

Operating instructions
**Electrical
switching
facility pCo**



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1. Before you start

1.1 Brief description

pCo is an integrated compact controller for regulating and monitoring pump lubrication. Five keys and a back-lit two-line LCD display are used for settings and operation; they are accessed by opening the cover on the front of the pump. All lubrication tasks possible on the pump are included in the software.

The controller offers a variety of options for exchanging information with customer systems.

1.2 Using this manual

The operating manual should be read carefully before you use a pump with integrated pCo controller.

Inexperienced users should start with Chapter 2 *pCo integrated controller* and 3 *General operation*

in order to familiarise themselves with the general design and operation of the system.

Chapter 5 *Basic settings*

is important for **starting** the pump.

Operators responsible for **correct lubrication** in terms of amounts and intervals should pay particular attention to Chapter 6 *Setting parameters*

Operators responsible for **monitoring** the pump but not making any adjustments will find information on displaying the desired information in Chapter 4 *Display level use*

Generally speaking, details of the different pump functions and their settings can be found in the appropriate sections of Chapter 7 *Description of controller functions*

Information on troubleshooting can be found in Chapter 8 *Reference data*

2. pCo integrated controller

2.1 Design

The controller consists of the following components:

- a **control unit** incorporated in the pump housing
- a **controller board** mounted in the pump housing
- an **adapter board** mounted in the end cap

All components are interconnected by ribbon cables.

2.2 Control unit

LCD display

to show status data and setting changes

Control keys

for selecting and changing values

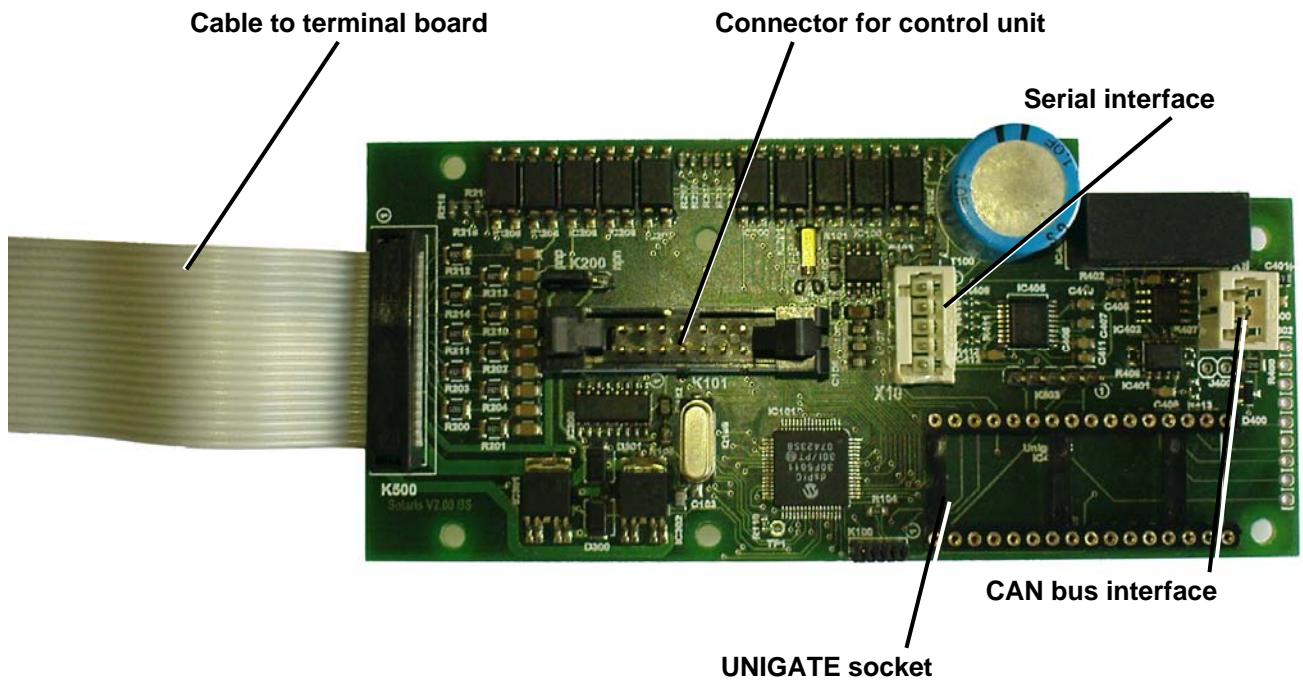


Fault indicator

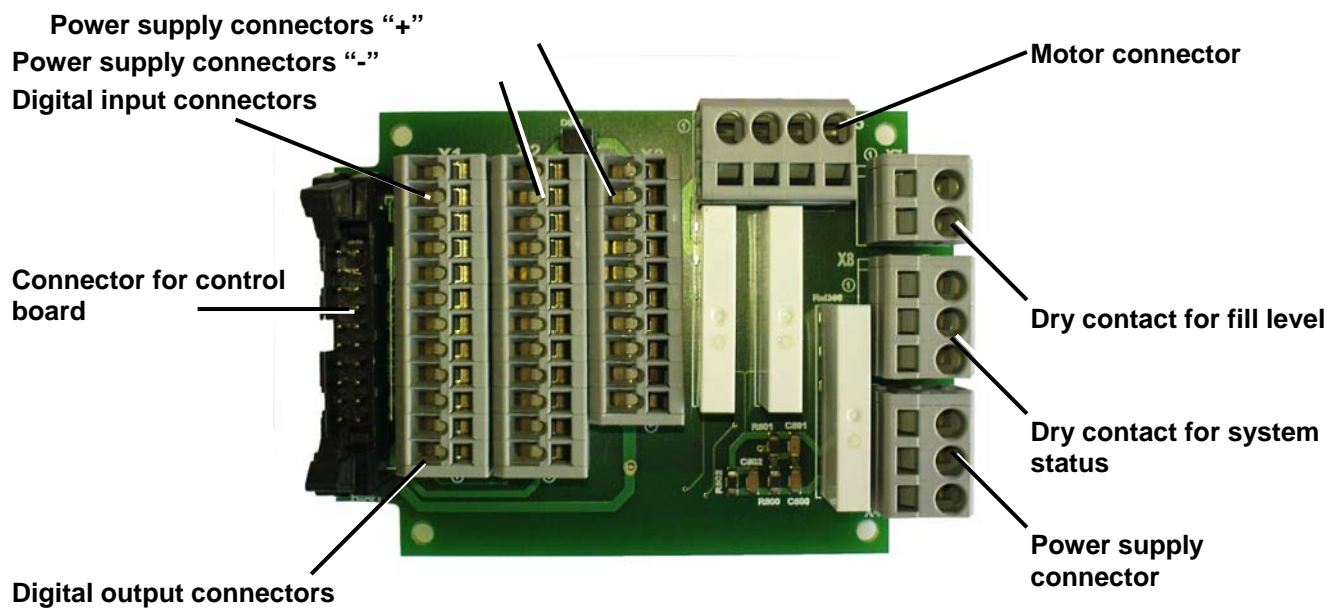
flashes red for fault; short flashes if display off

2. pCo integrated controller (cont.)

2.3 Controller board



2.4 Terminal board



3. General operation

3.1 Elements

The pCo controller is operated mainly from the control panel. The progress of the lubrication cycle can also be controlled by external signals.

The control panel contains a back-lit LED with two lines and 16 characters per line, a red message LED for general fault messages, and five control keys:



3.2 Operating levels

The user interface is divided into three levels, each allowing different access depths into the controller:

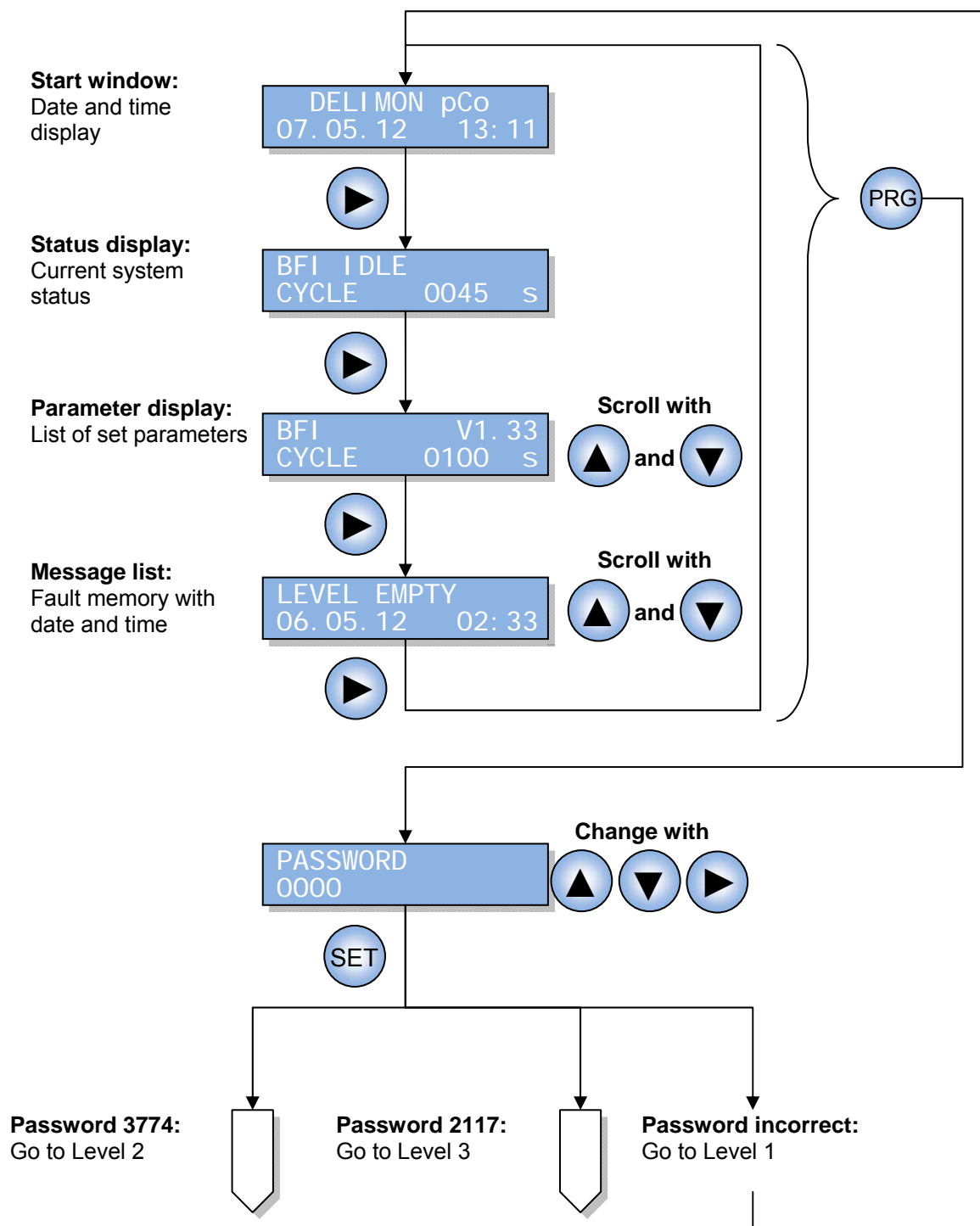
- Level 1: Display level
- Level 2: Parameter level
- Level 3: Programming level

The top levels are password-protected and should only be used by operators with the appropriate background knowledge.

3. General operation (cont.)

3.2.1 Level 1 (display level) and password entry

This level can be accessed without any restrictions and serves to display system information such as the current system mode, parameters and fault messages. No settings can be changed at this level. A password is needed to enter other levels from this level.



3. General operation (cont.)

3.2.2 Level 2 (parameter level)

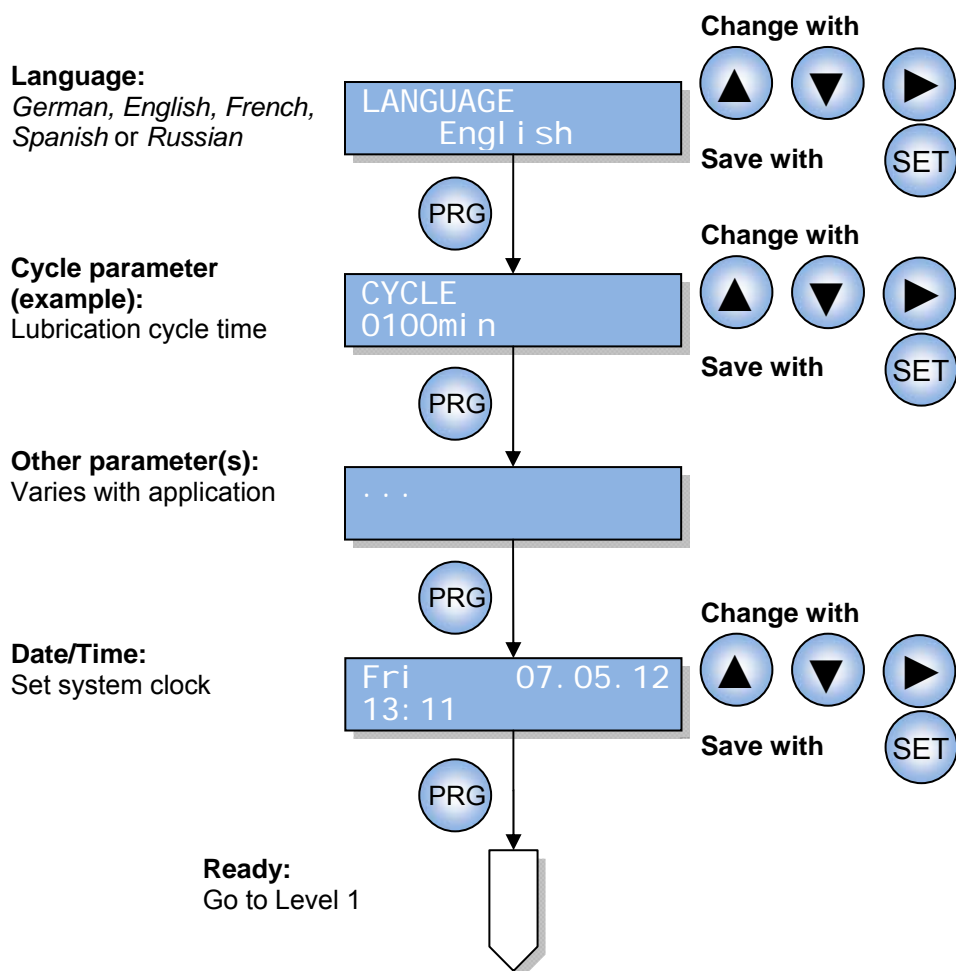
This level is password-protected and allows the operator to set system parameters. The type and number of parameters varies with each kind of system.

Incorrect input at this level can lead to unwanted conditions and even damage to the lubrication system. This level should, therefore, only be used by trained personnel.

Some settings unrelated to system operation can also be made here:

- Interface language
- Date and time

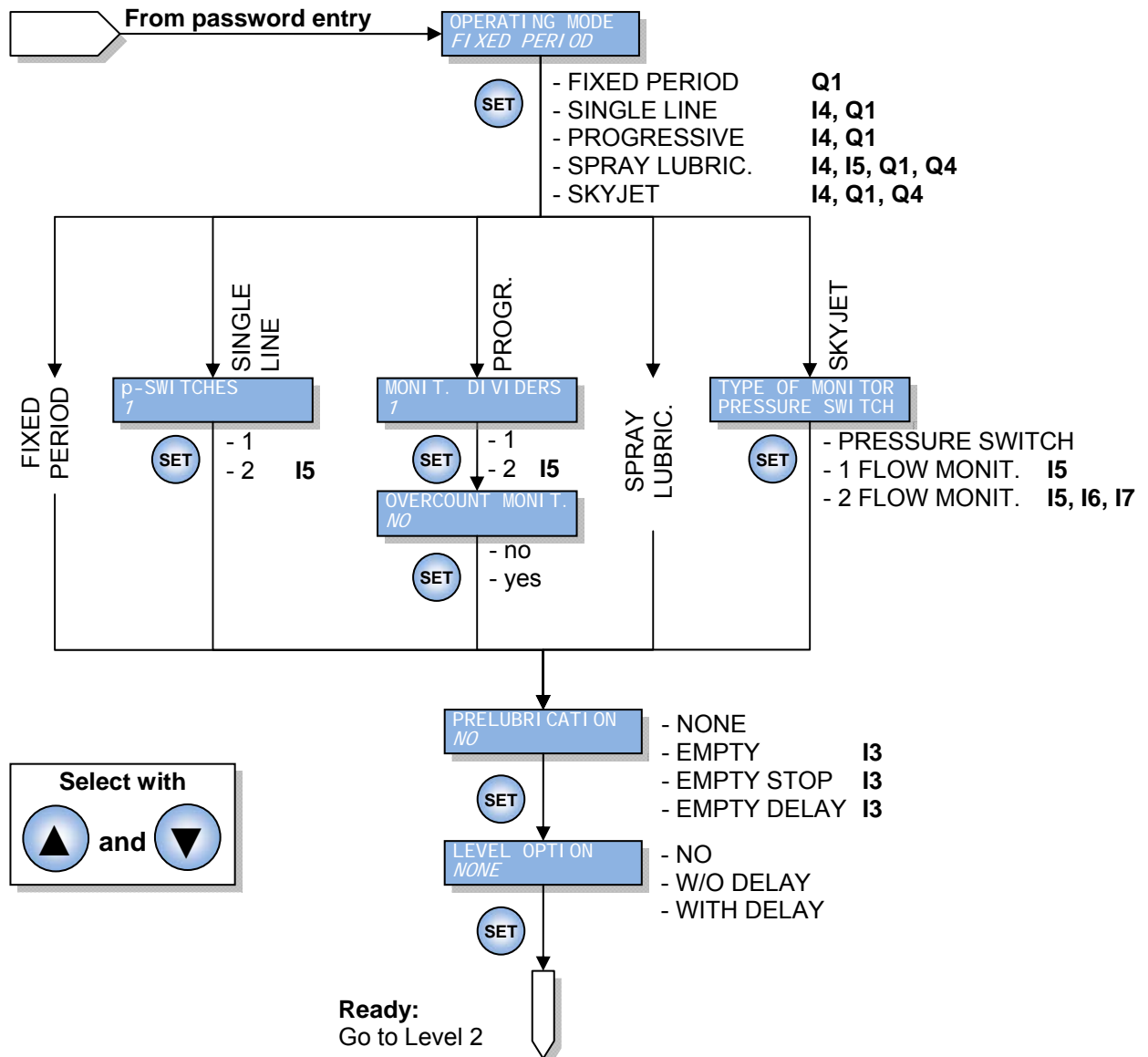
After settings have been entered, the software returns automatically to Level 1. To make switching again to Level 2 easier (e.g. when a system starts), the password is stored for 60 seconds and only needs to be confirmed (indicated by **** on the display when the password is entered).



