December 2015

Universal SDI-12 Converter

Contents

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Overview

The PDS-PC-UNI provides configurable protocol conversion from Modbus Master to SDI-12 and also NMEA0183 to SDI-12. The unit is configured using the Windows ® software available as a down load at: **http://downloads.pacdatasys.com.au/pds-pc-uni-config.zip**.

Power: The converter provides bypass power to the connected sensor, which is a parallel connection to the input voltage. After power on, the protocol converter takes approximately 5 seconds to start up.

SDI-12 Specification: Supports the SDI-12 V1.3 standard. The default SDI-12 Address of the converter is 0 (zero). The address can be changed using the standard SDI-12 command “aAb!” or by the PDS-PC-UNI-Config.exe software.

Specifications

Power Requirement: 9 – 40 VDC
Power Consumption: 40mA
Signal Input: RS422 / RS485 (NMEA0183)
Signal Output: RS485 Modbus Master + SDI-12 V1.3
Switched Output: Controlled output switches input voltage to connector 15 (NMEA0183 mode only)
Default SDI-12 Address: 0

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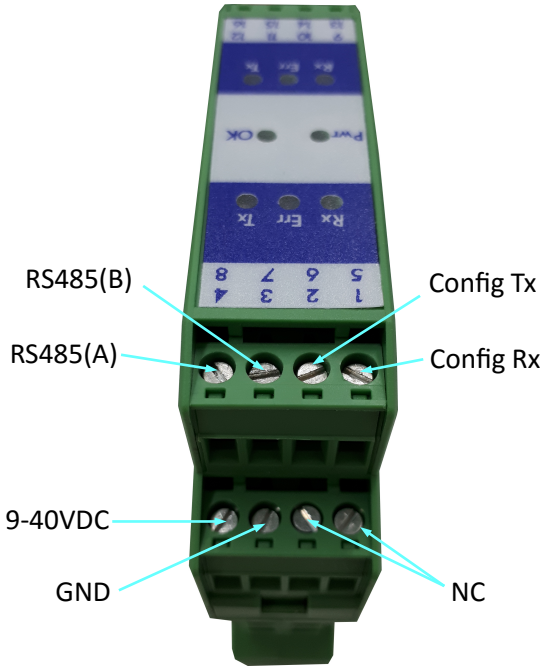
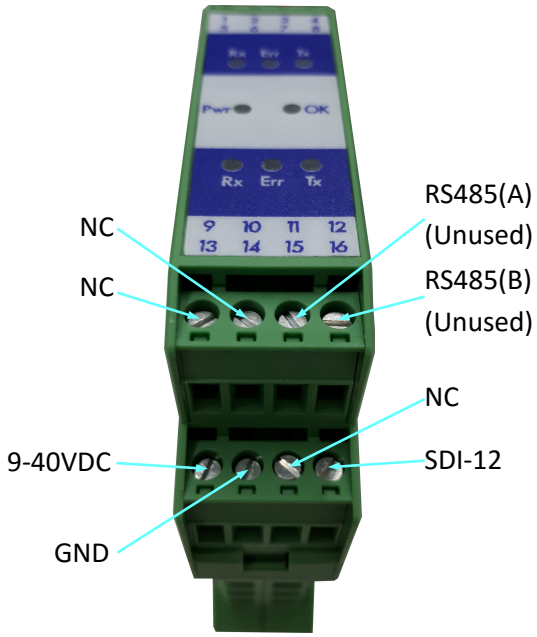
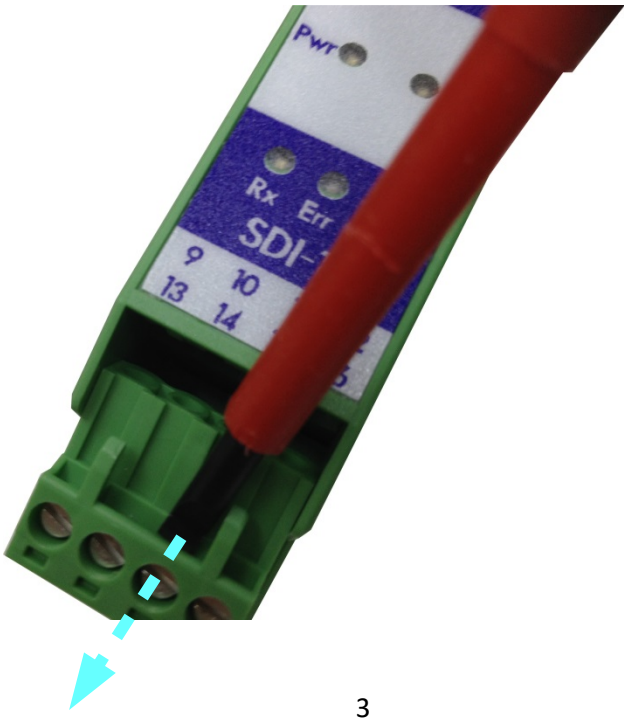
RS485 & SDI-12 Electrical Connections





Removing Terminal Blocks

Gently lever the terminal blocks away using a flat screwdriver.

