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ELSTER ◆ Instromet

EnSonic Programmer
Software Configuration Program

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Rijkmakerlaan 9
B 2910 Essen
Belgium

Phone: +32-3-670 0700
Fax: +32-3-667 6940

Revision History

Revision	**Remark**	**Date**
001	First edition	25-01-2004

Preface

This document covers the configuration software for the EnSonic unit.

The EnSonic is configured using the windows based software program '*EnSonic Programmer'*. The currently described version V *1.5* has been used and updated throughout the development of the system and is likely to undergo minor changes. However, the main functionality of the program will not be altered.

Related documents:

'EnSonic Installation Manual'   code: 10735.ENSCNF.001   dd 20-01-2004
'EnSonic User Manual'   code: 10735.USER.001   dd 20-01-2004
'Model 2000 Programmer'   code: 10735.M2KCNF.001   dd 25-01-2004
'Model 2000 Gas Flow Computer'   code: Model 2000 issue 6, 202/09-02 dd 16-09-2002

General requirements

The configuration program runs under the Windows operating systems 95, 98, ME, 2000 and XP. There are no special requirements for the amount of free memory or free hard disk space. The program with sub-directories and related files requires about 1.8 MB of hard disk space.

The program requires a serial communication port (COM-port) to communicate with the EnSonic. Systems with USB-ports only can use USB- to COM-port converters. Positive experience has been gained with both programs running simultaneously under Windows-XP and -2000 using EdgePort/4 and Edgeport/8 converters.

Communication takes place via (Modbus) Port 1 of the EnSonic system (Port 2 is used for communication with the M2000 or a user supplied control system). For short distances upto approx. 20 m the RS 232 communication protocol is used. Since for longer distances the EnSonic has been equipped internally with a RS 232-RS 485 converter, a RS 485–RS 232 converter must be connected to the PC or laptop running the configuration software.

Startup

The configuration program is started by double-clicking on the program icon, directly after startup a username and password must be entered, see fig 1.

Figure 1, Startup screen

Since all parameters determining the operation of the EnSonic can be accessed when in the highest security mode, dedicated user accounts may be generated to hide or allow read-only access to specific windows. The username and password may therefore be installation dependent.

After supplying a proper username and password a 'Connection List' window is displayed with a list of configured devices. When the reference 'EnSonic' is selected a connection with the unit can be opened when the proper COM port has been selected. The COM:-port setting can be changed via the Modify button or by double clicking on the selected instrument.
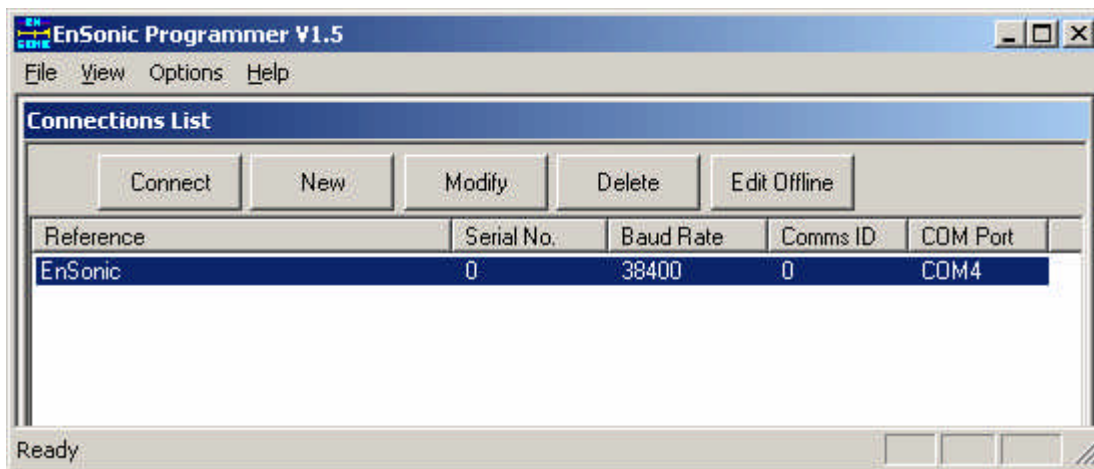

Figure 2, Connections List

In certain situations it may be necessary to configure the unit offline, in this case the *Edit Offline* option must be selected. Keep in mind that when using the *Edit Offline* option the instrument setup is not read from the unit and that overwriting the unit's setup may cause serious malfunctions. Also when using the *Connect* option in which the setup is read from the unit prior to entering the edit mode, it is good practice to save the unit's current setup prior to making changes and to save modified setups using appropriate names prior to updating the unit's internal setup.

After establishing a connection via the *Connect* option a window the 'Connection Menu' is opened in which a number of options are displayed, see fig 3:

1) In the upper part of the window the type number of the EnSonic and the firmware version of the operating software in the EnSonic are displayed.

2) *Setup EnSonic*: loads the setup from the unit into the program and brings up a window with topic related icons on the left side of the window. By selecting a specific icon a topic related page is

opened in which the topic related data can be modified. Depending on the security level, certain pages may be hidden or read only. After modifying specific parameters, the modified setup must be sent to the unit by selecting the *Update* button. Setup's may be Saved and Loaded. The Undo option only operates on the currently selected page. When switching to a different page the modifications cannot be Undone. The Close option closes the window.

3) *View Preset Data, View Ultrasonic/CO2/IPB Active Data*: these options are used to view the low-level data within the system.

4) *View Calculation Data*: presents the (low-level) input data and the results of the last calculation performed.

5) *View Calculation History*: presents the input data and the results of the last 100 calculations.

6) *View Calibration Data / History*: presents data from the last and previous calibrations.

7) *View Mode*: displays information about the current operating mode of the unit.

8) *Update Unit Software*: used to update the firmware of the unit, to be used by qualified Instromet employees only.

9) *Close*: closes the Connection Menu window.

