PSM INSTRUMENTATION LTD

ACU1000

Modbus Configuration Utility

For

APT 1000 Series Transmitters

Applicable to Firmware Version 7.00 and later

Burrell Road Industrial Estate
Haywards Heath, West Sussex RH16 1TW, UK
Tel: +44 (0)1444 410040 Fax: +44 (0)1444 410121
www.psmmarine.com E-mail: sales@psmmarine.com

Doc Ref: Man 088 Iss E May 2022

SECTION	TITLE	PAGE
1.0	**Introduction**	**3**
2.0	**Installation**	**3**
3.0	**Application Settings**	**5**
4.0	**Main Menu**	**6**
4.1	**Live Display**	**6**
4.2	**Change Modbus I.D.**	**7**
4.3	**Lookup Table**	**8**
4.4	**Overview Page**	**9**
4.4.1	Overview Key	**9**
4.4.2	Overview Summary	**10**
4.4.3	Overview Controls	**11**
4.4.4	Overview mA Output	**11**
4.5	**Modbus Map**	**12**
4.5.1	Control Buttons	**12**
4.6	APT Configuration	**13**
4.6.1	Customer Tag	**14**
4.6.2	Units Of Measure	**14**
4.6.3	mA Output Configuration	**15**
4.6.4	Fault Conditions Configuration	**15**
5.0	**Utilities**	16
5.1	Modbus ID Finder	16
6.0	**Temperature Utilities (for information only)**	17

1.0 Introduction

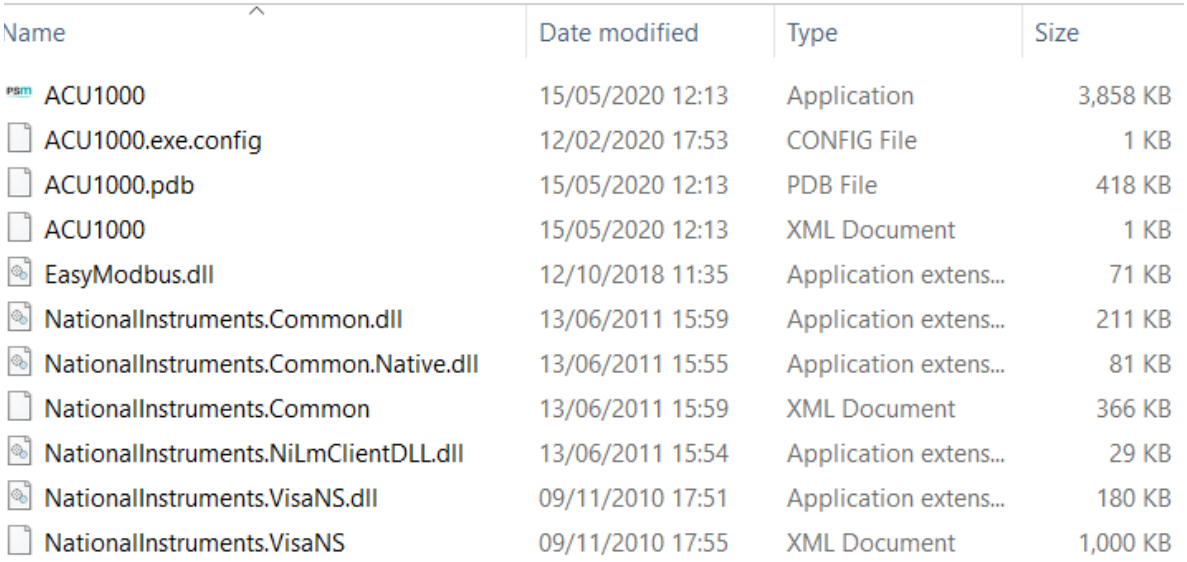
This manual provides guidance on installation and use of the ACU1000 Modbus configuration utility provided by PSM to facilitate setup and configuration of the APT1000 series of transmitters.
It is applicable to all APT1000 transmitters with firmware release 7.00 and later.
The version of firmware for the APT100 may be read from address 1004 of the Modbus map. Refer to section 4.5 of this manual. Note that the firmware version may be shown as an integer value where 70 would mean firmware version 7.00

For guidance on the application, mechanical and electrical installation of APT transmitters refer to the latest issue of PSM Manual MAN 087 APT1000 and RFM User Manual.

2.0 Installation

ACU1000 is a Windows PC application compatible with Windows 7 and Windows 10.
All required files for operation are provided in the compressed folder which will be provided by PSM on request or may be downloaded from the PSM website www.psmmarine.com in the downloads section.

To install decompress the folder to the root folder of the PC - normally C drive. The following files should be observed



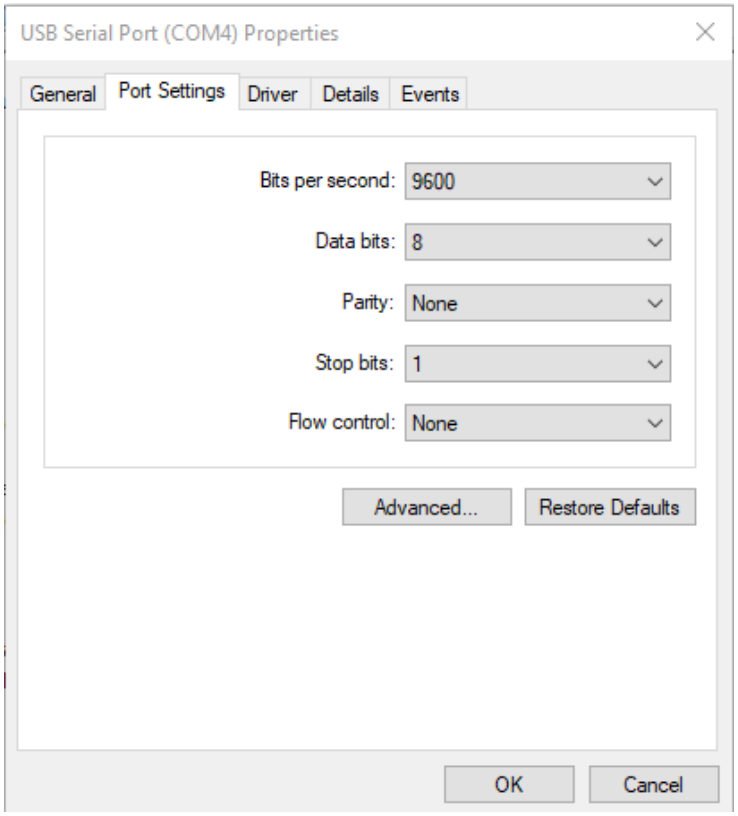
Name	Date modified	Type	Size
ACU1000	15/05/2020 12:13	Application	3,858 KB
ACU1000.exe.config	12/02/2020 17:53	CONFIG File	1 KB
ACU1000.pdb	15/05/2020 12:13	PDB File	418 KB
ACU1000	15/05/2020 12:13	XML Document	1 KB
EasyModbus.dll	12/10/2018 11:35	Application extens...	71 KB
NationalInstruments.Common.dll	13/06/2011 15:59	Application extens...	211 KB
NationalInstruments.Common.Native.dll	13/06/2011 15:55	Application extens...	81 KB
NationalInstruments.Common	13/06/2011 15:59	XML Document	366 KB
NationalInstruments.NiLmClientDLL.dll	13/06/2011 15:54	Application extens...	29 KB
NationalInstruments.VisaNS.dll	09/11/2010 17:51	Application extens...	180 KB
NationalInstruments.VisaNS	09/11/2010 17:55	XML Document	1,000 KB

To run the application click on the APT1000 Application icon. If required a shortcut to this application may be placed directly on the PC desktop in the normal way.

