

Model 100EL

Meter-Master Flow Recorder

Operating Instructions

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Rev. 3.5 (Oct-06) • Program Software Version 3.0+

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Chapter One

GETTING STARTED

1.1 About The Meter-Master Model 100EL

The METER-MASTER MODEL 100EL Flow Recorder is a battery-powered, portable flow recording instrument that converts a meter's magnetic drive signal to a digital output that is stored for later downloading. It is compatible with almost all water meters, small enough to fit inside a residential meter box, and easy to set up.

The submersible Model 100EL uses a patented sensor to pick up the magnetic pulses generated by a meter's drive magnets. No electrical or mechanical connection or adapter is required for most meters (gear-driven meters, Hersey MHR meters, and Sensus Compound meters require available adapters).

The Model 100 Program for Windows provides a variety of report and graph options. Data may easily be exported into the MeterSizer™ software accessory, the Trace Wizard™ end-use recognition software accessory, or other software, such as Lotus™, Excel™, Quattro Pro™, WordPerfect™, and MS Word™.

Meter-Master set-up in the field is simple, requiring only velcro straps to secure the sensor in position. Typically, the sensor is placed on the side of the water meter's register with the sensor cable going straight up or down. A small number of meters have different sensor locations (see Section 2.3 and Appendix A). The rocker switch toggles the recording on/off and initiates a test of the sensor pick-up. The switch's LED signal light verifies accurate recording during the sensor test. The front of the Model 100EL has receptacles for cable connections to the sensor, battery charger, and computer. Two internal 2 volt, lead-acid, rechargeable batteries power the unit. Because batteries release small quantities of gas when overcharging occurs, there is a low-pressure relief valve on the back of the unit which enables the gas to escape. Batteries are recharged by using the battery charger provided; recharging completely discharged batteries takes at least 14 hours. Continuous AC operation is available via the battery charger. With proper care, the batteries should last a minimum of three years.

Meter-Master products are durably built for long, accurate service in accordance with military quality standards. Each unit is manufactured at our factory and shipped ready for operation.

F. S. Brainard & Co. reserves the right to modify its designs at any time in order to supply the best products possible. All instruments are warranted for two years from either the date of purchase or the date of manufacture (see Section 6.3). Maintenance agreements are available following the initial two year warranty period.

1.2 Meter-Master Care And Maintenance

The Model 100EL requires a minimum of care and maintenance. However, as a piece of electronic equipment powered by internal, rechargeable batteries, several points should be kept in mind.

- ➔ **Keep Batteries Charged.** Lead-acid battery life is maximized when the batteries are maintained in a charged condition as often as possible. Complete discharging of lead-acid batteries can result in their permanent damage. Although the Meter-Master batteries should last a minimum of 3 months after being fully charged, whenever possible, connect the Meter-Master to the battery charger when the Meter-Master is connected to the computer and always recharge the batteries after each use if time permits. Leave the Model 100EL connected to the charger whenever it is not in the field.

Because the Model 100EL is built to power-down when it senses low battery power, the batteries are protected from complete discharge during normal operation. However, after a power-down due to low battery power, do not allow the Meter-Master to sit for more than 7 days without recharging.

The Model 100EL uses the same battery power whether it is recording or not. Do not store the Meter-Master in a discharged condition unless it is connected to the battery charger. Store the instrument either fully charged or, preferably, connected to the battery charger. If not connected to the charger while in storage, remember to recharge the batteries at least once every 2 months.

A battery charger is furnished with the Meter-Master. It has been selected as optimal for this application. Other chargers may not provide for the same level of battery performance.

- ➔ **Avoid Needless Submersions.** Although the Meter-Master is sealed to resist water intrusion, care should be taken to avoid needless submersion. If the unit is chained inside a pit, ensure that it can float up to the top if the pit fills with water. If water accumulates inside the unit, it should be returned to the factory for service.
- ➔ **Handle Cables With Care.** To ensure long cable life, handle cables carefully and avoid attempting to insert a cable into the wrong receptacle on the front of the unit. Each connector has a unique number of pins and two channel guides for proper connector mating. Each cable should seat easily into the receptacle; never try to push or press a cable into place. (NOTE: Although the RS232 cable and battery cable have a different number of pins, the RS232 cable can be mistakenly plugged into the Meter-Master battery connection. No damage will result.)
- ➔ **Handle Degraded Batteries With Care.** Lead-acid batteries contain sulfuric acid. If contact is made with the acid, immediately flush the area with water. A good neutralizing solution for sulfuric acid is household baking soda in water. Dispose of lead-acid batteries with automotive battery scrap at an EPA registered reclaimer. Under normal circumstances, battery replacement will be performed at our factory.

1.3 Installing The Model 100 Program Software

IF YOU HAVE AN INFRARED CONNECTION ON YOUR COMPUTER (E.G., PALM PILOT OR MS ACCESS SYNC): Any infrared connection must be disabled when using Meter-Master software.

The Model 100 Program for Windows software is designed to run on Windows 3.1, 3.11, 95, 98, NT, 2000, ME, and XP. As a minimum, your computer should have a Pentium processor, 16MB RAM, and 100MB free hard disk space. A minimum of 32MB of RAM is recommended.

While the Meter-Master software has been designed to run on a network, it does not work in all network environments and is not currently supported by F. S. Brainard & Co. in a network environment. If you encounter a Meter-Master software problem while operating on your network, reinstall the Meter-Master program on a stand-alone computer.

TO INSTALL SOFTWARE

1. Insert the CD into your computer's CD ROM drive.

If the install program does not start automatically, select RUN from the Windows 95/98/NT Start menu ("File" menu in Windows 3.1) and type "E:\setup" (without quotes) in the Open text box. (Replace "E" with the drive letter of your CD ROM.) If you require floppy disks, please contact the factory.

2. Click OK Or Next To Continue. Follow The Onscreen Commands.

When finished, the setup program will create Meter-Master icons and prompt you to reboot your computer.

3. Open The Meter-Master Program.

Select the Meter-Master program group and then select the Model 100 Program.

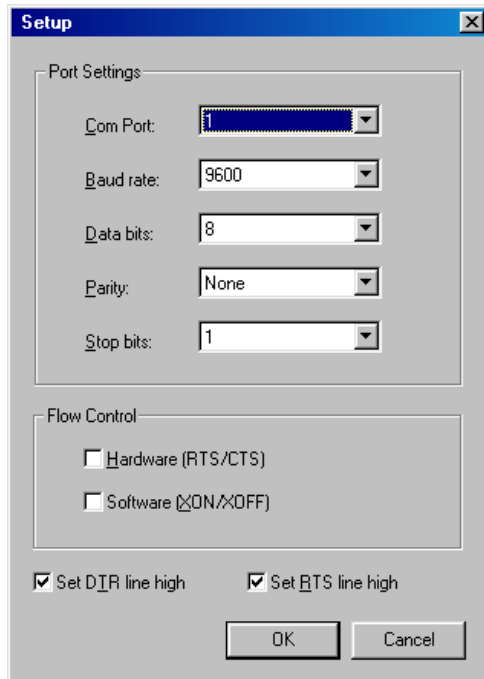
4. Review Communication Port Settings.

After loading the software, you must tell the Meter-Master program which serial port you will be using to attach the Meter-Master RS232 cable. The default is COM 1.

5. Confirm Communication With The MM100EL.

Connect the unit to your computer's serial port with the RS-232 cable provided. Click on "Update Screen" on the Main Screen of the Model 100 Program. "Flow Recorder is connected" should appear on the screen just above "Update Screen".

A rectangular button with a light gray background and a thin border. The text "Update Screen" is written in a red, sans-serif font.



The Port Settings may be changed at any time by clicking the “Setup” menu bar option at the top of the Main Screen and choosing “Port” (the Meter-Master does not have to be connected). The default baud rate is 9600.

The default Port settings are: Com Port: 1; Baud Rate: 9600; Data Bits: 8; Parity: None; Stop Bits: 1; RTS/CTS: Off; XON/XOFF: Off; DTR: High; RTS: High.

If you are unable to complete any of these steps, see Chapter 5, “Troubleshooting”.

1.4 MM100EL Specifications

- **Size:** 8.6" x 5.4" x 2.1" (225 mm x 139 mm x 54 mm).
- **Weight (including internal batteries; excluding cables):** 3.75 lbs. (1.7 kg).
- **Case With Integral Handle:** Submersible, ABS/polycarbonate blend. Handle may be used to chain unit for security.
- **Stainless Steel Threaded Connectors.**
- **Recording On/Off Via Rocker Switch.**
- **Test Of Sensor Location Initiated By Pressing Rocker Switch ON.** Because rocker switch automatically returns to middle position when turned on, a new sensor test may be initiated at any time.
- **Strap-On Magnetic Sensor:** fastens to outside of meter with velcro straps provided.
- **Computer, Minimum Requirements:** receptacle for RS232 cable (9 pin or adapter); Windows: 3.1, 3.11, 95, 98, NT, 2000, ME, XP; Pentium processor; 16MB RAM; 100MB free hard disk space. (Program files use 12MB of hard disk space; swap space plus real memory should be at least 30MB.) Any infrared connection (Palm Pilot, MS Access Sync) must be disabled when using Meter-Master software.
- **Variable Data Storage Interval.** 4 interval settings: 5, 10, 30, and 60 seconds.
- **Data Storage Capacity:** 256K bytes. Length of time before memory is filled varies with size of Data Storage Interval: a 5 second interval = 7.5 days ; 10 sec. = 15 days; 30 sec. = 45 days; 60 sec. = 90 days. Recording stops when memory is used up; unit will not overwrite.
- **Power Requirements (approx.):** 1.8 milliamps.
- **Low Battery Power-Down:** automatically stops recording and powers down when battery is low to preserve recorded data and avoid battery damage. Power-down is indicated by either no light at all or a 6 second alternating long-short flash on the Meter-Master rocker switch LED when the switch is toggled ON from the OFF position.
- **Internal Power:** 2 rechargeable lead-acid, 2 volt, 5 ampour batteries. Internal battery life (approx.): 3+ months on each charge. Relief valve allows battery gases to escape when overcharging occurs.
- **External Battery Operation through Battery Charger Receptacle:** an external battery may be used to increase the continuous operating time. (A 6 volt, 33 ampour battery is available as an accessory.)
- **AC Operation via Battery Charger.**
- **Overnight (14 hours) Battery Charging.**
- **Capacity to Make 20 Records:** recording can be started/stopped 20 times before downloading. Brief records (shorter than one data storage interval) are ignored.
- **Downloaded Data Accuracy Verification:** software compares the register volume (difference between beginning and ending meter readings) to the volume registered

by the Meter-Master (total pulse count multiplied by actual meter pulse factor in database as supplied to F. S. Brainard & Company by the meter manufacturers).

- **Recording Accuracy Verification in the Field:** flashing LED signal light integral to “on” side of rocker switch verifies accurate sensor location based on preset meter specifications. (Initialized settings for the meter affect only the sensor test; they are not used for the recording of data or generation of reports.)
- **Auto Shut-Off of LED:** sensor test ends after 30 flashes. Test can be reinitiated without affecting recording status by pressing the ON side of the switch again.
- **“Realtime Display” Option:** provision to view 3-D graphic display of current flow through meter (cumulative volume and rate updated each second).
- **AccuRate Software:** A unique software feature which removes false data oscillations caused by slow pulse rates during periods of steady flow.
- **Units of Measure Supported:** Gallons, Cubic Feet, Cubic Metres, Litres, and Imperial Gallons.
- **Meters Supported:** see following table for magnetic-drive meters with program support. User may easily add meters to the database. An adapter is available for recording from non-magnetic "Gear-Driven" meters.

Meter Models with Program Support	
The Meter-Master software comes with the following meters in its database. Any new meter may be added to the database by using the “Add/Delete Meter” option under “Settings” on the Main Screen’s menu bar.	
Sensus (Rockwell)	SR, SR II, Turbo, SRH, SRM
Schlumberger (Neptune)	Trident 8 (& Triseal), Trident 10, Trident Turbine, HP Turbine, TRU/FLO, Protectus III, HP Protectus III
Badger	Easy-Read, Recordall PD, Recordall Turbo, Recordall Compound, Turbo I, TSM (turbo III), Easy-Read Turbine, Easy-Read Compound
Hersey	400 Series, MHD, MMD II, MVR, MHR, MFM, MFM II, MCT, MCT II
ABB (Kent)	C-700, T-3000
Precision	PMM
Water Specialties	ML-03, TM
Master Meter	Multi-jet, Turbine

Chapter Two

COLLECTING DATA

The Meter-Master Quick Reference provides a summary of the information in this section.

2.1 Making A Recording

IN THE OFFICE BEFORE A TEST

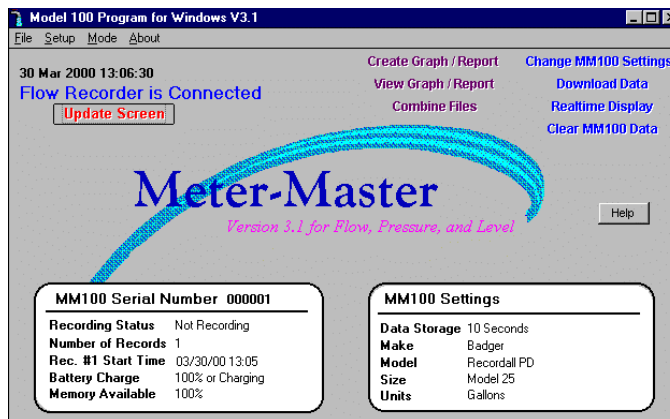
1. Verify That The Meter-Master Rocker Switch Is In The OFF Position.

