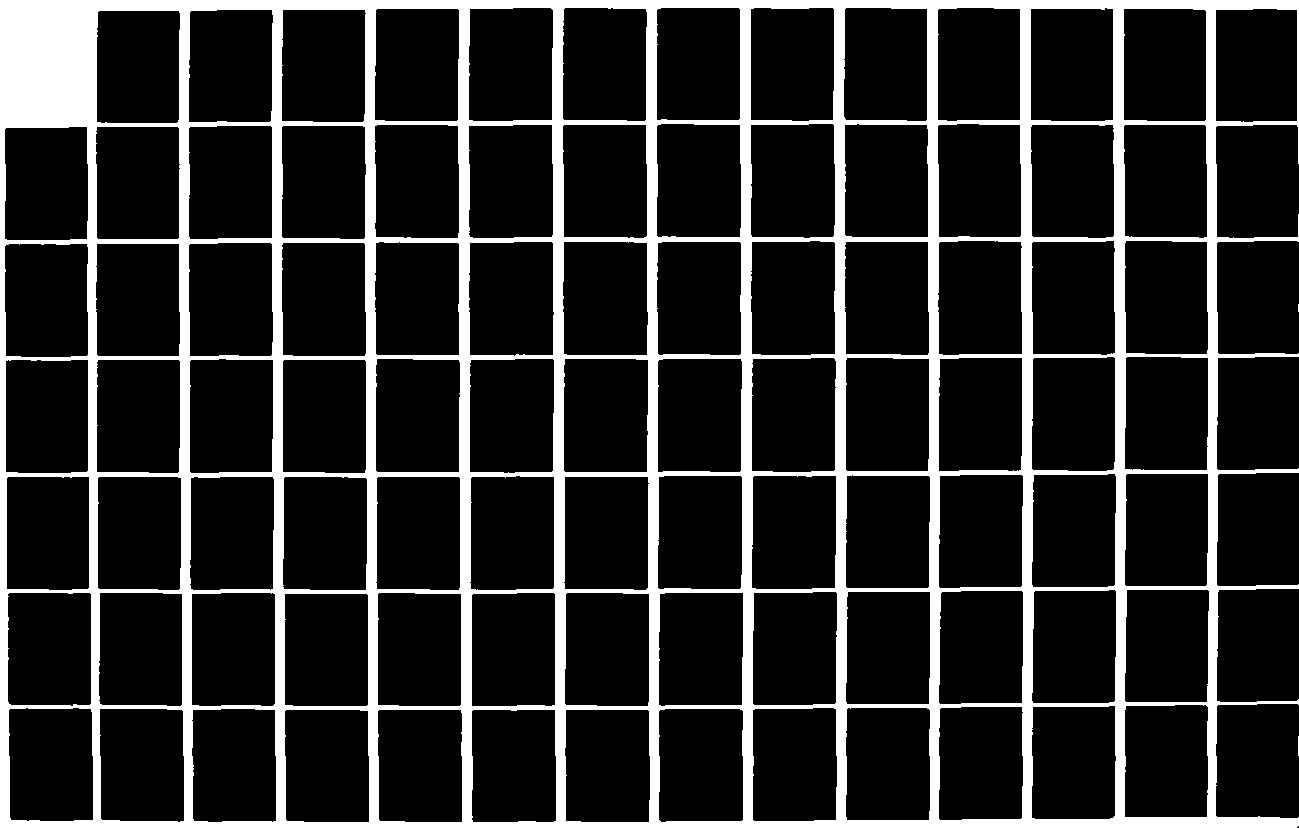
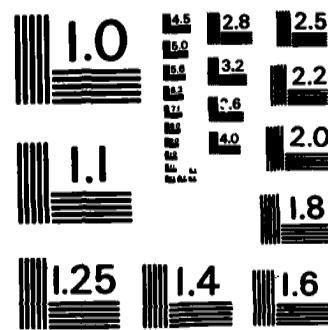


RD-A121 934 MIL-STD-1553 MULTIPLEX DATA BUS WORD FORMATS(U) BOEING 1/2  
MILITARY AIRPLANE CO SEATTLE WA DEC 81  
F33615-80-C-0124

UNCLASSIFIED

F/G 9/2 NL





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS - 1963 - A

ADA121934

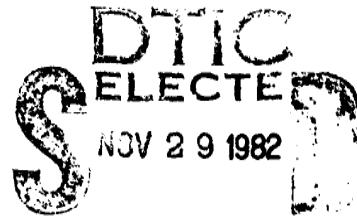
MIL-STD-1553 MULTIPLEX DATA  
BUS WORD FORMATS

FINAL REPORT FOR PERIOD NOVEMBER 1980 - DECEMBER 1981

CONTRACT NO. F33615-80-C-0124  
CDRL SEQUENCE NO.3  
DECEMBER 1981

Prepared For:

Aeronautical Systems Division  
Air Force Systems Command  
Wright-Patterson Air Force Base, Ohio 45433



Prepared by:

Boeing Military Airplane Company  
Seattle, Washington 98124

This document has been approved  
for public release and sale; its  
distribution is unlimited.

82 11 26 054

WMC FILE COPY

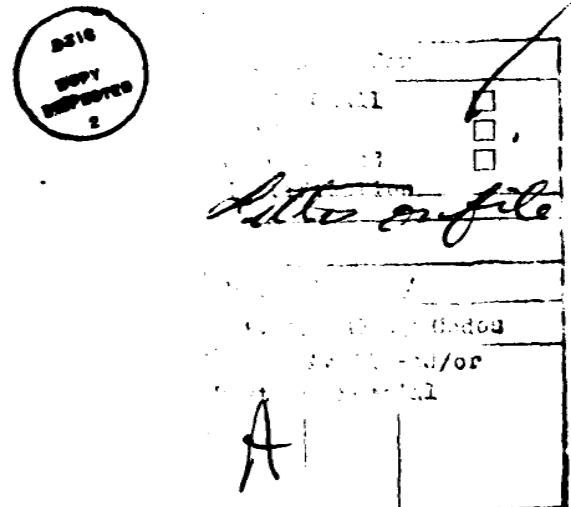
**CHAPTER 11**  
**DATA WORD AND MESSAGE FORMAT**  
**GUIDELINES**

## Table of Contents

| <u>Paragraph</u> |  | <u>Page</u> |
|------------------|--|-------------|
| 11.0             | Data Word and Message Format Guidelines                  | 1           |
| 11.1             | Introduction   | 1           |
| 11.2             | Data Word Formats  | 2           |
| 11.2.1           | General Rules for Word Construction                      | 2           |
| 11.2.2           | Interface Control Document Signal<br>Presentation Format | 6           |
| 11.2.3           | How To Construct a Data Word Format                      | 15          |
| 11.2.4           | Signal Naming  | 18          |
| 11.2.5           | Standard Data Word Formats                               | 30          |
| 11.3             | Message Formats  | 87          |
| 11.3.1           | General Rules for Message Construction                   | 87          |
| 11.3.2           | Recommended Standard Messages                            | 88          |

## List of Figures

| <u>Figure</u> |   | <u>Page</u> |
|---------------|---|-------------|
| Figure 11.2-1 | Standard Data Word Bit Designation Related to<br>MIL-STD-1553 Word Definition | 4           |
| Figure 11.2-2 | Examples of Standard Data Words   | 5           |
| Figure 11.2-3 | Method of Establishing a Data Word Format                                     | 16          |



List of Tables (Sheet 1 of 4)

| <u>Table</u>  |  | <u>Page</u> |
|---------------|--|-------------|
| Table 11.2-1  | Example 1, Unsigned Single Precision   | 7           |
| Table 11.2-2  | Example 2, Multiple Parameters, ASCII-8  | 8           |
| Table 11.2-3  | Example 3, Signed Single Precision<br>With Validity Bit  | 9           |
| Table 11.2-4  | Example 4, Signed Double Precision   | 10          |
| Table 11.2-5  | Example 5, Discrete (Coded) Parameter  | 11          |
| Table 11.2-6  | Presentation Format, Single Precision<br>Quantity  | 12          |
| Table 11.2-7  | Presentation Format, Double Precision<br>Quantity  | 13          |
| Table 11.2-8  | Signal Categories  | 17          |
| Table 11.2-9  | Index of Signal Name Tables  | 19          |
| Table 11.2-10 | Signal Names, Acceleration Category  | 19          |
| Table 11.2-11 | Signal Names, Angular Category   | 20          |
| Table 11.2-12 | Signal Names, Angular Velocity Category  | 21          |
| Table 11.2-13 | Signal Names, Counts Category  | 21          |
| Table 11.2-14 | Signal Names, Distance Category  | 22          |
| Table 11.2-15 | Signal Names, Frequency Category   | 24          |
| Table 11.2-16 | Signal Names, Temperature Category   | 24          |
| Table 11.2-17 | Signal Names, Time Category  | 24          |
| Table 11.2-18 | Signal Names, Velocity Category  | 25          |
| Table 11.2-19 | Signal Names, Voltage Category   | 25          |
| Table 11.2-20 | Signal Names, Communications Category  | 26          |
| Table 11.2-21 | Signal Names, Data Validity Category   | 26          |
| Table 11.2-22 | Signal Names, Display Data Category  | 27          |
| Table 11.2-23 | Signal Names, Header Word Category   | 27          |
| Table 11.2-24 | Signal Names, Navigation Category  | 28          |
| Table 11.2-25 | Signal Names, Stores Management<br>Category  | 29          |
| Table 11.2-26 | Data Word Format for Example Signal  | 31          |
| Table 11.2-27 | Standard Data Word Format Index  | 34          |
| Table 11.2-28 | Standard Data Word Format, Acceleration<br>Category, Subcategory Feet/Second <sup>2</sup> Single Precision | 36          |

List of Tables (Sheet 2 of 4)

| <u>Table</u>  |   | <u>Page</u> |
|---------------|---|-------------|
| Table 11.2-29 | Standard Data Word Format, Acceleration Category, Subcategory Meter/Second <sup>2</sup> , Double Precision  | 37          |
| Table 11.2-30 | Standard Data Word Format, Angular Category, Single Precision   | 38          |
| Table 11.2-31 | Standard Data Word Format, Angular Category, Double Precision   | 39          |
| Table 11.2-32 | Standard Data Word Format, Angular Velocity Category, Single Precision                                      | 40          |
| Table 11.2-33 | Standard Data Word Format, Counts Category, Single Precision  | 41          |
| Table 11.2-34 | Standard Data Word Format, Distance Category, Subcategory Feet, Single Precision                            | 42          |
| Table 11.2-35 | Standard Data Word Format, Distance Category, Subcategory Feet, Double Precision                            | 43          |
| Table 11.2-36 | Standard Data Word Format, Distance Category, Subcategory Meters, Double Precision                          | 44          |
| Table 11.2-37 | Standard Data Word Format, Distance Category, Subcategory Kilometers, Double Precision                      | 45          |
| Table 11.2-38 | Standard Data Word Format, Distance Category, Subcategory UTM Grid Zone, Northing/Easting, Single Precision | 46          |
| Table 11.2-39 | Standard Data Word Format, Distance Category, Subcategory Nautical Miles, (Low Range), Single Precision     | 47          |
| Table 11.2-40 | Standard Data Word Format, Distance Category, Subcategory Nautical Miles, (High Range), Single Precision    | 48          |
| Table 11.2-41 | Standard Data Word Format, Frequency Category, Four-Word Quantity   | 49          |
| Table 11.2-42 | Standard Data Word Format, Temperature Category, Subcategory Low Range, Single Precision                    | 53          |
| Table 11.2-43 | Standard Data Word Format, Temperature Category, Subcategory High Range, Single Precision                   | 54          |
| Table 11.2-44 | Standard Data Word Format, Time Category, Subcategory Time of Day, Six-Word Quantity                        | 55          |

List of Tables (Sheet 3 of 4)

| <u>Table</u>  |   | <u>Page</u> |
|---------------|---|-------------|
| Table 11.2-45 | Standard Data Word Format, Velocity Category, Subcategory Feet/Second, Single Precision                     | 61          |
| Table 11.2-46 | Standard Data Word Format, Velocity Category, Subcategory Feet/Second, Double Precision                     | 62          |
| Table 11.2-47 | Standard Data Word Format, Velocity Category, Subcategory Meters/Second, Double Precision                   | 63          |
| Table 11.2-48 | Standard Data Word Format, Velocity Category, Subcategory Knots, Single Precision                           | 64          |
| Table 11.2-49 | Standard Data Word Format, Single Category, Subcategory Mach, Single Precision                              | 65          |
| Table 11.2-50 | Standard Data Word Format, Voltage Category, Subcategory High Range, Single Precision                       | 66          |
| Table 11.2-51 | Standard Data Word Format, Voltage Category, Subcategory Mid Range, Single Precision                        | 67          |
| Table 11.2-52 | Standard Data Word Format, Voltage Category, Subcategory Low (Millivolt) Range, Single Precision            | 68          |
| Table 11.2-53 | Standard Data Word Format, Communications Category, Channel Select Subcategory                              | 69          |
| Table 11.2-54 | Standard Data Word Format, Communications Category, Radio Selection Subcategory                             | 70          |
| Table 11.2-55 | Standard Data Word Format, Data Validity Category, Checksum Subcategory                                     | 71          |
| Table 11.2-56 | Standard Data Word Format, Data Validity Category, Cyclic Redundancy Check Subcategory                      | 72          |
| Table 11.2-57 | Standard Data Word Format, Data Validity Category, Validity Bit Subcategory                                 | 73          |
| Table 11.2-58 | Standard Data Word Format, Display Data Category, Character Display Subcategory                             | 74          |
| Table 11.2-59 | Standard Data Word Format, Header Word Category, Message Header Subcategory                                 | 75          |
| Table 11.2-60 | Standard Data Word Format, Navigation Category, Convergence Factor Subcategory                              | 76          |
| Table 11.2-61 | Standard Data Word Format, Navigation Category, Direction Cosine Subcategory, Platform to Earth Coordinates | 77          |
| Table 11.2-62 | Standard Data Word Format, Navigation Category, Direction Cosine Subcategory, Aircraft Body Coordinates     | 78          |
| Table 11.2-63 | Standard Data Word Format, Navigation Category, 100,000-Meter Grid Zone Subcategory                         | 80          |
| Table 11.2-64 | Standard Data Word Format, Navigation Category, iv  | 81          |

List of Tables (Sheet 4 of 4)

| <u>Table</u>  |  | <u>Page</u> |
|---------------|--|-------------|
|               | Spheroid/UTM Grid Zone Subcategory   |             |
| Table 11.2-65 | Standard Data Word Format, Stores Management Category, Laser Code Subcategory                | 82          |
| Table 11.2-66 | Standard Data Word Format, Stores Management Category, Release Command Code Subcategory      | 82          |
| Table 11.2-67 | Standard Data Word Format, Stores Management Category, Store Inventory Subcategory           | 84          |
| Table 11.2-68 | Standard Data Word Format, Stores Management Category, Station/Store Status Subcategory      | 85          |
| Table 11.2-69 | Standard Data Word Format, Stores Management Category, Weapon Selection (ID/QTY) Subcategory | 86          |
| Table 11.3-1  | Recommended Inertial Navigation Unit (INU)<br>Standard Message - IO1                         | 89          |
| Table 11.3-2  | Recommended Inertial Navigation Unit (INU)<br>Standard Message - IO2                         | 90          |
| Table 11.3-3  | Recommended Air Data Computer Standard Message   | 91          |
| Table 11.3-4  | Recommended Radar Altimeter Standard Message   | 92          |

## **11.0 DATA WORD AND MESSAGE FORMAT GUIDELINES**

### **11.1 Introduction**

The emphasis in this chapter is the development of data word and message formats for MIL-STD-1553 data bus applications. This chapter is intended as a guide to the designer to identify standard data words and messages that are being used in today's avionic systems and subsystems. These standard words and messages, as well as the documentation format for interface control document (ICD) sheets, provide the basis for defining new 1553 systems. The standards defined in this chapter have met the test of application usage across several 1553 systems and thus provide the acceptable method for transmitting signals of this type in a 1553 system. Also provided in this chapter is the method for developing additional data word formats and messages that may be required by a particular system but are not covered by the standards provided herein. It is essential that any new word formats or message formats that are developed for a 1553 application follow the fundamental guidelines established in this chapter in order to ease future standardization of these words and messages if experience and usage demand it.

The standard word formats presented represent a composite result of studies conducted by the U.S. Air Force, Army, and Navy (see references 1 and 2). Where appropriate, metrication has been considered for future systems and NATO applications. Certain standard words for signals such as distance, velocity, and acceleration are expressed in both English and metric units.

### **References**

1. MIL-STD-1553 Multiplex Data Bus Word Format Study, Boeing Military Airplane Company, October 1981, USAF/ASD Contract No. F33615-80-C-0124.
2. MIL-STD-1553 Data Word Standardization Technical Report, STR-DD-81273-1, SEMCOR, September 1981, U.S. Army Avionics R&D Activity, Contract No. DAAK80-79-C-0258.

The necessity for standardizing data word and message formats became evident as more and more subsystems provided 1553 interfaces as the basic input and output communication interface. Without coordination of these interfaces, outputs from a subsystem were incompatible with the input requirements of the interfacing subsystem. When new 1553 hardware and system design are required, the system designer is responsible for identifying the interface requirements of all devices and establishing compatible words and messages for proper communications. Naturally, this is accomplished during the early system development phases and is then reflected into future procurement specifications for the subsystem elements of the design. This method provides an integrated system that meets all the individual communication requirements. However, as more 1553 systems are developed, this approach may result in subsystems that are incapable of exchanging data because of word and message formatting differences, even though the units meet all the requirements of MIL-STD-1553 and their individual procurement specifications. In this case, the system designer is faced with the choice of using additional processing equipment to translate words and messages from one subsystem to another or

modifying the off-the-shelf hardware to achieve integration. Usually the job of data manipulation falls on the bus controller-processor. Messages from each subsystem must be transmitted to the bus controller (RT to bus controller), which constructs new words with the appropriate engineering units, scaling, encoding, bit positions, etc., before retransmission (bus controller to RT) to the subsystem requiring the data. A similar condition exists for messages when insufficient data in one message require the use of multiple messages. Word order is another message inconsistency that must be solved. The solution to this problem does not lie in bus controller manipulation or in subsystem modifications; it lies in establishing some common usage word formats and some common usage output message formats to provide a subsystem designer the information required to build compatible communication interfaces. This chapter provides the standards and guidelines required to solve this problem.

The following sections are subdivided to allow easy access when selecting the appropriate word or message format from the standards available. For signals that do not fit the standard word formats available, guidelines are provided for establishing the appropriate word format. In addition, recommended standard message formats are identified, and the associated guidelines required for developing other nonstandard message formats are also provided. Standard signal naming practices and an ICD presentation format are provided. Some of the key benefits gained by use of the principles presented in this chapter will be (1) subsystem word format definition, (2) subsystem output message format definition, (3) common signal naming practices, and (4) standardization of interface control document format across programs.

## **11.2 Data Word Formats**

A data word format is the structure, order, and value represented by the bits in a signal data transmission. To properly define a data word format requires knowledge concerning the signal, the 1553 application, and the coding technique used to communicate the information. All of these elements are discussed in the following paragraphs.

The general rules for 1553 word construction (paragraph 11.2.1) apply to all data words whether standard or nonstandard. These rules are to be followed in the development of words that do not fit the formats listed in the standard word tables (paragraph 11.2.5). The procedures on how to construct a data word format described in paragraph 11.2.3 also apply to any data word whether or not it is eventually determined to fit a standard format. Paragraph 11.2.2 describes the standardized ICD presentation format that shall be used for all 1553 data words.

### **11.2.1 General Rules for Word Construction**

The general rules for constructing compatible word formats apply to the standard words listed in paragraph 11.2.5 and to those words that do not meet the requirements for the standardized format. The following paragraphs provide generalized rules for establishing the basic word structure.

### **11.2.1.1 Data Word/Bit Designation**

Figure 11.2-1 shows the horizontal presentation of the 16-bit data field of the data word defined in MIL-STD-1553. The data field bits are numbered 1 through 16, left to right, with bit 1 designated as the most significant bit (MSB) and bit 16 designated as the least significant bit (LSB). In conformance to the requirements of MIL-STD-1553, the most significant bit (bit 1) is transmitted first on the data bus.

The MSB and LSB designations indicated here refer to the relative weighting of the entire 16 bits in a binary-coded numeric representation (BNR) of signal value. The MSB and LSB designations will also be employed to define the most significant and least significant bits of parameters requiring less than or more than 16 bits. There can also be more than one signal value in a data word, thus requiring multiple MSB's and LSB's within the data field. Discrete bits and binary codes are also used to represent characters or modes.

Throughout this document the term "data word" will be used in reference to this 16-bit data field.

### **11.2.1.2 Signal Coding and Placement**

Several coding techniques are provided because of the variety of signal types that must be accommodated in a data word format. The following are the typical coding conventions and the presentation notations:

| <u>Data Type</u>  | <u>Presentation Notation</u>      |
|---|-----------------------------------|
| 1. Binary numeric representation (BNR)<br>signed and unsigned | SIGN, MSB, LSB, and * (data bits) |
| 2. Binary coded decimal (NBCD, 8421)                          | MSB, LSB, and * (data bits)       |
| 3. Discrete bit   | R                                 |
| 4. Coded bits   | R                                 |
| 5. ASCII alphanumeric codes                                   | MSB, LSB, and * (data bits)       |
| 6. Unused or reserved bits                                    | O                                 |
| 7. Validity bit   | V                                 |

Figure 11.2-2 shows some examples of typical word formats employing the above digital representations. The following general rules apply to all word structures:

1. Left justify; the sign, MSB, or first discrete (in that order of precedence) should appear in the left-most (bit 1) position.
2. No unused zero (0) bits should be placed in more significant bit positions than <sup>a</sup>. Exceptions to this rule are:

MIL-STD-1553  
WORD BIT  
POSITIONS

|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|

MIL-STD-1553  
DATA WORD



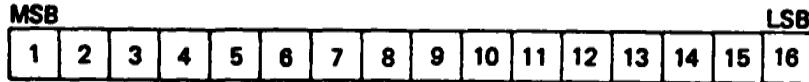
DATA FIELD BITS  
(STD DATA WORD)

| MSB | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | LSB |
|-----|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|-----|
|     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |     |

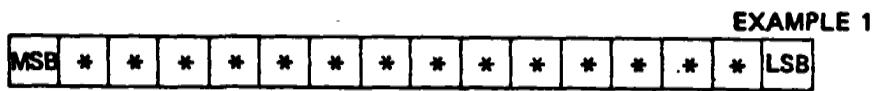
SYNC - WORD SYNCHRONIZATION  
P - PARITY (ODD)

Figure 11.2-1. Standard Data Word Bit Designation Related to MIL-STD-1553 Word Definition

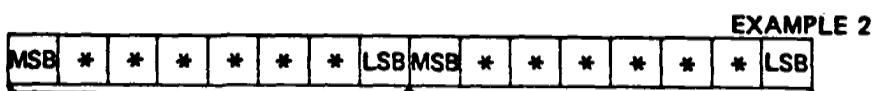
## **STANDARD DATA WORD BIT DESIGNATION**



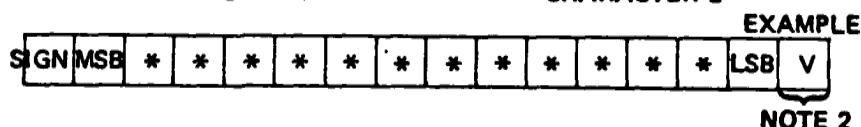
## **UNSIGNED SINGLE PRECISION**



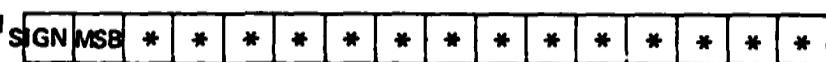
## MULTIPLE PARAMETERS (ASCII-8)



## **SIGNED SINGLE PRECISION WITH VALIDITY BIT**

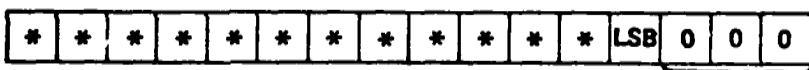


## **SIGNED DOUBLE PRECISION WITH UNUSED BITS**



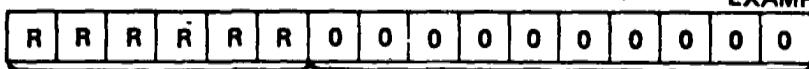
**NOTE 2**

**EXAMPLE 4**



UNUSED BITS NOTE 1

## **DISCRETE (CODED) PARAMETER**



**EXAMPLE 5**

9

**Notes:**

- 1 - Unused or reserved bits are set to zero (0) state
- 2 - A validity bit (V) may be placed in bit location 16 to specify validity status of transmitted data.
- 3 - Discrete and coded data are designated by "R" and are defined in the ICD data sheet remarks section

**Figure 11.2-2. Examples of Standard Data Words**

- a. Validity bit always occupies the right-most position (bit 16), if available. (Refer to figure 11.2-2, example 3.)
  - b. In special cases, unused bits are included for fill. An example is ASCII-7, in eight-bit applications, where the eighth bit is set to zero to format the ASCII-7 code. (Refer to the formats shown in figure 11.2-2, example 2.)
3. Combining BNR, BCD, or other coded data with discrete data in the same word should be avoided.
  4. Packing of discretes to data of similar functions within the receiving subsystem should be limited.

Tables 11.2-1 through 11.2-5 show the standardized word presentation format for the examples shown in figure 11.2-2. The presentation format used in the tables is described in detail in paragraph 11.2.2.

### **11.2.2 Interface Control Document Signal Presentation Format**

The ICD format required for the documentation of all data words in a 1553 system is shown in tables 11.2-6 and 11.2-7. Presentation formats are provided for single word or less precision values (table 11.2-6) and double word quantities (table 11.2-7). Signals that require greater than double word precision shall use the single word format with the number of words indicated in the REMARKS section (e.g., 3 word quantity--word 1 of 3) of the word format presentation sheet. The ICD presentation sheet entries are discussed in the following paragraph.

