water flow too low	Increase
	Dirt collector clogged	Clean
	Cooling-water solenoid valve not opening	Check, changing if necessary
	Air in the system	Bleed

[Display] / Problem	Possible Cause	Remedy
[WARNING MS-BUS:A06]	Module failed	Check module power supply. Check fuse in module.
[FAULT MS-BUS:A06]	Module failed during [BYPASS OPERATION] operating mode (option).	Check module power supply. Check fuse in module. If applicable, switch over to [SPEED REGULATION ON] (see Chapter 1.7.2)
[WARNING MS-BUS:A12]	Relay module failed for ZLT.	Check power supply for module. Check fuse in module.
[WARNING MS-BUS:A02]	Analogue output module failed.	Check power supply for module. Check fuse in module.
[FAULT BYPASS]	Failure of "bypass ready" signal during [BYPASS OPERATION] operating mode (option).	Check bypass in converter (see Chapter 1.7.2).
[FAULT FEEDBACK]	"converter ready" and "bypass ready" signals present at same time.	Check signal wiring (see Chapter 1.7.2).
[FAULT EXT FAULT]	Shut down by external fault (monitored through input: EXT FAULT (3))	Check, search for cause
[WARNING EXT WARNING]	Warning through external unit. (Monitored through input: EXT WARNING (3))	Check, search for cause
[BEKOMAT FAULT]	Connected condensate drainage valves (Bekomat) faulty.	Check, search for cause
[BEKOMAT WARN.]	Connected condensate drainage valves (Bekomat) faulty.	Check, search for cause
[WARNING DRYER WARNING]	Fault has been received from integrated dryer.	See Chapter on Integrated dryer in the operating instructions of the compressor system
[FAULT DRYER FAULT]	Fault has been received from integrated dryer.	See Chapter on Integrated dryer in the operating instructions of the compressor system
[FAULT ELECTRONIC]	Hardware fault in DELCOS	Change DELCOS electronics
[FAULT DRIVE BELT]	Set of the V-belts is faulty/snapped (monitored through input: ROT /BELTS (3))	Check, changing if necessary
[WARNING AIR FILTER]	Air filter differential pressure too high	Check, changing air filter if necessary
[WARNING WATER FILTER]	Water filter differential pressure too high	Check, changing water filter if necessary
[WARNING OIL LEVEL]	Oil level too low (monitored through input: OIL LEVEL (3))	Check, topping up oil if necessary
[WARNING DISCH TEMP]	Compressed-air discharge temperature too high (monitored though input: DISCH TEMP(3))	Check, search for cause
[WARNING LINE PRESS]	Operating pressure of system (1) has been exceeded by 0.5 bar / 7 psi through the remote on-load /off-load controller	Check, search for cause and acknowledge warning
[WARNING Mot.Lub.System]	A fault has occurred in the motor lubrication system or the LC unit is running low.	See Chapter on Motor lubrication system in the operating instructions of the compressor system

[Display] / Problem	Possible Cause	Remedy
[WARNING BATTERY]	The realtime clock battery is exhausted.	Change realtime clock module
[WARNING OPTION 1] [WARNING OPTION 2] [WARNING OPTION 3]	One of the spare inputs 1-3 has been activated but is programmed as [FREE].	Check relevant input assignment (3)
[FAULT POWER LOSS 20V]	20V supply of control power transformer has failed.	Check control-power transformer and fuses.
[FAULT LEVELSWITCH]	Both level switches closed (not mechanically possible).	Check level switches and their wiring.
[FAULT DRAINAGE 1]	Fault in water exchange: No feedback from level switch that the water level has reached the bottom limit.	Check level switches and wiring Check solenoid value for water drainage Check control transformer for solenoid valves Set DRAINAGE MAX. higher.(6)
[WARNING SUPPLY 2]	Fault in water exchange: No feedback from level switch that the water level is increasing.	Check whether the water supply of the machine is guaranteed; the water pressure may be too low. Check whether there is enough water in the tank of the water treatment unit. Check level switch and wiring. Check solenoid valve for water inlet. Check control transformer. Set SUPPLY MAX. higher.(6)
[FAULT SUPPLY 2]	Fault in water exchange: The WARNING SUPPLY 2 occurred twice in a row and was not acknowledged.	See WARNING SUPPLY 2
[WARNING SUPPLY 3]	Fault in water exchange: No feedback from level switch that the water level has reached the upper level.	See WARNING SUPPLY 2
[FAULT SUPPLY 3]	Fault in water exchange: The WARNING SUPPLY 3 occurred twice in a row and was not acknowledged.	See WARNING SUPPLY 2
[FAULT DRAINAGE 4]	Fault in water exchange: No feedback from level switch that the water level has dropped.	See FAULT DRAINAGE 1
[WARNING SUPPLY 5]	Fault in automatic water level regulation (no water exchange active): No feedback from level switch that the water level is increasing.	See WARNING SUPPLY 2
[FAULT DRAINAGE 5]	Fault in automatic water level regulation (no water exchange active): No feedback from level switch that the water level has dropped.	See FAULT DRAINAGE 1
[* Wrong SR-Serial Number] [SETUP-CODE 1:_____?]	The serial number of the SR drive resident in DELCOS 3100 does not concur with the serial number read out from the SR drive. The electronics PCB's may have been swapped in the SR drive.	Re-enter setup code.
[*** Wrong SR-Mode ***] [SETUP-CODE 1:_____?]	The mode of the SR drive resident in DELCOS 3100 does not concur with the mode read out from the SR drive. The electronics PCB's may have been swapped in the SR drive.	Re-enter setup code.

[Display] / Problem	Possible Cause	Remedy
[GARDNER DENVER] [SETUP-CODE 1:_____?]	Hardware fault DELCOS	DELCOS electronics must be changed as a temporary measure: enter setup codes, check all settings and re-set if necessary (2)(3)(4)(5) After changing the DELCOS electronics, the message shows no fault. The new setup code must now be re-entered
A fault/warning cannot be acknowledged	Fault/warning still present.	Search for cause and rectify
No display	No voltage on the machine.	Check fuses, changing if necessary
	No DELCOS control voltage (10 VAC)	Establish power supply, check fuses.
Pressure and temperature indicator failed, indicator (----)	Ground fault or short circuit for sensor B1, B2 or R2	Check fuses, changing if necessary
System not starting automatically after power failure	[AUTO RESTART] function not activated Power failure lasted too long (4)	
System constantly running off-load without automatically switching to standby	[CONTINUOUS OPERATION] mode selected (4)	Switch on (4)
	Very short pressure requests during run-on time	Select [automatic mode] mode
No compressed-air request within the selected switching points (4)	Pressure changeover active through timer or external contact (5)	
Incorrect display of volumetric flow (version RS and SR only)	Volumetric flows incorrectly set.	RS: Check max. and min. volumetric flow in [CONTROL MENU] menu (see Chapter 1.4.1). SR: Check max. and min. volumetric flow in [LIMIT VALUES] menu (see Chapter 1.3.4). RS and SR: Check volumetric flows of BLS slaves in [BASE LOAD SELECT.] menu.
[FAULT SR-DRIVE (1)] Control board overvoltage (+15V internal)	Control-power transformer incorrectly set, undervoltage in power supply.	Check power supply (all 3 phases). Check control-power transformer setting, correcting if necessary.
[FAULT SR-DRIVE (2)] Control board undervoltage (+15V internal)	Ribbon cable faulty between control board (PCB94) and gate drive board (PCB95).	Check ribbon cable between control board (PCB94) and gate drive board (PCB95).
	Faulty RPT sensor or its connection lead.	Check RPT sensor connection cable as far as control board (PCB94) plug J1.
	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (3)] Control board overvoltage (+15V external)	Wiring fault at plug of control board J5.	Make sure that nothing is connected at terminal 3 of control board J5 plug.
[FAULT SR-DRIVE (4)] Control board Undervoltage (+15V external)	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.

[Display] / Problem	Possible Cause	Remedy
[FAULT SR-DRIVE (5)] Control board overvoltage (-15V internal) [FAULT SR-DRIVE (6)] Control board undervoltage (-15V internal) [FAULT SR-DRIVE (7)] Control board overvoltage (-15V external) [FAULT SR-DRIVE (8)] Control board undervoltage (-15V external)	Ribbon cable faulty between control board (PCB94) and gate drive board (PCB95).	Check ribbon cable between control board (PCB94) and gate drive board (PCB95). Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (9)] Control board, supply voltage, current sensor (+15V)	Faulty cabling or faulty plug of current sensor.	Check cabling or plug of current sensor to control board J10.
[FAULT SR-DRIVE (10)] Undervoltage, supply voltage, current sensor (+15V) [FAULT SR-DRIVE (11)] Overvoltage, supply voltage, current sensor (-15V) [FAULT SR-DRIVE (12)] Undervoltage, supply voltage, current sensor (-15V)	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (13)] Control board overvoltage (+24V)	Faulty cabling from emergency OFF push button to control board.	Check connection between control board J5, terminal 4, and control board J3, terminal 9.
[FAULT SR-DRIVE (14)] Control board undervoltage (+24V)	Ribbon cable faulty between control board (PCB94) and gate drive board (PCB95).	Check ribbon cable between control board (PCB94) and gate drive board (PCB95).
	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (15)] Motor overcurrent	Motor incorrectly connected or faulty motor cables.	Check connection of motor phases at power electronics.
	Motor insulation fault.	Check motor cables for damage.
	Current sensor cabling or plug faulty.	Check cabling and plug of control centre as far as control board J10.
	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (16)] Motor overcurrent, phase B [FAULT SR-DRIVE (17)] Motor overcurrent, phase C	Power monitoring is not being used for phases B or C. The occurrence of this malfunction points to a fault on the control or gate drive board.	Contact Gardner Denver Service.

