Series FXS
Solar Injection System
Operating Manual

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APPENDIX 35

CheckPoint's **Solar FXS Chemical Injection System** was designed to provide a quality, low-maintenance, and environmentally friendly chemical injection solution. From its high-grade materials of construction (316 SS, Hastelloy, and PVC) to its unique tripod stand, this system was designed with maximum utility in mind.

The Series FXS Solar Injection System's lightweight, portable, and sturdy design lends itself to easy mobility in the field. Each system is prewired with industry-standard MC4 quick connectors for both the panel and the pump, ensuring minimal installation and setup time. The entire system was designed to be effortlessly assembled by one person in as little as fifteen minutes. The front access enclosure containing its battery and charge controller is raised to an easy-access level that provides clearance for rain or snow. The integrated base allows the pump to dependably stand alone or to be easily bolted to a structure.

To ensure proper operation and to maximize the system's durability, please read and follow this manual. Failure to correctly install and maintain the product is the primary cause of premature failure and voids the product warranty.

NOTE:	This IOM applies to the CheckPoint Solar FXS Chemical Injection Pumps, part number FXS2-(FXS Code)-(Injection Assembly) for Series 1250 head, and FXS5-(FXS Code)-(Injection Assembly) for Series 1500 head.

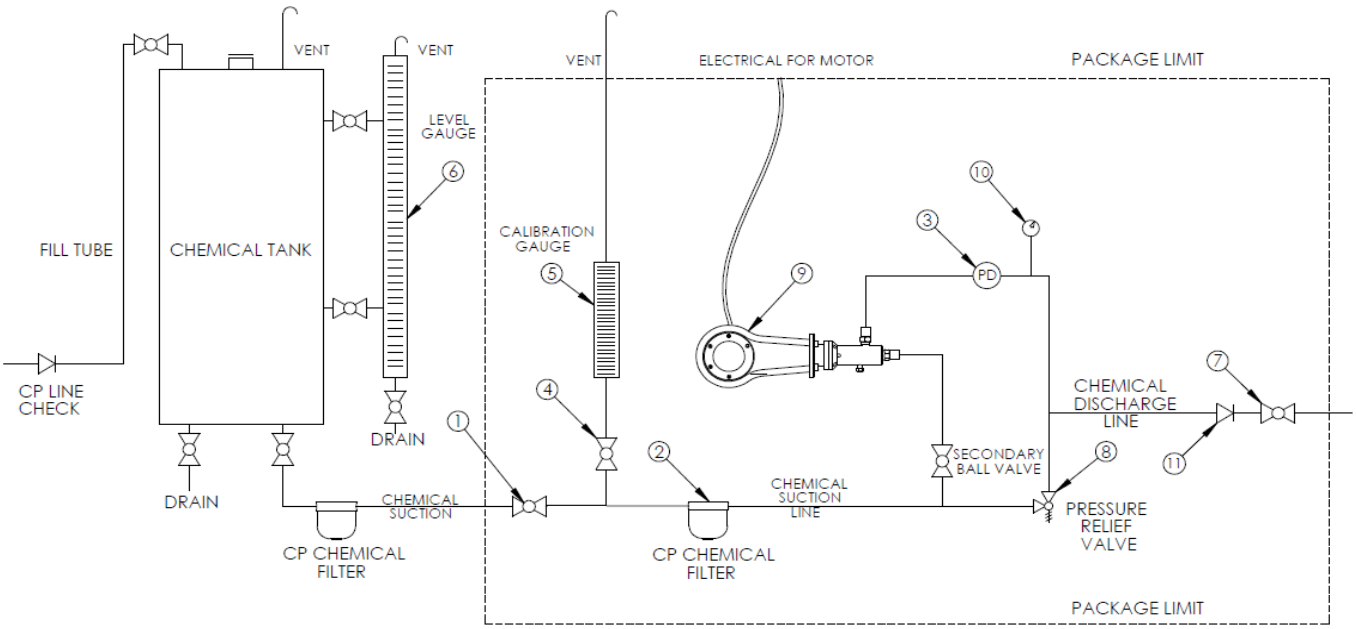
NOTE:	Important illustrations, graphs, and charts are located throughout this manual.

PUMP INSTALLATION

1.1 Process Design & Setup

1.1.1 Before installation, please inspect the pump carefully for any possible in-transit damage. If the pump appears to be damaged, immediately call your authorized CheckPoint distributor, or call CheckPoint customer service directly at (800) 847-7867 or (504) 340-0770 to confirm damaged condition. If CheckPoint determines that the damage has occurred during transit, you will need to file a claim with the carrier.

FIGURE 1: TYPICAL INSTALLATION SCHEMATIC



CheckPoint packages are available for FXS Series pumps that contain all necessary components indicated within the PACKAGE LIMIT in Figure 1. CheckPoint can supply packages that contain ALL components in Figure 1, including the tank, mounted on a single skid with or without full leak containment.

1. Suction line block valve	4. Calibration Gauge Block Valve	7. Discharge line block valve	10. Discharge Pressure Gauge
2. CP Chemical Filter*	5. CP Calibration Gauge*	8. Pressure Relief Valve	11. Discharge Check Valve
3. Pulsation Dampener	6. Tank Gauge	9. CP DC FXS Chemical Pump	

All items in Figure 1 can be purchased directly from CheckPoint.

Call today for our latest prices on pumps, gauges, packages and other components.

*CheckPoint original equipment manufacturer (OEM) products

1.1.2 Referring to Figure 1, ensure that all necessary components are present in your injection system and are in good working order. CheckPoint recommends all components shown above to maximize productivity and life of the pump in typical field or plant use. CheckPoint is available to answer all of your process questions or to help design and build a package system utilizing components appropriate for your application.

NOTE:	In Figure 1, the secondary chemical filter is optional under certain conditions but is highly recommended.

1.1.3 CheckPoint requires horizontal mounting of Solar FXS model pumps. Failure to do so will result in oil leakage from the breather vent. The Solar FXS comes standard with a floor stand to ensure proper orientation.

1.1.4 Accurately setting the flow rate of the pump can only be accomplished with either a suction-side calibration gauge or a discharge flow meter. Many variables, including temperature, chemical viscosity, and other environmental factors, preclude the use of tables, graphs, or formulas to determine the rate of injection. Additionally, without a calibration gauge or flow meter, it cannot be determined if the pump is primed and functioning normally. For instructions on the proper use of a suction-side calibration gauge, please refer to Section 2.3.1, Setting Pump Speed Using a Calibration Gauge for more information. The proper placement of a calibration gauge is shown in Figure 1, item 5. CheckPoint offers a complete range of accurate and durable calibration gauges and discharge-side flow meters suitable for Solar FXS pump service.

NOTE:	It is necessary to attach a vent tube to the top of all calibration gauges, chemical tanks, and tank level gauges. The height of the top of each vent tube should always be greater than the highest possible liquid level in the system, and the tube should have features to prevent water entry, such as a 180 degree bend.

1.1.5 The Solar FXS does not require flooded suction or positive chemical pressure to prime and can therefore be mounted above the chemical container. This feature depends upon proper adherence to all points made in Section 1.1.6. Solar FXS pumps with plunger sizes of 1/8" and 3/16", and applications where the injection chemical is prone to gas off, will benefit by having flooded suctions.

1.1.6 ALL COMPONENTS AND PIPEWORK BETWEEN THE CHEMICAL TANK AND THE SUCTION CHECK VALVE OF THE PUMP MUST BE 100% BUBBLE-TIGHT AND FULLY COMPATIBLE WITH THE CHEMICAL AND WITH EACH OTHER. FAILURE TO ADHERE STRICTLY TO THIS DIRECTIVE WILL LEAD TO LOSS OF PRIME AND DAMAGE TO THE WETTED SEALS AND PLUNGER. SPECIFICALLY:

1.1.6.1 Any fitting or screw-on joint without Teflon™ tape or other acceptable sealant may allow air at atmospheric pressure to enter the suction tubing, even if no chemical leakage is visible.

1.1.6.2 Dissimilar metals in the suction side of the injection system may react with each other, creating gas bubbles that will be carried into the pump head. All suction components, tubing, pipe, fittings, and valves must be composed of similar or compatible materials. Please note that CheckPoint offers wetted parts comprised of 316 SS, Hastelloy C, PVC, Titanium and Alloy 20.

1.1.7 CheckPoint ships the FXS pump with a pre-drilled floor stand, and this is the recommended method for mounting the pump. The pump may be mounted to a skid or other surface in a number of ways; however, clamping around the outside of the pump can permanently affect the cylindricity of the injection head or housing, which will void the product warranty. Furthermore, this method reduces accessibility during maintenance and troubleshooting and is therefore not recommended.

1.1.8 Always check to ensure that all process block valves (labeled as items 1 & 7 in Figure 1) are closed prior to disconnecting or reinstalling any chemical injection pump. There should always be a block valve placed between a properly installed pump and the process flow and the chemical supply. Conversely, while the pump is in operation, the suction and discharge block valves should always remain open. The calibration gauge ball valve (labeled as item 4 in Figure 1) should remain closed at all times unless flow rate calibration is being performed. Failure to close the calibration gauge ball valve may allow air to enter the injection head, which may subsequently cause loss of prime.