APT1000 transmitters communicate using Modbus RTU via an RS485 serial connection and so this type of connection must be provided on the PC. In most cases this will be achieved by means of a converter module which connects to a USB port on the PC.
PSM recommend the use of an EasySynch ES-U-2101-M unit and can provide one if required—contact our sales team.
Requirements for setting up the converter will vary depending upon the specific unit chosen, but in general the settings required for communication with APT1000 are :-
Baud rate :9600
Data Bits: 8
Stop Bits: 1
Parity: None

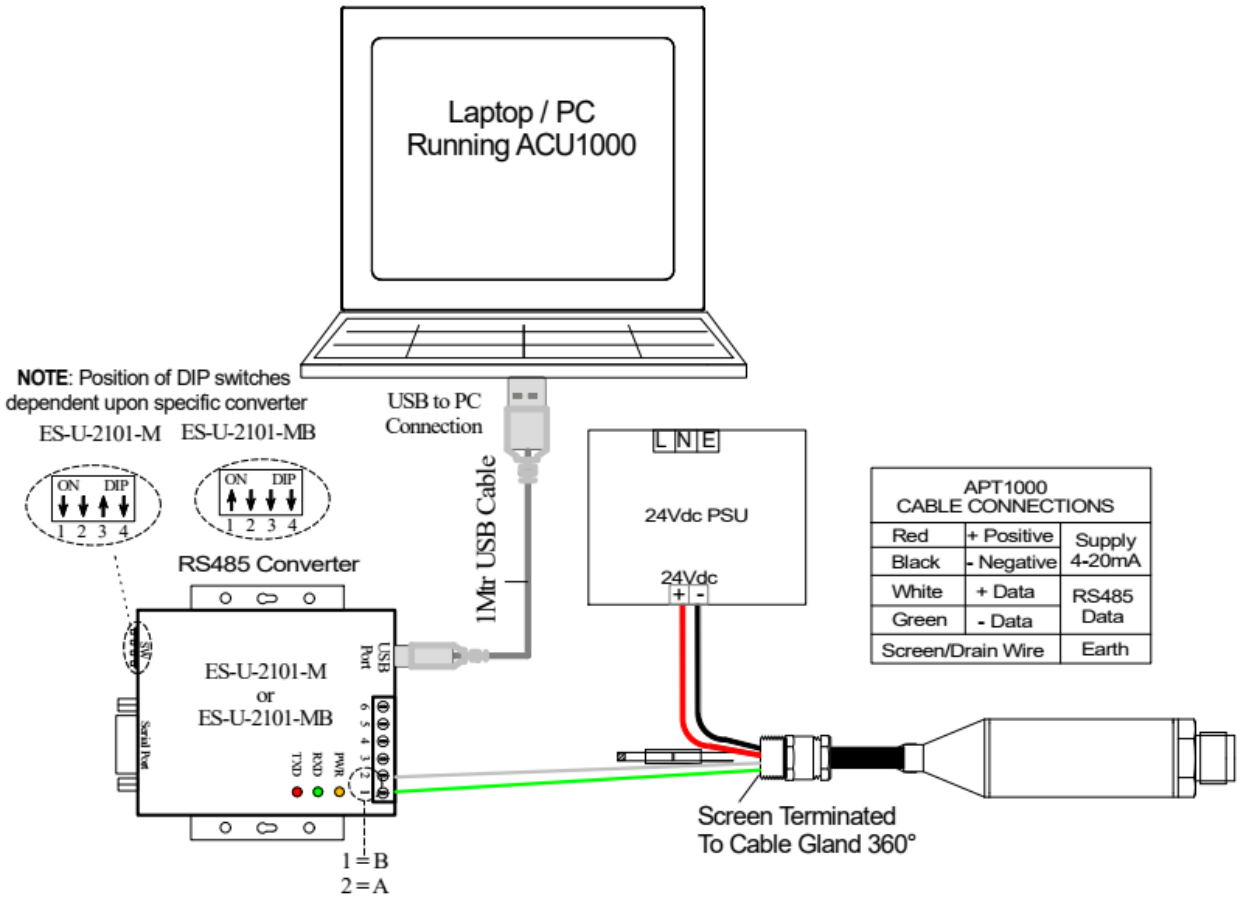
Once the Converter module is powered in accordance with the manufacturers instructions and connected to an available USB port on the PC Windows will assign a COM Port number to it.
The ACU1000 application needs to know which COM Port the converter is connected to and so in the Windows Device Manager look for the Ports (Com & LPT) section and within this the connected USB / RS485 converter should be shown along with the allocated COM Port number. Make a note of this number.

Next, open up the properties for this Port and ensure that the settings are as shown below



Once these are confirmed and the COM port number is noted, the Device Manager may be closed.

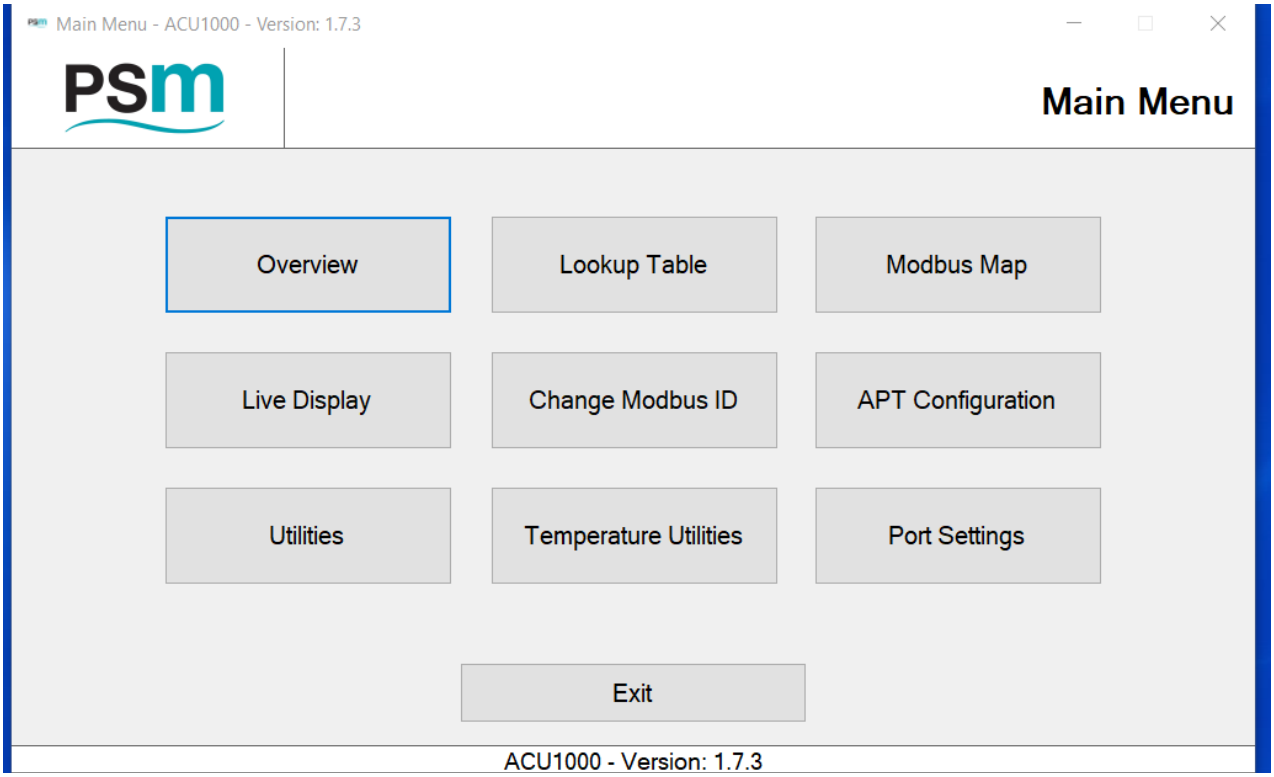
Following is an illustration of the connections required between the APT1000 transmitter, USB/RS485 con-