[Display] / Problem	Possible Cause	Remedy
[FAULT SR-DRIVE (18)] Negative current conversion through current sensor.	Motor cable incorrectly laid through current sensor.	Check connection of motor phases at power electronics and check for correct installation through the current sensor.
	Motor incorrectly connected.	Check cabling and plug of current sensor as far as control board J10.
	Current sensor incorrectly connected or not connected to control board.	Make sure that current sensor is connected to phase A of control board.
	Current sensor or cabling faulty.	Otherwise contact Gardner Denver Service.
	Control or gate drive board faulty.	
	Motor insulation fault.	
[FAULT SR-DRIVE (19)] Overvoltage in intermediate direct-current circuit	Mains voltage too high.	Make sure that the phase-to-phase voltages do not exceed 506 V.
	Motor insulation fault.	Otherwise contact Gardner Denver Service.
	Control or gate drive board faulty.	
[FAULT SR-DRIVE (20)] System setting(s) incorrect.	Error in basic initialisation.	Contact Gardner Denver Service.
[FAULT SR-DRIVE (21)] Capacitor voltage not symmetrical.	One or more faulty electrolyte capacitor(s) or balancing resistor.	Check connection of balancing resistors.
	Control or gate drive board faulty.	
	Ribbon cable faulty between control board (PCB94) and gate drive board (PCB95).	Check ribbon cable between control board (PCB94) and gate drive board (PCB95).
	Cabling fault in intermediate circuit.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (22)] Plug of measuring facility for intermediate circuit not connected.	Gate drive board J8 plug not connected.	Check connection at plug, gate drive board J8, terminal 1 and 2.
	Break at plug, gate drive board J8, terminal 1 and 2.	
	Ribbon cable faulty between control board (PCB94) and gate drive board (PCB95).	Check ribbon cable between control board (PCB94) and gate drive board (PCB95).
	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (23)] Emergency-OFF safety input open, however no shutdown by Delcos 3100.	Open circuit between Delcos and emergency-OFF.	Check connection of emergency-OFF contact at Delcos (terminal 22 and 23).
	Faulty emergency-OFF switching element.	Check emergency-OFF contacts.
		Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (24)] Shut-down by safety logic (watchdog)	Control board faulty.	Contact Gardner Denver Service.
[FAULT SR-DRIVE (25)] Main contactor monitoring	A main contactor is not installed. Occurrence of this fault, therefore, points to a wiring fault or a malfunction on the control or gate drive board.	Check connections at control board J11, terminal 3 and 6, to gate drive board J15, terminal 4 and 5.
		Otherwise contact Gardner Denver Service.

[Display] / Problem	Possible Cause	Remedy
[FAULT SR-DRIVE (26)] Braking resistance over current	A braking resistor is not installed. Occurrence of this fault, therefore, points to a wiring fault or to a malfunction on the control board.	Make sure that the current sensor is connected to phase A on the control board.
		Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (27)] Control board hardware interlock.	Control board faulty.	Contact Gardner Denver Service.
[FAULT SR-DRIVE (28)] [FAULT SR-DRIVE (29)] Phase missing on mains side or undervoltage.	One phase missing or has significant undervoltage.	Check phase-to-phase voltages. Check external fuses.
	Incorrect phase sequence.	Check phase sequence.
	Ribbon cable faulty between control board (PCB94) and gate drive board (PCB95).	Check wiring to gate drive board J13 and J14.
	Wiring fault in voltage monitoring system.	
	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (30)] Intermediate circuit undervoltage.	Wiring fault in converter control lines.	Check wiring and plug from gate drive board to the converter modules.
	Ribbon cable faulty between control board (PCB94) and gate drive board (PCB95).	Check ribbon cable between control board (PCB94) and gate drive board (PCB95).
	Converter module(s) faulty.	Otherwise contact Gardner Denver Service.
	Control or gate drive board faulty.	
[FAULT SR-DRIVE (31)] Motor phase A open	Motor cable not connected or faulty.	Check connection and cable of motor phase A.
	Motor winding faulty.	Check continuity of motor phase A.
	IGBT control open or faulty (plug J1 and J2 of gate drive board).	Check plug J1 and J2 and wiring from gate drive board to power electronics.
	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (32)] Motor phase B open	Motor cable not connected or faulty.	Check connection and cable of motor phase B.
	Motor winding faulty.	Check continuity of motor phase B.
	IGBT control open or faulty (plug J3 and J4 of gate drive board).	Check plug J3 and J4 and wiring from gate drive board to power electronics.
	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (33)] Motor phase C open	Only in systems with 3-phase motor:	
	Motor cable not connected or faulty.	Check connection and cable of motor phase C.
	Motor winding faulty.	Check continuity of motor phase C.
	IGBT control open or faulty (plug J5 and J6 of gate drive board).	Check plug J5 and J6 and wiring from gate drive board to power electronics.
	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.

[Display] / Problem	Possible Cause	Remedy
[FAULT SR-DRIVE (34)] IGBT fault A1 [FAULT SR-DRIVE (35)] IGBT fault A2 [FAULT SR-DRIVE (36)] IGBT fault B1 [FAULT SR-DRIVE (37)] IGBT fault B2 [FAULT SR-DRIVE (38)] IGBT fault C1 [FAULT SR-DRIVE (39)] IGBT fault C2	IGBT module or gate drive board faulty.	Contact Gardner Denver Service.
[FAULT SR-DRIVE (40)] IGBT braking resistor fault	A braking resistor is not installed. Occurrence of this fault points to a malfunction on the Control or gate drive board.	Contact Gardner Denver Service.
[FAULT SR-DRIVE (41)] RS232 communication	RS232 communication is not used. Occurrence of this fault points to a malfunction on the control board.	Contact Gardner Denver Service.
[FAULT SR-DRIVE (42)] RPT sensor supply faulty.	RPT sensor cabling faulty.	Check plug connection J1 on control board. Check connection cable of RPT sensor.
	RPT sensor faulty. Control board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (43)] RPT sensor faulty	RPT sensor not or incorrectly connected.	Check plug connection J1 on control board.
	RPT sensor cabling faulty.	Check connection cable of RPT sensor.
	RPT-Sensor faulty. Control board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (44)] Overspeed	RPT sensor not or incorrectly connected.	Check plug connection J1 on control board.
	RPT sensor cabling faulty.	
	RPT sensor faulty. Control board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (45)] Heat sink temperature sensor faulty	Cabling or plug connection J11 faulty on control board.	Check cabling and plug connection J11 on control board.
	Temperature sensor faulty. Control board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (46)] Motor temperature sensor faulty	The motor temperature sensor is monitored by Delcos 3100. Occurrence of this fault, therefore, points to a malfunction on the control board.	Contact Gardner Denver Service.

[Display] / Problem	Possible Cause	Remedy
[FAULT SR-DRIVE (47)] Heat sink temperature exceeded	Fan motor circuit breaker has responded.	Switch motor circuit breaker back on again.
	Control-cabinet filter dirty.	Clean or change control-cabinet filter mats.
	System operated while ambient temperature too high.	Reduce ambient temperature.
	Wiring to fan faulty.	Check wiring from control power transformer to fan.
	Fan faulty.	
	Ribbon cable faulty between control board (PCB94) and gate drive board (PCB95).	Check connection at plug, gate drive board J15, terminal 4 and 5.
		Check ribbon cable between control board (PCB94) and gate drive board (PCB95).
	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (48)] Motor temperature exceeded	The motor temperature sensor is monitored by Delcos 3100. Occurrence of this fault, therefore, points to a malfunction on the control board.	Contact Gardner Denver Service.
[FAULT SR-DRIVE (49)] Current sensor faulty	Motor cables not routed through the current sensor.	Check for correct installation of motor cables through current sensor.
	Current sensor incorrectly connected or not connected at control board.	Check cabling and plug from current sensor to control board J10.
	Current sensor, plug or cabling faulty.	Make sure current sensor is connected to phase A on control board.
	Control or gate drive board faulty.	Otherwise contact Gardner Denver Service.
[FAULT SR-DRIVE (50)] Current sensor – phase B [FAULT SR-DRIVE (51)] Current sensor – phase C	Current monitoring of phase B and C is not used. Occurrence of this fault points to a malfunction on the control or gate drive board.	Contact Gardner Denver Service.
[FAULT SR-DRIVE (52)] CAN communication error	Ribbon cable faulty between control board (PCB94) and gate drive board (PCB95).	Check ribbon cable between control board (PCB94) and gate drive board (PCB95).
	Faulty cable or plug of CAN connection from control board to Delcos 3100.	Check CAN connection from control board to Delcos 3100.
	Control board faulty.	Otherwise contact Gardner Denver Service.
	Delcos 3100 faulty.	
[FAULT SR-DRIVE (53)] Enable input (user enable) open	This input is deactivated on the hardware side. Occurrence of this fault points to a malfunction on the control board.	Contact Gardner Denver Service.
[FAULT SR-DRIVE (54)] Motor seized	Motor or compressor seized.	Contact Gardner Denver Service.
	RPT sensor faulty.	
	Control or gate drive board faulty.	
[FAULT SR-DRIVE (55)] Precharging fault	Occurrence of this fault points to a malfunction on the control or gate drive board.	Contact Gardner Denver Service.

