WOODWARD

Application Note 51599
(Revision -, 10/2018)
Original Instructions

MBEDrv for Modbus TCPIP
Interaction with Woodward Controls

Re: Modbus Application Protocol Specification v1.1b3

MBEDrv
Interaction with Woodward Controls

Application

Any application using the MBEDrv for Modbus TCPIP Ethernet communication and using Woodward controls

Purpose

The purpose of this document is to diagnose Modbus TCP/IP communication issues with Woodward VxWorks based controls. The Mobus master (typically the HMI or DCS computer terminal) will exhibit communication errors.

Assumptions

The engineer is familiar with the GE MBEDrv utility, Woodward tools such as AppManager, GAP, and Control Assistant, GE HMI packages such as iFix or Cimplicity. The user is also familiar with Wireshark and capturing packet capture (pcap) files from a network.

Tools:

- Engineering workstation
- Network tap or port mirror on switch
- Wireshark & WinPcap
- MBEDrv
- GE iFix
- GAP
- AppManager

Table 1. Glossary

Syscon	Primary CPU
Backup	Backup CPU
TCP	Transport Control Protocol – reliable protocol for transmitting data over Ethernet
UDP	Unified Datagram Protocol – unreliable protocol for transmitting data over Ethernet
NIC	Network Interface Controller – the “network card” on the computer
MBE or MBEDrv	GE MBEDrv (Modbus Ethernet) driver
Modbus	An application layer messaging protocol, positioned at layer 7 of the OSI model, which provides client/server communication between devices connected on different types of buses or networks

Symptoms:

The network will appear unstable after a period of use. TCP Modbus may exhibit time outs and errors with the CPU, this can lead to dropped connections and attempts to re-establish communications numerous times.

Communications between MBE and the CPU will exhibit instability by:

- Connecting and reconnecting often
- Stale data (not updating in a timely fashion)
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In extreme cases, communication between a CPU and RTN expansion rack will also be impacted because of the network conditions.

Diagnosis:

The issue can be identified by reviewing the MBE PowerTool utility for errors in the MBE driver configuration or through Monitor GAP. A high number of errors in the MBE power tool may be indicative of an issue. Additional information may be captured by network tools such as Wireshark and a network tap or mirror port.

Wireshark analysis:

This assumes a pcap exists of the network having an issue. This assumes a network map of IP addresses does not exist or is incomplete

Determine the Woodard CPU

To determine the Woodward CPU, follow the steps below.