The rocker switch on the Meter-Master toggles the recording on/off and initiates a sensor test; it does not turn the power on/off. The Meter-Master's power is always on, unless it has powered down due to low battery charge because the charger was not connected for 3 months.

2. Confirm Battery Charge And Memory Available.

Connect the MM100 to the computer and enter the Model 100 Program. Click on "Update Screen" to refresh the information on the Main Screen and confirm connection to the MM100. If "Meter-Master is not connected" appears on the Main Screen, see Section 5, "Troubleshooting". The screen displays the remaining battery charge and remaining data storage capacity of the connected Model 100EL.

Update Screen



Batteries last approximately 3 months with a full charge. Whenever possible, connect the charger to the Meter-Master so that the batteries remain as fully charged as possible.

The number of days of recording time permitted by the available memory depends on the Data Storage Interval (see box later in this section, “About The Data Storage Interval”).

When First Turning On The Instrument During Or After Recharging From A Power-Down State: Make sure to depress the ON side of the rocker switch completely and then turn off again. There is a 3 minute delay while the electronics settle before recording begins. If you press the rocker switch ON during that time, the signal light will not give the 3 second flash that marks the beginning of the recording session. Instead, you will see a series of either short flashes (indicating recording delay) or long-short flashes (indicating power-down) or no flash at all (indicating recording delay for earlier Meter-Master models). The 3 minute delay only occurs if the unit has powered-down due to a low battery charge. In normal use, this should not occur. **NOTE: the unit will not download or record unless the rocker switch is first depressed ON completely and then turned OFF again.**

To Access The Model 100 Program:

1. Connect the Model 100EL to your computer and enter the Model 100 Program.
2. Enter the Model 100 Program by selecting the Meter-Master program group and then selecting the Model 100 Program.
3. Check to ensure that “Flow Recorder is connected” appears at upper left of the Main Screen. If the screen indicates that the Meter-Master is not connected, see on-screen “Help” (click on “Help” button) or see Section 5.3 in the Troubleshooting chapter.



To Clear Meter-Master Memory Of Prior Records:

- Click on “Clear MM100 Data”.



To Recharge The Meter-Master Batteries:

1. Connect the battery charger. (Whenever the Model 100EL is not in the field, it should remain connected to the charger continuously.)
2. Recharge overnight. If the Meter-Master has powered down due to low battery, recharge for at least 14 hours. Power-down is indicated by a 6 second alternating long-short flash on the Meter-Master rocker switch LED when the switch is toggled ON from the OFF position.

3. If Desired, Change Meter Type And Data Storage Interval.



The meter settings (make, model, size, and unit of measure) displayed on the screen are used for testing the sensor’s location on the meter in the field; they should match the meter you will be recording from. However, the recording itself is not affected by the meter settings. Even if the settings do not match the meter in the field, the data will still be accurate. In other words, it is not necessary to change the meter settings before making a recording. If desired, you can simply take the Model 100EL off the shelf, attach it to a meter in the field, and turn it on. The correct meter type can be entered during the download routine. Moreover, a sensor test will usually

indicate whether or not the sensor is positioned properly even if the settings are different from the current meter (see box later in this section, “About Multiple Tests”). Any meter “model” followed by “(with Sensus adapter)” refers to the Sensus Compound Adapter, which can also be used to increase the pulse frequency on Schlumberger and ABB meters.



The Data Storage Interval is the only setting that directly affects the recording of data. A 10 second interval provides adequate resolution in most cases and 15 days of recording time (see box later in this section, “About The Data Storage Interval”).

Changing the Model 100EL settings also automatically sets the Meter-Master date/time to the computer date/time.

New meters may be added to and deleted from the Meter-Master database by selecting Add/Delete Meter under the “Setup” option at the top of the Main Screen (see Section 4.4).

Changing The MM100 Settings Erases All Data In The Meter-Master!!
Ensure that you have successfully downloaded the data from the prior test(s) before continuing.

To Change The MM100 Settings:

1. Make sure that you are at the Main Screen and that you are connected to the Meter-Master (see above).
2. Click on “Change MM100 Settings”.
3. Select the desired meter make, model, size, and unit of measure from the options presented on the pull-down menus. Click on item to display pull-down menu and see options; click on option to select.
4. Select the desired Data Storage Interval from the options listed in the pull-down menu (see box later in this section, “About The Data Storage Interval”).
5. Click on "OK" button to save the new settings. Click on "Cancel" button to keep the prior settings. Warning: clicking on "OK" will erase all data in the Meter-Master!

ABOUT THE DATA STORAGE INTERVAL (5, 10, 30, 60 seconds): Determines the resolution of the Meter-Master data file (*.MDB) from which all subsequent graphs and reports are created. This is the resolution of the original data recorded by the Meter-Master in the field: the shorter the interval, the greater the detail possible in subsequent graphs and reports. For example, a data storage interval of 10 seconds allows accurate data analysis for periods of 10 seconds or longer. The Data Storage Interval is chosen before the Meter-Master goes into the field and represents the time interval over which the Meter-Master counts magnetic pulses before that interval's pulse count is logged into memory.

This interval effects the size of the data file and the length of time you can record before running out of memory. The same test recorded with a 5 second interval will take up six times more memory in the Meter-Master than one stored with a 30 second interval. The recording times for the 4 intervals are: 5 sec. interval = 7.5 days; 10 sec. = 15 days; 30 sec. = 45 days; 60 sec. = 90 days.

Choosing the Data Storage Interval: A 10 second interval provides adequate detail for most applications and 15 days of recording time. Should you find you want more detail, shorten the interval; if you want to record for longer than 15 days or do not need 10 second resolution, lengthen the interval. A 10 second interval is required for the Trace Wizard software accessory and recommended for the MeterSizer software accessory.

ABOUT MULTIPLE TESTS: Although it is usually desirable to initialize the Meter-Master before each test, it is not necessary because the Model 100EL can hold up to 20 individual records. (Brief records of less than one Data Storage Interval in length are ignored.) As long as there is still room in the Meter-Master memory for the additional data you wish to collect, you may end a Meter-Master recording and move the Meter-Master to a new location, attach the sensor, and then start a new test. Even if the meter type is different from the current meter setting, the sensor test will usually show you if the sensor is properly positioned by providing flashes at consistently spaced intervals. However, consistently spaced flashes will not be easily recognized if either the meter setting or the current meter is one with an asterisk in Appendix A and the other is not. Consult Section 2.3, "Pointers for positioning the Meter-Master sensor", and Appendix A for additional information about testing the sensor location.

TO BEGIN A TEST

1. Attach The Sensor Cable To The Meter-Master.

The sensor receptacle is the middle one. Two keyways align the cable connector with the receptacle. Align the keyways before threading the cable into place. Never push or press a connector into a receptacle.

2. Secure The Sensor To The Meter.

Attach the Meter-Master sensor to the meter with the velcro strap(s) provided (heavy duty tape may also be used). Two different lengths of velcro are supplied; they may be secured together to create one long piece if necessary. Be sure that you are using the correct side of the velcro strap(s) and that you have tightened the strap(s) as much as possible in order to prevent sensor movement. The velcro will loosen slightly over time.

The sensor is typically placed on a side of the meter register that is not over the pipe; however, the best location varies, especially for large meters. When placed on the side of the register, the sensor cable should extend either straight down or up. For

more detailed information on positioning the Meter-Master sensor, see Section 2.3, “Pointers for Positing the Meter-Master Sensor”, and Appendix A.

3. Turn Meter-Master Recording On.

Press and release the side of the rocker switch with the light (LED). The switch will automatically return to its middle position. The LED will light for approximately 3 seconds indicating that the recording session has begun.

If the unit was just recharged after a power-down state, recording will start 3 minutes after being turned on in order to allow time for the electronics to settle. When turning the instrument on after it has powered-down, make sure to depress the ON side of the rocker switch completely and then OFF again. In normal operation, it is not necessary to push the switch beyond the middle position when starting a recording.

If desired, or if more convenient, you may toggle the Meter-Master recording on/off by clicking on the “Mode” tool bar option on the Main Screen. In order to toggle the recording on/off through the software, the MM100EL switch must be in the center position.

Low Battery Signal: *If the signal light displays alternating long-short flashes for six seconds, the batteries are low and the instrument has powered-down. Recording is not possible without first recharging the batteries and then depressing the ON side of the rocker switch completely and then turning the instrument OFF again.*

4. Verify Sensor Position.

After the 3-second signal at the beginning of the recording session, the signal light will flash 30 times in synchronization with the meter’s dial movement. When the Meter-Master is initialized for any positive displacement, multi-jet, and some turbine meters, each flash represents 1/20 of a dial revolution (e.g., with a 100 gallon dial, the signal light flashes every 5 gallons). When initialized for a turbine meter preceded by an asterisk in Appendix A, each flash represents one pulse. Appendix A shows the volume equivalent of a pulse for these slow pulsing turbine meters in U.S. gallons.

Moving the Sensor

If the sensor signal does not flash regularly or in proportion to the flow rate, try the sensor in other locations. For more information, see Section 2.3, “Pointers for Positioning the Meter-Master Sensor”, and Section 5.2, “Field Operation”.

***New Sensor Test:** You may start a new sensor test at any time without interrupting the current recording by pushing the ON (LED) side of the switch again. Whenever you change the sensor location, wait 10 seconds to allow electronics to settle before initiating a sensor test.*

5. Fill Out The Test Data Sheet.

Note the beginning meter reading and the date/time. If the meter type is different from the current MM100 setting, also note the meter type. Ensure that all meter readings include at least all digits to the decimal place, including the exact position of the sweep hand on the dial face. Do not ignore the digits which would normally be ignored for billing purposes. Keep in mind that zeros painted on a dial face represent additional digits before the decimal place. As a rule, be sure to record a number for each revolving dial and painted-on zero. An accurate meter reading allows you to validate data accuracy during the downloading routine. Appendix B is a sample test data sheet.

TO END A TEST

1. If Desired, Confirm Recording Accuracy.

Before ending the recording session, you may test the sensor to verify that the Meter-Master is still recording accurately by pushing the ON (LED) side of the switch again (see above, “Verify Sensor Position”).

2. Turn Meter-Master Recording Off.

Push rocker switch to OFF position.

3. Fill Out Test Data Sheet.

Note the ending meter reading and the date/time.

4. Remove All Equipment From The Meter Site.

2.2 Downloading Data And Adding Customer Information

The Downloading Data routine transfers Meter-Master data to your computer and enables you to add customer information to the data file. The Meter-Master holds up to 20 records at a time; you may download them in any order and multiple times. The dialog box indicates whether or not each record in the MM100 has been downloaded. The customer information and unit of measure may be edited later when creating a graph or report.

TO DOWNLOAD DATA AND ADD CUSTOMER INFORMATION

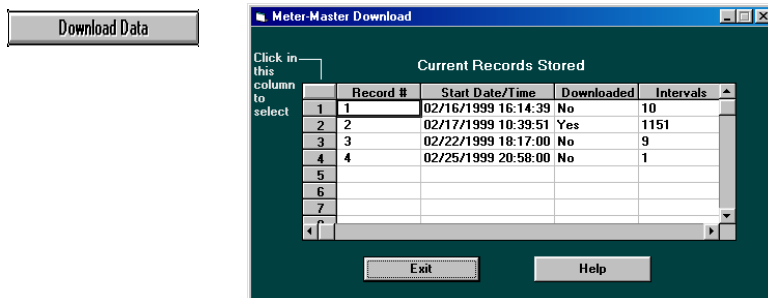
1. Connect The Meter-Master To Computer And, If Possible, To Battery Charger; Enter The Model 100 Program.

Click on “Update Screen” to confirm connection to the Meter-Master. “Flow Recorder is connected” should appear on the Main Screen. If not, refer to Chapter 5, “Troubleshooting”. The Meter-Master should not be recording (rocker switch should be in the OFF position).

Whenever the instrument is in the office, it is good practice to leave it connected to the battery charger. Batteries last longer if they are charged often and stored attached to the charger.

2. On The Main Screen, Click On “Download Data” Button.

Clicking on Download Data brings up the Meter-Master Download Screen.



3. Verify Dates/Times.

If any record start date/time is not correct, double click on each incorrect date/time and edit. Make sure you maintain the exact same format. You may also permanently fix the start date/time when you create a graph or report (see Section 3.4, “Data Grid And Customer Information Screen”).

4. Select Record To Download.

Click on column to left of record desired. If some records were created inadvertently (e.g., due to problems with sensor location), you can identify the record you want by the large number of intervals. A short test will have only a few intervals.

5. Enter File Name.

File names have a maximum of 8 characters; an “.mdb” extension will automatically be added if you do not include one. Do not use an existing file name. You can download to any directory desired. Click on “OK” when done. (Click on “Exit” if you do not want to continue with the download procedure.) After entering the filename, the data will take a few moments to download.

6. Add Customer Information.

After the record is downloaded into your computer, the Customer Information Screen appears. Use the Tab key or mouse to select items, then enter information. The Customer Information Screen may also be edited later through the Create Graph/Report procedure (Section 3.1).

- **Location / Meter ID:** You must enter a location or meter ID; the program uses this number to identify the file later. Typically, this is either the meter serial number or the customer account number.
- **Meter Settings:** Change the meter type and unit of measure only if not correct for the current record. If you want graphs and reports to have a different unit of measure than that of the meter, change the unit of measure later when you create the graph or report. (See Section 3.4, “Data Grid And Customer Information Screen”.)
- **Beginning/Ending Meter Readings:** Enter the beginning and ending meter readings. The register volume is based on these numbers. Verify data accuracy by comparing the register volume to the Meter-Master volume. The two numbers should be close. If they are not close, decide whether the difference is reasonable or the data is not accurate. Use the Data Conversion Factor (see below) to adjust for reasonable differences. Before concluding that

the data is not accurate, carefully review the meter type and the beginning and ending meter readings to make sure that they are correct. If you are not certain that the meter readings are correct, compare the Meter-Master volume on a pro-rated basis to the most recent billed volume for the customer. If the Meter-Master volume appears reasonable on this basis, it is safe to assume that one or both of the meter readings are not correct and that the Meter-Master volume is correct. In this case, leave the Data Conversion Factor set to “None”. (See also Chapter 5, “Troubleshooting”.)