1.1.9 The pump suction line should be sized appropriately to the flow rate to avoid cavitation. A general rule of thumb is to size the suction line such that the instantaneous flow velocity through the line does not exceed 2 feet per second at any point. For multiple pump installations, for extremely viscous chemicals, and for chemicals with low vapor pressures, additional allowances may be needed. Contact CheckPoint or your authorized CheckPoint distributor for design assistance.

1.1.10 TO AVOID OVER-PRESSURIZING CHEMICAL DISCHARGE LINES, CHECKPOINT REQUIRES PLACING A PROPERLY TESTED AND CALIBRATED PRESSURE RELIEF VALVE (PRV labeled as item 8 in figure 1) BETWEEN THE DISCHARGE PORT OF THE PUMP AND THE PROCESS FLOW. THE PRV DISCHARGE CAN BE RUN TO A TEE UPSTREAM OF THE PUMP'S CHEMICAL SUCTION CHECK VALVE OR REROUTED TO TANK. FAILURE TO USE A PRV IS INHERENTLY UNSAFE AND MAY LEAD TO CATASTROPHIC FAILURE OF PROCESS EQUIPMENT DUE TO EXCESSIVE PRESSURE. CHECKPOINT IS NOT RESPONSIBLE FOR ANY DAMAGE CAUSED BY OVER-PRESSURIZED CHEMICAL. CheckPoint offers a range of PRVs suitable for use with the FXS pump.

CAUTION:	**When using a pressure relief valve (PRV), the chemical tank MUST BE properly vented to atmosphere to avoid the possibility of over-pressurizing the tank if the pressure relief valve actuates.**

1.1.11 Although the FXS does not require the use of a pulsation dampener for proper operation, pulsation dampeners may be required in your installation depending on a variety of factors. Consult with CheckPoint if you have any concerns about pulsation.

1.2 Connecting the Chemical Supply

1.2.1 Clean all suction lines and check chemical containers to ensure that they are free of all foreign matter, sand, sludge, or chemical buildup.

NOTE:	Removing foreign debris from suction lines and chemical containers will substantially extend the life of the packing and other components of the pump. Even a new chemical tank can contain debris that can be carried into the pump and cause damage.

NOTE:	If early packing failure is observed during operation, a common cause is the presence of abrasive particles carried into the pump through the suction plumbing. Use of a pre-suction in-line chemical filter is highly recommended. CheckPoint offers a range of chemical filters suitable for use with the FXS solar pump.

CAUTION: Substantial scoring of the plunger can lead to severe leakage of chemical into the surrounding environment.

1.2.2 Connect the chemical suction line to the suction check valve on the pump head (See illustrations in CheckPoint's Series FXS Solar Injection System Parts List document, available upon request or for download at cppumps.com). The suction check valve is a 1/4" MNPT for the Series 1250 and 1/2" MNPT for the Series 1500. Care must be taken not to over-tighten NPT connections. For more information regarding the procedure for properly making NPT connections, please refer to the CheckPoint NPT connection procedure, available on request.

NOTE:	Always apply Teflon™ tape or other appropriate thread sealant to the check valve threads prior to attachment to prevent leakage. Take care not to allow Teflon™ tape or other appropriate thread sealant to cover check valve ports or become frayed to the point that pieces of the tape may become lodged in check valves, causing loss of prime.

NOTE:	Never relocate the suction check valve away from the chemical head. To operate properly, the check valve must remain directly attached to the chemical head.

1.2.3 Connect the discharge line to the pump discharge check valve. (See illustrations in CheckPoint's Series FXS Solar Injection System Parts List document, available upon request or for download at cppumps.com). The discharge port is 1/4" FNPT for the Series 1250 and 1/2" FNPT for the Series 1500. Care must be taken not to over-tighten NPT connections. For more information regarding the procedure for properly making NPT connections, please refer to the CheckPoint NPT connection procedure, available on request.

1.2.4 Open the process block valve (item 7 in Figure 1), to allow the process pressure to reach the chemical head. Correct any leakage observed.

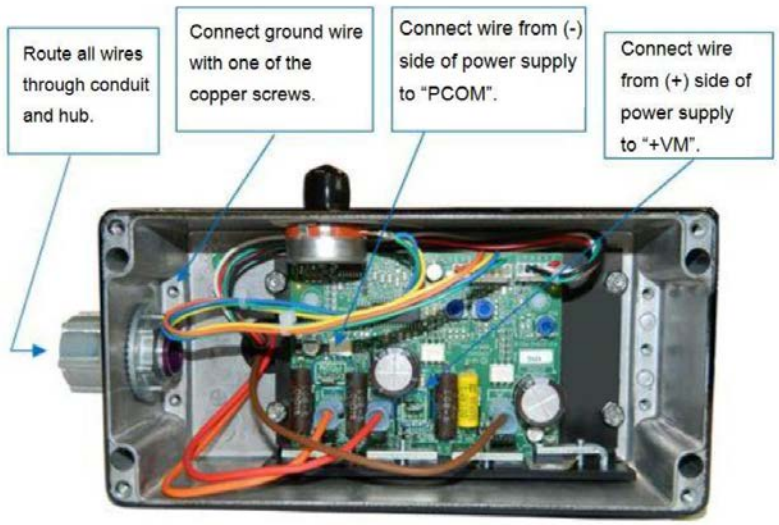
CAUTION: The Solar FXS Series 1250 pump universal chemical head is rated for a maximum working pressure of 7,500 PSIG, and the 1250 1/8" head is rated for 12,000 PSIG. The FXS Series 1500 pump universal chemical head is rated for a maximum working pressure of 7,500 PSIG, and the 1500 HP head is rated for 15,000 PSIG. If the discharge line is inadvertently blocked for any reason, the pump can generate pressures in excess of the indicated rated pressures. A relief valve MUST be placed between the discharge port and the process flow to prevent this condition.

NOTE: Always open the process block valve prior to operating the pump. Operating the pump with a closed block valve can generate enough pressure to rupture the discharge line, damage process equipment and the chemical head itself, and reduce the overall life of the pump.

CAUTION: Discharge line size must remain consistant to avoid unnecessary backpressure to the pump. Installing devices with small orifices may cause the pump to consume excess power, reduce the life of the battery bank, and cause the pump to stop. All ball valves, check valves, flow meters, and other equipment and accessories must be appropriately sized with the discharge line. For plunger sizes of 1/8", 3/16", 3/8" and 1/2", the discharge line size should be 3/8" or greater; for plunger sizes of 3/4", 1" and 1-1/2" discharge line size should be 1/2" or greater.

1.3 Connecting the Solar Power Supply

FIGURE 2: ELECTRICAL INSTALLATION LOCATION



1.3.1 The solar powered electric motor must be connected in accordance with all local regulations, including overload protection. FXS Solar pumps are equipped with Class 1, Div 2 (Group A, B, C, D) 1/5 HP motors.

CAUTION:	**INCORRECTLY CONNECTING POWER SUPPLY TO THE MOTOR WILL RESULT IN DAMAGE TO THE MOTOR CONTROL BOARD AND WILL VOID THE PUMP WARRANTY.**

CAUTION:	**NEVER TAMPER WITH THE SETTINGS OF THE PCB MOUNTED POTENTIOMETERS. THESE CONTROLS ARE SPECIFICALLY INTENDED FOR FACTORY CALIBRATION PURPOSES ONLY, AND ALLOW FOR SLIGHT CORRECTIONS TO COMPONENT RESISTANCE VARIATIONS. TAMPERING WITH THESE CONTROLS MAY RESULT IN REDUCED FLOW RATES, MOTOR/PUMP STALLING UNDER LOWER DISCHARGE PRESSURES, OR INCREASED POWER CONSUMPTION RESULTING IN BATTERY FAILURE AND WILL VOID PRODUCT WARRANTY.**

NOTE:	It is important that the solar panels are positioned correctly and are in a space that would avoid shading from direct sunlight to allow for maximum sunlight hours at the installation location. Please refer to local standards for appropriate angle and direction of solar panels.

1.3.2 The complete installation should be equipped with an on/off switch (Figure 12A) that is easily and quickly accessible by the user. Solar power packs are equipped with charge controllers which have on/off capabilities or will have a main breaker in instances where more than one charge controller is necessary.

2. PUMP OPERATION

2.1 Bleeding/Priming the Injector Head

NOTE:	Prior to initial pump operation, ensure the suction check valve is connected to adequate chemical supply per Section 1.2.

2.1.1 The bleed screw on the Series 1500 injection head is fitted with a 1/8" FNPT connector to allow the user to tube chemical used in the bleeding process to the proper containment area or vessel. An optional threaded bleed screw is also available for the Series 1250 injection heads as well.

2.1.2 Prior to bleeding air from the pump head, check to ensure that the packing nut is properly adjusted. Before attempting to adjust or tighten the packing nut, refer to Section 2.4, Packing Adjustment. It is important not to overtighten the packing nut.

2.1.3 Open the chemical supply block valve.

2.1.4 Open the process block valve.

CAUTION:	**OTHER THAN DURING BRIEF TESTING, NEVER OPERATE THE PUMP WITHOUT CHEMICAL SUPPLY AVAILABLE AND FLOWING FREELY. DOING SO WILL DECREASE THE LIFE OF THE PACKING, HASTEN CHEMICAL LEAKAGE, AND VOID THE PUMP WARRANTY.**

2.1.5 Start the pump via on/off button located on the solar charge controller.

2.1.6 Open the bleed screw 1-1/2 to 2 turns. The pump will begin to pull air and chemical through the chemical supply plumbing, into the head, and out of the bleed valve port. Leave the valve open until a solid stream of chemical pumps out of the bleed port with each stroke of the pump.