[Display] / Problem	Possible Cause	Remedy
[FAULT SR-LOCKOUT (1)] Configuration fault	Fault in hardware configuration as a result of severe electromagnetic or line-fed disturbance. Control board faulty.	Completely switch power supply off and back on again. If fault still occurs, contact Gardner Denver Service.
[FAULT SR-LOCKOUT (2)] Diagnostic unit faulty	A faulty diagnostic unit (Gardner Denver Service) is connected to the control board. Control board faulty.	Make sure that nothing is connected to plug connection J1 on the control board. Completely switch power supply off and back on again. If fault still occurs, contact Gardner Denver Service.
[FAULT SR-LOCKOUT (3)] Faulty initialisation	Initialisation routine has been interrupted by a break in voltage Faulty cable or plug of CAN connection from control board to Delcos 3100. Control board faulty. Delcos 3100 faulty.	Check ribbon cable between control board (PCB94) and gate drive board (PCB95). Check CAN connection from control board to Delcos 3100. Completely switch power supply off and back on again. If fault still occurs, contact Gardner Denver Service.
[FAULT SR-LOCKOUT (4)] Safety interlock input open	Occurrence of this fault points to a malfunction on the control board.	Completely switch power supply off and back on again. If fault still occurs, contact Gardner Denver Service.
[FAULT SR-LOCKOUT (5)] Setting parameters faulty	Occurrence of this fault points to a malfunction on the control board.	Completely switch power supply off and back on again. If fault still occurs, contact Gardner Denver Service.
FAULT SR-LOCKOUT (6)] Internal fault	Fault in hardware configuration as a result of severe electromagnetic or line-fed disturbance. Control board faulty.	Completely switch power supply off and back on again. If fault still occurs, contact Gardner Denver Service.
[FAULT SR-LOCKOUT (7)] Main contactor fault (open)	A main contactor is not installed. Occurrence of this fault points to a wiring fault or a malfunction on the control or gate drive board.	Check connections at control board J11, terminal 3 and 6, to gate drive board J15, terminal 4 and 5. Completely switch power supply off and back on again. If fault still occurs, contact Gardner Denver Service.
[FAULT SR-LOCKOUT (8)] Main contactor fault (closed)	A main contactor is not installed. Occurrence of this fault points to a wiring fault or a malfunction on the control or gate drive board	Check connections at control board J11, terminal 3 and 6, to gate drive board J15, terminal 4 and 5. Completely switch power supply off and back on again. If fault still occurs, contact Gardner Denver Service.

(1) System-specific setting: see Chapter 1.3.4 [LIMIT VALUES] menu
(2) Customised setting: see Chapter 1.3.1 [MAINTENANCE SCHED.] menu
(3) Customised setting: see Chapter 1.3.5 [OPTIONAL INPUTS] menu
(4) Customised setting: see Chapter 1.3.2 [CONTROL MENU] menu
(5) Customised setting: see Chapter 1.3.7 [TIMER CONTROL] menu
(6) Customised setting: see Chapter 1.3.6 [WATER] menu

1.6 Maintenance intervals

Danger

When programming the system in standby mode, i.e. LED a flashing, the compressor can start automatically at any time!

The maintenance intervals can be programmed specifically to suit your particular application conditions as, for example, the degree of air-filter soiling depends on intake conditions

In the factory setting, therefore, the values set for maintenance intervals in the [MAINTENANCE SCHED.] menu are blocked, the plaintext field shows [- - - -].

You can set your own specific maintenance intervals for air filter, water filter and engine grease yourself (see Chapter 1.3.8) and thus partially replace your maintenance log. The settings for maintenance intervals can be programmed in a range from 0 to 9999 hours.

If you do not want the maintenance intervals to be monitored, program a value above 9999 hours. The displays shows [- - - -], i.e. this/these maintenance interval(s) is/are blocked.

Once the setting reaches 0 hours, the plaintext field shows [MAINTENANCE ELAPSED] and LED f (maintenance) flashes at the same time.

You should then carry out the planned maintenance activities because failure to perform maintenance work can lead to faults.

The relevant maintenance interval counter reading is shown in the [MAINTENANCE SCHED.] menu.

It is possible that negative, i.e. exceeded maintenance intervals, will be displayed.

For maintenance intervals, it is also possible to activate/deactivate shutdown once a maintenance interval has elapsed to -100 hours. If any of the intervals reaches the shutdown threshold, the system will be shut down with group fault LED h in addition to LED f. The [FAULT MAINT PER] message is entered in the fault memory as well as in the plaintext field.

After completing maintenance work, the maintenance interval should be reprogrammed and the [maintenance] fault should then – for restarting - be acknowledged by pressing the ⊖ key.

1.7 Operating modes

1.7.1 Automatic and continuous operation

For this, go to the [CONTROL MENU] menu and select either [AUTOMATIC OPERATION] or [CONTINUOUS OPERATION] (see Chapter 1.3.8 changing values).

The [AUTOMATIC OPERATION] mode is the most economical operating mode because the control system shuts the compressor down when compressed air is no longer needed (standby) and restarts the system automatically when compressed air is required again.

The [CONTINUOUS OPERATION] mode is only required in specific applications. Continuous operation prevents the drive motor from shutting down when air consumption stops. The compressor then continues to run in the off-load operating mode. In contrast to the automatic operating mode, continuous operation allows you to start the system although no network pressure is being requested.

1.7.2 Motor control operating modes (version RS only)

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

1.7.2.1 Speed regulation ON

This is the machine's default setting in which volumetric flow is adjusted as a function of motor speed.

When the converter is ready, the "setpoint > 3.5mA" signal is present and no [WARNING MS-BUS:A02] or [WARNING MS-BUS:A06] is given, you can switch to [SPEED REGULATION ON] in the menu. The setpoint speed is constantly calculated and output.

If the "setpoint > 3.5mA" feedback signal fails to arrive, the [WARNING SPEED-SIG.] is triggered, switching over to [SPEED REGULATION OFF].

It is also possible to switch over to [SPEED REGULATION OFF] while operation is in progress.

1.7.2.2 Speed regulation OFF

It is only expedient to set motor speed to maximum speed for test purposes, i.e. to keep speed constant.

In this operating mode, the drive can be started once the "converter ready" feedback signal is received. The request for maximum speed is given to the converter and the “max. speed” digital output additionally switches to maximum speed. This maximum speed is pre-programmed in the converter.

On-load/off-load control by the intake regulator takes place in the standard mode, i.e. if network pressure > max. network pressure, the machine is switched to off-load mode, if network pressure < target pressure, machine is switched to on-load mode.

If base-load sequencing (BLS) is activated, it must also be noted that the machine will now be integrated into the base-load sequencing system in the same way as a standard compressor. After changeover, it can be at base or peak-load position and also rotates within the BLS system.

If the “setpoint > 3.5mA” feedback signal fails to arrive in the [SPEED REGULATION ON] operating mode, the [WARNING SPEED-SIG.] will be triggered, switching to maximum speed with the “max. speed” digital output.

Providing all conditions are met, switching over to [SPEED REGULATION ON] can take place while operation is in progress.

1.7.2.3 Bypass operating mode (option)

By way of option, a star-delta bypass can be installed in the converter cabinet. If the converter fails, it is possible to switch over to the [BYPASS OPERATION] mode with the machine shut down. The drive can then be restarted via the star-delta bypass.

This is subject to the condition that the converter is not feeding back any standby message and that the bypass is not malfunctioning.

On-load/off-load control by the intake regulator takes place in the standard mode, i.e. if network pressure > max. network pressure, the machine is switched to off-load mode, if network pressure < target pressure, machine is switched to on-load mode.

If base-load sequencing (BLS) is activated, it must also be noted that the machine will now be integrated into the base-load sequencing system in the same way as a standard compressor. After changeover, it can be at base or peak-load position and rotates in the BLS system.

It is not possible to switch over to the [SPEED REGULATION ON] operating mode until the machine is shut down and the [FEEDBACK CONVERTER] has been received.

The "bypass ready" and "converter ready" messages must not be present at the same time. This would result In a fault (see Chapter 1.5.2 Faults/warnings table).

