Intelligent Wireless SCADA
Distributed RTU Systems

Plexus Hub Model IWS-100-MB User Guide
Modbus®
Ver 1.0

User Guide

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1 About this Document

This document provides the information you need to operate the Plexus Controls Hub HM3. The HM3 Hub provides the connectivity between the distributed Plexus RTU's, the Network Management System (NMS) and Data Collection System at a Network Operations Centre (NoC).

This document describes the Modbus implementation on the HM3. The terms Hub and HM3 are used interchangeably through this document.

2 Hub Overview

The Plexus Hub (HM3) provides a highly robust wireless mesh network to the RTU's. It also provides an interface to the wired network infrastructure. A network of RTU's requires at least one Hub.

(Future Release) The HM3 provides a Web Interface to monitor and configure the RTU's as well as view real-time data. Additionally, The HM3 provides a local real time logging capability. This functionality allows the RTU data to be accurately date stamped and logged locally even if the network between the Hub and the NoC is interrupted. For example, in some installations, the link between the Hub and the NoC may be over a wireless cellular modem link or similar and suffer periods of outage – or in some cases such as solar or satellite, only available periodically.

The Plexus Controls Data Management Application automatically retrieves this data and provides a standard database and data export interfaces for monitoring and analysing the information from the RTUs [2].

2.1 Modbus® Support (Software Option)

The HM3 also optionally supports a Modbus TCP/IP implementation that allows the Plexus IWS system to be fully integrated into an existing Modbus network.

Please ensure that your system is loaded with the Modbus option before continuing. Please contact Plexus Controls if you are unsure.

The HM3 presents the RTU's within its span of control as RTU's mapped into a Modbus Map, each RTU occupies a particular location that is established when the RTUs are initially installed and configured (this can be changed later using the Plexus Configuration Tool if required).
Data from any RTU can be retrieved via a standard Modbus Poll to Registers, similarly any RTU parameters can be changed by writing to a Modbus Register or Coil.

3 Installation

3.1 HM3 Hub

Detailed instructions are provided in the ***Plexus Hub installation Guide*** [1] and not repeated here.

3.2 Plexus Configuration Tool

Detailed instructions are provided in the ***Plexus Configuration Tool – Installation and User Manual*** [3]. The Configuration Tool is required to commission the HM3 (Modbus) and set-up the Modbus and other parameters.

4 Before you begin

Before you begin, please ensure that the following steps are carried out.

4.1 IP connectivity and Firewall Configuration

Please ensure that you have the correct IP networking information such as the subnet (e.g. 192.168.1.xxx), Gateway (e.g. 192.168.1.1), DNS Server or Proxy ; preferred NTP server (for setting time).

Also please verify if static IP addressing is used or DHCP server is available. Also ensure that any firewall between the PC and the Hub is disabled or allows access to several ports used by the HM3 (80, 502, 2022,2023,21, 22, 123)

From a PC connected to the Network, verify that you can “ping’ the HM3 (e.g. Ping 192.168.1.199), do not proceed with the remainder of this document until this step is successfully completed.

If you are not sure about these settings, please check with your IT department. Incorrect settings may cause loss of connectivity with the hub.

4.2 Plexus Configuration Tool

Please verify that the Plexus Configuration Tool (PCT) can communicate with the Hub - See PCT user manual [3].

4.3 Modbus Master

Please ensure that your Modbus Master is configured to poll the HM3 – please verify connectivity as described above.

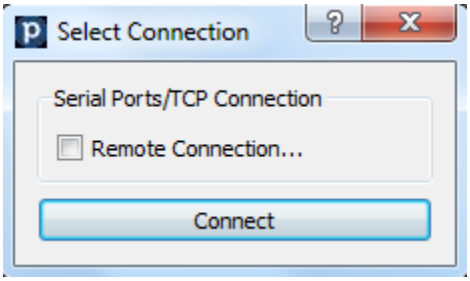
5 Getting Started

This section provides the steps to get you started with configuring the HM3 for Modbus Operation. The primary tool for configuring the HM3 for Modbus is the **Plexus Configuration Tool** (PCT). Refer to the PCT User Manual for details on installing the PCT.

This section shows the main steps required for a typical set-up.

5.1 Launch PCT

Launch PCT by **double clicking** on the PLconfig.exe shortcut that was created during PCT installation.

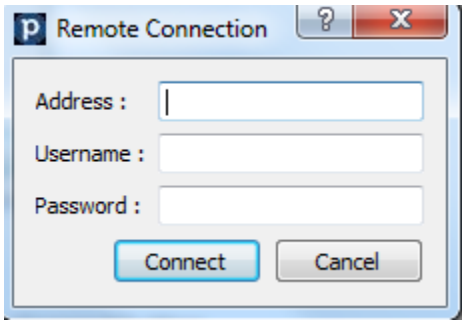


5.2 Connect to HM3 Hub

The PCT communicates over the TCP/IP network to the HM3 Hub.