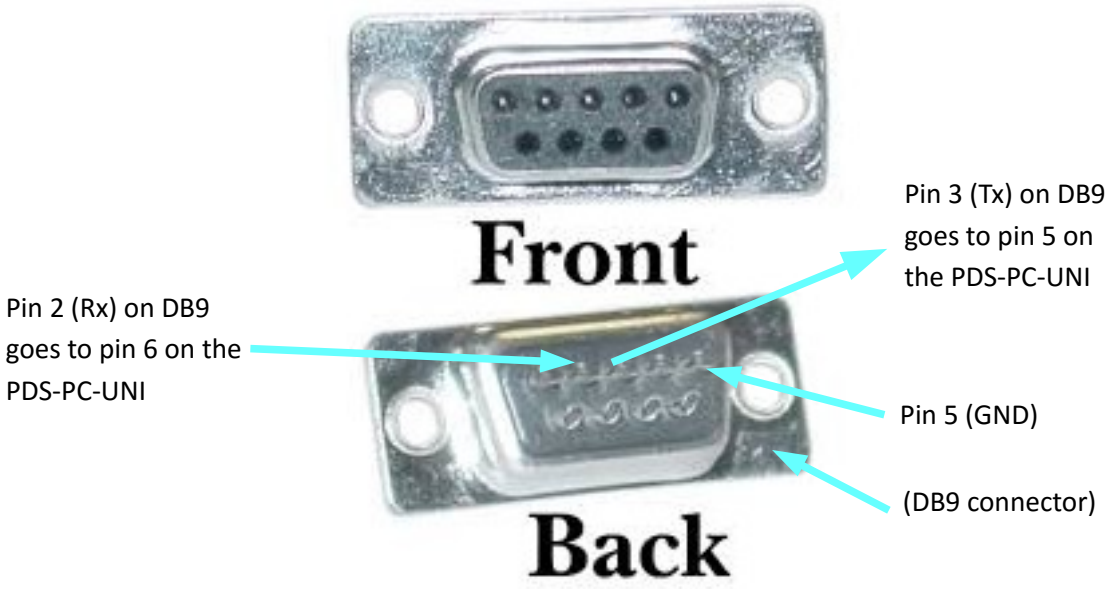


Configuring the Converter

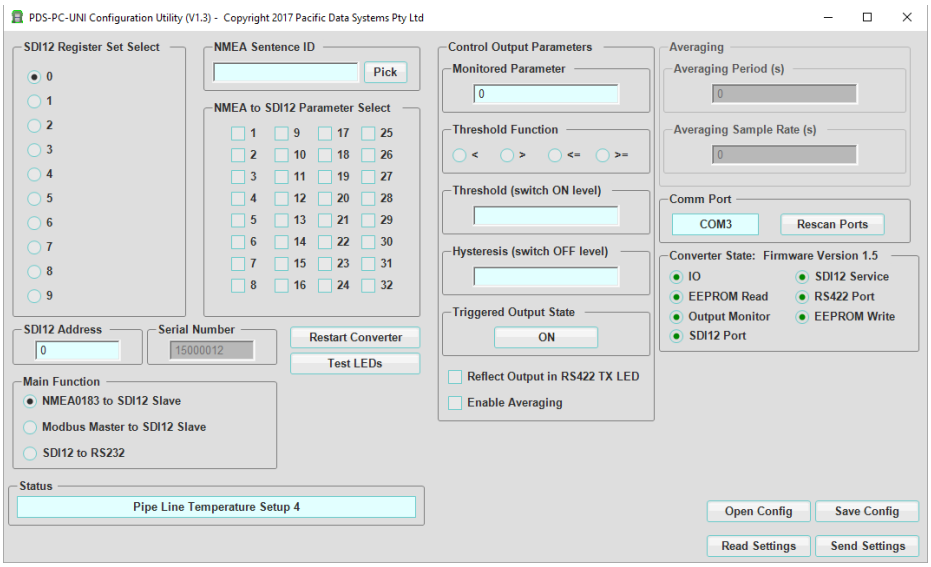
The converter is configured via the RS232 interface using the PDS-PC-UNI-Config.exe software (available as a down load from **http://downloads.pacdatasys.com.au/pds-pc-uni-config.zip**). A USB to RS232 interface may be required if your PC doesn't have a serial port.

This cable should be wired into ports 5 & 6 (RS232 Tx & Rx) on the converter. Ground for the RS232 communications can be wired into port 3 or 14 (internally they are the same connection).

RS232 Female DB9 Connector



Configuration Software



The PDS-PC-UNI-Config.exe (*software for Windows® Operating Systems*) can be used to configure which NMEA0183 sentences to listen for, what information in those sentences to collect and which SDI-12 register set to send the information to. It can also be used to configure which Modbus requests to send to Modbus slave devices. The software displays information about the converter such as the SDI-12 address, device serial number, the converter's firmware version, its current configuration and some diagnostic information regarding some hardware and firmware modules running on the converter.

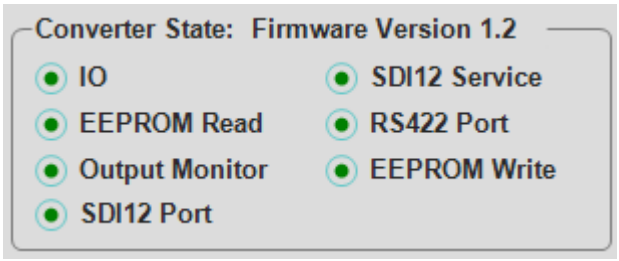
When the software starts up it will attempt to find a PDS-PC-UNI Protocol Converter on a serial port by polling each available port and listening for a response. The ***Comm Port*** group in the main screen of the software shows this 'scanning' activity.

While the scanning process is taking place the ***Comm Port*** group will indicate which serial port it is currently checking and the button text will display ***"Stop Scanning"***. Clicking this button will stop the scanning process. When a protocol converter has been detected the ***Comm Port*** group will display the serial port the converter has been detected on and the button text will display ***"Rescan Ports"***. Clicking this button will rescan the ports starting with COM1 and continue searching for a protocol converter.

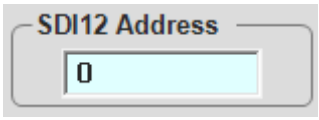
When a protocol converter has been detected the ***Converter State*** group will display the status of the unit. The circular 'LED' style icons reflect the state of the various components in the converter.

A green 'LED' indicates the component appears to be functional. If a component is faulty the 'LED' will be flashing red. This group also displays the current firmware version in the converter.

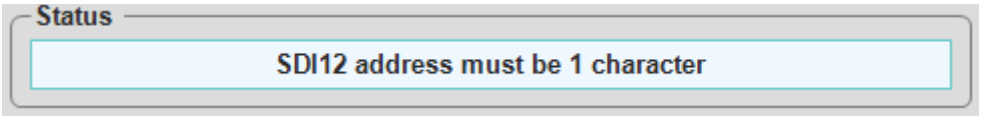
Converter State Group



On this main screen, you will also see the converter's current SDI-12 address. This field may be edited and should only contain one single character in the ranges: ['0' - '9'], ['a' – 'z'], ['A' – 'Z']

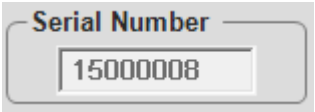


Under the ***SDI12 Address*** group is a ***Status*** group which displays status about the last command. For example, if more than one character is typed into the ***SDI12 Address*** group the status will display the following:

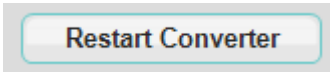


It also displays some information when communicating with the protocol converter and becomes a real-time parameter viewer when ***NMEA to SDI12 Parameter Select*** check boxes are right-clicked on.

To the right of the ***SDI12 Address*** group is the ***Serial Number*** group which displays the currently connected protocol converter's serial number. This field is not able to be edited.



To the right of the ***Serial Number*** group are two utility buttons:



This button will restart the converter.

This button will light up all LEDs for a few seconds to ensure they are working. A short beep will also be emitted from the converter to test it's internal speaker.