3. General operation (cont.)

3.2.3 Level 3 (programming level)

This level is protected by a separate password and allows the controller to be matched to pump use. These settings define the assignment of inputs and outputs to different functions and are, therefore, safety-critical. Incorrect input at this level will prevent proper operation of the pump, so any changes here should only be made by trained personnel.



The operating mode is selected first. This causes the controller to jump to various selection trees and call up only the basic settings for the selected mode. After data has been entered at this level, the software returns to Level 2 automatically so that the system just specified can be parameterised immediately.

3. General operation (cont.)

3.3 Key assignment

Key functions depend on the particular situation:

Level 1

- ▲▼ : scroll through the stored data (e.g. fault messages)
- : change to the next display window
- PRG : change to password entry
- SET : *short press (<1 s)* acknowledge queued fault messages
long press (>1 s) acknowledge and start intermediate lubrication

Level 2

- ▲▼ : change the value at the current cursor position
- : move the cursor to the next changeable position
- PRG : change to the next settings window
- SET : store the changes to the current settings window



Warning: If you do not press SET, the changes will not be saved; if a value has been changed but not saved, an asterisk (*) will appear in the lower right of the screen.

Level 3

- ▲▼ : scroll through selection options
- : not assigned
- PRG : not assigned
- SET : accept selection and jump to next option

Password entry

- ▲▼ : change the value at the current cursor position
- : move the cursor to the next position
- PRG : not assigned
- SET : submit input (password is checked)

4. Display level use

The display level contains a number of windows. You can scroll through them using ►. The different windows are described below.

4.1 Start window

This window is displayed as soon as the pump switches on. The controller changes to the status display when ► is pressed or automatically after approx. 5 seconds.



4.2 Status display

The first line of the status display shows the current pump status. The second line shows the value of the relevant parameter for this status. When ► is pressed, the controller jumps to the settings display.




The current operating mode is always abbreviated in the status display and the parameter list. The abbreviations mean:

- **BFI** **FIXED PERIOD mode**
- **B1L** **SINGLE LINE mode**
- **BPR** **PROGRESSIVE mode**
- **BSP** **SPRAY LUBRICATION mode**
- **BSJ** **AIR-OIL LUBRICATION mode (SkyJet)**

4.3 Parameter display

The system settings relevant for lubrication are displayed in the settings level (Level 2). They can be viewed without a password having to be entered.

The first line shows the set mode (in the example, FIXED PERIOD lubrication mode [BFI] and the software version V1.32).

The second line shows the changeable values for the parameters used, i.e. all those in the parameter level (Level 2). The ▲ and ▼ keys are used to switch between parameters.

When ► is pressed, the controller jumps to the message list.



4.4 Message list

The message list shows the most recent fault message in clear text, plus the date and time the fault occurred. The ▲ and ▼ keys are also used to view previous fault messages (up to 20).

When ► is pressed, the controller returns to the start window.



5. Basic settings

For easier understanding, you are recommended to take a look at the diagram for Level 3 in Section 3.2.3.

If you are unsure of the basic settings for your application, consult the functional descriptions for each operating mode.

Use ▲ and ▼ to make your selection in Level 3. Press **SET** to confirm.

5.1 Starting

The controller will be in display level (Level 1) when you switch on the system. You need to change to programming level (Level 3) to select the basic settings.

- Press **PRG** to go to password entry.
- Enter the Level 3 password (2117). Press ▲ and ▼ to change the number at the cursor position. Use ► to move the cursor.
- Confirm the input by pressing **SET**.
- If the password is correct, you will see the adjacent image (a different mode from set interval may have been selected previously).

You are now in Level 3.

PASSWORD
0000

PASSWORD
2117

OPERATING MODE
FIXED PERIOD

5.2 Selecting operating mode

After you reach Level 3 by entering the correct password, you can select the operating mode.

pCo supports five operating modes:

- FIXED PERIOD lubrication
- SINGLE LINE lubrication system
- PROGRESSIVE lubrication system
- SPRAY LUBRICATION
- AIR-OIL LUBRICATION

pCo can now call up system-specific basic settings for the chosen mode.

The steps for each operating mode are described below.

OPERATING MODE
FIXED PERIOD

5.2.1 FIXED PERIOD mode

There are no additional options for this mode. The basic settings continue with *Selecting fill level monitoring* (Section 05.3).

5.2.2 SINGLE LINE mode

Single line lubrication systems can work with one or two pressure switch signals. The first window shows an appropriate selection.

You then specify which overpressure valve is to be used as the regular pressure-limiting valve for the 1-line system. This valve will not then be interpreted as a fault.

The basic settings then continue with *Selecting fill level monitoring* (Section 05.3).

p-SWITCHES
1

5.2.3 PROGRESSIVE mode

The first system-specific setting relates to the number of dividers to be monitored electronically.

The second system-specific setting relates to divider overcount.

The basic settings then continue with *Selecting fill level monitoring* (Section 5.3).

MONIT. DIVIDERS
1

OVERCOUNT CYCLES
NO

5.2.4 SPRAY LUBRICATION mode

There are no additional options for this mode. The basic settings continue with *Selecting fill level monitoring* (Section 5.3).

5. Basic settings (cont.)

5.2.5 SKYJET mode (Air-Oil lubrication)

In order to operate, Air-Oil lubrication systems require compressed air or the air flow resulting from it. Depending on the application the air is monitored with one of these methods:

- **PRESSURE SWITCH:** a single pressure switch is used
- **1 FLOW MONITOR:** 1 flow monitor is used
- **2 FLOW MONITORS:** 2 flow monitors is used

TYPE OF MONITOR.
2 FLOW MONITORS

The basic settings then continue with *Selecting fill level monitoring* (Section 5.3).

5.3 Selecting fill level monitoring

This setting specifies whether and to what extent fill level monitoring is carried out. The options are:

- **NONE:** no monitoring or filling
- **EMPTY:** Check for EMPTY, with message, no shutdown
- **EMPTY STOP:** Check for EMPTY, with message and shutdown
- **EMPTY DELAY:** Check for EMPTY, with warning and delayed shutdown

Detailed descriptions of each option can be found in Section 7.1 *Fill level check*.

LEVEL OPTION
EMPTY STOP

5.4 Prelubrication setting

The prelubrication setting defines pump behaviour when it is switched on. The options are:

- **NO:** no prelubrication
- **W/O DELAY:** lubrication occurs immediately after switch-on
- **WITH DELAY:** lubrication occurs at a set time after switch-on

That is the end of the basic settings (Level 3) for the pump. The operating parameters are set in a second step. pCo now switches to parameter level (Level 2) for this purpose.

PRELUBRICATION
WITH DELAY

6. Setting parameters

For easier understanding, you are recommended to take a look at the diagram for Level 2 in Section 3.2.2.

If you are unsure of the basic settings for the parameter, consult the functional descriptions for each operating mode.