5.2.1 Username and Password

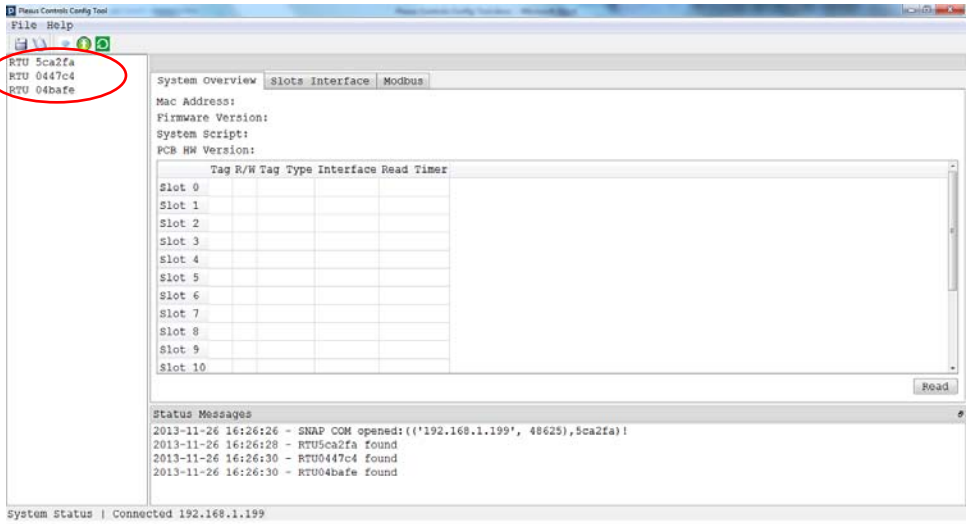
Select remote connection and click Connect button and you will get the following display to prompt you for IP address and password.



The default IP address is **192.168.1.199** and both user name and password are **HM3** (ALL CAPS). If your HM3 is at a different IP address, please use this.

5.2.2 Connect to Hub

Click Connect button to connect to HM3. The main window of the PCT will be displayed as shown below.



The PCT will connect to the Hub and list all the RTUs that are powered and reporting to the HM3. These will be shown on the left side of the main screen. The example above shows 3 RTU's. This list will update automatically.

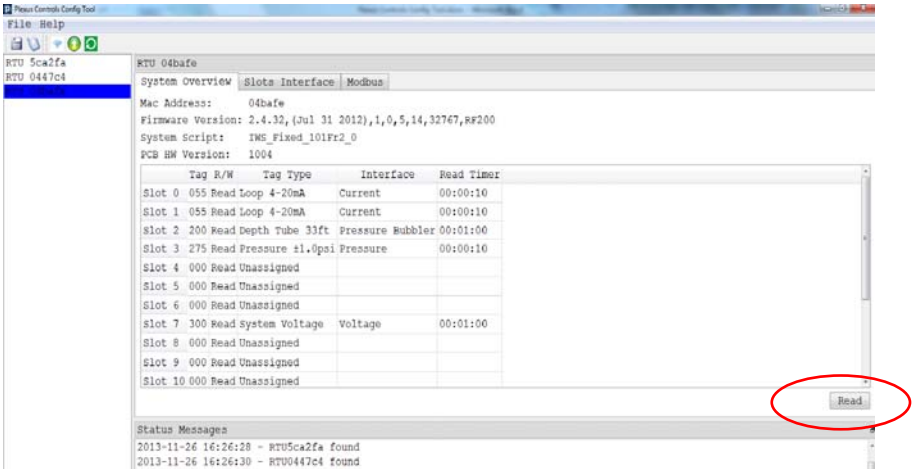
The right side of the main window shows three tabs.

- System Overview
- Slots interface
- Modbus

Each of these will be described in detail in the following sections.

5.2.3 System Overview

Select a RTU by clicking on the item in the RTUs list on the left side and then click read button in the bottom right corner.