Below the ***Serial Number*** group are the ***Main Function*** radio buttons. This is where you select the main operation mode of the protocol converter.

- NMEA0183 to SDI-12 Slave
- Modbus Master to SDI-12 Slave
- SDI12 to RS232 (this monitoring feature will be available in future versions of the PDS-PC-UNI firmware)

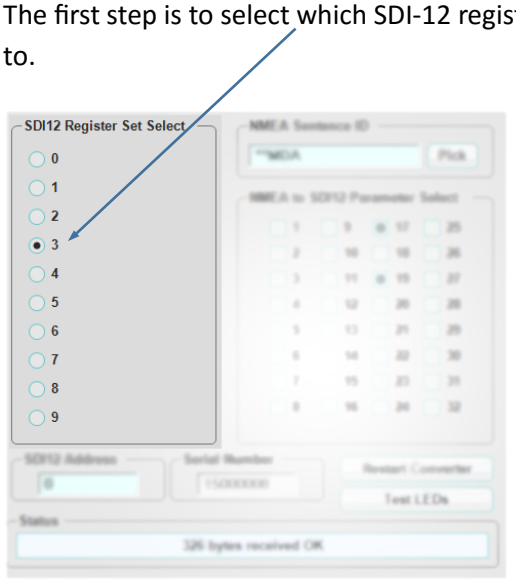
Connecting to the converter.

Plug the converter into the serial port (or USB-serial converter). Run the PDS-PC-UNI Configuration software. The software will automatically scan the available ports for a converter. If it is not found then check the serial cable is wired correctly into ports 5 & 6 of the converter and click the 'Rescan Ports" button. Once discovered the software will display the units serial number and SDI-12 address etc.

Configuring for NMEA-0183 to SDI-12 Conversion

1. SDI12 Register Set Select

The first step is to select which SDI-12 register-set you want the NMEA0183 sentence data to be sent to.



This ***SDI12 Register Set Select*** group of 'radio' buttons allows you to select an SDI-12 register set that you would like NMEA0183 information to be sent to. Your data logger will be able to read the NMEA information using an SDI-12 request for that register set.

The following is an example of a typical SDI-12 request.

aMn!

a: The SDI-12 address of the protocol converter (default value is '0' and can be changed via this configuration software)

M: "Take a measurement"

n: "Select SDI-12 register set *n*"

The data logger will then send the following command to read the data.

aD0!

The protocol converter understands SDI12 Version 1.3 including ***aR0! aMCn! aRC0!*** Etc. commands.

2. NMEA Sentence Select.

The second step is to select what NMEA0183 sentence you want to send to this SDI-12 register set. This is done via the ***NMEA Sentence ID*** text box. You can type the required sentence ID directly into this text box. The '*' character is used to filter out the NMEA0183 'talker IDs' if required.

For example the sentence ID "**MDA" will recognise "WIMDA" or "XYMDA" etc.

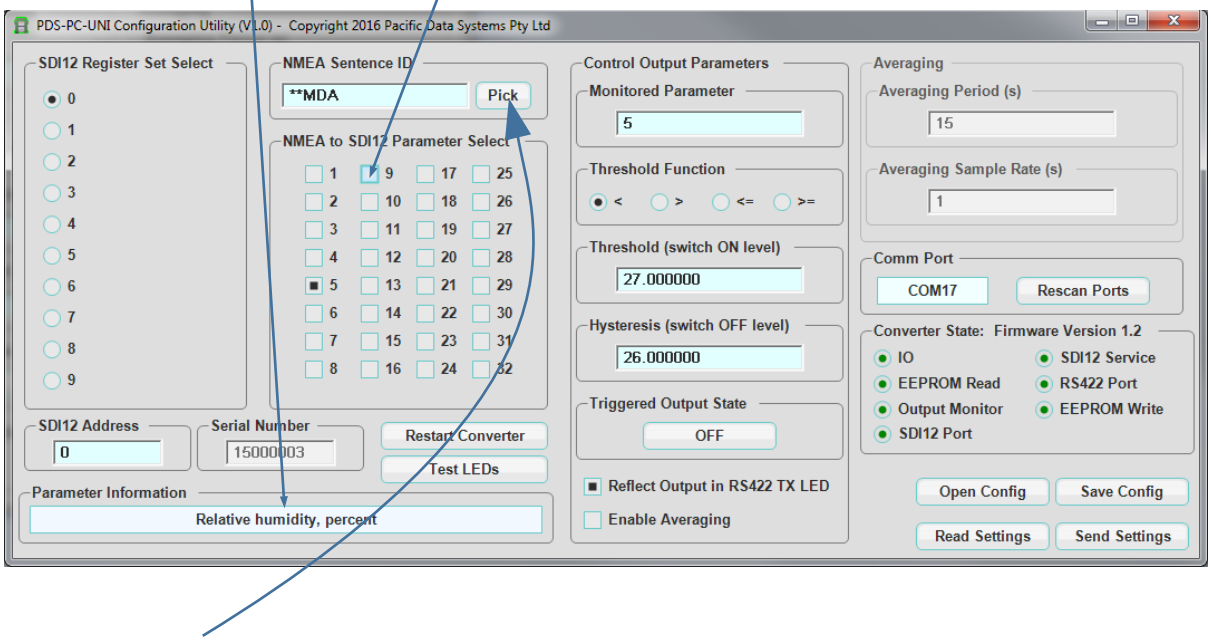
Note: A sentence ID of "*****" will recognise ALL sentences which may not be desirable.

You can also select from a list of common NMEA sentences by clicking on the "Pick" button.

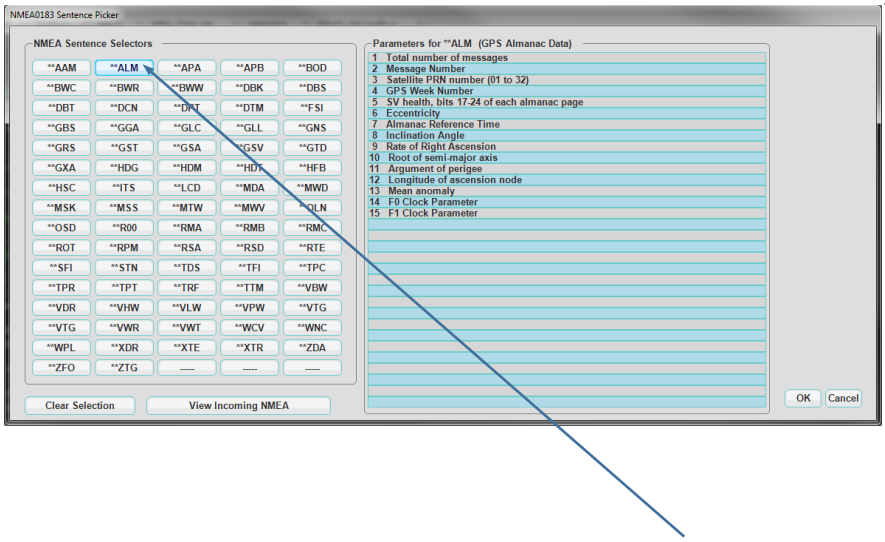
NMEA Parameter Select.