Remember that the content at parameter level depends on the settings at programming level (Level 3). You should start with parameterisation only after the basic settings have been defined.



After the basic settings have been defined, the controller returns automatically from Level 3 to Level 2. No password is needed in this case.

6.1 Starting parameterisation

Proceed as follows to start parameterisation from display level (Level 1):

- Press **PRG** to go to password entry.
- Enter the Level 2 password (3774). Press ▲ and ▼ to change the number at the cursor position. Use ► to move the cursor.
- Confirm the input by pressing **SET**.
- If the password is correct, you will now see the display on the right. You are now in Level 2.

PASSWORD
0000

PASSWORD
3774

LANGUAGE
Engl i sh

6.2 Selecting operating language

The operating language is set in the first parameterisation window. The options are:

- German
- English
- French
- Spanish
- Russian

The setting applies to all text shown on the display.

LANGUAGE
Engl i sh

6.3 Entering system parameters

The parameters derived from the basic settings are specified in the subsequent windows. The type and number of parameters vary considerably, depending on the operating mode and options. The descriptions for each operating mode include a list of the parameters used, with explanations and principles of operation. This section will be limited to explaining how the parameters are set.

The setting window for a parameter contains the following elements:

- Parameter name
- Parameter value
- Unit (not always present)

{Parameter name}
{value} {unit}

The following elements can be set:

- Parameter value: all digits including leading zeros can be used; the setting range may be limited under some conditions
- Units: the unit can be selected for most parameters (e.g. SEC, MIN, etc.)

6. Setting parameters (cont.)


Example:

The figure on the right shows the parameter *Cycle*, common to all systems.

The value can be set from 1 to 9999.

The unit can be set to:

- IMP: pulses
- s: seconds
- min. minutes
- h: hours




Cycle
0100s

Press ▲ and ▼ to change the value at the cursor position. Use ► to move the cursor. Press **SET** to confirm. Press **PRG** to jump to the next parameter. If **PRG** is pressed without pressing **SET** after the previous entry, any changes will be lost.

6.4 Entering time and date

After all parameters have been entered or confirmed, a window appears for entering the date and time.

Press ▲ and ▼ to change the value at the cursor position. Use ► to move the cursor. Press **SET** to confirm. Press **PRG** to jump to the next window. If **PRG** is pressed without pressing **SET** after the previous entry, any changes will be lost.



Mon 07.05.12
13:11

7. Description of controller functions

Some pump functions do not depend on the selected operating mode. These will be described first. They are followed by descriptions of each operating mode.

7.1 Release

The pump can be controlled via an external release signal, i.e. the set lubrication cycle will run once the release signal is active. This dependency can be circumvented by bridging the signal to the controller's adapter board. See wiring diagram for details.

7.2 Reset / Intermediate lubrication / Continuous operation

Fault messages in the controller must usually be acknowledged. To do so, press the SET key on the display briefly (<1 s). A longer press (>1 s) will also acknowledge existing fault messages, but will also initiate intermediate lubrication.

An external signal can also be used in the same way as pressing the key (see wiring diagram for details). A special case is the continuous signal to the external controller input, which switches the pump to continuous operation.

7.3 Fill level monitoring

7.3.1 Connections used

The pump usually has a fill level switch which indicates when the level is on EMPTY. This is connected internally to digital input I3. Depending on the setting, the status of the switch affects operation of the pump and message outputs Q2 and Q3, and/or triggers a fault message.

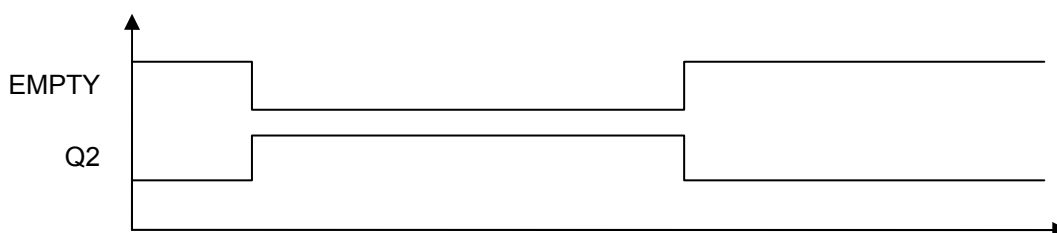
7.3.2 "No monitoring" setting

This setting means that the pump controller does not monitor the fill level. This must then be done manually.

7.3.3 "EMPTY" setting: EMPTY monitoring without shutdown

The EMPTY setting means the lubricant container is checked for the minimum permitted fill level. As soon as the EMPTY switch opens, output Q2 activates and the signal "Filling needed" is sent. Q2 is deactivated again as soon as the fill level switch changes.

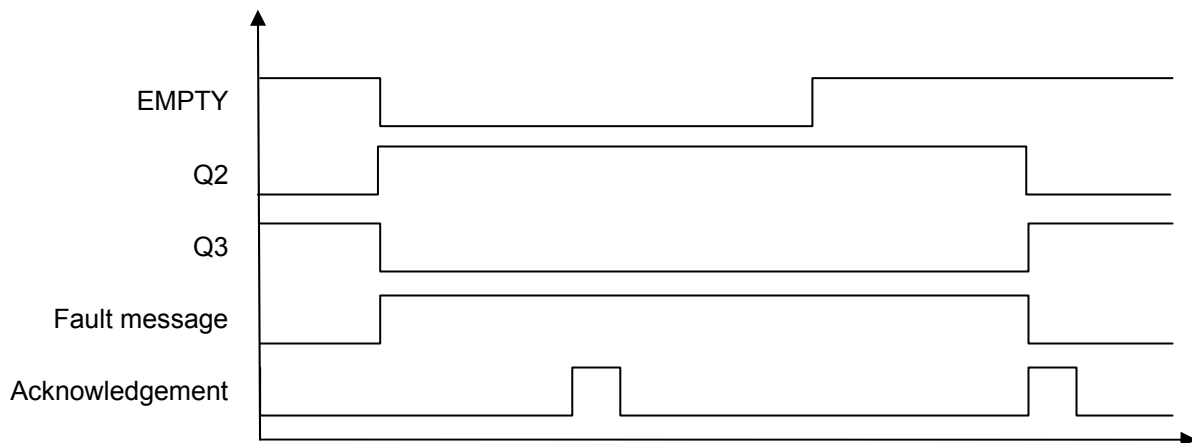
A fault number in text form is not sent with this setting.



7. Description of controller functions (Fortsetzung)

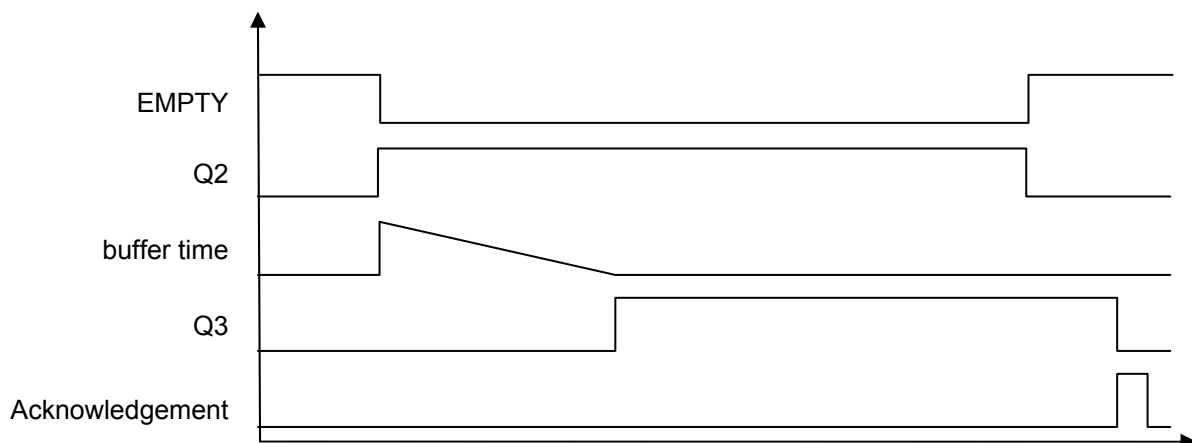
7.3.4 “EMPTY STOP” setting: EMPTY monitoring with shutdown

Similar to “EMPTY monitoring without shutdown”, except that further operation of the pump is prevented when the EMPTY fill level switch at **I3** opens to prevent the pump running dry. The fault message “LEVEL EMPTY” is also displayed. **Q2** is activated and reports “Filling needed”; **Q3** is deactivated to signal that the pump has stopped (fault message). The EMPTY condition must be corrected and acknowledged so the pump can continue operation.



