

# 1553 Bus Protocol

---

- Specification Overview
  - Word Formats
  - Message Formats
  - Broadcast Message Formats
  - Single Receiver Message Formats
- Model Overview
  - Remote Terminal Block
  - Bus Controller Block
  - Test Model

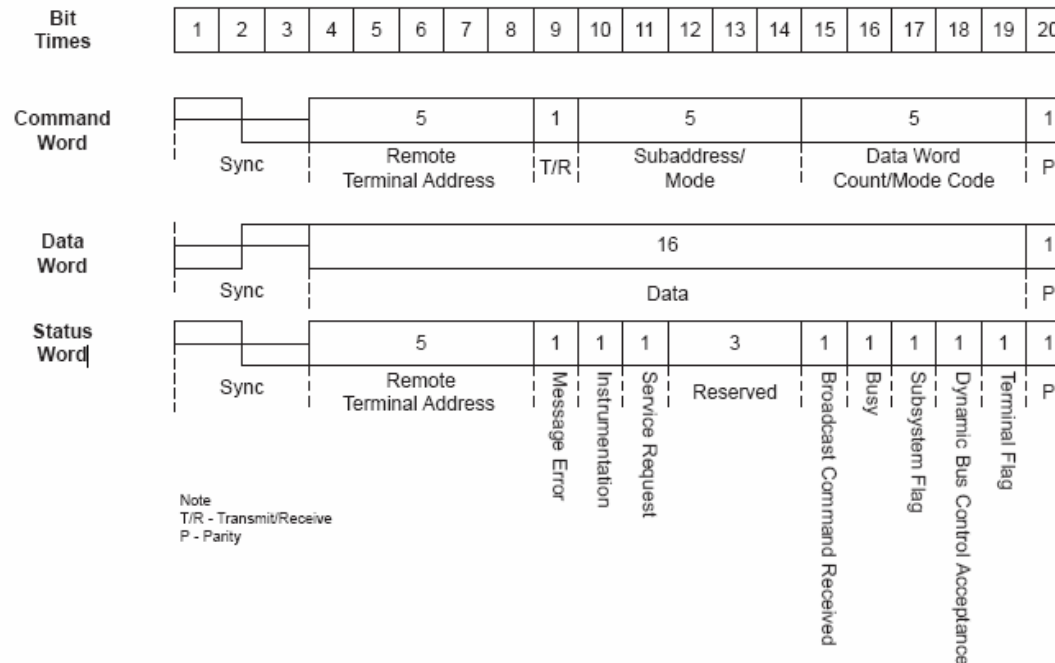
# Word Formats

- 1553 Protocol contains 20% Overhead
  - 16 Bit Word + Sync Word (3) + Parity (1)

## 3.5 Word Formats

The word formats shall be as shown in [Figure 3.5.1](#) for the command, data, and status words. A specification of each format is given in clauses 13-16.

The 20-bit word size represents the number of bit times for a word of 16 data bits, three bit time sync pattern and one bit time for a single parity bit. The three bit time sync pattern is described in clause 13.2.

