Smart Meter-Master Operating Instructions

SMM Operating Instructions (22.6b).doc
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F. S. Brainard & Company

1. Overview and Software Installation

OVERVIEW

For Smart Meter-Master (SMM) Requirements: see Section 7 (page 10).

Powering the Smart Meter-Master

The SMM operates with 12-24 VDC. However, if your unit has internal batteries, the power supply must provide greater than 12.6 VDC in order for the batteries to charge. For 4-20mA applications, 24 VDC external power is required because of the high power requirement.

Battery life varies with configuration. For two channel encoder recording with a 10-second measurement interval, the batteries should last about 8 days. Pulse and flux inputs should have longer battery life.

Charging the batteries takes about 8 hours. *IMPORTANT: The device needs to be turned ON for the batteries to charge.*

General Procedure

- **Install the SMM program on your computer** (see "Software Installation" below)
1. **Configure the SMM for your application** (page 2)
2. **Install the SMM at the site** (pages 3-7; see page 5 for wiring instructions)
3. **For logging models: Importing and Displaying data** (pages 8-9)

SOFTWARE INSTALLATION

The software for setting up your SMM is free of charge and available on our website, www.meter-master.com. If you don't have the link and password, please contact F. S. Brainard & Co. Use of the program for importing data from the SMM and for creating graphs and reports requires the purchase of a license.

1. **Install the SMM software:** Download and run the Smart Meter-Master installation program. Follow the prompts.

2. **For Logging Models:** If you have purchased a license to import and display SMM data, you will be asked to enter your SMM product key when you open the program the first time.

2. Configuring the Smart Meter-Master

The Smart Meter-Master Program is needed for changing the device's settings. It is also needed if you have purchased a software License for importing SMM recordings and using the graph/report suite. If your SMM has been pre-configured at the factory for your application and you are using it only for signal conversion, you may want skip to the SMM Installation instructions on page 3.

For software installation, see page 1.

1. **Attach the SMM to the computer using the USB cable and open the SMM Program.** The program automatically finds Smart Meter-Masters connected to your computer. If there is more than one SMM connected to your computer, a "Select Connected SMM" button will appear to enable you to choose the SMM to load into the program.

2. **Click on the "Configure Device" button at the bottom of the SMM Program Home screen.** The Configuration Screen will open.

3. **Choose the Channel Types (if needed):** If your SMM provides for different input or output types and you would like to change which types are currently active or if you would like to add a Display-Only output:

   ▪ **Open the Channel Configuration Screen:** Click on the "Configure Channels" button.
   ▪ **To change or add an input channel:** click on an input icon and choose an input type.
   ▪ **To change or add an output channel:** click on an output icon and choose an output type.
   ▪ **To change the input source of an output (devices with 2 inputs):** click a radio button to change how the channels are routed.
   ▪ **Save the changes:** When done, press the "Save" button.

4. **Set the Measurement Intervals for all channels.** The measurement intervals for all input and output channels can be set to the same value and be changed at the same time using the "Measurement Interval" text box above the properties table. Larger intervals decrease power consumption; shorter intervals increase resolution.

   ▪ *Encoder Inputs:* For some meters, an interval of less than 5 minutes will shorten the input meter's battery life, which may impact the meter's warranty (see section 3, subsection 4).

5. **Configure the properties of the input and output channels.** In the properties table, click on a feature in the left column, and then click on the value of the property in the right column that you would like to change. Explanations of the properties are given in the pop-up dialogs when you click on the property value.

6. **Modify the Configuration File Name (if needed).** The configuration file name is in the top right text box. This is also the file name should you save the configuration on your computer. If you wish, you can also give the configuration file a description.

7. **Copy the configuration to the Smart Meter-Master.** When you have finished changing the configuration, click on the "Copy Settings to Device" button. After the SMM has received the new configuration, it will send the configuration back to the program and the configuration screen should refresh. NOTE: Configuring the SMM resets any output cumulative volume to zero.

