MANTECH
OPTIMIZE YOUR RESULTS. PROTECT OUR ENVIRONMENT.

MANTECH-INC.COM

MT Series

Maintenance Manual

For MT-10, MT-30 and MT-100 Systems

Table of Contents

1.0 Daily Maintenance Tasks

The following are a checklist of things to be done each day before running the MT system. Note that the purging and priming of burets and pumps can be done automatically by the system by running the start-up schedules from the autorun buttons on the main screen of the PC-Titrate software (if applicable).

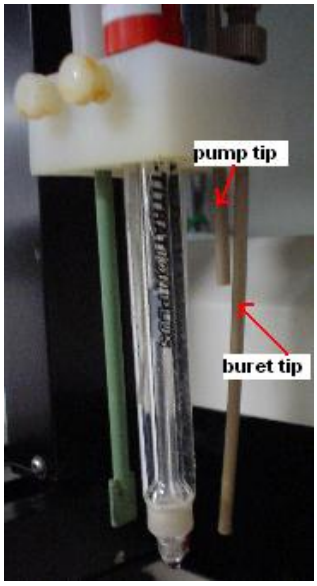
The following section has been separated into categories, as there are several tasks to perform prior to running the system. It is suggested that the user gets into a routine to complete this checklist, as it ensures the system is running optimally and that issues are identified easily.

1.1 Electrodes:

1. Top up electrode fill solution with the appropriate fill solution.
2. Inspect electrode for physical damage (e.g. cracks) or for excess sample or salt crystals that may be blocking junction or sensing membrane. Clean or replace if necessary.
3. Ensure that the cable is securely attached to the electrode and to the back of the interface.
4. Ensure that the electrode is placed low enough in the probe holder and/or TitraSip so that the junction will be sufficiently covered by solution when running the system.

1.2 Hardware:

1. Inspect the placement of the tips – the buret tips should be down far enough in the probe holder and/or sample vessel so that they are submerged into solution. The pump tips should be placed farther up so that they rest just above the liquid level when the system is running.
2. Tighten all fittings on pumps and burets, if necessary.
3. Ensure that all modules and the Autosampler is turned on and that pumps are all set to auto (if applicable).
4. Purge/prime all burets and pumps, and ensure there are no air bubbles in the syringe or tubing.



1.3. Chemical:

1. Check the level of all reagent and titrant bottles, and top up, if necessary.
2. Check waste and water carboys and empty/fill if necessary.

2.0 Weekly Maintenance Tasks

On a weekly basis, the following tasks should be completed.

2.1. Electrodes:

- Drain fill solution, rinse electrode, and refill with fresh fill solution. This will ensure that the electrode junction does not clog with salt crystals, and keep the response time quick.

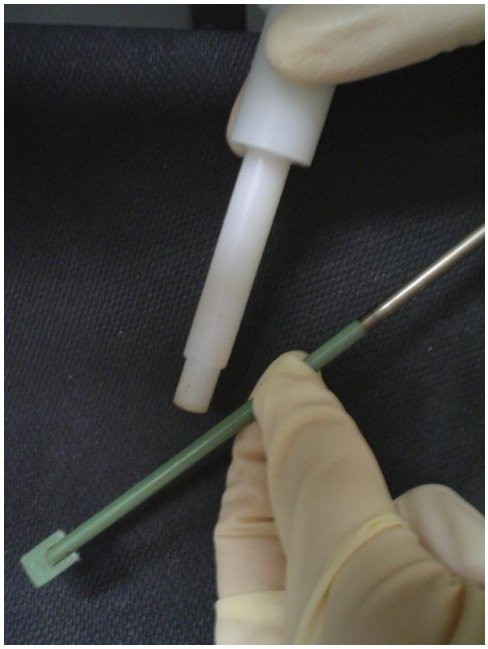
2.2. Hardware:

- Clean out the rinse station (if necessary). Some applications can form a precipitate (i.e. the chloride method), causing the rinse station to get quite dirty. It is a good idea to keep it clean to prevent it from becoming clogged and overflowing.

3.0 Monthly Maintenance Tasks

3.1. Clean the Stirrer Rod:

- The stirrer rod can collect dirt that may get into the stirrer body where the rinse station cannot clean it. If it builds up too much dirt, it can cause the stirrer to stick and stop working.
- Free the stirrer from the Autosampler arm and/or TitraSip for easy access to the rod.
- Remove the stirrer rod from the body by simply pulling it out.
- Wipe the rod down and rinse if necessary.

