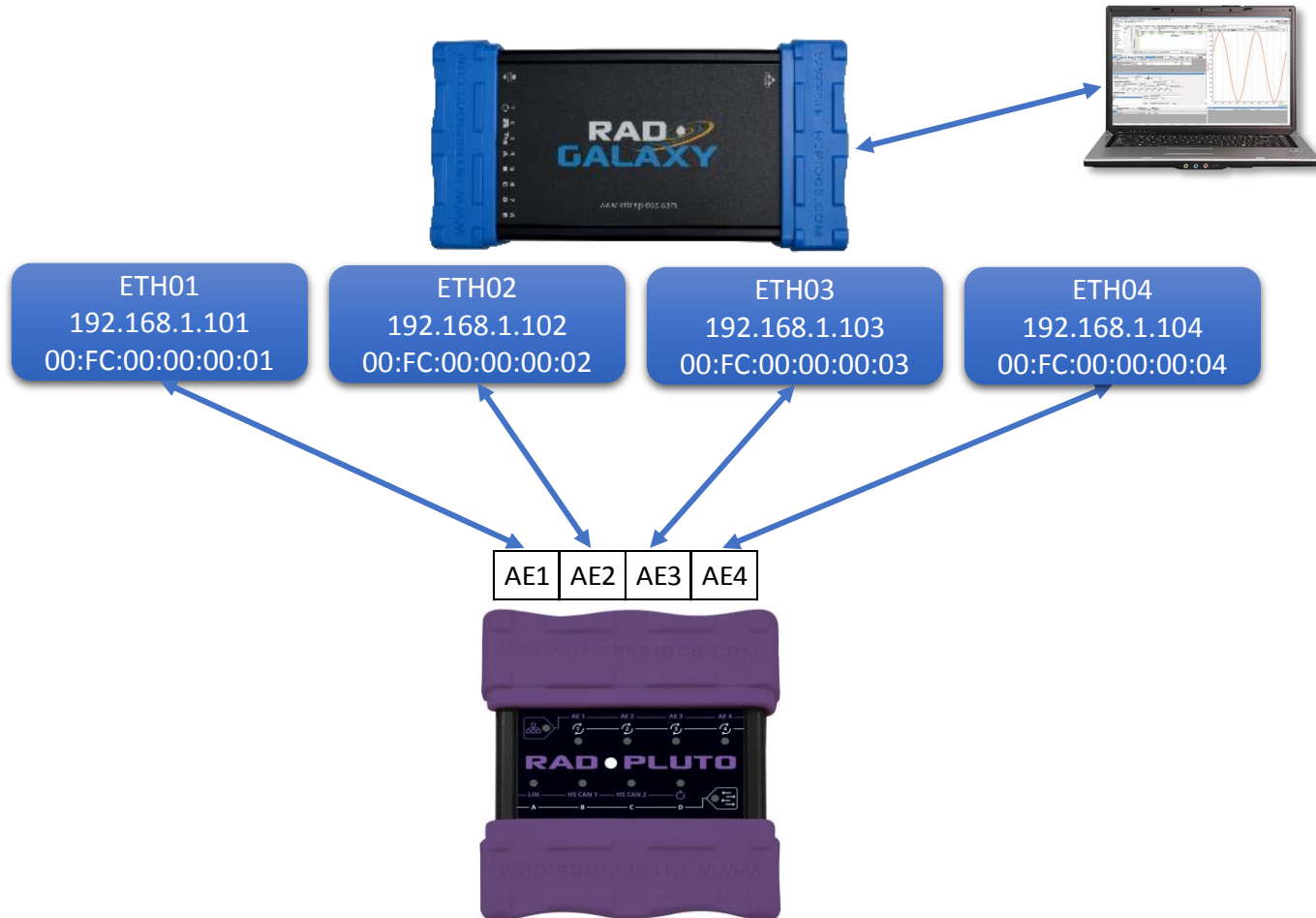


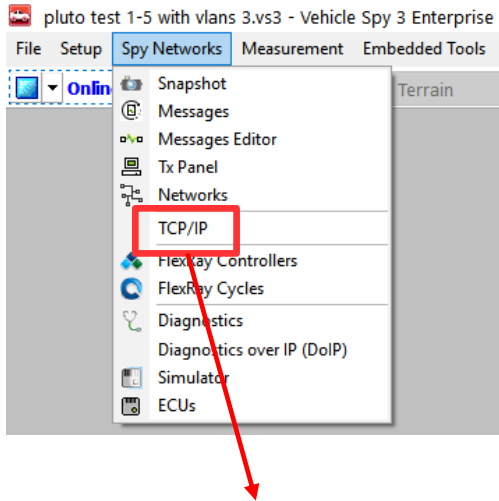
TCP/IP and UDP Support in Vehicle Spy

1

Switch Test Setup on Galaxy



VSPY TCP/IP Support



- TCP is managed as a “Virtual Network”
 - Single TCP Message = Multiple MAC Frames
- TCP/IP Tab Found Under “Spy Networks” Menu

A screenshot of the TCP/IP configuration window in Vehicle Spy 3 Enterprise. The window shows various configuration options for a virtual network, including IP addresses, VLAN, Gateway Address, Subnet Mask, and Ethernet network selection. A table at the bottom is currently empty.

Remote IP	Remote port	Local IP	Local port	State	Rx seq #	Rx window	Rx count	Tx seq #	Tx window	Tx count	Re-Tx count	Error c...	Comments
-----------	-------------	----------	------------	-------	----------	-----------	----------	----------	-----------	----------	-------------	------------	----------

3

TCP Server Setup

Each tab represents an independent server

The screenshot shows a network configuration interface for TCP/IP. At the top, there are five tabs representing different physical ports: 192.168.3.1 on OP (BR) ETH01, 192.168.3.2 on OP (BR) ETH02, 192.168.3.3 on OP (BR) ETH03, 192.168.3.4 on OP (BR) ETH04, and 192.168.3.5 on Ethernet. Below the tabs, there are configuration fields for MAC Address (00:FC:70:00:00:01), VLAN (None), IP Address (192.168.3.1), Gateway Address (192.168.63.254), and Subnet Mask (255.255.255.0). There are also checkboxes for 'Enable DHCP Server', 'Report IGMP group memberships', and 'Send gratuitous ARP announce'. A table below the