MPC 3000 CONTROL SYSTEM

Spectra Watermakers 200C / 380C / Santa Cruz / Gulfstream 400 systems

INSTALLATION GUIDE

- COMPONENT PLACEMENT & WIRING GUIDELINES
- WIRING DIAGRAMS
- PLUMBING CONNECTION DIAGRAMS
- TROUBLESHOOTING GUIDE

ADD THIS MANUAL TO THE REGULAR SYSTEM OWNERS' MANUAL

REV 12/15/01

MPC installation

COMPONENT PLACEMENT GUIDELINES:

- **CONTROL BOX** [*and solenoid valve panel on Santa Cruz models*]
- The control box must be mounted vertically on a bulkhead, with the wiring access holes pointing down, away from spray or dripping water.

- Do not connect DC power to the control box until after all wiring connections are been finished! Do not connect DC power to the control box unless the remote control display[s] are connected!

- The supply circuit must be rated to support a 30 amp continuous load for 12 volt systems, or 15 amps continuous for 24 volt systems. Use LARGE gauge feed wire rated as follows to avoid a voltage drop and related loss of performance.

**** NOTE * Length in feet is measured from source circuit breaker to control box***
and back *to source [total length of supply wires]*

12 volt systems:

WIRE LENGTH	AWG wire size	Square MM wire size
10 feet to 20 feet	8 awg	8 sq mm
20 feet to 30 feet	6 awg	13 sq mm
30 feet to 40 feet	4 awg	19 sq mm
40 feet to 50 feet	4 awg	19 sq mm
50 feet to 60 feet	2 awg	32 sq mm

24 volt systems:

WIRE LENGTH	AWG wire size	Square MM wire size
10 feet to 20 feet	12 awg	3 sq mm
20 feet to 30 feet	10 awg	5 sq mm
30 feet to 40 feet	8 awg	8 sq mm
40 feet to 50 feet	6 awg	13 sq mm
50 feet to 60 feet	6 awg	13 sq mm

- For large wires, it may be advisable to use a terminal block or distribution posts near the control box to terminate the large cables, then run smaller cables to the power inlet studs on the circuit board.

- The wire leads for the stoke sensor, and the pressure sensors are 6ft [2M] long. The control box must be located so that the wire leads can reach the sensors. If the wire leads for the sensors must be extended, see details below for proper wiring procedures.

- The control box has two waterproof toggle switches located on the right hand side. These switches directly power the feed pump[s] in the event of a control box failure, or for servicing the system as in pickling procedures or cleaning the membrane. For normal operation both switches must be "OFF" [down].

- **REMOTE CONTROL DISPLAY PANEL[S]:**
- The system can accommodate up to 3 remote control display panels. The displays must be mounted in a protected location, out of direct sunlight, and away from spray or dripping water. Commands can be entered at any panel.

- The display panels connect with the supplied 50 foot modular-type cable, to the control box sockets marked "DISPLAYS". Do not substitute a different type of cable! If you need longer cables contact the factory.

- Use care when pulling the modular cable through the ships' wiring harness, as the end plugs are easily damaged by excessive force. Fold back 4" of wire and tape over the end plugs before pulling the cable to prevent damage. If the cables are damaged during installation, the system will not operate, and the controller may also be damaged. If in doubt, use a new cable.

- Each remote control display panel can accommodate an external alarm buzzer to provide audible alerts in the event of a fault or at the end of certain timed cycles. Use only the buzzer units supplied by Spectra Watermakers, as current on the buzzer circuit is limited to 20 milliamps, any excessive load may damage the controller or remote display panel. Connect the buzzer RED wire to the terminal marked +POSITIVE, connect the buzzer BLACK wire to the terminal marked – NEGATIVE on the back of the remote display panel.

- A buzzer may also be installed at the control box. *See accessories, below.*

- **FEED PUMP WIRING:**
- The feed pumps should mount vertically with the motor pointing up, pump head pointing down. This allows the pump to prime properly, and prevents any leaks from ruining the motor.

- * IMPORTANT * <u>On Spectra 200C systems using only 1 feed pump it is necessary to jumper together the two sets of feed pump terminals inside the control box.</u> Connect a #14 AWG [2 sq mm] red wire from "PMP 1" terminal, to the "PMP 2" terminal. The feed pump wires can then connect to either set of pump output terminals. This is necessary to enable the automatic priming sequence to function properly. *See diagrams for wiring detail.*

- The feed pumps should be wired to the control box with at least 14 AWG [2 sq mm] wire. If the wire run from the control box to the feed pumps is greater than 10 feet, use larger wire.

- The feed pumps connect to the "PMP 1 / GND" and "PMP 2 / GND" terminals inside the control box. The feed pump RED + wires connect to the "PMP 1" and "PMP 2" terminals. The pump BLACK – wires connect to the "GND" terminals. Be sure to leave the manual override switch black wires attached to the "PMP 1" + and "PMP 2" + terminals. Do not confuse these black wires [DC+] for other black [DC-] negative ground wires!

- The feed pump cooling fan wires can connect to the pump wire terminals inside the control box, or to the pump wires near the feed pumps. Be sure to use waterproof heat shrink tubing on all connections made outside of the control box. The fan RED wire connects to the pump DC+ RED wire, and the fan BLACK wire connects to the pump DC- BLACK wire.

- When installing the cooling fans, be certain not to push the fan clip too far onto the motor, as this can jam the fan blades and prevent them from turning. This will cause the pumps to overheat and shut off intermittently.

- **<u>PRESSURE SENSORS:</u>**
- The pressure sensors mount on tee fittings on the prefilter[s] housing to monitor the system pressure, and differential pressure across the filter[s].

- The sensors are extremely sensitive, and therefore must mount as close to the prefilters as possible; as any length of hose or extra fittings between the filter and the sensor can cause errors in the readings, due to plumbing 'drag' through the system. This can lead to the system constantly shutting down in a clogged prefilter condition. *See diagrams for assembly details*.

- The sensor connected to the INLET side of the filter must connect to the set of inputs on the LEFT side of the green terminal plug, and the sensor on the OUTLET side of the filter must connect to the set of inputs on the RIGHT side of the terminal plug. *See diagrams for wiring details.*

- If the wire leads for the sensors must be extended, you must use a minimum #18AWG [.8 sq mm] three conductor, twisted and shielded marine-grade wire. Make a waterproof, soldered, splice connection to the new wire, and seal the splice in waterproof heat shrink tubing.

- Integrity of the sensor wiring is critical, as any minute loss in the connections will be interpreted by the controller as a drop in pressure. Be sure to carefully solder-tin the bare strands of the wires before inserting them into the terminal plugs. Make certain that no extra strands are free to make contact with other conductors or components. *See diagrams for wiring details.*

- Ground the shield conductors to the chassis ground screw in the upper right hand corner of the circuit board. Make certain that the bare shield conductor cannot touch any components or other wires on the circuit board.

- **STROKE SENSOR:**
- The stroke sensor snaps into the side of the end block of the clark pump, and the wires connect to the terminal plug inside the control box marked "stroke sensor 1" on the LEFT side of the terminal plug.

- If the wire leads for the sensor must be extended, you must use a three conductor, twisted and shielded marine-grade wire. Make a waterproof, soldered, splice connection to the new wire, and seal the splice in waterproof heat shrink tubing.

- Integrity of the sensor wiring is critical, as any loss in the connections will be interpreted by the controller as a stall condition. Be sure to carefully solder-tin the bare strands of the wires before inserting them into the terminal plugs. Make certain that no extra strands are free to make contact with other conductors or components.

- **DIVERSION VALVE & SALINITY PROBE:**
- The diversion valve solenoid & salinity probe must be installed in a tee fitting in the product water tube, between the product service valve, and the ships' fresh water tank. The salinity sensor must be oriented with the wire pointing down, to avoid any air bubbles from forming on the face of the sensor. *See diagrams for assembly detail.*

- The salinity probe wire plugs into the socket marked "PROBE" on the circuit board, using the 6 foot modular type cable. Do not substitute a different type of wire for the probe cable. If you need a longer cable, contact the factory. Use the rubber boot to seal sensor to the cable after assembly is complete.

- The diversion valve solenoid wires connect to the terminals marked "D VLV" and "GND" inside the control box.

- **FRESH WATER FLUSH SYSTEM:**
- The fresh water flush panel must mount vertically with the arrow on the check valve pointing up, to prevent fresh water from constantly flowing out to the ocean. * *NOTE* On Santa Cruz systems the check valve is installed on the panel with the control box. This panel must also be mounted vertically to allow proper operation of the check valve.*

- The fresh water flush solenoid valve wires connect to the terminals marked "FW V" and "GND" inside the control box.

- The fresh water connection to the ships' fresh water system must connect on the pressure side of the ships' fresh water pump, to supply a constant 35 – 45 psi and 1.0 – 1.5 gallons per minute for flushing operation. The ships' fresh water system must remain active during the **auto store** mode for automatic flushing to occur. Do not rely on the Spectra system pump[s] to suck flushing water from the water tank. Insufficient flushing water supply can lead to a permanently damaged RO membrane; and is not covered under the Spectra warranty.

- **CONNECTION OF OPTIONAL ACCESSORIES:**
- Use of any external devices not approved by the factory may cause permanent damage to the controller, and is not covered under the Spectra warranty. Accessory outputs are limited to 2 amps maximum load! Do not connect motors, pumps, etc. to accessory outputs.

- **ULTRAVIOLET STERILIZER:** Detailed instructions are included with the sterilizer kit. The UV sterilizer lamp module and ballast unit should mount vertically, with the product water inlet at the bottom, outlet at the top. The ballast unit wires plug into the end of the bulb in the lamp module. The ballast unit power wires connect to the "STER" and "GND" terminals inside the control box. Ballast RED wire connects to "STER" terminal, and ballast BLACK wire connects to "GND" terminal. If the wires must be extended, use minimum #16 AWG [1 sq mm] wire.

