VxI POWER LTD

VxI Power Ltd.

IPM-01 / IPM-01H MODBUS TCP/RTU Bridge User Guide

01/12/2015

Contents

1.0 Device Overview

The IPM-01 can give any VxI MODBUS RTU compatible device network visibility, allowing a serially connected device to be controlled or monitored over the internet*. The IPM-01 creates a communication bridge between MODBUS TCP and Modbus RTU devices, appearing transparent to both master and slave devices. The device is configurable via its embedded HTTP web server.

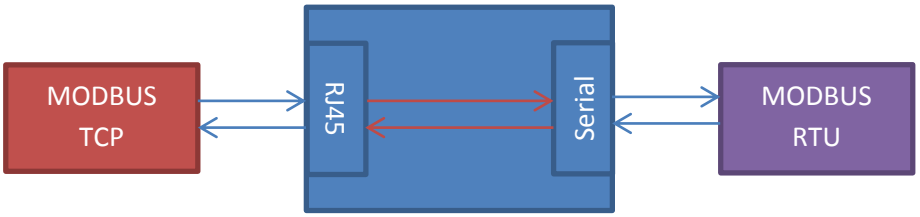


Figure 1

* The module will be visible to the Local Area Network. Your network administrator will need to configure the gateway beyond the local area network (using i.e. Dynamic DNS, Port Forwarding etc.) in order to give the device external visibility.

2.0 Getting Started

Figure 2A

Figure 2B

2.1 Connecting the Device

Figure 2A shows a IPM-01 device. The most common arrangement for the IPM-01 is for a MODBUS master to be connected to the IPM-01 via Ethernet and the slave device via serial (Default settings); see section 8.0 (Appendix I) for connection examples.

Figure 2B shows a IPm-01H device.

2.2 Finding the device

There are 2 options for initially connecting to the device, choice will be dependant upon whether you have access to a local area network and DHCP server, or if you want to connect directly to the IPM01 independent of or in the absence of any LAN.

2.2.1 Option1 connecting via your local network using DHCP

Connect both your computer and the IPM01 network connections to your local network.

DHCP is enabled on the device by default. This means that the IPM-01 will request an IP address from a DHCP server when connected to a network. Your DHCP server will supply an IP address to the IPM01. In order to find your devices IP address you will need to use the VxI Power TCP/IP discovery tool.

VxI Power TCP/IP Discovery tool: The VxI power **TCP/IP Discovery tool** is a desktop program and is available for download at **www.vxipower.com/ipm01/downloads/**.

Download and unzip to a location of your choice.

It is a Java based program (a single file ending .jar) meaning that Java must be installed on the machine for the program to run. If the file does not run the application (shown in Figure 3), then please ensure that the Java Runtime Environment has been installed on your machine.

Note: When running for the first time, Windows may show that the firewall has blocked the program's execution. A dialog may be shown asking the user if windows firewall should block/unblock the program. If this dialog is shown, the 'unblock' option must be selected for the program to run correctly.

The program's interface is shown in **figure 3**:

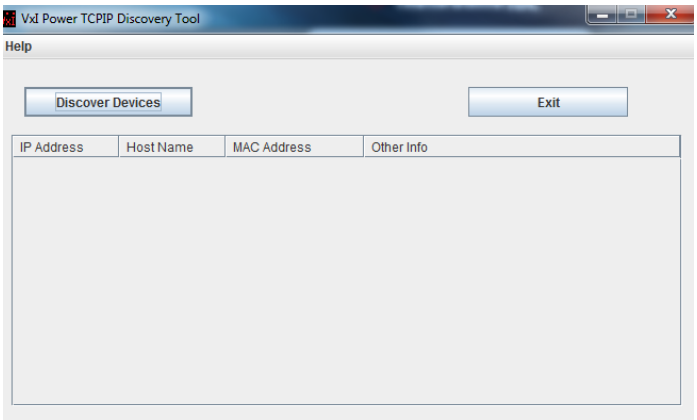


Figure 3

In order to find the IP address of a connected IPM-01 device, the user should click on the 'Discover Devices' button. If the program is able to find a device on the network, its details should populate the table below as is shown in **Figure 4**.

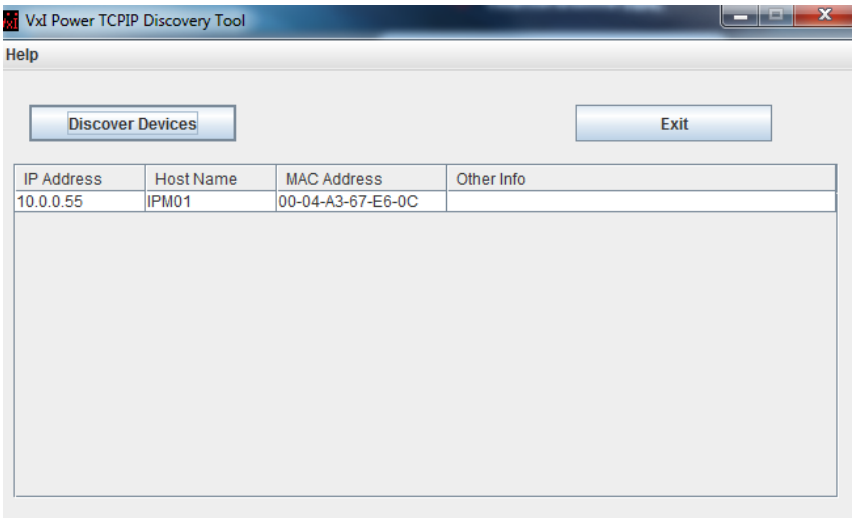


Figure 4

If the TCP Discovery tool is not showing your device, then please see the Troubleshooting procedure (Section 4.0).