Select what parameters you want sent to the SDI-12 register set. In the case of a "WIMDA" sentence, you may be interested in wind speed and direction. The check boxes in the ***NMEA to SDI12 Parameter Select*** group are used to select the parameters you are interested in. In the case of wind speed and direction, parameters 13 (wind direction) and 19 (wind speed m/s) would be checked. Checking and un-checking parameters can be performed by clicking on the check boxes.

If the sentence in the ***NMEA Sentence ID*** text box is recognised by this software, hovering your mouse over the ***NMEA to SDI12 Parameter Select*** check boxes will display a definition of that parameter in the ***Status*** area.



Clicking the "Pick" button inside the 'NMEA Sentence ID' group box will produce the following screen allowing you to pick from a list of common NMEA sentences and associated parameters.



This screen shot shows the effect of the mouse hovering over the ****ALM*** selector button. To select a sentence click on the button that displays the required sentence ID. The button will then turn a green colour. To deselect that button click on the ***Clear Selection*** button near the bottom of the screen or simply click on another sentence ID button.

Once a sentence has been selected, parameters can be chosen by clicking on them in the list displayed in the right hand pane. When a parameter has been selected it will turn a green colour. To deselect it click on it again. Multiple parameters can be selected to be sent to the same SDI-12 register set although it is recommended to ensure the resulting SDI-12 sentence is not too long.

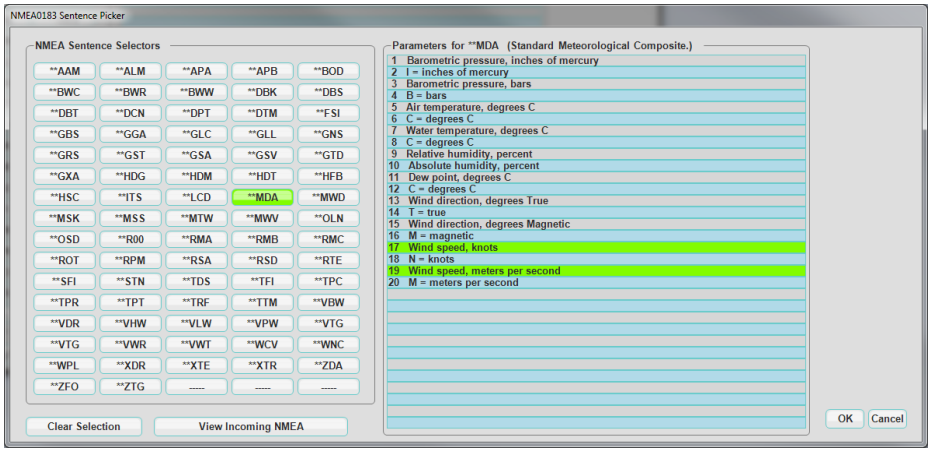


Figure 5

Figure 5 above shows the ****MDA*** sentence selected with parameters 17 (wind speed in knots) and 19 (wind speed in m/s) selected. Clicking the ***OK*** button will close this screen and populate the ***NMEA Sentence ID*** with ****MDA*** and will also check ***NMEA to SDI12 Parameter Select*** check boxes 17 & 19. The result is shown in Figure 6 below.

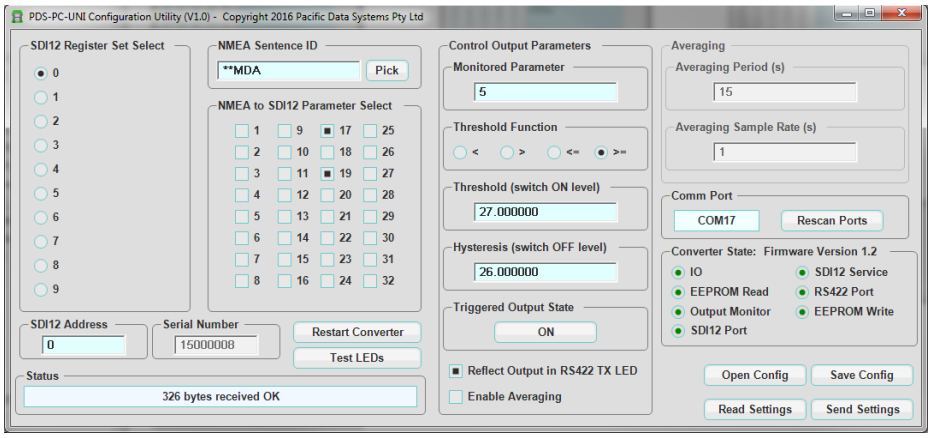


Figure 6

The procedure above has configured the protocol converter to send wind speed in knots and m/s to SDI-12 register set 0. The SDI-12 sentence returned will be similar to:

0+1+0.5144<CR><LF>

SDI12 Address ***(0)*** Wind Speed (knots) ***(+1)*** Wind Speed (m/s) ***(+0.5144)***

This process may be repeated for any of the ***SDI12 Register Set Select*** radio buttons.

If you want all of the parameters for a particularly long sentence you may want to consider breaking the sentence up rather than send them all to the same SDI12 register set. For example, for a hypothetical sentence "**XYZ" that has 25 parameters of interest, it would be advisable to have 4 parameters sent to SDI12 register set 0, 4 to register set 1 etc.