configuration fields has columns for Remote IP, Remote port, Local IP, Local port, State, Rx seq #, Rx window, Rx count, Tx seq #, Tx window, Tx count, Re-Tx count, Error c..., and Comments. Four green callout boxes with numbers 1, 2, 3, and 4 point to the Ethernet network dropdown, the MAC/VLAN fields, the IP Address/Gateway/Subnet Mask fields, and the DHCP/IGMP/ARP checkboxes respectively.

1. Physical Port (on Galaxy, RS2, PC NIC, etc.)
2. MAC/VLAN: Inherit or assign
3. IP Address/Gateway/Subnet: Inherit or assign
4. Configurations
 - DHCP Server
 - Report IGMP Group Memberships
 - Gratuitous ARP

Create Listening Ports

Messages Editor

2

1

3

Key	Description	Source	Port	Destination	Port	Len	Raw Payload Bytes	Tx Msg	Color
in349	Message TCP 01				60001			None	
in350	Message TCP 11				60002			None	
in351	Message TCP 06				60003			None	
in352	Message TCP 03				60004			None	

4

5

Setup for Message TCP 01

Description: Message TCP 01
Enable: Enabled
Color: Black
 Ignore Tx Messages

Message Filter Specification

Listen for incoming TCP connections Has Protobuf payload

Signals in Message

8

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0

1. Select TCP Network
2. Select Receive Message Table
3. Add Message
4. Define Destination Port
5. Enable Listening Port

Listening Port Status

TCP/IP

192.168.3.1 on OP (BR) ETH01 192.168.3.2 on OP (BR) ETH02 192.168.3.3 on OP (BR) ETH03 192.168.3.4 on OP (BR) ETH04 192.168.3.5 on Ethernet

Manually assigned VLAN Manually assigned Gateway Address 192.168.63.254 Enable DHCP Server DHCP Server Setting

