



# **SonixCom Operating & Maintenance Manual**

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## Description

Sonix ultrasonic meters are inferential gas meters that utilize the time-of-flight technique to measure the consumption of natural gas. A basic overview of the technology is as follows. Gas flows into the inlet area of the meter and passes through a flow tube. Ultrasonic sound waves are transmitted between two transducers. The time for the sound waves to go from one transducer to the other is measured. Since sound waves travel faster with the direction of flow, than against the direction of flow, the meter can tell the direction of flow and the velocity. Once the velocity is determined, the volume is calculated by multiplying the velocity times the cross-sectional area of the flow tube.

## Application

Sonix meters should be used with clean, dry natural gas. The table below provides information on rated capacity with a 0.5" w.c. (1.25 mbar) pressure loss, using 0.6 specific gravity natural gas.

Meter	Qmax	MAOP	Qmax	MAOP
Sonix 6	215 cfh	5 psi	6 m3h	345 mbar
Sonix 12	420 cfh	15 psi	12 m3h	1 bar
Sonix 16	565 cfh	20 psi	16 m3h	1.4 bar
Sonix 25	880 cfh	20 psi	25 m3h	1.4 bar

*The maximum allowable operating pressure (MAOP) should never be exceeded. If the MAOP is exceeded, the meter should be removed from service and inspected for damage.*

Operating Sonix meters at capacities greater than the rated capacity does not harm the meter; however, meter accuracy may degrade. Above 1.8 times Qmax, Sonix meters stop recording flow. The table below shows the maximum flow through Sonix meters at atmospheric and maximum allowable operating pressures. Operating Sonix meters above the flow rates may cause measurement accuracy degradation.

Meter	Over-range Capacity at Atmospheric Pressure	Over-range Capacity at MAOP
Sonix 6	258 cfh	340 cfh
Sonix 12	588 cfh	1000 cfh
Sonix 16	620 cfh	1450 cfh
Sonix 25	1056 cfh	2470 cfh

Sonix meters are suitable for use in an operating temperature range of -30 °F to +130 °F (-35 °C to +55 °C).

## Installation

Sonix meter accuracy is not affected by installation orientation (unlike diaphragm and rotary meters). There are no requirements for the sets to be level. Sonix 6 meters are capable of top-in top-out or bottom-in bottom-out installation. Sonix 12, 16, and 25 only come with a top-in top-out configuration. However, Sonix 12, 16, and 25 meters can be installed in any orientation provided that they are protected from the moisture.

Carefully unpack the Sonix meter. Make sure that there is no obvious damage to either the plastic cover or metal case. Make sure that the LCD is functioning. The LCD should only have 9's displayed. The LCD rolls over after a limited amount of gas runs through the meter (10 cubic feet, or 1 cubic meter). When the display rolls over, all flags will be cleared and the diagnostics reset. The LCD display may blink off and then back on during installation. This happens when the LCD is performing a segment check. The segment check occurs once every minute. When the LCD is going through the segment check, all segments are energized (light up). If the LCD is not operating, go to the replacement of battery section.

Examine the label data to make sure that the meter specifications match the application on which it will be used (capacity required and maximum allowable operating pressure).

When installing Sonix meters, make sure that the meter is not subjected to undue mechanical stresses, or located where it could be subject to attack by aggressive chemicals. Sonix meters are not designed for use in environments where flammable dusts may constitute a hazard.

## Intrinsic Safety

### Sonix 6

THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS 1, DIVISION 2, GROUP D OR NON-HAZARDOUS LOCATIONS ONLY.

Only listed, non-incendive equipment is to be connected to the field-wiring terminals via the AMR cable. Meters so equipped must meet the following requirements:

- $V_{oc} \leq 3.64$  VDC (open circuit voltage of the external device)
- $I_{sc} \leq 5.9$  A
- $L \leq 110$   $\mu$ H (internal inductance of the external device)
- $C \leq 1.466$   $\mu$ F (internal capacitance of the external device)

### Sonix 12, 16, and 25

Sonix meters conform to paragraph 1.2.7 of annex II in the ATEX directive 94/9/EC.

THIS EQUIPMENT IS SUITABLE FOR USE IN TYPE i, ZONE 0, IIB, T4, OR NON-HAZARDOUS LOCATIONS ONLY.

THIS EQUIPMENT HAS AN ALUMINUM HOUSING, WHICH IS CONSIDERED A POTENTIAL FRICTIONAL IGNITION RISK. IT SHOULD BE PROTECTED FROM IMPACT OR FRICTION.

The Sonix 12, 16, and 25 meters are designed to meet the requirements of EN50014 and EN50020, for Category ia, Group IIB and Temperature Class T4 (Ta = 40 °C).

Repair of the electronics is not permitted. Should the meter electronics develop a fault, return the meter to Invensys Metering Systems.

### **SonixCom Software (Version 1.0)**

SonixCom is a Windows based program that enables the user to leak test (or shut-in test); program; perform a battery change, or download information from Sonix ultrasonic gas meters.

**Minimum system requirements:** **Processor speed** – 333mHz or greater; **Memory (RAM)** – 32 megabytes; **Hard disk** – 250 megabytes; **Monitor** – 800 x 600 or high screen resolution; **Operating System** – Windows 9x/ME/2000/NT.

To install the program, insert the autorun CD into the CD-ROM drive. If the CD doesn't start, then double-click the SonixDirectory.exe file from the CD directory.

The first menu to appear is the Main Menu. The Main Menu has twelve choices. A brief description of each menu choice is as follows:

1. Index – enables the user to set or read the index.
2. Main Data – enables the user to see basic meter data and configuration information.
3. Data Log – enables the user to access and save the 45 days of hourly data in Sonix 12, 16, and 25 meters.
4. Modes – enables the user to custom configure the meter for the following:
  - Air in the meter detection (**on or off**)
  - Secure communications (will be **on**)
  - Temperature compensation (**on or off**)
  - Fast sample mode (on or off, **should normally be off**)
  - EEPROM lock (on or off, **will be on when the meter leaves the factory**)
  - Units of measure (**imperial or metric, DO NOT CHANGE UNITS OF MEASURE DURING OPERATION**)
5. Flow Rate – enables the user to check the flow rate through the meter.
6. Time – enables the user to check the meter's time and set the meter's time.
7. Diagnostics – provides the user a log of problems or events (including the number of EEPROM reboots and diagnostic resets).