3.0 Application Settings

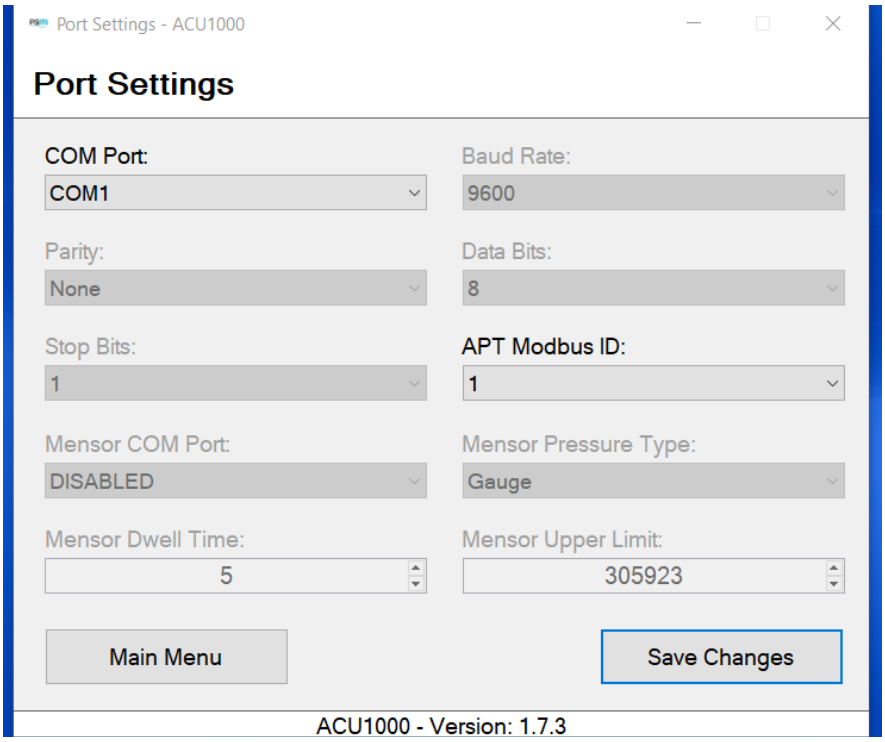
Once the application has been installed and a connection to the APT1000 made it may be run by clicking on the application icon (or shortcut if one was made).

The following main menu screen will be displayed



The version number of the ACU1000 application is shown at the bottom of the page.

The application must first be set to connect to the USB converter via the COM Port that Windows has assigned to it.
Click Port Settings for the following screen



In the COM Port Field use the drop down to select the Com Port that Windows has assigned to the USB to RS485 converter (as described previously using Device Manager).

Next, the Modbus ident of the connected APT1000 transmitter must be entered in the APT Modbus ID field. This ident number is usually factory configured during manufacture to be the last 2 digits of the serial number of the sensor which will be found etched on the sensor body.
If the Modus ident has been set specifically for a particular project or has been changed previously the current ident must be known. If the ident is unknown then Modbus ID finder can be used. Refer to Section 5.1 of this manual.

Once settings are made click Save Changes to return to the Main Menu.

Note that there are other setting options which are greyed out (disabled) these relate to factory operations during manufacture and no changes to these are needed or possible in user mode.

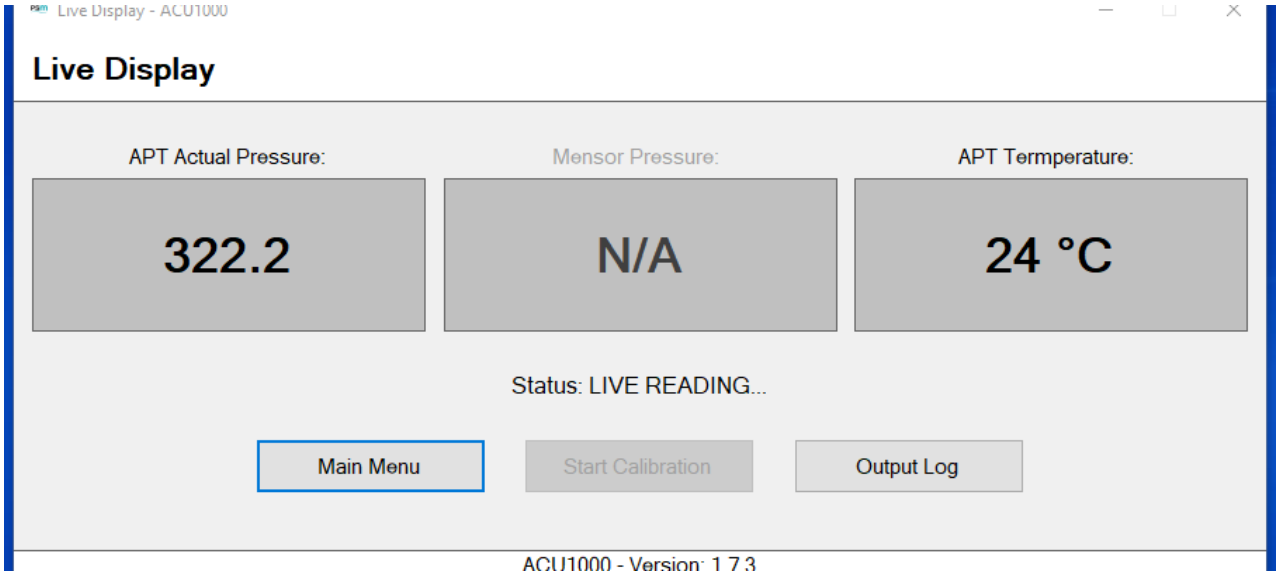
It will be observed that there are various pages in the application that have similar disabled functions, again these are for factory / manufacturing purposes and are not required in user mode.

4.0. Main Menu

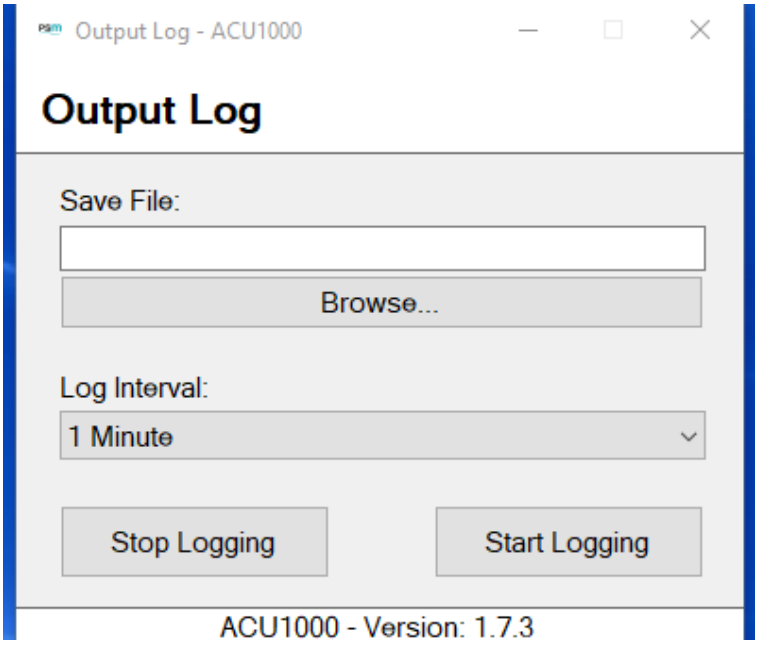
The Main Menu provides access to the various parameters which may be set up in the APT1000 as well as a an Overview and Live Display of the current status.
The commonly used functions of Lookup Table entry and Changes to Modbus Ident number have their own dedicated button.
Detailed parameter configuration can be undertaken in the Modbus Map option. This Modbus map option allows access to all user editable parameters. The screen presentation provides a summary of all parameters but for a detailed explanation of these, a Spreadsheet titled APT1000 Modbus Register Map is provided as an appendix to this manual.

