

**BRAZOS RIVER AUTHORITY
STANDARD OPERATING PROCEDURES**

P&ED-FF-1001

Flowmeter Initialization

Revision 1

Author

Date

Section Chief

Date

Quality Assurance Officer

Date

1.0 Applicability

This procedure applies to the initialization of all ISCO 3230 and ISCO 4230 flowmeters utilized in field operations by the Brazos River Authority (BRA), Waco, Texas.

2.0 Purpose

The purpose of this procedure is to provide written documentation of the procedures used by BRA field personnel to initialize the memory of the flowmeters into separate partitions. The flowmeters are initialized with three memory partitions to collect and store level data, sampler data and rainfall data.

3.0 Definitions

3.1 General maintenance sheets - field sheets used specifically to record field activities, measurements, observations and notes.

3.2 Maintenance - functions or actions required to ensure the proper working order of a piece of equipment. These actions include, but are not limited to, cleaning, minor repairs, changes of tubing, lubricants and other consumable parts, checks for damaged or worn components, and protective measures.

3.3 Flow meter -

ISCO 3230 Flowmeter - a scientific instrument designed to monitor the level of water in a stream, pipe or other system. The bubbler system, used by this particular flowmeter to measure level, detects changes in the level of the flow stream by measuring the amount of air pressure required to force an air bubble from the end of a submerged tube. As the liquid level in the flow stream increases, the amount of air pressure required to force the bubble from the tube also increases.

ISCO 4230 Flowmeter - Is an updated version of the ISCO 3230 Flowmeter utilizing the same type of bubbler system.

3.4 Partition - separation of a class or whole into constituent parts. In the case of the flow meter, the memory is allocated into three or more separate partitions.

4.0 Equipment, Calibration & Maintenance

4.1 ISCO Model 3230 and Model 4230 Flow Meter

4.1.1 Calibration - See SOP P&ED-FF-1002 Programming Flow Meter Equipment, *Instruction Manual Model 3230 Flow Meter* and *Instruction Manual Model 4230 Flow Meter*

4.1.2 Maintenance - See SOP P&ED-FF-1006 General Maintenance, *Instruction Manual Model 3230 Flow Meter* and *Instruction Manual Model 4230 Flow Meter*.

4.2 Laptop computer

4.2.1 Calibration - not applicable.

4.2.2 Maintenance - not applicable.

5.0 Procedure

When installing a new site, the flowmeter is programmed to enable the sampler based on the level of the stream. In order to monitor the rise and fall of the stream, the flowmeter is also programmed to record and store the level in a partition of the internal memory. In addition, records of rainfall and collected samples are also recorded and stored. Three separate partitions are set up in the internal memory of the flowmeter. Each partition is identified with the site ID number and the type of partition it represents: level, sampler, and rainfall. In order to partition the flowmeter, a laptop computer with a connecting cable is needed. Instructions for the initialization are as follows:

Once the flowmeter is programmed using the external keyboard, the flowmeter is ready to be partitioned. Using a laptop computer, connect to the flowmeter using the flowlink software provided by ISCO. Attach one end of the computer cable to the interrogator outlet of the flowmeter and the other end of the cable to the serial port of the computer.

Once a communication line has been established, go to the setup icon and make sure that the internal clock is set to the appropriate Central Standard Time. Once the time has established, it is time to partition the flowmeter. Go to the memory icon and see if any partitions already exist. If partitions exist, remove each partition using the remove icon. Once all the existing partitions are deleted, use the create icon and go through each step to establish the first partition. Establish the name of the partition, type of partition, interval frequency, length of time, and finally rollover mode. These steps will be done for each of the three partitions to be created. The first partition will be the level partition, five-minute intervals, for 31 days using the rollover mode. The second partition will be the sampler partition, 15-minute intervals, for 1 day using the rollover mode. The third and final partition will be the rainfall partition, 15-minute intervals, for 31 days using the rollover mode. After creating the three partitions, select the hang up icon and terminate communication with the flowmeter.

At this point, turn off the computer and disconnect the cable from the flowmeter and computer. The flowmeter is now programmed and partitioned. On a two-week basis, the flowmeter needs to be downloaded and data reviewed for accuracy.

The rainfall and level partitions will store data for approximately 30 days before an overlap begins. If an overlap occurs, the oldest data will be overwritten with the latest collected data. The sampler partition will continue to collect data for an unknown period of time. The length of time this partition will store data before an overlap occurs depends on the frequency of samples collected. If rainfall events occur often and samples are collected frequently, the partition may only last one or two months.

If rainfall events are rare and samples are not collected frequently, the partition may last for approximately six to eight months.

Once the flow meter is correctly partitioned, be sure to complete the general maintenance sheet with all relevant information.

6.0 Quality Control & Safety Aspects

6.1 The field notebook shall remain in a notebook controlled by the field manager.

6.2 No maintenance, adjustment or repair shall be performed on any field instrument without consultation with the field manager.

7.0 References

7.1 ISCO, Inc., 1992. Flowlink Instruction Manual, 1992.

7.2 ISCO, Inc., 1995. Flowlink 3 Tutorial, 1995.

7.3 ISCO, Inc., 1990. Instruction Manual Model 3230 Flow Meter, 1990.

7.4 ISCO, Inc., 1994. Instruction Manual Model 4230 Flow Meter, 1994.

8.0 Attachments

8.1 General Maintenance Sheet.

P&ED-FF-1002

Programming Flowmeter Equipment

Revision 1

Author

Date

Section Chief

Date

Quality Assurance Officer

Date

1.0 Applicability

This procedure applies to all ISCO 3230 and ISCO 4230 flowmeters used in field applications at Brazos River Authority (BRA), Waco, Texas.

