



Solar Production Equipment Corp

PCC2 Injection Controller **User Guide**

www.solarproductionequipment.com



CLASS 1 DIV 2

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Overview

PCC2 Controller

The PCC2 controller is a programmable, cycled-time chemical injection pump controller capable of simultaneously controlling either one or two chemical injection pumps, each pump operating in its own independent injection profile. The PCC2 controller allows for local or remote control of the chemical injection pump (or pumps.) Remote control is accomplished by utilizing either RS-232 or RS-485 Modbus serial communication.

The PCC2 features three analog and two digital inputs to facilitate additional signal, monitoring, and control inputs. The PCC2 incorporates proprietary application firmware with an interface that is simple and easy to understand. Operators can control the PCC2 to set parameters that define specific injection profiles which consistently deliver very accurate chemical injection dosing.

Programming of the PCC2 controller is achieved by one of two methods:

1. Local Control – via the physical operator interface (composed of tactile push button keys and a compact fluorescent display interface located on the face of the controller.)
2. Remote Control – via Modbus communication link to a PC equipped with SPEC's PCC2 GUI or other software capable of communicating with the PCC2 by using a serial Modbus interface.

The PCC2 controller can operate either one or two chemical injection pumps simultaneously. Each pump is controlled individually and operates within its own fully configurable profile.

The PCC2 controller has three 4-20 mA analog input channels and 2 dry contact inputs that can be used for external inputs, control or measurement.

There are two serial port connections which allow the unit to communicate using either RS-485 or RS-232 serial communication mode. The PCC2 controller supports direct serial and Modbus communication using ASCII or RTU communication protocols.

The PCC2 controller must be calibrated before use to ensure accurate injection dosing. ***Note: System calibration can only be accomplished locally since a sight glass draw-down observation is required.***

Important Safety Information about the PCC2

WARNING – EXPLOSION HAZARD. DO NOT CONNECT OR DISCONNECT WHEN ENERGIZED. DO NOT REMOVE OR REPLACE FUSE WHEN ENERGIZED. Power as well as input and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods of CEC within Canada and in accordance with the local authority having jurisdiction.

Installation

Field Wiring

PCC2 controllers use pluggable screw termination style connectors for termination of field wiring. These connectors accommodate solid or stranded wires from 12 to 22 AWG. The connectors are removable, allowing replacement of the PCC2 controller without disturbing the field wiring. Leave enough slack in the field wiring for the connectors to be removed.

CAUTION: Disconnect power before servicing the unit!

There are 6 connectors for field wiring. Refer to *Figure 2* on page 7

- The communication port (COM) connects to one of two 3 pin removable connectors. One is configured for RS-232 and the other is configured for RS-485. Refer to *section 4.1: RS-232 / RS-485 Serial Communication Port* for pinout details and wiring.
- All other field wiring terminates in removable terminal connectors.

Power Supply

The PCC2 controller is powered from any 12 or 24 volt DC power source. Refer to specifications of this manual for the minimum and maximum operating voltages and actual power requirements.

- The PCC2 controller will shut down when the supply voltage is below the minimum recommended voltage.
- **Exceeding the maximum input voltage or applying a reverse voltage will blow the input power fuse.**

System Grounding

In most applications, it is desirable to ground the system by connecting the system power supply common to the chassis or panel ground. The negative side of the DC power input terminal, as well as all I/O point terminals labeled GND are connected to chassis ground.

Analog Inputs

There are three analog inputs available to the user. These analog inputs use an 8-bit analog to digital converter. The analog inputs are transient protected.

The analog inputs are identified as A1, A2, and A3.

The analog inputs support loop powered and self powered external devices.

Load Outputs

The PCC2 controller provides 2 outputs. Outputs are SSR-type sourcing outputs capable of 15A continuous or 20A at max 10% duty cycle and 70A peak.

The positive sides of the loads (Pump) connect to the output + terminals on the controller.

The negative side of the loads (pumps) connects to the negative of the DC bus.

Inductive load transient suppression is built into each digital output point

Digital Inputs

The PCC2 controller provides 2 digital inputs. The inputs are for use with dry contacts such as switches and relay contacts. The PCC2 controller can provide the source voltage (**loop power**) for the contacts.

The digital inputs can be configured to be either a normally open (NO) or normally closed (NC) dry contact. Default condition is normally open.

Digital input 1 (HEX version 183) is configured to operate with an ESD loop or motor stop. Activation of the input will halt the program cycle. The program will begin again where it was halted once the condition is released.

Digital input 2 (HEX version 183) is configured to monitor the chemical tank level switch. Activation of the switch will set a flag in the Modbus register that can be remotely monitored by the PCC2 controller user interface or an RTU system.

Maintenance

The PCC2 controller requires no maintenance.

If the PCC2 controller is not functioning correctly, contact SPEC Technical Support for information on acquiring an RMA number and failure report in order to return the PCC2 controller for inspection and repair.