8. **Save the configuration to a file.** If you wish, under "Configuration" in the menubar is an option to "Export Configuration to a file". The file name will be the name given in the "Configuration File Name" field.

9. **Detach the USB cable and screw on protective cap.** Make sure protective cap is in place over the USB connector when not in use.

3. Installing the Smart Meter-Master at the Site

For Smart Meter-Master Requirements, see page 9.

1. **Permanent Installations: Mounting the Smart Meter-Master to a Wall**

   1.1 **Install Wall Bracket:** Determine the best location for the wall bracket (e.g., near AC outlet). With clip at top, attach the mounting plate to the wall.

   1.2 **Attach the SMM to the Bracket.** Insert bottom edge of the SMM into the rail at the bottom of the mounting plate with the bosses on the SMM aligned with the notches in the rail. Press the top of the SMM toward wall keeping the top of the SMM under the clip. After the SMM is flat against the bracket, push clip down over top of the case so it snaps into place and secures the SMM.

2. **Attach Wires or Sensors:**

   See Section 4 for Wiring Instructions. See Appendixes for attaching a flux sensor or Neptune Transmitter.

   Make sure SMM's power is off. Labels on the wires indicate the type of input or output. Secure all cable conductors using waterproof connectors (e.g., Scotchlok). Connect external power cable last. *Make sure any unused wires are protected against shorting.*

3. **Turn On the Smart Meter-Master and Verify that It Is Operating Properly**

   For LCD Display, Indicator Lights, and Keypad Operation, see page 7.

   3.1 **Turn SMM Power On.** Briefly press the "Power" button on the SMM to power on. If power is already on, pressing any button will activate the LCD. If the LCD backlight goes out while the screen is still showing values, press the "Power" button briefly to keep the LCD lit without changing the display.

   3.2 **Verify Power.** Two flashes of the green LED above power button indicate external power is present (1 flash indicates internal batteries only)

   3.3 **Verify Input Values:** Input values should appear in the LCD screen. If there are two inputs, use the down arrow to scroll to the second input. Horizontal dashes indicate no input.

   - **Encoder Inputs:** The value in the LCD screen should match the register reading.
     - o *2-Wire versus 3-Wire Inputs:* The LCD screen shows the encoder type (2W or 3W). If no input, verify that this setting is correct. (To change settings, see step #4.)

   - **Flux and Pulse Inputs:** The LCD screen should show the rate of flow as well as the units of measure. The rate of flow is updated at the end of each measurement interval, so there is a lag of one measurement interval before you will see an interval's rate in the display. *Flux sensors also require as much as 3–4 minutes to output a signal at the beginning.* No pulses at the beginning may produce an error message until pulses are recorded.

     Too Many or Too Few Pulses: Are most often caused by wrong scale factor settings or by an input source that is itself generating more or less pulses than expected. In some cases, it may also be caused by a minimum pulse width that is either too wide or too narrow. In the case of flux inputs, these errors can also be caused by a sensitivity setting that is either too low or too high. Such signal problems can sometimes be solved by changing the Pulse Width or the Flux Sensitivity.
     - o *Pulse Width:* Default pulse width is 5ms. For higher input hertz, set width to 0. For unwanted pulses (pulse "bounce"), set pulse width longer.
     - o *Flux Sensitivity:* For week magnetic signals, increase sensitivity. For extra unwanted pulses caused by electromagnetic interference, decrease sensitivity.

- o *Pulse Input from Omni Meters.* Omni meters sometimes come with pulse outputs disabled. Also, they may not pulse on the right-most digit, which means that there may be a long wait for a pulse. Check your Omni purchase order to see how your meter is configured.

