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## Test Plan for The Digital Time Division Command/Response Multiplex Data Bus Couplers, Terminators, and Data Bus Cables

### RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

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## FOREWORD

This test plan consists of three major sections. The first deals with testing data bus couplers, a second with testing data bus terminators, and a third section with testing of the data bus cable.

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## 1. SCOPE:

### 1.1 General:

This test plan defines the requirements of data bus components which comply with the requirements of MIL-STD-1553B, Digital Time Division Command/Response Multiplex Data Bus.

### 1.2 Application:

The requirements of the test plan shall apply to data bus components designed to meet MIL-STD-1553B, when invoked in a specification or a statement of work. The test plan may be used for both design verification and production testing of data bus components.

This test plan addresses only the electrical characteristics of the data bus components. Differences between data bus systems will exist due to particular program requirements and designer options. The system designer and contractor must therefore allow for the effects of temperature, vibration, sealing, EMI/EMP, and other environmental factors on data bus component characteristics. Consideration of these factors will improve the possibility that data bus components will operate properly when used in the intended environment.

The pass/fail requirements of the test plan shall be met under all system operating environments. The DC resistance criteria, however, are assumed to be measured at 25°C and would have to be corrected for measurements made at another temperature.

For the purposes of this test plan, it must be possible to identify all bus and stub connections, the selected bus cable characteristic impedance, the transformer winding resistances, and the values of any series and terminating resistors used within the coupler. This information must be included in a supporting documentation package provided by the bus coupler or bus terminator manufacturer.

Because transformer coupled data bus couplers may contain terminating resistors and/or have cables attached, it will not be possible to directly test the transformer and resistors in every case. In such cases the transformers and resistors shall be tested prior to assembly to verify they meet the requirements of MIL-STD-1553B. Again, system designers must make allowances for the expected environment when testing those coupler components.

## 1.2 (Continued):

Both connectorized and nonconnectorized couplers and terminators can be tested using this plan, provided electrical contact can be made to all signal (high and low) and shield (ground) connections of the components.

Multiple stub couplers are tested by repeating the tests contained herein for each individual stub. An adjustment to the test limits may be required. The adjustments are specified in the appropriate sections.

The tests may be performed in any order unless otherwise specified.

## 2. APPLICABLE DOCUMENTS:

### 2.1 Military Publications:

Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

MIL-STD-202F Test Methods for Electronic and Electrical Component Parts  
MIL-STD-1553B Internal Time Division/Response Multiplex Data Bus, with  
Notice 2, 8 Sept. 1986

### 2.2 Definitions:

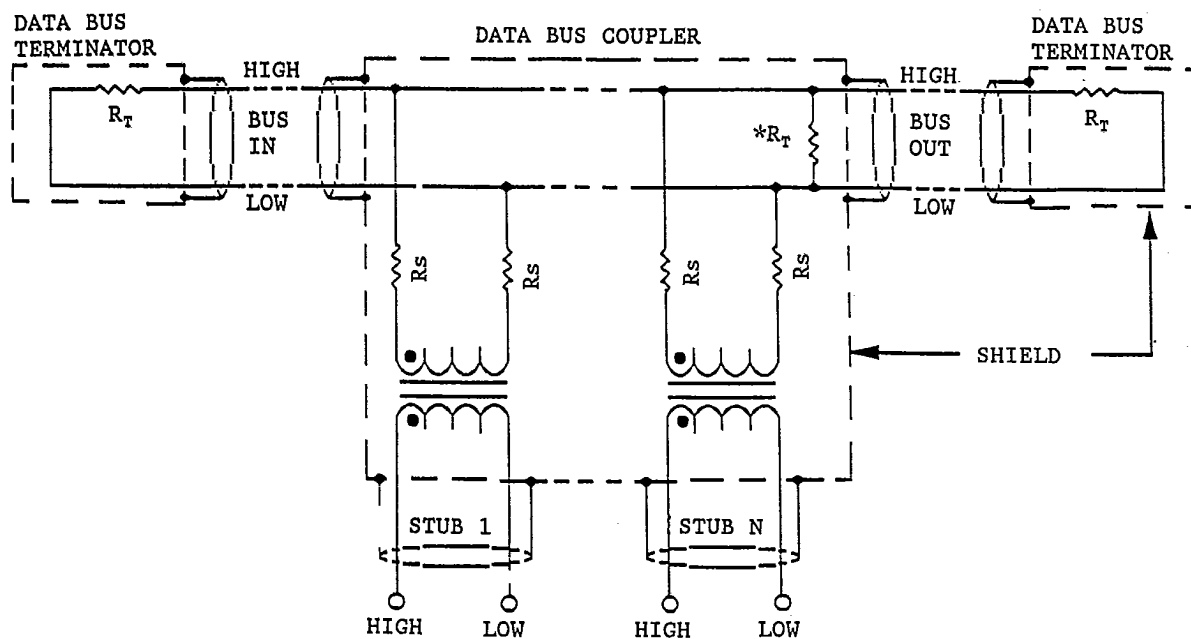
2.2.1 BUS CONNECTION(S): Connection(s) designated for attachment of the coupler to the bus cable. The test plan refers to them as bus in and bus out; each is functionally identical. Attachment may be in the form of connector(s) or cable leads. See Figure 1A or 1B.