2.0 Purpose

The purpose of this procedure is to provide written documentation of the methods implemented by BRA field personnel to program all ISCO flowmeters used to monitor the stream levels at automated sampling locations

3.0 Definitions

3.1 Field Notebook - notebook of general maintenance sheets used specifically to record field activities, measurements, observations and notes.

3.2 Maintenance - functions or actions required to ensure the proper working order of a piece of equipment. these actions include, but are not limited to, cleaning, minor repairs, changes of tubing, lubricants and other consumable parts, checks for damaged or worn components, and protective measures.

3.3 Flow meter -

ISCO 3230 Flowmeter - a scientific instrument designed to monitor the level of water in a stream, pipe or other system. The bubbler system, used by this particular flowmeter to measure level, detects changes in the level of the flow stream by measuring the amount of air pressure required to force an air bubble from the end of a submerged tube. As the liquid level in the flow stream increases, the amount of air pressure required to force the bubble from the tube also increases.

ISCO 4230 Flowmeter - Is an updated version of the ISCO 3230 Flowmeter utilizing the same type of bubbler system.

4.0 Equipment, Calibration & Maintenance

4.1 ISCO Model 3230 and Model 4230 Flow Meter

4.1.1 Calibration - See SOP P&ED-FF-1002 Programming Flow Meter Equipment, *Instruction Manual Model 3230 Flow Meter* and *Instruction Manual Model 4230 Flow Meter*

4.1.2 Maintenance - See SOP P&ED-FF-1006 General Maintenance , *Instruction Manual Model 3230 Flow Meter* and *Instruction Manual Model 4230 Flow Meter*.

5.0 Procedure

The ISCO 3230 flowmeter with plotter has 12 program steps and that each step may have one or a series of options to choose from. The option that is flashing in a given step indicates the current or default setting. Pushing 'Enter' will accept a flashing option.

THE PASSNUMBER NEEDED TO CHANGE ANY OPTION OF THE PROGRAM IS 3230.

Time Based Programming

In order to make major changes in the ISCO 3230's Programming, Report Generation Function must be turned off initially. To do so:

Press "Go to Program Step"
Type 11 and press Enter
Select OFF and press Enter
Press Enter again

Program Step 1

Press Enter
Select Mode of Operation
Choose Level Only press Enter
Select Units of Level Measurements: 1. FEET 2. METERS
Choose FEET press Enter

Program Step 2

Select Sampler Control: 1. Enable 2. Disable 3. Level 4. Rain 5. Other
Choose Level and press Enter
Enter Level at which to Enable Sampler:
Type in number from keypad and press Enter
Note: This level should be 0.12 ft. above the current level;(0.06 ft. if the flowmeter is a SPA 652)
Once Enabled, Keep Sampler Enabled: 1. Yes 2. No
Choose Yes and press Enter

Program Step 3

Select Plotter On/Off with Samp Enab 1. Yes 2. No
Choose Yes and Press Enter
Select Plotter Mode of Operation: 1. Off 2. Level 3. Flow
Choose Level and Press Enter

Program Step 4

Plotter Full - Scale: 100% = xx FT
From keypad choose a value higher than average depth and press Enter

Program Step 5

Select Plotter Chart Speed: 1. .5"/HR 2. 1"/HR 3. 2"/HR 4. 4"/HR
Choose .5"/HR and press Enter

Program Step 6

Set: Year Month Day Hour Minute

Choose the current value for each category and press Enter after each
Program Step 7

Site Identification Number: Site Number = XXX
Choose a value and press Enter (must be numeric)

Program Step 8

Select Auto-Purge Frequency: 1. Off 2. 5 3. 10 4. 15 5. 30 6. 60
Choose number of minutes between purges and press Enter

Program Step 9

Adjust Level: Use Arrow Keys or Enter Value Enter present Level:

Note: Measure the level of the water above the stainless steel bubbler line and record it in the field book. This is the value that should be entered in, unless the meter is label SPA 652. If labeled SPA 652 divide the value measured by 2 and enter the quotient as the current level.

Use keypad type in current level and press Enter

Program Step 11

Report Generation: 1. On 2. Off
Choose On and press Enter
Report Interval to be In: 1. Hours 2. Days 3. Months
Choose Days and press Enter
Enter Interval in Days
Choose 7 From keypad and press Enter
Enter the Interval Start Time YR: MONTH: DAY: HR: MIN:
From keypad choose the current values for each category and press Enter

after each

Note: Start date should be the Monday of the current week at 08:00 a.m..

Program Step 12

Enable Program Lock?: 1. Yes 2. No
Choose Yes and press Enter

The ISCO 4230 flowmeter with plotter has 9 program steps and that each step may have one or a series of options to choose from. In addition, there is also a set-up step, which needs to be programmed before going through the 9 individual steps. The option that is flashing in a given step indicates the current or default setting. Pushing 'Enter' will accept a flashing option.

THE PASSNUMBER NEEDED TO CHANGE ANY OPTION OF THE PROGRAM IS 4230.

Press the Enter/Program Step button

Select Option: Program . . Setup

Use the arrow keys to select setup and press Enter.

Setup Options: 'exit' to quit

Select 'set clock' and press Enter.

Make sure the time and date are correct. If they are not, input the appropriate time/date, pressing enter after each setting (year, month, day, hour and minute).

Use the arrows to select 'site id' and press Enter.

Input the site id number for the site you are currently at. The site id number should be very site specific.

Use the arrow keys to select 'measurement setup' and press Enter.

Use the arrow keys to select 'level reading interval' and press Enter.

Select continuous and press Enter.

Use the arrow keys to select 'do/pH reading' and press Enter.

Select continuous and press Enter.

Use the arrow keys to select 'ysi600 reading interval' and press Enter.

Select continuous and press Enter.

Use the arrow keys to select 'purge interval' and press Enter.