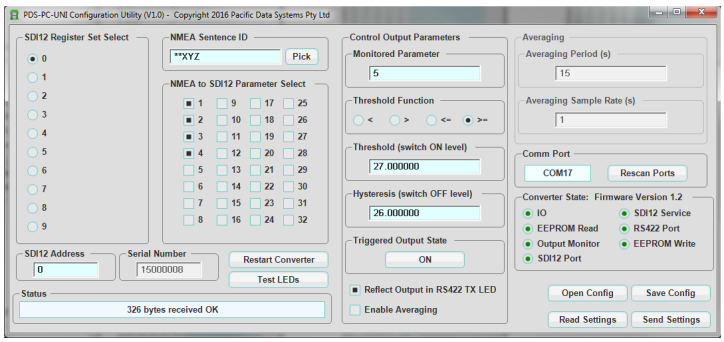


Figure 7 – Four parameters sent to SDI12 Register Set 0

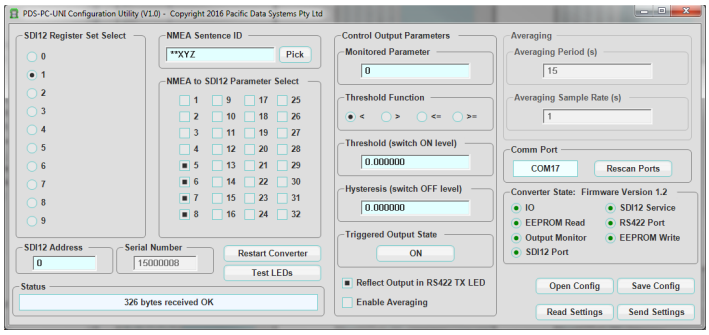
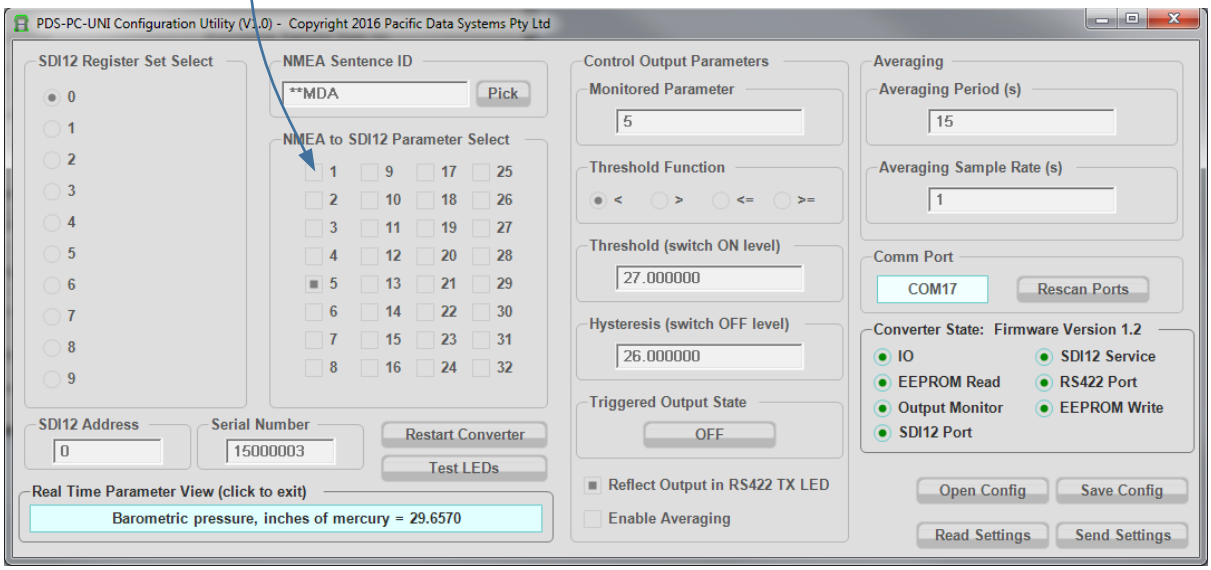


Figure 8 - Four parameters sent to SDI12 Register Set 1

Right-clicking on one of the ***NMEA to SDI12 Parameter Select*** check boxes will enable real time parameter viewing. In the example in the screen shot below, the real time view is showing barometric pressure (parameter 1) from a "$WIMDA" sentence. The check box that is right-clicked on does not have to be checked for this feature to work. Note that the sentence ID in the ***NMEA Sentence ID*** text box must match the ID of the incoming sentence. This is to ensure that parameter 1 from any other sentence being received is not displayed in the real time viewer.



Each time the real time value is updated from an incoming NMEA sentence the back ground colour of the Real Time Parameter Viewer will flash green for a short period to indicate it's value has been refreshed.

Control Output

The PDS-PC-UNI includes a programmable output switch which (when active) will switch the input voltage to connector 15. The control output is configured via the ***Control Output Parameters*** *group* and can be used to energise a beacon, relay or trigger an SMS alert using a wireless modem etc.

Example Wind Speed Alarm

To explain the control output set up, a wind speed alarm will be configured using the NMEA0183 $WIMDA sentence.

The first parameter near the top of the ***Control Output Parameters*** group is the ***Monitored Parameter*** text box. In Figure 10 the monitored parameter is '17'.

There can only be one number in this text box and it must be one of the selected NMEA parameters in the ***NMEA to SDI12 Parameter Select*** group box.

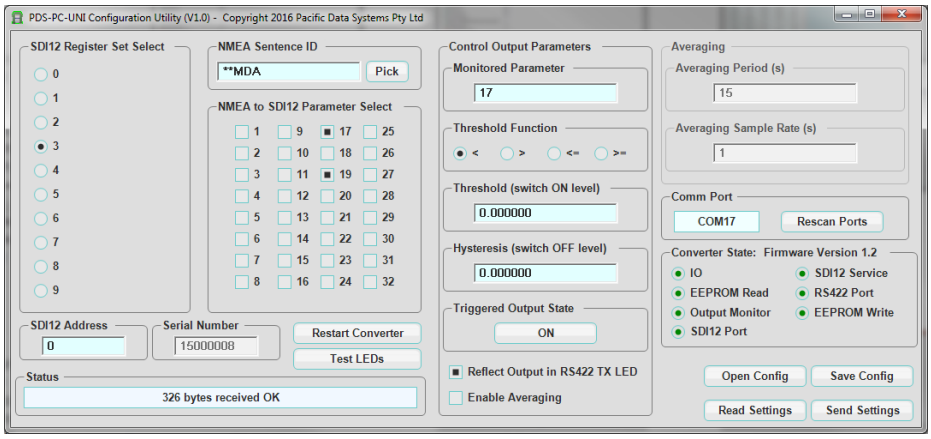


Figure 10

In the case of our example wind speed alarm set up, the monitored parameter can only be 17 or 19 – only parameters selected in the ***NMEA to SDI12 Parameter Select*** group can be monitored for control output.

The next parameter is the ***Threshold Function*** which is simply a comparison function. For our wind speed alarm we will select '**>**' because we want to activate the switched output if the wind speed is greater than a certain threshold.

