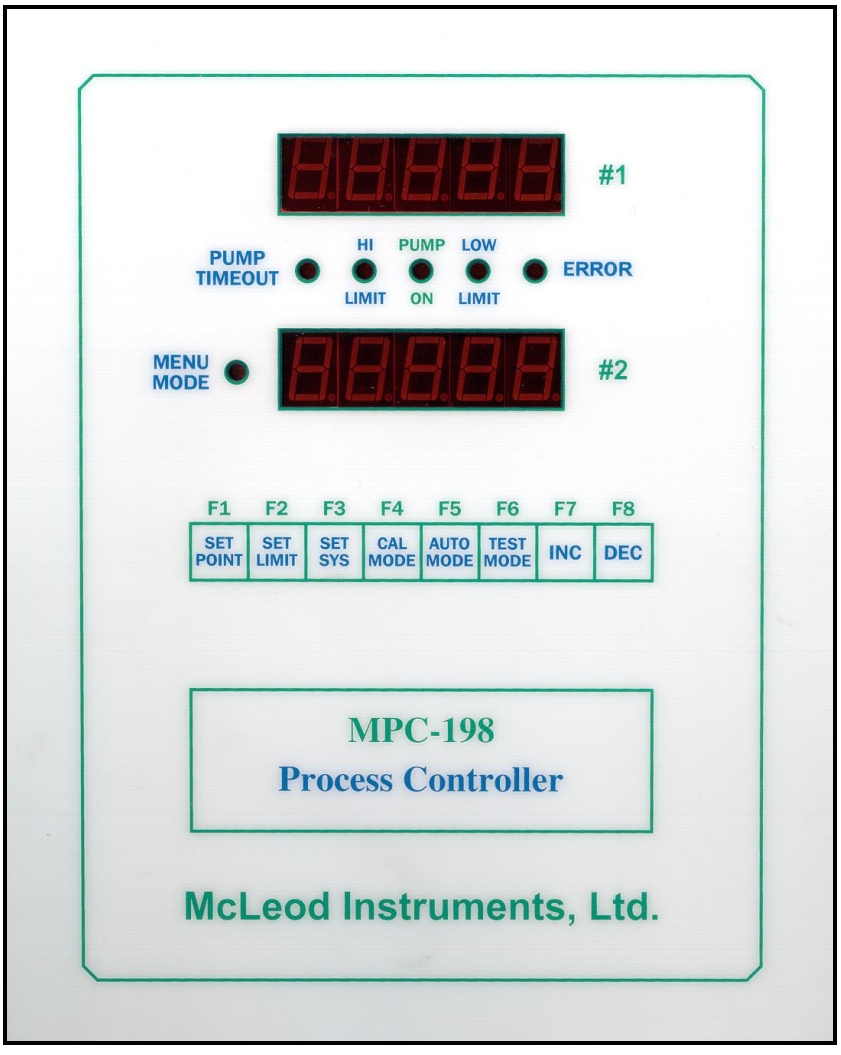
McLeod Instruments, Ltd.™

MPC-198
Process Controller



Users Manual

Revision 1.1
8/26/1999

This manual presents the installation, setup and operation of the McLeod Instruments, Ltd. MPC-198 Electroless Nickel Process controller. Software revision 1.1 dated 8/21/99

Detailed internal operation of the MPC-198 is beyond the scope of this manual and not presented.

Note: The MPC-198 process controller is Y2K (YEAR 2000) compliant.

MPC-198 Process Controller Features

The MPC-198 PC is used to assist the plating technician with the control and analysis of Electroless Nickel (EN) plating baths.

The MPC-198 PC can be used to:

- Help control the plating bath nickel concentration.
- Help control the plating bath pH level.
- Provide pump timers for both pH and nickel replenishment pumps.
- Provide upper and lower control limits for pH and nickel values.
- Provide manual control of the pH and nickel replenishment pumps.
- Provide manual adjustment of pH and nickel control readings.
- Provide an alarm signal for out of control range limits and pump timers.
- Provide ease of use for non-technical personal.
- Provide simplified calibration for pH and nickel sensors.

✓ Optional: Provide RS-422 communications to a remote computer data logger with bi-directional communications using Wonderware Intouch ™

✓ Optional: Windows NT™ DDE server for Wonderware to MPC-198 communications Interface.

