



PSM INSTRUMENTATION LTD

ACU1000

Modbus Configuration Utility

For

APT 1000 Series Transmitters

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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.













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
 APT 1000	15/11/2019 07:43	Application	1,888 KB
 APT 1000.exe.config	15/11/2019 07:43	CONFIG File	1 KB
 APT 1000.pdb	15/11/2019 07:43	PDB File	216 KB
 APT 1000	15/11/2019 07:43	XML Document	1 KB
 connection_settings	15/11/2019 07:49	Text Document	1 KB
 EasyModbus.dll	15/11/2019 07:43	Application extens...	71 KB
 NationalInstruments.Common.dll	15/11/2019 07:43	Application extens...	211 KB
 NationalInstruments.Common.Native.dll	15/11/2019 07:43	Application extens...	81 KB
 NationalInstruments.Common	15/11/2019 07:43	XML Document	366 KB
 NationalInstruments.NiLmClientDLL.dll	15/11/2019 07:43	Application extens...	29 KB
 NationalInstruments.VisaNS.dll	15/11/2019 07:43	Application extens...	180 KB
 NationalInstruments.VisaNS	15/11/2019 07:43	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

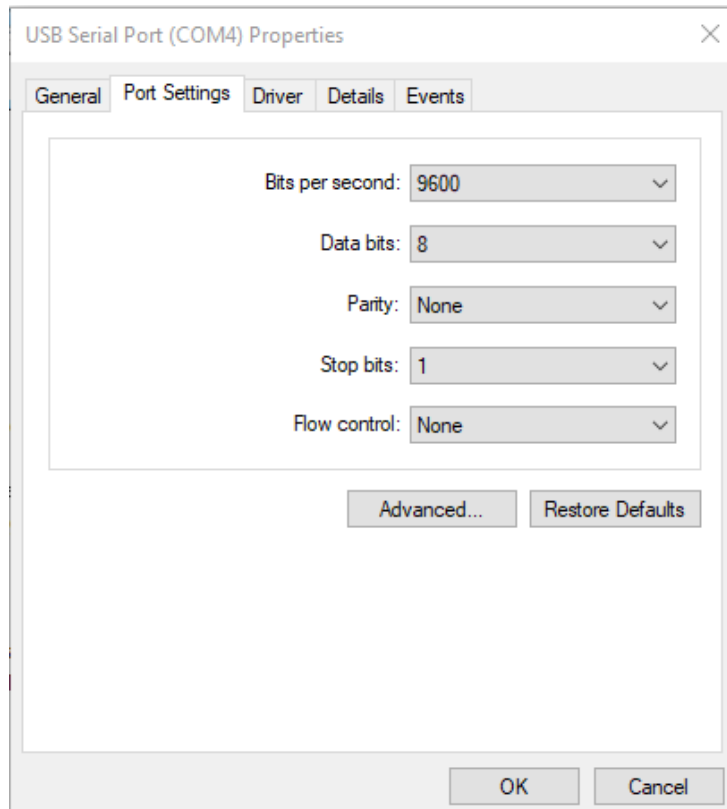
Stop Bits: 1

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.