The IP Address will be required for a Master device to connect to the IPM-01. The IP Address is also used to access the Device's built-in client and configuration menu.

The IPM-01 can also be found via its NetBIOS Hostname. If the device has been plugged into a network or a Host that supports NetBIOS, then its configuration page can be accessed via the address 'http://IPM01/' in the browsers address bar.

If your network will not allow a DHCP enabled device to acquire an IP address, connect to the device using the crossover cable supplied as shown in option2.

2.2.2 Option2 Using a Crossover cable (direct connection)

By default the IPM-01's DHCP client is enabled. This means that it will request an IP address from a DHCP server when connected to a device or network. When connected directly to a PC, unless the PC has a DHCP server installed (no DHCP server in Windows by default), the IPM-01 receives no response, it uses its default Static IP address instead.

169.254.1.2

When connected to the IPM-01, the PC is in a similar state. It also attempts to request an IP address from a DHCP server. The request fails and the PC assigns itself an IP address on the 169.254.X.X subnet (more details in Appendix III), as it is also unable to acquire an IP address from a DHCP server.

NOTE: It may take a few seconds before Windows assigns itself a 169.254.X.X (APIPA) address.

Once you are connected to your device you can then configure the device, disable DHCP and select an appropriate IP address for network compatibility if required.

3.0 Web Browser Client/ Configuration

The IPM-01's configuration and Modbus Client are presented to the user in the form of a website, accessible via a browser.

3.1 User Authentication

The user is prompted to enter a username and password to gain access to any section of the website that allows changes to the device's configuration to be made: SERIAL CONFIG, TCP CONFIG, FIRMWARE UPGRADE and USER. The default Username and Password for the IPM-01 is:

Username: admin

Password: password

If the assigned Username and Password has been forgotten, the device must be reset to its factory default values.

3.2 Modbus Client

The in browser MODBUS client makes extensive use of JavaScript and some native browser JavaScript functions. It is for this reason that the MODBUS client is only supported by the following Browsers:

Internet Explorer 9 and above

Google Chrome (All Versions) - **Recommended**

Mozilla Firefox 5 and above

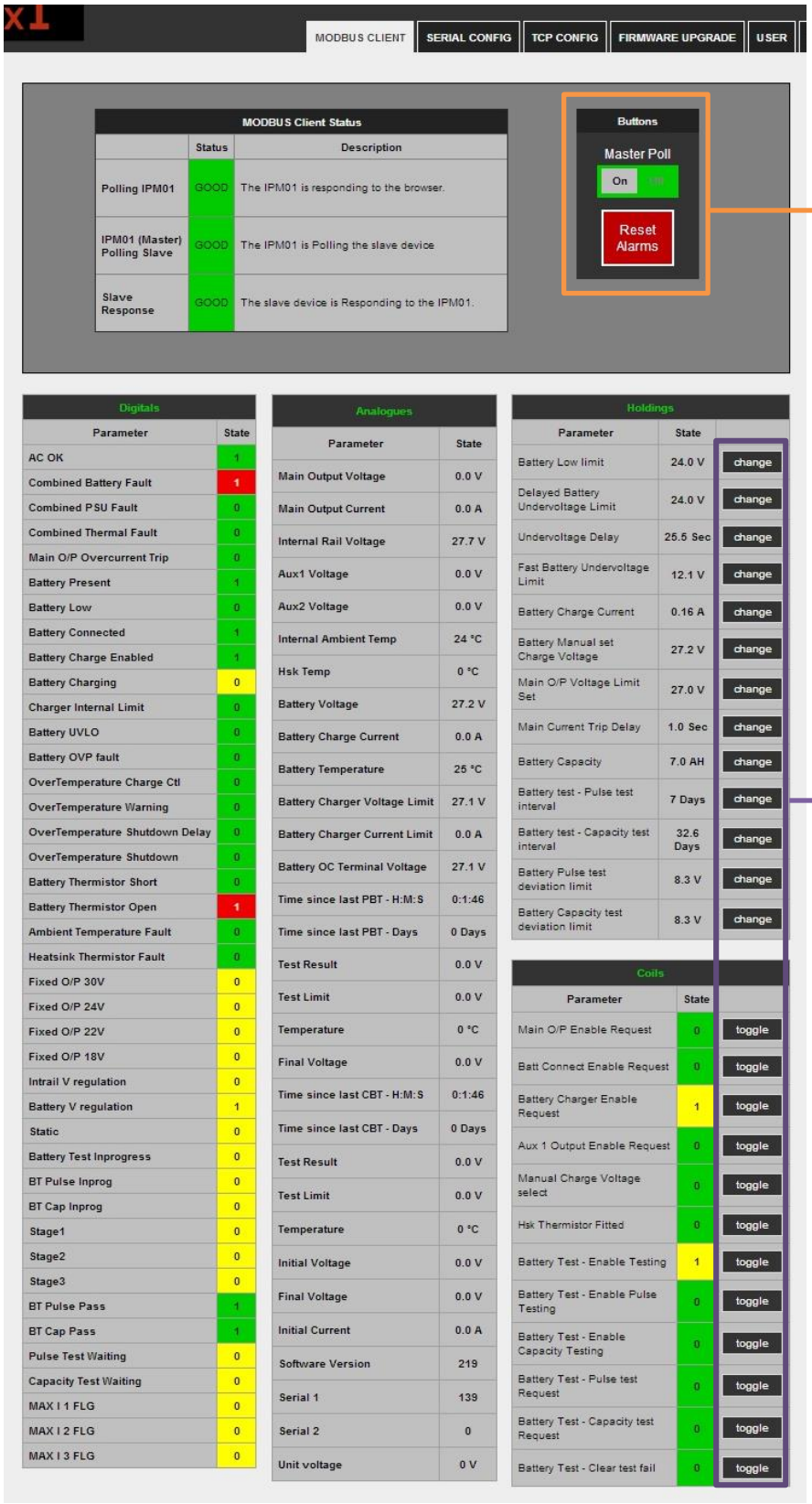
Safari (All Versions)