Use the arrow keys to select 10 min and press Enter.

Purge Duration

Use the arrow keys to select ½ sec and press Enter.

Use the arrow keys to select superbubble mode and press Enter.

Superbubble Mode

Use the arrow keys to select on and press Enter.

Press Exit Program

Use the arrow keys to select 'enable/alarm hysteresis' and press Enter.

Hysteresis 0.000ft.

Press Enter

Press Enter

Use the arrow keys to select 'optional outputs' and press Enter.

Use the arrow keys to select 'analog output' and press Enter.

Press Enter.

Use the arrow keys to select off and press Enter.

Press exit program

Use the arrow keys to select 'serial output' and press Enter.

Use the arrow keys to select off and press Enter.

Use the arrow keys to select alarm box and press Enter.

Use the arrow keys to select off and press Enter.

Use the arrow keys to select 'report setup' and press Enter.

Use the arrow keys to select report A and press Enter.

Use the arrow keys to select flow and press Enter.

Level in report. Use the arrow keys to select yes and press Enter.

Flow in report. Use the arrow keys to select no and press Enter.

Rainfall in report. Use the arrow keys to select yes and press Enter.

Use the arrow keys to select DO/PH and press Enter.

pH or DO in report. Use the arrow keys to select no and press Enter.

Temperature in report. Use the arrow keys to select no and press Enter.

Use the arrow keys to select YSI 600 and press Enter.

YSI data in report. Use the arrow keys to select no and press Enter.

Use the arrow keys to select sample history and press Enter.

Sample history in report. Use the arrow keys to select no and press Enter.
Use the arrow keys to select flow meter history and press Enter.
Flowmeter history in report. Use the arrow keys to select no and press

Enter.

Press exit program.
Use the arrow keys to select report B and press Enter.
Use the arrow keys to select flow and press Enter.
Level in report. Use the arrow keys to select yes and press Enter.
Flow rate in report. Use the arrow keys to select no and press Enter.
Rainfall in report. Use the arrow keys to select yes and press Enter.
Use the arrow keys to select do/pH and press Enter.
pH or do in report. Use the arrow keys to select no and press Enter.
Temperature in report. Use the arrow keys to select no and press Enter.
Use the arrow keys to select YSI 600 and press Enter.
YSI data in report. Use the arrow keys to select no and press Enter.
Use the arrow keys to select sample history and press Enter.
Sample history in report. Use the arrow keys to select yes and press Enter.
Use the arrow keys to select flow meter history and press Enter.
Flowmeter history in report. Use the arrow keys to select yes and press

Enter.

Press exit program.
Press exit program.
Use the arrow keys to select LCD backlight and press Enter.
Use the arrow keys to select keypress timeout and press Enter.
Use the arrow keys to select program lock and press Enter.
Program lock. Use the arrow keys to select on and press Enter.
Use the arrow keys to select program and press Enter.

Program Steps

Select option.
Use the arrow keys to select program and press Enter.
Level units of measure.
Use the arrow keys to select ft. and press Enter.
Flow rate units of measure
Use the arrow keys to select not measured and press Enter.
Rainfall units of measure
Use the arrow keys to select in. and press Enter.
pH units of measure
Use the arrow keys to select not measured and press Enter.
Dissolved oxygen units of measure
Use the arrow keys to select not measured and press Enter.
Temperature units of measure
Use the arrow keys to select not measured and press Enter.
YSI 600 connected
Use the arrow keys to select no and press Enter.
Data type for analog output 1

Use the arrow keys to select off and press Enter.

Parameter to adjust

Use the arrow keys to select none and press Enter.

Sampler pacing

Use the arrow keys to select disable and press Enter.

Sampler enable mode

Use the arrow keys to select conditional and press Enter.

Condition

Use the arrow keys to select level and press Enter.

Level

Use the arrow keys to select greater than and press Enter.

Level

Input a level approximately 0.12ft. above the current water level and press

Enter.

Operator

Use the arrow keys to select done and press Enter.

When enable condition is no longer met

Use the arrow keys to select keep enabled and press Enter.

Plotter on/off with enable

Use the arrow keys to select yes and press Enter.

Alarm dialout

Use the arrow keys to select disable and press Enter.

Plotter Speed

Use the arrow keys to select 1/2"/hr and press Enter.

Input for plotter line A

Use the arrow keys to select level and press Enter.

Plotter line A full scale

Input 5.0 ft and press Enter.

Input for plotter line B

Use the arrow keys to select off and press Enter.

Input for plotter line C

Use the arrow keys to select off and press Enter.

Plot rainfall on chart

Use the arrow keys to select yes and press Enter.

Rainfall full scale

Input 0.50 in and press Enter.

Report Generator A

Use the arrow keys to select on and press Enter.

Report A duration to be in

Use the arrow keys to select days and press Enter.

Report A duration

Input 7 days and press Enter.

Print first report A at

Input the date of the previous Monday, at 8:00 a.m., pressing Enter after

each parameter.

Report Generator B

Use the arrow keys to select on and press Enter.
Report B duration to be in
Use the arrow keys to select months and press Enter.
Report B duration
Input 1 month and press Enter
Print first report B at
Input the 1st of the current month at 8:00 a.m., pressing Enter after each parameter.
Print flow meter history
Use the arrow keys to select no and press Enter.
Clear history
Use the arrow keys to select yes and press Enter.

You should now be at the main display screen of the flowmeter. The current time, date and water level should be displayed on the right side of the flowmeter. You are now ready to use P&ED-FF-1001 to partition the flowmeter.

6.0 Quality Control & Safety Aspects

- 6.1 The field notebook shall remain in a notebook controlled by the field manager.
- 6.2 No maintenance, adjustment or repair shall be performed on any field instrument without consultation with the field manager.

