CHAPTER 9

Telemetry Attributes Transfer Standard

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Acronyms

API	Application Programming Interface
ARINC	Aeronautical Radio, Incorporated
ASCII	American Standard Code for Information Interchange
CR	carriage return
dB	decibel
DDML	Data Display Markup Language
FFI	frame format identification
FM	frequency modulation
HTML	hypertext markup language
Hz	hertz
IAW	in accordance with
IHAL	Instrumentation Hardware Abstraction Language
iNET	integrated Network Enhanced Telemetry
kHz	kilohertz
LF	line feed
MDL	Metadata Description Language
MFS	maximum field size
MHz	megahertz
MIL-STD	Military Standard
ODBC	open database connectivity
PCM	pulse code modulation
PM	phase modulation
RF	radio frequency
SST	serial streaming telemetry
SVG	Scalable Vector Graphics
TMATS	Telemetry Attributes Transfer Standard
TmNS	telemetry network system
W3C	World Wide Web Consortium
XidML	eXtensible Instrumentation Definition Markup Language
XML	extensible markup language
XSD	XML schema document

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CHAPTER 9

Telemetry Attributes Transfer Standard

9.1 General

Telemetry attributes are those parameters required by the receiving/processing system to acquire, process, and display the telemetry data received from the test item/source. The Telemetry Attributes Transfer Standard (TMATS) provides a common definition and format to facilitate the transfer of information between the user and the test range and between ranges. The telemetry attributes defined in this chapter provide the information required to set up the telemetry receiving and processing equipment. The format, while not necessarily compatible with any receiving/processing system, will allow test ranges or other receiving systems to develop a computer conversion program to extract the information and to set up data required for their unique equipment configuration. Nonstandard parameter variations are not included in the attribute tables later in the chapter, but may be included by exception in the comments section of each attribute group.

The intent of this chapter is to cover, primarily, attributes and terminology included in or consistent with the other chapters within this telemetry standards document. For example, pulse code modulation (PCM) format attributes should comply with the PCM standards as given in Chapter 4. Other attributes are sometimes included for service and utility, but should not be construed as endorsements apart from the other chapters.

9.2 Scope

The TMATS provides the definition of the telemetry attributes and specifies the media and data format necessary to permit the transfer of the information required to set up the telemetry receiving/processing functions at a test range. The standard does not conform to, nor does it define, existing or planned capabilities of any given test range. The parameters included in this document are defined by specific reference. Other nonstandard parameter values/ definitions may be included in the comments section of each group.

9.3 Purpose

The TMATS provides a common format for the transfer of information between the user and a test range or between ranges (see Appendix H). This format will minimize the "station-unique" activities that are necessary to support any test item. In addition, TMATS is intended to relieve the labor-intensive process required to reformat the information by providing the information on computer-compatible media, thereby reducing errors and requiring less preparation time for test support.

9.4 Media and Data Structure

A variety of physical and electronic media is available for use in exchanging attribute information. The most important factor in selecting a medium is that the parties involved agree to use that specific medium. If any data compression (such as backup/restore or zip/unzip) will be used, both parties should agree to its use.

A cover sheet describing the system that produced the attribute medium should accompany the attribute information. A recommended format for the cover sheet is given in Appendix I.

9.4.1 Physical Format

Attributes for each mission configuration are to be supplied in a single physical file with contents as 7-bit American Standard Code for Information Interchange (ASCII) coded characters. Line feed (LF) and carriage return (CR) may be used to improve readability of the information. Nonprintable characters will be discarded by the destination agency prior to translating the attributes into telemetry system configuration information.

Multiple mission configurations may be provided on a single disk; however, each configuration must be in a separate file identified in the disk directory. File names should use the file extensions ".TXT" to indicate a text file or ".TMT" or ".TMA" to indicate a TMATS file. A stick-on label and the accompanying cover sheet identify the file names corresponding to the mission configuration used for each mission.

9.4.2 Logical Format

Each attribute appears in the file as a unique code name and as a data item. The code name appears first, delimited by a colon. The data item follows, delimited by a semicolon. Thus, an attribute is formatted as A:B; - where A is the code name and B is the data item, in accordance with (IAW) the tables in Section 9.5. Numeric values for data items may be either integer or decimal. Scientific notation (see note below) is allowed only for the specific data items defined for its use in the tables in Section 9.5. For alphanumeric data items, including keywords, either upper or lower case is allowed; TMATS is not case sensitive. All defined keyword values are shown as upper case and enclosed in quotes in the tables in Section 9.5. Leading, trailing, and embedded blanks are assumed to be intentional; they can be ignored in most cases but should not be used in code names, keywords, and data items used as links, such as measurement name. Semicolons are not allowed in any data item (including comment items). Any number of attributes may be supplied within a physical record; however, the number of attributes supplied is subject to the 2048-byte maximum length limitation of a single physical record (see Subsection 9.4.1 above). Attributes may appear in any order.

NOTE	Any numeric data item expressed in scientific notation must conform to the following regular expression: ([-+]?(([0-9]+\.?[0-9]*)|([0-9]*\.[0-9]+)))([eE][-+]?[0-9]{1,3}) This expression limits the number of digits in the exponent to three or less, but allows any number of digits (including none) both before and after the decimal point in the fraction. Also, the decimal point can be omitted (for example, "3E5" is valid).

The two basic types of attribute code names are single-entry and multiple-entry. Single-entry attributes are those for which there is only one data item. Multiple-entry attributes appear once in the definition tables in Section 9.5 but have multiple items; these items are assigned a number. The number appears in the code name preceded by a hyphen. For example, data source identifiers might have the following entries:

G\DSI-1:Aircraft;

G\DSI-2:Missile;

G\DSI-3:Target;

The code name COMMENT may be used to interject comments to improve readability. The comment data items, such as G\COM, are intended to convey further details within the TMATS file itself. Comments must follow the attribute logical format, as shown below:

COMMENT: This is an example of a comment;

Refer to Section 9.5 for detailed definitions of code names and attributes and Appendix J for an example application of this standard.

NOTE	It is recommended that data source/link names and measurement names consist of only the following: • Capitalized alphabetic characters • Numeric characters • The underscore symbol ("_") Specifically, it is recommended to avoid the use of embedded spaces and other special characters in data source/link names and measurement names.

9.4.3 Extensible Markup Language Format

In addition to the code name format described in Subsection 9.4.2, TMATS attributes can also be expressed in extensible markup language (XML). The TMATS XML format is implemented as a standard XML schema consisting of a collection of XML schema document (XSD) files, which can be found here.

The TMATS XML schema is identical in content to the telemetry attributes described in Section 9.5 below, with the exceptions shown in the following list.

a. There is a C group for each data link instead of only one C group in the TMATS file.

b. The schema has no counter ("\N") attributes; they are not needed in XML.

c. Keyword attribute values are expanded for readability in the schema.

d. Date and time formats are different; the schema uses the XML standard date and time formats (not the ones in Section 9.5).

e. Text entries in the XML schema may contain semicolons; the code name format uses the semicolon as a delimiter.

f. The inherent structure of an XML schema implies order, while the code name format allows the attributes to be given in any order.

In addition to the TMATS XML schema, there are two other XML schemas that describe related areas of information. The first one, Data Display Markup Language (DDML), covers commonly used types of data displays. Refer to Section 9.6 for a full description of this standard format for data display definitions. The other one, Instrumentation Hardware Abstraction

Language (IHAL), deals with the instrumentation hardware configuration on a test item. See Section 9.7 for a full description of this standard format for describing instrumentation hardware.

9.5 Telemetry Attributes

The description of the mission configuration includes all potential sources of data; these sources are radio frequency (RF) links, pre- or post-detected tapes, and onboard recorded tapes and storage media. Each of these data sources has unique characteristics that must be defined. Each source is given a unique identity and its characteristics are specifically defined in associated attribute fields. In multiplexed systems, each data stream is uniquely identified by a data link name, which is related to the data source name.

NOTE	Only the information that is essential to define the attributes of a system is required. Non-applicable information does not need to be included in the file; however, all attribute information given is to be provided in the specified format.

The attributes defined in this section proceed from the general level to the detailed level. The groups, defined in terms of data to be entered, are:

a. General Information: Establishes the top-level program definition and identifies the data sources.

b. Transmission Attributes: Defines an RF link. There will be one group for each RF link identified in the General Information group.

c. Recorder-Reproducer Attributes: Identifies a tape or storage data source.

d. Multiplex/Modulation Attributes: Describes the FM/FM (frequency modulation), FM/PM (phase modulation), or PM/PM multiplex characteristics. Each multiplexed waveform must have a unique set of attributes. For the analog measurement, the tie to the engineering units conversion is made in this group.

e. Digital Data Attributes: Divided into four groups: the PCM Format Attributes, the PCM Measurement Description, the Bus Data Attributes, and the Packet Format Attributes.

   (1) PCM Format Attributes: Defines the PCM data format characteristics, including embedded formats. Each PCM format will have a separate format attributes group.

   (2) PCM Measurement Descriptions: Defines each PCM measurement within the overall PCM format.

   (3) Bus Data Attributes: Specifies the PCM-encoded Military Standard (MIL-STD) 1553 or Aeronautical Radio, Incorporated (ARINC) 429 bus format characteristics or the direct recorder track/channel MIL-STD-1553 or ARINC 429 bus format characteristics.

   (4) Message Data Attributes: Specifies the message-based data streams.

CHANGE

f. Pulse Amplitude Modulation Attributes: As of RCC IRIG 106-13, this section has been removed. See Appendix K for applicable Pulse Amplitude Modulation data standards.

g. Data Conversion Attributes: Contains the data conversion information for all measurements in this telemetry system. The calibration data and conversion definition of

raw telemetry data to engineering units is included. The tie to the measurands of the telemetry systems defined in the previous groups is via the measurement name.

h. Airborne Hardware Attributes: Defines the configuration of airborne instrumentation hardware in use on the test item.

i. Vendor-Specific Attributes: Provides information that is specific to a vendor.

9.5.1 Contents

The following subparagraphs discuss the organization of the attributes and their relationships with the various groups.

a. Organization. Attribute information is organized according to a hierarchical structure in which related items are grouped and given a common heading. The number of levels varies within the overall structure and is a function of the logical association of the attributes. At the highest level, the telemetry attributes are defined for the groups displayed in Table 9-1.

Table 9-1. Telemetry Attribute Groups

Identifier	Title
G	General Information
T	Transmission Attributes
R	Recorder-Reproducer Attributes
M	Multiplex/Modulation Attributes
P	PCM Format Attributes
D	PCM Measurement Description
B	Bus Data Attributes
S	Message Data Attributes
C	Data Conversion Attributes
H	Airborne Hardware Attributes
V	Vendor-Specific Attributes

Within the structure, a lower-case letter, for example, n, p, or r, indicates a multiple-entry item with the index being the lower-case letter. The range of these counters is from one to the number indicated in another data entry, usually with the appendage \N.

Within the tables, the code name and definition, which includes maximum field size (MFS), are given for each individual attribute. The MFS is intended to be a guideline indicating the intended use of the attribute, and does not imply support of the maximum capacity by all ranges. For example, the fact that the Number of Data Sources attribute is two characters long does not mean that 99 data sources are supported. Each range should be consulted as to their specific capabilities.

NOTE	Table 9-2 indicates, via the Code Name column, attributes that are required Chapter 10 TMATS Setup Record attributes. The *R-CH10* tag indicates attributes that are required for all Setup Records; all *RO-CH10* tags indicate attributes that are conditionally required.

NEW

Table 9-2. Chapter 10 TMATS Setup Record Required Attributes	
Code Name TAG	**Chapter 10 Requirements**
R-CH10	Chapter 10 required TMATS Setup Record Attribute in all cases.
RO-CH10	If applicable data type or group is used, this attribute is required.
RO-CH10-PAK	This attribute is required when the Data Packing Option (R-x\PDP-n) is UNPACKED (UN) or PACKED (PFS). When the Data Packing Option is THROUGHPUT (TM), this attribute is NOT required, but must contain correct information if used.

b. Group Relationships. Representative interrelationships between the various groups are shown pictorially in Figure 9-1. Not all valid paths are shown.

NOTE

a. Data Source ID is unique within a General Information group (G). It ties the Transmission group (T) or the Recorder-Reproducer group (R) or both to the G group and to the Multiplex/Modulation group (M).

b. The tie from the M group to a PCM group (P) is the Data Link Name.

c. The tie from the P group to an embedded P group is another Data Link Name.

d. The tie from the M group to the Data Conversion group (C) for an analog measurement is the Measurement Name.

e. The tie from the P group to the PCM Measurement Description group (D) or Bus group (B) is the Data Link Name.

f. The tie from the R group to the P group is from the Channel Data Link Name (R) to the Data Link Name (P).

g. The tie from the R group to the B group is from the Channel Data Link Name or Sub-Channel Name (R) to the Data Link Name (B).

h. The tie from the R group to the Message Data group (S) is from the Channel Data Link Name, Sub-Channel Name, or Network Name (R) to the Data Link Name (S).

i. The tie from either the R, D, B, or S group to the Data Conversion group is the Measurement Name.