NOTE:	If the pump is not new, it is possible for dried or solidified chemical to be present in the bleed assembly. If your pump does not bleed when following the directions above, try cleaning these items in solvent or replacing them, and then repeat the above process.

2.1.7 Close the bleed screw until the chemical flow through the bleed port stops.

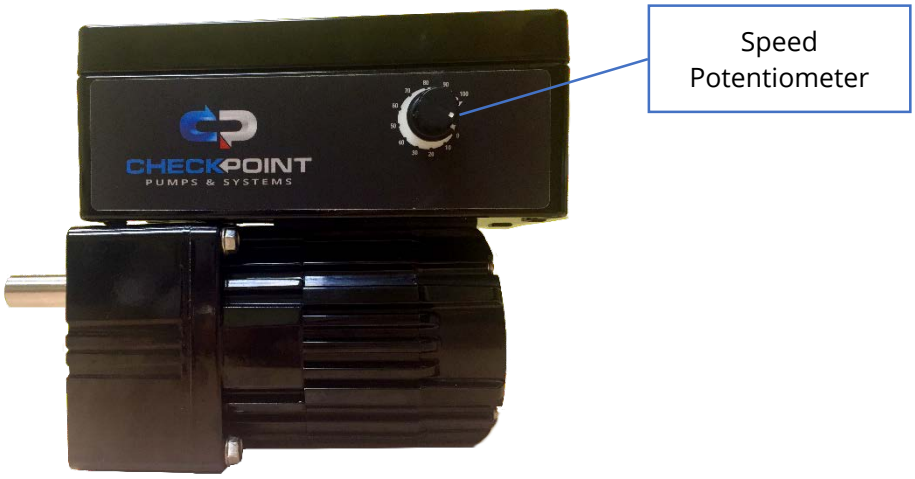
CAUTION:	**DO NOT OVER-TIGHTEN THE BLEED SCREW. TIGHTEN THE BLEED SCREW ONLY UNTIL CHEMICAL STOPS FLOWING AND UNTIL SNUG WITH 7/16" WRENCH FOR SERIES 1250 INJECTION HEADS AND 7/8" FOR SERIES 1500 INJECTION HEADS. TORQUE VALUE IS APPROXIMATELY 10 IN-LBS FOR SERIES 1250 INJECTION HEADS AND 15 IN-LBS FOR SERIES 1500 INJECTION HEADS. APPLYING EXCESS TORQUE TO THE BLEED VALVE MAY IMPAIR FUTURE VALVE OPERATION.**

NOTE:	Occasionally, soon after closing the bleed assembly, you may observe packing leakage. If so, this is usually due to a loose packing nut. Stop pump stroking, relieve pressure from inside the head, and adjust the packing nut per the instructions in Section 2.4: Packing Adjustment.

2.1.8 Solar FXS motors are equipped with an integrated manual motor speed control located on the side of the motor, and can be supplied with the ability to accept a 0–5v signal for remote adjustment. Adjust the delivery volume per directions in Section 2.2: below.

2.2 Setting and Adjusting the Pump Delivery Volume

FIGURE 3: SPEED POTENTIOMETER LOCATION



2.2.1 The stroke length of the FXS Series pump remains constant at all times.

2.2.2 The pump delivery volume is controlled by varying the RPMs of the power drive mechanism; the integrated speed control is located on the front side of the motor as shown above in Figure 3.

2.2.3 Adjusting the RPM during operation will not damage the FXS Series pump or motor.

2.2.4 The speed should only be set from 10 to 100%.

2.3 Setting the Pump Stroke Rate

2.3.1 Setting Pump Speed Using a Calibration Gauge

NOTE:	The Solar FXS Series pump maintains a constant stroke length during operation. The discharge volume can only be varied through a change in RPM. This may be achieved with either the manual motor speed control or with a remote 0-5 V signal. Rate calibration is particularly important for solar pump systems since battery bank and solar array are specifically sized based on application flow rate, discharge pressure, and installation location. Failure to maintain flow rate supplied with application requirements may result in power loss and battery failure. If application requirements have changed, please contact your CheckPoint representitive to recalculate solar requirements.

The following directions are for setting the pump speed using a calibration gauge. A variety of calibration gauges are available, including a complete line of CheckPoint gauges appropriately sized for every CheckPoint pump. To ensure that your pump is working as it should and that chemical is being delivered at the rate you need, it is important to use a calibration gauge or a discharge-side flow meter.

2.3.1.1 Most calibration gauges are designed to read properly when one full minute of pumping has taken place. However, if the liquid level drops too fast to allow for a full minute, shorter periods are acceptable. Try to size the gauge so that at least a 15 second test can be accomplished; however, a loss of accuracy may result with test durations shorter than one minute. Alternatively, increasing the test duration will increase accuracy.

2.3.1.2 Proper gauge placement and plumbing is important. Please refer to Figure 1 for appropriate valving and placement, and for reference numbers as used in this section. The calibration gauge is labeled as item 5 in Figure 1.

2.3.1.3 With the pump either running or stopped, open the gauge fill valve (shown as item 4 in Figure 1). The gauge should begin to fill. Continue filling until the chemical level is at or near the top markings on the gauge, then close the gauge fill valve.

2.3.1.4 Ensure that the CheckPoint pump is running. Take note of the level of chemical in the gauge, using the appropriate scale for your preferred pump output volume units. Usually, the gauge will show liters on one scale and quarts or gallons on the other. It is best to write down the initial chemical level in order to accurately calculate flow.

2.3.1.5 Open the gauge fill valve (Figure 1, item 4), and simultaneously close the chemical supply valve (Figure 1, item 1). This isolates the pump and gauge so that the gauge is directly supplying the pump with the chemical.

2.3.1.6 The level in the gauge should begin to fall (if it does not, or if the level seems to go down and then back up with each stroke, refer to troubleshooting in Section 7). When the liquid level in the gauge nears the bottom of the gauge, or when one minute has expired (whichever comes first), stop timing, note the ending level on the gauge, and reopen the chemical supply valve.

2.3.1.7 Write down the amount of time in seconds and the final gauge reading, and close the gauge fill valve.

NOTE:	In cases where the chemical flow rate is extremely low, you may need to time for longer than one minute to allow an adequate amount of chemical to move out of the gauge. Divide flow rate by number of minutes timed to determine flow rate.
NOTE:	Failure to reopen the chemical supply valve will result in the pump quickly depleting the remaining chemical in the gauge and running on air, necessitating pump repriming.

2.3.1.8 The pumping volume (in the units specified on the gauge scale) can be determined by the following equation:

$$\textbf{PUMPING VOLUME} = \frac{\textbf{[END READING] - [BEGINNING READING]}}{\textbf{DURATION OF READING IN SECONDS}} \times \textbf{60}$$

NOTE:	To ensure accurate stroke rate measurement, allow sufficient measurement duration. Where possible, allow at least thirty seconds of gauge drawdown. Generally, accuracy improves as test duration increases.

2.3.2 Calculation of Stroke Rate

It is possible to calculate your pump's required stroke rate. To do so, you must look up a volume factor, multiply it by your desired chemical flow rate requirement, and compensate for the discharge pressure using a graph. The instructions below will detail this process. This is most helpful when determining if a particular plunger or pump size will output a required volume.

NOTE:	This procedure should not be used as the sole method of setting the pump's speed in the field. It is not recommended for use with solar pumps other than as a quick reference tool to visually ensure that the pump is running at the same speed, without having to manually check flow rate with a calibration gauge or flow meter. Without checking pump output with a calibration gauge, it cannot be positively determined that the pump is delivering the correct liquid flow rate. For example, if the suction check valve is stuck due to debris or thickened chemical, chemical would not be injected even if the stroke rate was properly set.

2.3.2.1 Using your desired chemical flow rate, calculate an Unrated Stroke Rate (USR). Figure 4 contains volume factor using Series 1250. Figure 4A contains volume factor using Series 1500. Figure 5 contains basic conversions to assist you. Figure 6 displays the volume de-rating percentage vs. discharge pressure.

