

Smart Meter-Master Operating Instructions For Neptune Meters

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1. Overview and Software Installation

OVERVIEW

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

Neptune Compatibility

The SMM is compatible with the following Neptune Encoders:

- ProCoder™
- E-CODER®
- MACH 10®

Note: R900i models are not compatible due to a lack of access to wiring on fully-potted integrated models.

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. 24 power is required for 4-20mA applications.

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 to 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.
- 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 menu bar 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 the protective cap.** Make sure the 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 10.

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.

Labels on the wires indicate the type of input or output. Secure all cable conductors using waterproof connectors (e.g., Scotchlok). *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.
 - *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.

- *Pulse Width:* Default pulse width is 5ms. For higher input hertz, set width to 0. For unwanted pulses (pulse “bounce”), set pulse width longer.
- *Flux Sensitivity:* For weak magnetic signals, increase sensitivity. For extra unwanted pulses caused by electromagnetic interference, decrease sensitivity.

- **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).
 - *Zero the Sensor if values appear high or low.* To calibrate the zero setting, 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", then "Zero Sensor." The LCD should show "0".

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. 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.

- **Encoder Outputs:** The LCD screen shows the encoder digits sent as an encoder output.
 - *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.
 - *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.
 - *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. The pulses per interval are updated at the end of each measurement interval, so there is a lag of one measurement interval before you will see the pulse count of the prior interval.
 - *Pulse Output Width:* The pulses outputted to your device are spread evenly over the measurement interval *following* the interval where the pulses are counted.
 - *Pulse Outputs with Encoder Inputs:* The value of one pulse equals the value of the least significant encoder wheel being output by the register. 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.
- **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.

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), Flux Sensitivity, and Pulse Width. To change any of these settings, press "Menu," then "Change Settings." Select the setting desired and change the value.

- **Encoder Reading Intervals** (set through Software): When connecting the SMM to a Neptune C&I MACH 10, it is necessary to set the encoder reading intervals appropriately in order to maintain the meter's expected battery life. The C&I MACH 10's expected battery life of 10 years is based on the meter's typical operational parameters as well as providing AMR/AMI readings every 15 minutes.

Setting the intervals at too frequent of a rate can result in a less-than-expected battery life. Therefore, it is highly recommended to set the SMM reading interval between 300 seconds and 900 seconds when connecting to a C&I MACH 10 meter. Reading intervals below 300 seconds will result in the C&I MACH 10 battery having a life expectancy less than 10 years and will impact the meter's battery warranty.

Reading Interval	C&I MACH 10 Estimated Battery Life
5 secs	2 years
10 secs	3 years
15 secs	4 years
30 secs	7 years
60 secs	9 years
300 secs	10 years
600 secs	10 years
900 secs	10 years

4. Wiring Instructions

ENCODER ... For both inputs and outputs and for both 2-wire and 3-wire connections, wiring matches color code.

2-WIRE

Neptune 2-wire Encoder Connections	
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.

3-WIRE

Neptune 3-wire Encoder Connections	
SMM	External Device
Green	G (Green or White)
Red	R (Red)
Black	B (Black)

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	External Device
Red	Signal (+)
Green	Signal Return (-)
Black (Gnd)	(unused; protect wire end)

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

OUTPUT

SMM is Active (SMM is source of current)	
SMM	External Device
Blue	Signal (+)
White	Connect Red and White wires together.
Red (Pwr +)	
Green (Gnd)	Signal Return (-)

SMM is Passive (SMM is not source of current)	
SMM	External Device
Blue	Signal Return (-)
White	Signal (+)
Red (Pwr +)	(unused; protect wire end)
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.

VOLTSPlus-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").
 - **Start Running Total (Display-Only Outputs):** Begins a running total on the LCD display. Is enabled via software.
 - **Encoder 2W/3W (Encoder Inputs/Outputs):** Switches between 2-wire and 3-wire connections.
 - **Zero the Sensor (Analog Inputs):** Sets the zero value for analog inputs.
 - **Flux Sensor Sensitivity (Flux Inputs):** Switches between Standard, High, Low, and Sub-Low magnetic sensitivity.
 - **Pulse Width:** Changes minimum pulse width allowed for a pulse to be counted.
- **Input/Output Info:** Shows the main channel settings.
- **System & Diags:** Factory troubleshooting information.

6. Importing & Displaying Data (Logging Activated)

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 greater than 12.6 VDC in order to charge. 4-20mA requires 24 VDC.

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..... Neptune
 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.

Flux Sensor..... Works only with meter registers that are magnetically coupled to base.
 For other restrictions as well as how to attach sensor.

Pulse 499K Ω 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 \leq 0.5V, high \geq 3.5V.
- Internal Pullup: 3.3V; 6.04K Ω . Pulse source must be able to sink min 1.5mA.

4-20 mA 100 Ω load. SMM can be wired as active (15V loop) or passive.

Volts 1M Ω Load; max measured volts = 16V; input protected up to 30V.

OUTPUT REQUIREMENTS

Encoder..... Neptune
 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; 10K Ω .

4-20 mA Active by default (specially ordered passive option is optically isolated).

- Active: max load depends on SMM power source: 12V = 500 Ω ; 24V = 1000 Ω .
- Passive: 7.5–36 V (special order).

Volts Min load 1k Ω ; max current 11mA.

Serial RS232 or RS485.

TECHNICAL SUPPORT

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