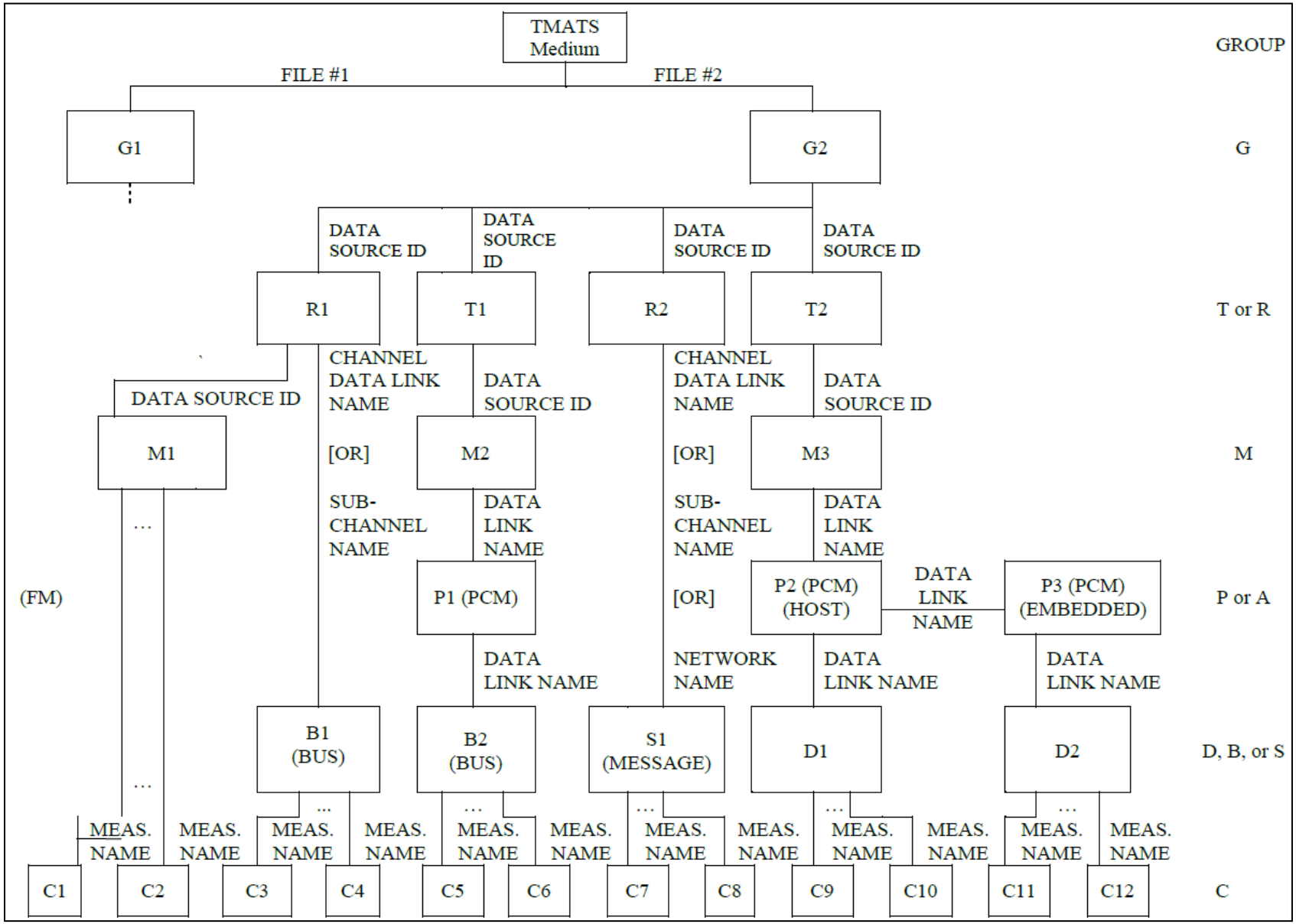

Figure 9-1. Group Relationships

9.5.2 General Information (G)

The General Information group provides overall program information. Figure 9-2 below gives the overall information that is included in this group. Table 9-3 identifies and defines the data required, including the dates associated with the detailed information. Since the identification of the data sources is an integral part of the remaining groups, each source must be uniquely identified.

Figure 9-2. General Information Group (G)				Code Name
PROGRAM NAME - 9-8				(G\PN)
9-8	TEST ITEM			(G\TA)
	***Information**			
		TMATS FILE NAME		(G\FN)
		RCC IRIG 106 REVISION LEVEL		(G\106)
		ORIGINATION DATE		(G\OD)
		REVISION NUMBER		(G\RN)
		REVISION DATE		(G\RD)
		UPDATE NUMBER		(G\UN)
		UPDATE DATE		(G\UD)
		TEST NUMBER		(G\TN)
		NUMBER OF POINTS OF CONTACT		(G\POC\N)
9-9		***Point of Contact**		
			NAME	(G\POC1-n)
			AGENCY	(G\POC2-n)
			ADDRESS	(G\POC3-n)
			TELEPHONE	(G\POC4-n)
9-9	***Data Source Identification**			
		NUMBER OF DATA SOURCES		(G\DSI\N)
			DATA SOURCE ID	(G\DSI-n)
			DATA SOURCE TYPE	(G\DST-n)
			DATA SOURCE SECURITY CLASSIFICATION	(G\DSC-n)
9-10	***Test Information**			
		TEST DURATION		(G\TI1)
		PRE-TEST REQUIREMENT		(G\TI2)
		POST-TEST REQUIREMENT		(G\TI3)
9-10	SECURITY CLASSIFICATION			(G\SC)
	*** Comments**			
9-10		COMMENTS		(G\COM)
*Heading Only - No Data Entry				

Table 9-3. General Information Group (G)		
Parameter	**Code Name**	**Definition**
PROGRAM NAME	G\PN	Name of program. MFS 16.
TEST ITEM	G\TA	Test item description in terms of name, model, platform, or identification code, as appropriate. MFS 64.

Table 9-3. General Information Group (G)

Parameter	Code Name	Definition
Information		
TMATS FILE NAME	G\FN	Name of this TMATS file. MFS 256.
RCC IRIG 106 REVISION LEVEL	G\106 *R-CH10*	Version of RCC IRIG 106 standard used to generate this TMATS file. MFS 2
ORIGINATION DATE	G\OD	Date of origination of this mission configuration. "DD" (Day). "MM" (Month). "YYYY" (Year). (MM-DD-YYYY). MFS 10.
REVISION NUMBER	G\RN	Revision number associated with this mission configuration. MFS 4.
REVISION DATE	G\RD	Date of revision. "DD" (Day). "MM" (Month). "YYYY" (Year). (MM-DD-YYYY). MFS 10.
UPDATE NUMBER	G\UN	Update number of current change that has not been incorporated as a revision. MFS 2
UPDATE DATE	G\UD	Date of update. "DD" (Day). "MM" (Month). "YYYY" (Year). (MM-DD-YYYY) . MFS 10.
TEST NUMBER	G\TN	Test identification. MFS 16.
NUMBER OF POINTS OF CONTACT	G\POC\N	Number of points of contact to be given. MFS 1.
POINT OF CONTACT: NAME AGENCY ADDRESS TELEPHONE	 G\POC1-n G\POC2-n G\POC3-n G\POC4-n	List each of the responsible agencies and their point of contact. MFS 24. MFS 48. MFS 48. MFS 20.
Data Source Identification		
NUMBER OF DATA SOURCES	G\DSI\N *R-CH10*	Specify the number of data sources: for RF telemetry systems, give the number of carriers; for tape or storage recorded data, identify the number of tape or storage sources. MFS 2
DATA SOURCE ID	G\DSI-n *R-CH10*	Provide a descriptive name for this source. Each source identifier must be unique. MFS 32.
DATA SOURCE TYPE	G\DST-n *R-CH10*	Specify the type of source. MFS 3. "RF". "TAP" (Tape). "STO" (Storage). "REP" (Reproducer). "DSS" (Distributed source). "DRS" (Direct source). "OTH" (Other).
NEW DATA SOURCE SECURITY CLASSIFICATION	G\DSC-n	Provide the classification of the data for this source. Provide a description of the classification guide and any information concerning declassification and/or downgrading in comments. "U" (Unclassified). "C" (Confidential). "S" (Secret). "T" (Top secret). "O" (Other). MFS 1.
NOTE: Provide the above three items for each data source.		

Table 9-3. General Information Group (G)		
Parameter	**Code Name**	**Definition**
Test Information		
TEST DURATION	G\TI1	Approximate duration of test in hours. MFS 4.
PRE-TEST REQUIREMENT	G\TI2	Indicate whether a pre-test requirement is applicable (“Y” or “N”). Provide details in comments. MFS 1.
POST-TEST REQUIREMENT	G\TI3	Specify whether a post-test requirement is applicable (“Y” or “N”). Provide details in comments. MFS 1.
SECURITY CLASSIFICATION	G\SC	Provide the classification of the project data. Provide a description of the classification guide and any information concerning declassification and/or downgrading in comments. “U” (Unclassified). “C” (Confidential). “S” (Secret). “T” (Top secret). “O” (Other) MFS 1.
Comments		
COMMENTS	G\COM	Provide the additional information requested or any other information desired. MFS 1600.

9.5.3 Transmission Attributes (T)

The Transmission attributes are presented graphically in Figure 9-3 and specified in Table 9-4. The information contained within this group is used to set up the RF receiver through the detection and recovery of the baseband composite waveform. The format contains the information needed to configure the antenna and receiver subsystems.

Additional equipment inserted in a specific range configuration, such as microwave or other relay, is intended to be transparent to the user and is not described under Transmission Attributes.

Because the information is mutually exclusive, only the appropriate FM or PM system data set is required for a link.

Figure 9-3. Transmission Attributes Group (T)				Code Name
DATA SOURCE ID - 9-11				(T-x\ID)
	***Source RF Attributes**			
		TRANSMITTER ID		(T-x\TID)
		FREQUENCY		(T-x\RF1)
		RF BANDWIDTH		(T-x\RF2)
		DATA BANDWIDTH		(T-x\RF3)
		MODULATION TYPE		(T-x\RF4)
		TOTAL CARRIER MODULATION		(T-x\RF5)
		POWER (RADIATED)		(T-x\RF6)
9-12		NUMBER OF SUBCARRIERS		(T-x\SCO\N)
9-12			SUBCARRIER NUMBER	(T-x\SCO1-n)
			MODULATION INDEX	(T-x\SCO2-n)
		MODULATOR NON-LINEARITY		(T-x\RF7)
9-12		***Premodulation Filter**		

					BANDWIDTH	(T-x\PMF1)
					SLOPE	(T-x\PMF2)
					TYPE	(T-x\PMF3)
9-12			*Transmit Antenna			
					TRANSMIT ANTENNA TYPE	(T-x\AN1)
					TRANSMIT POLARIZATION	(T-x\AN2)
					ANTENNA LOCATION	(T-x\AN3)
9-12				*Antenna Patterns		
				DOCUMENT		(T-x\AP)
				*Point of Contact		
				NAME		(T-x\AP\POC1)
				AGENCY		(T-x\AP\POC2)
				ADDRESS		(T-x\AP\POC3)
				TELEPHONE		(T-x\AP\POC4)
9-13	*Ground Station Attributes					
		IF BANDWIDTH				(T-x\GST1)
		BASEBAND COMPOSITE BANDWIDTH				(T-x\GST2)
9-13		*Gain Control				
			AGC TIME CONSTANT			(T-x\GST3)
		OR	MGC GAIN SET POINT			(T-x\GST4)
		AFC/APC				(T-x\GST5)
			TRACKING BANDWIDTH			(T-x\GST6)
9-13		POLARIZATION RECEPTION				(T-x\GST7)
9-13		*FM Systems				
			DISCRIMINATOR BANDWIDTH			(T-x\FM1)
			DISCRIMINATOR LINEARITY			(T-x\FM2)
9-13	OR	*PM Systems				
			PHASE LOCK LOOP BANDWIDTH			(T-x\PLL)
	*Comments					
9-13		COMMENTS				(T-x\COM)
*Heading Only - No Data Entry						

Table 9-4. Transmission Attributes Group (T)

Parameter	Code Name	Definition
DATA SOURCE ID	T-x\ID	Data source ID consistent with General Information group. MFS 32.
Source RF Attributes		
TRANSMITTER ID	T-x\TID	Transmitter identification. MFS 12.
FREQUENCY	T-x\RF1	Carrier frequency, in megahertz (MHz). If programmable, enter “P”, and define in comments. MFS 6.
RF BANDWIDTH	T-x\RF2	Total RF bandwidth (-60 decibel [dB]) of modulated signal, in MHz. MFS 6.
DATA BANDWIDTH	T-x\RF3	Composite baseband data bandwidth (3 dB), in kilohertz (kHz). MFS 6.