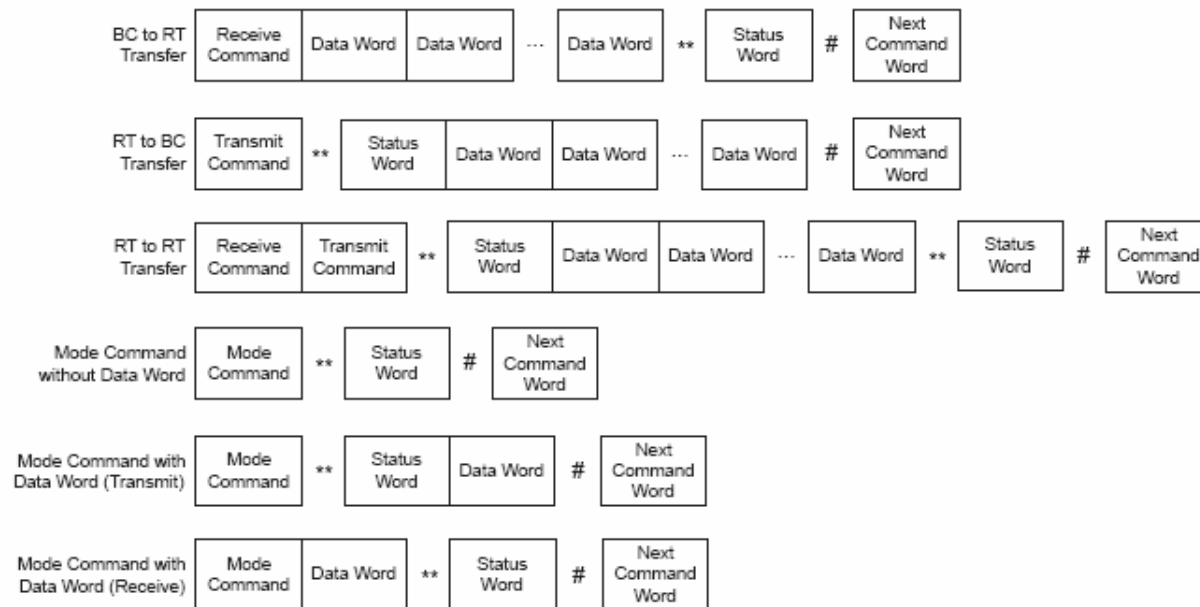


# Message Formats

- Combinations of Word Formats
  - 20 Bits Words, Sync contains information of word type

## 5.1 Message Formats

*The messages transmitted on the data bus shall be in accordance with the formats in [Figure 5.1.1](#) and [Figure 5.1.2](#). The maximum and minimum response times shall be as stated in clauses 25 and 26. No message formats, other than those defined below, shall be used on the bus.*



Notes  
 \*\* response time  
 # intermessage gap

# Broadcast Message Formats

- Combinations of Word Formats
  - Terminal Address of 31 (11111) interpreted as broadcast, cannot be Bus Controller.

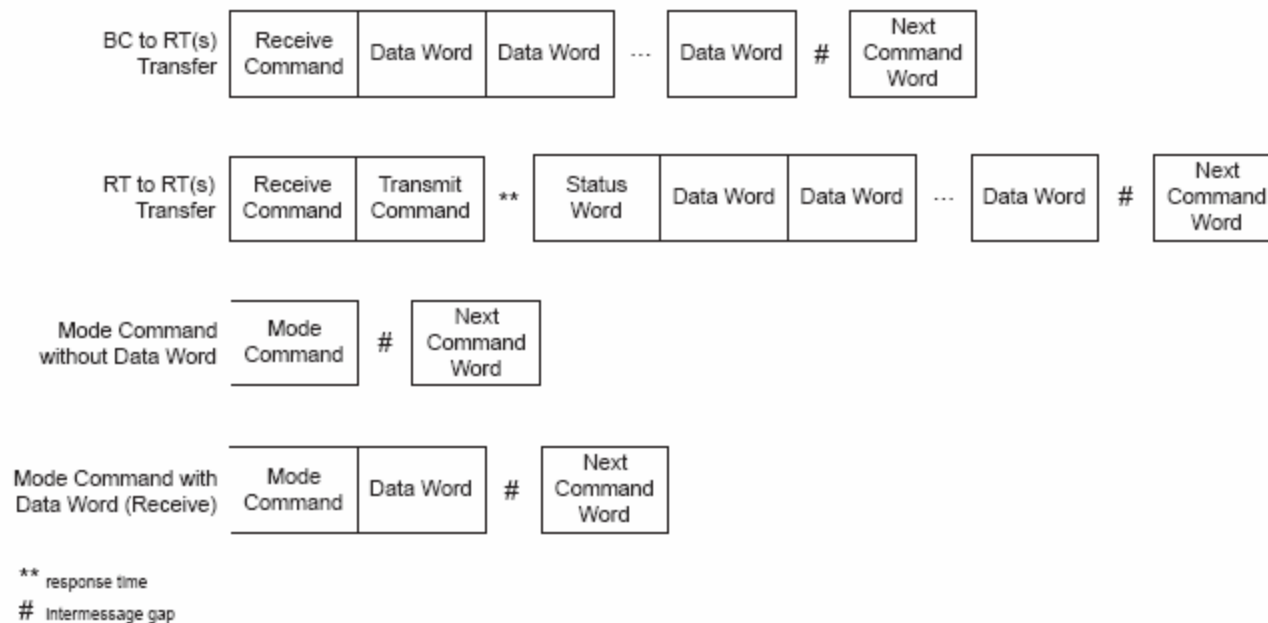
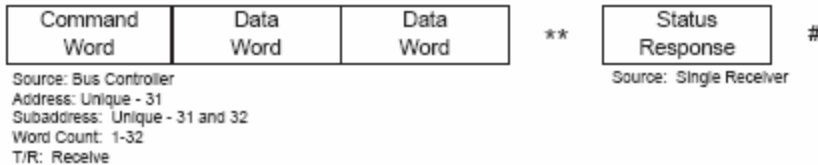