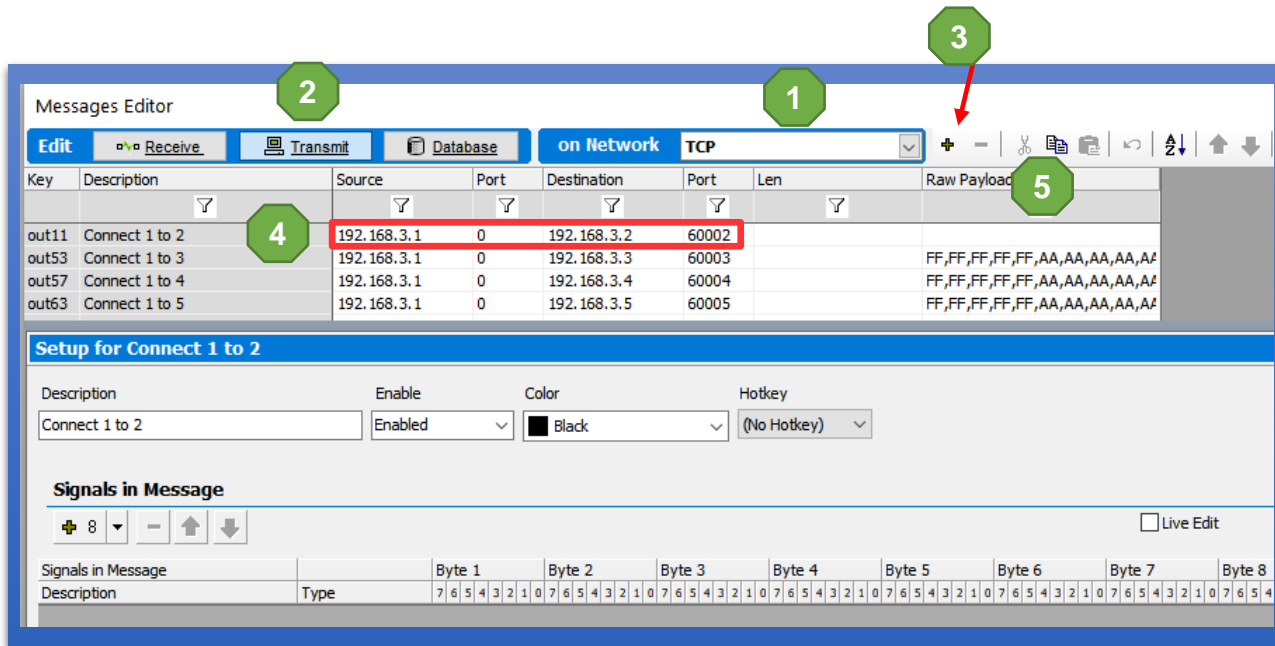
MAC Address 00:FC:70:00:00:01 None IP Address 192.168.3.1 Subnet Mask 255.255.255.0 Ethernet network Report IGMP group memberships

OP (BR) ETH01 Send gratuitous ARP announce

Remote IP	Remote port	Local IP	Local port	State	Rx seq #	Rx window	Rx count	Tx seq #	Tx window	Tx count	Re-Tx count	Error c...	Comments
0	0.0.0.0	60001	60001	LISTEN	0	0	0	0	0	0	0	0	Listening for incoming TCP connection to Message TCP 01 (in349)
0	0.0.0.0	60002	60002	LISTEN	0	0	0	0	0	0	0	0	Listening for incoming TCP connection to Message TCP 11 (in350)
0	0.0.0.0	60003	60003	LISTEN	0	0	0	0	0	0	0	0	Listening for incoming TCP connection to Message TCP 06 (in351)
0	0.0.0.0	60004	60004	LISTEN	0	0	0	0	0	0	0	0	Listening for incoming TCP connection to Message TCP 03 (in352)
0	0.0.0.0	60005	60005	LISTEN	0	0	0	0	0	0	0	0	Listening for incoming TCP connection to Message TCP 05 (in353)

TCP/IP Tab will now show ports listening for connections

Create TX Messages for Socket Connection



1. Select TCP Network
2. Select TX Message Table
3. Add Message
4. Define Message
 - Source IP
 - Source Port = 0**
 - Dest IP/Port
 - Payload