ALL RETURNS MUST BE ACCOMPANIED BY A FULLY COMPLETED RMA

ANY SHIPMENT RECEIVED WITHOUT THE RMA NUMBER CLEARLY MARKED WILL BE REFUSED AT THE DOOR.

Warning: Do not connect or disconnect any field wiring, including the wiring to the COM port, unless the power is off or the area is known to be non-hazardous.

Fuses

A single 0.5 Amp fast-blow fuse protects the power supply. The fuse is mounted under the cover.

When the controller's internal power supply fuse is blown, a red indicator light at the bottom right hand corner of the controller face plate will turn on.

CAUTION: Do not remove or replace fuse unless the power is off or the area is known to be non-hazardous

Always replace a defective fuse with a fuse of the same type and rating. Under no circumstances should a fuse be bypassed or replaced with a fuse of a higher rating.

CAUTION: to maintain area rating use only porcelain or sand filled fuses

In all cases investigate and address the cause of the fuse failure before replacement. Common causes of fuse failure are reversed power supply polarity, incorrect polarity on inputs and excessive input voltages.

Fuse replacement procedure.

1. Disconnect power, and disconnect all of the outer orange quick connect terminal blocks from the controller. Remove the four screws from the back of the controller case.
2. Separate the controller case cover from the back plate
3. Carefully remove the printed circuit board from the back plate.
4. The fuse is located on the front of the board in the lower right hand corner.
5. Replace the fuse with a ceramic or sand filled fuse of the specified rating.
6. Reassemble, mount and reconnect the terminal block assemblies to return the unit to service

Pump power fuses - Use "Mersen ATM 15" external midget fuses for P1+ & P2+ circuit protection.

PCC2 Specifications

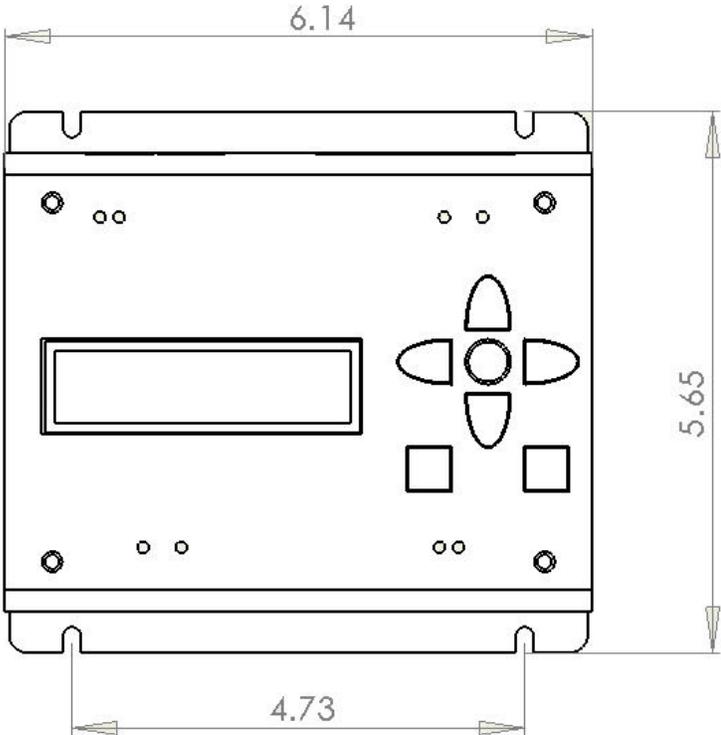


Figure 1: Front plate view (measurements in inches)

General

I/O Terminations	Pluggable terminal blocks. 12 to 22 AWG 15A contacts
Dimensions (LxWxD) (inch)	6.1 x 5.6 x 1
Weight (lb)	1
Packaging	Steel with blue powder coat
Environment	5% RH to 95% RH, non-condensing –40 °C to 60 °C

Communications

Communication Port (COM)	RS-485 serial port or RS-232-compatible serial port
Baud	2400, 9600, 28800 Default: 9600
Parity	Even, Odd, None (RS-485)
Word Length	7 bits
Stop Bit	1 bit
Isolation	Common ground return connected to Chassis Ground.
Cable Length	RS-232 –maximum 3 m RS-485 –maximum 1200 m
Protocol	Modbus ASCII , Modbus RTU

Analog Inputs

Input Points	3 - 4/20 mA
Accuracy	±1% of full scale at 25 °C (77 °F)
Isolation	Analog common side connected to Chassis ground
Response Time	0.8 s typical for 10% to 90% signal change

Digital Inputs/Outputs (2)

Output Rating	Please consult factory
Input Rating	Dry contact input.

Approvals and Certifications

Safety	Class I, Division 2 Groups C and D T3 Hazardous Locations.
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Controller Features and Operation

Local operator interface

The PCC2 controller utilizes a vacuum fluorescent visual display coupled with a key pad consisting of four arrow-shaped navigation keys surrounding a round-shaped **ENTER** key to highlight, select, or enter desired parameters.