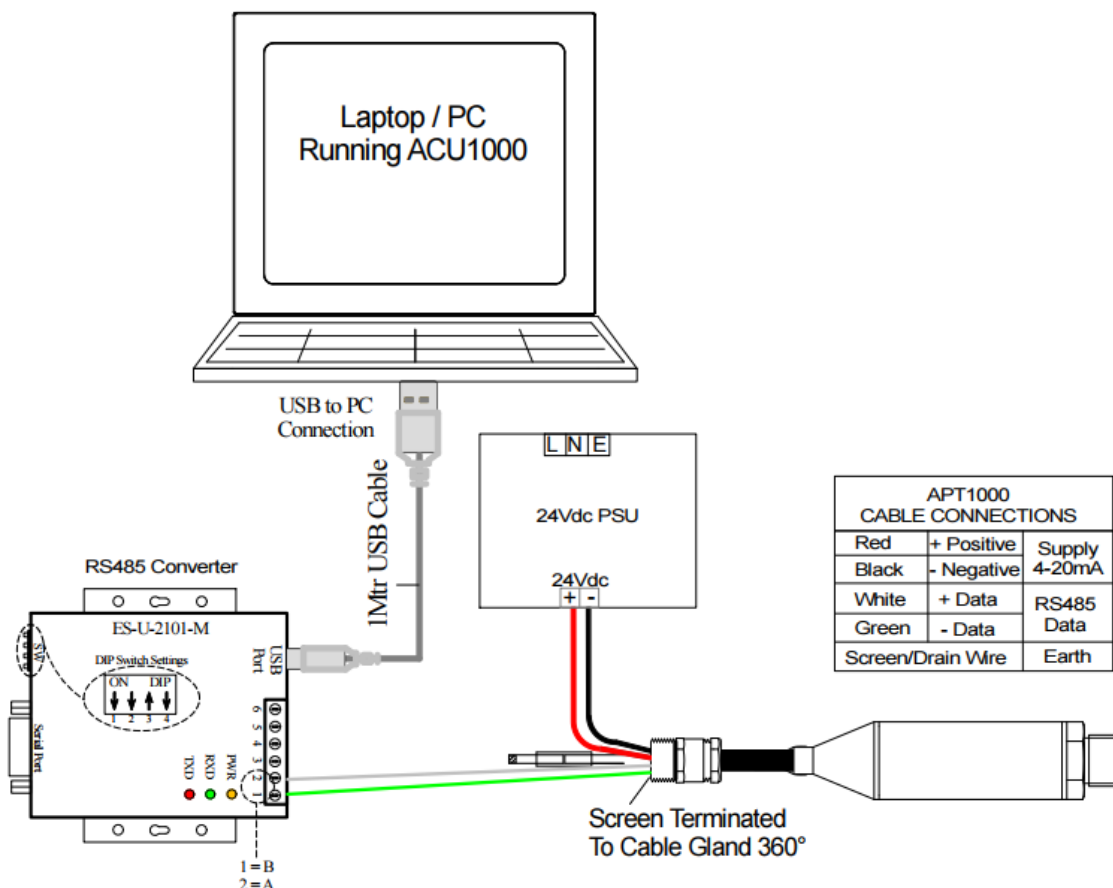
The ACU1000 application needs to know which COM Port the converter is connected to and so in the Windows Device Manager look for the Ports (Com & LPT) section and within this the connected USB / RS485 converter should be shown along with the allocated COM Port number. Make a note of this number.

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



Once these are confirmed the Device Manager may be closed.

Following is an illustration of the connections required between the APT1000 transmitter, USB/RS485 converter, and the PC. This is specific to the converter recommended by PSM but will provide a general indication of the requirements. Contact PSM for further guidance if required.