If [WARNING MS-BUS:A06] (BLS-Module) is present, the "bypass ready" signal is not valid.

Switching over to bypass operation (option)

If the converter is malfunctioning, DELCOS 3100 shuts down the machine with [FAULT CONVERTER]. Provided the bypass reports that it is ready, the system switches over to bypass mode and the compressor is restarted as follows:

- Switch over from [SPEED REGULATION ON] to [BYPASS OPERATION] in the [CONTROL MENU] menu
- Quit menu (press key so that LED b goes out)
- Acknowledge [FAULT CONVERTER] by pressing the acknowledgement key
- Restart compressor in bypass mode

Note

Switching over with the power contactors in the converter switch cabinet is delayed for a few seconds with a time-delay relay. This means it is necessary to wait for a short while after converter fault occurs.

Switching back from bypass mode (option) to speed control

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

- Switch compressor off and wait until motor comes to a standstill
- Switch convertor on
- Switch over from [BYPASS OPERATION] to [SPEED REGULATION ON] in the [CONTROL MENU] menu
- Quit menu (press key so that LED b goes out)
- Acknowledge fault: [FAULT BYPASS] by pressing the acknowledgement key
- Restart the compressor in the [SPEED REGULATION ON] operating mode.

1.7.3 Setting the volumetric-flow unit for the status display [DISPLAY UNITS = m3/min] (version RS and SR only)

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

The status display indicates the machine's current volumetric flow rate. As the LCD display can only show a limited number of characters, the display unit is preset here. This unit does not appear on the status display.

1.7.4 Speed limitation (version SR only)

The maximum speed of the machine can be limited.

This is done by programming one of the inputs to the [EXT: RPM LIMIT] function in the [OPTIONAL INPUTS] menu.

If the relevant input is now connected via an external contact, speed will be limited to the value set in the [EXT: LIMIT] menu option from the [LIMIT VALUES] menu.

It must be noted that this value does not represent a fixed speed, i.e. if less air is required in the compressed-air network, the machine can still adjust the speed to a value below [EXT. LIMIT].

1.7.5 Remote control

Danger

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

Attention

It is only permissible to connect floating contacts to the terminal strip. Interference voltages will irreparably damage the DELCO3100.

The floating contacts must not be further than 20 metres from the terminal strip. If necessary, coupling relays must be installed in the control cabinet.

The control system provides the capability of switching the compressor on and off externally by connecting a floating contact.

To activate the remote on/off input (terminals 3.25/X3.26), you must switch the remote control [REMOTE CONTROL ON] on in the [CONTROL MENU] menu.

- With [[REMOTE CONTROL ON], LED d lights up and the compressor's I key and O key are disabled.
- To start the system, the controller expects a REMOTE ON edge at the remote on/off input.
- The system continues to run until the remote ON/OFF input is closed.
- The system stops when the remote on/off input is opened.
- If the system has already been switched off manually and if it is set to [ON], it remains in operation when the remote on/off input is closed.
- On deactivating the [REMOTE CONTROL OFF] remote operating mode, the system stays ON or OFF.

1.7.6 Changing over pressure by remote control

Danger

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

Attention

It is only permissible to connect floating contacts to the terminal strip. Interference voltages will irreparably damage the DELCO3100.

The floating contacts must not be further than 20 metres from the terminal strip. If necessary, coupling relays must be installed in the control cabinet.

Version RS: Pressure changeover can be activated through an external, floating contact. This takes place through a digital input on the base-load sequencing module.

Version FS: as version RS, however the module is optional.

Version SR: It is possible to switch over to a second pressure range through the "second pressure band" input (terminals X4.6,X4.14) (see Chapter 1.3.7 [TIMER CONTROL]) menu.

While pressure is being changed over, you will see the [p2] symbol flashing in front of the display of the current network pressure.

1.7.7 Switching on-load/off-load by remote control (version FS only)

Danger

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

Attention

It is only permissible to connect floating contacts to the terminal strip. Interference voltages will irreparably damage the DELCO3100.

The floating contacts must not be further than 20 metres from the terminal strip. If necessary, coupling relays must be installed in the control cabinet.

The control system provides the capability of switching the compressor on-load and off-load externally by connecting a floating contact

The remote on-load/off-load input (terminals X3.23/X3.24) is always active, i.e. you do not need to make any further settings in the DELCOS 3100 menu.

Operating principle:

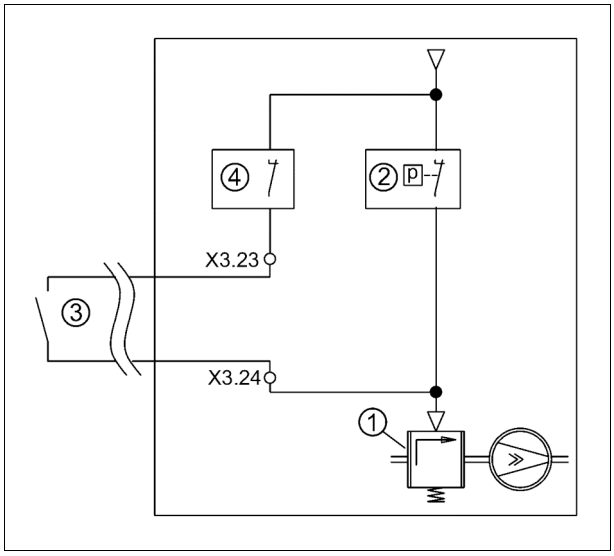


Figure 1

Legend:

(1) Controller for switching compressor on-load/off-load
(2) Internal electronic pressure switch, see [CONTROL MENU] for setting
(3) External floating contact for remote on-load
(4) Overpressure protection logic

- During normal operation, the compressor's on-load/off-load controller (1) is governed by the internal electronic pressure switch (2). You program the switching points of the internal electronic pressure switch (2) in the [CONTROL MENU] menu using the [CUT-OUT POINT] and [CUT-IN POINT] parameters.
- The external floating contact (3) is parallel to the internal pressure control (2).
- A protective circuit (4) interrupts the function of the external floating contact (3) if you have attempted to operate the system 0.5 bar/7psi above rated operating pressure. The display shows [WARNING LINE PRESS] while the external floating contact (3) is deactivated. After acknowledging [WARNING LINE PRESS] the external floating contact (3) is re-enabled.

Note

By arranging the two pressure switches (2) + (3) in parallel, the setting of the internal electronic pressure switch (2) may have to be reduced in the [CONTROL MENU] menu.

To deactivate the internal electronic pressure switch (2) or connect an external floating contact for remote on-load in series, see Chapter 1.7.8.

1.7.8 Remote control for enabling on-load operation

By connecting an external floating contact, the control system provides the capability of:

- interrupting the enable for the compressor's on-load/off-load control ler (1) or
- connecting an external floating contact for remote load-on in series with the internal electronic pressure switch.

Operating principle

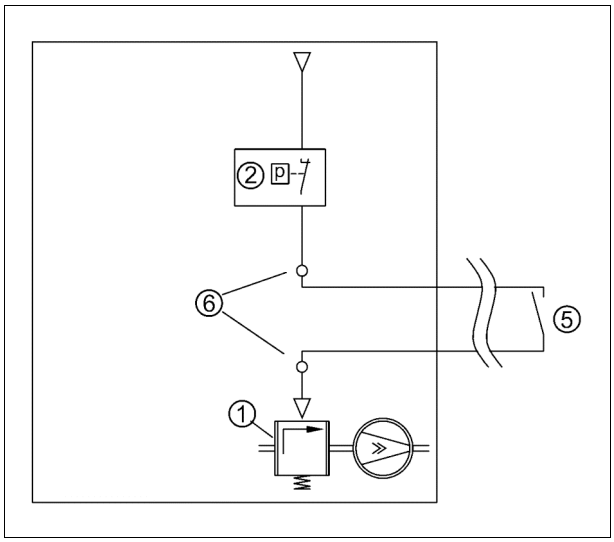


Figure 2

Legend:

(1) Compressor's on-load/off-load controller
(2) Internal electronic pressure switch: for setting, see [CONTROL MENU] menu
(5) Enable switch or external floating contact for remote on-load
(6) Terminals

- In normal operation, the compressor's on-load/off-load controller (1) is governed exclusively by the system's internal electronic pressure switch (2). The switching points of the internal electronic pressure switch (2) are programmed in the [CONTROL MENU] menu using the [CUT OUT POINT] and [CUT IN POINT] parameters for Version FS and [TARGET PRESSURE] for version RS.
- In the [OPTIONAL INPUTS] menu, program one of the three programmable inputs to the [OPERATE_B1] function. As a result, the input selected with the terminals (6) is now connected in series with the internal electronic pressure switch (2).
- Connect the external switch (5) to the terminals (6).

Assignment of terminals (6) depending on input selected:

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

Note

By connecting the two pressure switches (2) + (5) in series, it may be necessary to increase the setting of the internal electronic pressure switch (2) in the [CONTROL MENU] menu.