1. Open wireshark and the pcap file

2. Apply a display filter:
   (eth.dst[0:3] == 00:12:8c) && (tcp.dstport==502)

3. Open the Conversations display (Statistics->Conversations)

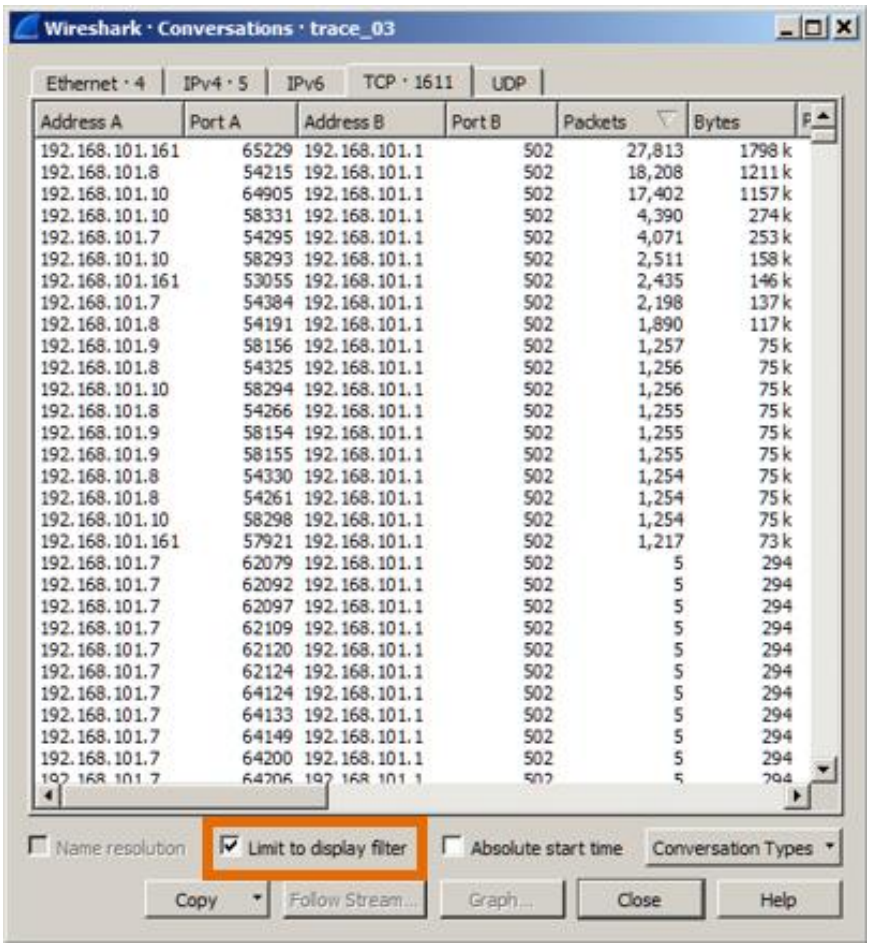

Figure 1. Wireshark Conversions Display

4. Select “Limit to Display Filter
   a. The IP Addresses in Address B will be the Woodward control’s IP address, annotate this value.
   b. The IP Address in Address A will be the HMI or device creating the Modbus connections.
   c. Sort on Packets (descending) to see which conversations have the most packets in the capture.

Analyzing the Conversations

In general the conversations with the higher number of packets are valid Modbus TCP sockets. The conversations with a lower number of packets (5 or less) are conversations that indicate an error.

To analyze a conversation further, a filter may be applied from the Conversations dialog:

1. Right click on the conversation and follow the dropdowns as illustrated in Figure 2.

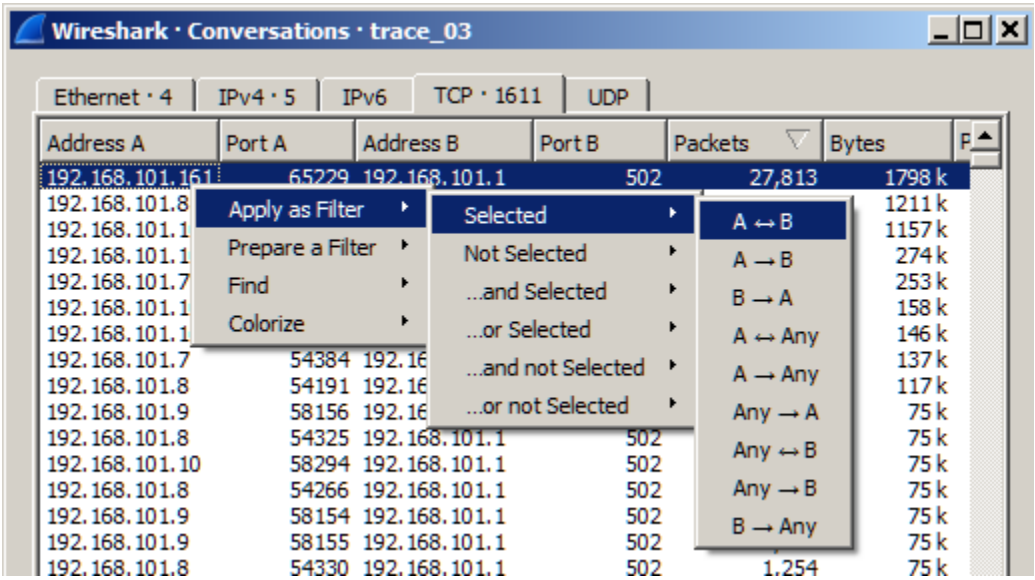

Figure 2. Conversations Dropdown Menu Series

The main Wireshark window will apply the filter from the conversations:

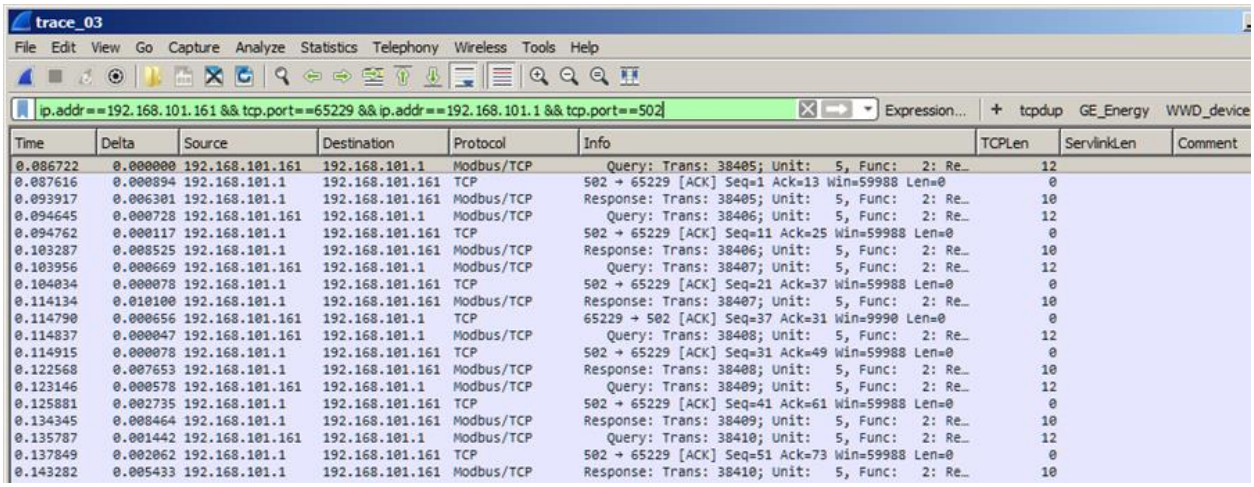

Figure 3. Filter from Conversations Applied

The above indicates a healthy Modbus session with the control. Notice there is consistent Query and Response traffic between the device and the Woodward control.

2. Select a conversation with a lower (5) number of packets:

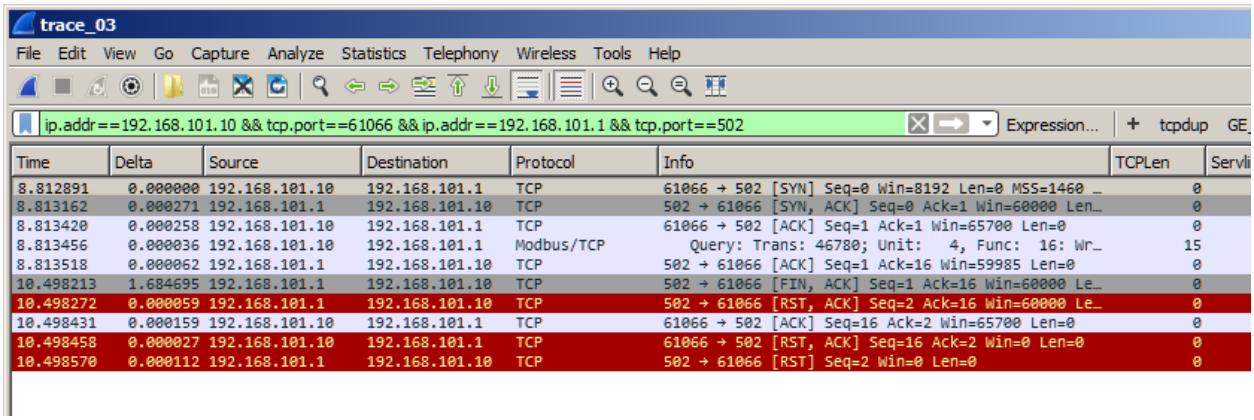

Figure 4. Selecting a Discrete Number of Packets

Notice there is a socket creation (SYN packet), a Modbus query, but no response, then a socket teardown (FIN, ACK). This pattern is an example of a misconfigured Modbus configuration. The creation and tear down of a socket is “expensive” on the embedded control.

MBE Configuration

Locate the suspect computer and the MBE configuration. The MBE configuration may be accessed through the SCU utility in iFix or in the iFix project directory.