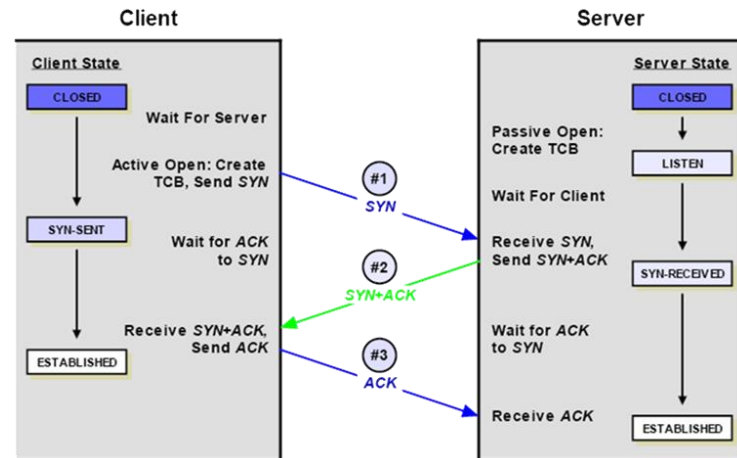
**Stack will use Ephemeral Port

7

Opening a Socket

Tx Panel																
Edit Transmit Messages		Disable All Tx		Protocol: All												
Description	Tx	Auto Tx	Rate (s)	Arb ID	Len	B1	B2	B3	B4	B5	B6	B7	B8	Network	Color	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Connect 1 to 2	<input type="checkbox"/>	Periodic	None					3.3.1	0	3.3.2	0002	A,AA		TCP		
Connect 1 to 3	<input type="checkbox"/>	Periodic	None					3.3.1	0	3.3.3	0003	A,AA		TCP		
Connect 1 to 4	<input type="checkbox"/>	Periodic	None					3.3.1	0	3.3.4	0004	A,AA		TCP		
Connect 1 to 5	<input type="checkbox"/>	Periodic	None					3.3.1	0	3.3.5	0005	A,AA		TCP		
Connect 2 to 1	<input type="checkbox"/>	Periodic	None					3.3.2	0	3.3.1	0001	A,AA		TCP		
Connect 2 to 3	<input type="checkbox"/>	Periodic	None					3.3.2	0	3.3.3	0003	A,AA		TCP		
Connect 2 to 4	<input type="checkbox"/>	Periodic	None					3.3.2	0	3.3.4	0004	A,AA		TCP		

- Sending a message on the TCP network will automatically initiate the TCP 3-way handshake
- Listening TCP ports will respond to TCP 3-way handshake. Port remains open until terminated.



TCP Socket Status

The screenshot shows a network configuration interface for TCP/IP. At the top, there are tabs for different interfaces: 192.168.3.1 on OP (BR) ETH01, 192.168.3.2 on OP (BR) ETH02, 192.168.3.3 on OP (BR) ETH03, 192.168.3.4 on OP (BR) ETH04, and 192.168.3.5 on Ethernet. Below the tabs are input fields for MAC Address (00:FC:70:00:00:01), IP Address (192.168.3.1), Subnet Mask (255.255.255.0), and Gateway Address (192.168.63.254). There are also checkboxes for 'Enable DHCP Server', 'Report IGMP group memberships', and 'Send gratuitous ARP announce'. The main part of the screenshot is a table with the following columns: Local IP, Local port, State, Rx seq #, Rx window, Rx count, Tx seq #, Tx window, Tx count, Re-Tx count, Error count, and Comments.

Local IP	Local port	State	Rx seq #	Rx window	Rx count	Tx seq #	Tx window	Tx count	Re-Tx count	Error count	Comments
192.168.3.2	60002	ESTABLISHED	✘ 44935	32768	3	51849	32768	0	0	0	TCP connection accepted by Message TCP 11 (in350)
192.168.3.1	49164	ESTABLISHED	✘ 51849	32768	0	44935	29618	3	0	0	TCP connection from Connect 1 to 2 (out11)
0.0.0.0	60001	LISTEN	0	0	0	0	0	0	0	0	Listening for incoming TCP connection to Message TCP 01 (in349)
0.0.0.0	60002	LISTEN	0	0	1	0	0	0	0	0	Listening for incoming TCP connection to Message TCP 11 (in350)
0.0.0.0	60003	LISTEN	0	0	0	0	0	0	0	0	Listening for incoming TCP connection to Message TCP 06 (in351)
0.0.0.0	60005	LISTEN	0	0	0	0	0	0	0	0	Listening for incoming TCP connection to Message TCP 05 (in353)
192.168.3.1	49165	SYN_SENT	0	32768	0	65675	32768	0	3	0	