- **EXTERNAL BUZZER[S]:** In addition to the external buzzer[s] installed at each remote control display panel, a buzzer unit may be installed at the control box. The buzzer RED wire connects to the "BUZZ" terminal, and the buzzer BLACK wire connects to the "GND" terminal.

- **TANK FULL SWITCHES:** The system can accommodate 2 float switches in separate water tanks, to automatically turn off the watermaker when both tanks reach the full level.

* NOTES *

  - Switches are not supplied with the system, as many different industry standard type switches can be used. The controller waits for 2 minutes after BOTH switch contacts are closed before turning off the system, and sounding the alarm.

  - It is normal for water to be discharged from the water tank vent[s] as the tanks approach the full level, and during the 2 minute delay, before the system shuts off. Make certain that the tank vents are plumbed in such a manner that the excess water will be discharged overboard, and not back into the vessel.

  - The switches must be of the normally open type, that close a contact when the tank is full. Use at least #16AWG [1 sq mm] 2 conductor marine grade, twisted shielded wire to connect the tank switches to the control box. The tank full switches connect to the terminal plug inside the control box marked "FLOAT SWITCH". *See diagrams for wiring details.*

  - If only 1 tank switch is used, you must jumper the unused tank float switch terminals to make the system function properly.
    See diagrams for wiring detail

Spectra Watermakers MPC 3000
BASIC OPERATIONS GUIDE

INITIAL START-UP: (if power has been turned off, or if system has been pickled)

- turn on main DC supply circuit breaker
- push ALARM / DISP button to cancel alarm, and open pressure relief valve on clark pump
- push START/ STOP button
- system will purge storage chemical for 20 minutes, then sound alarm and shut off
- push ALARM / DISP button to cancel alarm, and close pressure relief valve on clark pump
- push AUTO RUN or START / STOP button to start the system normally

*** NOTE *** it is not necessary to go through the full initial start-up and chemical purge sequence unless the power has been interrupted, or there are cleaning / storage chemicals in the system.

*** CAUTION *** always open the [clark pump] pressure relief valve and purge storage / cleaning chemicals from the system for at least 20 minutes after any membrane service procedures. Pressurizing the system with any storage or cleaning chemicals will cause permanent damage to the reverse osmosis membrane, and is not covered under the Spectra warranty.

START / STOP button:

- push once to start and run the system manually
- push again to stop all operations
- system will not fresh water flush when stopped manually

HIGH / LOW OPERATION:

- If system was started with START / STOP button, push *and hold* START / STOP button for 5 seconds to toggle between high & low modes
- If system was started with AUTO RUN button, push *and hold* AUTO RUN button for 5 seconds to toggle between high & low modes

AUTO RUN button:

- push once to start system and run in automatic mode
- Each additional push of the AUTO RUN button adds 1 hour of run time, up to 12 hours max.
- When time expires, system will turn off and begin **auto store** mode

AUTO STORE button:

** NOTE * ships' fresh water system must remain on for proper flushing operation*

- push once to activate an automatic fresh water flush cycle every 5 days
- push *and hold* to activate a single fresh water flush cycle

ALARM / DISPLAY button:

- push to silence audio alarms, red LED will continue to flash until fault is cleared
- push repeatedly to toggle through different display options
- push *and hold* to change display to read metric units

EMERGENCY OPERATION / MANUAL BYPASS MODE / PICKLING OR STORAGE MODE:

- use manual override switches on control box to manually activate pumps as needed
- always open [clark pump] pressure relief valve when using storage or cleaning chemicals
- always turn off the main DC supply breaker when system is pickled

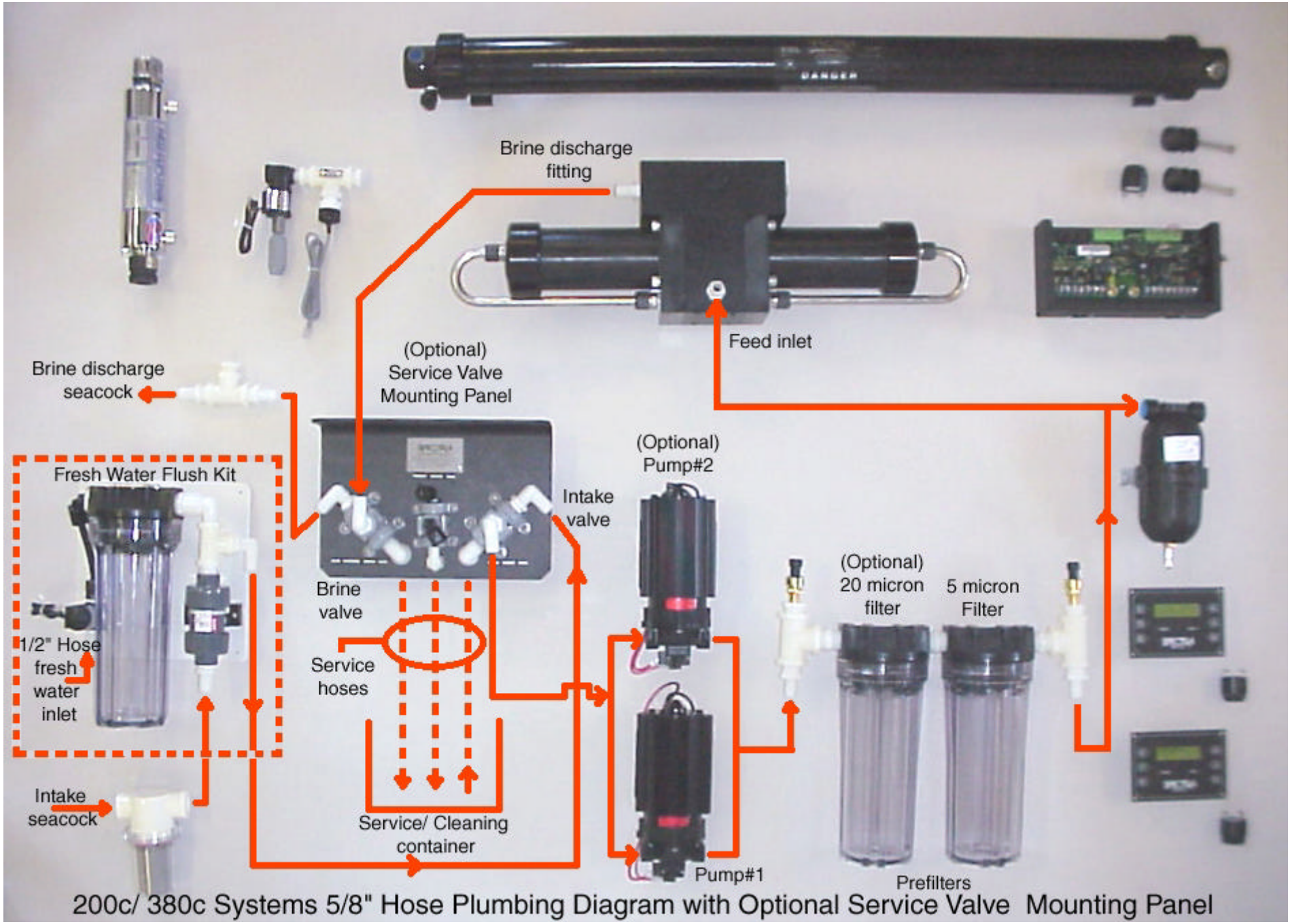
Spectra Watermakers MPC 3000 troubleshooting procedures