The IPM-01 features an in browser MODBUS Master and client. The MODBUS CLIENT page gives a live display of the slave device's Modbus data. The client also allows a user to perform standard MODBUS write operations.

Depending upon your devices factory configuration you may have a single MODBUS client option or dual, single client configuration is shown for simplicity.

Figure 5

Figure 5 shows the Modbus client start up screen (***the figure shows the client for the 14653 PSU**). Most of the boxes appear grey, with only the ON/OFF button and Polling IPM-01 section of the MODBUS Client Status table, showing in colour. To activate the IPM-01 Master Polling, the user should click the ON/OFF button. Figure 6 shows the client when the MODBUS master has been switched on.



The Master Poll switch is used to stop/start the IPM-01 Modbus Master polling the PSU.

The 'Reset Alarms' Button can be used to reset the PSU Modbus to its default settings.

The 'change' buttons can be used to change values in the Holding Register (*see note). The Toggle buttons can be used to change Coil values.

Figure 6

*Attempting to change a value in a Holding register presents the user with a dialog box. The box outlines the accepted value range for the selected Holding register. These values change depending on selected register, as does the resolution of these values. The value entered by the user will be scaled to the closest value possible within the limits of the number of bits assigned to storing that particular value (the size of the register e.g. 8-bits). The actual value may be slightly different to the one entered, but will be as close to the entered value as is possible.

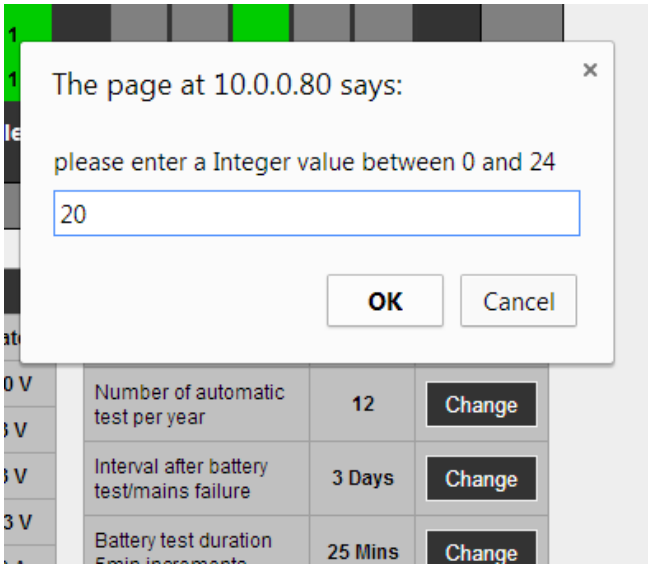


Figure 7

3.3 Configuration

Once the address of the device has been resolved, the user is then able to change its configuration settings. This section shows the available configuration settings for the device.

3.3.1 Serial Configuration

The serial configuration page (Figure 8) allows the user to change the following Serial Port settings:

- Parity enabled – checkbox.
- Parity – odd or even. Radio buttons disabled when 'parity enabled' is unchecked.
- Baud Rate – dropdown menu with the following options: 9600, 19200, 38400, 57600.

Figure 8

3.3.1.1 Slave Address

The Slave address for the Modbus RTU client is specified by the TCP master device.