Installing the MPC-198

Before using the MPC-198, complete the following steps.

Step-1: Installation.

Select a location to mount the MPC-198 PC that is away from direct contact with EN solution or fumes from any plating tank. Do not mount the MPC-198 or the remote wet stage directly above the plating tank, acid or caustic tank, rinse tank ,or above the replenishment tanks. Be sure there is adequate ventilation in the selected area so that condensation will not occur on the MPC-198 or wet stage.

- Place the sample stage above the liquid level of the tank. This will prevent siphoning of the EN solution out of the plating tank when the pH probe is removed from the cell block for calibration.
- The sample input line should be kept as short as possible. If the sample input line is long, then the controller will take more time to respond as the EN tank concentration changes.
- Be sure the power supplied to the controller is clean. IE. No large pumps or solenoids that would generate electrical spikes. This could damage the unit if the spikes are very large.

Warning:

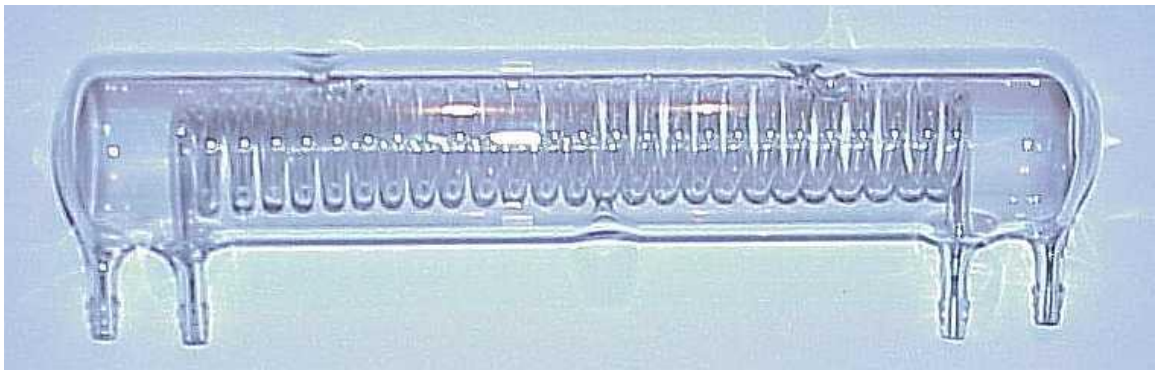
Be sure you are wearing required safety gear when working with any hazardous process chemicals.

The above photos are typical installations of various McLeod EN controllers.

Step-2: Plumbing hookup

- ❑ Install the sample pickup line from plating tank to either a cooling coil made of glass or stainless steel.

  A glass coil is the preferred method as this keeps the tubing length to a minimum.



Optional glass cooling coil.

- ❑ Connect the chilled sample output line from the cooling unit to sample input fitting on the remote stage.
- ❑ Connect the sample output from the wet stage back to the tank. The sample output line should be returned to the front of the plating tank.

Note: See the plumbing diagram for details on connecting the pump and cell block tubing.

Warning:

If the EN sample is pumped backwards through the cell block, damage to the pH probe will occur and possibly to the cell block itself. The pressure through the cell block may blow off the tubing on the glass cuvette. If this occurs, the cell block will require repair or replacement.

- ❑ Connect the replenishment pump suction lines to the pH adjust, nickel and or hypo holding tanks with the proper tubing.
- ❑ Route the replenishment pump outputs to the plating tank.
- ❑ Re-check all fittings, connections and power connections.
- ❑ Mount the sample pump to the wet stage cabinet with the provided stainless steel screws.
- ❑ Be sure that the MPC-198 is not power on.

Note: Maximum current draw should be less than 5-amps at 120vac for both pumps.

- ❑ Connect a single head replenishment pump power input to outlet #1 on the bottom of the MPC-198 for pH adjustment.
- ❑ Connect a dual head replenishment pump power input to outlet #2 on the bottom of the MPC-198 for the nickel/hypo replenishment. (NOTE: The MPC-198 does not control Hypo.).

Note: Replenishment pumps, tubing, tanks and chemicals are not supplied by McLeod Instruments.

