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INTRODUCTION

General

The Q51MetriNet is a portable battery powered tool that supports many M-Node sensor applications. It can be used with permanently installed Q52 MetriNet systems, with any other logging system using M-Node sensors, or as a complete stand-alone data logger to run M-Node sensors directly.

Although the sensor list is always expanding, currently available M-Nodes are as follows:

Parameter	Range	Resolution
Free Chlorine	0–5.00 ppm	0.01 ppm
Combined Chlorine	0–5.00 ppm	0.01 ppm
Total Chlorine	0–5.00 ppm	0.01 ppm
Turbidity	0–40.00 NTU	0.01 NTU
pH	2–12 pH	0.01 pH
Conductivity	0–2000 μ S	1 μ S
ORP	0–1000 mV	1 mV
Nitrite	0–2.000 ppm	0.001 ppm
Dissolved Oxygen	0–20.00 ppm	0.01 ppm
Fluoride	0.1–10.00 ppm	0.01 ppm
Dissolved Ozone	0–5.00 ppm	0.01 ppm
Chlorine Dioxide	0–5.00 ppm	0.01 ppm
Peracetic Acid	0–200 ppm	1 ppm
Hydrogen Peroxide	0–20.00 ppm	0.01 ppm
Pressure	0–300 PSI	1 PSIG

The Q51 MetriNet communicates with individual sensor nodes using the Modbus RTU protocol. Each measuring node is a complete Modbus smart transmitter with a submersible multi-pin M8 connector on the back. If only one sensor is used, that sensor is connected directly to the Q51 MetriNet. If more than one sensor is used, sensors plug into a multi-sensor M-Node sensor bus bar, which is then connected to the instrument. Systems with more than 5 sensors require 2 bus bars.

The Q51 can also communicate wirelessly with a Q52 MetriNet using BLE (Bluetooth Low Energy) mode. This lets you perform all the same activities as it would if directly connected to the Q52.

M-Nodes are normally installed in modular flow chambers, secured with twist-lock pins on the front of the node. When used with the portable Q51 MetriNet, they can be used in the same flow chamber for periodic maintenance and calibration, or they can simply be placed into liquid filled beakers. Some sensors, like the Q32T turbidity sensor, may require flow-chamber mounting only, as they are required to operate under some amount of liquid pressure.

Flow chambers clamp together with locking rings on each end. Push-to-connect fittings are installed on each end but end fittings contains 1/8 inch NPT female threads to accommodate other fittings. The outlet side of the flow assembly normally contains a fixed-flow regulator to maintain a constant flow of 200 ml/min. when sample line pressure is 10–50 PSI (0.7–3.4 bar). A fixed and stable reading between 10–50 psig (0.7–3.4 bar) is required.

In operation, the Q51 MetriNet logs measurement data at an interval programmed by the user, from a minimum of every 1 minute to a maximum of 99 minutes. Data is stored in on-board non-volatile Q51 MetriNet memory which may be off-loaded with a PC using a USB cable and the Badger Meter Data Log Utility software on a PC.



Figure 1: Portable Q51 MetriNet with 1 meter cable and one M-Node sensor

SPECIFICATIONS

General Specifications

Displayed Parameters (for each M-Node)	Four digit node measurement (ppm, NTU, mV, for example) Sensor temperature –10.0 to 55.0 °C (14–131 °F) Other measurement displays on lower line dependent on specific sensor
Display	128 × 64 OLED graphic display, 2.24 in. (56.89 mm) × 1.14 in. (28.95 mm) viewable
Data Logger	Internal 4 MB SPI Flash memory. Data is removed via USB cable and special Badger Meter PC program.
Controls	4-key polycarbonate keypad, UV resistant coating
Power	Three AA batteries
Bus or Node Connection	Data cable with M8 waterproof connector, 3.28 ft (1 m)
Ambient Temperature	Controller Service, –20 to 60 °C (–4 to 140 °F) Sensor Node Service, –5 to 55 °C (23–131 °F) Storage, –5 to 70 °C (23–158 °F)
Ambient Humidity	0–95%, indoor/outdoor use, non-condensing to rated ambient temperature range
Environmental	RoHS Compliant
EMI/RFI Influence	Designed to EN 61326-1
Enclosure	ABS 94 - V0 rated enclosure; Includes silicone boot HWD: 3.29 in. (83.57 mm) × 5.59 in. (141.99 mm) × 1.89 in. (48.00 mm) with boot
Weight	0.95 lb (0.43 kg) with batteries
Bluetooth Low Energy (BLE)	The Bluetooth Low Energy (BLE) device is a Class 2 device where the distance can vary based on the installation environment but typically has a distance of 10 meters by line of sight.

Performance Specifications (M-Node)

Accuracy	Sensor-dependent
Repeatability	Sensor-dependent
Sensitivity	Sensor-dependent
Non-Linearity	Sensor-dependent
Warm-up Time	Sensor-dependent
Supply Voltage Effects	$\pm 0.05\%$ of range
Power	When running continuously in <i>Service</i> mode with one Q32P sensor, approximately 30 mA DC @ 4.6V DC, or 138 mW. Off-state leakage current approximately 12 μA. When running in data logger mode, the instrument shows the same 30 mA DC @ 4.6V DC or 138 mW when a user is calibrating or configuring a single Q32P sensor. However, the instrument operates in ON-OFF cycles in data logger mode, and automatically drops to a <i>sleep</i> mode during non-measurement times and after display time-out occurs. During sleep, the instrument consumes only about 1.4 mA @ 4.6V DC, or about 6.4 mW. NOTE: Other than the Q32T, all other M-Node sensors consume approximately the same power. The Q32T consumes about 2x the power of the standard M-Node.
Run Time/Service Mode	Battery operating time is highly dependent on user settings, type and number of sensors and how often instrument is used. Typical 5 hours per week with one Q32P: >3 months. Continuous running with one Q32P: 2 to 3 days. NOTE: Assumes 2500 mA AA-alkaline batteries used. Other than the Q32T, all other M-Node sensors consume approximately the same power. The Q32T consumes about 2x the power of the standard M-Node.
Run Time/Data Log Mode	Battery operating time is highly dependent on user logging settings and type and number of sensors. The OLED display is OFF the majority of the time in data logger mode. A sleeping Q51 MetriNet consumes about 1.4 mA @ 4.6V, or 6.4 mW. Active current, or "pulse power," then adds to that to calculate final average power over some period of time. Calculating this total power can be a little complex as the pulse of high current must be average over some period of sleep time. Batteries see average power. Some typical power examples based on user settings: 1. One Q32P sensor, sensor delay 10 sec, log interval 15 min. So the Q51 MetriNet + Q32P consumes 13 mA @ 4.6V when active for only 10 seconds per 15 min. Average active power per hour is then 0.6 mW. Add baseline sleep power of 6.4 mW for a total average power of 7 mW. Run-time estimate of 1645 hours or about 2 months. 2. One Q32P sensor, sensor delay 10 sec, log interval 1 min. So the Q51 MetriNet + Q32P consumes 13 mA @ 4.6V when active for only 10 seconds per minute. Average active power per minute is then 10 mW. Add baseline sleep power of 6.4 mW for a total average power of 16.4 mW. Run-time estimate of 701 hours or about 30 days. 3. Three sensors, Q32P, Q32T, Q32H0, sensor delay 30 sec, log interval 15 min. So the Q51 MetriNet + Q32P/Q32T/Q32H0 consumes 35 mA @ 4.6V when active for only 30 seconds per 15 minutes. Average active power is then 5.4 mW. Add baseline sleep power of 6.4 mW for a total average power of 11.8 mW. Run-time estimate of 974 hours or about 40 days. NOTE: Display is off in all cases above. Assumes 2500 mA AA-alkaline batteries used. Other than the Q32T, all other M-Node sensors consume approximately the same power. The Q32T consumes about 2x the power of the standard M-Node. The biggest influence in battery life for data logger mode is how often samples are taken, as all sensors are powered up at that time.