The slave address for the Modbus RTU client is automatically extracted from the message header sent from the Modbus TCP master. MODBUS TCP supports the use of a slave address to allow communication with RTU devices and includes the field as a part of its message header. For a MODBUS TCP master to talk to a MODBUS RTU device using the IPM-01, the slave address must be configured at the TCP master device.

When using an IPM-01 RS485 version, it is possible to communicate with multiple RS485 clients (configured with individual slave addresses) if the master TCP device is able to request data from different RTU slave addresses whilst using the same IP address.

The MODBUS TCP master device must also be able to do this sequentially as multiple message handling is not supported.

See Section 9.1 Appendix I: Connection Examples

3.3.2 TCP Configuration

The TCP configuration page (**Figure 9**) allows the user to change the following values:

- MAC Address – A unique number assigned to IP based electronic devices. This value is Read only.
- NetBIOS Host Name – Netbios name, 1-16 alphanumeric characters. (Default is 'IPM01')
- DHCP enable – Checkbox.

- If checked, the device will request the assignment of an IP address from the local server. *We recommed the use of a static IP address or statically allocating an ip address in the servers DHCP table. Please contact your network administrator for more information regarding DHCP*.

- IPM-01 IP Address – IP Address Format (e.g. 169.254.1.1).
- Gateway - IP Address Format.
- Subnet Mask - IP Address Format.
- TCP Port – decimal value between 0-65535.

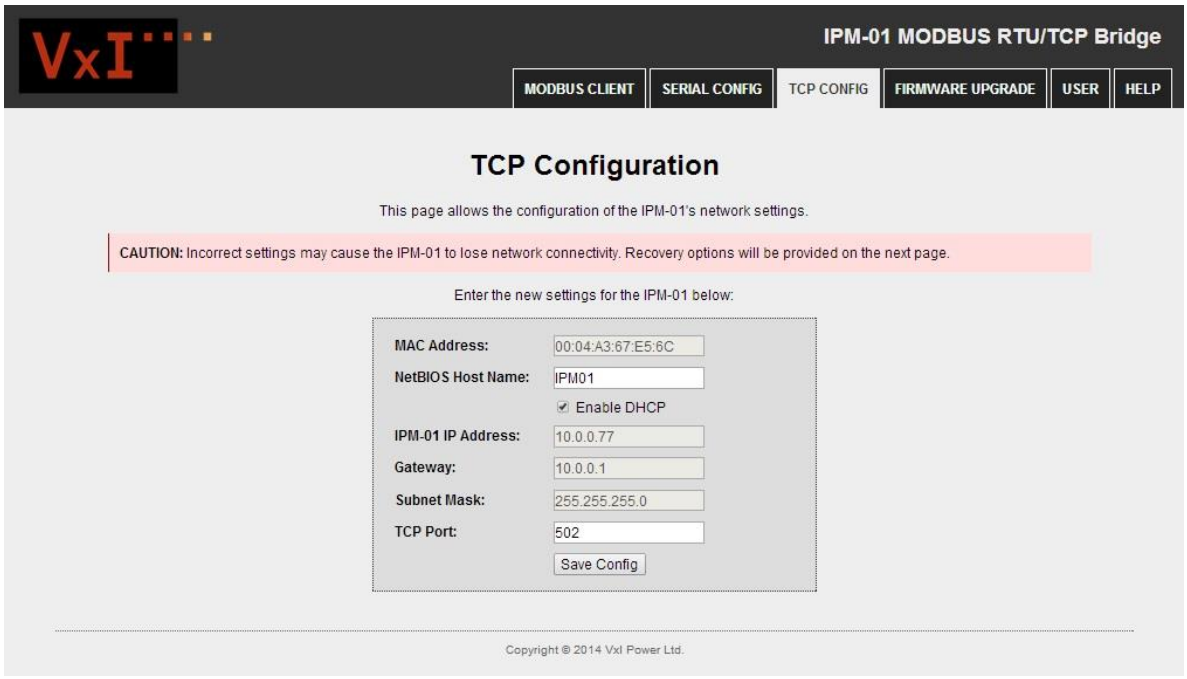


Figure 9

3.3.3 Firmware Upgrade

If there are Firmware updates for this product they will be available for download at www.vxipower.com. The Firmware Upgrade page allows the upload of a file from a local directory. **Figure 10** shows the Firmware Upgrade page. The can upload a file to the device by clicking the 'choose file' button, navigationg to the file and then clicking on the 'Upload and Flash' button.

If the IPM-01 accepts the uploaded file, it will then reboot and reflash its firmware to the new version. When the new firmware has been applied, it will display a newer firmware version number on the configuration startup page and display "Firmware Update Success". If the update was unsuccessful, or the IPM-01 continues to have problems, then the device can also be rolled back to its factory default settings. When a rollback is selected a dialog box appears asking for confirmation before performing the action. If selected, a rollback will be perfomed and a "Firmware Rollback Success" message shown on the configuration startup screen (**Figure 11**).

A rollback to factory defaults can also be executed by holding down the Reset button (see Section 7.0) for 4 seconds.

