COMposer

For Sital Tester Devices

Simulator & Monitor GUI Tool

Mil-Std-1553
EBR (Enhanced Bit Rate) 1553
PP194
H009
RS485
Arinc429
Scope (MCX C)

User Manual

Rev 2.9

Jan 2021

Table of Contents

1 Introduction

1.1 General Info

This document provides a walkthrough accompanied by screenshots and descriptions for basic operations of Sital Testers.

COMposer works with the following Testers:

- **MultiComBox – versions B and C (includes Scope and ARINC429)**

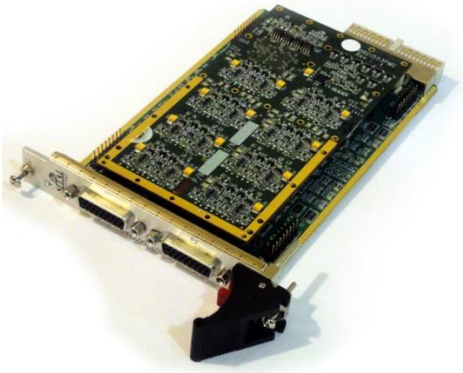
Contains 1 or 2 devices (redundant channels)

- **Grip2**

Contains a single device

- **PMC Board** (Interfaces: PCI/ PCIe/ PXI (cPCI)/ VPX)

Contains 2 and up to 8 devices



1.2 Audience

This document assumes that the reader is familiar with the below specified protocols.

This user guide aims for handling serial bus communications over Sital's tester devices with easy-to-use graphical interface.

1.3 Support

If you have any question or require further assistance, use any of the following methods to contact Sital customer support:

- By Email: support@sitaltech.com
- By Phone: +972-9-7633300
- By Fax: +972-9-7663394

1.4 System Requirements

The minimal virtual requirement for local PC: a minimum of 16K MB.

In order to access and modify (Windows7):

My Computer --> Right click, Properties --> Advanced System Settings --> Advanced Tab--> Performance,

press Settings button --> Advanced Tab --> Change button --> Initial Size: 16384

1.5 Devices

1.5.1 MultiComBox

MulitComBox B|C or MCX B|C is a tester device. This device type requires loading a compatible firmware file, .rbf file for MCX B and .bit file for MCX C. The file is loaded via USB on initialization.
Each MCX device contains 2 Mil-Std-1553 devices (Bus A and B for each of the 1553 devices) or a single EBR 1553 device or a H009 device.
Optionally, the tester can include RS485, 4 channels (MCX B|C), Arinc429, 4 channels (MCX C) and Oscilloscope (MCX C).

1.5.2 PMC

PMC device is a PCI tester device that contains a static firmware version. Upgrading the firmware can be done by reflashing the PMC device via Sital's reflasher.
Each PMC contains 1 | 2 | 4 Mil-Std-1553 devices (Bus A and B for each of the 1553 devices) or a 1 | 2 EBR 1553 devices or a combination of 2 Mil-Std-1553 and 1 EBR 1553 devices.
The PMC can also contain 1 | 2 H009 devices (Bus A and Bus B).

In the configuration of 2x1553&1xEBR, the ordering of the devices is as follow; devices 0 and 1 are 1553 and device 2 is EBR device.

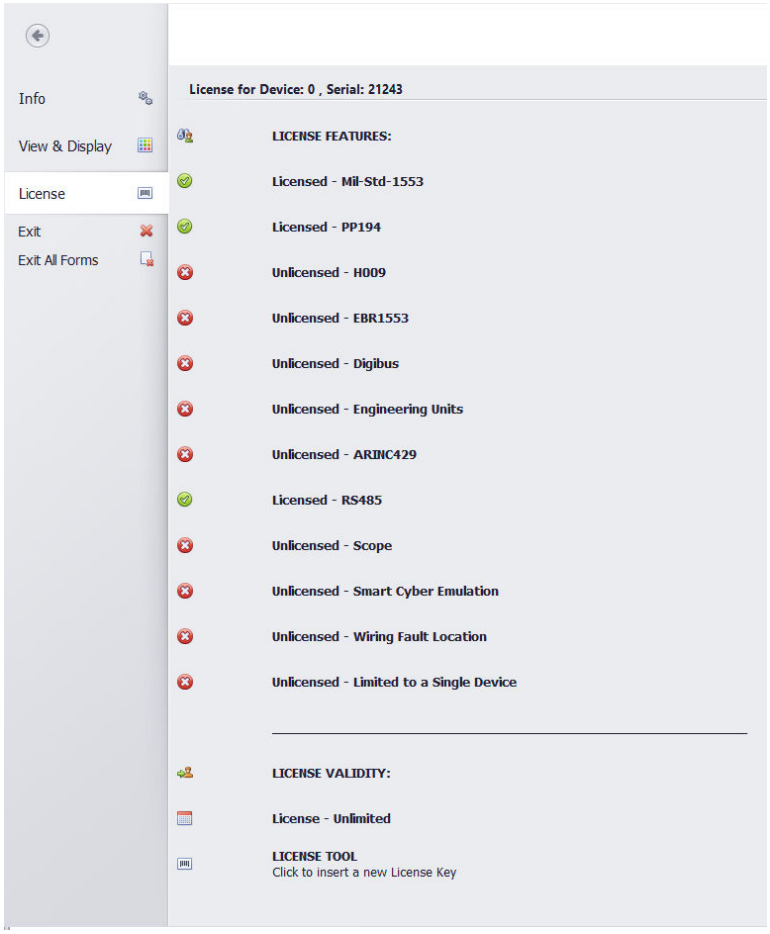
1.5.3 Grip2

Grip2 is a light weight tester device that contains a static firmware version. Upgrading the firmware can be done by reflashing the Grip2 device via Sital's reflasher.
The Grip2 contains a single Mil-Std-1553 device (Bus A and B).

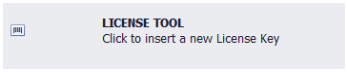
1.6 Licensing

As of COMposer version 4.3.1.0 a new licensing mechanism is applied to Tester devices.
A factory released device contains no license key.
On running the COMposer for the first time, the License tool opens requesting a License Key.
NOTE – this key is provided by Sital: support@sitaltech.com.

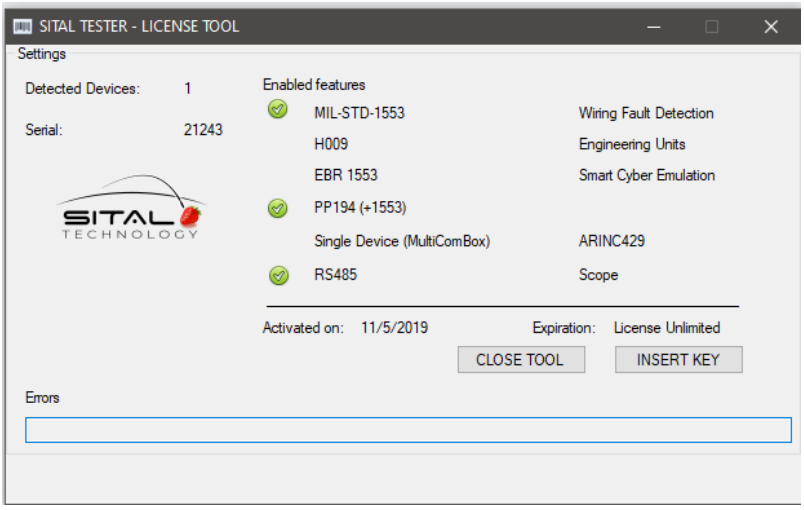
For upgrading / modifying the Device features, extending expiration date (if exists) or any other additions, go to Composer -> Tools -> License



Click on License Tool



And the License Tool will open



For inserting a new key press ‘INSERT KEY’ button.

2 Concept & High Level Workflow

The COMposer is a graphic interface to perform serial avionics bus communications using Sital Technology's tester devices.

The basic workflow of simulating and monitoring avionics bus traffic includes:

1. Launching Simulator and/or Monitor
2. Adjust or add to the default Simulator message
3. Run frame and monitor the traffic

The COMposer user interface communicates with the Muxbus via MCX API which is the software mid-layer that translates the user's requests to standard (selected) protocol communication and to the hardware.

The MCX API can be handled directly for user applications using .Net (C# or VB.net) and C/C++.

For additional information, use the reference guide released with the application - 'Sital_MCX_API_Programming_Reference'.

2.1 Protocols and Modes

The device can be initialized to 1553/PP194 mode (default) or H009 or Multiple RTs only mode.

The workflow in SW is the same for all modes of operation; the difference is the signaling on the bus wires for H009 or 1553/PP194.

For Multiple RT mode (MultiRT), the workflow is the same, except that when device Start command is issued, the MultiRT does not start transmission, but rather waits for an incoming message from an external bus controller.

When a message arrives and that RT (or RIU) is enabled for simulation, it is scanned in the BusList (Frame) of Elements (Messages), and if a match is found, that Element (Message) will service the message, either transmitting data or receiving it. If no match is found zero data is transmitted, and no data is stored.

Note – currently H009 activation in COMposer is not implemented.

Note II – On MultiRT only mode, the tester replies to messages on both buses, regardless the user pre-defined messages / selections.

As of Composer version 4.3.1.18, the following protocols and modes are available for licensed devices:

RS485, 4 channels (MCX B|C)

Arinc429, 4 channels (MCX C)

Scope (MCX C)

NOTE – The Scope feature can be coupled and used via Composer with any of the following – 1553 | Arinc429 | RS485.

NOTE II – The following protocols can be used individually via Composer – 1553 | Arinc429 | RS485.

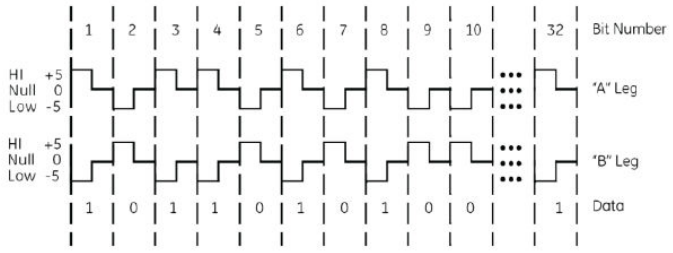
2.1.1 Arinc429 Block

The tester cards include several Arinc429 transmitters and receivers that can be connected to Arinc429 bus.

A FIFO is provided for transmitted words, as well as a FIFO for received Words.

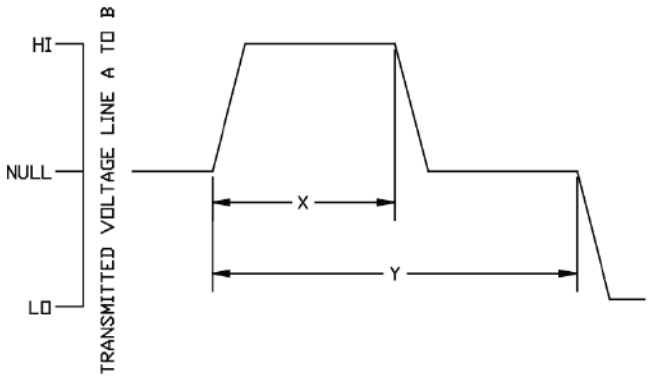
A control word defines the clock rate for each node as well as Parity generation.

Bit Encoding Example:



Bit Characteristics

Parameter	High Speed	Low Speed
Bit Rate	100K bits/second	12.5K-14.5K bits/second
Time Y (one bit)	10 µsec ± 2.5%	1÷(bit rate) µsec ± 2.5%
Time X	5 µsec ± 5%	Y/2 µsec ± 5%
Pulse Rise Time	1.5 ± 0.5 µsec	10 ± 5 µsec
Pulse Fall Time	1.5 ± 0.5 µsec	10 ± 5 µsec



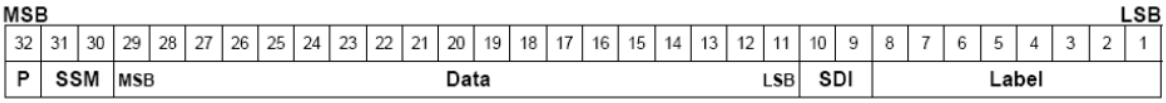
Slew Rates and Bit Timing Diagram

ARINC 429 Word Format

ARINC 429 is a very simple, point-to-point protocol. There can be only one transmitter on a wire pair. The transmitter is always transmitting either 32-bit data words or the NULL state. There is at least one receiver on a wire pair; there may be up to 20.
In most cases, an ARINC message consists of a single data word. The label field of the word defines the type of data that is contained in the rest of the word.
ARINC 429 data words are 32 bit words made up of five primary fields:

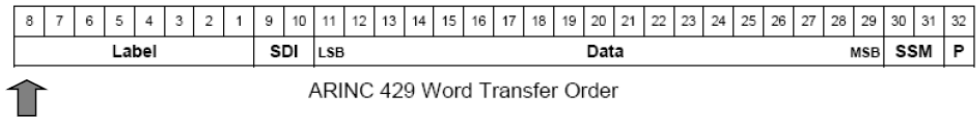
- Parity – 1 bit
- Sign/Status Matrix (SSM) – 2 bits
- Data – 19 bits
- Source/Destination Identifier (SDI) – 2 bits
- Label – 8 bits

ARINC convention numbers the bits from 1 (LSB) to 32 (MSB):



The only two fields definitively required are the Label and the Parity bit, leaving up to 23 bits available for data representation.
Parity - The MSB is always the parity bit for ARINC 429. Parity is normally set to odd.
SSM - Bits 31 and 30 contain the Sign/Status Matrix or SSM.
Data - Bits 29 through 11 contain the data, which may be in a number of different formats.

In some cases, the data field overlaps down into the SDI bits. In this case, the SDI field is not used.
SDI - Bits 10 and 9 provide a Source/Destination Identifier.
Label - Bits 8 through 1 contain a label identifying the data type and the parameters associated with it. The label is used to determine the data type of the remainder of the word and, therefore, the method of data translation to use. Labels are typically represented as octal numbers.
When transmitting data words on the ARINC bus, the Label is transmitted first, MSB first, followed by the rest of the bit field, LSB first. Bit transmission order looks like this:
8, 7, 6, 5, 4, 3, 2, 1, 9, 10, 11, 12, 13 … 32.

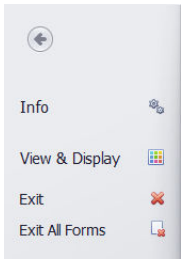


The Label is always transmitted first, in reverse order to rest of the ARINC word. The receiving Unit is responsible for data translation and regrouping of bits into proper order.

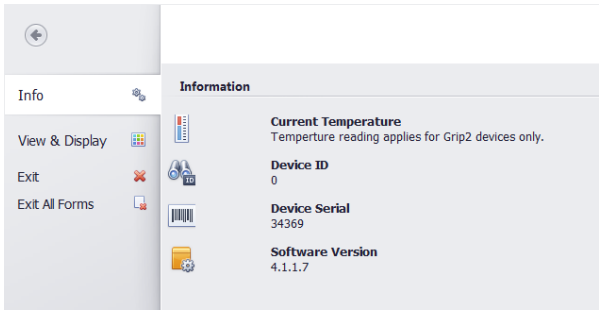
2.2 Common Tools

For both Monitor and Simulator there is a common Tools area that can be easily accessed from 'Tools' on the upper left area.

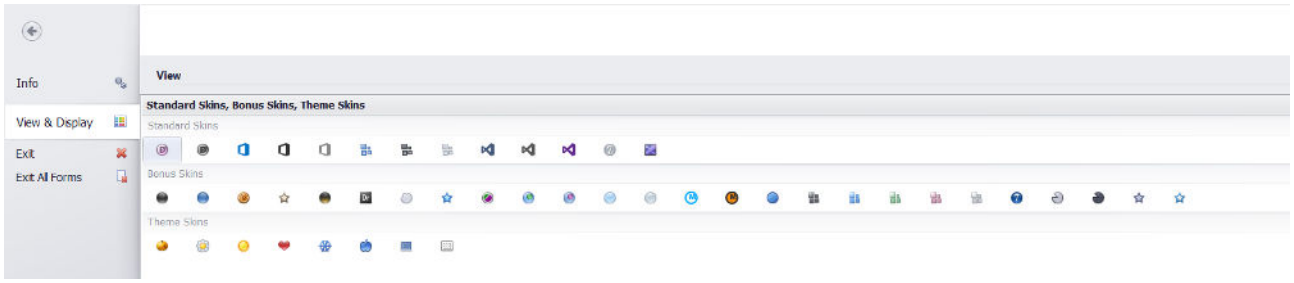
Once accessing the Tools area, four selections are displayed



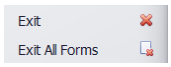
- Info – displays the device serial # and the Software version.



- View & Display – skin selector for alternative backgrounds and coloring.



- Exit (current window) or exit the Composer while closing the application.



2.3 Composer Un-Install

To Uninstall Composer go to installation folder {Default folder is located at 'C:\Sital\COMposer\COMposer_<version>\'} and run the unins000.exe.

3 MultiComBox Hardware

3.1 USB Data

MultComBox™ connects to a host PC via a USB 2.0 connection. This connection uses high speed 480Mbps data transfer, and thus requires an appropriate cable. Please use only the provided USB cable. Using other USB cables may cause the unit not to work properly or not to work at all.

The USB cable should be connected to the USB connection and to any USB 2.0 port of your PC.

3.2 USB Connection

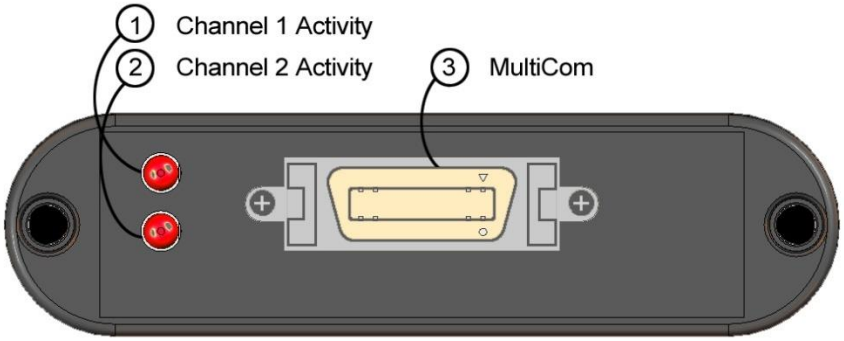
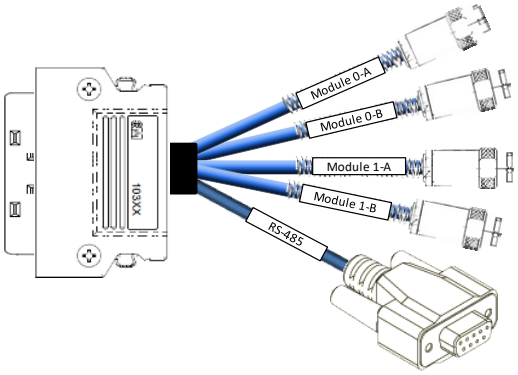
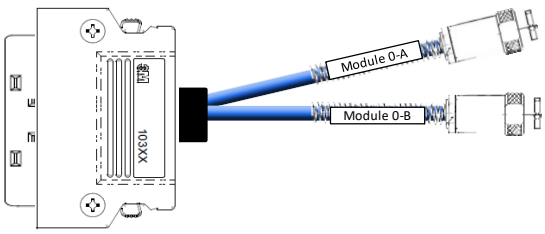


Figure 1: MultiCom Panel

The MultiCom Panel includes a 20 pin Mini-D-Ribbon connector (3) and two LED indicators (1 and 2). The MultiCom connectors in used for the 1553 and RS-485 connections and the LED indicators are used to monitor the activity in each 1553 module.

In addition, the unit comes with a cable assembly that, according to the configuration you purchased, contains 4 Triax connectors for 1553 and 1 female 9 pin D-type connector for RS 485, or 2 Triax connectors for a single Dual-Redundant 1553 channel. These connectors are marked with accordance to the bus they should be connected to.





1x 1553 channel

2 x 1553 and 4 x Serial channels

Figure 1:MultiCom Cable Assemblies

This cable should be connected to the “MultiCom” connector at the MultiComBox unit.

A MultiComBox unit contains an internal termination of 240 Ohm per each 1553 channel. Therefore, for a very simple test environment it is possible to connect the MultiComBox 1553 ports directly to the unit that is under test.

Figure 1:Direct connection to unit under test

Note that this is not a standard/recommended way to use Mil-Std-1553. Yet, for a simple test environment, if you plan to test your unit for its protocol capabilities, then this would be the simplest way to use MultiComBox.

If you wish to connect via a 1553 coupler, then a simple Mil-Std-1553 test environment is typically connected in the following way:

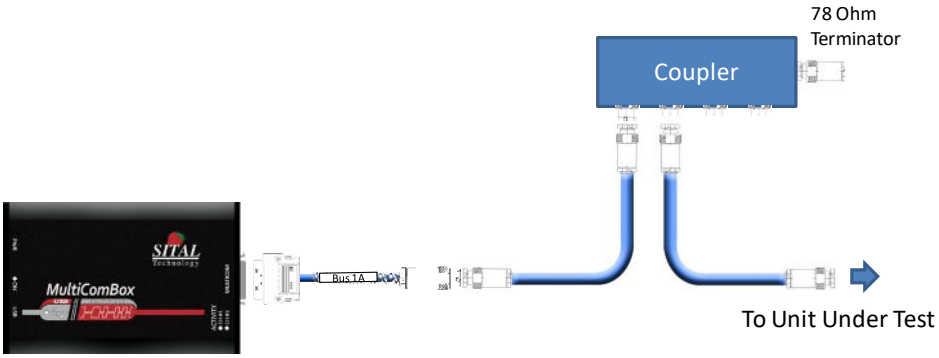


Figure 1:Mil-Std-1553 connection environment for single channel, via short stubs

When a long cable is required, or if more units need to connect to the bus, then it is required to connect more than one coupler. Such connection will typically be done in the following way:

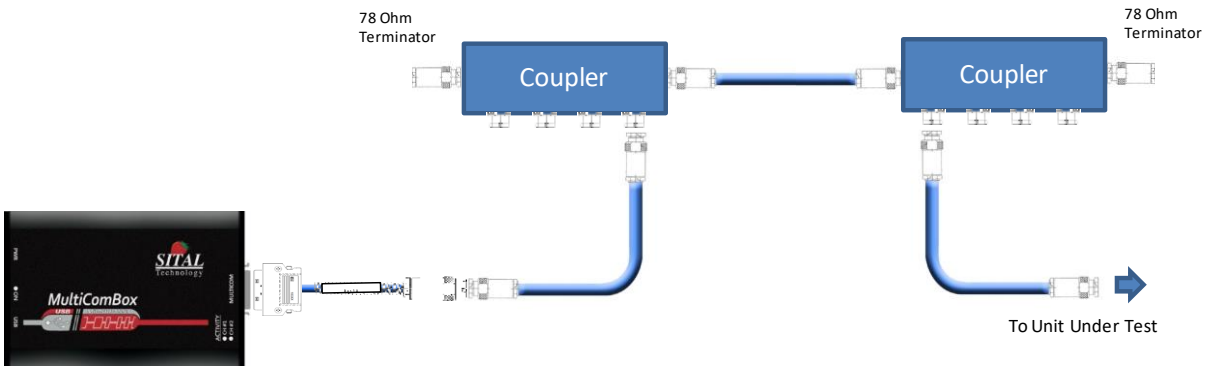


Figure 1:Mil-Std-1553 connection environment for single channel, via long stubs

In this example, only Bus 1A is used. When you need to connect other busses as well, for example Bus 2A, you would need to duplicate this connection, using an additional 1553 Coupler and cables.