8. Leak Test – this function enables the user to perform a system leak test when the meter is first installed or any system changes have taken place.
9. Battery change – tells the meter that the last power down was to remove the battery so that it could be changed. It also resets the battery life clock.
10. TC/PC – Enables the user to adjust the base temperature used in temperature correction and add custom values for fixed (operating) pressure, base pressure, and atmospheric pressure for use in fixed factor pressure compensation. This option works with all Sonix 12, 16 and 25 meters and Sonix 6 meters with a firmware version 1Q0 or later.
11. Pulse Output – enables the user to select the volume per pulse using SonixCom software.
12. Exit – ends the session and takes the user back to Windows.

## MAIN MENU DETAIL

### Index

When the user clicks on the **Index** icon, the various index readings (uncorrected, corrected, and reverse) will appear and three pushbuttons appear in a block on the screen. The various index readings have the units of measure to the right.

Sonix 6 – The user will see current and reverse index readings.

Sonix 12, Sonix 16, or Sonix 25 – The user will see uncorrected, corrected, and reverse index readings.

Regardless of the meter being read, the three pushbuttons are: (1) Set Index; (2) Read Index; and (3) Close. Putting the mouse pointer over the pushbutton and then left clicking using the mouse can access the various options.

**NOTE:** If the user changes the units of measure, the existing meter data will **NOT** convert from Imperial to Metric (or vice versa) units.

The “**Read Index**” option is used to obtain current index reading information only.

Sonix 6 – In the Imperial units mode, the right most digit in the index reading starts with 100 cubic feet. In the Metric units mode, the right most digit is 0.1 cubic meters.

Sonix 12, Sonix 16, and Sonix 25 – In the Imperial units mode, the right most digit in the index readings start with 100 cubic feet. In the Metric units mode, the right most digit in the index readings start with 1 cubic meter if a diagnostic flag is displayed. If a diagnostic flag is not being displayed, the LCD will display volume to 0.001 cubic meters.

The “**Set Index**” option is used to change the current index readings. *The user can only change the index readings if the EEPROM is unlocked. To unlock the EEPROM, go to the Meter Modes page and click on the **EEPROM Lock** button. The user will be asked to enter a password. The default password is an empty set. The user just has to hit the **OK** button.* To change the index readings, the user must erase the existing readings using the backspace key and then enters the desired index readings.

Sonix 6 -- 5 digits should be entered in the Imperial unit mode. In the metric mode the user will enter four digits, the decimal point and a fifth digit. It is important to remember to add the decimal point.

Sonix 12, Sonix 16, and Sonix 25 -- 6 digits should be entered in the Imperial unit mode. In the metric mode, the user will also enter 6 digits.

After you enter the desired index reading, click on the “**Send Index**” button. You will notice that you are taken back to the main index page and the wording in the lower text block on the page will say “**Done**”. The next time the LCD cycles, the index will be updated.

The “**Close**” option will close the Index page and take the user back to the main menu.

## **Main Data**

When the user clicks on the **Main Data** icon, a page with two tabs appears. The first tab is titled “**Meter Data**”. This tab has the following general meter information: (1) meter serial number; (2) current meter date and time; (3) meter diagnostic flag; (4) software version; (5) meter model number; (6) meter firmware protocol number; (7) uncorrected index reading; (8) corrected index reading; (9) reverse index reading; (10) current temperature in the meter; (11) minimum temperature sensed inside meter; (12) maximum temperature sensed inside meter; and, (13) meter modes. The meter modes show how the meter is configured.

The user has four buttons to select from on the bottom of the tab: (1) Update, (2) Auto Update, (3) Log, and (4) Close. By hitting the “Update” button, the user updates the meter information as of the lasting calculation. By hitting the “Auto Update” button, the user forces the meter to update the information every ten (10) seconds. After selecting the “Auto Update” button, the user hits the “Stop” button to go back to the menu. The third option, “Log” enables the user to log the meter information. The information is stored as a text file in the same directory as the SonixCom software. The user is given the opportunity to select the file name for the text file. To exit the page, the user can hit the “Close” button or the “X” button (in the upper right hand corner).

The second tab is titled “**Measurement Info**”. This tab has the following meter information: (1) the speed of sound of the gas in the meter; (2) the calibration factor; and, (3) the measurement status at the last reading.



Sonix meters are designed to operate with gases that have a speed of sound between about 1000 and 1640 feet per second (305 m/s and 500 m/s). If the speed of sound is outside of this range, the meter accuracy degrades.

The calibration factor is a number that is used to adjust the proof curve of the meter. Each one-digit change in the calibration factor represents a proof shift of approximately 0.04%.

The measurement status shows the status of the last meter reading. The user can decode the information in any box by double clicking on the box.

Just as on the “Meter Data” tab, the user has four buttons to select from on the bottom of the “Measurement Info.” tab: (1) Update; (2) Auto Update; (3) Log; and, (4) Close. By hitting the “Update” button, the user updates the meter information as of the lasting calculation. By hitting the “Auto Update” button, the user forces the meter to update the information every ten (10) seconds. After selecting the “Auto Update” button, the user hits the “Stop” button to go back to the menu. The third option, “Log” enables the user to log the meter information. The information is stored as a text file in the same directory as the SonixCom software. The user is given the opportunity to select the file name for the text file. To exit the page, the user can hit the “Close” button or the “X” button (in the upper right hand corner).

## **Data Log**

This feature is currently not available on Sonix 6 meters. If you try to access this screen with a Sonix 6 meter, you will get the following message: “*Meter type detected does not support this feature*”. Click on the OK button to clear the message.