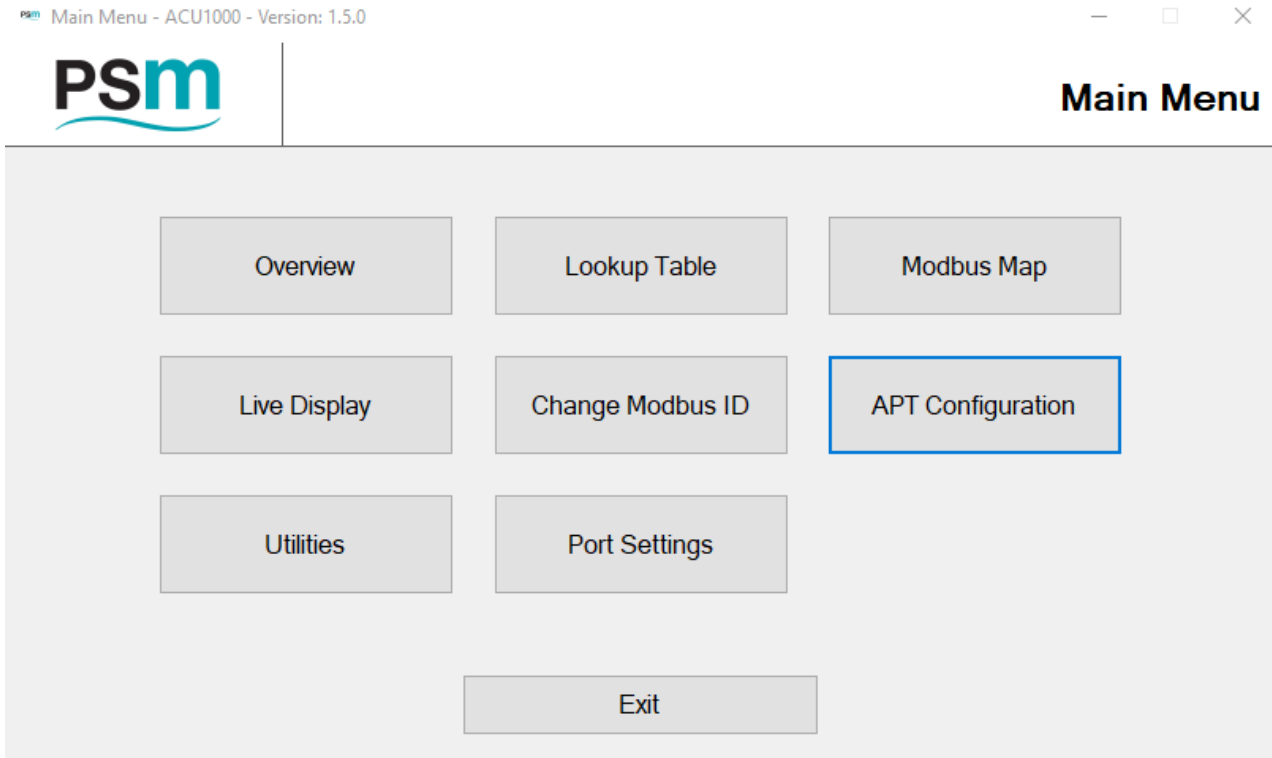
3.0 Application Settings

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

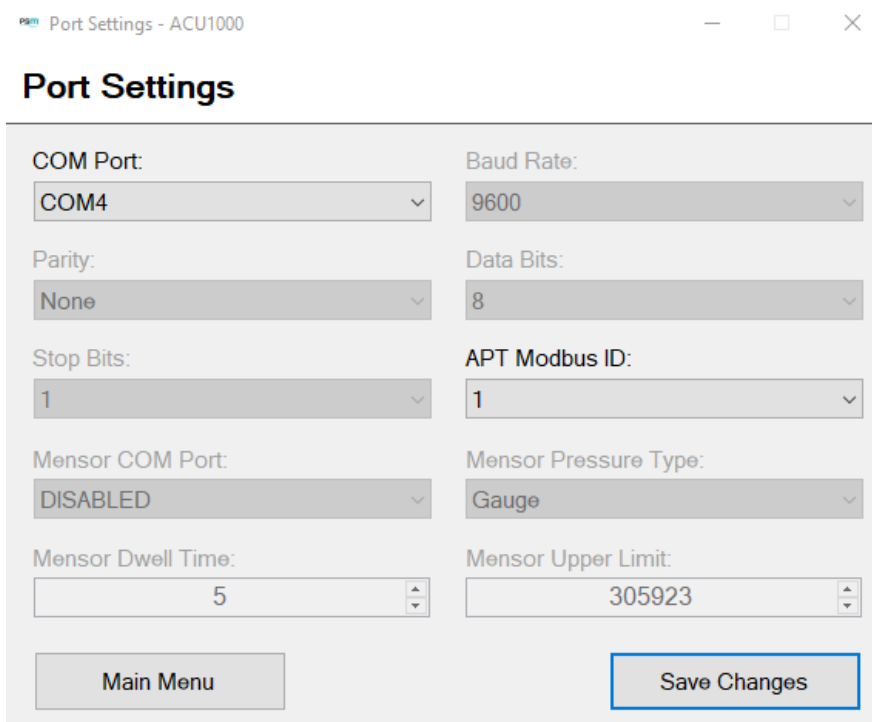
The following main menu screen will be displayed

Version number of the 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.

In addition the unique 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 Modbus ident has been set specifically for a particular project or has been changed previously the current ident must be known and used.

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 various pages in the application have similar disabled functions, again these 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 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.