UNRATED STROKE RATE (USR) (STROKES/MIN) = FLOW RATE (QT/DAY) × VOLUME FACTOR

FIGURE 4: VOLUME FACTOR TABLE, SERIES FXS 1250 TYPE

PLUNGER DIAMETER (IN)	VOLUME FACTOR
1/8"	3.477
1/4"	0.869
3/8"	0.386
1/2"	0.217

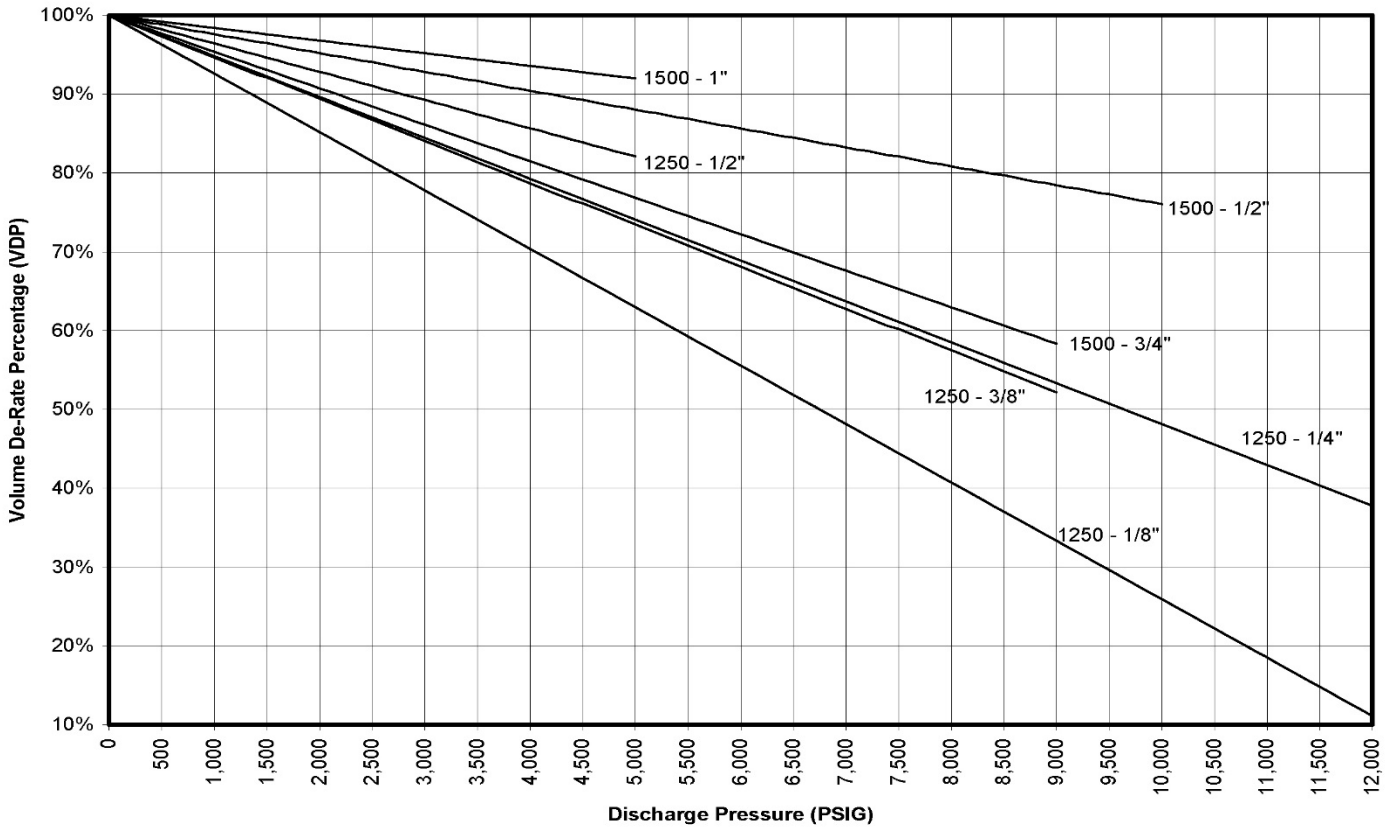
FIGURE 4A: VOLUME FACTOR TABLE, SERIES FXS 1500 TYPE

PLUNGER DIAMETER (IN)	VOLUME FACTOR
1/2"	1.049
3/4"	0.370
1"	0.227

FIGURE 5: GENERAL CONVERSION TABLE

TO CONVERT:	TO:	MULTIPLY BY:
GALLONS	QUARTS	4.00
LITERS	QUARTS	1.058
CUBIC INCHES	QUARTS	0.0173
MINUTES	DAYS	0.000694

FIGURE 6: VOLUME DE-RATING PERCENTAGE VS. DISCHARGE PRESSURE



2.3.2.2 Volume per stroke decreases as the discharge pressure rises. It is necessary to apply a Volume De-Rating Percentage (VDP) to the Unrated Stroke Rate (USR). The VDP is based on the expected discharge pressure the pump will experience. Use the VDP Graph (Figure 6) to find the VDP, taking care to use the curve for your specific plunger diameter:

2.3.2.3 Use the resulting VDP to calculate the Target Stroke Rate as follows:

$$\textbf{TARGET STROKE RATE} = \frac{\textbf{[USR]}}{\textbf{[VDP]}} \times 60$$

2.3.2.4 Finally, ensure that the Target Stroke Rate does not exceed the maximum recommended stroke rate. If the Target Stroke Rate exceeds the maximum recommended stroke rate (per Figures 7 and 7A) for the type of service you intend, it will be necessary to use a larger plunger size:

FIGURE 7: MAXIMUM RECOMMENDED STROKE RATE, SERIES 1250

TYPE OF SERVICE	MAXIMUM RECOMMENDED STROKE RATE
CONTINUOUS USE	67 STROKES PER MINUTE

FIGURE 7A: MAXIMUM STROKE RATE, SERIES 1500

TYPE OF SERVICE	MAXIMUM RECOMMENDED STROKE RATE
CONTINUOUS USE	67 STROKES PER MINUTE

2.3.2.5 Assuming your pump is correctly sized; simply adjust the integrated manual speed control or other motor control device until the Target Stroke Rate is achieved.

2.4 Packing Adjustment

2.4.1 Packing adjustment is usually necessary when adjustable packing is installed in the pump and leakage is observed around the packing nut or coming out of the weep hole drilled through the packing nut. In most cases, if there is no leakage, no adjustment is necessary.

2.4.2 To adjust the packing, use a CheckPoint T55-101 packing adjuster, which is specifically designed for this purpose. If one is not available, you may order one at no charge directly from CheckPoint. In an emergency or if time is short, a 6" length of ¼" OD tubing or a metal rod may be used.

2.4.3 If the pump is already in service, the packing should generally be adjusted while the pump is running.

2.4.4 To tighten the packing, insert the tool into one of the six shallow radial holes in the packing nut and tighten the nut (away from the motor). Snug the nut until light pressure with one finger on the packing nut tool no longer moves the packing nut.

2.4.5 From this point, TIGHTEN THE NUT 1/8 TURN ONLY as follows:

2.4.6 If adjusting the packing while pump is operating, pause after each 1/8 turn to determine if the leakage has stopped, allowing for enough time to ensure that previous leakage has already drained from the nut weep holes and threads. If the pump is still leaking, turn the packing nut an additional 1/8 turn and check again. Continue turning the nut 1/8 turn at a time as many times as necessary to stop the leakage. If the leakage cannot be stopped, or if excessive force is required to stop leakage, it is time to replace the packing.

2.4.6.1 If adjusting the packing prior to new installation or when not currently running, tighten the nut 1/8 turn from the finger tight position.

NOTE:	If the packing is being adjusted while the pump is running, the pump will typically not stall, regardless of how much the packing nut is tightened. Therefore, care must be taken not to apply too much pressure when adjusting the packing nut, as this can dramatically reduce packing life and can overdraw power from the battery bank.

2.5 Packing Replacement

Follow the steps below to change the packing.

NOTE:	Unless the pump has a dedicated high pressure head, the 3/16”, 1/4", and 3/8" plunger sizes on the 1250 type head and the 1/2" plunger sizes on the 1500 type head require a metal adapter sleeve in the packing gland. When removing the packing, this sleeve should also be removed and cleaned. It is important to remember to reinstall the sleeve.

NOTE:	The 3/16" plunger size on the Series 1250 and the 1/2" plunger sizes on the Series 1500 require an O-ring and a backup ring.

2.5.1 Shut off power to the pump.

2.5.2 Close the block valves on the chemical supply and discharge.

2.5.3 Disconnect the chemical supply from the pump at the suction check valve, and disconnect the discharge line from the discharge check.

2.5.4 Remove the chemical head, by removing the two head bolts and then separating the head component from the body of the pump.

2.5.5 Unscrew and remove the packing nut, using 1/4" tubing or a packing nut tool. A packing nut tool is available at no charge from CheckPoint. For all sizes other than 3/16", proceed to step 2.5.7.

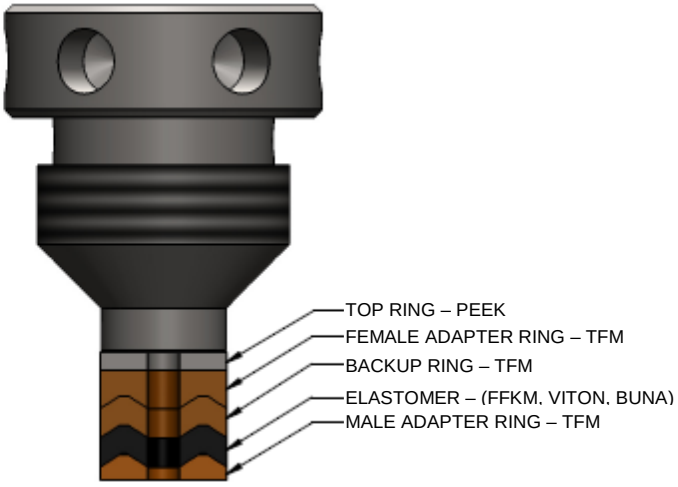
2.5.6 Using the access hole where the suction check valve was located, push out the packing and sleeve with a punch or screwdriver. For the 3/8" Series 1250 head, proceed to step 2.5.10. For 1/2" Series 1250 head and the 1" Series 1500 head, proceed to step 2.5.11.

2.5.7 Remove the packing from the sleeve, along with the O-ring and backup ring on the small outside diameter of the sleeve. Clean the sleeve and lightly grease it, then install the new O-ring and backup ring supplied with your new packing. If you cannot locate these parts, please contact CheckPoint for replacements. Your pump may leak chemical without replacing these components when you replace the packing.