MECHANICAL FAULTS

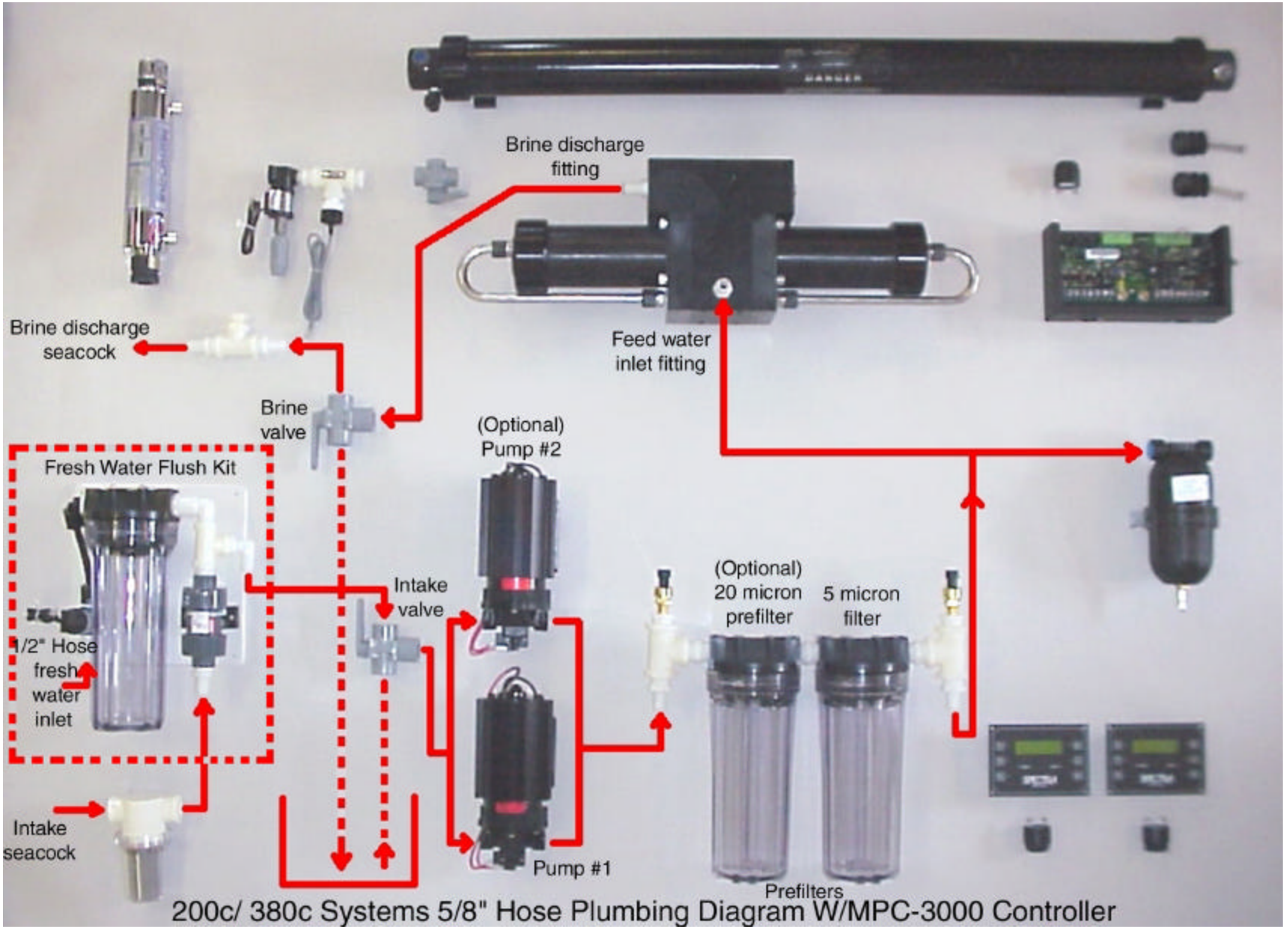
SYMPTOMS	PROBABLE CAUSE	REMEDY
Feed pumps run constantly, will not turn off	-manual override switches in ‘on’ position	-turn ‘off’ manual switches on control box
No lights or display, system does not operate	-remote display not connected -no power to control box	-check display cable connections at back of display and inside control box -check and reset main DC supply breaker -check for voltage [12 or 24VDC] at control box power input studs -try manual bypass switches, if pumps run, then control is defective, or display is not connected to controller.
Pumps run intermittently / cycling on & off	-pump pressure switches out of adjustment -pump cooling fan jammed or defective -pump thermal cutout switch defective	-adjust cutoff pressures [see system manual] -check fan blades for free rotation -check fan wires for voltage [12 or 24 volts] -replace feed pump or temporarily bypass thermal cutout switch [contact factory]
Display activates, but pump[s] do not run	-loose or broken pump[s] wire connection -blown F3 or F5 fuse on circuit board	-check wiring at terminal block inside control box and at feed pump terminals -replace fuse [mini automotive type ATM]
Display activates, system runs, no product water output, no feed pressure	-low feed pressure causing no output -Intake seacock closed, no feed water -Intake service valve in ‘service’ position	-Check and close pressure relief valve -Open seacock valve -Verify service valves all in ‘run’ position
System runs, no product water delivered to water tanks, GPH bar graph shows OK, ‘good’ LED activated	-product service valve in ‘service’ position -loose or broken diversion valve wires -diversion valve plunger stuck	-verify service valves all in ‘run’ position -check wiring at terminal block inside control box and at diversion valve -disassemble & clean diversion valve plunger or replace valve [contact factory]
System runs, no product water delivered to water tanks, GPH bar graph shows OK, ‘reject’ LED stays activated	-high salinity of product water, causing system to reject water constantly -product service valve in ‘service’ position -chlorine damage to membranes	-check for low feed pressure -check for leaks at high pressure hoses -verify service valves all in ‘run’ position -test product water with hand held tester, if constantly over 500 PPM for 1 hour, replace RO membrane [contact factory]

ERROR MESSAGES

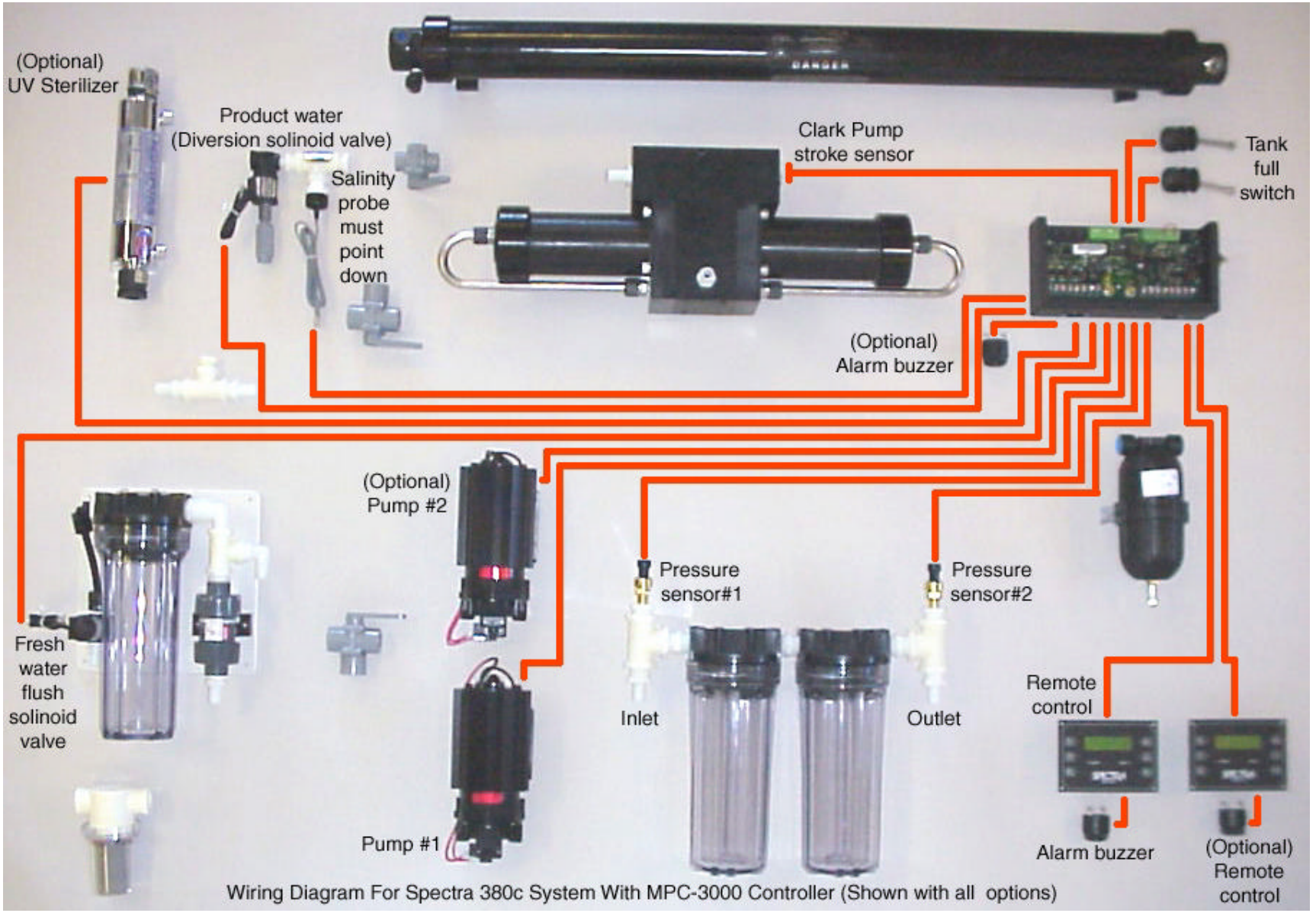
'System stalled'	-no feed water flow, air in system -no signal from clark pump stroke sensor -loose or broken wires for sensor -stroke sensor defective	-Open pressure relief valve, restart system -Check blinking green LED on clark pump, verify sensor fully inserted into pump -check wires in control box and at sensor -turn system 'on', check for 5VDC between sensor RED & GREEN wires on terminal plug, if voltage is present, controller is OK, remove sensor from clark pump [see diagram for removal] and place a strong magnet near sensor, if green LED does not activate, replace sensor [contact factory]
'Over pressure'	-feed pressure too high, cold water -feed pressure too high, fouled membrane	-activate low mode -clean membrane [see manual]
'Voltage too high'	-battery system voltage too high	-adjust charging system, turn down settings
'Voltage too low'	-battery system voltage too low -loose supply wires or poor connections	-charge batteries -check supply wires in control box, and at electrical source for poor connections
'Restarting' [followed by countdown timer]	-system stalled, air in system -no signal from clark pump stroke sensor	-see remedy above, for 'system stalled' -see remedy above for stroke sensor
'Check fuse' [followed by fuse number]	-blown fuse on circuit board	-replace fuse [mini automotive type ATM]
'Service prefilters'	-prefilter[s] clogged -loose or defective pressure sensor wires	-install new filter[s] -check sensor wiring at filter housings -disconnect sensors connector plugs
'Salinity high'	-high salinity of product water, causing system to reject water constantly -product service valve in 'service' position -chlorine damage to membranes -low feed pressures causing high salinity -corroded or damaged salinity probe cable	-check for low feed pressure -check for leaks at high pressure hoses -verify service valves all in 'run' position -test product water with hand held tester, if constantly over 500 PPM for 1 hour, replace RO membrane [contact factory] -test system feed flow [see system manual] -disconnect cable at control box & retest, if system 'good' LED activates, replace cable