3.3.4 Webpage Update Procedure

Though the Firmware update also includes a webpage update, it may be that only the webpage has changed. In this case, a new webpage can be uploaded using the device address appended with /mpfsupload (e.g. http://169.254.1.2/mpfsupload). The user can then select the downloaded webpage 'Image' file to perform this task.

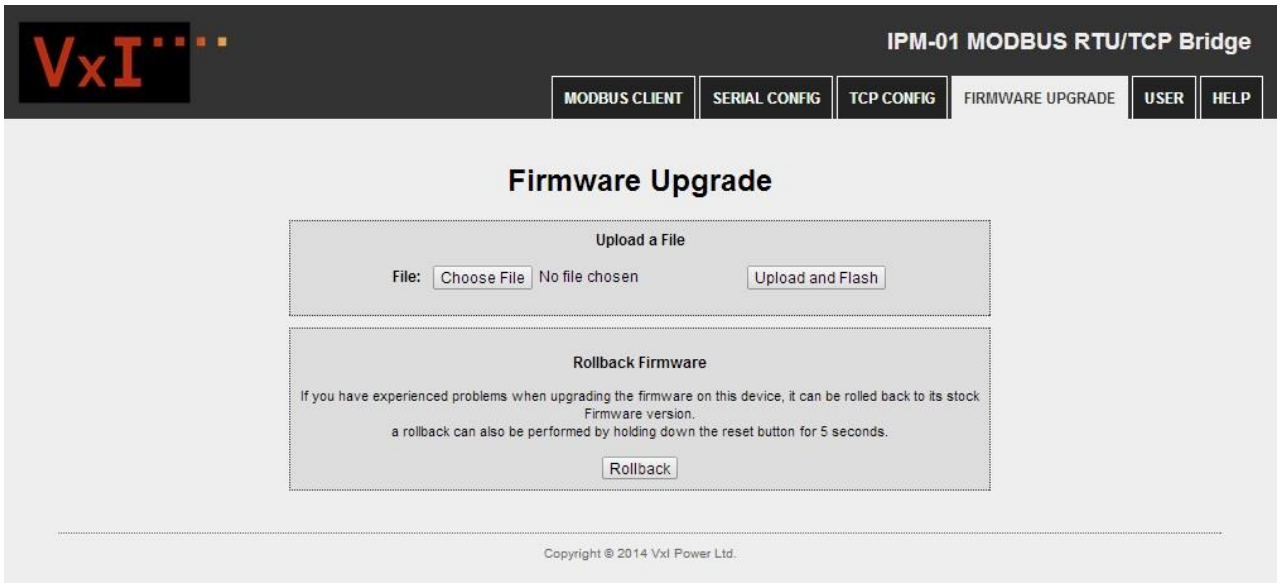


Figure 10

Figure 11

3.3.5 User Configuration

Figure 12 shows the User Page. The User page allows the user to change the current Username and Password. To do so it requires:

- Current Username
- Current Password
- New Username
- Confirm New Username
- New Password
- Confirm New Password

Only when this data is submitted correctly will it be saved and the board reset. The new settings are loaded on reboot.

Figure 12

4.0 Troubleshooting

Before executing any of the following, please ensure that:

- ✓ The Device is powered via an appropriate input source (See Input Power in Specification).
- ✓ The network cable is securely plugged in to the Ethernet Port.
- ✓ A device is securely attached to the Serial Port (Not required for configuration or device discovery).

4.1.1 The TCP Discovery Tool is unable to find my device?

a. **Check that the Program is not being blocked by a firewall. Did you see a dialog box from a firewall program asking you if the program was safe?**
(The windows firewall may ask to 'Block' or 'Unblock' the program)

Please make sure that the VxI Power TCP/IP Discovery tool is not being blocked by a firewall program. If you are being presented with a dialog box from windows firewall, make sure that you select 'Unblock'. It may also be possible that your firewall is set to automatically block suspicious programs, so always make sure that the Discovery Tool is 'Allowed' on the local network.
If after verifying that your firewall is not preventing the execution of the program, you are still having problems, continue to **b**.

b. The network to which you have attached the device may have rejected your device's request for an IP Address. The device therefore needs to be given an IP Address that the Network will allow.

In its default configuration, the IPM-01 asks for an IP Address using DHCP and then Defaults to '169.254.1.2' if DHCP is not enabled on the network. Talk to your network administrator about what an appropriate setup for the IPM-01 would be.

The following procedure describes how to change the device's IP Address:

a) Connect the device directly to a computer, via a CAT5 crossover cable.
b) Type '169.254.1.2' (device default IP address) into the address bar of your browser.

c) The Device configuration menu should now be displayed. Click on the 'TCP CONFIG' tab and configure your device to work with your network.

5.2 Master TCP

4.2.1 My MODBUS TCP master is unable to establish a TCP connection with the IPM-01?

The IPM-01 implements a TCP server, allowing a MODBUS TCP Master Client to open a connection to the device. The information the client needs to make a connection is the IP Address of the IPM-01 device (or sub network that it is attached to), and the Port on which the device resides. By default the IPM-01's Port number is **502**. Its IP Address can be found using the TCP discovery tool. These values can be changed in the IPM-01's configuration menu.