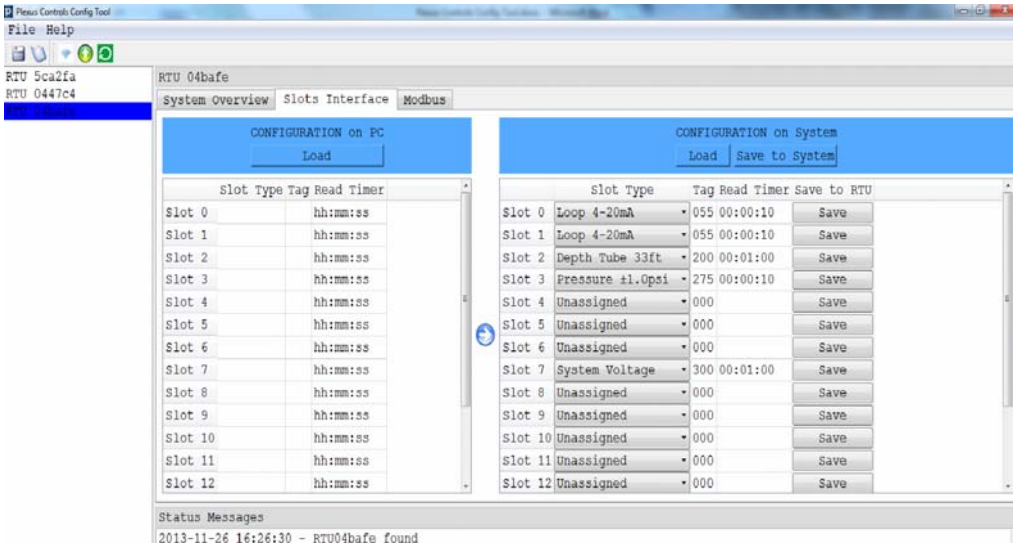


This screen shows the main characteristics of the RTUs such as the MAC Address, Firmware Version as well as the number and type of "slots" supported. The example above shows that this RTU has two current loop interfaces, one pressure and one pressure bubbler (depth) interface.

There are a total of 16 slots per each RTU. Each slot can be configured using the slots interface described next.

5.2.4 Slots Interface

The slots interface tab shows the current configuration for selected RTU. The left side of the screen show the configuration saved on the PC (if one has been saved – otherwise it is empty). The right side shows the current configuration on the RTU (click load).



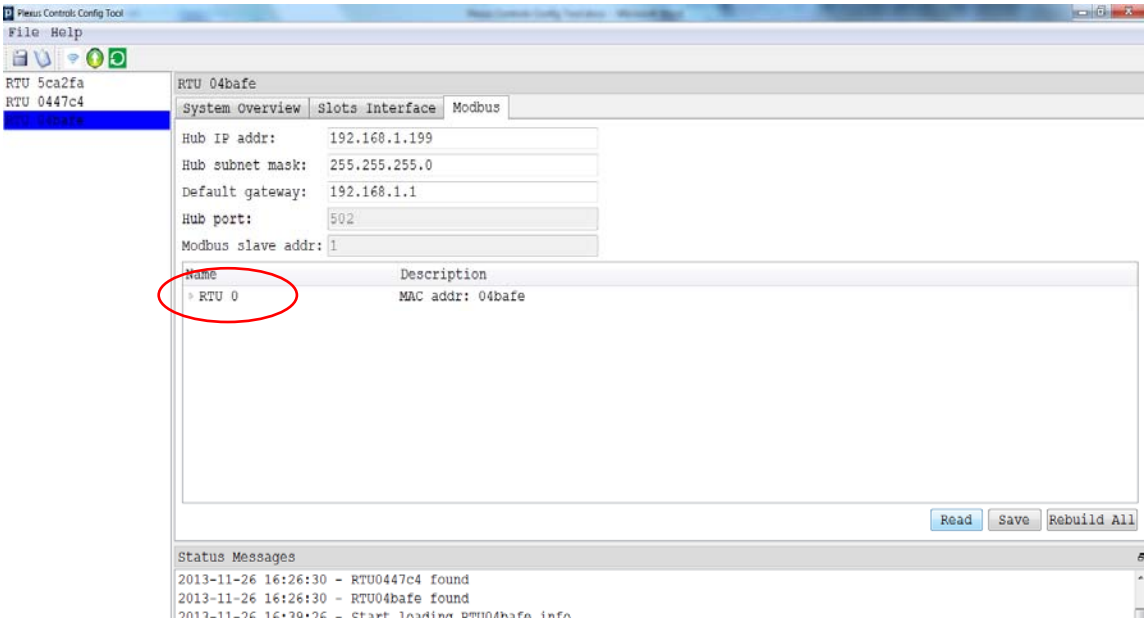
Once you change the slot type, click the right side **save button** in every slot row is for that slot only.

Save to system button click will save all 16 slots changes. , click **save to system** button which is in the top of the configuration on system window.