2.2.2 STUB CONNECTION(S): Connection(s) designated for attachment of the stub cable to the coupler. The cable connection is made to a distinct transformer for a transformer coupled data bus coupler, while for a direct coupler, the connection is made directly to the bus. Attachment may be in the form of connector(s) or cable leads. See Figure 1A or 1B.

2.2.3 TERMINATORS: The shielded resistor used to terminate the bus in its characteristic impedance ( $Z_0$ ).

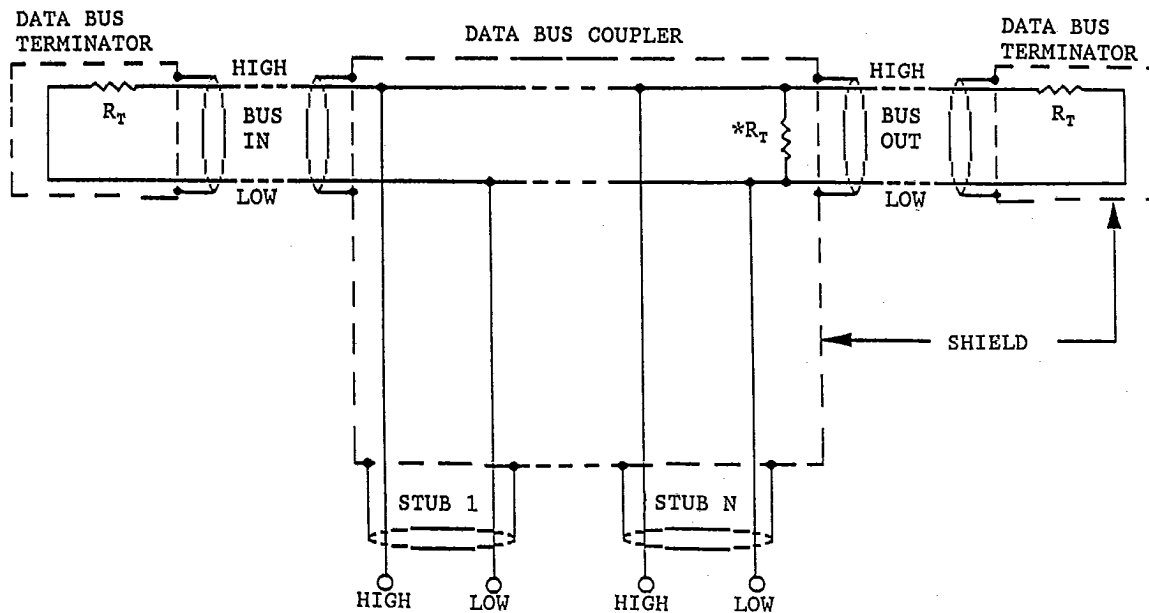
NOTE: The terminating resistor may be located inside the coupler. See Figure 1A or 1B.

2.2.4 SHIELD: The metallic enclosure which surrounds the coupler or terminator or the metallic braid surrounding the data bus cable. See Figure 1A or 1B.



\*IF REQUIRED, THE TERMINATING RESISTOR COULD BE LOCATED INSIDE THE DATA BUS COUPLER.

FIGURE 1A - Transformer Data Bus Coupler



\*IF REQUIRED, THE TERMINATING RESISTOR COULD BE LOCATED INSIDE THE DATA BUS COUPLER.

FIGURE 1B - Direct Data Bus Coupler

FIGURE 1 - Data Bus Couplers

2.2.5 DATA BUS COUPLER: It is the electronic module where the connection(s) between the stub(s) and the data bus are made. It consists of bus in and bus out connections and at least one stub connection. For transformer coupled applications, the stub connection is made using two isolation resistors and a coupling transformer per MIL-STD-1553B. A terminating resistor may be placed inside the coupler as shown in Figure 1A.

For direct coupled applications, the coupler consists of a shield in which a connection is made between the proper bus in and bus out signal leads to the corresponding stub signal leads. See Figure 1B.

NOTE: When an internal terminating resistor is used it is possible the coupler may have only one bus connection.

There are two basic styles of data bus coupler, one which has connectors and one which has cables attached. The type which has connectors is referred to in the test plan as "connectorized". The type with cables attached are referred to in the test plan as either in-line data bus couplers or cable-equipped data bus couplers.

2.2.6 DATA BUS CABLE: Two twisted, shielded, and jacketed conductors.

2.2.7  $Z_0$ : The characteristic impedance of the data bus cable, where Characteristic Impedance =

$$Z_0 = \sqrt{L/C_m}, \text{ with}$$

L = Inductance per Foot

$C_m$  = Mutual Capacitance per Foot

2.2.8 CABLE ATTENUATION: Cable power loss per unit length at a specified frequency, e.g., (db/100 ft at 1 MHz).

### 3. ELECTRICAL TESTS:

The following paragraphs define the configurations, pass/fail criteria, and general procedures for testing data bus couplers, terminators, and cables.

#### 3.1 Data Bus Couplers:

The following four continuity tests shall be performed before attempting any other tests defined in this section.

3.1.1 Static Continuity Tests: The purpose of the following tests is to perform DC continuity and resistance measurements on the data bus couplers:

3.1.1.1 Bus Continuity Test (Bus In to Bus Out): Measure the resistance R, between bus in high and bus out high, as defined in Figure 1A or 1B. The pass criteria for a coupler with connectors attached shall be:

$$R = 0.050 \, \Omega \text{ maximum} \quad (\text{Eq.1})$$