7.0 References

- 7.1 ISCO, Inc., 1990. Instruction Manual Model 3230 Flow Meter, 1990.
- 7.2 ISCO, Inc., 1994. Instruction Manual Model 4230 Flow Meter, 1994.

8.0 Attachments

- 8.1 General Maintenance Sheet

P&ED-FF-1004

Sample Retrieval

Revision 1

Author

Date

Section Chief

Date

Quality Assurance Officer

Date

1.0 Applicability

This procedure applies to all samples retrieved from automated sampling sites utilized at the Brazos River Authority, Waco, Texas.

2.0 Purpose

The purpose of this procedure is to provide written documentation of the methods used by BRA field personnel when retrieving water samples following a storm event from automated samplers

3.0 Definitions

3.1 Field Notebook - notebook of general maintenance sheets used specifically to record field activities, measurements, observations and notes.

3.2 Maintenance - functions or actions required to ensure the proper working order of a piece of equipment. These actions include, but are not limited to, cleaning, minor repairs, changes of tubing, lubricants and other consumable parts, checks for damaged or worn components, and protective measures.

3.3 Chain of Custody (COC) - a form that accompanies a sample or group of samples from the field technician responsible for sample collection to the laboratory to final disposition. The COC designates who accepts custody and responsibility for the sample(s) by their signature and could, under many circumstances, become a legally binding document for use in a court of law.

3.4 Custody - a sample is considered to be in a person's custody if it is in the physical possession or immediate sight of the individual, secured in a tamper-proof manner by that individual, or secured in an area restricted to authorized personnel.

3.5 Flow meter -

ISCO 3230 Flowmeter - a scientific instrument designed to monitor the level of water in a stream, pipe or other system. The bubbler system, used by this particular flowmeter to measure level, detects changes in the level of the flow stream by measuring the amount of air pressure required to force an air bubble from the end of a submerged tube. As the liquid level in the flow stream increases, the amount of air pressure required to force the bubble from the tube also increases.

ISCO 4230 Flowmeter - Is an updated version of the ISCO 3230 Flowmeter utilizing the same type of bubbler system.

3.6 Automatic Sampler - a scientific instrument used to collect water samples based on time or flow conditions, depending on the program of the instrument. The sampler retrieves samples based on automation, not human actions.

4.0 Equipment, Calibration & Maintenance

4.1 ISCO Model 3700 Automatic Sampler

4.1.1 Calibration - See P&ED-FF-1002 Programming Flow Meter Equipment and *ISCO 3700 Portable Water Sampler Instruction Manual*.

4.1.2 Maintenance - maintenance of the flow meter is described in further detail in section 5 of this manual.

4.2 ISCO Model 3230 Flow Meter

4.2.1 Calibration - See P&ED-FF-1002 Programming Flow Meter Equipment and *Instruction Manual Model 3230 Flow Meter*.

4.2.2 Maintenance - See SOP P&ED-FF-1006 General Maintenance.

4.3 ISCO Model 4230 Flow Meter

4.3.1 Calibration - See P&ED-FF-1002 Programming Flow Meter Equipment and *Instruction Manual Model 4230 Flow Meter*.

4.3.2 Maintenance - See SOP P&ED-FF-1006 General Maintenance.

5.0 Procedure

5.1 Upon arrival at the site, the following procedures need to be performed:

Record on the field sheet what the LCD screen on the face of the sampler reads (i.e. Sampler Inhibited)

Press Display Status

[Review, Print] Program Information. Use the arrow keys to select Review and press Enter.

Review Program [No, Settings, Results]. Use the arrow keys to select Results and press Enter.

Keep pressing Enter to toggle through the results. If any samples were collected, i.e. Bottle 1 Source: enable Time: xx:xx Date x-x-xx, then the sampler needs to be downloaded. If no samples were taken, record on the field sheet that the sampler was inhibited.

When you reach the end of the "results", you will be back at the "Review Program" screen with "No" flashing. By pressing Enter, the sampler will resume its normal sampling routine.

If samples were collected, continue to the Sampler Downloading instructions in section II. If no samples were collected, proceed to section III.

5.2 Sampler Downloading

Attach one end of the downloading cable to the printer port terminal on the back of the sampler and attach the other end of the cable to the serial port of the computer. Turn on the computer and at the C:\ prompt type 'sl' and press Enter.

After typing 'sl', the samplink program should appear on the screen. Press 1 for COM channel 1. Follow the directions at the bottom of the screen until you reach the end of the program (Press 'n' to view each page of the results, press 'c' to scroll through the results without stopping). Once the

samplink program is complete, record the file name (i.e. si275f00.dat) that appears at the bottom of the screen and type Q to exit the program. If the sampling site is not a flow based composite site, you may now turn off the computer and unplug the connecting cable. If the site is flow based composite, you need to download the flowmeter.

5.3 Flowmeter

Record the current level and time displayed on the screen of the flowmeter.

For 3230 flowmeters, press the "Go To Program Step" key and press 2 and Enter. Continue pressing Enter until the screen displays "Level at which to enable sampler" and record this level. This is the enable/disable level. Press the Enter key six more times and then press "Exit Program" key and return to the regular display screen.

5.4 Retrieving Samples

Remove the top portion of the sampler and place lids on the bottles containing samples.

Remove the center ring.

Label the appropriate bottles with the site name and bottle number and remove them from the sampler, replacing them with clean bottles.

Replace the center ring and place the sampler top back on the base.

5.5 Printing Sampler Data

Once you have returned to the office, plug the small field computer into the base station and make sure it is properly plugged in. After turning on the field computer, type in "wl" and press enter. On the desktop computer, double click on the winlink icon. When the screen comes up, it should display the c-drive on both the desktop and field computers. Click on the flowdata directory on the remote (field computer) and drag it over to the desktop flowdata directory. Answer yes to the question 'do you wish to copy remote flowdata to desktop flowdata.