7.3.5 “EMPTY DELAY” setting: EMPTY monitoring with warning and delayed shutdown

Similar to “EMPTY monitoring with shutdown”, except that further operation of the pump is continued for a programmable buffer time when the EMPTY fill level switch at **I3** opens. The fault message “LEVEL WARNING” is displayed as soon as the level switch opens. **Q2** is activated and reports “Filling needed”. If the delay time elapses without the level rising again, the fault message “LEVEL EMPTY” is also displayed. **Q3** is deactivated to signal that the pump has stopped (fault message). The EMPTY condition must be corrected and acknowledged so the pump can continue operation.



7. Description of controller functions (Fortsetzung)

7.4 Prelubrication

The "Prelubrication" option defines controller behaviour when it is switched on.

- *No prelubrication*: The controller has stored the status the last time the pump was switched off and sets the lubrication cycle to the known value
- *Prelubrication without delay*: When the pump is switched on, the controller starts a lubrication process regardless of the status of the pump the last time it was switched off.
- *Prelubrication with delay*: When the pump is switched on, the "power-on delay" time runs in the controller; initial lubrication starts when this is complete.

7.5 Overpressure monitor

Controller inputs **I6** and **I7** are reserved for connecting electrically monitored overpressure valves. A signal to one of these inputs results in a corresponding fault message. A special case is SINGLE LINE mode, where one of the overpressure valves is used as a regular pressure limiting valve and is therefore not assessed as a fault. This assignment is specified in the basic settings. Details on connecting the monitor can be found in the schematics.

7.6 FIXED PERIOD mode

7.6.1 Signals used

The following signals are used for the FIXED PERIOD operating mode.

Signal	Connection	Switch type
Release	Signal connector	NO contact
Switch on pump	internal	NO contact

7.6.2 Parameters

Cycle time: The period from one lubrication start to the next; the cycle can be specified in seconds, minutes and hours (s, min, h), in which case a timer operates until the release signal is received; if the signal is interrupted, the timer pauses and restarts at the same point the signal resumes. The cycle can also be specified in pulses (IMP); release signal pulses are then counted and a timer is not used.

Lube ON-time: Switch-on period for lubrication pump; the time can be specified in s, min or h.

7.6.3 Lubrication cycle process

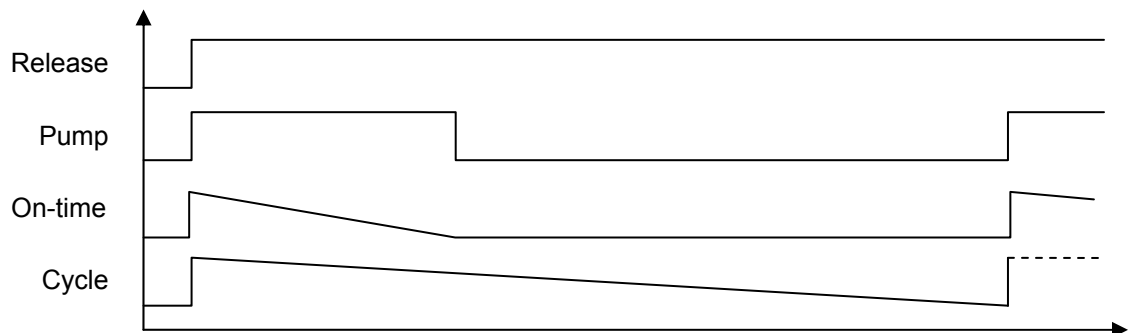
- The pump is switched on; *ON-time* and *Cycle time* are started simultaneously.
- The pump supplies lubricant.
- The pump is switched off as soon as the *ON-time* finishes.
- The cycle time counts down while the release is received.
- A new lubrication process starts when the cycle time ends.

BFI RUNNING
ON_TIME 0017 s

BFI IDLE
CYCLE 0030min

7. Description of controller functions (Fortsetzung)

7.6.4 Example



7.7 SINGLE LINE operating mode

7.7.1 Signals used

The following signals are used for the progressive operating mode:

Signal	Connection	Switch type
Release	Signal connector	NO contact
Pressure switch 1	Cable gland to I4	NO contact
Pressure switch 2	Cable gland to I5	NO contact
Switch on pump	Internal	NO contact
Lubricant valve	Cable gland to Q4	NO contact
Ready/Fault	Signal connector	Changeover contact

7.7.2 Parameters

Cycle time:	The period from one lubrication start to the next; the cycle can be specified in seconds, minutes and hours (s, min, h), in which case a timer operates until the release signal is received; if the signal is interrupted, the timer pauses and restarts at the same point the signal resumes. The cycle can also be specified in pulses (IMP); release signal pulses are then counted and a timer is not used.
Monitoring time:	Monitors pump switch-on time; a countdown starts at switch-on; if the switch-off condition of the pump has not been satisfied at the end of the monitoring time, a fault message is sent and the pump switched off; unit is always s.
Hold time:	Time during which the switch-off pressure must be present continuously before the pump is switched off; unit is always s.

7.7.3 Lubrication cycle process

- The pump and lubricant valve are switched on; *Monitoring* and *Cycle* timers are started at the same time.
- The pump builds up pressure in the main line; the pressure increase is checked via input **I4** (and **I5** if 2 pressure switches are used); the remaining monitoring time is displayed while this happens.
- As soon as switch-off pressure (pressure switch 1) is reached, the switch-off delay starts; if the pressure is interrupted during the switch-off delay, the timer restarts as soon as the pressure is re-established.
- The pump is switched off at the end of the switch-off delay; this resets and stops *Monitoring*. The fault message "Monitoring" is displayed if *Monitoring* terminates before the switch-off delay is complete.
- The cycle time counts down while the release is received.
- A new lubrication process starts when the cycle time ends.

B1L RUNNING
MONITOR 017 S

B1L RUNNING
HOLDT. 05 S

B1L FAULT
CYCLE 0030mi n

B1L IDLE
CYCLE 0030mi n

7. Description of controller functions (Fortsetzung)

7.7.4 Pressure monitoring

The pressure switch is evaluated as a factor of the *p-SWITCHES* setting specified in Level 3:

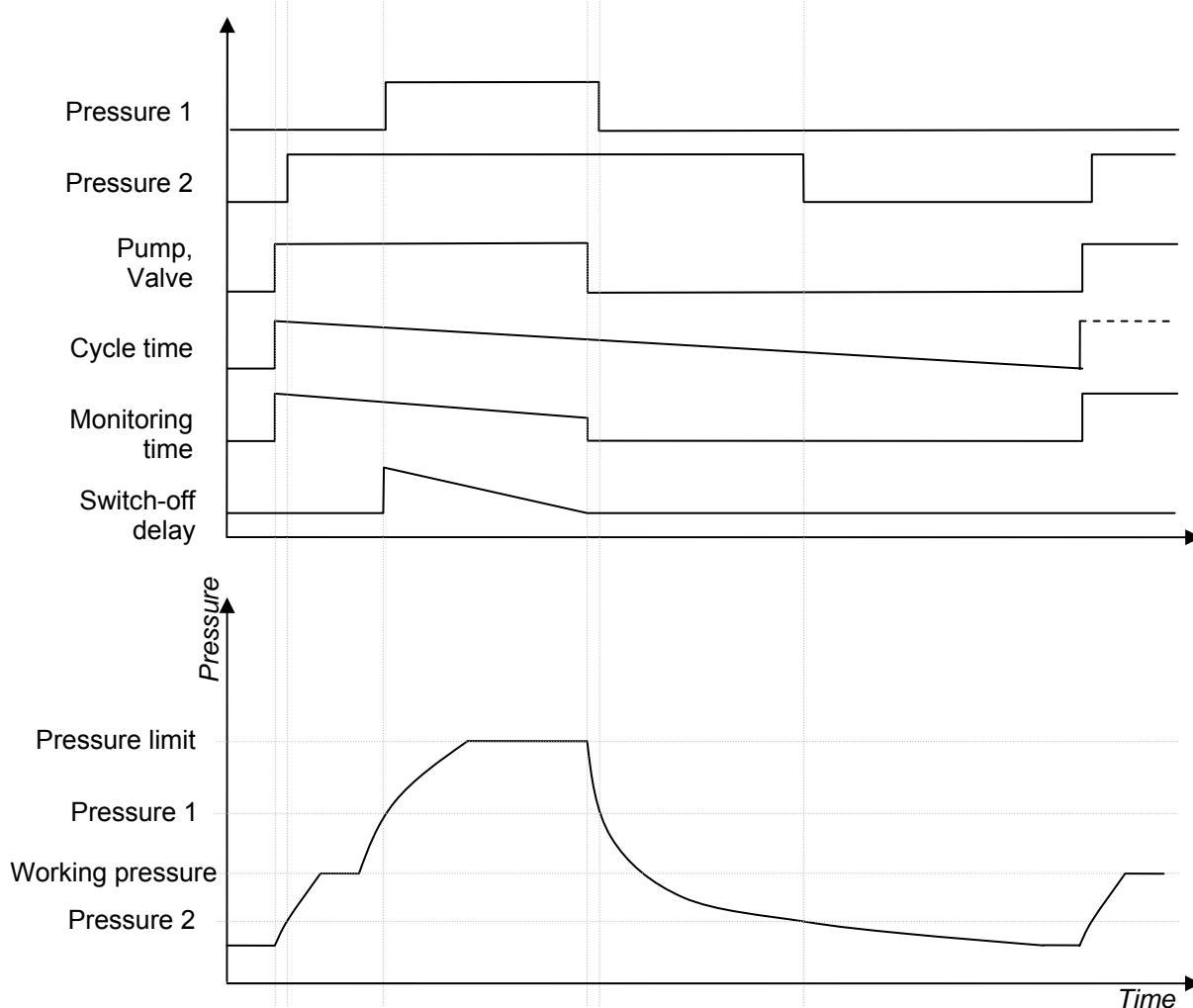
- 1 *p-SWITCHES* → at the end of the cycle time, that is the start of a new lubrication cycle, pressure switch 1 (**I4**) must be switched off, otherwise a fault message will be sent and the start of the lubrication cycle blocked.
- 2 *p-SWITCHES* → at the end of the cycle time, that is at the start of a new lubrication cycle, pressure switches 1 and 2 (**I4** and **I5**) must be switched off, otherwise a fault message will be sent and the start of the lubrication cycle blocked.