Tables 11.2-6 and 11.2-7 are the skeleton ICD sheets. The definition of each entry is as follows:

|                     |  |
|---------------------|--|
| <b>DOC. NO.:</b>    | The interface control document number.   |
| <b>REV.:</b>        | The revision symbol for this sheet.  |
| <b>DATE:</b>        | The calendar date of the latest revision to this sheet   |
| <b>PAGE 1 OF:</b>   | This page count allows multiple pages, for extensive REMARKS or for greater than double word precision data.                           |
| <b>SIGNAL NAME:</b> | The formal name selected for this signal--A name that is to be used in this and other documents (see Signal Naming, paragraph 11.2.4). |
| <b>UNITS:</b>       | The engineering units of the transmitted signal.<br>Note: Some signals may be unitless.  |
| <b>SOURCE:</b>      | Name of the subsystem transmitting the signal, usually abbreviated or an acronym.  |

Table 11.2-1. Example 1, Unsigned Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: #

|                    |   |               |                     |
|--------------------|---|---------------|---------------------|
| SOURCE:            | # | MSB: # NOTE 1 | MAX: #              |
| DESTINATION:       | # | LSB: # NOTE 1 | MIN: #              |
| MSG ID:            | # | CODING: BNR   | SCALE FACTOR: #     |
| WORD NO.:          | # |               | RESOLUTION: #       |
| MSG-LENGTH:        | # |               | ACCURACY: #         |
| TRANSMISSION RATE: | # |               | COMPUTATION RATE: # |

BIT-01 MSB  
BIT-02 #  
BIT-03 #  
BIT-04 #  
BIT-05 #  
BIT-06 #  
BIT-07 #  
BIT-08 #  
BIT-09 #  
BIT-10 #  
BIT-11 #  
BIT-12 #  
BIT-13 #  
BIT-14 #  
BIT-15 #  
BIT-16 LSB

REMARKS:

NOTE 1 - THE RATIO OF MSB TO LSB IS 32,768 (2E+15)

# - APPLICATION DEPENDENT

Table 11.2-2. Example 2, Multiple Parameters, ASCII-8

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |         |         |                   |     |
|--------------------|---|---------|---------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A     | MAX:              | N/A |
| DESTINATION:       | # | LSB:    | N/A     | MIN:              | N/A |
| MSG ID:            | # | CODING: | ASCII-8 | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |         | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # |         |         | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |         |         | COMPUTATION RATE: | #   |

|        |     |                  |
|--------|-----|------------------|
| BIT-01 | MSB |                  |
| BIT-02 | *   |                  |
| BIT-03 | *   |                  |
| BIT-04 | *   |                  |
| BIT-05 | *   | ASCII            |
| BIT-06 | *   | FIRST CHARACTER  |
| BIT-07 | *   |                  |
| BIT-08 | LSB |                  |
| BIT-09 | MSB | NOTE 1           |
| BIT-10 | *   |                  |
| BIT-11 | *   |                  |
| BIT-12 | *   | ASCII            |
| BIT-13 | *   | SECOND CHARACTER |
| BIT-14 | *   |                  |
| BIT-15 | *   |                  |
| BIT-16 | LSB |                  |

REMARKS:

NOTE 1 - THE CODING SHOWN ALLOWS FOR ASCII-8. STANDARD ASCII OR USASCII MAY BE EMBEDDED IN THE FIRST SEVEN BITS WITH THE EIGHTH BIT SET TO ZERO.

# - APPLICATION DEPENDENT

Table 11.2-3. Examples, Signed Single Precision With Validity Bit

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: #

|                      |                                 |                     |
|----------------------|---------------------------------|---------------------|
| SOURCE: #            | MSB: #                          | MAX: #              |
| DESTINATION: #       | LSB: #                          | MIN: #              |
| MSG ID: #            | CODING: 2'S COMPLEMENT/DISCRETE | SCALE FACTOR: #     |
| WORD NO.: #          |                                 | RESOLUTION: #       |
| MSG-LENGTH: #        |                                 | ACCURACY: #         |
| TRANSMISSION RATE: # |                                 | COMPUTATION RATE: # |

BIT-01 SIGN

BIT-02 MSB

BIT-03 \*

BIT-04 \*

BIT-05 \*

BIT-06 \*

BIT-07 \*

BIT-08 \*

BIT-09 \*

BIT-10 \*

BIT-11 \*

BIT-12 \*

BIT-13 \*

BIT-14 \*

BIT-15 LSB

BIT-16 V - VALIDITY BIT (NOTE 1)

REMARKS:

NOTE 1: V = 0, DATA VALID  
V = 1, DATA INVALID

# APPLICATION DEPENDENT

Table 11.2-4. Example 4, Signed Double Precision

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: #

UNITS: #

|                      |         |                |                     |
|----------------------|---------|----------------|---------------------|
| SOURCE: #            | MSB: #  | NOTE 1         | MAX: #              |
| DESTINATION: #       | LSB: #  | NOTE 1         | MIN: #              |
| MSG ID: #            | CODING: | 2'S COMPLEMENT | SCALE FACTOR: #     |
| WORD NO.: #          |         |                | RESOLUTION: #       |
| MSG-LENGTH: #        |         |                | ACCURACY: #         |
| TRANSMISSION RATE: # |         |                | COMPUTATION RATE: # |

WORD 1

|        |      |
|--------|------|
| BIT-01 | SIGN |
| BIT-02 | MSB  |
| BIT-03 | *    |
| BIT-04 | *    |
| BIT-05 | *    |
| BIT-06 | *    |
| BIT-07 | *    |
| BIT-08 | *    |
| BIT-09 | *    |
| BIT-10 | *    |
| BIT-11 | *    |
| BIT-12 | *    |
| BIT-13 | *    |
| BIT-14 | *    |
| BIT-15 | *    |
| BIT-16 | *    |

WORD 2

|        |     |
|--------|-----|
| BIT-01 | *   |
| BIT-02 | *   |
| BIT-03 | *   |
| BIT-04 | *   |
| BIT-05 | *   |
| BIT-06 | *   |
| BIT-07 | *   |
| BIT-08 | *   |
| BIT-09 | *   |
| BIT-10 | *   |
| BIT-11 | *   |
| BIT-12 | *   |
| BIT-13 | *   |
| BIT-14 | *   |
| BIT-15 | *   |
| BIT-16 | LSB |

REMARKS:

NOTE 1 - THE RATIO OF THE MSB TO THE LSB IS  $1.0737 \times 10^9$  (2E+30).

\* APPLICATION DEPENDENT

Table 11.2-5. Example 5, Discrete (Coded) Parameter

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: # (CDU CONTROL WORD)

UNITS: #

|                    |   |                          |                   |     |
|--------------------|---|--------------------------|-------------------|-----|
| SOURCE:            | # | MSB: N/A                 | MAX:              | N/A |
| DESTINATION:       | # | LSB: N/A                 | MIN:              | N/A |
| MSG ID:            | # | CODING: DISCRETE (CODED) | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |                          | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # |                          | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |                          | COMPUTATION RATE: | #   |

BIT-01 R  
 BIT-02 R  
 BIT-03 R  
 BIT-04 R      FUNCTION SELECT CODE  
               NOTE 1  
 BIT-05 R  
 BIT-06 0  
 BIT-07 0  
 BIT-08 0  
 BIT-09 0  
 BIT-10 0  
 BIT-11 0  
 BIT-12 0  
 BIT-13 0  
 BIT-14 0  
 BIT-15 0  
 BIT-16 0

REMARKS:      NOTE 1 - FUNCTION SELECT CODES      # - APPLICATION DEPENDENT

| <u>CODE</u> | <u>FUNCTION</u>      |
|-------------|----------------------|
| 00000       | OFF                  |
| 00001       | STORED HEADING ALIGN |
| 00010       | G/C ALIGN            |
| 00011       | AIR ALIGN            |
| 00100       | NAVIGATE             |
| 00101       | OVERFLY FIX          |
| 00110       | AUX. FIX             |
| 00111       | CALIBRATE            |
| 01000       | ALTITUDE             |
| 01001       | TEST                 |
| 01010       |                      |
| THRU        | RESERVED             |
| 11111       |                      |

Table 11.2-6. Presentation Format, Single Precision Quantity

DOC. NO.  
REV.  
DATE  
PAGE 1 OF

SIGNAL NAME:

UNITS:

|                    |         |                   |
|--------------------|---------|-------------------|
| SOURCE:            | MSB:    | MAX:              |
| DESTINATION:       | LSB:    | MIN:              |
| MSG ID:            | CODING: | SCALE FACTOR:     |
| WORD NO.:          |         | RESOLUTION:       |
| MSG-LENGTH:        |         | ACCURACY:         |
| TRANSMISSION RATE: |         | COMPUTATION RATE: |

BIT-01  
BIT-02  
BIT-03  
BIT-04  
BIT-05  
BIT-06  
BIT-07  
BIT-08  
BIT-09  
BIT-10  
BIT-11  
BIT-12  
BIT-13  
BIT-14  
BIT-15  
BIT-16

REMARKS:

**Table 11.2-7. Presentation Format, Double Precision Quantity**

DOC. NO.  
REV.  
DATE  
PAGE 1 OF

**SIGNAL NAME:**

**UNITS:**

|                    |         |                   |
|--------------------|---------|-------------------|
| SOURCE:            | MSB:    | MAX:              |
| DESTINATION:       | LSB:    | MIN:              |
| MSG ID:            | CODING: | SCALE FACTOR:     |
| WORD NO.:          |         | RESOLUTION:       |
| MSG-LENGTH:        |         | ACCURACY:         |
| TRANSMISSION RATE: |         | COMPUTATION RATE: |

**WORD 1**

BIT-01  
BIT-02  
BIT-03  
BIT-04  
BIT-05  
BIT-06  
BIT-07  
BIT-08  
BIT-09  
BIT-10  
BIT-11  
BIT-12  
BIT-13  
BIT-14  
BIT-15  
BIT-16

**WORD 2**

BIT-01  
BIT-02  
BIT-03  
BIT-04  
BIT-05  
BIT-06  
BIT-07  
BIT-08  
BIT-09  
BIT-10  
BIT-11  
BIT-12  
BIT-13  
BIT-14  
BIT-15  
BIT-16

**REMARKS:**

|                    |  |
|--------------------|--|
| DESTINATION:       | Names of the subsystem that will receive the signal, usually abbreviated or an acronym.  |
| MSG ID:            | Code identifying the message of which this word is part.   |
| WORD NO.:          | The position of word in the message. If more than one word is required for a signal, the words will be numbered in sequence (e.g., double precision data, words no. 5 and 6). The lowest numbered word will appear on the left in the bit pattern format.  |
| MSG-LENGTH:        | Length of the message in which this word appears.  |
| TRANSMISSION RATE: | The rate in times per second that the message is transmitted.  |
| MSB:               | The value of the most significant bit of the signal.   |
| LSB:               | The value of the least significant bit of the signal.  |
| CODING:            | Binary Numeric Representation (BNR)--A digital (binary) representation in which the decimal value of a bit is related to the adjacent bit by a power of two.<br><br>Binary Coded Decimal (BCD)--The natural binary coded decimal (NBCD) or four-bit (8421) code is a special BCD form. The NBCD code allows only 10 (0-9) valid states, with the values 10-15 being invalid. |
|                    | Two's Complement--A special representation of a signed value BNR where the negative codes are modified to two's complement by adding one to the complement of the number. The use of two's complement in a digital computer facilitates the subtraction process.   |
|                    | Coded--A grouping of bits in which the pattern of <u>ones</u> and <u>zeros</u> has a specified meaning.  |
|                    | Discrete--A single binary bit whose state of <u>one or zero</u> has a specified meaning.   |
|                    | ASCII--A seven-bit binary code representing alpha and numeric characters. An eighth bit is sometimes employed as a parity check bit.   |
|                    | ASCII-8--Extended ASCII using eight bits for additional character representations.   |
| MAX:               | The maximum value that the signal can attain. On the standard data word format sheets (paragraph 11.2.5), this is the maximum value that can be transmitted using that format.   |

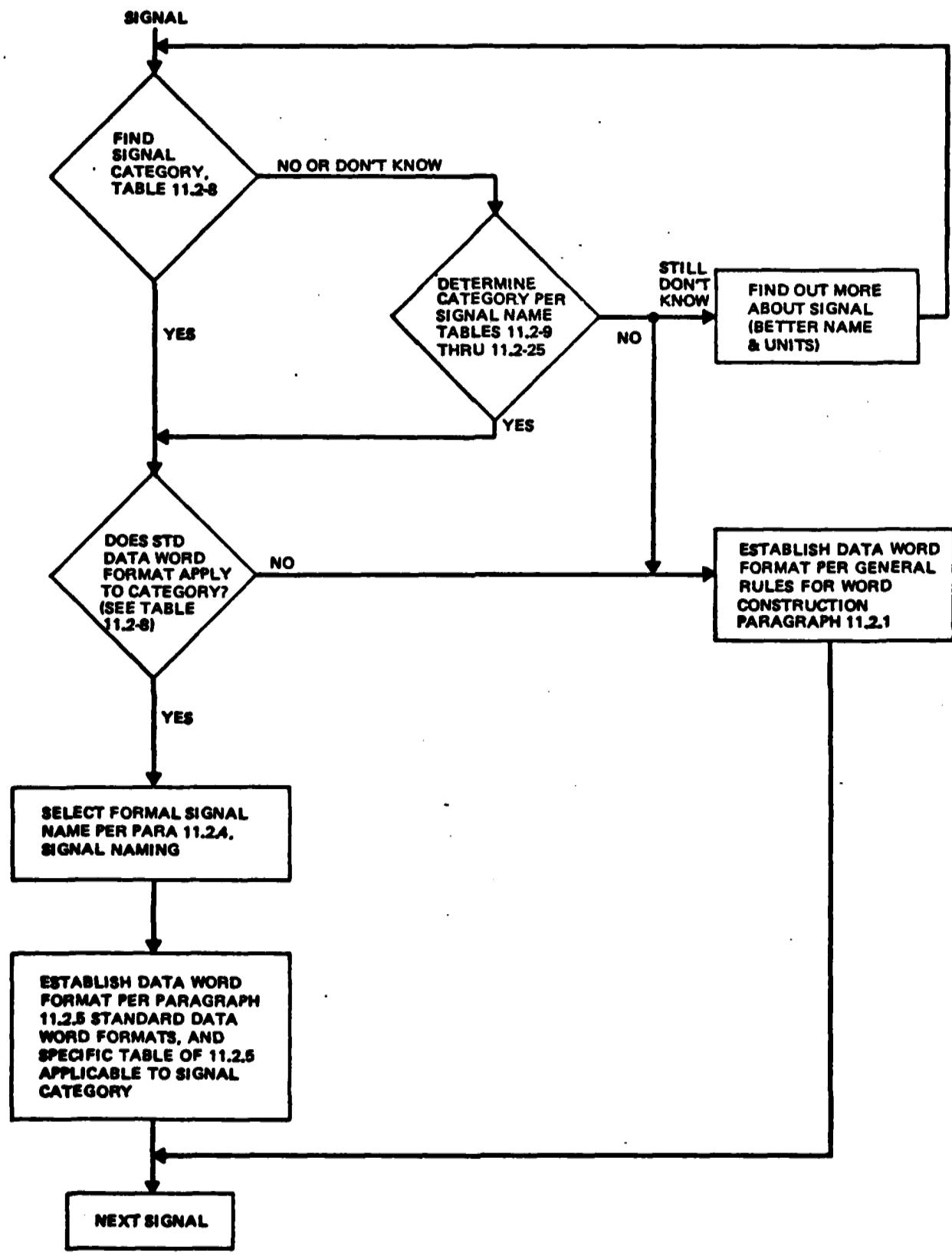
|                          |   |
|--------------------------|---|
| <b>MIN:</b>              | The minimum value that the signal can attain. On the standard data word format sheets (paragraph 11.2.5), this is the minimum value that can be transmitted using that format.  |
| <b>SCALE FACTOR:</b>     | In analog terms, scale factor is a multiplier applied to a parameter value to adjust the signal range to the operating range of the data channel. In digital terms, scale factor is the number of places that the binary point is shifted in converting a binary quantity to its fractional representation (for two's complement fractional encoding) or to its integer representation (for two's complement integer and BNR encoding). |
| <b>RESOLUTION:</b>       | Resolution is defined as the minimum detectable change in value. The resolution of a binary number is equal to the LSB value.   |
| <b>ACCURACY:</b>         | In analog terms, accuracy of a specified parameter is defined as the overall RMS error, expressed in physical units or as a percentage of full range. The RMS error is the difference between the measured value and the actual value of the parameter.<br><br>In digital terms, accuracy or precision is related to the number of significant bits and the scaling employed for conversion of the parameter to digital form.           |
| <b>COMPUTATION RATE:</b> | The rate in times per second that the data are computed.  |

### 11.2.3 How To Construct a Data Word Format

The purpose of this paragraph is to guide the user through the task of establishing the specific data word formats needed for system integration. The information required to start this process is, as a minimum, a signal list. The task will be easier if more information about each signal is known, such as engineering units (if any), maximum and minimum values, resolution, accuracy, and computation rate. This signal information will be required for each signal of the signal list before the word and message format definition can be completed.

The method for establishing a data word format is presented as a flow chart in figure 11.2-3 with an explanation below:

1. Pick a signal from the signal list. Example: present position latitude.
2. Refer to table 11.2-8, Signal Categories, and find the category that applies to the signal. In the example signal, present position latitude, the key word is latitude. Latitude is an angular measurement; therefore, the signal falls in the "angular" category. Note that table 11.2-8 is divided into categories for signals with engineering units and categories of unitless signals. It will be easier to find the appropriate



*Figure 11.2-3. Method of Establishing a Data Word Format*

Table 11.2-8. Signal Categories

| <u>Category</u>                               | <u>Standard Data Word Format</u> |
|---|----------------------------------|
| Categories for Signals with Engineering Units |                                  |
| 1. Acceleration                               | Tables 11.2-28 and 11.2-29       |
| 2. Angular                                    | Tables 11.2-30 and 11.2-31       |
| 3. Angular Velocity                           | Table 11.2-32                    |
| 4. Counts                                     | Table 11.2-33                    |
| 5. Distance                                   | Tables 11.2-34 through 11.2-40   |
| 6. Frequency                                  | Table 11.2-41                    |
| 7. Temperature                                | Tables 11.2-42 and 11.2-43       |
| 8. Time                                       | Table 11.2-44                    |
| 9. Velocity                                   | Tables 11.2-45 through 11.2-49   |
| 10. Voltage                                   | Tables 11.2-50 through 11.2-52   |
| Categories of Unitless Signals                |                                  |
| 1. Communications                             | Tables 11.2-53 and 11.2-54       |
| 2. Data Validity                              | Tables 11.2-55 through 11.2-57   |
| 3. Display Data                               | Table 11.2-58                    |
| 4. Header Word                                | Table 11.2-59                    |
| 5. Navigation                                 | Tables 11.2-60 through 11.2-64   |
| 6. Stores Management/<br>Weapons Delivery     | Tables 11.2-65 through 11.2-69   |

category if it is known whether the signal is unitless or which units apply.

After the signal category is determined, go to step 4. If the category cannot be determined or there is uncertainty whether the signal really fits in a given category, go to step 3.

3. Refer to tables 11.2-10 through 11.2-25. These tables contain common signal names in alphabetical order. These signals are listed with the keyword first and then typical modifiers. The category to which each signal belongs can be used to provide the data needed for step 2. The method is to find a match or close match to the signal name and note the associated category. The example signal, present position latitude, would match the table entry keyword "latitude," typical modifiers "present position," in table 11.2-11, Signal Names, Angular Category.

If the signal category has been determined, go to step 4. If there is still uncertainty about the signal category, get a better definition of the signal. Determine more descriptive or functional details about the signal, including the source, destination, name, and engineering units (if any). Then go back to step 2. If the signal definitely does not fall into any of the listed categories, refer to paragraph 11.2.1, General Rules for Word Construction, for general guidance in establishing the data word format for this signal.

4. Refer to table 11.2-8 again. For the example signal, present position latitude, the correct category is "angular" and in the standard data word format column of the table we find and note for later use the reference to tables 11.2-30 and 11.2-31. Find the category of your signal in table 11.2-8 and note the tables referenced in the standard data word format column.
5. A necessary part of data word format development is the selection of a formal signal name for each signal. Refer to paragraph 11.2.4, Signal Naming, to select the formal signal name. Return and proceed to step 6.
6. Refer to paragraph 11.2.5, Standard Data Word Formats and the applicable tables (noted in step 4). Construct the data word format and complete the ICD data sheet(s) for this signal.
7. Select next signal from signal list and start the process at step 2.

#### 11.2.4      Signal Naming

A necessary part of data word format development is the selection of a formal signal name for each signal. A naming convention will make signals more easily traceable within an integrated system as well as across various systems.

The basic principle for naming signals consistently is placing the most important word (keyword) first, followed by modifiers. The keyword is the word most related to the category or engineering units (if any) of the signal. The keyword may be the same as the signal category.

Table 11.2-9. Index of Signal Name Tables

| <u>Category</u>   | <u>Signal Name Table</u> |
|-------------------|--------------------------|
| Acceleration      | Table 11.2-10            |
| Angular           | Table 11.2-11            |
| Angular Velocity  | Table 11.2-12            |
| Counts            | Table 11.2-13            |
| Distance          | Table 11.2-14            |
| Frequency         | Table 11.2-15            |
| Temperature       | Table 11.2-16            |
| Time              | Table 11.2-17            |
| Velocity          | Table 11.2-18            |
| Voltage           | Table 11.2-19            |
| Communications    | Table 11.2-20            |
| Data Validity     | Table 11.2-21            |
| Display Data      | Table 11.2-22            |
| Header Word       | Table 11.2-23            |
| Navigation        | Table 11.2-24            |
| Stores Management | Table 11.2-25            |

Table 11.2-10. Signal Names, Acceleration Category

| <u>Keyword</u> | <u>Typical Modifiers</u>                                     |
|----------------|--|
| Acceleration   | Normal<br>Target, X<br>Target, Y<br>Target, Z<br>X<br>Y<br>Z |

Table 11.2-11. Signal Names, Angular Category

| <u>Keyword</u> | <u>Typical Modifiers</u>  |
|----------------|---|
| Angle          | AOA (Angle-of-Attack)<br>AOA, Error<br>AOA, True<br>Drift<br>Ground Track<br>Ground Track, Present<br>Pitch<br>Roll<br>Sideslip<br>Tilt |
| Azimuth        | Platform<br>Relative<br>Relative to Steerpoint<br>Relative to Nth Waypoint<br>Relative to Nth Markpoint<br>Symbol                       |
| Bearing        | Same as Azimuth   |
| Course         | Magnetic, Computed<br>Magnetic, Inserted  |
| Elevation      | Bullet<br>Circle<br>Command Angle<br>LOS (Loss-of-Signal)<br>Position<br>Reference, Aircraft<br>Scale                                   |
| Heading        | Error<br>Magnetic<br>Magnetic, Inserted<br>Magnetic, Present<br>True<br>True, Inserted<br>True, Present                                 |
| Latitude       | Markpoint<br>Nth Markpoint<br>Nth Waypoint<br>Present Position, Inserted<br>Waypoint Position, Inserted                                 |
| Longitude      | Same as Latitude  |
| Variation      | Magnetic, Computed<br>Magnetic, Inserted  |

Table 11.2-12. Signal Names, Angular Velocity Category

| <u>Keyword</u> | <u>Typical Modifiers</u>                     |
|----------------|--|
| Gyro Bias      | Correction X<br>Correction Y<br>Correction Z |
| Pitch Rate     | None   |
| Roll Rate      | None   |
| Yaw Rate       | None   |

Table 11.2-13. Signal Names, Counts Category

| <u>Keyword</u> | <u>Typical Modifiers</u>              |
|----------------|---------------------------------------|
| Counts         | Track Control, RN<br>Track Control, N |
| Frames         | Film Recording Data                   |
| Pulses         | Ripple                                |
| Revolutions    | Rotor Speed No. n                     |
| Rounds         | Remaining                             |
| Words          | Instrumentation Port Data             |

Table 11.2-14. Signal Names, Distance Category (Sheet 1 of 2)

| <u>Keyword</u> | <u>Typical Modifiers</u>   |
|----------------|--|
| Altitude       | Above Fixpoint<br>Barometric<br>Barometric Reference<br>Desired<br>Electronic Altimeter<br>Helo (Helicopter)<br>Inertial<br>Pressure<br>Radar<br>Sonobuoy Launch<br>System |
| Azimuth        | Cursor<br>Deviation Steering<br>Steering Dot   |
| Circle         | Display  |
| Distance       | To Nth Waypoint/Markpoint<br>To Steerpoint   |
| Easting        | Inserted Position<br>Inserted Waypoint<br>Nth Waypoint/Markpoint UTM<br>Present Position UTM   |
| Elevation      | Same as Azimuth  |
| Error          | Allowable Steering<br>Position East<br>Position North  |
| Height         | Above Target (HAT)   |
| Northing       | Same as Easting  |
| Range          | Aircraft Symbol<br>Contact<br>Ground Track, Incremental<br>Manual<br>Maximum<br>Minimum<br>Pull Up<br>Radar<br>Slant<br>TACAN<br>Tactical                                  |

Table 11.2-14. Signal Names, Distance Category (Sheet 2 of 2)

| <u>Keyword</u> | <u>Typical Modifiers</u>  |
|----------------|---|
| Range (Cont'd) | X, Relative Target<br>Y, Relative Target<br>Z, Relative Target  |
| Rate Position  | Acquisition Cursor  |
| Separation     | Impact  |
| Wingspan       | None  |
| X              | Cursor Correction<br>Cursor Total<br>Delta<br>Display Delta<br>Display Position<br>Display - Translate<br>Helo Position<br>Helo Position at Initialization<br>Ownship Position<br>Pointer Position<br>Position<br>Position, Fly to Point<br>Sonobuoy, Position<br>Symbol Position |
| Y              | Same as X   |
| Z              | Cursor Total<br>Position  |

Table 11.2-15. Signal Names, Frequency Category

| <u>Keyword</u> | <u>Typical Modifiers</u> |
|----------------|--------------------------|
| Frequency      | HF-n<br>UHF-n<br>VHF-n   |

Table 11.2-16. Signal Names, Temperature Category

| <u>Keyword</u> | <u>Typical Modifiers</u>   |
|----------------|--|
| Temperature    | Degrees C<br>Degrees Celsius<br>Outside Air<br>True Freestream Air |

