

USER GUIDE

PCS 3000™ CONTROLLER

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BASIC OPERATIONS

Controller's Faceplate

Figure 1 shows the controller's faceplate with the power on/off switch, status display, and keypad.

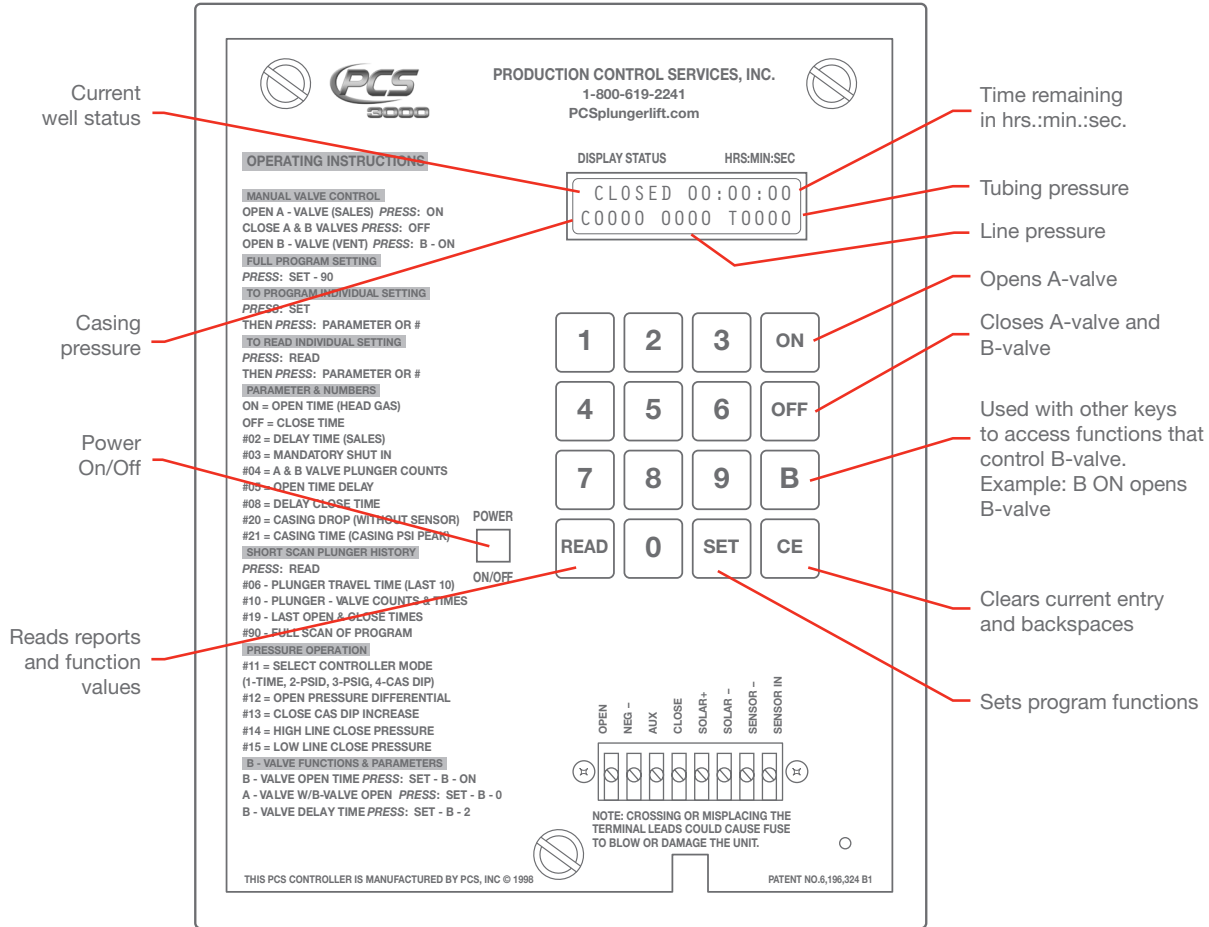


Figure 1 – Controller's Faceplate

Turning the Controller On and Off

To turn the PCS 3000 Controller on or off, insert a screw driver into the slot marked POWER ON/OFF. See Figure 1.

Move the toggle switch to the left to turn the controller on. Move the toggle switch to the right to turn the controller off.

The plunger program does not run while the controller is off. When you turn the controller on, it closes the A-valve and starts counting down the OPEN TIME DELAY (FALL TIME). See step 1 on page 7.

Status Display

After you turn the PCS 3000 Controller on, the status display remains on. The controller never sleeps.

The first line of the status display shows the currently running program function and the time remaining.

Example:

```
CLOSED 00:00:00
```

If all 3 transducers are used, the second line of the status display shows the casing pressure, line pressure, and tubing pressure.

Example:

```
C0315 0150 T0268
```

If a transducer is off, the second line of the status display does not show a pressure value for that transducer.

Example when the tubing transducer is off:

```
C0315      L0150
```

Units of Measurement

Time is in hours:minutes:seconds.

Example: 08:15:00

Pressure is in pounds per square inch (psi).

Example: 0100

Operating the A-Valve and B-Valve Manually

Open the A-Valve = ON

- Press ON.

ON overrides all programmed operation functions such as OPEN TIME DELAY (FALL TIME) and MANDATORY SHUT-IN TIME.

ON does **not** override safeguard functions such as LOW LINE CLOSE PRESSURE, HIGH LINE CLOSE PRESSURE, and FAST PLUNGER TIME.

Open the B-Valve = B ON

- Press B ON.

Close the A-Valve (and B-Valve if Used) = OFF

- Press OFF.

OFF overrides all programmed operation functions such as OPEN TIME and DELAY TIME (SALES).

Reading Reports and Program Functions

Read a Report or the Value of a Single Program Function

- 1 Press READ.

The status display shows:

```
READ :
```

- 2 Enter the number of the report or function you want to display. Example: 10.

Read the Values of All Program Functions = READ 90

For a list of the program functions, see “READ 90 Program Function List” on page 4.

Setting Program Functions

Set a Single Program Function

- 1 Press SET.

The status display shows:

```
SET :
```

- 2 Enter the number of the function you want to set. Example: 05.

- 3 Enter the value for the function. See “Units of Measurement” on this page.

To exit the function without changing its value, press CE.

Set All Program Functions = SET 90

For a list of the program functions, see “SET 90 Program Function List” on page 4.

REPORT AND PROGRAM FUNCTION REFERENCE

The tables in this section cross-reference the reports and program functions described in this *User Guide*.

Reports

Report	READ	Page
Software Version Report	CE	6
Battery Status Report	00	6
A-Valve and Plunger Counts History	04	5
B-Valve and Plunger Counts History	B4	5
Plunger Travel Time History	06	5
A-Valve Total Time Report	07	5
B-Valve Total Time Report	B7	5
Sensor Status	09	6
Valve/Plunger Counts History and Total Time Reports	10	5
Operating Mode Report	11	6
Last Time Open and Closed Report	19	6

Clearing Report Values

Program Function	SET	Display Name	Page
Clearing Report Values	10	ZERO ALL TOTALS	5

Program Functions

READ 90 Program Function List

Press READ 90 to display the current times and pressures programmed in all functions listed below except Sensor Operation (READ 09).