B1L FAULT
CYCLE 0030mi n

The above conditions also apply if a lubrication cycle (intermediate or prelubrication) is started independently of the cycling process.

7.7.5 Example

The diagram below shows lubrication with two pressure switch points, with the cycle time dependent on input **I1**. If there is only one pressure switch point, "Pressure 2" is omitted.



7. Description of controller functions (Fortsetzung)

7.8 PROGRESSIVE mode

7.8.1 Signals used

The following signals are used for the PROGRESSIVE operating mode:

Signal	Connection	Switch type
Release	Signal connector	NO contact
Divider monitor 1	Cable gland to I4	NO contact
Divider monitor 2	Cable gland to I5	NO contact
Switch on pump	Internal	NO contact
Ready/Fault	Signal connector	Changeover contact

7.8.2 Parameters

- Cycle time:** The period from one lubrication start to the next; the cycle can be specified in seconds, minutes and hours (s, min, h), in which case a timer operates until the release signal is received; if the signal is interrupted, the timer pauses and restarts at the same point the signal resumes. The cycle can also be specified in pulses (IMP); release signal pulses are then counted and a timer is not used.
- Monitoring time:** Monitors pump switch-on time; a countdown starts at switch-on; if the switch-off condition of the pump has not been satisfied at the end of the monitoring time, a fault message is sent and the pump switched off; unit is s or min.
- Cycles Divider 1:** The number of pulses at input I4; unit is always IMP; the pump is switched off again when the entered number of pulses has counted down.
- Cycles Divider 2:** The number of pulses at input I5; unit is always IMP; the pump is switched off again when the entered number of pulses has counted down (only with 2 monitored dividers).

7.8.3 Lubrication cycle process

- The pump is switched on; *Monitoring* and *Cycle* timers are started simultaneously.
- The pump supplies lubricant to the dividers (up to 2, 1 per pump element). The divider turns are counted via input I4 (and I5 if 2 dividers). The remaining monitoring time is displayed during this process.
- The pump is switched off as soon as all monitored distributors have completed the programmed number of cycles. *Monitoring* is reset and stopped. The fault message "Monitoring" is displayed if *Monitoring* terminates before all dividers have completed their turns.
- The cycle time counts down while the release is received. If overcount monitoring is on, any divider turns are counted.
- A new lubrication process starts when the cycle time ends.

BPR RUNNING
MONITOR 017 S

BPR FAULT
MONITOR 000 S

BPR IDLE
CYCLE 0030min

7.8.4 Overcount monitoring

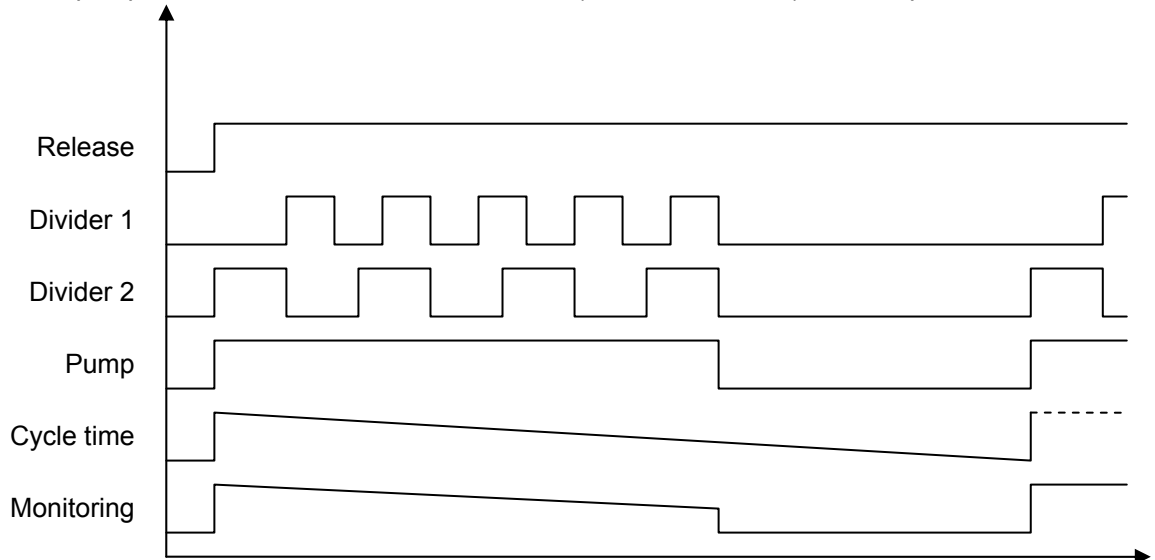
If overcount monitoring is on, any divider turns are counted during the pause. Up to 3 turns are permitted, but any further turns during the pause activate the fault message "DIVIDER OVERCNT".

BPR FAULT
CYCLE 0031min

7. Description of controller functions (Fortsetzung)

7.8.5 Example

The diagram below shows the process for a system with 2 monitored dividers. Both are programmed for 4 turns. The pump is switched off when the last divider (here, distributor 2) has completed its turns.



7.9 SPRAY LUBRICATION mode

7.9.1 Connections used

The following signals are used for the progressive operating mode:

Signal	Connection	Switch type
Release	Signal connector	NO contact
Divider monitoring	Cable gland to I4	NO contact
Pressure switch	Cable gland to I5	NO contact
Switch on pump	Internal	NO contact
Spray air valve	Cable gland to Q4	NO contact
Ready/Fault	Signal connector	Changeover contact

7.9.2 Parameters

- Cycle time:** The period from one lubrication start to the next; the cycle can be specified in seconds, minutes and hours (s, min, h), in which case a timer operates until the release signal is received; if the signal is interrupted, the timer pauses and restarts at the same point the signal resumes. The cycle can also be specified in pulses (IMP); release signal pulses are then counted and a timer is not used.
- Monitoring time:** Monitors pump switch-on time; a countdown starts at switch-on; if the switch-off condition of the pump has not been satisfied at the end of the monitoring time, a fault message is sent and the pump switched off; unit is s or min.
- Cycles Divider 1:** The number of pulses at input I4; unit is always IMP; the pump is switched off again when the entered number of pulses has counted down.
- Spray time:** The spraying duration; unit is always s; after the pump is switched off, output Q4 is switched on for the set period.

7. Description of controller functions (Fortsetzung)

7.9.3 Lubrication cycle process

- The pump is switched on; *Monitoring* and *Cycle* timers are started simultaneously.
- The pump supplies lubricant to the divider. The divider turns are counted via input **I4**. The remaining monitoring time is displayed during this process.
- The pump is switched off as soon as the divider has completed the programmed number of turns. *Monitoring* is reset and stopped. The fault message “*Monitoring*” is displayed if *Monitoring* terminates before the divider has completed its turns.
- The solenoid valve for spray air is switched on via output **Q4** for the duration of the *spraying time*. During this time, the pressure switch at input **I5** must switch and should not drop out before the end of the *spraying time*. On the other hand, the pressure switch should not change when the spray air is switched on. Both faults result in the fault message “no pressure”.
- The cycle time counts down while the release is received.
- A new lubrication process starts when the cycle time ends.