Table 11.2-17. Signal Names, Time Category

| <u>Keyword</u> | <u>Typical Modifiers</u>   |
|----------------|--|
| Calendar       | None   |
| Clock          | Kalman   |
| Time           | Align<br>Coordinated Universal<br>Greenwich Mean<br>Of Day<br>Sonobuoy, Last Correct<br>Sonobuoy Launch<br>Symbol<br>Tag<br>To Nth Waypoint/Markpoint<br>To Steerpoint |

Table 11.2-18. Signal Names, Velocity Category

| <u>Keyword</u> | <u>Typical Modifiers</u>  |
|----------------|---|
| Airspeed       | Calibrated<br>Indicated<br>True   |
| Groundspeed    | Predicted<br>Present<br>Tail Warning System   |
| MACH           | Number  |
| Range Rate     | None  |
| Speed          | Bias<br>Desired<br>Helo<br>Helo Wind<br>Ownship<br>Symbol   |
| Velocity       | Correction X<br>Correction Y<br>Doppler Drift<br>Doppler Heading<br>Doppler Vertical<br>Drift<br>Heading<br>Vertical<br>Wind<br>X<br>X, Relative Target<br>Y<br>Y, Relative Target<br>Z<br>Z, Relative Target |

Table 11.2-19. Signal Names, Voltage Category

| <u>Keyword</u> | <u>Typical Modifiers</u>  |
|----------------|---|
| Voltage        | Display Intensity<br>Fore/Aft Cursor Deflection<br>Left/Right Cursor Deflection<br>Stick X Deflection<br>Stick Y Deflection |

Table 11.2-20. Signal Names, Communications Category

| <u>Keyword</u> | <u>Typical Modifiers</u>                    |
|----------------|---|
| Channel        | Select                                      |
| IFF            | Code<br>Control<br>Interrogator             |
| Radio          | Select<br>Status<br>Test                    |
| Receiver       | Channel<br>Command<br>Frequency<br>Tune     |
| RF             | Channel<br>Disposition<br>Level<br>Transmit |
| UHF            | Channel<br>Mode                             |

Table 11.2-21. Signal Names, Data Validity Category

| <u>Keyword</u> | <u>Typical Modifiers</u> |
|----------------|--------------------------|
| Check (CRC)    | Cyclic Redundancy        |
| Checksum       | Bits<br>Word             |
| Validity       | Bit<br>Data<br>Discretes |

Table 11.2-22. Signal Names, Display Data Category

| <u>Keyword</u> | <u>Typical Modifiers</u>  |
|----------------|---|
| Bar            | Horizontal<br>Vertical  |
| Character      | Left<br>Middle<br>Right   |
| Display        | Alpha<br>Border<br>Branch<br>Character<br>Control<br>Data<br>Intensity<br>Miscellaneous<br>Numeric<br>Position<br>Radar<br>Symbol<br>Window |
| Symbol         | Control<br>Identification<br>Internal<br>Reference  |

Table 11.2-23. Signal Names, Header Word Category

| <u>Keyword</u> | <u>Typical Modifiers</u>  |
|----------------|---|
| Header         | BIT<br>Display/Control<br>Interrogator Control<br>Message ID<br>Position<br>Tune Receiver<br>Weapon Inventory<br>Weapon Release<br>Word Count |

Table 11.2-24. Signal Names, Navigation Category

| <u>Keyword</u>     | <u>Typical Modifiers</u>  |
|--------------------|---|
| Convergence Factor | Inserted<br>Present, In Use   |
| Direction Cosines  | a. CXX      Reference platform to Earth<br>CXY      coordinate system<br>CXZ<br><br>b. DIRXL      Reference A/C body coordinate<br>DIRYL      system<br>DIRZL<br><br>c. DIRCOSX      (Same as b.)<br>DIRCOSY<br>DIRCOSZ |
| Position           | Grid Zone<br>Inserted<br>Present<br>Spheroid<br>UTM Grid Zone<br>UTM 100,000 Meter Grid Zone  |
| Waypoint/Markpoint | Inserted<br>Nth<br>UTM Grid Zone<br>UTM 100,000 Meter Grid Zone   |

Table 11.2-25. Signal Names, Stores Management Category

| <u>Keyword</u>       | <u>Typical Modifiers</u>                                 |
|----------------------|--|
| Station              | Store<br>Weapon  |
| Store                | Bomb<br>Ejector<br>Missile<br>Rack<br>Sonobouy<br>Weapon |
| (Store Type) Control | Arm<br>Jettison<br>Launch<br>Release<br>Safe<br>Select   |
| (Store Type) Monitor | ID<br>Inventory<br>Position<br>Status<br>Test            |

Table 11.2-9 is an index of the signal name tables (tables 11.2-10 through 11.2-25), which present typical signal names by category. Within each table is a list of keywords associated with that category and some typical modifiers associated with those keywords. These tables should be helpful in selecting a formal signal name by using the following procedure:

1. Find the appropriate table for your signal category. For our example signal, present position latitude, the category is "angular"; therefore, we find that the appropriate table is 11.2-11.
2. Determine if your signal's keyword is listed. For the example signal, present position latitude, the keyword is "latitude" and is listed in table 11.2-11.
3. If your signal's keyword is not listed in the appropriate category table, consider using the category name as your signal's keyword. If the category name is an inappropriate keyword for your signal, choose the most meaningful word in the name as the keyword.
4. Define your signal's formal name by placing the keyword first, followed by the remaining words (modifiers). The table for your signal's category lists some typical modifiers for common keywords. The formal name for our example signal would therefore be "latitude, present position."
5. Return to paragraph 11.2.3 to complete data word format definition.

#### **11.2.5 Standard Data Word Formats**

This paragraph presents the standard data word formats, and provides the user guidance necessary to fit real-life signals into the standard data word formats. An example signal is used to illustrate the application of the standard data word formats to real-life signals. The derivation of the example data word is presented below, and the completed data word format is presented in table 11.2-26.

Table 11.2-27 is an index that keys the user into the various standard data word formats. The standard data word formats are presented in tables 11.2-28 through 11.2-69. Having established the category of your signal (by following the method of paragraph 11.2.3), refer to the appropriate standard data word format(s), as indexed in table 11.2-27, and to the following example for guidance.

An effective means of guiding the user in establishing data word formats for his signals is by example. We have been using a typical signal, "latitude, present position," as our example. The data word format for this signal is derived as follows. It is necessary to have certain information about the signal before the data word format can be defined. For signals that have engineering units, the minimum necessary information is (1) the formal signal name (established in paragraph 11.2.4), (2) the engineering units, (3) the range (maximum and minimum) of signal value, and (4) the resolution required.

Table 11.2-26. Data Word Format for Example Signal

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: LATITUDE, PRESENT POSITION

UNITS: SEMICIRCLES

|                    |     |                                      |                                   |
|--------------------|-----|--------------------------------------|-----------------------------------|
| SOURCE:            | GPS | MSB: 1/2                             | MAX: +1/2                         |
| DESTINATION:       | INS | LSB: 2E-26 ( $1.49 \times 10^{-8}$ ) | MIN: -1/2                         |
| MSG ID:            | #   | CODING: 2'S COMPLEMENT               | SCALE FACTOR: 1                   |
| WORD NO.:          | #   | FRACTIONAL                           | RESOLUTION: $1.52 \times 10^{-8}$ |
| MSG-LENGTH:        | #   |                                      | ACCURACY: #                       |
| TRANSMISSION RATE: | #   |                                      | COMPUTATION RATE: #               |

WORD 1

BIT-01 SIGN  
 BIT-02 MSB  
 BIT-03 #  
 BIT-04 #  
 BIT-05 #  
 BIT-06 #  
 BIT-07 #  
 BIT-08 #  
 BIT-09 #  
 BIT-10 #  
 BIT-11 #  
 BIT-12 #  
 BIT-13 #  
 BIT-14 #  
 BIT-15 #  
 BIT-16 #

WORD 2

BIT-01 #  
 BIT-02 #  
 BIT-03 #  
 BIT-04 #  
 BIT-05 #  
 BIT-06 #  
 BIT-07 #  
 BIT-08 #  
 BIT-09 #  
 BIT-10 #  
 BIT-11 LSB  
 BIT-12 0  
 BIT-13 0  
 BIT-14 0  
 BIT-15 0  
 BIT-16 0

REMARKS:

# APPLICATION DEPENDENT

POSITIVE SENSE: PLUS IS NORTH

The following information is used in our example:

SIGNAL NAME: LATITUDE, PRESENT POSITION  
UNITS: DEGREES  
RANGE: +90 DEGREES (POSITIVE IS NORTH)  
RESOLUTION:  $2.73 \times 10^{-6}$  DEGREES

Refer to the index in table 11.2-27. We established that the category of our example signal is "angular." The index refers us to table 11.2-30 for angular category, single precision, and to table 11.2-31 for angular category, double precision. Proceed as follows to decide whether data word will be single or double precision:

1. Is RANGE of signal covered by MAX and MIN of standard data word format? If not, define data word format for the signal by using the General Rules for Word Construction, paragraph 11.2.1, and the standard data word formats as examples.

The RANGE of our signal is +90 DEGREES. We see that the UNITS of the standard data word format are SEMICIRCLES so we must convert all signal parameters from DEGREES to SEMICIRCLES. To convert, divide DEGREES by 180. The signal RANGE (+90 DEGREES) becomes +0.5 SEMICIRCLES, and is within the MAX (+1) and MIN (-1) of the standard format for both single and double precision.

2. Can the required signal RESOLUTION be transmitted using the single precision standard format? If yes, proceed; if no, can double precision standard format accommodate RESOLUTION? If yes, proceed; if no, refer to paragraph 11.2.1, General Rules for Word Construction, and define data word format for the signal using the standard data word formats as examples.

The example signal's required RESOLUTION is  $2.73 \times 10^{-6}$  DEGREES or after conversion  $1.52 \times 10^{-8}$  SEMICIRCLES. The LSB value of the single precision standard format (which is the standard format's best resolution) is  $2E-15$  (i.e.,  $3.05 \times 10^{-5}$ ) SEMICIRCLES. The single precision standard format with resolution of  $3.05 \times 10^{-5}$  cannot accommodate the  $1.52 \times 10^{-8}$  resolution required. The LSB value of the double precision standard format is  $2E-31$  (i.e.,  $4.66 \times 10^{-10}$ ) SEMICIRCLES, which is sufficient to accommodate the  $1.52 \times 10^{-8}$  signal resolution.

By the above steps it was determined that the appropriate standard data word format for the example signal is table 11.2-31, for angular category, double precision. Now use a blank ICD presentation format sheet (see tables 11.2-6 and 11.2-7 for single and double precision formats, respectively) as a worksheet and to document the data word format that will be derived. We need to use the ICD format of table 11.2-7 because our example data word will be double precision. The completed ICD presentation for our example signal's data word format is shown in table 11.2-26. The derivation of each entry, which is not application dependent, is as follows:

1. SIGNAL NAME: LATITUDE, PRESENT POSITION (formal signal name, selected in paragraph 11.2.4).
2. UNITS: SEMICIRCLES (as specified in standard data word format).
3. SOURCE: GPS (source of example signal).
4. DESTINATION: INS (destination of example signal).
5. MSB: 0.5 (MSB value as specified in standard data word format).  
The MSB value is fixed for each standard data word format; therefore, the maximum range transmittable (MAX and MIN) of each data word format is fixed.
6. LSB:  $1.49 \times 10^{-8}$  ( $2E-26$ ). Notice note 1 of standard format, table 11.2-3C, which states: "the LSB value and location may be changed, as required, to adjust resolution of data word format. Any bits after LSB must be set to zero." The full resolution of the double precision standard angular format ( $4.66 \times 10^{-8}$ ) is not required; therefore, the LSB location was adjusted to BIT-11 of word 2 to provide an LSB value ( $1.49 \times 10^{-8}$ ) just under the signal resolution ( $1.52 \times 10^{-8}$ ). The five bits after the LSB are set to zero.
7. CODING: The encoding format of the digital data is 2's COMPLEMENT FRACTIONAL notation, as specified in the standard format.
8. MAX: The maximum value of our signal is +0.5 SEMICIRCLES (converted from +90 DEGREES).
9. MIN: The minimum value of our signal is -0.5 SEMICIRCLES (converted from -90 DEGREES).
10. SCALE FACTOR: 1 (as specified in standard data word format).
11. RESOLUTION:  $1.52 \times 10^{-8}$  (the signal resolution).
12. WORD 1: This defines the bit assignments for the first data word. This is a signed quantity; therefore, BIT-01 is the SIGN. BIT-02 is the MSB (MSB of data is transmitted first per MIL-STD-1553B). BIT-03 through BIT-16 are data bits (#=Data Bit).
13. WORD 2: This defines the bit assignments for the second data word. BIT-01 through BIT-10 are data bits. BIT-11 is the LSB, whose location was selected to match the signal resolution. BIT-12 through BIT-16 are set to 0, as specified in note 1 of the standard format.
14. REMARKS: POSITIVE SENSE: PLUS IS NORTH (statement that data is transmitted as plus equals north latitude).

Table 11.2-27. Standard Data Word Format Index (Sheet 1 of 2)

| <u>Category</u>  | <u>Subcategory</u>  | <u>Table No.</u>  |
|------------------|---|---|
| Acceleration     | Feet/Second <sup>2</sup> , Single Precision<br>Meters/Second <sup>2</sup> , Double Precision  | 11.2-28<br>11.2-29  |
| Angular          | Single Precision<br>Double Precision  | 11.2-30<br>11.2-31  |
| Angular Velocity | Single Precision  | 11.2-32   |
| Counts           | Single Precision  | 11.2-33   |
| Distance         | Feet, Single Precision<br>Feet, Double Precision<br>Meters, Double Precision<br>Kilometers, Double Precision<br>UTM Grid Zone, Northing/Easting;<br>Single Precision<br>Nautical Miles, Low Range, Single<br>Precision<br>Nautical Miles, High Range,<br>Single Precision | 11.2-34<br>11.2-35<br>11.2-36<br>11.2-37<br>11.2-38<br>11.2-39<br>11.2-40 |
| Frequency        | Four Words  | 11.2-41   |
| Temperature      | Low Range, Single Precision<br>High Range; Single Precision   | 11.2-42<br>11.2-43  |
| Time             | Time of Day, Six Words  | 11.2-44   |
| Velocity         | Feet/Second, Single Precision<br>Feet/Second, Double Precision<br>Meters/Second, Double Precision<br>Knots, Single Precision<br>Mach, Single Precision  | 11.2-45<br>11.2-46<br>11.2-47<br>11.2-48<br>11.2-49                       |
| Voltage          | High Range, Single Precision<br>Mid Range, Single Precision<br>Low (Millivolt) Range, Single Precision  | 11.2-50<br>11.2-51<br>11.2-52   |
| Communications   | Channel Select<br>Radio Selection   | 11.2-53<br>11.2-54  |
| Data Validity    | Checksum<br>Cyclic Redundancy Check<br>Validity Bit   | 11.2-55<br>11.2-56<br>11.2-57   |
| Display Data     | Character Display   | 11.2-58   |
| Header Word      | Message Header  | 11.2-59   |

**Table 11.2-27. Standard Data Word Format Index (Sheet 2 of 2)**

| <u>Category</u>          | <u>Subcategory</u>                                 | <u>Table No.</u> |
|--------------------------|--|------------------|
| <b>Navigation</b>        | Convergence Factor                                 | 11.2-60          |
|                          | Direction Cosine, Platform<br>To Earth Coordinates | 11.2-61          |
|                          | Direction Cosine, Aircraft Body<br>Coordinates     | 11.2-62          |
|                          | 100,000 Meter Grid Zone                            | 11.2-63          |
|                          | Spheroid/UTM Grid Zone                             | 11.2-64          |
| <b>Stores Management</b> | Laser Code   | 11.2-65          |
|                          | Release Command Code                               | 11.2-66          |
|                          | Store Inventory                                    | 11.2-67          |
|                          | Station/Store Status                               | 11.2-68          |
|                          | Weapon Selection (ID/QTY)                          | 11.2-69          |

**Table 11.2-28. Standard Data Word Format, Acceleration Category,  
Subcategory Feet/Second<sup>2</sup>, Single Precision**

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: FT/SEC<sup>2</sup>

|                      |                        |                     |
|----------------------|------------------------|---------------------|
| SOURCE: #            | MSB: 512               | MAX: +1024          |
| DESTINATION: #       | LSB: 2E-5 (NOTE 1)     | MIN: -1024          |
| MSG ID: #            | CODING: 2's COMPLEMENT | SCALE FACTOR: 32    |
| WORD NO.: #          | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH: #        |                        | ACCURACY: #         |
| TRANSMISSION RATE: # |                        | COMPUTATION RATE: # |

|        |              |
|--------|--------------|
| BIT-01 | SIGN         |
| BIT-02 | MSB          |
| BIT-03 | #            |
| BIT-04 | #            |
| BIT-05 | #            |
| BIT-06 | #            |
| BIT-07 | #            |
| BIT-08 | #            |
| BIT-09 | #            |
| BIT-10 | #            |
| BIT-11 | #            |
| BIT-12 | #            |
| BIT-13 | #            |
| BIT-14 | #            |
| BIT-15 | #            |
| BIT-16 | LSB (NOTE 1) |

**REMARKS:**

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

**Table 11.2-29. Standard Data Word Format, Acceleration Category,  
Subcategory Meters/Second<sup>2</sup>, Double Precision**

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: METERS/SECOND<sup>2</sup>

|                      |                        |                     |
|----------------------|------------------------|---------------------|
| SOURCE: #            | MSB: 512               | MAX: +1024          |
| DESTINATION: #       | LSB: 0.000976          | MIN: -1024          |
| MSG ID: #            | CODING: 2's COMPLEMENT | SCALE FACTOR: 2E21  |
| WORD NO.: #          | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH: #        |                        | ACCURACY: #         |
| TRANSMISSION RATE: # |                        | COMPUTATION RATE: # |

BIT-01 SIGN

BIT-02 MSB

BIT-03 \*

BIT-04 \*

BIT-05 \*

BIT-06 \*

BIT-07 \*

BIT-08 \*

BIT-09 \*

BIT-10 \*

BIT-11 \*

BIT-12 \*

BIT-13 \*

BIT-14 \*

BIT-15 \*

BIT-16 \* (NOTE 1)

BIT-01 \*

BIT-02 \*

BIT-03 \*

BIT-04 \*

BIT-05 LSB

BIT-06 0

BIT-07 0

BIT-08 0

BIT-09 0

BIT-10 0

BIT-11 0

BIT-12 0

BIT-13 0

BIT-14 0

BIT-15 0

BIT-16 0

**REMARKS:**

NOTE 1: IF A RESOLUTION FINER THAN 0.03125 M/SEC<sup>2</sup> IS REQUIRED, USE WORDS 1 AND 2.  
IF A RESOLUTION 0.03125 M/SEC<sup>2</sup> OR COARSER IS REQUIRED, USE ONLY WORD 1. THE  
LSB (BIT 16) OF WORD 1 IS EQUAL TO 0.03125 M/SEC<sup>2</sup>.

# APPLICATION DEPENDENT

Table 11.2-30. Standard Data Word Format, Angular Category, Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: SEMICIRCLES

|                    |   |         |                |                   |    |
|--------------------|---|---------|----------------|-------------------|----|
| SOURCE:            | # | MSB:    | 1/2            | MAX:              | +1 |
| DESTINATION:       | # | LSB:    | 2E-15 (NOTE 1) | MIN:              | -1 |
| MSG ID:            | # | CODING: | 2's COMPLEMENT | SCALE FACTOR:     | 1  |
| WORD NO.:          | # |         | FRACTIONAL     | RESOLUTION:       | #  |
| MSG-LENGTH:        | # |         |                | ACCURACY:         | #  |
| TRANSMISSION RATE: | # |         |                | COMPUTATION RATE: | #  |

|        |              |
|--------|--------------|
| BIT-01 | SIGN         |
| BIT-02 | MSB          |
| BIT-03 | #            |
| BIT-04 | #            |
| BIT-05 | #            |
| BIT-06 | #            |
| BIT-07 | #            |
| BIT-08 | #            |
| BIT-09 | #            |
| BIT-10 | #            |
| BIT-11 | #            |
| BIT-12 | #            |
| BIT-13 | #            |
| BIT-14 | #            |
| BIT-15 | #            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-31. Standard Data Word Format, Angular Category, Double Precision

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: #

UNITS: SEMICIRCLES

|                      |                        |                    |
|----------------------|------------------------|--------------------|
| SOURCE: #            | MSB: 1/2               | MAX: +1            |
| DESTINATION: #       | LSB: 2E-31 (NOTE 1)    | MIN: -1            |
| MSG ID: #            | CODING: 2's COMPLEMENT | SCALE FACTOR: 1    |
| WORD NO.: #          | FRACTIONAL             | RESOLUTION: #      |
| MSG-LENGTH: #        |                        | ACCURACY: #        |
| TRANSMISSION RATE: # |                        | COMPUTATION RATE:# |

WORD 1

|        |      |
|--------|------|
| BIT-01 | SIGN |
| BIT-02 | MSB  |
| BIT-03 | #    |
| BIT-04 | #    |
| BIT-05 | #    |
| BIT-06 | #    |
| BIT-07 | #    |
| BIT-08 | #    |
| BIT-09 | #    |
| BIT-10 | #    |
| BIT-11 | #    |
| BIT-12 | #    |
| BIT-13 | #    |
| BIT-14 | #    |
| BIT-15 | #    |
| BIT-16 | #    |

WORD 2

|        |              |
|--------|--------------|
| BIT-01 | #            |
| BIT-02 | #            |
| BIT-03 | #            |
| BIT-04 | #            |
| BIT-05 | #            |
| BIT-06 | #            |
| BIT-07 | #            |
| BIT-08 | #            |
| BIT-09 | #            |
| BIT-10 | #            |
| BIT-11 | #            |
| BIT-12 | #            |
| BIT-13 | #            |
| BIT-14 | #            |
| BIT-15 | #            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

**Table 11.2-32. Standard Data Word Format, Angular Velocity Category,  
Single Precision**

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: SEMICIRCLES/SECOND

|                      |                        |                     |
|----------------------|------------------------|---------------------|
| SOURCE: #            | MSB: 2                 | MAX: +4             |
| DESTINATION: #       | LSB: 2E-13 (NOTE 1)    | MIN: -4             |
| MSG ID: #            | CODING: 2's COMPLEMENT | SCALE FACTOR: 2E-2  |
| WORD NO.: #          | FRACTIONAL             | RESOLUTION: #       |
| MSG-LENGTH: #        |                        | ACCURACY: #         |
| TRANSMISSION RATE: # |                        | COMPUTATION RATE: # |

|        |              |
|--------|--------------|
| BIT-01 | SIGN         |
| BIT-02 | MSB          |
| BIT-03 | #            |
| BIT-04 | #            |
| BIT-05 | #            |
| BIT-06 | #            |
| BIT-07 | #            |
| BIT-08 | #            |
| BIT-09 | #            |
| BIT-10 | #            |
| BIT-11 | #            |
| BIT-12 | #            |
| BIT-13 | #            |
| BIT-14 | #            |
| BIT-15 | #            |
| BIT-16 | LSB (NOTE 1) |

**REMARKS:**

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-33. Standard Data Word Format, Counts Category, Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: (NOTE 1)

|                    |   |         |        |                   |        |
|--------------------|---|---------|--------|-------------------|--------|
| SOURCE:            | # | MSB:    | 32,768 | MAX:              | 65,536 |
| DESTINATION:       | # | LSB:    | 1      | MIN:              | 0      |
| MSG ID:            | # | CODING: | BNR    | SCALE FACTOR:     | 1      |
| WORD NO.:          | # |         |        | RESOLUTION:       | #      |
| MSG-LENGTH:        | # |         |        | ACCURACY:         | #      |
| TRANSMISSION RATE: | # |         |        | COMPUTATION RATE: | #      |

BIT-01 MSB  
BIT-02 #  
BIT-03 #  
BIT-04 #  
BIT-05 #  
BIT-06 #  
BIT-07 #  
BIT-08 #  
BIT-09 #  
BIT-10 #  
BIT-11 #  
BIT-12 #  
BIT-13 #  
BIT-14 #  
BIT-15 #  
BIT-16 LSB

REMARKS:

NOTE 1: UNITS MAY BE ANY WITH INTEGER VALUES; SUCH AS, COUNTS, FRAMES, PULSES, REVOLUTIONS, ROUNDS AND WORDS.