SET 90 Program Function List

Press SET 90 to program all functions listed below.

Program Function	SET or READ	Display Name	Page
OPEN TIME	ON	OPEN	9
CLOSE TIME	OFF	CLOSED	10
DELAY TIME (SALES)	02	A DELAY	12
MANDATORY SHUT-IN TIME	03	MAND-SI	9
B OPEN TIME	B ON	B OPEN	9
B DELAY TIME	B2	B DELAY	11
OPEN TIME DELAY (FALL TIME)	05	DEL-ON	9
DELAY CLOSE TIME	08	DEL-OFF	10
Sensor Operation	09	SENSOR?	9
Operating Mode	11	1-TIME 2-PSID 3-PSIG 4-CS-DIP	9
DIFFERENTIAL OPEN PRESSURE	12	ABS OPEN PRES.	9
DIFFERENTIAL CLOSE PRESSURE (DIP)	13	ABS CLOSE PRES.	10
HIGH LINE CLOSE PRESSURE	14	HIGH LINE PRES.	11
LOW LINE CLOSE PRESSURE	15	LOW LINE PRES.	11
CASING DROP PRESSURE	20	CASING DROP PRS.	11
CASING PEAK TIME and CASING RISE PRESSURE	21	CS TIME CASING RISE PRS.	10
DELAY HIGH LINE CLOSE TIME	22	L-DELAY	12

Additional Program Functions

To program these functions, press SET *parameter*.

To display their current values, press READ *parameter*.

Program Function	SET or READ	Display Name	Page
Status of A-Valve when B-Valve Is Open	B0	A OPEN W/ B VAL.	9
FAST PLUNGER TIME, FAST COUNT, and CRITICAL TIME	28	FAST-TM FAST COUNT CRITICAL-TM	12

Note: Some software versions do not have this function.

CONTROLLER REPORTS

Plunger Travel Time History = **READ 06**

This report provides information about the 10 most recent plunger travel times.

Use the READ button to scan through the report.

- PLT-0 A shows the most recent plunger run during OPEN TIME.
- PLT-1 A shows the 2nd most recent plunger run during OPEN TIME.
- PLT-9 A shows the 10th most recent plunger run during OPEN TIME.
- PLT-0 B shows the most recent plunger run during B OPEN TIME.
- PLT-0 C shows the most recent plunger run: the CASING DROP PRESSURE was reached before the plunger arrived.
- PLT-0 NO PLUNGER shows the most recent plunger run: the plunger did not surface.

The time shows how long the plunger took to surface.

Example: PLT-0 A 00:08:15

In this example, the plunger surfaced after 8 minutes and 15 seconds of OPEN TIME.

Valve/Plunger Counts History and Total

Time Reports = **READ 10**

This reporting option displays the 2 Valve and Plunger Counts Histories (READ 04 and READ B4) and the 2 Total Time Reports (READ 07 and READ B7). To display the next report, press READ.

A-Valve and Plunger Counts History = **READ 04**

This report shows how many times the A-valve opened, and how many times the plunger arrived while the A-valve was open.

Example:

A PLUNGER = 0092
A VALVE = 0096

In the example:

- A-VALVE = 0096 shows that the A-valve opened 96 times.
- A PLUNGER = 0092 shows that the plunger arrived 92 times while the A-valve was open.
- 96-92=4. The plunger did not arrive 4 times while the A-valve was open.

Note: If the well has a B-valve, this report shows 2 A-valve counts for each B-valve count in the B-Valve and Plunger Counts History. If the plunger did not arrive 4 times while the A-valve was open, the plunger may have arrived up to 2 times while the B-valve was open.

B-Valve and Plunger Counts History = **READ B4**

This report shows how many times the B-valve opened, and how many times the plunger arrived while the B-valve was open.

Example:

B PLUNGER = 0002
B VALVE = 0002

In the example:

- B VALVE = 0002 shows that the B-valve opened 2 times.
- B PLUNGER = 0002 shows that the plunger arrived 2 times while the B-valve was open.

A-Valve Total Time Report = **READ 07**

This report shows 2 times of up to 999 hrs., 59 min., 59 sec. accumulated since the report was last cleared:

- Total OPEN TIME and DELAY TIME (SALES).
- Total time that the controller was closed. MANDATORY SHUT-IN (if any), OPEN TIME DELAY (FALL TIME) (if any), and CLOSE TIME are accumulated under TOT CLS time.

Example:

A TOTAL016:31:13
TOT CLS008:12:45

B-Valve Total Time Report = **READ B7**

This report shows the total amount of B OPEN TIME accumulated since the report was last cleared, up to 999 hrs., 59 min., 59 sec.

Example:

B TOTAL001:24:32

Clearing Report Values = **SET 10**

The display shows:

ZERO ALL TOTALS
ON=YES OFF=NO

Press the ON button to clear all of the valve and plunger counts (READ 04 and READ B4) and total times (READ 07 and READ B7).

Note: Press the OFF button to exit the Clearing Report Values function without clearing any of the report values.

Last Time Open and Closed Report =  READ 19

This report provides information about the last time the A-valve was open, and the last time the A-valve was closed.

Example:

LST OP T00:20:00

LST CL D00:15:00

LST OP information shows:

- A letter that explains why the A-valve closed:
 - P = pressure input
 - S = switch gauge input
 - T = time ran out
- How long the A-valve was open. Time Open includes:
 - OPEN TIME
 - DELAY TIME (SALES)
 - DELAY CLOSE TIME (if any)
 Time Open does **not** include B OPEN TIME (if any).

LST CL information shows:

- A letter that explains why the A-valve opened:
 - C = casing peak pressure input
 - D = differential open pressure input
 - T = CLOSE TIME counted down to zero
- How long the A-valve was closed

Operating Mode Report =  READ 11

The controller's operating mode:

- TIME (mode 1)
- PSID (mode 2) – casing pressure minus tubing pressure differential
- PSIG (mode 3) – casing pressure (high PSI open, low PSI closed)
- CS-DIP (mode 4) – casing pressure minus sales line pressure differential

For more information, see “How Pressure Operation Works” on page 7.

Battery Status Report =  READ 00

This report displays BATTERY OK or BATTERY LOW.

Sensor Status =  READ 09

This report shows whether the sensor is ON or OFF.

Note: The sensor must be ON for the controller to act on the sensor input.

When using the Time operating mode, you can set the sensor to OFF. PCS recommends setting the sensor to off only if you are not running a plunger.

Software Version Report =  READ CE

This report displays the chip and software version numbers.