Table 9-4. Transmission Attributes Group (T)

Parameter	Code Name	Definition
MODULATION TYPE	T-x\RF4	Define the modulation type. MFS 12. “FM”. “PM”. “BPSK”. “DPSK”. “QPSK”. “FQPSK-B”. “FQPSK-JR”. “SOQPSK-TG”. “MULTI-H CPM”. “OTHR”.
TOTAL CARRIER MODULATION	T-x\RF5	For FM system, define total carrier deviation, peak-to-peak, in kHz. For PM system, define total phase modulation, peak-to-peak, in radians. MFS 6.
POWER (RADIATED)	T-x\RF6	Total transmitted power when modulated, in watts. MFS 4.
NUMBER OF SUBCARRIERS	T-x\SCO\N	Number of subcarriers in the composite baseband waveform, n. If none, enter “NO”. MFS 2.
SUBCARRIER NUMBER	T-x\SCO1-n	Give the IRIG channel number for the subcarrier. If nonstandard subcarrier, enter “NO”, and enter frequency in the comments section where n is an identification tag for the subcarrier. MFS 5.
MODULATION INDEX	T-x\SCO2-n	Specify the modulation index for each subcarrier in the composite waveform, as appropriate. MFS 4.
MODULATOR NONLINEARITY	T-x\RF7	Modulator nonlinearity, in percent. MFS 4.
Premodulation Filter		
BANDWIDTH	T-x\PMF1	Pre-modulation composite filter bandwidth, 3 dB cut-off frequency, in kHz. MFS 6.
SLOPE	T-x\PMF2	Pre-modulation filter asymptotic roll-off slope, dB/octave. MFS 2.
TYPE	T-x\PMF3	Specify the filter type. MFS 2. “CA” (Constant amplitude). “CD” (Constant delay). “OT” (Other).
Transmit Antenna		
TRANSMIT ANTENNA TYPE	T-x\AN1	Transmit antenna type. MFS 16.
TRANSMIT POLARIZATION	T-x\AN2	Transmit antenna polarization. MFS 4. “RHCP”. “LHCP”. “LIN” (linear).
ANTENNA LOCATION	T-x\AN3	Describe the antenna location. MFS 16.
Antenna Patterns		
DOCUMENT	T-x\AP	Identify document having antenna patterns. MFS 16.
POINT OF CONTACT:		Identify the point of contact for additional information.
NAME	T-x\AP\POC1	MFS 24.
AGENCY	T-x\AP\POC2	MFS 48.
ADDRESS	T-x\AP\POC3	MFS 48.
TELEPHONE	T-x\AP\POC4	MFS 20.

Table 9-4. Transmission Attributes Group (T)

Parameter	Code Name	Definition
Ground Station Attributes		
IF BANDWIDTH	T-x\GST1	Define IF bandwidth (3 dB) in MHz. MFS 6.
BASEBAND COMPOSITE BANDWIDTH	T-x\GST2	Define the cutoff frequency (3 dB), of the output filter, in kHz. MFS 6.
Gain Control		
AGC TIME CONSTANT	T-x\GST3	Specify the AGC time constant desired in milliseconds. MFS 4.
MGC GAIN SET POINT	T-x\GST4	Provide the manual gain control set point in terms of received signal strength, dBm. MFS 6.
AFC/APC	T-x\GST5	Specify automatic frequency control (“AFC”) or automatic phase control (“APC”) or none (“NON”). MFS 3.
TRACKING BANDWIDTH	T-x\GST6	Specify tracking loop bandwidth, in hertz (Hz). MFS 4.
POLARIZATION RECEPTION	T-x\GST7	Specify polarization to be used. MFS 5. “RHCP”. “LHCP”. “BOTH”. Both with diversity combining: “B&DPR” (Pre-detection), “B&DPO” (Post-detection). Diversity combining only: “PRE-D” (Pre-detection), “POS-D” (Post-detection). “OTHER” (Specify in comments).
FM Systems		
DISCRIMINATOR BANDWIDTH	T-x\FM1	Specify the discriminator bandwidth required, in MHz. MFS 4.
DISCRIMINATOR LINEARITY	T-x\FM2	Specify the required linearity over the bandwidth specified. MFS 4.
PM Systems		
PHASE LOCK LOOP BANDWIDTH	T-x\PLL	Specify the phase-locked loop bandwidth. MFS 4.
Comments		
COMMENTS	T-x\COM	Provide the additional information requested or any other information desired. MFS 1600.

9.5.4 Recorder-Reproducer Attributes (R)

This group describes the attributes required when the data source is a magnetic tape as specified in Appendix D or a data storage device as specified in Chapter 10. In the case of the tape data link identification, each data source must be identified. In some cases, the data source identification may be identical, particularly when the same information has been received from different receiver sites, on different polarizations, or on different carriers for redundancy purposes. Some of the information requested will be available only from the recording site or the dubbing location.

Figure 9-4 indicates the information required. Various categories of information have been included. In the data section of the attributes, it will be necessary to repeat the items until all of the data sources have been defined, including the multiple tracks, that contain ground station data of interest. Table 9-5 defines the information required. Any nonstandard tape recordings will require explanation in the comments and may require supplemental definition.

Recorder - Reproducer filtering and post process data filtering and overwrite will use TMATS attributes to describe the requirements. Recorder - Reproducer channel types that support filtering and overwrite will define these attributes. The PCM channels will use R, P, and D attributes and the bus channels will use R and B attributes to define filtering and overwrite definitions.

Figure 9-4. Recorder-Reproducer Attributes Group (R)				**Code Name**
DATA SOURCE ID - 9-21				(R-x\ID)
9-21	RECORDER-REPRODUCER ID			(R-x\RID)
	RECORDER-REPRODUCER DESCRIPTION			(R-x\R1)
9-22	***Recorder-Reproducer Media Characteristics**			
		RECORDER-REPRODUCER MEDIA TYPE		(R-x\TC1)
		RECORDER-REPRODUCER MEDIA MFG		(R-x\TC2)
		RECORDER-REPRODUCER MEDIA CODE		(R-x\TC3)
		RECORDER-REPRODUCER MEDIA LOCATION		(R-x\RML)
		EXTERNAL RMM BUS SPEED		(R-x\ERBS)
		TAPE WIDTH		(R-x\TC4)
		TAPE HOUSING		(R-x\TC5)
		TYPE OF TRACKS		(R-x\TT)
		NUMBER OF TRACKS/CHANNELS		(R-x\N)
		RECORD SPEED		(R-x\TC6)
		DATA PACKING DENSITY		(R-x\TC7)
		TAPE REWOUND		(R-x\TC8)
		NUMBER OF SOURCE BITS		(R-x\NSB)
9-23	***Recorder-Reproducer Information**			
		RECORDER-REPRODUCER MANUFACTURER		(R-x\RI1)
		RECORDER-REPRODUCER MODEL		(R-x\RI2)
		ORIGINAL RECORDING		(R-x\RI3)
		ORIGINAL RECORDING DATE AND TIME		(R-x\RI4)
9-23		***Creating Organization Point of Contact**		
			NAME	(R-x\POC1)
			AGENCY	(R-x\POC2)
			ADDRESS	(R-x\POC3)
			TELEPHONE	(R-x\POC4)
		DATE AND TIME OF COPY		(R-x\RI5)
9-23		***Copying Organization Point of Contact**		
			NAME	(R-x\DPOC1)
			AGENCY	(R-x\DPOC2)
			ADDRESS	(R-x\DPOC3)
			TELEPHONE	(R-x\DPOC4)

		POST PROCESS MODIFIED RECORDING		(R-x\RI6)
		POST PROCESS MODIFICATION TYPE		(R-x\RI7)
		DATE AND TIME OF MODIFICATION		(R-x\RI8)
		***Modifying Organization Point of Contact**		
			NAME	(R-x\MPOC1)
			AGENCY	(R-x\MPOC2)
			ADDRESS	(R-x\MPOC3)
			TELEPHONE	(R-x\MPOC4)
		CONTINUOUS RECORDING ENABLED		(R-x\CRE)
		RECORDER-REPRODUCER SETUP SOURCE		(R-x\RSS)
		RECORDER SERIAL NUMBER		(R-x\RI9)
		RECORDER FIRMWARE REVISION		(R-x\RI10)
		NUMBER OF MODULES		(R-x\RIM\N)
			MODULE ID	(R-x\RIMI-n)
			MODULE SERIAL NUMBER	(R-x\RIMS-n)
			MODULE FIRMWARE REVISION	(R-x\RIMF-n)
		NUMBER OF RMMS		(R-x\RMM\N)
			RMM IDENTIFIER	(R-x\RMMID-n)
			RMM SERIAL NUMBER	(R-x\RMMS-n)
			RMM FIRMWARE REVISION	(R-x\RMMF-n)
		*** Recorder-Reproducer Ethernet Interfaces**		
			NUMBER OF ETHERNET INTERFACES	(R-x\EI\N)
			ETHERNET INTERFACE NAME	(R-x\EINM-n)
			ETHERNET INTERFACE TYPE	(R-x\EIT-n)
			ETHERNET INTERFACE IP ADDRESS	(R-x\EIIP-n)
			NUMBER OF ETHERNET INTERFACE PORTS	(R-x\EIIP\N-n)
			PORT ADDRESS	(R-x\EI\PA-n-m)
			PORT TYPE	(R-x\EI\PT-n-m)
		*** Recorder-Reproducer Channel Group Streams**		
			NUMBER OF CHANNEL GROUPS	(R-x\CG\N)
			CHANNEL GROUP NAME	(R-x\CGNM-n)
			CHANNEL GROUP STREAM NUMBER	(R-x\CGSN-n)
			NUMBER OF GROUP CHANNELS	(R-x\CGCH\N-n)
			GROUP CHANNEL NUMBER	(R-x\CGCN-n-m)
		*** Recorder-Reproducer Drives and Volumes**		
			NUMBER OF DRIVES	(R-x\DR\N)
			DRIVE NAME	(R-x\DRNM-n)
			DRIVE NUMBER	(R-x\DRN-n)
			DRIVE BLOCK SIZE	(R-x\DRBS-n)
			NUMBER OF DRIVE VOLUMES	(R-x\DRVL\N-n)
			VOLUME NAME	(R-x\VLNM-n-m)
			VOLUME NUMBER	(R-x\VLN-n-m)
			VOLUME BLOCKS TO ALLOCATE	(R-x\VLBA-n-m)
			VOLUME NUMBER OF BLOCKS	(R-x\VLNB-n-m)

		*** Recorder-Reproducer Stream/Drive-Volume Links**		
			NUMBER OF LINKS	(R-x\L\N)
			LINK NAME	(R-x\LNM-n)
			LINK SOURCE STREAM NAME	(R-x\LSNM-n)
			LINK SOURCE STREAM NUMBER	(R-x\LSSN-n)
			LINK DESTINATION DRIVE NUMBER	(R-x\LDDN-n)
			LINK DESTINATION VOLUME NUMBER	(R-x\LDVN-n)
	*** Computer Generated Data Packet, User-Defined Definition**			
		USER-DEFINED CHANNEL ID		(R-x\UD\TK1)
9-26	***Recording Event Definitions**			
		RECORDING EVENTS ENABLED		(R-x\EV\E)
		RECORDING EVENTS CHANNEL ID		(R-x\EV\TK1)
		NUMBER OF RECORDING EVENTS		(R-x\EV\N)
		RECORDER INTERNAL EVENTS ENABLED		(R-x\EV\IEE)
9-27		***Recording Event**		
			EVENT ID	(R-x\EV\ID-n)
			EVENT DESCRIPTION	(R-x\EV\D-n)
			EVENT DATA PROCESSING ENABLED	(R-x\EV\EDP-n)
			EVENT TYPE	(R-x\EV\T-n)
9-27			EVENT PRIORITY	(R-x\EV\P-n)
			EVENT CAPTURE MODE	(R-x\EV\CM-n)
			EVENT INITIAL CAPTURE	(R-x\EV\IC-n)
			RECORDING EVENT LIMIT COUNT	(R-x\EV\LC-n)
			EVENT TRIGGER MEASUREMENT SOURCE	(R-x\EV\MS-n)
			EVENT TRIGGER MEASUREMENT NAME	(R-x\EV\MN-n)
			EVENT PROCESSING MEASUREMENT DATA LINK NAME	(R-x\EV\DLN-n)
			NUMBER OF MEASUREMENTS TO PROCESS	(R-x\EV\PM\N-n)
			MEASUREMENT NAME TO PROCESS	(R-x\EV\PM\MN-n-m)
			PRE-EVENT PROCESSING DURATION	(R-x\EV\PM\PRE-n-m)
			POST-EVENT PROCESSING DURATION	(R-x\EV\PM\PST-n-m)
9-28	***Recording Index**			
		RECORDING INDEX ENABLED		(R-x\IDX\E)
		RECORDING INDEX CHANNEL ID		(R-x\IDX\TK1)
		RECORDING INDEX TYPE		(R-x\IDX\IT)
9-28		*** Time Index Type Attribute**		
			INDEX TIME VALUE	(R-x\IDX\ITV)
	OR	*** Count Index Type Attribute**		
			INDEX COUNT VALUE	(R-x\IDX\ICV)
9-28	***MIL-STD-1553 Recorder Control**			
		MESSAGE MONITOR RECORD CONTROL ENABLED		(R-x\MRC\E)