MultiComBox™ enables you to connect up to two dual-redundant Mil-Std-1553 channels. These are marked at the cable assembly as “Module 0-A”, “Module 0-B”, “Module 1-A” and “Module 1-B”. When operating MuxSim™ and MuxMonitor™ software you will notice that the two channels are defined as Modules – “Module 0” and “Module 1”.

- **Module 0-A** represents BUS A in Module 0.
- **Module 0-B** represents BUS B in Module 0.
- **Module 1-A** represents BUS A in Module 1.
- **Module 1-B** represents BUS B in Module 1.

When operating a Dual-Redundant environment, you should not connect Module 0-A and Module 0-B on the same 1553 Coupler, nor Module 1-A and Module 1-B. There must be a complete duplication of the connection in the following way:

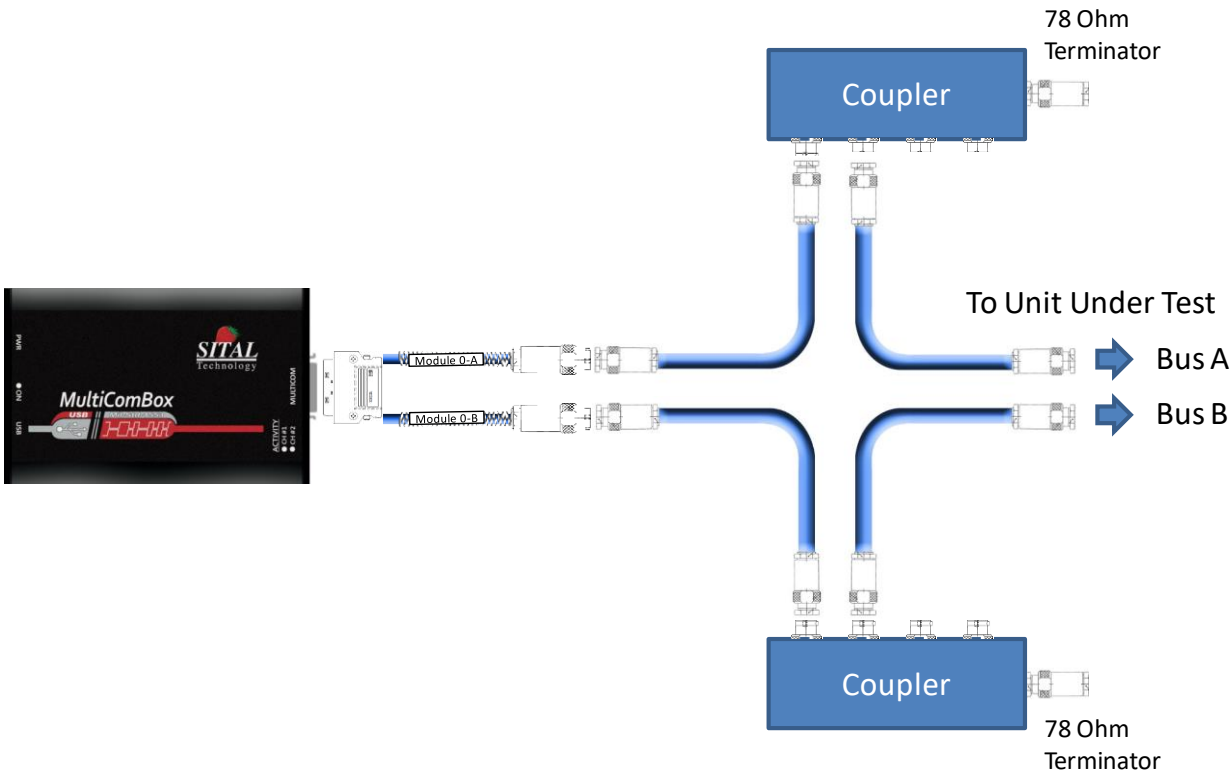


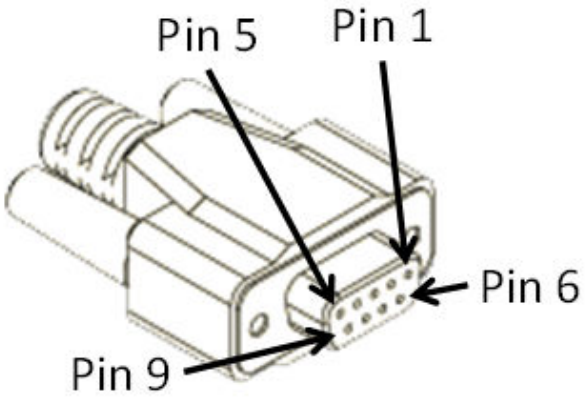
Figure 2: Dual Redundant 1553 test environment connection.

When using both 1553 Modules on the same bus, for example – it is possible to use Module 0 as BC, RT or MultiRT and Module 1 as Monitor Terminal, or vice-versa. In such case, channels A of both modules and channels B of both modules can be connected to the same couplers, and so channel A of Module 0 will be connected to channel A of Module 1, and channel B of Module 0 will be connected to channel B of Module 1.

3.3 RS485 (and EBR1553) Connection

MultiComBox™ enables up to 4 channels of RS-485. RS-485 is a two-wire, half-duplex, multipoint serial communications channel, that can be used for serial protocols or for discrete line as an event trigger.

The four channels of RS-485 are



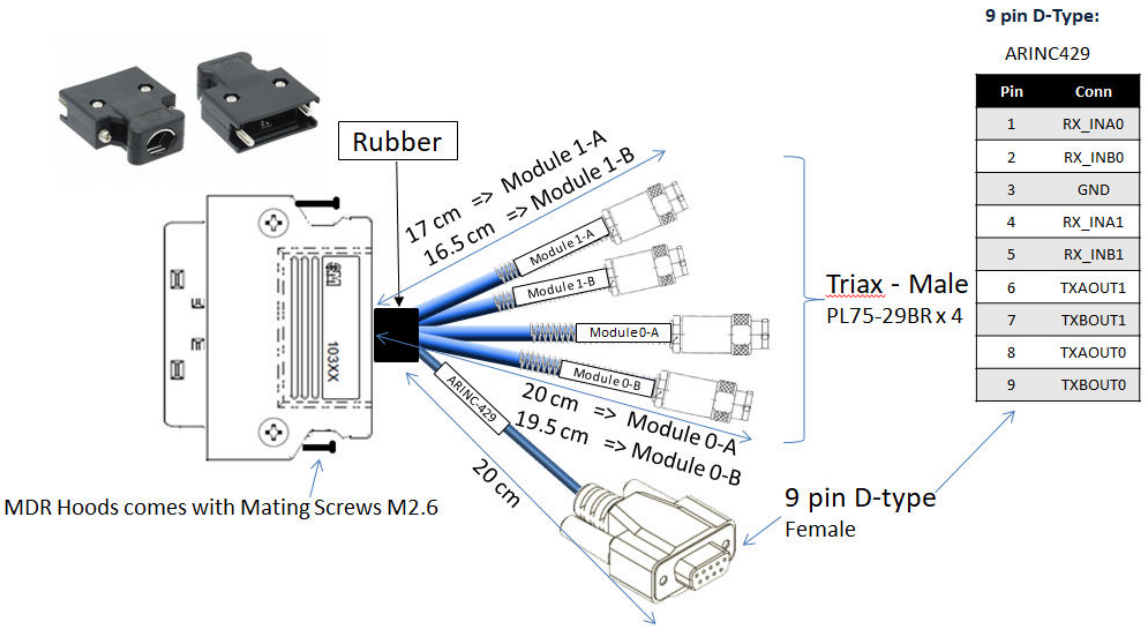
Pin	Conn
1	CH 1 +
2	CH 1 -
3	NC
4	CH 2 +
5	CH 2 -
6	CH 3 +
7	CH 3 -
8	CH 4 +
9	CH 4 -

available via the Female 9 pin D-type connector in the following manner:

Figure 1:9 Pin D-type for RS-485

These channels are also used for Extended Bit Rate 1553 (EBR1553) where applicable.

3.4 ARINC429 Connection



9 pin D-Type:

ARINC429

Pin	Conn
1	RX_INA0
2	RX_INB0
3	GND
4	RX_INA1
5	RX_INB1
6	TXAOUT1
7	TXBOUT1
8	TXAOUT0
9	TXBOUT0

3.5 PCI MIL-STD-1553 + RS485 Connection

	BRD1553PCI I/O Connector Pinout Mapping				
	1553 Bus	RS485	P1 pin #	1553 Description	RS485 Description
GROUP1	BUSA_P0	RS485_A0	1	MIL-STD-1533 bus P, positive signal	Non-inverting receiver input and non-inverting driver output
	BUSA_N0	RS485_B0	20	MIL-STD-1533 bus N, negative signal	Inverting receiver input and inverting driver output.
	BUSB_P0	NC	2	MIL-STD-1533 bus P, positive signal	Not Connected
	BUSB_N0	NC	21	MIL-STD-1533 bus N, negative signal	Not Connected
	BUSA_P1	RS485_A1	3	MIL-STD-1533 bus P, positive signal	Non-inverting receiver input and non-inverting driver output
	BUSA_N1	RS485_B1	22	MIL-STD-1533 bus N, negative signal	Inverting receiver input and inverting driver output.
	BUSB_P1	NC	5	MIL-STD-1533 bus P, positive signal	Not Connected
	BUSB_N1	NC	24	MIL-STD-1533 bus N, negative signal	Not Connected
	BUSA_P2	RS485_A2	6	MIL-STD-1533 bus P, positive signal	Non-inverting receiver input and non-inverting driver output
	BUSA_N2	RS485_B2	25	MIL-STD-1533 bus N, negative signal	Inverting receiver input and inverting driver output.
	BUSB_P2	NC	7	MIL-STD-1533 bus P, positive signal	Not Connected
	BUSB_N2	NC	26	MIL-STD-1533 bus N, negative signal	Not Connected
	BUSA_P3	RS485_A3	8	MIL-STD-1533 bus P, positive signal	Non-inverting receiver input and non-inverting driver output
	BUSA_N3	RS485_B3	27	MIL-STD-1533 bus N, negative signal	Inverting receiver input and inverting driver output.
	BUSB_P3	NC	9	MIL-STD-1533 bus P, positive signal	Not Connected
	BUSB_N3	NC	28	MIL-STD-1533 bus N, negative signal	Not Connected
GROUP2	BUSA_P4	RS485_A4	11	MIL-STD-1533 bus P, positive signal	Non-inverting receiver input and non-inverting driver output
	BUSA_N4	RS485_B4	29	MIL-STD-1533 bus N, negative signal	Inverting receiver input and inverting driver output.
	BUSB_P4	NC	12	MIL-STD-1533 bus P, positive signal	Not Connected
	BUSB_N4	NC	30	MIL-STD-1533 bus N, negative signal	Not Connected
	BUSA_P5	RS485_A5	13	MIL-STD-1533 bus P, positive signal	Non-inverting receiver input and non-inverting driver output
	BUSA_N5	RS485_B5	31	MIL-STD-1533 bus N, negative signal	Inverting receiver input and inverting driver output.
	BUSB_P5	NC	14	MIL-STD-1533 bus P, positive signal	Not Connected
	BUSB_N5	NC	32	MIL-STD-1533 bus N, negative signal	Not Connected
	BUSA_P6	RS485_A6	15	MIL-STD-1533 bus P, positive signal	Non-inverting receiver input and non-inverting driver output
	BUSA_N6	RS485_B6	33	MIL-STD-1533 bus N, negative signal	Inverting receiver input and inverting driver output.
	BUSB_P6	NC	17	MIL-STD-1533 bus P, positive signal	Not Connected
	BUSB_N6	NC	35	MIL-STD-1533 bus N, negative signal	Not Connected
	BUSA_P7	RS485_A7	18	MIL-STD-1533 bus P, positive signal	Non-inverting receiver input and non-inverting driver output
	BUSA_N7	RS485_B7	36	MIL-STD-1533 bus N, negative signal	Inverting receiver input and inverting driver output.
	BUSB_P7	NC	19	MIL-STD-1533 bus P, positive signal	Not Connected
	BUSB_N7	NC	37	MIL-STD-1533 bus N, negative signal	Not Connected
	GND	GND	4	Ground (Can be left uncconected)	Ground
	GND	GND	10	Ground (Can be left uncconected)	Ground
	GND	GND	16	Ground (Can be left uncconected)	Ground
	GND	GND	23	Ground (Can be left uncconected)	Ground
	IRIG_IN/NC		34	IRIG_B or Ground (default=NC-Can be left uncconected)	IRIG_B or Ground (default=NC-Can be left uncconected)
	STANDARD CONNECTIVITY COULD NOT MIX 1553 AND RS485 SIGNALS IN THE SAME GROUP				

3.6 PCI ARINC429 Connection

BRD429PCI-12-16 I/O Connector Pinout Mapping					
Pin #	**Pin Name**	**Pin #**	**Pin Name**	**Pin #**	**Pin Name**
62	arinc_txa0	42	arinc_rxa9	21	arinc_rxa0
61	arinc_txb0	41	arinc_rxb9	20	arinc_rxb0
60	arinc_txa1	40	cgnd	19	arinc_rxa1
59	arinc_txb1	39	arinc_rxa10	18	arinc_rxb1
58	arinc_txa2	38	arinc_rxb10	17	arinc_rxa2
57	arinc_txb2	37	cgnd	16	arinc_rxb2
56	arinc_txa3	36	arinc_rxa11	15	arinc_rxa3
55	arinc_txb3	35	arinc_rxb11	14	arinc_rxb3
54	arinc_txa4	34	cgnd	13	arinc_rxa4
53	arinc_txb4	33	arinc_rxa12	12	arinc_rxb4
52	arinc_txa5	32	arinc_rxb12	11	arinc_rxa5
51	arinc_txb5	31	cgnd	10	arinc_rxb5
50	arinc_txa6	30	arinc_rxa13	9	arinc_rxa6
49	arinc_txb6	29	arinc_rxb13	8	arinc_rxb6
48	arinc_txa7	28	cgnd	7	arinc_rxa7
47	arinc_txb7	27	arinc_rxa14	6	arinc_rxb7
46	arinc_txa8	26	arinc_rxb14	5	arinc_rxa8
45	arinc_txb8	25	arinc_rxa15	4	arinc_rxb8
44	arinc_txa9	24	arinc_rxb15	3	cgnd
43	arinc_txb9	23	arinc_txa10	2	arinc_txa11
		22	arinc_tx10	1	arinc_tx11

4 Key Features & Enhancements

4.1 Asynchronous Messaging

As of March 20th 2018 a new Async message sending mode was added to the transmission capabilities of MCX BC.
This new mode of operation allows the controller to inject a new message instantaneously to the transmissions on the bus.
1. If the MCX is running and transmitting a bus list, say message #3, and the Async is initiated, then it will be transmitted ONCE after #3 ends, but before message #4.
2. If MCX is running, but it is in a passive phase, i.e., between two frames, the message would go out instantly with no delay, and the first message on the next frame might be delayed until the Async message has been transmitted.
3. If the MCX is in idle mode, i.e. no bus lists are running, the Async message would be instantly transmitted ONCE and MCX returns to idle mode.
4. If the MCX is in idle mode, i.e. no bus lists are running, the Async message would be instantly transmitted ONCE and if during transmission, bus-list transmission is engaged, MCX would start the bus-list transmission back-to-back with the Async message completion.

Some avionic systems make use of asynchronous messages, and the above method facilitates this mode to MCX.
The usage of Async message on IDLE simplifies the procedure for sending messages, and avoids using bus lists. The controller can transmit any message one after the other, and each can be different from the previous one. This mode of operation might be useful for some application that want the controller intimately managing the bus list. Please note that if message results are tested, there would be no bus activity periods between two messages, depending on this result analysis takes.

An Async message is defined by a standard message block format.

This feature is accessible via MIL-STD-1553 Simulator top menu.

4.2 Device Time-Tag Synchronizing

The Composer is now capable to synchronize the internal clock to a user defined input, as well as synchronize to the PC's clock.
The Time Tag sync is accessible via Monitor's Top Menu.

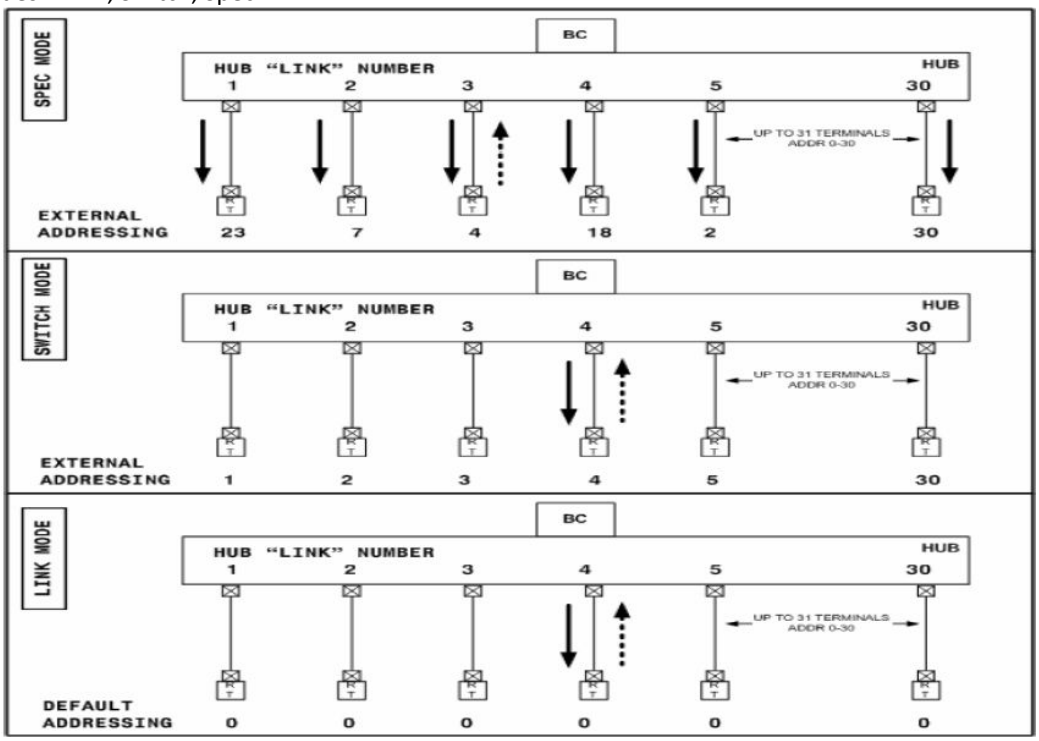
4.3 Data Injection

The Simulator can inject incremental data across messages. This feature provides valuable testing capabilities where the UUT (Unit Under Test) can verify that no data is missed by checking data integrity and continuity.

4.4 EBR1553

What is EBR1553?
Enhanced Bus Rate (EBR) is a special 10Mhz 1553 link. http://www.sitaltech.com/EBR1553D.asp
What is different with MultiComBox (MCX) in EBR1553 mode?

In EBR1553 mode MCX loads a different firmware to communicate through the RS485 lines instead of through the standard 1553 transceivers. No standard transceiver signaling activity is possible. No standard RS485 serial communication activity is possible.
MCX supports a HUB of 4 lines, and can act as a BC+MultiRT, or MultiRT stand-alone mode, just like the regular 1553 mode.
Note: Error Injection is also supported.
EBR Modes – Link, Switch, Spec:



4.5 Cyber Attack Emulation

4.5.1 Introduction

Sital Technology's MultiComBox has been elevated to being able to emulate a cyber-attack for multi-drop bus protocols.

Development groups of aerospace products that would request to protect their products from cyber-attacks may use this emulation mode of operations to attack their product under development, and enhance their counter measures and firewalls.
For activating the following attack modes, refer to function mcx_SetCyberAttack(..).

4.5.2 Supported Attacks in Emulation Mode

4.5.2.1 Periodic Attack - After Period of Time

This type of attack would follow this algorithm:

1. Wait for predefined period of time.
2. Wait for bus idle on both bus A and B of the first message.

3. Transmit all frame messages to the bus based on the frame rate parameters.

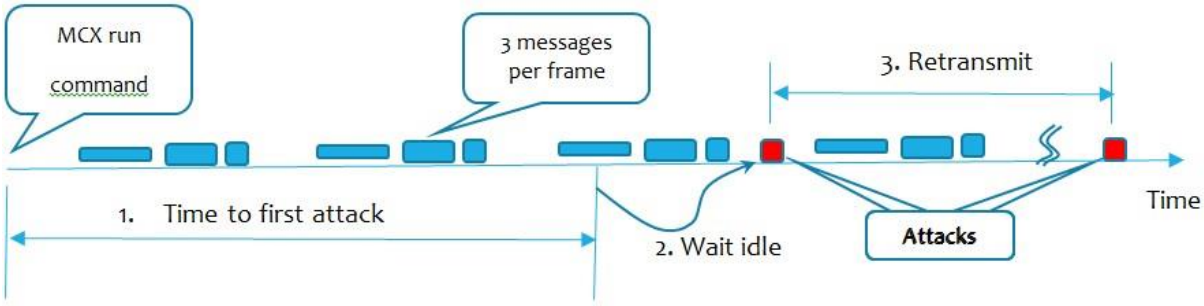
This attack allows the attacker to delay an attack, and then be persistent with it.