When the user clicks on the **Data Log** icon, the Data Logging page is displayed for Sonix 12, 16, and 25 meters. Sonix 12, 16, and 25 meters store hourly data for the most recent 45 days. After 45 days, the data overwrites the oldest data.

The following information is logged hourly: (1) date; (2) uncorrected volume; (3) corrected volume; (4) maximum temperature; (5) minimum temperature; (6) flag; and (7) summary.

The “Date” is in day/month/year/hour format. A typical reading might look like the following: 06 Mar 2002 01 hrs. The data is from March 6, 2002 between 1:00 a.m. and 2:00 a.m.

The “Uncorrected Volume” is the reading less fixed factor pressure and Charles’ Law temperature correction.

The “Corrected Volume” is the uncorrected reading corrected for either or both fixed factor pressure compensation and Charles’ Law temperature correction.

The “Maximum Temperature” is the maximum temperature (°F or °C) recorded during the hour.

The “Minimum Temperature” is the minimum temperature (°F or °C) recorded during the hour.

The “Flag” is the highest-level flag activated during the hour. The rank order is A, b, C, d, E, H, L, n, P, F, r – with “A” being the highest-level flag.

The “Summary” information can be decoded as follows (please remember that binary numbers are read from right to left):

**Bits 0 and 1** indicate the unsatisfactory readings status for that hour, coded as follows:

<b>Bit 0</b>	<b>Bit 1</b>	<b>Description</b>
0	0	Zero unsatisfactory readings.
1	0	Between 1 and 31 unsatisfactory readings in the hour.
0	1	Between 32 and 127 unsatisfactory readings in the hour.
1	1	More than 127 unsatisfactory readings in the hour.

**Bit 2** indicates that air has been detected in meter during the hour.

**Bits 3 and 4** indicates the diagnostic status within the hour, coded as follows:

<b>Bit 3</b>	<b>Bit 4</b>	<b>Description</b>
0	0	No events or operational problems occurred in the hour.
1	0	At least one minor operating problem occurred in the hour.
0	1	At least one major operational problem occurred in the hour.
1	1	At least one major event occurred in the hour.

**Bit 5** indicates that at least one successful communications occurred via the optical port in the hour.

**Bit 6** indicates that at least one reset occurred in the hour.

**Bit 7** indicates that at least one event of significant reverse flow occurred in the hour.

The user can also double click on a cell in the summary section to decode the information.

### **Viewing Data**

The user has the option of viewing data in the Sonix meter. Data can be viewed by pushing the **Retrieve Data** button on the Data Logging page. When the user pushes the button, they are asked to enter the date for which they would like to view data. The default is the current date. The user can type a date in, or the user can click on the selector arrow on the right hand side of the date box and a calendar will be displayed. The user can then choose any date in the past 45 days to view by clicking on the calendar date. To move backwards or forwards by month, push on the arrow keys to the left and right of the month heading.

## Contract Hour

The user has the option of setting a contract day. The contract day is a twenty-four (24) hour period that starts at a user specified hour. If the user sets the contract hour at 13 (1 p.m.), data for the period 13:00 yesterday through 13:00 today is displayed. If the user tries to view the contract data before the twenty-four hour period is up, only the data through the last hour will be displayed.

## Multiplier

The user has the option of setting a multiplier (decimal point) in the data. The default is 100 when imperial units are used and 1 when metric units are used. In the imperial units mode, if the 100 multiplier is used, the digit immediately to the left of the decimal point will be hundreds of cubic feet. When the data is downloaded, the decimal point is in the data field.

## Downloading Data

The user has the option of downloading data from the Sonix meter. Data can be downloaded for one day; for a contract day, for a user specified date range; or, all of the data can be downloaded. To download data, the user first selects the amount of data desired (one day, contract day, date range, or all data). The user then hits the Save to File button. The user is asked to enter a file name (the default is Hourly Data.txt). After the file name is entered, the user should hit the OK button. To accept the default file name, the user just hits the OK button. The data log will be stored in the same directory as the SonixCom software. The data log file is a “text” file with headings. It can be easily imported into any spreadsheet or word processing program for analysis.

To exit from the Data Logging page, the user hits the Close button, or the “x” in the upper right hand corner of the Data Logging page.

## Meter Modes

When the user clicks on the **Modes** icon, the Current Meter Modes page is displayed. Six-meter modes are displayed and two pushbuttons (Read All and Close) are also displayed. The meter modes are as follows:

Air in the meter detection (**on or off**)

Secure communications (will be **on**)

Temperature compensation (**on or off**)

Fast sample (on or off, **should be off**)

EEPROM lock (on or off, **will be on when the meter leaves the factory**)

Units of measure (**imperial or metric, DO NOT CHANGE UNITS OF MEASURE DURING OPERATION**)

### Air in Meter

The **Air in Meter** button is used to engage, or disengage the air in the meter detection algorithm. The meter is designed to detect the presence of air in the meter. Air should not be in the meter

during normal operation. If the meter detects air, it can indicate a serious system problem (air is flowing through the distribution system) or, it can indicate that the meter has been removed from service. This algorithm is primarily used to detect and deter customers who might remove the meter at their home to steal gas. If air is detected in the meter, the flag will be displayed at midnight. To turn the air detection algorithm off, left click on the **Air in Meter** button. The box to the right of the button will switch to **OFF**. We recommend that the Air in Meter button be switched to **ON**.

### **Secure Communications**

A software handshake is used before allowing a user to communicate with Sonix meters. If the handshake is turned off – anyone can talk to a Sonix meter – you have insecure communications. Since we do not want any unauthorized people to communicate with Sonix meters, the Secure Communications option will always be **ON**. This option may be disabled in larger Sonix meters in the future.

### **Temperature Compensation**

Sonix meters can perform two temperature corrections: (1) a Charles' Law correction; and, (2) a component thermal expansion or contraction correction. Regardless of the meter mode, the thermal expansion or contraction correction is applied. If the user has specified that the meter is to be temperature compensating, the Temperature Compensation will be **ON**, and the meter will also perform the Charles' Law correction. If you have not purchased a temperature compensating meter, you will need additional software from us to turn the Charles' Law temperature correction on/off. Please contact your local Invensys Metering Systems representative for more information.