4.2.2 The IPM-01's configuration menu is accessible, and a TCP connection has been established but the device isn't sending data to my Serially Attached device?

a. Is the Green (Serial Transmission) LED blinking when the device is sent a request by the master?

No – If the LED does not blink, then there may be a problem with the data being sent from the master on the TCP port. The IPM-01 will ignore any MODBUS TCP request that:

- Is larger than 150 bytes.
- Is smaller than 5 bytes.
- Has incorrect MODBUS TCP header information.

For more information on the structure of a MODBUS TCP request message visit www.modbus.org.

Yes - See answer to question 3.

4.2.3 The IPM-01 Sends data on its serial port, but receives no response?

If the IPM-01 is sending data to a Slave device and the Slave receives no or bad data, then there is likely an issue with the Serial configuration on the IPM-01. **The IPM-01's Serial configuration (Baud rate, Parity and Slave ID) must match that of the slave device**. If the configurations do not match, then the slave device could receive bad data and respond with an error message, which will in turn be received as bad data by the IPM-01 and ignored.

4.2.4 The IPM-01 Works fine with a direct Ethernet connection, but not when used on the network?

This problem may occur as the result of the device's response to the master not being fast enough. High network traffic or general lack of band-width may cause performance issues. If this happens the master program may time-out before receiving a response. Please see section **8.0 IPM-01 Performance Considerations**.

If you are still experiencing problems with your IPM-01 then contact VxI Power Technical Support

Phone: +44 (0)1522 500511

Email: support@vxipower.com

4.4 Error Codes

Error codes are returned when incorrect data is submitted to the device, via its web interface. The error codes are shown and described below:

Error	Cause	Solution
101	If you have received this error it is because the browser is submitting bad data to the IPM-01.	Ensure that you have JavaScript enabled in your browser
302	This error occurs if the uploaded file fails its validity check	Ensure correct file is being uploaded.

4.5 Reset procedure

The device has a reset button accessible through a pin-hole in the casing. The functionality of this button is as follows:

- If pressed when board is running, the board will reboot and load default settings.
- If the button is pressed and held down for longer than **4 seconds**, the device will roll back to its factory settings and firmware.

5.0 Specification

Table 1

	IPM-01 (Din-Rail)	IPM-01H (Hand Held)
Input Voltage Range:	9-32V DC	5V (USB) or 9-32V DC
Connections	**Power – 2x Screw Terminal (Max Conductor Size 4mm^2)** **Serial – 3x Screw Terminal (Max Conductor Size - 4mm^2)** **Ethernet RJ45 socket** See Section 6.0 for connection details	**Power – Micro USB or 2way Micro-Fit.** **Serial – RJ45 / DE-9 Cable** **Ethernet RJ45 socket** See Section 6.0 for connection details
User Indicators	1x Serial Transmit indicator LED – Green 1x Serial Receive indicator LED – Red 1x Reset/Restore Button	1x Reset/Restore Button
Operating Temperature: **Storage Temperature:** **Storage Humidity:**	-20°C - +50°C * -20°C - +85°C 5% - 95%, non-condensing * -40oC version available on request	
Storage Humidity:	5% - 95%, non-condensing	
Dimensions:	20mm DIN-rail mountable case	Hand Held moulded case
Power Requirement (typical Active):	720mW (See Power Consumption information - table 2)	
Protocol:	MODBUS TCP MODBUS RTU	
Serial Port Details:	**Parity:** 8O-1, 8E-1, 8N-2 **Supported Baud Rates:** 9600, 19200, 38400, 57600	
Ethernet Details	RJ45, 10Base-T, 802.3 compliant	
Maximum Read/write request size:	Supports Reads/Writes of up to 150 registers	
Other Features:	DHCP (Client only) – Enabled by default. NetBIOS Device name resolution HTTP Server with Configuration Interface.	
EMC	Low voltage directive 2006/95/EC: EN60950-1:2006 + A12:2011 EN 61000-6-1:2007 EN61000-6-3:2007 + A1:2011 RoHS directive 2002/95/EC	EMC directive 2004/108/EC: EN 61000-6-2: 2005 EN 61000-6-4: 2007 + A1:2011