Resources: the frame length counter is used for the delay. 16 bits, two resolutions, one with LSB=65 milliseconds second with LSB=100 us. Maximum delay for LSB=65 ms is 65ms X 64K => 4295 seconds which are 71 minutes => 1 hour and 10 minutes.

Rate of attack: Message gap counter of all messages in the frame. This is typically 16 bits gap of micro seconds, up to a total of 65 ms.

Example attack: Wait for 10 minutes, and then transmit broadcast reset time tag every 65 milliseconds.

In this case there would be a frame with one message with message gap time set to 0xFFFF, and frame length counter set to 10x60x(1000/65) = 9230.



Set attack type to 1 to enable this type of attack.

4.5.2.2 Triggering Command

This type of attack would follow this algorithm:

1. Wait for BC to transmit a particular command for N times.
2. Wait for destination buses to idle
3. Transmit Attacking Command N times, every re-transmit Gap.

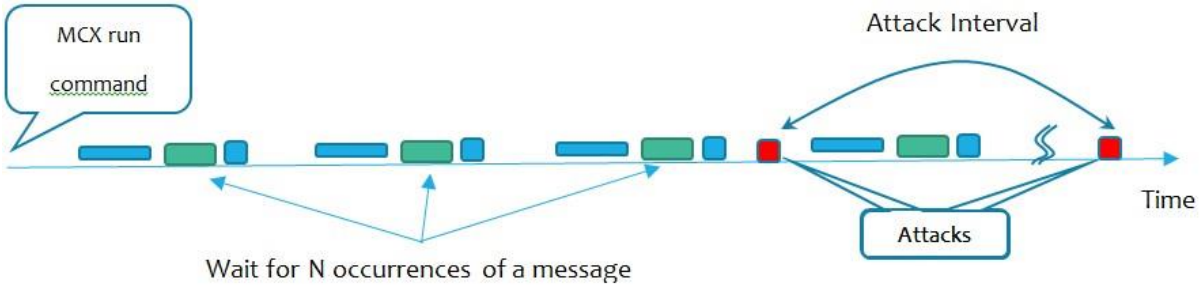
This attack allows the attacker to wait for a particular event on the 1553 bus in the form of a specific message, count N such occurrences, and then transmit the preplanned frame to the bus.

Resources: the frame length counter is used for N. N can be in the range of 0 to 64K. 0 would transmit without delay, 1 would indicate right after first occurrence of trigger message, 2 would wait for 2 such occurrences…

The Sync pattern register (0x46) defines the triggering command.

The attacker chooses to wait for an event such as a particular station (RT) becoming armed and replying to the bus. When that event happens, the attack includes transmitting predefined messages to that particular RT, to

damage its operation.

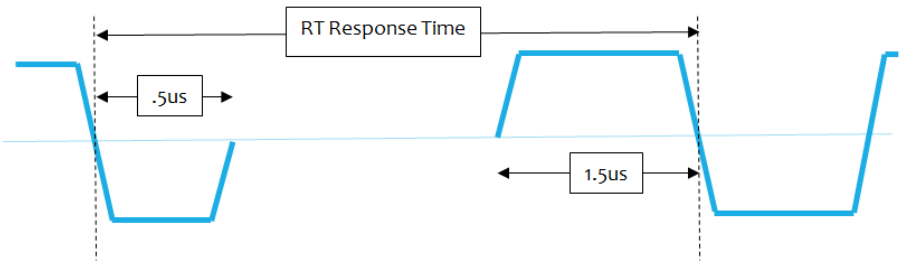


Set attack type to 3 in order to enable this type of attack.

4.5.2.3 RT Spoofing – Global Response Time

This type of attack would follow this algorithm:
In order for an RT to spoof another RT, do the following:
1. Find out what is your spoofed RT response time.
2. Find out what is your spoofed RT address.
3. Enable simulation for that RT address.
4. Set the MultiRT response time to either shorter / longer response time than measured RT.
5. Add the attacked messages into the MultiRT frame (could be grabbed from the Monitor).
6. Run the frame when spoofing is required.

NOTE - If the MultiRT response is shorter than the spoofed RT, some spoofed RTs would back off,
Others would transmit at their response time.
The latter case might error out the spoofed RT response.
In case that the MultiRT's response time is greater than the spoofed RT response time,
the MultiRT's response would probably overlap the spoofed RT.
NOTE II - 200 nano seconds are added to any user's requested MultiRT response time.
NOTE III - in case the MultiRT response is greater than the standard allows (14 us), unexpected behavior might occur.
Measure of response time:



4.6 Offline Mode – Working in Device-less mode

Composer release version 4.3.0.25 introduces an Offline Mode allowing users to experiment subset of features available in Simulator and Monitor.
For example, the Offline Mode allows creating, saving, editing and loading Frames to the Simulator.

Workflow

- Install and launch the Composer, the Offline Mode is available when no tester device is connected to the USB port and/or to the PCI slot.

- A popup message stating that now devices found appears, see Fig 1 below.
  Press OK to start the Offline Mode.
- A single device with 'Offline' indication will appear, see Fig 2 below.
  Press Launch to start working with Simulator and Monitor.

Fig 1

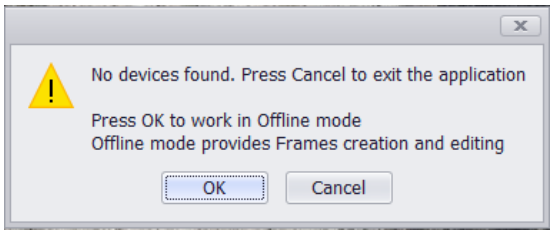
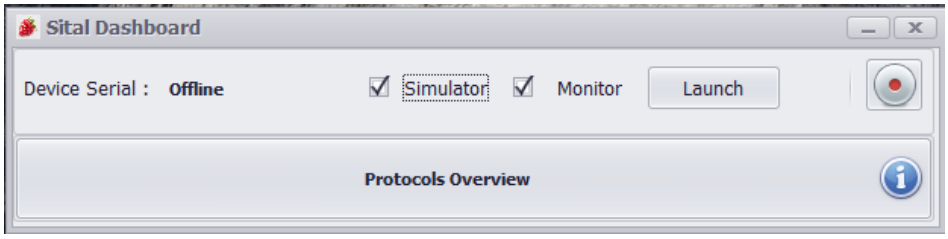


Fig2



4.7 Frame Run Modes – GAP / RATE MODES

4.7.1 Frame Gap Mode

When setting a frame to run in a Gap mode, each of the frame messages can define a gap, which is the amount of microseconds from the beginning of this message to the beginning of the next message. A value could be in the range of 0 us to 64K us =~ 65 ms.

NOTE – this mode was the mode available in the Tester API and UI up to Release 4.3.0.32 (release on April 18, 2019).

4.7.2 Frame Rate Mode

For each message define its rate. Possible rates are
0 – skip this message.
1/1 – send every frame.
1/2 – send every second frame.
1/4 – send every forth frame.
1/8 – send every 8th frame.
:
1/N – Where N is a power of 2 and Nmax = 2^14, i.e., once every 16,384 frames.
15 – send only once. Core will change to 0 after transmission.
If two stack entries point to the same message, than the resulting rate of that message would be higher. The resulting rate would be the sum of both rates. For example 1/4 + 1/16 would be 5/16, which is almost 1/3 of the frame rate.

The HW core sequences the messages at lower rates, such that for each frame, only the 1/1 rate messages are transmitted along side only ONE slower rate messages. Such that 1/N (N>1) messages and 1/M (M>1, N<>M) messages are not transmitted in the same frame.
The HW core provides a register that indicates the frame number. After start command this frame counter starts counting up until the operation is stopped. The host can determine which message is transmitted on which frame using a simple equation. This will allow the host to update the transmitted data buffers on time.

It might happen that the transmission length in time of all messages of rate 1/1 and messages of lower rate in a specific frame sum up to a total length which is too long for the frame length. If one of the following frames is not crowded, the HW core supports message skew definition. A specific stack entry message can be skewed forward 1 to 15 frames ahead from its designated frame.

Example

Definition.
Typically MIL-STD-1553 (“MuxBus”) has a frame time definition.
The frame is a period of time, typically 10 or 20 milliseconds long.
Several messages are transmitted every frame. These messages manage the system.
In more complex MuxBus systems, not all messages are transmitted every frame. For example, the direction that a Radar Antenna is pointing at, should be transmitted every frame, i.e. 50 times a second, for display units to display target position. On the other hand, button position on one of the panels can be transmitted twice a second, since its not practical that the pilot would press that button faster than that.
The Operational Flight Program (OFP) programmer tailors the frames based on the Interface Control Document (ICD) that defines all message types required. In the ICD, each message is tagged by its usage rate.
Existing sequencing mechanisms.
For example, let’s define a system with a rate of 50 frames per second (50 Hz).
Message A50 and B50 are transmitted every frame.
Message E25 is transmitted every 2nd frame.

Message G125 is transmitted every 4th frame.

A possible order of the system would be:

Frame #1	Frame #2	Frame #3	Frame #4
A50 B50 E25	A50 B50 G125	A50 B50 E25	A50 B50

Frame #5 repeats frame #1 and so on…
As exampled, message G125 is transmitted in the frame that does not serve 25 Hz messages. This is done for load balancing as explained below.
Existing Bus Controllers (BC) use a stack of message entries to control their message sequencing. The Host CPU updates the stack, and initiates the bus controller to execute the messages automatically and autonomic.
Each Stack entry points to a location in its memory where the actual message command and words are stored.
Existing BCs define minor and major frames. In the above example, there is one Major Frame that is 4x20ms => 80ms, and 4 minor frames, each one take 20ms.
The stack would look like this: A50 B50 E25 A50 B50 G125 A50 B50 E25 A50 B50.

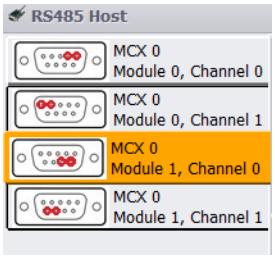
This list would be transmitted every 80ms, BUT there need to be a tool to force a gap between the end of E25 of frame #1 and A50 of frame #2 in order to make frame #1 20ms

in length. So, existing BCs also hold in their stack a ‘message-length’ parameter. So the stack would now look like (message-length in parenthesis):
A50 (1ms) B50 (1ms) E25 (18ms) A50 (1ms) B50 (1ms) G125 (18ms) …
Message-length parameter in stack is a way of composing a minor frame of 20ms.

This technique starts falling apart when lower rate messages have to be sequenced. If the slowest message is 50Hz/64 => 0.78 Hz then a complete list of more than a second has to be stacked. Most of the stack entries point to the very same message, it's simply a very big stack.

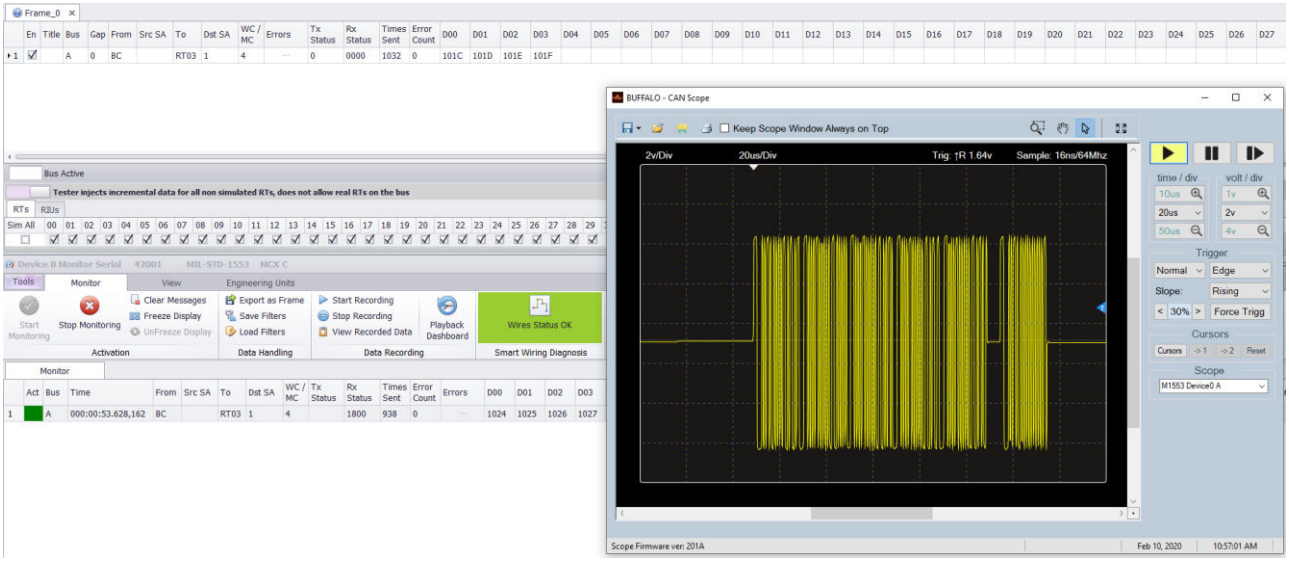
4.8 RS485 Bus Corruption Detection

With COMposer version 4.3.1.12 on detecting bus corruption or data overlapping (compromised data integrity), a RED tab flag will flicker on the relevant LINE.



4.9 Bus Scope and Monitor

As of version 4.3.1.18, Scope capabilities are available for licensed MCX C devices. The Scope monitors live traffic and data detected on the following available buses: MIL-STD-1553, RS485, and Arinc429.



5 Launching Window

After a successful installation, a COMposer shortcut is created on the desktop

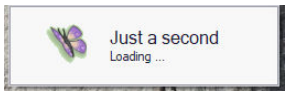
Double clicking on it will run the COMposer application.

Note – the COMposer executable file can be found in:

C:\Sital\COMposer\COMposer_<SOFTWARE VERSION>\Binaries\COMposer.exe

Once launching the COMposer, an intro window will be displayed (Fig 1), In case that one or more of the connected devices is MultiComBox tester (see 1.1); the loading process may last up to 8-10 seconds for loading the firmware file into the device.

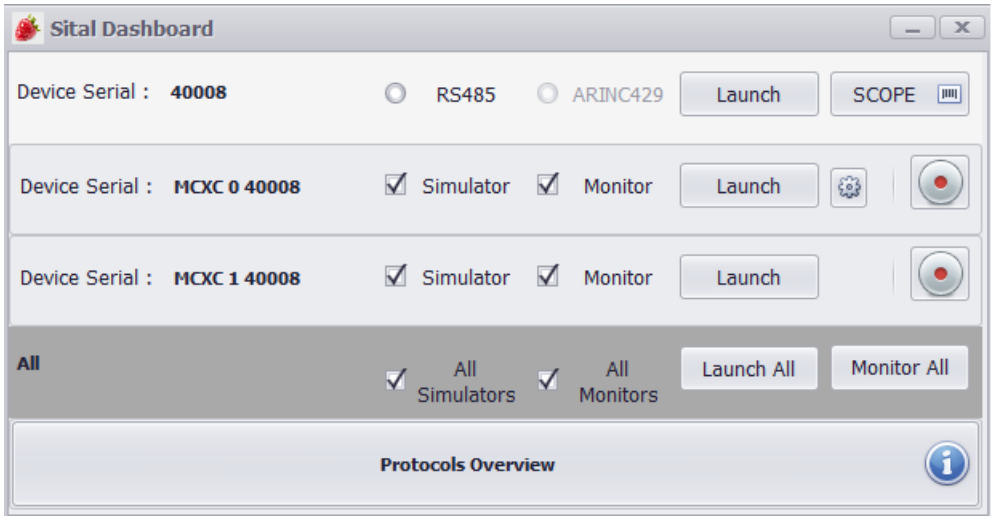
Fig 1



After loading is completed, the main application's dashboard containing devices lists is displayed.

Each device controls an independent Simulator and Monitor.

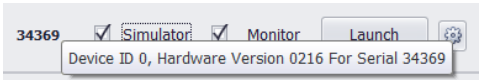
Fig 2



Note - you can launch a single device's Simulator and/or Monitor by clicking Launch button related to it or launch all by clicking Launch All button on the bottom of the Dashboard.

Note II – after launching Simulator and Monitor, the relative positions on screen are saved and will be automatically opened to these locations on the next activation of the COMposer.
Note III – in case you would like to prevent automatic opening of windows, go to dashboard, unset relevant feature, and press launch to memorize this new setting.

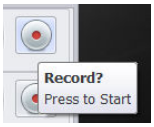
Note - Closing this window will instantly exit the COMposer application and close all opened Simulators and Monitors.
The recognized devices are grouped by Device Serial. General info about the device can be displayed by hoovering the serial number.



In order to change Protocol and/or re-load a new / different firmware file (.rbf file) click on the Change Configuration button

 And select the file's new location and desired Protocol.

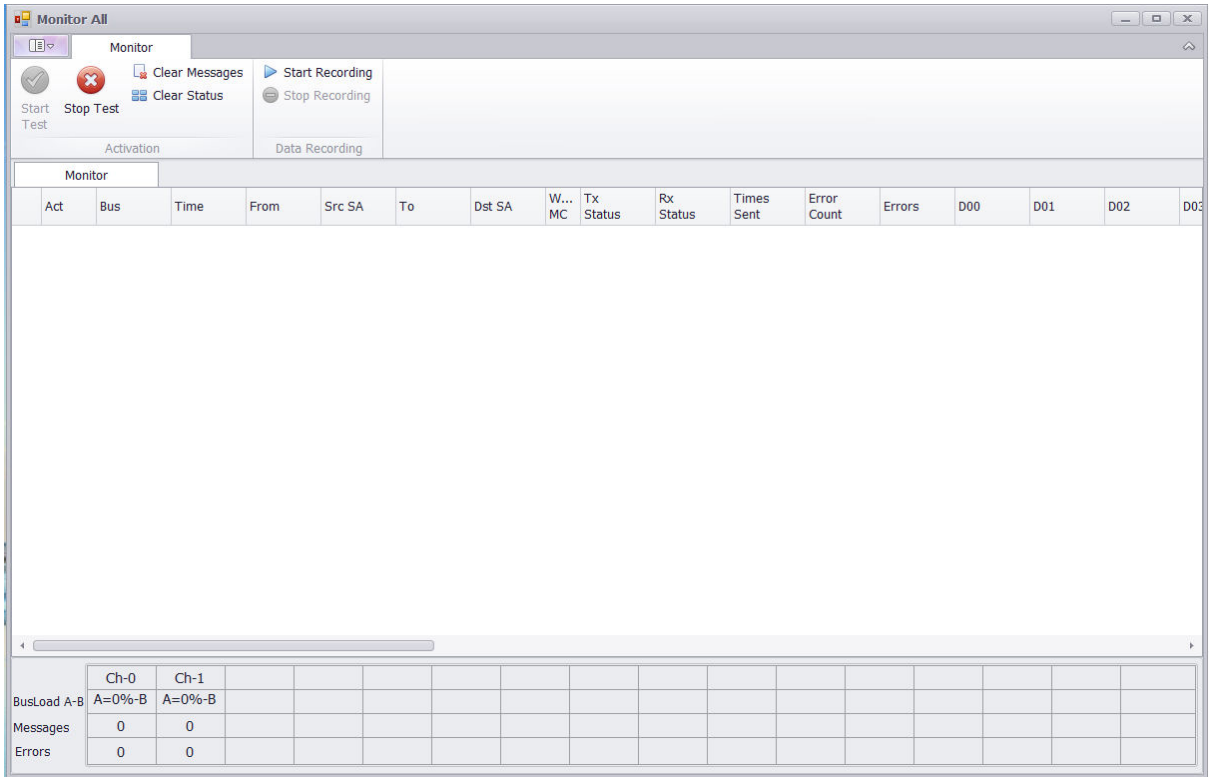
The Launching window contains a recording capability allowing the user to record monitored data to binary file without opening the Monitor window.
In order to start the binary recording, press the Start Recording button



while the data is recoded, the button will indicate activation (by flickering). The recorded binary data can be displayed and played via Monitor, see Monitor section for details.

5.1 Monitor All

Monitor All button will launch Monitor All window.
The following window monitors error messages from all devices and channels.



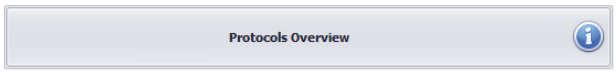
Ribbon:
Start/Stop button - Start/Stop simulating and monitoring all channels in all devices.
Clear messages – Clear error messages that are presented in the Monitor tab window.
Clear Status – Clear data from the status bar.
Start/Stop Recording – Record all messages to files.

Monitor Tab:
Present all error messages from all channels in all devices.

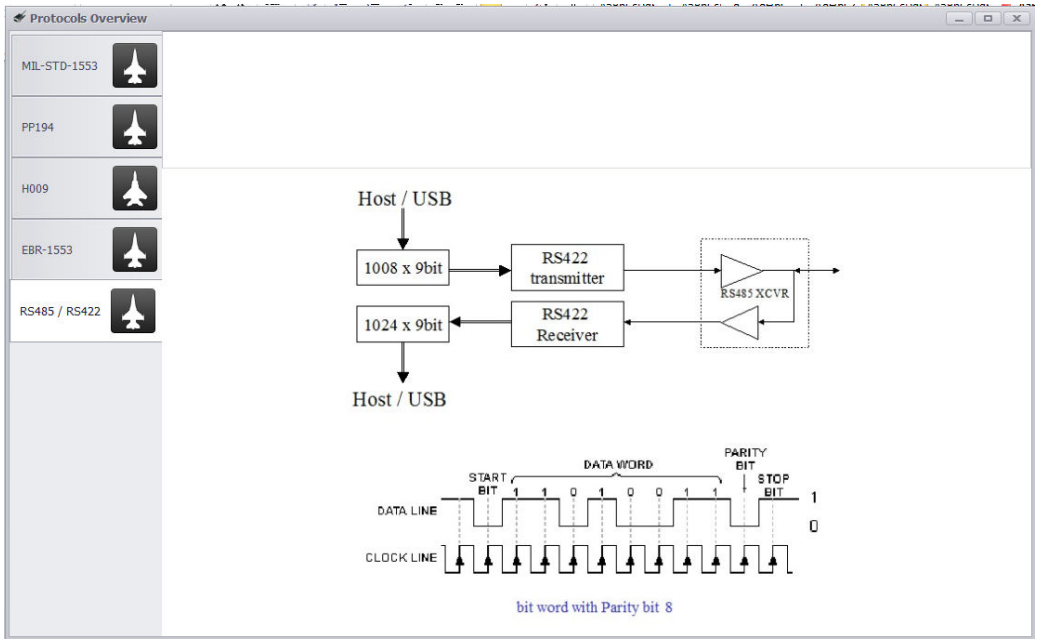
Status Bar Shows:
Bus load in each channel.
Counter of all messages in each channel.
Counter of error messages in each channel.