# APPLICATION DEPENDENT

Table 11.2-34. Standard Data Word Format, Distance Category,  
Subcategory Feet, Single Precision

DOC. NO. # ---  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: FEET

|                    |   |                        |                     |
|--------------------|---|------------------------|---------------------|
| SOURCE:            | # | MSB: 16,384            | MAX: +32,768        |
| DESTINATION:       | # | LSB: 1 (NOTE 1)        | MIN: -32,768        |
| MSG ID:            | # | CODING: 2's COMPLEMENT | SCALE FACTOR: 1     |
| WORD NO.:          | # | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH:        | # |                        | ACCURACY: #         |
| TRANSMISSION RATE: | # |                        | COMPUTATION RATE: # |

|        |              |
|--------|--------------|
| BIT-01 | SIGN         |
| BIT-02 | MSB          |
| BIT-03 | *            |
| BIT-04 | *            |
| BIT-05 | *            |
| BIT-06 | *            |
| BIT-07 | *            |
| BIT-08 | *            |
| BIT-09 | *            |
| BIT-10 | *            |
| BIT-11 | *            |
| BIT-12 | *            |
| BIT-13 | *            |
| BIT-14 | *            |
| BIT-15 | *            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-35. Standard Data Word Format, Distance Category,  
Subcategory Feet, Double Precision

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: #

UNITS: FEET

|                      |                        |                     |
|----------------------|------------------------|---------------------|
| SOURCE: #            | MSB: 16,777,216        | MAX: +33,554,432    |
| DESTINATION: #       | LSB: 2E-6 (NOTE 1)     | MIN: -33,554,432    |
| MSG ID: #            | CODING: 2's COMPLEMENT | SCALE FACTOR: 64    |
| WORD NO.: #          | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH: #        |                        | ACCURACY: #         |
| TRANSMISSION RATE: # |                        | COMPUTATION RATE: # |

WORD 1

|        |      |
|--------|------|
| BIT-01 | SIGN |
| BIT-02 | MSB  |
| BIT-03 | #    |
| BIT-04 | #    |
| BIT-05 | #    |
| BIT-06 | #    |
| BIT-07 | #    |
| BIT-08 | #    |
| BIT-09 | #    |
| BIT-10 | #    |
| BIT-11 | #    |
| BIT-12 | #    |
| BIT-13 | #    |
| BIT-14 | #    |
| BIT-15 | #    |
| BIT-16 | #    |

WORD 2

|        |              |
|--------|--------------|
| BIT-01 | #            |
| BIT-02 | #            |
| BIT-03 | #            |
| BIT-04 | #            |
| BIT-05 | #            |
| BIT-06 | #            |
| BIT-07 | #            |
| BIT-08 | #            |
| BIT-09 | #            |
| BIT-10 | #            |
| BIT-11 | #            |
| BIT-12 | #            |
| BIT-13 | #            |
| BIT-14 | #            |
| BIT-15 | #            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-36. Standard Data Word Format, Distance Category,  
Subcategory Meters, Double Precision

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: # (ALTITUDE)

UNITS: METERS

|                    |   |                        |                     |
|--------------------|---|------------------------|---------------------|
| SOURCE:            | # | MSB: 8,388,608         | MAX: +16,777,216    |
| DESTINATION:       | # | LSB: 0.0078            | MIN: -16,777,216    |
| MSG ID:            | # | CODING: 2's COMPLEMENT | SCALE FACTOR: 128   |
| WORD NO.:          | # | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH:        | # |                        | ACCURACY: #         |
| TRANSMISSION RATE: | # |                        | COMPUTATION RATE: # |

WORD 1

BIT-01 SIGN  
BIT-02 MSB  
BIT-03 #  
BIT-04 #  
BIT-05 #  
BIT-06 #  
BIT-07 #  
BIT-08 #  
BIT-09 #  
BIT-10 #  
BIT-11 #  
BIT-12 #  
BIT-13 #  
BIT-14 #  
BIT-15 #  
BIT-16 #

WORD 2

BIT-01 #  
BIT-02 #  
BIT-03 #  
BIT-04 #  
BIT-05 #  
BIT-06 #  
BIT-07 #  
BIT-08 #  
BIT-09 #  
BIT-10 #  
BIT-11 #  
BIT-12 #  
BIT-13 #  
BIT-14 #  
BIT-15 #  
BIT-16 LSB

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-37. Standard Data Word Format, Distance Category,  
Subcategory Kilometers, Double Precision

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: # (RANGE)

UNITS: KILOMETERS

|                    |   |                |                     |
|--------------------|---|----------------|---------------------|
| SOURCE:            | # | MSB: 32,768    | MAX: 65,536         |
| DESTINATION:       | # | LSB: 0.0000153 | MIN: 0              |
| MSG ID:            | # | CODING: BNR    | SCALE FACTOR: 2E16  |
| WORD NO.:          | # |                | RESOLUTION: #       |
| MSG-LENGTH:        | # |                | ACCURACY: #         |
| TRANSMISSION RATE: | # |                | COMPUTATION RATE: # |

WORD 1

|        |            |
|--------|------------|
| BIT-01 | MSB        |
| BIT-02 | *          |
| BIT-03 | *          |
| BIT-04 | *          |
| BIT-05 | *          |
| BIT-06 | *          |
| BIT-07 | *          |
| BIT-08 | *          |
| BIT-09 | *          |
| BIT-10 | *          |
| BIT-11 | *          |
| BIT-12 | *          |
| BIT-13 | *          |
| BIT-14 | *          |
| BIT-15 | *          |
| BIT-16 | * (NOTE 1) |

WORD 2

|        |     |
|--------|-----|
| BIT-01 | *   |
| BIT-02 | *   |
| BIT-03 | *   |
| BIT-04 | *   |
| BIT-05 | *   |
| BIT-06 | *   |
| BIT-07 | *   |
| BIT-08 | *   |
| BIT-09 | *   |
| BIT-10 | *   |
| BIT-11 | *   |
| BIT-12 | *   |
| BIT-13 | *   |
| BIT-14 | *   |
| BIT-15 | *   |
| BIT-16 | LSB |

REMARKS:

NOTE 1: IF A RESOLUTION FINER THAN 1 KILOMETER IS REQUIRED, USE WORDS 1 AND 2. IF A RESOLUTION OF 1 KILOMETER OR COARSER IS REQUIRED, USE ONLY WORD 1. THE LSB (BIT 16) OF WORD 1 IS EQUAL TO 1 KILOMETER

\* APPLICATION DEPENDENT

Table 11.2-38. Standard Data Word Format, Distance Category,  
Subcategory UTM Grid Zone, Northing/Easting,  
Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: METERS

|                    |   |             |                     |
|--------------------|---|-------------|---------------------|
| SOURCE:            | # | MSB: 65,536 | MAX: 99,998         |
| DESTINATION:       | # | LSB: 2      | MIN: 0              |
| MSG ID:            | # | CODING: BNR | SCALE FACTOR: 1/2   |
| WORD NO.:          | # |             | RESOLUTION: #       |
| MSG-LENGTH:        | # |             | ACCURACY: #         |
| TRANSMISSION RATE: | # |             | COMPUTATION RATE: # |

BIT-01 MSB  
BIT-02 #  
BIT-03 #  
BIT-04 #  
BIT-05 #  
BIT-06 #  
BIT-07 #  
BIT-08 #  
BIT-09 #  
BIT-10 #  
BIT-11 #  
BIT-12 #  
BIT-13 #  
BIT-14 #  
BIT-15 #  
BIT-16 LSB

REMARKS:

# APPLICATION DEPENDENT

Table 11.2-39. Standard Data Word Format, Distance Category,  
Subcategory Nautical Miles (Low Range),  
Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: NAUTICAL MILES

|                    |   |                    |                     |
|--------------------|---|--------------------|---------------------|
| SOURCE:            | # | MSB: 327.68        | MAX: 655.36         |
| DESTINATION:       | # | LSB: 0.01 (NOTE 1) | MIN: 0              |
| MSG ID:            | # | CODING: BNR        | SCALE FACTOR: 100   |
| WORD NO.:          | # |                    | RESOLUTION: #       |
| MSG-LENGTH:        | # |                    | ACCURACY: #         |
| TRANSMISSION RATE: | # |                    | COMPUTATION RATE: # |

|        |              |
|--------|--------------|
| BIT-01 | MSB          |
| BIT-02 | #            |
| BIT-03 | #            |
| BIT-04 | #            |
| BIT-05 | #            |
| BIT-06 | #            |
| BIT-07 | #            |
| BIT-08 | #            |
| BIT-09 | #            |
| BIT-10 | #            |
| BIT-11 | #            |
| BIT-12 | #            |
| BIT-13 | #            |
| BIT-14 | #            |
| BIT-15 | #            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-40. Standard Data Word Format, Distance Category  
Subcategory Nautical Miles (High Range),  
Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: NAUTICAL MILES

|                    |   |         |              |                   |        |
|--------------------|---|---------|--------------|-------------------|--------|
| SOURCE:            | # | MSL:    | 3276.8       | MAX:              | 6553.6 |
| DESTINATION:       | # | LSB:    | 0.1 (NOTE 1) | MIN:              | 0      |
| MSG ID:            | # | CODING: | BNR          | SCALE FACTOR:     | 10     |
| WORD NO.:          | # |         |              | RESOLUTION:       | #      |
| MSG-LENGTH:        | # |         |              | ACCURACY:         | #      |
| TRANSMISSION RATE: | # |         |              | COMPUTATION RATE: | #      |

|        |              |
|--------|--------------|
| BIT-01 | MSB          |
| BIT-02 | *            |
| BIT-03 | *            |
| BIT-04 | *            |
| BIT-05 | *            |
| BIT-06 | *            |
| BIT-07 | *            |
| BIT-08 | *            |
| BIT-09 | *            |
| BIT-10 | *            |
| BIT-11 | *            |
| BIT-12 | *            |
| BIT-13 | *            |
| BIT-14 | *            |
| BIT-15 | *            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

\* APPLICATION DEPENDENT

Table 11.2-41. Standard Data Word Format,  
Frequency Category, Four-Word Quantity  
(Sheet 1 of 4)

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 4

SIGNAL NAME: #

UNITS: HERTZ

|                    |   |              |                                    |
|--------------------|---|--------------|------------------------------------|
| SOURCE:            | # | MSB: N/A     | MAX: 9999X10 <sup>9</sup> (WORD 1) |
| DESTINATION:       | # | LSB: N/A     | MIN: 0                             |
| MSG ID:            | # | CODING: NBCD | SCALE FACTOR: N/A                  |
| WORD NO.:          | # |              | RESOLUTION: #                      |
| MSG-LENGTH:        | # |              | ACCURACY: #                        |
| TRANSMISSION RATE: | # |              | COMPUTATION RATE: #                |

|        |     |   |  |
|--------|-----|---|--|
| BIT-01 | MSB |   |  |
| BIT-02 | *   | LSB = 1 X 10 <sup>12</sup> Hz (1,000 GHz) |  |
| BIT-03 | *   |   |  |
| BIT-04 | LSB |   |  |
| BIT-05 | MSB |   |  |
| BIT-06 | *   | LSB = 1 X 10 <sup>11</sup> Hz (100 GHz)   |  |
| BIT-07 | *   |   |  |
| BIT-08 | LSB |   |  |
| BIT-09 | MSB |   |  |
| BIT-10 | *   | LSB = 1 X 10 <sup>10</sup> Hz (10 GHz)    |  |
| BIT-11 | *   |   |  |
| BIT-12 | LSB |   |  |
| BIT-13 | MSB |   |  |
| BIT-14 | *   | LSB = 1 X 10 <sup>9</sup> Hz (1 GHz)      |  |
| BIT-15 | *   |   |  |
| BIT-16 | LSB |   |  |

REMARKS:

\* APPLICATION DEPENDENT

Table 11.2-41. Standard Data Word Format,  
Frequency Category, Four-Word Quantity  
(Sheet 2 of 4)

DOC. NO. #  
REV. #  
DATE #  
PAGE 2 of 4

SIGNAL NAME: #

UNITS: HERTZ

|                      |              |                                    |
|----------------------|--------------|------------------------------------|
| SOURCE: #            | MSB: N/A     | MAX: 9999X10 <sup>5</sup> (WORD 2) |
| DESTINATION: #       | LSB: N/A     | MIN: 0                             |
| MSG ID: #            | CODING: NBCD | SCALE FACTOR: N/A                  |
| WORD NO.: #          |              | RESOLUTION: #                      |
| MSG-LENGTH: #        |              | ACCURACY: #                        |
| TRANSMISSION RATE: # |              | COMPUTATION RATE: #                |

|        |     |  |
|--------|-----|--|
| BIT-01 | MSB |  |
| BIT-02 | #   | LSB = 1 X 10 <sup>8</sup> Hz (100 MHz) |
| BIT-03 | #   |  |
| BIT-04 | LSB |  |
| BIT-05 | MSB |  |
| BIT-06 | #   | LSB = 1 X 10 <sup>7</sup> Hz (10 MHz)  |
| BIT-07 | #   |  |
| BIT-08 | LSB |  |
| BIT-09 | MSB |  |
| BIT-10 | #   | LSB = 1 X 10 <sup>6</sup> Hz (1 MHz)   |
| BIT-11 | #   |  |
| BIT-12 | LSB |  |
| BIT-13 | MSB |  |
| BIT-14 | #   | LSB = 1 X 10 <sup>5</sup> Hz (100 KHz) |
| BIT-15 | #   |  |
| BIT-16 | LSB |  |

REMARKS:

# APPLICATION DEPENDENT

Table 11.2-41. Standard Data Word Format,  
Frequency Category, Four-Word Quantity  
(Sheet 3 of 4)

DOC. NO. #  
REV. #  
DATE #  
PAGE 3 of 4

SIGNAL NAME: #

UNITS: HERTZ

|                    |   |              |                     |
|--------------------|---|--------------|---------------------|
| SOURCE:            | # | MSB: N/A     | MAX: 99990 (WORD 3) |
| DESTINATION:       | # | LSB: N/A     | MIN: 0              |
| MSG ID:            | # | CODING: NBCD | SCALE FACTOR: N/A   |
| WORD NO.:          | # |              | RESOLUTION: #       |
| MSG-LENGTH:        | # |              | ACCURACY: #         |
| TRANSMISSION RATE: | # |              | COMPUTATION RATE: # |

|        |     |                                   |
|--------|-----|-----------------------------------|
| BIT-01 | MSB |                                   |
| BIT-02 | *   | LSB = $1 \times 10^4$ Hz (10 KHz) |
| BIT-03 | *   |                                   |
| BIT-04 | LSB |                                   |
| BIT-05 | MSB |                                   |
| BIT-06 | *   | LSB = $1 \times 10^3$ Hz (1 KHz)  |
| BIT-07 | *   |                                   |
| BIT-08 | LSB |                                   |
| BIT-09 | MSB |                                   |
| BIT-10 | *   | LSB = $1 \times 10^2$ Hz (100 Hz) |
| BIT-11 | *   |                                   |
| BIT-12 | LSB |                                   |
| BIT-13 | MSB |                                   |
| BIT-14 | *   | LSB = 10 Hz                       |
| BIT-15 | *   |                                   |
| BIT-16 | LSB |                                   |

REMARKS:

# APPLICATION DEPENDENT

Table 11.2-41. Standard Data Word Format,  
Frequency Category, Four-Word Quantity  
(Sheet 4 of 4)

DOC. NO. #  
REV. #  
DATE #  
PAGE 4 of 4

SIGNAL NAME: #

UNITS: HERTZ

|                    |   |              |                     |
|--------------------|---|--------------|---------------------|
| SOURCE:            | # | MSB: N/A     | MAX: 9.999 (WORD 4) |
| DESTINATION:       | # | LSB: N/A     | MIN: 0              |
| MSG ID:            | # | CODING: NBCD | SCALE FACTOR: N/A   |
| WORD NO.:          | # |              | RESOLUTION: #       |
| MSG-LENGTH:        | # |              | ACCURACY: #         |
| TRANSMISSION RATE: | # |              | COMPUTATION RATE: # |

|        |     |  |  |
|--------|-----|--|--|
| BIT-01 | MSB |  |  |
| BIT-02 | #   | LSB = 1 Hz                             |  |
| BIT-03 | #   |  |  |
| BIT-04 | LSB |  |  |
| BIT-05 | MSB |  |  |
| BIT-06 | #   | LSB = $1 \times 10^{-1}$ Hz (0.1 Hz)   |  |
| BIT-07 | #   |  |  |
| BIT-08 | LSB |  |  |
| BIT-09 | MSB |  |  |
| BIT-10 | #   | LSB = $1 \times 10^{-2}$ Hz (0.01 Hz)  |  |
| BIT-11 | #   |  |  |
| BIT-12 | LSB |  |  |
| BIT-13 | MSB |  |  |
| BIT-14 | #   | LSB = $1 \times 10^{-3}$ Hz (0.001 Hz) |  |
| BIT-15 | #   |  |  |
| BIT-16 | LSB |  |  |

REMARKS:

# APPLICATION DEPENDENT

Table 11.2-42. Standard Data Word Format, Temperature Category,  
Subcategory Low Range, Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: DEGREES CELSIUS

|                    |   |                        |                     |
|--------------------|---|------------------------|---------------------|
| SOURCE:            | # | MSB: 256               | MAX: +512           |
| DESTINATION:       | # | LSB: 2E-6 (NOTE 1)     | MIN: -512           |
| MSG ID:            | # | CODING: 2's COMPLEMENT | SCALE FACTOR: 64    |
| WORD NO.:          | # | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH:        | # |                        | ACCURACY: #         |
| TRANSMISSION RATE: | # |                        | COMPUTATION RATE: # |

|        |              |
|--------|--------------|
| BIT-01 | SIGN         |
| BIT-02 | MSB          |
| BIT-03 | #            |
| BIT-04 | #            |
| BIT-05 | #            |
| BIT-06 | #            |
| BIT-07 | #            |
| BIT-08 | #            |
| BIT-09 | #            |
| BIT-10 | #            |
| BIT-11 | #            |
| BIT-12 | #            |
| BIT-13 | #            |
| BIT-14 | #            |
| BIT-15 | #            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-43. Standard Data Word Format, Temperature Category,  
High Range, Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: DEGREES CELSIUS

|                    |   |                        |                     |
|--------------------|---|------------------------|---------------------|
| SOURCE:            | # | MSB: 1024              | MAX: +2048          |
| DESTINATION:       | # | LSB: 2E-4 (NOTE 1)     | MIN: -2048          |
| MSG ID:            | # | CODING: 2's COMPLEMENT | SCALE FACTOR: 16    |
| WORD NO.:          | # | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH:        | # |                        | ACCURACY: #         |
| TRANSMISSION RATE: | # |                        | COMPUTATION RATE: # |

|        |              |
|--------|--------------|
| BIT-01 | SIGN         |
| BIT-02 | MSB          |
| BIT-03 | #            |
| BIT-04 | #            |
| BIT-05 | #            |
| BIT-06 | #            |
| BIT-07 | #            |
| BIT-08 | #            |
| BIT-09 | #            |
| BIT-10 | #            |
| BIT-11 | #            |
| BIT-12 | #            |
| BIT-13 | #            |
| BIT-14 | #            |
| BIT-15 | #            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-44. Standard Data Word Format, Time Category,  
Subcategory Time of Day, Six-Word Quantity  
(Sheet 1 of 6)

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 6

SIGNAL NAME: #

UNITS: MONTH

|                    |   |         |         |                   |     |
|--------------------|---|---------|---------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A     | MAX:              | 12  |
| DESTINATION:       | # | LSB:    | N/A     | MIN:              | 01  |
| MSG ID:            | # | CODING: | ASCII-8 | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |         | RESOLUTION:       | #   |
| MSG-LENGTH:        | # |         |         | ACCURACY:         | #   |
| TRANSMISSION RATE: | # |         |         | COMPUTATION RATE: | #   |

|        |                            |
|--------|----------------------------|
| BIT-01 | MSB                        |
| BIT-02 | *                          |
| BIT-03 | *                          |
| BIT-04 | *                          |
|        | ASCII-8 ENCODED TENS DIGIT |
| BIT-05 | *                          |
| BIT-06 | *                          |
| BIT-07 | *                          |
| BIT-08 | LSB                        |
| BIT-09 | MSB                        |
| BIT-10 | *                          |
| BIT-11 | *                          |
| BIT-12 | *                          |
|        | ASCII-8 ENCODED ONES DIGIT |
| BIT-13 | *                          |
| BIT-14 | *                          |
| BIT-15 | *                          |
| BIT-16 | LSB                        |

REMARKS:

# APPLICATION DEPENDENT

Table 11.2-44. Standard Data Word Format, Time Category,  
Subcategory Time of Day, Six-Word Quantity  
(Sheet 2 of 6)

DOC. NO. #  
REV. #  
DATE #  
PAGE 2 of 6

SIGNAL NAME: #

UNITS: DAY

|                    |   |         |         |                   |     |
|--------------------|---|---------|---------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A     | MAX:              | 31  |
| DESTINATION:       | # | LSB:    | N/A     | MIN:              | 01  |
| MSG ID:            | # | CODING: | ASCII-8 | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |         | RESOLUTION:       | #   |
| MSG-LENGTH:        | # |         |         | ACCURACY:         | #   |
| TRANSMISSION RATE: | # |         |         | COMPUTATION RATE: | #   |

|        |     |                            |
|--------|-----|----------------------------|
| BIT-01 | MSB |                            |
| BIT-02 | #   |                            |
| BIT-03 | #   |                            |
| BIT-04 | #   | ASCII-8 ENCODED TENS DIGIT |
| BIT-05 | #   |                            |
| BIT-06 | #   |                            |
| BIT-07 | #   |                            |
| BIT-08 | LSB |                            |
| BIT-09 | MSB |                            |
| BIT-10 | #   |                            |
| BIT-11 | #   |                            |
| BIT-12 | #   | ASCII-8 ENCODED ONES DIGIT |
| BIT-13 | #   |                            |
| BIT-14 | #   |                            |
| BIT-15 | #   |                            |
| BIT-16 | LSB |                            |

REMARKS:

# APPLICATION DEPENDENT

Table 11.2-44. Standard Data Word Format, Time Category,  
Subcategory Time of Day, Six-Word Quantity  
(Sheet 3 of 6)

DOC. NO. #  
REV. #  
DATE #  
PAGE 3 of 6

SIGNAL NAME: #

UNITS: HOUR

|                    |   |         |         |                   |     |
|--------------------|---|---------|---------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A     | MAX:              | 23  |
| DESTINATION:       | # | LSB:    | N/A     | MIN:              | 00  |
| MSG ID:            | # | CODING: | ASCII-8 | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |         | RESOLUTION:       | #   |
| MSG-LENGTH:        | # |         |         | ACCURACY:         | #   |
| TRANSMISSION RATE: | # |         |         | COMPUTATION RATE: | #   |

|        |     |                            |
|--------|-----|----------------------------|
| BIT-01 | MSB |                            |
| BIT-02 | *   |                            |
| BIT-03 | *   |                            |
| BIT-04 | *   | ASCII-8 ENCODED TENS DIGIT |
| BIT-05 | *   |                            |
| BIT-06 | *   |                            |
| BIT-07 | *   |                            |
| BIT-08 | LSB |                            |
| BIT-09 | MSB |                            |
| BIT-10 | *   |                            |
| BIT-11 | *   |                            |
| BIT-12 | *   | ASCII-8 ENCODED ONES DIGIT |
| BIT-13 | *   |                            |
| BIT-14 | *   |                            |
| BIT-15 | *   |                            |
| BIT-16 | LSB |                            |

REMARKS:

\* APPLICATION DEPENDENT

**Table 11.2-44. Standard Data Word Format, Time Category,  
Subcategory Time of Day, Six-Word Quantity  
(Sheet 4 of 6)**

DOC. NO. #  
REV. #  
DATE #  
PAGE 4 of 6

SIGNAL NAME: #

UNITS: MINUTE

|                    |   |         |         |                   |     |
|--------------------|---|---------|---------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A     | MAX:              | 59  |
| DESTINATION:       | # | LSB:    | N/A     | MIN:              | 00  |
| MSG ID:            | # | CODING: | ASCII-8 | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |         | RESOLUTION:       | #   |
| MSG-LENGTH:        | # |         |         | ACCURACY:         | #   |
| TRANSMISSION RATE: | # |         |         | COMPUTATION RATE: | #   |

|        |     |
|--------|-----|
| BIT-01 | MSB |
| BIT-02 | *   |
| BIT-03 | *   |
| BIT-04 | *   |
| BIT-05 | *   |
| BIT-06 | *   |
| BIT-07 | *   |
| BIT-08 | LSB |
| BIT-09 | MSB |
| BIT-10 | *   |
| BIT-11 | *   |
| BIT-12 | *   |
| BIT-13 | *   |
| BIT-14 | *   |
| BIT-15 | *   |
| BIT-16 | LSB |

ASCII-8 ENCODED TENS DIGIT

ASCII-8 ENCODED ONES DIGIT

REMARKS:

\* APPLICATION DEPENDENT

**Table 11.2-44. Standard Data Word Format, Time Category,  
Subcategory Time of Day, Six-Word Quantity  
(Sheet 5 of 6)**

DOC. NO. #  
REV. #  
DATE #  
PAGE 5 of 6

SIGNAL NAME: #

UNITS: SECOND

|                    |   |         |         |                   |     |
|--------------------|---|---------|---------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A     | MAX:              | 59  |
| DESTINATION:       | # | LSB:    | N/A     | MIN:              | 00  |
| MSG ID:            | # | CODING: | ASCII-8 | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |         | RESOLUTION:       | #   |
| MSG-LENGTH:        | # |         |         | ACCURACY:         | #   |
| TRANSMISSION RATE: | # |         |         | COMPUTATION RATE: | #   |

|        |     |                            |
|--------|-----|----------------------------|
| BIT-01 | MSB |                            |
| BIT-02 | #   |                            |
| BIT-03 | #   |                            |
| BIT-04 | #   | ASCII-8 ENCODED TENS DIGIT |
| BIT-05 | #   |                            |
| BIT-06 | #   |                            |
| BIT-07 | #   |                            |
| BIT-08 | LSB |                            |
| BIT-09 | MSB |                            |
| BIT-10 | #   |                            |
| BIT-11 | #   |                            |
| BIT-12 | #   | ASCII-8 ENCODED ONES DIGIT |
| BIT-13 | #   |                            |
| BIT-14 | #   |                            |
| BIT-15 | #   |                            |
| BIT-16 | LSB |                            |

REMARKS:

# APPLICATION DEPENDENT

Table 11.2-44. Standard Data Word Format, Time Category,  
Subcategory Time of Day, Six-Word Quantity  
(Sheet 6 of 6)

DOC. NO. #  
REV. #  
DATE #  
PAGE 6 of 6

SIGNAL NAME: #

UNITS: HUNDRETH (OF SECOND)

|                    |   |         |         |                   |     |
|--------------------|---|---------|---------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A     | MAX:              | 99  |
| DESTINATION:       | # | LSB:    | N/A     | MIN:              | 00  |
| MSG ID:            | # | CODING: | ASCII-8 | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |         | RESOLUTION:       | #   |
| MSG-LENGTH:        | # |         |         | ACCURACY:         | #   |
| TRANSMISSION RATE: | # |         |         | COMPUTATION RATE: | #   |

|        |     |                            |
|--------|-----|----------------------------|
| BIT-01 | MSB |                            |
| BIT-02 | #   |                            |
| BIT-03 | #   |                            |
| BIT-04 | #   | ASCII-8 ENCODED TENS DIGIT |
| BIT-05 | #   |                            |
| BIT-06 | #   |                            |
| BIT-07 | #   |                            |
| BIT-08 | LSB |                            |
| BIT-09 | MSB |                            |
| BIT-10 | #   |                            |
| BIT-11 | #   |                            |
| BIT-12 | #   | ASCII-8 ENCODED ONES DIGIT |
| BIT-13 | #   |                            |
| BIT-14 | #   |                            |
| BIT-15 | #   |                            |
| BIT-16 | LSB |                            |

REMARKS:

# APPLICATION DEPENDENT

Table 11.2-45. Standard Data Word Format, Velocity Category, Subcategory  
Feet/Second, Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: FEET/SECOND

|                    |   |                        |                     |
|--------------------|---|------------------------|---------------------|
| SOURCE:            | # | MSB: 4096              | MAX: +8192          |
| DESTINATION:       | # | LSB: 2E-2 (NOTE 1)     | MIN: -8192          |
| MSG ID:            | # | CODING: 2's COMPLEMENT | SCALE FACTOR: 4     |
| WORD NO.:          | # | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH:        | # |                        | ACCURACY: #         |
| TRANSMISSION RATE: | # |                        | COMPUTATION RATE: # |

|        |              |
|--------|--------------|
| BIT-01 | SIGN         |
| BIT-02 | MSB          |
| BIT-03 | *            |
| BIT-04 | *            |
| BIT-05 | *            |
| BIT-06 | *            |
| BIT-07 | *            |
| BIT-08 | *            |
| BIT-09 | *            |
| BIT-10 | *            |
| BIT-11 | *            |
| BIT-12 | *            |
| BIT-13 | *            |
| BIT-14 | *            |
| BIT-15 | *            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-46. Standard Data Word Format, Velocity Category,  
Subcategory Feet/Second, Double Precision

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: #

UNITS: FEET/SECOND

|                      |                        |                     |
|----------------------|------------------------|---------------------|
| SOURCE: #            | MSB: 8192              | MAX: +16,384        |
| DESTINATION: #       | LSB: 2E-17 (NOTE 1)    | MIN: -16,384        |
| MSG ID: #            | CODING: 2's COMPLEMENT | SCALE FACTOR: 2E17  |
| WORD NO.: #          | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH: #        |                        | ACCURACY: #         |
| TRANSMISSION RATE: # |                        | COMPUTATION RATE: # |

WORD 1

BIT-01 SIGN  
BIT-02 MSB  
BIT-03 \*  
BIT-04 \*  
BIT-05 \*  
BIT-06 \*  
BIT-07 \*  
BIT-08 \*  
BIT-09 \*  
BIT-10 \*  
BIT-11 \*  
BIT-12 \*  
BIT-13 \*  
BIT-14 \*  
BIT-15 \*  
BIT-16 \*

WORD 2

BIT-01 \*  
BIT-02 \*  
BIT-03 \*  
BIT-04 \*  
BIT-05 \*  
BIT-06 \*  
BIT-07 \*  
BIT-08 \*  
BIT-09 \*  
BIT-10 \*  
BIT-11 \*  
BIT-12 \*  
BIT-13 \*  
BIT-14 \*  
BIT-15 \*  
BIT-16 LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

\* APPLICATION DEPENDENT

Table 11.2-47. Standard Data Word Format, Velocity Category,  
Subcategory Meters/Second, Double Precision

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: #

UNITS: METERS/SECOND

|                    |   |                        |                     |
|--------------------|---|------------------------|---------------------|
| SOURCE:            | # | MSB: 4096              | MAX: +8192          |
| DESTINATION:       | # | LSB: 3.81E-6           | MIN: -8192          |
| MSG ID:            | # | CODING: 2'S COMPLEMENT | SCALE FACTOR: 2E18  |
| WORD NO.:          | # | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH:        | # |                        | ACCURACY: #         |
| TRANSMISSION RATE: | # |                        | COMPUTATION RATE: # |

WORD 1

|        |          |        |     |
|--------|----------|--------|-----|
| BIT-01 | SIGN     | BIT-01 | *   |
| BIT-02 | MSB      | BIT-02 | *   |
| BIT-03 | *        | BIT-03 | *   |
| BIT-04 | *        | BIT-04 | *   |
| BIT-05 | *        | BIT-05 | *   |
| BIT-06 | *        | BIT-06 | *   |
| BIT-07 | *        | BIT-07 | *   |
| BIT-08 | *        | BIT-08 | *   |
| BIT-09 | *        | BIT-09 | *   |
| BIT-10 | *        | BIT-10 | *   |
| BIT-11 | *        | BIT-11 | *   |
| BIT-12 | *        | BIT-12 | *   |
| BIT-13 | *        | BIT-13 | *   |
| BIT-14 | *        | BIT-14 | *   |
| BIT-15 | *        | BIT-15 | *   |
| BIT-16 | (NOTE 1) | BIT-16 | LSB |

WORD 2

REMARKS:

NOTE 1: IF A RESOLUTION FINER THAN 0.25 M/SEC. IS REQUIRED, USE WORDS 1 AND 2. IF A RESOLUTION OF 0.25 M/SEC. OR COARSER IS REQUIRED, USE ONLY WORD 1. THE LSB (BIT 16) OF WORD 1 IS EQUAL TO 1 KILOMETER

# APPLICATION DEPENDENT

Table 11.2-48. Standard Data Word Format, Velocity Category,  
Subcategory Knots, Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: KNOTS

|                    |   |         |               |                   |      |
|--------------------|---|---------|---------------|-------------------|------|
| SOURCE:            | # | MSB:    | 4096          | MAX:              | 8192 |
| DESTINATION:       | # | LSB:    | 2E-3 (NOTE 1) | MIN:              | 0    |
| MSG ID:            | # | CODING: | BNR           | SCALE FACTOR:     | 8    |
| WORD NO.:          | # |         |               | RESOLUTION:       | #    |
| MSG-LENGTH:        | # |         |               | ACCURACY:         | #    |
| TRANSMISSION RATE: | # |         |               | COMPUTATION RATE: | #    |

|        |              |
|--------|--------------|
| BIT-01 | MSB          |
| BIT-02 | #            |
| BIT-03 | #            |
| BIT-04 | #            |
| BIT-05 | #            |
| BIT-06 | #            |
| BIT-07 | #            |
| BIT-08 | #            |
| BIT-09 | #            |
| BIT-10 | #            |
| BIT-11 | #            |
| BIT-12 | #            |
| BIT-13 | #            |
| BIT-14 | #            |
| BIT-15 | #            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-49. Standard Data Word Format, Velocity Category,  
Subcategory Mach, Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: MACH

|                    |   |         |                |                   |      |
|--------------------|---|---------|----------------|-------------------|------|
| SOURCE:            | # | MSB:    | 16             | MAX:              | 32   |
| DESTINATION:       | # | LSB:    | 2E-11 (NOTE 1) | MIN:              | 0    |
| MSG ID:            | # | CODING: | BNR            | SCALE FACTOR:     | 2E11 |
| WORD NO.:          | # |         |                | RESOLUTION:       | #    |
| MSG-LENGTH:        | # |         |                | ACCURACY:         | #    |
| TRANSMISSION RATE: | # |         |                | COMPUTATION RATE: | #    |

|        |              |
|--------|--------------|
| BIT-01 | MSB          |
| BIT-02 | #            |
| BIT-03 | #            |
| BIT-04 | #            |
| BIT-05 | #            |
| BIT-06 | #            |
| BIT-07 | #            |
| BIT-08 | #            |
| BIT-09 | #            |
| BIT-10 | #            |
| BIT-11 | #            |
| BIT-12 | #            |
| BIT-13 | #            |
| BIT-14 | #            |
| BIT-15 | #            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

**Table 11.2-50. Standard Data Word Format, Voltage Category,  
Subcategory High Range, Single Precision**

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: VOLTS

|                      |                        |                     |
|----------------------|------------------------|---------------------|
| SOURCE: #            | MSB: 256               | MAX: +512           |
| DESTINATION: #       | LSB: 2E-6 (NOTE 1)     | MIN: -512           |
| MSG ID: #            | CODING: 2's COMPLEMENT | SCALE FACTOR: 64    |
| WORD NO.: #          | INTEGER                | RESOLUTION: #       |
| MSG-LENGTH: #        |                        | ACCURACY: #         |
| TRANSMISSION RATE: # |                        | COMPUTATION RATE: # |

|        |              |
|--------|--------------|
| BIT-01 | SIGN         |
| BIT-02 | MSB          |
| BIT-03 | *            |
| BIT-04 | *            |
| BIT-05 | *            |
| BIT-06 | *            |
| BIT-07 | *            |
| BIT-08 | *            |
| BIT-09 | *            |
| BIT-10 | *            |
| BIT-11 | *            |
| BIT-12 | *            |
| BIT-13 | *            |
| BIT-14 | *            |
| BIT-15 | *            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-51. Standard Data Word Format, Voltage Category,  
Subcategory Mid Range, Single Precision

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 OF 1

SIGNAL NAME: #

UNITS: VOLTS

|                    |   |         |                |                   |      |
|--------------------|---|---------|----------------|-------------------|------|
| SOURCE:            | # | MSB:    | 16             | MAX:              | +32  |
| DESTINATION:       | # | LSB:    | 2E-10 (NOTE 1) | MIN:              | -32  |
| MSG ID:            | # | CODING: | 2's COMPLEMENT | SCALE FACTOR:     | 1024 |
| WORD NO.:          | # |         | INTEGER        | RESOLUTION:       | #    |
| MSG-LENGTH:        | # |         |                | ACCURACY:         | #    |
| TRANSMISSION RATE: | # |         |                | COMPUTATION RATE: | #    |

|        |              |
|--------|--------------|
| BIT-01 | SIGN         |
| BIT-02 | MSB          |
| BIT-03 | *            |
| BIT-04 | *            |
| BIT-05 | *            |
| BIT-06 | *            |
| BIT-07 | *            |
| BIT-08 | *            |
| BIT-09 | *            |
| BIT-10 | *            |
| BIT-11 | *            |
| BIT-12 | *            |
| BIT-13 | *            |
| BIT-14 | *            |
| BIT-15 | *            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

**Table 11.2-52. Standard Data Word Format, Voltage Category,  
Subcategory Low (Millivolt) Range, Single Precision**

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 OF 1

SIGNAL NAME: #

UNITS: VOLTS

|                    |   |         |                |                   |      |
|--------------------|---|---------|----------------|-------------------|------|
| SOURCE:            | # | MSB:    | 1/8            | MAX:              | +1/4 |
| DESTINATION:       | # | LSB:    | 2E-17 (NOTE 1) | MIN:              | -1/4 |
| MSG ID:            | # | CODING: | 2's COMPLEMENT | SCALE FACTOR:     | 4    |
| WORD NO.:          | # |         | FRACTIONAL     | RESOLUTION:       | #    |
| MSG-LENGTH:        | # |         |                | ACCURACY:         | #    |
| TRANSMISSION RATE: | # |         |                | COMPUTATION RATE: | #    |

|        |              |
|--------|--------------|
| BIT-01 | SIGN         |
| BIT-02 | MSB          |
| BIT-03 | *            |
| BIT-04 | *            |
| BIT-05 | *            |
| BIT-06 | *            |
| BIT-07 | *            |
| BIT-08 | *            |
| BIT-09 | *            |
| BIT-10 | *            |
| BIT-11 | *            |
| BIT-12 | *            |
| BIT-13 | *            |
| BIT-14 | *            |
| BIT-15 | *            |
| BIT-16 | LSB (NOTE 1) |

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

# APPLICATION DEPENDENT

Table 11.2-53. Standard Data Word Format, Communications Category, Channel Select Subcategory

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |              |                   |     |
|--------------------|---|--------------|-------------------|-----|
| SOURCE:            | # | MSB: N/A     | MAX:              | N/A |
| DESTINATION:       | # | LSB: N/A     | MIN:              | N/A |
| MSG ID:            | # | CODING: NBCD | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |              | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # |              | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |              | COMPUTATION RATE: | #   |

|        |     |                 |
|--------|-----|-----------------|
| BIT-01 | MSB |                 |
| BIT-02 | #   | THOUSANDS (0-9) |
| BIT-03 | #   |                 |
| BIT-04 | LSB |                 |
| BIT-05 | MSB |                 |
| BIT-06 | #   | HUNDREDS (0-9)  |
| BIT-07 | #   |                 |
| BIT-08 | LSB | NOTE 1          |
| BIT-09 | MSB |                 |
| BIT-10 | #   | TENS (0-9)      |
| BIT-11 | #   |                 |
| BIT-12 | LSB |                 |
| BIT-13 | MSB |                 |
| BIT-14 | #   | ONES (0-9)      |
| BIT-15 | #   |                 |
| BIT-16 | LSB |                 |

REMARKS:

NOTE 1 - RADIO CHANNEL NUMBER

# APPLICATION DEPENDENT

Table 11.2-54. Standard Data Word Format,  
Communications Category,  
Radio Selection Subcategory

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |         |           |                   |     |
|--------------------|---|---------|-----------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A       | MAX:              | N/A |
| DESTINATION:       | # | LSB:    | N/A       | MIN:              | N/A |
| MSG ID:            | # | CODING: | DISCRETES | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |           | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # |         |           | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |         |           | COMPUTATION RATE: | #   |

|        |     |                        |
|--------|-----|------------------------|
| BIT-01 | R1  |                        |
| BIT-02 | R2  |                        |
| BIT-03 | R3  |                        |
| BIT-04 | R4  |                        |
| BIT-05 | R5  |                        |
| BIT-06 | R6  |                        |
| BIT-07 | R7  | RADIO SELECT DISCRETES |
| BIT-08 | R8  | NOTE 1                 |
| BIT-09 | R9  |                        |
| BIT-10 | R10 |                        |
| BIT-11 | R11 |                        |
| BIT-12 | R12 |                        |
| BIT-13 | R13 |                        |
| BIT-14 | R14 |                        |
| BIT-15 | R15 |                        |
| BIT-16 | R16 |                        |

REMARKS:

NOTE 1 - DISCRETES FOR RADIO SELECTION. LOGIC "ONE" IS SELECTED; LOGIC "ZERO" IS DESELECTED.

# - APPLICATION DEPENDENT

Table 11.2-55. Standard Data Word Format, Data Validity Category, Checksum Subcategory

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |         |     |                   |     |
|--------------------|---|---------|-----|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A | MAX:              | N/A |
| DESTINATION:       | # | LSB:    | N/A | MIN:              | N/A |
| MSG ID:            | # | CODING: | BNR | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |     | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # |         |     | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |         |     | COMPUTATION RATE: | #   |

BIT-01 MSB

BIT-02 \*

BIT-03 \*

BIT-04 \*

BIT-05 \*

BIT-06 \*

CHECKSUM WORD

BIT-07 \*

BIT-08 \*

NOTE 1

BIT-09 \*

BIT-10 \*

BIT-11 \*

BIT-12 \*

BIT-13 \*

BIT-14 \*

BIT-15 \*

BIT-16 LSB

REMARKS:

NOTE 1 - THE CHECKSUM WORD CONSISTS OF THE ARITHMETIC SUM, WITHOUT REGARD TO OVERFLOWS, OF A SELECTED GROUP OF DATA WORDS. MORE THAN ONE CHECKSUM WORD CAN BE USED, IF REQUIRED.

\* APPLICATION DEPENDENT

Table 11.2-56. Standard Data Word Format, Data Validity Category, Cyclic Redundancy Check Subcategory

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: #

UNITS: N/A

|                      |                      |                     |
|----------------------|----------------------|---------------------|
| SOURCE: #            | MSB: N/A             | MAX: N/A            |
| DESTINATION: #       | LSB: N/A             | MIN: N/A            |
| MSG ID: #            | CODING: BINARY (CRC) | SCALE FACTOR: N/A   |
| WORD NO.: #          |                      | RESOLUTION: N/A     |
| MSG-LENGTH: #        |                      | ACCURACY: N/A       |
| TRANSMISSION RATE: # |                      | COMPUTATION RATE: # |

WORD 1

|        |     |        |
|--------|-----|--------|
| BIT-01 | MSB |        |
| BIT-02 | *   |        |
| BIT-03 | *   |        |
| BIT-04 | *   |        |
| BIT-05 | *   |        |
| BIT-06 | *   |        |
| BIT-07 | *   | NOTE 1 |
| BIT-08 | *   |        |
| BIT-09 | *   |        |
| BIT-10 | *   |        |
| BIT-11 | *   |        |
| BIT-12 | *   |        |
| BIT-13 | *   |        |
| BIT-14 | *   |        |
| BIT-15 | *   |        |
| BIT-16 | *   |        |

WORD 2

|        |     |        |
|--------|-----|--------|
| BIT-01 | *   |        |
| BIT-02 | *   |        |
| BIT-03 | *   |        |
| BIT-04 | *   |        |
| BIT-05 | *   |        |
| BIT-06 | *   |        |
| BIT-07 | *   | NOTE 1 |
| BIT-08 | *   |        |
| BIT-09 | *   |        |
| BIT-10 | *   |        |
| BIT-11 | *   |        |
| BIT-12 | *   |        |
| BIT-13 | *   |        |
| BIT-14 | *   |        |
| BIT-15 | *   |        |
| BIT-16 | LSB |        |

REMARKS:

NOTE 1 - THE NUMBER OF BITS REQUIRED WILL DEPEND ON:

- a) NUMBER OF WORDS IN GROUP CHOSEN FOR ERROR DETECTION/CORRECTION
- b) NUMBER OF ERRORS REQUIRED TO BE DETECTED/CORRECTED
- c) PROBABILITY OF DETECTION REQUIRED

IF ALL 32 BITS ARE NOT REQUIRED, THE MOST SIGNIFICANT PART SHOULD BE USED AND UNUSED BITS SHOULD BE SET TO ZERO. IF 16 BITS OR LESS IS REQUIRED, USE ONLY WORD 1.

# - APPLICATION DEPENDENT

Table 11.2-57. Standard Data Word Format, Data Validity Category, Validity Bit Subcategory

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |         |          |                   |     |
|--------------------|---|---------|----------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A      | MAX:              | N/A |
| DESTINATION:       | # | LSB:    | N/A      | MIN:              | N/A |
| MSG ID:            | # | CODING: | DISCRETE | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |          | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # |         |          | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |         |          | COMPUTATION RATE: | #   |

|        |                           |
|--------|---------------------------|
| BIT-01 | MSB                       |
| BIT-02 | *                         |
| BIT-03 | *                         |
| BIT-04 | *                         |
| BIT-05 | *                         |
| BIT-06 | *                         |
| BIT-07 | *                         |
| BIT-08 | *                         |
| BIT-09 | *                         |
| BIT-10 | *                         |
| BIT-11 | *                         |
| BIT-12 | *                         |
| BIT-13 | *                         |
| BIT-14 | *                         |
| BIT-15 | LSB                       |
| BIT-16 | V - (VALIDITY BIT) NOTE 1 |

REMARKS:

NOTE 1: - V = 0 - DATA WORD VALID

V = 1 - DATA WORD INVALID

THE VALIDITY BIT MAY BE PLACED IN BIT POSITION 16 OF ANY SELECTED DATA WORD.

\* APPLICATION DEPENDENT

Table 11.2-58. Standard Data Word Format, Display Data Category, Character Display Subcategory

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |         |                  |                   |     |
|--------------------|---|---------|------------------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A              | MAX:              | N/A |
| DESTINATION:       | # | LSB:    | N/A              | MIN:              | N/A |
| MSG ID:            | # | CODING: | ASCII-8 (NOTE 1) | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |                  | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # |         |                  | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |         |                  | COMPUTATION RATE: | N/A |

|        |     |                  |
|--------|-----|------------------|
| BIT-01 | MSB |                  |
| BIT-02 | *   |                  |
| BIT-03 | *   | FIRST CHARACTER  |
| BIT-04 | *   |                  |
| BIT-05 | *   |                  |
| BIT-06 | *   |                  |
| BIT-07 | *   |                  |
| BIT-08 | LSB |                  |
| BIT-09 | MSB |                  |
| BIT-10 | *   |                  |
| BIT-11 | *   |                  |
| BIT-12 | *   | SECOND CHARACTER |
| BIT-13 | *   |                  |
| BIT-14 | *   |                  |
| BIT-15 | *   |                  |
| BIT-16 | LSB |                  |

REMARKS:

NOTE 1 - IF STANDARD 7-BIT ASCII IS USED, THE FIRST BIT OF EACH CHARACTER FIELD SHALL BE SET TO LOGIC ZERO (0), AND THE 7-BIT ASCII CODE SHALL OCCUPY THE REMAINING SEVEN BITS OF THE FIELD.

# APPLICATION DEPENDENT

Table 11.2-59. Standard Data Word Format, Header Word Category, Message Header Subcategory

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 OF 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |                        |                   |     |
|--------------------|---|------------------------|-------------------|-----|
| SOURCE:            | # | MSB: N/A               | MAX:              | N/A |
| DESTINATION:       | # | LSB: N/A               | MIN:              | N/A |
| MSG ID:            | # | CODING: BINARY (CODED) | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |                        | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # |                        | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |                        | COMPUTATION RATE: | #   |

|        |     |            |
|--------|-----|------------|
| BIT-01 | MSB |            |
| BIT-02 | *   |            |
| BIT-03 | *   |            |
| BIT-04 | *   |            |
| BIT-05 | *   |            |
| BIT-06 | *   | MESSAGE ID |
| BIT-07 | *   | NOTE 1     |
| BIT-08 | *   |            |
| BIT-09 | *   |            |
| BIT-10 | *   |            |
| BIT-11 | LSB |            |
| BIT-12 | MSB |            |
| BIT-13 | *   |            |
| BIT-14 | *   | WORD COUNT |
| BIT-15 | *   | NOTE 2     |
| BIT-16 | LSB |            |

REMARKS:

NOTE 1: MESSAGE ID MAY BE USED TO DESIGNATE SIGNIFICANT INFORMATION; EITHER MESSAGE NUMBER, TYPE, SUBSYSTEM OPERATING MODE OR OTHER FEATURES.

NOTE 2: WORD COUNT MAY BE USED TO DESIGNATE THE NUMBER OF SIGNIFICANT WORDS ASSOCIATED WITH THE MESSAGE, UP TO A MAXIMUM OF 32. THIS NUMBER MAY OR MAY NOT BE THE SAME AS THE 1553 COMMAND WORD COUNT FIELD.

# APPLICATION DEPENDENT

Table 11.2-60. Standard Data Word Format, Navigation Category, Convergence Factor Subcategory

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 OF 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |             |                     |
|--------------------|---|-------------|---------------------|
| SOURCE:            | # | MSB: 1      | MAX: 2              |
| DESTINATION:       | # | LSB: 2E-15  | MIN: 0              |
| MSG ID:            | # | CODING: BNR | SCALE FACTOR: 2E-15 |
| WORD NO.:          | # |             | RESOLUTION: #       |
| MSG-LENGTH:        | # |             | ACCURACY: #         |
| TRANSMISSION RATE: | # |             | COMPUTATION RATE: # |

BIT-01 MSB

BIT-02 \*

BIT-03 \*

BIT-04 \*

BIT-05 \*

BIT-06 \*

BIT-07 \*

BIT-08 \*

BIT-09 \*

BIT-10 \*

BIT-11 \*

BIT-12 \*

BIT-13 \*

BIT-14 \*

BIT-15 \*

BIT-16 LSB

REMARKS:

\* APPLICATION DEPENDENT

Table 11.2-61. Standard Data Word Format, Navigation Category,  
Direction Cosine Subcategory, Platform to  
Earth Coordinates

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: # (NOTE 1)

UNITS: N/A

|                    |   |                        |                     |
|--------------------|---|------------------------|---------------------|
| SOURCE:            | # | MSB: 1/2               | MAX: +1             |
| DESTINATION:       | # | LSB: 2E-23             | MIN: -1             |
| MSG ID:            | # | CODING: 2's COMPLEMENT | SCALE FACTOR: 1     |
| WORD NO.:          | # | FRACTIONAL             | RESOLUTION: #       |
| MSG-LENGTH:        | # |                        | ACCURACY: N/A       |
| TRANSMISSION RATE: | # |                        | COMPUTATION RATE: # |

WORD 1

BIT-01 SIGN  
BIT-02 MSB  
BIT-03 #  
BIT-04 #  
BIT-05 #  
BIT-06 #  
BIT-07 #  
BIT-08 #  
BIT-09 #  
BIT-10 #  
BIT-11 #  
BIT-12 #  
BIT-13 #  
BIT-14 #  
BIT-15 #  
BIT-16 #

WORD 2

BIT-01 #  
BIT-02 #  
BIT-03 #  
BIT-04 #  
BIT-05 #  
BIT-06 #  
BIT-07 #  
BIT-08 LSB  
BIT-09 0  
BIT-10 0  
BIT-11 0  
BIT-12 0  
BIT-13 0  
BIT-14 0  
BIT-15 0  
BIT-16 0

REMARKS:

NOTE 1 - A. THE DIRECTION COSINES (CXX, CXY, CXZ) ARE PLATFORM TO EARTH COORDINATES WHICH, WITH LONGITUDE, DEFINE THE LOCATIONS OF THE AIRCRAFT RELATIVE TO THE EARTH. THESE COSINES CAN BE EXPRESSED AS:

$$\begin{aligned} \text{CXX} &= \text{COSINE } \gamma \text{ COSINE } a \\ \text{CXY} &= -\text{COSINE } \gamma \text{ SIN } a \\ \text{CXZ} &= + \text{SIN } \gamma \\ \text{WHERE } \gamma &= \text{LATITUDE, AND } a = \text{WANDER ANGLE} \end{aligned}$$

B. SIX DATA WORDS ARE REQUIRED TO DEFINE THE DIRECTION COSINES.

\* APPLICATION DEPENDENT

Table 11.2-62. Standard Data Word Format, Navigation Category,  
Direction Cosine Subcategory, Aircraft Body  
Coordinates (Sheet 1 of 2)

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 2

SIGNAL NAME: # (SEE NOTE 1)

UNITS: N/A

|                    |   |                        |                     |
|--------------------|---|------------------------|---------------------|
| SOURCE:            | # | MSB: 1/2               | MAX: +1             |
| DESTINATION:       | # | LSB: 2E-15             | MIN: -1             |
| MSG ID:            | # | CODING: 2's COMPLEMENT | SCALE FACTOR: 1     |
| WORD NO.:          | # | FRACTIONAL             | RESOLUTION: #       |
| MSG-LENGTH:        | # |                        | ACCURACY: #         |
| TRANSMISSION RATE: | # |                        | COMPUTATION RATE: # |

|        |      |
|--------|------|
| BIT-01 | SIGN |
| BIT-02 | MSB  |
| BIT-03 | *    |
| BIT-04 | *    |
| BIT-05 | *    |
| BIT-06 | *    |
| BIT-07 | *    |
| BIT-08 | *    |
| BIT-09 | *    |
| BIT-10 | *    |
| BIT-11 | *    |
| BIT-12 | *    |
| BIT-13 | *    |
| BIT-14 | *    |
| BIT-15 | *    |
| BIT-16 | LSB  |

REMARKS:

NOTE 1 - THE DIRECTION COSINES (DIRXL, DIRCOSX, DIRYL, DIRCOSY, DIRZL, DIRCOSZ) AIRCRAFT BODY COORDINATES. THREE DATA WORDS ARE REQUIRED TO DEFINE THE DIRECTION COSINE. THE DEFINITION OF THE AIRCRAFT COORDINATE SYSTEM IS CONTAINED ON PAGE 2.