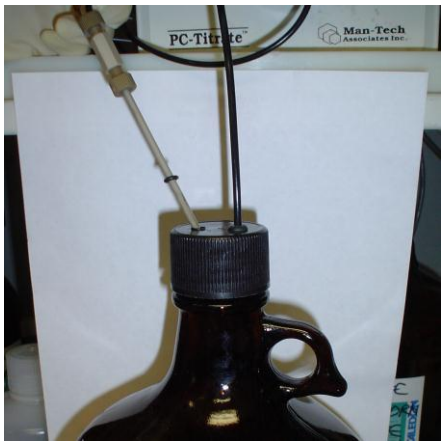


4.0 Semi-Annual Maintenance Tasks

4.1. Cleaning the Dosing Pump Head

- The head of the dosing pump can become dirty over time, causing it to stick and affect the accuracy of pump. Therefore, it should be cleaned <u>approximately every 6 months</u> to maintain good function, or when erratic pumping is noticed.
- Any time the pump head is taken apart, check and update the flow rate of the pump. See below for instruction.

- To rid the lines and the pump of excess reagent, raise the tubing in the reagent container above the liquid level, and place the dispense tip in the lid of the container.



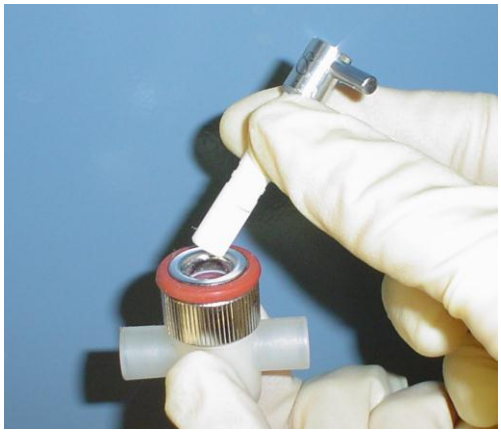
- Manually turn on the pump until no more reagent comes out of the dispense tip.
- While wearing safety glasses and gloves, remove the tubing by unscrewing the brown screws going into either side of the pump head.

- Unscrew the two silver screws on the front of the pump head with a screwdriver.

- Pull off the black hood covering the pump head.

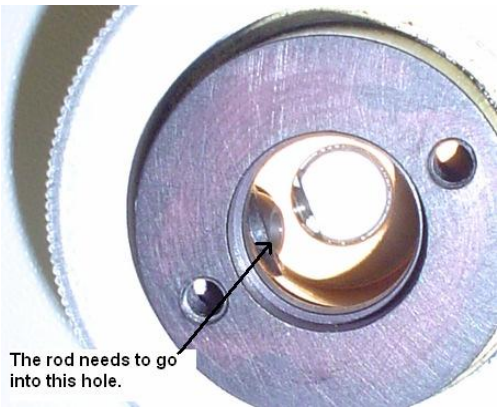
- Pull out the pump head.

- Remove the piece coming out the back of the pump head (the piece that has a small silver rod sticking out sideways).



- Run tap water over all pieces.

- Replace the rod into the back of the pump head.
- You should now be able to EASILY turn this piece.
- Replace the pump head back onto the module. The silver piece that sticks out to the side in the back of the pump head needs to be placed into the small hole inside the pump head holder.



- Replace the black hood onto the pump head.
- Replace the screws onto the front of the pump head.
- Replace the tubing. The bottom right side of the pump is the intake, so the tube coming from the reagent container should be connected here. The top left side of the pump should be connected to the tube going to the arm of the autosampler.

4.2. Check the Flow Rate of the Pumps:

- The pumps are calibrated to different flow rates when they are built, but they can drift over time. Therefore, flow rates need to be checked periodically so that the system can continue to pump the correct amount of reagent.
- This needs to be done any time that the pump head is taken apart (e.g. after it has been cleaned).

- There are schedules set up to test each of the pumps requiring accurate flow rates used on the system. Run each one in turn, with ~3 repetitions each.
- Once the timetable begins, the user will be prompted with instructions on how to check the flow rate.
- The user will now need to make changes in the software to reflect the new flow rate:
  - Go into the **Interface** menu….**Hardware setup**.
  - Click on the **Digital/Amplifiers** tab along the bottom of the screen.
  - In the section entitled "Extended Digital Output Lines", click on the row for the pump number of interest and in the flow rate text box, change the flow rate to reflect the new value.
  - Click OK in the top right-hand corner of the screen.