Example: VERSION 076-07

Note: Controller software version 186-01 supports the fast plunger time safeguard. For more information, see “Fast Plunger Time Safeguard” on page 12.

HOW PRESSURE OPERATION WORKS

When set to a pressure operating mode, the controller opens the A-valve based on the difference between 2 pressure values. The pressure values used are:

- Mode 1: Time only input (no pressure)
- Mode 2: Casing pressure minus tubing pressure
- Mode 3: Casing pressure (high PSI open, low PSI closed)
- Mode 4: Casing pressure minus sales line pressure

Note: When set to Mode 1 or time mode, the controller opens and closes the A-valve and B-valve based on time input. It does not respond to pressure input.

Here are the steps in the pressure operation cycle.

- 1 The controller closes the A-valve and counts down the OPEN TIME DELAY (FALL TIME) (SET 05). This gives the plunger time to fall to the bottom of the well. The status display shows CLOSED 00:00:00.

Note: CLOSE TIME is normally set to 00:00:00 because the controller opens the A-valve in response to changes in pressure.

- 2 While the A-valve is closed, the casing pressure and tubing pressure rise.
- 3 The controller monitors:
 - The casing pressure minus tubing pressure differential in Mode 2
 - The casing pressure (high PSI open, low PSI closed) in Mode 3
 - The casing pressure minus line pressure differential in Mode 4

The controller opens the A-valve when:

- The difference between the 2 pressures is equal to or greater than the DIFFERENTIAL OPEN PRESSURE (SET 12) value (see “DIFFERENTIAL OPEN PRESSURE” on page 9), **and**
- The OPEN TIME DELAY (FALL TIME) countdown has reached zero.

If the DIFFERENTIAL OPEN PRESSURE value is reached during the OPEN TIME DELAY (FALL TIME) countdown, the status display shows the OPEN TIME DELAY (FALL TIME) remaining.

Note: You can use any “open” function together with or in place of DIFFERENTIAL OPEN PRESSURE. After the OPEN TIME DELAY (FALL TIME) countdown has reached zero, the controller opens the A-valve as soon as it receives input from any “open” function. For more information, see “Features for Opening the A-Valve” on page 10.

- 4 The controller opens the A-valve and counts down the OPEN TIME (SET ON).
 - If the plunger arrives during the OPEN TIME countdown, the controller goes to step 6.
 - If the plunger does not arrive during the OPEN TIME countdown, the controller goes to step 5.
- 5 The controller opens the optional B-valve and counts down the B OPEN TIME (SET B ON).
 - If the plunger arrives during the B OPEN TIME countdown, the controller goes to step 6.
 - If the plunger does not arrive during OPEN TIME or B OPEN TIME, the controller closes the A-valve and B-valve and counts down the MANDATORY SHUT-IN TIME (SET 03). When this countdown reaches zero, the controller goes to step 4.

Note: If the well has liquid trailing behind the plunger, you may want to set B DELAY TIME. See “B DELAY TIME” on page 11 for more information.

- 6 The controller counts down the DELAY TIME (SALES) (SET 02) while monitoring the casing pressure.

Note: The DELAY TIME (SALES) does not reach zero during the sale of gas because the DIFFERENTIAL CLOSE PRESSURE (DIP) (SET 13) monitors casing pressure.

- 7 Casing pressure normally drops while the plunger rises. When the casing pressure starts to build, the controller monitors the increase in pressure. When the increase equals the DIFFERENTIAL CLOSE PRESSURE (DIP) value, the controller goes to step 8. Usually, a minimal increase in pressure, such as 1 or 2 psi, is desirable.
- 8 The controller counts down the DELAY CLOSE TIME (SET 08). When the DELAY CLOSE TIME countdown reaches zero, the controller checks the casing pressure again to see if it has still increased by the DIFFERENTIAL CLOSE PRESSURE (DIP) value.
 - If the increase is a brief spike in pressure, the controller continues the DELAY TIME (SALES) countdown. The controller goes back to step 7.
 - If the increase is an actual or solid pressure increase, the controller goes back to step 1.

CALIBRATING THE TRANSDUCERS

Pressure operation uses pressure transducers:

- Casing transducer (SET 16)
- Tubing transducer (SET 17)
- Sales line transducer (SET 18)

You must calibrate all pressure transducers being used.

Casing Transducer Calibration

- 1 Calibrate the casing transducer for the low pressure:
 - With transducer in place, remove pressure.
 - Press SET 16, ON, OFF, ON.
- 2 Calibrate the casing transducer for the high pressure:
 - Apply pressure to the transducer.
 - After applying pressure, measure with an accurate pressure gauge to obtain the pressure value for the next step.
 - Press SET 16, ON, ON, enter the pressure value.

For example: if the current casing pressure is 200 psi, enter 0200.

Tubing Transducer Calibration

- 1 Calibrate the tubing transducer for the low pressure:
 - With transducer in place, remove pressure.
 - Press SET 17, ON, OFF, ON.
- 2 Calibrate the tubing transducer for the high pressure:
 - Apply pressure to the transducer.
 - After applying pressure, measure with an accurate pressure gauge to obtain the pressure value for the next step.
 - Press SET 17, ON, ON, enter the pressure value.

For example: if the current tubing pressure is 200 psi, enter 0200.

Sales Line Transducer Calibration

- 1 Calibrate the sales line transducer for the low pressure:
 - With transducer in place, remove pressure.
 - Press SET 18, ON, OFF, ON.
- 2 Calibrate the sales line transducer for the high pressure:
 - Apply pressure to the transducer.
 - After applying pressure, measure with an accurate pressure gauge to obtain the pressure value for the next step.
 - Press SET 18, ON, ON, enter the pressure value.

For example: if the current sales line pressure is 50 psi, enter 0050.

Turn off a Transducer

If you are not using a transducer, you can turn it off.

- To turn off the casing transducer, press SET 16, OFF.
- To turn off the tubing transducer, press SET 17, OFF.
- To turn off the sales line transducer, press SET 18, OFF.

When a transducer is turned off, its pressure value no longer appears on the status display.

CREATING A PRESSURE-OPERATION PLUNGER PROGRAM

The fastest way to program the time and pressure functions is to press SET 90. See “SET 90 Program Function List” on page 4.

Pressure-Operation Selection Functions

Operating Mode = SET 11

Set the operating mode, which specifies the 2 pressures that the controller uses for the DIFFERENTIAL OPEN PRESSURE set point:

- Mode 2: casing pressure minus tubing pressure
- Mode 3: casing pressure (high PSI open, low PSI closed)
- Mode 4: casing pressure minus sales line pressure

Sensor Operation = SET 09

- Set SENSOR to ON.

Transducer Calibration = SET 16, SET 17, and SET 18

See “Calibrating the Transducers” on page 8.

Status of A-Valve when B-Valve Is Open = SET B 0

The controller works on wells that require the A-valve to be either open or closed when the B-valve is open.