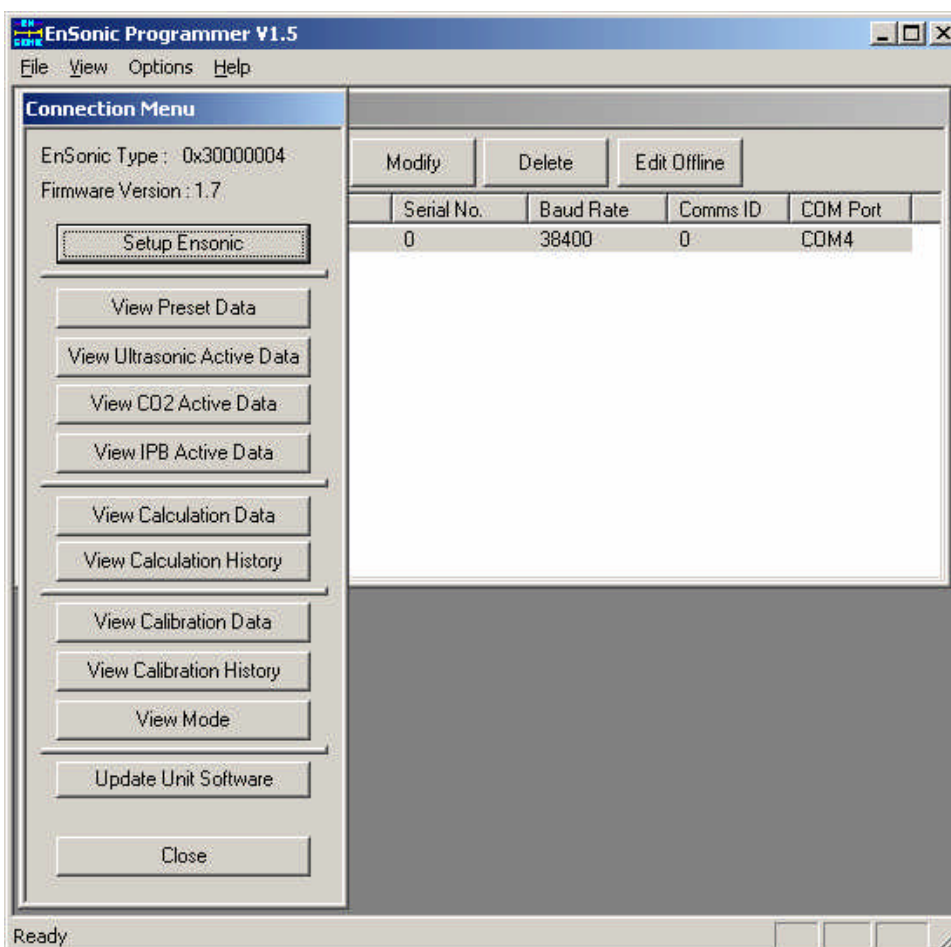Using the 'Save As' button the data shown in the different windows can be saved to an ASCII file.

Figure 3, Connection Menu

Setup Pages

In the following sections the different Setup Pages are described. These pages can be reached either via the Setup EnSonic option on the Connection Menu or via the Edit Offline on the Connection List window.

Date & Time

This page is used to set various time and clock related items of the EnSonic.

Available options:
1) The date and time can be set by using the PC's internal clock or a manually specified date and time can be entered.
2) The daily start of the contract time can be set in hours. The contract time is related to the calculation of the daily averages of the measurement results of the EnSonic.
3) A hardware serial number for the boards in the unit can be set. This item is not time related and normally is assigned a specific number during manufacturing.

Remarks:
- if the battery backup on the EnSonic processor board is not activated (dip-switch 4) the unit will loose it's date and time information each time power to the unit is switched off
- during normal operation the date and time of the EnSonic unit is updated regularly using the FC2000's date and time
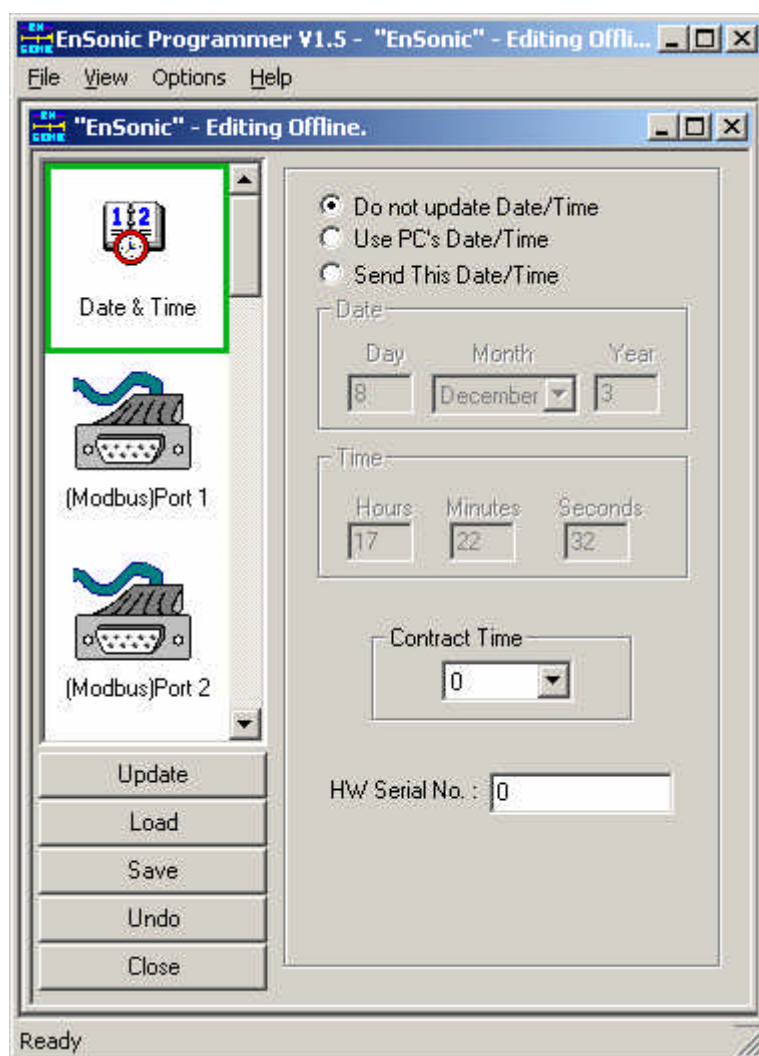
(Modbus) Port 1

This page is used to set the parameters of serial communication port 1 (: TER1 on the EnSonic processor board). Although this port is normally used to configure the EnSonic, it can also be used for MODBUS communication (ASCII or RTU). Since this port only supports the RS-232 protocol a RS232-485 converter should be used for long communication lines.

The pin layout of TER1: pin 1 -> Tx, pin 2 -> Rx, pin 5 -> GND.