**Important Note: If the user changes modes from non-TC to TC, the index and LCD will display temperature corrected readings from that point on. Prior data will not be converted.**

### **Fast Sample Mode**

Sonix meters normally measure the velocity of the gas on an average of every 2 seconds. In the Fast Sample Mode, Sonix meters measure the velocity of the gas every  $\frac{1}{4}$  second. The Fast Sample Mode is used during calibration and meter diagnostics when more readings are required in a short period of time. Since the meter is taking 8 times as many readings as normal, the battery life is greatly reduced in this mode. To change between normal and fast sampling, left click on the **Fast Sample Mode** button. The box to the right of the button will toggle between **ON** or **OFF**. **IT IS STRONGLY RECOMMENDED THAT THE METER BE IN THE "OFF" MODE.**

**Important Note: If the user puts the meter into the fast sample mode and does not perform a diagnostic reset, a "b" flag will be triggered at midnight. The meter is put into the fast sample mode when a leak test performed and when a flow test is run. Therefore, after each time a flow rate test is run, or the leak test feature is used, the user should perform a diagnostic reset, or a "b" flag will appear at midnight.**

### **EEPROM Lock**

To change the meter mode for all options other than the Fast Sample mode, the user must first unlock the EEPROM. To unlock the EEPROM, click on the **EEPROM Lock** button. The user will be asked to enter a password. The default password is an empty set. The user just has to hit the **OK** button. When the user sees the word “Done” in the dialog box at the bottom of the Meter Modes page, the EEPROM is unlocked and any of the meter modes can be changed and the index can be updated. In order to change any of the meter modes, the user highlights the pushbutton for the desired option and then left clicks with the mouse. The user can also toggle between options using the up and down arrow keys and hit the “enter” key to change a selection.

If EEPROM lock is on, no meter settings can be changed. **IT IS STRONGLY RECOMMENDED THAT ALL METERS IN THE FIELD HAVE THE EEPROM LOCKED.**

### **Units**

Sonix meters can present data in Imperial or Metric units. To change between Imperial and Metric units, left click on the **Units** button. The box to the right of the button will toggle between **Imperial** and **Metric**.

**Important Note: If the user changes the units of measure (from Imperial to Metric, or vice versa), the meter will convert readings from that point on. Prior data will not be converted.**

**WARNING: DO NOT CHANGE THE UNITS OF MEASURE DURING OPERATION – THE DATA WILL NOT BE CONVERTED!**

The “**Read All**” pushbutton will read the current meter modes. The “**Close**” pushbutton will close the current Meter Modes page and take the user back to the Main Menu page.

### **Passwords**

Sonix meters come with two levels of password protection. The first level is the **Diagnostic Reset** level. If the user wants to clear the diagnostics, they will first have to enter the Diagnostic Reset password. The password can be any combination of up to four numbers between 0 and 9.

The second level of password protection is the **Calibration Factor/Unlock** level. This password is used to unlock the EEPROM that allows the user to change the configuration of the meter, the volume registers, and the meter calibration factor. The password can be any combination of up to four numbers between 0 and 9. **THIS PASSWORD SHOULD BE DIFFERENT THAN THE DIAGNOSTIC RESET PASSWORD AND IT SHOULD BE CLOSELY GUARDED.**

### **Setting Passwords For The First Time**

In order to change the passwords from the factory defaults, go to the Password drop down menu (located directly above the Main Data icon). Click on the word Password and the Change Passwords page will appear. Type in any combination of up to four numbers between 0 and 9 in the New Password box. Re-enter the same number in the Confirm Password box. Click on the Update Passwords button. The user has now changed the passwords from the factory default passwords.

## Changing Passwords

In order to change the passwords, go to the Password drop down menu (located directly above the Main Data icon). Click on the word Password and the Change Passwords page will appear. Enter the current password (any combination of up to four numbers between 0 and 9) in the Old Password box. Type in any combination of up to four numbers between 0 and 9 in the New Password box. Re-enter the same number in the Confirm Password box. Click on the Update Passwords button. The passwords have been changed.

## Flow Rate

**Important Note: In order to run a flow rate check, the meter is automatically put into the fast sample mode. If the user does not perform a diagnostic reset after the check is completed, a “b” flag will be triggered at midnight. Therefore, after each time the flow rate check is run, the user should perform a diagnostic reset, or a “b” flag will appear at midnight.**

When the user clicks on the **Flow Rate** icon, the Flow Rate page is displayed. The page is composed of two basic parts. The top part of the page – Test Setup – is used to set how frequently the meter is polled for flow rate. The user sets the **Sample Time** (in seconds). The default is 5 seconds. This means that the meter flow rate is calculated every 5 seconds. The Sample Time limits are 1 – 60 seconds.

The lower part of the page – Flow Rate – displays the flow rates from the meter. When the user hits the **Begin** button, the software starts polling the meter every “X” seconds (based upon the Sample Time selected). The calculated flow rate is displayed in the box. If the meter is set in the Imperial unit mode, the volume is measured in thousandths of a cubic foot per hour (0.000 cfh). If the meter is in the metric unit mode, the volume is measured in thousandths of a cubic meter per hour (0.000 m<sup>3</sup>h). When the user hits the **Stop** button, the software stops polling the meter. When the user is finished, the user hits the **Close** button, or the X button in the upper right hand corner of the Flow Rate page to exit the Flow rate page.

## Time

**Important Note: Sonix meters do not adjust for daylight savings time.**

When the user clicks on the **Time** icon, the Date and Time page is displayed. The user will see the current computer date and time; the current meter time and date; and three pushbuttons (Send Time, Read Time, and Close).