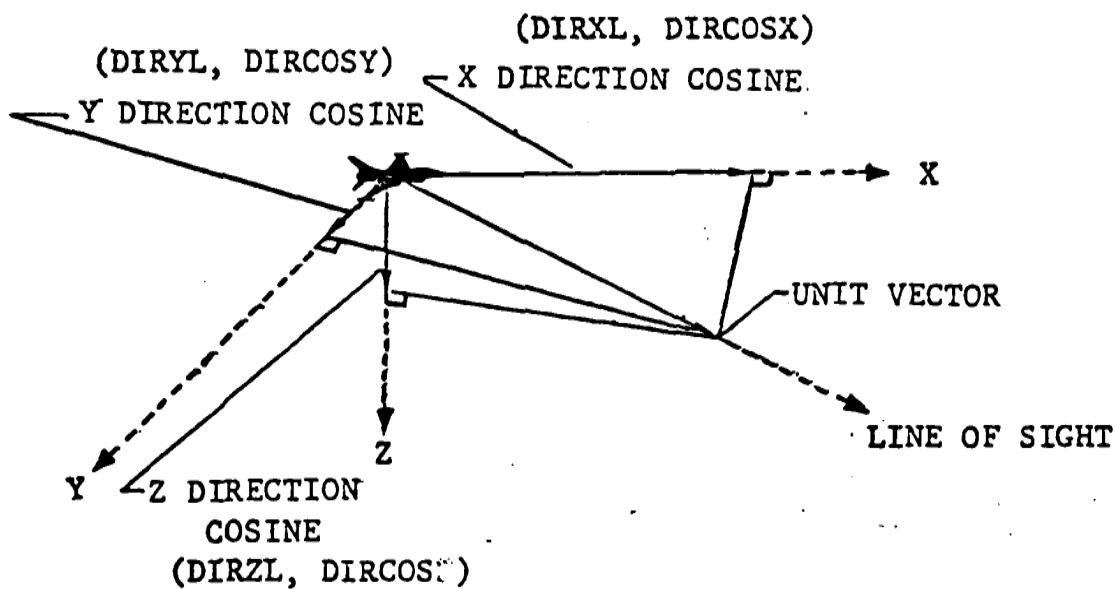
# APPLICATION DEPENDENT

Table 11.2-62. Standard Data Word Format, Navigation Category,  
Direction Cosine Subcategory, Aircraft Body  
Coordinates (Sheet 2 of 2)

PAGE 2 OF 2

SIGNAL NAME: # (SEE NOTE 1)

NOTE 1 - (CONTINUED)



- X IS PARALLEL TO FUSELAGE REFERENCE LINE (INTERSECTION OF A/C BUTTOCK LINE AND WATER LINE PLANES) (POSITIVE FORWARD)
  - Y IS PERPENDICULAR TO A/C BUTTOCK LINE PLANE (POSITIVE TO PILOT'S RIGHT)
  - Z IS PERPENDICULAR TO A/C WATER LINE PLANE (POSITIVE DOWN)
- DIRECTION COSINES ARE POSITIVE AS SHOWN ABOVE

AIRCRAFT BODY COORDINATE SYSTEM DEFINITION

Table 11.2-63. Standard Data Word Format, Navigation Category,  
100,000-Meter Grid Zone Subcategory

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |         |       |                   |     |
|--------------------|---|---------|-------|-------------------|-----|
| SOURCE:            | # | MSB:    | N/A   | MAX:              | N/A |
| DESTINATION:       | # | LSB:    | N/A   | MIN:              | N/A |
| MSG ID:            | # | CODING: | ASCII | SCALE FACTOR:     | N/A |
| WORD NO.:          | # |         |       | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # |         |       | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |         |       | COMPUTATION RATE: | #   |

|        |     |                |
|--------|-----|----------------|
| BIT-01 | MSB |                |
| BIT-02 | *   |                |
| BIT-03 | *   | UTM AREA (MSC) |
| BIT-04 | *   | NOTE 1         |
| BIT-05 | *   |                |
| BIT-06 | *   |                |
| BIT-07 | LSB |                |
| BIT-08 | 0   |                |
| BIT-09 | MSB |                |
| BIT-10 | *   |                |
| BIT-11 | *   | UTM AREA (LSC) |
| BIT-12 | *   | NOTE 1         |
| BIT-13 | *   |                |
| BIT-14 | *   |                |
| BIT-15 | LSB |                |
| BIT-16 | 0   |                |

REMARKS:

NOTE 1: THE ORDER OF THE ALPHA (A-Z) CHARACTERS DESIGNATING THE 100,000 METER GRID ZONE IS COLUMN FIRST AND THEN ROW. MSC IS MOST SIGNIFICANT CHARACTER AND LSC IS LEAST SIGNIFICANT CHARACTER.

Table 11.2-64. Standard Data Word Format, Navigation Category,  
Spheroid/UTM Grid Zone Subcategory

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: #

UNITS: N/A

|                      |               |                       |
|----------------------|---------------|-----------------------|
| SOURCE: #            | MSB: N/A      | MAX: N/A              |
| DESTINATION: #       | LSB: N/A      | MIN: N/A              |
| MSG ID: #            | CODING: ASCII | SCALE FACTOR: N/A     |
| WORD NO.: #          |               | RESOLUTION: N/A       |
| MSG-LENGTH: #        |               | ACCURACY: N/A         |
| TRANSMISSION RATE: # |               | COMPUTATION RATE: N/A |

WORD 1 (MSP) NOTE 3  
 BIT-01 MSB  
 BIT-02 \*  
 BIT-03 \* SPHEROID MODEL  
 BIT-04 \* NOTE 1  
 BIT-05 \*  
 BIT-06 \*  
 BIT-07 LSB  
 BIT-08 0  
 BIT-09 MSB  
 BIT-10 \*  
 BIT-11 \* UTM GRID ZONE  
 BIT-12 \* NOTE 2 (MSC)  
 BIT-13 \*  
 BIT-14 \*  
 BIT-15 LSB  
 BIT-16 0

WORD 2 (LSP) NOTE 3  
 BIT-01 MSB  
 BIT-02 \*  
 BIT-03 \* UTM GRID ZONE  
 BIT-04 \*  
 BIT-05 \*  
 BIT-06 \*  
 BIT-07 LSB  
 BIT-08 0  
 BIT-09 MSB  
 BIT-10 \*  
 BIT-11 \* UTM GRID ZONE  
 BIT-12 \* NOTE 2 (LSC)  
 BIT-13 \*  
 BIT-14 \*  
 BIT-15 LSB  
 BIT-16 0

REMARKS:

NOTE 1 - SPHEROID MODEL CODES

| MODEL            | ASCII CODE | BINARY  |
|------------------|------------|---------|
| INTERNATIONAL    | 0          | 0110000 |
| CLARK 1866       | 1          | 0110001 |
| CLARK 1880       | 2          | 0110010 |
| EVEREST          | 3          | 0110011 |
| BESSEL           | 4          | 0110100 |
| AUSTRALIAN NAT.  | 5          | 0110101 |
| AIRY             | 6          | 0110110 |
| HOUGH            | 7          | 0110111 |
| SOUTH AMERICAN   | 8          | 0111000 |
| MODIFIED EVEREST | 9          | 0111001 |
| WGS 72           | A          | 1000001 |

NOTE 2 - THE ORDER OF CHARACTERS DESIGNATING UTM GRID ZONE IS COLUMN FIRST AND THEN ROW. MSC IS MOST SIGNIFICANT CHARACTER AND LSC IS LEAST SIGNIFICANT CHARACTER.

NOTE 3 - MSP IS MOST SIGNIFICANT PART AND LSP IS LEAST SIGNIFICANT PART

\* - APPLICATION DEPENDENT

Table 11.2-65. Standard Data Word Format, Stores Management Category, Laser Code Subcategory

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

|                      |                        |                     |
|----------------------|------------------------|---------------------|
| SOURCE: #            | MSB: N/A               | MAX: N/A            |
| DESTINATION: #       | LSB: N/A               | MIN: N/A            |
| MSG ID: #            | CODING: BINARY (OCTAL) | SCALE FACTOR: N/A   |
| WORD NO.: #          |                        | RESOLUTION: N/A     |
| MSG-LENGTH: #        |                        | ACCURACY: N/A       |
| TRANSMISSION RATE: # |                        | COMPUTATION RATE: # |

|        |             |
|--------|-------------|
| BIT-01 | MSB         |
| BIT-02 | * (0-7) MSP |
| BIT-03 | LSB         |
| BIT-04 | MSB         |
| BIT-05 | * (0-7)     |
| BIT-06 | LSB         |
| BIT-07 | MSB         |
| BIT-08 | * (0-7)     |
| BIT-09 | LSB         |
| BIT-10 | MSB         |
| BIT-11 | * (0-7) LSP |
| BIT-12 | LSB         |
| BIT-13 | 0           |
| BIT-14 | 0           |
| BIT-15 | 0           |
| BIT-16 | 0           |

REMARKS:

MSP - IS MOST SIGNIFICANT PART  
 LSP - IS LEAST SIGNIFICANT PART

# - APPLICATION DEPENDENT

Table 11.2-66. Standard Data Word Format, Stores Management Category, Release Command Code Subcategory

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |                        |                   |     |
|--------------------|---|------------------------|-------------------|-----|
| SOURCE:            | # | MSB: N/A               | MAX:              | N/A |
| DESTINATION:       | # | LSB: N/A               | MIN:              | N/A |
| MSG ID:            | # | CODING: DISCRETE FIXED | SCALE FACTOR:     | N/A |
| WORD NO.:          | # | BIT PATTERN            | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # |                        | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |                        | COMPUTATION RATE: | #   |

|        |              |
|--------|--------------|
| BIT-01 | R            |
| BIT-02 | R            |
| BIT-03 | R            |
| BIT-04 | R            |
| BIT-05 | R            |
| BIT-06 | R            |
| BIT-07 | R            |
|        | RELEASE CODE |
| BIT-08 | R            |
|        | NOTE 1       |
| BIT-09 | R            |
| BIT-10 | R            |
| BIT-11 | R            |
| BIT-12 | R            |
| BIT-13 | R            |
| BIT-14 | R            |
| BIT-15 | R            |
| BIT-16 | R            |

REMARKS:

NOTE 1 - IF ALL 16 BITS NOT USED, PLACE PATTERN IN MOST SIGNIFICANT PART OF WORD AND SET UNUSED BITS TO ZERO.

# - APPLICATION DEPENDENT

**Table 11.2-67. Standard Data Word Format, Stores Management Category, Store Inventory Subcategory**

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |                      |                   |     |
|--------------------|---|----------------------|-------------------|-----|
| SOURCE:            | # | MSB: N/A             | MAX:              | N/A |
| DESTINATION:       | # | LSB: N/A             | MIN:              | N/A |
| MSG ID:            | # | CODING: BNR (NOTE 2) | SCALE FACTOR:     | N/A |
| WORD NO.:          | # | DISCRETE CODES       | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # | (NOTES 1 AND 3)      | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |                      | COMPUTATION RATE: | #   |

|        |     |                |
|--------|-----|----------------|
| BIT-01 | R   |                |
| BIT-02 | R   |                |
| BIT-03 | R   |                |
| BIT-04 | R   | WEAPON/RACK ID |
| BIT-05 | R   | NOTE 1         |
| BIT-06 | R   |                |
| BIT-07 | R   |                |
| BIT-08 | R   |                |
| BIT-09 | MSB |                |
| BIT-10 | *   | WEAPONS QTY.   |
| BIT-11 | *   | NOTE 2         |
| BIT-12 | LSB |                |
| BIT-13 | R   |                |
| BIT-14 | R   | STATION ID     |
| BIT-15 | R   | NOTE 3         |
| BIT-16 | R   |                |

**REMARKS:**

NOTE 1 - CODED WEAPON/RACK TYPE

NOTE 2 - QUANTITY OF WEAPONS REMAINING

NOTE 3 - STATION LOCATION OF WEAPON/RACK

\* - APPLICATION DEPENDENT

**Table 11.2-68. Standard Data Word Format, Stores Management Category, Station/Store Status Subcategory**

DOC. NO. #  
REV. #  
DATE #  
Page 1 OF 1

SIGNAL NAME: #

UNITS: N/A

|                      |                            |                     |
|----------------------|----------------------------|---------------------|
| SOURCE: #            | MSB: N/A                   | MAX: N/A            |
| DESTINATION: #       | LSB: N/A                   | MIN: N/A            |
| MSG ID: #            | CODING: DISCRETES (WORD 1) | SCALE FACTOR: N/A   |
| WORD NO.: #          | DISCRETES (CODED)          | RESOLUTION: N/A     |
| MSG-LENGTH: #        | (WORD 2)                   | ACCURACY: N/A       |
| TRANSMISSION RATE: # |                            | COMPUTATION RATE: # |

| <u>WORD 1</u> |                      |
|---------------|----------------------|
| BIT-01        | STA-1                |
| BIT-02        | STA-2                |
| BIT-03        | STA-3                |
| BIT-04        | STA-4                |
| BIT-05        | STA-5 STATION FAILED |
| BIT-06        | STA-6 NOTE 1         |
| BIT-07        | STA-7                |
| BIT-08        | STA-8                |
| BIT-09        | STA-9                |
| BIT-10        | STA-10               |
| BIT-11        | STA-11               |
| BIT-12        | STA-12               |
| BIT-13        | STA-13               |
| BIT-14        | STA-14               |
| BIT-15        | STA-15               |
| BIT-16        | STA-16               |

| <u>WORD 2</u> |          |
|---------------|----------|
| BIT-01        | R        |
| BIT-02        | R        |
| BIT-03        | R        |
| BIT-04        | R        |
| BIT-05        | R        |
| BIT-06        | R        |
| BIT-07        | R        |
| BIT-08        | <u>R</u> |
| BIT-09        | R        |
| BIT-10        | R        |
| BIT-11        | R        |
| BIT-12        | <u>R</u> |
| BIT-13        | R        |
| BIT-14        | R        |
| BIT-15        | R        |
| BIT-16        | R        |

REMARKS:

NOTE 1: STATION FAILURE = 1 - INDICATES THAT FAILURE HAS OCCURRED AT STATION INDICATED. FAILURE MAY BE IN STATION EQUIPMENT OR STORE. IF ALL 16 POSITIONS NOT REQUIRED, USE MOST SIGNIFICANT PART OF WORD AND SET UNUSED BITS TO ZERO.

NOTE 2: IDENTIFIES FAILED STORE (REF. STORE CODE TABLE).

NOTE 3: IDENTIFIES FAILED STORE POSITION AT SELECTED STATION.

# - APPLICATION DEPENDENT

Table 11.2-69. Standard Data Word Format, Stores Management Category,  
Weapon Selection (ID/QTY) Subcategory

DOC. NO. #  
REV. #  
DATE #  
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

|                    |   |                      |                   |     |
|--------------------|---|----------------------|-------------------|-----|
| SOURCE:            | # | MSB: N/A             | MAX:              | N/A |
| DESTINATION:       | # | LSB: N/A             | MIN:              | N/A |
| MSG ID:            | # | CODING: BNR (NOTE 2) | SCALE FACTOR:     | N/A |
| WORD NO.:          | # | DISCRETES (CODED)    | RESOLUTION:       | N/A |
| MSG-LENGTH:        | # | (NOTES 1 & 3)        | ACCURACY:         | N/A |
| TRANSMISSION RATE: | # |                      | COMPUTATION RATE: | #   |

|        |     |            |
|--------|-----|------------|
| BIT-01 | R   |            |
| BIT-02 | R   |            |
| BIT-03 | R   |            |
| BIT-04 | R   | WEAPON ID  |
| BIT-05 | R   | NOTE 1     |
| BIT-06 | R   |            |
| BIT-07 | R   |            |
| BIT-08 | R   |            |
| BIT-09 | MSB |            |
| BIT-10 | *   | WEAPON QTY |
| BIT-11 | *   | NOTE 2     |
| BIT-12 | LSB |            |
| BIT-13 | R   |            |
| BIT-14 | R   | STATION ID |
| BIT-15 | R   | NOTE 3     |
| BIT-16 | R   |            |

REMARKS:

NOTE 1: CODED WEAPONS TYPE (REF. TABLE)

NOTE 2: QUANTITY OF WEAPONS REMAINING FOR WEAPONS TYPE DESIGNATED BY WEAPONS ID.

NOTE 3: STATION SELECTED ID (1-16)

# - APPLICATION DEPENDENT

### **11.3 Message Formats**

Message is defined in MIL-STD-1553B as the transmission of a command word, status word, and data words if they are specified. For the RT-to-RT transmission, the message definition is expanded to include the two command words, the two status words, and the data words. In chapter 8, page 8-3, of this MUX Handbook, a message is defined to be the data words (1-32) that are part of the information transfer format. The information transfer format is defined the same as 1553B message definition. For purposes of the discussion to follow, message format is defined to mean the order and content of the data words within the information transfer formats shown in figures 6 and 7 of MIL-STD-1553B.

The general rules for message construction and recommended standard messages for certain subsystems are included in this section. Selection of the standard messages was based on an analysis of INU, ADC, radar altimeter, and GPS subsystem output messages contained in the word format data base.

#### **11.3.1 General Rules for Message Construction**

The following is a list of general rules for message construction developed from the message format analysis, common usage, and good engineering practice.

1. Multiple messages from a subsystem containing the same data words should have those data words in the same position and order.
2. Shorter messages, which contain some of the data words found in a longer message, should be a subset of the longer message with the same data word positions.
3. A header word may be provided as the first word of the message. The header may contain message ID, subsystem mode and status information, and word count. A standard header word format is contained in table 11.2-59.
4. Use standard data words, defined in paragraph 11.2.5, whenever possible.
5. When initially assigning words to messages, leave space for later expansion. In other words, do not assign all 32 word spaces in the beginning. A recommended maximum number of words to be assigned initially is 28.

When assigning words to messages, do not program in spare or reserved words. This has been done in the past by assigning word positions with all zeros (no data) for expansion purposes.

6. The use of built-in-test (BIT) status words is encouraged.

When a BIT status word is used, it should be placed immediately after the message header word, if one is used. If a message header word is not used, the BIT status word should be the first word in the message.

7. Investigate the data interface and processing requirements of the destination subsystem, and construct source messages for efficient data processing at the receiving subsystem.

### 11.3.2 Recommended Standard Messages

Recommended standard message formats have been developed by analyzing the INU, ADC, radar altimeter, and GPS subsystems. These messages resulted from message analyses that compared subsystem output messages for commonality within the system (F-16, F<sup>3</sup>INS, A-10 INS, LAMPS, GPS, and B-52 OAS) and between systems. The message analysis made use of the data base developed for the word format analysis. Standard messages were developed for the INU, ADC, and radar altimeter subsystems. No standard message was determined for GPS because of the wide disparity between existing messages.

The standard messages are listed below, and are defined in detail in the tables referenced.

| <u>Subsystem</u> | <u>Message ID</u> | <u>Number of Words</u> | <u>Table No.</u> |
|------------------|-------------------|------------------------|------------------|
| INU              | I01               | 29                     | 11.3-1           |
| INU              | I02               | 10                     | 11.3-2           |
| ADC              | C01               | 23                     | 11.3-3           |
| Radar Altimeter  | A01               | 3                      | 11.3-4           |

Table 11.3-1. Recommended Inertial Navigation Unit (INU)  
Standard Message - I01

| Message ID - I01 | Signal Name                       | Standard Word Table No. |
|------------------|-----------------------------------|-------------------------|
| <u>Word No.</u>  |                                   |                         |
| 01               | INU Header Word                   | 11.2-59                 |
| 02               | Time Tag                          | None                    |
| 03-08            | Velocity x, y, z                  | 11.2-46                 |
| 09               | Platform Azimuth                  | 11.2-30                 |
| 10, 11           | Roll, Pitch                       | 11.2-30                 |
| 12               | True Heading                      | 11.2-30                 |
| 13               | Magnetic Heading                  | 11.2-30                 |
| 14-16            | Acceleration x, y, z              | 11.2-28                 |
| 17-22            | Direction Cosines (Cxx, Cxy, Cxz) | 11.2-61                 |
| 23, 24           | Longitude                         | 11.2-31                 |
| 25, 26           | Inertial Altitude                 | 11.2-35                 |
| 27               | Computed Course Deviation         | 11.2-30                 |
| 28               | X-Axis Residual Tilt              | 11.2-32                 |
| 29               | Y-Axis Residual Tilt              | 11.2-32                 |

AD-A121 934 MIL-STD-1553 MULTIPLEX DATA BUS WORD FORMATS(U) BOEING 2/2  
MILITARY AIRPLANE CO SEATTLE WA DEC 81  
F33615-80-C-0124

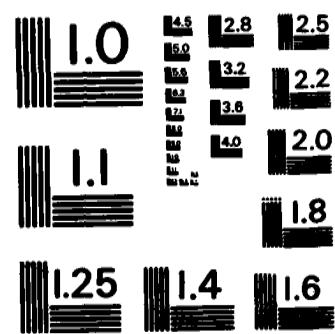
UNCLASSIFIED

F/G 9/2 NL

END

TIME0

OTC



**MICROCOPY RESOLUTION TEST CHART**  
**NATIONAL BUREAU OF STANDARDS-1963-A**

Table 11.3-2. Recommended Inertial Navigation Unit (INU)  
Standard Message - I02

Message ID - I02

| <u>Word No.</u> | <u>Signal Name</u>          | <u>Standard Word Table No.</u> |
|-----------------|-----------------------------|--------------------------------|
| 01              | INU Header Word             | 11.2-59                        |
| 02, 03          | INU BITE Summary Word 1 & 2 | None                           |
| 04, 05          | Alpha Display Characters    | 11.2-58                        |
| 06              | Alpha Display Discretes     | None                           |
| 07, 08          | Left Misc. Display          | 11.2-58                        |
| 09, 10          | Right Misc. Display         | 11.2-58                        |

Table 11.3-3. Recommended Air Data Computer Standard Message

Message ID - C01

| <u>Word No.</u> | <u>Signal Name</u>         | <u>Standard Word Table No.</u> |
|-----------------|----------------------------|--------------------------------|
| 01              | ADC Header Word            | 11.2-59                        |
| 02              | ADC BIT Status Word        | None                           |
| 03, 04          | Pressure Altitude          | 11.2-35                        |
| 05, 06          | Baro Ref. Altitude         | 11.2-35                        |
| 07              | True Airspeed              | 11.2-48                        |
| 08              | Mach Number                | 11.2-49                        |
| 09              | Calibrated Airspeed        | 11.2-48                        |
| 10              | True Angle of Attack       | 11.2-30                        |
| 11              | Pressure Ratio             | Ref. Para. 11.2.1              |
| 12              | Air Density Ratio          | Ref. Para. 11.2.1              |
| 13              | True Freestream Air Temp.  | 11.2-42                        |
| 14              | Pressure Altitude Rate     | 11.2-45                        |
| 15              | Indicated Airspeed         | 11.2-48                        |
| 16              | Static Pressure            | Ref. Para. 11.2.1              |
| 17              | Total Pressure             | Ref. Para. 11.2.1              |
| 18              | Impact Pressure            | Ref. Para. 11.2.1              |
| 19              | Total Temperature          | 11.2-42                        |
| 20              | Ambient (Static) Air Temp. | 11.2-42                        |
| 21              | Indicated Angle of Attack  | 11.2-30                        |
| 22              | Altitude Hold              | 11.2-34                        |
| 23              | Mach Hold                  | Ref. Para. 11.2.1              |

Table 11.3-4. Recommended Radar Altimeter Standard Message

Message ID - A01

| <u>Word No.</u> | <u>Signal Name</u>          | <u>Standard Word Table No.</u> |
|-----------------|-----------------------------|--------------------------------|
| 01              | Radar Altimeter Header Word | 11.2-59                        |
| 02, 03          | Radar Altitude              | 11.2-35                        |

## **12.0 INDEX**

### **A-10:**

**4-64, 11-88**

### **AAH:**

**4-28, 4-64, 6-23, 6-24, 6-26, 6-28, 6-31, 6-37**

### **AMUX:**

**3-2, 3-13, 3-45, 4-80, 6-1, 6-7, 6-11, 9-3, 9-5, C-4**

### **ADDRESS:**

**2-18, 3-14, 3-19, 3-25, 3-26, 3-19, 3-31, 3-37, 3-40, 3-52, 3-53, 4-1, 4-4, 4-5, 4-38, 4-39, 4-43, 4-45, 4-50 to 4-52, 4-56, 4-60, 4-62, 4-69, 4-70, 4-71, 4-73, 4-75, 4-83, 5-7, 5-20 to 5-22, 5-26, 5-32 to 5-34, 5-36, 5-39, 5-41, 5-42, 5-45, 5-47, 5-49, 5-50, 5-53, 6-2, 6-5, 6-26, 6-34, 6-44, 6-51 to 6-53, 6-57, 6-59 to 6-61, 7-2, 7-5, 7-8 to 7-11, 7-14, 7-16, 7-22 to 7-25, 7-28, 7-32, 7-33, 7-36, 7-42, 7-43, 7-45**

### **ALTERNATE BUS:**

**3-37, 5-26, 5-38, 6-7, 6-10, 6-12, 6-27, 6-46, 6-50, 6-69, 6-70**

### **AMPLITUDE SHIFT KEY:**

**2-16**

### **ANALYSIS:**

**1-5, 2-24, 2-21, 3-1, 3-8, 3-16, 3-27, 3-34, 3-38, 3-42, 3-44 to 3-46, 3-53, 3-54, 3-57, 4-18, 4-34, 5-14, 5-19, 5-44, 6-10, 6-67 to 6-71, 7-5, 7-28, 7-45, 7-73, 9-4, 11-87, 11-88, A-1, A-3 to A-5, B-1 to B-3, B-5, B-15, B-16, C-4, D-1, D-2**