4.1 Live Display

This screen provides a real time indication of the actual pressure and temperature the APT1000 is measuring.



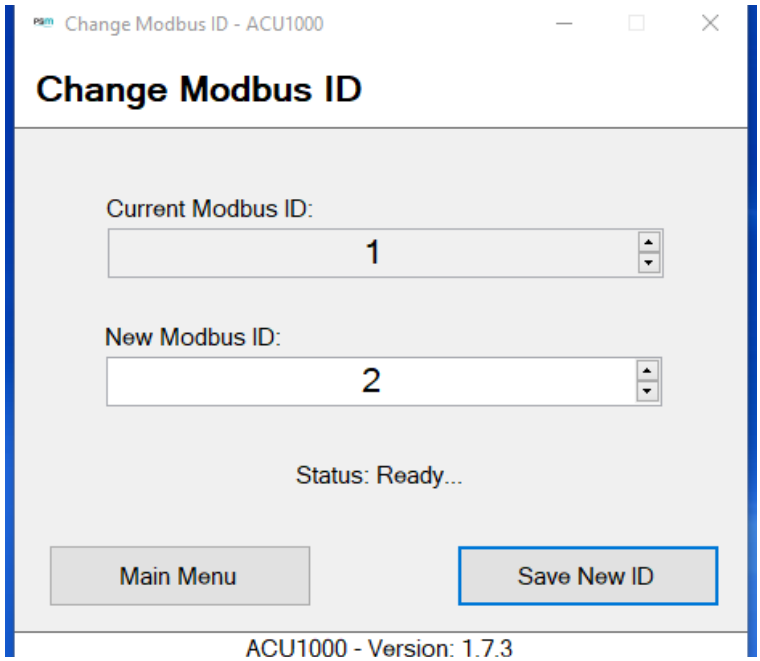
The button Output Log opens up a further screen

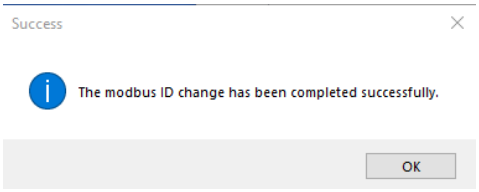


This screen enables the pressure and temperature values to be logged to a CSV file.
Use Browse to set a location for the saved file and enter a name for it to be saved as.
Log interval allows settings from 2 seconds to 60 minutes for each log sample to be recorded.
The logging will commence when Start Logging is pressed and stop when Stop Logging is pressed, and the window may be closed.

The Log file may be opened in Excel and provides temperature and pressure readings at time stamped intervals.

4.2 Change Modbus ID

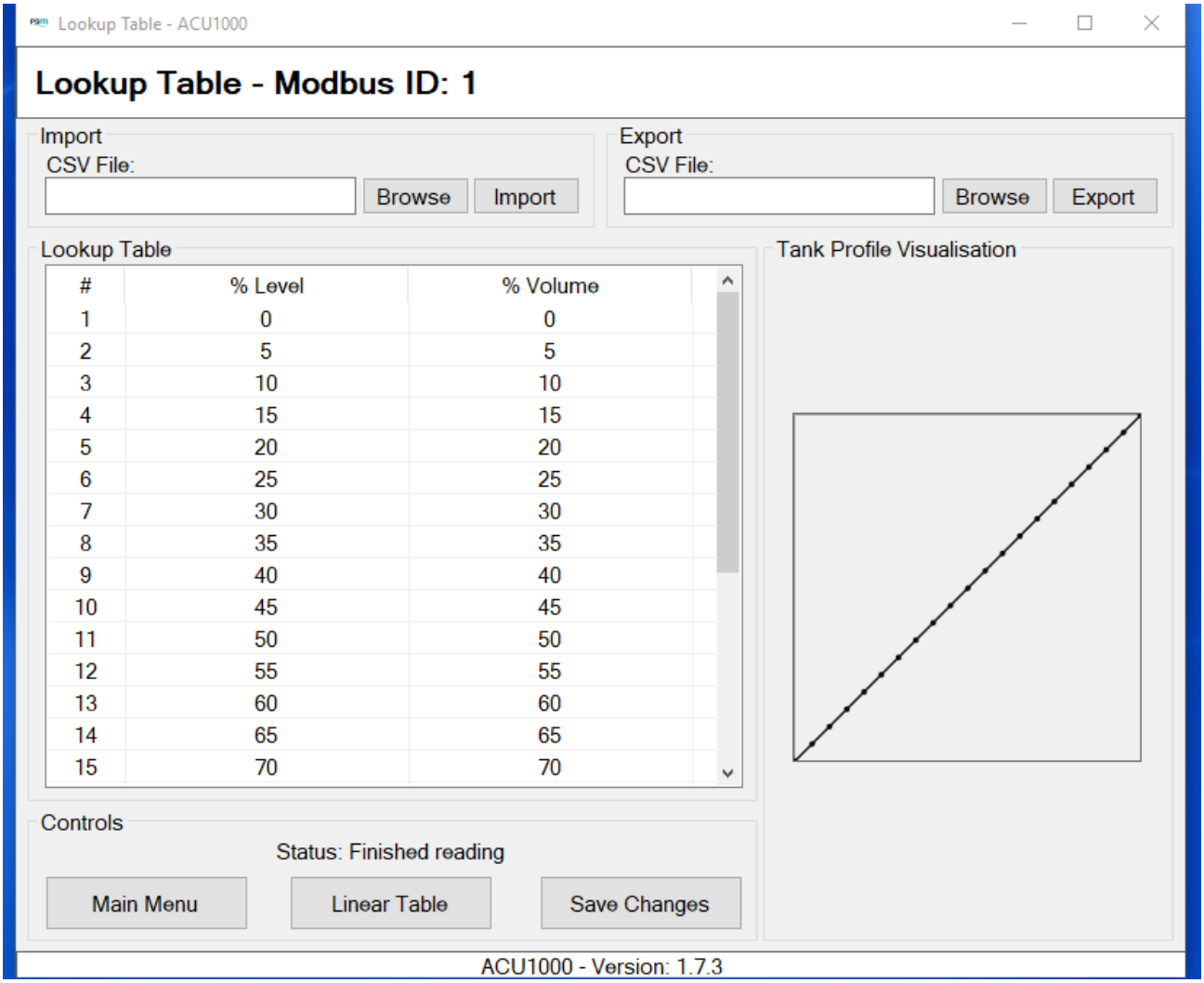




This screen displays current Ident number of the connected APT1000 and allows entry of a new one. Once desired Ident is selected press Save New ID to write to the APT1000. and allow the process to complete before quitting to main menu. A confirmation message is shown.