- **Data Conversion Factor:** The Data Conversion Factor allows you to automatically apply a multiplier to all of the Meter-Master data when creating a graph, or report. It also allows you to apply a multiplier when using the raw data with MeterSizer, Trace Wizard, or any other software accessory. The raw data file (*.mdb) will always provide flow rates based on the current settings on this screen.

Data Conversion Factor	1.000
<input checked="" type="radio"/> None	<input type="radio"/> Automatic
<input type="radio"/> Manual	
Register Volume	1295.000
Meter-Master Volume	1291.060

Once you are assured that the Meter-Master has stored accurate data, use the conversion factor to account for reasonable differences between the Meter-Master volume and the register volume (see box below, “About The Data Conversion Factor”).

- **None:** Leaves Meter-Master data as is (Data Conversion Factor = 1).
- **Automatic:** Adjusts Meter-Master volume to equal register volume.
- **Manual:** Allows you to specify any multiplier desired.

7. Click On "OK" Button When Finished.

8. Repeat Steps 4-7.

Repeat the above routine until all desired records are downloaded, then exit.

9. If Desired, Initialize For Next Test.

Once downloading has been completed, you may prepare for the next recording. If you wish to change the meter settings or data storage interval, click on “Change MM100 Settings” on the Main Screen to clear current stored records and to initialize for a new meter type (see Section 2.1, “Making A Recording”). If the meter settings and data storage interval are to remain the same, clicking on “Clear MM100 Data” will clear the current Meter-Master records. If desired, you can store more data without clearing records as long as there is adequate memory available.

Change MM100 Settings

Clear MM100 Data

ABOUT THE DATA CONVERSION FACTOR. Generally, the Data Conversion Factor is used to account for change gears used for calibration purposes in some large meters (e.g., Neptune Trident turbines and Hersey turbines) and in instances in which a 2-pole signal is experienced on a meter with a 4-pole magnet. In both cases, the MM100 data must have a multiplier applied in order to account for explicable differences between the MM100 and register volumes. The "Automatic" Data Conversion Factor may also be used to ensure that data provided to a customer exactly matches the volume registered by the meter during the same period. Use the "Manual" option when: (1) converting the data to a unit of measure not included in the program, or (2) adjusting the data to account for meter inaccuracy discovered during meter testing. If you have previously set the Data Conversion Factor to "Automatic" and then change the unit of measure, the software will automatically change to the "Manual" Data Conversion Factor and maintain the same Data Conversion Factor (multiplier). This convenient feature allows you to view graphs and reports in a different unit of measure than the meter, yet with the same conversion factor deemed desirable for the original unit of measure.

2.3 Pointers For Positioning The Meter-Master Sensor

BEFORE YOU BEGIN

The METER-MASTER digitizes the magnetic flux change generated by the rotation of the magnets which couple the register of a water meter to its base. An adapter for gear-driven meters is available as an accessory.

Know your meters

Attaching the Meter-Master sensor is straightforward for most meters, especially positive displacement meters. However, it is strongly recommended that, before taking the Meter-Master out into the field, you bench-test the Meter-Master on samples of the meter makes, models, and sizes from which you plan to gather data. Appendix A describes the suggested sensor locations for almost all meters used in the U.S. and Canada. Use your meter test-bench to experiment with different sensor locations. The "sweet spot" on some meters is larger than on others. By experimenting on your meter test-bench, you may avoid searching for an alternative sensor location under less favorable conditions in the field. You may also use this initial experimentation period to familiarize yourself with the Meter-Master operation.

Testing the sensor by itself

Even without water flowing, you can create magnetic pulses by flipping the sensor over and back again continuously with your hand, which causes the Meter-Master to sense the earth's magnetic field.

Special adapters

Sensus SRH and SRM turbine meters require the Sensus Compound Adapter available as an accessory. This adapter may also be used with ABB/Kent (U.S. models) and Schlumberger turbine meters to increase the resolution of the recorded data from these meters by a factor of 12, which is important when defining maximum and minimum flow rates. These meters pulse relatively slowly, and each pulse represents a substantial amount of water. The adapter enables more accurate data to be generated.

In Appendix A, some Hersey turbine meters have been noted as requiring a modified gear train in order to attain compatibility with the Meter-Master. These adapters are available as accessories.

Using the
Meter-Master
with a
notebook
computer

Checking The Sensor Location With A Notebook Computer. If you have a notebook computer, you may also test the sensor location by attaching the Meter-Master to your computer in the field and choosing the "Realtime Display" option at the Main Screen. Select a method for calculating the rate from the two options shown. The 10 second option causes each second's rate calculation to be based on the number of pulses sensed in the preceding 10 seconds; the 60 second option uses a sliding 60 second interval to calculate the rate each second. Use the 60 second option for any meter with an asterisk in Appendix A. The screen displays both the current rate and the cumulative volume since the beginning of the current record making it possible to do quick, in-field accuracy checks while the Meter-Master is recording. If not recording, the cumulative volume display starts at zero each time you enter the Realtime Display.

TO POSITION THE SENSOR

Appendix A describes the location of the sensor for almost all meters used in the U.S./Canada and can be used as a guide for other meters with similar construction (meters with "similar construction" have their drive magnets in similar locations). Refer to the pictorial representations of the suggested sensor locations located at the end of Appendix A.

In general, the four most important points in positioning the sensor are:

Sensor
attachment

1. Position Sensor At Meter's Sweet Spot.

- **Positive Displacement Meters:** Unless instructed otherwise in Appendix A, place the sensor on a side of the meter register that is not over the pipe. The sensor cable should extend either straight up or down.
- **Turbine Meters:** Locate the sensor as instructed in Appendix A. If the current meter is not included in Appendix A, check the sensor location diagrams in this manual for a meter of similar construction and try the indicated location first. If that location proves unsatisfactory, try other locations. Move the sensor to the other side of the meter, place the sensor flat on top of the register, etc. When you move the sensor, remember to wait ten seconds to allow the electronics to settle before initiating a sensor test.
- **Shielded Registers:** If no signal is detected when the sensor is placed on the side of the register because of shielding on the side of the register, place the sensor flat on top of the register. Note that when the sensor is placed flat on top of the register, a 4-pole magnet will typically generate a 2-pole signal (half as many pulses), and the Meter-Master volume will be 50% of the expected volume. The Data Conversion Factor can correct this.
- **Drive Magnets Integral To Turbine Rotor:** If the meter's drive magnet is integral to the turbine rotor (e.g., Sensus Turbo), place the sensor on the side of the meter body with the cable extending in a *horizontal* direction. (See sensor location diagrams at the end of Appendix A.)
- **Compound Meters With Two Registers:** Position the sensors on the sides of both registers such that the sensors are physically located as far away from the other register as possible. If the registers are close to each other, a spacer (wood, plastic, etc.) between the sensor and the register on the turbine side can prevent

the sensor on the turbine side from picking up the PD register when only the PD side is moving.

- **Insulated Meters:** Because it is not necessary for the Meter-Master sensor to make direct contact with the meter housing, it may not be necessary to remove insulation when it covers a meter. Test the sensor pick-up from the outside of the insulation before removing any meter insulation.

2. Do Not Cock Sensor Or Sensor Cable.

The sensor itself should be positioned flat against the meter casing or register with the velcro on the outside, away from the meter. It is not necessary for the sensor to touch the meter. If the sensor is on the side of the register, position the sensor such that the sensor cable extends straight up or straight down toward the ground. If the sensor is on the side of the meter body (Sensus Turbos, Hersey MHR 2"-3", Badger Turbo I's, and Badger Recordall Compounds—turbine side), position the sensor such that the cable extends in a horizontal direction.

3. Secure The Sensor As Tightly As Possible.

Velcro straps come with the Meter-Master. The straps will stretch slightly over time, so test each attachment to ensure that the sensor will resist any effort to move it. The velcro is best secured by starting one end of the velcro strap on the sensor's velcro tab. Then, while holding the sensor in place with one hand, use the other hand to wrap the velcro around the register or meter body and to firmly secure the other end of the strap over the back of the sensor. The velcro is provided in 2 lengths which may be attached together to create one extended length. Note that only one side of the velcro straps secures properly to the velcro tab on the sensor. If desired, heavy duty tape can also be used to keep the sensor in place.

4. Wait For The Electronics To Settle Before Initiating A Sensor Test.

If you have just moved the sensor, wait 10 seconds to allow the electronics to settle. Then push the rocker switch ON to initiate a new test.

Try sensor in
other
locations

Normally, the Meter-Master quickly picks up an accurate signal, and there is no need to move the sensor. However, if the sensor signal does not flash appropriately in unison with the register's dial movement, try the sensor in other locations. A new sensor test may be started at any time without interrupting the current recording by pushing the ON (LED) side of the switch again. Whenever you change the sensor location, *wait 10 seconds to allow the electronics to settle before initiating a sensor test*. If the LED still does not flash as expected, consult Chapter 5, "Troubleshooting".

Once you have identified a good sensor location, turn the rocker switch OFF and then ON again so that the record will have only the data you want. When downloading, you can ignore records with only a few intervals.

UNDERSTANDING THE LED SIGNAL

After the rocker switch is pressed ON, the LED will flash 30 times in synchronization with the movement of the sweep hand on the meter's dial face. When the Meter-Master is initialized for either a positive displacement meter, a multi-jet meter, or one of the

turbine meters that is not marked with an asterisk in Appendix A, the LED will flash every 1/20 of a dial revolution. For example, with a 100 gallon dial, the signal light will flash every 5 gallons. Large meters marked with an asterisk in Appendix A have slow pulse rates (slow moving magnets). When the unit is initialized for one of these meters, each flash represents one pulse. U.S. gallon equivalents for each pulse generated by these larger meters are given in Appendix A, along with conversion factors for other units of measure.

**Sensor test
for non-
initialized
meters**

You may perform a sensor test for a meter other than the one for which the Meter-Master is initialized. (The meter initialization pertains only to the sensor test, not the recorded data.) Generally, if the LED flash rate is proportional to the flow rate, the Meter-Master is recording accurately. Positive displacement meters should always provide a strong, high frequency output signal as long as there is water flowing and the equipment is working properly. Large meters vary greatly in strength of signal and pulse frequency. Do not anticipate a particular flash rate for a given size meter based on experience with other meter makes of the same size. Internal magnet and gearing configurations vary from one meter manufacturer to the next, and some magnets spin much faster than others. Accordingly, the same size meters from different manufacturers rarely generate similar numbers of magnetic pulses per unit of liquid measure. Moreover, some meters have 4-pole magnets, and others have 2-pole magnets.

If you initiate a sensor test and the sensor cable is not attached to the Meter-Master, the sensor LED may flash randomly.

ELECTROMAGNETIC INTERFERENCE (EMI)

Place the sensor farthest from any nearby equipment which may generate electromagnetic interference (EMI). Typical examples are motors, burglar alarms, and generators. Because the Meter-Master is designed to pick up the magnetic signal generated by a water meter, you may encounter a circumstance in which the location of the meter is so close to other electromagnetic noise sources that the LED flashes extremely quickly or stays solid for a brief period when no flow is occurring. Unless you can deactivate or shield the source of EMI, an accurate record may not be possible. The sensor circuit has been designed to minimize the potential for external interference. If desired, a low-sensitivity sensor circuit modification can be made at no charge to reduce the potential for EMI.

Chapter Three

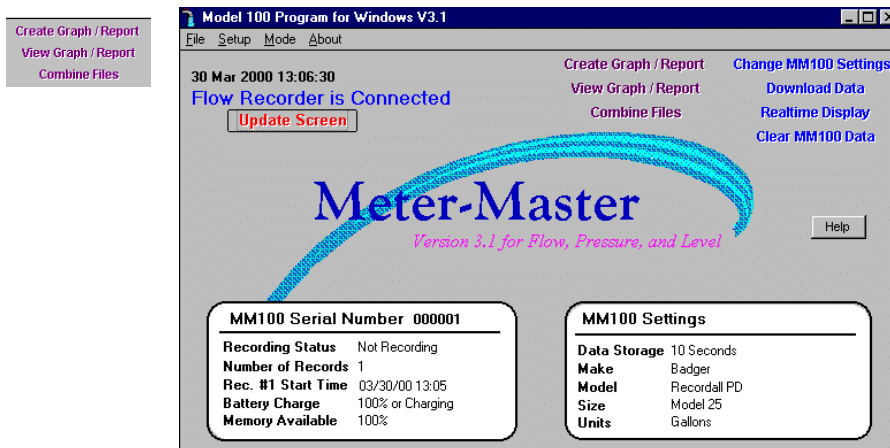
GRAPHS AND REPORTS

3.1 Overview: Creating, Printing, Saving, Exporting, Viewing

Create Graph/Report: Generates, prints, saves, and exports graphs and reports from a data file in a variety of styles.

View Graph/Report: Displays graphs and reports that you have previously created and saved or exported.

Combine Files : Makes a new Meter-Master data file by adding together the data of two existing files over the span of time that the files overlap (see Section 4.2).



For customizing graphs and for customizing and exporting reports to other applications, see the sections following this one.