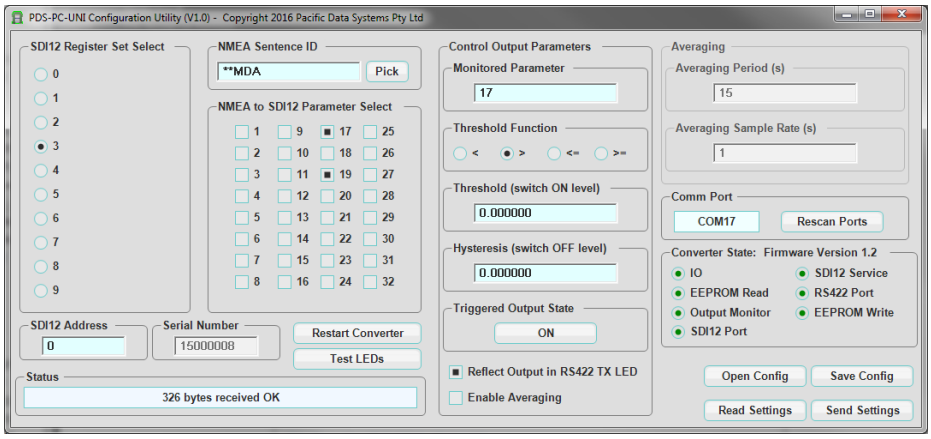


Figure 11

Next is the ***Threshold (switch ON level)*** which is the value to be compared. For our wind speed alarm we will select 28 knots as an output threshold.

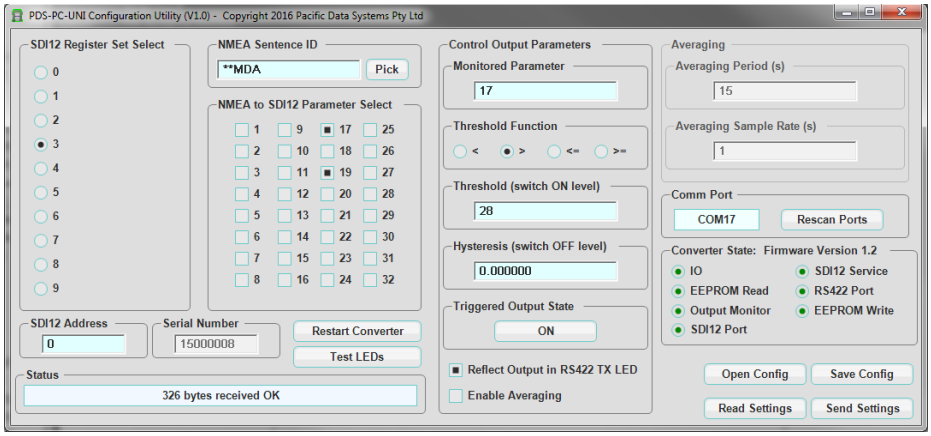


Figure 12

The next parameter is the ***Hysteresis (switch OFF level)*** which defines the level at which the output will switch off. For our hypothetical application we will consider 27 knots a desirable level to switch off the output. The output will switch off if the level falls to 27 knots or below.

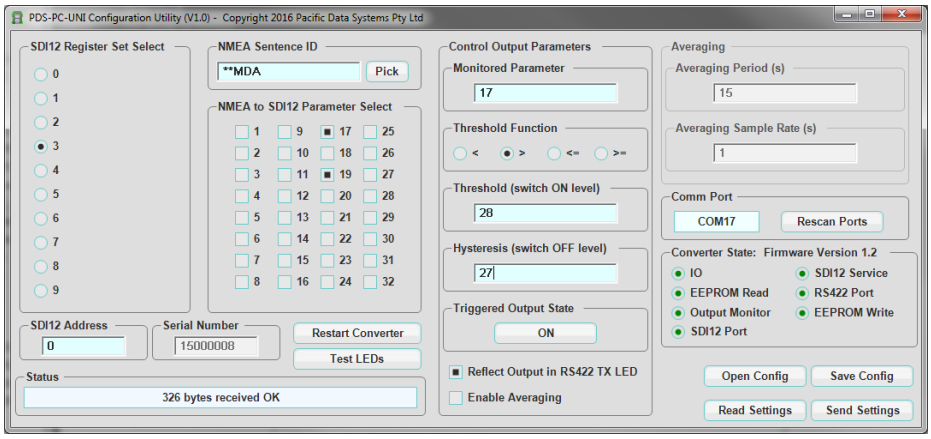


Figure 13

This ***Hysteresis (switch OFF level)*** value is important particularly in applications such as temperature control, to avoid the 'hunting' effect where chillers / refrigeration units are turned on and off rapidly as the temperature rises and falls above and below the threshold set points.

Triggered Output State is the next parameter which simply inverts the output state. Clicking this button will alternatively cause the button to display 'ON' or 'OFF'. If the button state is 'ON' then the output will be OFF until the wind speed is > 28 knots and will then switch ON.

If the button state is 'OFF' then the output will be ON until the threshold is reached and will then switch OFF (until the wind speed falls below 27 knots at which point it will switch back ON again).

Just under the ***Triggered Output State*** group are two check boxes:

Reflect Output in RS422 Tx LED	This check box (if checked) will cause the RS422 Tx LED to become an output indicator for the control output switch. If the switch output is active the LED will light up. This may be helpful during system setup as a debugging tool to be sure what the output state is.
Enable Averaging	If this check box is checked the ***Averaging*** group is enabled.

Averaging

For some control applications averaging is desirable. In the case of a wind speed alarm, it may not be desirable for a short duration gust to trigger an alarm (unless that gust is quite forceful).

Averaging ensures that the wind speed (or other monitored parameter) will trigger a control output when the parameter has been at the threshold level for a certain time (or if the parameter greatly exceeds the threshold).

When the **Enable Averaging** check box is checked the ***Averaging*** group becomes active and editable.

The first parameter in the averaging group is the ***Averaging Period (s)*** text box. This is where you define the period over which you want to average. We have arbitrarily chosen a 15 second averaging period.

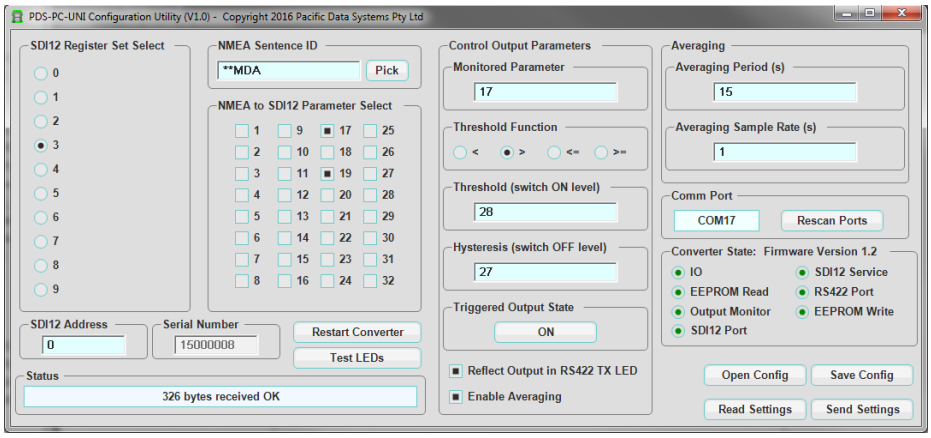


Figure 14

Immediately under this text box is the ***Averaging Sample Rate (s)*** which defines how often a sample is fed into the averaging buffer. In this example we have chosen to add a value into the average every second.