5.0 Yearly Maintenance Tasks

5.1. Change the Lip Seals and Gland Washers in the Dosing Pump Head:

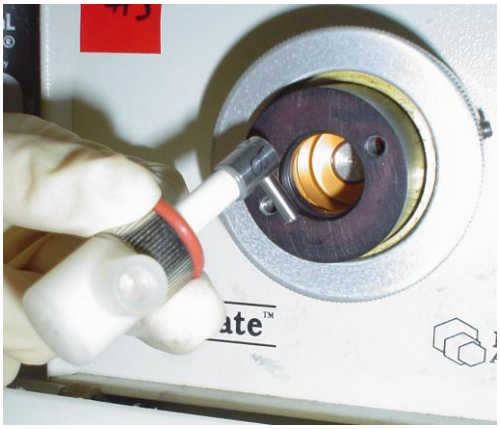
- The lip seals and gland washers are in place in the pump head to create a seal that will prevent leakage. These should be changed yearly to maintain a good seal in the pump head.
- If you ever notice leaking around the base of the dosing pump head, these seals may need to be replaced earlier.
- In order to rid the lines and the pump of excess reagent, raise the intake end of the tube above the liquid level in the reagent container, and place the dosing tip in the lid of the container.
- Manually turn on the pump until no more liquid comes out of the dosing tip.
- While wearing safety glasses and gloves, remove the tubing by unscrewing the brown screws going into either side of the pump head.

- While wearing safety glasses and gloves, remove the tubing by unscrewing the brown screws going into either side of the pump head.

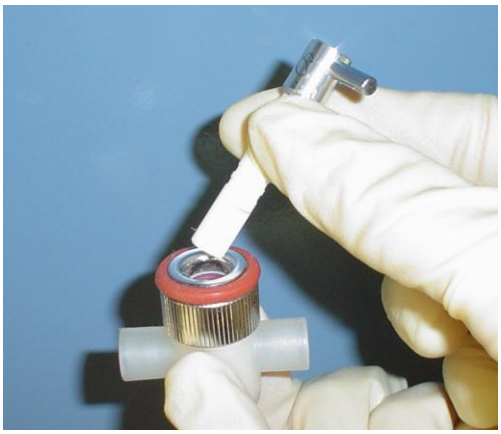
- Unscrew the two silver screws on the front of the pump head with a screwdriver.

- Pull off the black hood covering the pump head.

- Pull out the pump head.



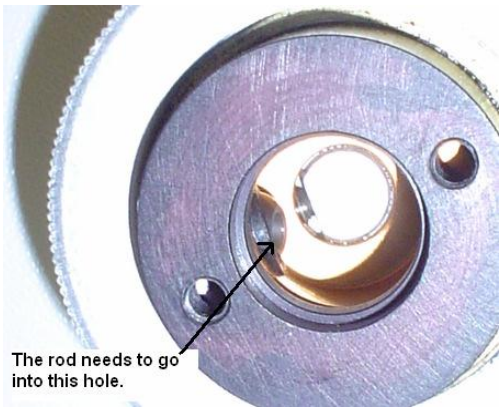
- Remove the piece coming out the back of the pump head (the piece that has a small silver rod sticking out sideways).



- Unscrew the silver piece from the back of the pump head.

- Rinse the pump head out with water while apart.
- Remove all lip seals and gland washers and replace with new ones.

- Replace the orange o-ring and the rod back into the pump head. It may be difficult to get the rod to go through the centre of the washers, but it will fit with some effort.
- Replace the pump head back onto the module. The silver piece that sticks out to the side in the back of the pump head needs to go into the small hole inside the pump head holder.



- Replace the black hood onto the pump head.
- Replace the screws onto the front of the pump head.
- Replace the tubing. The bottom right side of the pump is the intake, so the tube coming from the reagent container should be connected here. The top left side of the pump should be connected to the tube going to the arm of the autosampler.

5.2. Replace all Tubing/Fittings/Tips and Rollers on the Pumps:

- The use of solvents and other harsh chemicals, as well as physical wear and tear can affect the quality of the consumable parts, which may affect the accuracy of the results. Therefore, it is recommended that all tubing, fittings and tips are replaced at least once a year to ensure the system remains in good working condition.

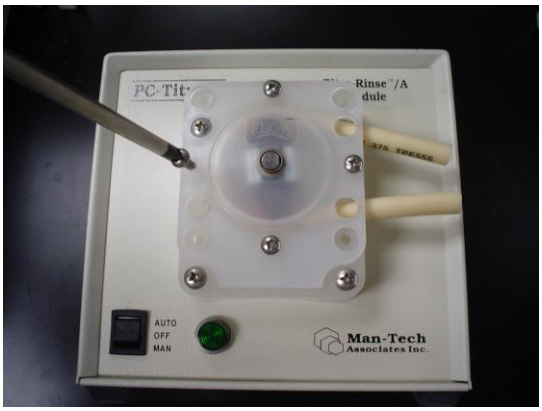
Dosing Pumps

- Purge the dosing pump lines of excess reagent by raising the tubing in the reagent container above the liquid level, and placing the dosing tip from the arm of the autosampler into a waste container.
- Manually turn on the pump until no more solvent comes out of the tip.
- While wearing safety glasses and gloves, unscrew the brown screws on either side of the pump, and remove the tubing from the reagent container.
- Throw away all old tubing (with fittings) and the dispense tip, and replace with new. The right side of the pump is the intake, so the tubing coming from the reagent bottle attaches here, and the tubing going to the dispense tip on the arm of the autosampler attaches to the left side of the pump.