- To keep A-valve open when B-valve is open, press ON.
- To close A-valve when B-valve is open, press OFF.

Pressure-Operation Control Functions

OPEN TIME DELAY (FALL TIME) = SET 05

OPEN TIME DELAY (FALL TIME) guarantees a minimum shut-in time for the plunger to fall to the bottom of the well.

DIFFERENTIAL OPEN PRESSURE = SET 12

DIFFERENTIAL OPEN PRESSURE is the pressure value that must be reached before the controller opens the A-valve. See step 3 on page 7.

The 2 pressures that determine the DIFFERENTIAL OPEN PRESSURE vary depending on the mode of operation:

- Mode 2, casing pressure minus tubing pressure
- Mode 3, casing pressure (high PSI open, low PSI closed)
- Mode 4, casing pressure minus sales line pressure

Choose an appropriate value for your well by adjusting the DIFFERENTIAL OPEN PRESSURE based on the plunger travel time. The optimal plunger speed is between 500 and 1000 feet per minute.

- If the plunger is running fast, lower the DIFFERENTIAL OPEN PRESSURE.
- If the plunger is running slow, increase the DIFFERENTIAL OPEN PRESSURE.

OPEN TIME = SET ON

OPEN TIME is when the well is first opened and gas is flowing through the A-valve (motor valve). During OPEN TIME, the plunger starts to surface and the well sells its initial head gas.

B OPEN TIME = SET B ON Optional

B OPEN TIME is after the well has sold its initial head gas, but the plunger has not arrived. During B OPEN TIME, the plunger surfaces with the liquid load it is carrying. Typically, gas during B OPEN TIME is vented to the low pressure side of the separator or to a tank.

If you are not using a B-valve, set B OPEN TIME to 00:00:00.

MANDATORY SHUT-IN TIME = SET 03 Optional

This time is used when a plunger does not surface. Usually, after the A-valve and B-valve are opened, but a plunger does not surface, a well likely needs more time to rebuild pressure for the next plunger attempt.

Set the MANDATORY SHUT-IN TIME to at least twice the time required to build enough pressure to surface the plunger. For example, if a well usually takes 2 hours to build enough pressure to surface the plunger, set MANDATORY SHUT-IN TIME to 4 hours or more.

Note: The MANDATORY SHUT-IN TIME must be greater than OPEN TIME DELAY (FALL TIME) and CLOSE TIME (if any). If the plunger does not surface, MANDATORY SHUT-IN TIME replaces OPEN TIME DELAY (FALL TIME). MANDATORY SHUT-IN TIME is not in addition to OPEN TIME DELAY (FALL TIME).

If you are not using MANDATORY SHUT-IN TIME, set it to 00:00:00.

DIFFERENTIAL CLOSE PRESSURE (DIP) =  SET 13

After the plunger surfaces, the casing pressure falls and then levels off. The casing pressure then starts to build as liquids accumulate at depth. The higher you set the DIFFERENTIAL CLOSE PRESSURE (DIP), the longer the well attempts to sell gas.

Example: During an operation cycle, the controller records the well's minimum casing pressure at 150 psi.

- If the DIFFERENTIAL CLOSE PRESSURE (DIP) is 3 psi, the controller stops the sale of gas and closes the well when the casing pressure rises to 153 psi.
- If the DIFFERENTIAL CLOSE PRESSURE (DIP) is 10 psi, the controller stops the sale of gas and closes the well when the casing pressure rises to 160 psi.

A good DIFFERENTIAL CLOSE PRESSURE (DIP) setting for many wells is 1, 2, or 3 psi.

The casing pressure flutters up and down as it falls. For example, the casing pressure may go: 160, 159, 160, 159, 158, 159, 158, 157, 158, 157, 156 psi. To keep the controller from closing the well too soon, use DIFFERENTIAL CLOSE PRESSURE (DIP) together with DELAY CLOSE TIME (see below).


Important! A good minimum DIFFERENTIAL CLOSE PRESSURE (DIP) is 1 psi. If you set the DIFFERENTIAL CLOSE PRESSURE (DIP) to 0 psi and the DELAY CLOSE TIME (see below) to 00:00:00, the controller closes the well as soon as the casing pressure flutters up. Because the casing pressure is still falling, the controller has closed the well too soon.

DELAY CLOSE TIME =  SET 08

This time ensures that the casing pressure increase is not a brief spike in pressure. During the level period before the casing pressure starts to build, the pressure may flutter up and down. The controller delays closing the A-valve to make sure that the casing pressure has not dropped again.

If you set DIFFERENTIAL CLOSE PRESSURE (DIP) to 1, 2, or 3 psi, set DELAY CLOSE TIME to 10, 20, or 30 seconds.

Important! Don't set the DELAY CLOSE TIME to 00:00:00. If you do, the controller may close the well too soon, while the casing pressure is still falling. A good minimum DELAY CLOSE TIME is 10-30 seconds.

Features for Opening the A-Valve**CLOSE TIME =  SET OFF**

CLOSE TIME is normally set to 00:00:00 because the controller opens the A-valve in response to changes in pressure.

If you want to open the A-valve after a period of time, regardless of pressure changes, you can set the CLOSE TIME. If you do program a CLOSE TIME, make sure to set the time no lower than your OPEN TIME DELAY (FALL TIME). This will ensure that the plunger has time to reach the bottom of the tubing before the controller opens the A-valve.

If the controller opens the well when the CLOSE TIME countdown reaches zero, you are using the controller to operate the well based on time instead of pressure.

CASING PEAK TIME and**CASING RISE PRESSURE =  SET 21**

CASING PEAK TIME is normally set to 99:00:00 when the feature is not used.

When you use this feature, the controller opens the A-valve after the casing pressure peaks. The controller monitors the casing pressure independently of the DIFFERENTIAL OPEN PRESSURE. The controller counts down the CASING PEAK TIME. It restarts the countdown whenever the casing pressure increases by the CASING RISE PRESSURE value.

For example, the CASING PEAK TIME is 10 minutes and the CASING RISE PRESSURE is 1 psi. When the A-valve closes, the controller counts down the CASING PEAK TIME. If the casing pressure builds 1 psi within 10 minutes, the controller restarts the CASING PEAK TIME countdown. If the casing pressure does not build 1 psi within 10 minutes, the controller counts down the CASING PEAK TIME to zero. It then checks the OPEN TIME DELAY (FALL TIME) countdown. It opens the A-valve when both the CASING PEAK TIME and OPEN TIME DELAY (FALL TIME) countdowns have reached zero.

Note: While the controller counts down the CASING PEAK TIME, the display shows CLOSED 00:00:00.

Typical CASING PEAK TIME values for a well with casing pressure that builds fast are 10-12 minutes. For a well with casing pressure that builds slowly, a typical value is 30 minutes.

Possible CASING RISE PRESSURE values range from 0-5 psi. Typical values for a fast-building well are 3 or 4 psi. Typical values for a slow-building well are 1 or 2 psi.