**Computer Date and Time** is the current time and date in the computing device used to interrogate the Sonix meter.

**Meter Date and Time** is the current time in the meter.

### **Sonix 6 meters with firmware version 0Q8 and 0Q9**

Time is stored one way: time blocks. In Sonix 6 meters with version 0Q8 and 0Q9 firmware, the user can only set the meter time to the nearest three-hour time block. If the user goes to the **Time** icon and “reads” the meter time, the user will be able to see which three-hour time block the meter is in. If the user tries to set the meter by using the **Send Time** function, the user will set the time to the nearest preceding three-hour time block. In addition, if the user goes to the **Main Data** icon or the **Diagnostics** icon, they will see the three-hour time block.

### **Sonix 6 meters with firmware version 1Q0 and later**

Time is stored two ways in later versions of Sonix 6 meters: (1) actual time; and, (2) time blocks. In Sonix 6 meters with version 1Q0 and later firmware, the user can set the meter time to the nearest minute (actual time). If the user then goes to the **Time** icon and “reads” the meter time, the user will be able to read the meter time to the minute. In earlier versions of the meter firmware, the user could only set the time to the nearest three-hour time blocks.

**Important Note:** If the user goes to the **Main Data** icon or the **Diagnostics** icon, they will only see the three-hour time block – even though the meter is storing time to the nearest minute.

### **Sonix 12, 16, and 25**

While time is stored in one-hour blocks in Sonix 12, 16, and 25 meters, it is only displayed in three-hour blocks.

The **Send Time** pushbutton enables the user to send the current computer date and time to the meter. The EEPROM does not have to be unlocked to update the meter’s time. To update the meter’s time, highlight the “Send Time” button and left click with the mouse or hit the enter key. The word “Done” will appear in the lower text block of the page. In order to activate the new meter time, the EEPROM is re-booted. The EEPROM reboot will show-up in the diagnostic log.

The **Read Time** pushbutton enables the user to read the current meter time. To read the meter’s time, highlight the **Read Time** button and left click with the mouse or hit the enter key. The word “Done” will appear in the lower text block of the page. In Sonix 6 meters with version 1Q0 and later firmware, the time will be to the nearest minute. In older versions of the Sonix 6 meter, the time is to the nearest hour. In Sonix 12, 16, and 25 meters, the time is displayed to the nearest prior three-hour time block.

The **Close** pushbutton will close the Date and Time page and take the user back to the main menu.

### **Diagnostics**

When the user clicks on the **Diagnostics** icon, the Diagnostics page appears. This page displays: the meter serial number; meter date and time; the highest diagnostic flag; the diagnostic report; and, four pushbuttons (Retrieve, Reset, Log, and Close). The diagnostic flags are discussed in greater detail in the Diagnostic Flags section of the manual. A list of the diagnostic flags will be displayed if the user hits the “F1” key while this page is displayed.

The diagnostic report is a table that displays key diagnostic data from the meter. The table looks like the one that follows:

<b>Serial Number</b>	<b>Date &amp; Time</b>	<b>S/W Version</b>	<b>Flag</b>
E6Q7986648	23 May 2000 09:00	1Q0	B

<b>Problem/Event</b>	<b>Occurrences</b>	<b>Last Date</b>	<b>First Date</b>
EEPROM reboot	003	28 Dec 1999 12 hrs	
Diagnostic reset	005	28 Dec 1999 12 hrs	
Air in meter	040	28 Dec 1999 00 hrs	19 Nov 1999 00 hrs

The **Serial Number** field shows the meter type (E for electronic), size (6), manufacturer (Q for Invensys), and the seven-digit serial number.

The **Date & Time** field shows the date and time information stored in the meter. The date information is in day, month, year format. The time is the last time block stored to non-volatile memory. With Sonix 6 meters, the time is stored in non-volatile memory every three hours. In Sonix 12, 16, and 25 meters, the time is stored in non-volatile memory every hour.

The **Problem/Event** column displays the piece of information being logged. It is operating data that is important to user of the meter. The **Occurrences** column shows how many times (days) the problem or event has occurred. The **Last Date** column shows the last day and time block that the problem or event occurred in. The **First Date** column shows the first day and time block that the problem or event occurred in.

In the above table, the information tells the user that the EEPROM has been rebooted three times. Every time something that affects meter identification (serial number), meter time, or metrology (calibration, index) is changed, before the change is performed, the EEPROM must be rebooted. The number of EEPROM reboots cannot be reset. It provides the user with a permanent record of changes.

The “Diagnostic reset” tells the user the number of times the diagnostics have been cleared and when the last time a reset occurred. All diagnostic flags (except an “A” flag) are cleared when the “Reset” pushbutton is clicked on.

The “Air in meter” line item tells the user that the meter has had air running through it for 40 days. The first day the meter detected air was on November 19, 1999. The meter still had air in it on December 28.

The four pushbuttons (Retrieve, Reset, Log, and Close), are described as follows:

- Retrieve** – enables the user to immediately update the diagnostic information
- Reset** – enables the user to reset the diagnostics (accept EEPROM reboots)
- Log** – logs the displayed data to a text file for analysis later
- Close** – closes the diagnostics page and takes the user back to the main menu



To use any of the pushbuttons, highlight the pushbutton and left click the mouse or hit the “enter” key. There maybe a slight pause after clicking on one of the pushbuttons, up to several seconds, depending upon when the transducers are firing.

### **Diagnostic Reset**

For data security reasons, the diagnostic “Reset” option is password protected. For more information on passwords, see the password section above. To “Reset” the diagnostics, highlight the **Reset** pushbutton and left-click the mouse, or hit the “enter” key. The user will be asked to enter the password. The default password is an empty set. The user just has to hit the **OK** button. There maybe a slight pause after clicking on the pushbutton, up to several seconds, depending upon when the transducers are firing. The diagnostics screen will blink off for a brief period of time. When the screen is refreshed, any diagnostic counters or diagnostic flags are cleared. To refresh the screen, the user will have to left click on the **Retrieve** button. The “Diagnostics reset” counter will increment and show the last date that it was reset. Please note, that the diagnostic reset counter and the EEPROM reboot counter cannot be reset.