TO CREATE A GRAPH OR REPORT

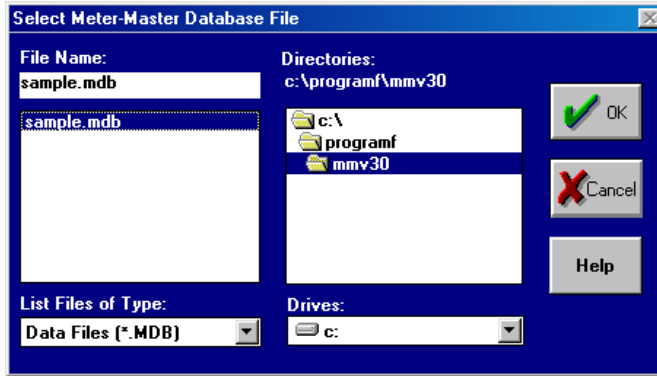
1. Enter The Create Graph/Report Procedure by clicking on the Create Graph/Report button on the Main Screen.

The Select File Dialog Box appears.



2. Select The Desired Data File (*.MDB).

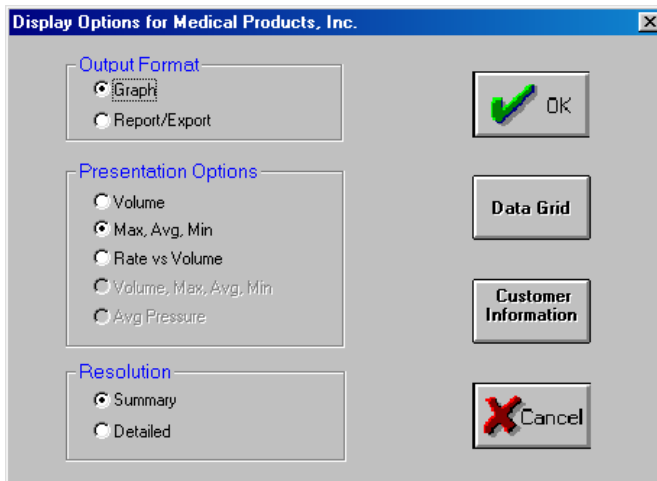
In the Select File Dialog Box, choose a data file; Meter-Master data files have a *.mdb extension. You may select a file in any drive or directory.



Once you have selected a downloaded file, click on “OK”. The Display Options Dialog Box appears unless the data file selected was downloaded with a previous version of the Model 100 Program, in which case, you will be given the opportunity to create a new file which has been converted to the version 3.0+ format.

3. Select Display Options.

The Display Options Dialog Box controls general features of the data display.



- **Choose An Output Format.** In the Display Options Dialog Box, click on:
 - **Graph** to create a graph.
 - **Report/Export** to create a report and to export data to a third party program such as MS Word or Excel.
- **Choose Among Presentation Options.** Click on:
 - **Volume** for graphs showing volume data.
 - **Max, Avg, Min** for graphs showing maximum, average, and minimum rates of flow.

- **Rate vs Volume** to display both the percentage and the volume of flow in various flow rate ranges. User enters ranges on the following screen.
- **Volume, Max, Avg, Min** for a comprehensive report with this data.
- **Choose Resolution (certain graphs only).** Click on:
 - **Summary** to display all data in a condensed format. Graph shows all of test on one screen.
 - **Detailed** to display all data in an expanded format. Graph shows entire test on multiple screens with a scroll bar.

4. If Desired, Change Data Start Time, Report Start Time, Grid Interval, Or Max-Min Interval, Or Edit The Customer Information Screen.



Start Time, End Time, Grid Interval, and Max-Min Interval for graphs and reports are edited on the **Data Grid Screen**. Customer and meter information, including the unit of measure, is edited on the **Customer Information Screen**.

- **Changing Graph/Report Resolution:** The default graph/report shows approximately 150 data intervals unless the raw data file has less than 450 intervals, in which case, a smaller number of data intervals are used. If you wish to increase the number of intervals, click on “Data Grid” and then decrease the Grid Interval so that more data points are used.
- **Changing Unit of Measure For Graph/Report:** If you would like graphs and reports to have a different unit of measure than that of the meter, click on “Customer Information” and then on “Change MM100 Settings” and change the unit of measure to the one desired.

Important

If either the meter, make, model, or size is not correct, you must change the incorrect selections first, then click OK to exit the Customer Information Screen, and then reenter the screen a second time to change the unit of measure (see Section 3.4).

5. When Done, Click On “OK” On The Display Options Screen To Display Graph Or Report.

6. Working With Graphs and Reports (see following sections).

When the Graph Screen or Report Screen appears, you may scan data and customize, save, export, and print the graph or report:

To Scan Data:

- **Summary Graph:** Initial graph shows entire file. Intervals to the right side of the graph will be condensed if you have significantly decreased the Grid Interval on the Data Grid. Click once on graph and then use cursor movement keys (End/Home, Page Up/Down, Up/Down/Right/Left arrows) to change first interval displayed on graph. Graph will then show the new first interval through end of record. Double-click on any colored section of the graph, and a balloon will appear with date/time and values associated with the two (2) grid intervals closest to that point on the graph. (See also Section 3.2, “The Graph Screen”.)

- **Detailed Graph:** Initial graph shows first 12 or so intervals of record. Place cursor on bottom axis of graph (becomes an up/down arrow) and pull up approximately half way in order to expose the date/time associated with each graph interval. Use the scroll bar below x-axis or cursor movement keys (End/Home, Page Up/Down, Up/Down/Right/Left arrows) to scan the rest of the record. (See also Section 3.2.)
- **Reports:** To scan report, use scroll bar on right of window or cursor movement keys (End/Home, Page Up/Down, Up/Down/Right/Left arrows). There are also buttons for page changing on top of the window. (See also Section 3.3, “The Report Screen And Exporting”.)

To Print A Graph Or Report:



- Click on “printer” button. For landscape printing, you must select landscape in your Windows printer control.

To Save A Graph/Report To A File:



- **Graphs:** Click on “diskette” button (2nd button from left). Enter a filename (max. 8 characters); the program will automatically add a “.CHF” extension. Change drive/directory if desired.



- **Reports:** Click on “envelope” button at the top of the window. Select desired file format from options displayed. Enter filename; change drive and directory if desired.

To Export Data To Another Application (Report Routine):



- Click on “envelope” button at the top of the report window. Select desired application from options displayed, e.g., Lotus, Excel, Quattro Pro, WordPerfect, or MS Word. Enter filename, change drive and directory if desired.

TO VIEW SAVED GRAPHS AND REPORTS

1. Click On "View Graph/Report" Button On Main Screen.



After clicking on “View Graph/Report”, the Select File Dialog Box will appear.



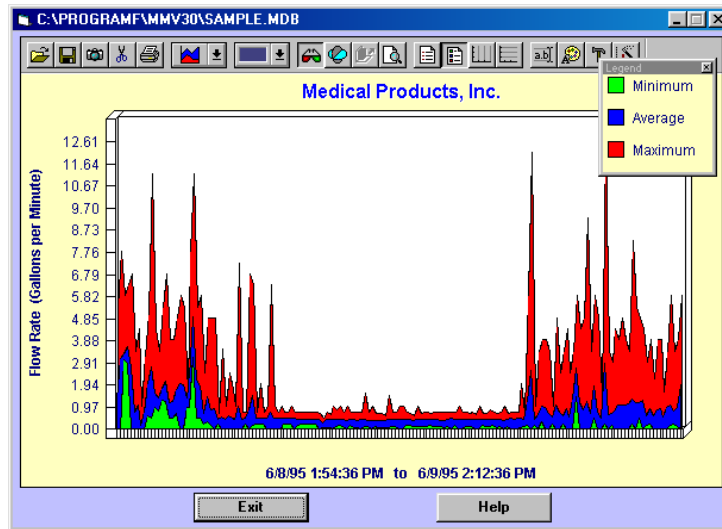
2. Select An Existing File (e.g., *.CHF, *.XLC, *.DOC).

Once a file is selected, it will open in whatever format it was saved.

- **Graph File:** Graph files (*.CHF) open within the Meter-Master graphic software described above and in the next section. You may modify the appearance of the graph, but not the display options, customer information, and data grid.
- **Report File:** A report may be opened in the appropriate application (e.g., Excel, Microsoft Word, WordPerfect) from within the Model 100 Program software, as long as the Model 100 Program directory, the report file's directory, and the third-party program directory are all on the current PATH in your AUTOEXEC.BAT file. Alternatively, you can always access files exported to other applications (third-party programs) through the applications themselves.

3.2 The Graph Screen

Graphs made with the Meter-Master software are created and viewed using the Graph Screen. When creating a graph, the Graph Screen appears whenever the “Graph” Output Format is selected on the Display Options Screen. To view a previously saved graph, select the “View Graph/Report” option on the Main Screen and then select the desired *.CHF file in the Select File Dialog Box.



The Graph Screen generates, displays, prints, and saves graphs from a data file in a variety of styles. Each plotted vertical bar represents one Grid Interval, which can be viewed/edited on the Data Grid Screen before a graph is created. You may double-click anywhere on the colored portion of a graph, and a balloon will appear with data associated with the two (2) closest intervals.

COMMON PROCEDURES

To Display A Text Description Of Each Button On Toolbar:

- Click on graph, then move mouse pointer over top of button. After a short time, a balloon will appear with button description.

To Display Legend Of Any Visible Graph Interval:

- Click on graph, then double-click the mouse button while holding mouse pointer over desired interval on graph.

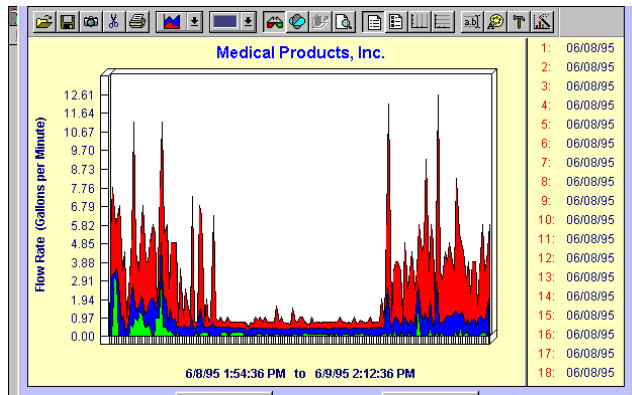
To Increase/Decrease The Size Of A Graph:

1. Move mouse pointer to any edge of graph; a double vertical or horizontal arrow will appear.

- Click and hold mouse button while dragging the edge up/down or right/left to desired position. Release button.

To Display X-Axis Legend In Its Own Box And Scan Data:

- Click on the first of the two legend buttons on the toolbar (8th button from right; on right of "magnifying glass" button). To display dates/times (volume and max, avg, min graphs), you may need to click-and-drag left border of legend to left. The legend begins with the first interval on the left side of the graph.

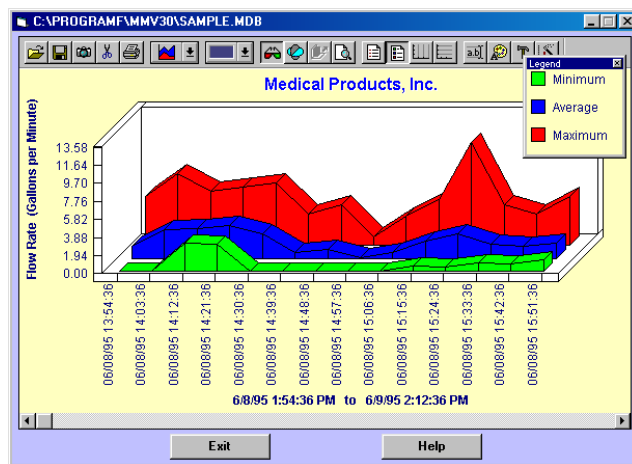


- Use cursor movement keys (End/Home, Page Up/Down, up/down/right/left arrows) to scan data. The graph will begin at another Data Interval and the legend will change accordingly. Summary graphs show data from that point onward; detailed graphs show approximately 12 Data Intervals at a time.

To Display X-Axis Date/Time Legend Along Bottom Of Detailed Graph:

(detailed volume and max, avg, min graphs only):

- Move mouse pointer to x-axis of graph; a double vertical arrow will appear.
- Click and hold mouse button while dragging base of graph halfway up screen. Release button; legend will appear along bottom.



- Reverse procedure to return graph to original size.

To Zoom A Portion Of Graph To Full Graph Size:

1. Click on magnifying glass icon (11th button from left; in middle of toolbar).
2. Move mouse pointer to corner of rectangle you wish to expand.
3. Press and hold down left mouse button as you move mouse pointer to opposing corner. Rectangle on screen highlights area to be graphed.
4. Release mouse button to show expanded graph. Double-click on any segment, and a balloon will identify data associated with that interval.
5. Click on magnifying glass button again to return to prior screen.

To Copy Graph Or Data To A Third Party Software Product:

The camera button copies the current graph to the Windows clipboard as a bitmap file; the scissors button copies the data as text to the clipboard. They can then be easily pasted into a spreadsheet or a word processor document.

1. Display the desired graph.
2. Click on either the camera button or the scissors button.
3. Minimize or close the Meter-Master software.
4. Open your spreadsheet or word processor and place the cursor where you want the graph or data.
5. In the Edit menu, choose "Paste" (or press Ctrl-V).

To Save A Graph To A File:

1. Click on diskette button (second button from left). The Export Chart Dialog Box will appear.
2. Enter a new file name in the space provided; program will automatically add ".chf" as file extension. If desired, you may choose a different drive and/or directory into which you would like the file to be saved.

To Print A Graph:

- Click on printer button (fifth button from left). The program uses your default Windows printer setup. To change from portrait to landscape orientation, you must exit the program and change your default printer setting.