Navigation Keys and push buttons

- *Navigation keys:* Use the arrow shape navigation keys to move the in-screen cursor to the desired input selection or input parameter. Once a parameter is highlighted the up and down arrow keys are used to change parameters to the desired value.
- *Enter key:* Use the round enter key located in the middle of the four directional keys to select desired input parameter or value that the cursor is identifying (the value being identified is highlighted).
- *P1 and P2 pushbuttons:* Pump one and pump two can be turned on or off at any time by pressing the appropriate square key (labeled *P1* or *P2*) located on the face of the controller directly below the navigation and enter keys.

Indicator lights

There are 8 indicator lights on the face of the controller:

- **Output 1:** Lights up when the output FET is in the closed position providing power to the *P1* output terminal. This means that Pump 1 is running.
- **Output 2:** Lights up when the output FET is in the closed position providing power to the *P2* output terminal This means that Pump 2 is running.
- **Power:** Lights up when power is supplied to the PCC2 controller.
- **Fuse:** Lights up when the unit's internal power supply circuit protection fuse is opened (blown).
- **RX:** Lights up when the unit is receiving data.
- **TX:** Lights up when the unit is transmitting data.
- **D1:** Lights up when the digital contact *D1* changes state.
- **D1:** Lights up when the digital contact *D2* changes state.

Programming notes

The PCC2 controller supports several functions. These functions can be accessed using the navigation keys to move the cursor in the gas fluorescent display to the desired selection, function or controller input parameter. Pressing the enter key will select the highlighted function, value or parameter.

To change the value of the select parameter (highlighted by the cursor) use the up and down directional keys.

When you are satisfied with the value displayed pressing enter will commit the setting displayed to memory.

Controller Interface

Navigating the Controller

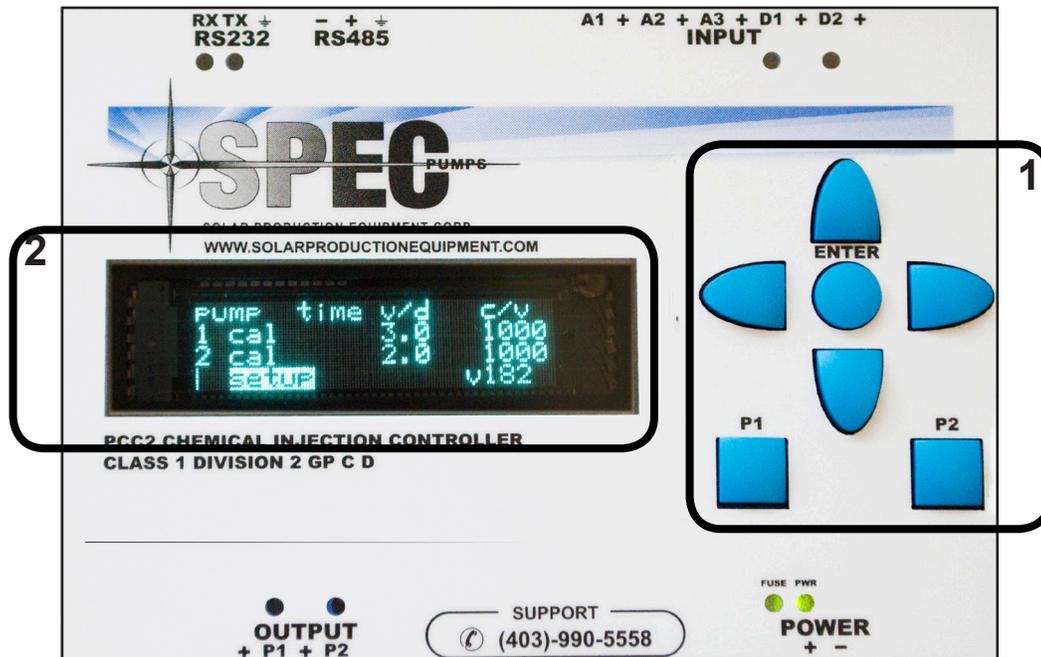


Figure 3: Front page controls

The PPC2 interface is composed of:

1. seven push buttons
2. the display window

The interface is designed to guide the user through most procedures: instructions are often displayed on the screen.

The **up**, **down**, **right**, and **left** buttons are used to navigate through the menu

The **Enter** button is used to select menu options, for example to enter setup or to set a value

The **P1** and **P2** buttons are used to control (turn on or turn off) pump 1 and pump 2 respectively.

Note: The **ENTER** button is often referred to as the **OK** button in the display prompts

PCC2 Display

```
Initializing....
```

```
SPEC Pumps
```

Pump	time	v/d	c/v
1	cal	3.0	1000
2	cal	2.0	1000
Setup		v182	

```
!*EXIT*!
```

```
cycle time p1      6000sec
cycle time p2      6450sec
# of pumps         2
```

```
!*EXIT*!
```

```
cycle time p1      6000sec
cycle time p2      6450sec
# of pumps         2
```

Initialization Screen:

When the controller is first turned on it will need a few moments to initialize. During this time, this initialization screen will be displayed.