Step-3: Startup

- Be sure that the power supplied to the MPC-198 is a nominal 117vac 60 cycles and wired properly. Be sure that the unit is properly grounded.
- Plug the sample pump into a wall outlet or switched power strip (not supplied). Be sure that the sample pump is connected properly and running.
- Be sure that EN solution is flowing through the cooling coil to the remote sample box, through the cell block to the pump and then returning the plating tank. Repair any leaks.
- Titrate your bath sample and manually adjust your EN tank to 100% activation.
- Be sure that the MPC-198 power switch is off and the unit is plugged in.
- Be sure that the MPC-198 cell block is connected to the MPC-198 unit and that properly sized replenishment pumps are connected to the MPC-198's pump outputs. Be sure that the cell block is connected to the CELL connector on the bottom of the MPC-198
- pH pump is output #P1 and nickel/Hypo is output #P2. See the photo below.

pH pump Power Switch Nickel Pump

Power To Cell Fuse

Figure-1

- Turn on the MPC-198 with the toggle switch. The MPC-198 will start up and show (198uP) on the bottom set of LED displays. This will show that the MPC-198 has started correctly and is waiting for a reset command. If the operator presses the DEC key once while the LED display is showing (198uP), the MPC-198 will initialize the internal variables to factory defaults and then Display (rESEt) on the bottom led display. If the DEC key is not pressed within a few seconds, the display will reset to (PC-198 on the top leds and rEAdY on the bottom leds).

  The reset command is required only if data has been lost or the user wants to restore all internal variables to known values. The reset command is not required for daily operations.

- Press the Test mode key. This puts the MPC-198 in the Test pump control mode. Press INC now. The nickel pump #P2 output will turn on. Press DEC now. The nickel pump #2 will go off. Press the F1 key now. The pH pump #P1 output will turn on. Press the F2 key now. The pH pump output will turn off.

  The Test mode is used to test the pump outputs and help calibrate the pumps. If the pump timers are set to (1) minute, each pump can be adjusted for correct replenishment amounts.

  When a pump output is activated, the pump timer for that output is started. If the timer counts up to the timeout period, the pump output is turned off and the alarm is activated. To restart the selected pump output. Press the INC or Set Point key. Once the pumps have been adjusted, press the TEST mode key to return to the Menu Mode. The MENU led will light. If the pump timers have been changed, reset the timers in the Set Limits mode.

Figure-2: MPC-198 CELL BLOCK

Step-4: Adjust limits.

- With the MENU led on, press the SET LIMIT key. The bottom led will show SetSlt. By pressing

  The SET LIMITS key again, the system will let the operator select which limits can be set. You can only go down through the menus until the end is reached. The following is the menu order.
  The top leds will show the current limit variable.

  PhHiA — This is the pH high alarm value. If the pH reading goes above this value, the alarm Hi Limit led will turn on and alarm beeper activated in Auto mode.

  PhLoA — This is the pH low alarm value. If the pH reading goes below this value, the alarm Low Limit led will turn on and alarm beeper activated in Auto mode.

  NiHiA — This is the nickel high alarm value. If the nickel reading goes above this value, the Hi Limit led will turn on and alarm beeper activated in Auto mode.

  NiLoA — This is the nickel low alarm value. If the nickel reading goes above this value, the Low Limit led will turn on and alarm beeper activated in Auto mode.

  PhPut — This is the pH pump timer value in minutes. Default is 30. When the pH pump has been on longer than 30 minutes, the Pump Timeout led will turn on and the alarm beeper activated.

  NiPut — This is the nickel pump timer value in minutes. Default is 30. When the nickel pump has been on longer than 30 minutes, the Pump Timeout led will turn on and the alarm beeper activated.

  DACAL — This is the cell block calibration reference voltage. Default is 500. This value is used to calibrate the internal lamp voltage for a zero point reference value. Sometimes it is necessary to lower this value if the nickel bath is very concentrated. Usually this variable it is never changed.

  RS422 — This value is used to set the controller address if the optional communications package is installed. The range is 0-255. Default is zero.

  NOTE: Each value in for the above limits can be changed with the INC and DEC keys. After all of the Limits have been adjusted.

Step-5: Adjust Set Points.

The operator can now set the pH and Nickel set points.