- Displays socket status and statistics
- Socket can be closed using the “Red X” button next to socket state

TCP “Three-Way Handshake”

Line	Time	Tx	Er	Description	Source	Src Port	Destination	Dst Port	EtherType	Protocol	VLAN	Len	Seq#	Ack#	Window	Flags
				54.225.225.147						tcp						
1				Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP	66	66	84287138	0	65535	SYN
2	72.401 ms			Ethernet 54.225.225.147 to ...54.225.225.147	54.225.225.147	80	10.5.1.245	57967	IPv4	TCP	66	66	205960898	84287139	29200	ACK,SYN
3	83 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP	54	54	84287139	205960899	1024	ACK
4	120 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP	485	485	84287139	205960899	1024	ACK,PSH
5	75.992 ms			Ethernet 54.225.225.147 to ...54.225.225.147	54.225.225.147	80	10.5.1.245	57967	IPv4	TCP	60	60	205960899	84287570	237	ACK
6	5.953 ms			Ethernet 54.225.225.147 to ...54.225.225.147	54.225.225.147	80	10.5.1.245	57967	IPv4	TCP	204	204	205960899	84287570	237	ACK,PSH
7	0 μs			Ethernet 54.225.225.147 to ...54.225.225.147	54.225.225.147	80	10.5.1.245	57967	IPv4	TCP	60	60	205961049	84287570	237	ACK,FIN
8	55 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP	54	54	84287570	205961050	1023	ACK
9	151 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP	54	54	84287570	205961050	1023	ACK,FIN
10	73.652 ms			Ethernet 54.225.225.147 to ...54.225.225.147	54.225.225.147	80	10.5.1.245	57967	IPv4	TCP	60	60	205961050	84287571	237	ACK

- SYN – Initial request to initiate TCP connection (also synchronize requestor's seq #)
- ACK + SYN – Acknowledgement of request (also synchronize other party's seq #)
- ACK – Requestor acknowledges other party's seq #

TCP – HTTP Exchange Example

Line	Time	Tx	Er	Description	Source	Src Port	Destination	Dst Port	EtherType	Protocol	VLAN	Len	Seq#	Ack#	Window	Flags
				54.225.225.147						tcp						
1				Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP		66	84287138	0	65535	SYN
2	72.401 ms			Ethernet 54.225.225.147 to ...54.225.225.147		80	10.5.1.245	57967	IPv4	TCP		66	205960898	84287139	29200	ACK,SYN
3	83 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP		54	84287139	205960899	1024	ACK
4	120 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP		485	84287139	205960899	1024	ACK,PSH
5	75.992 ms			Ethernet 54.225.225.147 to ...54.225.225.147		80	10.5.1.245	57967	IPv4	TCP		60	205960899	84287570	237	ACK
6	5.953 ms			Ethernet 54.225.225.147 to ...54.225.225.147		80	10.5.1.245	57967	IPv4	TCP		204	205960899	84287570	237	ACK,PSH
7	0 μs			Ethernet 54.225.225.147 to ...54.225.225.147		80	10.5.1.245	57967	IPv4	TCP		60	205961049	84287570	237	ACK,FIN
8	55 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP		54	84287570	205961050	1023	ACK
9	151 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP		54	84287570	205961050	1023	ACK,FIN
10	73.652 ms			Ethernet 54.225.225.147 to ...54.225.225.147		80	10.5.1.245	57967	IPv4	TCP		60	205961050	84287571	237	ACK

- PSH – Push data (HTTP request)
- ACK – Acknowledgement of request
- PSH – Push data (HTTP response back to requestor)