Primary Information Screen:

After the controller finishes initialization, it will display the information screen, which summarizes important information about the controller.

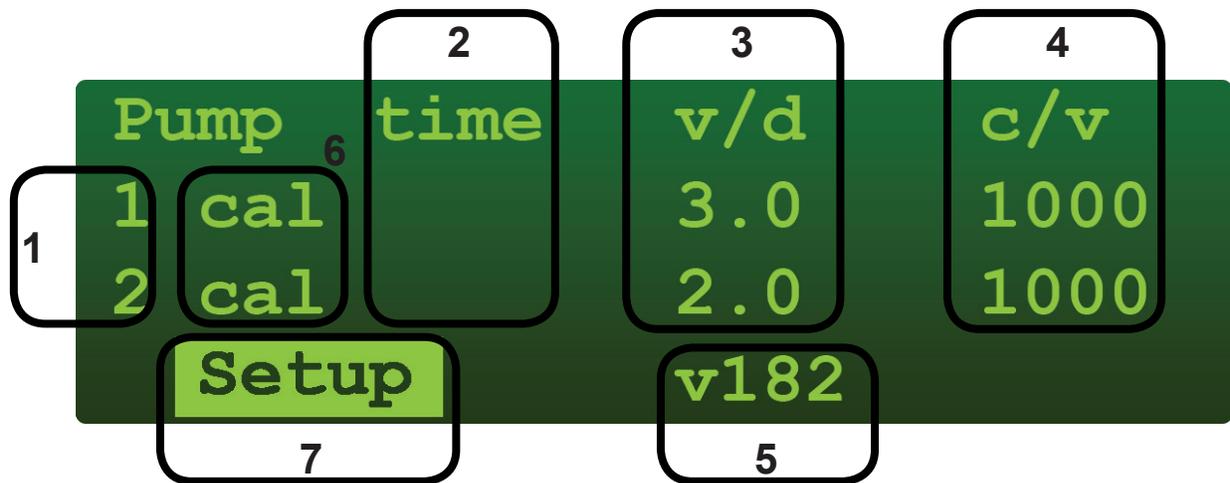
Setup screen:

The set up screen facilitates access to all control parameters that may be configured.

Setup screen (option selected):

In the set up screen, use the up and down arrow keys to navigate the cursor to highlight the menu item that you want to configure. Press **Enter** to select the highlighted menu item and then follow the on screen prompts.

The primary Information Screen



The primary information screen provides the operator with the following information:

1. The number of pumps that the unit is controlling - one or two
2. Whether or not each of the pumps individual cycle controller channels are active (if the channel is active the time counter to the right of the indicated pump will be counting down).
3. v/d (Volume per day) - indicates the volume per day that the pump is set to deliver against the calibrated volume delivery rate. (See calibration)
4. c/v (Calibrated volume) –indicates the specified volume the pump would deliver in one 24 hour period against the pressure that the pump was calibrated at. (See calibration)
5. v (Version of the controller’s firmware) - indicates the version of firmware that is loaded into the controller as the operational program.
6. cal - (Calibrate) – selecting this option for either pump will move you into the calibration screen for the pump displayed.
7. SET UP – selecting SET UP will move you to the set up screen for the controller.

Setup Screen

```

      !*EXIT*!
cycle time p1      6000sec
cycle time p2      6450sec
# of pumps         2
  
```

The setup screen allows you to configure the controller as required in accordance with the site conditions, equipment utilized and your individual operational preferences.

In the set up screen use the blue directional arrows of the keypad to navigate the cursor in the display through the set up menu. Press enter to select the highlighted menu item you wish to configure.

The menu items are:

- **cycle time p1:** Displays the total cycle time (including both the *on* and *off* periods in the cycle) for pump #1. This value is calculated automatically based on the stipulated volume against the calibrated volume. This value is **read only** and cannot be changed.
- **cycle time p2:** Displays the total cycle time (including both the *on* and *off* periods in the cycle) for pump #2. This value is calculated automatically based on the stipulated volume against the calibrated volume. This value is **read only** and cannot be changed.
- **# of pumps** – Use this to configure the controller for either one or two pumps.

Press either the up or down keys to change the desired number of pumps to be controlled (one or two). Press enter to select the displayed number and exit back to the menu.

- **cal time P1** – Use this to set the calibration cycle run time for Pump 1. The calibration run time is the time in seconds that the pump will run to facilitate the viewing of a drawdown of the appropriate isolated sight glass.

The calibration time is defaulted to 3 seconds at the factory. You may require more or less run time depending on the pressure you are injecting into and the amount of fluid you have in the sight glass.