				CHANNEL ID NUMBER	(R-x\MRC\ID)
				MESSAGE RECORD CONTROL TYPE	(R-x\MRC\RCT)
				STOP-PAUSE COMMAND WORD	(R-x\MRC\SPM)
				START-RESUME COMMAND WORD	(R-x\MRC\SRM)
		***Data**			
				TRACK NUMBER/ CHANNEL ID	(R-x\TK1-n)
				RECORDING TECHNIQUE	(R-x\TK2-n)
				INPUT STREAM DERANDOMIZATION	(R-x\IDDR-n)
9-29				DATA SOURCE ID	(R-x\DSI-n)
9-29				DATA DIRECTION	(R-x\TK3-n)
				RECORDER PHYSICAL CHANNEL NUMBER	(R-x\TK4-n)
				CHANNEL ENABLE	(R-x\CHE-n)
				CHANNEL DATA TYPE	(R-x\CDT-n)
				CHANNEL DATA LINK NAME	(R-x\CDLN-n)
NEW				SECONDARY HEADER TIME FORMAT	(R-x\SHTF-n)
				***Data Type Attributes**	
CHANGE 9-30			***PCM Data Type Attributes**		
				PCM DATA TYPE FORMAT	(R-x\PDTF-n)
				DATA PACKING OPTION	(R-x\PDP-n)
				INPUT CLOCK EDGE	(R-x\ICE-n)
				INPUT SIGNAL TYPE	(R-x\IST-n)
				INPUT THRESHOLD	(R-x\ITH-n)
				INPUT TERMINATION	(R-x\ITM-n)
				PCM VIDEO TYPE FORMAT	(R-x\PTF-n)
				PCM RECORDER-REPRODUCER MINOR FRAME FILTERING ENABLED	(R-x\MFF\E-n)
				PCM POST PROCESS OVERWRITE AND FILTERING ENABLED	(R-x\POF\E-n)
				PCM POST PROCESS OVERWRITE AND FILTERING TYPE	(R-x\POF\T-n)
				MINOR FRAME FILTERING DEFINITION TYPE	(R-x\MFF\FDT-n)
				NUMBER OF MINOR FRAME FILTERING DEFINITIONS	(R-xMFF\N-n)
				FILTERED MINOR FRAME NUMBER	(R-x\MFF\MFN-n-m)
				NUMBER OF SELECTED MEASUREMENT OVERWRITE DEFINITIONS	(R-x\SMF\N-n)
				SELECTED MEASUREMENT NAME	(R-x\SMF\SMN-n-m)
				MEASUREMENT OVERWRITE TAG	(R-x\SMF\MFOT-n-m)
CHANGE 9-32		OR	***MIL-STD-1553 Bus Data Type Attributes**		
				MIL-STD-1553 BUS DATA TYPE FORMAT	(R-x\BTF-n)
				MIL-STD-1553 RECORDER - REPRODUCER FILTERING ENABLED	(R-x\MRF\E-n)

		MIL-STD-1553 POST PROCESS OVERWRITE AND FILTERING ENABLED	(R-x\MOF\T-n)
		MIL-STD-1553 MESSAGE FILTERING DEFINITION TYPE	(R-x\MFD\FDT-n)
		NUMBER OF MESSAGE FILTERING DEFINITIONS	(R-x\MFD\N-n)
		MESSAGE NUMBER	(R-x\MFD\MID-n-m)
		MESSAGE TYPE	(R-x\MFD\MT-n-m)
		COMMAND WORD ENTRY	(R-x\CWE-n-m)
		COMMAND WORD	(R-x\CMD-n-m)
		REMOTE TERMINAL ADDRESS	(R-x\MFD\TRA-n-m)
		TRANSMIT/RECEIVE MODE	(R-x\MFD\TRM-n-m)
		SUBTERMINAL ADDRESS	(R-x\MFD\STA-n-m)
		DATA WORD COUNT/MODE CODE	(R-x\MFD\DWC-n-m)
		RECEIVE COMMAND WORD ENTRY	(R-x\RCWE-n-m)
		RECEIVE COMMAND WORD	(R-x\RCMD-n-m)
		RT/RT REMOTE TERMINAL ADDRESS	(R-x\MFD\RTRA-n-m)
		RT/RT SUBTERMINAL ADDRESS	(R-x\MFD\RSTA-n-m)
		RT/RT DATA WORD COUNT	(R-x\MFD\RDWC-n-m)
		NUMBER OF SELECTED MEASUREMENT OVERWRITE DEFINITIONS	(R-x\BME\N-n)
		SELECTED MEASUREMENT NAME	(R-x\BME\SMN-n-m)
		MEASUREMENT OVERWRITE TAG	(R-x\BME\MFOT-n-m)
9-34	OR	***Analog Data Type Attributes**	
		ANALOG DATA TYPE FORMAT	(R-x\ATF-n)
		NUMBER OF ANALOG CHANNELS/PKT	(R-x\ACH\N-n)
		DATA PACKING OPTION	(R-x\ADP-n)
		SAMPLE RATE	(R-x\ASR-n)
9-34		MEASUREMENT NAME	(R-x\AMN-n-m)
		DATA LENGTH	(R-x\ADL-n-m)
		BIT MASK	(R-x\AMSK-n-m)
		MEASUREMENT TRANSFER ORDER	(R-x\AMTO-n-m)
		SAMPLE FACTOR	(R-x\ASF-n-m)
		SAMPLE FILTER 3DB BANDWIDTH	(R-x\ASBW-n-m)
		AC/DC COUPLING	(R-x\ACP-n-m)
		RECORDER INPUT IMPEDANCE	(R-x\AII-n-m)
		INPUT CHANNEL GAIN	(R-x\AGI-n-m)
		INPUT FULL SCALE RANGE	(R-x\AFSI-n-m)
		INPUT OFFSET VOLTAGE	(R-x\AOVI-n-m)
		RECORDED ANALOG FORMAT	(R-x\AF-n-m)
		INPUT TYPE	(R-x\AIT-n-m)
		AUDIO	(R-x\AV-n-m)
		AUDIO FORMAT	(R-x\AVF-n-m)

9-35	OR	***Discrete Data Type Attributes**	
		DISCRETE DATA TYPE FORMAT	(R-x\DTF-n)
		DISCRETE MODE	(R-x\DMOD-n)
		SAMPLE RATE	(R-x\DSR-n)
		NUMBER OF DISCRETE MEASUREMENTS	(R-x\NDM\N-n)
		MEASUREMENT NAME	(R-x\DMN-n-m)
		BIT MASK	(R-x\DMSK-n-m)
		MEASUREMENT TRANSFER ORDER	(R-x\DMTO-n-m)
9-35	OR	***ARINC 429 Bus Data Type Attributes**	
		ARINC 429 BUS DATA TYPE FORMAT	(R-x\ABTF-n)
		NUMBER OF ARINC 429 SUB-CHANNELS	(R-x\NAS\N-n)
		ARINC 429 SUB-CHANNEL NUMBER	(R-x\ASN-n-m)
		ARINC 429 SUB-CHANNEL NAME	(R-x\ANM-n-m)
9-36	OR	***Video Data Type Attributes**	
		VIDEO DATA TYPE FORMAT	(R-x\VTF-n)
		MPEG-2 CHANNEL XON2 FORMAT	(R-x\VXF-n)
		VIDEO SIGNAL TYPE	(R-x\VST-n)
		VIDEO SIGNAL FORMAT TYPE	(R-x\VSF-n)
		VIDEO CONSTANT BIT RATE	(R-x\CBR-n)
		VIDEO VARIABLE PEAK BIT RATE	(R-x\VBR-n)
		VIDEO ENCODING DELAY	(R-x\VED-n)
		OVERLAY ENABLED	(R-x\VCO\OE-n)
		OVERLAY X POSITION	(R-x\VCO\X-n)
		OVERLAY Y POSITION	(R-x\VCO\Y-n)
		OVERLAY EVENT TOGGLE ENABLED	(R-x\VCO\OET-n)
		OVERLAY FORMAT	(R-x\VCO\OLF-n)
		OVERLAY BACKGROUND	(R-x\VCO\OBG-n)
		ANALOG AUDIO CHANNEL INPUT LEFT	(R-x\ASI\ASL-n)
		ANALOG AUDIO CHANNEL INPUT RIGHT	(R-x\ASI\ASR-n)
		VIDEO DATA ALIGNMENT	(R-x\VDA-n)
9-37	OR	***Time Data Type Attributes**	
		TIME DATA TYPE FORMAT	(R-x\TTF-n)
		TIME FORMAT	(R-x\TFMT-n)
		TIME SOURCE	(R-x\TSRC-n)
9-37	OR	***Image Data Type Attributes**	
		IMAGE DATA TYPE FORMAT	(R-x\ITF-n)
		STILL IMAGE TYPE	(R-x\SIT-n)
		DYNAMIC IMAGE FORMAT	(R-x\DIF-n)
		IMAGE TIME STAMP MODE	(R-x\ITSM-n)
		DYNAMIC IMAGE ACQUISITION MODE	(R-x\DIAM-n)

		IMAGE FRAME RATE	(R-x\IFR-n)
		PRE-TRIGGER FRAMES	(R-x\PTG-n)
		TOTAL FRAMES	(R-x\TOTF-n)
		EXPOSURE TIME	(R-x\EXP-n)
		SENSOR ROTATION	(R-x\ROT-n)
		SENSOR GAIN VALUE	(R-x\SGV-n)
		SENSOR AUTO GAIN	(R-x\SAG-n)
		SENSOR WIDTH	(R-x\ISW-n)
		SENSOR HEIGHT	(R-x\ISH-n)
		MAX IMAGE WIDTH	(R-x\MIW-n)
		MAX IMAGE HEIGHT	(R-x\MIH-n)
		IMAGE WIDTH	(R-x\IW-n)
		IMAGE HEIGHT	(R-x\IH-n)
		IMAGE OFFSET X	(R-x\IOX-n)
		IMAGE OFFSET Y	(R-x\IOY-n)
		LINE PITCH	(R-x\ILP-n)
		BINNING HORIZONTAL	(R-x\IBH-n)
		BINNING VERTICAL	(R-x\IBV-n)
		DECIMATION HORIZONTAL	(R-x\IDH-n)
		DECIMATION VERTICAL	(R-x\IDV-n)
		REVERSE X	(R-x\IRX-n)
		REVERSE Y	(R-x\IRY-n)
		PIXEL DYNAMIC RANGE MINIMUM	(R-x\IPMN-n)
		PIXEL DYNAMIC RANGE MAXIMUM	(R-x\IPMX-n)
		TEST IMAGE TYPE	(R-x\TIT-n)
9-40	OR	***UART Data Type Attributes**	
		UART DATA TYPE FORMAT	(R-x\UTF-n)
		NUMBER OF UART SUB-CHANNELS	(R-x\NUS\N-n)
		UART SUB-CHANNEL NUMBER	(R-x\USCN-n-m)
		UART SUB-CHANNEL NAME	(R-x\UCNM-n-m)
		UART SUB-CHANNEL BAUD RATE	(R-x\UCR-n-m)
		UART SUB-CHANNEL BITS PER WORD	(R-x\UCB-n-m)
		UART SUB-CHANNEL PARITY	(R-x\UCP-n-m)
		UART SUB-CHANNEL STOP BIT	(R-x\UCS-n-m)
		UART SUB-CHANNEL INTERFACE	(R-x\UCIN-n-m)
		UART SUB-CHANNEL BLOCK SIZE	(R-x\UCBS-n-m)
		UART SUB-CHANNEL SYNC WORD LENGTH	(R-x\UCSL-n-m)
		UART SUB-CHANNEL BLOCK SYNC VALUE	(R-x\UCSV-n-m)
		UART SUB-CHANNEL BLOCK RATE	(R-x\UCBR-n-m)
9-41	OR	***Message Data Type Attributes**	
		MESSAGE DATA TYPE FORMAT	(R-x\MTF-n)
		NUMBER OF MESSAGE SUB-CHANNELS	(R-x\NMS\N-n)

			MESSAGE SUB-CHANNEL NUMBER	(R-x\MSCN-n-m)
			MESSAGE SUB-CHANNEL NAME	(R-x\MCNM-n-m)
9-41	OR	***IEEE-1394 Data Type Attributes**		
			IEEE-1394 DATA TYPE FORMAT	(R-x\IETF-n)
9-41	OR	***Parallel Data Type Attributes**		
			PARALLEL DATA TYPE FORMAT	(R-x\PLTF-n)
9-41	OR	***Ethernet Data Type Attributes**		
			ETHERNET DATA TYPE FORMAT	(R-x\ENTF-n)
			NUMBER OF ETHERNET NETWORKS	(R-x\NNET\N-n)
			ETHERNET NETWORK NUMBER	(R-x\ENBR-n-m)
			ETHERNET NETWORK NAME	(R-x\ENAM-n-m)
	OR	***TSPI/CTS Data Type**		
			TSPI/CTS DATA TYPE FORMAT	(R-x\TDTF-n)
	OR	***CAN Bus Data Type**		
			CAN BUS DATA TYPE FORMAT	(R-x\CBTF-n)
			NUMBER OF CAN BUS SUB-CHANNELS	(R-x\NCB\N-n)
			CAN BUS SUB-CHANNEL NUMBER	(R-x\CBN-n-m)
			CAN BUS SUB-CHANNEL NAME	(R-x\CBM-n-m)
			CAN BUS BIT RATE	(R-x\CBBS-n-m)
9-42	***Reference Track**			
		NUMBER OF REFERENCE TRACKS		(R-x\RT\N)
		TRACK NUMBER		(R-x\RT1-n)
		REFERENCE FREQUENCY		(R-x\RT2-n)
	***Comments**			
9-42		COMMENTS		(R-x\COM)
*Heading Only - No Data Entry				