1.7.9 Combined remote control of on-load/off-load operation and enabling of on-load operation (version FS only)

You can combine the two procedures for activating on-load/off-load operation and enabling on-load operation.

Example

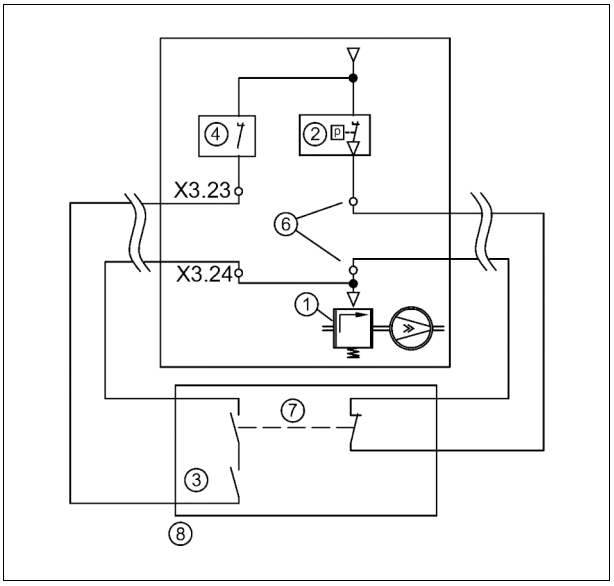


Figure 3

Legend:

(3) Load requested by higher-order controller
(7) Active signal from higher-order controller
(8) Higher-order control system

- In the example, a higher-order controller (8) is connected to DELCOS 3100.
- In the event of controller (8) failure, contact (7) switches DELCOS 3100 to internal operation (as shown above).
- When the higher-order controller (8) is active and not malfunctioning, it withdraws the on-load enable from DELCOS 3100 at contact (7) and now controls the compressor autonomously through ist own load request (3).

1.7.10 Automatic restart after power failure

Danger

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

You can activate or deactivate automatic restart in the [CONTROL MENU] (see Chapter 1.3.2).

After a power failure lasting no longer than approx. 2 seconds, the compressor is automatically restarted if it was switched on, i.e. in operation (standby), before voltage failed

Power failures lasting longer than 2 seconds produce the [POWER LOSS] message and [AUTO RESTART] does not take place.

The [POWER LOSS TIME] menu option (see Chapter 1.3.2) can be programmed to between 2 and 999 seconds.

In addition, you can also program a start-up delay of 1 to 60 seconds to ensure staggered start-up in the case of multiple-compressor stations – to ease the strain on the power supply system. The plaintext field then shows:

[WARNING START IN xx s].

In remote-controlled operation, restarting also requires the [REMOTE ON]. In timer-controlled operation, the timer enable must be given.

1.7.11 Unlimited automatic restart after power failure

The control system is able to conduct an automatic restart after a power failure of any length.

For this purpose, you must have read the following safety information and, by entering a code, enable unlimited automatic restart.

Please request the required code from the Gardner Denver customer service.

Danger

In this operating mode, the compressor can start automatically at any time and after power failure of unlimited duration. Check the safety regulations applicable in your country (e.g. EN1012-1, EN60204) to ascertain whether you are allowed to perform an unlimited automatic restart and establish which safety precautions must be taken.

At all events, provide the compressor with warning signs, keep the compressor room locked and instruct personnel.

Install the main switch prescribed under EN60204 and affix appropriate warning signs there.

This is how to enable unlimited automatic restart:

1. Press the C code key
2. Enter the code
3. Press the ↵ key to accept the code you have set

After enabling, you can now also program the menu option for max. failure time to [POWER LOSS TIME–s]. This corresponds to unlimited automatic restart.

Entering the code a second time withdraws enabling.

1.7.12 RS485 communication

DELCOS 3100's serial interface provides the capability of using two protocols. In addition, it is also possible to set different baud rates (4800, 9600, 19200 baud) and user addresses. These settings are made in the [CONTROL MENU] menu.

The DELCOS protocol is used together with the Gardner Denver profibus module. Using the profibus module, DELCOS 3100 can be connected to a profibus master (e.g. PLC).

Modbus interfaces and the associated drivers are available for almost all well-known makes of programmable logic controllers and PC visualisation software.

1.8 Water circuit

1.8.1 Electrical equipment

1.8.1.1 Relay module

The electrical equipment of the water circuit is connected to a relay module.
This has the designation “DH module“ and the MS bus address 04 in the circuit diagram.

1.8.1.2 Level switch

The level switch records the water level in the pressure tank. This is shown in the status bus in the [WATER] menu (see Chapter 1.8.2).
If the level switch simultaneously shows an excessively high or excessively low water level, FAULT LEVEL-SWITCH is read out (see Chapter 1.5 – Table Faults / Warnings).

1.8.1.3 Solenoid valves

The pressure tank can be topped up with water from the water treatment unit using the solenoid valve for water inlet. Since the water is topped up by the compressor stage the process can only be performed with the motor running under load.

Water can be drained from the pressure tank using the solenoid valve for water drainage. Since sufficient residual pressure must be present in the system to press the water from the pressure tank this can only be done when the motor is running.

The solenoid valve for water stop interrupts the water circuit if the motor has come to a standstill. This prevents the compressor stage from running full with water or water being pressed from the intake controller.

The current status of the solenoid valves is shown in the status bar in the [WATER] menu (see Chapter 1.8.2).

1.8.2 Status display for water circuit

The status display contains information on the remaining time to the next water exchange and the status of the solenoid valves and the water level in the pressure tank.

Example:

[22h y8 y9 Y10 >-<]

22h : Remaining time to the next water exchange (real time, i.e. not dependent on operating and load hours).

y8: Status of the solenoid valve for water inlet
y9: Status of the solenoid valve for water outlet
Y10: Status of the solenoid valve for water stop

The following is shown:
y solenoid valve not triggered
Y solenoid valve triggered

>–< Height of the water level

The following is shown:
⤒ water level too high
>–< water level within admissible range
⤓ water level too low

In order to obtain a fast overview of the status of the water circuit during the normal operation of the machine the key can be used outside the menu to fade in and out the status display of the water circuit. This is then displayed in alternation with the status display of the basic load sequencing (option in version FS and SR).

1.8.3 Automatic water level regulation

1.8.3.1 Water level too high

If the water level rises in the pressure tank during operation (not during water exchange (display ⤒) and if the motor is running, the solenoid valve for water drainage is automatically opened after a time delay. This permits the excess water to be drained until the water has reached the admissible level again (display >–<).

If this is not successful within a specific period, FAULT DRAINAGE 5 is read out (see Chapter 1.5.2).
This time can be set in the [WATER] menu in the DRAINAGE MAX. menu option.

1.8.3.2 Water level too low

If the water level drops in the pressure tank during operation (not during water exchange) (display ⤓) and if the machine is running under load, the solenoid valve for water inlet is automatically opened after a time delay. This causes the water to be passed from the water treatment unit to the pressure tank until the water has reached the admissible level again (display >–<).

If this is not successful within a specific period, WARNING SUPPLY 5 is read out (see Chapter 1.5.2).
This time can be set in the [WATER] menu in the SUPPLY MAX. menu option.

1.8.4 Water exchange

In order to guarantee a constant water quality, the water is exchanged at specific intervals. This interval can be set in the [WATER] menu in the CHANGE CYCLE menu option. The time set here is a real time, i.e. is independent of the overall and load hours of the machine. If the real time clock fails completely the cycle time will depend on the total machine hours.

Note

If the time for the CHANGE CYCLE is too short, the water treatment plant cannot provide sufficient water for the water exchange and fault messages will occur during the water exchange.

The remaining time to the next water exchange is displaced in the status bar. If an immediate water exchange is desired, the time can be reduced to 1min, in the [WATER] menu.

Note

Do not trigger a water exchange several times in a row because otherwise the water treatment plant cannot provide sufficient water. This will cause fault messages during the water exchange.

The water exchange is performed in the following order:

1. The solenoid valve for water drainage is opened until the water has reached the lower level limit.

   Status display after reaching the lower level limit:
   [0min y8 Y9 Y10 ↓]

2. The solenoid valve for water inlet is opened until the water has reached the upper level limit.

   Status display after reaching the upper level limit:
   [0min Y8 y9 Y10 ↑]

3. The solenoid valve for water drainage is opened until the water level is within the admissible range again. The solenoid valve is then closed again and the residual time reset to the CHANGE CYCLE value in the [WATER] menu up to the next water exchange.

   Status display after the end of the water exchange:
   [24h y8 y9 Y10 >-<]

The water exchange is interrupted by idling or standstill of the machine and continued under load run until the end is reached.

If faults occur during the water exchange, these are shown in the display (see Chapter 1.5.2).

1.9 Factory settings

This menu provides you with the capability of checking the factory settings programmed for your system, but not for changing them, version SR being the exception: [1)].