Note: You can use both DIFFERENTIAL OPEN PRESSURE and CASING PEAK TIME to control the well. If you want to use only CASING PEAK TIME to open the well, set the DIFFERENTIAL OPEN PRESSURE to a high value that will never be reached.

Features for Special Circumstances

CASING DROP PRESSURE = SET 20

CASING DROP PRESSURE is used in these situations:

- The wellhead configuration affects the plunger travel into the lubricator. The plunger arrives but the plunger arrival sensor can't sense the plunger arrival every time. Use CASING DROP PRESSURE as a backup.
- A well is intermitted without a plunger. CASING DROP PRESSURE allows the well to flow if it unloads.
- The plunger arrival sensor malfunctions, and the operator does not have an immediate replacement. Use CASING DROP PRESSURE as a temporary fix.

Note: If the arrival sensor malfunctions, the CASING DROP PRESSURE function prevents the B-valve from opening if the well is unloading. This may save wear and tear on the plunger.

If the casing pressure drops by the specified value, the controller starts the DELAY TIME (SALES) countdown even if it does not receive an input from the arrival sensor.

- 1 Note the casing pressure at the moment when the A-valve opens, for example, 400 psi.
- 2 Then note the casing pressure when the plunger surfaces, for example, 300 psi.
- 3 Set the CASING DROP PRESSURE to the difference between these 2 values (400 – 300 = 100). Add an additional 10-15 psi, for example, 115 psi.

The additional 10-15 psi makes sure that the plunger surfaces before the CASING DROP PRESSURE is reached. If the CASING DROP PRESSURE replicates a plunger arrival too closely, it may be reached before the plunger surfaces. The Plunger Travel Time History then shows a C when the CASING DROP PRESSURE is reached.

Example:
PLT-0 C 00:10:20

The C in the example above shows that the CASING DROP PRESSURE was reached after 10 minutes and 20 seconds of OPEN TIME (and B OPEN TIME, if any). The plunger did not surface during that time or the arrival sensor malfunctioned. Test the sensor. If it is OK, the CASING DROP PRESSURE may need to be increased.

If you are not using CASING DROP PRESSURE, set it to 0 psi.

B DELAY TIME = SET B2

B DELAY TIME is normally set to 00:00:00.

For those few wells that have liquid trailing behind the plunger, you may want to set a few seconds of B DELAY TIME to let the liquid clear out of the dump valve on the separator.

When the B DELAY TIME is set and when the plunger arrives during the B OPEN TIME countdown, the controller delays closing the B-valve by starting the B DELAY TIME countdown. When the countdown reaches zero, the controller closes the B-valve and starts the DELAY TIME (SALES) countdown.

Sales-Line Safeguard Features

LOW LINE CLOSE PRESSURE = SET 15

If the sales line pressure reaches this low value, the controller prevents the A-valve from opening and closes the A-valve if it is open. If you don't want the controller to monitor low sales line pressure, set LOW LINE CLOSE PRESSURE to 0 psi.

HIGH LINE CLOSE PRESSURE = SET 14

If the sales line pressure reaches this high value, the controller prevents the A-valve from opening and closes the A-valve if it is open. You can use HIGH LINE CLOSE PRESSURE to shut in the well when the line pressure increases to the point where the plunger will not surface.

Reopening the A-valve after high sales-line pressure is reached:

The controller prevents the A-valve from opening until the line pressure drops 15 psi below the HIGH LINE CLOSE PRESSURE. For example, if the HIGH LINE CLOSE PRESSURE is 300 psi, the controller prevents the A-valve from opening until the line pressure drops below 285 psi.

Venting: If the HIGH LINE CLOSE PRESSURE is reached during B OPEN TIME, which is used to vent the well, the controller does not close the B-valve.

DELAY HIGH LINE CLOSE TIME =  SET 22

If you are using HIGH LINE CLOSE PRESSURE, you can use DELAY HIGH LINE CLOSE TIME to keep the controller from shutting in the well if there is a brief spike in sales-line pressure. Brief spikes in pressure often occur when the controller opens the well after an extended shut-in period.

When the controller opens the A-valve, it does not monitor the sales line pressure during the DELAY HIGH LINE CLOSE TIME period.

Example:

- DELAY HIGH LINE CLOSE TIME is set at 6 minutes.
- When the controller opens the well and starts to count down the OPEN TIME, there is a 3 to 5 minute spike in line pressure.
- For the first 6 minutes of the OPEN TIME countdown, the controller does not shut in the well even if the HIGH-LINE CLOSE PRESSURE is reached.
- After 6 minutes, the controller shuts in the well if the high line condition still exists.

DELAY TIME (SALES) =  SET 02

DELAY TIME (SALES) sells gas through the A-valve after the plunger has arrived.

Set DELAY TIME (SALES) to the maximum time that you want to sell gas.

Example: A well normally sells gas for 5 hours. Set DELAY TIME (SALES) to 6 hours.


If you want to limit how long the well flows after a plunger arrival for any reason, program DELAY TIME (SALES).

Important! You **must** set the DELAY TIME (SALES).

The controller closes the A-valve in response to the first “close” input it receives: DIFFERENTIAL CLOSE PRESSURE (DIP) or DELAY TIME (SALES). If DELAY TIME (SALES) is 00:00:00, the controller closes the A-valve as soon as the plunger arrives. In pressure operation, you want the controller to close the A-valve in response to DIFFERENTIAL CLOSE PRESSURE (DIP).

Fast Plunger Time Safeguard

Important! Use the fast plunger time safeguard as an added safety precaution.

FAST PLUNGER TIME, FAST COUNT, and CRITICAL TIME =  SET 28

Note: Controller software version 186-01 supports the fast plunger time safeguard. Version 076-07 does not support the safeguard. To check your controller’s version number, see “Software Version Report” on page 6.

The controller uses FAST PLUNGER TIME, FAST COUNT, and CRITICAL TIME to shut in the well if the plunger runs too fast. After the controller shuts in the well, the status display shows TOO FAST SHUT-IN. To restart the plunger operation program, press ON or OFF.

ON opens the A-valve and counts down the OPEN TIME. See step 4 on page 7 (under “How Pressure Operation Works”).

OFF leaves the A-valve closed and counts down the OPEN TIME DELAY (FALL TIME). See step 1 on page 7 (under “How Pressure Operation Works”).

Tip! The recommended plunger travel speed is between 500 and 1000 feet per minute. Use these values to set the FAST PLUNGER TIME.

Example: For a 7000 foot well, a good plunger arrival time is 7-14 minutes. Continual high-speed plunger runs faster than 3000 ft/min can cause the PCS lubricator to fail. An extreme plunger run up a 7000 foot well takes 2 minutes and 20 seconds.

- Set the FAST PLUNGER TIME to 00:04:00.
- Set the FAST COUNT to 2. If the plunger has 2 consecutive travel times faster than 4 minutes, the controller shuts in the well.