5.2 Protocol Help

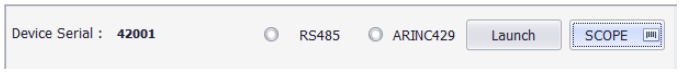
The Launch window contains Protocols information that can be accessed by clicking the Protocols button



Once clicking it, a standalone window is opened and the various Protocols cab be explored



As of Composer version 4.3.1.18, for licensed MCX B and C, the Dashboard includes launching button for RS485 (MCX B|C), ARINC429 (MCX C) and Scope (MCX C).



For activation and working with these features, see section 8 of this document.

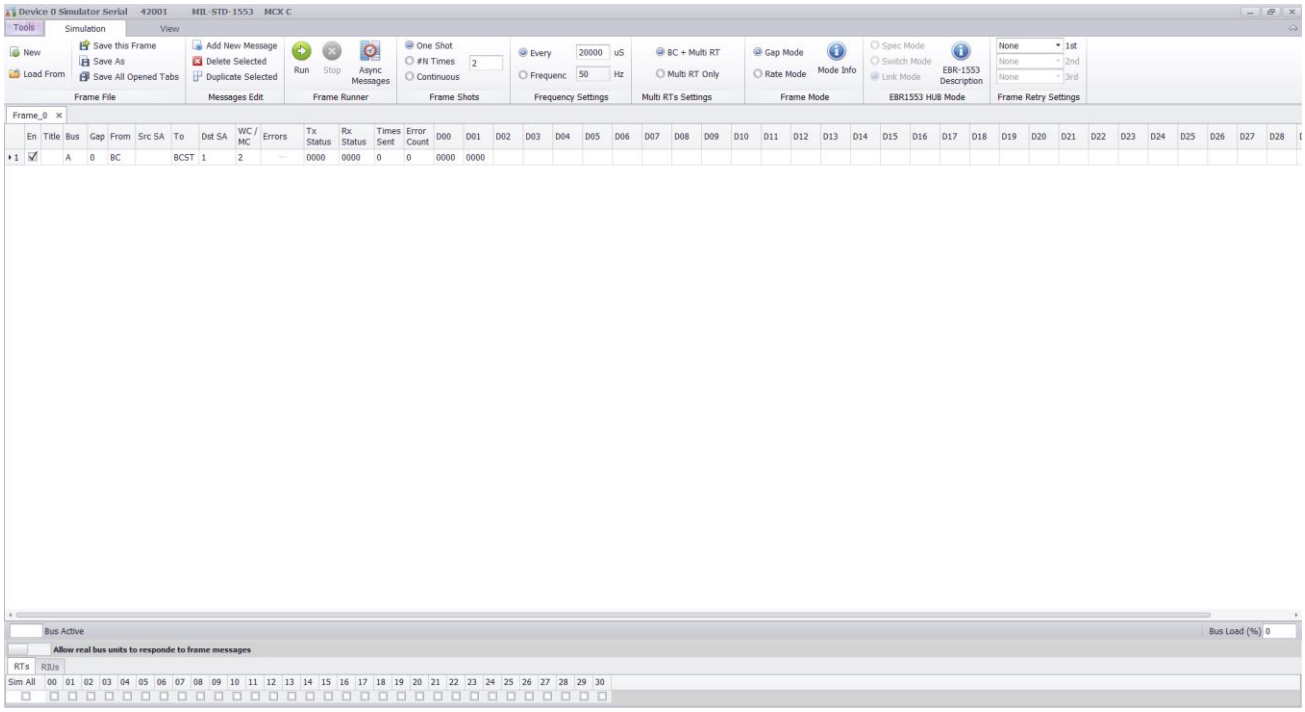
6 COMposer – Simulator

6.1 MIL-STD-1553 & PP194

6.1.1 Simulator Main Window

Default Simulator opens as described in Fig 3.

Fig 3

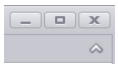


In order to run the default message; BC to Broadcast, 2 words, simply click on Run button

On the Frame Runner buttons group.

The Simulator window header specifies the Device ID, Device Serial and the main running protocol.

The Tab Menus can be minimized or maximized via right pane button click:

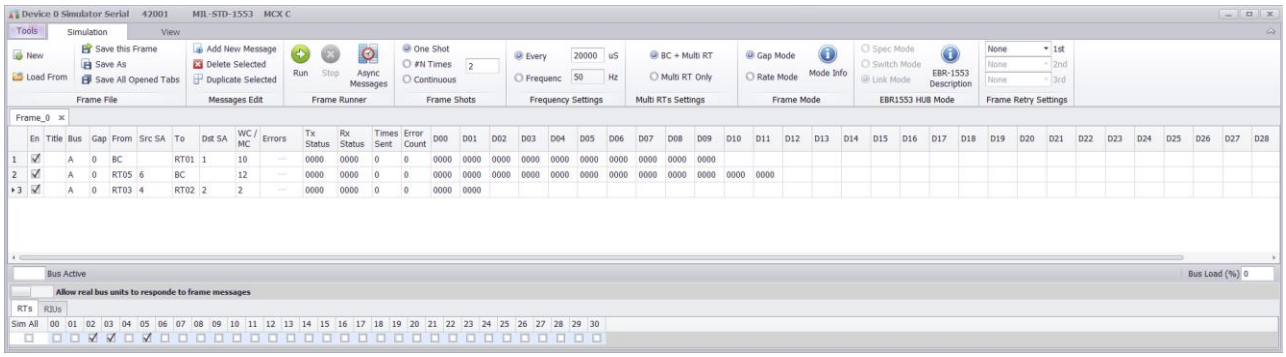


The following example (Fig. 4) demonstrates a frame which contains the following command:

- 0x82A – BC to RT01, sub address 01, 10 data words
- 0x2CCC- RT05 to BC, sub address 06, 12 data words
- 0x1042 (Rx command) 0x1C82 (Tx command) – RT03, sub address 02 to RT02 sub address 02, 2 data words.

In this example, note that only RT02, RT03 and RT05 are enabled (the Tester will simulate the replies) – meaning, RT01 is the unit under test, a unit connected to the Tester and expected to reply according to the tested standard.

Fig. 4


Device 0 Simulator Serial 42001 MIL-STD-1553 MCX C
Tools
Simulation
View
New
Load From
Save this Frame
Save As
Save All Opened Tabs
Frame File
Add New Message
Delete Selected
Duplicate Selected
Messages Edit
Run
Stop
Async Messages
Frame Runner
One Shot
#N Times
Continuous
Frame Shots
Every
Frequenc
Frequency Settings
BC + Multi RT
Multi RT Only
Multi RTs Settings
Gap Mode
Rate Mode
Mode Info
Frame Mode
Spec Mode
Switch Mode
Link Mode
EBR-1553 Description
EBR1553 HUB Mode
Frame Retry Settings
Frame_0
Bus Active
Bus Load (%)
Allow real bus units to responde to frame messages
RTs
RBUs
Sim All

6.1.2 Simulation Tab Menus

Frame File

New – creates a new Frame in a new tab with the default message settings.

Save this Frame – save the Frame focused in the current tab.

Note – all frames are saved to running folder (where the COMposer.exe is located) into Frames folder.

Save All Frames – iterate all Frame tabs currently opened in the application and save them.

Load From – opens a file browser allowing the user to select and open existing frame. The selected Frame will be opened in a new tab.

Messages Edit

Note – all the Messages Edit functionality and additional functionalities are available on the Data Grid Columns – Right Clicks menu, see below.

Add New Message – creates a new message in a new row of the Grid, on the focused Frame tab. The new message is created with default values.

Delete Selected – deletes the selected message. When few messages are selected, all the selected messages are deleted.

Note – a Frame must contain at least a single message, therefore the user can select N – 1 messages to delete.

Duplicate Selected – duplicate the selected message / s in new rows of currently focused Frame.

Frame Runner

Run - Runs the currently focused Frame. Once Run is clicked, the button turns disabled till Stop button is clicked.

Stop – Stops the currently running frame. Once the Stop is clicked, the button turns disabled till Run button is clicked.

Async Messages – launch a standalone async messages window that provides the capabilities to transmit up to 2 async messages.

Note – An Async message can be transmitted on an idle bus (while no messages and frames are running) and / or while bus is active.

Frame Shots

One Shot – Once Run pressed, the selected Frame runs Once.

N Times – Once Run pressed, the selected Frame runs specified iterations. The default value, 2, can be modified in the textbox.

Continues – Once Run pressed, the selected Frame runs infinitely till Stop is clicked.

Frequency Settings

Every - Frame shot every X microseconds. The default value of 20000 can be modified in the textbox.

Frequency – Frame shot in Hertz. The default value of 50 Hz can be modified in the textbox.

Multi Remote Terminal Settings

BC + Multi RT - sets the device to behave as Bus Controller and as all Remote Terminals.

Multi RT Only – sets the device to behave as Remote Terminal/s, expecting an external BC.

EBR 1553 Hub Mode

Spec Mode - transmit on all lines, only one RT reply, RT address 0 to 30. MultiRT answers on the line based on its RT address.

Switch Mode - BC transmits on the Line x to the RT X. Reply from RT address X, X is in 0 to 3. MultiRT replies on line X.

Link Mode - BC transmits a message for RT X on line X, and change command to RT0. MultiRT changes RT0 to RT X based on the line it received the command, and answers on X with RT0.

EBR 1553 Description – pops an info window overviewing the various EBR methods.

Frame Retry Settings

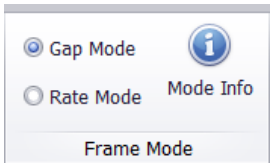
1st – sets a single retry on the same bus or on the opposite bus.

2nd – sets 2 retries on the same bus or on the opposite bus.

3rd – sets 3 retries on the same bus or on the opposite bus.

Frame Mode

Mode selection between frame modes Gap and Rate.
For additional info view section 4.7 of this document or click the ‘Mode Info’ in the Simulator’s Frame Mode group:


Gap Mode
Rate Mode
Mode Info
Frame Mode

6.1.3 View Tab Menus

Messages Table View

Best Fit Columns – sets the Simulator's columns width to fit title and content.

Narrow Columns – minimize the columns width every button click.

Enlarge Columns – enlarges the columns width every button click.

Monitor

Launch Monitor – once clicked, launches the paired Monitor of currently selected Device ID and serial tester.

6.1.4 Data Grid Columns – Data Editing

En – enabled / included in the Frame to run.

Title – optional text description for a message.

Bus – bus A or B on which the message will run on.

Gap – specifies a gap in milliseconds between previous message to selected message within this Frame.

From – source can be Bus Controller, Broadcast or any of the RTs.

Src SA – source sub address. In case of RT selected, specify the source sub address in this field.

To – destination can be Bus Controller, Broadcast or any of the RTs.

Dst SA – destination sub address. In case of RT selected, specify the source sub address in this field.

WC / MC – WC => word count. MC => mode code for 1553 mode words.

Errors – for reported standard protocols errors, this field will contain a button that once clicked will pop errors descriptions. See Fig 1.

Tx Status – transmit status of the message. This value can be edited and injected to the message on transmit command and will be updated from the message results.

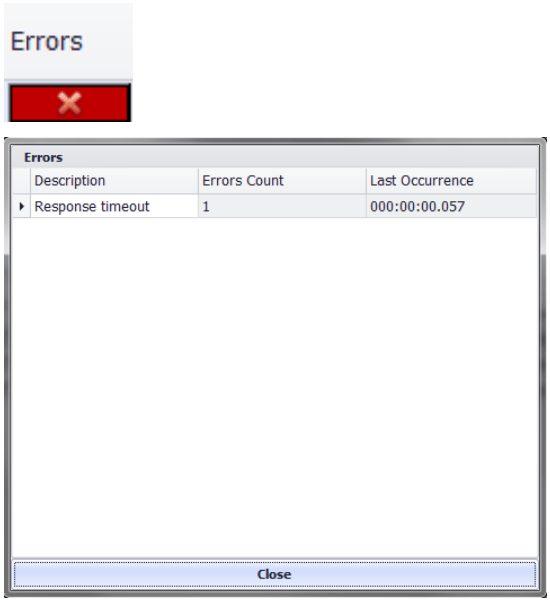
Rx Status – receive status of the message. This value can be edited and injected to the message on receive command and will be updated from the message results.

Times Sent – displays the number of times this message was transmitted per Run click.

Error Count – counts the number of errors detected without opening the Errors window.

D0 – D31 – 32 data words. The data can be manually edited for each column, the number of words for each message is determined by the WC field.

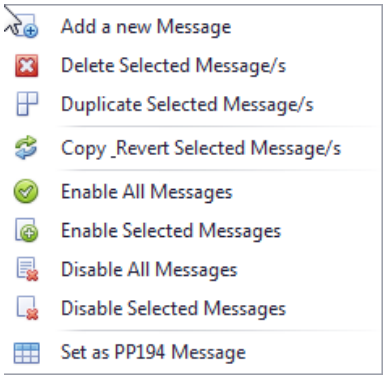
Fig 1.



6.1.5 Data Grid Columns - Right Clicks

Rx Status – receive status of the message. This value can be edited and injected to the message on receive

Data Editing – the following options are available once right click on message cells En to Error Count



Add New Message – creates a new message in a new row of the Grid, on the focused Frame tab. The new message is created with default values.

Delete Selected – deletes the selected message. When few messages are selected, all the selected messages are deleted.

Duplicate Selected – duplicate the selected message / s in new rows of currently focused Frame.

Copy and Revert Selected Message/s – creates a new message with inverted fields from the selected message/s, i.e. the new message created contains in From and Src SA fields the To and Dst SA fields and so on.

Enable All Messages – checks all available messages at En (enabled) column.

Enable Selected Messages – checks all selected messages at En (enabled) column.

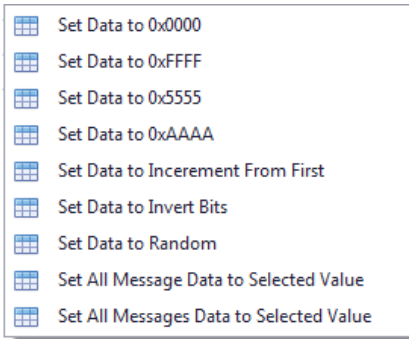
Disable All Messages – un-checks all available messages at En (enabled) column.

Disable Selected Messages – un-checks all selected messages at En (enabled) colu

Set as PP194 Message – turns the selected message to a default PP194 message with default values; From CIU To RIU1.

Set as MIL-STD-1553 Message – once right click on a PP194 message, this option will replace the Set as PP194 Message in the right click menu. Clicking it will turn the selected message to a default 1553 messags.

Data Words Editing – the following options are available once right click on message cells D0 to D31.



Set Data to 0x0000 – set all data words to 0000.

Set Data to 0xFFFF – set all data words to FFFF.

Set Data to 0x5555 – set all data words to 5555.

Set Data to 0xAAAA – set all data words to AAAA.

Set Data to Incremental From First – set incremental data starting from D0. For example, if D0 = 0x000B, D1 will be 0x000C, D2 0x000D and so on.

Set Data to Invert Bits – flips the bits for all data words columns. For example if D0 = 0x000B, after clicking this option D0 = 0xFFF4.

Set Data To Random – set all data words columns with random data.

Set All Message Data to Selected Value – set all the selected message data words to the selected value.

Set all Messages Data to Selected Value – set all messages in the Frame data words to the selected value.

Error Injection

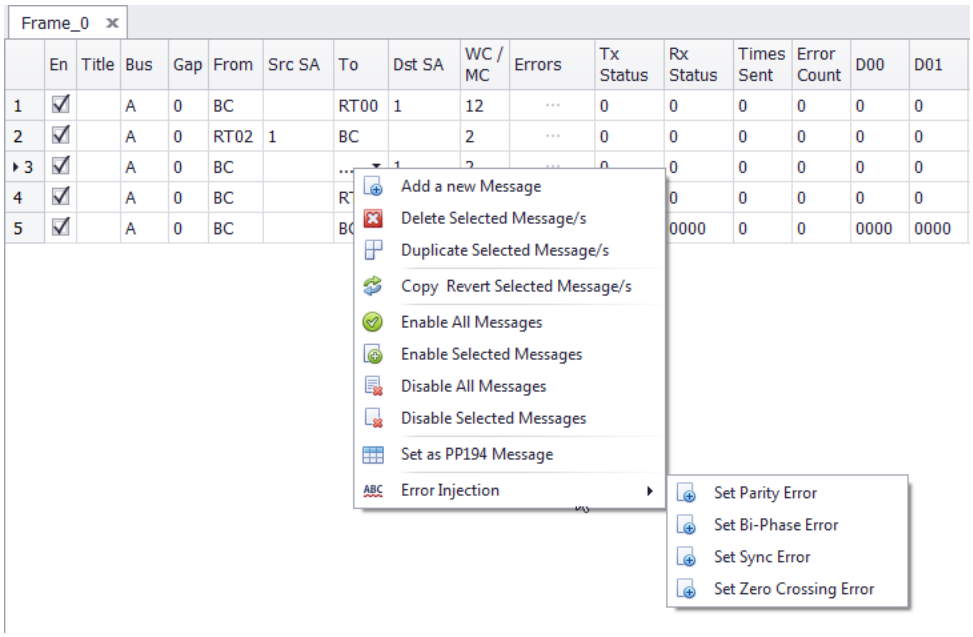
General Notes:

- Error injection can be set to be one of the first 4 messages of the frame (messages 0-3)
- A single error can be injected to a single message within a frame, i.e. a frame can contain up to 1 message that includes an error.
- The MCX tester supports 4 types of error injected messages:
    - Parity
    - Sync
    - Zero Crossing
    - Bi-Phase
- For EBR1553, additional error injection type – Noise can be applied.

The 'Sital_MCX_API_Programming_Reference' document elaborate about the various errors and gives explanation of how to use this functionality using the MCX_API

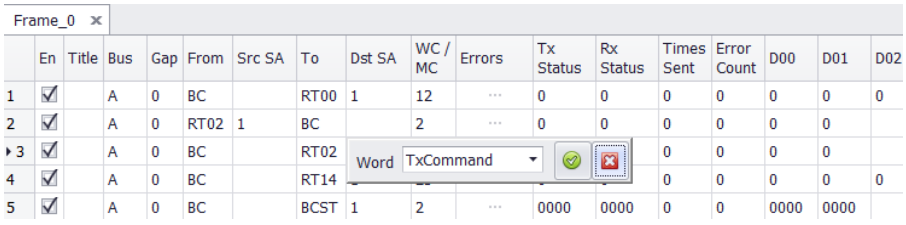
- In the Composer, a message that is set to contain error is colored in Orange

When the user right clicking on any of the first 4 messages of a frame, the last selection in the menu presents setting an error, see below figure:

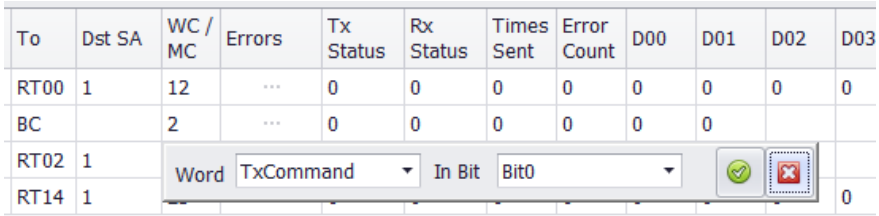


Selecting each error opens a floating modal window for specifying the relevant parameters as shown hereunder:

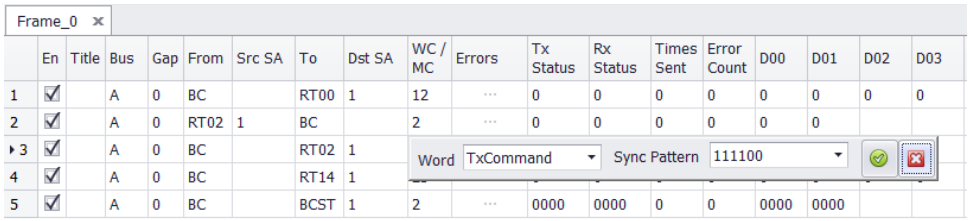
- **Parity Error**



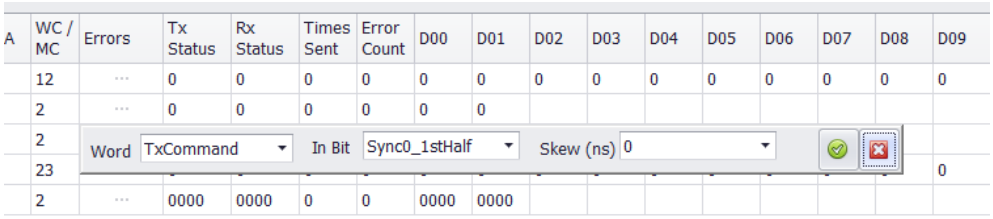
- **Bi-Phase Error**



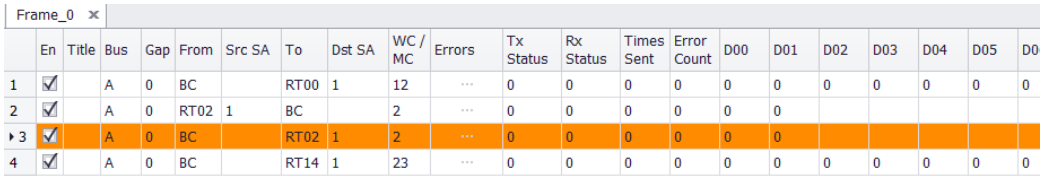
- **Sync Error**



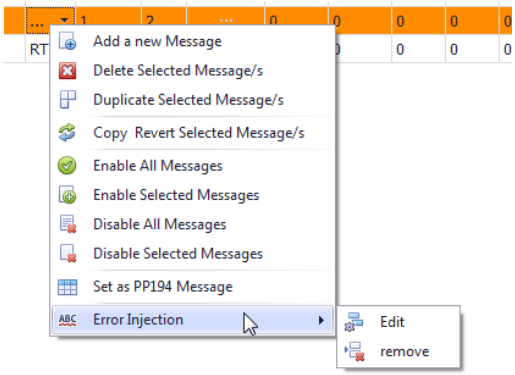
- **Zero Crossing Error**



Clicking V applies the parameters and the selected error to the clicked message, the message back color will turn to Orange. Clicking X will revert the Error settings.