Now open up the desktop samples directory. Now open the remote samplink directory. Copy all of the .smp files from the remote computer to the desktop computer. After copying the appropriate files, use notepad on the desktop computer to print out each file.

Once the files have been printed, you may delete all the files in the samplink directory of the remote computer.

5.6 Resetting the Sampler

Once the water level is at or below the enable/disable level, the sampler is ready to be reset to SI. At sites that utilize a 3230 flowmeter, reset the flowmeter using the following instructions.

Go to the flowmeter and press 'Go to Program Step'. Input 11 and press Enter

Use the arrow keys to turn off the report generation. Remember that the passnumber is 3230.

Once the report generation is off press Enter again to return to the main display screen.

The screen should display the current time, date and level

Press 'Go to Program Step'. Input 2 and press Enter twice.

The screen should display 'Enter Level at which to Enable Sampler'. Input a value 0.12-ft. above the current level, 0.06 ft. for a SPA 652 flowmeter, and press Enter.

Press enter six more times.

Press 'exit program'.

Press the +/- key and verify that the sampler is disabled. If the sampler is still enabled, repeat the previous instructions.

Press 'Go to Program Step'. Input 11 and press Enter.

Report Generation: 1. On 2. Off

Choose On and press Enter

Report Interval to be in: 1. Hours 2. Days 3. Months

Choose Days and press Enter

Enter Interval in Days

Input 7 and press Enter

Enter the Interval Start Time YR: MONTH: DAY: HR: MIN:

From the keypad choose the values from the previous Monday at 08:00 for each category and press Enter after each.

Press Enter

The screen of the flowmeter should display the current time, date and level.

Now, return to the sampler and turn off the sampler. Now, turn the sampler back on and the distributor arm should move back to position one.

Press Start Sampling and press Enter 2 times. The display should read 'SAMPLER INHIBITED'. If not press enter one more time.

At sites that utilize a 4230 flowmeter, reset the sampler using the following instructions.

On the flowmeter keypad, press go to program step and input 6 and press enter four times.

Input the appropriate enable/disable level. Usually 0.12 ft. above the current water level.

Press enter 7 more times and then press exit program.
The main screen should be displayed on the front of the flowmeter.

Now, return to the sampler and turn off the sampler. Now, turn the sampler back on and the distributor arm should move back to position one. Press Start Sampling and press Enter 2 times. The display should read 'SAMPLER INHIBITED'. If not press enter one more time.

5.7 Exceptions

At times during the retrieval of samples problems with the sampling routine have occurred have things need to be handled in a different manner. Different problems might include: blown suction line, loss of plotter power, clogged bubbler line, fatal error: distributor arm jam, loss of power, excessively large sample volumes, incorrect language display due to lightening, warning: replace pump tubing, sampler display frozen to previous sample, problem occurred press display status or other problems not yet encountered by the TIAER personnel.

Blown Suction Line

Periodically, the 1/4-inch polyethylene suction line will become disconnected from the 1/4 inch to 3/8-inch adapter leading to the sampler. The disconnection is due to excessive pressure on the adapter. In order to repair the problem, reattach the suction line to the adapter and use a hose clamp to firmly secure the line to the adapter. In order to test the attachment, pull a manual sample with the sampler and monitor the connection.

Loss of Plotter Power

The flowmeter sometimes will display the flashing message 'No Plotter Power, Check Fuse'. The flowmeter still functions correctly; however, the plotter quits printing a hydrograph of the present storm event. In order to correct the problem, the face of the flowmeter needs to be removed and the internal fuse should be checked and replaced if needed. If a new fuse does no correct the problem, replace the flowmeter and bring the broken flowmeter in for further investigation.

Clogged Bubbler Line

The display of the flowmeter may show a large fluctuation in the level of the stream. Generally, this high fluctuation indicates that the stainless steel bubbler line has become covered with sand, silt or gravel and causing the bubble rate to increase and decrease. Many times, especially at flow based sampling sites, this problem can cause the sampler to collect

samples based on the flowrate of the flowmeter, although it may not be indicative of the stream. At time based sampling sites, this problem may inhibit the sampler from shutting off and continue to collect samples.

In order to resolve the problem, uncover the bubbler line of and manually purge the flowmeter. Generally, this will force any debris out of the bubbler line, if not, the bubbler line will need to be replaced. Some sites may have a history of sand/silt deposition in the area of the bubbler line. In this instance, the bubbler line needs to be either raised or moved to a more suitable location.

Fatal Error: Distributor Arm Jam

This message may appear on the display of the sampler during a sampling routine. Usually the sampler will be beeping approximately once per second and the sampling routine will have been canceled. When this problem occurs, the keypad on the face of the sampler will not respond to any commands. The power cable from the 12-volt battery to the sampler needs to be disconnected and reconnected. If the cable is disconnected from the battery, the keypad will still not respond. The power must be disconnected from the back of the sampler.

Once the cable has been reconnected, turn the sampler off using the on/off button on the face of the sampler. After turning the sampler off, turn the sampler on and the display should read either 'Standby' or 'Program Halted'. Check the sampler for any samples and find out when the problem occurred.

After collecting any pertinent sampler information, lift the top of the sampler off the base and examine the distributor arm of the sampler. Many times the nut holding the arm will be loose and need to be tightened. After tightening the nut, go into the CONFIGURE portion of the sampler program. Toggle through the program until you reach 'Run Diagnostics' and press Enter. After the diagnostics have been tested, test the distributor arm. The arm should rotate forward through all 24 bottles and then rotate backward to bottle position #1. If the distributor arm passes the test, replace the top portion of the sampler and either restart the sampling program or inhibit the sampler until the next rainfall event. If the distributor arm does not pass the test, check the arm again and even take the arm off and reattach before retesting the distributor.

