

ECM-100 PRESSURE CALIBRATION PROCEDURE FOR ECM-100 BOARDS THAT HAVE A BATTERY PACK AND DO NOT HAVE A BNC CONNECTOR

This procedure documents the method of calibrating the older style pressure transducer on 23G machines in the field. These machines have a battery pack and DO NOT have a BNC connector on the main circuit board. Estimated time required is 30 to 45 minutes.

This procedure uses the existing pressure from the input feed line (or Clean-In-Place [CIP] pump) to pressurize the reverse osmosis (RO) machine on site and is referred to as a “static” pressure test because the machine is not running during the test.

Equipment Required:

- Pressure gauge of confirmed accuracy, 0-100 psi (or existing pressure gauge in the feed piping upstream of the RO machine if its calibration is confirmed).
- “Tee” and other fittings as appropriate.
- Manual shutoff valves in the concentrate and permeate outlet piping (standard on most machines).
- Miniature flat-blade screwdriver.

Definitions:

ECM-100	Electronic controlling unit on the 23G machine
Potentiometer (Pot)	Adjustable electronic component on the ECM-100 main board, to calibrate the pressure readings on the ECM-100 display
Permeate	Product water produced by the RO machine
Concentrate	Drain water from the RO machine
Pressure Transducer	Electro-mechanical sensor used to measure pressures at various locations on the 23G

Calibration Menu:

Pressure offsets are provided in the ECM-100 Calibration Menu (06) for convenience to temporarily adjust a reading in order to compensate for a failing transducer and keep the machine running until the replacement transducer arrives. The offset factor is added linearly across the range of the sensor and may be used to “fine tune” the pressure readings without going through the actual calibration procedure. For instance, if one of the pressures is reading 4 or 5 psi higher than it should, changing the offset factor from “-6” to “-14” (or “-8” to “-10” for primary and final) will reduce all the readings for that sensor by 4 psi.

Another example would be a machine that was operating normally for some time, but then over a 10-day period or so, the primary pressure reading drops to 146 instead of the normal 200 psi due to a failing sensor (54 psi is too low), and is therefore, now shutting the machine down. The machine is otherwise functioning normally and the final pressure reading is normal at 158, indicating that the primary pressure is really normal (confirmed with a manual gauge to be 206 psi). Switching the primary cable to the final transducer shows 158 on the “Primary” display

(now reading the Final pressure), indicating that the calibration is correct. Further checks with a gauge show that the transducer reads correctly at 0 and 10 psi, 70 and 100 psi and 146 with a pressure of 206 psi applied. In this case, we would not want to recalibrate to correct the readings, because it would only have to be calibrated back again after the transducer is replaced. Setting the calibration factor in the menu to “20” (was “-8”, so added 28 because primary and final are 2 psi per unit) adds 56 psi and forces the reading to 202. Tests with a manual gauge show that it now reads 56 at 0 psi, 126 at 100 psi, and 202 at 206 psi, so it is only accurate at the one reading, but the machine runs normally (at least until the sensor drifts some more). The offset factor can be quickly set back to “-8” again after the new sensor is installed, and calibration of the new sensor will only need a slight “touch-up”.

Calibration Procedure: * **

Since each transducer has slightly different characteristics, calibrating the pressure readings on the ECM-100 requires a means of applying calibrated pressures to the transducers mounted in the RO units piping. One method would be to remove each transducer and put it in a pressure test stand. The procedure described here uses the input feed line pressure to pressurize the entire RO machine to a constant value, and a manual dial gauge of confirmed accuracy for reference.

For best accuracy, the input feed pressure should be 80 to 90 psi, but must never be greater than 100 psi, and may be as low as 30 psi. The input pressure must not fluctuate more than 2 psi.

Four of the transducers will be calibrated with the main 3-phase power to the RO pump disconnected. Later, the permeate pressure will be calibrated with the machine running. The pressure readings will be calibrated by adjusting the pots on the ECM-100 board. The numbering of these pots is shown in Figure 1.

Pressure Sensor	Offset Pot (low)	Gain Pot (high)
Prefilter Pressure	P9	P15
Post-Filter Pressure	P5	P11
Primary Pressure	P6	P12
Final Pressure	P7	P13
Permeate Pressure	P8	P14

Figure 1, Pot Numbering

1. Install a pressure gauge (0-100 psi) of confirmed accuracy at a convenient location in the input feed piping, with a tee at the primary pressure sensor, or refer to an existing gauge in the feed line upstream of the RO machine.
2. Switch off the main 3-phase power to the RO pump.