Note: The maximum FAST COUNT is 8.

- Set the CRITICAL TIME to 00:02:30. If the plunger has any travel time faster than 2 minutes and 30 seconds, the controller shuts in the well.

USING PRESSURE OPERATION TO INTERMIT A WELL WITHOUT A PLUNGER

The fastest way to program the time and pressure functions is to press SET 90. See “SET 90 Program Function List” on page 4.

Pressure-Operation Selection Functions

Follow the plunger instructions for “Pressure-Operation Selection Functions” on page 9 to program these functions:

- Operating Mode = SET 11
- Sensor Operation = SET 09
- Transducer Calibration = SET 16, SET 17, and SET 18
- Status of A-Valve when B-Valve Is Open = SET B 0

Note: Make sure the SENSOR (SET 09) is ON. Don't turn it off.

Pressure-Operation Control Functions

OPEN TIME DELAY (FALL TIME) = SET 05

Set OPEN TIME DELAY (FALL TIME) to 00:00:00.

OPEN TIME DELAY (FALL TIME) is not needed because there is no plunger.

MANDATORY SHUT-IN TIME = SET 03

Set MANDATORY SHUT-IN TIME to 00:00:00.

MANDATORY SHUT-IN TIME is not needed because there is no plunger.

Other Functions

Follow the plunger instructions for “Pressure-Operation Control Functions” on page 9 to program these functions:

- DIFFERENTIAL OPEN PRESSURE = SET 12
- OPEN TIME = SET ON
- B OPEN TIME = SET B ON
- DIFFERENTIAL CLOSE PRESSURE (DIP) = SET 13
- DELAY CLOSE TIME = SET 08

Features for Opening the A-Valve

In addition to the basic functions for intermitting a well with pressure operation, you can use any of the features for opening the A-valve. For more information, see: “Features for Opening the A-Valve” on page 10.

Tip! CASING PEAK TIME works great in this situation. See “CASING PEAK TIME and CASING RISE PRESSURE” on page 10.

Features for Special Circumstances

CASING DROP PRESSURE = SET 20

Because the well does not have a plunger, the controller can't start the DELAY TIME (SALES) when the plunger surfaces during OPEN TIME or B OPEN TIME. Instead, the controller monitors the casing pressure. When the casing pressure drops by the CASING DROP PRESSURE value, the controller starts the DELAY TIME (SALES) countdown.

To specify the CASING DROP PRESSURE, follow these instructions.

- 1 Note the casing pressure at the moment when the A-valve opens. Example: A well, intermitting without a plunger into a 100 psi sales line and trying to produce 1 barrel of water each cycle, should have a beginning casing pressure near 400 psi.
- 2 Then note the casing pressure when the fluid hits surface. Example: 300 psi.
- 3 Set the CASING DROP PRESSURE to the difference between these 2 values. Example: 100 psi.

The Plunger Travel Time History shows a C when the CASING DROP PRESSURE is reached.

Example:

```
PLT-0 C 00:10:20
```

The C in the example above shows that the CASING DROP PRESSURE was reached after 10 minutes and 20 seconds of OPEN TIME (and B OPEN TIME, if any).

B DELAY TIME = SET B2

Set B DELAY TIME to 00:00:00.

B DELAY TIME is not needed because there is no plunger.

Sales-Line Safeguard Features

Follow the plunger instructions for “Sales-Line Safeguard Features” on page 11 to program these functions:

- LOW LINE CLOSE PRESSURE = SET 15
- HIGH LINE CLOSE PRESSURE = SET 14
- DELAY HIGH LINE CLOSE TIME = SET 22
- DELAY TIME (SALES) = SET 02

Fast Plunger Time Safeguard

The fast plunger time safeguard is not needed because there is no plunger.

TROUBLESHOOTING

If you have a problem with the controller, try these troubleshooting tips. If they don't solve the problem, call your PCS sales and service representative.

Controller Display Problems

Controller won't turn on or controller's display is blank

The controller never sleeps. The display should never be blank while the controller is on.

- 1 With a screwdriver, move the power switch to off (see page 3).
- 2 Wait a few seconds and then move the power switch back to on.

If the display remains blank, go to Test 1.

Test 1: Check fuse.

- 1 With a screwdriver, move the power switch to off.
- 2 Remove the controller's faceplate.
- 3 Remove the fuse from its yellow casing.
 - If the fuse is defective, replace it with a 5 amp, 250 volt fuse. The controller's box contains 1 extra fuse. When you are done, replace the controller's faceplate and move the power switch to on.
 - If the fuse is OK, go to Test 2.

Test 2: Check battery and wire connection.

The battery life is approximately 1 to 3 years.

The controller has a safety feature. If the battery voltage is low, the controller closes the motor valve and shuts in.

- 1 Check the battery voltage with a volt meter.
 - Replace the battery if it is below 6 volts.
- 2 Check the battery wire connection.
- 3 Replace the controller's faceplate.
- 4 With a screwdriver, move the power switch to on.
 - If the display is still blank, call your PCS sales and service representative.
- 5 If the controller's display is now working and if you replaced the battery, check the manufacture date on the battery. If the battery is less than 3 years old, check the solar panel. Go to Test 3.

Test 3: Check solar panel.

- 1 Disconnect the solar panel from the terminals. Use a volt meter to obtain the voltage and amperage. A good solar panel reading in full sun exposure is 10.7 volts and 350-430 mA.
- 2 If the solar panel is defective, change it.
- 3 Check the solar panel installation.
 - The solar panel should face south.
 - The tilt of the solar panel should be the latitude of the location plus 15 degrees. Example: if the latitude is 45 degrees, tilt the solar panel 60 degrees with respect to the horizon.
 - The element should be free from dirt, oil, and so on.
 - Check for cracks in the solar panel.
 - Check whether the solar panel is shaded during any part of the day. If it is, position it so it receives the most sunlight each day.
- 4 Check the solar panel wire connection.
- 5 Make sure the power switch is on. The controller's display should be on.
- 6 If the solar panel tests good, but the batteries are not lasting as long as they should, call your PCS sales and service representative.

Controller's display is scrambled

Static electricity may have made the controller lose its place in the program cycle.

- 1 Reset the controller: With a screwdriver, move the power switch to off (see page 3). Wait a few seconds and then move the power switch back to on.
- 2 If the display is still scrambled after this test, call your PCS sales and service representative.

Program Cycle Problems

Controller won't run program cycle or won't open motor valve

- 1 Check the status display. If it shows TOO FAST SHUT-IN, the plunger's travel time was too fast. Press ON or OFF to restart the plunger operation program.

Note: Some PCS 3000 Controllers do not have this feature. For more information, see "Fast Plunger Time Safeguard" on page 12.
- 2 Press READ 14 to check the HIGH LINE CLOSE PRESSURE. Make sure the pressure is set above the well's:
 - Expected casing peak pressure **and**
 - Normal high line pressure
- 3 Go to Test 1.