Equipment bearing this marking may not be discarded by traditional methods in the European community after August 12, 2005, per EU Directive 2002/96/EC. End users must return old equipment to the manufacturer for proper disposal.

CALIBRATOR DIAGRAM

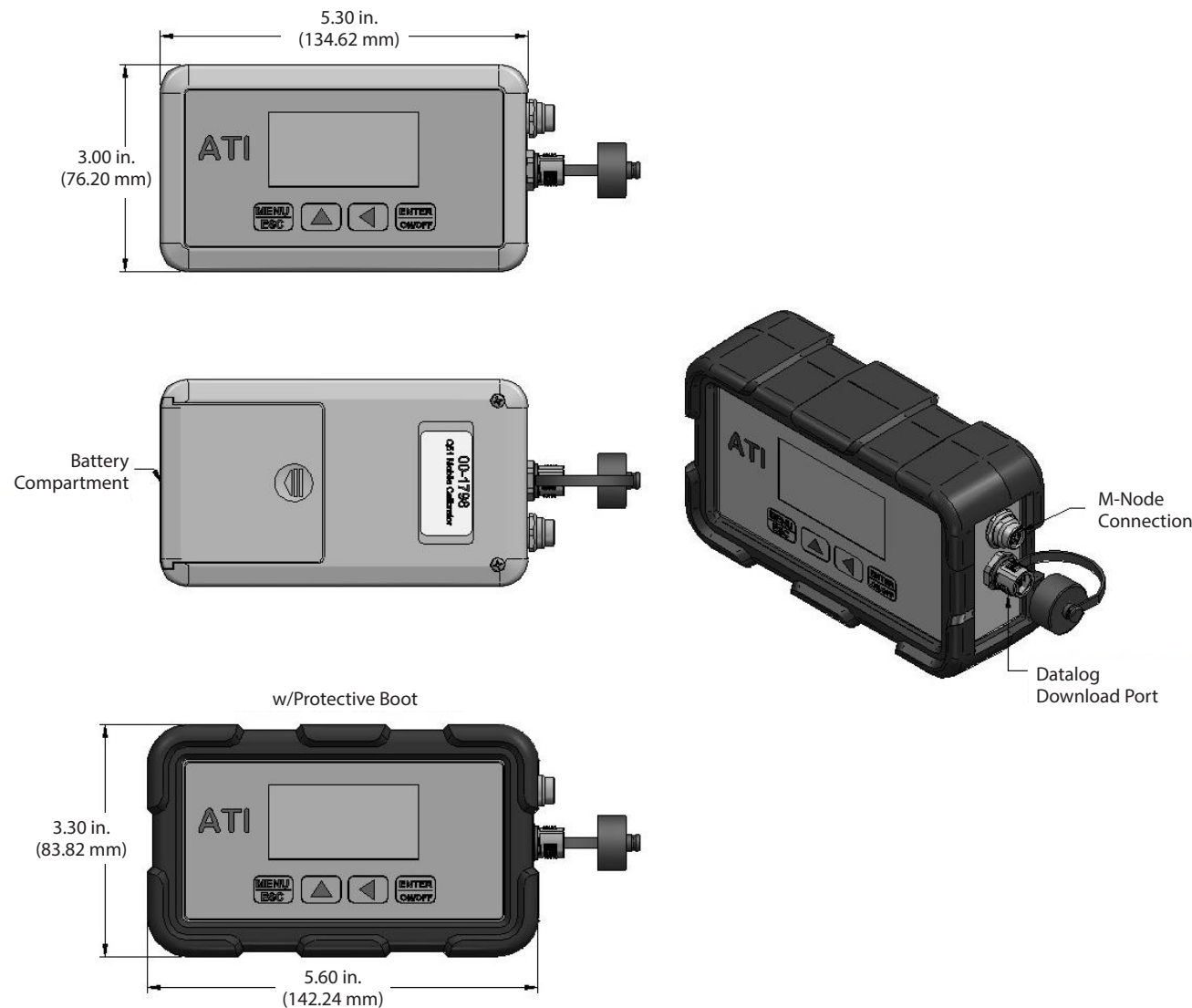


Figure 2: Calibrator diagram

OPERATION

General

The portable Q51 MetriNet operates in three distinct modes of operation: *Service* (Srv), *DataLog* (DLog) and *Bluetooth Low Energy* (BLE mode. These modes are selected the moment the instrument is first turned ON.

- *Service* mode is for general calibration and configuration of M-Node sensors.
- *DataLog* mode is selected to create a complete remote data logger system.
- *BLE* Mode is Bluetooth Low Energy mode used for wireless connection to the data logger system.

Power and Battery

To turn the instrument ON, momentarily press and hold **ON/OFF** key. To turn the instrument OFF, press and hold the **ON/OFF** key for 7 seconds. The query "Shut Down?" appears, with "NO" displayed. Change "NO" to "YES" and press **ENTER**.

The display has a battery icon in the upper right corner that indicates how much battery life remains. This symbolic representation varies based upon the measured battery voltage. In addition, one of the lower *INFO* screens displays the specific battery voltage level. The unit operates down to about 2.7V of total battery voltage. Battery life examples are shown in the ["Performance Specifications \(M-Node\)" on page 6](#).

If the instrument is plugged into a USB host device and is currently OFF, the display periodically displays the message "Bus Power On." The instrument is in *sleep* mode when plugged into USB power, as the USB connection is only used for off-loading data. However, the sensor bus power is turned on, so the unit can be used in this way to polarize sensors without using up battery power.

In *Service* mode, the display and sensor measurement remains active until the instrument is turned OFF, or until no key is pressed for 30 minutes. After 30 minutes of no key press, the instrument automatically shuts down.

Battery Replacement

Batteries are easily replaced by removing the protective boot, and then sliding off the lower battery cover.