Live Display - ACU1000

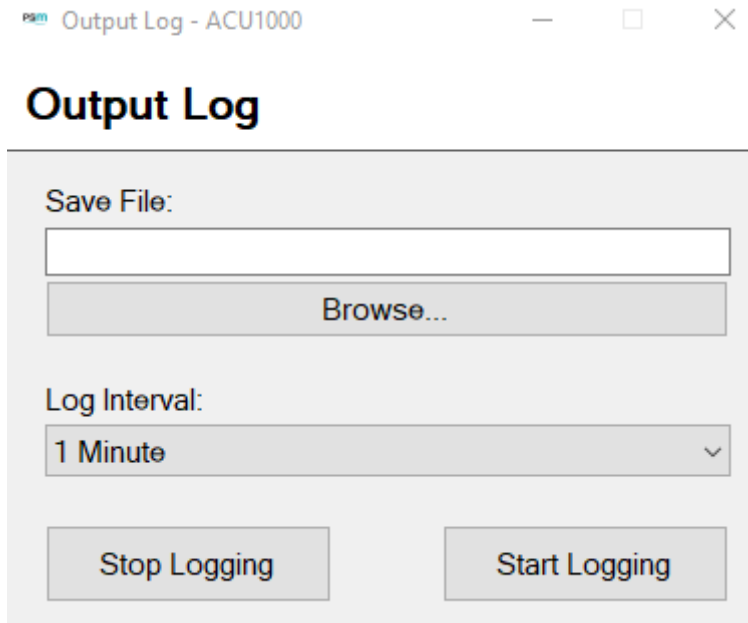
Live Display

APT Actual Pressure:	Mensor Pressure:	APT Temperature:
3.992	N/A	21.3 °C

Status: LIVE READING...

Main Menu Start Calibration Output Log

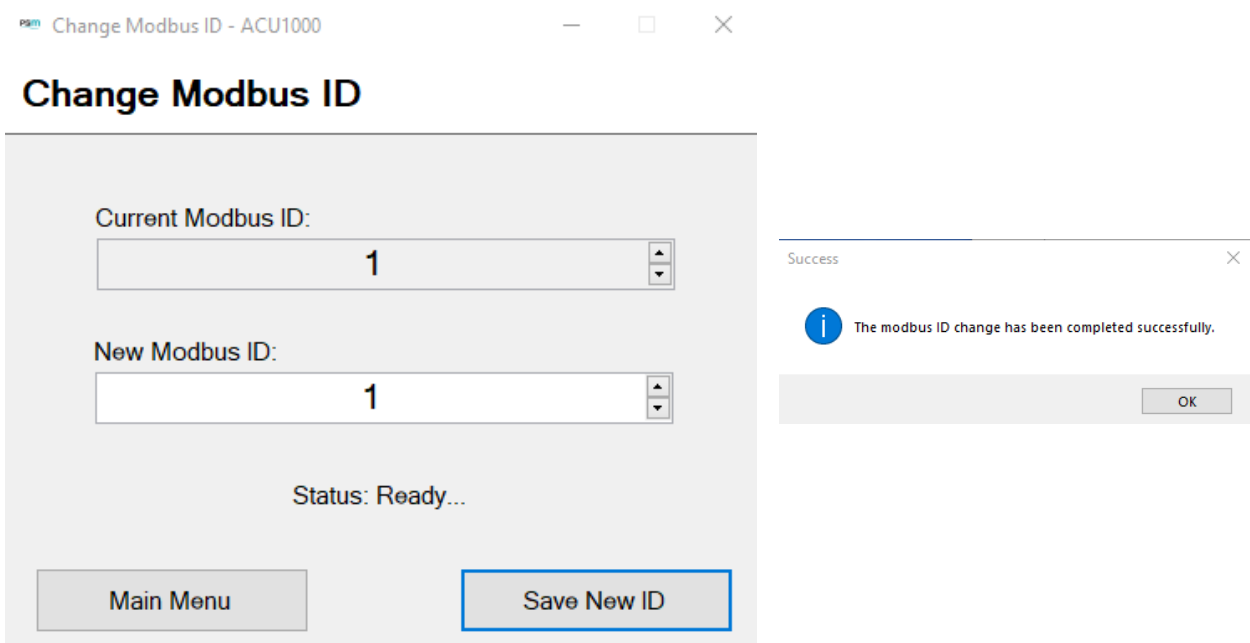
The button Output Log opens up a further screen



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.