TOOLBAR BUTTON DESCRIPTIONS (LEFT TO RIGHT)

Open File Button: Imports a previously saved graph for viewing.



Diskette (Save) Button: Saves and exports the current graph with a *.CHF extension to any directory.



Camera Button: Copies the current graph image to the Windows clipboard as a bitmap image so that it can be pasted into any document.



Scissors Button: Copies the current graph data to the Windows clipboard as a text file so that it can be pasted into a document.



Printer Button: Prints the current graph.



Graph Style Button: Changes the current graph style.



Color Button: Enables you to change the color of any graph segment including the background and frame. Click on color desired and then click again and drag the color (cursor will change to a paint bucket image) down to the applicable graph segment, and release button.



Glasses Button: Switches current graph between 2-D and 3-D.



Rotate Chart Button: Changes the 3-D viewing properties.



Z-Clustered Series Button: Available only for certain graph styles. Enhances 3-D perspective.



Magnifying Glass (Zoom) Button: Enables you to zoom in on a specific graph segment by clicking and dragging the mouse pointer to frame the segment desired. As with any graph displayed, once the zoomed portion is displayed, you may double-click anywhere on the graph to see the legend associated with that data point.



Legend Button: Displays the legend associated with each interval along the x-axis. You may need to click-and-drag the left border of box to the left in order to expose both date and time for Volume and Max, Avg, Min graphs.



Series Legend Button: Defines each graph color.



Vertical Grid Button: Inserts vertical grid lines in the current graph.



Horizontal Grid Button: Inserts horizontal grid lines in the current graph.



Edit Titles Button: Enables you to edit the axis labels displayed on each side of the graph.



Text Fonts Button: Enables you to change the font style, size, and color of all text associated with the graph.



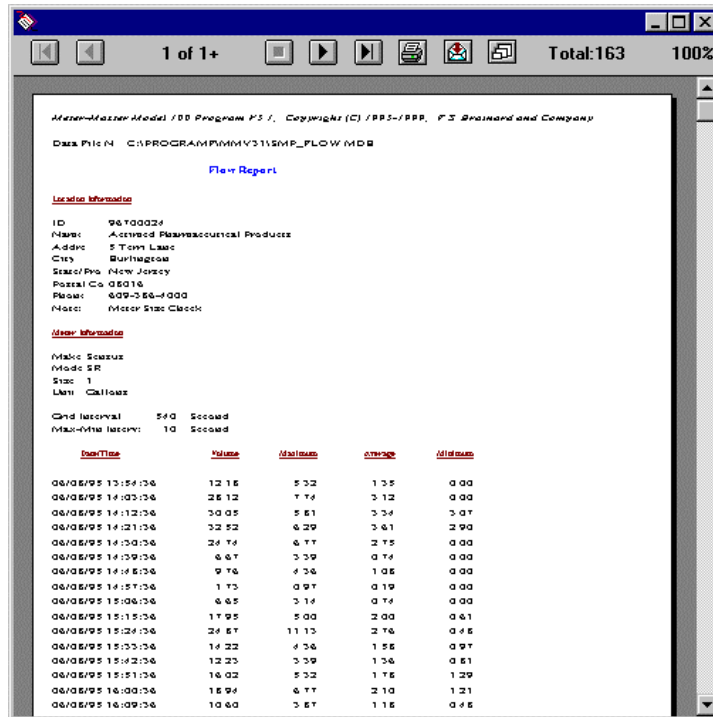
Tools Button: Enables you to control the display of legends, tool bars, etc.



Graph Options Button: Enables you to change properties of the current graph.

3.3 The Report Screen And Exporting

MM100 reports are created using the Report Screen. Additionally, exporting to other applications (e.g., Microsoft Word, Excel, Lotus, Quattro Pro, WordPerfect) is accomplished through the Report Screen.



The screenshot shows a window titled "1 of 1+" with a toolbar at the top containing navigation and export icons. The main content area displays the following information:

Master-Master Model / 100 Program P3 / Copyright (C) 1995-1999, P.S. Brinard and Company
 Data File N: C:\PROGRAM\M100\3115MP_FLOW.MDB
 File Report

Location Information

ID: 96700024
 Name: Activated Pharmaceutical Products
 Address: 5 Town Lane
 City: Burlington
 State/Prov: New Jersey
 Postal Code: 08016
 Phone: 609-356-1000
 Note: Motor Size Check

Motor Information

Motor Series:
 Motor SR:
 Size: 1
 Unit: Callouts

Grid Interval: 540 Second
 Max-Via Interval: 10 Second

GridTime	Volume	Maximum	Average	Minimum
06/06/95 13:54:36	12.16	5.32	1.35	0.00
06/06/95 14:03:36	26.12	7.74	2.12	0.00
06/06/95 14:12:36	30.05	5.61	3.34	3.07
06/06/95 14:21:36	32.22	6.29	3.61	2.90
06/06/95 14:30:36	24.74	6.77	2.75	0.00
06/06/95 14:39:36	6.67	3.39	0.74	0.00
06/06/95 14:48:36	9.76	4.36	1.06	0.00
06/06/95 14:57:36	1.73	0.97	0.19	0.00
06/06/95 15:06:36	6.65	3.14	0.74	0.00
06/06/95 15:15:36	17.95	5.00	2.00	0.61
06/06/95 15:24:36	24.67	11.13	3.76	0.46
06/06/95 15:33:36	14.22	4.36	1.56	0.97
06/06/95 15:42:36	12.23	3.39	1.36	0.61
06/06/95 15:51:36	16.02	5.32	1.76	1.29
06/06/95 16:00:36	18.94	6.77	2.10	1.21
06/06/95 16:09:36	10.60	3.67	1.16	0.46

The Volume, Max, Avg, Min report displays the customer information followed by the data, with each row of data representing one Grid Interval. Report data may be viewed/edited on the Data Grid Screen before a report is created. Reports can be customized within third-party software after they are saved in the format appropriate for that third-party software. Saving is the same as exporting in the report routine; both are accomplished by clicking on the “envelope” button at the top of the window.

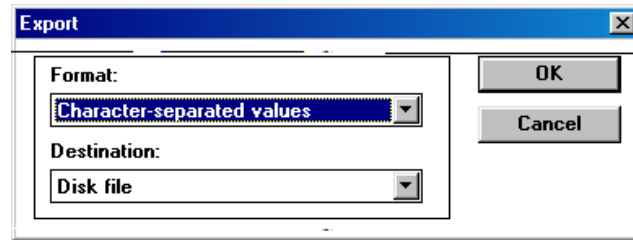
After a report has been created and saved, you may view and edit it through the View Graph/Report routine. A report will automatically open in the host application as long as the Model 100 Program directory, the report file’s directory, and the third-party program directory are all on the current PATH in your AUTOEXEC.BAT file. Alternatively, you can always access files saved/exported in third-party software formats through the third-party programs themselves.

COMMON PROCEDURES

To Save A Report To A File Or Export To Another Application:

1. Click on envelope button. The Export Dialog Box will appear.





2. Select the desired file format from the pull-down options on left. Many options are offered, including Microsoft Word, WordPerfect, Lotus, Excel, and Quattro Pro. Click on “OK” and the Choose Export File Dialog Box will appear.
3. Enter a new file name in the space provided; the program will add the appropriate file extension (e.g., “.doc” for Word) if you do not include one. Select the drive/directory into which you would like the file to be saved. Click on “OK”.

To Print A Report:



- Click on printer button at top of window. The program uses your default Windows printer setup.

TOOLBAR BUTTON DESCRIPTIONS (LEFT TO RIGHT)



Go To Beginning Button: Goes directly to beginning of report.



Page Up Button: Goes to the previous report page.



Page Down Button: Goes to the next report page.



Go To End Button: Goes directly to end of report.



Printer Button: Prints the current report.



Envelope Button: Saves/exports the current report in various formats to any directory.



Resize Button: Changes size of text in window (3 options).



Window Close Button (upper right corner of screen): Exits back to Display Options Screen.

3.4 Data Grid And Customer Information Screen

The Data Grid: Enables you to change the graph/report resolution by changing the Grid Interval and the Max-Min Interval. You may select a portion of the data for a graph or report instead of the entire data file. You may also correct the Data Start Time, select any Report Start Time desired, and edit individual data cells on the grid.

The Customer Information Screen: Allows you to edit customer information, meter information, and multiply the data values in the grid by any multiplier desired.

TO EDIT THE DATA GRID

To access the Data Grid, click on “Data Grid” on the Display Options Screen.

Data Grid

	Date/Time	Volume	Maximum	Average	Minimum
1	6/8/95 1:54:36 PM	12.177	5.323	1.353	0.000
2	6/8/95 2:03:36 PM	28.118	7.742	3.124	0.000
3	6/8/95 2:12:36 PM	30.050	5.806	3.339	3.065
4	6/8/95 2:21:36 PM	32.521	6.290	3.613	2.903
5	6/8/95 2:30:36 PM	24.736	6.774	2.748	0.000
6	6/8/95 2:39:36 PM	6.672	3.387	0.741	0.000
7	6/8/95 2:48:36 PM	9.758	4.355	1.084	0.000
8	6/8/95 2:57:36 PM	1.734	0.968	0.193	0.000
9	6/8/95 3:06:36 PM	6.653	3.145	0.739	0.000
10	6/8/95 3:15:36 PM	17.952	5.000	1.995	0.605
11	6/8/95 3:24:36 PM	24.871	11.129	2.763	0.484
12	6/8/95 3:33:36 PM	14.220	4.355	1.580	0.968
13	6/8/95 3:42:36 PM	12.231	3.387	1.359	0.806
14	6/8/95 3:51:36 PM	16.022	5.323	1.780	1.290
15	6/8/95 4:00:36 PM	18.938	6.774	2.104	1.210

- **The Grid Interval**

The Grid Interval is the time interval represented by each segment on a graph or each line of data in a report; the longer the interval, the fewer the points plotted on a graph and the shorter a report. The average rate-of-flow is a function of the Grid Interval. For example, if the Grid Interval is 900, the average for that interval is the volume divided by 15 minutes (900 seconds).

The Grid Interval can be any multiple of the Data Storage Interval (displayed above the grid). The length of the default Grid Interval for any given file is designed to plot approximately 150 Grid Intervals on a graph. (See box below, “About The Grid Interval”, for more information.)

For Large Meters Preceded By An Asterisk In Appendix A: Do not use a Grid Interval of less than 60 seconds because the pulse resolution is inadequate to provide meaningful data in short time segments. A minimum Grid Interval of 300 seconds is recommended.

To Change The Grid Interval:

1. Click in the Grid Interval box (below grid) and edit as desired. The default Grid Interval varies with the size of the data file: the larger the data file, the larger the default Grid Interval.
2. Click on the "Recalculate" button to display the new spreadsheet information.

- **The Max-Min Interval**

The Max-Min Interval is the time period used for calculating maximum and minimum rate-of-flow information. For example, if a 30 second Max-Min Interval is selected, each Grid Interval will be divided into 30 second increments, and the increments with the largest and the smallest average 30 second flow rates, respectively, will be displayed. The default Max-Min Interval is the Data Storage Interval, which should be an appropriate selection in most cases. The Max-Min Interval can be any multiple of the Data Storage Interval that is divisible into the Grid Interval. (See box below, "About The Max-Min Interval", for more information.)

To Change The Max-Min Interval:

1. Click in the Max-Min Interval box (below grid) and edit as desired. The default Max-Min Interval is the Data Storage Interval (displayed above the grid).
2. Click on the "Recalculate" button to display the new information.

Software version 3.0 introduces AccuRate, a software feature that removes false data oscillations during steady flow rates. Depending on the application, this feature should minimize the need for Max-Min Intervals larger than the Data Storage Interval.

- **Select A Portion Of Data**

To Select Data Using Scrollbar (vertical bar with arrows on right of grid):

1. Use scrollbar to locate interval where you would like graph/report to begin.
2. Select beginning of graph/report: click on interval number in column to left of date/time column.
3. Use scrollbar to move to where you would like graph/report to end, hold down Shift key, and click on ending interval number desired. Highlighted area indicates time period for graph/report.

To Select Data Using Cursor Movement Keys (Page Up, Page Down, etc.):

1. Use cursor movement keys to move cursor to where you would like graph/report to begin.

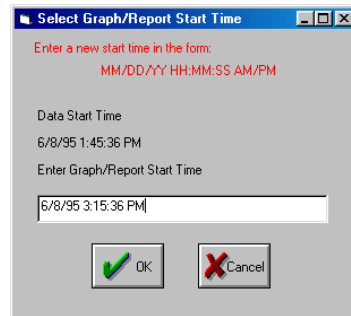
2. Select beginning of graph/report: click on interval number in column to left of date/time column.
3. Hold down Shift key as you move cursor to where you would like graph/report to end. Highlighted area indicates time period for graph/report.

To Select Data Using Mouse:

1. Use scrollbar or cursor movement keys to locate interval where you would like graph/report to begin.
2. Select beginning of graph/report: click on interval number in column to left of date/time column.
3. Hold down mouse button as you drag mouse pointer down over desired time period. Release button. Highlighted area indicates time period for graph/report.

- **Select Graph/Report Start Time**

1. Click on “Select Graph/Report Start Time” button.
2. Enter desired graph/report start time in the specified format and then click “OK”. The graph/report will ignore all data in the data file prior to this data/time.



- **Fix Data Start Time**

1. Click on “Fix Data Start Time” Button.
2. Enter correct data start time in the specified format and then click “OK”. Note that this change is permanent.

- **Editing A Data Cell**

The MM100 Graph/Report procedure allows access to individual data items for editing. Editing the data grid affects only the current session; pressing “Recalculate” or exiting the Create Graph/Report routine will return the original values.