- While the MENU led is on, press the SET POINT key. There are only two selections in this menu.

PHSet	This is the pH set point. If the pH reading goes BELOW this value, the pH pump will activate in Auto mode and the PUMP led will light.
NISet	This is the Nickel set point. If the nickel reading go ABOVE this value, the nickel Pump will activate in the Auto mode and the PUMP led will light.

- Use the INC/DEC keys to adjust the pH or nickel set points.
- Press the SET POINT key again will return to the main menu.
- Press the SET SYS key now. This will save all of the data into memory.

Note: Now that you have set all of the limits and Set points and stored the new values, you do not have to do this again unless the values need to be changed. If you change any limits, be sure to save them into memory, unless the change is only temporary.

Step-6: Calibration.

- Prepare a working (or sample) nickel bath and adjust to 100% activity. Circulate the nickel through the wet stage. Be sure that the pH probe is installed in the cell block and that the pH probe BNC connector is connected to the cell blocks BNC connector.

  MPC-198 units have a new feature that is not available in the previous EN-98 units which enable the user to automatically set the nickel concentration reading to approximately 100.0% at any time. Fine adjustments can be made in the Auto mode with the INC and DEC keys for the nickel and keys F1 and F2 for the pH.

- Verify that Nickel solution is being circulated as indicated in the solution flow diagram previously listed.

- With the MENU led on, press the CAL MODE key. The led display will show (Calib..Nical) for a few seconds and then display (SURE). At this point, verify that the top LED reading display is stable. Press the INC key now. This will start the nickel calibration process.

  The MPC-198 will automatically adjust the cell block and zero the new solution concentration. The top led display will show the voltage reading from the cell block and the bottom led display will show the zero value. This value is from 0 to 64 counts. The MPC-198 will stop the zero process when the number on the top display is close to 500 or whatever is set in the DACAL value in the set limits menu.

  After the MPC-198 stops counting, the display will switch to the pH calibration routine. If you want to bypass the pH calibration routine, press the (DEC) key now. This will exit the calibration routine and return back to the main menu.

- Turn off the sample pump now. Remove the pH probe from the Cell block, rinse the pH probe with clean water. Place the pH probe into pH 7.00 buffer solution. Stir the probe for about 10 seconds and then let the pH reading on the top LED display stabilize. When the pH reading is stable, press the INC key. This will store the current pH reading for buffer 7.00. The reading should be close to 7.00 + or - .5 pH units. If the reading is out of this range, the system will display Error pH7.00. If this occurs, check the pH buffers and/or pH probe.

  If the reading is within the pH calibration limits for pH 7.00, the value is stored and the next step is started.

- The LED display will show (Calib) pH4.00. Rinse the pH probe in water. Place the pH probe into pH 4.00 buffer and stir for about 10 seconds. Repeat the above procedure. When the pH reading for the pH4.00 buffer is stable, press the INC key. If an error occurs, check the buffers and/or probe again.

  When the INC key is pressed after the pH4.00 calibration is complete, the led display will show pHcal Done, then swich back to the main menu. The MENU led will light showing that the MPC-198 back at the Menu level.

- With the Main menu led on, press the SET SYS key to save the new calibration points.

Step 7: Auto Mode.

- With the MENU led on. Press the [Auto Mode] key.

  Verify the nickel display is stable and is reading close to 100.0 Verify that the pH reading is correct. Adjust the Nickel reading with the INC or DEC key. Some drift may occur while the system warms up to the operating temperature.

  Adjust the pH reading with the F1 key to increase and the F2 key do decrease the pH reading.

  The MPC-198 is programmed with (3) different alarm menus. By pressing the F3 key in the auto mode, the user can display any alarm at once, only the pH alarms, only the Nickel alarms, or no alarms at all.

  The following outlines the alarm functions.

  Mode-0: pH and Nickel alarm led, pump led and timeout led are common.
  Mode-1: pH alarm led, pump led, timeout led are active. Nickel led functions are off.
  Mode-2: Nickel alarm led, pump led, timeout led are active. PH led functions are off.
  Mode-3: All alarms are off, pump leds are common, timeout led are common.

  By pressing the SET SYS key, the system will cycle through the alarms modes. The LEDs will also flash which mode the unit is in. Try it.