2.5.8 Replace the metal sleeve.

2.5.9 Examine the new set of packing closely and ensure, prior to installation, that it is oriented properly according to Figure 8. Your packing will be similar to the cross sectional view shown.

FIGURE 8: TYPICAL PACKING INSTALLATION



NOTE:	When replacing adjustable packing, always install the packing rings exactly as they are shipped. Rearranging the order of the V-rings in an adjustable packing set will reduce the life of the elastomer ring in the packing set.

2.5.10 Grease the packing rings on their outside diameters lightly and install them, one ring at a time. It is important to adhere to the ring order and orientation as shown in the diagram.

NOTE:	On the 1/8" and 3/16” Series 1250 head and 1/2” and 3/4" Series 1500 head, the packing fits inside the sleeve, rather than directly into the packing gland.

2.5.11 On the 3/16” plunger model, replace the internal snap ring to retain the sleeve.

2.5.12 Grease the packing nut threads and replace the nut loosely by hand.

2.5.13 After inspection of the plunger for scars or ceramic damage, grease the plunger rod protruding from the pump drive.

2.5.14 Taking care to insert the plunger into the packing without damaging or bending it, and replace the chemical head onto the main body of the pump.

2.5.15 Grease the threads on the two head bolts, then insert and hand-tighten them.

2.5.16 Tighten the packing nut to the point where light pressure with one finger on the packing nut adjuster will no longer move the packing nut.

2.5.17 Fully tighten down the head bolts. Failure to adhere to this procedure can lead to a misaligned head and leaking packing.

2.5.18 Reattach all process lines to the chemical head, and open all isolation valves leading to the pump chemical supply and discharge.

2.5.19 Adjust the packing nut per the directions in Section 2.4.

3. PUMP MAINTENANCE

CheckPoint's Solar FXS is designed to provide trouble-free operation for many years with little adjustment, lubrication, or other routine maintenance. However, like any other device, proper maintenance can extend the life of the product. This can include periodic cleaning of the chemical inlets and lubrication.

3.1 Lubrication

The CheckPoint Solar FXS drive contains internal rotating parts that require constant lubrication. The housing for the drive acts as an oil reservoir and requires the oil level to be above the centerline of the plunger adapter.

3.1.1 **Startup** The Solar FXS Series pumps are delivered without a filled reservoir. Prior to startup, fill the FXS drive housing using 2 ounces (60mL) of SAE rated 5W-30 motor oil. CheckPoint recommends using Mobil 1 Fully Synthetic 5W-30 for extended life. Before filling the housing with oil, ensure that the drain plug in the bottom of the housing is installed. Remove the housing's top breather vent, and using a suitable funnel, pour 2 ounces (60mL) of oil into the housing. Replace the housing's top breather vent using Teflon tape on the threads. Care must be taken to avoid over-tightening NPT connections. For more information regarding the procedure for properly making NPT connections, please refer to the CheckPoint NPT connection procedure, available upon request.

3.1.2 **Periodic Inspection** Once a month, remove the top breather vent and inspect the fluid level to ensure that the oil level is above the centerline of the pump. Add recommended oil as required to maintain necessary lubrication levels for proper operation.

3.1.3 **Oil Change** CheckPoint recommends changing the drive oil every 2,000 hours using the previously recommended oil (Mobil 1 Fully Synthetic 5W-30).

NOTE:	CheckPoint offers an optional breather/oil level sight glass as a replacement for the supplied top vent. As long as a supply of oil is maintained in the sight glass, sufficient oil for operation is maintained.

4. FUSES

4.1 General Information

Fuses have been integrated into the control panel to protect the solar panel and charge controller should a short circuit occur. Further the motor fuse is sized to limit the draw of the motor to protect the system. If the motor fuse ever blows, this is normally a sign that the pump is working beyond the intended system capability range.

4.1.1 Should fuses ever need to be replaced, replace with the same size fuse. Please refer to the below chart for fuse orientation and sizing.

FIGURE 9: FUSE ORIENTATION AND SIZE

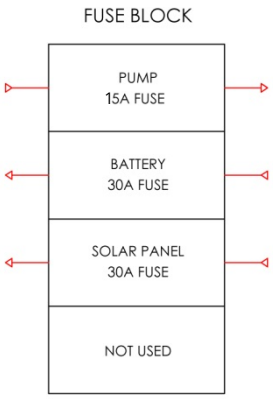
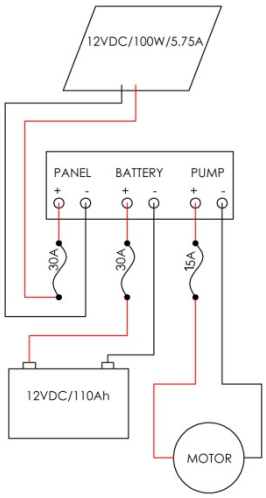


FIGURE 10: WIRE DIAGRAM



5. SOLAR SUPPORT COMPONENTS

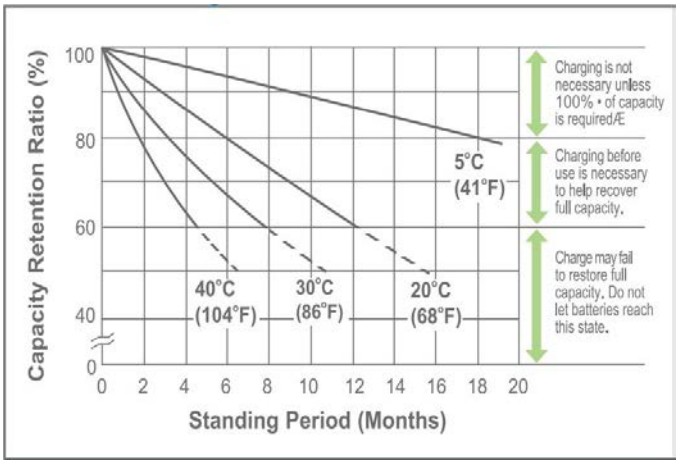
5.1 Battery Bank

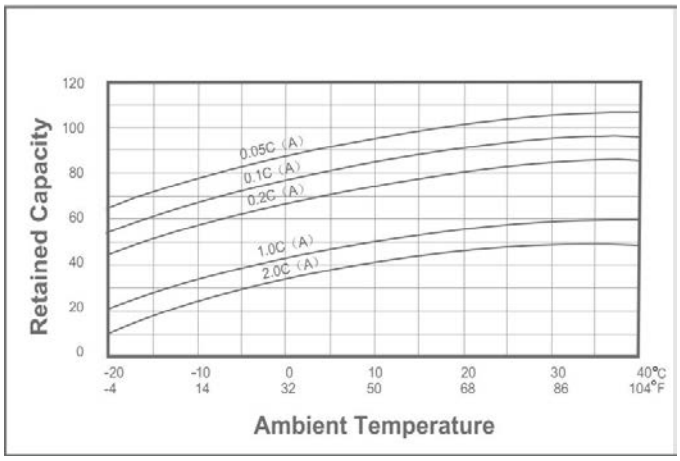
5.1.1 CheckPoint uses 100Ah and 110Ah sealed lead-acid (SLA) batteries. No maintenance is required for these batteries; however, disconnecting the terminal cables when the solar pump system is not in use will help to extend the life of the battery bank.

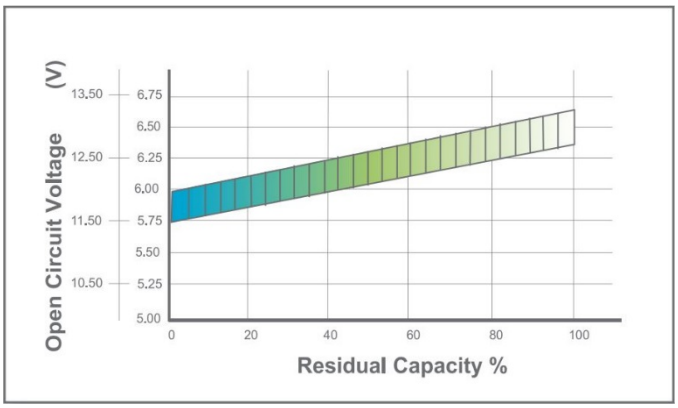
5.1.3 Shelf life loss can reach up to 2% per month of storage with terminals disconnected. To avoid serious damage, batteries should be routinely charged for longer storage periods (i.e. several months or more). Charge level should not be allowed to drop below 80% or 10.3 V.

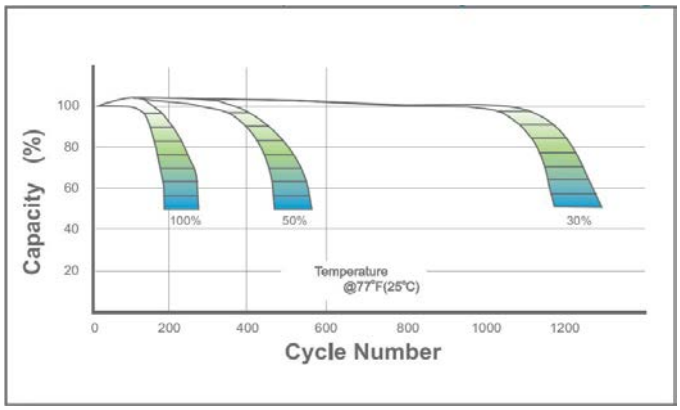
After storage, confirm that all batteries in the bank are fully charged. Failure to charge batteries prior to use may cause a shortened system autonomy range and result in pump or production downtime. Open circuit voltage of a fully charged 12-volt battery is 12.8 V at 77°F (25°C). See Figures 11A-11D below.