Available options:
1) Modbus Setup: determines which register setting is used by this port when communicating via MODBUS (see the pages 'Modbus Setup 1'and 'Modbus Setup 2' for the description of the register settings)
2) Modbus ID: Modbus Identity, default: 1
3) Baudrate: freely selectable and must match the control system's baudrate, default: 38400
4) Delay: time delay between request and answer in 10 ms units, default: 0
5) Reset Timeout: time limit before the port is reset, default: 5 sec.
6) Data Timeout: time limit before the data timeout flag is set, default: 10 sec.
7) Comms ID: identity of port when using the EnSonic configuration software, must match the Comms ID in the Connections List of the configuration program, default: 0 (do not change this value)

Remarks:
- to allow access to the unit at all times the WordLength, Parity and number of Stop Bits are fixed
- although the configuration software uses a dedicated protocol, assigning a Modbus Setup to this port does not influence the communication with the configuration software
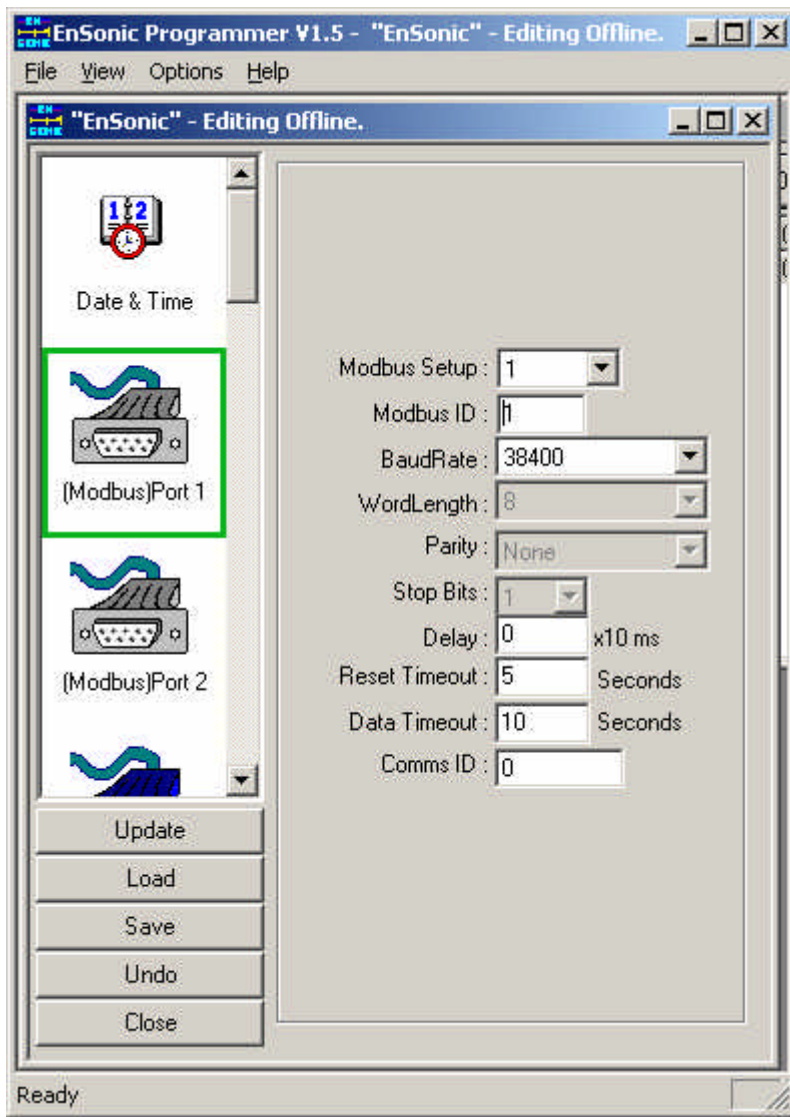
(Modbus) Port 2

This page is used to set the parameters of the serial communication port 2 (: TER2 on the EnSonic processor board). Data can only be sent to and retrieved from this port using the MODBUS protocol. The port does not support the dedicated protocol of the configuration software and can therefore not be used to configure the EnSonic. The port supports both the RS 232 and the RS 485 protocols. Normally, RS 485 is selected and the M2000 is connected to this port.

The pin layout of TER2:
      RS232: pin 1 -> Tx, pin 2 -> Rx, pin 5 -> GND
      RS485: pin 3 -> B, pin 4 -> A.

The pin layout of the M2000 serial ports:
      RS232: pin 2 -> Rx, pin 3 -> Tx, pin 5 -> GND
      RS485: pin 6 -> A, pin 9 -> B.

Available options:
- Modbus Setup: determines which Modbus register setting is used by this port
- Modbus ID: Modbus Identity, default: 1
- Baudrate: freely selectable, must match the control system's baudrate, default: 38400
- Wordlength: length of word in bits, default: 8
- Parity: parity check settings, default: None (no checking)

- Stop bits: number of stop bits, default: 1
- Delay: time delay between request and answer in 10 ms units, default: 0
- Reset Timeout: time limit before the port is reset, default: 5 sec.
- Data Timeout: time limit before the data timeout flag is set, default: 10 sec.
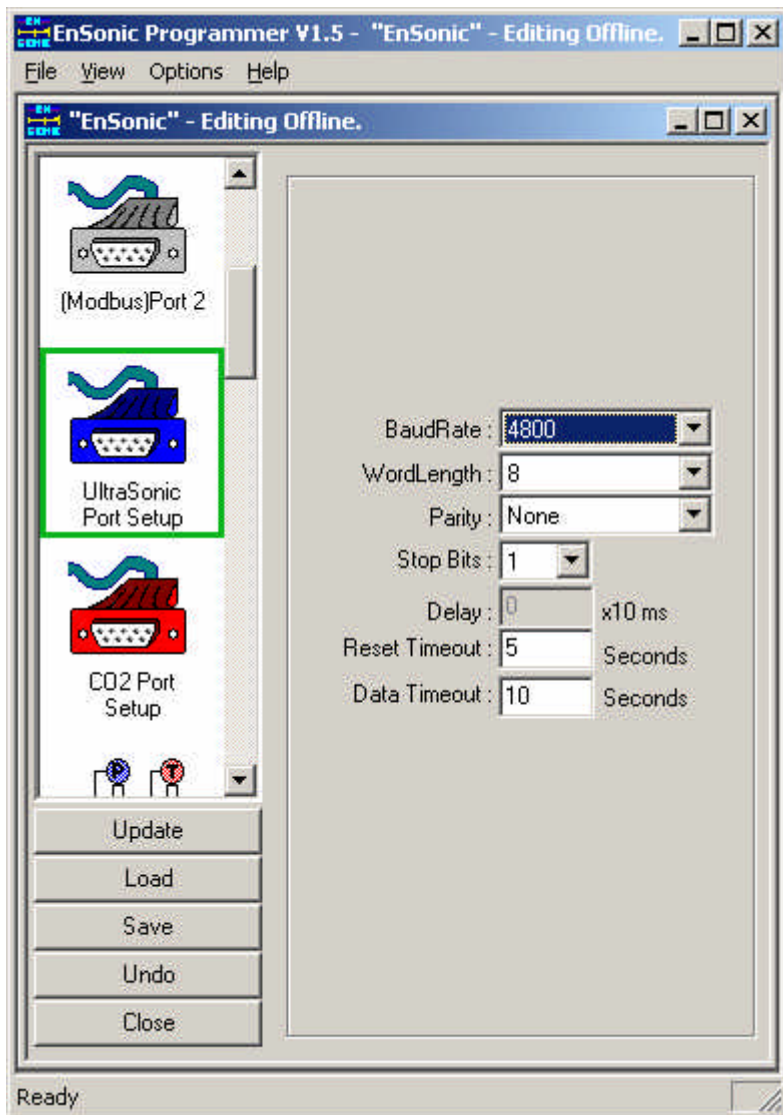- Protocol: RS485 or RS232, default RS485
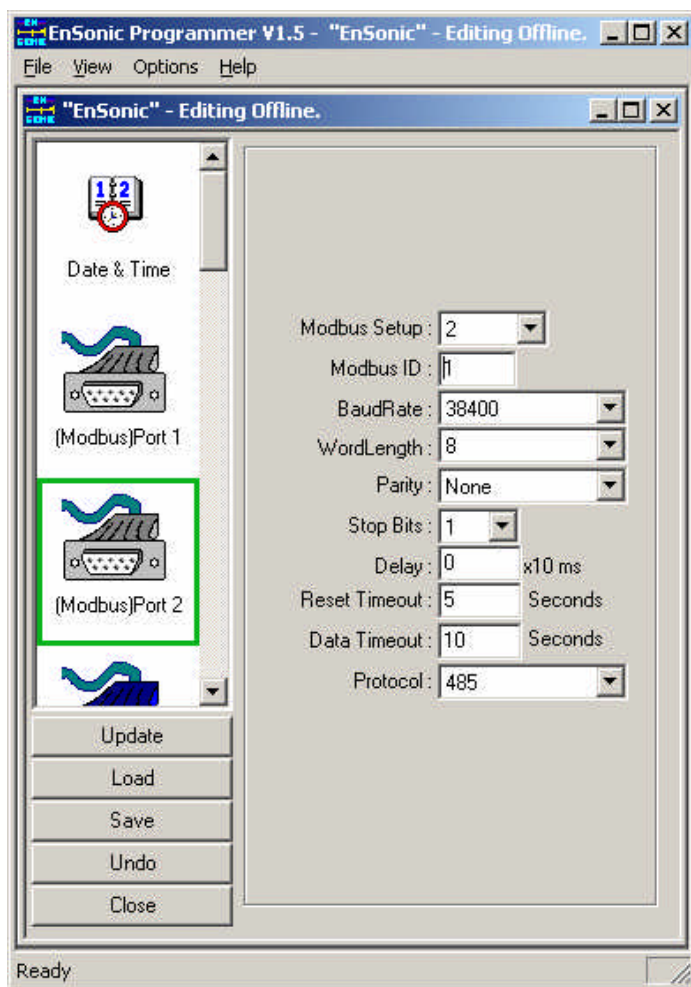
Ultrasonic Port Setup