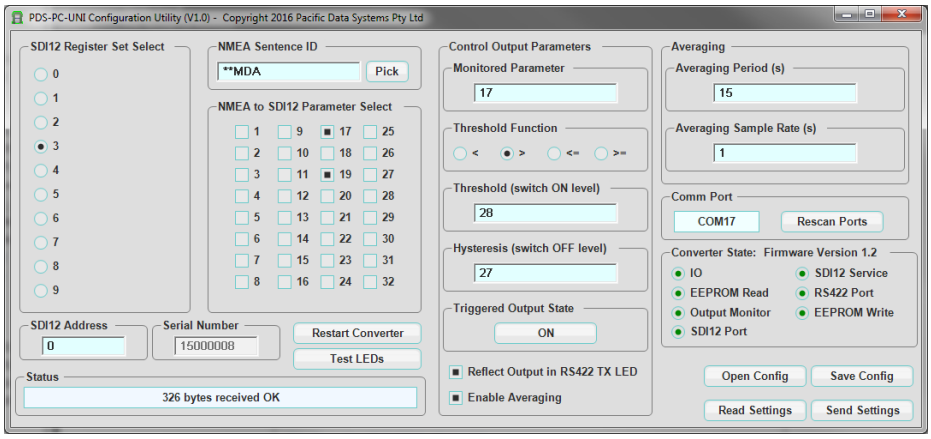


Figure 15

Read Settings Button

The ***Read Settings*** button will cause the software to attempt to read the configuration of the converter currently connected. It will read the configuration using the serial port in the ***Comm Port*** group. If there is no serial port listed there then you must click on the ***Rescan Ports*** button to establish a connection.

Send Settings Button

The ***Send Settings*** button will send all of the settings in the software to the connected protocol converter.

Open Config Button

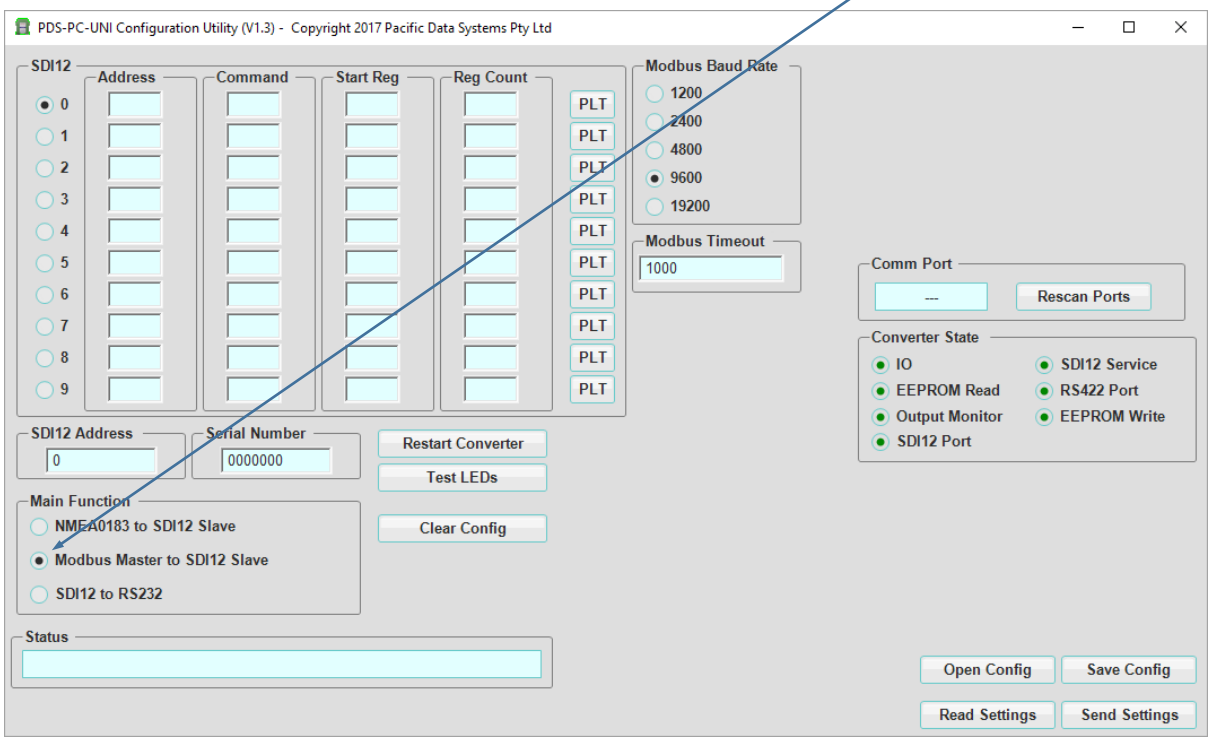
The ***Open Config*** button will open a configuration file store on your local disk. The configuration is not automatically sent to the protocol converter, you must use the ***Send Settings*** button to achieve this. Stored configurations may be helpful to quickly change a protocol converter from being a wind speed alarm to a temperature controller / monitor.

Save Config Button

The ***Save Config*** button is used to save the settings currently in the software to your local disk.