- **Analog Inputs (4-20mA or Volts):** The LCD screen should show the input value as well as the units of measure (e.g., gallons per minute, pressure, temperature).
  - o *Zero the Sensor:* To calibrate the zero setting if values appear high or low, first make sure the input should be recording exactly 0.0 (e.g., a pressure sensor should be open to atmosphere; a rate-of-flow input should have zero flow). Then press "Menu"→"Change Settings"→" Analog Zero"→"Zero the input." The LCD should show "0." Zeroing the sensor disables any preset zero threshold.
  - o *Set a Zero Threshold:* If you want the SMM to register zero when the input value is below a certain percent of full span, set a zero threshold. Press "Menu"→"Change Settings"→"Analog Zero"→"Zero Threshold". Value set is percent of full span.

If an input value does not appear (LCD shows horizontal dashes): Try powering the unit OFF and then ON again (see page 7). Some initial error messages on LCD can occur due to anomalies at start up. Push "OK" button to disable the error messages.

The Red LED also can be used to verify inputs; it flashes when the SMM is recording data. If there are two inputs and both are receiving data, the LED will flash twice.

SMM Error 1357 accompanied by the SMM not supplying external power (e.g., to power an Omni pulse output): The voltage supply wires may have shorted; power the SMM off then on again.

NOTE: If the SMM stops receiving an input: The display does not return to horizontal dashes. Flux, pulse, and volt values become zero; 4-20mA values drop below zero; and encoder values show 4 dashes in place of the first four number on the left.

3.4 For Signal Converter Applications: Verify Output Values. Use the up and down arrows to scroll through the outputs as well as inputs. *Note that pulse and analog outputs lag inputs by one measurement interval.*

- **Encoder Outputs:** The LCD screen shows the encoder digits sent as an encoder output.
  - o *2-Wire versus 3-Wire Outputs:* The LCD screen shows the encoder type (2W or 3W). If your external device isn't reading the SMM output, verify that this setting is correct.
  - o *Wire Colors:* Some utility systems have specific wiring instructions. Also check to see if wires are already reversed at the site where connected to the meter interface unit.
  - o *If Output Value Displayed on LCD Screen Is Incorrect.* Verify that the software setting for the output digits is correct.

- **Pulse Outputs:** The LCD screen shows pulses per interval, which are updated at the end of each measurement interval.
  - o *Pulse Output Width:* The pulses outputted to your device are spread evenly over the measurement interval *following* the interval where the pulses are counted.
  - o *Pulse Outputs with Encoder Inputs:* The value of one pulse may not equal the value of a digit of the least significant encoder wheel (the right-most wheel); some registers display more wheels than they are capable of outputting. Also, the SMM can be configured so that one output pulse can equal any value you might wish.

- **Analog Outputs (4-20mA, Volts):** The LCD screen shows the milliamps or volts sent as the analog signal. During the initial setup of the SMM, if the output is averaged over several intervals, the value should start low and increase to the expected value.

- **Serial Outputs:** Because serial transmission can be formatted in a variety of ways, the LCD display of the serial output will not necessarily exactly match the output. The value shown on the screen is just the variable portion of the output that comes from the SMM input source.

3.5 For Logging Applications: Start Recording. Press the 'Menu" button and with the "Start/Stop Recording" text highlighted, press the "OK" button, then "OK" again. This will start the recording; the red LED should also start flashing which indicates that the logger is recording. Follow the same steps to stop recording.

4. If Needed, Change SMM Settings

Use the SMM software to change settings (see section 2).

A few settings can be changed through the Menu on the SMM keypad. The settings that can be changed through the SMM Keypad are: Start/Stop Recording, Encoder 2W/3W (2-wire vs. 3-wire), Analog Zero Adjustment (input), Analog Zero Threshold (input), Flux Sensor Sensitivity (input), and Pulse Width (input). To change any of these settings, press "Menu," then "Change Settings." Select the setting desired and change the value.

- *Encoder Measurement Intervals (set through Software):* Setting the SMM Measurement Interval at too frequent a rate can result in a shorter than expected battery life for the meter and impact its battery warranty. For example, to preserve a 10-year battery life for a Neptune C&I MACH 10 meter, the interval should be set to at least 300 seconds (5 minutes); a 5-second interval, on the other hand, will shorten this meter's battery life to about 2 years.