5.2.5 Modbus

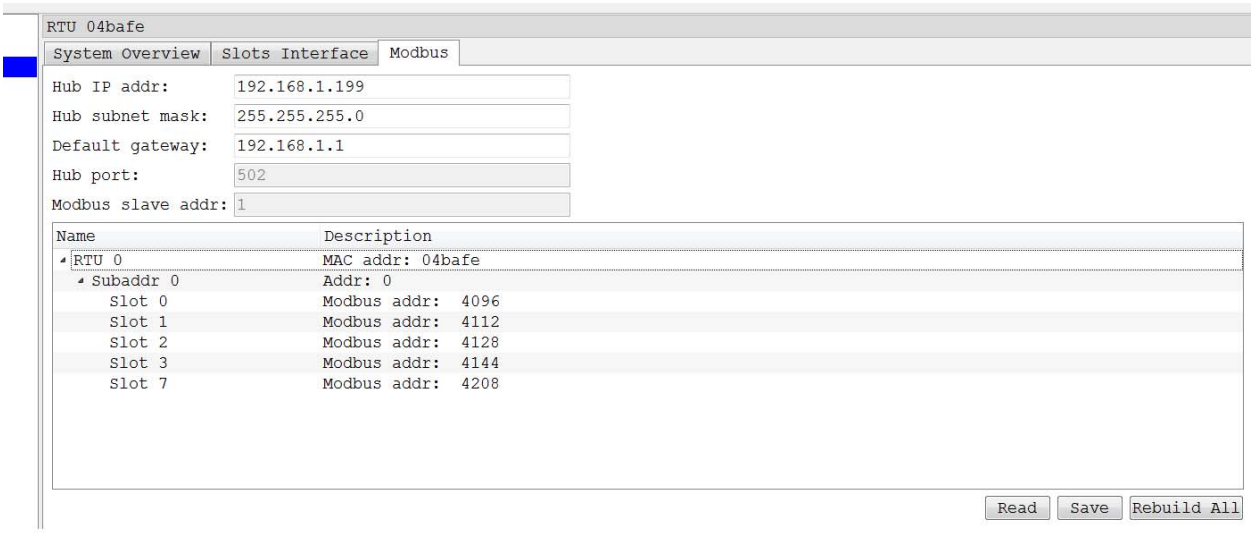
This is the primary tab to set up all the Modbus parameters. Note that the actual Modbus data read will be carried out by the Modbus server. You may consider using tools such as Modbus Poll[1] or similar to verify your configuration.

[1] http://www.modbustools.com/modbus_poll.asp



The RTUs are shown on the left side display as a tree structure. Select a RTU and its details will be shown on the main screen.

Click on left arrow of RTU, it will expand the tree display and all Modbus address information. Please note this down as it will be required to set up your Modbus server.



Setting Hub IP Address

The top part of this screen allows the IP address to be set. The Hub port and Modbus Slave address are fixed at 502 and 1 for this release (future release will allow this to be updated).

If you change the IP address please make a note of the new address.

If you lose this, you will be unable to connect to the HM3 and may require returning the Hub to Plexus Controls.

After noting the New IP, press save. Note: If you changed the IP subnet, you will need to set your computer to the new subnet to be able to reach the HM3. Please verify this as per section 4.1 before continuing.

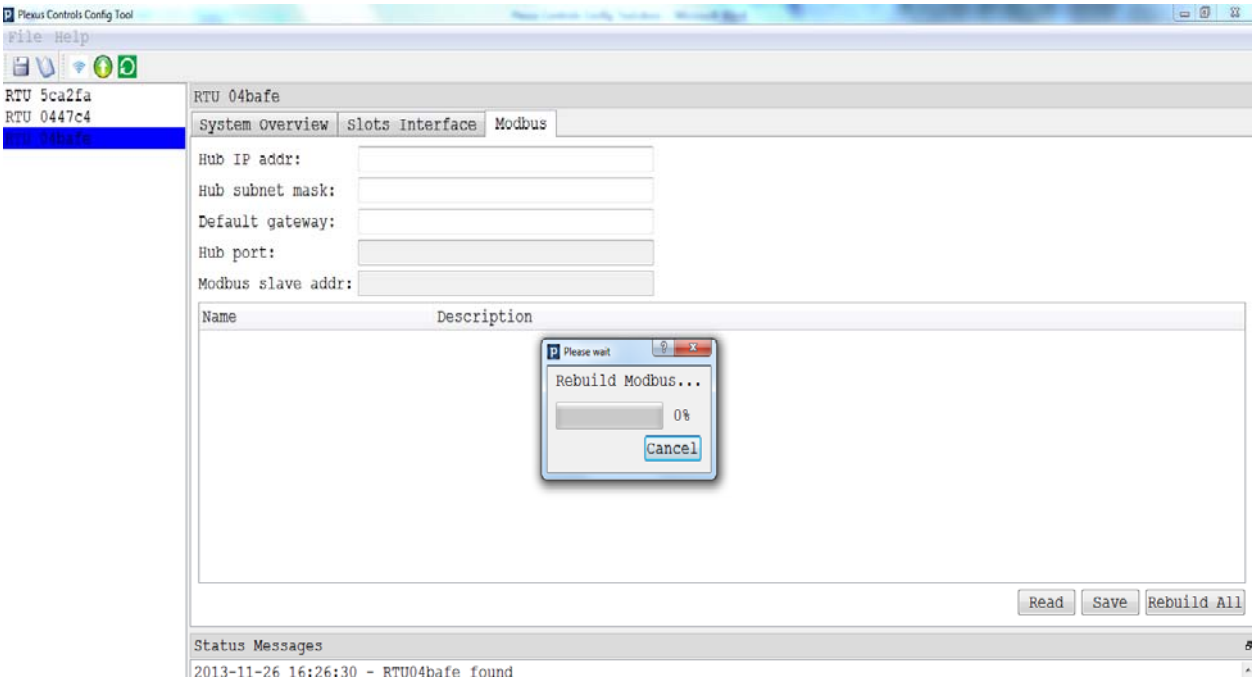
Rebuilding the Modbus Map.