Loss of Power

For some unknown reason, the sampler and flowmeter sometimes lose all power and fail to collect samples during a rainfall event. When this problem occurs, check the power cable from the sampler to the battery.

The wing nuts may be loose on the battery or the connectors could be corroded. If corroded, clean the connectors with a wire brush and spray the corrosive protectant on the battery posts and connectors before reconnecting the battery. The sampler and flowmeter should power up and run internal tests before recording any additional data. Check the sampler for any samples that might have been collected. If no samples were collected, the sampler should either be started to begin taking water samples or be inhibited for the next rainfall event.

Large Sample Volumes

Sometimes the sampler will collect water samples that are either too large or too small. This is an indication that the sampler needs to be calibrated. If the sampler is pulling an insufficient sample volume, collect a grab sample from the stream and in addition, retrieve the collected samples. If the sampler is pulling large sample volumes, remove the water from the bottom of the sampler and calibrate the sampler to the correct volume amount.

Incorrect Language Display

During severe thunderstorms, electromagnetic fields (EMFs) are sometimes created in the area that can cause the internal circuitry of the sampler and flowmeter to become weakened. Periodically, the sampler will change display languages or even change program routines. When this case scenario happens, the only thing to do is to change out the sampler or flowmeter with a different one and bring the troubled unit into the office for further investigation.

Warning Replace Pump Tubing

This message indicates that the pump tubing inside the pump housing has reached its warning count of 500,000 revolutions. The tubing can either be reversed or replaced depending on the condition of the opposite end of the tubing. Take the cover off the pump and liquid detector and disconnect the 1/4-inch to 3/8-inch adapter. Remove the tubing from the underneath side of the sampler and examine the tubing for past use. If both ends of the tubing have been used, replace the tubing with new. If possible, reverse the pump tubing and install the tubing back in the same manner in which it was removed. After the tubing has been replaced, reset the pump counter in the Configure portion of the sampler. After resetting the pump counter, resume or restart the sampling routine.

Sampler Display Frozen

During times of cold temperatures, the liquid crystal display screens will periodically freeze on a particular time/date reading. When this is observed, generally the sampling routine will not have been disturbed. Simply note that the screen was frozen and continue with the normal sample retrieval procedures.

Problem Occurred: Press Display Status

When checking the sampler for any collected samples, the display may be flashing the message 'Problem Occurred: Press Display Status'. Press the display status button and review the results portion of the program. Note if any problem occurred. Usually the problem will be a power failure or the sampler was inhibited when a sample should have been collected. These types of problems generally do not cause the sampling routine to be disturbed, however, should be noted in the event a problem occurs in the future.

Program Done, Restart Program

When the message 'Done xx Samples' is displayed on the sampler, the sampling program has been completed and no further samples will be collected. Retrieve the samples following the retrieval procedures and decide if additional samples need to be collected. If the water level has not dropped and there is flow in the stream, the program probably needs to be restarted. If the site is a flow based sampling site, press start sampling button and Enter two times and the display should read '1 of 4 Bottle 1 after 1 Pulse'. If the site is a time based sampling site, the program needs to be slightly altered. Go into the PROGRAM portion of the sampler and press the Enter button until 'Modify Sequence' appears on the display. Select Yes and press Enter. The password to make the change is 3700 and Enter. Press Enter and input 23 at 360minutes (instead of 3 at 60 minutes). When the sampler asks for a start time, input the time 6 hours after the last collected sample. Exit out of the program and press start sampling and Enter. The display should read 'Bottle 1 at xx:xx, aa:aa', where xx:xx is the start time input by field personnel and aa:aa is the current time.

6.0 Quality Control & Safety Aspects

6.1 The general maintenance sheets shall remain in a notebook controlled by the field manager.

6.2 No maintenance, adjustment or repair shall be performed on any field instrument without consultation with the field manager.

7.0 References

- 7.1 ISCO, Inc., 1990. Instruction Manual Model 3230 Flow Meter, 1990.
- 7.2 ISCO, Inc., 1994. Instruction Manual Model 4230 Flow Meter, 1994.
- 7.3 ISCO, Inc., 1992. 3700 Portable Sampler Instruction Manual, 1992.

8.0 Attachments

- 8.1 Chain of Custody Form
- 8.2 General Maintenance Sheet

P&ED-FF-1005

Downloading Automated Sampling Sites

Revision 1

Author

Date

Section Chief

Date

Quality Assurance Officer

Date

1.0 Applicability

This procedure applies to the downloading procedures used to collect data from the ISCO 3230 and ISCO 4230 flowmeters at the Brazos River Authority (BRA), Waco, Texas.

2.0 Purpose

The purpose of this procedure is to provide written documentation of the methods used by BRA personnel to retrieve stored data from the ISCO flowmeters utilized at all automated water sampling sites.

3.0 Definitions

3.1 Field Notebook - notebook of general maintenance sheets used specifically to record field activities, measurements, observations and notes.

3.2 Maintenance - functions or actions required to ensure the proper working order of a piece of equipment. These actions include, but are not limited to, cleaning, minor repairs, changes of tubing, lubricants and other consumable parts, checks for damaged or worn components, and protective measures.

3.3 Flow meter -
ISCO 3230 Flowmeter - a scientific instrument designed to monitor the level of water in a stream, pipe or other system. The bubbler system, used by this particular flowmeter to measure level, detects changes in the level of the flow stream by measuring the amount of air pressure required to force an air bubble from the end of a submerged tube. As the liquid level in the flow stream increases, the amount of air pressure required to force the bubble from the tube also increases.

ISCO 4230 Flowmeter - Is an updated version of the ISCO 3230 Flowmeter utilizing the same type of bubbler system.