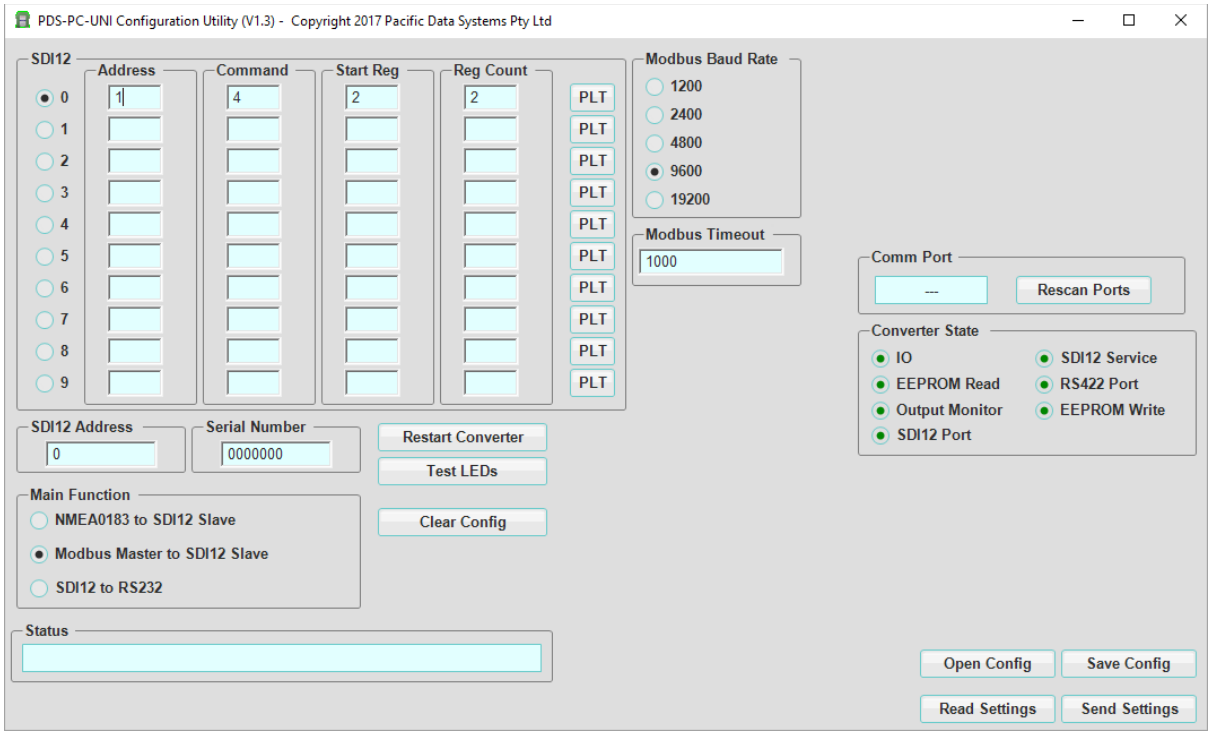
Configuring for Modbus Master to SDI-12 Conversion

To select Modbus master to SDI-12 mode click on the “Modbus Master to SDI12 Slave” radio button.



You will see that many of the parameters associated with the NMEA0183 to SDI12 are no longer displayed. In this mode the SDI12 select radio buttons don’t serve any function except to indicate which SDI12 register set is associated with the adjacent address, command, start reg and reg count text boxes.

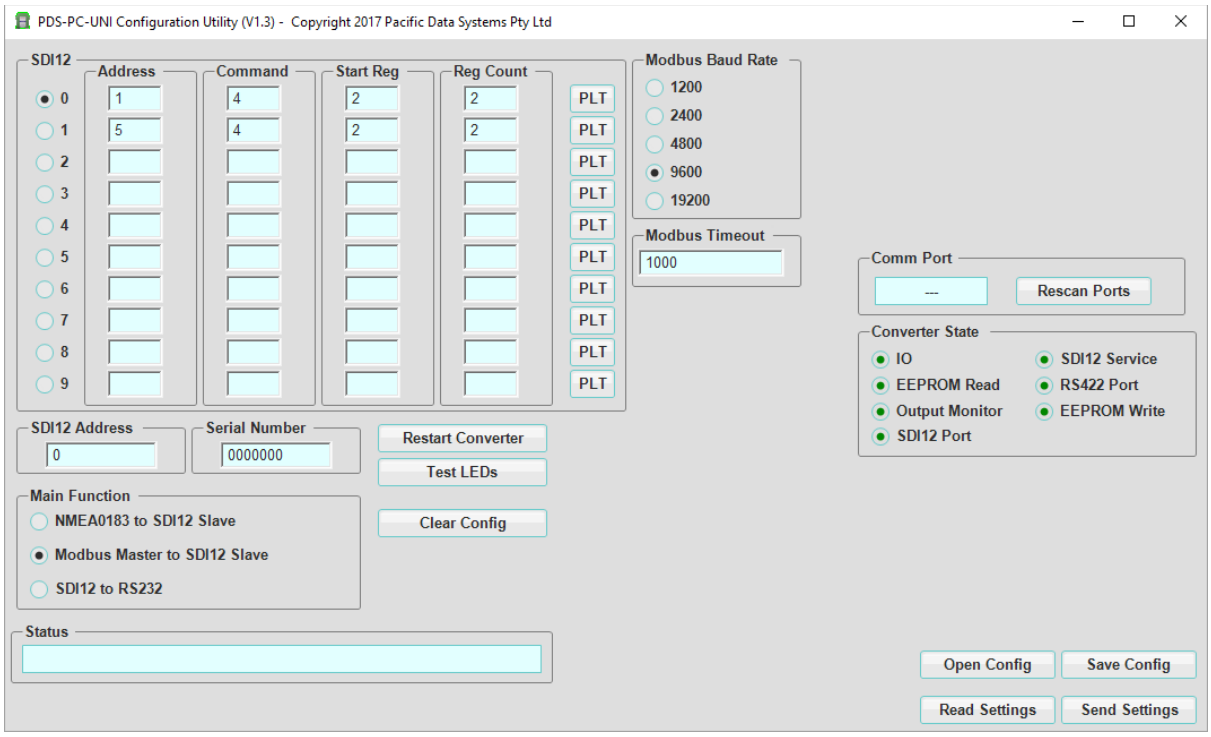
The function of the PDS-PC-UNI in this configuration is to accept an SDI12 measurement request and obtain the information by acting as a Modbus master. Each row of text boxes has a “PLT” button next to them. These buttons when clicked will populate the modbus text boxes with the required information to request temperature readings from the PDS-SENS-TMP-PL pipeline temperature transmitter.



The above screen shot shows the Modbus register contents after clicking the topmost PLT button. The only parameter that has to be filled is the Modbus address (the software will prompt you to fill this in).

Using the above screenshot as an example, the “Send Settings” button is used to send the configuration to the protocol converter. The converter will restart and enter the Modbus Master mode.

If an SDI12 measurement is requested (i.e.) the converter receives “0M!” on its SDI12 input, the converter will reply to the SDI12 master indicating the time expected to complete the request. It will then send a Modbus request on address 1 asking for input register 2. Once it gets a response it will store the data ready for when the SDI12 master sends the “0D0!” (read data) message. The converter will then respond to the SDI12 master with the data.



In the configuration above there is also a Modbus device on address 5 which will be accessed using the “0M1!” and “0D1!” SDI12 commands.