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
DATA SOURCE ID	R-x\ID *R-CH10*	Data source ID consistent with General Information group. MFS 32.
RECORDER-REPRODUCER ID	R-x\RID *R-CH10*	Recorder-reproducer identification. MFS 32.
RECORDER-REPRODUCER DESCRIPTION	R-x\R1	Recorder-reproducer description. MFS 32.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
Recorder-Reproducer Media Characteristics		
RECORDER-REPRODUCER MEDIA TYPE	R-x\TC1	Specify the recorder-reproducer media type. MFS 4. “ANAL” (Analog). “CASS” (Cassette). “HDDR”. “PARA” (Parallel). “SSR” (Solid-State Recorder). “MD” (Magnetic Disk). “N” (None, Data Publishing Only). “OTHR” (Other, define in comments).
RECORDER-REPRODUCER MEDIA MANUFACTURER	R-x\TC2	Name of manufacturer of the recorder-reproducer media. MFS 8.
RECORDER-REPRODUCER MEDIA CODE	R-x\TC3	Specify manufacturer’s recorder-reproducer media designation code. MFS 8.
RECORDER - REPRODUCER MEDIA LOCATION	R-x\RML *R-CH10*	Indicates the location of the recorder-reproducer media. “I” (Internal). “E” (External). “B” (Both internal and external). MFS 1.
EXTERNAL RMM BUS SPEED	R-x\ERBS *RO-CH10*	Indicates the speed of an external RMM IEEE-1394b bus. MFS 5. “AUTO”. “S100”. “S200”. “S400”. “S800”. “S1600”. “S3200”.
TAPE WIDTH	R-x\TC4	Physical dimension of tape width, in inches. MFS 4.
TAPE HOUSING	R-x\TC5	State the reel size. MFS 5. Inches: “10.5”. “14.0”. “15.0”. “16.0”. “OTHER”. Millimeters: “12.65”. “19.0”. “OTHER”.
TYPE OF TRACKS	R-x\TT	State the type of tracks on the tape. “LO” (Longitudinal). “RO” (Rotary). MFS 2.
NUMBER OF TRACKS/ CHANNELS	R-x\N *R-CH10*	State the number of tracks on the tape or the number of channels on the storage media. MFS 5.
RECORD SPEED	R-x\TC6	State record speed (inches/second). MFS 4.
DATA PACKING DENSITY	R-x\TC7	State recording system bandwidth. MFS 2. “IM” (Intermediate band). “WB” (Wide band). “DD” (Double density). “OT” (Other).
TAPE REWOUND	R-x\TC8	“Y” (Yes). “N” (No). MFS 1.
NUMBER OF SOURCE BITS	R-x\NSB *R-CH10*	Number of most significant bits of the channel ID used for multiplexer source ID. Default is zero (one source). MFS 2.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
Recorder-Reproducer Information		
RECORDER-REPRODUCER MANUFACTURER	R-x\RI1	Name of recorder-reproducer device manufacturer. MFS 64.
RECORDER-REPRODUCER MODEL	R-x\RI2	Manufacturer's model number of recorder-reproducer device used to create the recording. MFS 64.
ORIGINAL RECORDING	R-x\RI3 *R-CH10*	Indicates if this is an original recording from the source. "Y" (Yes). "N" (No). MFS 1.
ORIGINAL RECORDING DATE AND TIME	R-x\RI4	Date and time original recording was created: "MM" (Month). "DD" (Day). "YYYY" (Year). "HH" (Hour). "MI" (Minute). "SS" (Second). (MM-DD-YYYY-HH-MI-SS). MFS 19.
CREATING ORGANIZATION POC: NAME AGENCY ADDRESS TELEPHONE	 R-x\POC1 R-x\POC2 R-x\POC3 R-x\POC4	Point of contact at the facility creating the tape or storage media: name, agency, address, and telephone. MFS 24. MFS 48. MFS 48. MFS 20.
DATE AND TIME OF COPY	R-x\RI5 *RO-CH10*	Date and time the copy was made: "MM" (Month). "DD" (Day). "YYYY" (Year). "HH" (Hour). "MI" (Minute). "SS" (Second). (MM-DD-YYYY-HH-MI-SS). MFS 19.
COPYING ORGANIZATION POC: NAME AGENCY ADDRESS TELEPHONE	 R-x\DPOC1 R-x\DPOC2 R-x\DPOC3 R-x\DPOC4	Point of contact at the copying agency: name, address, and telephone. MFS 24. MFS 48. MFS 48. MFS 20.
POST PROCESS MODIFIED RECORDING	R-x\RI6 *R-CH10*	Indicates modified recording. "Y" (Yes). "N" (No). MFS 1.
POST PROCESS MODIFICATION TYPE	R-x\RI7 *RO-CH10*	Indicates the type of post-process modification to the recording. MFS 2. "1" (Time subset). "2" (Channel subset). "3" (Time - channel subset). "4" (Channel superset). "5" (Time subset - channel superset). "6" (Filter). "7" (Overwrite).