Rule of thumb: For a specific amount of fluid available in a sight glass (dependent on the liquid level in the tank):

- The higher the pressure you are calibrating the pumping against the greater the allowable time you have to view the drawdown of the sight glass.
- The lower the amount of fluid available to view in the sight glass the shorter the allowable runtime you have before sucking the sight glass dry

- **cal time P2** – Same as above but for pump 2
- **sw1 (ESD)** - use this to configure the #1 digital input to either normally open (NO) or normally closed (NC) state. Press either the up or down navigational key to change the “normal” state. Press enter to select and exit back to menu.
- **sw2 (Low tank)** - use this to configure the #2 digital input to either normally open (NO) or normally closed (NC) state. Press either the up or down navigational key to change the “normal” state. Press enter to select and exit back to menu.
- **Address** This is the address ID of the controller when used in a RS-485 set up. It is defaulted to 191 at the factory.

Warning: do not change this address without thorough documentation. If you lose or forget the address you have entered the controller may not be accessed. This is a non recoverable situation and the controller will have to be reprogrammed at the factory.

- **supply voltage:** Displays the current DC bus voltage being supplied to the controller. This value is **read only** and cannot be changed.
- **Analog 1** – This is a read out of the scaled analog 1 parameter.
- **Scale** - displays the scale range that Analog 1 reflects. To configure the scale settings navigate the cursor to highlight the “scale” menu item and press enter. In the “scaling analog1” menu navigate the cursor to the desired parameter and then press the up or down key to adjust the value. Press enter to commit the value to memory.

Example: if you want Analog 1 to display temperature from a temperature transmitter that is scaled from -40 °C to +60 °C, where: L: -40 °C (4 mA), H: +60 °C (20mA)

- **Analog 2** – This is a read out only of the analog 2 parameter (scaled).
- **Scale:** This displays the Analog 2 parameter scale setting. To configure the scale settings navigate the cursor to the “scale” menu item and press enter. In the “scaling analog 2” menu navigate the cursor to the desired parameter and then press the up or down key to adjust the value. Press enter to commit the value to memory.
- **Analog 3** – This is a read out only of the analog 3 parameter (scaled).
- **Scale:** This displays the Analog 3 parameter scale setting. To configure the scale settings navigate the cursor to the “scale” menu item and press enter. In the “scaling analog 3” menu navigate the cursor to the desired parameter and then press the up or down key to adjust the value. Press enter to commit the value to memory.
- **current out 1:** this is a read out of the controller’s current output to P1 at existing load and it is not configurable.
- **current out 2:** this is a read out of the controller’s current output to P2 at existing load and it is not configurable.

- **hour meter 1:** The hour meter gives you the total run time of Pump 1 since the last reset. To access the runtime resets press enter. Use the up or down arrow keys to reset the run time to 0. Press enter to exit. **Note:** Resetting the total runtime will affect the totalized volume calculation for P1.
- **hour meter 2:** the hour meter gives you the total run time of the pump 2 since the last reset. To access the runtime resets press enter. Use the up or down arrow keys to reset the run time to 0. Press enter to exit. **Note:** Resetting the total runtime will affect the totalized volume calculation for P2.
- **volume total 1:** This is a read out of the mathematically calculated total volume pumped by P1 at the “calibrated rate” since the last reset of either the run time or volume total.

CAUTION: Volume total is not a measured function!

The volume total is mathematically calculated utilizing the calibration input (fluid over time) and the run time of the motor.

- **volume total 2:** This is a read out of the mathematically calculated total volume pumped by P2 at the “calibrated rate” since the last reset of either the run time or volume total.

CAUTION - Volume is not a measured function!

The volume total is mathematically calculated utilizing the calibration input (fluid over time) and the run time of the motor.

- **reset defaults:** This function is used to restore the controller to the factory setting out of the box. Using the navigation keys highlight the selection and then press enter. Use the up or down key to reset ALL parameters to the factory presets. Press enter to commit setting to memory and exit.
- **baud rate:** Parameter for the serial communication link. Use this to change the baud rate of the COM port for RS-485 or RS-232 communication. Default value of baud rate is 9600.
- **parity:** Parameter for the serial communication link. Use this to change the parity setting of the COM port for RS-485 or RS-232 communication. Parity can be set to Even, Odd, or None
- **modbus mode:** Parameter for the serial communication link. Use this to change the the operational mode of the Modbus interface. Available modes are RTU and ASCII
- **min run time:** Allows the operator to configure the minimum time the pump will run during each individual cycle. The controller will override this input if it is mathematically incorrect with respect to the stipulated volume.
- **max cycles/min:** Allows the operator to adjust the number of cycles that the pump will turn on/off in a given minute. The value can be changed from the default value of 1 up to 4 cycles per minute. The controller will override this input if it is mathematically incorrect with respect to the stipulated volume.

Using the PCC2 Interface

Note: Programming the PCC2 controller for 1 or 2 pump operation is identical. The programming sequence for a dual pump configuration is described in detail below. If you require control for only one pump, first configure the controller for single pump operation in the set up menu and then program as required.