Test 1: Check transducer and transducer wire.

The controller's display must show values for the 2 pressures specified by the operating mode.

- 1 Check the transducers' calibration. If necessary, re-calibrate the transducers. See "Calibrating the Transducers" on page 8.
- 2 If a transducer won't hold the calibration:
 - Change the controller to Time Mode. Press SET 11 and enter 1.
 - Call your PCS sales and service representative.

Test 2: Check battery and wire connection.

The battery life is approximately 1 to 3 years.

The controller has a safety feature. If the battery voltage is low, the controller closes the motor valve and shuts in.

- 1 With a screwdriver, move the power switch to off (see page 3).
- 2 Remove the controller's faceplate.
- 3 Check the battery voltage with a volt meter. Replace the battery if it is below 6 volts.
- 4 Check the battery wire connection.
- 5 Replace the controller's faceplate.
- 6 With a screwdriver, move the power switch to on.
- 7 Check whether the controller is operating properly.
 - If the controller is now operating properly and if you replaced the battery, check the manufacture date on the battery. If the battery is less than 3 years old, check the solar panel. Go to Test 3.
 - If the controller still won't run the program cycle or open the motor valve, go to Test 4.

Test 3: Check solar panel.

- 1 Disconnect the solar panel from the terminals. Use a volt meter to obtain the voltage and amperage. A good solar panel reading in full sun exposure is 10.7 volts and 350-430 mA.
- 2 If the solar panel is defective, change it.
- 3 Check the solar panel installation.
 - The solar panel should face south.
 - The tilt of the solar panel should be the latitude of the location plus 15 degrees. Example: if the latitude is 45 degrees, tilt the solar panel 60 degrees with respect to the horizon.
 - The element should be free from dirt, oil, and so on.
 - Check for cracks in the solar panel.
 - Check whether the solar panel is shaded during any part of the day. If it is, position it so it receives the most sunlight each day.
- 4 Check the solar panel wire connection.
- 5 Make sure the power switch is on. The controller's display should be on.
- 6 If the solar panel tests good, but the batteries are not lasting as long as they should, call your PCS sales and service representative.

Test 4: Check solenoid (shift valve).

- 1 Press ON.
- 2 If the solenoid won't open, clean the supply hoses and puck inside the solenoid valve.
- 3 Retest.
- 4 If the supply hoses and puck inside the solenoid valve are good, replace the puck or the entire solenoid.

Test 5: Check gas supply pressure, filter, and regulator(s).

- 1 Check the gas supply pressure to the motor valve. The recommended supply pressure is 25-35 psi. If the pressure is too low or too high, it will not open the motor valve.
- 2 Check the filter and regulator(s) for debris and ice.
- 3 If the controller is still not working properly, call your PCS sales and service representative.

After CLOSE TIME has counted down to zero, controller goes directly to DELAY TIME (SALES)

- Press READ 06 to check the Plunger Travel Time History. If the display shows a few seconds of plunger travel time, such as PLT-0 A 00:00:03, the controller went through the opening and closing part of the program even though the plunger did not arrive.

Test 1: Check the sensor wire connections.

- 1 If a wire was spliced in because of the distance between the controller and the sensor, check the connection where the wire was spliced. The wire may be corroded and causing a short.
- 2 If the sensor wire connections are good, go to Test 2.

Test 2: Check controller by disconnecting the sensor.

- 1 At the terminal block on the front of the faceplate, disconnect the sensor from the Sensor IN and Sensor - terminals.
- 2 Press ON. The controller should count down the OPEN TIME.
 - If the controller goes from OPEN TIME to DELAY TIME (SALES), the controller's circuit board is not working properly. Call your PCS sales and service representative.
 - If the controller does not go to DELAY TIME (SALES), continue with the next step.
- 3 Use a wire to short the SENSOR IN and SENSOR - terminals. The controller is OK if it goes to DELAY TIME (SALES).
- 4 Reconnect the sensor to the terminals. Make sure the wires are put back in correctly.

Test 3: Check plunger.

- 1 Check whether the plunger is stuck in the lubricator.
- 2 If the plunger is not stuck in the lubricator, go to Test 4.

Test 4: Check the sensor.

- 1 Remove the sensor from the wellhead.
- 2 Press ON.
 - If the controller counts down the OPEN TIME, go to step 3.
 - If the controller goes straight into DELAY TIME (SALES), there is a short. Either the wire going to the controller is bad, or the sensor must be replaced. Go to step 5.
- 3 Hold the sensor in your hand, and move a steel wrench through the sensor band.
 - If the controller goes to DELAY TIME (SALES), the problem may be a wellhead electrical current.
 - Go to step 4.
- 4 Possible causes of a wellhead electrical problem:
 - The sensor or sensor wire may be defective, or
 - The well may need PCS newest style 2-coil sensor. This sensor is available in 2-wire or 3-wire connections.
- 5 Call your PCS sales and service representative.
Short-term fix for the sensor problem: Use the CASING DROP PRESSURE feature (see page 11).

Plunger has surfaced, but OPEN TIME does not go to DELAY TIME (SALES)

- Make sure sensor is turned on: Press READ 09. The controller's display should show SENSOR: ON.
 - If the display shows SENSOR: ON, go to Test 1.
 - If the display shows SENSOR: OFF, press SET 09 and then press ON. Go to Test 2, step 2.

Test 1: Check controller by disconnecting the sensor.

- 1 At the terminal block on the front of the faceplate, disconnect the sensor from the Sensor IN and Sensor - terminals.
- 2 Press ON. The controller should count down the OPEN TIME.
 - If the controller goes from OPEN TIME to DELAY TIME (SALES), the controller's circuit board is not working properly. Call your PCS sales and service representative.
 - If the controller does not go to DELAY TIME (SALES), continue with the next step.
- 3 Use a wire to short the SENSOR IN and SENSOR - terminals. The controller is OK if it goes to DELAY TIME (SALES).
- 4 Reconnect the sensor to the terminals. Make sure the wires are put back in correctly.

Test 2: Check sensor.

- 1 Press ON.
- 2 Run a steel wrench along the back of the sensor.
 - If the controller goes to DELAY TIME (SALES), the sensor is OK.
 - If the controller does not go to DELAY TIME (SALES), call your PCS sales and service representative.

Test 3: Check sensor alignment.

- 1 Realign the sensor by 90 degrees.
Example: If the sensor is aligned on the north or south side, realign it on the east or west side.
- 2 If realigning the sensor does not solve the problem, call your PCS sales and service representative.

Short-term fix for the sensor problem: Use the CASING DROP PRESSURE feature (see page 11).

Plunger has surfaced, but Plunger Travel Time History (READ 06) shows NO PLUNGER instead of a travel time

- Make sure sensor is turned on: Press READ 09. The controller's display should show SENSOR: ON.
 - If the display shows SENSOR: ON, go to Test 1.
 - If the display shows SENSOR: OFF, press SET 09 and then press ON. Go to Test 2, step 2.