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
DATE AND TIME OF MODIFICATION	R-x\RI8 *RO-CH10*	Date and time the copy was made: “MM” (Month). “DD” (Day). “YYYY” (Year). “HH” (Hour). “MI” (Minute). “SS” (Second). (MM-DD-YYYY-HH-MI-SS). MFS 19.
MODIFYING ORGANIZATION POC: NAME AGENCY ADDRESS TELEPHONE	 R-x\MPOC1 R-x\MPOC2 R-x\MPOC3 R-x\MPOC4	Point of contact at the modifying agency: name, address, and telephone. MFS 24. MFS 48. MFS 48. MFS 20.
CONTINUOUS RECORDING ENABLED	R-x\CRE *R-CH10*	Indicates if continuous recording is enabled. “T” (True). “F” (False). MFS 1.
RECORDER - REPRODUCER SETUP SOURCE	R-x\RSS *R-CH10*	Indicates the recorder-reproducer setup source. MFS 2. “R” (Setup file on RMM only). “C” (Command setup file only). “RP” (RMM primary, command secondary). “CP” (Command primary, RMM secondary).
RECORDER SERIAL NUMBER	R-x\RI9	Serial number of the recorder. MFS 64.
RECORDER FIRMWARE REVISION	R-x\RI10	Firmware revision number for the recorder. MFS 256.
NUMBER OF MODULES	R-x\RIM\N	Number of modules in the recorder. MFS 3.
MODULE ID	R-x\RIMI-n	Identify this module. MFS 64.
MODULE SERIAL NUMBER	R-x\RIMS-n	Serial number of this module. MFS 64.
MODULE FIRMWARE REVISION	R-x\RIMF-n	Firmware revision number for this module. MFS 256.
NUMBER OF RMMS	R-x\RMM\N	Number of RMMs. MFS 2.
RMM IDENTIFIER	R-x\RMMID-n	Identify this RMM. MFS 64.
RMM SERIAL NUMBER	R-x\RMMS-n	Serial number of the RMM. MFS 64.
RMM FIRMWARE REVISION	R-x\RMMF-n	Firmware revision number of the RMM. MFS 256.
Recorder-Reproducer Ethernet Interfaces		
NUMBER OF ETHERNET INTERFACES	R-x\EI\N *RO-CH10*	Number of recorder-reproducer Ethernet interfaces. MFS 2.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
ETHERNET INTERFACE NAME	R-x\EINM-n *RO-CH10*	Name of the recorder-reproducer Ethernet interface. MFS 32.
ETHERNET INTERFACE TYPE	R-x\EIT-n *RO-CH10*	Type of recorder-reproducer Ethernet interface. MFS 1. " 0" (Reserved). "1" (Download). "2" (Data streaming). "4" (Control and status). "X" (Sum values for multiple type).
ETHERNET INTERFACE IP ADDRESS	R-x\EIIP-n *RO-CH10*	Recorder-reproducer Ethernet interface IP address: specify the IP address in the form "xxx.xxx.xxx.xxx" where each group of xxx can range from 0 to 255. MFS 15.
NUMBER OF ETHERNET INTERFACE PORTS	R-x\EIIP\N-n *RO-CH10*	Number of Ethernet interface ports. MFS 2.
PORT ADDRESS	R-x\EI\PA-n-m *RO-CH10*	Recorder-reproducer Ethernet interface IP port address: specify the IP address in the form "xxxxx" where xxxxx can range from 0 to 99999 IAW ITF. MFS 5.
PORT TYPE	R-x\EI\PT-n-m *RO-CH10*	Recorder-reproducer Ethernet interface IP port type. MFS 1. "0" (Reserved). "1" (Download). "2" (Data streaming). "4" (Control and status). "X" (Sum values for multiple type).
Recorder-Reproducer Channel Group Streams		
NUMBER OF CHANNEL GROUPS	R-x\CG\N *RO-CH10*	Number of recorder-reproducer channel group streams. MFS 2.
CHANNEL GROUP NAME	R-x\CGNM-n *RO-CH10*	Name of the recorder-reproducer channel group. First character must be alphabetic. MFS 32.
CHANNEL GROUP STREAM NUMBER	R-x\CGSN-n *RO-CH10*	Specify the channel group stream as an integer number. MFS 2.
NUMBER OF GROUP CHANNELS	R-x\CGCH\N-n *RO-CH10*	Number of channels in the channel group stream. MFS 2.
GROUP CHANNEL NUMBER	R-x\CGCN-n-m *RO-CH10*	Specify the channel ID, from R-x\TK1-n. MFS 5.
Recorder-Reproducer Drives and Volumes		
NUMBER OF DRIVES	R-x\DR\N *RO-CH10*	Number of recorder-reproducer drives (stream destinations). Default is "1". MFS 4.
DRIVE NAME	R-x\DRNM-n *RO-CH10*	Name of the recorder-reproducer drive. First character must be alphabetic. MFS 32.
DRIVE NUMBER	R-x\DRN-n *RO-CH10*	Specify the drive as an integer number. MFS 4.
DRIVE BLOCK SIZE	R-x\DRBS-n *RO-CH10*	Specify the drive bytes per block size. MFS 8.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
NUMBER OF DRIVE VOLUMES	R-x\DRVL\N-n *RO-CH10*	Number of volumes in the drive. Default is "1". MFS 4.
VOLUME NAME	R-x\VLNM-n-m *RO-CH10*	Name of the drive volume. First character must be alphabetic. MFS 32.
VOLUME NUMBER	R-x\VLN-n-m *RO-CH10*	Specify the volume as an integer number. MFS 4.
VOLUME BLOCKS TO ALLOCATE	R-x\VLBA-n-m *RO-CH10*	Specify how volume blocks will be allocated. MFS 1. "0" (All). "1" (Available). "2" (Number of blocks).
VOLUME NUMBER OF BLOCKS	R-x\VLNB-n-m *RO-CH10*	Specify the volume as an integer number of blocks. MFS 32.
Recorder-Reproducer Stream/Drive-Volume Links		
NUMBER OF LINKS	R-x\L\N *RO-CH10*	Number of recorder-reproducer channel group streams/drive-volume links. MFS 2.
LINK NAME	R-x\LNM-n *RO-CH10*	Name of the recorder-reproducer channel group stream/drive-volume link. First character must be alphabetic. MFS 32.
LINK SOURCE STREAM NAME	R-x\LSNM-n *RO-CH10*	Specify the recorder-reproducer channel group stream name. MFS 32.
LINK SOURCE STREAM NUMBER	R-x\LSSN-n *RO-CH10*	Specify the recorder-reproducer channel group stream/drive-volume number, from R-x\CGSN-n. MFS 2.
LINK DESTINATION DRIVE NUMBER	R-x\LDDN-n *RO-CH10*	Specify the recorder-reproducer channel group stream destination drive number, from R-x\DRN-n. MFS 4.
LINK DESTINATION VOLUME NUMBER	R-x\LDVN-n *RO-CH10*	Specify the recorder-reproducer channel group stream destination volume number, from R-x\VLN-n-m. MFS 4.
Computer Generated Data Packet, User-Defined Definition		
USER-DEFINED CHANNEL ID	R-x\UD\TK1 *RO-CH10*	Specify the channel ID for computer-generated user-defined packets. MFS 5.
Recording Event Definitions		
RECORDING EVENTS ENABLED	R-x\EV\E *RO-CH10*	Indicates if events are enabled. Events must be enabled to generate event packets. "T" (True). "F" (False). MFS 1.
RECORDING EVENTS CHANNEL ID	R-x\EV\TK1 *RO-CH10*	Specify the channel ID for recording event packets. MFS 5.
NUMBER OF RECORDING EVENTS	R-x\EV\N *RO-CH10*	Specify the number of individual recording event types. MFS 3.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
RECORDER INTERNAL EVENTS ENABLED	R-x\EV\IEE *RO-CH10*	Indicates if recorder internal events are enabled. "T" (True). "F" (False). MFS 1.
Recording Event		
EVENT ID	R-x\EV\ID-n *RO-CH10*	Identify the name of the individual recording event. MFS 32.
EVENT DESCRIPTION	R-x\EV\D-n *RO-CH10*	Identify the description of the event. MFS 256.
EVENT DATA PROCESSING ENABLED	R-x\EV\EDP-n	Indicates if event data processing is enabled. "T" (True). "F" (False). MFS 1.
EVENT TYPE	R-x\EV\T-n *RO-CH10*	Indicate the recording event type. MFS 1. "E" (External). "D" (Measurement discrete). "L" (Measurement limit). "R" (Recorder). "O" (Other).
EVENT PRIORITY	R-x\EV\P-n *RO-CH10*	Indicate the recording event priority. MFS 1. "1" (Priority 1). "2" (Priority 2). "3" (Priority 3). "4" (Priority 4). "5" (Priority 5).
EVENT CAPTURE MODE	R-x\EV\CM-n *RO-CH10*	Indicate the recording event capture mode. MFS 1. "1" (Mode 1). "2" (Mode 2). "3" (Mode 3). "4" (Mode 4). "5" (Mode 5). "6" (Mode 6). "7" (Mode 7).
EVENT INITIAL CAPTURE	R-x\EV\IC-n *RO-CH10*	Indicates if initial capture of event is enabled. "T" (True). "F" (False). MFS 1.
RECORDING EVENT LIMIT COUNT	R-x\EV\LC-n *RO-CH10*	Specify the limit count for the individual recording event. MFS 8.
EVENT TRIGGER MEASUREMENT SOURCE	R-x\EV\MS-n *RO-CH10*	Identify the data link name consistent with the mux/mod group that contains the event trigger measurement if event type is "D" or "L". MFS 32.
EVENT TRIGGER MEASUREMENT NAME	R-x\EV\MN-n *RO-CH10*	Identify the event trigger measurand name if the event type is "D" or "L". MFS 32.
EVENT PROCESSING MEASUREMENT DATA LINK NAME	R-x\EV\DLN-n	Identify the data link name consistent with the PCM format and PCM measurement groups, bus data group, or message data group that contains the measurements to be processed. MFS 32.
NUMBER OF MEASUREMENTS TO PROCESS	R-x\EV\PM\N-n	Specify the number of measurements to process for this event. MFS 4.
MEASUREMENT NAME TO PROCESS	R-x\EV\PM\MN-n-m	Identify the measurement name to be processed for the event. MFS 32.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
PRE-EVENT PROCESSING DURATION	R-x\EV\PM\PRE-n-m	Specify the number of seconds the measurement will be processed before the event time. MFS 4.
POST-EVENT PROCESSING DURATION	R-x\EV\PM\PST-n-m	Specify the number of seconds the measurement will be processed after the event time. MFS 4.
Recording Index		
RECORDING INDEX ENABLED	R-x\IDX\E *RO-CH10*	Indicates if index is enabled. Index must be enabled to generate index packets. "T" (True). "F" (False). MFS 1.
RECORDING INDEX CHANNEL ID	R-x\IDX\TK1 *RO-CH10*	Specify the channel ID for recording index packets. MFS 5.
RECORDING INDEX TYPE	R-x\IDX\IT *RO-CH10*	"T" (Time). "C" (Count). MFS 1.
Time Index Type Attribute		
INDEX TIME VALUE	R-\IDX\ITV *RO-CH10*	Identify the number of microseconds for each index entry generation. MFS 8.
Count Index Type Attribute		
INDEX COUNT VALUE	R-\IDX\ICV *RO-CH10*	Identify the number of packets for each index entry generation. MFS 4.
MIL-STD-1553 Recorder Control		
MESSAGE MONITOR RECORD CONTROL ENABLED	R-x\MRC\E	Indicates if message monitor record control is enabled. "T" (True). "F" (False). MFS 1.
CHANNEL ID NUMBER	R-x\MRC\ID	Specify the MIL-STD-1553 channel ID that contains the record control message. MFS 5.
MESSAGE RECORD CONTROL TYPE	R-x\MRC\RCT	Specify the MIL-STD-1553 message monitor record control type. "0" (Stop-start). "1" (Pause-resume). MFS 2.
STOP-PAUSE COMMAND WORD	R-x\MRC\SPM	Specify the command word of the MIL-STD-1553 message to be used for stop-pause in hexadecimal format. MFS 4.
START-RESUME COMMAND WORD	R-x\MRC\SRM	Specify the command word of the MIL-STD-1553 message to be used for start-resume in hexadecimal format. MFS 4.
Data		
NOTE: Define information contained on each track of the tape or each channel of the storage media.		
TRACK NUMBER/ CHANNEL ID	R-x\TK1-n *R-CH10*	Specify the track number or the channel ID that contains the data to be specified. MFS 5.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
RECORDING TECHNIQUE	R-x\TK2-n	Specify the recording technique used for this track. MFS 6. “FM/FM”. “HDDR”. “PRE-D” (Pre-detection). “DIRECT”. “FMWBI” (FM-Wide Band GRP I). “FMWBII” (FM-Wide Band GRP II). “FM-IM” (FM-Intermediate Band). “FM-NB” (FM-Narrow Band). “DOUDEN” (Double Density). “RO-K” (Rotary [Single Track]). “RO-MUX” (Rotary [Multiplexed]). “SSR” (Solid State). “OTHER”.
INPUT STREAM DE-RANDOMIZATION	R-x\IDDR-n	Specify how input stream is recorded. “Y” (Yes). Stream is recorded after being derandomized. “N” (No). Stream is recorded as received. If PCM data type is not throughput and input data stream is randomized, this parameter must be “Y”. Default is “N”. MFS 1.
DATA SOURCE ID	R-x\DSI-n *R-CH10*	Specify the data source identification. For a site-recorded multiplexed track, provide a data source identification. MFS 32.
DATA DIRECTION	R-x\TK3-n	“FWD” (Forward). “REV” (Reverse). MFS 3.
RECORDER PHYSICAL CHANNEL NUMBER	R-x\TK4-n *R-CH10*	Specify the recorder physical channel for the channel ID (TK1). MFS 5.
CHANNEL ENABLE	R-x\CHE-n *R-CH10*	Indicates if source is enabled. Source must be enabled to generate data packets. “T” (True). “F” (False). MFS 1.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
CHANNEL DATA TYPE	R-x\CDT-n *R-CH10*	Specify the type of source if "STO" was specified in G group data source type. MFS 6. "PCMIN" (PCM Input). "VIDIN" (Video Input). "ANAIN" (Analog Input). "1553IN" (1553 Input). "DISIN" (Discrete Input). "TIMEIN" (IRIG Time Input). "UARTIN" (UART Input). "429IN" (ARINC 429 Input). "MSGIN" (Message Data Input). "IMGIN" (Image Data Input). "1394IN" (IEEE-1394 Input). "PARIN" (Parallel Input). "ETHIN" (Ethernet Input). "TSPIN" (TSPI/CTS Input). "CANIN" (CAN bus Input).
CHANNEL DATA LINK NAME	R-x\CDLN-n *R-CH10*	Identify the data link name consistent with the PCM format, bus data, or message data group for the channel. MFS 32.
NEW SECONDARY HEADER TIME FORMAT	R-x\SHTF-n *RO-CH10*	If enabled, the secondary header time format. MFS 1. "0" (Chapter 4 BCD). "1" (IEEE-1588). "2" (ERTC).
Data Type Attributes		
CHANGE **PCM Data Type Attributes**		
PCM DATA TYPE FORMAT	R-x\PDTF-n *RO-CH10*	PCM data type format. "0" (Format 0 [reserved]). "1" (Format 1 [Chapter 4, Chapter 8]). MFS 1.
DATA PACKING OPTION	R-x\PDP-n *RO-CH10*	How data is placed in the packets. MFS 1. "UN" (Unpacked). "TM" (Throughput mode). "PFS" (Packed with frame sync).
INPUT CLOCK EDGE	R-x\ICE-n *RO-CH10*	Specifies the input clock edge relative to the data in degrees. MFS 3. "0" (0 degrees). "180" (180 degrees).
INPUT SIGNAL TYPE	R-x\IST-n *RO-CH10*	Type of input signal. MFS 5. "SE" (Single ended). "DIFF" (Differential). "RS422" (RS-422 standard differential). "TTL" (Single ended with TTL).
INPUT THRESHOLD	R-x\ITH-n *RO-CH10*	Specifies the input threshold level for selectable electrical interface. The value is the threshold level in volts. MFS 5.
INPUT TERMINATION	R-x\ITM-n *RO-CH10*	Specifies the input termination if selectable: "LOW-Z" or "HIGH-Z". MFS 6.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
PCM VIDEO TYPE FORMAT	R-x\PTF-n *RO-CH10*	Compression technique for video recorded as standard Chapter 4 PCM. The compressed data is encapsulated in ISO Standard Transport Stream (TS) frames. If type format is "OTHER", then a vendor spec is required to identify the data compression technique. Specify "NONE" if data is not video data. MFS 5. "NONE". "MPEG1". "MPEG2". "H261". "WAVE". "OTHER".
PCM RECORDER - REPRODUCER MINOR FRAME FILTERING ENABLED	R-x\MFF\E-n *RO-CH10*	Indicates if recorder - reproducer minor frame filtering is enabled for the PCM channel. "T" (True). "F" (False) (not applicable for throughput mode PCM channels). MFS 1.
PCM POST-PROCESS OVERWRITE AND FILTERING ENABLED	R-x\POF\E-n *RO-CH10*	Indicates if post-process overwrite and filtering is enabled for the PCM channel "T" (True). "F" (False). MFS 1.
PCM POST-PROCESS OVERWRITE AND FILTERING TYPE	R-x\POF\T-n *RO-CH10*	Indicates the type of post-process overwrite and filtering for the PCM channel. MFS 2. "MF" (Minor frame). "SM" (Selected measurement). "B" (Both).
MINOR FRAME FILTERING DEFINITION TYPE	R-x\MFF\FDT-n *RO-CH10-PAK*	Specify the PCM minor frame filtering definition type. MFS 2. "IN" (Inclusive filtering). "EX" (Exclusive filtering).
NUMBER OF MINOR FRAME FILTERING DEFINITIONS	R-x\MFF\N-n *RO-CH10-PAK*	Specify the number of PCM minor frame filtering definitions. MFS 3.
FILTERED MINOR FRAME NUMBER	R-x\MFF\MFN-n-m *RO-CH10-PAK*	Specify the PCM minor frame number to be filtered. MFS 3.
NOTE: For PCM formats with multiple subframe ID counters, all minor frame numbers defined for filtering are associated with the first subframe ID counter.		
NUMBER OF SELECTED MEASUREMENT OVERWRITE DEFINITIONS	R-x\SMF\N-n *RO-CH10*	Specify the number of PCM selected measurement overwrite definitions. MFS 2.
SELECTED MEASUREMENT NAME	R-x\SMF\SMN-n-m *RO-CH10*	Specify the PCM selected measurement name to be overwritten. MFS 32.