4.3 Lookup Table

This page allows a lookup table to be entered which relates level in the tank to the equivalent volume at that level.
When the Lookup Table button is pressed the utility reads the current settings in the connected APT1000 and the following screen is displayed



Data is entered in percent terms i.e. % level between 0 and 100% and the corresponding % Volume between 0 and 100%

The table may have up to 25 discrete steps. Click in the field to open it and edit its value.
Each step must increase in value from the previous one.
It is not necessary to use all steps but unused steps should be set 100 / 100

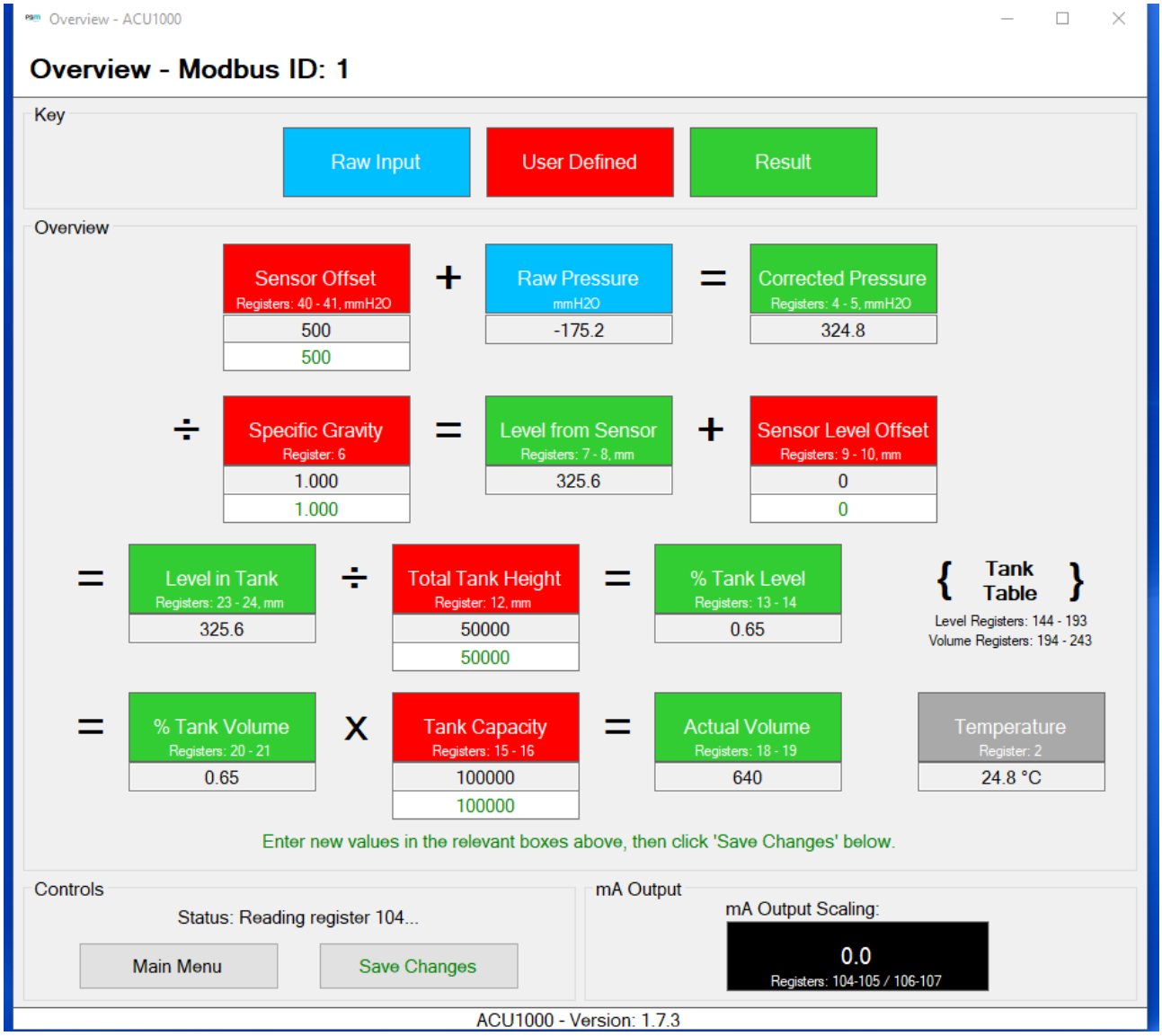
CSV File > Browse / Import: Allows location, selection and import of a CSV file which contains a 2 column table with the appropriate percent values.

Linear Table: enters a default table with linear increments

Save Changes: If any changes are made this writes any changes made into the connected APT1000

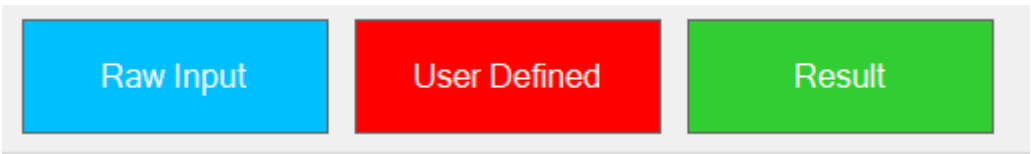
Tank Profile Visualisation: This provides a graphical visualisation of the table as entered and will assist in illustrating if there are any errors in the data entry.

4.4 Overview Page



This screen provides an overview of the APT1000 calculation chain, the current configuration values set, and the calculated results. These are detailed as follows:-

4.4.1 Overview Key



The Blue “Raw Input “ box shows the live value of the pressure the APT1000 is currently measuring in a field underneath the box.

The Red “User Defined” boxes show the parameters that may be programmed into the APT1000 to provide the required calculations. Note that the box shows the Modbus Registers for the parameter and units of measure where relevant.

The green “Result” boxes show the calculated results based on the actual pressure from the APT1000 and the user defined parameters.

4.4.2 Overview Summary

This page provides a complete overview of the current status of the APT1000 together with the user defined parameters and calculated results. It is arranged to show the flow of the calculations from start to finish with the mathematical function that is performed at each step.
Registers are continually read and updated.

For each step the current stored or calculated value of each parameter is shown in a field under the relevant box in black text.

For the red user defined parameters there is a second field in green text. This allows entry of a new value for the parameter.
If changes are made to the user configurable parameters they must be saved to the APT1000 by pressing the “Save Changes” button in the Controls section of the page
User defined parameters are as follows:-

Sensor offset: This parameter is used only if the output from the APT1000 is not reading 0mm when there is known to be no pressure applied. This can happen for example where the APT1000 has been manufactured with calibration assumed that installation will be vertical but in fact it is horizontal. If for example the mm reading is 5mm for zero applied pressure then the Sensor offset whould be entered as –5mm. This would subtract the detected offset meaning that the corrected pressure value was 0mm.

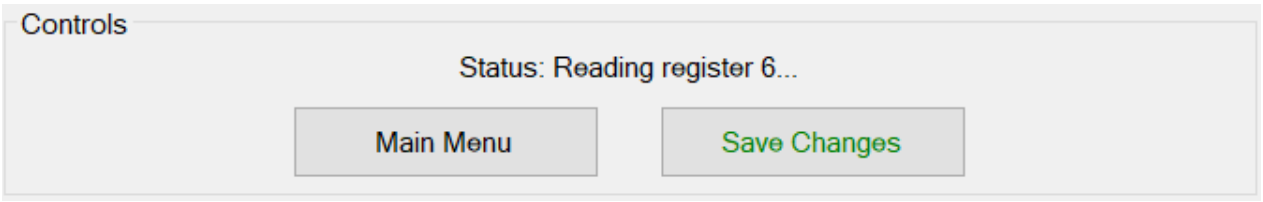
Specific Gravity: Should be entered according to the actual Specific Gravity of the liquid being measured. Valid values are in the range 0.500 to 3.000

Sensor level offset: This is different from Sensor offset as described above. It is used to specify where the APT1000 is mounted in the tank in relation to tank base. For example if the centreline of the APT1000 is mounted 100mm above the tank base then a value of 100 should be used. This, in combination with the Specific Gravity value used (see above) allows the APT1000 to calculate the physical level of liquid in the tank above tank base.
Note: It is important to ensure that this dimension is measured from the lowest point of the tank to the APT1000 centreline. For tank with a sloping base where the transmitter is mounted at the high end of the slope, then the amount of slope must also be added to the local measurement to tank floor to give the true value above base.

Total tank height: this is entered in millimetres and is the dimension from the tank base at lowest point to the top of the tank or the maximum fill point, whichever is lower.