On this page the items dealing with the internal communication with the ultrasonic metering system are displayed. Since the items have been set properly during manufacturing no modifications should be made to these parameters.

Available options:
- Baudrate: communication speed, must match the baudrate of the US electronics, default: 4800
- Wordlength: number of bits, default: 8
- Parity: parity check, default: None
- Stop bits: number of stop bits, default: 1
- Reset timeout: time in sec before the interface is reset when no data is received, default: 5 sec
- Data timeout: time in sec before data timeout flag is set, default: 10 sec

CO2 Port Setup

On this page the items dealing with the internal communication with the AGM-10 CO2 sensor are displayed. Since the items have been set properly during manufacturing no modifications should be made to the parameters.

Available options:
- Baudrate: communication speed, must match the baudrate of the sensor, default: 9600
- Wordlength: number of bits, default: 8
- Parity: parity check, default: None
- Stop bits: number of stop bits, default: 1
- Reset timeout: time in sec before reset of interface when no data is received, default: 5 sec
- Data timeout: time in sec before data timeout flag is set, default: 10 sec
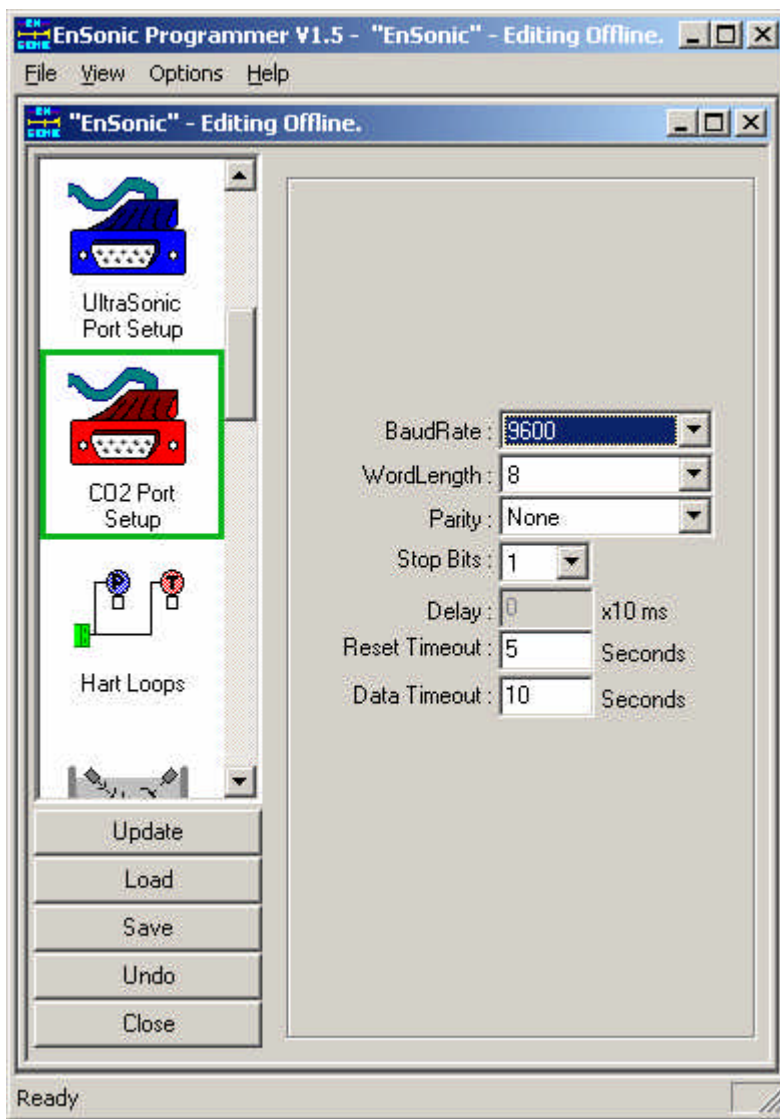
Hart Loops

This page is used to switch the different Hart loops on or off and to map the transmitter addresses to the HART loops.

Available options:
- Hart Loop 1/2/3 On/Off: when selected the Hart loop is switched on
- Hart Loop 1/2/3/ Transmitter address: HART address of the device connected to the loop.
- Reset Time: time in sec before reset when no data is returned from the devices, default: 5 sec
-Timeout: time in sec before timeout flag is set, default: 10 sec.