This feature is recommended for advanced user only. Normally there is no need to use this. Please contact Plexus Controls if you are unsure.

The **rebuild all button** will cause the HM3 to clear out its RTU and Modbus Maps and bring in all RTUs. This would normally only be used if you are re-installing the HM3 or have another reason.

The **rebuild all** will cause the HM3 and all RTUs to reboot and essentially start you with a clean configuration.

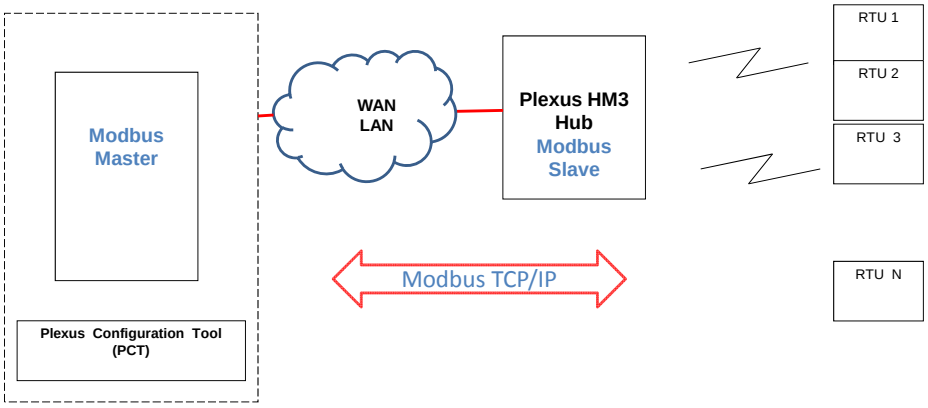
Please be patient if you invoke this feature as it may take several minutes to complete.



6 Modbus® TCP/IP

This only applies to HM3 with Modbus option installed. Please contact Plexus Controls for licensing details.

The Modbus implementation allows the Plexus Hub to act as a Modbus Slave that can be polled by a Modbus Master and retrieve readings from the RTU's. The Modbus mapping is such that the Modbus register(s) for a particular RTU can be easily determined based on the RTU Number – this is explained later in this section.



The full Modbus map is shown in **Error! Reference source not found.**

6.1 Setting Modbus parameters

It is critical that the Modbus settings are correctly set and that basic Modbus connectivity is verified before the unit is completely integrated into the Modbus Master.

6.1.1 Modbus Slave ID, IP address and Port

This release of the Modbus Release uses the following ports and Slave ID. Future versions will allow these to be changed.

- **Slave ID = 1** (Fixed in this release – future release will allow this to be changed, however we recommend that this be set to 1 unless there is a conflict with your existing Modbus map)
- **Port = 502** (Fixed in this release – this is the well know port assigned by IANA[2]. It is strongly recommended to leave this as assigned)

6.1.2 Modbus RTU Mapping

The Plexus Modbus implementation maps the RTUs into a single Modbus Slave that can be addressed using the slave ID mentioned above. Each RTU and sensor input (referred to as slot) can be identified by an offset. Please refer to **Error! Reference source not found.**.

[2] http://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xhtml

6.2 MODBUS Map

Unless specified otherwise, addresses are specified in HEX as follows 0x00 and if decimal simply as 0000.

6.2.1 Hub and RTU Information

Address	Type	Input/Output	Size (Bytes)	Function	Command /Function Code to Access	Notes
HUB						
00x00 – 00x01	Input Register	Read Only (2x16bit)	3	MAC Address of Hub	0x04– Read Input Register	
0x02	Input Register	Read-only (1x16bit)	2	Number of RTU	0x04– Read Input Register	
0x03~0x0F	Input Register	Read-only (13x16bit)	2	Hardware name	0x04– Read Input Register	String
0x10~0x1F	Input Register	Read-only (16x16bit)	2	Code image name	0x04– Read Input Register	String
0x20~0x27	Reserved					
RTU						
OFFSET						40 * RTU ID (Example RTU 1 starts @ 0x40)
00x00 – 00x01	Input Register	Read Only (2x16bit)	3	MAC Address of RTU	0x04– Read Input Register	
0x02	Input Register	Read-only (1x16bit)	2	Number of Sub	0x04– Read Input Register	Not used currently - Ignore
0x03~0x0F	Input Register	Read-only (13x16bit)	2	Hardware name	0x04– Read Input Register	String
0x10~0x1F	Input Register	Read-only (16x16bit)	2	Code image name	0x04– Read Input Register	String
0x20~0x27	Reserved					