For editing or removing the Error, right click on the relevant (Orange) row and select the action from the menu:



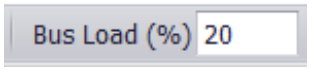
6.1.6 Bus Activity & Bus Load

Bus Activity displays a notion in the following logic

In case of BC + MultiRT – once Run button clicked.

In case of MultiRT only – once Run button clicked and activity detected on the bus.

Bus Load displays the current MuxBus load in %



6.1.7 Remote Terminal Simulation - RTs

RTs simulating can be achieved by selecting (checking) a specific RT on the Simulated Units row or selecting Sim All checkbox.

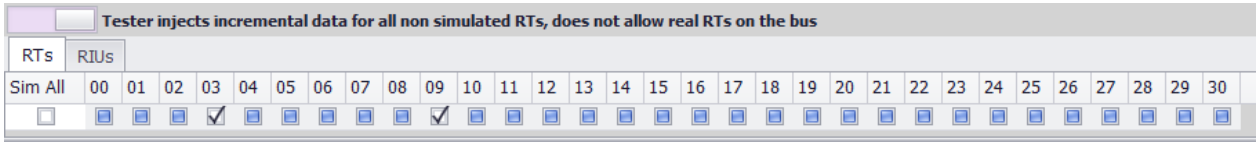
Once simulating a unit, the device “acts” as a unit and provides responses.

If the device is configured as MultiRT only and a command transmitted on the bus matches on of the messages currently running, the data will be reflected in the Simulator. For Rx messages, the data words will appear in this message and for Tx messages the transmitted data is taken from the Grid.

A unique feature of simulating units while injecting incremental data is also available.

For injecting data to unit/s, select (check) the Data Injection to be set to On and the desired RT to inject data must be checked.

The following figure shows RTs 3, 9 and 21 as simulated and data injection is on.

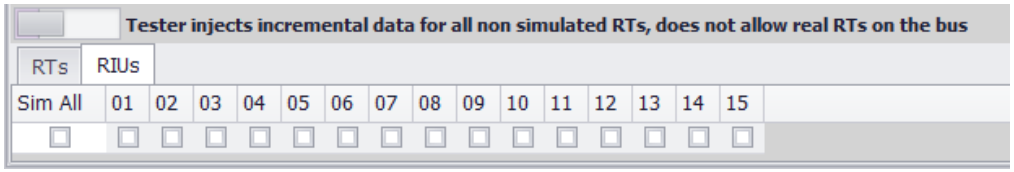


6.1.8 Remote Terminal Simulation – RIUs

RIUs simulating can be achieved by selecting (checking) a specific RIU on the Simulated Units row or selecting Sim All checkbox.

Once simulating a unit, the device “acts” as a unit and provides responses.

If the device is configured as MultiRT only and a command transmitted on the bus matches on of the messages currently running, the data will be reflected in the Simulator. For Rx messages, the data words will appear in this message and for Tx messages the transmitted data is taken from the Grid.

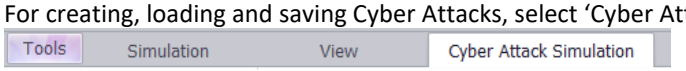


Note - Data injection is not implemented for PP194 protocol.

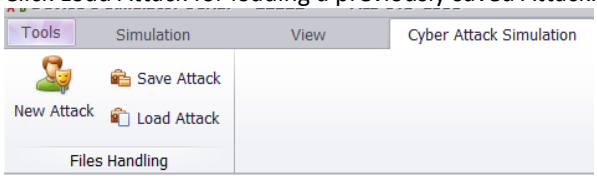
6.1.9 Cyber Attack Simulation

Note – Cyber Attack Simulation is a licensed feature, i.e. requires an elevated license in order to use this feature.
For additional info, contact support@sitaltech.com

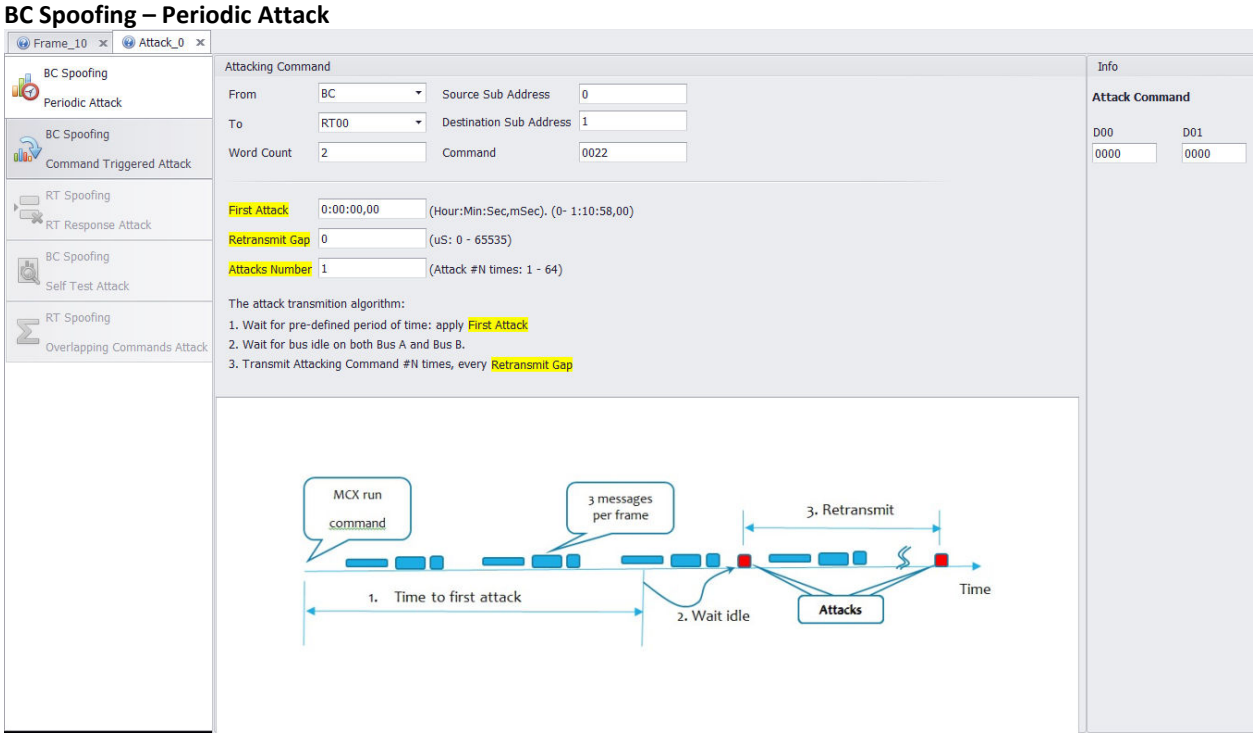
For creating, loading and saving Cyber Attacks, select 'Cyber Attack Simulation' tab.



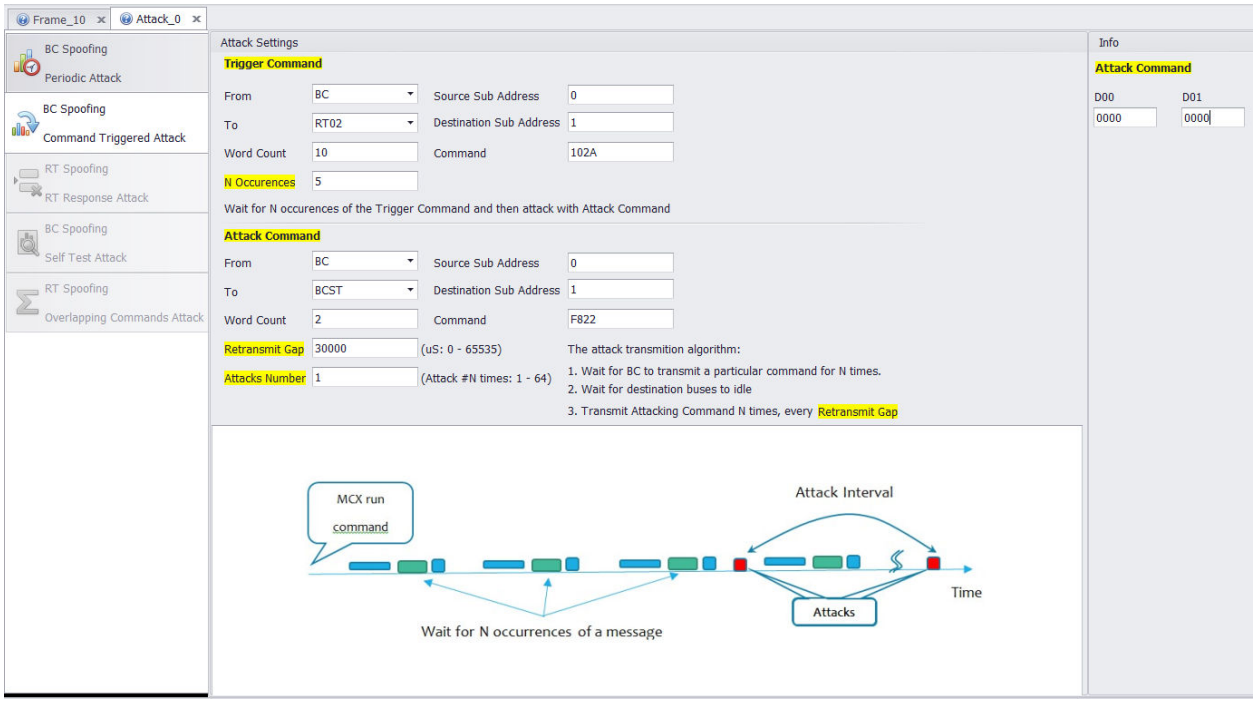
New Attack
Clicking new attack opens the Attacks dashboard. For running an Attack, select one of the available attacks, complete its parameters and hit Run button.
Note – Run button is common to Frames and Attacks.
Save Attack
Click the Save Attack for saving an Attack's parameters.
Load Attack
Click Load Attack for loading a previously saved Attack.



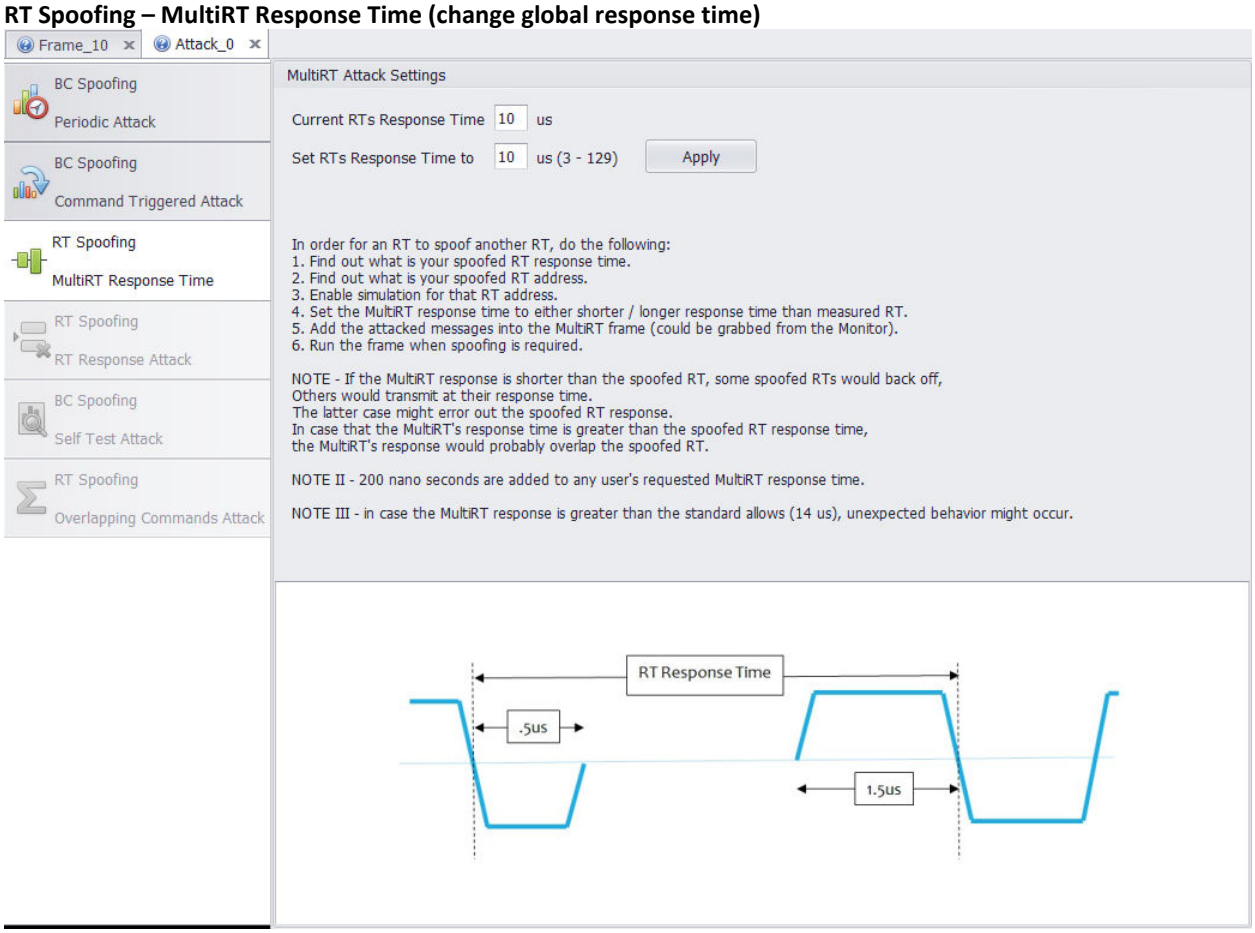
Note – for elaborated info about the different types of Attacks see in section 4.5.2 of this document.
BC Spoofing – Periodic Attack



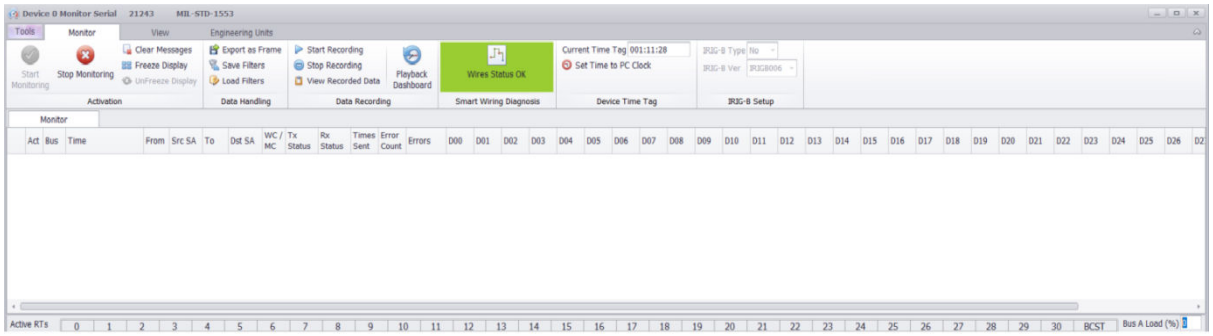
BC Spoofing – Command Triggered Attack



RT Spoofing – MultiRT Response Time (change global response time)



6.2 IRIG-B

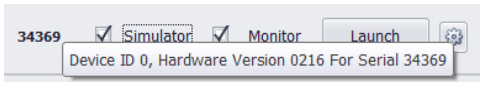


If IRIG_B Setup Group is enabled then IRIG-B protocol is supported on the device.
Type combo box chooses either to TX or RX the time which is presented in the Current Time Tag edit box.
In TX, the current time will be transmitted.
When on RX and an IRIG-B time signal is received and locked the current time Tag edit box will be updated with the received time and its back ground color will turn to green.

The Ver combo box determines the IRIG-B mode, IRIGB006, IRIGB126, IRIGB237.

6.3 H009

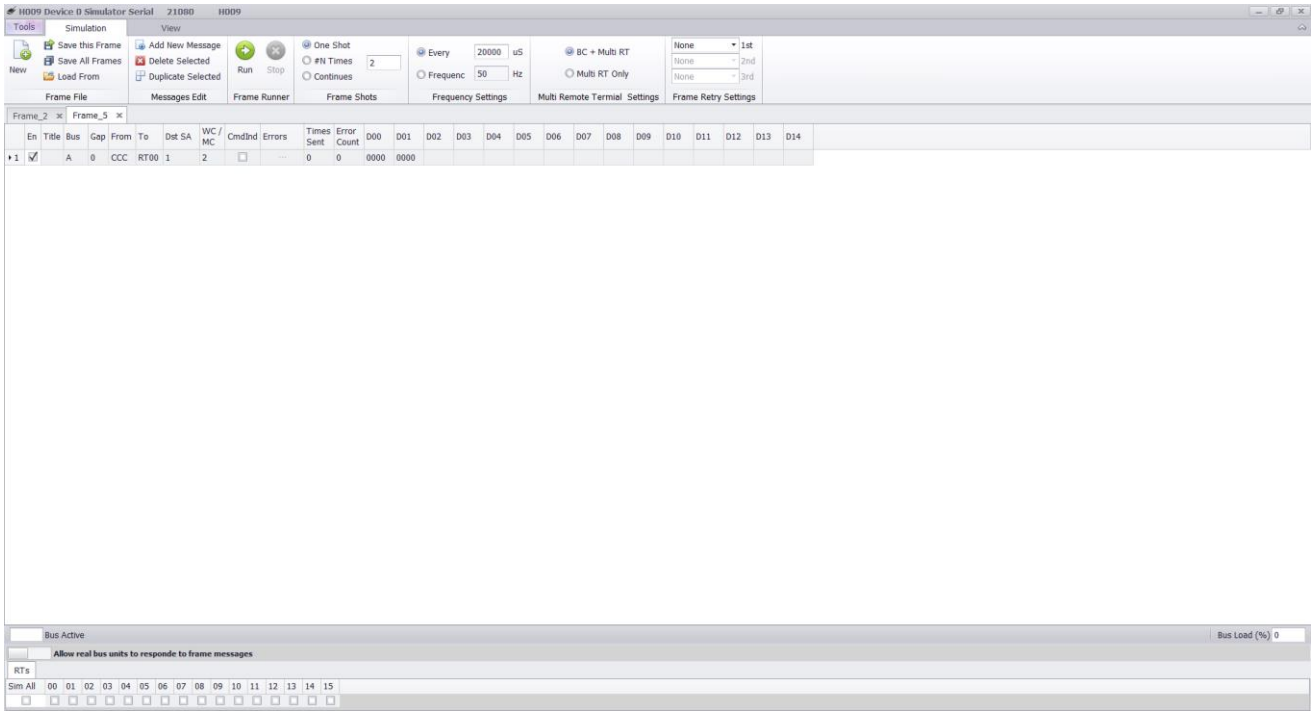
Note – as a default, the Composer opens with Mil-Std-1553 settings. Changing the configuration to H009 (or any other Protocol) is done via Configuration button:



6.3.1 Simulator Main Window

Default Simulator opens as described in Fig 1.

Fig 1

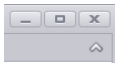


In order to run the default message; CCC to RT00, 2 words, simply click on Run button

On the Frame Runner buttons group.

The Simulator window header specifies the Device ID, Device Serial and the main running protocol.

The Tab Menus can be minimized or maximized via right pane button click:



6.3.2 Simulation Tab Menus

Frame File

New – creates a new Frame in a new tab with the default message settings.

Save this Frame – save the Frame focused in the current tab.

Note – all frames are saved to running folder (where the COMposer.exe is located) into Frames folder.

Save All Frames – iterate all Frame tabs currently opened in the application and save them.

Load From – opens a file browser allowing the user to select and open existing frame. The selected Frame will be opened in a new tab.

Messages Edit

Note – all the Messages Edit functionality and additional functionalities are available on the Data Grid Columns – Right Clicks menu, see below.

Add New Message – creates a new message in a new row of the Grid, on the focused Frame tab. The new message is created with default values.

Delete Selected – deletes the selected message. When few messages are selected, all the selected messages are deleted.

Note – a Frame must contain at least a single message, therefore the user can select N – 1 messages to delete.

Duplicate Selected – duplicate the selected message / s in new rows of currently focused Frame.

Frame Runner

Run - Runs the currently focused Frame. Once Run is clicked, the button turns disabled till Stop button is clicked.

Stop – Stops the currently running frame. Once the Stop is clicked, the button turns disabled till Run button is clicked.

Frame Shots

One Shot – Once Run pressed, the selected Frame runs Once.

N Times – Once Run pressed, the selected Frame runs specified iterations. The default value, 2, can be modified in the textbox.

Continues – Once Run pressed, the selected Frame runs infinitely till Stop is clicked.

Frequency Settings

Every - Frame shot every X microseconds. The default value of 20000 can be modified in the textbox.

Frequency – Frame shot in Hertz. The default value of 50 Hz can be modified in the textbox.

Multi Remote Terminal Settings

BC + Multi RT - sets the device to behave as Bus Controller and as all Remote Terminals.

Multi RT Only – sets the device to behave as Remote Terminal/s, expecting an external BC.

Frame Retry Settings

1st – sets a single retry on the same bus or on the opposite bus.

2nd – sets 2 retries on the same bus or on the opposite bus.

3rd – sets 3 retries on the same bus or on the opposite bus.

6.3.3 View Tab Menus

Messages Table View

Best Fit Columns – sets the Simulator's columns width to fit title and content.

Narrow Columns – minimize the columns width every button click.

Enlarge Columns – enlarges the columns width every button click.

Monitor

Launch Monitor – once clicked, launches the paired Monitor of currently selected Device ID and serial tester.