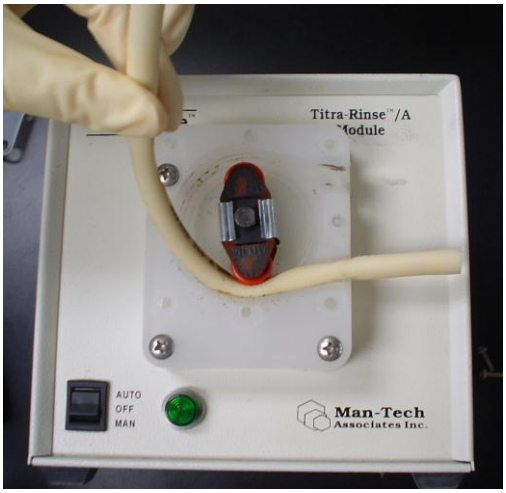
Peristaltic Pumps:

- Purge the pump lines of excess solvent by raising the tubing in the reagent container (or water carboy) above the liquid level, and placing the dosing tip from the arm of the autosampler into a waste container.
- Manually turn on the pump until no more solvent comes out of the dosing tip.

- While wearing safety glasses and gloves, remove the clear Tygon tubing and fittings. The fittings may be attached quite snuggly to the yellow tubing going into the pump, and so a flat head screwdriver may be required to pry them free.
- Using the old tubing as a guide, measure out the required length of new tubing for each pump, and then discard the old tubing and fittings (or keep them for future use – can be used as waste tubing).
- With a screwdriver, unscrew the 4 screws placed at the 12:00, 3:00, 6:00 and 9:00 positions on the front of the peristaltic pump.



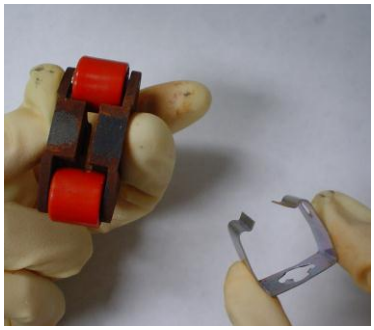
- Remove the face plate, pull out the yellow tubing, and discard.



- Using a flat head screwdriver, open the metal grips keeping the roller assembly into place.

- Pull the roller assembly and metal grip off the metal rod in the centre of the pump. It may be on quite snuggly, but a good tug will release it.

- Remove the roller assembly from the metal grip, discard the rollers, and replace with new ones.



- Replace the metal grip, making sure to keep the flat sides of the hole lined up.
- Push the roller assembly back onto the metal rod on the pump, and squeeze the metal grip together until you hear a click on both sides.
- By manually turning the roller assembly, secure new yellow tubing into the pump.

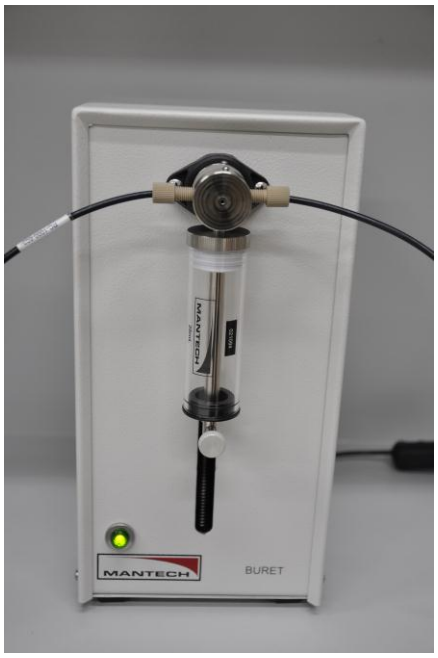
- Replace the face plate and screw into place.