Table 6-1 – HM3 Modbus Map

RTU1						
Range	RTU Group					
0x1000~0x12FF	Sub1					
	Range	Slot Group				
	0x1000~0x10FF	slot1				
		Range	Size	Offset Addr.	Register	Type
		0x1000~0x100F	16	0x0	output tag	Read-Only
				0x1	output value	
				0x2	output year	
				0x3	output month	
				0x4	output day	
				0x5	output hour	
				0x6	output minute	
				0x7	output second	
				0x8	reserved	
				0x9	reserved	
				0xA	reserved	
				0xB	In/Out tag	
				0xC	In/Out value	Read_write
				0xD	reserved	
				0xE	reserved	
				0xF	reserved	
		slot2				
		Range	Size	Offset Addr.	Register	Type
		0x1010~0x101F	16	0x0~0xF		
		.....				
		slot15				
		Range	Size	Offset Addr.	Register	Type
		0x10F0~0x10FF	16	0x0~0xF		
	Sub2					
	Range	Slot Group				
	0x1100~0x11FF	.....				
	Sub3					
	Range	Slot Group				
	0x1200~0x12FF	.....				

RTU2	
Range	RTU Group
0x1300~0x15FF	.....
.....	

RTU80	
Range	RTU Group
0xFD00~0xFFFF	.....

Table 6-2 – RTU Mapping

6.3 Examples

The following section shows examples of how to access data via a Modbus Poll[3] Test tool[4].

In this example, we will use the following RTUs (these are illustrative; the RTUs can be mapped in any order during configuration.

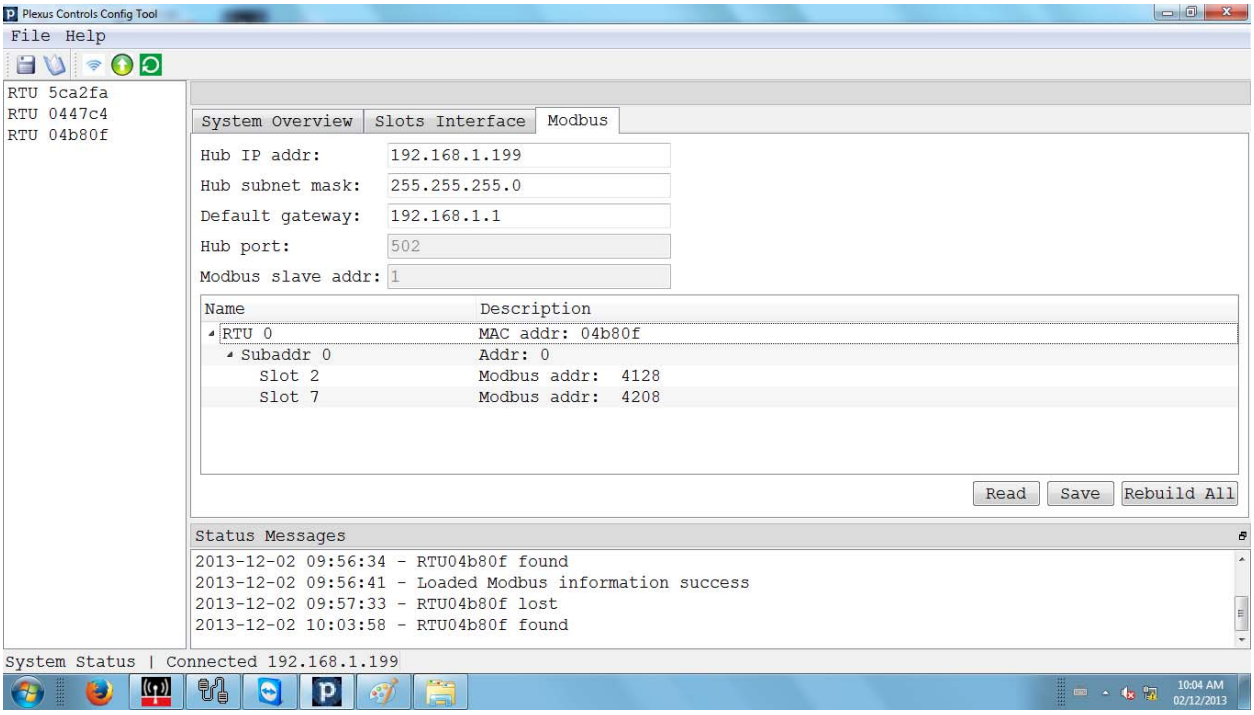
In this example, the HM3 is located at **192.168.1.199** and the Modbus TCP/IP communications is over port **502** and Slave address **1 .** If your settings are different, please substitute these.

6.3.1 Poll RTU 0 Slots 2 and 7

In this example, we show how to poll RTU 0 slots 2 and 7 (chosen arbitrarily).