4.0 Equipment, Calibration & Maintenance

- 4.1 Laptop computer
 - 4.1.1 Calibration - not applicable.
 - 4.2.2 Maintenance - not applicable.
- 4.2 ISCO 3230 and 4230 Flow Meters
 - 4.2.1 Calibration - See SOP P&ED-FF-1002 Programming Flow Meter Equipment, *Instruction Manual Model 3230 Flow Meter* and *Instruction Manual Model 4230 Flow Meter*
 - 4.2.2 Maintenance - See SOP P&ED-FF-1006 General Maintenance , *Instruction Manual Model 3230 Flow Meter* and *Instruction Manual Model 4230 Flow Meter*.

5.0 Procedure

The flow meters at the AWQS sites have approximately thirty days of memory allocated to each partition. However, as part of our QA/QC efforts, each flowmeter is downloaded, and the data reviewed, on a biweekly basis. The biweekly downloading helps to eliminate the potential for prolonged periods of missing data, such as a month. The procedure for downloading the flowmeter is as follows:

Using the corresponding cable, connect to the interrogator outlet of the flowmeter and the serial port of the laptop computer.

Turn the computer on and at the C:\ prompt, type in 'NFL' and press Enter.

You should now be at the main flowlink screen. Press alt F and select new. Press the enter key twice. The computer will now try to connect with the flowmeter. You can also use the mouse instead of using keystrokes.

Once communication with the flowmeter has been established, you are ready to download the flowmeter. Using the tab key, tab over to the interrogation icon and press enter. The computer will now download the flowmeter. You should see a smaller screen showing the percent download completed. Once the computer is finished interrogating the flowmeter, a screen will appear that states interrogation complete. Press enter. Tab over to the icon hang-up and press enter. This should close the established communication channel between the flowmeter and computer. Select the close box on the main screen and the download will be complete.

6.0 Quality Control & Safety Aspects

6.1 The general maintenance sheets shall remain in a notebook controlled by the field manager.

6.2 No maintenance, adjustment or repair shall be performed on any field instrument without consultation with the field manager.

7.0 References

- 7.1 ISCO, Inc., 1992. Flowlink Instruction Manual, 1992.
- 7.2 ISCO, Inc., 1990. Instruction Manual Model 3230 Flow Meter, 1990.
- 7.3 ISCO, Inc., 1993. Flowlink3 Tutorial, 1995.
- 7.4 ISCO, Inc., 1994 Instruction Manual Model 4230 Flow Meter, 1994.

8.0 Attachments

- 8.1 General Maintenance Sheet

P&ED-FF-1006

General Maintenance

Revision 1

Author

Date

Laboratory manager

Date

Quality Assurance Officer

Date

1.0 Applicability

This procedure applies to all field equipment used to monitor non-point source pollution at automated sampling sites utilized at the Brazos River Authority (BRA), Waco, Texas.

2.0 Purpose

The purpose of this procedure is to provide written documentation of the methods and procedures used by BRA field personnel to maintain all field equipment. Maintaining equipment in good working order is essential for production of high quality data in the field.

3.0 Definitions

3.1 Maintenance - functions or actions required ensuring the proper working order of a piece of equipment. These actions include, but are not limited to, cleaning, minor repairs, changes of tubing, periodic calibration, checks for damaged or worn components, changes of consumable materials and protective measures.

3.2 Field Notebook - notebook of general maintenance sheets used specifically to record field activities, measurements, observations and notes.

3.3 Flow meter -

ISCO 3230 Flowmeter - a scientific instrument designed to monitor the level of water in a stream, pipe or other system. The bubbler system, used by this particular flowmeter to measure level, detects changes in the level of the flow stream by measuring the amount of air pressure required to force an air bubble from the end of a submerged tube. As the liquid level in the flow stream increases, the amount of air pressure required to force the bubble from the tube also increases.

ISCO 4230 Flowmeter - Is an updated version of the ISCO 3230 Flowmeter utilizing the same type of bubbler system.

3.4 Automatic Sampler - a scientific instrument used to collect water samples based on time or flow conditions, depending on the program of the instrument. The sampler retrieves samples based on automation, not human actions.

4.0 Equipment, Calibration & Maintenance

4.1 ISCO Model 3700 Automatic Sampler

4.1.1 Calibration - See SOP P&ED-FF-1002 Programming Flow Meter Equipment and *ISCO 3700 Portable Water Sampler Instruction Manual*.

4.1.2 Maintenance - maintenance of the flow meter is described in further detail in section 5 of this manual.

4.2 ISCO Model 3230 Flow Meter

4.2.1 Calibration - See SOP P&ED-FF-1002 Programming Flow Meter Equipment and *Instruction Manual Model 3230 Flow Meter*.

4.2.2 Maintenance - maintenance of the flow meter is described in further detail in section 5 of this manual.

4.3 ISCO Model 4230 Flow Meter

4.3.1 Calibration - See SOP P&ED-FF-1002 Programming Flow Meter Equipment and *Instruction Manual Model 4230 Flow Meter*.

4.3.2 Maintenance - maintenance of the flow meter is described in further detail in section 5 of this manual.

5.0 Procedure

Maintenance of all field equipment is performed on weekly, monthly and quarterly time schedules. Maintenance for each schedule is as follows:

5.1 Weekly Maintenance

Using a general maintenance field data sheet, write down the site name, current date, your initials and Central Standard Time. Continue to fill in all blanks on the data sheet as follows:

Using a battery tester, check the percent charge of the 12-volt deep cycle marine battery. If the percent charge is less than 50%, replace the battery with a fully charged battery. If the charge is above 50%, record the percent charge on the data sheet.