Dual Pump Configuration

Initial Configuration

1. Power up the controller
2. The display will briefly flash the initialization screen (see the diagram on the left)
3. After the initialization screen, the display will default to the primary information screen.
4. If the controller is being started for the first time, move the cursor to highlight **SETUP** on the bottom of the screen and press **ENTER** in order to access the setup menu and set the parameters of the controller to correct values. If the controller is already set, skip ahead to the next section (Calibration).
5. Use the arrow keys to move the cursor up and down the list of menu items. Highlight the first displayed menu item in sequence, and use the enter button to select the highlighted item. Once selected, follow the on screen instructions to set the value of the parameter. When the parameter is set to your liking press enter to commit to memory and exit.
6. Repeat step **#5** for each menu item until all settings have correct values.

Initializing....

SPEC Pumps

Step #2: Initialization screen

Pump	time	v/d	c/v
1	cal	3.0	1000
2	cal	2.0	1000
	Setup	v182	

Step #3: Primary information screen

```

!*EXIT*!
cycle time p1      6000sec
cycle time p2      6450sec
# of pumps         2
    
```

Step #5: Setup Menu

```

!*EXIT*!
cycle time p1      6000sec
cycle time p2      6450sec
# of pumps         2
    
```

Step #6: Setup menu

Calibration

You must first prime the pump or pumps prior to attempting to calibrate or running any pump. The inlet tubing must be configured so as to achieve a “flooded suction” state using gravity for head.

1. In order to calibrate either pump, the pump to be calibrated must be shut off.

If the pump is running, shut the pump off by pressing the corresponding blue square pushbutton (labeled **P1** or **P2**) on the face of the controller located just below the navigational and enter key cluster.

2. In the “primary information screen” choose the pump you wish to calibrate by using the navigational arrows to move the cursor to highlight **cal** for the pump you wish to calibrate. Press **ENTER** to enter the calibration mode.

3. In calibration mode the screen will now indicate the pump you have selected to calibrate and will display three options (see diagram on right).

4. Prime the pump: move the cursor to **prime** and press the **Enter** key to start priming the pump. Press **Enter** again to stop when priming is done.

5. To properly calibrate the pump selected you must first isolate the sight glass from the chemical tank and observe the initial reading on the scale. **Note:** Use the scale that references “segments per minute equal (gallons/ liters/ or quarts) per day”. For the purpose of this example let’s assume the initial sight glass observation registers 100 units).

6. Record or remember the initial sight glass observation. In the calibration mode (shown above) move the cursor to “go” and press “enter”. This will initiate the pump calibration run and the cal period timer will begin to count down (the default is 3 seconds). The pump should run during this time and the sight glass level will drop.

7. Once the calibration run is complete the screen will change to indicate the calibration run is complete (see figure on the right). Select:

- **run good:** To go ahead with the calibration

```
Pump  time  v/d  c/v
1  cal      3.0  1000
2  cal      2.0  1000
   setup    v182
```

Step #2: Primary Information Screen

```
Pump 1 calibrate
go
prime
exit
```

Step #3: Calibration mode

```
Pump 1 calibrate
go
prime
exit
```

Step #4: Priming the pump

```
Pump 1 calibrate
go
prime
exit
```

Step #6: Starting the calibration

```
Pump 1 calibrate
go      2
prime
exit
```

Step #6: Running the pump calibration

```
Pump 1 calibrate
run good
prime
exit
```

Step #2: Calibration done.

- **retry:** to run the pump again
 - **exit:** to cancel the calibration
8. If the calibration run went well, you will be prompted to enter the calibrated volume for the selected pump. This is the volume of fluid that was pumped from the “isolated” sight glass during the calibration pump run. For this example the fluid in the sight glass dropped from an initial value of 100 units down to 20 units during the 3 second run ($100 - 20 = 80$). The calibrated value then for this example is 80 units. Move the cursor to high light the appropriate parameter and use the up and down navigational keys to adjust the value as required (for this example we have used 80 units). Press the enter key to commit the value displayed to memory and exit.
9. Enter the volume per day required. This is the volume of fluid that is to be injected in a 24 hour period (for this example we use 20 units). Move the cursor to highlight the appropriate parameter and the use the up and down navigational keys to adjust each of the appropriate values. When you are satisfied with the value displayed press the enter key to commit the value displayed to memory and exit.

```
Calibration volume p1
for 3 seconds= 0080
up or down to change
OK to exit
```

Step #8: Entering the calibrated volume

```
volume per day p1
= 0020
up or down to change
OK to exit
```

Step #9: Entering the daily volume required

10. The pump is now calibrated.

You have now finished setting up, calibrating and entering the required pumping volume for pump 1. Open the isolating valve between the tank and sight glass to restore fluid flow from the tank to the pump.

To start the pump press the square key labeled “Pump 1”. Pressing the key again will stop the pump.