Figure 3: Battery replacement

Instrument Interface

The user interface for the portable Q51 MetriNet consists of a graphical OED display and a membrane keypad. All functions are accessed from this user interface.

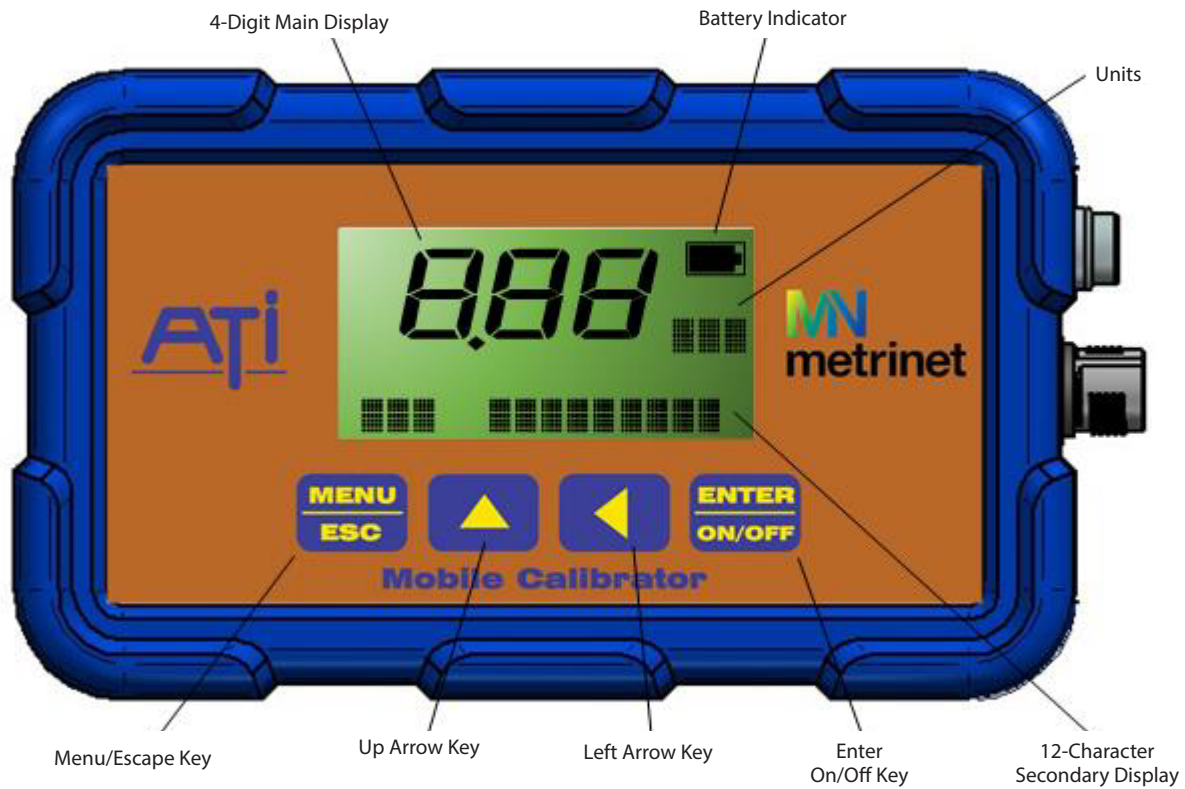
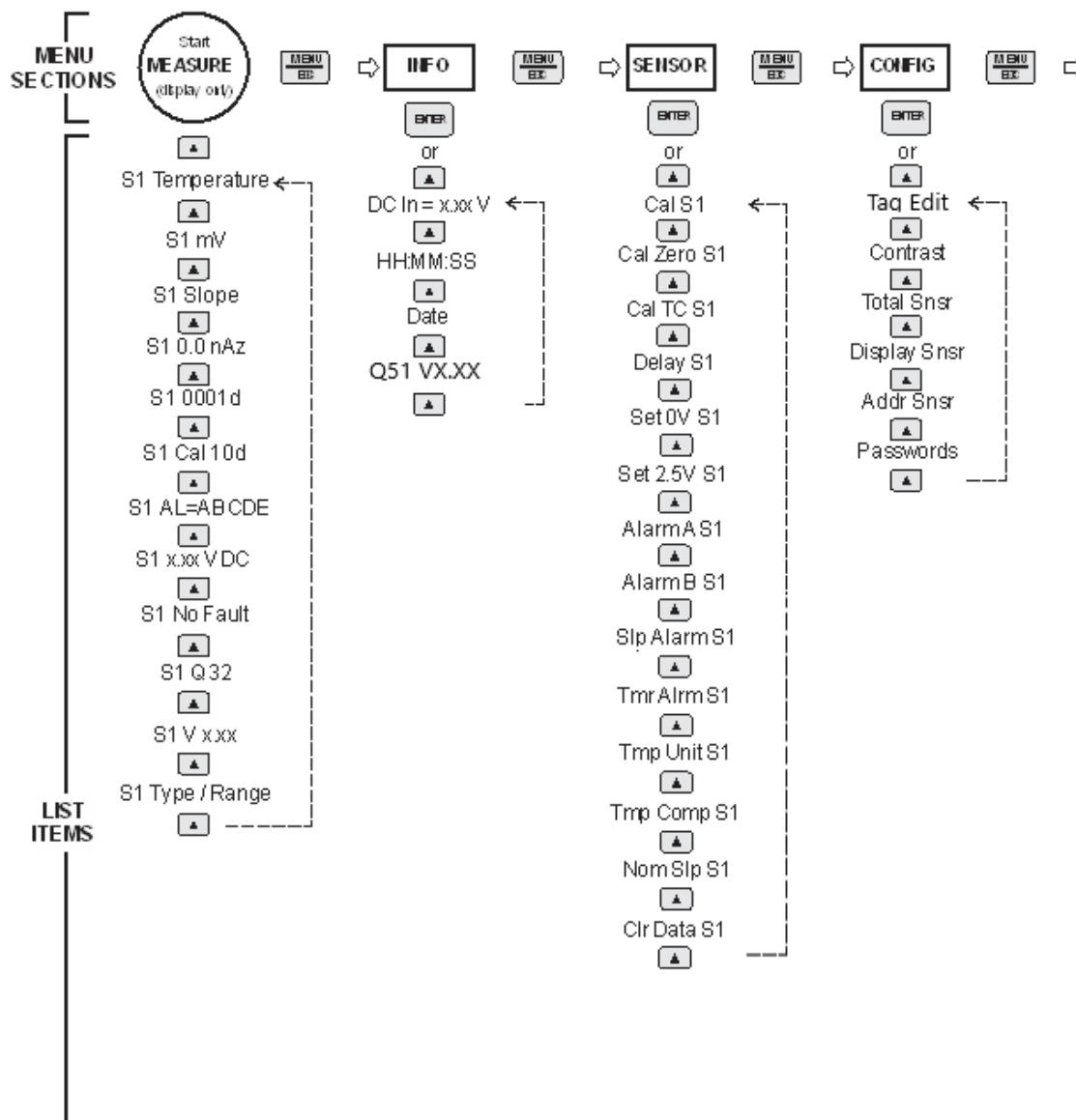