Below, please make a note of your specific settings:

Factory settings for version FS

[LIMIT VALUES]	
DESIGN PRESS	bar / psi
START PROTECT	bar / psi
FINAL TEMP WARN	°C / °F
FINAL TEMP MAX	°C / °F
MIN START TEMP	°C / °F
RUN-ON TIME	s
SOFT STOP	s
STAR/DELTA TIME	s
SOFTWARE:	

Factory settings for version RS

[LIMIT VALUES]	
DESIGN PRESS	bar / psi
START PROTECT	bar / psi
HEAVY STARTUP	bar / psi
FINAL TEMP WARN	°C / °F
FINAL TEMP MAX	°C / °F
MIN START TEMP	°C / °F
RUN-ON TIME	s
SOFT STOP	s
STAR/DELTA TIME	s
SOFTWARE:	

Factory settings for version SR

[LIMIT VALUES]	
DESIGN PRESS	bar / psi [1/2)]
START PROTECT	bar / psi
EXT. LIMIT	rpm [1)]
FINAL TEMP WARN	°C / °F
FINAL TEMP MAX	°C / °F
MIN START TEMP	°C / °F
RUN-ON TIME	s
SOFT STOP	s
VOL.MAX. =	m3/min [1/3)]
VOL.MIN. =	m3/min [1/3)]
SOFTWARE:	

1) These values can be changed without factory code.

2) The setting can be changed to lower values. It limits the settings possible for the desired network pressure in the [CONTROL MENU] menu and initiates shutdown in response to overpressure.

3) Values for linear, speed-dependent calculation of delivery rate indicated.

2.1 Overview

Base-load sequencing (BLS) is set in the [BASE LOAD SELECT.] menu option which is only displayed if the "base-load sequencing" option is installed (version FS and SR). BLS is a separate and independent part of the master's normal compressor control system. It only requires the following information from the master:

- Current network pressure
- Timer setting

The status in which the master machine is operating, therefore, is immaterial. In other words, the master can be shut down or even malfunctioning. These are the only events that result in BLS failure:

- Master without power supply
- Fault: network pressure centre
- [WARNING MS-BUS:A06] (failed relay module for activating slaves)

The following terms are used below:

BLS: Base-load sequencing

BLS array:: Array of compressors in relation to the given network pressure switching points.

Master: Compressor K1. This is the compressor to which the slave compressors are connected via the relay module.

Slave: Compressors K2 to K5 that are switched on-load via the relay module.

Relay module A06: Printed circuit board in the control cabinet of the master machine that is provided with floating contacts for activating slaves and to which (optional) the fault messages from slaves can be connected.

CHANGEOVER TIME: Period for which the current base-load machine is to be retained before changing over in the BLS array. Compressors K2 to K5 receive the on-load/off-load commands from the master control system. A relay module is installed in the master control system for this purpose (see electrical circuit diagram). The relay contacts must be integrated in the control system of the slave in such a way that when a relay responds (contact closed) the compressor connected is switched to on-load operation. To prevent the machine's normal on-load/off-load controller from influencing BLS operation, the switching-point setting must be changed accordingly on each slave.

Time remaining: Indication of when next changeover will be selected in the sequence.

For version SR only:

CUT-OUT POINT: BLS setting that defines the upper limit of the pressure band.

TARGET PRESSURE: BLS setting to which the speed-controlled system (master) tries to adjust.

CUT-IN POINT: This value results from the setting for CUT-OUT POINT and TARGET PRESSURE (see 2.6.5)

2.2 Functional description / attributes

The [CUT-OUT POINT] setting and [TARGET PRESSURE] (or [CUT-IN POINT] in version FS) setting in the [BASE LOAD SELECT.] menu defines the network pressure range that is to be maintained by base-load sequencing. The control system switches compressors on and off in relation to network pressure leaving this range or in relation to wide fluctuations in the demand for compressed. As the speed is also determined at which to leave the setpoint range, cut-in and cut-out takes places either quickly or slowly. The remaining functions are covered in the descriptions of the various setting capabilities.

Attributes of BLS:

- Independent operation, no station failure in response to a fault or temporary master shutdown.
- If one compressor fails, the following compressors move up, the malfunctioning compressor is re-incorporated after the fault has been eliminated (requires connection of slave fault messages to the master machine).
- Status display of remaining switchover time, on-load/off-load operation and malfunctioning of compressors; status display can also be selected in normal operation without entering the BLS menu.
- Capability of setting switchover time, remaining time and current base-load array in operation.
- Test routine (300s) and blockable switchover time (fixed BLS sequence)
- Switchover time runs while base-load system is in on-load operating mode
- Using the "LOAD NET IN xx min" parameter, it is possible to achieve a situation whereby only a limited number of compressors is switched on for the classic "Monday morning start".
- It is possible to define spare compressors that do not take part in BLS and are thus permanently allocated as (spare) peak-load compressors.
- Pressure changeover possible via timer and/or external contact.
- Version RS and SR only: the BLS disconnects slave compressors if their volumetric flow reserve is sufficient to provide the delivery rate. The status display shows the delivery rate of an individual machine and/or of the entire station.

- The current delivery rate is output via an analogue output (version RS only, optional in version SR).

2.3 Connecting slaves to BLS

2.3.1 Load request

Compressors K2 to K5 receive the on-load/off-load commands from relay module A06 in the BLS system. Relay responded means on-load operation.

The relay contacts must switch into the system controlling the slaves. To prevent the machine's normal on-load/off-load controller from influencing BLS operation, their setting must be changed accordingly.

2.3.2 Fault message

Fault messages from the slaves (K2 to K5) can (optionally) be wired to the terminals on the master relay module. Power circuit closed means no fault.

Version RS and SR only:
For compressors with DELCOS 3100, it makes sense to wire back the "operating" message. Otherwise, the “disconnect” function faults and the analogue output delivers incorrect values (e.g. slave is manually switched off = not malfunctioning => is requested and included in delivery rate calculation

2.4 Connecting the master to BLS

If BLS is not activated [OFF operating mode] or has failed [OPERATION —], the master machine (K1) is controlled with the network pressure switching points set in the [control] menu.

As soon as BLS is activated [ON/TIMER], the master machine is connected by software to the BLS system. On-load and off-load commands then only come from the BLS system. The fault message from the master (K1) is recorded internally and is therefore always available.

2.5 Remote control

Using external contacts, it is possible to activate/ deactivate BLS by remote control and switch the BLS system or the machine itself to a second pressure range.

At the installation stage, coupling relays must be used if line length between the machine and the external contacts exceeds 20 m.

2.5.1 Remote-controlled pressure changeover

The BLS system can be forced to switch to a second pressure range via input E07.5 (module A06) (see Chapter on [TIMER CONTROL] menu). While pressure is being switched over, you will see the p2 symbol flashing in front of the display of current network pressure.

2.5.2 Switching off by remote control [OPERATION ON]

BLS can be switched off temporarily via input E07.4 (module A06). Switching off in this way is not the equivalent of deactivating BLS manually. It only disconnects the load requests to all machines. The “BLS active” message remains in tact – in contrast to manual shutdown.

2.5.3 Switching on by remote control with [OPERATION TIMER]

When BLS is shut down by the timer, it can be forced to switch on via input E07.4 (module A06).

2.6 Overview of [BASE LOAD SELECT.] menu

All menu settings can be locked/unlocked again with code 3031.

Version FS:

BASE LOAD SELECT.		{menu header}
OPERATION	ON	{off, on, optional timer, fault}
CUT-OUT POINT	9.7 bar	{max. network pressure}
CUT-IN POINT	9.3 bar	{min. network pressure}
BASE LOAD COMP	2	{current base-load system}
123h K2 K3 k4 r5 k1		{Status line: hours remaining and array}
CHANGEOVER TIME	240h	{setpoint time planned for the array}
QUANT.SLAVES	3	{for normal BLS operation}
QUANT.RESERVE	1	{as backup in case of emergency}
START DELAY	5s	{staggered start-up}
LOAD NET IN	15min	{start-up speed}
VOLUME OF NET	20%	{operating figure for compressed-air station}

Version RS and SR:

BASE LOAD SELECT.		{menu header}
OPERATION	ON	{off, On, timer, fault}
CUT-OUT POINT	13,0 bar / 188 psi	{max. network pressure}
TARGET PRESSURE	12,5 bar / 181 psi	{target network pressure}
BASE LOAD COMP	2	{current base-load system}
24h K1 K2 k3 k4 k5		{status line: hours remaining and array}
CHANGEOVER TIME	24h	{setpoint time planned for array}
QUANT.SLAVES	3	{for normal BLS operation}
QUANT.RESERVE	1	{as backup in case of emergency}
VOL.COMP2 =	20.0 m3/min	{rate delivered from compressor 2}
VOL.COMP3 =	15.0 m3/min	{rate delivered from compressor 3}
VOL.COMP4 =	15.0 m3/min	{rate delivered from compressor 4}
VOL.COMP5 =	8.0 m3/min	{rate delivered from compressor 5}
SWITCH OFF DELAY	30s	{time until disconnected}
START DELAY	5s	{gradual start-up}
LOAD NET IN	15min	{start-up speed}
NET VOLUME	20m3	{network volume}

2.6.1 Setting information

This system of base-load sequencing provides every capability of supplying compressed air in the most efficient way possible.