To Edit A Data Item:

- Double-click on item in grid and enter desired value.

ABOUT THE GRID INTERVAL. The Grid Interval is the time interval represented by each plotted segment of a graph or each line of data in a report. For example, a Grid Interval of 300 seconds will provide volume data as well as maximum, average, and minimum rates-of-flow for each five minutes of the survey. The Grid Interval determines the resolution and size of a graph or report.

Choosing the Grid Interval (Default: Varies with size of data file in order to display approximately 150 intervals). The length of the Grid Interval depends on the purpose of the graph/report. Use smaller Grid Intervals for identifying leakage rates and specific water uses. Larger intervals are used for hydraulic modeling, cost of service studies, and meter sizing applications. You may find that you prefer to run short reports with long intervals first, and then run more detailed reports focusing on specific time periods. The Grid Interval must be the same as or a multiple of the Grid Storage Interval. The program accepts only seconds; accordingly, hours and minutes must be converted to seconds when entering a Grid Interval. If you change one or both intervals, click on the “Recalculate” button after the change is made to display the new spreadsheet information.

ABOUT THE MAX-MIN INTERVAL. The Max-Min Interval determines the resolution of maximum and minimum rate-of-flow information in graphs and reports. To compute a rate-of-flow, the Meter-Master software averages raw data flow rates over time periods equal to the Max-Min Interval. For example, in calculating the maximum and minimum rates-of-flow using a Max-Min Interval of 30 seconds, the Meter-Master software looks for the highest and lowest average 30 second flow rate within each Grid Interval (see above).

Choosing The Max-Min Interval (Default Is The Data Storage Interval): Because software ver. 3.0+ incorporates AccuRate software (see below), the default Max-Min Interval will consistently provide realistic values. A Max-Min Interval that is too long results in a “dampening” effect, with maximum and minimum rates-of-flow being understated. The default Max-Min Interval is recommended unless a specific application requires a different level of resolution. The Max-Min Interval must be the same as or a multiple of the Data Storage Interval. The Max-Min Interval must also be divisible into the Grid Interval.

ACCURATE FLOW DATA. Software ver. 3.0+ incorporates special software that removes the false data oscillations that occur during steady flows as a natural result of magnetic pulse logging. Without this feature, these oscillations appear as a spiking effect (sequential, exaggerated high and low flow rates during periods of steady flow) that is especially obvious during periods of low flow. The AccuRate feature smoothes these dips and spikes with the surrounding rate values whenever the pulse distribution indicates the presence of a steady flow pattern so that the recorded flow rates are much more consistent with the actual flow rates.

TO EDIT THE CUSTOMER INFORMATION SCREEN

To access the Customer Information Screen, click on the “Customer Information” button on the Display Options Screen.

The Customer Information Screen enables editing of customer information stored with a data file. Customer information is originally entered during the download procedure. See Section 2.2, “Downloading Data And Adding Customer Information”.

Use the mouse or Tab key to select items to edit.

- **Changing Unit Of Measure For Graphs/Reports:** If you want to create graphs and reports with a different unit of measure than that of the meter, click on “Customer Information” at the Display Options Screen and then on “Change MM100 Settings” and change the unit of measure to the one desired.

Important

If you wish to change the meter’s make, model, or size, you must change these values first, then click OK to exit the Customer Information Screen, and then reenter the screen a second time to change the units of measure. This procedure is necessary because some meters (i.e. ABB/Kent Turbine, Sensus Compound, Gear-Driven, and possibly user-added meters) use different gearing with different units of measure. If you change the meter make/model/size, the program assumes that the original meter data was incorrect and recalculates the rate data using the nutation factor for the new meter. If you change only the units of measure, the program recalculates the rate data using the standard conversion factors between units of measure.

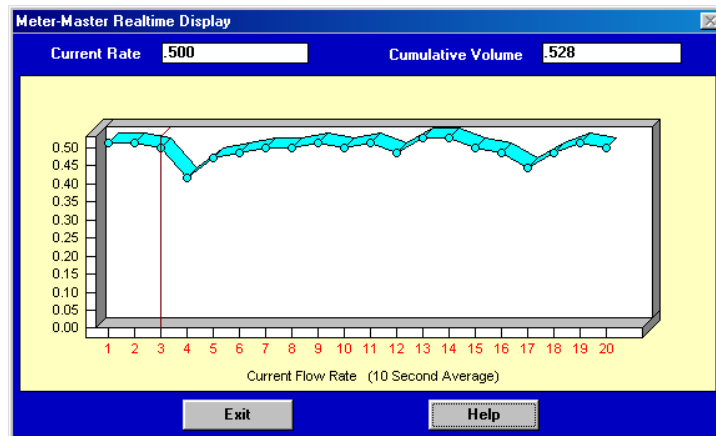
This ensures that the data presented using the new unit of measure (different than the meter in the field) is correct even if the register gearing differs for different units of measure. If you do not follow this procedure correctly or are concerned that you have altered the data in an unintended fashion, reset the meter settings to match the meter in the field and then use the “Restore Data” option under the “File” option on the Main Screen tool bar to restore the data to the exact values calculated at the time the data was originally downloaded.

Chapter Four

OTHER FEATURES

4.1 Realtime Display

Displays rate-of-flow and cumulative volume currently being registered by the Meter-Master. Graph holds 20 intervals of data. The current per-minute flow rate is shown above graph on left, updated each second and is indicated by the moving vertical bar. Cumulative volume is shown above graph on right and begins at start of display when not recording and at start of current recording session when recording. Two options for computing rate-of-flow compensate for varying meter magnetic pulse rates.



TO DISPLAY A REALTIME GRAPH OF CURRENT RATE-OF-FLOW

1. Press "Update Screen" And Verify That The Meter-Master Is Connected To Your Computer.

"Flow Recorder is connected" should appear on the Main Screen.

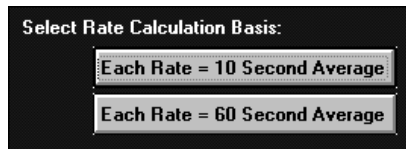
2. Click On "Realtime Display" Button.

Realtime Display

3. Choose The Rate Basis For Computing Rate-Of-Flow (2 Options).

A 10 second average will base each second's rate on the total number of pulses logged during the preceding 10 seconds. A 60 second average will base each

second's rate on the total number of pulses logged during the preceding 60 seconds. (Both options use a "sliding window" allowing new rates to be calculated every second.)



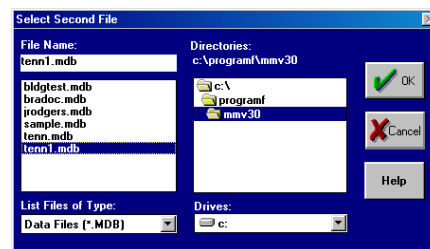
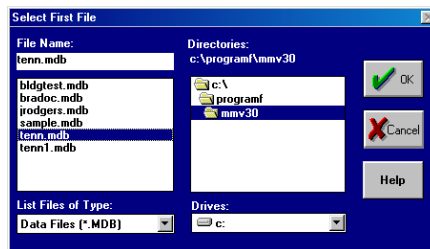
Generally, choose the 10 second average unless you are recording from a large, slow-pulsing meter (meter preceded by an asterisk in Appendix A), in which case a 60 second average is recommended. If the graph displays a spiking effect (large variance in flow rates during short time periods) when the flow rate appears relatively steady on the meter register's dial face, use the 60 second average.

4. Click On "Exit" Button.

When done, click on "Exit" to return to the Main Screen.

4.2 Combine Files

This feature enables the user to make a new Meter-Master data file (*.mdb) by combining the data from two existing files. Only the data from time periods which overlap will be combined. The Data Storage Interval and the unit of measure must be the same. If the unit of measure is different, change the unit of measure of one file to match the other at the Customer Information Screen. Once a new file is created, another file may be combined with it. Accordingly, it is possible to combine data from as many files as desired with overlapping time intervals. Once files have been combined, it is no longer possible to access the Customer Information Screen.



To Combine Files

1. Click On "Combine Files" Button.

The Combine Files button is on the Main Screen.

2. Select The First Data File.

When the Select First File Dialog Box appears, select a *.MDB file and click OK.

3. Select The Second Data File.

In the Select Second File Dialog Box, choose second file and click OK. Customer information from this second file will be used for the new file.

4. Enter A Filename For The New Data File.

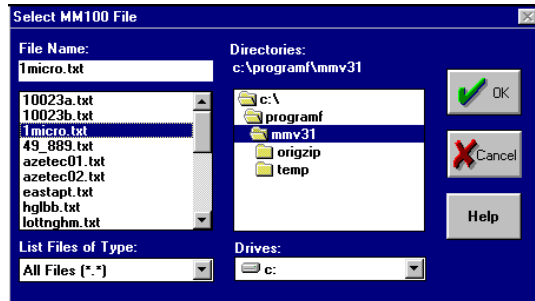
After filename is entered, click on OK. After files are combined, the program will return to the Main Screen. If a report is created, the meter “make” will be identified as “Combined File”.

4.3 Import MM100 Spreadsheet File

Datafiles created using the MM100 spreadsheet operation may be imported for use with the program's graphic and report features.

TO IMPORT A SPREADSHEET FILE:

Select "Import MM100 Spreadsheet" under "File" on the Main Screen menu bar. In the Select File dialog box, find the file you wish to import. Select the file and press OK. The program will ask you to create a filename for the new *.mdb file and will then create the new file. Similar to a download, you must then complete the Customer Information Screen, including the identification of the correct meter type. You can then create graphs and reports.



4.4 Add/Delete Meter

Permits new meters to be permanently added to and deleted from the program database. Default meter options provided with the program cannot be removed. If you do not know the pulse factor for a meter which you want to add to the database, use the “Pulse Factor Calculation” procedure described later in this section.

TO ADD A METER TO THE DATABASE

Setup

1. Enter The Routine Via “Setup”.

Setup is on the menu bar (top of screen) on the Main Screen. Then select “Add/Delete Meter”.

2. Specify The Desired Meter.

Enter the meter make, model, size, and unit of measure in the spaces provided. Although any make, model, and size can be entered, you must select one of the 5 standard units of measure.

3. Enter The Meter’s Pulse Factor.

As the poles of a water meter’s rotating drive magnets move past the sensor, they generate pulses. The pulse factor is the number of magnet poles that equals one unit of measure for a given meter. Some meters use magnets with 2 poles (one North and one South pole per revolution), while others use magnets with 4 poles (two North and two South poles per revolution). If you do not have the pulse factor for the desired meter, contact the meter manufacturer or use the Pulse Factor Calculation procedure described below. If the pulses are being generated by a device other than the Meter-Master sensor, the pulse factor is the total number of pulses per unit of measure multiplied by 2.

4. Enter The Meter's LED Factor (Dial Size).

The dial size is the number of units (e.g., the number of gallons, cubic feet, litres, etc.) represented by one revolution of the meter's sweep hand. The dial size setting enables the LED on the Meter-Master's rocker switch to flash each 1/20 of a dial revolution or with each pulse. If a meter's magnet speed is relatively slow and you want the LED to flash with each pulse, select the "One Flash For Each Pulse" option.

5. Click On "Add".**6. If You Wish To Add Other Meters, Repeat Steps 2-5.****7. When Finished, Click On "Exit".****TO DELETE A METER FROM THE DATABASE**

You may only delete meters you have previously added to the database.

1. Enter The Routine Via "Setup".

Setup is on the menu bar (top of screen) on the Main Screen. Then select "Add/Delete Meter".

2. From The Pull Down Menus, Select The Meter You Wish To Delete.**3. Click On "Delete".**

Only one meter option can be deleted at a time.

4. If You Wish To Delete Other Meters, Repeat Steps 2-3.**5. When Finished, Click On "Exit".****PULSE FACTOR CALCULATION****1. Make A Datafile.**

Record data from a meter for a sufficient amount of time to record a substantial amount of usage.

2. Download The Data.

Download the data taking care to enter precise beginning and ending meter readings at the Customer Information Screen. Change the meter setting to a "Sensus, Turbo, W-2000, gallons" meter.

3. Calculate The Pulse Factor Using The Automatic Data Conversion Factor.

Select the “Automatic” Data Conversion Factor. The reciprocal of the Data Conversion Factor shown ($1 \div$ the factor displayed on the screen) is the pulse factor for the current meter.