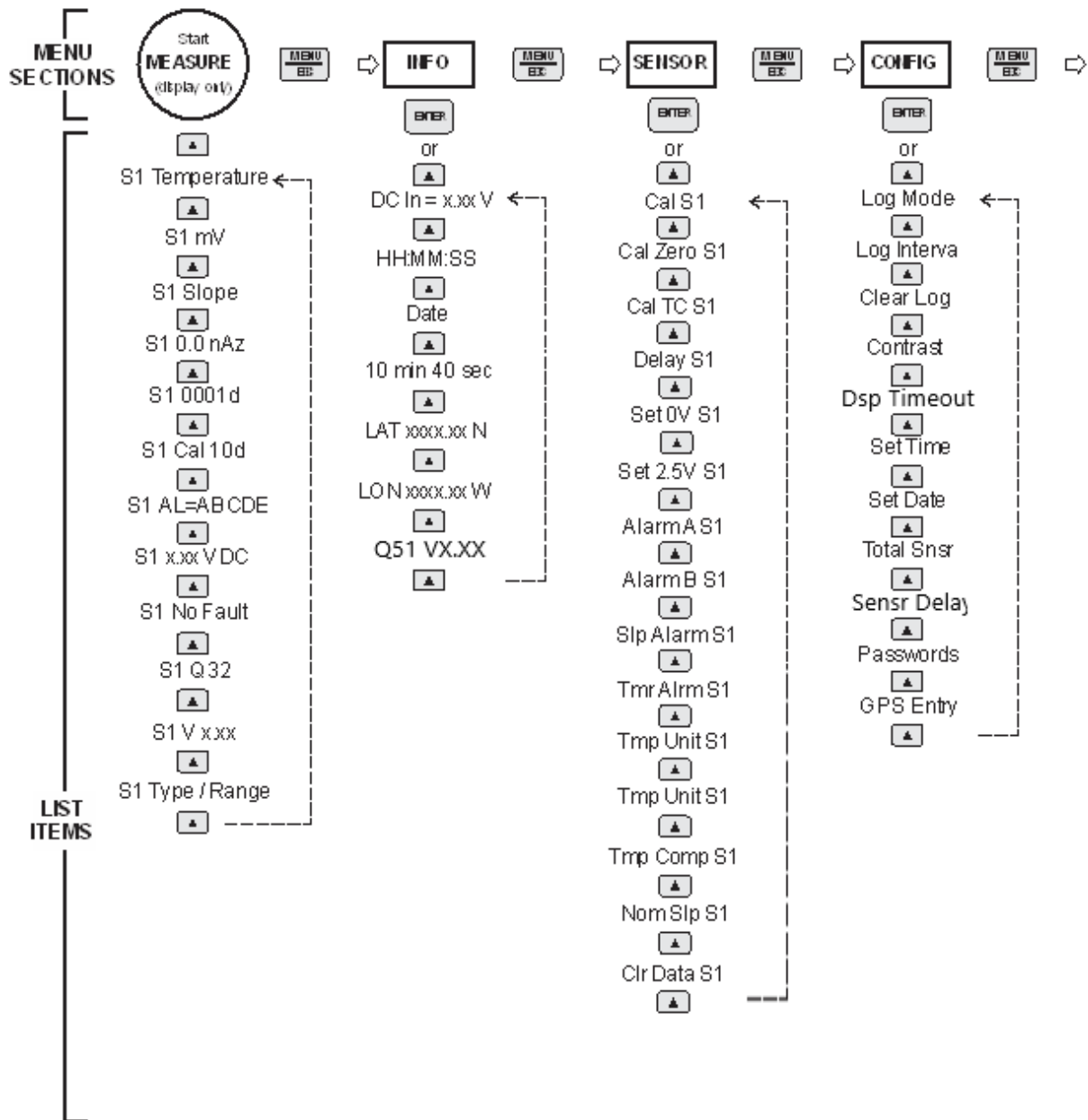
Figure 4: Portable MetriNet interface

The interface is organized around the four main menu sections: *MEASURE*, *INFO*, *SENSOR* and *CONFIG*. The *MEASURE* and *SENSOR* menu displayed data is controlled by the individual M-Node sensor, while *INFO* contains display-only information about the Q51 MetriNet system. The *CONFIG* menu contains Q51 MetriNet setup parameters. Depending on the mode of operation, the software map appears in two different arrangements.



NOTE: S1 refers to sensor position. Additional fields appear depending on the number of sensors installed. These fields can be accessed by pressing the **LEFT** arrow on the display panel.

Figure 5: Service mode software map



NOTE: S1 refers to sensor position. Additional fields appear depending on the number of sensors installed. These fields can be accessed by pressing the **LEFT** arrow on the display panel.

Figure 6: Data log mode software map

MEASURE Menu

The default menu is *MEASURE*. This menu is display-only. When left alone, the unit returns to the *MEASURE* menu after 30 minutes. The lower line information applies to the node currently displayed. To look at information on an individual node, press the **LEFT** arrow key. After selecting the node you wish to look at, use the **UP** arrow key to scroll through variables on the lower display line. The information is not exactly the same for every node but includes the following:

NOTE: The S1 designation means sensor #1 and changes for each sensor.

S1 25.7 °C	Temperature display. Can be displayed in °C or °F, depending on user selection.
S1 32.0 nA	Raw sensor data. Could be mA, mV or other.
S1 100%	Sensor output response vs. ideal calibration. Also referred to as sensor “slope” and indicates sensor condition. Value updates after each calibration.
S1 0.0 nAz	Sensor output current at a zero ppm input. Value updates after a zero-calibration.
S1 0001d	Sensor life run-time in days. Indicates how long the sensor has been in operation.
S1 Cal 10d	Calibration timer. Indicates number of days since last calibration.
S1 AL=ABCDE	Alarm indicator. Shows which alarms are active.
S1 2.50V DC	Sensor voltage output. (Only shown for Q32 sensors.)
S1 No Fault	Sensor fail message to define detected fault condition.
S1 Q32H0	Sensor model number.
s1 VX.XX	Sensor firmware version.
S1 Res Clr/0 - 5.00	Identifies type of measurement and overall range. Display alternates between measurement type and range. This is the text <i>TAG</i> field, and it can be modified in some newer sensors.

To manually sequence through the M-nodes, press the **LEFT** arrow key. By pressing the **LEFT** arrow key repeatedly, you can cycle through all S1–S8 measurements. If no key is activated for 30 minutes, the display reverts to scan mode. When you select a specific S-# sensor using the **LEFT** arrow key, you can then sequence through the information screens on the bottom line using the **UP** arrow key.

Once you have selected a specific node, you can go to the *SENSOR* menu for that node by pressing **Menu** twice. From the *SENSOR* menu, you can adjust sensor zero and sensor span, calibrate temperature, set alarms and adjust other settings.