Remark: the temperature transmitter MUST have address 0 assigned to it since the transmitter is operating using the 4-20 mA analog output and the HART protocol simultaneously. The pressure transmitters may have different addresses assigned.
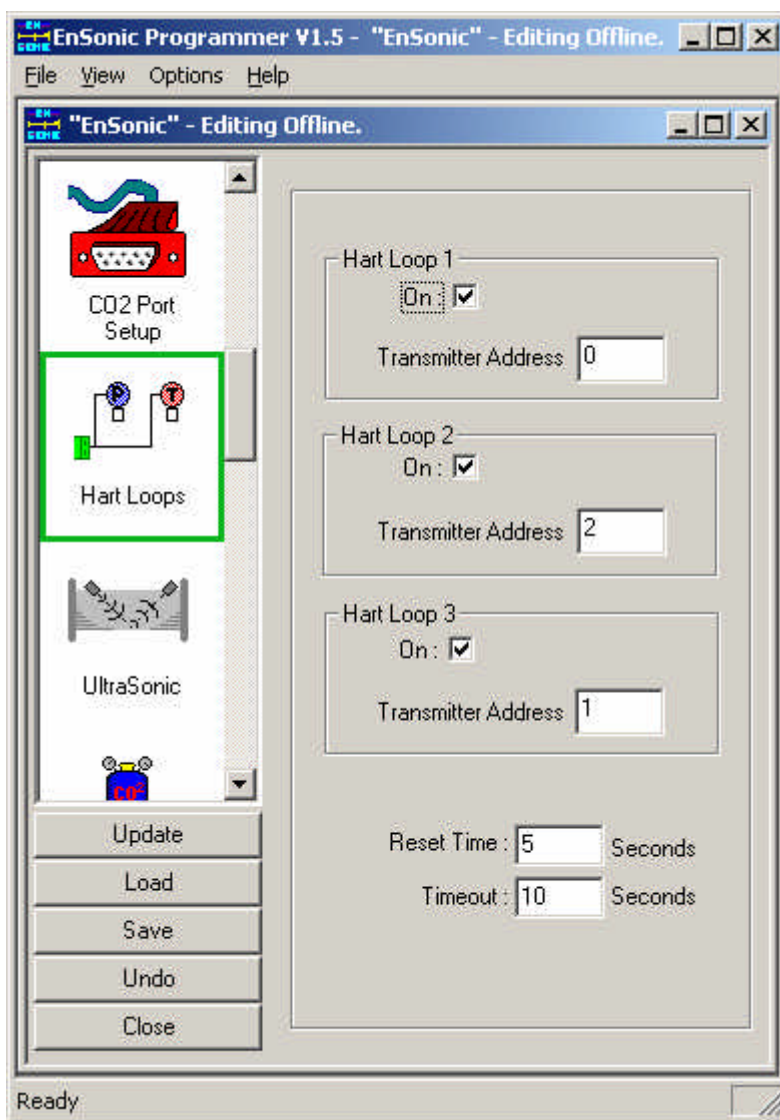
Ultrasonic

On this page the parameters determining the operation of the ultrasonic velocity of sound measurements are displayed. Since the parameters were determined during manufacturing and calibration of the unit they should not be modified. Modifications will directly influence the performance and accuracy of the EnSonic.

Available options:
- Number of paths: number of paths on the ultrasonic meter, this number is used to distinguish between the data package of different size, default: 3.
- Clock Period: number depending on the type of electronics used, default: 25

For the acoustich paths of the high and low pressure cell 'Path VOS High' and 'Path VOS Low' the following parameters can be modified:
- Path VOS High/Low Path: the mapping of the path to the fysical path number of the US meter, default: 1 and 2
- Path VOS High/Low Length: the path length as entered in the setup of the US meter
- Path VOS High/Low Kt: the Kt factor as entered in the setup of the US meter
- Path VOS High/Low C Phi: the cosine of the path angles as entered in the setup of the US meter
- Path VOS High/Low Length True: the true path length of the VOS cell
- Path VOS High/Low Kt True: the true Kt factor of the VOS cell
- Path VOS High/Low C Phi True: the true cosine of the path angle of the VOS cell, default: 1
- Path VOS High/Low Vpp:
    i. Use default in Alarm: when the measured Vpp (Velocity per path) exceeds the upper or lower limit (: 'Vpp Min' or 'Vpp Max') the value of 'Vpp default' is used in the calculations, otherwise the measured value is used
    ii. Vpp Min/Max: the upper and lower alarms limits for Vpp in m/s, when a limit is set and the actual velocity exceeds the limit a corresponding error bit is set in the EnSonic status word
    iii. Vpp Default: value to be used when the measured value exceeds the limits.
- Path VOS High/Low Cpp: see Vpp for explanation, Cpp stands for the velocity of sound per path.

The parameters are used to convert the by the US meter measured V and C to travel times which are used to recalculate V and C using the true path length, Kt-factor and path angle.
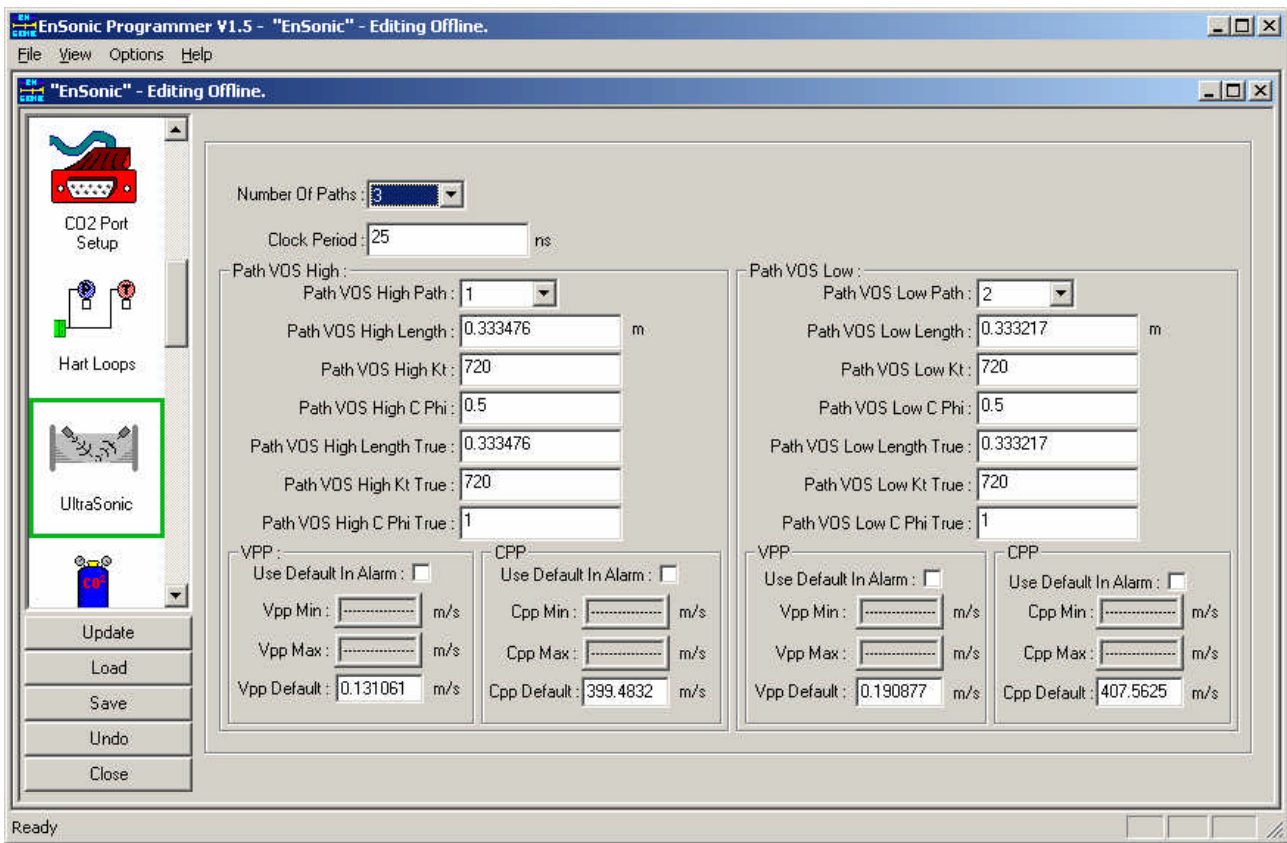
CO2