Figure 5.1.2: Broadcast Information Transfer Formats

# Single Receiver Message Formats

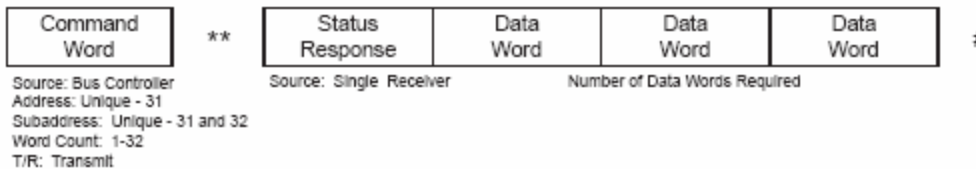
- Combinations of Word Formats
  - Three Combinations.

## Bus Controller to Remote Terminal



Notes  
 \*\* Response Time  
 # Intermessage Gap

## Remote Terminal to Bus Controller



## Remote Terminal to Remote Terminal

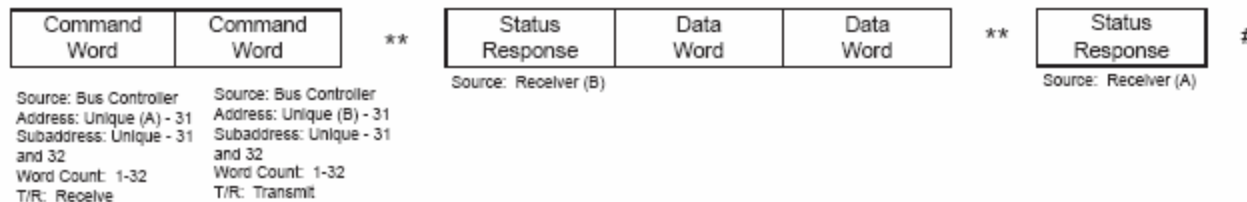


Figure 5.8.1: Single Receiver Data Message Formats

# Response Time

---

- 4usec to 12usec.
  - Variable based on Remote Terminal

# Model Overview

---

- Models Remote Terminal and Bus Controller.
  - Including Response Time, Cable Propagation Delay.
  - User can set Remote Terminal, Bus Controller length in Feet.
  - User can send external Data Structure through the Model.
    - INDEX, ID modified by 1553 Bus Model.
  - User can specify Field Name for Message Size, Destination for Remote Terminal.
- Models Broadcast Mode (Address – 11111)
  - User specifies Message Destination as 31.
- Collects Statistics
  - Remote Terminal Queue, Bus Controller Queue.
  - Throughput Batch Statistics, Latency Histogram, and Size Histogram.