BSP RUNNING
MONI TOR 017 S

BSP FAULT
MONI TOR 000 S

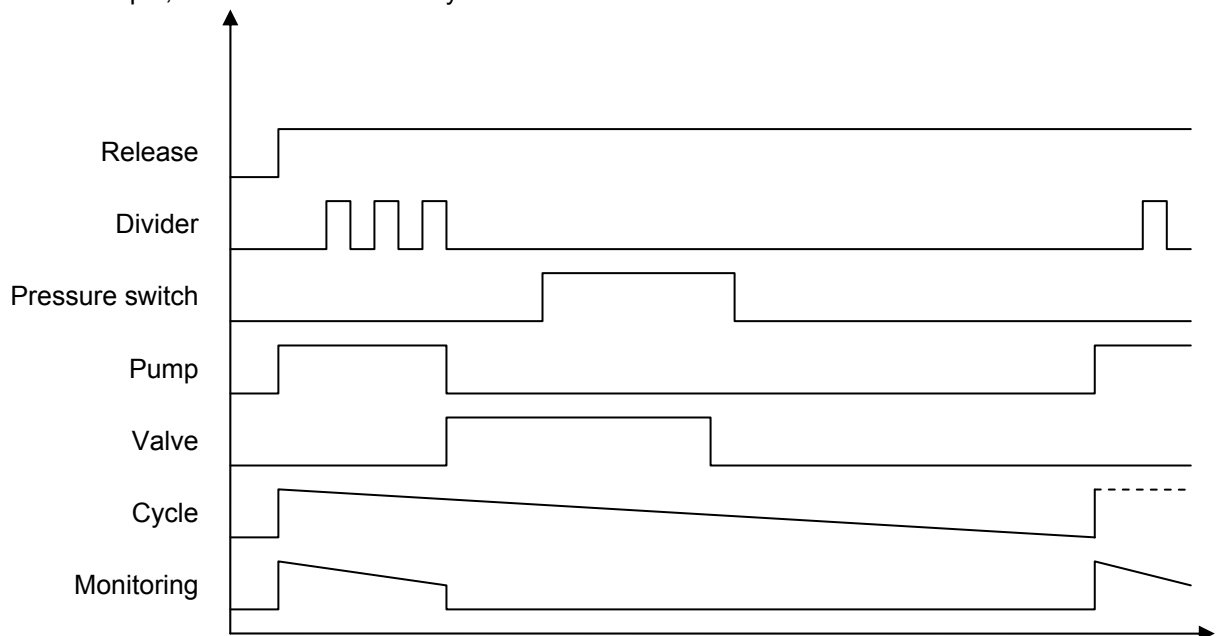
BSP SPRAYING
SPRAYT. 05 S

BSP FAULT
CYCLE 30mi n

BSP IDLE
CYCLE 30mi n

7.9.4 Example

In the example, the divider is set to 3 cycles.



7. Description of controller functions (Fortsetzung)

7.10 Mode SKYJET

7.10.1 Connections used

The following signals are used for the progressive operating mode:

Signal	Connection	Switch type
Release	Signal connector	NO contact
Flow monitor 1	Cable gland to I4 and I5	NO contact
Flow monitor 2	Cable gland to I6 and I7	NO contact
Pressure switch	Cable gland to I5	NO contact
Switch on pump	Internal	NO contact
Compressed air valve	Cable gland to Q4	NO contact
Ready/Fault	Signal connector	Changeover contact

7.10.2 Parameters

Cycle time: The period from one lubrication start to the next; the cycle can be specified in seconds, minutes and hours (s, min, h), in which case a timer operates until the release signal is received; if the signal is interrupted, the timer pauses and restarts at the same point the signal resumes. The cycle can also be specified in pulses (IMP); release signal pulses are then counted and a timer is not used.

Lube ON-time: Switch-on period for lubrication pump; the time can be specified in s, min or h.

Monitoring Time: monitors the air supply or the air flow; is started when pressure switch does not react or the air flow monitor(s) measure a deviation while the air valve is switched on; if the situation resets on its own while the monitoring time is not expired yet the timer is reset; if the timer expires completely an alarm message is created; lubrication will go on notwithstanding

7.10.3 Lubrication cycle process

- The pump is switched on; *ON-time* and *Cycle time* are started simultaneously and the air supply valve is switched on.
- The pump supplies lubricant.
- The pump is switched off as soon as the *ON-time* finishes.
- The cycle time counts down while the release is received.
- A new lubrication process starts when the cycle time ends.
- During the cycle described above the air supply is continuously monitored (either by pressure switch or flow monitor(s)); in case of a deviation from the set thresholds the monitoring time is started and displayed on the screen

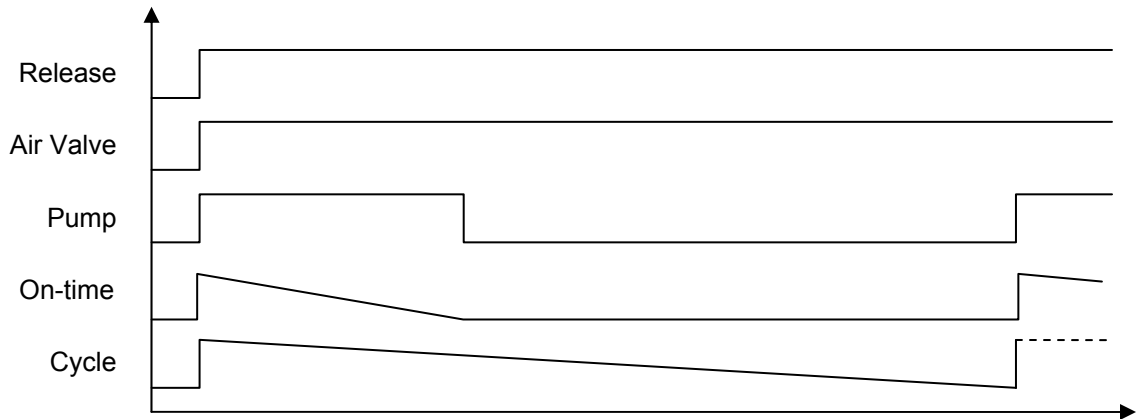
BSJ RUNNING
ON_TIME 0017 s

BSJ IDLE
CYCLE 0030min

BSJ IDLE
MONITOR 014 s

7. Description of controller functions (Fortsetzung)

7.10.4 Example



8. Reference data

8.1 Electrical connections

8.1.1 External connections

For information on the electrical plugs please refer to the pump's manual. All available versions are described there.

8.1.2 Internal connections

Depending on the type of lubrication system to be controlled, there can be several external electrical devices used, e.g. proximity switches, pressure switches, solenoid valves. In many cases these are pre-wired at delivery, especially if the devices are mounted on the pump itself or when the pump is delivered as part of a more complex unit.

Nevertheless there are cases when the wiring of the devices needs to be done by the customer. The following pictures show the connection of all devices used in the standard.

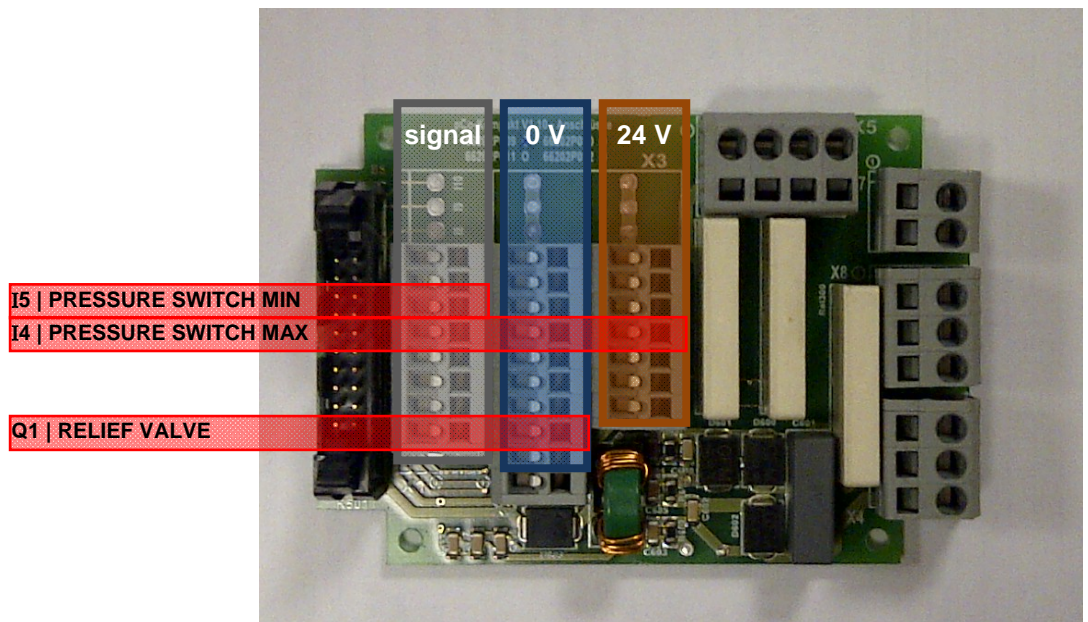
8.1.2.1 FIXED PERIOD mode

In this mode there are no external devices.