Calibrating Pump 2

The calibration sequence for calibrating Pump 2 is exactly the same as the sequence for calibrating Pump 1. In the primary information screen use the navigational keys to move the cursor to highlight cal to the right of pump 2 and press enter to re-enter the calibration sequence. Repeat the sequence steps.

```
Pump  time    v/d    c/v
1  cal        3.0    1000
2  cal        2.0    1000
   setup      v182
```

Calibrating pump 2

Changing the volume per day

If you feel there is no need to run a calibration but wish to change the volume per day that you want the pump to inject this can be accomplished in the primary information screen.

Make sure you are in the primary information screen

Use the navigational keys to highlight the **v/d** for the appropriate pump. Press enter to select.

Use the navigational keys to move the cursor to the appropriate parameter and highlight.

Once the appropriate values have been entered press enter to commit to the values to memory and exit.

Pump	time	v/d	c/v
1	cal	3.0	1000
2	cal	2.0	1000
	setup	v182	

Step #9: Entering the daily volume required

volume per day p1
= 0020
up or down to change
OK to exit

Step #9: Entering the daily volume required

Running

Once the pumps have been calibrated and the daily volume have been set for both pumps, the display will come back to the main information screen, and the time display will contain countdown values for the pumps (if the pumps are running).

- To start/stop Pump 1, press **P1**
- To start/stop Pump 2, press **P2**

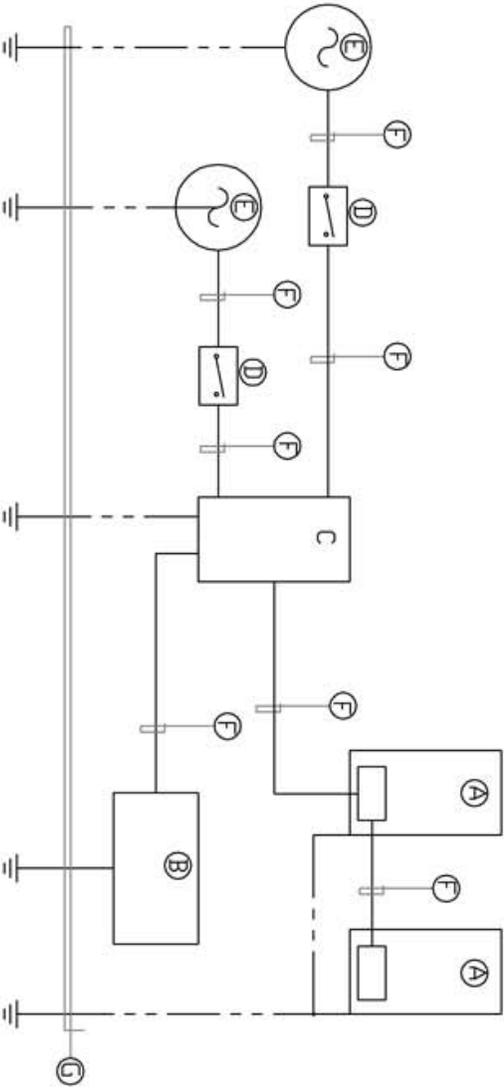
If there is a mistake in any entered value, highlight and press **cal** in the primary information screen to return to the calibration menu to make your corrections.

Pump	time	v/d	c/v
1	cal	0000	3.0
2	cal	0000	2.0
	setup	v182	

Step #9: Running the pumps

Power Save Feature

If the software does not detect any user activity for 5 minutes, the display will be turned off in order to save power. The controller is still running and the program is still counting down. To turn the display back on, press any button.



NOTES:
 A. ALL WIRING METHODS AND EQUIPMENT ARE TO BE SUITABLE FOR USE AND LOCATION AS PER CANADIAN ELECTRICAL CODE (CURRENT EDITION) AND LOCAL CODES.
 B. 1. BBOX TYPES SHALL BE SPEC BBOX2, BBOX4, BBOX 4 FLA, BBOX 8 FLA.
 2. BATTERY BOXES MUST BE APPROPRIATELY MARKED FOR HAZARDOUS LOCATION INSTALLATION.
 C. CONTROL ASSEMBLY SHALL BE: SPEC - CBOX-PCC, D2-PCC AND SHALL BE APPROVED FOR USE IN HAZARDOUS LOCATIONS CID2 OR CIZ2.
 D. PUMP ASSEMBLY SHALL BE: SPEC - P075-M1/8-1750-12 AND SHALL BE APPROVED FOR HAZARDOUS LOCATION CID1 GROUP C.D.