# DS\_1553 Data Structure

---

```

• /*
•     1553 Bus Data Structure

•     Port_ID           Port Number, used to identify the incoming port number
•     Port_Length       Port Length, ingoing Remote Terminal length, outgoing Bus
•                       Controller length
•     Destination_ID    Destination ID, corresponds to Destination Port_ID
•     Transaction_Bytes  Number of Bytes this transaction, minimum 2, maximum 2 *
31
•     Transaction_Delay  Calculated Transaction Delay in seconds
•     Propagation_per_Foot ns per foot of Cable, needed in three different blocks

• */

•     Port_ID           int           0           ; /* 0 corresponds to Port ID           */
•     Port_Length       double        0.5         ; /* Port Length, in Feet           */
•     Destination_ID    int           1           ; /* 1 corresponds to Destination ID */
•     Transaction_Bytes int           2           ; /* Transaction Size               */
•     Transaction_Delay double        3.0E-06     ; /* Transaction Delay              */
•     Propagation_per_Foot double     1.5E-09     ; /* Propagation Constant           */

```



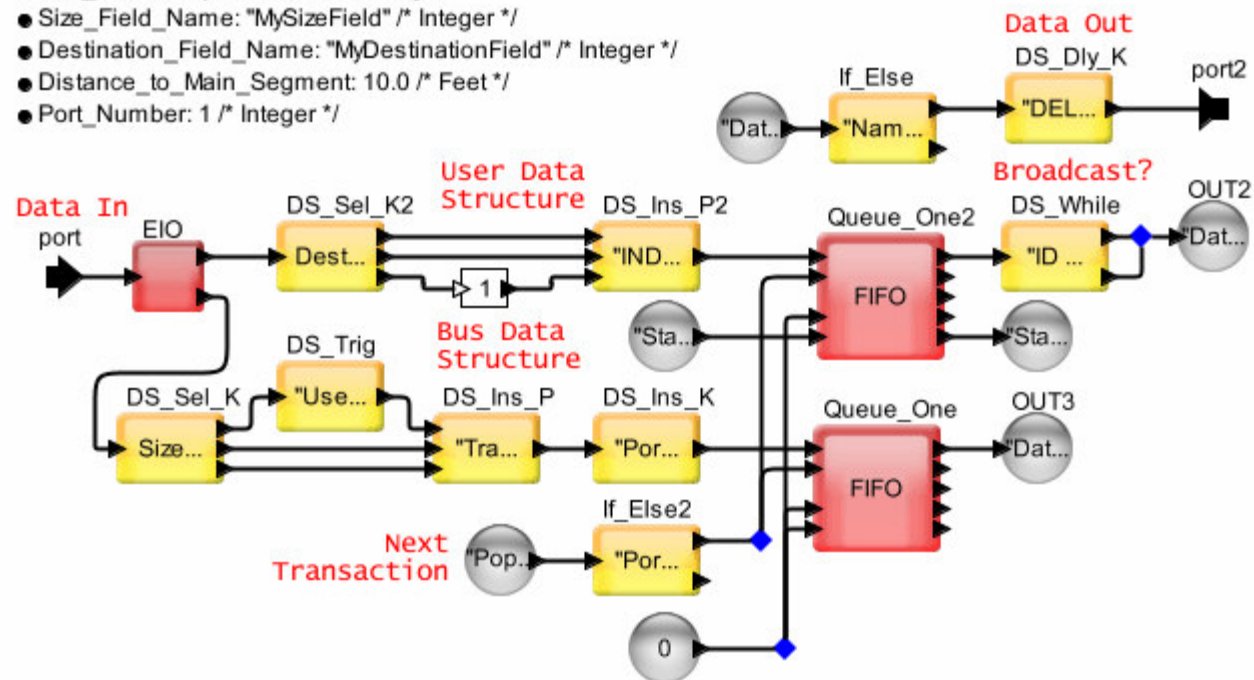
# Remote Terminal Block

## 1553 Remote Terminal.

This hierarchical block implements a Remote Terminal with several key parameters: Distance from Main Bus Segment (double feet), name of Data Structure field containing transaction bytes (integer), name of Data Structure field contain destination port ID (integer). The Port\_Number must match the Bus Controller.