Lookup Table - ACU1000



Lookup Table - Modbus ID: 1

Import
CSV File:

Lookup Table

#	% Level	% Volume
1	0	0
2	5	5
3	10	10
4	15	15
5	20	20
6	25	25
7	30	30
8	35	35
9	40	40
10	45	45
11	50	50
12	55	55
13	60	60
14	65	65
15	70	70

Controls
Status: Finished reading

Tank Profile Visualisation

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

When the button is pressed the utility reads the current settings in the connected APT1000 and the following screen is displayed

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: Allows selection of a CSV file which contains a 2 column table with the appropriate percent values.

Browse / Import: This allows the selected CSV file to be imported.

Linear Table: enters a default table with linear increments

Save Changes: writes any changes made into the 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

Overview - ACU1000

— □ ×

Overview - Modbus ID: 1

Key

Raw Input

User Defined

Result

Overview

Sensor Offset
Registers: 40 - 41, mmH2O

+

Raw Pressure
mmH2O

=

Corrected Pressure
Registers: 4 - 5, mmH2O

26	-22.113	3.887
26		

÷

Specific Gravity
Register: 6

=

Level from Sensor
Registers: 7 - 8, mm

+

Sensor Level Offset
Registers: 9 - 10, mm

0.800	3.109	0
0.800		0

=

Level in Tank
Registers: 23 - 24, mm

÷

Total Tank Height
Register: 12, mm

=

% Tank Level
Registers: 13 - 14

3.109	10000	0.03
	10000	

=

% Tank Volume
Registers: 20 - 21

×

Tank Capacity
Registers: 15 - 16

=

Actual Volume
Registers: 18 - 19

0.03	100000	30
	100000	

Temperature
Register: 2

}

Tank Table

Level Registers: 144 - 193
Volume Registers: 194 - 243

Enter new values in the relevant boxes above, then click 'Save Changes' below.

Controls

Status: Reading register 20...

Main Menu

Save Changes

mA Output

mA Output Scaling:

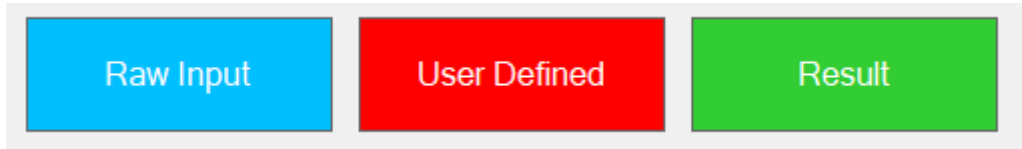
0.000 - 40790.000

Registers: 104-105 / 106-107

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

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4.4.1 Overview Key



This section defines the colour coding used for each of the parameters

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 relevant 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