### **APERIODIC:**

**3-16, 4-2, 4-60, 4-66, 4-69, 4-77, 5-3, 5-4, 5-13, 5-24, 5-25, 5-30, 8-1, 8-4**

### **APPLICATION SOFTWARE:**

**1-4, 3-16, 5-1, 5-5, 5-19, 5-23, 5-29, 5-30, 6-65 to 6-70**

### **ARCHITECTURE:**

**1-4, 2-14, 3-2, 3-16, 3-23, 3-53, 5-1, 5-3, 5-5, 5-13, 5-30, 6-1 to 6-3, 6-12, 6-19, 6-23, 6-38, 6-40, 6-41, 6-59, 6-61, 6-63, 6-65, 7-6, 8-1, 8-2, 9-1, D-4**

### **ASYNCHRONOUS:**

**2-11, 3-25, 3-29 to 3-33, 3-37, 4-5, 4-53, 4-57, 4-70, 5-34, 5-37, 5-38, 5-42, 5-50, 5-54, 6-4, 6-21, 6-59, 6-67 to 6-71, 7-4, 7-5, 7-20, 7-1, 8-1, B-2, B-14**

**ASYNCHRONOUS OPERATION:**

6-4, 6-21, 7-4, 7-5, 7-1, 8-1

**AVIONICS:**

1-4, 1-5, 2-1 to 2-6, 2-9, 2-12, 3-1, 3-8, 3-18, 3-19, 3-41, 3-42, 3-44, 3-46, 3-50 to 3-54, 4-4, 4-29, 4-30, 4-85, 5-2, 5-6, 5-7, 5-13, 6-22, 6-60, 6-67 to 6-71, 8-1, 9-1 to 9-6, 11-1, A-1, A-3, C-1, C-4, C-17

**B-1:**

2-3, 2-4, 3-45, 4-4, 9-3, 9-5, B-2, B-4 to B-6, C-4

**B-52:**

1-5, 3-2, 3-13, 4-57, 6-37, 6-38, 6-40, 6-49, 6-59, 11-88

**BASEBAND MODULATION:**

2-14, 2-16,

**BALANCED LINE:**

4-18

**BC:**

4-62, 4-70, 4-71, 4-73, 4-75, 6-51, 6-52

**BI-PHASE:**

7-7

**BIT:**

2-2, 2-8, 2-9, 2-16, 2-18, 2-19, 2-21, 2-24, 3-17, 3-18, 3-23, 3-25 to 3-30, 3-32, 3-34 to 3-36, 3-39, 3-45, 3-46, 3-51, 4-2, 4-4 to 4-6, 4-14, 4-15, 4-18, 4-22, 4-37, 4-50, 4-51, 4-53 to 4-57, 4-60 to 4-62, 4-64, 4-66, 4-68, 4-70, 4-71, 4-73, 4-75, 4-83, 5-3, 5-5, 5-7, 5-8, 5-17, 5-18, 5-20 to 5-22, 5-25, 5-33, 5-34, 5-36 to 5-39, 5-41, 5-42, 5-44, 5-48, 5-49 to 5-54, 6-3, 6-5, 6-10, 6-11, 6-16, 6-18, 6-19, 6-22, 6-26, 6-32, 6-34 to 6-36, 6-44, 6-47, 6-49, 6-51, 6-53, 6-56 to 6-61, 6-53, 6-69, 6-71, 6-75, 7-2, 7-5, 7-7 to 7-9, 7-11 to 7-14, 7-16 to 7-20, 7-22 to 7-29, 7-32, 7-33, 7-36, 7-38, 7-43 to 7-45, 7-69 to 7-71, 7-75, 7-76, 7-1 to 7-3, 7-6, 8-1, 8-5, 11-2, 11-3, 11-6, 11-14, 11-33, 11-87, A-4, B-1, B-2, C-2

**BIT RATE:**

3-9, 6-19, 7-2, 7-7, 7-8, 7-1, 8-1

**BIU:**

2-14, 3-29 to 3-33, 3-36, 3-37, 4-45, 4-50 to 4-57, 5-1, 5-21, 5-23 to 5-26, 5-28, 5-30 to 5-34, 5-36 to 5-39, 5-41, 5-42, 5-44, 5-45, 5-47, 5-49 to 5-54, 6-40

**BROADCAST:**

2-7, 2-18, 3-19, 3-25 to 3-27, 3-31, 3-38, 4-1, 4-83, 5-5, 5-7, 5-12, 5-22, 5-38, 5-39, 5-42, 6-2, 6-3, 6-40, 7-5, 7-9 to 7-11, 7-13, 7-14, 7-16 to 7-18, 7-22 to 7-26, 7-29, 7-32, 7-33, 7-36, 7-42, 7-44, 7-1, 7-3, 7-6, 8-2, A-4, B-3

**BUS:**

1-1, 1-2, 1-4, 1-5, 2-1 to 2-5, 2-7 to 2-11, 2-13, 2-14, 2-16, 2-18, 2-19, 2-21, 2-25, 3-2, 3-6, 3-8, 3-11 to 3-14, 3-17 to 3-20, 3-23, 3-25 to 3-38, 3-40 to 3-42, 3-44 to 3-46, 3-50, 3-51, 3-53 to 3-56, 4-2, 4-4 to 4-6, 4-8, 4-10, 4-11, 4-12, 4-15 to 4-19, 4-22, 4-25, 4-27, 4-28, 4-30, 4-31, 4-33, 4-34, 4-36, 4-37, 4-39, 4-43 to 4-45, 4-51 to 4-53, 4-56, 4-57, 4-60 to 4-62, 4-64, 4-68, 4-71, 4-73, 4-75, 4-80, 4-82, 4-85, 5-1 to 5-3, 5-5 to 5-8, 5-12 to 5-14, 5-17 to 5-26, 5-28, 5-30 to 5-34, 5-36, 5-38, 5-39, 5-41, 5-42, 5-44, 5-45, 5-49 to 5-51, 5-53, 5-54, 6-5, 6-7 to 6-16, 6-18 to 6-21, 6-23, 6-24, 6-26, 6-27, 6-29 to 6-32, 6-34 to 6-38, 6-40, 6-44 to 6-46, 6-48, 6-50, 6-51, 6-53, 6-54, 6-56 to 6-61, 6-65, 6-67 to 6-76, 7-1, 7-3 to 7-8, 7-10 to 7-14, 7-16 to 7-19, 7-22 to 7-29, 7-32, 7-33, 7-36, 7-38, 7-41 to 7-45, 7-52, 7-55 to 7-57, 7-59, 7-62, 7-67, 7-68, 7-70, 7-71, 7-76, 7-77, 7-1 to 7-7, 8-1 to 8-5, 9-1 to 9-6, 11-1 to 11-3, A-2 to A-4, B-3, B-5, B-10, B-13 to B-16, C-1, C-2, C-17

**BUS CONTROLLER:**

1-1, 2-7 to 2-9, 2-11, 2-14, 3-6, 3-8, 3-12, 3-14, 3-17 to 3-20, 3-23, 3-25, to 3-33, 3-35 to 3-38, 3-40, 3-50, 3-51, 3-53, 4-1, 4-4, 4-5, 4-15, 4-39, 4-43, 4-45, 4-62, 4-64, 4-68, 4-71, 5-2, 5-5 to 5-8, 5-12, 5-13, 5-17 to 5-21, 5-23, 5-25, 5-26, 5-28, 5-33, 5-34, 5-38, 5-39, 5-41, 5-40, 5-45, 6-5, 6-7, 6-8, 6-11, 6-13 to 6-16, 6-18, 6-21, 6-24, 6-26, 6-27, 6-28 to 6-32, 6-34, 6-35, 6-37, 6-44, 6-50, 6-51, 6-53, 6-56, 6-57, 6-63, 6-67, 6-69, 6-72, 6-73, 7-3 to 7-6, 7-10, 7-11, 7-14, 7-16, 7-17, 7-19, 7-24 to 7-29, 7-32, 7-33, 7-36, 7-38, 7-41 to 7-45, 7-71, 7-77, 7-1, 7-3, 8-2 to 8-4, 9-4, 11-2, B-2, B-3, B-5, B-10, B-13, B-14

**BUS COUPLER:**

1-4, 4-19, 4-27, 4-31, C-17

**BUS INTERFACE:**

1-4, 2-10, 2-13, 2-14, 3-14, 3-17, 3-40, 3-41, 3-50, 3-53, 3-55, 4-1, 4-4 to 4-6, 4-11, 4-43 to 4-45, 4-62, 4-64, 4-71, 4-80, 4-82, 4-85, 5-3, 5-5, 5-13, 5-18 to 5-21, 5-23, 5-45, 6-2, 6-14, 6-35, 6-40, 6-54, 6-63, 6-73, 7-8, 7-62, 7-6, 7-7, 8-1, 8-3, 9-2, 9-4, C-2

**BUS INTERFACE UNIT:**

1-4, 2-13, 2-14, 3-17, 3-55, 4-44, 4-45, 4-66, 5-5, 5-18, 5-19, 5-21, 6-2, 6-14, 6-35, 6-40, 6-54, 6-63, 6-73, 7-8, 7-62, 7-6, 7-7, 8-1, 8-3, 9-2, 9-4, C-2

**BUS MONITOR:**

2-8, 2-14, 3-33, 3-51, 3-56, 4-1, 4-39, 4-43, 4-66, 5-21, 6-37, 7-3 to 7-5, 7-41, 7-45, 7-1, 7-4, 8-2, 8-4

**BUSY:**

3-26, 3-27, 4-52, 4-55, 4-70, 5-22, 5-34, 5-38, 5-50, 5-52, 6-48, 6-63, 6-71, 7-16, 7-22, 7-23, 7-25, 7-26, 7-3, 7-6

**CMR:**

4-25, 4-55, 4-70, 7-71

**CHANNELING:**

2-16, 2-19

**CHARACTERISTICS:**

1-2, 1-4, 2-1 to 2-3, 2-6, 2-9, 2-14, 2-25, 3-1, 3-14, 3-17, 3-34, 3-41, 3-42, 3-46, 3-55, 4-1, 4-2, 4-6, 4-8, 4-10, 4-11, 4-13, 4-17 to 4-19, 4-22, 4-31, 4-33, 4-36, 4-37, 4-71, 4-85, 5-3, 5-5, 5-14, 5-28, 5-32, 5-45, 6-14, 6-64, 7-3, 7-6, 7-45, 7-52, 7-55, 7-56, 7-62, 7-67 to 7-71, 7-73, 7-75, 7-76, 7-1, 7-4 to 7-7, A-5, C-2, C-3, D-1, D-9

**CODING:**

2-2, 2-14, 2-16, 2-19, 2-21, 3-56, 4-2, 4-62, 11-2, 11-3, D-4

**COMMAND WORD:**

2-7 to 2-9, 3-23, 3-25, 3-26, 3-40, 3-46, 3-51, 3-52, 4-1, 4-4, 4-5, 4-45, 4-50, 4-51, 4-56, 4-57, 4-60 to 4-62, 4-71, 4-73, 4-75, 5-20, 5-22, 5-33, 5-34, 5-36, 5-45, 5-47, 5-49, 5-53, 5-54, 6-4, 6-5, 6-11, 6-15, 6-26, 6-53, 6-59 to 6-61, 7-3, 7-5, 7-6, 7-8 to 7-11, 7-13, 7-14, 7-16, 7-18, 7-20, 7-24, 7-25, 7-28, 7-29, 7-32, 7-33, 7-36, 7-42 to 7-44, 7-77, 7-2, 8-3, 11-87

**COMMAND/RESPONSE:**

2-1, 2-5, 2-11, 2-13, 2-16, 2-18, 3-19, 3-20, 4-39, 4-68, 5-7, 5-8, 6-3, 6-14, 6-25, 6-45, 6-63, 7-1, 7-5, 7-6, 7-10, 7-29, 7-44, 8-1

**COMMON MODE REJECTION:**

2-9, 2-26, 4-19, 4-22, 4-25, 4-26, 4-31, 6-75, 7-56, 7-57, 7-71

**COMPUTER:**

2-2, 3-18, 3-42, 3-45, 3-46, 3-53 to 3-57, 4-5, 4-10, 4-43, 4-65, 4-77, 5-6, 5-25, 6-1, 6-2, 6-8, 6-12, 6-14, 6-15, 6-18 to 6-21, 6-23, 6-24, 6-26, 6-35, 6-37, 9-1 to 9-3, 11-14, A-1, A-2, A-5, C-1 to C-3, C-10, C-17

**CONTROL:**

1-4, 1-5, 2-3, 2-5, 2-8, 2-11, 2-13, 2-14, 2-16, 2-18, 2-19, 3-2, 3-6, 3-8, 3-11 to 3-14, 3-16 to 3-20, 3-23, 3-25, 3-27 to 3-33, 3-35 to 3-38, 3-40, 3-41, 3-44, 3-45 to 3-56, 4-2, 4-4 to 4-6, 4-11, 4-18, 4-36 to 4-39, 4-43, 4-45, 4-51, 4-52, 4-56, 4-57, 4-60 to 4-62, 4-64 to 4-66, 4-68, 4-70, 4-71, 4-75, 4-77, 4-85, 5-3, 5-5 to 5-8, 5-12, 5-13, 5-17, 5-19 to 5-26, 5-28, 5-31, 5-33, 5-34, 5-37 to 5-39, 5-42, 5-45, 5-47, 5-49, 5-50, 5-53, 5-54, 6-1 to 6-3, 6-5, 6-7, 6-8, 6-10 to 6-15, 6-18, 6-19, 6-21, 6-23, 6-24, 6-26, 6-27, 6-29, 6-30, 6-32, 6-34, 6-35, 6-37, 6-38, 6-40, 6-43, 6-45, 6-48 to 6-50, 6-53, 6-54, 6-58 to 6-51, 6-63, 6-65, 6-68, 6-69, 6-72 to 6-75, 7-4 to 7-6, 7-9, 7-11 to 7-14, 7-17, 7-18, 7-22, 7-23, 7-27, 7-29, 7-32, 7-36, 7-42, 7-44, 7-68, 7-1 to 7-3, 8-1 to 8-3, 8-5, 9-5, 9-6, 11-2, 11-2, 11-6, A-2, A-3, B-1, B-2, B-5, B-10, B-13, B-14

**CORRECTION:**

3-12

**COUPLER:**

1-4, 4-2, 4-6, 4-8, 4-10, 4-11, 4-19, 4-22, 4-25 to 4-28, 4-31, 4-33, 6-15, 7-55 to 7-57, 7-62, 7-67, 7-6, C-17

**COUPLING REQUIREMENTS:**

4-6, 7-52, 7-7

**DAIS:**

1-5, 2-3, 2-12, 6-61, 6-63, 6-65, 6-68, 6-69, 6-71, 6-72, 6-75, 8-1, 9-1, 9-3,  
9-6

**DATA CODE:**

2-9, 7-1

**DATA FIELD:**

7-22, 11-3

**DATA LINK:**

4-28, 6-12, 6-24, 7-6

**DATA BUS:**

1-2, 1-5, 2-1, 2-3 to 2-5, 2-8 to 2-10, 2-13, 2-14, 2-16, 2-18, 2-19, 2-21,  
2-25, 3-2, 3-6, 3-8, 3-11 to 3-14, 3-17, 3-18, 3-23, 3-25, 3-34, 3-36 to 3-48,  
3-41, 3-42, 3-44 to 3-46, 3-50, 3-51, 3-53 to 3-56, 4-2, 4-6, 4-10, 4-11,  
4-13, 4-15 to 4-18, 4-25, 4-28, 4-30, 4-31, 4-33, 4-34, 4-37, 4-39, 4-43,  
4-45, 4-56, 4-57, 4-61, 4-64, 4-71, 4-73, 4-77, 4-82, 4-85, 5-1, 5-2, 5-5,  
5-6, 5-13, 5-14, 5-19 to 5-21, 5-53, 6-1 to 6-3, 6-5, 6-11 to 6-15, 6-18 to  
6-21, 6-23, 6-24, 6-26, 6-29 to 6-32, 6-35, 6-36, 6-38, 6-48, 6-53, 6-57, 6-59  
to 6-61, 6-63, 6-65, 6-71 to 6-73, 6-75, 6-76, 7-1, 7-3 to 7-7, 7-10, 7-11,  
7-13, 7-14, 7-18, 7-23, 7-29, 7-36, 7-41, 7-42, 7-45, 7-52, 7-57, 7-59, 7-62,  
7-68, 7-70, 7-71, 7-76, 7-77, 7-1, 7-4 to 7-7, 8-1 to 8-5, 9-1 to 9-6, 11-1,  
11-3, A-2 to A-4, B-2, B-15, C-1 to C-3, C-17

**DATA TRANSFERS:**

2-7, 2-11, 3-11, 3-14, 3-17 to 3-20, 3-26, 4-50, 4-68, 5-2, 5-3, 5-5 to 5-8,  
5-12, 5-47, 6-9, 6-20, 6-57, 6-73, 7-11, 7-42

**DATA WORD:**

2-7, 2-9, 2-11, 3-23, 3-25, 3-26, 3-28, 3-29, 3-32, 3-34, 3-37, 3-50 to 3-52,  
4-2, 4-5, 4-55, 4-57, 4-62, 4-64, 4-73, 4-83, 5-3, 5-12, 5-17, 5-34, 5-37,  
5-39, 5-51, 5-54, 6-5, 6-14, 6-16, 6-26, 6-44, 6-61, 6-63, 7-7, 7-12 to 7-14,  
7-16 to 7-20, 7-24 to 7-26, 7-33, 7-36, 7-43, 7-44, 7-71, 7-76, 7-2, 7-3, 7-6,  
8-2, 11-1 to 11-3, 11-6, 11-14, 11-15, 11-18, 11-30, 11-32, 11-33, 11-87, A-3,  
B-2, B-3

**DEFINITIONS:**

1-4, 1-5, 2-6, 2-8, 3-26, 3-44, 3-50, 4-1, 4-39, 4-43, 4-44, 5-12, 6-2, 7-2,  
7-5, 7-42, 7-1, 7-7, 8-1

**DELAY:**

2-21, 2-24, 2-25, 3-45, 5-21, A-2, B-1, B-10, B-13, C-4

**DRIVER:**

4-2, 4-11, 4-14, 4-33, 4-36 to 4-38, 4-44, 4-68, 6-32, 6-34, 6-35, 7-71, D-2

**DYNAMIC BUS CONTROL:**

3-6, 3-23, 3-25, 3-27, 3-29, 3-30, 4-1, 4-56, 5-22, 5-54, 7-4, 7-5, 7-14,  
7-22, 7-23, 7-27, 7-1 to 7-3, 8-2

**EMUX:**

3-2, 3-12, 3-35, 4-2, 4-80, 4-83, 4-85, 5-17, 7-45

**EFFICIENCY:**

2-18, 3-8, 3-45, 4-13, 4-38, 5-32, 7-7, B-2, B-5, B-10, B-13, B-14, D-4

**ELECTRICAL CHARACTERISTICS:**

2-2, 2-6, 2-9, 4-19, 6-63, 7-76, A-5

**ERROR:**

1-5, 2-10, 2-14, 2-16, 2-18, 2-19, 2-21, 2-25, 3-23, 3-25, 3-26, 3-28 to 3-30, 3-32 to 3-35, 3-38 to 3-40, 3-55, 4-2, 4-6 to 4-8, 4-8, 4-15, 4-17, 4-18, 4-22, 4-28, 4-45, 4-53 to 4-57, 4-68, 4-71, 4-73, 4-75, 4-88, 5-1, 5-3, 5-12 to 5-14, 5-17, 5-19, 5-20, 5-22 to 5-24, 5-26, 5-31 to 5-36, 5-37 to 5-39, 5-44, 5-45, 5-50 to 5-54, 6-5, 6-8 to 6-11, 6-16, 6-21, 6-22, 6-27, 6-35, 6-44, 6-53, 6-63, 6-67, 6-69 to 6-73, 7-5, 7-11, 7-12, 7-16, 7-17, 7-19, 7-20, 7-22 to 7-24, 7-28, 7-29, 7-41, 7-43 to 7-45, 7-55, 7-62, 7-70, 7-71, 7-73, 7-75, 7-2, 8-2, 11-15, A-2, B-2, C-2, C-3, D-2

**ERROR HANDLING:**

2-14, 3-25, 3-28 to 3-30, 3-32, 3-38, 5-1, 5-24, 5-44, 6-9, 6-72, 7-17, 7-19, 7-20, 7-28, B-2

**ERROR RECOVERY:**

3-28, 3-32, 3-55, 7-29, 7-45, 8-2

**EXAMPLES:**

1-1, 1-2, 1-5, 2-14, 3-1, 3-40, 3-46, 4-4, 4-5, 4-38, 4-39, 4-44, 5-14, 5-20, 6-1, 7-14, 11-3, 11-6, 11-32, B-1, C-1, C-4, C-10, D-4

**EXECUTIVE:**

2-3, 3-31, 3-32, 3-56, 5-1, 5-6, 5-12, 5-13, 5-23 to 5-25, 5-30, 5-31, 5-41, 6-9, 6-22, 6-48 to 6-50, 6-54, 6-57, 6-58, 6-63, 6-68 to 6-73, 8-1, A-2

**F-16:**

1-5, 2-3, 2-4, 3-2, 4-28, 4-82, 6-1 to 6-3, 6-5, 6-7 to 6-9, 6-11, 6-12, 9-1, 9-4, 11-88

**FAILURES:**

2-7, 2-11, 3-14, 3-17, 3-18, 3-20, 3-33 to 3-36, 3-38, 3-40, 4-53, 4-55, 4-57, 5-1, 5-5, 5-6, 5-8, 5-13, 5-14, 5-17 to 5-20, 5-34, 5-50, 5-51, 5-54, 6-5, 6-9, 6-30, 6-31, 6-38, 6-69 to 6-72, 7-10, 7-17, 7-19, 7-44, 7-71, 7-76, 7-5, 8-2, A-4, D-1

**FIELD:**

2-4, 3-12, 3-26, 3-50, 3-51, 4-4, 4-68, 4-71, 4-73, 4-83, 5-37, 5-43, 6-3, 6-5, 6-9, 6-12, 6-15, 6-16, 6-26, 6-44, 6-63, 7-8, 7-9, 7-11, 7-12, 7-14, 7-17, 7-22 to 7-25, 7-28, 7-29, 7-32, 7-33, 7-36, 7-41, 7-43, 11-3, D-2, D-12

**FRAME:**

2-16, 2-18, 3-16, 3-37, 3-38, 4-31, 5-4, 6-4, 6-7, 6-9, 6-18, 6-21, 6-26, 6-43, 6-45, 6-46, 6-48 to 6-53, 6-58, 6-59, A-3, A-4, B-16, C-9, C-10

**FREQUENCY SHIFT KEY:**

2-16

**GAP:**  
2-9, 7-32, 7-33, 7-36, 7-41, 7-43, 7-3, 7-6, B-2, B-3

**GPS:**  
3-12, 11-33, 11-87, 11-88

**HALF DUPLEX:**  
2-19, 6-24, 7-3, 7-6, 7-1, 8-3

**HANDBOOK:**  
1-2, 2-2, 2-7, 8-1 to 8-3, 9-4, 11-87, D-1

**HOTBENCH:**  
3-34, 3-50 to 3-52, 5-14, D-7

**HYBRID:**  
2-12, 2-14, 4-2, 4-37, 4-44, 4-64, 4-80, 4-85, 6-32, 6-35, 6-37, 9-3, A-4

**IMPEDANCE:**  
2-29, 2-25, 2-26, 4-6, 4-8, 4-10, 4-15, 4-16, 4-18, 4-19, 4-22, 4-25, 4-26, 4-31, 4-33, 4-36, 4-37, 6-7, 6-14, 6-24, 6-38, 7-52, 7-55 to 7-57, 7-62, 7-70, 7-71, 7-75, 7-4, 7-5, C-2, C-3

**INSTRUMENTATION BIT:**  
3-25, 3-26, 7-11, 7-16, 7-22 to 7-24, 7-2

**INTERRUPT:**  
3-23, 3-30 to 3-32, 3-35, 3-40, 4-51, 4-53 to 4-57, 4-60, 4-66, 4-68, 4-70, 4-71, 4-73, 4-75, 5-12, 5-13, 5-17, 5-20 to 5-26, 5-30, 5-34, 5-36 to 5-39, 5-42, 5-49, 5-51 to 5-54, 6-4, 6-9 to 6-11, 6-22, 6-26, 6-34, 6-43, 6-45, 6-46, 6-48 to 6-51, 6-57, 6-58, 6-68 to 6-70, 6-74, 7-4

**INTERRUPT INTERFACE:**  
4-53, 5-51

**ISOLATION:**  
2-13, 2-26, 3-8, 3-11 to 3-13, 3-51, 3-53, 4-2, 4-6, 4-8, 4-19, 4-22, 4-25, 4-26, 4-28, 4-31, 4-71, 5-1, 5-31, 6-2, 6-3, 6-7, 6-11, 6-14, 6-18, 6-21, 6-24, 6-27, 6-30, 6-35, 6-45, 6-48, 7-3, 7-55, 7-57, 7-59, 7-62, 7-76, 7-4, 7-5, 8-2, 8-5

**KEYBOARD:**  
6-30 to 6-32

**LAMPS:**  
1-5, 9-2, 9-4, 11-88

**LATENCY:**  
2-18, 3-8, 3-19, 3-45, 4-70, 5-3, 5-7, 6-4, B-1

**LIFE CYCLE:**  
1-5, 2-12, 3-1, 3-46, 3-54, 6-37, D-1, D-2, D-7

**LOADING:**  
3-45, 4-19, 4-26, 4-71, 6-50, 7-62, A-3 to A-5, B-1, B-15, B-16, C-17

**MIL-STD-1553:**

1-1, 1-2, 1-1, 1-3, 1-4, 1-12, 1-14, 3-6, 3-8, 3-17, 3-34, 3-39, 3-40, 3-44, 3-50, 3-51, 3-54, 4-2, 4-6, 4-80, 4-82, 4-85, 5-2, 5-5, 5-14, 8-1, 9-1, 9-4, 11-1, 11-3, 11-33, 11-87, A-4