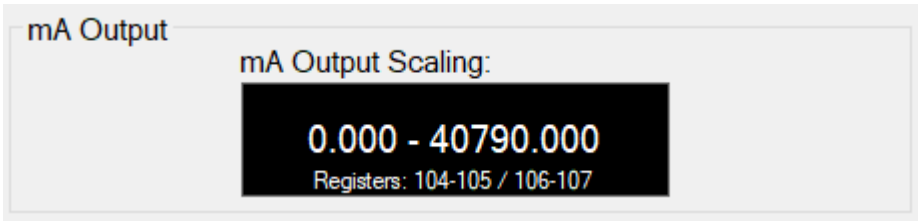
Tank capacity: This is entered in whichever Engineering Units the APT1000 is required to provide data in.

4.4.3 Overview Controls



The Controls section will indicate that it is saving changes and once complete will revert to normal operation, reading the registers to update the screen.
Exit to main menu by pressing the Main menu button,

4.4.4 Overview mA Output



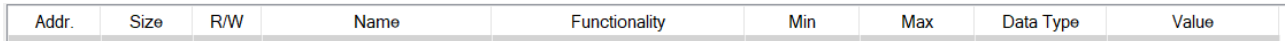
This section shows the current settings for the mA output scaling. Note that it is only relevant if the mA value has been set up to represent scaled pressure.
The behavior of the mA output is defined by the setting of register 250 - Refer to the appendix "APT1000 Modbus Register Map" for a full description of the options available.
If Register 250 has been set to a value of 2 it will output according to scaled pressure.
The value of scaled pressure to which 4mA relates is set in registers 104 & 105, and the value to which 20mA relates is set in registers 106 & 107

4.5 Modbus Map

This button accesses a complete map of all registers stored in the APT1000.
This includes both factory set and user defined values.
Factory set parameters are read only whereas user defined parameters may be changed from this page.

For a full explanation of the meaning and function of each parameter refer to the appendix to this Manual "APT1000 Modbus Register Map"

The page has a number of columns:-



Addr. - the Modbus Register Address. Each register is a Single Word (16 Bit)

Size - the size of the Register. 1 = Single Word, 2 = Double Word. Note that in the case of a double word only the address for the first register is shown. For example the value for Actual pressure is stored as a Double Word starting at Register 4 but is actually stored in registers 4 & 5

R/W. - Access. R+W = User accessible for Read & Write. P = Factory Programmed - Read Only - Indicated by grey highlighting.

Name - Identifying name for the register

Functionality - Brief description of function. Note that the functions are fully described in the appendix "APT1000 Modbus Register Map"

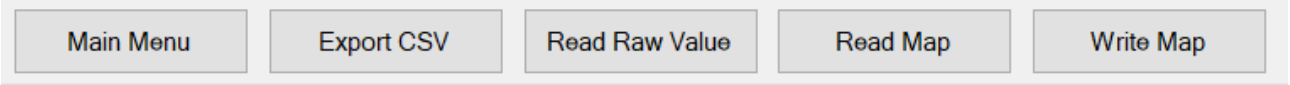
Min - The minimum permitted value for the parameter

Max - The maximum permitted value for the parameter

Data Type - Type of Data held in the register(s)

Value - The current value stored in or calculated by the APT1000. Note that when the Map is initially opened it reads all parameters to populate this column. Where values are editable (R+W) type clicking in the field opens a dialogue box where a new value can be entered. Select save to store the new value.
Note: This value is saved locally to the Utility and not immediately written to the APT1000. It is recommended to make all changes to values required and save them. Once all changes are saved, write them to the APT1000. Writing to the APT1000 is detailed in the following section under "Write Map".

4.5.1 Control Buttons



At the bottom of the map there are control buttons

Main Menu - Returns to Main Menu

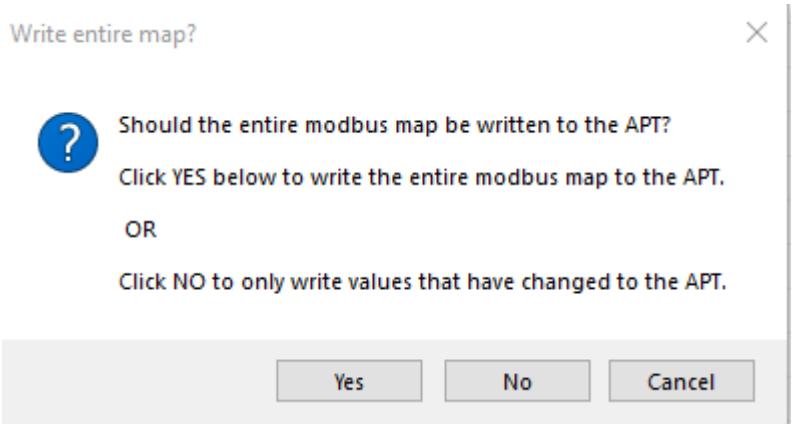
Export CSV - This allows a CSV file containing the current values of all registers to be created. Clicking on it will open up a dialogue box prompting for a name and save location. Once entered click Save to create the CSV file.

Read Raw Value - This allows the value of a specific register to be read. Note that this will take a fresh reading of the Raw Value from the selected register. The meaning of the returned value should be defined by reference to the "APT1000 Modbus Register Map" to understand how the rav value must be scaled or combined with other register values to derive the parameter value.

Read Map - This performs a full read of the Map to refresh the values in Value Column.

Write Map - This allows amended values to be written to the connected APT1000. There are two choices for writing to the APT1000:-
A) Write the values of the entire Modbus Register Map to the APT1000
B) Write only to those Registers which have changed value (see description of Value above)

When the Write Map button is selected a dialogue screen is shown which prompts for the type of write to be performed.