FIGURES 11A-11D SHELF LIFE AND STORAGE EFFECT OF TEMPERATURE ON CAPACITY







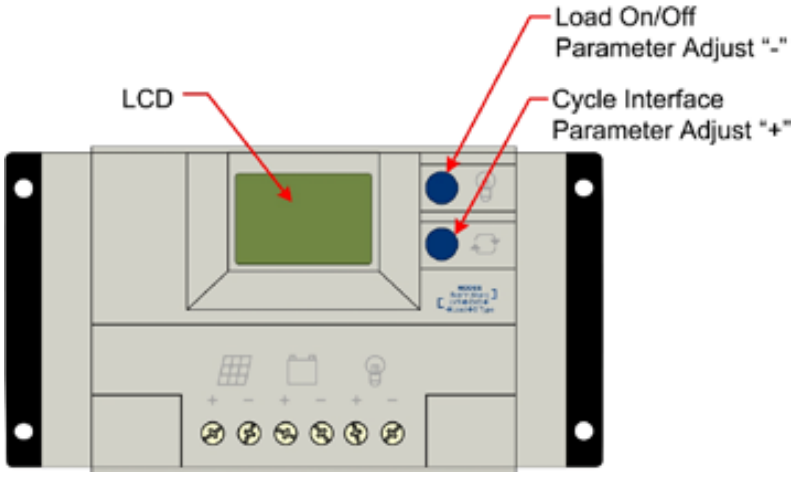


5.1.3 Batteries are approved for transport by air, D.O.T., I.A.T.A., F.A.A., and C.A.B. certified. U.L. recognized under file number MH 20567.

NOTE:	Do not store or install batteries in sealed containers.

5.2 Charge Controller

FIGURE 12A: CHARGE CONTROLLER

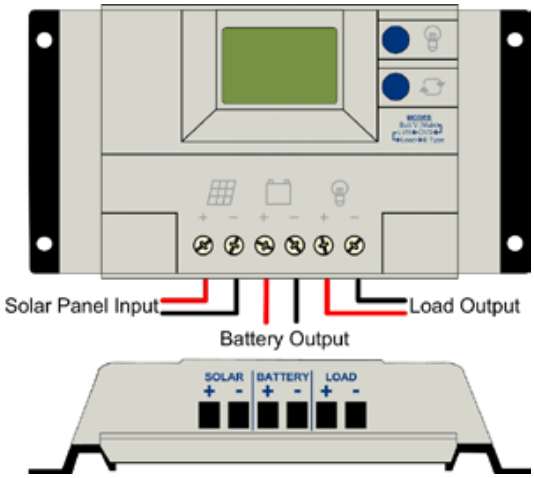


	LOAD	• At "MAIN" interface screen, will turn the LOAD on and off. • Negative (-) parameter adjustments
	CYCLE	• Toggles the active LCD interface in a circular motion as defined in Section 3.3 • Positive (+) parameter adjustments. • Holding button for >5 seconds will reset parameter setting state.

5.2.1 The charge controller serves as the power disconnect.

5.2.2 Typical charge controller connections are shown below in Figure 12B.

FIGURE 12B: CHARGE CONTROLLER



5.2.3 **LCD Graphic Indicators**

FIGURE 13: LCD GRAPHIC INDICATORS

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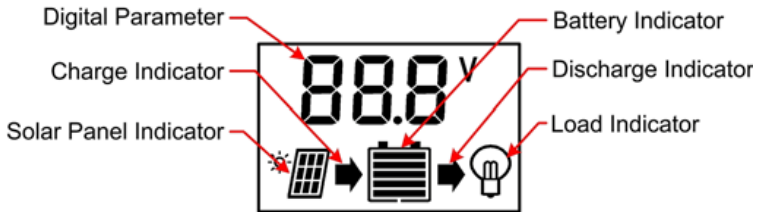
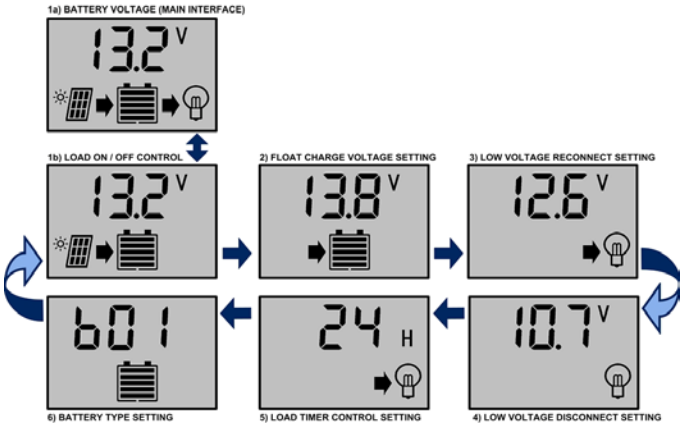


LCD Symbol	Description
Digital parameter	Shows measurement in numerical format (0 - 9)
Charge Indicator	When visible, indicates that the solar panel is charging the battery When blinking, battery is fully charged and in 'float' state.
Solar Panel Indicator	When visible, indicates that the solar panel is producing energy
Battery Indicator	Visual representation of the batteries state of charge
Discharge Indicator	When visible, indicates that the load is drawing power from the battery When blinking, there is a problem with the controller
Load Indicator	When visible, indicates that the load is on. When blinking, there is a problem with the load.

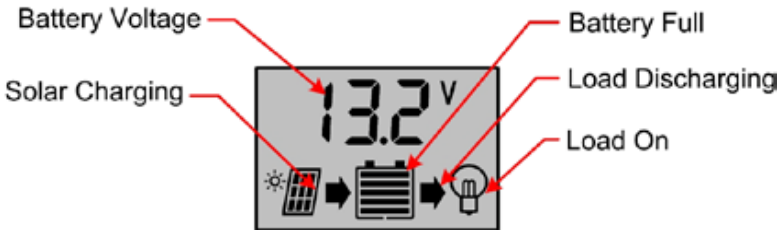
5.2.4 LCD Interface Cycle

FIGURE 14: LCD INTERFACE CYCLE



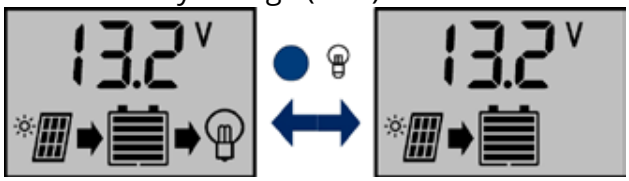
5.2.5 Interface Definitions

The SOLR0008-021 has six different graphical interfaces. Each interface contains different information. The Main Interface displays the current state of the Load, PV charging, Load discharging, battery capacity, and overall system working condition as shown below.



5.2.6 Battery Voltage - Main Interface

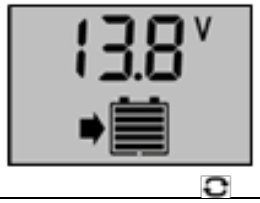
The main interface displays the present battery voltage (VDC).



NOTE:	By pressing the load button from this interface, you can turn the pump ON or OFF. The on/off function is NOT available in any other interface.

5.2.7 **Float Charge Interface**

The value displayed in this interface is the float charge voltage setting. When the battery reaches the set voltage, the controller will maintain this value to prevent the battery from overcharging.



NOTE:	To change the float charge setting, press the 'CYCLE' button for five (5) seconds or until the number starts to blink or flicker. The controller will enter the adjustment mode where you can use the 'cycle' and 'load' buttons to adjust the parameter. After the value has been set, press the 'mode' button for five (5) seconds to exit the adjustable mode and to save the adjusted setting.

5.2.8 **Low Voltage Reconnect (LVR) Interface**

The value displayed in this interface is the Low Voltage Reconnect (LVR) voltage set for the controller. After the controller enters into a low voltage protection state (Section 4.2.9), and the battery voltage recovers to the value set for the Low Voltage Reconnect , the controller will reconnect the load automatically.

NOTE:	To change LVR setting, press the 'CYCLE' button for five (5) seconds or until the number starts to blink or flicker. The controller will enter the adjustment mode where you can use the 'cycle' and 'load' buttons to adjust the parameter. After the value has been set, press the 'mode' button for five (5) seconds to exit the adjustable mode and to save the adjusted setting.

5.2.9 **Low Voltage Disconnect (LVD) Interface**

The value displayed in this interface is the Low Voltage Disconnect protection voltage set for the controller. If the battery voltage is lower than the set protection voltage, the controller will automatically disconnect the load to prevent the battery from over-discharging. The Low Voltage Disconnect is user-definable.

NOTE:	To change LVD setting, press the 'CYCLE' button for five (5) seconds or until the number starts to blink or flicker. The controller will enter the adjustment mode where you can use the 'cycle' and 'load' buttons to adjust the parameter. After the value has been set, press the 'mode' button for five (5) seconds to exit the adjustable mode and to save the adjusted setting.

5.2.10 **Load Mode - Timed Control Interface**

The P20L charge controller has a mode setting function to set specific operation parameters. It is preset to the factory default of normal control (24 hours). In 'Normal' mode, the load will draw from the battery at all times, and the PV panel will charge the battery when sunlight is available. It is also possible to have the load remain on for a set duration, and when that set time period has elapsed, the load will switch off. The duration setting is available in increments of 1 hour and 1-23 hour delays can be selected. See below table for various modes and corresponding functions.