4. Wiring Instructions

ENCODER ... For both inputs and outputs and for both 2-wire and 3-wire connections, wiring matches color code, *except typically for 3-wire Sensus and Elster outputs.**

2-WIRE

All (e.g. touchpad, touch-couple)	
SMM	**External Device**
Green	(unused)
Red	R (Red)
Black	B (Black)

DO NOT connect the green wire if the SMM is programmed for a 2-wire connection; data communication may fail.

NOTE: Some meters only allow 3-wire or 2-wire connections.

3-WIRE

Inputs: All Outputs: Neptune Only	
SMM	**External Device**
Green	G (Green or White)
Red	R (Red)
Black	B (Black)

Sensus & Elster Outputs Red and Green/White wires are reversed*	
SMM	**External Device**
Green	R (Red)
Red	G (Green or White)
Black	Signal Return (-)

* Encoder Inputs: If LCD input volume appears frozen, especially with 4-20mA output (typically showing 20mA), try turning SMM power off and restarting unit.

Encoder Outputs: Some utilities have specific wiring instructions. Also check if wires are already reversed at the site where connected to the meter interface device.

PULSE .... **INPUT:** Green to sensor (+); black to sensor (-). If needed, red provides external 20 VDC power (+) with black wire as ground. *If red wire is unused, protect end against shorting.*

OUTPUT: Plus-to-plus; minus-to-minus in all cases.

SMM Error 1357 accompanied by pulse input failure: The voltage supply wires may have shorted. Power the SMM off then on again.

4-20mA .... Wiring depends on whether 4-20mA is input or output and whether SMM is active (the source of the current) or passive (not the source of the current).

IMPORTANT: Make sure external power wires are not mistaken for signal wires. Any unused SMM wires should have their ends protected against shorting.

INPUT

SMM is Active (SMM is source of current)		SMM is Passive (SMM is not source of current)	
SMM	**External Device**	**SMM**	**External Device**
Red	Signal (+)	Red	(unused; protect wire end)
Green	Signal Return (-)	Green	Signal (+)
Black (Gnd)	(unused; protect wire end)	Black (Gnd)	Signal Return (-)

OUTPUT

SMM is Active (SMM is source of current)		SMM is Passive (SMM is not source of current)	
SMM	**External Device**	**SMM**	**External Device**
Blue	Signal (+)	Blue	Signal Return (-)
White	Connect Red and White wires together.	White	Signal (+)
Red (Pwr +)		Red (Pwr +)	(unused; protect wire end)
Green (Gnd)	Signal Return (-)	Green (Gnd)	(unused; protect wire end)

If the SMM LCD display shows only horizontal lines (indicating that the SMM is not receiving a signal), check the wiring. The external device's wire colors may not have the same meaning as the SMM wire colors.

SMM Error 1357 accompanied by 4-20mA failure: The current supply wires may have shorted. Power the SMM off then on again.

VOLTS .... Plus-to-plus; minus-to-minus in all cases.

SERIAL .... **RS232:** Connects using standard 9-pin connector.

RS485: Connect Transmit (TX), Receive (RX), and Ground (GND) per labels on wires.

5. Indicator Lights, LCD Display, and Keypad Operation

LED Indicator Lights

- **Power Light:** Indicates whether unit has power. Double-flash indicates external power. LED is off in low-power mode.

- **Record Light:** Indicates whether unit is recording data; does not flash until input has been successfully measured. Double-flash indicates two input channels. LED is off in low-power mode.

LCD Display & Keypad

- **Up/Down Arrows:** Selects different inputs and outputs and, in "Menu," different menu options.
- **Cancel:** Cancels current screen and goes back one screen.
- **OK:** Accepts selection on screen.
- **Menu:** Opens up the menu to change certain settings and view input/output settings (see "SMM Menu" below).
- **Power:** Turns SMM on and off. To turn off, hold button down 10 seconds and then press "OK" button. To turn on, press briefly.