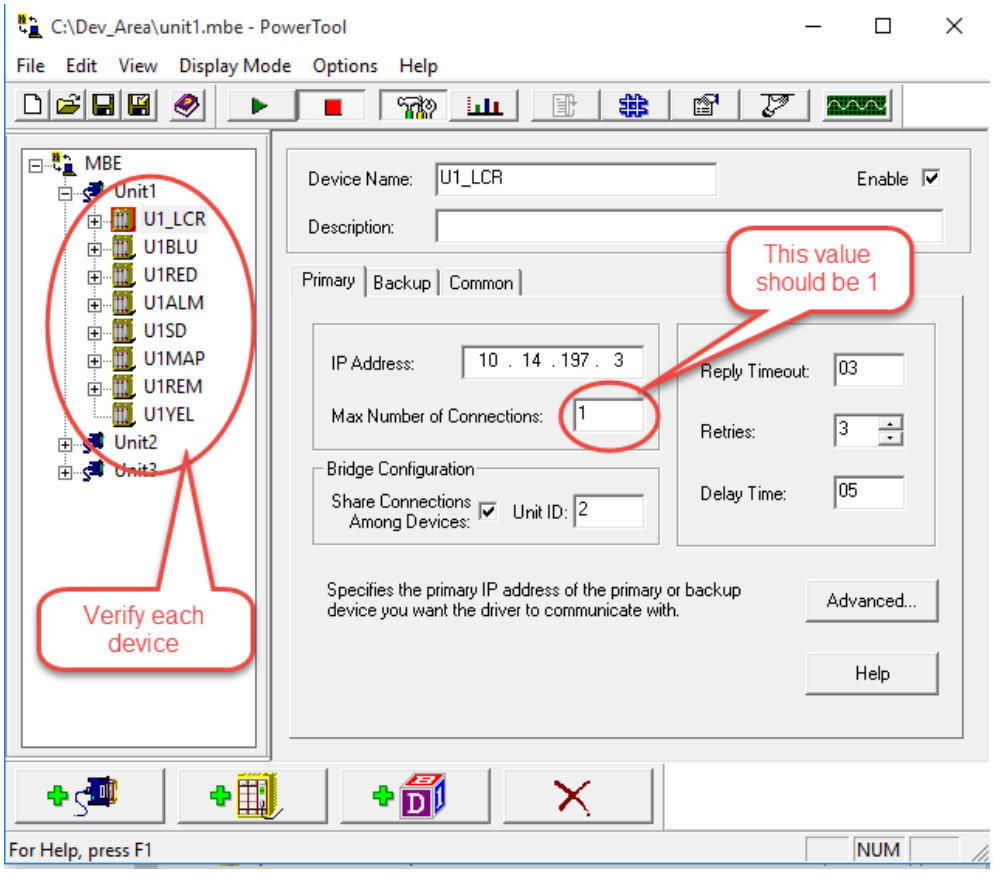

Figure 5. MBE Configuration Example

Examine each device in the MBE driver under the Channel, verify the max connection is set to “1”. The MBE Driver will default this value to “4” when creating new devices and channels. This needs to be verified on the Primary and Backup tabs.

The Common tab contains the strategy for Backup and Primary communications:

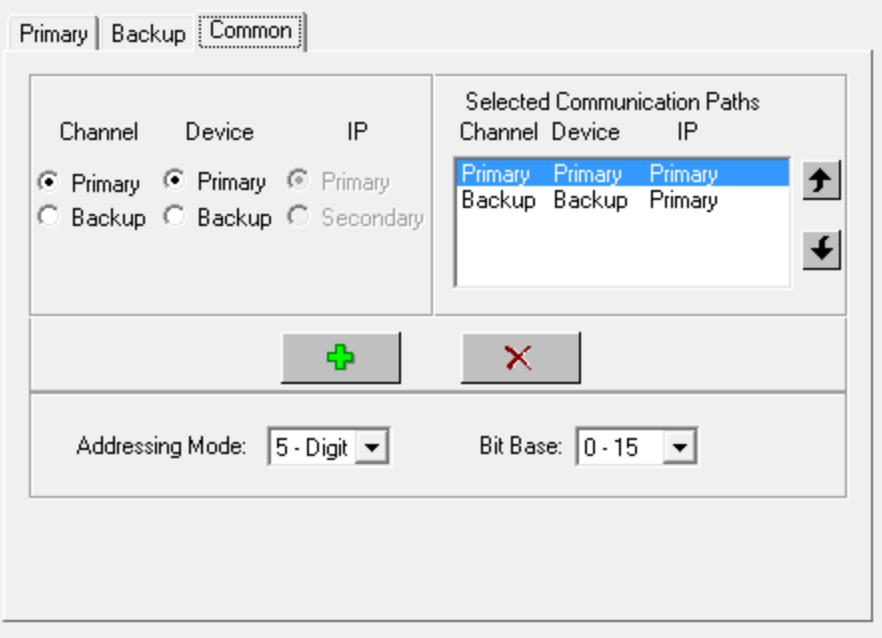

Figure 6. Common Tab Contents

Any changes made should be saved to the MBE driver.

Validation of changes:

A pcap should be performed on the link to verify the elimination of small packet conversations. The Wireshark capture should demonstrate several conversations with consistent communications.