NOTE:	The use of the default 24h setting is highly recommended; any other setting may cause the pump to automatically turn off.
NOTE:	To change Load Control Value setting, press the 'CYCLE' button for five (5) seconds or until the number starts to blink or flicker. The controller will enter the adjustment mode where you can use the 'cycle' and 'load' buttons to adjust the parameter. After the value has been set, press the 'mode' button for five (5) seconds to exit the adjustable mode and to save the adjusted setting.
NOTE:	There is a ten (10) minute delay before turning on the load to ensure that the controller is not getting a false reading by a passing cloud or shadow.

Value	Mode	Function
24h	Normal (Default)	Load is supplied continuous power
1h - 23h	Timed Control	Load is supplied power at nighttime and continues working for the specified duration (in hours). For example, if the Load Control Value is set to 2h, then the load will be turned on at night time and remain on for a period of 2 hours.
0h	Light Control	Load starts to supply power after dark and stops at dawn (sunrise)

5.2.11 **Battery Type Selection Interface**

The charge controller has the ability to charge many battery types with parameters pre-defined based on the battery type selected. The battery types available are listed in the following table:

Battery Type	LCD Selection	Boost Voltage (2 hour duration)
Lithium Battery	b00	Adjust Float Parameter to battery
Sealed Battery (default)	b01	14.4V / 28.8V
Gel Battery	b02	14.2V / 28.4V
Flooded Battery	b03	14.6V / 29.2V

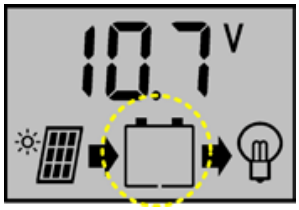
NOTE: For best results, the factory setting of b01 (sealed battery) should not be changed for the default setting.

NOTE: To change Battery Type Setting, press the 'CYCLE' button for five (5) seconds or until the number starts to blink or flicker. The controller will enter the adjustment mode where you can use the 'cycle' and 'load' buttons to adjust the parameter. After the value has been set, press the 'mode' button for five (5) seconds to exit the adjustable mode and to save the adjusted setting.

5.2.12 **Error Conditions - Low Voltage Protection**

If the battery voltage is lower than the protection voltage (Section 4.2.9), the controller will enter the low voltage protection state and the load will be disconnected. The use of solar panels or an alternate charger is required to charge the battery to the recovery level (Section 4.2.8). The controller will enter into the normal working state, and power will be supplied to the load once the battery voltage exceeds the Low Voltage Protection voltage.

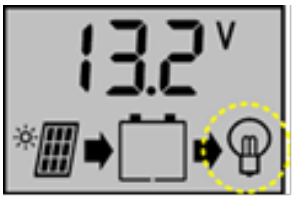
When in the Low Voltage Protection State, the LCD will look similar to the image below and the circled Battery icon will blink.



5.2.13 **Error Conditions - Overload Protection**

If the load is drawing a current 1.2 times the rated current of the controller for three (3) seconds or more, the controller will enter into an Overload Protection State. When in this state, any loads applied will need to be removed one by one until power is again supplied to the loads. The controller will supply power to the loads automatically within seconds of being within an acceptable level.

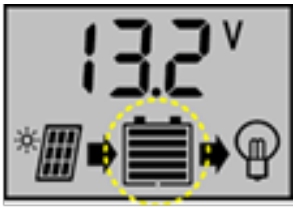
When in Overload Protection State, the LCD will look similar to the image below and the circled Load Icon will blink or flicker.



5.2.14 **Input Over Voltage Protection**

If the battery voltage to the controller is higher than the rated input voltage, the controller will stop output and enter the Over-Circuit Protection State.

When in Over-Circuit Protection State, the LCD will look similar to the image below and the circled Battery Icon will blink or flicker.



5.3 Solar Panels

5.3.1 The number of panels needed to allow for continuous operation will differ from application to application. Should the solar package need to be moved to a different application or location, please contact your CheckPoint representative, to ensure that your solar support equipment is properly sized.

5.3.3 Correct alignment is important to properly maintain battery charge levels. Follow local guidelines to determine optimal direction and tilt of solar array for optimal performance.

5.3.3 Solar panels should be positioned in a manner that will avoid shading from trees or structures to ensure that the solar panels operate optimally.

5.3.7 Solar panels should be regularly cleaned and free of snow, leaves, or other debris to ensure full power output.

> NOTE: Shade or debris covering a small section of the solar panel can reduce power output by a very large percentage, because the individual photovoltaic cells are connected in series.

5.3.8 Solar Panel Technical Information

Maximum Power (Pm)	100.0W
Power Tolerance	+/- 5%
Voltage at Max Power (Vmp)	17.4V
Current at Max Power (Imp)	5.75A
Open Circuit Voltage (Voc)	21.6V
Short Circuit Current (Isc)	6.32A
Operating Temperature	-40°C to +85°C
Maximum System Voltage	1,000V (600 VDC UL)
Maximum Series Fuse Rating	8A
Standard Test Condition	Irradiance 1,000W/m², 25°C, AM=1.5
Coefficients Noct	48°C +/- 2°C
Current Temp	0.06 +/- 0.01/k
Voltage Temp	-(78 +/- 10)MV/K
Power Temp	-(0.5 +/- 0.05)%/K
Solar Cell	Polycrystalline Silicon Cell (6.0” x 6.0”)
No. of Cells	36 (4*9)
Weight	18.7 lbs.
Junction Box	Ip65 rated
Warranty	Pm >90% @ 10 years, Pm >80% @ 20 years
Resistance	60 m/s wind

6. FLOW INFORMATION

6.1 Flow Charts

6.1.1 The CheckPoint Series Series FXS Solar Injection System assembly has four standard configurations designed to meet specific application requirements: a single panel, single battery system, a single panel, dual battery system, a dual panel single battery system and a dual panel, dual battery system. Your CheckPoint representative will help to determine the correct system for your application and geographic location.

6.1.2 To set flow rate, refer to the Performance Tables in the appendix.

NOTE:	CheckPoint is constantly improving and innovating its products. For most up-to-date performance data, contact CheckPoint directly, or check the FXS Solar Injection System product page at cppumps.com.

NOTE:	Never set a flow rate higher than the maximums shown below or pump downtime and battery bank damage may occur.

7. TROUBLESHOOTING

7.1 Pump Runs, but Chemical does not Discharge at the Correct Rate

7.1.1 **Suction check valve may be clogged with debris** To flush, allow pump to cycle at its maximum rate for at least 60 seconds. If no improvement is noted, remove the suction check valve from the body of pump, blow it out with air or water pressure, or rebuild if necessary, and reinstall.

NOTE:	CheckPoint FailSafe™ check valves do not need replacement when they do not check properly. A simple rebuild kit is available to replace the O-rings, which should correct all but the most severe check problems. If corrosion of the valve seat, retainer and/or poppet is apparent, a different type of check valve material is required.

NOTE:	Always replace Teflon™ tape or other appropriate thread sealant on check valve threads during reinstallation to avoid chemical leakage and/or air getting into the chemical head.

7.1.2 **Pump may have lost prime/become "air locked"** Check to ensure that there are no leaks in any process lines, particularly upstream of the pump in the chemical suction lines. If the pump is getting any air through the suction side, the pump will possibly lose prime. Please carefully read section 1.1.6 and its subsections for more details. A common source of air in the supply is the block valve ahead of the suction check. Inspect this valve to ensure that the stem packing is tight and that the materials of construction are compatible with the chemical being pumped. Check also that the pump's packing is not leaking. Finally, with pumps supplying chemical into gas lines, it is possible that the discharge port may be leaking, allowing gas under pressure to "back into" the chemical head.

7.1.3 **Check valves may have been relocated away from the chemical head of the pump** The checks must stay directly attached to the head in order to facilitate chemical movement.

7.1.4 **Chemical may be obstructed from entering the pump** Pumping upstream of the chemical head may have blockage preventing chemical from getting to the suction check valve. A common example is an in-line chemical filter becoming clogged with debris. In this case, the solution is to clean out the suction plumbing and clean or replace the chemical filter.

7.1.5 **Calibration gauge may be reading incorrectly due to a clogged air vent** If the calibration gauge is not reading correctly, it may appear that the chemical is not getting into the process. Check for an obstruction in the gauge or in the air vent atop the gauge.

7.2 Pump Does Not Stroke

7.2.1 **Power to motor** Ensure motor has required power supplied and is turned on.

7.2.2 **Power to motor** Ensure that the fuse has not blown.

7.2.3 **Solar battery bank power too low** Charge controllers are designed to automatically shut off the pump if battery power becomes too low to avoid battery damage and to avoid sporadic pump cycling. Please consult the charge controller section (Section 4.2) for further information.

7.2.4 **Pump stalled** The actual discharge pressure may be exceeding the stated maximum. Please turn off the pump power on the controller and contact your CheckPoint representative for assistance.

7.2.5 **Plunger adapter pin is sheared** Inspect the connection between the plunger and plunger adapter. If the plunger is disconnected from the plunger adapter, contact your authorized CheckPoint distributor.

7.2.6 **Drive cam follower is damaged** Contact your authorized CheckPoint distributor.