To Activate the LCD Screen: Press any key to activate the display when not using low power mode; in low power mode, press the "Power" button. Press the "Power" button briefly to keep the LCD lit without changing the display. The LCD time-on period can be changed through the SMM software.

If the LCD display shows horizontal dashes: Horizontal dashes indicate that the SMM has not yet received data on that channel. Turn the SMM off and then back on again. Also check the wiring.

NOTE: If the SMM stops receiving an input, the last received input value remains on the LCD screen. It does *not* return to horizontal dashes. The exception is encoder inputs, which show horizontal dashes for the first four digits.

SMM Menu

The first screen shows the SMM's date and time (Greenwich Mean time). It also shows the battery charge if there are internal batteries, and the memory available for logging versions of the SMM. The main menu options are:

- **Start/Stop Record:** Begins and ends recordings. Shows only for logging versions of the SMM.
- **Change Settings:** Allows changing the following settings. These settings can be password protected via the SMM Program's "Security Code" property (under "LCD Display & Keypad").
    - o **Start Running Total (Display-Only Outputs):** Begins a running total on the LCD display. Is enabled via software.
    - o **Encoder 2W/3W (Encoder Inputs/Outputs):** Switches between 2-wire and 3-wire connections.
    - o **Analog Zero (Analog Inputs) → Zero the input:** Adjusts present input value to equal 0.
    - o **Analog Zero (Analog Inputs) → Zero threshold:** Sets percent of full span below which SMM will register zero (select "None" to disable).
    - o **Flux Sensor Sensitivity (Flux Inputs):** Switches between Standard, High, Low, and Sub-Low magnetic sensitivity.
    - o **Pulse Width (Pulse Inputs):** Sets minimum pulse width allowed for pulses to be counted.
- **Input/Output Info:** Shows the main channel settings.
- **System & Diags:** Factory troubleshooting information.

6. Importing & Displaying Data (Logging Models)

Starting the Recording

1. Close the Smart Meter-Master Program on the PC. Disconnect the USB cable from the Smart Meter-Master and reinstall the protective cover on the Smart Meter-Master USB connector.

2. Select "Menu" on the Smart Meter-Master LCD display, and with the "Start/Stop Recording" text highlighted, press the "OK" button, then "OK" again. This will start the recording; the red LED should start flashing at the same time as the green LED, which indicates that the recording has restarted.

3. Select "Cancel" to exit the Menu and return to the main screen that shows the input/output values. "REC: ON" should show in the lower right corner of the LCD display. The LCD display should update once each interval; verify that the LCD display is updating its values as expected. Encoder and analog input values should update immediately; pulse and flux sensor values will take an interval or two to start registering. (See also page 3, section 3.3.)

Important: If you are recording from a meter, take a picture of the register at the beginning and end of the logging session so that you have a means to verify the total amount of water used (current reading minus prior reading). If needed to verify data accuracy, this amount can be compared to the total volume indicated by the data for this time period imported from the Smart Meter-Master.

Stopping the Recording

Press the "OK" button on the Smart Meter-Master keypad in order to activate the LCD display. Press the 'Menu" button and select "Change Settings." With the "Start/Stop Recording" text highlighted, press the "OK" button. This will stop the recording; the red LED should also stop flashing which indicates that the recording has stopped.

Importing Recorded Data from the SMM

1. Connect the USB Cable to the PC and the Smart Meter-Master.

2. Open the Smart Meter-Master Program.

3. Select "Import Recorded Data".

4. Select desired record # to download in "Channel" column.

5. Select "Next".

6. Typically, you will want to leave the default filename and destination directory unchanged.

7. Select "Next".

8. Enter a "Location/Meter ID" (optional).

9. Enter the Customer Name (required).

10. Click "Next" (entering additional information is optional).

11. You should not need to change the "Imported Data Properties".

12. Select "Finish".

The data will be imported and the Data Grid will appear on the PC with the imported data presented in the preselected resolution levels. Once the Data Grid appears and there are values in the cells (not all

zeros), you know that you have successfully imported the data. Scroll down thru the data to see that the timeframe covered by the data is correct in order to confirm that you imported the correct record #.