### Parameters

- Bus\_Name: "MyBusName" /\* String \*/
- Size\_Field\_Name: "MySizeField" /\* Integer \*/
- Destination\_Field\_Name: "MyDestinationField" /\* Integer \*/
- Distance\_to\_Main\_Segment: 10.0 /\* Feet \*/
- Port\_Number: 1 /\* Integer \*/



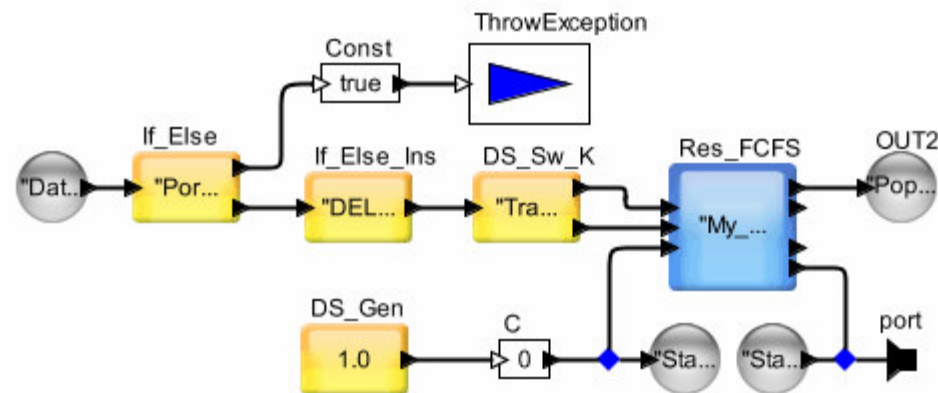
# Bus Controller Block

## 1553 Bus Controller.

This hierarchical block implements a Bus Controller with several key parameters: Bus Name (string), Main Bus segment length (double feet), Number of Remote Terminals (integer), and SimTime (Sec).

### Parameters

- Bus\_Name: "MyBusName" /\* String \*/
- Main\_Bus\_Length: 10.0 /\* Feet \*/
- Number\_of\_Remote\_Terminals: 4 /\* Integer \*/
- Sim\_Time: 100.0 /\* double, export up \*/
- Internal\_Constant: Main\_Bus\_Length / 2.0 /\* Do Not Modify \*/



# Test Model – Block Diagram

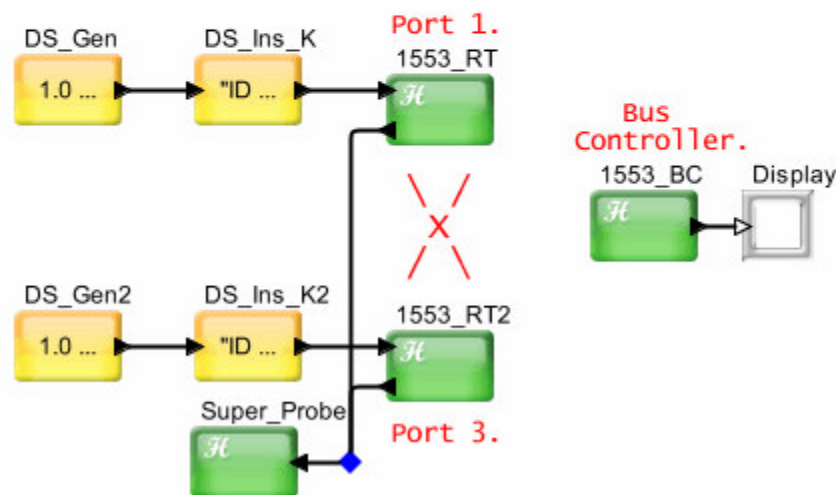
## 1553 Test Model.

This Test Model sends traffic from Port 1 to Port 3. The same Port\_IOS\_per\_Sec are used for both. The Traffic goes to the Bus Controller to arbitrate bus Access, and includes process time to finish a multi-word message.