**MAJOR:**

1-1, 1-2, 1-4, 2-1, 2-2, 2-5, 2-12, 3-1, 3-8, 3-16, 3-37, 3-38, 3-54, 3-55, 4-1, 4-2, 4-5, 4-18, 4-19, 4-22, 4-28, 4-31, 4-33, 4-36, 4-38, 4-43, 4-68, 5-3, 5-4, 5-24, 5-28, 6-1, 6-4, 6-9, 6-11, 6-12, 6-21, 6-31, 6-44, 6-45, 6-48 to 6-50, 6-53, 6-73, 6-75, 7-59, 7-73, 8-3, A-2

**MASTER:**

2-5, 4-51, 4-54, 4-55, 4-57, 5-26, 5-28, 5-34, 5-38, 5-39, 4-40, 4-41, 4-48 to 4-50, 4-52, 5-53, 6-15, 6-21, 6-40, 6-43, 6-61, 6-63, 6-65, 6-68 to 6-73, B-3, B-5, B-10, B-13

**MESSAGE:**

2-7, 2-8, 2-11, 2-16, 2-18, 2-19, 2-21, 3-8, 3-16, 3-17, 3-19, 3-20, 3-23, 3-25 to 3-37, 3-39, 3-40, 3-45, 3-46, 3-50, 3-52, 3-53, 3-55, 3-56, 4-2, 4-4, 4-5, 4-14, 4-37, 4-43, 4-45, 4-50 to 4-57, 4-62, 4-71, 4-73, 4-75, 4-83, 5-26, 5-28, 5-34, 5-38, 5-39, 5-41, 5-42, 5-49 to 5-51, 5-53, 5-54, 6-4, 6-5, 6-11, 6-15, 6-19, 6-22, 6-24, 6-26, 6-27, 6-34, 6-35, 6-40, 6-44, 6-46 to 6-48, 6-50, 6-51, 6-55, 6-61, 6-63, 6-67 to 6-71, 6-74, 6-75, 7-3 to 7-7, 7-10 to 7-14, 7-16, 7-17, 7-19, 7-20, 7-22 to 7-27, 7-29, 7-32, 7-33, 7-36, 7-39, 7-41, 7-43 to 7-45, 7-69, 7-71, 7-75, 7-76, 7-1 to 7-3, 7-6, 8-1, 8-3, 11-1, 11-2, 11-14, 11-87, 11-88, A-2 to A-4, B-3, B-5, B-10, B-13 to B-16, C-9

**MESSAGE ERROR:**

3-25, 3-26, 3-34, 3-35, 4-5, 4-54 to 4-57, 4-75, 5-17, 5-26, 5-51 to 5-54, 6-16, 6-22, 6-26, 6-35, 6-44, 6-69 to 6-71, 7-16, 7-17, 7-22 to 7-24, 7-41, 7-43 to 7-45, 7-75, 7-2

**MINOR:**

A-3, A-4, B-5, B-15, B-16, 3-8, 3-16, 3-19, 3-25, 3-30, 3-31, 3-33, 3-37, 3-39, 3-41, 3-50, 4-6, 4-51, 4-57, 5-4, 5-7, 5-19, 5-23 to 5-26, 5-30 to 5-33, 5-36 to 5-39, 5-41, 5-42, 5-50, 5-47, 6-9, 6-18, 6-21, 6-43, 6-47, 6-48 to 6-53, 6-58, 6-59, 6-65, 6-67 to 6-69, 6-72, 7-52, 8-3

**MODE CODES:**

3-8, 3-26, 3-25, 3-28, 3-35, 3-36, 3-50, 4-60, 4-61, 5-3, 5-6, 5-12, 5-17, 5-18, 6-5, 6-26, 6-27, 6-40, 6-44, 6-45, 6-60, 6-63, 6-69, 6-75, 7-5, 7-6, 7-9, 7-10, 7-12 to 7-14, 7-20, 7-29, 7-44, 7-2, 7-7

**MODELS:**

2-21, 3-41, 3-45, 3-46, A-3, A-4, C-1, C-2, C-4, D-1, D-4, D-9, D-10, D-12

**MODES:**

2-8, 3-2, 3-8, 3-11, 3-14, 4-1, 4-37, 4-66, 4-68, 4-71, 5-2, 5-19, 6-29, 6-65, 6-73, 7-2, 7-44, 11-3, A-5

**MODULATION:**

2-9, 2-14, 2-16, 2-21, 2-24, 2-25, 7-3, 7-7, 7-1, 8-3, 8-4

**MULTIPLEX:**

1-1, 1-2, 1-4, 1-5, 2-1 to 2-3, 2-5, 2-7, 2-10, 2-13, 2-14, 3-2, 3-8, 3-11, 3-12, 3-14, 3-17 to 3-20, 3-23, 3-28, 3-34 to 3-36, 3-42, 3-45, 3-46, 3-50, 3-51, 3-53, 3-54, 4-1, 4-2, 4-4, 4-6, 4-28, 4-38, 4-43, 4-44, 4-57, 4-60, 4-62, 4-66, 4-82, 4-83, 5-1 to 5-3, 5-5 to 5-8, 5-12 to 5-14, 5-17, 5-18, 5-23 to 5-25, 5-28, 5-30, 5-32, 5-33, 5-38, 5-39, 5-44, 6-3, 6-5, 6-11, 6-12, 6-14, 6-19, 6-23, 6-24, 6-27, 6-30 to 6-32, 6-35 to 6-38, 6-40, 6-43 to 6-45, 6-59, 6-61, 6-63, 6-65, 7-1, 7-6, 7-8, 7-12, 7-17, 7-36, 7-38, 7-43 to 7-45, 7-52, 7-55, 8-1, 8-3, 9-1 to 9-3, A-1, A-2, A-4, B-1, B-5, B-15, C-2, C-4, C-9, D-1, D-2, D-4, D-7, D-9, D-12

**MUXSIM:**

3-42, 3-44, 3-45

**NETWORK:**

1-4, 1-5, 2-25, 2-26, 3-1, 3-44 to 3-46, 3-50, 4-2, 4-6, 4-10, 4-11, 4-13, 4-15, 4-18, 4-19, 4-22, 4-27, 4-28, 4-31, 4-33, 4-36, 6-2, 6-11, 6-40, 7-52, 7-55, 7-62, 7-70, 8-3, A-2, C-1 to C-3, C-17

**NOISE:**

2-9, 2-16, 2-19, 2-21, 3-34, 4-2, 4-10, 4-13 to 4-19, 4-34, 4-71, 5-14, 6-75, 7-12, 7-55, 7-68, 7-70, 7-71, 7-73, 7-75, 7-76, 7-4 to 7-7, 9-4, A-4, C-2, C-3

**NRZ:**

2-21, 2-24, 2-25, 4-34, 4-62, 6-34, 6-35

**OAS:**

3-2, 4-57, 4-60, 4-61, 6-37, 6-38, 6-40, 6-43 to 6-46, 6-48, 6-49, 6-53, 6-57, 6-59, 6-60, 9-5, 11-88

**PACKAGING:**

4-4, 4-27, 4-28, 4-38, 6-37

**PACKING:**

2-18, 3-17, 5-5, 5-32, 7-7, 11-6

**PARITY:**

2-8, 2-19, 3-26, 3-51, 3-52, 4-2, 4-14, 4-37, 4-54, 4-60, 4-62, 4-73, 5-22, 5-51, 6-5, 6-26, 6-35, 6-44, 6-59, 6-70, 6-75, 7-3, 7-8, 7-9, 7-12, 7-17, 7-20, 7-22 to 7-24, 7-28, 7-41, 7-44, 7-69, 7-75, 7-2, 8-5, 11-14

**PERIODIC:**

3-8, 3-16, 4-18, 4-53, 5-3, 5-4, 5-12, 5-13, 5-24, 5-25, 5-30, 6-7, 6-9, 6-15, 6-18, 6-20, 6-45, 6-46, 6-49, 7-4, 7-25, 7-73, 8-3, 8-4, A-3

**PERIODIC MESSAGES:**

5-30

**PHASE SHIFT KEY:**

2-16

**POLAR:**

2-21, 2-24, 2-25

**POLLING:**

B-1, B-5, B-10, B-13, 2-16, 3-6, 3-8, 3-29 to 3-33, 3-36 to 3-38, 3-45, 5-18, 5-26, 5-38, 6-7, 6-9, 6-18, 6-20, 7-11

**PRIMARY BUS:**

3-36, 3-37, 4-1, 4-65, 5-13, 5-18, 5-19, 5-32, 5-33, 6-8, 6-11, 6-13, 6-19, 6-21, 6-24, 6-27, 6-32, 6-50, 6-51, 6-57

**PROCESSOR:**

1-4, 2-3, 2-14, 3-18, 3-29, 3-32, 3-40, 4-2, 4-4, 4-5, 4-43, 4-45, 4-51 to 4-53, 4-57, 4-62, 4-64, 4-66, 4-68, 4-70, 4-71, 4-85, 5-5 to 5-7, 5-12, 5-13, 5-18 to 5-26, 5-28, 5-30 to 5-34, 5-36 to 5-39, 5-41, 5-42, 5-45, 5-47, 5-49, 5-50, 6-9, 6-19, 6-35, 6-38, 6-40, 6-43, 6-48, 6-50 to 6-52, 6-54 to 6-57, 6-59, 6-61, 6-63, 6-65, 6-67 to 6-74, 11-2, B-5, B-10, B-14

**PULSE CODE MODULATION:**

2-9, 7-3, 7-7, 7-1, 8-4

**RECEIVER:**

2-9, 2-21, 2-26, 3-25, 3-28, 3-34, 3-36, 3-45, 4-2, 4-8, 4-13, 4-15 to 4-18, 4-31, 4-33, 4-34, 4-38, 4-56, 4-57, 4-71, 4-77, 4-80, 5-18, 5-22, 5-39, 5-33, 5-54, 6-5, 6-19, 6-32, 6-34, 6-35, 6-43, 6-52, 6-71, 7-5, 7-14, 7-17, 7-18, 7-20, 7-32, 7-33, 7-36, 7-55, 7-57, 7-70, 7-71, 7-73, 7-75, 7-6, 8-2, 8-4, C-1 to C-3, C-9

**REDUNDANCY:**

1-1, 2-3, 2-7, 2-10, 2-13, 2-14, 3-2, 3-8, 3-11 to 3-13, 3-39, 3-54, 4-6, 4-43, 4-80, 4-85, 5-1, 5-2, 5-31, 6-1, 6-2, 6-7, 6-11, 6-18, 6-21, 6-24, 6-36, 6-40, 6-61, 6-63, 7-11, 8-4, A-6

**REDUNDANT:**

2-14, 3-11, 3-12, 3-19, 3-29, 3-36, 5-2, 5-5, 5-13, 5-18, 5-19, 5-22, 5-24, 5-26, 5-28, 5-33, 6-2, 6-7, 6-11, 6-13, 6-14, 6-18, 6-21, 6-23, 6-24, 6-32, 6-36, 6-40, 6-63, 6-65, 6-69 to 6-72, 6-76, 7-5, 7-18, 7-19, 7-76, 7-77, 7-1, 8-4, 9-2

**REDUNDANT DATA BUS:**

7-5, 7-18, 7-76, 7-1, 8-4

**REMOTE TERMINAL:**

2-8, 2-9, 3-12, 3-14, 3-17 to 3-20, 3-23, 2-25 to 3-28, 3-34 to 3-36, 4-1, 4-39, 4-43 to 4-45, 4-54, 4-57, 4-62, 4-64, 4-73, 4-75, 4-80, 4-82, 4-85, 5-5 to 5-8, 5-12, 5-14, 5-17, 5-18, 5-21, 5-25, 5-26, 5-28, 5-34, 5-37 to 5-39, 5-42, 5-44, 5-45, 5-51, 5-54, 6-5, 6-11, 6-19, 6-21, 6-24, 6-36, 6-40, 6-59, 6-75, 7-3 to 7-5, 7-8 to 7-12, 7-14, 7-17, 7-19, 7-23, 7-25 to 7-29, 7-32, 7-33, 7-41 to 7-45, 7-77, 7-1 to 7-3, 8-2 to 8-4, A-2, A-3, A-6, B-2, B-4, B-5, B-15

**RESPONSE TIME:**

2-7 to 2-9, 3-17, 3-19, 3-20, 4-70, 4-75, 4-83, 5-5, 5-7, 5-8, 7-3, 7-6, 8-1, 7-36, 7-38, 7-77, A-4, B-2, B-3, B-5, B-15

**ROUND ROBIN:**

3-6, 3-8, 3-32, 3-38, 3-45, B-1, B-13, B-14

**RT:**

2-3, 2-14, 3-14, 3-20, 3-35, 4-1, 4-4, 4-5, 4-39, 4-43, 4-45, 4-50 to 4-53, 4-57, 4-60 to 4-62, 4-64 to 4-66, 4-68, 4-70, 4-71, 4-73, 4-75, 4-80, 4-82, 4-83, 4-85, 5-17, 5-21, 5-22, 5-25, 5-26, 5-28, 5-32, 5-33, 5-39, 5-41, 5-42, 5-44, 5-45, 5-47, 5-49, 5-50, 5-54, 6-2, 6-5, 6-11, 6-12, 6-14 to 6-16, 6-20 to 6-24, 6-26, 6-27, 6-29, 6-30, 6-32, 6-34 to 6-37, 6-40, 6-43 to 6-45, 6-51, 6-52, 6-61, 6-60, 6-63, 6-68 to 6-71, 6-73, 6-75, 6-76, 7-1, 7-2, 7-3, 7-9, 7-11, 7-12, 7-14, 7-16 to 7-20, 7-22 to 7-29, 7-32, 7-33, 7-36, 7-38, 7-42 to 7-45, 7-59, 7-70, 7-75, 8-3, 11-2, 11-87, A-3

**SECONDARY BUS:**

6-10, 6-21

**SERVICE REQUEST:**

4-51, 4-52, 4-56, 5-22, 5-25, 5-42, 5-49, 5-50, 5-52, 5-54, 6-63, 7-3, 7-16, 7-20, 7-22 to 7-25

**SIAAP:**

3-42, 3-44, 3-45, A-1, A-5, A-6, B-15

**SIMULATION:**

3-42, 3-45, 3-46, 3-52, 3-53, 3-57, 4-10, 4-66, 6-20, A-1, A-4, B-15, C-3, C-4, C-9, C-10, C-17,

**SIMULATOR:**

3-42, 3-51, 3-53, A-1, B-15, C-17

**SOFTWARE:**

1-1, 1-2, 1-4, 1-5, 2-3 to 2-7, 2-12, 2-18, 3-1, 3-6, 3-8, 3-12, 3-14, 3-16, 3-18 to 3-20, 3-23, 3-30 to 3-42, 3-44, 3-46, 3-52, 3-54, 3-56, 3-57, 4-43, 4-45, 4-66, 4-68, 4-70, 5-1 to 5-3, 5-5 to 5-8, 5-12 to 5-14, 5-17 to 5-24, 5-26, 5-28, 5-30 to 5-33, 5-36, 5-37, 5-41, 5-42, 5-45, 6-1, 6-8 to 6-11, 6-13, 6-19, 6-34, 6-45, 6-46, 6-48 to 6-51, 6-61, 6-63, 6-65, 6-69, 6-70, 6-72, 6-73, 8-1, 8-3, 8-4, 9-2 to 9-4, 9-6, 7-1, 7-10, 7-16, 7-29, 7-44, A-1, A-2, B-15, C-17, D-2, D-4, D-7, D-9

**STATIONARY MASTER:**

3-6, 3-8, 3-29 to 3-36, 3-38, 3-45, B-1, B-5, B-13

**STATUS BITS:**

3-20, 3-26, 3-50, 4-83, 5-8, 7-3, 7-17, 7-25

**STATUS WORD:**

2-7, 2-9, 3-6, 3-19, 3-20, 4-1, 4-2, 4-5, 4-51 to 4-53, 4-55, 4-56, 4-60, 4-61, 4-73, 4-75, 4-85, 5-8, 5-12, 5-14, 5-17, 5-18, 5-20, 5-22, 5-23, 5-34, 5-37, 5-42, 5-49 to 5-54, 6-2, 6-4, 6-5, 6-8, 6-11, 6-12, 6-16, 6-20 to 6-22, 6-26, 6-29, 6-34, 6-40, 6-46, 6-51, 6-52, 6-56, 6-57, 6-60, 6-63, 6-68 to 6-71, 7-2, 7-3, 7-6, 7-16 to 7-20, 7-5, 7-10, 7-11, 7-13, 7-14, 8-3, 11-87, B-2

**SUBADDRESS:**

3-17, 3-19, 3-26, 3-29, 3-31, 4-5, 4-50, 4-56, 4-57, 4-60 to 4-62, 4-73, 4-75, 4-83, 5-5, 5-7, 5-8, 5-25, 5-26, 5-32, 5-33, 5-37, 5-39, 5-41, 5-42, 5-45, 5-53, 5-54, 6-2, 6-3, 6-5, 6-9, 6-15, 6-16, 6-26, 6-53, 6-59 to 6-61, 7-2, 7-9 to 7-12, 7-14, 7-24, 7-33, 7-36, 7-43

**SUBSYSTEM:**

1-1, 2-2, 2-3, 2-7, 2-8, 2-10, 2-12 to 2-14, 3-1, 3-2, 3-6, 3-8, 3-11, 3-12, 3-14, 3-18 to 3-20, 3-26, 3-27, 3-35, 3-36, 3-42, 3-45, 3-50, 3-53, 3-56, 3-57, 4-2, 4-4, 4-5, 4-38, 4-39, 4-43 to 4-45, 4-51, 4-52, 4-55, 4-56, 4-60 to 4-62, 4-77, 4-80, 4-83, 4-85, 5-6 to 5-8, 5-18, 5-22, 5-26, 5-49, 5-50, 5-52, 5-54, 6-1, 6-2, 6-4, 6-5, 6-7, 6-9, 6-11, 6-13, 6-14, 6-16, 6-18, 6-19, 6-21, 6-23, 6-30 to 6-32, 6-34, 6-38, 6-40, 6-46, 6-56, 6-59, 6-60, 6-63, 6-69, 6-70, 6-75, 7-1, 7-3, 8-1 to 8-5, 7-1, 7-3, 7-5, 7-7, 7-12, 7-16 to 7-18, 7-22 to 7-27, 7-32, 7-42, 7-52, 11-1, 11-2, 11-6, 11-14, 11-87, 11-88, A-2 to A-5, C-4

**SUBSYSTEM FLAG:**

3-26, 3-27, 3-35, 3-36, 4-5, 4-52, 4-56, 5-18, 5-22, 5-30, 5-54, 7-16, 7-18, 7-22, 7-23, 7-26, 7-27, 7-3

**SYMMETRY:**

2-9, 4-13, 4-14, 4-19, 4-46, 4-37, 7-4, 7-5, C-2

**SYNC:**

2-8, 2-9, 3-26, 3-51, 4-2, 4-4, 4-54, 4-62, 4-64, 4-71, 4-77, 5-51, 6-5, 6-19, 6-26, 6-44, 6-75, 7-3, 7-8, 7-9, 7-20, 7-22 to 7-24, 7-36, 7-38, 7-41, 7-2, 7-6, 8-5, C-2, C-3

**TAGWORD:**

3-39, 4-50, 5-19, 5-31, 5-32, 5-34, 5-39, 5-41, 5-47

**TERMINAL:**

1-4, 2-2, 2-8, 2-9, 2-14, 2-19, 2-25, 2-26, 3-1, 3-12 to 3-14, 3-17 to 3-20, 3-23, 3-25 to 3-30, 3-33 to 3-39, 3-45, 3-50, 3-52, 3-53, 3-56, 3-57, 4-2, 4-4 to 4-6, 4-8, 4-10, 4-11, 4-14 to 4-19, 4-22, 4-27, 4-31, 4-33, 4-37 to 4-39, 4-43 to 4-45, 4-54, 4-55, 4-57, 4-60, 4-62, 4-64 to 4-66, 4-68, 4-73, 4-75, 4-80, 4-82, 4-83, 4-85, 5-1, 5-5 to 5-8, 5-12, 5-14, 5-17 to 5-19, 5-21, 5-22, 5-25, 5-26, 5-28, 5-34, 5-36 to 5-39, 5-41, 5-42, 5-44, 5-45, 5-51, 5-52, 5-54, 6-2 to 6-5, 6-7, 6-9, 6-11, 6-12, 6-14 to 6-16, 6-18, 6-19, 6-21, 6-22, 6-24, 6-32, 6-35, 6-36, 6-40, 6-44, 6-52, 6-59, 6-68 to 6-71, 6-75, 7-3 to 7-5, 7-8 to 7-12, 7-14, 7-16, 7-17, 7-19, 7-20, 7-22 to 7-29, 7-32, 7-33, 7-36, 7-38, 7-41 to 7-45, 7-52, 7-55, 7-57, 7-59, 7-62, 7-67 to 7-71, 7-73, 7-75 to 7-77, 7-1 to 7-7, 8-1 to 8-5, 9-1 to 9-4, A-2 to A-4, B-2, B-3, B-5, B-15, C-1, C-2, C-10

**TERMINAL FAIL:**

5-19, 7-41, 7-3

**TEST:**

1-4, 2-5, 2-10, 2-14, 3-2, 3-16, 3-26, 3-28, 3-35, 3-36, 3-46, 3-50 to 3-53, 3-55 to 3-57, 4-2, 4-5, 4-10, 4-13 to 4-18, 4-26, 4-37, 4-51, 4-53 to 4-57, 4-56, 4-68, 4-74, 5-4, 5-13, 5-18, 5-34, 5-37, 5-49, 5-50, 5-52 to 5-54, 6-1, 6-7, 6-9, 6-16, 6-32, 6-34, 6-36, 6-48, 6-49, 6-63, 6-65, 6-70 to 6-72, 6-75, 7-5, 7-6, 7-12, 7-16, 7-17, 7-24, 7-43, 7-45, 7-56, 7-57, 7-67, 7-69 to 7-71, 7-73, 7-75, 7-76, 7-1, 7-2, 7-6, 7-7, 8-1, 9-4, 11-1, 11-87, A-3, C-3, D-1, D-2, D-4, D-9

**THRESHOLD:**

4-2, 4-15, 4-3, 4-33, 4-34, 6-71, 7-62, 7-70, 7-76, C-3

**TIME DIVISION:**

2-1, 2-3, 2-5, 2-10, 2-13, 6-23, 7-1, 7-3, 8-1, 8-5, 9-1, 9-2, 9-5

**TIME DIVISION MULTIPLEXING:**

2-1, 7-1, 7-3, 8-1, 8-5

**TOPOLOGY:**

1-4, 2-13, 2-19, 3-1, 3-2, 3-16, 3-26, 3-28, 3-35, 3-36, 3-46, 3-50 to 3-53,  
3-55 to 3-57, 8-1 to 8-3, 8-5

**T/R:**

4-50, 4-56, 4-57, 4-60 to 4-62, 4-73, 4-75, 5-33, 5-36, 5-45, 5-53, 6-53, 6-59  
to 6-61, 7-9, 7-11 to 7-14, 7-43

**TRANSCEIVER:**

1-4, 4-22, 4-31, 4-33, 4-34, 4-38, 7-70, 7-71, 8-3

**TRANSFERS:**

2-7, 2-8, 2-11, 3-11, 3-14, 3-16 to 3-20, 3-26, 3-38, 4-1, 4-39, 4-50, 4-60,  
4-61, 4-68, 4-71, 4-73, 5-2, 5-3, 5-5 to 5-8, 5-12, 5-26, 5-47, 6-9, 6-14,  
6-15, 6-20, 6-26, 6-48, 6-57, 6-59, 6-60, 6-73, 7-3, 7-11, 7-29, 7-32, 7-42,  
8-2, 11-87

**TURNS RATIO:**

4-8, 4-10, 4-11, 4-16, 4-22, 4-24 to 4-26, 4-31, 4-36, 4-37, 7-55, 7-62, 7-70

**WORD:**

2-2, 2-7 to 2-9, 2-11, 2-16, 2-18, 2-19, 3-6, 3-12, 3-17, 3-19, 3-21, 3-23,  
2-25 to 3-30, 3-32 3-34 to 3-37, 3-39, 3-40, 3-46, 3-50 to 3-52, 4-2, 4-4 to  
4-6, 4-14, 4-17, 4-18, 4-37, 4-43, 4-45, 4-50 to 4-57, 4-60 to 4-62, 4-64,  
4-66, 4-70, 4-71, 4-73, 4-75, 4-77, 4-83, 4-85, 5-3, 5-5, 5-7, 5-8, 5-12,  
5-14, 5-17 to 5-20, 5-22 to 5-25, 5-31 to 5-34, 5-36, 5-37, 5-39, 5-41, 5-42,  
5-45, 5-47, 5-49 to 5-54, 6-2 to 6-5, 6-9, 6-11, 6-12, 6-14 to 6-16, 6-20 to  
6-22, 6-26, 6-29, 6-32, 6-34, 6-35, 6-40, 6-44, 6-46, 6-51 to 6-54, 6-56 to  
6-63, 6-68 to 6-71, 6-44, 6-46, 6-51 to 6-54, 6-56 to 6-61, 6-63, 6-68 to  
6-71, 7-3 to 7-14, 7-16 to 7-20, 7-22 to 7-29, 7-32, 7-33, 7-36, 7-38, 7-41 to  
7-45, 7-69, 7-61, 7-73, 7-75 to 7-77, 7-1 to 7-3, 7-6, 8-1 to 8-3, 8-5, 9-3,  
11-1, 11-2, 11-18, 11-32, 11-33, 11-87, A-2 to A-4, B-2, B-3, B-15, C-2

**WORD COUNT:**

3-19, 3-34, 3-39, 3-52, 4-5, 4-50, 4-55, 4-60, 4-61, 4-65, 4-70, 4-84, 5-8,  
5-17, 5-19, 5-25, 5-34, 5-37, 5-41, 5-47, 5-52, 6-3, 6-5, 6-16, 6-22, 6-26,  
6-59, 6-60, 7-9, 7-12, 7-17, 7-36, 7-43, 7-44, 7-2

**WORD PROCESSOR:**

4-2, 4-4, 4-5, 4-43, 4-57, 4-62

**YAH-64:**

1-5, 4-64, 6-23, 6-30, 6-36, 9-1, 9-5