NOTE: If passwords are enabled, you must enter your password in order to make sensor adjustments.

INFO Menu

The *INFO* menu provides some basic reference-only information on the Q51 MetriNet, also called the Q51. Since the portable Q51 MetriNet runs in two distinct modes, *Service* and *DataLog*, the display here changes slightly based on which mode is running.

INFO items shown in Srvc Mode:

13:59:40	Hour/Minute/Seconds time in 24-hour format.
Jan 20, 2000	Current date.
Q51 Ver X.XX	Q51 software version number.
DC In = 4.6	Measured DC input voltage (from battery or power supply).

INFO items shown in Dlog Mode:

13:59:40	Hour/Minute/Sec time. 24-hour format.
Jan 20, 2000	Current date.
10min 40sec	Time until next data point is recorded.
LAT 1234.56N	User entered latitude position.
LON 1234.56W	User entered longitude position.
Q51 VX.XX	Q51 software version number.
DC In = 4.6	Measured DC input voltage from battery supply.
BLE	Bluetooth Low Energy mode, used for wireless communication with the MetriNet Controller.

SENSOR Menu

The *SENSOR* menu provides all M-Node sensor configuration and calibration functions. This menu information largely originates from sensor memory and *there is some variation in the exact menu displays from sensor type to sensor type*. The information below illustrates a Free Chlorine sensor as an example.

The functions outlined below allow users to adjust various parameters and calibrate sensors. When making adjustments, pressing **Enter** normally starts the process. Values may be adjusted using the **UP** and **LEFT** arrow keys. Pressing **Enter** again accepts the changes. Pressing **Menu/Esc** during a routine cancels the adjustment and go back to the starting screen.

Cal Chlr S1	Calibration routine for sensor span adjustment.
Cal Zero S1	Calibration routine for sensor zero adjustment.
Cal TC S1	Temperature calibration routine.
Delay S1	Routine for adjustment of sensor “damping” or response time.
Set 0V S1	Routine to adjust zero value for 0–2.5V output. No adjustment necessary for sensors used with MetriNet systems. Used to set up sensors for other applications. Q32 sensors only.
Set 2.5V S1	Routine to adjust full scale value for 0–2.5V output. No adjustment necessary for sensors used with MetriNet systems. Used to set up sensors for other applications. Q32 sensors only.
Alarm A S1	Setpoint for Alarm A. User may define an alarm limit above which the A alarm is shown in the <i>MEASURE</i> menu.
Alarm B S1	Setpoint for Alarm B. User may define a second alarm limit above which the B alarm is shown in the <i>MEASURE</i> menu.
Slp Alrm S1	User may define a “slope” alarm limit. If the sensor slope falls below that limit after a calibration, Alarm C is shown in the <i>MEASURE</i> menu.
Tmr Alrm S1	User may define an alarm limit for the time between calibrations. If a calibration is not done within the defined time period, Alarm D is shown in the <i>MEASURE</i> menu.
Tmp Unit S1	Allows temperature reading in °C or °F.
Tmp Comp S1	Allows modification of sensor temperature compensation.
Nom Slp S1	Normalizes slope to 100%. May be done after a sensor has been serviced and calibrated for the first time.
Clr Data S1	Resets all sensor stored data to factory default values.

CONFIG Menu

The *CONFIG* menu provides access to the Q51 MetriNet system configuration settings. Routines defined here are not sensor specific. Since the portable Q51 MetriNet can be operated in one of two modes, *Service* or *DataLog*, the menu listing appears slightly different in either case, as different functions are required.

Menus shown in Srv Mode:

Tag Edit	Editor for <i>TAG</i> name in M-Node sensor.
Contrast	Sets <i>OLED</i> graphic display contrast level.
Total Snsr	Sets total number of sensors, 1–8, that the system queries.
Disply Snsr	Displays whether sensor 1–8 is readable.
Addr Snsr	Configures unique slave address of sensor.
Password	Sets system user passwords.

Menus shown in Dlog Mode:

Log Mode	Configures data log to either wrap or fill.
Log Interval	Sets measurement time period.
Clear Log	Clears old data from stored measurement memory.
Contrast	Sets <i>OLED</i> graphic display contrast level.
Dsp Timeout	Sets the amount of time display stays active after last key press.
Set Time	Sets current time of day.
Set Date	Sets current date.
Total Snsr	Sets total number of sensors, 1–8, that the system queries.
Sensr Delay	Sets the amount of time sensor is running before measuring.
Password	Sets system user password.
GPS Entry	Sets location.

Details on Individual Srvc/Dlog Menus:

Tag Edit	Used to edit the <i>Tag</i> field in the M-Node sensor. The tag editor function allows the user to edit the sensor tag field (two-line text string) in the M-Node sensors. The <i>Tag Edit</i> function is only available in the <i>Service</i> mode. 1. In the <i>CONFIG</i> menu, select <i>Tag Edit</i> and press ENTER. 2. The available characters that may be entered are displayed. On the lower line of the display, the tag stored in the selected sensor is displayed. The character that is blinking is the character that is changed or overwritten. The underlined character is the character that is selected. Use the UP arrow key to select the line, and the LEFT arrow key to move the characters on the selected line to the underlined position. 3. Press the ENTER key to select the character. The blinking character advances to the next position. 4. When finished editing the lower line, press the MENU key. 5. The unit prompts to "Write Data? (Yes/No)." Change the "Yes/No" prompt using the UP arrow key, then press ENTER.
Contrast	Used to adjust display contrast. Default is 1. Range is 1–8. Lowest value consumes the least amount of power.
Total Snsr	1–8. Total sensors connected. 1. Press Menu key to access <i>CONFIG</i> menu. 2. Press UP arrow key until lower line display shows "Total Snsr." 3. Press Enter and the main number on the display flashes. 4. Use the UP arrow key to adjust the flashing number to the total number of sensors in your system and then press Enter.
Display Snsr	Tests communication to each sensor. Press Enter to test the status of comms for each sensor. Sensors found indicate "Yes" while sensors not found indicate "No." Press Enter again to exit.
Addr Snsr	Each measurement node must have a unique sensor number. By default, all sensors shipped from Badger Meter are set to sensor #1. If there is more than one sensor in your system, a new sensor number must be assigned to each additional sensor. Only one sensor can be connected to the Q51 during this address setting operation. BEFORE SETTING ADDRESS, make sure you have correctly set the total numbers of sensors being used, as that setting limits the addresses you can enter here. NOTE: This menu does not appear if more than one sensor is connected to sensor bus. 1. Press Menu key to access <i>CONFIG</i> menu. 2. Press the UP arrow key 5 times to access "Addr Snsr" and then press Enter. 3. The display flashes "NO." Press UP arrow once for "YES" and press Enter. 4. The controller shows the current sensor number assigned to that node and it flashes. Use the UP arrow key to set the required sensor number and press Enter. 5. Repeat steps 1–4 for each M-Node in the system until you have assigned a unique number to each one.
Passwords	0000. A single 4-digit password. The Q51 MetriNet is designed with a single level of password protection to prevent unauthorized adjustments. The password is numerical, consisting of 4-digit numbers. As shipped, the Q51 MetriNet is not password protected. The user must decide whether to use password protection or not. 1. Go to <i>CONFIG</i> menu and press UP arrow repeatedly until bottom line indicates "Password." 2. Press Enter. Display shows 0000 with right digit flashing. Using the UP and LEFT arrow keys, enter a 4-digit supervisor password. 3. Press Enter and that number is recorded. NOTE: Consult Factory for password reset instructions, if forgotten.