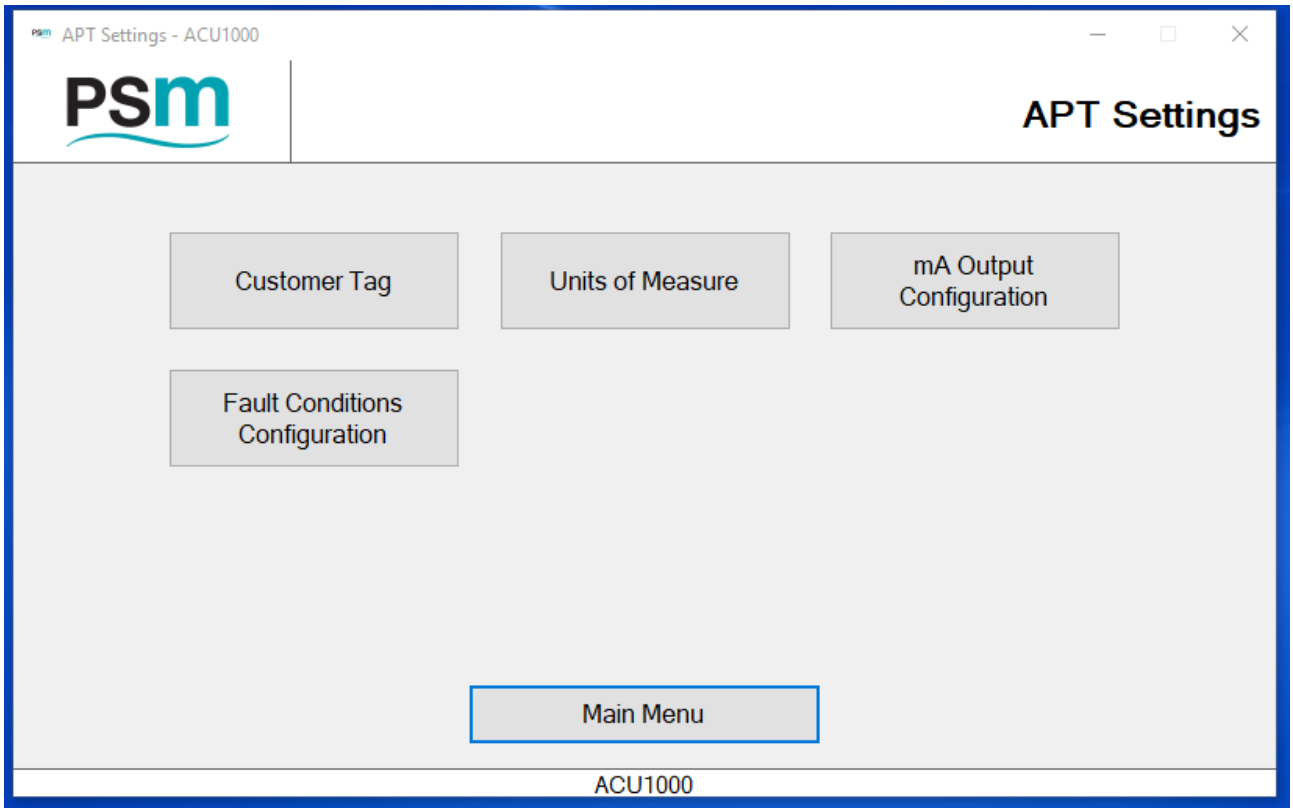


Once the selection is made the appropriate write action is taken.
A status message above the control buttons indicates progress and success.

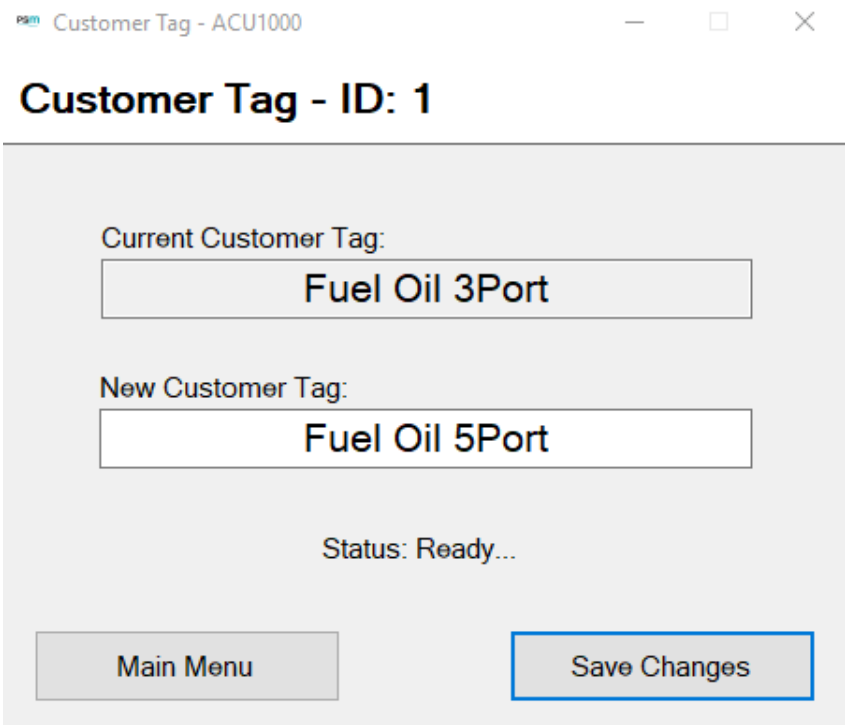
Note that writing the full Map will take some time because values are readback for confirmation as they are written.

4.6 APT Configuration

This menu option leads to a further screen where specific parameters may be configured for the connected APT1000.

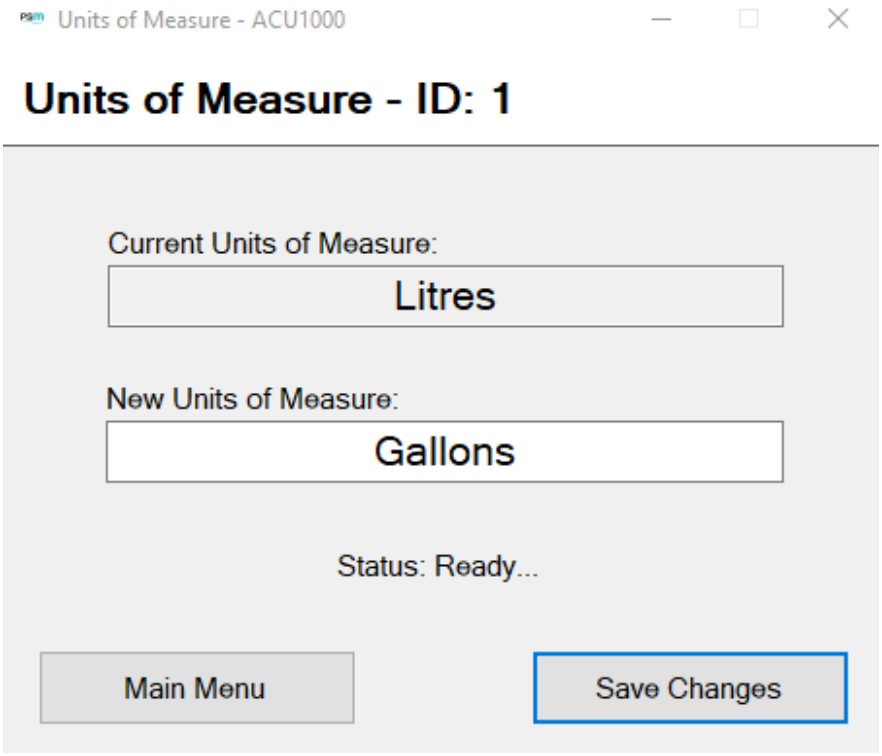


4.6.1 Customer Tag



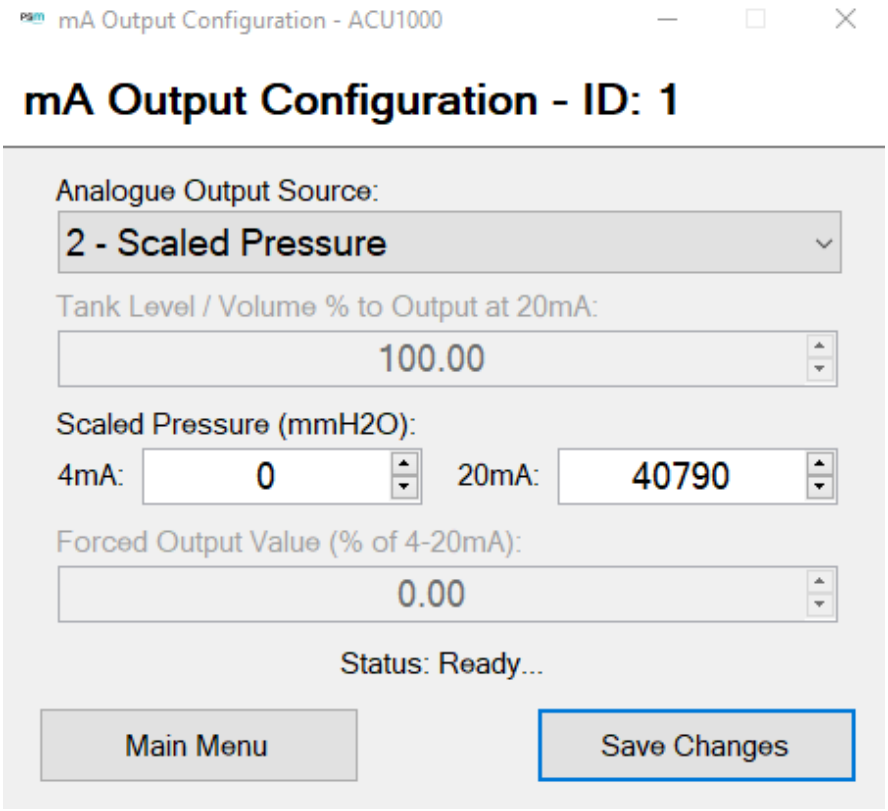
This screen reads the current tag when opened and displays it in the “Current Customer Tag” box.
A new Tag may be typed in and written to the APT1000 by using the “Save Changes” button.
Note that the Tag may have a maximum of 20 characters including spaces.