6.3.4 Data Grid Columns – Data Editing

En – enabled / included in the Frame to run.

Title – optional text description for a message.

Bus – bus A or B on which the message will run on.

Gap – specifies a gap in milliseconds between previous message to selected message within this Frame.

From – source can be CCC any of the RTs.

To – destination can be CCC or any of the RTs.

Dst SA – destination sub address. In case of RT selected, specify the source sub address in this field.

WC / MC – WC => word count.

Errors – for reported standard protocols errors, this field will contain a button that once clicked will pop errors descriptions. See Fig 2.

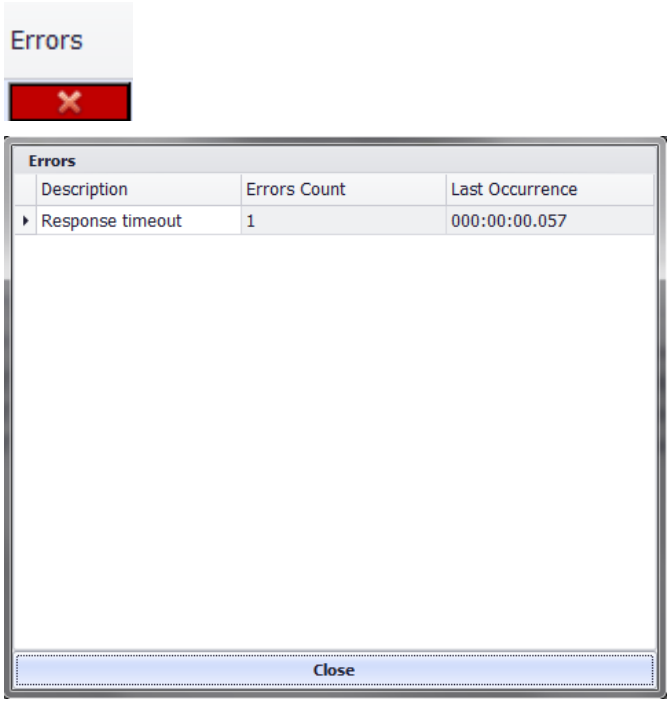
CmdInd – command indicator (on = checked/off = unchecked).

Times Sent – displays the number of times this message was transmitted per Run click.

Error Count – counts the number of errors detected without opening the Errors window.

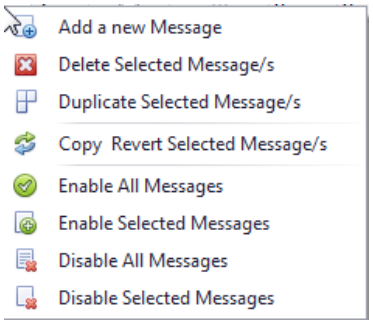
D0 – D14 – 15 data words. The data can be manually edited for each column, the number of words for each message is determined by the WC field.

Fig 2.



6.3.5 Data Grid Columns - Right Clicks

Data Editing – the following options are available once right click on message cells En to Error Count



Add New Message – creates a new message in a new row of the Grid, on the focused Frame tab. The new message is created with default values.

Delete Selected – deletes the selected message. When few messages are selected, all the selected messages are deleted.

Duplicate Selected – duplicate the selected message / s in new rows of currently focused Frame.

Copy and Revert Selected Message/s – creates a new message with inverted fields from the selected message/s, i.e. the new message created contains in From and To and Dst SA fields and so on.

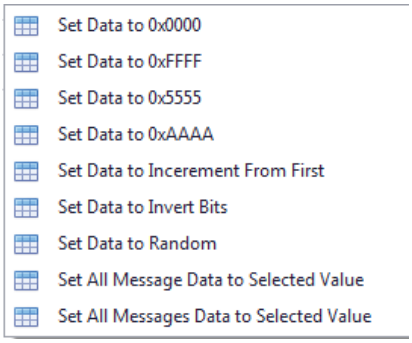
Enable All Messages – checks all available messages at En (enabled) column.

Enable Selected Messages – checks all selected messages at En (enabled) column.

Disable All Messages – un-checks all available messages at En (enabled) column.

Disable Selected Messages – un-checks all selected messages at En (enabled) colu

Data Words Editing – the following options are available once right click on message cells D0 to D14.



Set Data to 0x0000 – set all data words to 0000.

Set Data to 0xFFFF – set all data words to FFFF.

Set Data to 0x5555 – set all data words to 5555.

Set Data to 0xAAAA – set all data words to AAAA.

Set Data to Incremental From First – set incremental data starting from D0. For example, if D0 = 0x000B, D1 will be 0x000C, D2 0x000D and so on.

Set Data to Invert Bits – flips the bits for all data words columns. For example if D0 = 0x000B, after clicking this option D0 = 0xFFF4.

Set Data To Random – set all data words columns with random data.

Set All Message Data to Selected Value – set all the selected message data words to the selected value.

Set all Messages Data to Selected Value – set all messages in the Frame data words to the selected value.

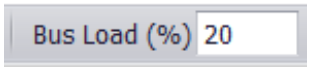
6.3.6 Bus Activity & Bus Load

Bus Activity displays a notion in the following logic

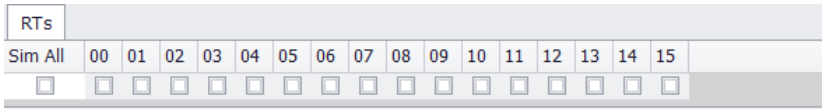
In case of BC + MultiRT – once Run button clicked.

In case of MultiRT only – once Run button clicked and activity detected on the bus.

Bus Load displays the current MuxBus load in %



6.3.7 Remote Terminal Simulation - RTs



RTs simulating can be achieved by selecting (checking) a specific RT on the Simulated Units row or selecting Sim All checkbox.

Once simulating a unit, the device “acts” as a unit and provides responses.

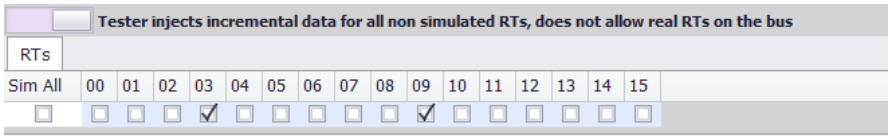
If the device is configured as MultiRT only and a command transmitted on the bus matches on of the messages currently running, the data will be reflected in the Simulator. For Rx

messages, the data words will appear in this message and for Tx messages the transmitted data is taken from the Grid.

A unique feature of simulating units while injecting incremental data is also available.

For injecting data to unit/s, select (check) the Data Injection to be set to On and the desired RT to inject data must be checked.

The following figure shows RTs 3 and 9 simulated and data injection is on.



7 COMposer – Monitor

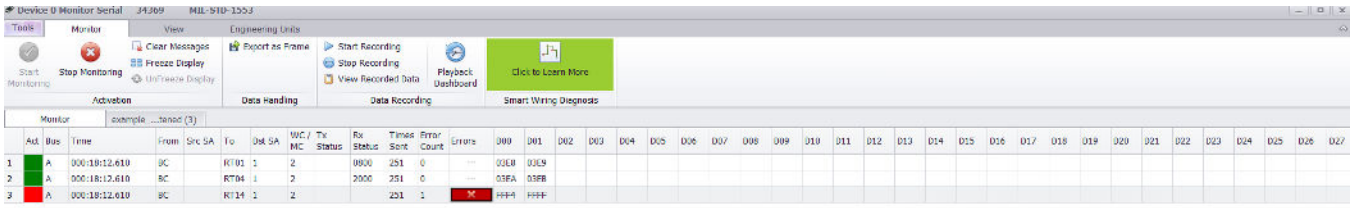
7.1 MIL-STD-1553 & PP194

7.1.1 Monitor Main Window

The main Monitor's window displays messages that are running on the bus, see Fig 8. The Monitor is a listener; it does not perform any activity on the bus.

The Monitor window header displays the Device ID and Device Serial.

Fig 8.



Active messages are marked with Green activity indication while messages that contain errors are marked in Red.

If a message detected as containing errors in previous runs and the error does not exist anymore, this message is marked with Yellow.

In any case, any detected error is reported in the message's Errors column. Clicking the Error button will open Errors window containing information for all detected errors.

7.1.2 Monitor Tab

Activation

Start Monitoring – the Monitor application is updating the messages and continues the polling / listening to the bus. This is the default Monitor state.

Stop Monitoring – the Monito application is not updating the messages but continues the polling / listening to the bus. Once continuing the Monitor (using Start Monitor) the messages data, count and errors is accumulated.

Clear Messages – clear all rows in the monitor table. Does not stop listening to the bus.

Freeze Display – the Monitor application stops polling / listening to the bus.

UnFreeze Display – the Monitor application returns polling / listening to the bus.

Data Handling

Export as Frame – export the currently visible messages as a single Frame file (in .xml file). The exported Frame can be imported in the Simulator.

Data Recording

Start Recording – creates a text file with currently running data. The recorded text filename is in the following structure - Monitor_Device_<ID>_Data_YYYY-MM-DD_HH-MM-SS.txt.

Note – each recorded data file size is limited to 10Mb. Once 10Mb size is reached, a new file is created in the background, no user action needed.

Stop Recording – stop currently recording of the text file.

View Recorded Data – open the data files location in a file browser.

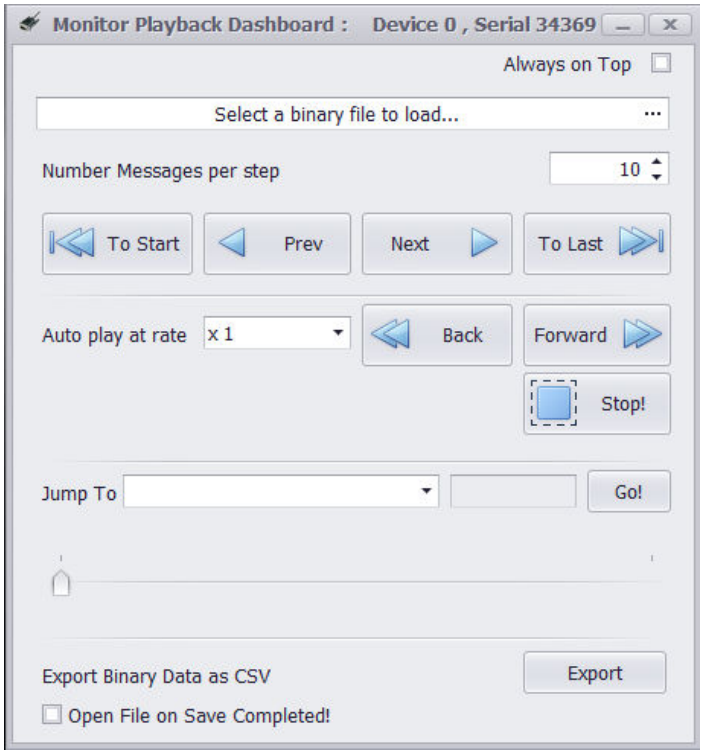
Note – recorded files can be found in - C:\Sital\COMposer\COMposer_<SOFTWARE VERSION>\Binaries\Data\

Playback Dashboard- launch the Playback Dashboard window, see image below.

The playback Dashboard can load and play binary files (.bin files).

Note – the binary files are recorded from the Launching Window, see Launching Window section. In order to record large and raw data in relatively small files, binary data is recorded.

The text files mentioned above cannot be played in this Playback window.



Always on Top – keeps the Playback window as top most.

Select a binary file to load… - clicking on the most right button (marked with …) will open the saved binary files in files browser.

Number of Messages per step – defines the step size for Next and Previous actions.

To Start – jump to the first messages in the binary file.

Prev – jump one step back (#N messages as defined in Number of Messages per step.)

Next – jump one step forward (#N messages as defined in Number of Messages per step.)

To Last – jump to the last messages in the binary file.

Auto play at rate – sets the numbers of jumps per second

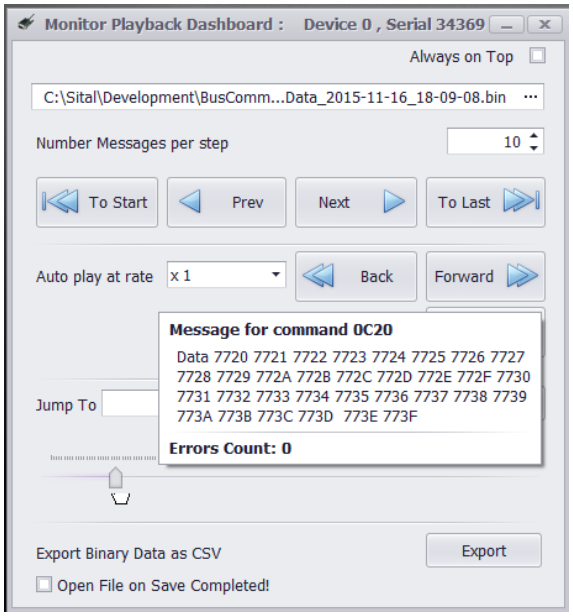
Back – automatically play back at the selected rate.

Forward – automatically play forward at the selected rate.

Stop – stop automatic play.

Jump To – on clicking Go! Button, jump to instance defined by selection of: First Error | Last Error | First Command Instance | Last Command Instance | Data Equals to (typed text in the textbox).

Quick Jump To – provides a quick access to a saved data message from the file. The data can be view in a tool tip once scrolling right / left.



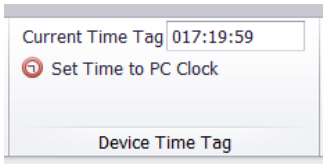
Export Binary Data as CSV – export the binary data in a CSV format.

Open File on Save Completed – once checked, opens the exported CSV file after export is done.

Smart Wiring Diagnostic

TBD

Device Time Tag



The Time Tag default display contains the time elapsed from the Tester's power-up in the following format; HHH:MM:SS.

The Time Tag can be synchronized to PC's clock by clicking the 'Set Time to PC Clock' button.

7.1.3 View Tab

Messages Table View

Best Fit Columns – sets the Simulator's columns width to fit title and content.

Narrow Columns – minimize the columns width every button click.

Enlarge Columns – enlarges the columns width every button click.

Group View – display the messages as grouped: once a message is detected on the bus, if the same command already exists on the visible messages, the times sent and errors are accumulated, the data is updated.

Note – the Monitor default display.

Stacked View – each message detected on the bus is displayed in a new row. The most recent messages are displayed on the table top (each new message is inserted to the first line) and scrolling is enabled.

Note – switching from group view to stacked view clears the Monitor messages.

Simulator

Launch Simulator – once clicked, launches the paired Simulator of currently selected Device ID and serial tester.

Pp194 Monitor

When checked, show monitor messages of pp194 protocol.

7.1.4 Engineering Units Tab

Engineering Units displays data in a parsed, user friendly and accessible way. Once defining an EU, the defined bits from a message's data are displayed in a textual manner in the EU table.

For example, lower 8 bits of a data word can represent Height in Feet and the high 8 bits can represent Longitude in Degrees.

It is possible to import Exalt Plus™ by Excalibur Systems™ Engineering Units xml file in order to display, edit it for further activities.

NOTE – the Engineering Units is a licensed feature.

Note II – all in-table activations and actions are done using right-click menus.

Workflow

- Load Engineering Units Template

- Save As in order to apply current changes and rename the working configuration.

  Note that 'Save' and 'Save As' can be performed at any stage of working with the Engineering Units.
- Add Commands / RTs definitions by Messages
- Add Engineering Unit/s
- Edit created Unit/s as needed
- Add Graphs and/or Gauges to Engineering Unit/s

Loading and Saving – Activation Group

For the initial usage, load the Engineering Units Template xml file; EuTemplate.xml. Press the 'Load From' button on the top left menu as shown in Fig 9.1 below.

Once template loaded, RTs list will be displayed on the left pane, see Fig 9.2.

Fig 9.1

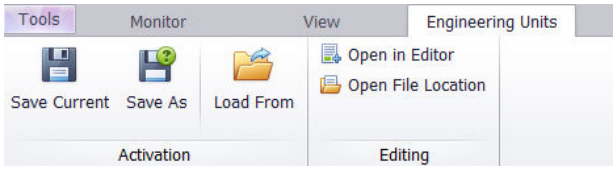


Fig 9.2

The file is located in folder: 'C:\Sital\COMposer\COMposer_<version number>\Binaries\EngineeringUnits\'

Save Button – save the recent additions and editing to current file in use.

Save As Button – save the recent additions and editing under a new name to a new file.

Creating

On the left pane, Right click on the selected RT, for example, RT6 (For the purpose of this user manual, Remote Terminal 6 is used).

Select 'Add / Edit Message Properties' option as shown in Fig 9.3. A new 'Command Editor' window will open, see Fig 9.4.

Command Editor

Insert details to RT Name, Sub Address Name and Message Name and press on 'Apply' or 'Apply and New EU' button.

Apply button – Adding the specified details to the tree in the left pane. The Command Editor window remains opened for additional editing.

Apply and New EU button - Adding the specified details to the tree in the left pane and an 'Engineering Unit Editor' window opens enabling creation of Engineering Unit/s.

Engineering Unit Editor

On the EU table, the following properties are displayed: Name, Value (real time live data), Units (property – Display Unit) and Time (real time live data). See Fig 9.6 below.

Apply and Close button – applies edited or added data to the specified EU into the table and it's filtered properties. Once closing the EU Editor, it is possible to continue working with the Command Editor that remained opened.

Apply and New EU button – clears all previous fields and properties in order to prepare new data to be applied.

Cancel button – cancels all recent changes and closes the EU Editor window.

Name property – a Name of the EU. Each EU within a Message Type must have a unique name.

Description property – [Optional] Description of the EU.

Type property - Value type. Available options are: Integer, Unsigned, Sign & magnitude, BCD (Binary Coded Decimal), Floating Point IEEE, String, Discrete 1 Bit, and Discrete 2 Bit.

Word property - This field determines in which word of the message the EU begins (0–31 or 1–32). An EU can span two words.

Bit property - determines in which bit of the word, the EU begins (0–15).

Length property – the Length of the EU in bits. The available lengths vary depending on the selection in the Type field.

Radix property - Numeric base value. Available options are: decimal, hex, binary, octal.

Scale property - [Optional] Raw data is multiplied by this number before displaying the EU value.

Offset property - [Optional] This number is added to the raw data before displaying the EU value.

Base Unit property - [Optional] Unit of the raw data, for example, Feet.

Display Unit property - [Optional] Unit for display purposes, for example, Meters.

Value/Discrete property -Whether the data is a value or a discrete. A discrete is a name for a value or range of values. To configure discrete ranges, click Discrete. Available options are: Value and Discrete.

Display Range Low - Lowest value to display on graphs.

Display Range High - Highest value to display on graphs.

Alarm Low - [Optional] Low value for alarm.

Alarm High - [Optional] High value for alarm.

Alarm Type - [Optional] This field determines whether the alarm values are within the Low and High values, or outside of these values. Available options are: Within Limits and Out of Limits.

Discretes

Click on Discretes button launches the Discretes Editor window, see Fig 9.7.

In order to add a discrete, click the '+' button and in order to remove a discrete, focus a line in the discretes table and click the 'X' button. For saving edited data, press 'Done' button that will save changes and close the Discretes Editor window.

Once selecting to display data by specified discretes, on Discretes Editor specified value hit, the specified Description is shown in the EU table.