Power Consumption information

Table 2

Input Voltage (V)	Current (mA)	Power (mW)
8	90	720
12	60	720
24	30	720
32	22	704

6.0 Basic Hardware Information

IPM-01

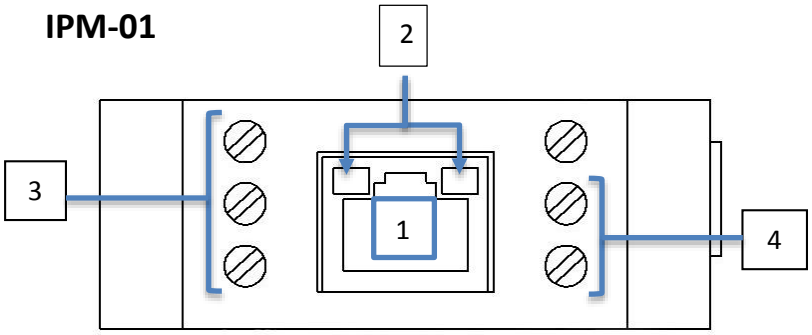


Figure 13 – Front View

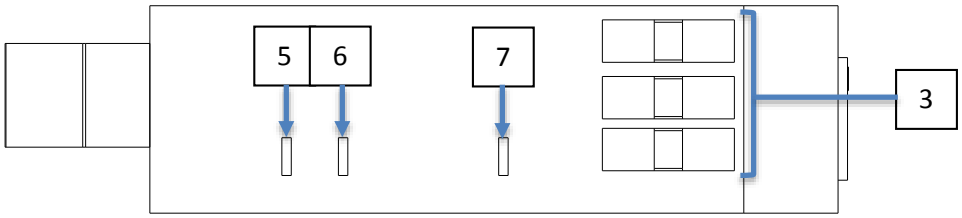


Figure 14 – Top view

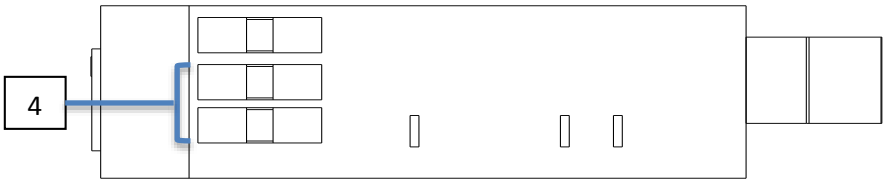
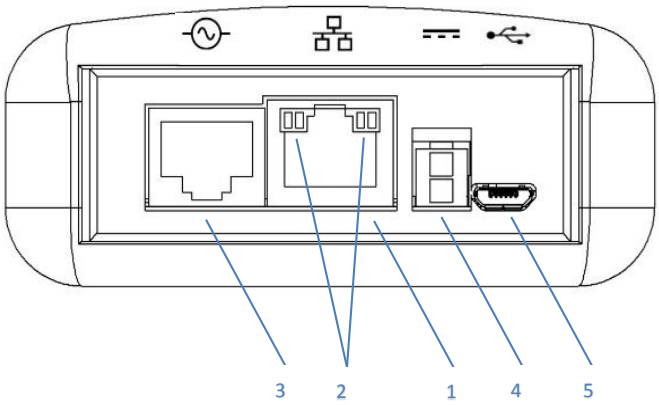


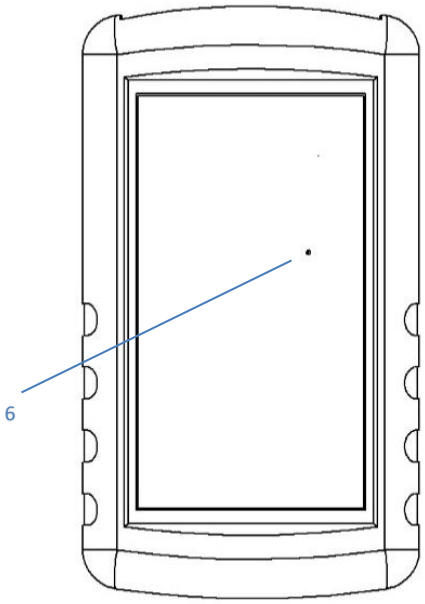
Figure 15 – Bottom view

1. RJ45 Socket (Ethernet)
2. Ethernet LEDs - Please See Table1 in sub-section **2.1** (Ethernet LED behaviour) for more information.
3. Serial Port Pins (Screw Terminal x3: RS232 - TX, RX, 0V
   RS485 - A(+), B(-), 0V)
4. Input Power Pins (Screw Terminal x2: +VIN, 0V)
5. Serial Receive (Red) indication LED
6. Serial Transmit (Green) indication LED
7. Reset Button

IPM-01H



Front View



Top View

1. RJ45 Socket (Ethernet)
2. Ethernet LEDs - Please See Table1 in sub-section **2.1** (Ethernet LED behaviour) for more information.
3. RJ45 Socket (Serial RS232)
4. Input Power (Micro-Fit: +VIN, 0V)
5. Input Power (USB)
6. Reset Button

6.1 RJ45 Socket LED Behaviour

The RJ45 socket features two LEDs, primarily used for Ethernet activity indication. The LEDs can emit both **Orange** and **Green** light. Green is used to indicate Ethernet activity and orange is used for Firmware update and rollback operations.