8.1.2.2 SINGLE LINE mode

Usually the external devices of a single line lubrication system are mounted directly on the pump and are pre-wired on delivery. Especially the solenoid valve and its valve block is part of the pump. The pressure switch however can be mounted separately at the far end of the lubrication system and then needs to be wired during installation. There are 2 versions:

- Pressure switch with 1 switching point: the switch is connected to the terminals labeled PRESSURE SWITCH MAX below
- Pressure switch with 2 switching points: the lower switching point signal is connected to the terminal labeled PRESSURE SWITCH MIN and the higher switching point to the terminal labeled PRESSURE SWITCH MAX below



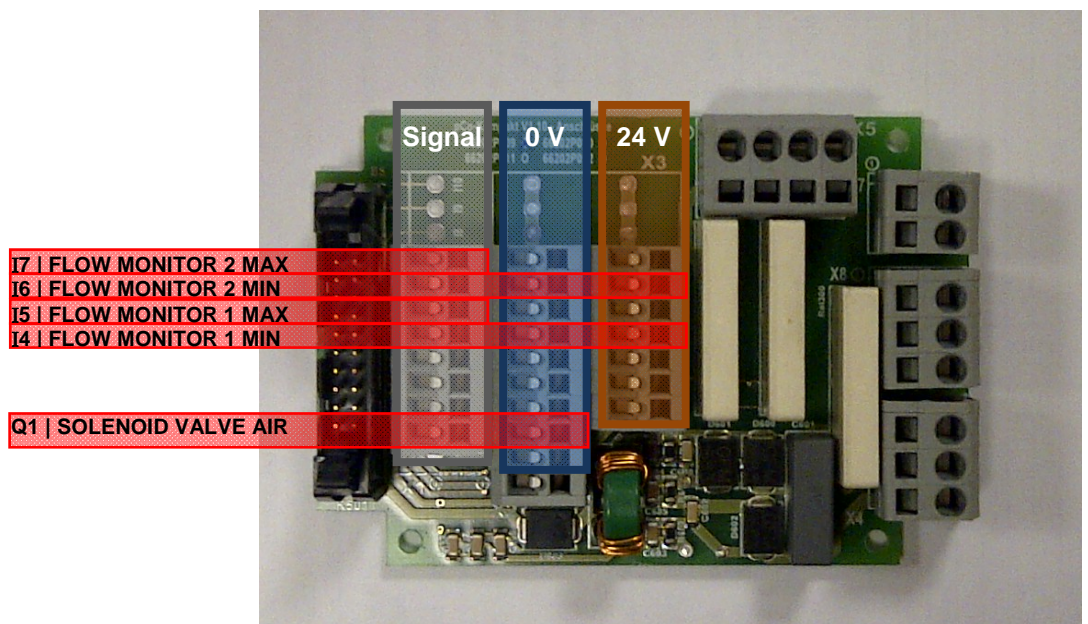
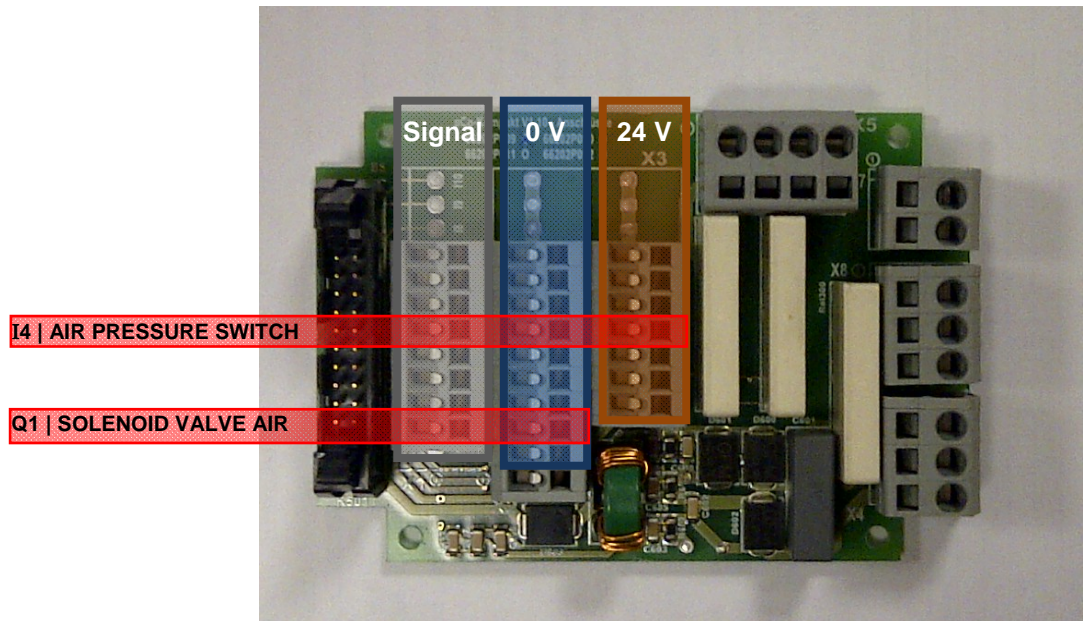
8. Reference data (Fortsetzung)

8.1.2.5 SKYJET mode

SKYJET system usually are delivered as complete systems with complete wiring. Yet in some cases the wiring may be done on installation.

SKYJET systems are available with the following monitoring functions

- Monitoring with pressure switch: the air supply is monitored only with the air pressure (see first picture)
- Monitoring with flow monitors: the air supply is checked by monitoring the air flow to the outlet directly; 1 or 2 outlets may be monitored, each one with a separate MIN and MAX switching point (see second picture)



8. Reference data (Fortsetzung)

8.2 Troubleshooting

Fault message	Fault description	Possible cause	Action
SIGNAL ERROR	Mode B1L: Pressure switch 1 has triggered before switch 2.	Signals transposed	Check signal assignment
		Pressure switch set wrongly	Check pressure switch setting
LEVEL EMPTY	All modes: lubricant container is empty	—	Fill container
PRESSURE RELIEF	Mode B1L: at least one pressure switch is triggered at start of lubrication cycle	Insufficient pressure relief in main line during pause	Check pressure rate during and after lubrication cycle
		Pressure switch set too low	Check pressure switch setting
		Relief time too short	Check relationship between lubrication duration and cycle time
OVERPRESSURE 1 and/or OVERPRESSURE 2	All modes: corresponding overpressure valve has triggered	Back pressure in lubrication system too high	Check lubrication system for possible causes
		Overpressure valve set too low	Check overpressure valve setting
NO PRESSURE	Mode B1L: Switch-off pressure not achieved	No back pressure in lubrication system	Check lubrication system for possible causes
		Pressure build-up too slow	Extend monitoring time
		Pressure switch set too high	Check pressure switch setting
	Mode BSP: Spray air pressure too low	Faulty compressed air supply	Check compressed air supply
		Pressure switch set too high	Check pressure switch setting
	Mode BSJ: Air pressure too low	Faulty compressed air supply	Check compressed air supply
		Pressure switch set too high	Check pressure switch setting
	Modes BPR and BSP: Divider turns not terminated on time	Faulty divider monitoring	Check monitor switch and connections
		Faulty lubrication system	Check lubrication system for possible causes

8. Reference data (Fortsetzung)

Fault message	Fault description	Possible cause	Action
DI VI DER OVERCNT	Mode BPR: one or more divider(s) did more than 3 turns during pause time	Faulty divider monitoring	Check monitor switch and connections
		Pump motor did not stop during pause time	Check function of pump motor
Q1 < MI N (Q2 < MI N)	Mode BSJ Air flow on Q1 (2) is too low	Faulty compressed air supply	Check compressed air supply
		Quick coupling not connected	Check quick coupling
		Flow monitor set too high	Check Flow monitor setting
Q1 > MAX (Q2 > MAX)	Mode BSJ Air flow on Q1 (2) is too high	Open end line or considerable leakage in Air-Oil line	Check Air-Oil line
		Flow monitor set too low	Check Flow monitor setting