4.6.2 Units Of Measure



As detailed above for Customer Tag, a maximum of 20 characters including spaces can be used.

4.6.3 mA Output Configuration



This screen allows which parameter the mA output represents to be selected from the drop down menu.

The Choices are:

0 - Tank Volume % This option sets 4-20mA over the volume of the tank as defined in the look up table. 0% is 4mA and 100% is 20mA

1 - Tank Level % This option sets 4-20mA over the actual level of the tank as defined in the look up table. 0% is 4mA and 100% is 20mA

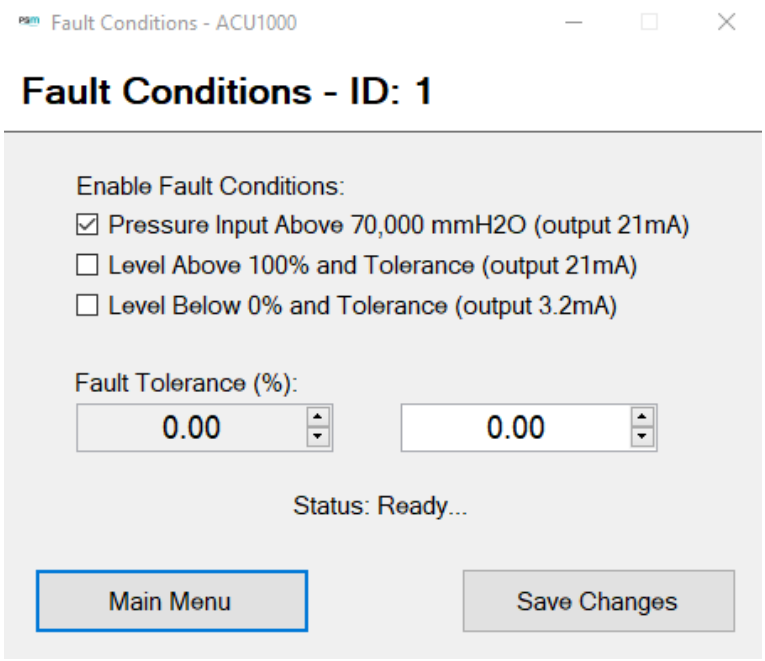
2 - Scaled Pressure Allows the 4-20mA Output to be scaled over a specified pressure range in mmH20. If selected the Scaled Pressure dialogue boxes are enables and values for 4mA and 20mA can be entered.

3 - Actual Pressure This option provides 4-20mA over the full factory calibrated range of the APT1000

4 - Switch off - The mA output is fixed at 3.2mA

5 - Force Output Value. If this option is selected the Forced Output Value text box is enabled which allows a specific value to be entered that the APT1000 will set the mA output signal to. The value is entered in % terms, i.e. an entry of 50% would force the output to 12mA.
This setting is intended for testing of externally connected reading equipment to validate that it shows the expected indication for a given mA signal.

4.6.4 Fault Conditions Configuration



This screen allows selection of the conditions which will cause the mA output to drive to its fault indication current value of either 3.2mA or 21mA,

Notes
70,000 mmH20 is the maximum possible calibrated range of an APT1000

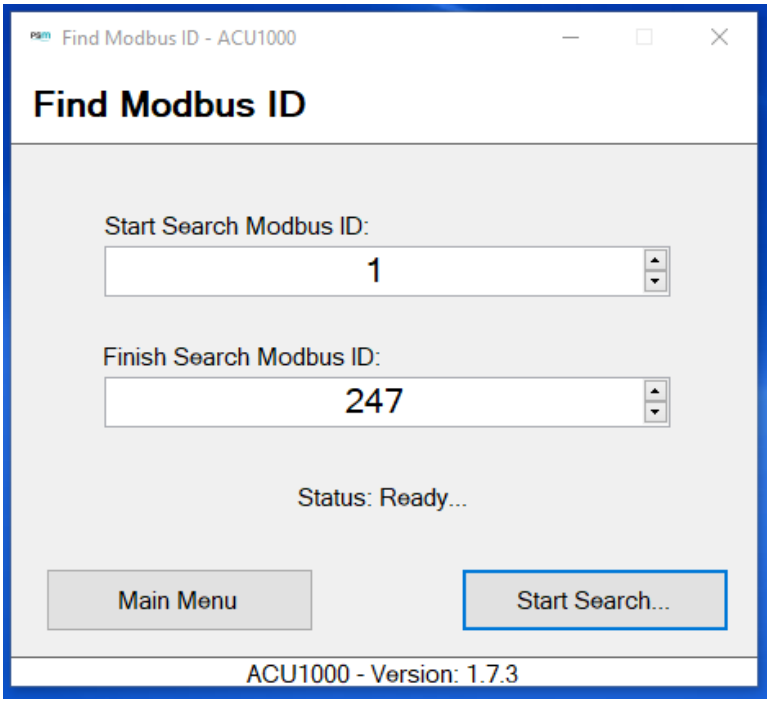
Level Above 100% as defined by the tank full level plus any tolerance percent value which is entered into the dialogue box.

Level below 0% as defined by the tank empty level plus any tolerance percent value which is entered into the dialogue box.

5.0 Utilities

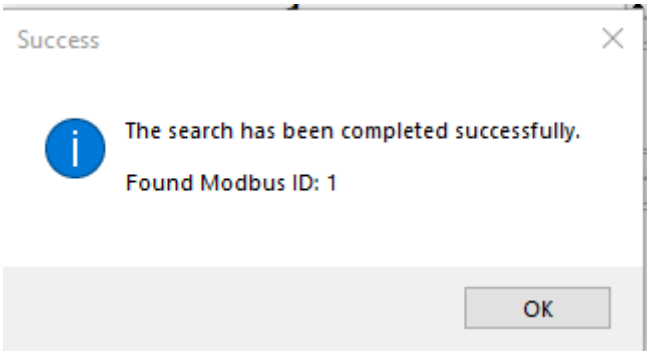
5.1 Modbus I.D. Finder

This utility can be used when the Ident number of the APT1000 connected is unknown. When selected the following screen is displayed.



The utility sequentially searches for Ident numbers in the range between the start and finish ID numbers entered. Note that 247 is the maximum ID value.

Once the Ident number is identified a message will be displayed



6.0 Temperature Utilities

THIS MENU OPTION IS NOT APPLICABLE TO APT1000 TRANSMITTERS WHICH ARE MANUFACTURED AS LIQUID LEVEL OR PRESSURE TRANSMITTERS.

This section is only applicable where the APT1000 has been supplied as a temperature measurement transmitter.

The temperature measurement transmitters are fitted with a PT100 temperature probe in place of the pressure measurement cell of the APT1000 for pressure / liquid level applications.

THIS SECTION OF THE ACU1000 UTILITY MUST NOT BE USED FOR LEVEL OR PRESSURE TRANSMITTERS.

A display of the temperature being measured by the internal temperature detector on the APT1000 transmitters which are fitted with a pressure measurement cell may be read on the Live Display page - see section 4.1 of this manual.

PSM WEEE Producer Registration No WEE/HC0106WW

PSM Instrumentation Ltd
Burrell Road Industrial Estate
Haywards Heath, West Sussex RH16 1TW, UK
Tel: +44 (0)1444 410040 Fax: +44 (0)1444 410121
www.psmmarine.com E-mail: sales@psmmarine.com