Table 3

	Orange		**Green**	
	LEDA	**LEDB**	**LEDA**	**LEDB**
On	N/A	N/A	N/A	Network Link made
Off	N/A	N/A	No Activity	No Network Link
Blinking	Firmware Update/Rollback	Firmware Update/Rollback	Transmit/Receive Activity	N/A

7.0 IPM-01 Performance Considerations

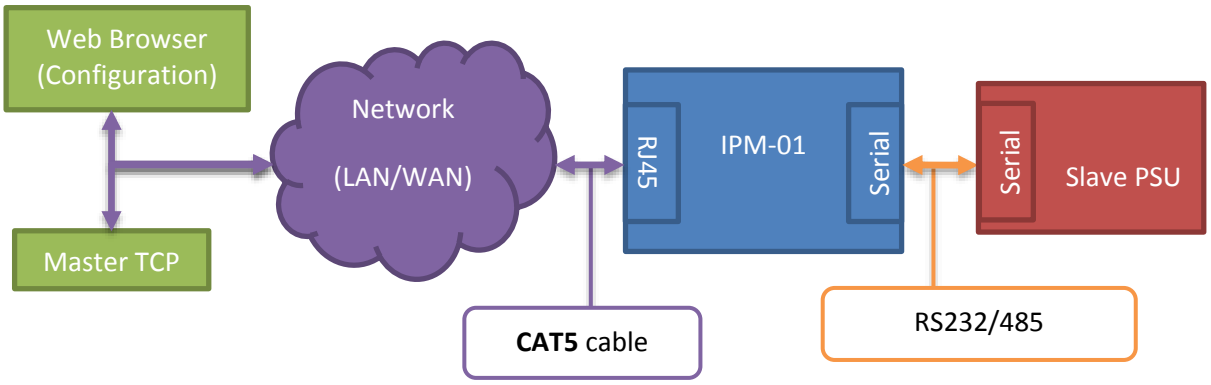
When using the IPM-01 in your system, it is important to consider the potential performance impact of involving a networked device. The time it takes for a MODBUS TCP device to receive a response may be affected by high network traffic. For this reason a master device must give adequate time for a response.

Consideration should also be given to the available bandwidth of the slave device. The performance of this device will dictate how quickly it is able to perform an operation and respond. Appropriate timeout values and settings may need to be applied to the master program in order to account for these constraints.

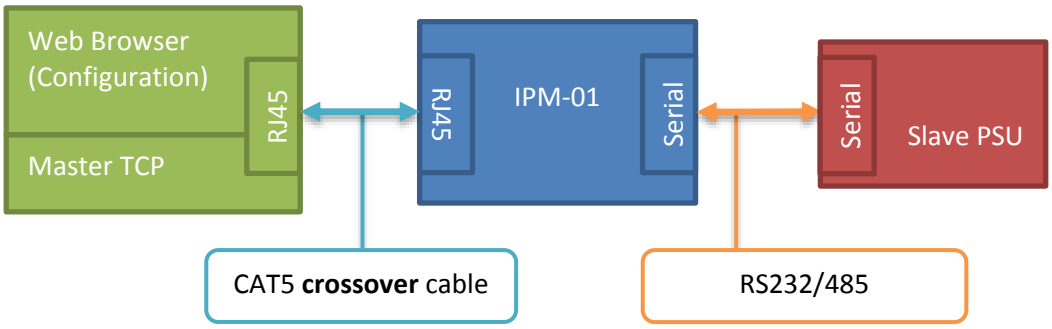
8.0 Appendices

8.1 Appendix I: Connection Examples

Networked Master TCP (**Typical**)



Direct Master TCP



8.2 Appendix II: Crossover Connection details (direct connection)

DHCP enabled on both PC and IPM-01 (**Default Configuration**)

If a windows machine is unable to retrieve an IP address from a DHCP server (as in this case, due to the IPM-01's lack of DHCP server) it uses APIPA to assign itself an IP address. Windows will assign itself an address in the 169.254.x.x subnet, (reserved for when DHCP fails) a subnet mask of 255.255.0.0 and a default gateway of 0.0.0.0. No default gateway address is required as devices in the 169.254.x.x address range are link-local only. This means that they are only able to communicate with other devices on the immediate local network. The IPM-01 behaves in the same way, and reverts to its default address, if DHCP is enabled and the request for an address from a server has failed.

NOTE: It may take a few seconds before Windows assigns itself an APIPA address.

DHCP enabled on IPM-01, Disabled (static IP) on PC

If the PC has a static IP address or DHCP disabled, it must be manually set to have an IP address on the 169.254.X.X subnet. This will allow the IPM-01's configuration menu to be accessed and changed if necessary.

Static IP Address for both devices

To have both devices communicate with each other via crossover cable and each have assigned static IP addresses, it is best to revert the IPM-01 to factory Defaults, if DHCP is not already enabled. Using the instructions above, you can then access the configuration menu and assign the IPM-01 with a known static IP address and gateway address. Make sure that the gateway Address of the IPM-01 is the same as the PC's IP address (or IP address that you intend to assign it), and that the IPM-01's IP address is recorded so that the PC's gateway address can be assigned accordingly.

For example:

IPM-01 IP address:	192.168.1.4
PC's address:	192.168.1.92
IPM-01 Gateway Address:	192.168.1.92
PC's Gateway Address:	192.168.1.4

9.0 Appendix II: Other Resources

www.modbus.org – Information on the MODBUS protocol

www.vxipower.com - Information about the IPM-01