Overview

	<table border="1"> <tr><td colspan="2">Sensor Offset</td></tr> <tr><td colspan="2">Registers: 40 - 41, mmH2O</td></tr> <tr><td>26</td><td></td></tr> <tr><td>26</td><td></td></tr> </table>	Sensor Offset		Registers: 40 - 41, mmH2O		26		26		+	<table border="1"> <tr><td colspan="2">Raw Pressure</td></tr> <tr><td colspan="2">mmH2O</td></tr> <tr><td>-22.259</td><td></td></tr> </table>	Raw Pressure		mmH2O		-22.259		=	<table border="1"> <tr><td colspan="2">Corrected Pressure</td></tr> <tr><td colspan="2">Registers: 4 - 5, mmH2O</td></tr> <tr><td>3.741</td><td></td></tr> </table>	Corrected Pressure		Registers: 4 - 5, mmH2O		3.741								
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Corrected Pressure																																
Registers: 4 - 5, mmH2O																																
3.741																																
÷	<table border="1"> <tr><td colspan="2">Specific Gravity</td></tr> <tr><td colspan="2">Register: 6</td></tr> <tr><td>0.800</td><td></td></tr> <tr><td>0.800</td><td></td></tr> </table>	Specific Gravity		Register: 6		0.800		0.800		=	<table border="1"> <tr><td colspan="2">Level from Sensor</td></tr> <tr><td colspan="2">Registers: 7 - 8, mm</td></tr> <tr><td>2.992</td><td></td></tr> </table>	Level from Sensor		Registers: 7 - 8, mm		2.992		+	<table border="1"> <tr><td colspan="2">Sensor Level Offset</td></tr> <tr><td colspan="2">Registers: 9 - 10, mm</td></tr> <tr><td>0</td><td></td></tr> <tr><td>0</td><td></td></tr> </table>	Sensor Level Offset		Registers: 9 - 10, mm		0		0						
Specific Gravity																																
Register: 6																																
0.800																																
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=	<table border="1"> <tr><td colspan="2">Level in Tank</td></tr> <tr><td colspan="2">Registers: 23 - 24, mm</td></tr> <tr><td>2.992</td><td></td></tr> </table>	Level in Tank		Registers: 23 - 24, mm		2.992		÷	<table border="1"> <tr><td colspan="2">Total Tank Height</td></tr> <tr><td colspan="2">Register: 12, mm</td></tr> <tr><td>10000</td><td></td></tr> <tr><td>10000</td><td></td></tr> </table>	Total Tank Height		Register: 12, mm		10000		10000		=	<table border="1"> <tr><td colspan="2">% Tank Level</td></tr> <tr><td colspan="2">Registers: 13 - 14</td></tr> <tr><td>0.02</td><td></td></tr> </table>	% Tank Level		Registers: 13 - 14		0.02		<table border="1"> <tr><td colspan="2">{ Tank Table }</td></tr> <tr><td colspan="2">Level Registers: 144 - 193</td></tr> <tr><td colspan="2">Volume Registers: 194 - 243</td></tr> </table>	{ Tank Table }		Level Registers: 144 - 193		Volume Registers: 194 - 243	
Level in Tank																																
Registers: 23 - 24, mm																																
2.992																																
Total Tank Height																																
Register: 12, mm																																
10000																																
10000																																
% Tank Level																																
Registers: 13 - 14																																
0.02																																
{ Tank Table }																																
Level Registers: 144 - 193																																
Volume Registers: 194 - 243																																
=	<table border="1"> <tr><td colspan="2">% Tank Volume</td></tr> <tr><td colspan="2">Registers: 20 - 21</td></tr> <tr><td>0.02</td><td></td></tr> </table>	% Tank Volume		Registers: 20 - 21		0.02		×	<table border="1"> <tr><td colspan="2">Tank Capacity</td></tr> <tr><td colspan="2">Registers: 15 - 16</td></tr> <tr><td>100000</td><td></td></tr> <tr><td>100000</td><td></td></tr> </table>	Tank Capacity		Registers: 15 - 16		100000		100000		=	<table border="1"> <tr><td colspan="2">Actual Volume</td></tr> <tr><td colspan="2">Registers: 18 - 19</td></tr> <tr><td>20</td><td></td></tr> </table>	Actual Volume		Registers: 18 - 19		20		<table border="1"> <tr><td colspan="2">Temperature</td></tr> <tr><td colspan="2">Register: 2</td></tr> <tr><td>21.2 °C</td><td></td></tr> </table>	Temperature		Register: 2		21.2 °C	
% Tank Volume																																
Registers: 20 - 21																																
0.02																																
Tank Capacity																																
Registers: 15 - 16																																
100000																																
100000																																
Actual Volume																																
Registers: 18 - 19																																
20																																
Temperature																																
Register: 2																																
21.2 °C																																

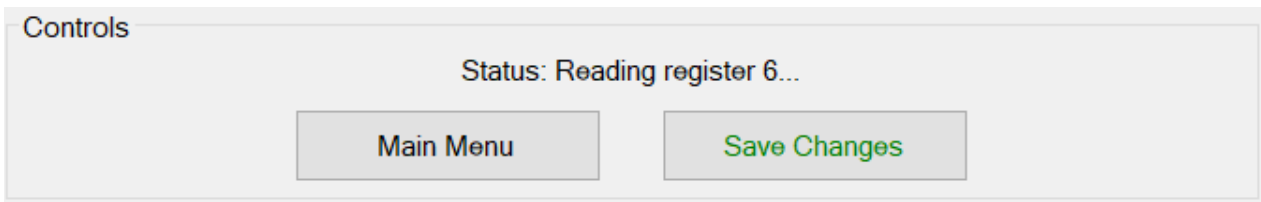
Enter new values in the relevant boxes above, then click 'Save Changes' below.