5.3. Replace the Tubing/Fittings/Tips and Syringes on the Burets

- The use of solvents and other harsh chemicals, as well as physical wear and tear can affect the quality of the consumable parts, which may affect the accuracy of the results. Therefore, it is recommended that all tubing, fittings and tips are replaced at least once a year to ensure the system remains in good working condition.
- The syringes may also become dirty over time, and because it cannot be taken apart, purging is used to clean them. Therefore, it is recommended that syringes are replaced at least yearly, as purging alone cannot always rid the syringes of all dirt build-up.

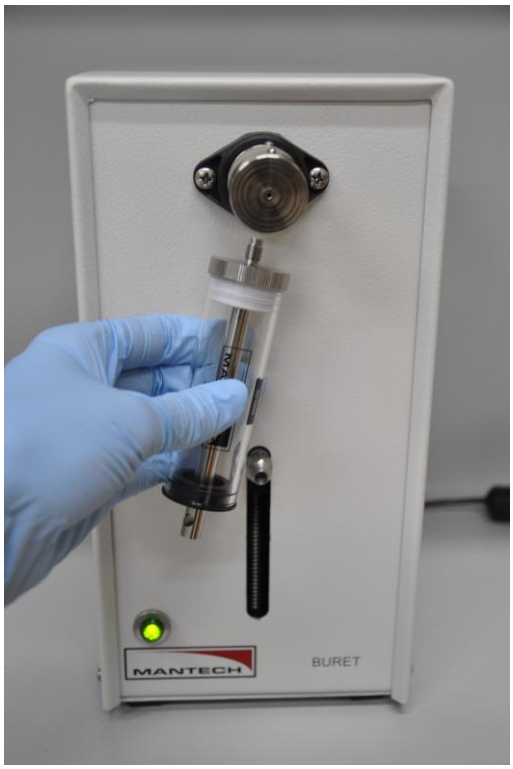
- Purge the buret of titrant:
  i. Raise the tubing above the liquid level in the titrant bottle.
  ii. Ensure that the dispense tip is in a waste container.
  iii. In the software, go into the **Titrator** menu…**Manual Control**.
  iv. Select the **Serial Devices** tab.
  v. Select the tab corresponding to the buret number you wish to purge.
  vi. By using the arrows, select the number of times you wish to purge.
  vii. Click on the **Purge Buret** button.
  viii. Once it is finished purging, proceed with the following instructions.

- Unscrew the brown screws on either side of the buret valve, and remove the tubing from the titrant bottle.



- Throw away the old tubing (with fittings) and the dispense tip.
- Unscrew the three light brown screws keeping the valve and syringe connected to the buret

- Remove the syringe from the buret module by unscrewing it from the valve.



- Throw away the old syringe, and screw the new one into place on the valve.
- Attach new tubing to either side of the buret valve. The tube coming from the titrant bottle should be attached to the right side of the valve, and the tubing going to the dispense tip on the arm of the autosampler should be connected to the left side of the valve.

6.0 Service Tasks

The following tasks are not part of a regular maintenance routine, and are required on an as need basis. This frequency of these tasks varies based on the use of the system.

6.1. Replace electrodes:

- The requirement for electrode replacement generally falls in the range of 6 months to 1 year, but depends on the type of chemicals used and user handling and storage.
- Remove the old electrode from the autosampler arm or TitraSip, and unscrew from the BNC cable, and discard.
- Open the new electrode box, and inspect the electrode for physical damage. Look for cracks.
- Remove the storage bottle or boot on the end of the electrode, and remove the sleeve covering the fill hole.
- Invert the electrode and drain the fill solution using the transfer pipette provided, if applicable.
- Rinse the electrode out with deionized water, using a squirt bottle or transfer pipette.
- Fill the electrode with fresh fill solution from the bottle provided, using a transfer pipette.
- Soak in pH 4 buffer (for pH electrodes) or a low end standard (for ISE electrodes) for 30 minutes to one hour before running the system.
- Attach the electrode to the electrode cable, being careful not to cross-thread, and carefully place in the autosampler arm / TitraSip.

6.2. Replace Stirrers:

- Stirrers generally last for a long time, but when using harsh chemicals the fumes can waft up into the stirrer motor, causing sticking that cannot be repaired.
- Unplug the old stirrer from the back of the interface module, and remove from the autosampler arm or TitraSip.
- Pull out the stirrer rod, wipe it down and rinse if necessary, and push into the new stirrer motor (if a new rod has not been purchased).
- Plug the new stirrer into the back of the interface module, and place into the arm of the autosampler or TitraSip.

Document Change Log

Version	Date	Author	Changes
2	2-Aug-2019	Heather Jasumani	• Document ID assigned • Formatting

www.mantech-inc.com

MANTECH Inc.
5473 Highway 6 North
Guelph, Ontario, N1H 6J2, Canada
519-763-4245