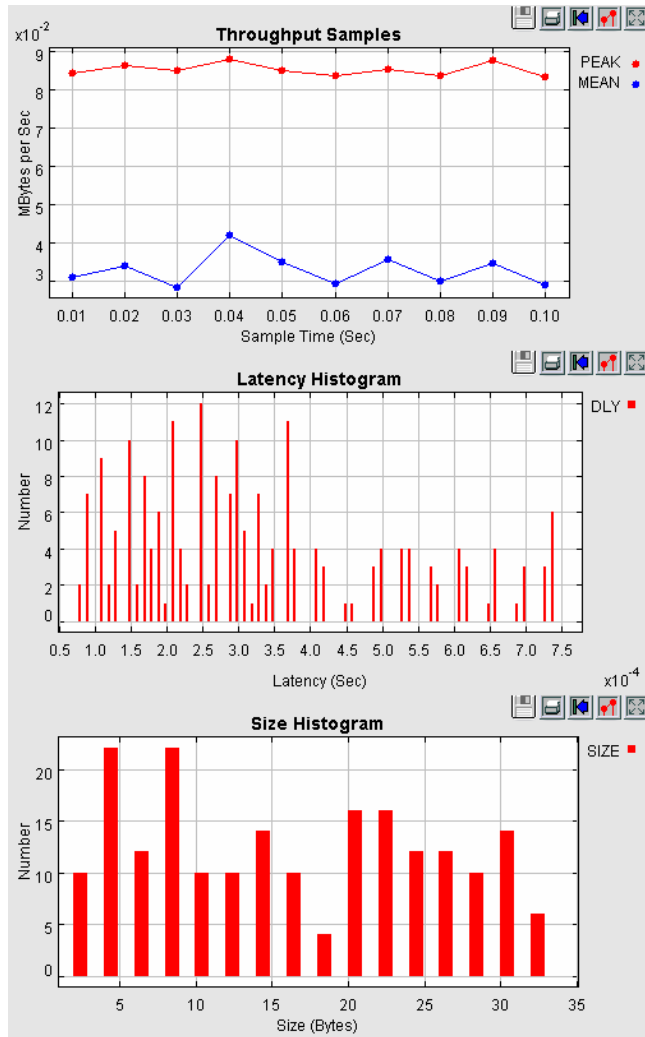


### Parameters.

- Sim\_Time: 0.1 /\* double \*/
- Port\_IOS\_per\_Sec: 1000.0 /\* double \*/



# Test Model – Results



BLOCK Res\_FCFS  
 DELTA 0.0  
 INDEX 0

DS\_NAME Resource\_Stats  
 TIME 0.09917404500000009  
 ID 2

Dimension\_Number int 0  
 Number\_in\_Resource int 0  
 Requests\_Entered int 200  
 Requests\_Exited int 200  
 Requests\_Rejected int 0  
 Min\_Buffer\_Occupancy double 1.0  
 Mean\_Buffer\_Occupancy double 1.5  
 StDev\_Buffer\_Occupancy double 0.5012547071170855  
 Max\_Buffer\_Occupancy double 2.0  
 Min\_Delay\_thru\_Resource double 8.402250000000278E-5  
 Mean\_Delay\_thru\_Resource double 3.269487500000004E-4  
 StDev\_Delay\_thru\_Resource double 1.8084113676871652E-4  
 Max\_Delay\_thru\_Resource double 7.430449999999977E-4  
 Min\_Utilization double 35.26164285714286  
 Mean\_Utilization double 44.00754191964869  
 StDev\_Utilization double 4.52732459458965  
 Max\_Utilization double 100.0

int 0  
 int 0  
 int 200  
 int 200  
 int 0  
 double 1.0  
 double 1.5  
 double 0.5012547071170855  
 double 2.0  
 double 8.402250000000278E-5  
 double 3.269487500000004E-4  
 double 1.8084113676871652E-4  
 double 7.430449999999977E-4  
 double 35.26164285714286  
 double 44.00754191964869  
 double 4.52732459458965  
 double 100.0