This page provides the 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 the start to finish with the mathematical function that is performed at each step.

The current 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. Once changes have been made they must be saved to the APT1000 this is done as described below.

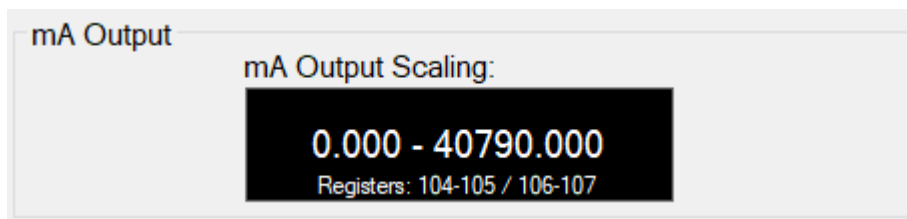
4.4.3 Overview Controls



This section shows a live status where the utility is reading the Modbus register values from the connected APT1000.

It allows return to the Main Menu of the utility, and also if any of the user defined values have been changed as described in section 4.4.2 the "Save Changes" button will cause these to be written to the APT1000. This process will take a short period while the data is written and the Overview display will then be updated with the new values confirming that changes have been saved into the APT1000.

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.	Size	R/W	Name	Functionality	Min	Max	Data Type	Value
-------	------	-----	------	---------------	-----	-----	-----------	-------

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.

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

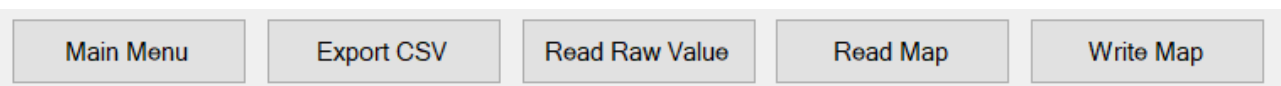
Data Type - Type of Data held in the register(s)

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.

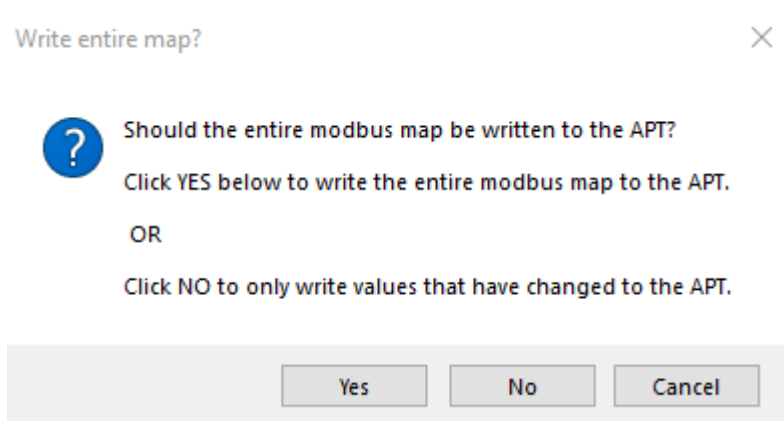
Read Raw Value - This allows the value of a specific register to be read. Note that this will take a fresh reading of the Raw Value from the selected register. The meaning of the returned value should be defined by reference to the "APT1000 Modbus Register Map" to understand how the raw value must be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