  The MPC-198 will activate the pH pump output if the pH reading is below the pH set point . If the pH reading is above or below the pH limits. The High or Low alarm led will light and the alarm will sound.

  The MPC-198 will activate the nickel pump output if the nickel concentration is above 100.0: If the nickel concentration is above or below the nickel alarm limits, the High or Low alarm Led will light and the alarm will sound.

  If a pump timer exceeds the pre-programmed limit, the timeout led will light. If this happens, The pH or Nickel pump output will turn off and the alarm will sound. Press the TEST MODE key to clear both timers for the pH pump and Nickel pumps.

- To stop the unit and turn off the pumps, press the Auto key again. This places the unit back in the menu mode.

  The MPC-198 will control the plating bath as long as the pH and Nickel pumps are adjusted correctly. If the pumps are not pumping enough chemicals, the Nickel concentration will increase and the pH level will decrease. If the pumps are pumping too much, over shoot will occur. A good setting for the pumps is twice the consumption rate.

  If you want to save any changes to the pH or Nickel readings, press the AUTO mode key now, the MENU led will light. Press the SET SYS key now. This will save any offsets added or subtracted in the AUTO mode. When the MPC-198 restarts, these offsets will be restored into memory.

Maintenance:

Be sure your replenishment holding tanks are full and the pump input lines are completely down into the replenishment tanks. Remember if the nickel reading or pH reading does not change within the pump time-out period the pump timer will sound indicating a replenishment or sample pump failure.

If this happens check that the replenishment amount is correct, the pump is pumping and the replenishment output is getting to the correct tank.

Follow these steps to help prevent problems in normal day to day operation of the MPC-198.

1). Change the sample pump head tubing every 30 days. The tubing wears out and prevents the pump head from operating correctly. This procedure takes about 5 minutes.

2). Keep the Plexiglas cover on the MPC-198 closed and latched when not adjusting the unit.

3). Do not let unauthorized personnel touch the unit while the MPC-198 while the unit is in operation. If some unauthorized person uses the INC/DEC keys, your bath concentration may be out of control limits.

4). Do not wash down the controller or sample stage at any time. If cleaning is necessary, use a damp cloth (water only) DO NOT USE ANY SOLVENTS to clean the unit at any time

5). If controller response for the nickel readings are weak, the cuvette that is inside of the sample block is probably dirty. Remove the cell block from the sample stage. Remove the (4) 6/32 screws on the cover side of the cell block.

Gently remove the cuvette and clean out the cuvette with a 10% nitric acid solution and replace the cuvette back into the cell holder. Replace the cover and screws, re-install the cell block into the remote stage. Recalibrate the nickel sensor. Step-6

6). Keep replenishment lines tied up and away from damage.

7). Replace the sample pickup line from the plating tank when Nickel starts to plate out in the lines.

8). Stock some spare parts to prevent unnecessary down time.

Spare parts.	Part number
S200c pH electrode.	S200C-BNC
BW pump with head.	A1600-30
BW pump tubing insert.	A-002-6
Norprene tubing.	Available from RYAN HERCO.
Glass coil.	Glass coil
Cell block	MPC-198 EN cell
Cuvette.	Glass cuvette
Fuse	3AG-5A

Warranty Information.

The MPC-198 controller will provide the user with many hours of operation. No internal calibration is required. If any problems occur with the MPC-198 unit, please call our service department for warranty/ non warranty repairs or technical assistance.

McLeod Instruments, Ltd. will either replace the unit or repair it for no charge while the unit is in the warranty period.

Warranty period is 1-year parts and labor. No other warranties apply, expressed or implied.

Use this product at your own risk. This product has not been tested for CE compliance or FCC rules. Do not ship to any CE country.

The MPC-198 will be certified for FCC and CE/CSA in the near future.

McLeod Instruments reserves the right to make changes to this manual and any of its products. This manual and MPC-198 are preliminary and may have errors and omissions.

Please call for a RMA before returning the product for repairs.

Return freight to you will be paid by us for ground return only, except for international customers which will be returned freight collect.

The sample pump and pH probe are warranted by the respective their manufacturer.

Pump tubing, sample lines, replenishment tanks/pumps and lines are not covered under warranty.

If you have any comments or ides for product improvement, give us a call or fax.

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