To select the “Log” option, highlight the **Log** pushbutton and click the left mouse button or hit the “enter” key. A box asking for a filename will appear. The default filename is “diag.txt”. Enter a file name and hit the **OK** button, or just hit the **OK** button and a default file name will be selected for you. The information will be logged in the SonixCom directory. To exit the Diagnostics page, highlight the **Close** button and hit the “enter” key, or left click with the mouse.

To go back to the main menu, left click on the **Close** button. The user can also highlight the word **Close** button and hit the enter key. This will close the Diagnostics page and return the user to the main menu page.

### **Leak Test**

**Important Note: In order to run a leak test, the meter is automatically put into the fast sample mode. If the user does not perform a diagnostic reset after the test is completed, a “b” flag will be triggered at midnight. Therefore, after each time a leak test is run, the user should perform a diagnostic reset, or a “b” flag will appear at midnight.**

When the user clicks on the **Diagnostics** icon, the user opens the Leak Test page. This page will enable the user to perform a leak test (or shut-in test) on the meter system. The page is broken-up into two parts: Test Setup; and, the test results. The “Test Setup” section of the page controls the leak test variables (duration of the test and allowable leak limit). The user can select the “Duration” of the test (the default is 5 minutes) and the allowable leak “Limit” (the default is **0.02** cf or **0.0005** m3). To change either parameter (duration or limit), the user enters the desired number in the appropriate block. The duration of the test can be between 1 and 60 minutes.

The table below presents the flow through the meter in cubic feet per hour (cfh) given a certain time in minutes and allowable leak limit in cubic feet.

## Leak Rate in Cubic Feet Per Hour

Time (minutes)	Leak Limit (cubic feet)				
	0.01	0.02	0.03	0.04	0.05
1	0.60	1.20	1.80	2.40	3.00
2	0.30	0.60	0.90	1.20	1.50
3	0.20	0.40	0.60	0.80	1.00
4	0.15	0.30	0.45	0.60	0.75
5	0.12	0.24	0.36	0.48	0.60
6	0.10	0.20	0.30	0.40	0.50
7	0.09	0.17	0.26	0.34	0.43
8	0.08	0.15	0.23	0.30	0.38
9	0.07	0.13	0.20	0.27	0.33
10	0.06	0.12	0.18	0.24	0.30

The “test results” section has three data blocks: Beginning Volume; Current Volume; and Difference. The “Beginning Volume” is the beginning volume from the meter. A truncated version of the meter volume is displayed on the LCD. The “Current Volume” is the volume stored in the meter at the last reading. The “Difference” is the difference between the “Current Volume” and the “Beginning Volume”. If the “Difference” is less than the “Limit” specified in the “Test Setup” block at the end of the test, the page will display the word “PASS”. If the “Difference” is more than the “Limit” specified in the “Test Setup” block at the end of the test, the page will display the word “FAIL” in red letters.

When the user is ready to run the test, they highlight the **Begin** button and left click with the mouse or hit the “enter” key. The result of the test is displayed in the middle of the screen. The test can be stopped at any time by highlighting the **Stop** pushbutton and hitting the “enter” key or left clicking on the button. After the test is completed, the user can save the leak test result to a file by hitting the **Save to File** button. The data is stored in a text file called “Leak Test Data.txt”. If the user stops the leak test before it is complete, the result will not be logged. The file can be opened in any spreadsheet or word processing package. The user exits the leak test program by highlighting the **Close** button and hitting the enter key, or by clicking on the **Close** button. This will close the Leak Test page and return the user to the main menu page.

### Battery

When the user clicks on the **Battery** icon, the user opens the Battery Change page. This page enables the user to see when the battery was last changed in the meter and also to tell the meter that the last power down was a battery change.

When the user highlights the **OK** pushbutton and hits the “enter” key or left clicks with the mouse, the meter will not trigger the power reset alarm (a “b” flag). It also resets the clock for the battery flags (F and r). It is important to note that up to three hours worth of data in the

Sonix 6 meter and up to one hour worth of data in larger Sonix meters (12 – 40) is lost when a battery change is performed. By using the Set Index feature on the Index page, the user can reset the index so that no volume is lost.

After the test is completed, the user can highlight the **Close** button and hit the “enter” key, or they can click the left mouse button. This will close the Battery Change page and return the user to the main menu page.

## TC/PC

When the user clicks on the TC/PC icon, the user opens the Pressure and Temperature Compensation page. This page enables the user to set the base temperature used for temperature correction and the fixed (operating), base, and atmospheric pressures for fixed factor pressure compensation. **THIS OPTION ONLY WORKS WITH ALL SONIX 12, 16, AND 25 METERS AND ANY SONIX 6 METERS THAT HAVE SOFTWARE VERSION 1Q0 OR HIGHER.** If the user tries to access this screen with a Sonix meter does not have pressure correction capabilities, the following message is displayed: *“Meter type detected does not support this feature.”*

When the meter is in the Imperial units mode, temperature is in °F and pressure is in PSI. When the meter is in the Metric units mode, the temperature is in °C and pressure is in Bar. The conversion for Canadian customers is 100 KPa per bar.

The screen is divided into two blocks: (1) Compensation Parameters; and, (2) Compensation Status. In the Compensation Parameters block, the user enters the base temperature, the fixed (operating, base, and atmospheric) pressures.

The **Base Temperature** will default to 60 °F or 15 °C; however, it can be configured to whatever base temperature is required by the customer.

The **Operating Pressure** is the operating pressure in gauge pressure units (PSIG or Bar). The user can set the fixed pressure to between 0 - 20 psig (0 - 1.4 bar) for Sonix 12, Sonix 16, and Sonix 25 meters. **THE FIXED PRESSURE MUST NOT EXCEED THE METER'S MAOP.**

The **Base Pressure** is in absolute pressure units (PSIA, Bar). The user can set the base pressure to between 10-16 psia (0.7 – 1.1 bar) for Sonix 12, Sonix 16, and Sonix 25 meters.

The **Atmospheric Pressure** is in absolute pressure units (PSIA, Bar). The user can set the atmospheric pressure to between 10-16 psia (0.7 – 1.1 bar) for Sonix 12, Sonix 16, and Sonix 25 meters.