Fig 9.3

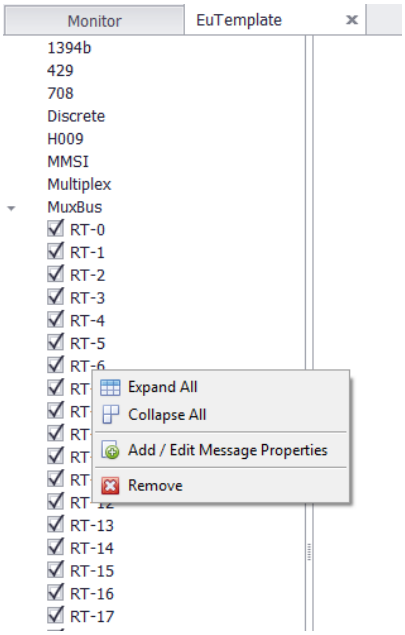


Fig 9.4

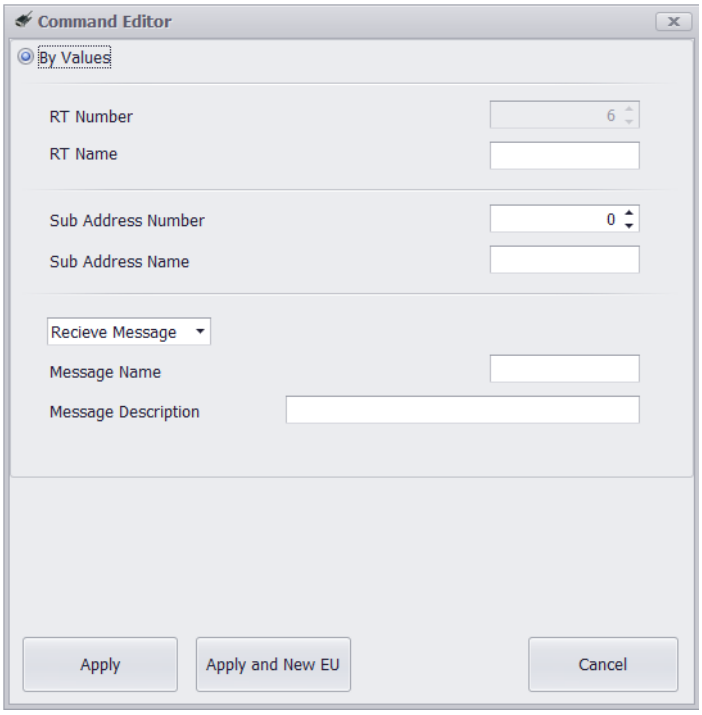


Fig 9.5

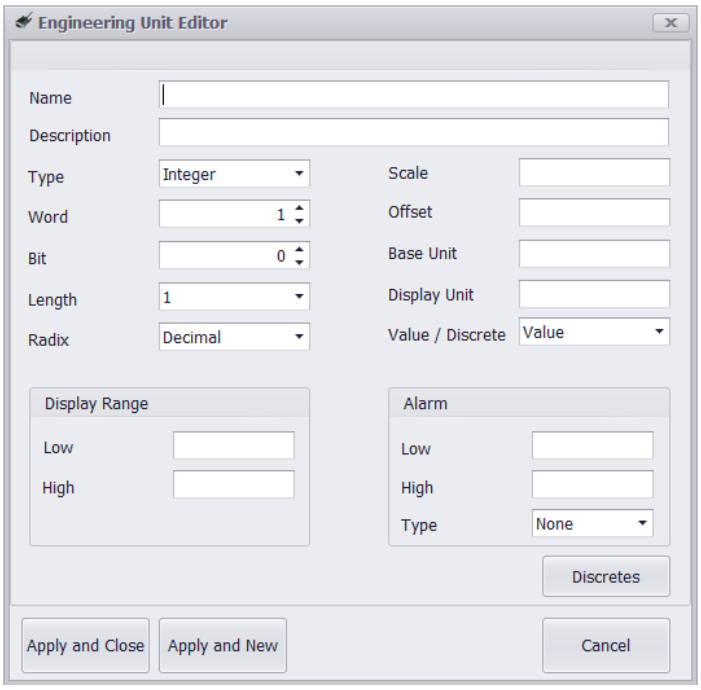

Engineering Unit Editor
Name
Description
Type
Integer
Word
1
Bit
0
Length
1
Radix
Decimal
Scale
Offset
Base Unit
Display Unit
Value / Discrete
Value
Display Range
Low
High
Alarm
Low
High
Type
None
Discretes
Apply and Close
Apply and New
Cancel

Fig 9.6

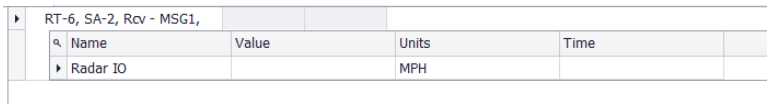
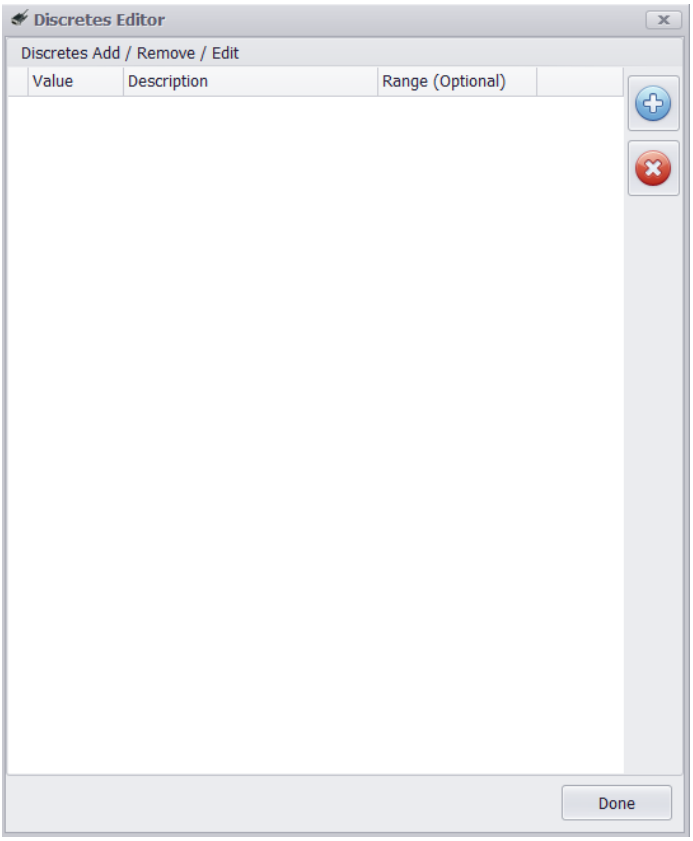

RT-6, SA-2, Rcv - MSG1,
Name
Value
Units
Time
Radar IO
MPH

Fig 9.7


Discretes Editor
Discretes Add / Remove / Edit
Value
Description
Range (Optional)
Done

Editing

Editing Command

Right click on the left pane items on RT or Sub Address (SA) or Message direction (Transmit or Receive) [Fig 10 below] and press on 'Add / Edit Message Properties'. On selection, the Command Editor window opens allowing editing. After applying changes to properties, press Apply button in order to save it. Pressing Cancel will discard all changes.

Editing Engineering Unit

Right click on the left pane EU item [Fig 10.1 below] and press on 'Edit Engineering Unit'. On selection, the Engineering Unit Editor window opens allowing editing. Press Apply and Close in order to save changes. Clocking the Cancel button will discard all recent changes.

Fig 10

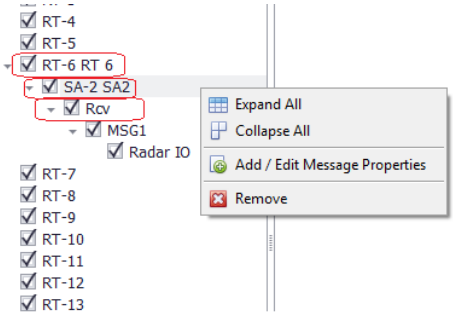
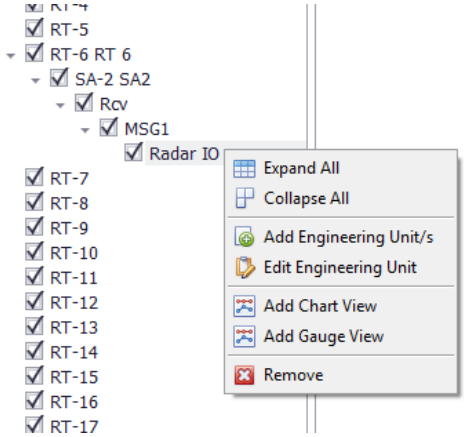


Fig 10.1



Charts and Gauges

The purpose of the Gauges and Charts is to display an Engineering Unit value changes over time.

In order to create a Gauge or a Chart, right click on EU (Engineering Unit) and click on the desired display format, see Fig 11.

For saving created Graphs and Charts, click Save button on top menu.

Charts

Displays in a floating window the EU over time [Fig 11.1]. In order to view a specific detail, hover with cursor over the Chart and the values will appear in a tool tip.

Removing a chart is done by clicking the 'Remove and Delete this View' button located at the bottom of each Chart window.

Gauges

Displays in a floating window the EU over time [Fig 11.2].

Removing a chart is done by clicking the 'Remove and Delete this View' button located at the bottom of each Chart window.

Fig 11

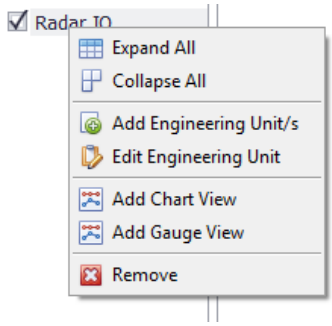


Fig 11.1

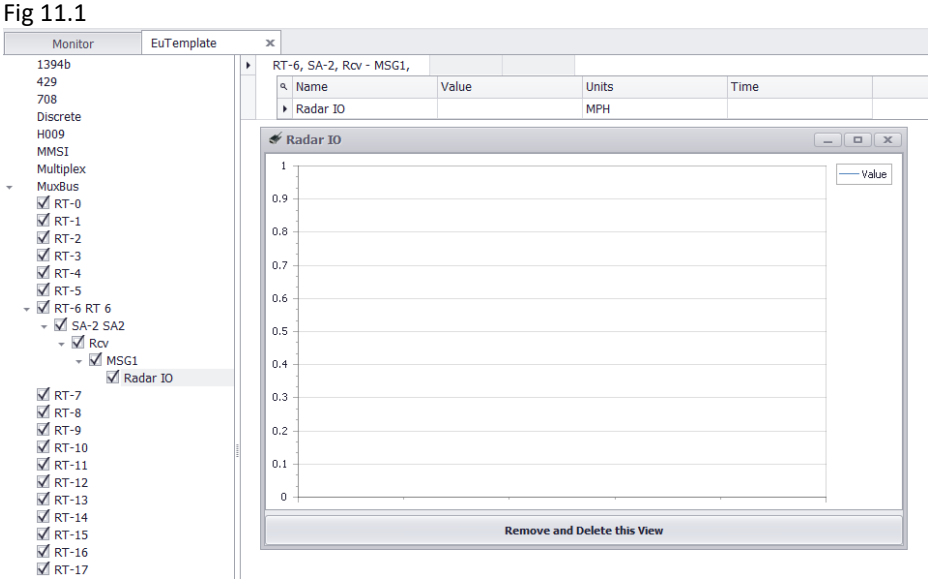
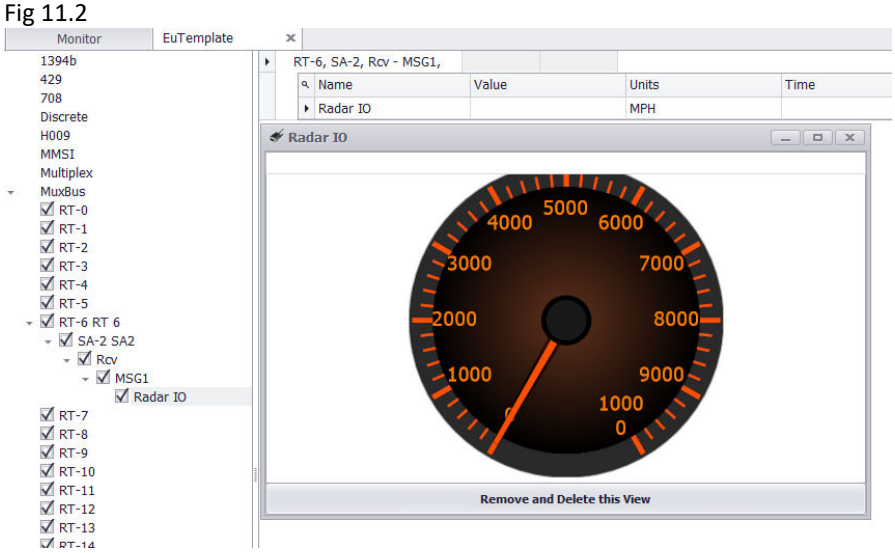


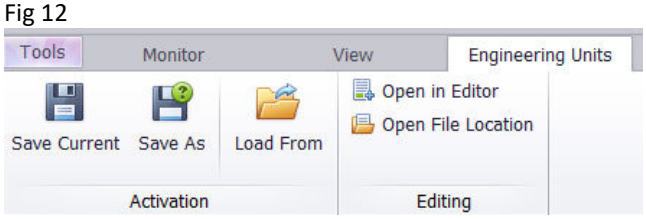
Fig 11.2



Editing Group

On top menu of Editing Group, see Fig 12, there are two useful buttons:
Open in Editor – opens the saved Engineering Units xml file in default editor (such as Note Pad) in order to view existing data.
Open File Location – opens the folder where the saved Engineering Units xml file is located.

Fig 12



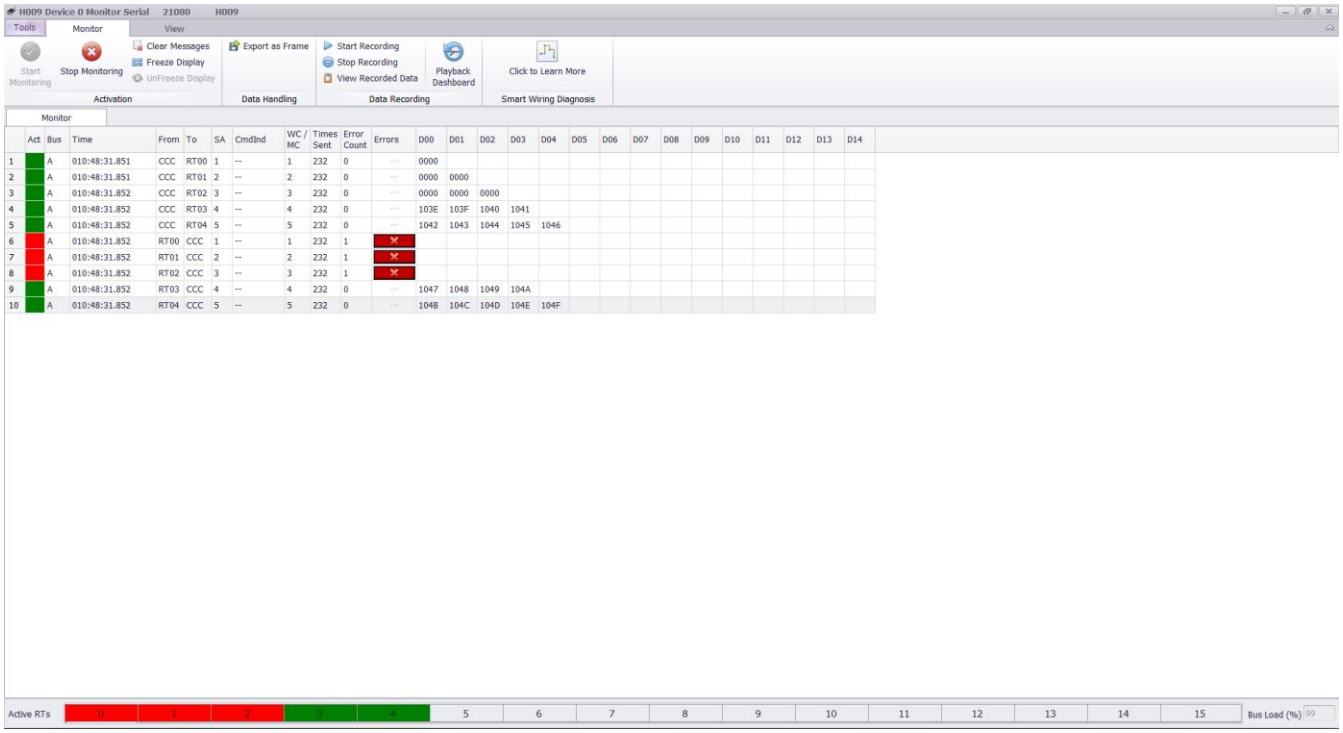
7.2 H009

7.2.1 Monitor Main Window

The main Monitor's window displays messages that are running on the bus, see Fig 8. The Monitor is a listener; it does not perform any activity on the bus.

The Monitor window header displays the Device ID and Device Serial.

Fig 8.



Active messages are marked with Green activity indication while messages that contain errors are marked in Red.

If a message detected as containing errors in previous runs and the error does not exist anymore, this message is marked with Yellow.

In any case, any detected error is reported in the message's Errors column. Clicking the Error button will open Errors window containing information for all detected errors.

7.2.2 Monitor Tab

Activation

Start Monitoring – the Monitor application is updating the messages and continues the polling / listening to the bus. This is the default Monitor state.

Stop Monitoring – the Monito application is not updating the messages but continues the polling / listening to the bus. Once continuing the Monitor (using Start Monitor) the messages data, count and errors is accumulated.

Clear Messages – clear all rows in the monitor table. Does not stop listening to the bus.

Freeze Display – the Monitor application stops polling / listening to the bus.

UnFreeze Display – the Monitor application returns polling / listening to the bus.

Data Handling

Export as Frame – export the currently visible messages as a single Frame file (in .xml file). The exported Frame can be imported in the Simulator.

Data Recording

Start Recording – creates a text file with currently running data. The recorded text filename is in the following structure – Monitor_H009_Device_<ID>_Data_YYYY-MM-DD_HH-MM-SS.txt.

Note – each recorded data file size is limited to 10Mb. Once 10Mb size is reached, a new file is created in the background, no user action needed.

Stop Recording – stop currently recording of the text file.

View Recorded Data – open the data files location in a file browser.

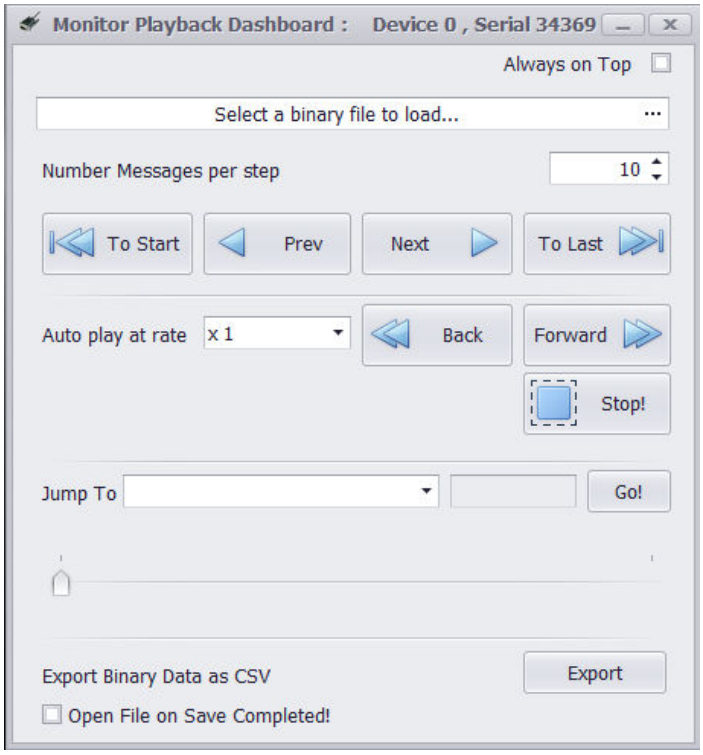
Note – recorded files can be found in - C:\Sital\COMposer\COMposer_<SOFTWARE VERSION>\Binaries\Data\

Playback Dashboard- launch the Playback Dashboard window, see image below.

The playback Dashboard can load and play binary files (.bin files).

Note – the binary files are recorded from the Launching Window, see Launching Window section. In order to record large and raw data in relatively small files, binary data is recorded.

The text files mentioned above cannot be played in this Playback window.



Always on Top – keeps the Playback window as top most.

Select a binary file to load… - clicking on the most right button (marked with …) will open the saved binary files in files browser.

Number of Messages per step – defines the step size for Next and Previous actions.

To Start – jump to the first messages in the binary file.

Prev – jump one step back (#N messages as defined in Number of Messages per step.)

Next – jump one step forward (#N messages as defined in Number of Messages per step.)

To Last – jump to the last messages in the binary file.

Auto play at rate – sets the numbers of jumps per second

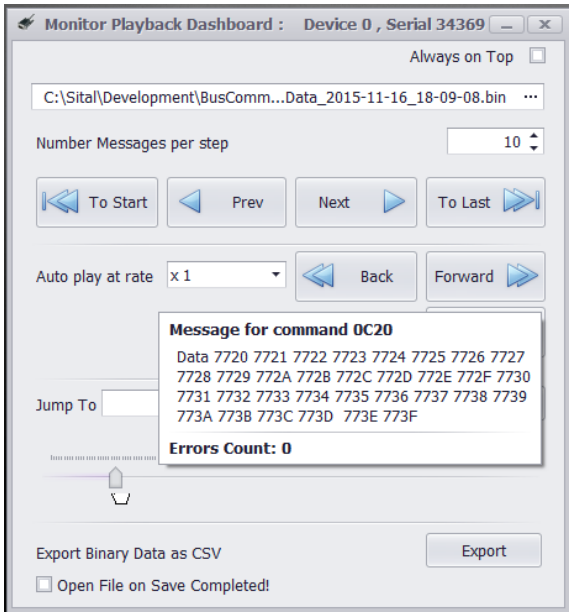
Back – automatically play back at the selected rate.

Forward – automatically play forward at the selected rate.

Stop – stop automatic play.

Jump To – on clicking Go! Button, jump to instance defined by selection of: First Error | Last Error | First Command Instance | Last Command Instance | Data Equals to (typed text in the textbox).

Quick Jump To – provides a quick access to a saved data message from the file. The data can be view in a tool tip once scrolling right / left.



Export Binary Data as CSV – export the binary data in a CSV format.

Open File on Save Completed – once checked, opens the exported CSV file after export is done.

Smart Wiring Diagnostic

TBD

7.2.3 View Tab

Messages Table View

Best Fit Columns – sets the Simulator's columns width to fit title and content.

Narrow Columns – minimize the columns width every button click.

Enlarge Columns – enlarges the columns width every button click.

Group View – display the messages as grouped: once a message is detected on the bus, if the same command already exists on the visible messages, the times sent and errors are accumulated, the data is updated.

Note – the Monitor default display.

Stacked View – each message detected on the bus is displayed in a new row. The most recent messages are displayed on the table top (each new message is inserted to the first line) and scrolling is enabled.

Note – switching from group view to stacked view clears the Monitor messages.

Simulator

Launch Simulator – once clicked, launches the paired Simulator of currently selected Device ID and serial tester.

Pp194 Monitor

When checked, show monitor messages of pp194 protocol.

7.2.4 Engineering Units Tab

Activation

TBD

Editing

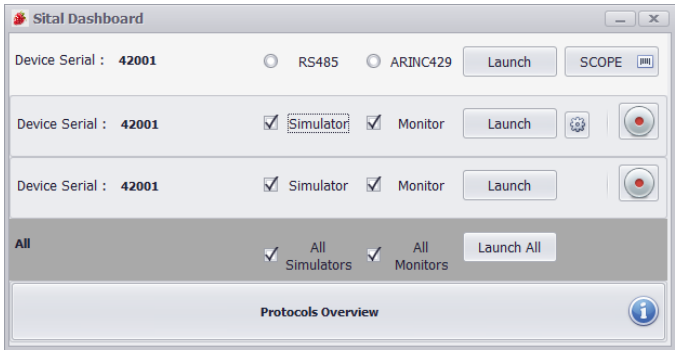
TBD

8 RS485 TESTER'S MODULES

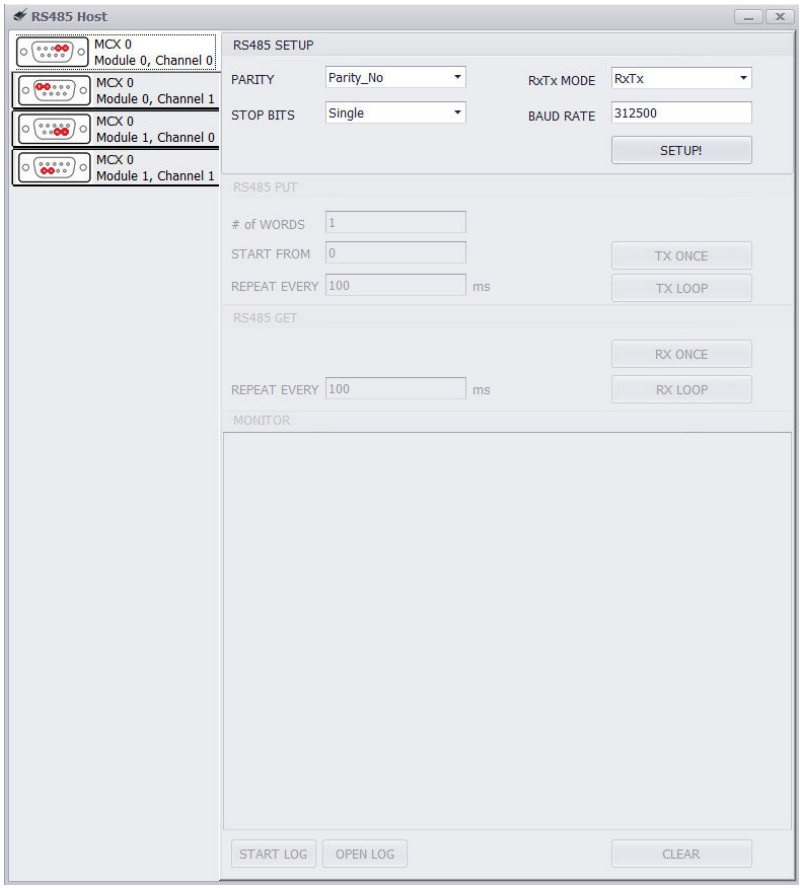
8.1 Activation

On the COMposer Dashboard, a new group is added (starting from Composer Version 4.3.1.12 and for Licensed Devices).