Table 9-5. Recorder-Reproducer Attributes Group (R)		
Parameter	**Code Name**	**Definition**
MEASUREMENT OVERWRITE TAG	R-x\SMF\MFOT-n-m *RO-CH10*	Indicates if the PCM measurement is tagged for overwriting. MFS 1. Default is "N". "O" (Overwrite). "N" (No overwriting).
MIL-STD-1553 Bus Data Type Attributes		
MIL-STD-1553 BUS DATA TYPE FORMAT	R-x\BTF-n *RO-CH10*	MIL-STD-1553 bus data type format. MFS 1. "0" (Format 0 [reserved]). "1" (Format 1 [MIL-STD-1553B data]). "2" (Format 2 [16PP194 bus]).
MIL-STD-1553 RECORDER - REPRODUCER FILTERING ENABLED	R-x\MRF\E-n *RO-CH10*	Indicates if recorder - reproducer filtering is enabled for the MIL-STD-1553 channel. "T" (True). "F" (False). MFS 1.
MIL-STD-1553 POST-PROCESS OVERWRITE AND FILTERING ENABLED	R-x\MOF\T-n *RO-CH10*	Indicates if post process overwrite and filtering is enabled for the MIL-STD-1553 channel. "T" (True). "F" (False). MFS 1.
MIL-STD-1553 MESSAGE FILTERING DEFINITION TYPE	R-x\MFD\FDT-n	Specify the message filtering definition type. MFS 2. "IN" (Inclusive filtering). "EX" (Exclusive filtering).
NUMBER OF MESSAGE FILTERING DEFINITIONS	R-x\MFD\N-n	Specify the number of message filtering definitions. MFS 2.
MESSAGE NUMBER	R-x\MFD\MID-n-m	Specify the message number to be filtered and overwritten MFS 8.
MESSAGE TYPE	R-x\MFD\MT-n-m	Specify the message type. MFS 4. "RTRT" (RT/RT). "RTBC" (RT/BC). "BCRT" (BC/RT). "MC" (Mode code).
COMMAND WORD ENTRY	R-x\CWE-n-m	Method used to specify the command word. MFS 1. "W" - enter the entire command word in the "COMMAND WORD" attribute. "F" - enter the command word fields separately in the "REMOTE TERMINAL ADDRESS", "SUBTERMINAL ADDRESS", "TRANSMIT/ RECEIVE MODE", and "DATA WORD COUNT/MODE CODE" attributes. Default is "F".
COMMAND WORD	R-x\CMD-n-m	Specify the entire command word for this message in hexadecimal. MFS 4.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
REMOTE TERMINAL ADDRESS	R-x\MFD\TRA-n-m	Specify the five-bit remote terminal address for this message. Use "X" to indicate a "don't care" value. MFS 5.
TRANSMIT/ RECEIVE MODE	R-x\MFD\TRM-n-m	Indicate if this command word is a transmit or receive command. For RT/RT, specify transmit. "1" (Transmit). "0" (Receive). MFS 1.
SUBTERMINAL ADDRESS	R-x\MFD\STA-n-m	Specify the five-bit subterminal address for this message. Use "X" to indicate a "don't care" value. MFS 5.
DATA WORD COUNT/MODE CODE	R-x\MFD\DWC-n-m	Enter the number of data words as a binary string, using "X" to indicate a "don't care" value. If the subterminal address indicates a mode code, enter the mode code value as a binary string. MFS 5.
RECEIVE COMMAND WORD ENTRY	R-x\RCWE-n-m	Method used to specify the receive command word. MFS 1. "W" - enter the entire command word in the "RECEIVE COMMAND WORD" attribute. "F" - enter the command word fields separately in the "RT/RT REMOTE TERMINAL ADDRESS", "RT/RT SUBTERMINAL ADDRESS", and "RT/RT DATA WORD COUNT" attributes. Default is "F".
RECEIVE COMMAND WORD	R-x\RCMD-n-m	Specify the entire receive command word for this RT/RT message in hexadecimal. MFS 4.
RT/RT REMOTE TERMINAL ADDRESS	R-x\MFD\RTRA-n-m	Specify the five-bit remote terminal address for this RT/RT message. MFS 5.
RT/RT SUBTERMINAL ADDRESS	R-x\MFD\RSTA-n-m	Specify the five-bit subterminal address for this RT/RT message. Use "X" to indicate a "don't care" value. MFS 5.
RT/RT DATA WORD COUNT	R-x\MFD\RDWC-n-m	Enter the number of data words as a binary string, using "X" to indicate a "don't care" value. Exclude status and time words (an RT/RT message cannot contain a mode code). MFS 5.
NUMBER OF SELECTED MEASUREMENT OVERWRITE DEFINITIONS	R-x\BME\N-n *RO-CH10*	Specify the number of bus measurement overwrite definitions. MFS 2.
SELECTED MEASUREMENT NAME	R-x\BME\SMN-n-m *RO-CH10*	Specify the bus measurement name to be overwritten. MFS 32.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
MEASUREMENT OVERWRITE TAG	R-x\BME\MFOT-n-m *RO-CH10*	Indicates if the bus measurement is tagged for overwriting. MFS 1. Default is "N". "O" (Overwrite). "N" (No overwriting).
Analog Data Type Attributes		
ANALOG DATA TYPE FORMAT	R-x\ATF-n *RO-CH10*	Analog data type format. MFS 1. "0" (Format 0 [reserved]). "1" (Format 1 [analog data]).
NUMBER OF ANALOG CHANNELS/PKT	R-x\ACH\N-n *RO-CH10*	Specify the number of analog channels per packet. MFS 3.
DATA PACKING OPTION	R-x\ADP-n *RO-CH10*	How data is placed in the packets. MFS 3. "YES" (Packed). "NO" (Unpacked).
SAMPLE RATE	R-x\ASR-n *RO-CH10*	Sample rate of the fastest channel(s) in samples per second. MFS 10.
MEASUREMENT NAME	R-x\AMN-n-m *RO-CH10*	Identify the measurement name consistent with the Data Conversion group for an analog channel. MFS 32.
DATA LENGTH	R-x\ADL-n-m *RO-CH10*	Number of bits per data word. MFS 2.
BIT MASK	R-x\AMSK-n-m *RO-CH10*	Binary string of 1s and 0s to identify the bits in a word location that are assigned to this measurement. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the MSB. MFS 64.
MEASUREMENT TRANSFER ORDER	R-x\AMTO-n-m *RO-CH10*	"M" (MSB first). "L" (LSB first). "D" (Default). MFS 1.
SAMPLE FACTOR	R-x\ASF-n-m *RO-CH10*	$1/(2^n)$ times the fastest sample rate (defined above) gives the sample rate for this channel. Specify the value "n" in this field. MFS 2.
SAMPLE FILTER 3DB BANDWIDTH	R-x\ASBW-n-m *RO-CH10*	Sample filter in units of Hz (000,000,000). MFS 9.
AC/DC COUPLING	R-x\ACP-n-m *RO-CH10*	Analog signal coupling. MFS 1. "A" (AC). "D" (DC).
RECORDER INPUT IMPEDANCE	R-x\AII-n-m *RO-CH10*	Analog signal input impedance to the recorder. Units of ohms (000,000). MFS 6.
INPUT CHANNEL GAIN	R-x\AGI-n-m *RO-CH10*	Signal gain of analog signal. Milli units (10x = 010000). MFS 6.
INPUT FULL SCALE RANGE	R-x\AFSI-n-m *RO-CH10*	Full scale range of input signal. Units of millivolts (20vpp = 020000) (vpp = 2xvp). MFS 6.
INPUT OFFSET VOLTAGE	R-x\AOVI-n-m *RO-CH10*	Offset voltage of input signal. Units of millivolts (10v=010000). MFS 6.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
RECORDED ANALOG FORMAT	R-x\AF-n-m *RO-CH10*	Format of input signal. MFS 1. “1” (One’s complement). “2” (Two’s complement). “3” (Sign and magnitude binary [+=0]). “4” (Sign and magnitude binary [+=1]). “B” (Offset binary). “U” (Unsigned binary). “F” (IEEE 754 single-precision [IEEE 32] floating point).
INPUT TYPE	R-x\AIT-n-m *RO-CH10*	Type of input signal. “S” (Single-ended). “D” (Differential). MFS 1.
AUDIO	R-x\AV-n-m *RO-CH10*	Indicate if input signal is audio. MFS 1. “Y” (Audio present). “N” (Audio not present).
AUDIO FORMAT	R-x\AVF-n-m *RO-CH10*	Format of audio if present. MFS 4. “RAW”. “WAV”. “LPCM”. “AC3”. “PRED”. “PSTD”. “O” (Other).
Discrete Data Type Attributes		
DISCRETE DATA TYPE FORMAT	R-x\DTF-n *RO-CH10*	Discrete data type format. MFS 1. “0” (Format 0 [reserved]). “1” (Format 1 [(discrete data]).
DISCRETE MODE	R-x\DMOD-n *RO-CH10*	Indicate the mode whereby discrete events are placed in the packets. MFS 4. “EV” (Event mode). “SAMP” (Sample mode).
SAMPLE RATE	R-x\DSR-n *RO-CH10*	Sample rate in samples per second. MFS 7.
NUMBER OF DISCRETE MEASUREMENTS	R-x\NDM\N-n *RO-CH10*	Specify the number of discrete measurements. MFS 3.
MEASUREMENT NAME	R-x\DMN-n-m *RO-CH10*	Identify the measurement name consistent with the data conversion group for one or more discrete bits. MFS 32.
BIT MASK	R-x\DMSK-n-m *RO-CH10*	Binary string of 1s and 0s to identify the bits in a word location that are assigned to this measurement. If the full word is used for this measurement, enter “FW”. Left-most bit corresponds to the MSB. MFS 64.
MEASUREMENT TRANSFER ORDER	R-x\DMTO-n-m *RO-CH10*	“M” (MSB first). “L” (LSB first). “D” (Default). MFS 1.
ARINC 429 Bus Data Type Attributes		
ARINC 429 BUS DATA TYPE FORMAT	R-x\ABTF-n *RO-CH10*	ARINC 429 bus data type format. MFS 1. “0” (Format 0 [ARINC 429 data]). “1” (Format 1 [reserved]).

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
NUMBER OF ARINC 429 SUB-CHANNELS	R-x\NAS\N-n *RO-CH10*	Number of ARINC 429 bus sub-channels. MFS 5.
ARINC 429 SUB-CHANNEL NUMBER	R-x\ASN-n-m *RO-CH10*	ARINC 429 bus sub-channel ID. MFS 5.
ARINC 429 SUB-CHANNEL NAME	R-x\ANM-n-m *RO-CH10*	ARINC 429 bus sub-channel name. MFS 32.
Video Data Type Attributes		
VIDEO DATA TYPE FORMAT	R-x\VTF-n *RO-CH10*	Video data type format. MFS 1. “0” (Format 0 [MPEG-2/H.264]). “1” (Format 1 [MPEG-2 ISO 13818]). “2” (Format 2 [MPEG-4 ISO 14496]).
MPEG-2 CHANNEL XON2 FORMAT	R-x\VXF-n *RO-CH10*	Type of video carried for XON2 formats (MPEG-2 video channels). MFS 1. “0” (2ON2 [MPEG-2]). “1” (264ON2 [H.264]).
VIDEO SIGNAL TYPE	R-x\VST-n *RO-CH10*	The video signal input type. MFS 1. “0” (Auto detect). “1” (Composite). “2” (YUV). “3” (S-VIDEO). “4” (DVI). “5” (RGB). “6” (SDI). “7” (VGA).
VIDEO SIGNAL FORMAT TYPE	R-x\VSF-n *RO-CH10*	The video signal input type. MFS 2. “0” (Auto detect). “1” (NTSC). “2” (PAL). “3” (ATSC). “4” (DVB). “5” (ISDB). “6” (SECAM).
VIDEO CONSTANT BIT RATE	R-x\CBR-n *RO-CH10*	Contains aggregate stream bit rate in bits per second. Scientific notation may be used. MFS 32.
VIDEO VARIABLE PEAK BIT RATE	R-x\VBR-n *RO-CH10*	Contains peak stream bit rate in bits per second. Scientific notation may be used. MFS 32.
VIDEO ENCODING DELAY	R-x\VED-n *RO-CH10*	Delay introduced by video encoding hardware in milliseconds. MFS 8.
OVERLAY ENABLED	R-x\VCO\OE-n	Indicates if overlay is enabled. “T” (True). “F” (False). MFS 1.
OVERLAY X POSITION	R-x\VCO\X-n	Specify the X pixel position of the overlay in the video channel. Zero indicates the leftmost position of the video image. MFS 5.
OVERLAY Y POSITION	R-x\VCO\Y-n	Specify the Y line position of the overlay in the video channel. Zero indicates the uppermost position of the video image. MFS 5.
OVERLAY EVENT TOGGLE ENABLED	R-x\VCO\OET-n	Indicates if overlay event toggle is enabled. “T” (True). “F” (False). MFS 1.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
OVERLAY FORMAT	R-x\VCO\OLF-n	Indicates format of the time overlay. MFS 3. “DT” day and time (DDD:HH:MM:SS); “TO” time only (HH:MM:SS); “TM” time and milliseconds (HH:MM:SS:SSS); “DTM” day, time and milliseconds (DDD:HH:MM:SS:SSS).
OVERLAY BACKGROUND	R-x\VCO\OBG-n	Indicates background of the time overlay. MFS 3. “BOT” (Black on transparent). “WOT” (White on transparent). “BOW” (Black on white). “WOB” (White on black).
ANALOG AUDIO CHANNEL INPUT LEFT	R-x\ASI\ASL-n	Indicates the analog channel source of the left audio channel ID for the video channel. MFS 5.
ANALOG AUDIO CHANNEL INPUT RIGHT	R-x\ASI\ASR-n	Indicates the analog channel source of the right audio channel ID for the video channel. MFS 5.
VIDEO DATA ALIGNMENT	R-x\VDA-n *RO-CH10*	Specifies the data alignment of the video data within the packet. MFS 1. “L” (Little endian). “B” (Big endian).
Time Data Type Attributes		
TIME DATA TYPE FORMAT	R-x\TTF-n *R-CH10*	Time data type format. MFS 1. “0” (Format 0 [reserved]). “1” (Format 1 [time data]).
TIME FORMAT	R-x\TFMT-n *R-CH10*	Indicate the format for the time. MFS 1. “A” (IRIG-A 1xy). “B” (IRIG-B 1xy). “G” (IRIG-G 1xy). “I” (Internal). “N” (Native GPS time). “U” (UTC time from GPS). “X” (None). y is an optional last digit. For additional information, see RCC 200-04.[1]
TIME SOURCE	R-x\TSRC-n *R-CH10*	Indicate the time source. MFS 1. “I” (Internal). “E” (External). “R” (Internal from RMM). “X” (None).
Image Data Type Attributes		
IMAGE DATA TYPE FORMAT	R-x\ITF-n *RO-CH10*	Image data type format. MFS 1. “0” (Format 0 [image]). “1” (Format 1 [still imagery]). “2” (Format 2 [dynamic imagery]).