When Leaving an SMM at a Site after Importing Recorded Data:

1. If you are powering the SMM from an external source, make sure that you are seeing the green power light flash twice each 4 seconds. 2 flashes indicates external power is being applied. 1 flash indicates that the unit is being powered only by its internal batteries, which means that the external power is not present and needs to be restored.

2. When leaving the site after completing the download, make sure that the green LED is flashing at the same time as the green, which indicates that the unit is recording.

Locating the Downloaded Datafile in the Windows Directory

1. Go to your C:\ drive on your PC (top level)

2. Select "Users"

3. Select "Public"

4. Select "F.S. Brainard & Co"

The filenames include the date and time of the recording in the filename, e.g., 90057-Encoder@2018-06-18T13-02-18-269.smmdata. 90057 is the unit serial number.

When not in Use

Charge the batteries (takes about 8 hours) and turn the SMM off. *IMPORTANT: The device needs to be turned ON for the batteries to charge.*

7. Smart Meter-Master Requirements & Technical Support

EXTERNAL POWER REQUIREMENTS

12-24 VDC .... 1 Amp. Internal Batteries require >12.6 VDC in order to charge.

MAXIMUM WIRE LENGTHS (estimated; 22 AWG)

Encoder .... 200' (for some registers, up to 500').
Pulse .... 500' (shielded).
4-20mA .... Best if <1000'; max 2000'.
Volts .... Best if <25' (max 100').
Serial .... RS232: 50'. RS485: 4000'.

INPUT REQUIREMENTS

Encoder .... Sensus, Neptune, or Elster protocol (per factory installation).
Protocol must match SMM cable label and be enabled by *software setting*.
2-Wire vs. 3-wire connection depends on wiring (see page 5) and *software setting*.
Run 3-wire cable to allow option to use either 2-wire or 3-wire connection.

> REGISTER PROGRAMMING. In some cases, you may want to reprogram the register to which the Smart Meter-Master is attached in order to output the maximum number of wheels. If the SMM has a 4-20mA or Volts output, an 8-wheel register programmed to output all 8 wheels is desirable. SMM encoder outputs can be programmed to output whatever wheel pattern is desired.

Flux Sensor .... Works only with meter registers that are magnetically coupled to base.
For other restrictions as well as how to attach sensor, see flux sensor appendix.
Pulse .... 499KΩ load; max 1kHz. Low pass filter set by software or keypad.
External vs. internal pullup set by software.
- External Pullup: Open collector: 3.3–30V; Push-pull: low <=0.5V, high >=3.5V.
- Internal Pullup: 3.3V; 6.04KΩ. Pulse source must be able to sink min 1.5mA.
4-20 mA .... 100Ω load. SMM can be wired as active (15V loop) or passive.
Volts .... 1MΩ Load; max measured volts = 16V; input protected up to 30V.

OUTPUT REQUIREMENTS

Encoder .... Sensus, Neptune, or Elster protocol (per factory installation).
Protocol must match SMM cable label and be enabled by SMM software.
2-Wire vs. 3-wire connection depends on wiring and software setting.
Pulse .... Pulse value and external vs. internal pullup set by software. 100Hz max.
- External Pullup: 3.3–30V, max 50mA; open collector.
- Internal Pullup: 15V; 10KΩ.
4-20 mA .... Active versus Passive set by wire connections.
- Active: 24 V. Max load depends on the SMM's power source:
  12V = 500Ω; 24V = 1000Ω.
- Passive: 7.5–36 V.
An optically isolated passive version can be specially ordered.
Volts .... Min load 1kΩ; max current 11mA.
Serial .... RS232 or RS485.

TECHNICAL SUPPORT

Contact us at: service@meter-master.com or 1-888-388-FLOW (3569).