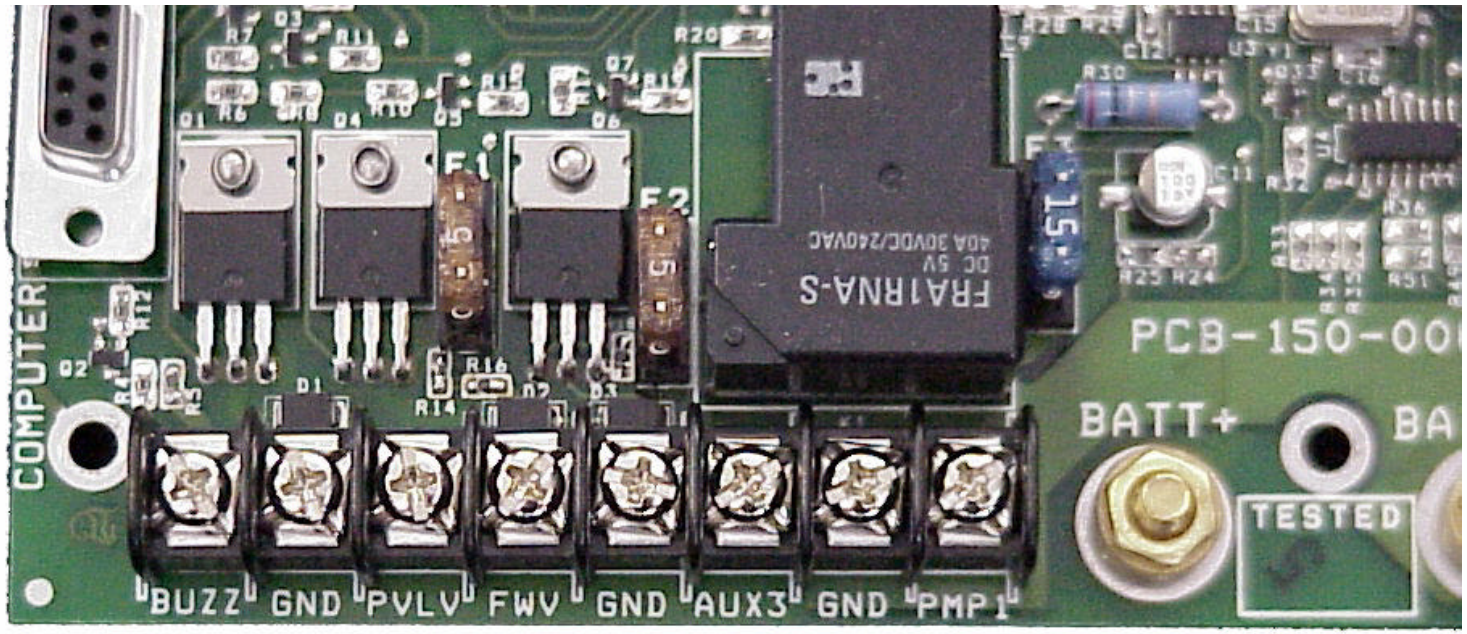
200c/ 380c Systems 5/8" Hose Plumbing Diagram with Optional Service Valve Mounting Panel

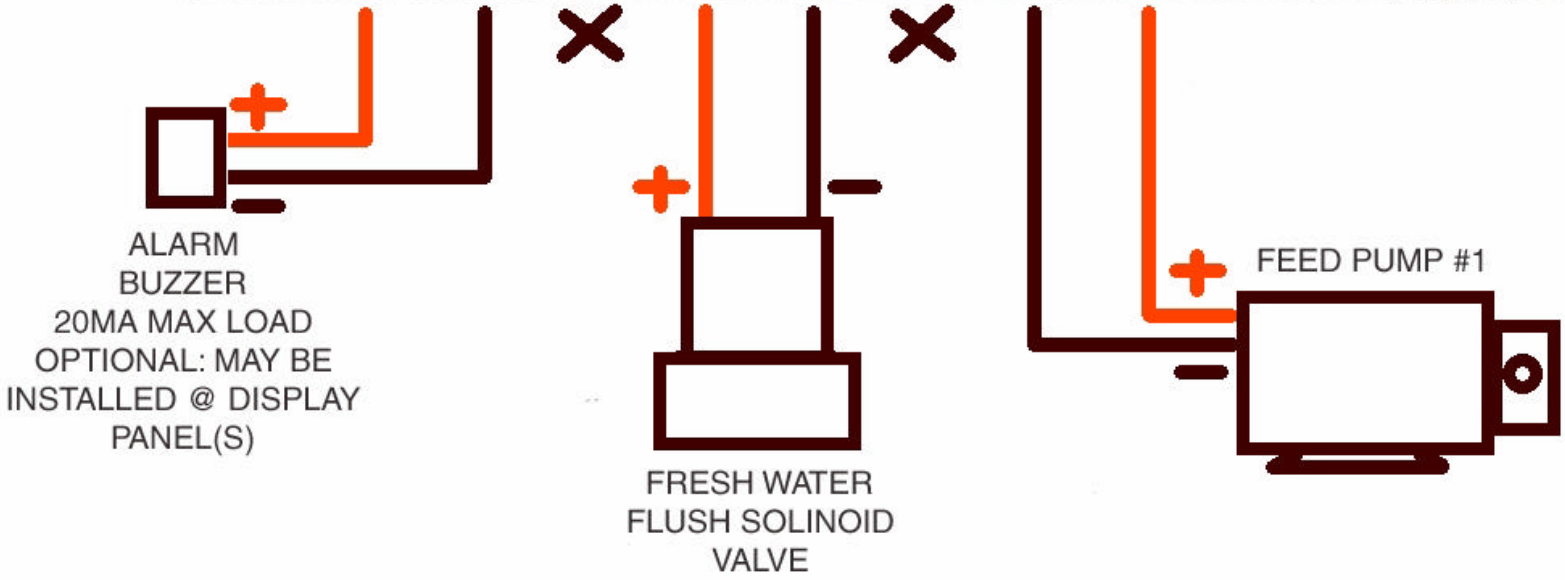


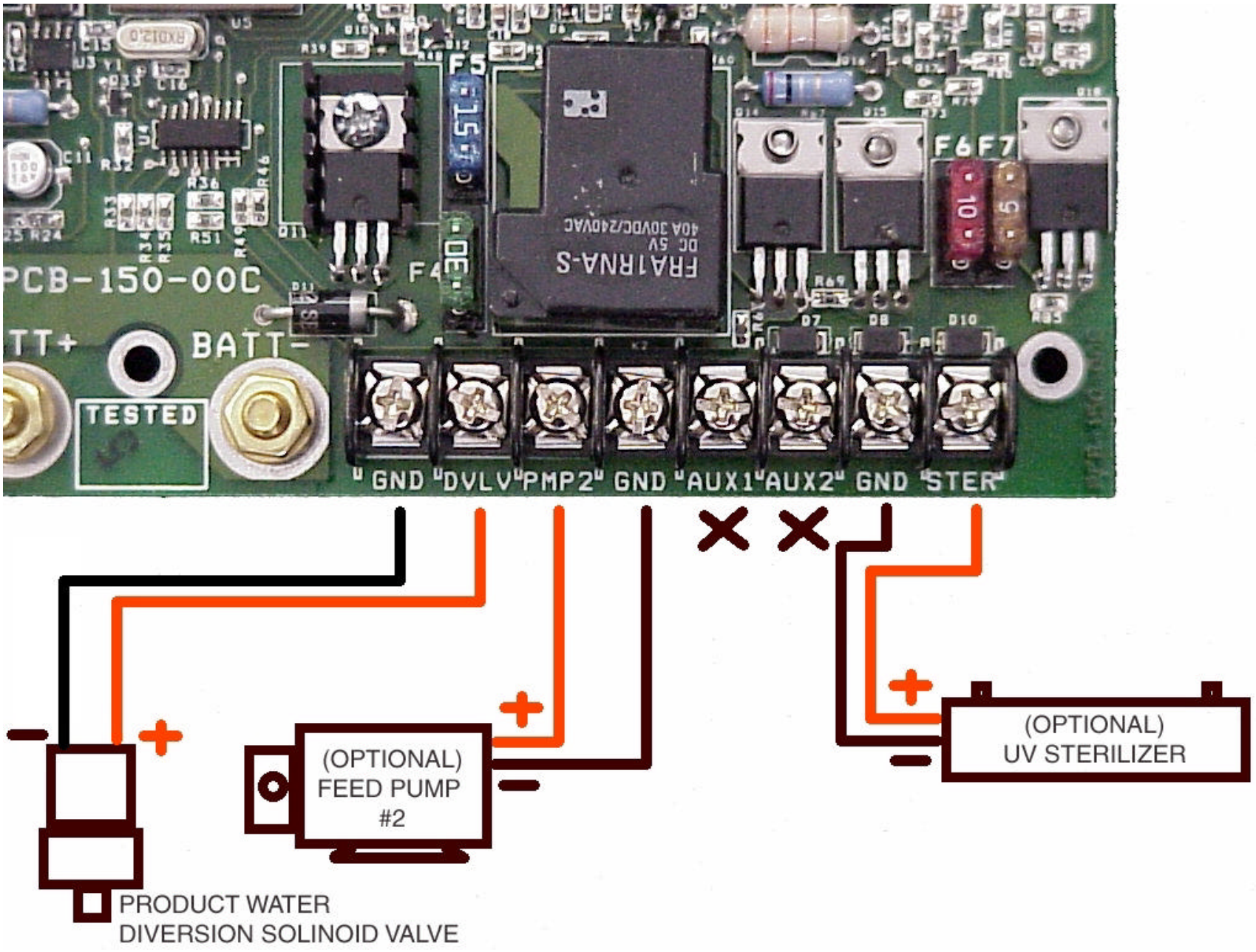
200c/ 380c Systems 5/8" Hose Plumbing Diagram W/MPC-3000 Controller