The first thing you need to know is which address to poll. This can be determined as follows

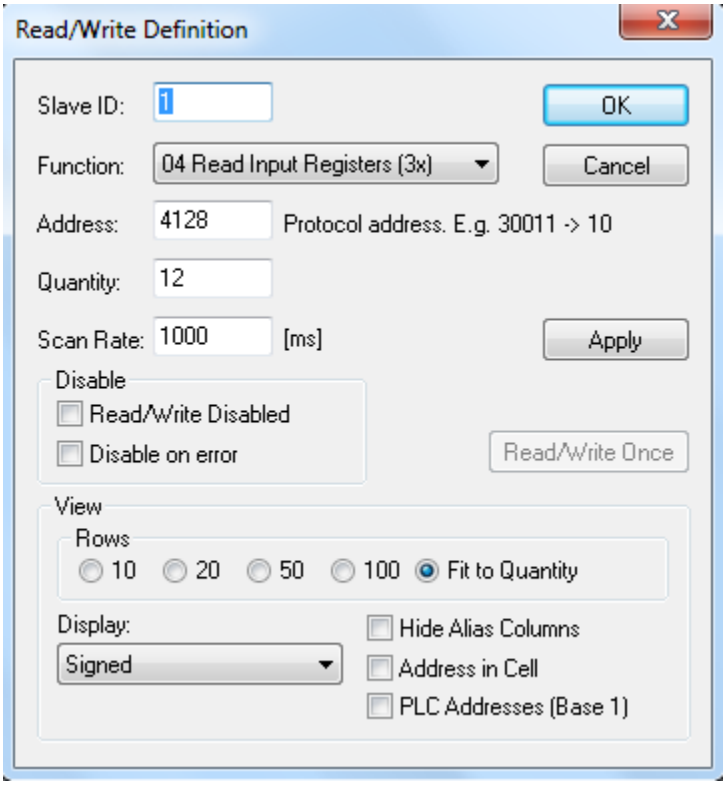
In the PCT, navigate to the Modbus tab and click on the RTU 0 (in this case MAC address 04b80f – this is arbitrary).



In this example, there are two slots of RTU 0, slot 2 and slot 7 and the Modbus address is 4128 and 4208 respectively.

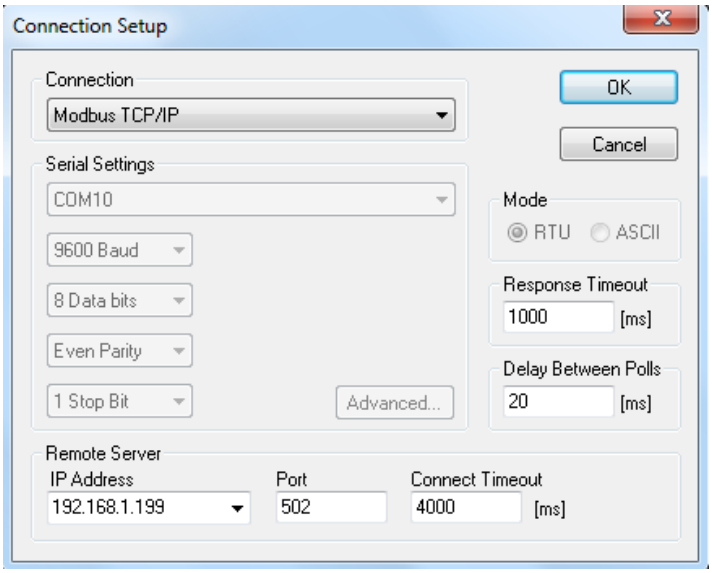
Running Modbus Poll[5] software, you could create a new Modbus window by click File-→New. Typing in Modbus address 4128 in menu Setup→Read/Write Definition, the screen is like the following.

[3] http://www.modbustools.com/modbus_poll.asp
[4] Plexus Controls does not endorse any particular Modbus Test Software. We simply provide this as an example.



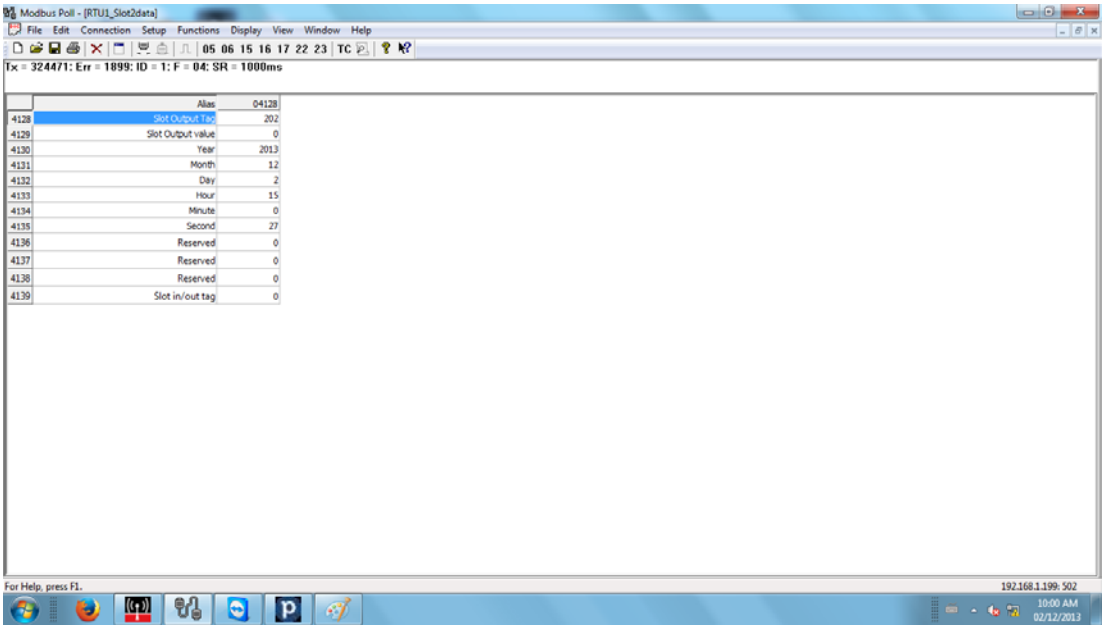
Please note the the slave ID is 1, function select is "04 Read InputRegisters(3x) and view selection is "Fit to Quantity"