Fig 1



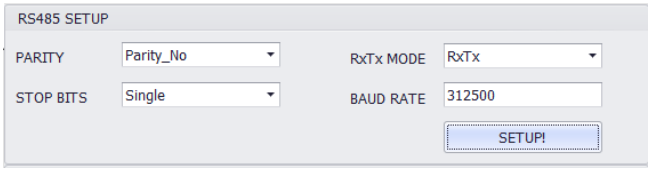
For opening the RS485 Host panel, check the 'RS485' radio button as shown in Fig 1 above and click Launch. The RS485 Host window will open.



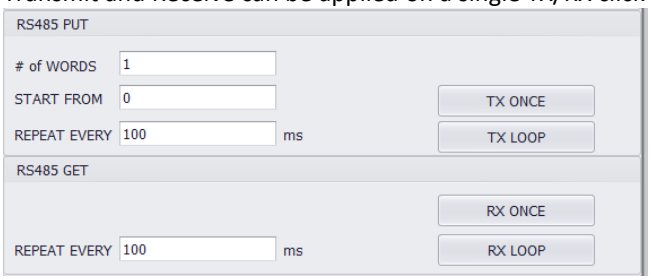
NOTE – since RS485 window cannot run alongside other windows, in case that other windows (Simulator, Monitor, etc.) are opened, a popup message waning that all opened windows will be closed will be shown.

8.2 SETUP and TX RX

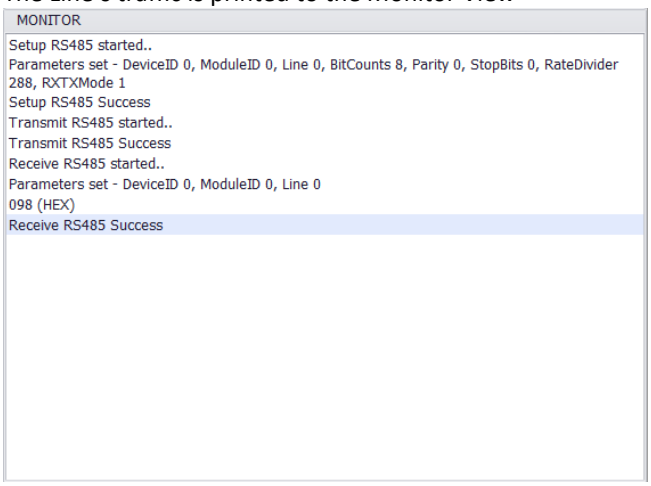
The work with each of the Lines should start with setting up the desired RS485 configuration and press SETUP button.



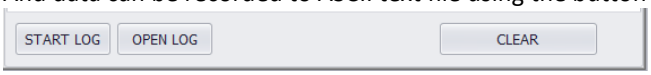
The Setup can be modified later on by changing each of the values and applying by clicking on SETUP button again.
Transmit and Receive can be applied on a single TX/RX click or by iterating in Loops.



The Line's traffic is printed to the Monitor View



And data can be recorded to ASCII text file using the button below.

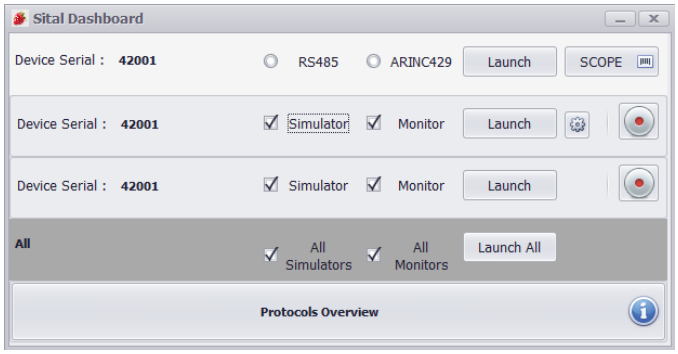


9 Arinc429 Channels

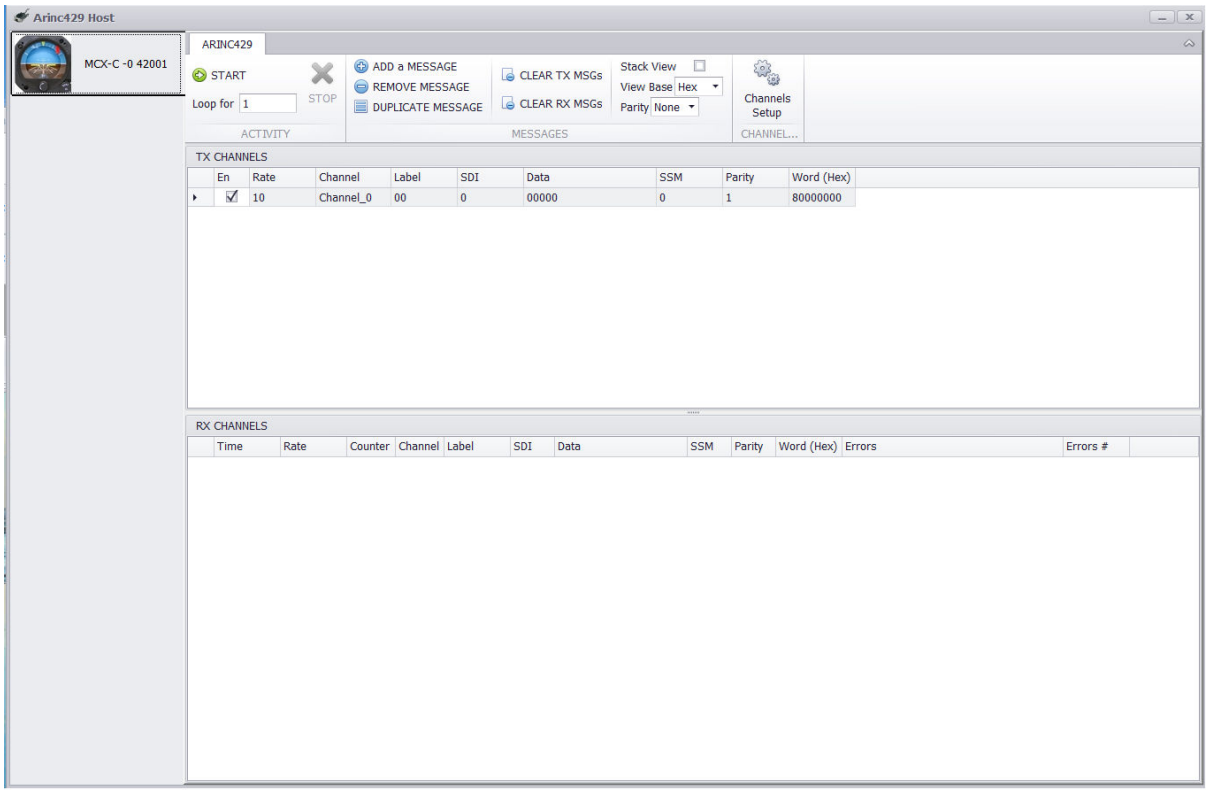
9.1 Activation

On the COMposer Dashboard, a new group is added (starting from Composer Version 4.3.1.12 and for Licensed Devices).

Fig 1



For opening the Arinc429 panel, check the 'ARINC429' radio button as shown in Fig 1 above and click Launch. The Arinc429 window will open.



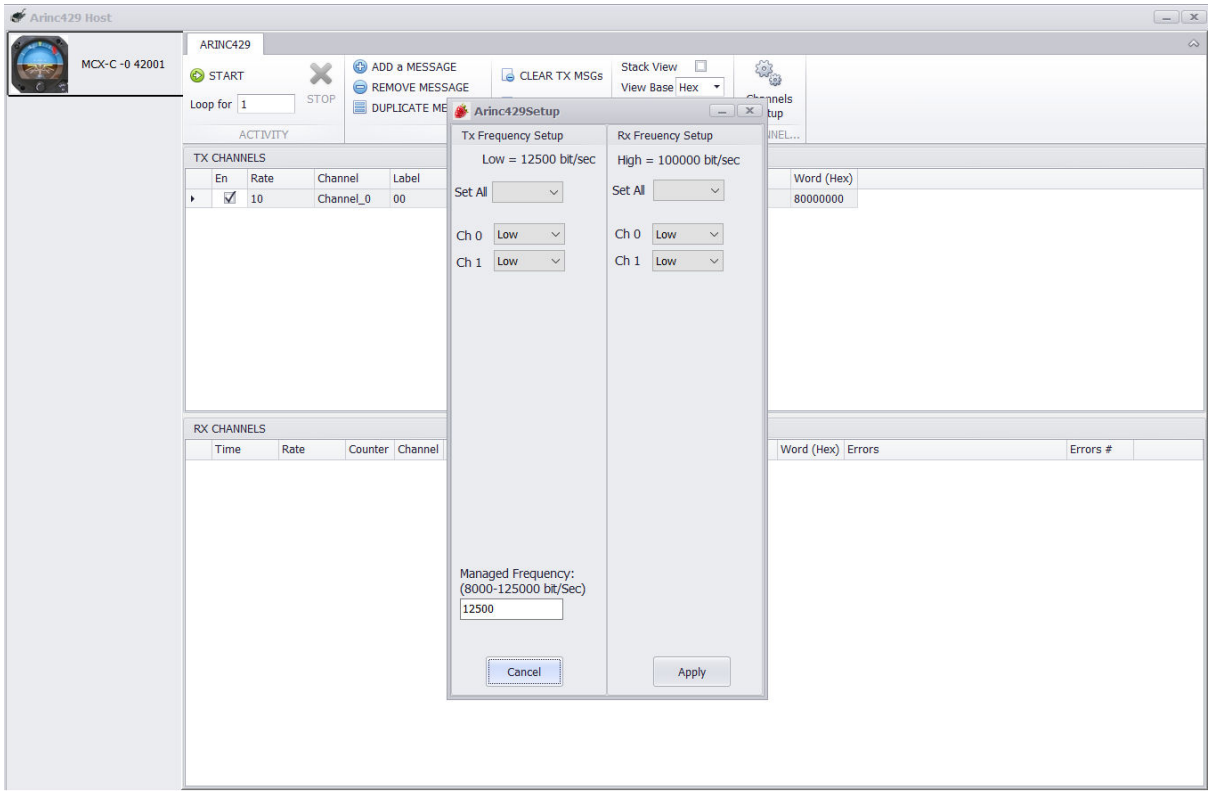
NOTE – since Arinc429 window cannot run alongside other windows, in case that other windows (Simulator, Monitor, etc.) are opened, a popup message warning that all opened windows will be closed will be shown.

9.2 Setup and transmissions

The MultiComBox C (MCX C) contains 4 Arinc429 channels, 2 Tx channels and 2 Rx channels.
On opening the Arinc429 window, the Rx Channels are being monitored.

Detected Arinc429 messages from Rx channels are displayed in the lower panel of the window in 'RX CHANNELS' section.

Each message is added to a new row.
Closing the Arinc429 window will also stop the Rx channels monitoring.



For TX channels, each of the Arinc429 messages is transmitted in loop (0 for infinite loop).

Rx messages can be viewed in one line per channel or Stack View (new line for each message).

View Base – The message's Label and Data can be viewed in Binary, Octal or Hex bases.

Parity Mode is defined (not using parity or Even or Odd), if using parity each message's parity can be set.

TX Rate column indicates the number of messages per sec (Hz).

RX Rate column is a calculated rate of the actual received messages.

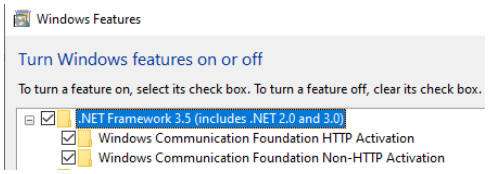
In channel Setup:

Each channel's frequency can be set to High (100kbit/sec) or Low (12.5kbit/sec) and TX channel's frequency can be managed, in this case its frequency can be set manually in the text box (8000 – 125000 bit / sec).

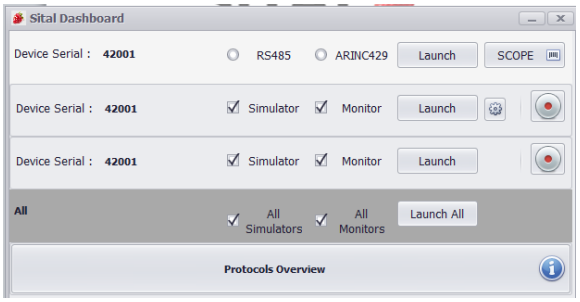
9.3 Oscilloscope (Scope)

The Scope is a licensed feature available in Composer v4.3.1.18 and up, for MultiComBox C tester.
The Scope monitors live data for MIL-STD-1553, RS485 and Arinc429 and can run simultaneously with each.

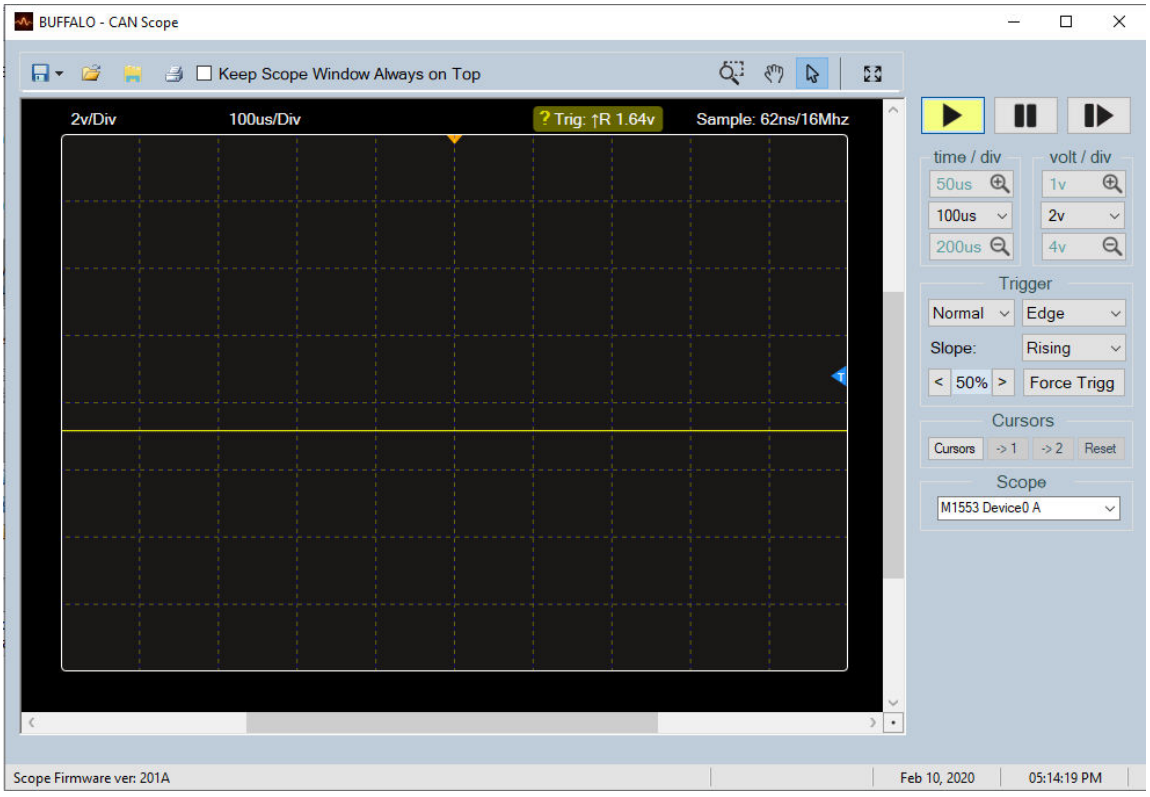
NOTE – pre-requisite for running the Scope -> ALL features of .NET 3.5 should be enabled on the PC running the Composer application:



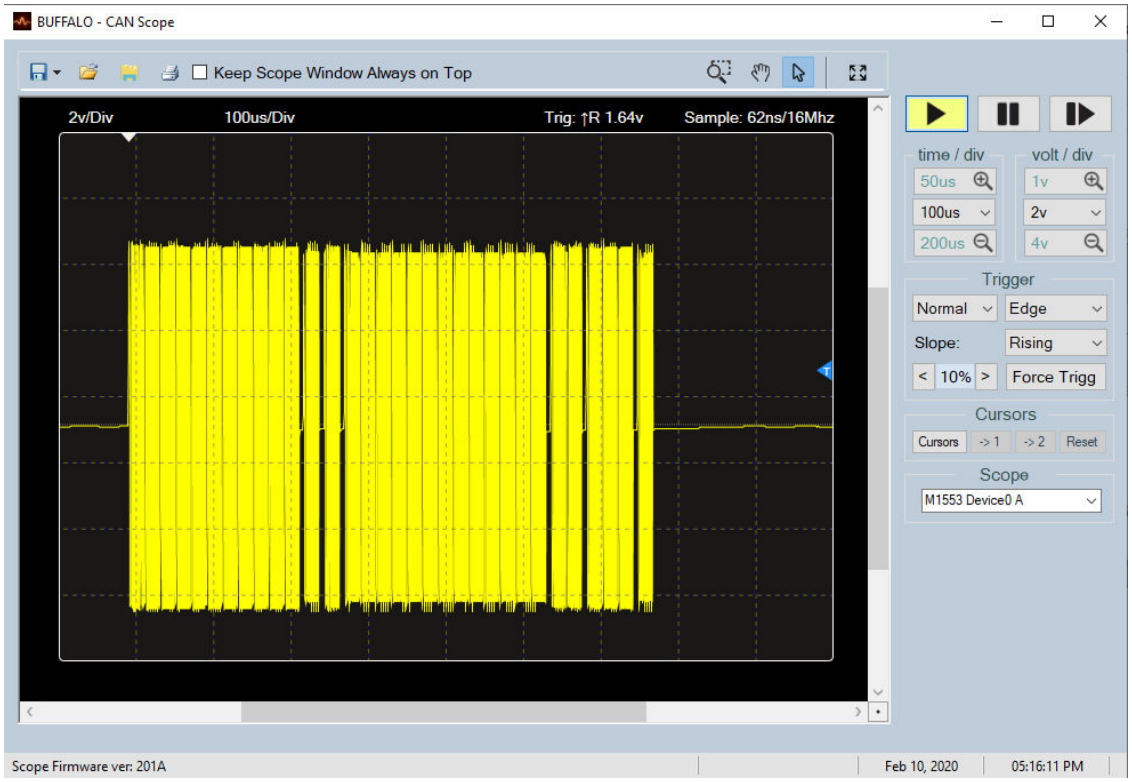
Running the Scope is done from the Dashboard by clicking the 'Scope' button



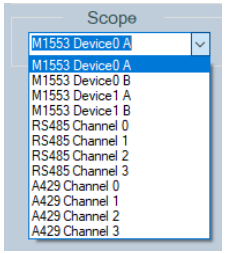
Once running the Scope, the Scope Window opens with default trigger on MIL-STD-1553 module 0, bus A



Once live data detected, the Scope displays by selected trigger level



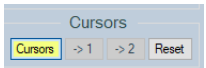
For selecting a different Channel / Module for the Scope to monitor and display, select from the dropdown list of 'Scope' entries



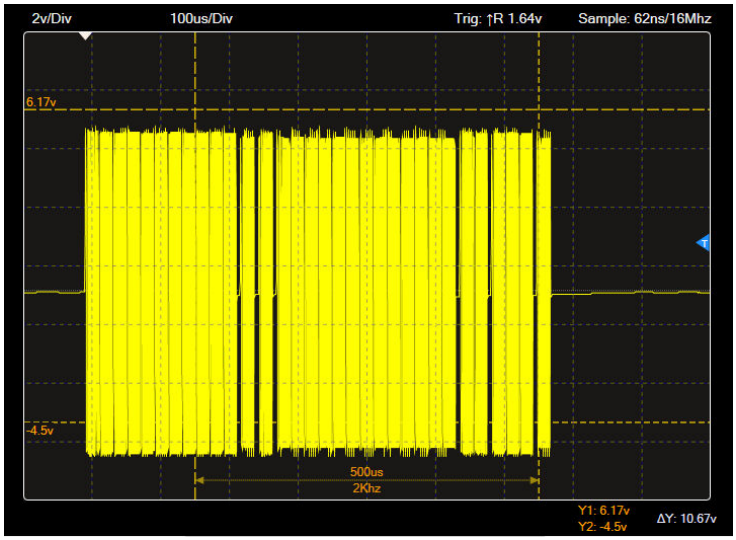
For freezing and / or manual play live data, press the 'Pause' and 'Pause and Play' buttons

In addition, the 'Cursors' button, once pressed enables measuring signals height and width using left mouse drag and drop.

For activation press 'Cursors'



For measuring, move the orange cursors up/down, left/right



The deltas are displayed on the bottom right corner of the Scope

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