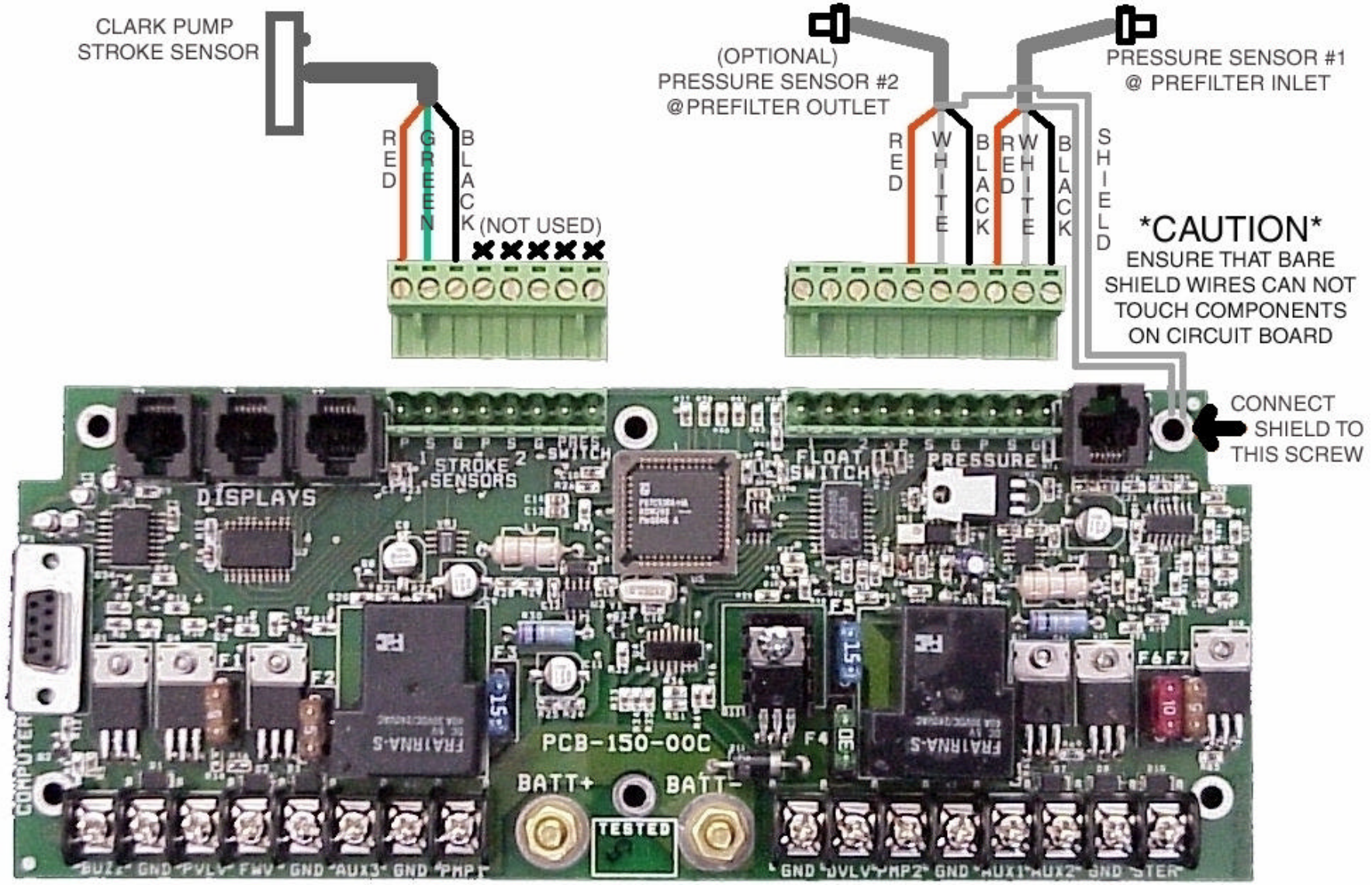


Wiring Diagram For Spectra 380c System With MPC-3000 Controller (Shown with all options)