The next step is to set up connection. In the menu Connection-→Connect, set up parameters like the following

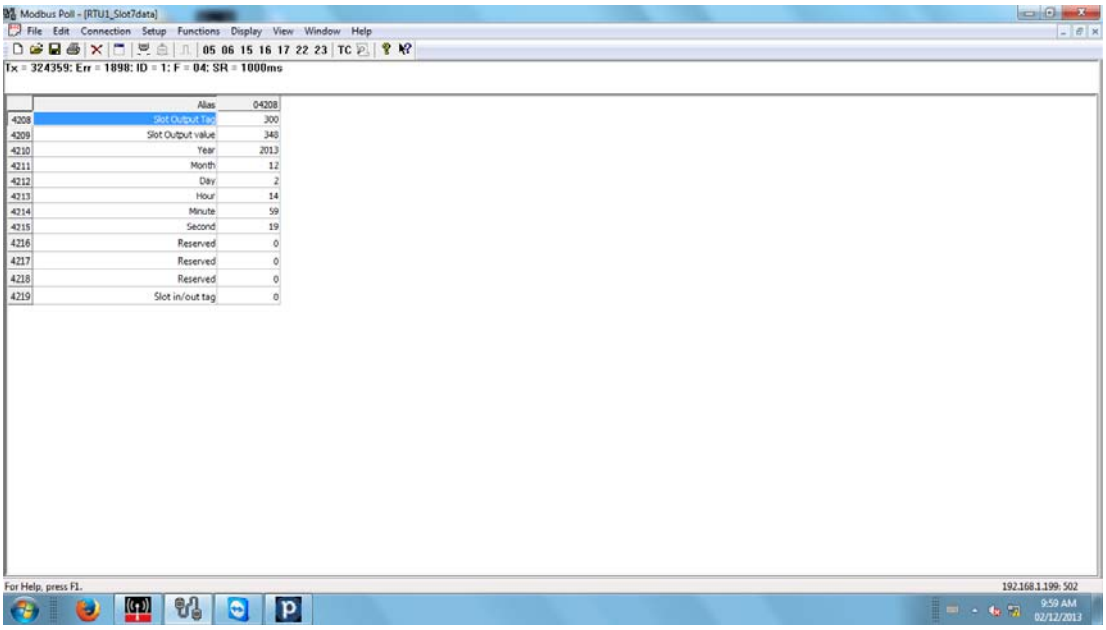


Please note the remote server is **192.168.1.199** and port number is **502**. The typical value for connect time is **4000** ms but you could change it.

After these set up in Modbus Poll, you should get the Modbus register map like the following.



Repeat above steps to set up RTU 0, slot 7. The Modbus address is 4208 and the output screen looks like the following



Please note the output date and time is UTC time

7 Troubleshooting

System	Cannot connect to Hub and RTU's	Check that IP level connectivity is present between the PC running the PCT and the Hub. Run **ping** command from the PC to the Hub (e.g. ping 192.168.1.199) If ping is unsuccessful, verify that the IP subnet is correct and all firewalls are disabled Also ensure that any antispyware or antivirus software is not blocking access to ports used by the Plexus Configuration Tool or Modbus Master
Modbus	Cannot Poll Hub	Check that IP level connectivity is present between the PC running the Modbus Master and the Hub. Run **ping** command from the PC to the Hub (e.g. ping 192.168.1.199) If ping is unsuccessful, verify that the IP subnet is correct and all firewalls are disabled Ensure that the Modbus Master is polling port 502 Also ensure that any antispyware or antivirus software is not blocking access to ports used by the Plexus Configuration Tool or Modbus Master
Forgotten Password	Contact Plexus Tech Support	For security, it is not possible to reset the password locally.

8 References

1. Plexus Hub – Installation Manual
2. Plexus Data Management Application - User Manual (Not yet available – not required for Modbus)
3. Plexus Configuration Tool – Installation Guide

To find out more, contact Plexus Controls:

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