7.2.7 **Shaft or shaft keyway is damaged** Remove motor from pump and inspect key and keyway. If problem persists, contact your authorized CheckPoint distributor.

7.3 Pump is Excessively Noisy

7.3.1 **Drive components may be worn** Motor or gear reducer may be worn. Contact your CheckPoint representative for assistance.

7.3.2 **FXS shaft or follower may be worn** Clearances between rotating components may have increased due to wear.

NOTE:	When troubleshooting for excessive noise, care must be exercised as noise may appear to come from sources other than the worn component.

7.4 Chemical Leakage from Packing

7.4.1 **Packing may be worn** Prior to replacing the packing, it is important to determine if wear is premature. Common causes of prematurely worn packing are:

7.4.1.1 **Chemical may be attacking packing elastomer material** The packing will appear swollen or badly damaged once removed from the packing gland if it is being attacked by the chemical. Contact CheckPoint or your authorized CheckPoint distributor. If the chemical has recently been changed, or if the pump has just been placed in service, there is a good chance that new packing materials are needed to do the job.

7.4.1.2 **Chemical may be attacking plunger material** The plunger will be severely worn, pitted, or corroded when inspected.

7.4.1.3 **Chemical may have abrasives suspended in it** The plunger will appear scored, and the packing will appear severely worn. CheckPoint offers high performance chemical filters appropriate for Solar FXS applications.

7.5 Other Problems

If you are experiencing an operating problem not listed above, or if none of the above troubleshooting actions solve your operating problem, please contact your authorized CheckPoint distributor, or contact CheckPoint directly at help@cppumps.com, (800) 847-PUMP or (504) 340-0770, so that CheckPoint can assist you directly in determining appropriate solutions. Once CheckPoint has had the opportunity to help you troubleshoot your problem, please keep in mind the following information, regarding repairs:

7.5.1 **CheckPoint offers exchange programs to keep you in service** Before sending us your existing pump, we will ship you a rebuilt pump to install at your location for immediate use. When we receive your pump, we will tear it down, report back to you with any problems we uncovered, and rebuild it to factory condition to send back to you. We offer a fixed-price exchange plan, an actual-cost plan, and a consigned exchange plan that allows you to stock rebuilt pumps and charges you only when you use them. Please contact CheckPoint to learn more about this unique service.

7.5.2 **Nothing beats factory-direct repairs** Although the Solar FXS has been designed for easy operation and the injector heads easy to repair, the best way to ensure continued reliable service is to have your pump repaired at the factory. This is the only way to ensure you always get the quality and reliability you invested in when you purchased a CheckPoint product.

7.5.3 **After you repair your CheckPoint pump, it should perform as well as it did when it was new** If it doesn't, call us so that we can determine what we can do to restore the pump to "like-new" performance.

7.5.4 **Training sessions are available** Please contact CheckPoint to set one up.

APPENDIX

PERFORMANCE DATA

Series FXS Solar Injection System

CHECKPOINT PUMPS & SYSTEMS

www.cppumps.com

100W Single Panel System

1/8" Plunger

Min Flow Rate: 0.34 [GPD]
Max Pressure: 12,000 [PSIG]

Discharge Pressure	Insolation Factor [Hours]											
	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
0 PSIG	0.46	0.66	0.86	1.06	1.26	1.46	1.66	1.86	2.07	2.27	2.47	2.67
1,000 PSIG		0.45	0.64	0.82	1.00	1.18	1.36	1.54	1.72	1.90	2.08	2.26
2,000 PSIG		0.44	0.61	0.77	0.93	1.10	1.26	1.42	1.59	1.75	1.91	2.08
3,000 PSIG		0.40	0.55	0.71	0.86	1.02	1.17	1.33	1.49	1.64	1.80	1.95
4,000 PSIG		0.36	0.50	0.64	0.78	0.92	1.06	1.20	1.34	1.48	1.62	1.76
5,000 PSIG		0.25	0.39	0.52	0.66	0.79	0.93	1.06	1.20	1.34	1.47	1.61
6,000 PSIG		0.22	0.35	0.48	0.60	0.73	0.86	0.99	1.11	1.24	1.37	1.50
8,000 PSIG		0.13	0.21	0.28	0.36	0.44	0.52	0.60	0.67	0.75	0.83	0.91
10,000 PSIG		0.12	0.20	0.27	0.33	0.39	0.45	0.51	0.58	0.64	0.70	0.76
12,000 PSIG		0.11	0.17	0.22	0.26	0.31	0.35	0.40	0.45	0.49	0.54	0.59
Battery Rating	Rated Autonomy [Days]											
110 Ah	12.7	9.5	7.6	6.3	5.4	4.7	4.2	3.8	3.4	3.1	2.9	2.7

Max Flow Rate [GPD]

3/16" Plunger

Min Flow Rate: 0.78 [GPD]
Max Pressure: 7,500 [PSIG]

Discharge Pressure	Insolation Factor [Hours]											
	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
0 PSIG		1.22	1.67	2.12	2.57	3.03	3.48	3.93	4.38	4.83	5.28	5.73
1,000 PSIG		0.91	1.36	1.81	2.26	2.71	3.16	3.61	4.06	4.51	4.97	5.42
2,000 PSIG		0.87	1.26	1.65	2.03	2.42	2.81	3.19	3.58	3.97	4.35	4.74
3,000 PSIG		0.63	0.96	1.30	1.64	1.97	2.31	2.65	2.98	3.32	3.66	3.99
4,000 PSIG			0.78	1.06	1.35	1.64	1.93	2.22	2.51	2.80	3.08	3.37
5,000 PSIG				0.87	1.14	1.41	1.68	1.96	2.23	2.50	2.77	3.04
6,000 PSIG					0.74	1.00	1.26	1.52	1.78	2.04	2.30	2.56
7,000 PSIG					0.71	0.93	1.16	1.39	1.62	1.84	2.07	2.30
7,500 PSIG					0.60	0.80	1.11	1.33	1.54	1.70	1.97	2.18
Battery Rating	Rated Autonomy [Days]											
110 Ah	12.7	9.5	7.6	6.3	5.4	4.7	4.2	3.8	3.4	3.1	2.9	2.7

Max Flow Rate [GPD]

1/4" Plunger

Min Flow Rate: 1.47 [GPD]
Max Pressure: 7,500 [PSIG]

Discharge Pressure	Insolation Factor [Hours]											
	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
0 PSIG	1.91	2.85	3.78	4.72	5.66	6.59	7.53	8.47	9.40	10.34	11.28	12.21
1,000 PSIG		1.83	2.51	3.19	3.87	4.55	5.23	5.91	6.58	7.26	7.94	8.62
2,000 PSIG			1.70	2.25	2.81	3.36	3.92	4.47	5.03	5.59	6.14	6.70
3,000 PSIG			1.29	1.77	2.25	2.73	3.21	3.69	4.17	4.65	5.13	5.61
4,000 PSIG				1.23	1.65	2.06	2.47	2.89	3.30	3.72	4.13	4.55
5,000 PSIG					1.24	1.58	1.93	2.27	2.61	2.95	3.29	3.63
6,000 PSIG									1.22	2.12	2.19	2.52
7,000 PSIG											1.16	1.67
7,500 PSIG											1.10	1.60
Battery Rating	Rated Autonomy [Days]											
110 Ah	12.7	9.5	7.6	6.3	5.4	4.7	4.2	3.8	3.4	3.1	2.9	2.7

Max Flow Rate [GPD]

3/8" Plunger

Min Flow Rate: 2.5 [GPD]
Max Pressure: 3,250 [PSIG]

Discharge Pressure	Insolation Factor [Hours]											
	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
0 PSIG	3.93	5.83	7.74	9.64	11.55	13.45	15.36	17.26	19.16	21.07	22.97	24.88
1,000 PSIG		2.27	3.41	4.56	5.70	6.84	7.98	9.13	10.27	11.41	12.55	13.70
2,000 PSIG					2.54	3.60	4.65	5.62	6.45	7.27	8.10	8.92
3,000 PSIG								2.55	3.55	4.54	5.15	5.76
3,250 PSIG								2.50	3.50	4.09	4.67	5.24
Battery Rating	Rated Autonomy [Days]											
110 Ah	12.7	9.5	7.6	6.3	5.4	4.7	4.2	3.8	3.4	3.1	2.9	2.7

Max Flow Rate [GPD]

1/2" Plunger

Min Flow Rate: 5.66 [GPD]
Max Pressure: 1,850 [PSIG]

Discharge Pressure	Insolation Factor [Hours]											
	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
0 PSIG	8.08	11.64	15.20	18.76	22.32	25.88	29.44	33.00	36.56	40.12	43.68	47.24
500 PSIG			6.41	9.80	13.19	15.71	17.97	20.22	22.47	24.73	26.98	29.23
1,000 PSIG							8.69	12.78	13.95	15.75	17.55	19.35
1,500 PSIG										5.36	8.48	11.59
1,850 PSIG												4.94
Battery Rating	Rated Autonomy [Days]											
110 Ah	12.7	9.5	7.6	6.3	5.4	4.7	4.2	3.8	3.4	3.1	2.9	2.7

Max Flow Rate [GPD]

How to use this table:

- Determine the solar insolation factor based on system install location.
- In the appropriate insolation factor column, find a maximum flow rate and discharge pressure value that are both equal to or greater than the application requirement.
- Confirm that the minimum flow rate of that plunger is equal to or less than the application requirement.
- Please contact CheckPoint for assistance or to discuss a customized solution.