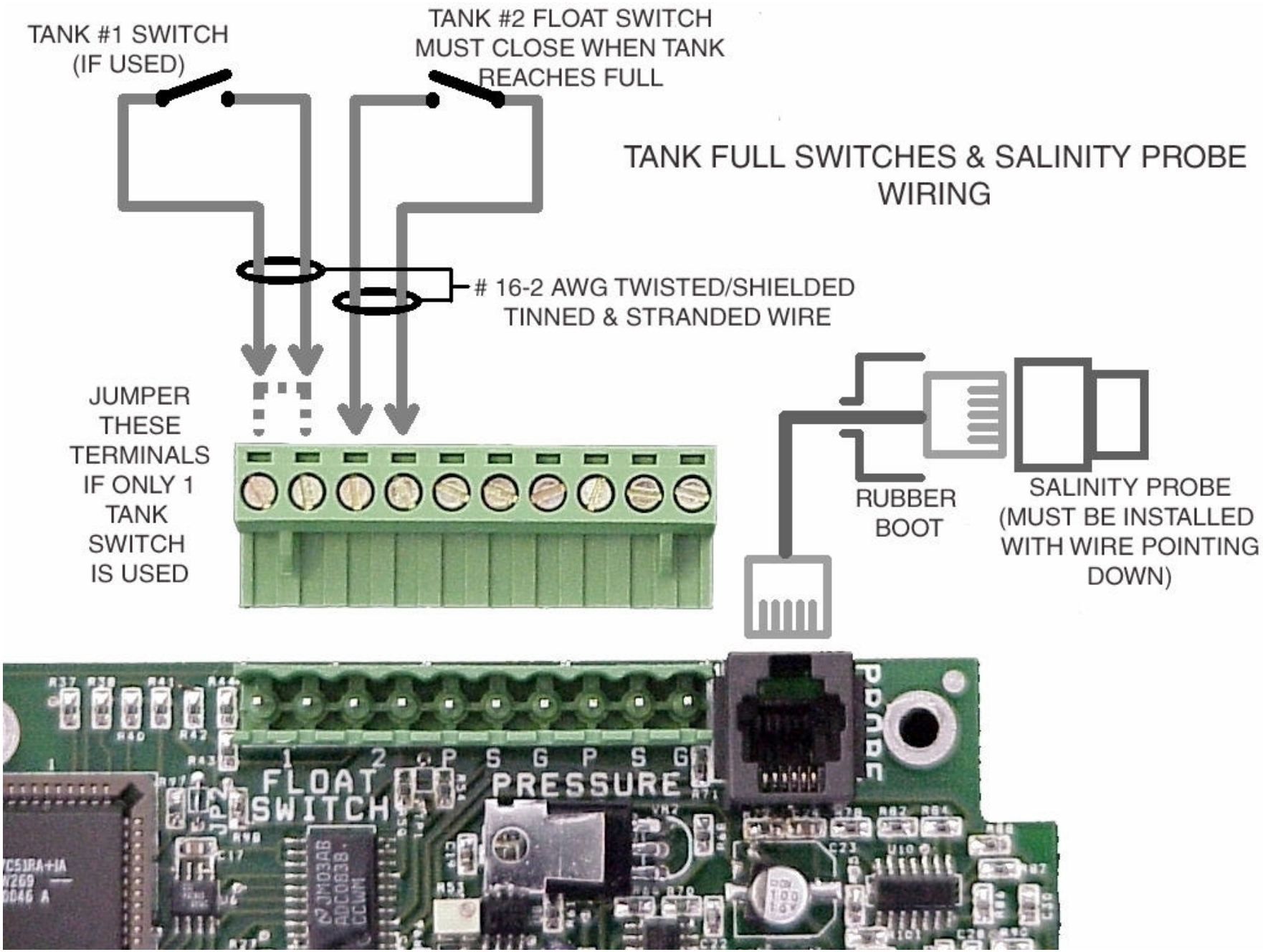

COMPUTER
F1
F2
FRA1RNA-S
PCB-150-00
BATT+
TESTED
BUZZ
GND
PVLV
FWV
GND
AUX3
GND
PMP1


ALARM
BUZZER
20MA MAX LOAD
OPTIONAL: MAY BE
INSTALLED @ DISPLAY
PANEL(S)
FRESH WATER
FLUSH SOLINOID
VALVE
FEED PUMP #1

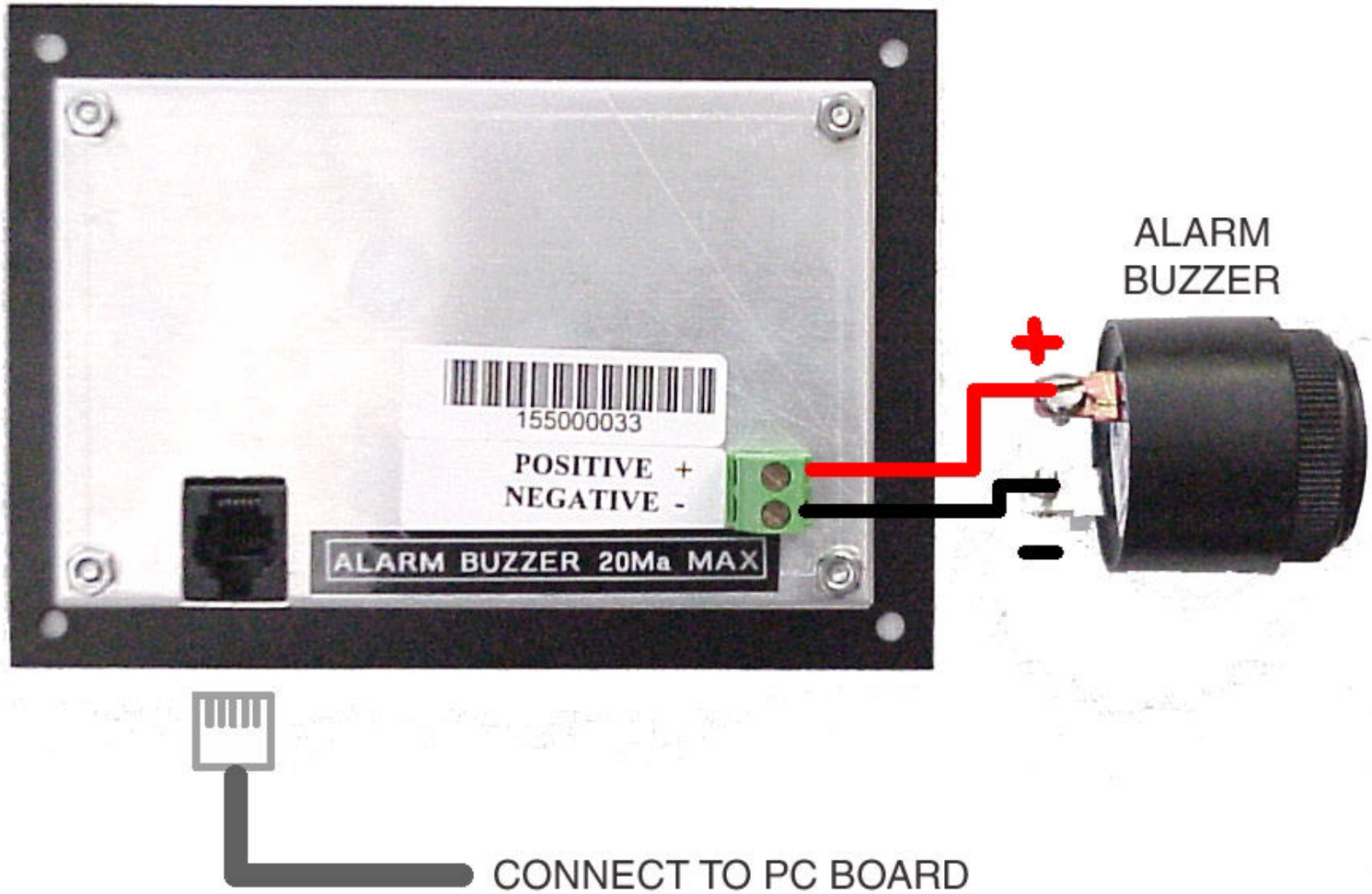

PCB-150-00C
BATT+
BATT-
TESTED
F5
F6F7
F4
FRA1RNA-S
" GND "DVLV"PMP2" GND "AUX1"AUX2" GND "STER"
(OPTIONAL)
FEED PUMP
#2
(OPTIONAL)
UV STERILIZER
PRODUCT WATER
DIVERSION SOLINOID VALVE



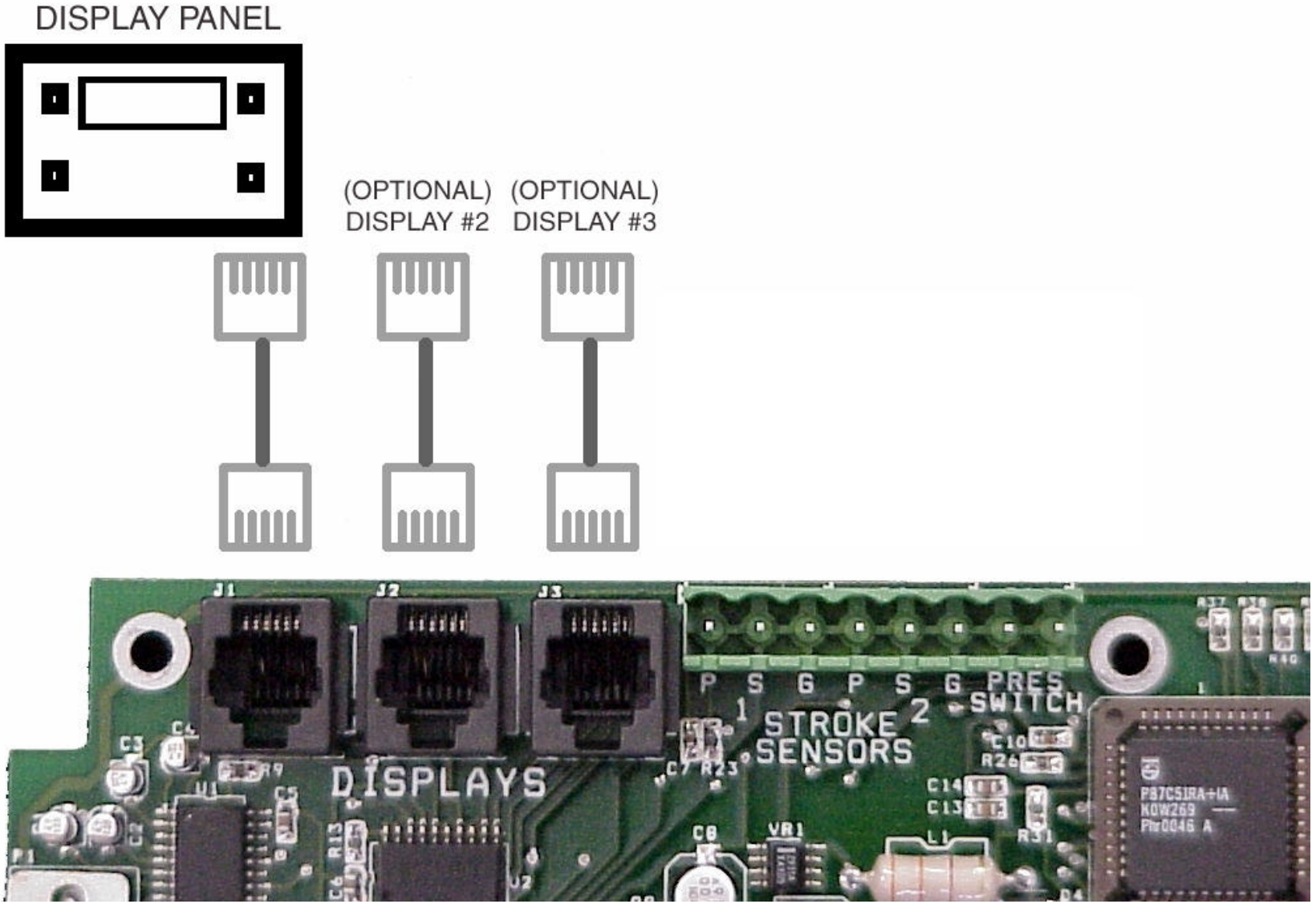
STROKE SENSOR & PRESSURE SENSOR WIRING

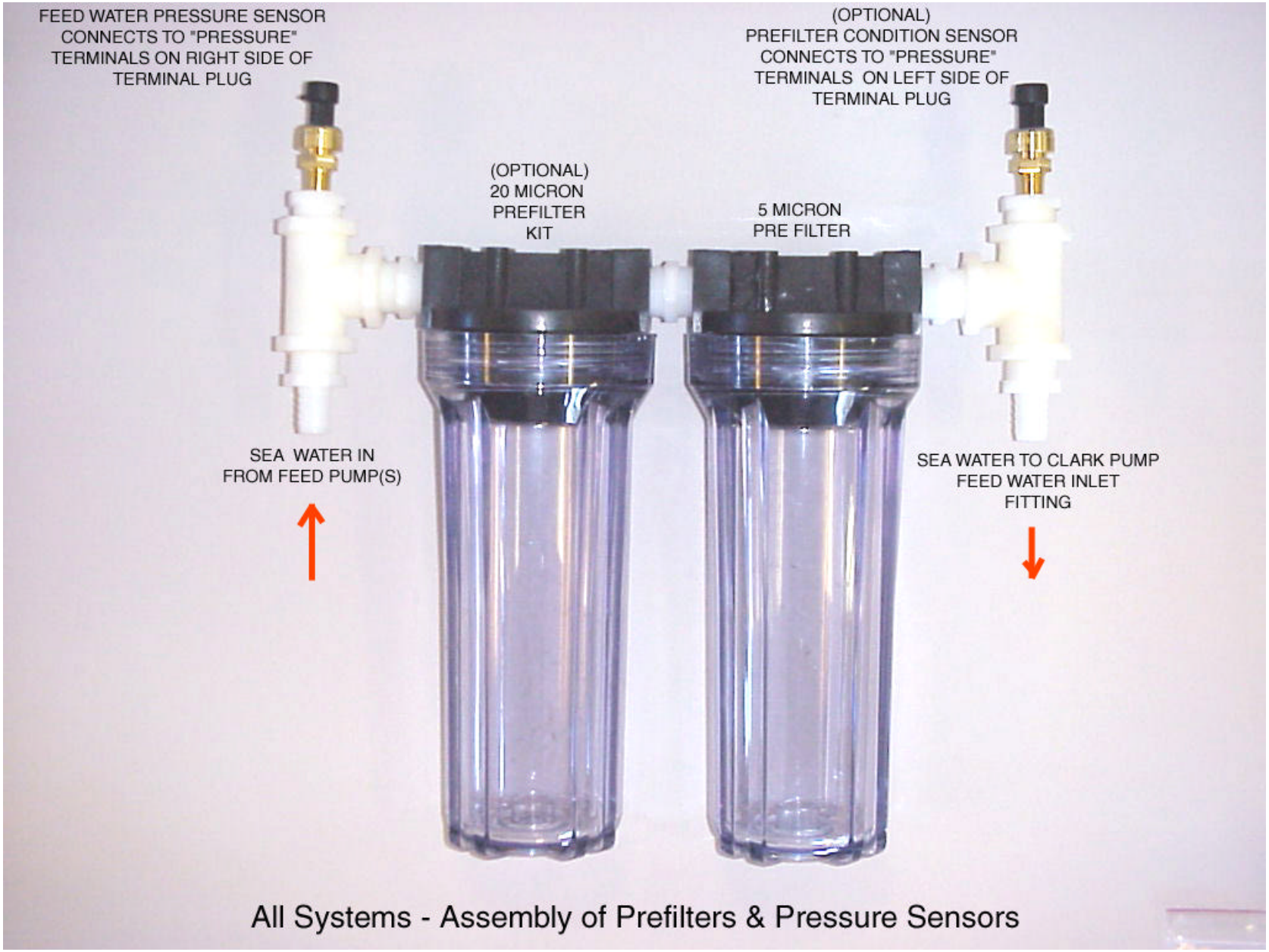

TANK #1 SWITCH
(IF USED)
TANK #2 FLOAT SWITCH
MUST CLOSE WHEN TANK
REACHES FULL
TANK FULL SWITCHES & SALINITY PROBE
WIRING
16-2 AWG TWISTED/SHIELDED
TINNED & STRANDED WIRE
JUMPER
THESE
TERMINALS
IF ONLY 1
TANK
SWITCH
IS USED
RUBBER
BOOT
SALINITY PROBE
(MUST BE INSTALLED
WITH WIRE POINTING
DOWN)
1 2 P S G P S G
FLOAT
SWITCH
PRESSURE
PROBE