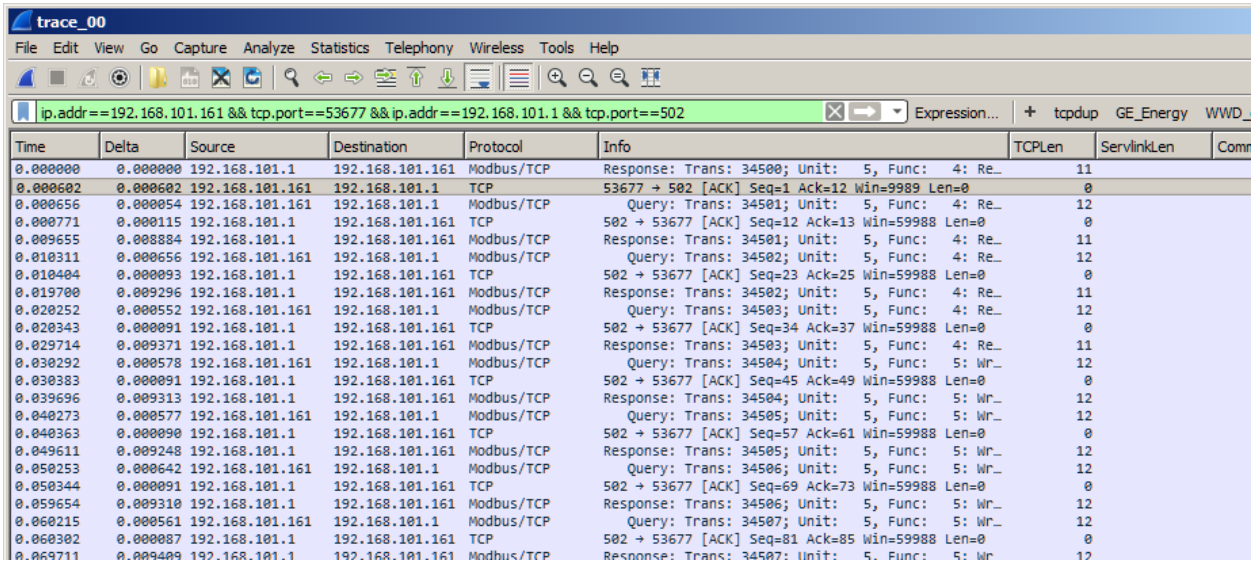

Figure 6. Wireshark Capture Example

Conversation dialog:

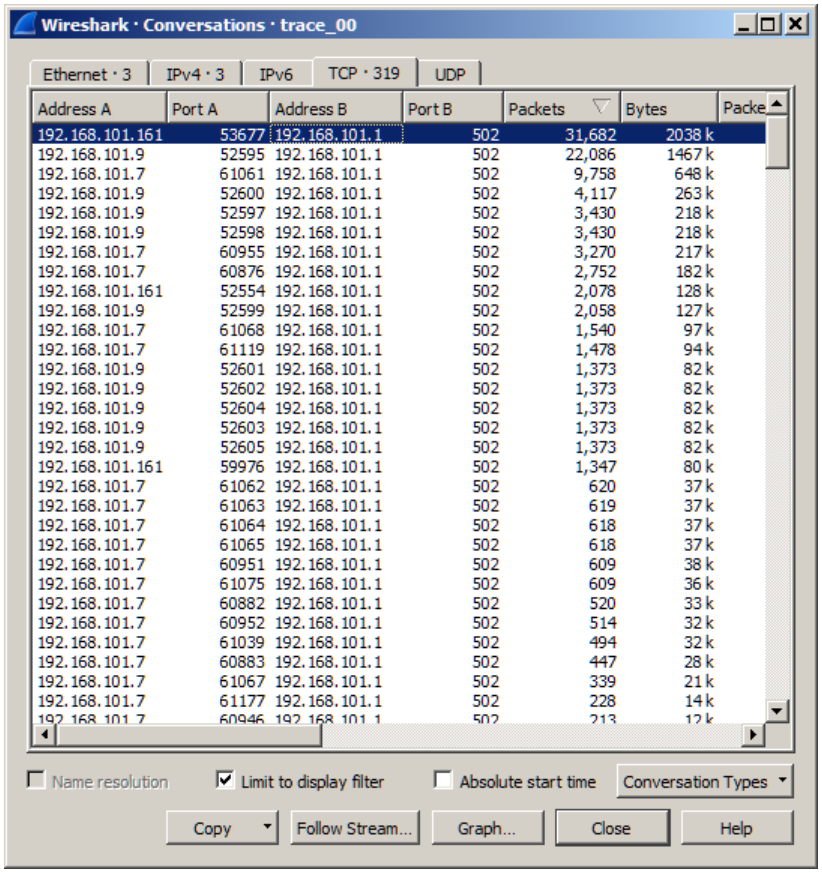

Figure 7. Conversation Dialog Example

Released

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 51599.

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