Chapter Five

TROUBLESHOOTING

5.1 List Of Topics

FIELD OPERATION (SECTION 5.2)

General

- (1) No 3-Second Signal When Rocker Switch Is Pressed ON
- (2) LED Stays On All The Time
- (3) LED Flashes Long-Short For Six Seconds When Rocker Switch Is Pressed ON
- (4) Sensor Does Not Seem To Be Working Properly
- (5) Insulated Meter

Sensor Test

- (6) Signal Light Does Not Flash At All
- (7) Signal Light Flashes Erratically
- (8) Signal Light Flashes Regularly But Not At The Right Rate
- (9) Signal Light Appears To Be On Solid

Notes On Specific Meters

- (10) Dual Register Compound Meters
- (11) Compound & Turbine Meters With Change Gears Or Non-Standard Register
- (12) Sensus (Rockwell): Turbo (W-3500, W-5500); Compound (SRH, SRM)
- (13) Schlumberger (Neptune): T-8 & T-10 (5/8", 3/4", 1"); Turbine; TRU/FLO
- (14) Badger: TC-ER
- (15) Hersey: MHR (4"-10"); MVR; MCT & MFM; All Models
- (16) ABB/Kent: C-700; T-3000
- (17) Precision: All Models; Turbine
- (18) Water Specialties: ML-03 & TM
- (19) Master Meter: All Models

COMPUTER OPERATION (SECTION 5.3)

Installing The Meter-Master Software

- (20) Error Immediately After Beginning Of Install Routine
- (21) Setup Does Not Finish (Does Not Create 4 Icons Or Prompt To Re-Boot Computer)

Entering Program

- (22) Application Error: Call To Undefined Dynalink
- (23) Meter-Master Is Connected To Computer But Screen Says It Is Not (COM Port Problems)

Downloading

- (24) Error After Naming File
- (25) Error Message During Downloading
- (26) Problems Entering Beginning/Ending Meter Readings
- (27) Meter-Master Volume Differs From Register Volume

Creating/Printing Graphs/Reports

- (28) Help Balloons For Graph And Report Screens Don't Always Appear
- (29) Report Routine: Error Messages

Anytime/Other

- (30) Run-Time Error (Various)
- (31) Realtime Display: Erratic Rates-Of-Flow For Large Meters

5.2 Field Operation

GENERAL

(1) No 3-Second Signal When Rocker Switch Is Pressed ON

- If rocker switch is in middle position, turn OFF. Leave off for 10 seconds and try again. The three second signal occurs only at beginning of recording, not when rocker switch is pressed ON again from middle position.
- Make sure the batteries are okay and charged sufficiently. If the Meter-Master is not connected to the battery charger, attach the charger and press the ON side of the rocker switch completely down, release, and turn OFF. ***When turning the Meter-Master ON after a power-down state, you must depress the ON side of the rocker switch completely and then OFF again.*** If there was no response when pressing switch down, wait at least three minutes, and then press switch ON again. If your Meter-Master responds after being connected to the battery charger, then the instrument powered down.

If you have a Model 100EL, you can check to make sure that your batteries have not degraded. Charge the unit for 14 hours, let sit off the charger for three days, and then use the screen display to confirm that the remaining battery charge is greater than 95%. If your Meter-Master has just been recharged after a power-down state, there is a 2 or 3 minute delay while the electronics settle before the signal light appears.

- If the logger connects to the computer, check to make sure memory is not full. If “Memory Available” equals 0%, the LED light will not go on.
- As a last resort, reset the instrument by pressing and holding down the ON side of the rocker switch for 20+ seconds (the LED should turn on after 20 seconds and then off again signaling the reset). Turn instrument off after resetting. ***WARNING: resetting the Meter-Master erases all data and returns the instrument to the factory defaults!***

Still no response; return unit to factory (call first for RMA #).

(2) LED Stays On All The Time

- The electronics have locked up and the instrument must be reset. If you have not already done so, first connect the unit to the battery charger. Then press and hold down the ON side of the rocker switch for 20+ seconds. (The LED should turn on after 20 seconds and then off again signaling the reset.) Release the switch and turn off once the LED goes off after the 20+ second period. When the switch is released, the LED should stay off. Usually, this problem is caused by batteries that have been allowed to completely discharge; it may signal degraded batteries. To check your batteries, charge the unit for 14 hours, let sit off the charger for three days, and then confirm that the battery charge is greater than 95%.
- If the LED remains on, or you experience other electronic problems with your unit, return the unit to the factory (call first for RMA #).

- (3) **LED Flashes Long-Short For Six Seconds When Rocker Switch Is Pressed ON**
- A long-short series of flashes indicates low battery charge. Connect battery charger and charge batteries at least 14 hours before making a recording. When turning the Meter-Master ON after a power-down state, make sure you depress the ON side of the rocker switch completely and then turn OFF again. If your Meter-Master has just been recharged after a power-down state, there is a 2 or 3 minute delay while the electronics settle before the signal light appears and the recording starts.
- (4) **Sensor Does Not Seem To Be Working Properly**
- Check sensor connection to Meter-Master. Make sure that none of the receptacle pins are bent. If connection seems okay:
 - Connect Meter-Master to PC, select Realtime Display, and then either:
 - Repeatedly turn sensor over and back again (flip like a pancake) to cause sensing of earth's magnetic field. Flipping the sensor over and back creates pulses.
 - Alternatively, attach sensor to a PD meter with active flow and check sensor operation.
- (5) **Insulated Meter**
- Sensor does not need to be touching meter and can be located on outside of insulation if distance from magnets does not result in too weak a signal.

SENSOR TEST

- (6) **Signal Light Does Not Flash At All**
- Check sensor cable connection. Make sure that none of the receptacle pins are bent.
 - Make sure that there is adequate flow to cause flashes.
 - Verify if initialized for current meter. (If Meter-Master is initialized for a meter listed in Appendix A without an asterisk, but sensor is now placed on an asterisk meter, LED flashes will be spaced far apart.)
 - Make sure sensor is in correct location for current meter (see Quick Reference and Appendix A).
 - For large meters, try the sensor in other locations.
 - You may confirm that the sensor is working properly by repeatedly turning the sensor over and back. (Flipping the sensor over and back like a pancake causes sensing of the earth's magnetic field, which creates pulses.)
 - You may confirm that the unit has power by turning the rocker switch OFF then ON again a few seconds later. The signal light will respond with either a 3 second signal to indicate the beginning of a new recording or long-short flashes for six seconds to indicate low battery power. If there is no signal at all, see topic #1 above, "No 3-second signal when rocker switch is pressed ON".

(7) Signal Light Flashes Erratically

- When you move the sensor, make sure you wait ten seconds to allow the electronics time to settle before initiating a sensor test.
- Make sure sensor is properly positioned for meter and not cocked (see Section 2.3 and Appendix A). When the sensor is not cocked, the sensor cable will extend straight down or straight up (or horizontally for some turbine meters).
- With some turbine meters, the sensor may pick up an irregular pulse count because the register magnet is not coupling smoothly with the drive magnet. This condition is indicated by excessive LED flashes or flashes of longer than usual duration. If this occurs, move the sensor away from the magnetic coupling area, e.g., slide the sensor farther up the register if Appendix A indicates a register location.
- Try the sensor in other locations until the signal becomes regular.
- Six seconds of long-short flashes immediately after the rocker switch is turned ON indicates low battery charge. Recording is not possible until batteries are recharged.

(8) Signal Light Flashes Regularly But Not At The Right Rate

- If 1/2 the expected flashes, leave as is. Correct later after downloading by using a conversion factor of “2.0”. The Automatic Data Conversion Factor should be close to “2.0”. Meter-Master is sensing 2-pole signal from 4-pole magnet.
- If twice the expected flashes, leave as is. Correct later after downloading by using a Data Conversion Factor of “0.5”. The Automatic Data Conversion Factor should be close to “0.5”. Meter has 4-pole magnet where 2-pole is expected.
- Meter-Master may not be initialized for current meter. If initialized for a different meter, recording is okay if flashes are spaced at consistent intervals. Leave as is and change to correct meter type when downloading data.
- Check below and Appendix A for special instructions for current meter.
- Meters with change gears may have discrepancies of as much as 15%. Leave as is and correct later using the Automatic Data Conversion Factor.
- If the pulses are regular and the signal appears strong (the flashes remain consistently spaced when the sensor is moved), the gearing of the current meter may not be the same as assumed by the Meter-Master database (unusual). Leave as is and correct later using the Automatic Data Conversion Factor.
- If LED is flashing more than 3 times too quickly, there may be magnetic noise interference. Check for switching equipment, transformers, motors, alarm systems, etc. in close proximity. Try moving sensor to side of meter away from noise source. Test may not be possible at this location. See Section 6.2 for information on optional low-sensitivity sensor circuit.
- The signal may simply be weak where the sensor is located due to peculiar magnet characteristics, location of magnets within the meter, or shielding material in the meter. Try the sensor in other locations. (See Section 2.3, “Pointers for positioning the Meter-Master sensor”.)

(9) Signal Light Appears To Be On Solid

- Verify if initialized for current meter. (If Meter-Master is initialized for a meter listed in Appendix A with an asterisk, but sensor is now placed on a non-asterisk meter, LED will remain solid for a brief period and then go off if significant flow is occurring.)
- Check below and Appendix A for special instructions for current meter.
- Possible noise interference area. Check for switching equipment, transformers, motors, alarm systems, etc. in close proximity. Try moving sensor to side of meter away from noise source. Test may not be possible at this location. Unit may be returned to factory for free conversion to low-sensitivity version (see Section 6.2).
- If signal light remains solid for more than 2 minutes, turn the Meter-Master OFF, wait 10 seconds, and then turn ON again. If problem persists, see topic #2 above, “LED Stays On All The Time”.

NOTES ON SPECIFIC METERS (SEE ALSO APPENDIX A)

In general, PD meters are straightforward; some turbine and compound meters require special care.

(10) Dual Register Compound Meters

- Position the sensors on the sides of both registers such that the sensors are physically located as far away from the other register as possible. Plastic or wood spacers may be used to extend sensor distance from each register if registers are very close to each other. See special instructions for Schlumberger (Neptune) TRU/FLO compound below.

(11) Compound & Turbine Meters With Change Gears Or Non-Standard Register

- *Meters with Change Gears:* Some large meters, e.g., Neptune Trident turbine and Hersey MCT, MFM, MCTII, MFMI, and MHR meters, use change gears for calibration. Different change gear combinations will cause variations (typically less than 15%) between the total volume per register and that per Meter-Master because change gears alter the relationship between the drive magnets and the register’s odometer. Use the Automatic Data Conversion Factor to account for differences between the register and Meter-Master volumes due to change gears.
- *Meters with Non-Standard Register:* If a meter uses a non-standard register, e.g., a 4" turbine with a 1000 gallon dial size instead of a standard 100 gallon dial size, the LED may flash at a different rate. Typically, the difference will be either 10 times faster or 10 times slower.

(12) Sensus (Rockwell)

- *SR:* If the sensor pick-up appears weak, place the sensor flat on top of the register. These meters use 2-pole magnets, which provide a 2-pole signal regardless of sensor location.
- *Turbo (W-3500, W-5500):* Because of the distance of the magnet from the sensor, you may not be able to use a Meter-Master that has been modified to the

low-sensitivity sensor circuit configuration (see Section 6.2). Accurate positioning of the sensor is more critical than with smaller Sensus turbos. Sensor should be centered on side of meter body.

- *Compound (SRH, SRM)*: Sensus Compound Adapter required. Call your sales representative.

(13) Schlumberger (Neptune)

- *T-8 & T-10 (5/8", 3/4", 1"; including TRU/FLO PD side)*. Place the sensor flat against the side of the register with the top of the sensor flush with the top of the register. In the case of small Schlumberger meters, a sensor located on the side of the register close to the plane of the meter's magnetic coupling area will frequently generate half as many pulses (2-pole signal) as a sensor placed high on the side of the register (4-pole signal). Because a 4-pole signal can convert to a 2-pole signal during high flow periods even with the sensor located high on the side of the register, the sensor may, alternatively, be placed flat on top of the register, which typically provides a 2-pole signal at all flow rates. When downloading, you will need to use the Automatic Data Conversion Factor to adjust for a 2-pole signal. If you use a sensor position on top of the register, the automatic factor should be close to "2.0". The software assumes a sensor location high on the side of the register (4-pole signal). These alternatives have been provided because experience on small Neptune meters can differ between versions of the same meter.
- *T-8 and T-10*. Registers may be (inadvertently) interchanged. Look at model information marked on register and on body to make sure they are the same.
- *Turbine (including TRU/FLO & Protectus)*: The Sensus Compound Adapter may be used to increase the pulse frequency and resultant data resolution by a factor of 12. For example, without the Sensus Compound Adapter, each pulse generated by a 6" Trident turbine equals 43.1 U.S. gallons; with the adapter, each pulse equals 3.6 U.S. gallons, which enables more accurate flow rate calculations. If the Sensus Compound Adapter is used, the LED will flash every 1/20 of a dial revolution (non-asterisk in Appendix A).
- *TRU/FLO*: Because the registers are close together on a TRU/FLO meter, it is possible for the magnetic field generated by the PD side to be sensed by the sensor on the turbine side when flow is occurring only on the PD side. To avoid this problem, locate a spacer (wood, plastic, etc.) between the sensor and the register on the turbine side, which will increase physical separation. The unit can also be modified to the low-sensitivity sensor circuit configuration which diminishes the potential for interference.

(14) Badger

- *TC-ER*: The positive displacement (small) side has two (2) different magnetic couplings occurring at different rotation speeds which diminishes the signal's accuracy. Use the "automatic" data conversion factor after downloading in order to minimize the adverse impact of the overlapping signals.

(15) Hersey

- *MHR (4"-10")*: Modified gear train is required. Call your sales representative. (Gear train part numbers: P/N B0600 for 4" and 8"; P/N B0610 for 6"; P/N

B0620 for 10".) The gear train is a standard Hersey part with an added gear, shaft, and magnet. It may be installed without any service interruption.

- *MVR*: Some sensor locations on/beside the register may provide a better signal than others.
- *MCT & MFM (Mag 1)*: A minority of MCT and MFM turbine meters require a modified gear train (P/N B3100) for pickup due to location and size of magnet. The same gear train is generic to all MCT and MFM meter sizes. MCTII & MFMII (Mag 2) never require a modified gear train. Because some Mag 1 meters use 2-pole magnets and some use 4-pole magnets, the Meter-Master data may show either one-half or twice the register volume. Correct the volume by using the Data Conversion Factor when downloading. Some MCT PD side registers have a different gearing; use the Automatic Data Conversion Factor to account for these register differences if necessary (the difference is typically about 30%). Gearing differences are more common with these meters than others, which frequently result in the need to use the Automatic Data Conversion Factor.
- *All Models*: Some Hersey remote reading registers have an additional magnet in the register as a component of the remote reading system. This additional magnet can distort the magnetic field generated by the drive magnets and make accurate reading difficult. In such cases, a register without the remote reading system must be used temporarily if a high degree of accuracy is required.