Log Mode	Continuous/Full. Data held in flash memory may be recorded until the memory is full or it may be stored in a circular file, with the oldest data overwritten by the newest data once the memory is full. The selection is made here. Choosing "Cont" selects a circular file mode of operation. Selecting "Full" stops the data logging when the memory is full.
Log Interval	1–120 minutes. Interval of measured data storage.
Clear Log	"YES/NO." This routine clears all data stored in flash memory. Once cleared, it cannot be recovered. Verify that all data has been saved (or is not needed) prior to clearing the log.
Display Timeout	15 sec, 30 sec, 1 min, 2 min, 5 min, continuous. Enter the time to shut off display after no key press. This is a power saving feature used to disable display during logging mode.
Set Time	Used to program current time. After pressing Enter , use a combination of the UP arrow and Enter keys to adjust hours, minutes and AM/PM. Hours 1–12 Minutes 0–59 AM/PM AM/PM
Set Date	Used to program current date. After pressing Enter , use a combination of the UP arrow and Enter keys to adjust year, month and day. Year 00–99. Enter current year Month 1–12. Enter current month Day 1–31. Enter current day
Sensor Delay	0–99 seconds. A delay time before sensor is read, after sensor has been powered up. This is used in datalogging mode when instrument is cycling on and off. NOTE: The Q32T requires a sensor delay of at least 25 seconds after power up.
GPS Entry	Manual entry of GPS Latitude and Longitude Data. Lat Degrees Range is 0–90. Enter the first two digits (DD) of the Latitude. Format for Latitude is DDMM.MM N/S. Lat Minutes Range is 00.00– 99.00. Enter the next four digits (MM.MM) of the Latitude. Lat N-S Enter N for North, enter S for South. Lon Degrees Range is 0–90. Enter the first three digits (DDD) of the Longitude. Format for Longitude is DDDMM.MM E/W. Lon Minutes Range is 00.00–99.00. Enter the next four digits (MM.MM) of the Longitude. Lon E-W Enter E for East, enter W for West.

SERVICE MODE OPERATION DETAILS

General

As the Q51 MetriNet instrument operates in three distinct modes of operation: *Service (Srv)*, *DataLog (DLog)* and *Bluetooth Low Energy (BLE)* mode, this section gives specific information on the use of the instrument in the *Service* mode using an example.

Individual M-Node Service

The primary usage of the portable MetriNet is to simply service or configure a single M-Node sensor. Only one sensor is connected, and it appears on the instrument at address 1–8 if the instrument is set to 8 total sensors. Once the sensor is connected to the instrument, the user simply scrolls through S1–S8 on the front *MEASURE* display until they see a valid sensor at a valid S address. From there, they can access all the internal menus of the sensor and configure or calibrate that single sensor.



Figure 7: Single M-Node calibration in beaker

An example of operation:

1. Make sure the Q51 MetriNet is set to 8 total sensors.
2. Connect one sensor.
3. Turn Q51 MetriNet ON, and select *SRVC* mode operation.
4. Once the Q51 MetriNet display comes up, it shows sensor S1 data, or "Err" as no sensor is detected at S1.
5. If this S1 is not the same as the sensor address connected, simply press the **LEFT** arrow key to move from S1–S2, S3 and so on. When valid data appears, this is the address of the connected sensor.
6. You may now operate all the sensor menus in the *SENSOR* menu listing to fully configure the sensor.

NOTE: The Q51 MetriNet only allows you to scan the number of sensors configured in the menu $\wedge$ *Total Sensors*.

Multi-Sensor M-Node Service

The Q51 MetriNet operates like the main Q52 MetriNet controllers that a full bus of up to 8 sensors can be scanned. All sensors must have their own unique address setting, 1–8. In this mode of operation, the user can simply disconnect the master cable from a Q52 MetriNet system and plugs in the master cable from the Q51 MetriNet portable system. Now, they can configure any sensor in the group. You must not attempt to change addresses in this mode, or errors can be created if there is already a sensor on the bus at the same address. Address changes should only be made with one sensor connected at a time.



Figure 8: Bus operation of several M-Node sensors

WIRELESS BLUETOOTH OPERATION DETAILS

General

As the instrument operates in three distinct modes of operation: *Service (Srv)*, *DataLog (DLog)* and *Bluetooth Low Energy (BLE)* mode, this section gives specific information on the use of the instrument in the *BLE* mode.

The Q51 is equipped with BLE (Bluetooth Low Energy) that enables it to wirelessly connect with any nearby Q52 that has Bluetooth capability turned on. Bluetooth Low Energy allows for devices to connect and communicate over short distances using less power than standard Bluetooth, which is very useful when using battery powered devices such as a Q51 or Q52.

A Q51 using BLE is very useful when you want to do a quick check on a Q52 or want to do remote calibrations. This is particularly helpful if the unit is in a tough-to-reach spot or may be inside of an enclosure or bollard and you do not want to open or take the cover off the unit.

If there is more than one Q52 device located nearby it is highly recommended that you give each of them a unique ID so that you can easily identify which unit you are connecting to with the Q51.

Connecting Q51 to Q52 Monitor

1. Power up the Q52 monitor.
2. Turn on the Q51 and press the **UP** arrow to select the *BLE* mode. Press **ENTER**.



Figure 9: Selecting BLE operating mode

3. The message "Start Scan?" displays. Press the **UP** arrow to select **YES**, and then press **ENTER**. The Q51 displays "----" during the scan process.



Figure 10: Select to start scan process

- After the Q52 is found, the Q51 displays "1 device found." Press **ENTER**. The Q51 displays the Q52 Unit ID that was found.



Figure 11: Displaying unit ID for the Q52

- Press **ENTER** to connect to the Q52 monitor.



Figure 12: Connecting to the Q52 monitor

6. When connected, the Q51 displays the Q52 display data, and the Q51 keypad functions just like the Q52 keypad.

Disconnecting Q51 from Q52 Monitor

1. Press and hold **ESC** until the disconnect prompt appears.
2. Select either **YES** and then press **ENTER**, OR press and hold **ENTER** until the shutdown prompt appears. Select **YES** and then press **ENTER** to power off the Q51.