TCP – Terminate Connection

Line	Time	Tx	Er	Description	Source	Src Port	Destination	Dst Port	EtherType	Protocol	VLAN	Len	Seq#	Ack#	Window	Flags
				54.225.225.147						tcp						
1				Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP		66	84287138	0	65535	SYN
2	72.401 ms			Ethernet 54.225.225.147 to ...54.225.225.147	54.225.225.147	80	10.5.1.245	57967	IPv4	TCP		66	205960898	84287139	29200	ACK,SYN
3	83 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP		54	84287139	205960899	1024	ACK
4	120 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP		485	84287139	205960899	1024	ACK,PSH
5	75.992 ms			Ethernet 54.225.225.147 to ...54.225.225.147	54.225.225.147	80	10.5.1.245	57967	IPv4	TCP		60	205960899	84287570	237	ACK
6	5.953 ms			Ethernet 54.225.225.147 to ...54.225.225.147	54.225.225.147	80	10.5.1.245	57967	IPv4	TCP		204	205960899	84287570	237	ACK,PSH
7	0 μs			Ethernet 54.225.225.147 to ...54.225.225.147	54.225.225.147	80	10.5.1.245	57967	IPv4	TCP		60	205961049	84287570	237	ACK,FIN
8	55 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP		54	84287570	205961050	1023	ACK
9	151 μs			Ethernet 10.5.1.245 to 54.2... 10.5.1.245	10.5.1.245	57967	54.225.225.147	80	IPv4	TCP		54	84287570	205961050	1023	ACK,FIN
10	73.652 ms			Ethernet 54.225.225.147 to ...54.225.225.147	54.225.225.147	80	10.5.1.245	57967	IPv4	TCP		60	205961050	84287571	237	ACK

- ACK+FIN – Acknowledge data received from other party, plus Finish (terminate connection)
- ACK – Acknowledgement of termination (requestor → other party)
- ACK+FIN – Acknowledge data received from requestor, plus Finish (terminate connection)
- ACK – Acknowledgement of termination (other party → requestor)

UDP Support

The screenshot displays the Messages Editor interface. At the top, there's a menu bar with options like Edit, Receive, Transmit, Database, and on Network. Below this is a table of messages. The selected message is 'Message OP (BR) ETH10 106', which is a UDP message from source IP 10.0.0.1, port 60001 to destination IP 10.0.0.2, port 60002.

The 'Setup for Message OP (BR) ETH10 106' section shows configuration options for the message, including Description, Enable (Enabled), Color (Black), and Default Period (ms). There's also a checkbox for 'Ignore Tx Messages'.

The 'Message Filter Specification' section allows for filtering based on EtherType (IPv4), VLAN (None), Protocol (UDP), Source IP (10.0.0.1), Port (60001), Destination IP (10.0.0.2), and Port (60002). It also includes options for PDU Type (None) and a checkbox for 'Has Protobuf payload'. There are also options to retransmit on the PC Ethernet interface and to change the destination (Leave Unchanged, Send to Self, or Send to Specified Target).