3. Plug in the ECM-100. Enter the Calibration Menu and verify the following calibration factors:

Prefilter Pressure	-06
Post-Filter Pressure	-06
Primary Pressure	-08
Final Pressure	-08
Permeate Pressure	-06

NOTE: The Calibration Menu is 06 and can be reached by pressing the up arrow six times from the main display (or the down arrow twice). Press <Enter> several times and verify the pressure offset factors as you proceed. Pressing <Enter> several more times will return you to the main display.

To correct one or more of the settings, enter the “pass code” by pressing <Hand/Auto>, <CIP>, and <Alarm By-Pass> keys in that order. Then press the up or down arrows to correct the setting, then <Enter> to save it and move on to the next item.

4. Open the permeate and concentrate sample valves to ensure there is no pressure in the machine. Using a miniature flat blade screwdriver, turn the Offset pots for Pre-, Post, Primary and Final to get a reading of 1 or 2 psi (clockwise lowers the reading, and counterclockwise increases it). Then close the sample valves.**
5. Open the inlet solenoid valve by turning the machine on in CIP mode (RO pump disconnected). From the main display, put the machine in “Hand” mode (press the <Hand/Auto> key to switch from “Auto” to “Hand”). Then press <On> and <CIP>. The “Machine On,” “RO Pump On,” and “CIP” system lights should come on.
6. Close the manual shutoff valve on the feed inlet, then close the manual shutoff valves at the concentrate and permeate outlet plumbing.
7. Slowly open the valve on the feed inlet to raise the machine pressure to equal the feed line pressure. Keep in mind that the feed line pressure must not fluctuate during calibration.
8. When the machine pressure has stabilized, adjust each of the four Gain pots (all except permeate) until their corresponding reading matches the gauge. **
9. Close the inlet shutoff valve, then open the permeate sample valve, then the concentrate sample valve, to release the pressure from the machine. Then re-adjust the four Offset pots for 1 or 2 psi, being careful not to go below zero. Then close the sample valves. Alternatively, close the concentrate and permeate sample valves, and open the inlet shutoff valve slightly to pressurize the machine to 10 or 20 psi. Adjust the four Offset pots to get the corresponding readings. (Sometimes it is easier to adjust for a reading of 10 rather than 1 or 2.)
10. Repeat steps 7 through 9 several times until no further adjustment is necessary (prefilter, post-filter and permeate should be within ± 2 psi, and primary and final should be ± 5 psi).
11. Finally, with no pressure in the machine, carefully adjust the four Offset pots slightly to just bring the readings to zero. This completes the calibration of these four pressures.
12. Press the <Off> button and open the concentrate and permeate manual shutoff valves, close the sample valves, and open the inlet shutoff valve.

13. If you installed the 0-100 psi gauge at the primary or final transducer in step 1, remove it now. (At this stage, you could install a 0-300 psi gauge at the primary or final pressure transducer and fine-tune the Gain pot while the machine is running normally.)
14. Install the 0-100 psi gauge in the permeate piping on the RO machine (at one of the plugs on the permeate collection manifold, or with a tee at the permeate pressure sensor) and open up any downstream valves to reduce the pressure on the permeate as low as possible.
15. Switch on the main 3-phase power for the RO pump. Turn the machine on in “Manual” or “CIP” mode and see that all is operating normally.
16. Enter the Calibration Menu, press <Enter> to scroll down to the “Permeate Pressure.” Enter the pass code (<Hand>, <CIP>, <Alarm>) so that the permeate pressure reading that shows on the left side of the row 3 on the display will update continuously.
17. Adjust the permeate Offset pot (P8) so that the reading matches the gauge.
18. Start closing the permeate outlet manual shutoff valve until the backpressure reaches 40 to 50 psi. Then adjust the Gain pot (P14) so that the reading matches the dial gauge.
19. Open the permeate shutoff valve fully and repeat steps 17 and 18 two or three times or until no further adjustment is needed.
20. Press <Enter> several times to return to the main display. Shut the machine off, remove any temporary gauges, and return the machine to “Auto” mode for normal operation. Calibration is now complete.

Permeate Pressure Relief – If Equipped:

Turn the machine On in CIP mode, slowly close the permeate outlet manual shutoff valve to bring the permeate pressure up to 60 psi. Adjust both permeate pressure relief valves so they both begin opening about equally at 58 psi, and also they prevent the permeate pressure from getting above 60 psi.

- * This procedure will have to be performed whenever a pressure transducer is replaced and should also be used to check calibrations annually.
- ** If any of the pressure readings are “stuck,” like at 0, 99 or 494, or “slingshot” from 0 to 99 or 494 as you adjust the Offset pot, then you have a bad cable or transducer. You can switch cables from one sensor to another to identify the problem and contact your representative to order a replacement.
- *** The primary and final transducers are 0-500 psi, and the other three are 0-100 psi.