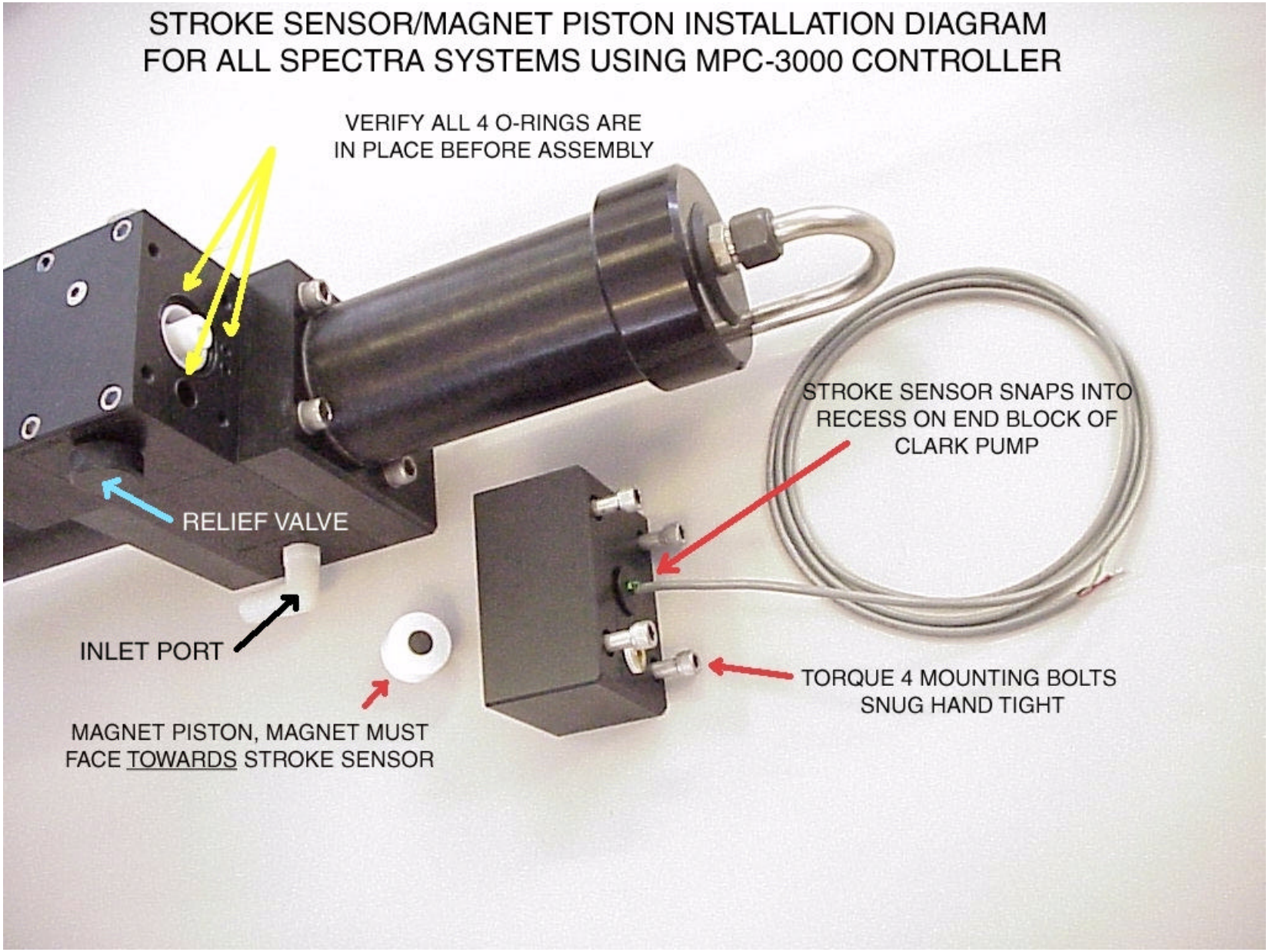
MPC-3000 REMOTE PANEL (BACK SIDE)