Observe the tube(s) of desiccant on the top or side of the flowmeter. It should be a shade of blue. If not, replace the desiccant(s) with new one(s). In addition, the internal square desiccant should also be checked and replaced if necessary. Please record the condition of the desiccants on the data sheet.

Observe the amount of plotter paper remaining on the printer of the flowmeter. Replace if necessary and record on the data sheet.

Record the current level reading displayed on the view screen of the flowmeter.

For 4230 flowmeters, press the "go to program step" button on the flowmeter. Press 6 and then press the enter button four times. The screen should display the current enable/disable level. This level should be approximately 0.12 feet above the current water level. If the "enable/disable" level does not correspond, the "enable/disable" level needs to be changed. Record the new enable/disable level on the general maintenance sheet.

For 3230 flowmeters, press the "go to program step" button on the flowmeter. Press 2 and then press the enter button two times. The screen should display the current enable/disable level. This level should be approximately 0.12 feet above the current water level. If the enable/disable level does not correspond, then change the enable/disable level appropriately. Record the new enable/disable level on the general maintenance sheet.

Check to make sure the automatic water sampler is full of clean sample bottles. If the sampler is not full, please fill with clean bottles.

Look at the display panel of the sampler. Record what is displayed on the screen. Press the display status button of the sampler and press the enter key one time to review the results program. Using the arrow key, toggle over until the word "results" is flashing and press the enter key. Keep pressing the "enter" key until the display reads "SAMPLER INHIBITED", and note if any water samples were collected. If water samples were collected, retrieve the samples.

Note the condition of the suction and bubbler lines.

If the sampling site contains a tipping bucket rain gage, check the funnel to ensure it is not clogged. Also check the QA rain gage for any rain measurement and record on the data sheet.

If the site is downloaded, please indicate which instrument was downloaded, either the flowmeter or sampler.

Check to make sure the report generation program of the flowmeter is turned on. Press 'Go to Program Step' and the number nine once and press Enter. Check both report A and report B and make sure both are on. The passnumber, if asked, is 4230. Set the Initiation date to the date of the previous Monday at 8:00 a.m., for report A. Set the initiation date to the previous 1st of the month for report B. Press 'exit program' to return the main screen. For 3230 flowmeters, press "go to program step" and the number 11 followed by Enter. For any changes on the 3230 flowmeter, the passnumber is 3230.

Finally, the flowmeters at the automated sampling sites are downloaded with a laptop computer biweekly.

5.2 Monthly Maintenance

The following procedures are performed at each of the automated water sampling sites on a monthly basis. The procedures performed are recorded on the weekly general maintenance data sheets along with any additional comments regarding the status of the sampling site.

The fluid levels in the batteries used to power the samplers and flowmeters are checked to monitor the water usage of the battery. If water levels are low in the battery, water is added to the battery to ensure that the battery maintains a full charge. In addition, if any corrosion is noted on the battery posts, the posts are cleaned using a wire brush and sprayed with a battery corrosion protectant.

The 1/8-inch polyethylene bubbler lines, used by the flowmeters to measure the depth of the water in the stream, are calibrated for accuracy using a staff gauge. If the display level on the flowmeter and measured level are different, the flowmeter level is adjusted accordingly and the change is noted in the field book.

Samples are collected at each automated sampling site to check the calibration of the sampler. The samplers are enabled through the flowmeter to check the ability of the flowmeter and sampler to respond during a storm event.

The stainless steel strainer and bubbler lines are cleaned of debris or anything, which might inhibit the correct operation of the sampling equipment. The strainer is cleaned using a wire brush to remove rust and possible algae growth. The

bubbler line is also cleaned with a wire brush and a piece of wire is used to clean the inside of the bubbler line of any sand, silt or algae.

If the site contains a tipping bucket rain gage, a test is performed to ensure a proper response from the rain gage. The rain gage is manually tipped five or ten times. After tipping the gage, a report is printed on the flow meter to make sure the rain was recorded in the rain partition. The number of tips is recorded on the general maintenance sheet and is taken out of the rainfall database.

5.2 Quarterly Maintenance

The following procedures are performed at each sampling site on a quarterly basis. Each of the procedures is recorded on the standard general maintenance sheet or on a sheet of paper to be filed.

The cross section of each sampling station is surveyed to record any changes in the shape of the channel. The survey is performed at the same location each time using a staff gage and topcon level. Readings are taken at 1-foot increments and all the surveys at each site are tied together using a common benchmark.

The suction line at each site is cleaned using 1 N hydrochloric acid. After washing the line with acid, the line is triple rinsed with deionized water.

The tipping bucket rain gages at all sites are calibrated using 16 ounces of water over a period of 15 minutes to 1 hour. In addition, the rain gage is tipped manually to make sure all the electronic components are responding correctly. This rain is recorded on the field data sheets and not input into the actual rainfall database.

Using the Global Positioning System equipment, the longitude and latitude of each sampling location is collected and stored. The data is differentially corrected and the positions are compared to previous readings.

6.0 Quality Control & Safety Aspects

6.1 The general maintenance sheets shall remain in a notebook controlled by the field manager.

6.2 No maintenance, adjustment or repair shall be performed on any field instrument without consultation with the field manager.

7.0 References

- 7.1 ISCO, Inc., 1992. Flowlink Instruction Manual, 1992.
- 7.2 ISCO, Inc., 1990. Instruction Manual Model 3230 Flow Meter, 1990.
- 7.3 ISCO, Inc., 1993. Flowlink 3 Tutorial, 1995.
- 7.4 ISCO, Inc., 1994. Instruction Manual Model 4230 Flow Meter, 1994.
- 7.5 ISCO, Inc., 1992. 3700 Portable Sampler Instruction Manual, 1992.

8.0 Attachments

8.1 General Maintenance Sheet

MWH
STANDARD OPERATING PROCEDURES