Figure 13: Disconnecting Q51 from Q52

Troubleshooting

If the Q51 does not find and connect with the Q52, repeat the procedure. If a connection cannot be made, make sure both the Q51 and Q52 have fresh batteries.

If Q51 does not find any connected devices, check that Bluetooth is enabled on the Q52 that you want to connect to. If you have multiple Q52 units make sure that each one is assigned a different, unique ID so that you can easily identify the unit you wish to connect to with the Q51.

DATALOG MODE OPERATION DETAILS

General

As the instrument operates in three distinct modes of operation: *Service (Srv)*, *DataLog (DLog)* and *Bluetooth Low Energy (BLE)* mode, this section gives specific information on the use of the instrument in the *Data Log* mode using several examples.

DataLog mode would be used in cases where the Q51 MetriNet might be deployed for a period of time to gather data from 1–8 sensors. It can run for up to 30 days in *cycle* mode operation, cycling and collecting data much like the Q52 MetriNet.

NOTE: The instrument is always in *cycle* mode of operation during data logging. So, the instrument only has an active display when a key is touched. The display is shut down and the unit goes to sleep in between measurement interval times to save power.

The display remains active for the *Display Timeout* time, and then shut down to conserve power. The instrument is still operating during this display-off time. The timer restarts any time a key is pressed. Once the display is active again, the sensors powers up and reads continuously, so that the user can scroll through them. Once the timer times out, the display turns off and the sensor power turns off, waiting for the next cycled measurement time. The *cycle* mode begins to wake up and poll the sensors at the selected *Log Interval*. Each time the sensor(s) are read, the data is written to the data log flash memory.

Data File Format

Data is stored inside the Q51 MetriNet in a standard *.CSV format. Data can be easily displayed and analyzed using Excel or other spreadsheet programs. [Figure 14](#) is part of a typical data file that has uploaded to the Badger Meter Q51 Data Utility.

AutoSave

Q51_data.csv - Saved

Jon McClain

FileHomeInsertDrawPage LayoutFormulasDataReviewViewHelp

Search

ShareComments

Paste

Clipboard

Font

Alignment

General

\$ %

Number

Conditional Formatting

Format as Table

Cell Styles

Cells

Editing

Ideas

R1

Q51 Data Record

Supply Voltage

Latitude

Longitude

Probe Type

Date

HH:MM:SS Temp

Sensor 1

Sensor 2

Sensor 3

Sensor 4

Sensor 5

Sensor 6

Sensor 7

Sensor 8

Q51_data

1	Q51 Data Record																	
2	Supply Voltage	5																
3	Latitude	000.00N																
4	Longitude	000.00E																
5																		
6																		
7	Probe Type																	
8	Date	HH:MM:SS Temp	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7	Sensor 8								
9	10/22/2019	8:01:39	25000	6180	1400	100	0	0	0	0	0							
10	10/22/2019	8:02:39	25000	6170	1400	100	0	0	0	0	0							
11	10/22/2019	8:03:39	24998	6180	1400	100	0	0	0	0	0							
12	10/22/2019	8:04:39	25000	6180	1395	100	0	0	0	0	0							
13	10/22/2019	8:05:39	25000	6180	1395	100	0	0	0	0	0							
14	10/22/2019	8:06:39	24999	6180	1399	100	0	0	0	0	0							
15	10/22/2019	8:07:39	24999	6190	1400	100	0	0	0	0	0							
16	10/22/2019	8:08:39	24999	6190	1400	100	0	0	0	0	0							
17	10/22/2019	8:09:39	25000	6190	1399	100	0	0	0	0	0							
18	10/22/2019	8:10:39	25000	6190	1400	100	0	0	0	0	0							
19	10/22/2019	8:11:39	25000	6190	1400	100	0	0	0	0	0							
20																		
21																		
22																		
23																		

Figure 14: Raw data format

All data is stored as 16-bit data with 4 decimal resolution. In order to convert raw data to actual engineering units, simply divide each value by 1000. So, 7140 would represent 7.140 pH for a Q32P sensor. Since each instrument can accommodate up to 8 nodes, zero values are stored for each unused sensor input. Data manipulation such as appending files and generating graphical reports is left to the user.

The time period required to fill the memory depends on how many nodes are connected and how often data is stored. A controller with a maximum of 8 nodes logging data every 6 seconds can store 48 hours of data. That's about 230,000 data points. A more typical application with 4 M-Nodes taking data once every 10 minutes holds about 239 days of data.

Data held in flash memory may be recorded until the memory is full or it may be stored in a circular file, with the oldest data overwritten by the newest data once the memory is full. The selection is made in the "Log Mode" routine of the *CONFIG* menu. Choosing "Cont" selects a circular file mode of operation. Selecting "Full" stops the data logging when the memory is full.

Data Logging Example

As an example of a logging set up, consider a 3-sensor example, Q23H, Q32P, Q32T. This example assumes time and date are already correct, and GPS entered location is correct, if even required.

1. **Turn on Q51 MetriNet and enter Dlog mode.**

2. **In CONFIG, set ^Log Mode to Cont.**

This means our storage log is in continuous mode.

3. **In CONFIG, set ^Log Intrval to 15 Min.**

This is how often we power up the sensors and take a measurement. Battery power is consumed much faster at a lower interval rate.

4. **In CONFIG, set ^Dsp Timeout to 15 seconds.**

This is how long the display stays active after the last key is pressed. Battery power is consumed much faster at a higher timeout value.

5. **In CONFIG, set ^Sensr Delay to 25 seconds.**

This is how long the sensors stays powered up before a reading is recorded. Most sensors only require about 5–10 seconds for a valid reading after power up. However, the Q32T sensor needs at least 25 seconds before a reading can be produced, so we have to account for that requirement. Battery power is consumed much faster at a higher delay value.

Once set up, simply leave the Q51 MetriNet in a safe location connected to the sensors and it continually records data, cycling ON and OFF. The sensors are not active all the time. They are powered ON and OFF as required to save maximum power. Our 3 sensor example above runs for roughly 30 days on a fresh set of AA alkaline batteries. Quality rechargeable AA batteries like Panasonic Eneloop may also be used and are highly recommended. The run-time of the unit is highly dependent on the user settings above, and also on the number and type of sensors being used.

Badger Meter Data Utility

First, the Badger Meter free data management software must be installed. Install the Windows program to any Windows PC prior to connecting the Q51 portable MetriNet. The free software utility is located for download here:

<https://www.badgermeter.com/software-firmware/>

NOTE: When installing the software onto your PC, make sure you have internet access as the installation utility may look for drivers needed for the program to run that may not be on your PC during the installation. Also, when you connect your PC to the Q51 MetriNet for the first time, your PC may need to install the driver for the virtual com port needed to communicate with the Q51 MetriNet. Once all drivers are installed, everything works even if your PC is not connected to the internet.

Data Off-load

1. To remove data, first turn OFF the Q51 MetriNet.
2. Make a connection via any USB cable to the Badger Meter Q51 instrument. Any USB cable along with the Badger Meter Q51 DataLog Utility is used to remove data stored on the Q51 MetriNet instrument.