(16) ABB/Kent

- *C-700*: There are two 5/8" models with different magnet rotation speeds. The older was produced until 1993. The newer has been produced since 1993.
- *T-3000*: The Model 100 Program assumes that the meter does not have gears in the register (direct drive), and that it has 4-pole magnets. However, some meters may use 2-pole magnets, in which case the register volume will be roughly twice the Meter-Master volume (correct with Data Conversion Factor). Because of the large registers (U.S. version), slow magnet speed, and poor pulse resolution, it is sometimes difficult to verify that the Meter-Master is recording accurately. If the meter does have gears in the register, the Meter-Master volume will be a multiple of the register volume, and the LED will flash significantly more than twice per revolution (e.g., 20 times). In this case, use the Data Conversion Factor to correct the data. It is highly recommended that the Sensus Compound Adapter be used with Kent turbines (U.S. version) in order to enhance the data resolution by a factor of 12. Without the adapter, the data resolution is inadequate for accurately determining low and high flow rates.

(17) Precision

- *All Models*: There is a magnetic shield on the side of some registers. The sensor may have to be located flat on top of the register. If the sensor is successfully located on the side of the register, the Automatic Data Conversion Factor may be necessary to account for a 4-pole vs. a 2-pole signal.
- *Turbine*: Although the Precision turbines are not yet included in the software, the Meter-Master is compatible with them. Use the "Pulse Factor Calculation" procedure (section 4.4) to determine the pulse factor and then you can add the meter to the database as a permanent meter option.

(18) Water Specialties

- *ML-03 & TM:* According to the manufacturer, meters with rate-of-flow indicators as registers may not provide the desired signal.

(19) Master Meter

- *All Models:* Because the magnet is very small in all Master Meter models, the Meter-Master must be modified to the high-sensitivity version. See Section 6.2 for information on the optional high-sensitivity sensor circuit configuration. In all cases, center the sensor flat on top of the register so that the sensor is as close to the meter's magnets as possible. If the meter register has a raised lens, it may not be possible to pick up an accurate signal even with the high-sensitivity circuit.

5.3 Computer Operation

INSTALLING THE METER-MASTER SOFTWARE

(20) Error Immediately After Beginning Of Install Routine

- Try starting setup through My Computer or Windows Explorer (Windows 95/98) or File Manager (Windows 3.1) by double-clicking SETUP.EXE in the appropriate drive.
- Disk may be bad.

(21) Setup Does Not Finish (Does Not Create 4 Icons Or Prompt To Re-Boot Computer)

- Make certain there are no other applications running.
- Make sure you are not connected to any network.
- Make sure you have enough free hard disk space (Meter-Master program requires 100MB of free hard disk space as a minimum during operation).
- Other applications may have altered the Windows system environment such that the program cannot install certain files. We have a list of files that should be installed during setup, which we can fax to you.
- The installation disk may be bad.

ENTERING PROGRAM

(22) Application Error: Call To Undefined Dynalink

- Most likely, some other Windows application is using or has modified *.DLL file(s) in the WINDOWS\SYSTEM directory that we need. One example has been Hansen Information Technologies software, which also uses Crystal Reports (see "Report Routine: Error Messages" under "Creating/Printing Graphs, Reports..." below).

(23) Meter-Master Is Connected To Computer But Screen Says It Is Not (COM Port Problems)

(A) If First Time Entering Meter-Master Program:

- Check to make sure Palm Pilot software is not install on the computer. If it is, you may need to switch to a computer without Palm Pilot software.
- Check the Meter-Master program COM port setting (under Setup) to make sure it matches the computer port you are using to connect the RS232 cable.
- Check cable connection (see "B" below).
- Make sure you are disconnected from any network (unless the Meter-Master software is installed on the network server). F. S. Brainard & Co. does not presently support the Meter-Master software on a network.
- The Meter-Master cannot be used with any port that is already reserved for another device. If your computer has an internal fax/modem, make sure that

its COM port is not the one used with the Meter-Master. If it is, try the Meter-Master with another COM Port, or remove/disable the fax/modem. If you have a COM Port with a 25 pin connector, you can purchase a 25 to 9 pin serial adapter at a computer or electronics retailer.

(B) If Not First Time Entering Program:

- If you have not already done so, connect the Meter-Master to the battery charger. Wait two minutes and then press the ON side of the switch all the way down and then turn OFF. Wait another two minutes and then press “Update Screen” again. If your unit is now connected to the computer, most likely the Meter-Master powered down due to low battery charge.
- Check RS232 cable connection. (NOTE: RS232 cable may be mistakenly plugged into Meter-Master battery connection. No damage will result.) Check that none of the receptacle pins are bent. Check that the black plastic insert inside the stainless steel RS232 receptacle on the Meter-Master is flush with the top of the steel shell (has not been pushed down through use).
- Confirm that your instrument is working properly. With your unit connected to the battery charger and the rocker switch in the OFF position for at least 10 seconds, press the rocker switch on and release. The LED should light for 3 seconds indicating the start of a recording. If there is no signal light or the light remains on continuously, see the discussion of these topics above.
- Should there still be a problem, try exiting the Meter-Master Program and then reentering the program.

DOWNLOADING

(24) Error After Naming File

- The following characters cannot be used when naming a file without causing an error: <space>, <comma>, <period>, +, =, /, [,], “, ;, :, ?, *, <, >, |.

(25) Error Message During Downloading

- If Meter-Master software is on your PC and your computer is part of a network, make sure your computer is off the network.
- Download again; the serial connection may have broken briefly.
- See #30, “Run-Time Error” below.

(26) Problems Entering Beginning/Ending Meter Readings

- Using Delete and Backspace keys, erase all characters in field and start over. Make sure *all* characters are erased; sometimes characters are hidden and appear only if you delete through the end of the field.
- Repeated editing of beginning/ending meter readings may interfere with the calculation of the register volume. If the register volume does not equal the difference between the two meter readings, exit and download the file again.
- Do not use Enter key to move between fields (use Tab key).

(27) Meter-Master Volume Differs From Register Volume

- Make sure the meter make, model, size, and unit of measure are correct.
- Make sure the beginning and ending meter readings are correct. Extreme care should be taken both in the field and in the office to ensure accurate meter readings. Make certain that a digit is entered for all rotating dials and painted-on zeros before entering any decimal.
- If the Meter-Master volume exceeds the register volume by a factor of roughly 10 or a multiple of 10, you have most likely not included all of the necessary digits for the meter readings. In other words, the volumes are in hundreds or thousands rather than to the decimal.
- If the Meter-Master volume is double or half of the register volume, the Meter-Master sensor was reading a magnet generating a signal with more or less poles than was assumed in the Meter-Master database. Correct the data using the Data Conversion Factor (0.5 if Meter-Master volume is double; 2.0 if Meter-Master volume is half).
- Check above and Appendix A for special instructions for current meter.
- If the meter has change gears, there may be a discrepancy of as much as 15%. Correct with the Automatic Data Conversion Factor.
- The Meter-Master may under-register (typically up to 30%) as a result of improper positioning of the sensor (most often on larger meters).
- If the Meter-Master volume exceeds the register volume by not more than 100% and much of the demand occurs at very low flow rates, then the discrepancy may be caused by backflow. Although this circumstance is unusual, it can occur, especially with fast pulsing meters (meters not marked with an asterisk in Appendix A), where slight fluctuations between forward and back flows are easily picked up by the Meter-Master sensor. If this situation occurs, low flow rates will not be accurate.
- If the discrepancy is less than 30% and the data seems in all other ways reasonable, the gearing of the current meter may not be the same as assumed by the Meter-Master database (most common with Hersey compound meters). Correct the data using the Automatic Data Conversion Factor.
- If the error is greater than 300%, the most probable cause is electromagnetic interference (EMI). Check to see if there is switching equipment, motors, alarm systems, etc. in close proximity. In such cases, it may not be possible to position the sensor in such a way as to avoid the EMI. EMI is usually detectable by doing a sensor test. If the LED flashes quickly or stays solid when no flow is occurring, EMI is present. This problem can usually be resolved by returning the Meter-Master to the factory for a free conversion to the low-sensitivity sensor circuit.

CREATING/PRINTING GRAPHS/REPORTS**(28) Help Balloons For Graph And Report Screens Don't Always Appear**

- You must first click on the graph screen before holding mouse pointer over a button.

- Balloons initially come up only for graph buttons; not always for combo boxes (with down arrowhead). After a balloon comes up, move mouse pointer across to combo boxes to see their balloons.
- At present, there are no help balloons for the Report Screen.

(29) Report Routine: Error Messages

A number of other software products use the same library (*.DLL) files that the Meter-Master report software package (“Crystal Reports”) uses, and some of them may maintain these files in a manner which conflicts with the Model 100 Program. Difficulties with Hansen Information Technologies software have been experienced.

- We have a list of files that should be installed during setup, which we can fax to you.

ANYTIME/OTHER

(30) Run-Time Error (Various)

Especially while downloading or building reports/graphs.

- These errors can occur randomly due to software conflicts. Attempt the same routine again.
- Exit the program and then reenter the program and attempt the same routine again.
- If you are on a network, log off the network. Make sure your computer is operating as a stand-alone PC and is not sharing any system files with other workstations. Some networks continue to monitor workstations even after they have logged off. If this is the case, you may need to physically disconnect your computer from the network.

(31) Realtime Display: Erratic Rates Of Flow For Large Meters

- If you started with the 10 second average for calculating the rate, leave the routine. Reenter and choose the 60 second option for calculating the rate. This will create a graph with more consistent flow rates.

Chapter Six

SERVICE AND SUPPORT

6.1 Customer Service

Should you experience any problems with your Meter-Master product, fax or call our Customer Service Department between 8 A.M. and 5 P.M. (Eastern U.S. Time). Phone and fax numbers are shown on the front page of these instructions. You may also email us at service@meter-master.com. Explain the problem, and we may be able to solve it on the telephone, via fax, or via email. If not, we will provide a Return Material Authorization Number (RMA #). Be sure to include: a packing slip with the RMA #, the serial number of the unit, a description of the problem, and a contact person including phone number and address. Pack the equipment in a solid cardboard box secured with adequate packing material. You may want to keep the original packaging material for this purpose. Ship prepaid and insured to the address shown on the cover of this manual.

6.2 Adapters And Circuit Modifications

Adapters are available for most meter compatibility problems. Fax or call for prices.

- **Gear-Driven Meter Converter:** Provides a magnetic pick-up for mechanical drive meters. 60 pulses are generated for each revolution of the meter's pointer. (See Appendix D)
- **Sensus Compound Adapter:** Enables recording from Sensus compound meters. May also be used with ABB/Kent (U.S. versions) and Schlumberger/Neptune turbines to increase the recorded resolution by a factor of 12. This is essential for accurate determination of low and high flow rates (see Appendix C).
- **Modified Gear Trains:** Enables recording from Hersey MHR meters. Sometimes (infrequently) required for Hersey MCT/MFM (Mag 1) meters.

The Meter-Master's standard sensitivity is optimal for most applications. You may also purchase Meter-Master products with high and low-sensitivity circuit configurations, or return your Model 100EL to the factory for a free conversion to a different sensitivity.

- **Low-Sensitivity Sensor Circuit:** For use where meters are located within a few feet of magnetic noise generating equipment (e.g., generators, motors, alarm systems) or with compound meters that have registers in close proximity to each other. A unit

with a low-sensitivity configuration may not be capable of recording accurately from Sensus Turbo W-3500 and W-5500 because of the distance from the magnets.

- **High-Sensitivity Sensor Circuit:** For use with Master Meter meters and any other meters that use relatively weak drive magnets.

6.3 Two Year Limited Warranty

F. S. Brainard & Co. (FSBCO) warrants to the original consumer purchaser that this Meter-Master product shall be free from defects in materials and workmanship for a period of two years from either the date of purchase, provided a proof-of-purchase is presented, or alternatively, if proof-of-purchase is not presented, the date of manufacture. During the two year warranty period, liability shall be limited to replacing or repairing, at FSBCO's option, any defective product. Product which has been subjected to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation is not covered by this warranty. FSBCO shall have the right of final determination as to the existence and cause of defect. As to product repaired or replaced, the warranty shall continue in effect for the remainder of the warranty period, or for ninety (90) days following date of shipment by FSBCO of the repaired or replaced product, whichever period is longer.

No liability is assumed for expendable items such as batteries and diskettes. No warranty is made with respect to custom equipment or products produced to buyer's specification, except as specifically stated in writing by FSBCO and contained in the contract. FSBCO liability arising out of its warranty shall be limited to a refund of the purchase price. In no event shall FSBCO be liable for costs of procurement of substitute products or services, loss of profits, or for any consequential, incidental, indirect, and/or other damages of any kind however caused and on any theory of liability, arising out of this warranty. Other products, not manufactured by FSBCO but distributed by FSBCO, such as computers, modems, and printers, are offered as third party products. As such, these products are not warranted by FSBCO. Requests for warranty or nonwarranty repairs of third party products should be addressed directly to the manufacturers of such products. Should your FSBCO product require nonwarranty repair, please contact FSBCO for available repair information.

All FSBCO software is sold on an "as is" basis without warranty of any kind. The entire risk as to the quality and performance of such software is with the purchaser. FSBCO shall have no liability or responsibility to the original consumer purchaser or to any other person or entity with respect to any claim, loss, liability, or damage caused or alleged to be caused directly or indirectly by any FSBCO software. This disclaimer includes but is not limited to any interruption of services, loss of business or anticipatory profits, or any consequential, incidental, indirect, and/or other damages of any kind resulting from the purchase, use, or operation of any FSBCO software.

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