GENERAL NOTES		SPEC@PMS		SOLAR PRODUCTION EQUIPMENT CORP.		10-121A0 - 44ST. S.E. Calgary, Alberta T2Z 4A6	
THIS DRAWING IS THE PROPERTY OF SPEC INC. COPYING OR REPRODUCTION OF THIS DRAWING IS PROHIBITED WITHOUT WRITTEN CONSENT FROM SPEC INC.		PUMP AND CONTROLLER TYPICAL WIRING CBOX		SIZE		A	
DRAWING NUMBER		SHEET		TE-PCC		1 of 1	
TOLERANCES		DIMENSIONS		FRACTIONS		± 1/32"	
DECIMALS		± 0.010"		DRAWN BY		GJC	
CHECKED BY		SCALE		DATE		11/23/08	
QUANTITY		REV		JOB NO.		0	
DESCRIPTION		HL TECK		DATE		12/2	
ID		PART #		DESCRIPTION			
A		SH80/123		SOLAR PANEL			
B		VARIDUS		BATTERY BDX			
C		CBOX-PCC		PUMP CONTROLLER			
D				DISCONNECT			
E		P-375/150-M1/8-1750-12		SPEC PUMP			
F				HL TECK		12/2	
G				#2 BONDING / GND			

Figure 5: Pump and Controller Typical Wiring (CBOX)

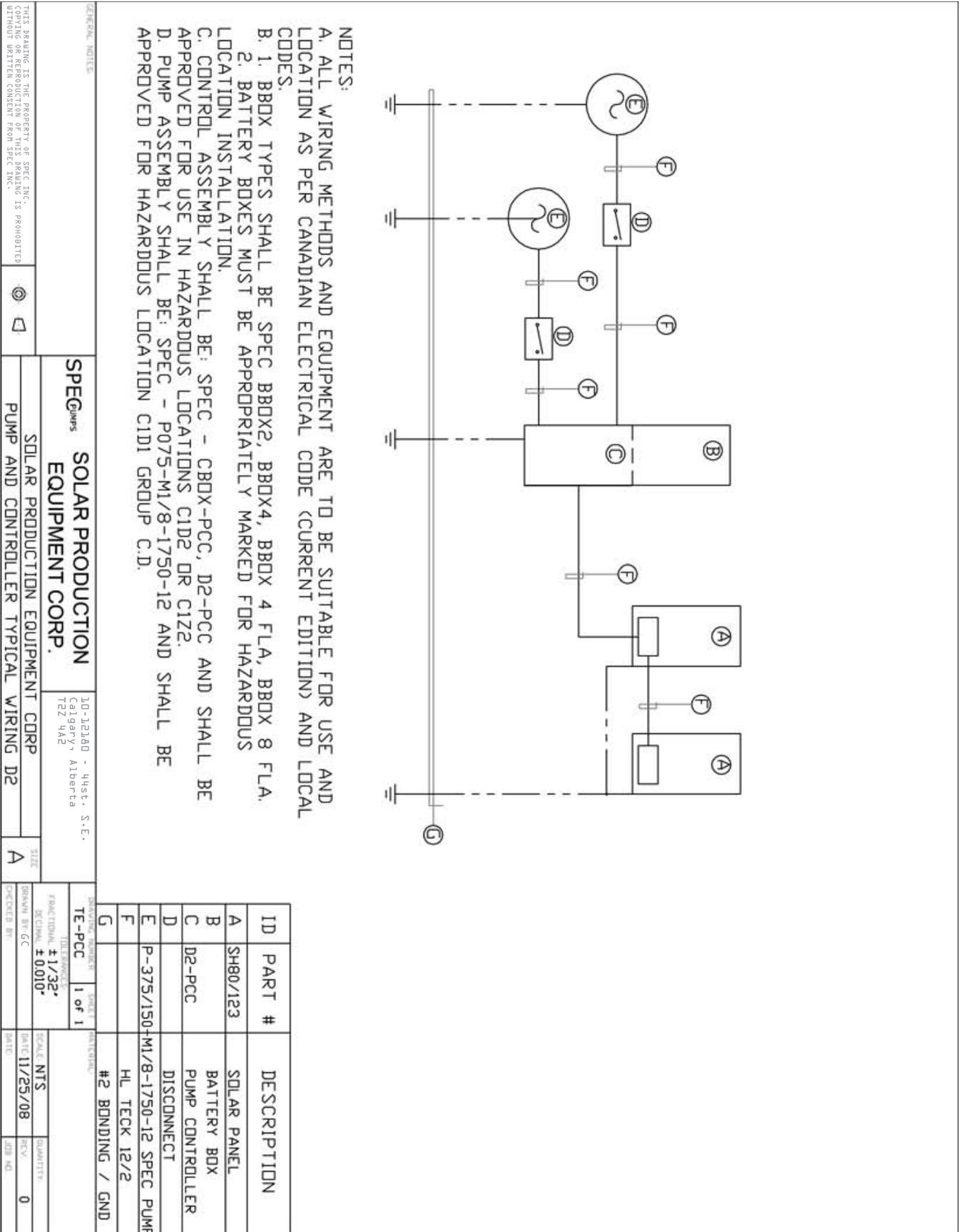


Figure 6: Pump and Controller Typical Wiring (D2)

Thank you for choosing Solar Production Equipment Corp

Terms of sale and Warranty can be found on our website "www.solarproductionequipment.com".

Go to the main page and click on the heading "Resources" and select the desired document for viewing or download.

Note: All connected loads (pumps) must incorporate reverse EMF protection (flyback) or SPEC warranty is void. Please contact us for further information.

SPEC

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