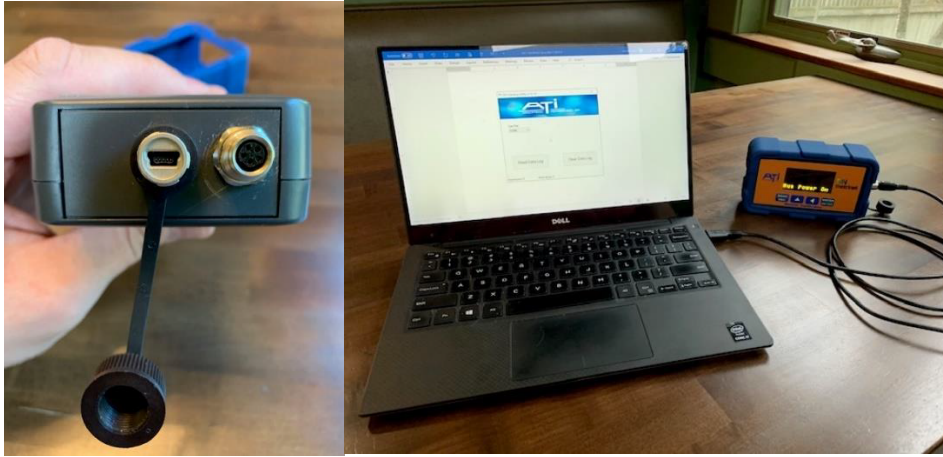


Figure 15: Connecting Q51 MetriNet to Windows PC via USB

3. Once software is installed and Q51 MetriNet is connected to that PC, launch the Q51 DataLog Utility. The screen below displays. Click on **Read Data Log**.

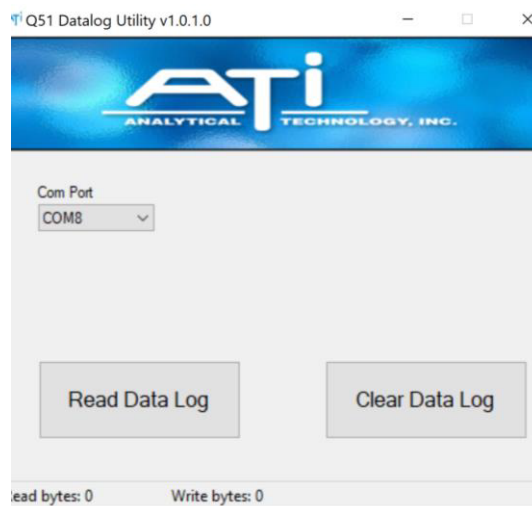


Figure 16: Badger Meter (ATI) Q51 Datalog utility

- When the window displays for the location of data storage, enter a name for the file and click **Save**. The default location for data is **C:/This PC/Documents/Analytical Technologies/Q51 Datalog Files/**.

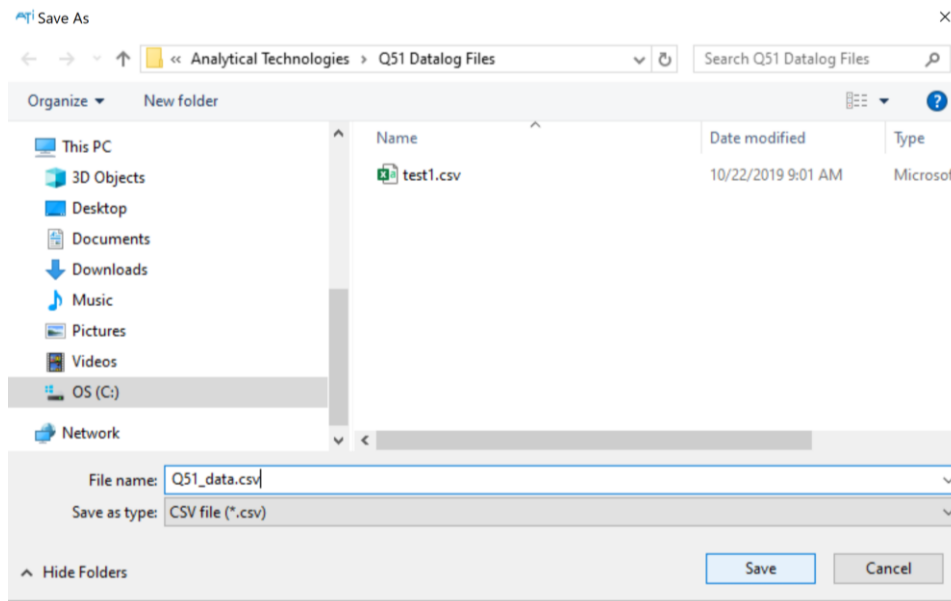


Figure 17: Storing Q51 Datalog file

- When a confirmation message states the file has been saved, close the window to finish program.

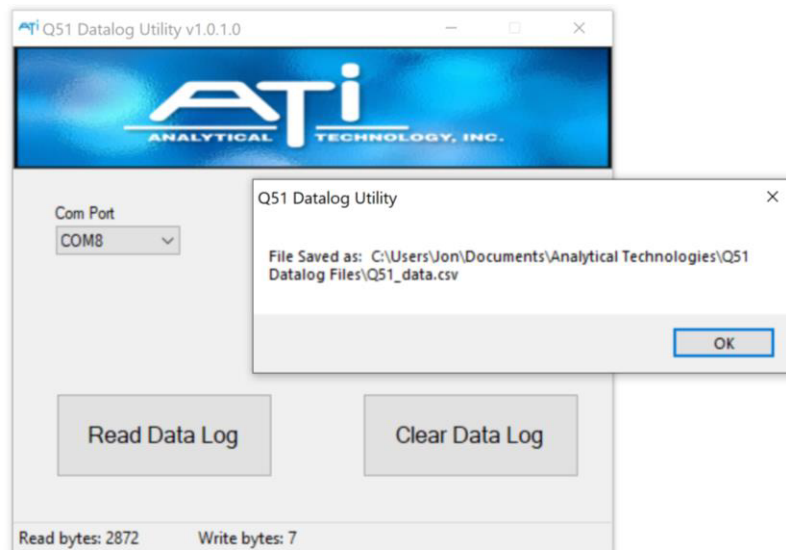


Figure 18: Confirmation of Q51 Datalog file storage

NOTE: Clicking on **Clear Data Log** permanently removes all data memory from the Q51 MetriNet, like the *Clear Log* function on the instrument.

SPARE PARTS

Part No.	Description
Electronics	
00-1798	M-Node Calibrator
Spare Sensors, Spare Sensor Components & Flow System	
Refer to the MetriNet Controller user manual.	
Cable Assemblies	
31-0216	USB, 2.0, A/B (mini)
31-0219	Node Cable, 3.25 ft (1 m)