It permits extremely narrow pressure bands with maximum precision and very low pressure levels etc. At the same time, it is possible to prevent compressors switching on unnecessarily in response, for example, to irrelevant, short-term dips in network pressure.

On the other hand, specific conditions may be given that are less than optimal (e.g. compressor installed has long start-up time) but which cannot be changed. In addition, the compressed-air accumulator may be too small or network losses (leakages) too high. Mention could be given to many other reasons at this point

This is why, of course, it is most important to match settings to BLS. Data must always be set as correctly and as realistically as possible, with care being taken to find the optimum setting.

2.6.2 Data protection

BLS setting data are protected from loss by a battery. Protection by battery is only important in phases when the machine is without current. Long before the battery is no longer able to protect the data, a warning appears on the display: battery. The electronics clock module (RTC) must then soon be changed.

Once the battery is completely exhausted, data will be lost after a power failure. To ensure the supply of compressed air in this case too, the BLS system will set itself to default values. The system-specific data can be re-set temporarily (of course only until the next power failure).

2.6.3 Setting [OPERATION]

This is where BLS is activated and deactivated. If activated BLS fails as a result of any of the above-mentioned events, the display shows [OPERATION —] until the fault is rectified. It is then possible to switch back from [OPERATION —] to [OPERATION OFF]. When BLS is deactivated, no load requests are sent to the slaves

The BLS system is timer-controlled by means of [TIMER]. The BLS system receives the timer information from the [TIMER CONTROL] menu which must be programmed accordingly. The timer setting is/can be used from the BLS (menu: [BASE LOAD SELECT.]) and/or from the machine itself (menu: [CONTROL MENU]) .

The timer LED on the sealed control panel is reserved exclusively for the machine, i.e. does not indicate that BLS is being controlled by the timer.

If a faulty clock is identified after a power failure, BLS is switched back from [TIMER] to [ON]. The display shows [WARNING BATTERY].

As the BLS system merely issues on-load/off-load commands, it is assumed that all machines involved are switched on or are on standby (waiting for pressure request). This also applies to the master machine itself.

2.6.4 [CUT-OUT POINT / CUT-IN POINT] setting (version FS only)

Network pressure range maintained by BLS. The pressure band cannot be set to below 0.3 bar. Particularly in small networks, this pressure band should be selected as realistically as possible to ensure maximum control stability.

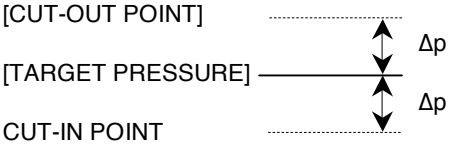
If pressure changeover is activated in the [TIMER CONTROL] menu (option), or if pressure changeover is initiated via the ext. contact, BLS operates with the [p_2 CUT-OUT POINT = xx bar] and [p2 CUT-IN POINT = xx bar] values from the [TIMER CONTROL] menu.

Compressors cut in or out if network pressure leaves the chosen range.

2.6.5 [CUT-OUT POINT / TARGET PRESSURE] setting (version RS and SR only)

Network pressure range maintained by BLS. The difference between CUT-OUT POINT and "setpoint pressure" cannot be set to below 0.3 bar. Particularly in small networks, this pressure band should not be set too low in order to keep control as steady as possible.

The [CUT-OUT POINT] and [TARGET PRESSURE] settings produce the internal value for CUT-IN POINT. If pressure falls below CUT-IN POINT, BLS switches compressors on. CUT-IN POINT is calculated as follows:



If pressure changeover is activated in the [TIMER CONTROL] menu (option), or if pressure changeover is initiated via the ext. contact, BLS operates with the [p_2 CUT-OUT POINT = xx bar] and [p2 TARGET PRESSURE = xx bar] values from the [TIMER CONTROL] menu.

Compressors cut in or out if network pressure leaves the chosen range

2.6.6 [BASE LOAD COMP] setting

This is where the base-load system currently scheduled is displayed and/or set.

In version SR, the speed-controlled compressor is permanently in first place. The base-load machine can, therefore, be set within the 2 to (number of BLS slaves) range.

In version RS, the speed-controlled compressor is permanently in first place in the [SPEED REGULATION ON] operating mode. The base-load machine can then only be set within the 2 to (number of BLS slaves) range. In [SPEED REGULATION OFF], the master machine – in the same way as a standard machine – participates in BLS. In this case, this setting value can be set within the limits of 1 to (number of BLS slaves).

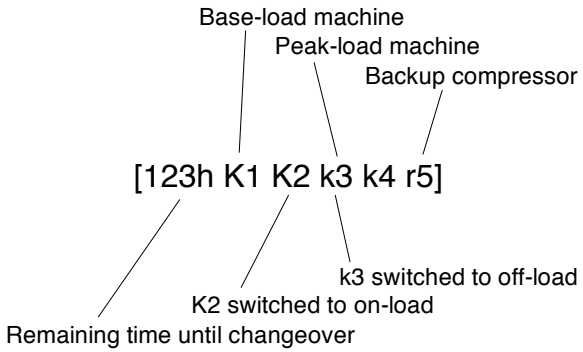
If a fault is identified in the base-load system, another compressor (temporarily) takes over and delivers the basic load. The actual base-load sequence is shown on the status display described below. Once the fault is rectified, the scheduled machine takes over again and delivers the basic load.

Changing the setting has no effect on the remaining changeover time for the BLS array.

2.6.7 BLS status display [123h K1 K3 k4 r2 r5]

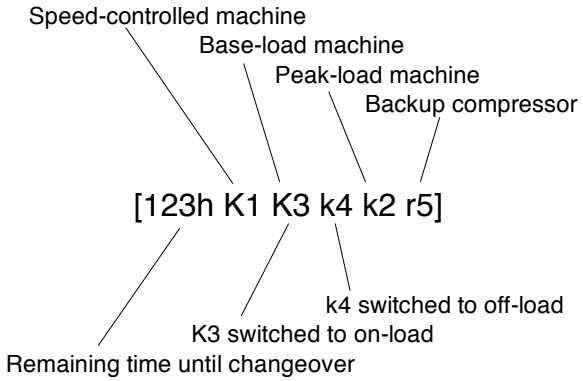
The status display contains information on the current BLS sequence, the time remaining until the next compressor is selected as well as on the status of the machines (on-load/off-load/fault). It also shows the backup machines.

Example of status display in version FS:



The display of the BLS array begins on the left with the base-load machine, followed by the current mean/peak-load machines and the backup compressors.

Example of status display in version RS and SR:



The display of the BLS array begins on the left with the speed-controlled machine, followed by the current base/mean/peak-load machines and the backup compressors.

The remaining time until changeover can be changed in the input mode within a range of 1h to changeover time (exceptions: [CHANGEOVER TIME 300s] or [CHANGEOVER TIME —h]). Changeover time elapses while the base-load system is switched to on-load operation.

The displays shows:

‘K2’ Compressor 2 switched to on-load operation

‘k2’ Compressor 2 switched to off-load operation

‘k!’ Compressor malfunctioning and moved to the back, display alternates once a second between ‘k2’ and ‘k!’

The same display procedure applies to the backup machines, however using the "R/r" (instead of "K/k").

To view BLS status quickly during normal machine operation, this status display can be shown and hidden by pressing the key. As this takes place outside the menu, it is not possible to set changeover time there. The status display remains visible for a max. of 60s, and is overwritten by any faults/warnings occurring.

2.6.8 [CHANGEOVER TIME] setting

This is where the setpoint time is specified for the BLS array. Changeover time elapses when the base-load system is switched to on-load operation. It is interrupted when no compressor is being requested.

Changeover time is set within the range of 300s, 1h to 999h, —h.

300s:	test mode
1h to 999h:	normal changeover times
—h:	no changeover, BLS array is permanently retained.

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

If changeover time is reduced, this may affect the remaining BLS changeover time. As described above, the time remaining until changeover is only shown in the BLS display and cannot be changed there.

2.6.9 [QUANT.SLAVES] setting

This setting defines how many slave machines, in addition to the master, are involved in the actual BLS system, i.e. take part in providing the base-load as a function of running hours.

This does not include the backup machines.

2.6.10 [QUANT.RESERVE] setting

Backup machines can be defined if there are less than 4 BLS slaves. Backup machines do not take part in the running-hour-based BLS system. They are always permanently in last place and are only connected when they are required. Typical backup machines are, for example, old compressors which, although in working order, are only to be connected in an emergency.

2.6.11 [VOL.COMP2...5] setting (version RS and SR only)

This is where to set the delivery rate for the slave compressors. Only enter delivery rates in the [m3/min] unit.

2.6.12 [SWITCH OFF DELAY] setting (version RS and SR only)

BLS knows all rates delivered by the slave compressors and the current rate being delivered by the speed-controlled machine. The [SWITCH OFF DELAY xy s] time set here elapses if calculation shows that the speed-controlled compressor can provide sufficient air to take over the rate of air being delivered by the current peak-load machine. The peak-load machine is then disconnected.