REMOTE DISPLAY PANEL WIRING

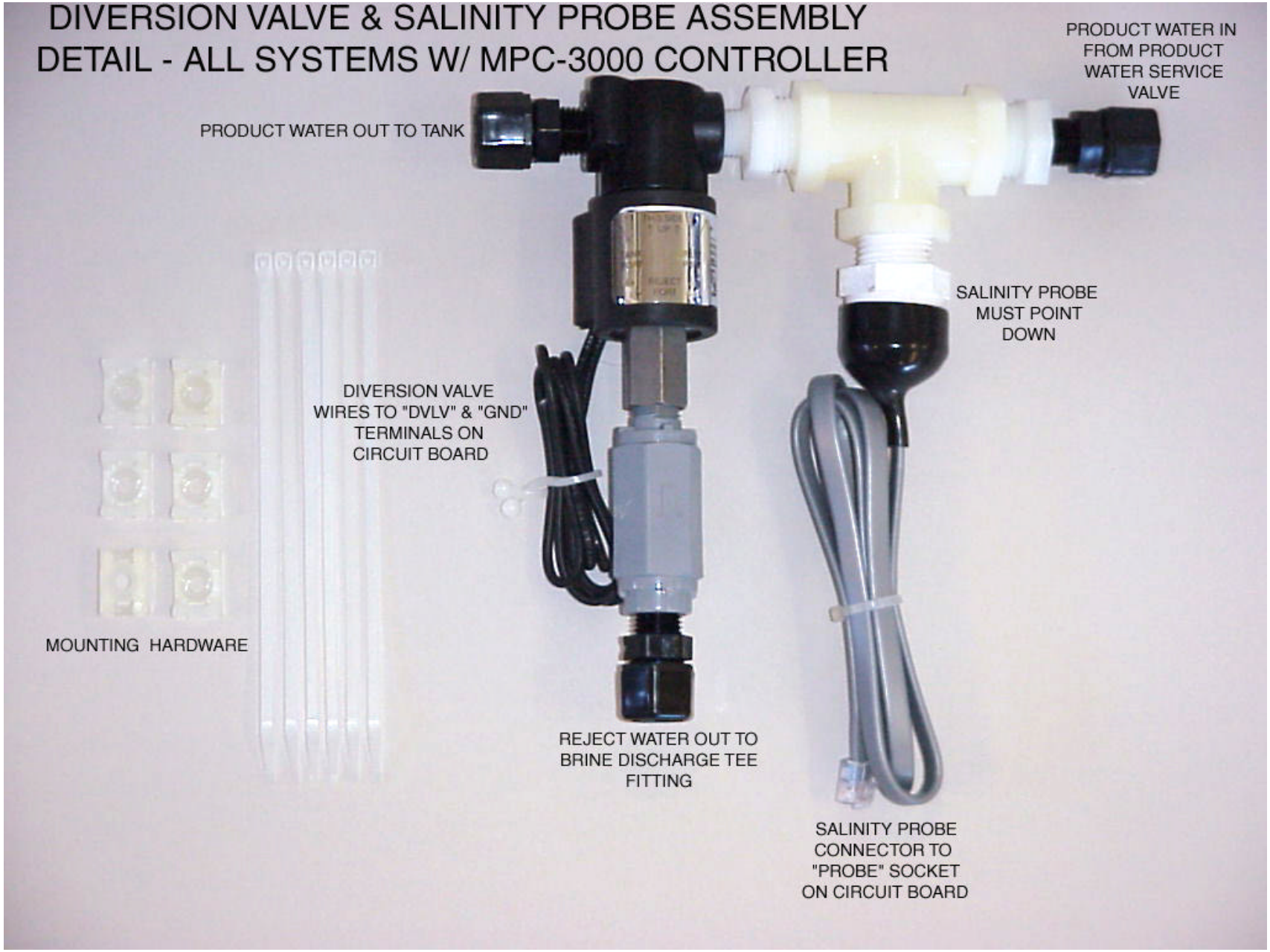


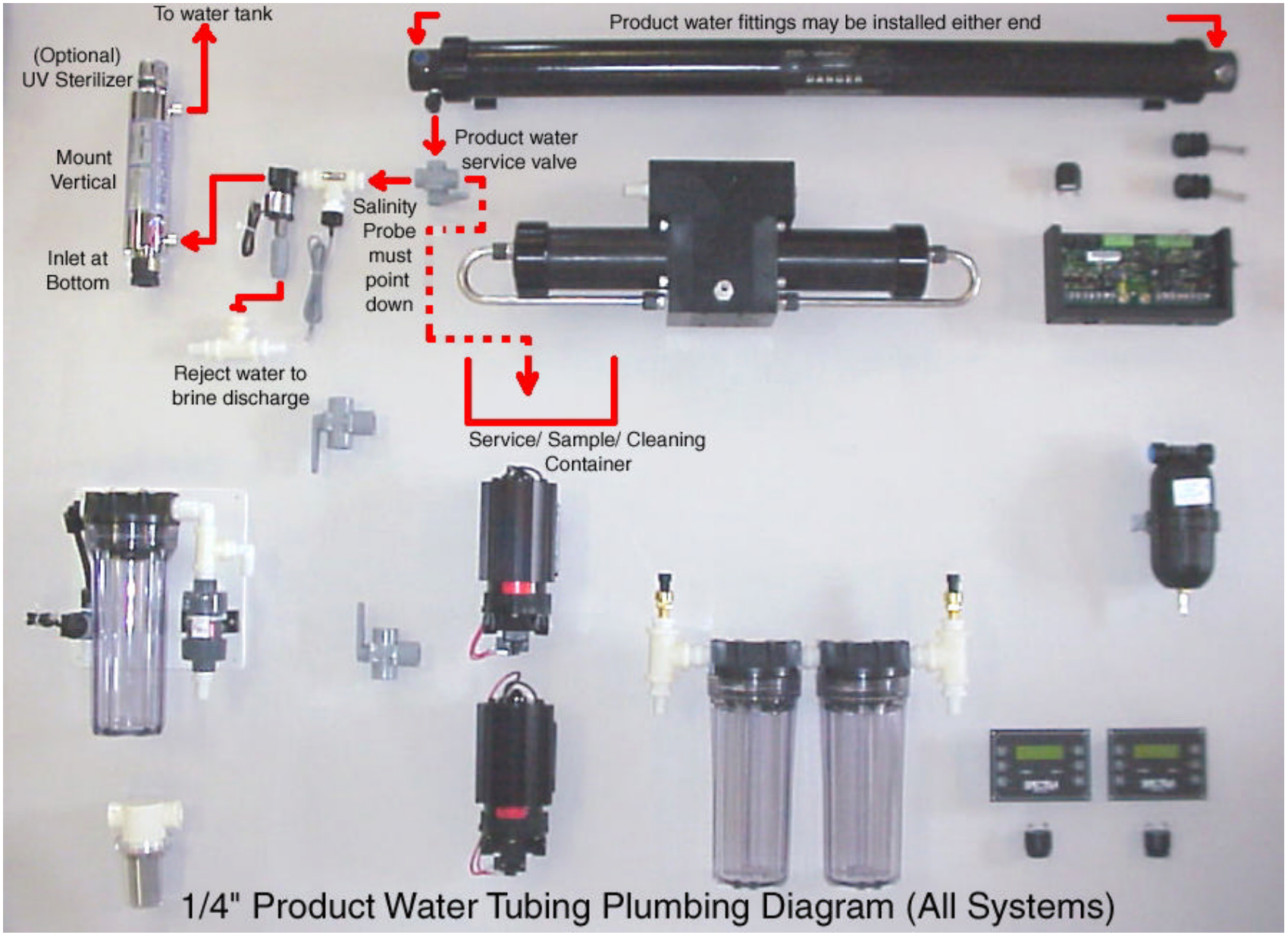

FEED WATER PRESSURE SENSOR
CONNECTS TO "PRESSURE"
TERMINALS ON RIGHT SIDE OF
TERMINAL PLUG
(OPTIONAL)
PREFILTER CONDITION SENSOR
CONNECTS TO "PRESSURE"
TERMINALS ON LEFT SIDE OF
TERMINAL PLUG
(OPTIONAL)
20 MICRON
PREFILTER
KIT
5 MICRON
PRE FILTER
SEA WATER IN
FROM FEED PUMP(S)
SEA WATER TO CLARK PUMP
FEED WATER INLET
FITTING
All Systems - Assembly of Prefilters & Pressure Sensors

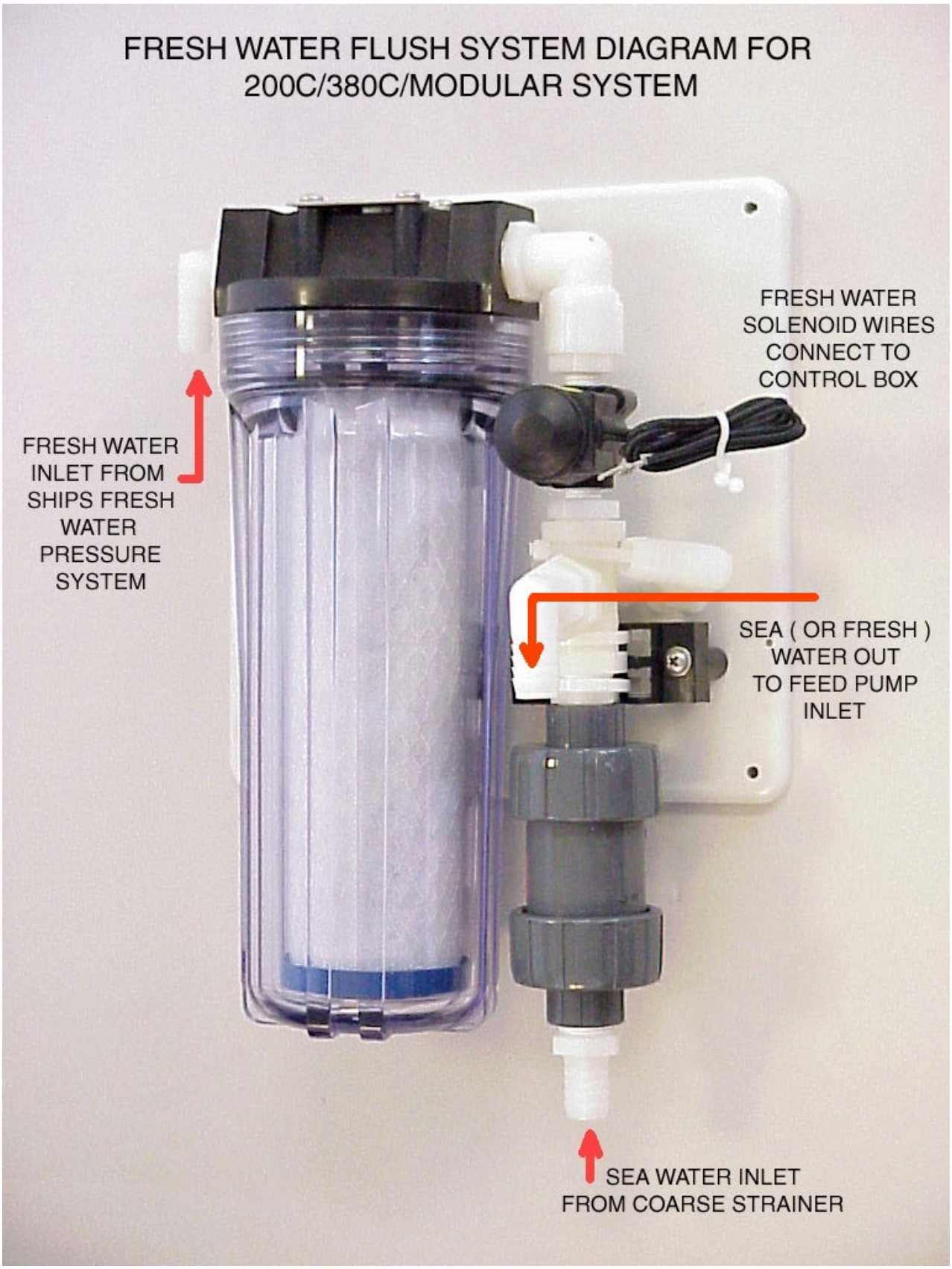

STROKE SENSOR/MAGNET PISTON INSTALLATION DIAGRAM
FOR ALL SPECTRA SYSTEMS USING MPC-3000 CONTROLLER
VERIFY ALL 4 O-RINGS ARE
IN PLACE BEFORE ASSEMBLY
STROKE SENSOR SNAPS INTO
RECESS ON END BLOCK OF
CLARK PUMP
RELIEF VALVE
INLET PORT
TORQUE 4 MOUNTING BOLTS
SNUG HAND TIGHT
MAGNET PISTON, MAGNET MUST
FACE TOWARDS STROKE SENSOR


STROKE SENSOR
Stroke sensor snaps into recess
on side of Clark pump
Push sensor in until it locks into place
-TO RELEASE SENSOR FROM THE PUMP-
Push Gently on sides of sensor
with a flat screwdriver lock taps
All systems with MPC-3000 controller - Stroke sensor
snaps into recess in side of Clark pump

DIVERSION VALVE & SALINITY PROBE ASSEMBLY DETAIL - ALL SYSTEMS W/ MPC-3000 CONTROLLER




To water tank
(Optional)
UV Sterilizer
Mount
Vertical
Inlet at
Bottom
Product water fittings may be installed either end
Product water
service valve
Salinity
Probe
must
point
down
Reject water to
brine discharge
Service/ Sample/ Cleaning
Container
1/4" Product Water Tubing Plumbing Diagram (All Systems)


FRESH WATER FLUSH SYSTEM DIAGRAM FOR
200C/380C/MODULAR SYSTEM
FRESH WATER
SOLENOID WIRES
CONNECT TO
CONTROL BOX
FRESH WATER
INLET FROM
SHIPS FRESH
WATER
PRESSURE
SYSTEM
SEA (OR FRESH)
WATER OUT
TO FEED PUMP
INLET
SEA WATER INLET
FROM COARSE STRAINER