On this page the parameters required to convert the 16-bit measurement results of the CO2 sensor to a physical value are presented.
Available items:
- Egu Min / Egu Max: parameters used to convert the digital measurement result transmitted by the CO2 sensor to a CO2 concentration. Do not modify these numbers.
- Pressure Min/Max: the upper and lower limit of the pressure transmitter on the CO2 sensor in mbar, when a limit has been set and the actual pressure exceeds the limit a corresponding alarm bit is set in the EnSonic Alarm status word, default values: 900 and 1200 mbar
- Cor 0/1/2/3: coefficients of a 3th order polynomal which are determined during the calibration of the CO2 sensor: $CO2\_corr = Cor\ 0 + Cor\ 1 * CO2 + Cor\ 2 * CO2^2 + Cor\ 3 * CO2^3$ where CO2 is the measured concentration and CO2_corr is the corrected concentration.
- Use Default in Alarm: when the measured CO2 concentration exceeds the upper or lower limit the value entered in 'Def' is used in the calculations, otherwise the measured value is used
- Min / Max: the lower and upper range limit for the corrected CO2
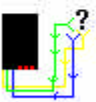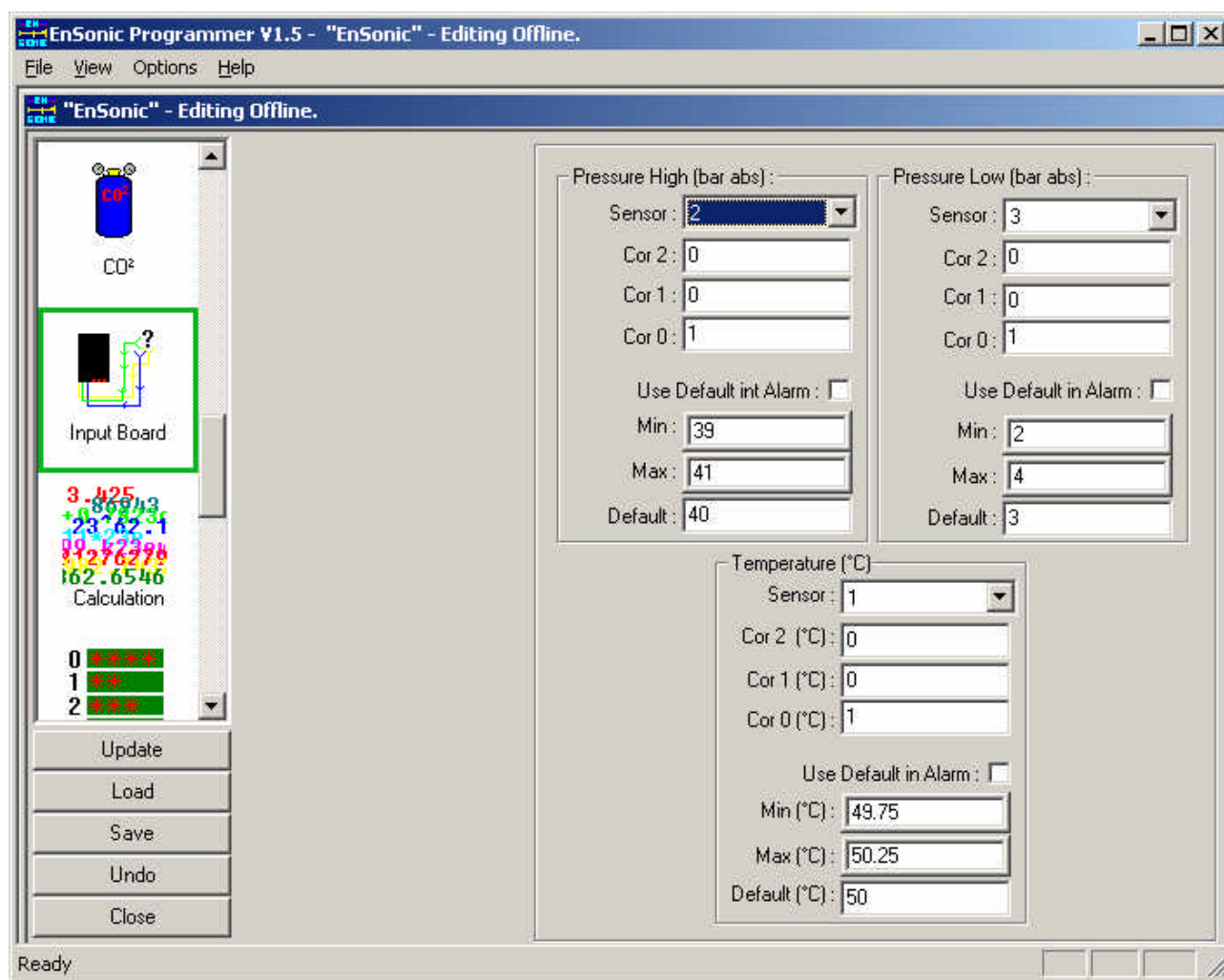
![ELSTER Instromet logo]

Input Board

This page presents the parameters used to configure the 3 HART interfaces on the input board.

Available options:
- Pressure High / Pressure Low / Temperature:
  i. Sensor: the mapping of a particular input parameter to a specific Hart loop (see also the page 'Hart Loops')
  ii. Cor 2 / Cor 1 / Cor 0: coefficients of a 2nd order polynomal used to correct the measured value for the ambient temperature, default: 0, 0 and 1 (: no correction applied)
  iii. Use default in Alarm: when the measured parameter exceeds the upper or lower limit the default value is used in the calculations, otherwise the measured value is used
  iv. Min/Max: the upper and lower alarms limits, when a limit has been set and the actual measured value exceeds the limit a corresponding alarm bit is set in the EnSonic Alarm status word
  v. Default: value to be used when the measured value exceeds the limits

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Calculation

On this page the parameters related to the internal calculations are presented.