In the Compensation Status block, there are two choices (Enabled and Disabled) for both Temperature and Pressure. If the Enabled option is selected in the Temperature block, then the meter will temperature compensate. If the Enabled option is selected in the Pressure block, then the meter will calculate and use a pressure multiplier. If both Temperature and Pressure compensation are Enabled, the meter will perform both corrections.

After the user has entered the desired Compensation Parameter values, make sure that the Enabled option(s) is highlighted in the Compensation Status block and hit the **Send** button. The values will be sent to the meter.

After the parameters have been sent to the meter, the user can highlight the **Close** button and hit the “enter” key, or they can click the left mouse button. This will close the Pressure and Temperature Compensation page and return the user to the main menu page.

### **Pulse Output**

When the user clicks on the **Pulse Output** icon, the user opens a page that enables them to custom configure the pulse output. The user will see a drop down box titled “Select the Amount of Volume Per Pulse”. By using the drop down menu, the user can select from a series of common pulse frequencies. After selecting a pulse multiplier, the user selects the **Send Pulse Factor** button to activate the multiplier.

The user will also notice a line titled “Current Meter Pulse Scalar”. As the title states, this line tells the user what the current pulse scalar is.

### **Exit**

If the user highlights the **Exit** icon and left clicks the mouse, or hits the “enter” key, the SonixCom program is exited and the user is taken back to Windows.

## DIAGNOSTIC FLAGS

Diagnostic flags appear in the left most location on the Sonix 6 LCD display and the upper right hand corner in Sonix 12, 16, and 25 meters.

Possible Sonix 6 meter diagnostic flags are: A, b, C, F, and r.

Possible Sonix 12, 16, or 25 meter diagnostic flags are: A, b, C, d, E, F, H, L, n, P, and r.

Should you notice any diagnostic flag – other than an “A” flag -- during operation, it does not mean that the meter is not working accurately. The diagnostic flags are, as the name implies, used to diagnose what is happening to the meter. If you wish to log the data, instructions can be found above.

The problem counters and all flags (except the “A” flag) are cleared on a diagnostic reset or a power reset.

### **The “A” Flag**

When the “A” flag is displayed, the meter stops measuring gas. The meter has to be removed from the field and diagnosed, and possibly repaired, in the meter shop. The “A” flag is caused by a failure of the checksum of a particular value stored in EEPROM. Every time the RAM based index is updated (or every three hours), the RAM index is checked against its checksum. If the two indexes do not agree, the first non-volatile index is checked against its checksum. If they do not agree, the second non-volatile index is checked against its checksum. If all three do not match, the “A” flag is raised.

Every time the meter backs-up (every three hours) to non-volatile memory, the calibration factor is checked against its own checksum in EEPROM. If the two values do not agree, the “A” flag is raised.

### **The “b” Flag**

The “b” flag tells the user that a non-metering related “event” has occurred. Any of the following will trigger the “b” flag: a power reset; negative flow; entering the fast sample mode; EEPROM reboot; or air in the meter. The “events” normally indicate that someone unauthorized is trying to do something to the meter.

A “Power reset” occurs when the battery voltage drops below 2.37 volts or the battery is disconnected. The “b” flag is generated immediately after the battery is replaced or the voltage comes back above 2.37 volts.

Negative flow will cause a “b” flag to be generated. When reverse flow is detected, the corrected and uncorrected volume registers will not increment or decrement. Any volume will be stored in the reverse flow register. In order for the negative flow register to be activated, the negative flow limit must be exceeded and the flow must be measured for 64 consecutive reads (about two minutes) in the Sonix 6 and 255 consecutive reads (about 8.5 minutes) in the Sonix, 12, 16, or 25 meters. This prevents the measurement of flow pulsations. When the reverse flow limit is surpassed the diagnostic flag appears at midnight. The problem counters are cleared on a diagnostic reset or a power reset. The following table provides the negative flow limits:

Meter	Trigger Flow (cfh)	Trigger Flow (l/h)	Time (minutes)
Sonix 6	-3.5	-100	2.1
Sonix 12	-9.5	-267	8.5
Sonix 16	-9.5	-267	8.5
Sonix 25	-9.5	-267	8.5

The fast sample mode is used when a large number of readings are required in a short period of time to speed up some process (i.e. during calibration, during the system leak test, or during the flow rate check). Instead of measuring flow approximately every two seconds, the meter measures flow every ¼ second. If the meter is in the fast sample mode, the battery will run down 8 times as fast as normal. The flag appears at midnight.

The EEPROM reboot command is used to reload values stored in EEPROM to RAM. This feature is normally used when you change calibration factors.

The “air in the meter” warning is used to detect instances where air is present in the meter. Air flowing through the meter is a potentially hazardous situation if gas is also present. The “air in the meter” warning can also be used to detect instances where the meter is removed from service and a bypass is run. On a diagnostic reset or a power reset the date of the last event and the number of events are lost.

A “b” flag in a Sonix 6 meter indicates that an event has occurred at some point in the past. A “b” flag in a Sonix 12, 16, or 25 meter indicates that an event has occurred within the past two (2) days.

When a “b” flag is detected, investigation is warranted.

### **The “C” Flag**

The “C” flag is caused by meter operation problems such as: unsatisfactory readings; flow out of range; the speed of sound out of range; or, the rate of change of speed of sound out of range. In order to generate the “C” flag, the problem must occur at least 128 times in a day (starting at midnight). While 128 times seems like a large number of bad readings, it represents 0.3% of one day’s readings. The maximum number of occurrences totalized per day is 255. The flag appears at midnight.

The meter not being certain of the integrity of the reading causes unsatisfactory readings. If the meter is not satisfied with the reading, it discards it. Unsatisfactory readings can be caused by a

timing problem with the course and fine counts, a voltage problem, if the transducer does not receive a pulse within an expected time, or if the amplitude of the received signal is larger or smaller than expected.