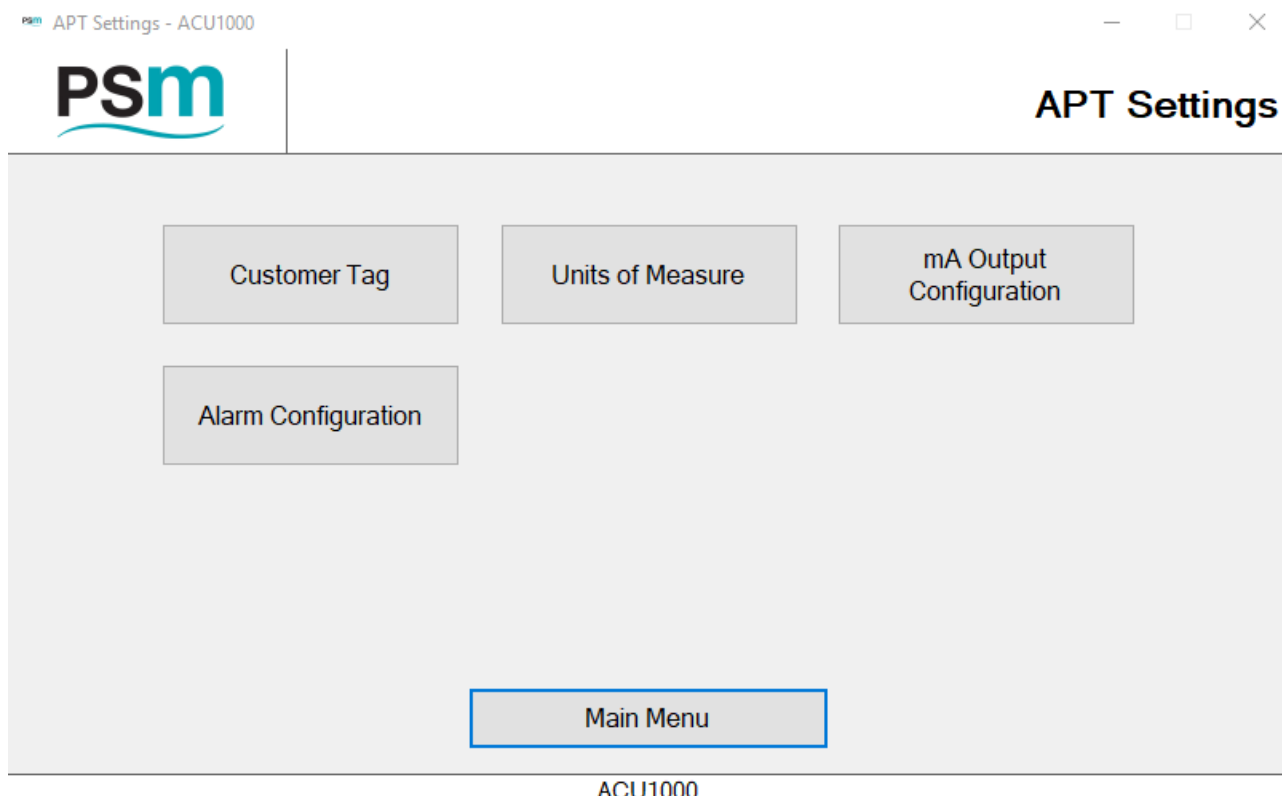


Once the selection is made the appropriate write action is taken. A status message above the control buttons indicates progress and success.

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 APT1000 being set up.



4.6.1 Customer Tag

Customer Tag - ACU1000

Customer Tag - ID: 1

Current Customer Tag:
Fuel Oil 3Port

New Customer Tag:
Fuel Oil 5Port

Status: Ready...

Main Menu Save Changes

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

Units of Measure - ACU1000

Units of Measure - ID: 1

Current Units of Measure:
Litres

New Units of Measure:
Gallons

Status: Ready...

Main Menu Save Changes

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

4.6.3 mA Output Configuration

Analogue Output Source:
2 - Scaled Pressure

Tank Level / Volume % to Output at 20mA:
100.00

Scaled Pressure (mmH2O):
4mA: 0 20mA: 40790

Forced Output Value (% of 4-20mA):
0.00

Status: Ready...

Main Menu Save Changes

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 mmH2O. 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 dialogue box below is enabled which allows the 4-20mA output signal to be driven to a specified value. The value is entered in % terms, i.e. an entry of 50% would force the output to 12mA

4.6.4 Fault Conditions Configuration

Fault Conditions - ACU1000

Fault Conditions - ID: 1

Enable Fault Conditions:

- Pressure Input Above 70,000 mmH2O (output 21mA)
- Level Above 100% and Tolerance (output 21mA)
- Level Below 0% and Tolerance (output 3.2mA)

Fault Tolerance (%):

0.00 0.00

Status: Ready...

Main Menu Save Changes

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 mmH2O 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.

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