Available options:
- Select AGA equation: AGA 8 – DC 92 or AGA 10, fixed to AGA 10
- Low Pass Filter Samples: number of samples used in the moving average of the output results
- (Use) Test CO2 / VOS high / VOS low / P high / P low / T high / T low: value to be used during tests and option to allow for the use of the test value in the calculations instead of the actually measured value
- Always Cold Start Calculation: when selected forces the unit to apply a cold start when starting a new iterative calculation
- Helium: fixed value for the Helium concentration in the gas
- Convergence Limit: absolute value of the convergence limit of the iterative calculations, default: 0.001
- Pb: base pressure, default: 1.01325 bar
- Tb: base temperature, default: 273.15 K
- Dens_air: density of air at base conditions, used to calculate the relative density, default: 1.2931 kg/m3
- Inhibit alarm when using test data: no alarms are raised when using test data
- Units: units to be used for the various calculation results and parameters, fixed values.
- Density, Wobbe, HV & Z:
    - i. Min / Max: the upper and lower range limit, when any of the parameters exceeds a limit a corresponding alarm bit is raised in the EnSonic Alarm Status word.
    - ii. Correction: the value of this parameter is simply added to the result of the iterative calculation, default: 0, use this parameter with care!
- Hysterisis: the amount of hysterisis in % on the output parameters, the hysterisis is applied after exceeding one of the range limits.
- Calc Timeout: time limit in 10 ms after which the iterative calculation is terminated and re-started using updated input parameters, default: 190 (: 1.90 sec).
- H / L Diameter: diameter of High and Low pressure cell in mm, used to calculate volume flow through the cells, default: 5 mm for the high pressure VOS cell and 10 mm for the low pressure VOS cell
- 'Don't add to Average / Low Pass Filter when in': used to determine what to do with the results of the iterative calculations when the EnSonic is in the selected condition. Average: hourly and daily averages, Low Pass Filter: filtered output data

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Modbus Passwords

On this page the passwords for the different security levels of the Modbus registers can be modified.

A four level security system is provided with password protection. The protection level of specific Modbus registers can be set in the 'Modus Setup 1' and 'Modbus Setup 2' pages.

Security Level 0 allows access to the parameters secured on level 0, 1, 2 and 3.
Security Level 1 allows access to the parameters secured on level 1, 2 and 3.
Security level 2 allows access to the parameters secured on level 2 and 3.
Security level 3 allows access to the parameters secured on level 3.

Remarks:
- Depending on the security level attached to a specific user account this page may not be visible or editable.
- The password protection only functions when dip-switches nr 1 and 2 on the processor board are set properly to the PARTIALLY SECURE mode:
  Available modes:
  SWITCH 1 = OFF SWITCH 2 = OFF :   UNIT TOTALLY SECURE
  SWITCH 1 = ON   SWITCH 2 = OFF :   UNIT PARTIALLY SECURE
  SWITCH 1 = OFF SWITCH 2 = ON   :   UNIT PARTIALLY SECURE
  SWITCH 1 = ON   SWITCH 2 = ON   :   UNIT NOT SECURE
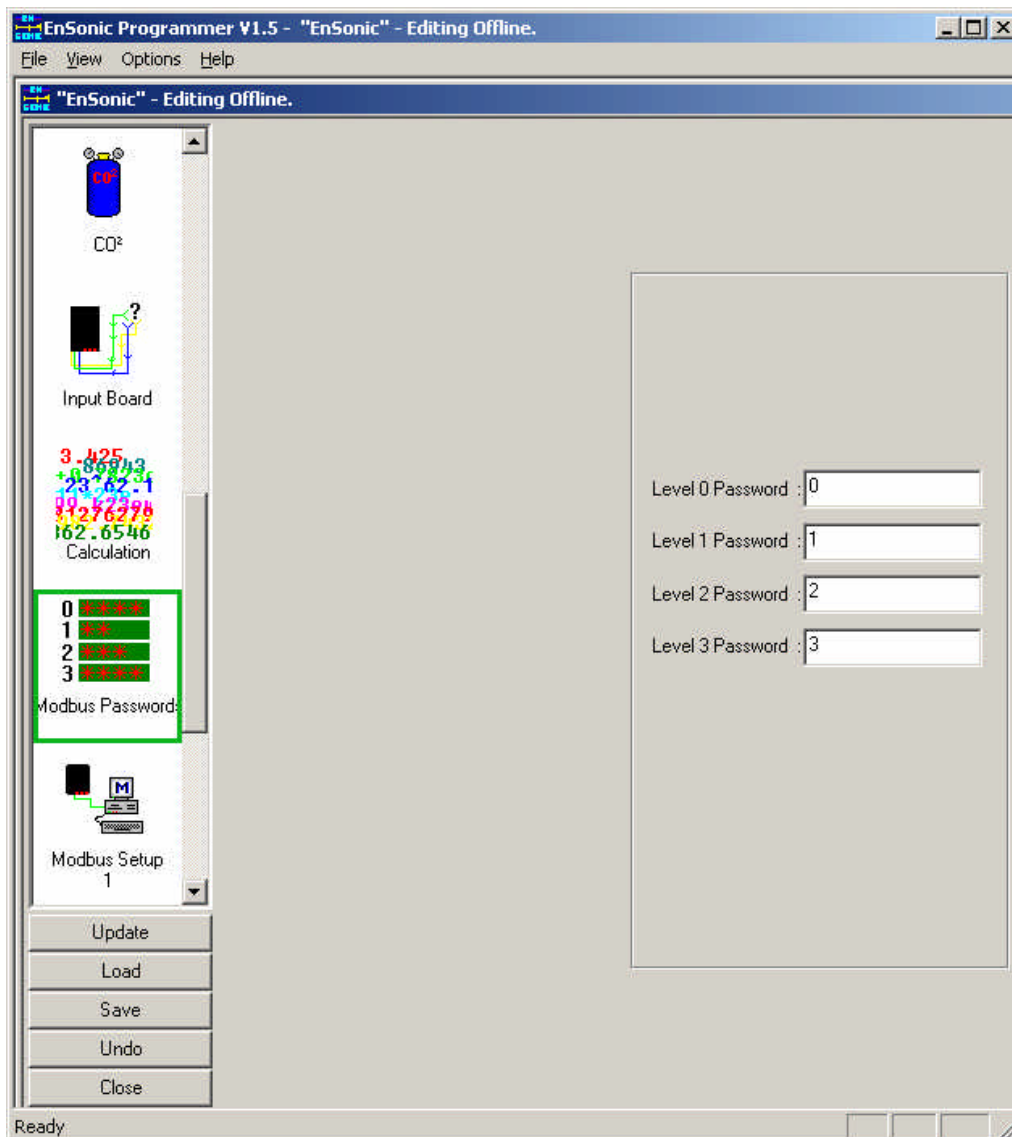
Modbus Setup 1 and 2