Test 1: Check controller by disconnecting the sensor.

- 1 At the terminal block on the front of the faceplate, disconnect the sensor from the Sensor IN and Sensor - terminals.
- 2 Press ON. The controller should count down the OPEN TIME.
 - If the controller goes from OPEN TIME to DELAY TIME (SALES), the controller's circuit board is not working properly. Call your PCS sales and service representative.
 - If the controller does not go to DELAY TIME (SALES), continue with the next step.
- 3 Use a wire to short the SENSOR IN and SENSOR - terminals. The controller is OK if it goes to DELAY TIME (SALES).
- 4 Reconnect the sensor to the terminals. Make sure the wires are put back in correctly.

Test 2: Check sensor.

- 1 Press ON.
- 2 Run a steel wrench along the back of the sensor.
 - If the controller goes to DELAY TIME (SALES), the sensor is OK.
 - If the controller does not go to DELAY TIME (SALES), call your PCS sales and service representative.

Test 3: Check sensor alignment.

- 1 Realign the sensor by 90 degrees.
Example: If the sensor is aligned on the north or south side, realign it on the east or west side.
- 2 If realigning the sensor does not solve the problem, call your PCS sales and service representative.

Short-term fix for the sensor problem: Use the CASING DROP PRESSURE feature (see page 11).

Plunger has surfaced, but Plunger Travel Time History (READ 06) shows C instead of A or B

- Make sure sensor is turned on: Press READ 09. The controller's display should show SENSOR: ON.
 - If the display shows SENSOR: ON, go to Test 1.
 - If the display shows SENSOR: OFF, press SET 09 and then press ON. Go to Test 3, step 2.

Test 1: Check CASING DROP PRESSURE.

- 1 Press READ 20.
- 2 Make sure the CASING DROP PRESSURE is high enough that the plunger surfaces before the pressure is reached. For instructions, see page 11.
- 3 If the CASING DROP PRESSURE is set correctly, go to Test 2.

Test 2: Check controller by disconnecting the sensor.

- 1 At the terminal block on the front of the faceplate, disconnect the sensor from the Sensor IN and Sensor - terminals.
- 2 Press ON. The controller should count down the OPEN TIME.
 - If the controller goes from OPEN TIME to DELAY TIME (SALES), the controller's circuit board is not working properly. Call your PCS sales and service representative.
 - If the controller does not go to DELAY TIME (SALES), continue with the next step.
- 3 Use a wire to short the SENSOR IN and SENSOR - terminals. The controller is OK if it goes to DELAY TIME (SALES).
- 4 Reconnect the sensor to the terminals. Make sure the wires are put back in correctly.

Test 3: Check sensor.

- 1 Press ON.
- 2 Run a steel wrench along the back of the sensor.
 - If the controller goes to DELAY TIME (SALES), the sensor is OK.
 - If the controller does not go to DELAY TIME (SALES), call your PCS sales and service representative.

Test 4: Check sensor alignment.

- 1 Realign the sensor by 90 degrees.
Example: If the sensor is aligned on the north or south side, realign it on the east or west side.
- 2 If realigning the sensor does not solve the problem, call your PCS sales and service representative.

Short-term fix for the sensor problem: Use the CASING DROP PRESSURE feature (see page 11).

Solenoid (Shift Valve) Problems

Solenoid (shift valve) does not operate at any time or does not operate at night

If the solenoid does not operate at night, the solar panel may be powering the controller during the day.

Test 1: Check fuse.

- 1 With a screwdriver, move the power switch to off (see page 3).
- 2 Remove the controller's faceplate.
- 3 Remove the fuse from its yellow casing.
 - If the fuse is defective, replace it with a 5 amp, 250 volt fuse. The controller's box contains 1 extra fuse. When you are done, replace the controller's faceplate and move the power switch to on.
 - If the fuse is OK, go to Test 2.

Test 2: Check battery and wire connection.

The battery life is approximately 1 to 3 years.

The controller has a safety feature. If the battery voltage is low, the controller closes the motor valve and shuts in.

- 1 Check the battery voltage with a volt meter.
Replace the battery if it is below 6 volts.
- 2 Check the battery wire connection.
- 3 Replace the controller's faceplate.
- 4 With a screwdriver, move the power switch to on.
- 5 Check whether the solenoid is operating properly.
 - If the solenoid is now operating properly and if you replaced the battery, check the manufacture date on the battery. If the battery is less than 3 years old, check the solar panel. Go to Test 3.
 - If the solenoid still does not operate, go to Test 4.

Test 3: Check solar panel.

- 1 Disconnect the solar panel from the terminals. Use a volt meter to obtain the voltage and amperage. A good solar panel reading in full sun exposure is 10.7 volts and 350-430 mA.
- 2 If the solar panel is defective, change it.
- 3 Check the solar panel installation.
 - The solar panel should face south.
 - The tilt of the solar panel should be the latitude of the location plus 15 degrees. Example: if the latitude is 45 degrees, tilt the solar panel 60 degrees with respect to the horizon.
 - The element should be free from dirt, oil, and so on.
 - Check for cracks in the solar panel.
 - Check whether the solar panel is shaded during any part of the day. If it is, position it so it receives the most sunlight each day.
- 4 Check the solar panel wire connection.
- 5 Make sure the power switch is on. The controller's display should be on.
- 6 If the solar panel tests good, but the batteries are not lasting as long as they should, call your PCS sales and service representative.

Test 4: Check solenoid (shift valve).

- 1 Press ON.
- 2 If the solenoid won't open, clean the supply hoses and puck inside the solenoid valve.
- 3 Retest.
- 4 If they are good, replace the puck or the entire solenoid.

Transducer Problems**Display shows transducer reading of 0 psi**

The surge protector or transducer may be defective, or the transducer wire may have been completely cut.

- 1 Re-calibrate the transducer. See "Calibrating the Transducers" on page 8.
- 2 If the transducer won't hold the calibration, change the controller to Time Mode. Press SET 11 and enter 1.
- 3 Call your PCS sales and service representative.

Display shows fluctuating or false transducer reading

The transducer wire may be defective.

- 1 Re-calibrate the transducer. See "Calibrating the Transducers" on page 8.
- 2 If the transducer won't hold the calibration, change the controller to Time Mode. Press SET 11 and enter 1.
- 3 Call your PCS sales and service representative.

PREVENTIVE MAINTENANCE**Battery**

Always replace the controller's battery when it is 3 years old.

You can get more information about the PCS products at: ProductionControlServices.com



3771 Eureka Way
Frederick, CO 80516
1.800.619.2241

Warranty: Production Control Services, Inc. warrants all PCS manufactured equipment to be free of defects in material and workmanship for ONE YEAR from date of purchase by original buyer only. Warranty is completely void if abuse, neglect, misuse or misapplication is the cause of the malfunction. Determination of abuse or damage to be made solely by PCS.

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