The meter will also generate a “C” flag if the flow rate is above  $Q_{max}$  for a given meter. This is called flow out of range. The meter may be working perfectly; however, the flag shows the customer that the meter may be sized incorrectly.

If the speed of sound is calculated to be out of the range of natural gas, the meter will trigger a “C” flag. The speed of sound range we look for is 1000 – 1640 fps (305 – 500 m/s).

A rate of change of speed of sound event is logged if the speed of sound changes significantly (more than 106 f/s) within a 44 second period.

A “C” flag in a Sonix 6 meter indicates that an operational problem has occurred at some point in the past. A “C” flag in a Sonix 12, 16, or 25 meter indicates that an operational problem has occurred within the past two (2) days.

#### **The “d” Flag**

A “b” flag changes into a “d” flag in a Sonix 12, 16, or 25 if an event has occurred more than two (2) days ago, but within the past six (6) months.

When a “d” flag is detected, investigation is warranted.

#### **The “E” Flag**

A “C” flag changes into an “E” flag in a Sonix 12, 16, or 25 if an operational problem has occurred more than two (2) days ago, but within the past six (6) months.

#### **The “H” Flag**

A “d” flag changes into a “H” flag in a Sonix 12, 16, or 25 if an event has occurred more than six (6) months ago, but within the past twelve (12) months.

When an “H” flag is detected, investigation is warranted.

#### **The “L” Flag**

A “E” flag changes into a “L” flag in a Sonix 12, 16, or 25 if an operational problem has occurred more than six (6) months ago, but within the past twelve (12) months.

#### **The “n” Flag**

An “H” flag changes into an “n” flag in a Sonix 12, 16, or 25 if an event has occurred more than twelve (12) months ago.

When an “n” flag is detected, investigation is warranted.

**The “P” Flag**

A “L” flag changes into a “P” flag in a Sonix 12, 16, or 25 if an operational problem has occurred more than twelve (12) months ago.

**The “r” and “F” Flags**

The “r” flag is generated when the meter perceives that 9.5 years have passed since the last battery change. The flag is used to tell the distribution company that they should consider changing the battery in the near future.

The “F” flag is generated when the meter perceives that 11 years have passed since the last battery change. The flag is used to tell the distribution company that they should change the battery as soon as possible.



## Maintenance

### Battery Replacement

BATTERY CARTRIDGES OR MODULES SHOULD NOT BE REMOVED OR REPLACED IN DAMP CONDITIONS.

ONLY USE APPROVED BATTERY ASSEMBLIES AS SPECIFIED BY THE MANUFACTURE

BATTERY CARTRIDGES OR MODULES CAN NOT BE REUSED.

Sonix 6 – To replace the battery on a Sonix 6 meter, use a flat blade screwdriver (or a Rockseal removal tool) to break the tamper obvious Rockseal. The seal can then be pried out with the screwdriver blade. After the Rockseal is removed, use the screwdriver blade to pry down on the battery cartridge tab. With a second small flat bladed screwdriver, gently pry the top of the battery cartridge away from the front cover. Once the connector on the battery cartridge is free from the connector on the meter body, the battery cartridge can be lifted off the meter.

The new battery cartridge is then pushed into place. It will make a “snapping” noise when it is seated properly. In addition, the LCD will light up within a few seconds.

Sonix 12, 16, and 25 – Break the top tamper obvious seal on the battery compartment cover. Running a thin knife or small screwdriver blade under the seal can break the seal. Once the seal has been removed, the battery compartment cover can be removed by sliding it up. The battery can then be removed from the battery area. Disconnect the battery by disconnecting the meter at the connector. Attached a new battery pack. Re-install the battery compartment cover by sliding it down onto the grooves. Insert a new tamper obvious seal. **NOTE: If you do not re-install the tamper obvious seal, the battery compartment cover can be easily removed.**

Old battery cartridges or modules should be disposed of properly based upon local regulations.

WARNING – EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

AVERTISSEMENT – RISQUE D’EXPLOSION – LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMBLEMES DE CLASSE 1, DIVISION 2.

WARNING – EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN TYPE i ZONE 0 ENVIRONMENT.

### Cleaning

WARNING – STATIC RISK – DO NOT RUB OR CLEAN THE PLASTIC DISPLAY COMPONENTS WITH SOLVENTS IN A HAZARDOUS AREA AS A SPARK MIGHT BE GENERATED.

**Approvals:**

<b>Agency</b>	<b>Type</b>	<b>Standard</b>
MET Laboratories	Intrinsic Safety	CSA C22.2 No 213-M1987
Hursley EMC Services	Metrology	OIML R-6 IEC801-3: 1984 RFI Radiated Emissions
Hursley EMC Services	Metrology	OIML R-6 EN61000-4-8: 1993 Immunity
Measurement Canada	Metrology	LMB-EG-08 and PS-G-06
TUV	Metrology	OIML R-6 IEC 68-2-31 Fc Vibrations
TUV	Metrology	OIML R-6 IEC 68-2-31 Test Ec Drop onto Face

## Trouble Shooting

### Sonix Meter Reading Difficulties – Time-Out Errors

There are several possible reasons for you to get a time-out error when you try to interface with a Sonix meter. The most common three are: (1) incorrect Comm port specified; (2) wrong software version; and (3) optical probe not lined up.

If you have the wrong Comm port specified you will get a time-out error. To resolve the problem go to the main menu in the software and select the “Ports” option. To select the “Ports” option, you can highlight the button with the word “Ports” and click the left mouse button. Try a different COM port. If you still cannot interface with the meter after selecting a new Comm port, please contact Invensys Metering System's technical support group.

If you try to read a UK meter with SonixCom, you will get a “time-out” error. The meters use a different protocol. You will get the same error if you try to read another manufacturer’s ultrasonic meter, or an electric meter, with SonixCom.

If you do not have the optical probe lined up properly, you may also have trouble reading meters. We recommend that the optical probe be oriented with the cable in any position from 4 o’clock to 8 o’clock. If the cable is outside of this area, you may have difficulty reading meters.