On these pages the Modbus Setups can be configured by selecting certain register and defining their setting.
The setups are independent and can be asssigned to one or both communication ports.
The tree like structure on the left is expandable and items can be dragged-and-dropped to the window on the right where the currently selected registers are displayed. The register address, byte order, parameter type, byte size and password level can be set. The Write option can be deselected to inhibit writing to a specific register.
The 'Auto Adjust Addresses' and 'Ask to fill addresses' options are used to facilitate the assignment of large numbers of register addresses.
The Import and Export button are used to import and export Modbus setup files from and to ASCII files. This option is to be used by experienced users only.
For the moment, the Help button does not provide any Help.
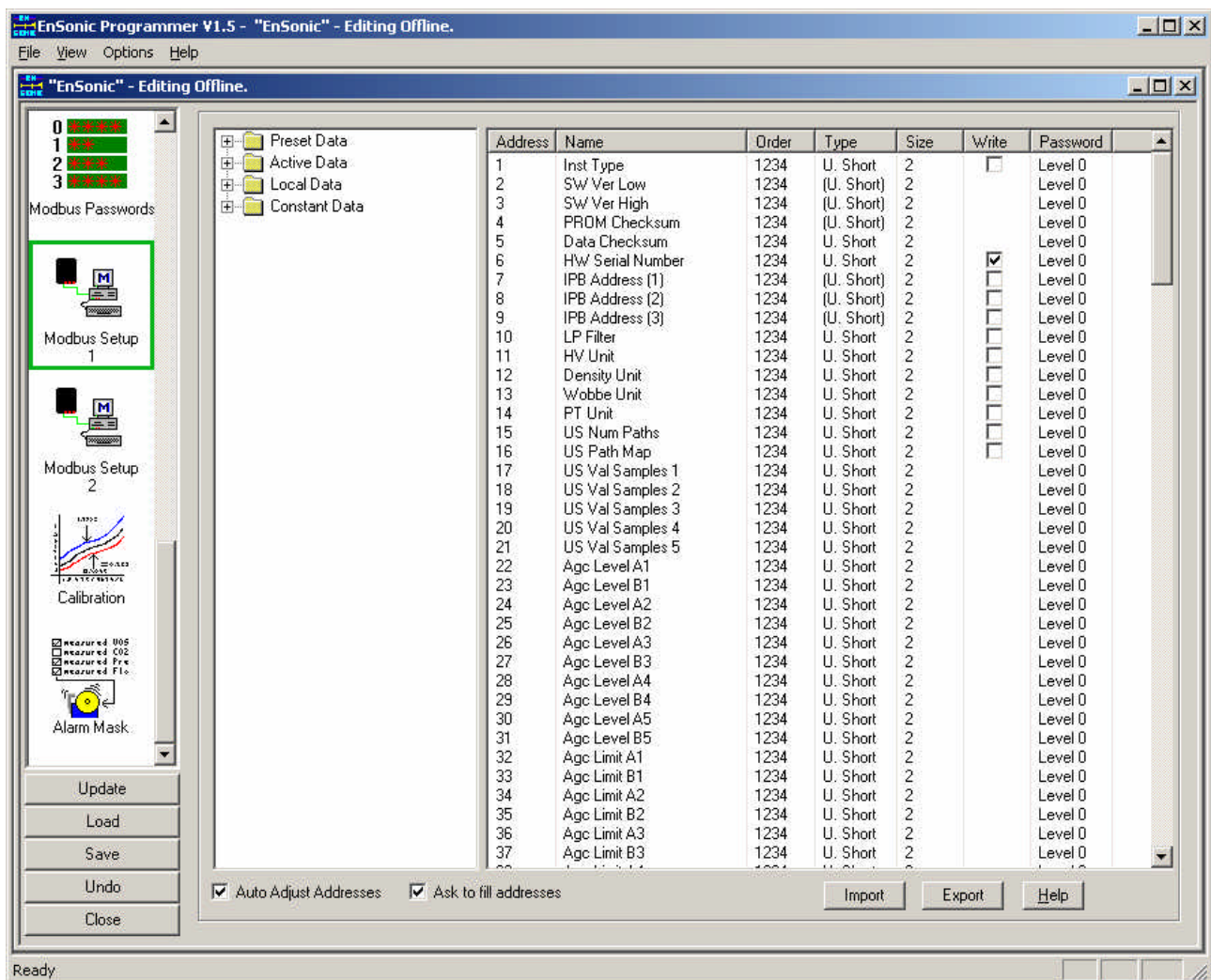
Calibration

On this page the parameters related to the calibration of the EnSonic are presented. More detailed information is presented in the section of the User Manual covering the internal calibration procedure of the EnSonic.

Available options:
- Calibration Interval: the interval between succesive calibrations, depending on the selected option the 'Date' or 'Day of Week' fields may be disabled.
- Gas Mix: when the 'full composition' option is selected the input parameters ànd the selected output result of the iterative calculation are checked against calculated values during calibration, when the '4 components' option is selected only the input parameters are checked against calculated values during calibration
- Gas Composition: the composition of the gas used to calibrate the EnSonic
- Sum of Composition / Wobbe Index: calculated values for the entered composition, used for checking the entered composition
- Calibration Deviation: the maximum allowed difference between successive calibrations in %, when a limit is exceeded a corresponding error bit in the Alarm Status word is set and the calibration error alarm is raised.
- Current Calibration: the deviations between the current and previous calibration in %, the numbers displayed are the relative ratio's between the calculated and measured values and should be close to zero. The item 'Performed' stands for the number of calibrations performed.
- Tcal, Tlp and Twait: timing parameters determining the duration of the calibration, the number of samples used in the low pass filter during the calibration and the time the unit waits after finishing the calibration before clearing the calibration bit.
- Calibration Parameter: one of the four available output parameters can be selected, the ratio between the calculated and measured value of the selected parameter is determined during a calibration, in the Current Calibration panel this ratio is named 'Ref Ref'
- Output state: during calibration the EnSonic is able to present the 'Last Good Valid Result' obtained during normal operation or the 'Actual Measured Value' obtained during calibration.
- Time Bit High: the length of the period in seconds during which the calibration error bit is kept high when a calibration error occurred, by applying a large number an infinitly long interval can be generated

Alarm Mask

The 'Calc Data Main Status' word of the EnSonic contains a generic alarm bit which is set when any of the selected alarms occures. The first 32 alarms are defined in the 'Calc Data Alarm Status 1' word, the CO_2 pressure Min and Max alarms are defined in the 'Calc Data Alarm Status 2' word.