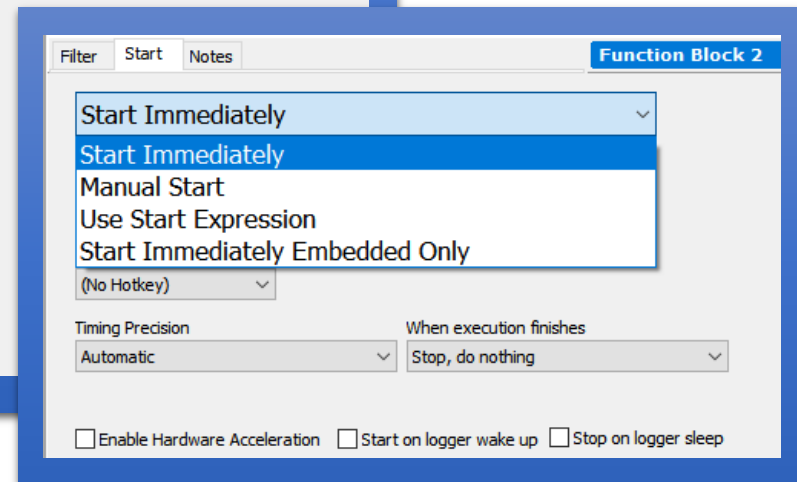
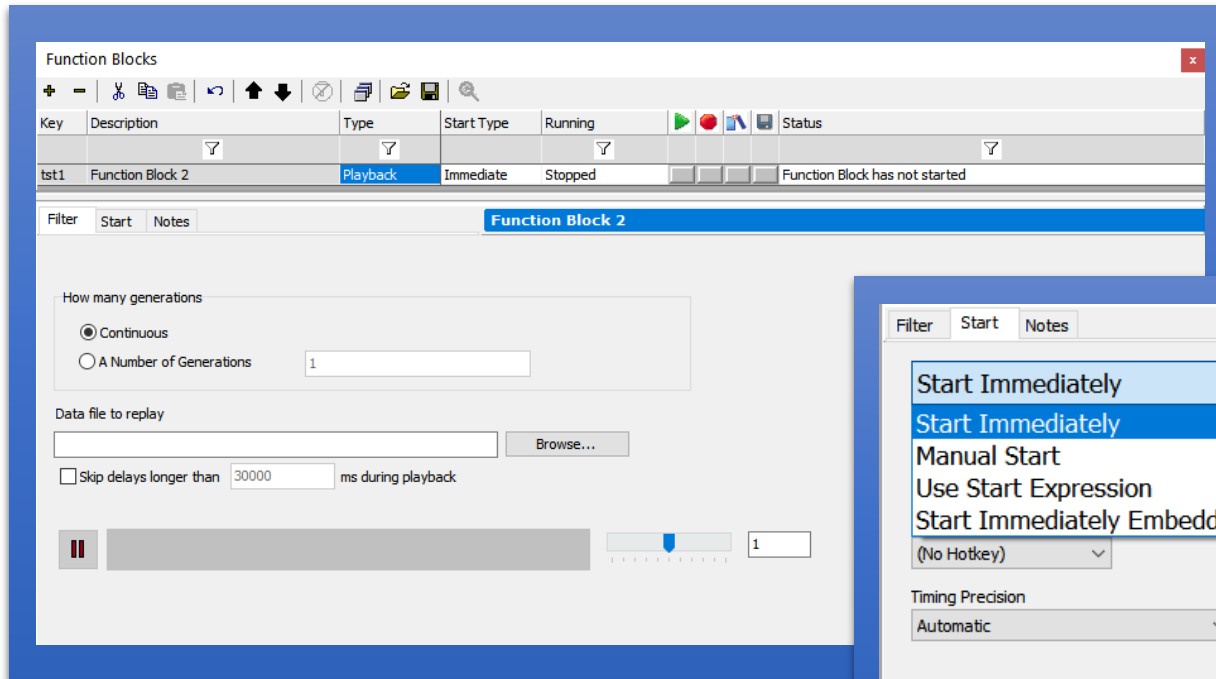
The 'Signals in Message' section shows a signal analysis view. It includes tabs for Ethernet Header, IPv4 Header, UDP Header, and UDP Data. An equation editor shows the formula: $\{Raw\ Value\}0,1,272,15$. Below this is a table of signals in the message:

Signals in Message	Type	Byte 35	Byte 36	Byte 37	Byte 38	Byte 39	Byte 40	Byte 41	Byte 42	Byte 43	Byte 44	Byte 45
Description												
Source Port	Analog	00	00	00	00	00	00	00	00	00	00	00
Destination Port	Analog	00	00	00	00	00	00	00	00	00	00	00
UDP Header + Data Length	Analog	00	00	00	00	00	00	00	00	00	00	00
UDP Checksum	Analog	00	00	00	00	00	00	00	00	00	00	00

- Unlike TCP, UDP frames do not have their own virtual network.
- Frames built in Message Editor

Sending UDP Stream

Simplest means of sending UDP Stream is to playback a logged stream.



BACKUP Slides

TCP Header

- TCP has IP protocol number 0x06

Offsets	Octet	0								1								2								3							
Octet	Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	0	Source port																Destination port															
4	32	Sequence number																															
8	64	Acknowledgment number (if ACK set)																															
12	96	Data offset	Reserved 0 0 0			N S	C R	E E	U R	A G	P K	R H	S T	F N	Window Size																		
16	128	Checksum																Urgent pointer (if URG set)															
20	160	Options (if data offset > 5. Padded at the end with "0" bytes if necessary.)																															
...																															

Sequence number, used to guarantee in-order delivery on other end

- The next sequence number the sender can receive
- All previous sequence numbers are acknowledged as received

TCP Sliding Window System

- Used to keep track of bytes sent and received
- Special pointer maintained for each connection
- ISO 15765-2 has a “sliding window”, but it only acknowledges one group of frames at a time