The peak-load machine may be a slave or backup compressor.

We recommend not setting this value too low so that the new operating point can become established after disconnecting the peak-load machine.

2.6.13 [START DELAY] setting

The start delay setting (setting range 5 to 30s) makes it possible to delay the response to falls in network pressure. As a result, machines cut in on a gradual basis. The value selected should be at least the highest star-delta time of the compressors connected

If the CUT-IN POINT is understepped, the first compressor is connected in without delay.

2.6.14 [LOAD NET IN] setting

By setting [LOAD NET IN xy min], only as many compressors will be started as are necessary to fill the network within the given time. This avoids connecting the entire station unnecessarily.

This function is not active after a power failure. In this case (of emergency), compressors are connected in the normal way.

If the BLS system is started manually [OPERATION ON], using the timer or by remote control, and if current network pressure is below setpoint pressure, the compressed-air network is filled on a controlled basis

Example:

At 6 a.m. on Mondays, the compressed-air network must be 8.0 bar. In order, for example, to minimise idle output during this period, as few compressors are to be switched on as possible.

Solution:

The master compressor is activated at 5:45 hrs by its timer for activating the BLS system. The BLS operating mode is set to 15 min at [TIMER] and [LOAD NET IN]. Network pressure of 8.0 bar is reached after 15 min at the latest, with as few compressors being switched on as possible.

2.6.15 [NET VOLUME] setting (version RS and SR only)

To calculate ideal control behaviour, the BLS system requires the network volume of the compressed-air station. This is where you enter the sum of all local reservoirs.

Attention:

Correctly setting the [NET VOLUME] parameter is crucial to achieving satisfactory base-load sequencing!

- Setting value too low (slow): in cases where consumption varies widely, the BLS system is unable to identify in the range between CUT-IN POINT and CUT-OUT POINT that it needs to disconnect compressors as a precautionary measure.
- Setting value too high (sensitive): the BLS system disconnects compressors prematurely in the range between CUT-IN POINT and CUT-OUT POINT

2.6.16 [VOLUME OF NET] setting (version FS only)

To calculate ideal behaviour, the BLS system requires the main characteristics of the compressed-air station.

- Total rate delivered by BLS compressors [m³/min] {without backup compressors}
- Network volume [m³] {local reservoir volume in immediate proximity}

$$\text{Network size} = \frac{\text{Network volume [m}^3\text{] x 100}}{\text{Total rate delivered by BLS compressors [m}^3\text{/min]}}$$

Attention:

Correctly setting the [VOLUME OF NET] parameter is crucial to achieving satisfactory base-load sequencing!

- Setting value too low (slow): in cases where consumption varies widely, the BLS system is unable to identify in the range between CUT-IN POINT and CUT-OUT POINT that it needs to disconnect compressors as a precautionary measure.

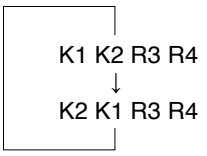
- Setting value too high (sensitive): the BLS system disconnects compressors prematurely in the range between CUT-IN POINT and CUT-OUT POINT.

2.7 Progression through the BLS array

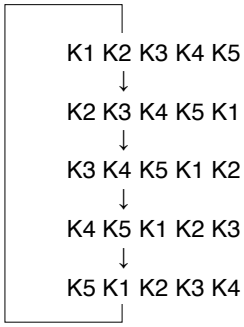
Once the changeover time has elapsed, the system switches over to the new array, and the time remaining until changeover is reset to the [CHANGEOVER TIME] set value. The backup compressors remain in peak-load position.

Example for version FS:

2 slave compressors
2 backup compressors

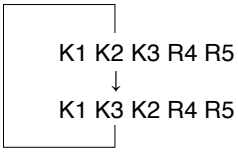


4 BLS compressors
No backup compressor possible

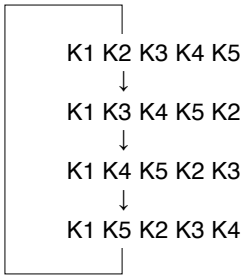


Example for version RS and SR:

2 slave compressors
2 backup compressors



4 BLS compressors
No backup compressor possible



On switching over, the network-pressure switching points are passed on together with the on-load enables prevailing before changeover.

2.8 Compressor fault

Slave faults can only be taken into account if their fault-message contacts are wired to the relay module.

If faults occur in a compressor, it is moved to the last position in the array, and the on-load enable is disconnected. The available, non-malfunctioning compressors move up. Once the fault has been rectified, the compressor(s) is(are) re-incorporated into the BLS series.

1. Example for version FS

System with 4 compressors, 1 backup compressor, [BASE LOAD COMP 3], fault K4

Before the fault:
103h K3 **K4** k1 k2 r5 {K3+K4 in on-load mode}

Fault **K4**:
103h K3 K1 k2 r5 **k!** {K3+K1 in on-load mode}

After fault:
102h K3 **K4** k1 k2 r5

On moving to the next BLS array, the new BLS array is newly configured with the machines available.

2. Example for version FS

System with 4 compressors, 1 backup compressor, [BASE LOAD COMP 3], [CHANGEOVER TIME 250h], Fault K4

Before the fault:
14h K3 **K4** k1 k2 r5 {K3+K4 in on-load mode}

Fault **K4**:
14h K3 K1 k2 r5 **k!** {K3+K1 in on-load mode}

Changeover:
250h K1 K2 k3 r5 **k!** {K4 is now scheduled base-load compressor, but still under fault conditions}

After the fault:
217h **K4** K1 k2 k3 r5 {K4 re-incorporated after fault rectification}

1. Example for version RS and SR:

System with 4 compressors, 1 backup compressor, [BASE LOAD COMP 3], fault K4

Before the fault:
103h K1 K3 **K4** k2 r5 {K1+K3+K4 in on-load mode}

Fault **K4**:
103h K1 K3 K2 r5 **k!** {K1+K2+K3 in on-load mode}

After fault:
102h K1 K3 **K4** k2 r5

On moving to the next BLS array, the new BLS array is newly configured with the machines available.

2. Example for version RS and SR:

System with 4 compressors, 1 backup compressor, [BASE LOAD COMP 3], [CHANGEOVER TIME 250h], Fault K4

Before the fault:
14h K1 K3 **K4** k2 r5 (K1+K3+K4 in on-load mode}

Fault **K4**:
14h K1 K3 K2 r5 **k!** {K1+K2+K3 in on-load mode}

Changeover:
250h K1 K2 K3 r5 **k!** {K4 is now scheduled base-load compressor, but still under fault conditions}

After the fault:
217h K1 **K4** K2 k3 r5 {K4 re-incorporated after fault rectification}

2.9 BLS active message

The slave compressors normally have their own or an internal pressure switch for controlling on-load/off-load operation. In conjunction with coupling relays, the BLS active message can be used to disconnect the slaves from their internal pressure switches, i.e. control takes place exclusively through the master's load request.

If the BLS system fails, the slave compressor can, in this way, switch over to its own pressure switch.

2.9.1 Via the spare-out output (option)

The BLS active function can be activated via the master's spare out using code 9348. The relay is pulled in when [OPERATION ON/TIMER] is active. The relay drops out if the following events prevent the BLS master from passing on load enables to the machines [OPERATION OFF/—]:

1. BLS is deactivated in the menu
2. Master without power supply
3. Fault: network pressure sensor B1
4. Warning: MS bus: A06 (relay module failed for activating slaves)

2.9.2 Via the BLS module

If the sum of slaves and backup machines is less than four, one relay is unused on relay module A06. This relay then accepts the BLS active message. This way, the spare out can remain free for other messages.

2.10 Messages to higher-order system when BLS is not activated (version RS and SR only)

If the number of slave + backup compressors = 0 and the BLS operating mode = OFF, the relay outputs on the BLS module report the following:

Relay A06.0 The speed-controlled machine is at 100% full load

Relay A06.1 The speed-controlled machine is in off-load mode

Relay A06.2 The speed-controlled machine is in on-load mode

Relay A06.3 Version RS: Speed control activated (not off or being bypassed)
Version SR : Reserved

3.1 Analogue output of delivered volumetric flow (version RS only)

Using channel 2, the delivered volumetric flow can be output through the analogue-out module. This information is purely computational in nature and is governed by the correct setting of the speed-controlled compressors delivery rate in the [CONTROL MENU] menu (see Chapter 1.4.1).

Channel No.	Scaling 4 to 20 mA
2	0 to maximum volumetric flow [1)]

1) When BLS is active, this corresponds to the sum of all compressors controlled by BLS.

Note

For the purpose of electrical isolation, an isolation amplifier must be used immediately downstream of this analogue output.

3.2 Analogue output (option only in version SR)

The optional analogue-output module has two 4 to 20 mA outputs.

Channel No.	Scaling 4 to 20 mA
1	0 to maximum speed
2	0 to maximum volumetric flow [1)]

1) When BLS is active, this corresponds to the sum of all compressors controlled by BLS.

Note

For the purpose of electrical isolation, an isolation amplifier must be used immediately downstream of this analogue output.

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