[1] Range Commanders Council. “IRIG Serial Time Code Formats.” RCC 200-04. May be superseded by update. Available at http://www.wsmr.army.mil/RCCSITE/Pages/Publications.aspx.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
STILL IMAGE TYPE	R-x\SIT-n *RO-CH10*	Type of still imagery format. MFS 2. “0” (NITF). “1” (JPEG). “2” (JPEG2). “3” (PNG).
DYNAMIC IMAGE FORMAT	R-x\DIF-n *RO-CH10*	Type of dynamic imagery format IAW Genicam standard features naming convention v1.5 or later and GigE Vision v1.2 or later. MFS 32. “Mono8”; “Mono8Signed”; “Mono10”; “Mono10Packed”; “Mono12”; “Mono12Packed”; “Mono14”; “Mono16”; “Bayergr8”; “Bayerrg8”; “Bayergb8”; “Bayerbg8”; “Bayergr10”; “Bayerrg10”; “Bayergb10”; “Bayerbg10”; “Bayergr12”; “Bayerrg12”; “Bayergb12”; “Bayerbg12” “Bayergr10packed”; “Bayerrg10packed”; “Bayergb10packed”; “Bayerbg10packed”; “Bayergr12packed”; “Bayerrg12packed”; “Bayergb12packed”; “Bayerbg12packed”; “Bayergr16”; “Bayerrg16”; “Bayergb16”; “Bayerbg16”; “RGB8Packed”; “BGR8Packed”; “RGBA8Packed”; “BGRA8Packed”; “RGB10Packed”; “BGR10Packed”; “RGB12Packed”; “BGR12Packed”; “RGB16Packed”; “BGR16Packed”; “RGB10V1Packed”; “BGR10V1Packed”; “RGB10V2Packed”; “BGR10V2Packed”; “RGB12V1Packed”; “RGB565Packed”; “BGR565Packed”; “YUV411Packed”; “YUV422Packed”; “YUV444Packed”; “Yuyvpacked”; “RGB8Planar”; “RGB10Planar”; “RGB12Planar”; “RGB16Planar”; “DEVICESPECIFIC”.
IMAGE TIME STAMP MODE	R-x\ITSM-n *RO-CH10*	Individual image time stamp mode. MFS 2. “0” (Image capture time). “1” (Image packetization time).
DYNAMIC IMAGE ACQUISITION MODE	R-x\DIAM-n *RO-CH10*	Dynamic image acquisition mode. MFS 2. “0” (Single frame). “1” (Multi-frame). “2” (Continuous).
IMAGE FRAME RATE	R-x\IFR-n *RO-CH10*	Frame rate in frames per second at which the frames are captured or streamed in continuous mode. MFS 16.
PRE-TRIGGER FRAMES	R-x\PTG-n	Number of frames to capture before acquisition trigger. MFS 16.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
TOTAL FRAMES	R-x\TOTF-n	Total number of frames to be captured including pre-trigger frames. MFS 32.
EXPOSURE TIME	R-x\EXP-n	Image exposure time in microseconds including fractional seconds if desired. MFS 16.
SENSOR ROTATION	R-x\ROT-n	Sensor rotation 0-360. MFS 3.
SENSOR GAIN VALUE	R-x\SGV-n	Sensor gain value in dB. MFS 5.
SENSOR AUTO GAIN	R-x\SAG-n	Sensor auto gain: “0” (Off). “1” (On). MFS 1.
SENSOR WIDTH	R-x\ISW-n *RO-CH10*	Effective sensor width in pixels used to capture images. MFS 16.
SENSOR HEIGHT	R-x\ISH-n *RO-CH10*	Effective sensor height in pixels used to capture images. MFS 16.
MAXIMUM IMAGE WIDTH	R-x\MIW-n *RO-CH10*	Maximum image width in pixels. MFS 16.
MAXIMUM IMAGE HEIGHT	R-x\MIH-n *RO-CH10*	Maximum image height in pixels. MFS 16.
IMAGE WIDTH	R-x\IW-n *RO-CH10*	Image width in pixels. MFS 16.
IMAGE HEIGHT	R-x\IH-n *RO-CH10*	Image height in pixels. MFS 16.
IMAGE OFFSET X	R-x\IOX-n *RO-CH10*	Image horizontal offset from origin to area of interest in pixels. MFS 16.
IMAGE OFFSET Y	R-x\IOY-n *RO-CH10*	Image vertical offset from origin to area of interest in pixels. MFS 16.
LINE PITCH	R-x\ILP-n	Total number of bytes between two successive lines. MFS 32.
BINNING HORIZONTAL	R-x\IBH-n	Number of horizontal photo-sensitive cells to combine together. A value of 1 indicates no horizontal binning. MFS 32.
BINNING VERTICAL	R-x\IBV-n	Number of vertical photo-sensitive cells to combine together. A value of 1 indicates no vertical binning. MFS 32.
DECIMATION HORIZONTAL	R-x\IDH-n	Horizontal sub-sampling of the image. A value of 1 indicates no horizontal decimation. MFS 32.
DECIMATION VERTICAL	R-x\IDV-n	Vertical sub-sampling of the image. A value of 1 indicates no vertical decimation. MFS 32.
REVERSE X	R-x\IRX-n	Flip horizontally the image sent by the device. “T” (True). “F” (False). MFS 1.
REVERSE Y	R-x\IRY-n	Flip vertically the image sent by the device. “T” (True). “F” (False). MFS 1.

Table 9-5. Recorder-Reproducer Attributes Group (R)		
Parameter	**Code Name**	**Definition**
PIXEL DYNAMIC RANGE MINIMUM	R-x\IPMN-n	Minimum value that can be returned during the digitization process. MFS 32.
PIXEL DYNAMIC RANGE MAXIMUM	R-x\IPMX-n	Maximum value that can be returned during the digitization process. MFS 32.
TEST IMAGE TYPE	R-x\TIT-n	Type of test image sent by the camera. MFS 32. "OFF"; "BLACK"; "WHITE"; "GREYHORIZONTALRAMP"; "GREYVERTICALRAMP"; "GREYHORIZONTALRAMPMOVING"; "GREYVERTICALRAMPMOVING"; "HORIZONTALLINEMOVING"; "VERTICALLINEMOVING"; "COLORBAR"; "FRAMECOUNTER"; "DEVICESPECIFIC".
UART Data Type Attributes		
UART DATA TYPE FORMAT	R-x\UTF-n *RO-CH10*	UART data type format. MFS 1. "0" (Format 0). "1" (Format 1).
NUMBER OF UART SUB-CHANNELS	R-x\NUS\N-n *RO-CH10*	Specify the number of UART sub-channels included within this channel. MFS 5.
UART SUB-CHANNEL NUMBER	R-x\USCN-n-m *RO-CH10*	Specify the UART sub-channel number. MFS 5.
UART SUB-CHANNEL NAME	R-x\UCNM-n-m *RO-CH10*	Specify the UART sub-channel name. MFS 32.
UART SUB-CHANNEL BAUD RATE	R-x\UCR-n-m *RO-CH10*	Baud rate in bits per second (00000000.000) MFS 12.
UART SUB-CHANNEL BITS PER WORD	R-x\UCB-n-m *RO-CH10*	Bits per word (7, 8, or 9). MFS 1.
UART SUB-CHANNEL PARITY	R-x\UCP-n-m *RO-CH10*	Parity. "O" (Odd). "E" (Even). "N" (None). MFS 1.
UART SUB-CHANNEL STOP BIT	R-x\UCS-n-m *RO-CH10*	Stop bit size. MFS 1. "0" (1.0). "1" (1.5). "2" (2.0).
UART SUB-CHANNEL INTERFACE	R-x\UCIN-n-m	UART interface. MFS 1. "0" (Other). "1" (RS-232). "2" (RS-422). "3" (RS-485). "4" (TTL).
UART SUB-CHANNEL BLOCK SIZE	R-x\UCBS-n-m	Block (frame) size in words; XXX,XXX words. MFS 6.
UART SUB-CHANNEL SYNC WORD LENGTH	R-x\UCSL-n-m	Sync word length in words (0 - 9 words maximum). MFS 1.

Table 9-5. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Definition
UART SUB-CHANNEL BLOCK SYNC VALUE	R-x\UCSV-n-m	Block sync word value in binary. Specify all bits. MFS 81.
UART SUB-CHANNEL BLOCK RATE	R-x\UCBR-n-m	Block rate in Hz (00000000.000). MFS 12.
Message Data Type Attributes		
MESSAGE DATA TYPE FORMAT	R-x\MTF-n *RO-CH10*	Message data type format. “0” (Format 0 [message data]). MFS 1.
NUMBER OF MESSAGE SUB-CHANNELS	R-x\NMS\N-n *RO-CH10*	Specify the number of message sub-channels included within this channel. MFS 5.
MESSAGE SUB-CHANNEL NUMBER	R-x\MSCN-n-m *RO-CH10*	Specify the message sub-channel number. MFS 5.
MESSAGE SUB-CHANNEL NAME	R-x\MCNM-n-m *RO-CH10*	Specify the message sub-channel name. MFS 32.
IEEE-1394 Data Type Attributes		
IEEE-1394 DATA TYPE FORMAT	R-x\IETF-n *RO-CH10*	IEEE-1394 data type format. MFS 1. “0” (Format 0 [IEEE-1394 TRANS]). “1” (Format 1 [IEEE-1394 PHY]).
Parallel Data Type Attributes		
PARALLEL DATA TYPE FORMAT	R-x\PLTF-n *RO-CH10*	Parallel data type format “0” (Format 0 [parallel]). MFS 1.
Ethernet Data Type Attributes		
ETHERNET DATA TYPE FORMAT	R-x\ENTF-n *RO-CH10*	Ethernet data type format. “0” (Format 0 [Ethernet data]). MFS 1.
NUMBER OF ETHERNET NETWORKS	R-x\NNET\N-n *RO-CH10*	Specify the number of Ethernet networks included within this channel. MFS 5.
ETHERNET NETWORK NUMBER	R-x\ENBR-n-m *RO-CH10*	Specify the Ethernet network number. MFS 5.
ETHERNET NETWORK NAME	R-x\ENAM-n-m *RO-CH10*	Specify the Ethernet network name. MFS 32.
TSPI/CTS Data Type Attributes		
TSPI/CTS DATA TYPE FORMAT	R-x\TDTF-n *RO-CH10*	TSPI/CTS data type format. MFS 1. “0” (Format 0 [NMEA-RTCM]). “1” (Format 1 [EAG ACMI]). “2” (Format 2 [ACTTS]).

NEW

Table 9-5. Recorder-Reproducer Attributes Group (R)		
Parameter	**Code Name**	**Definition**
CAN Bus Data Type Attributes		
CAN BUS DATA TYPE FORMAT	R-x\CBTF-n *RO-CH10*	CAN bus data type format. "0" (Format 0 [CAN bus]). MFS 1.
NUMBER OF CAN BUS SUB-CHANNELS	R-x\NCB\N-n *RO-CH10*	Specify the number of CAN bus sub-channels in the packet. MFS 3.
CAN BUS SUB-CHANNEL NUMBER	R-x\CBN-n-m *RO-CH10*	Specify the CAN bus sub-channel ID. MFS 3.
CAN BUS SUB-CHANNEL NAME	R-x\CBM-n-m *RO-CH10*	Specify the CAN bus sub-channel name. MFS 32.
CAN BUS BIT RATE	R-x\CBBS-n-m *RO-CH10*	Specify the bit rate of the CAN bus sub-channel in bits per second. MFS 7.
Reference Track		
NUMBER OF REFERENCE TRACKS	R-x\RT\N	Specify the number of reference tracks. MFS 1.
TRACK NUMBER	R-x\RT1-n	State the track location of the reference signal. MFS 2.
REFERENCE FREQUENCY	R-x\RT2-n	Frequency of reference signal, in kHz. MFS 6.
NOTE: There will be one tape/storage source attributes group for each tape or storage source.		
Comments		
COMMENTS	R-x\COM *RO-CH10*	Provide the additional information requested or any other information desired. MFS 3200.

9.5.5 Multiplex/Modulation (Mux/Mod) Attributes (M)

The composite baseband waveform is received from the receiver or tape reproducer electronics and is passed to the demultiplexer/demodulator for further processing. Figure 9-5 summarizes the information that is required to continue processing the data. The composite baseband waveform may consist of any number of signals that are modulated directly onto the RF carrier, including a baseband data signal and one or more subcarriers.

The baseband data signal may be PCM or analog data. The PCM data streams must be defined in terms of a data link name. This data link name is unique for each system that contains different data, has a different format, or has a different data rate. The analog measurand is typically converted into engineering units appropriate for the measurand. The measurement name provides the connection to the Data Conversion Attributes group (C).

Subcarriers, both standard and nonstandard, may be part of the baseband composite waveform. These, in turn, may be modulated with PCM or analog data. As with the baseband data signal, these data channels must be defined. Table 9-6 specifies the required information for the data signal attributes.

Figure 9-5. Multiplex/Modulation Attributes Group (M)							Code Name
DATA SOURCE ID - 9-43							(M-x\ID)
9-43	***Composite Signal Structure**						
		SIGNAL STRUCTURE TYPE					(M-x\BB1)
		MODULATION SENSE					(M-x\BB2)
		COMPOSITE LPF BANDWIDTH					(M-x\BB3)
9-44	***Baseband Signal**						
		BASEBAND SIGNAL TYPE					(M-x\BSG1)
		***Low Pass Filter**					
			BANDWIDTH				(M-x\BSF1)
			TYPE				(M-x\BSF2)
9-44		***Baseband Data Link Type**					
			***PCM**				
		OR		DATA LINK NAME			(M-x\BB\DLN)
			***Analog**				
				MEASUREMENT NAME			(M-x\BB\MN)
9-44	***Subcarriers**						
		NUMBER OF SUBCARRIERS					(M-x\SCO\N)
		***IRIG Subcarriers**					
			NUMBER OF SCOs				(M-x\SI\N)
				SCO NUMBER			(M-x\SI1-n)
					SCO #n DATA TYPE		(M-x\SI2-n)
					MODULATION SENSE		(M-x\SI3-n)
9-44					***Low Pass Filter**		
						BANDWIDTH	(M-x\SIF1-n)
						TYPE	(M-x\SIF2-n)
9-44					***Data Link Type**		
						***PCM**	
							DATA LINK NAME (M-x\SI\DLN-n)
					OR	***Analog**	
							MEASUREMENT NAME (M-x\SI\MN-n)
9-45		OTHER					(M-x\SO)
	REFERENCE CHANNEL						(M-x\RC)
	***Comments**						
9-45		COMMENTS					(M-x\COM)
*Heading Only - No Data Entry							

Table 9-6. Multiplex/Modulation Group (M)		
Parameter	**Code Name**	**Definition**
DATA SOURCE ID	M-x\ID	Data source identification. MFS 32.
Composite Signal Structure		
SIGNAL STRUCTURE TYPE	M-x\BB1	Specify the composite baseband signal structure. MFS 7. “PCM”. “ANALOG”. “SCO’s”. “OTHER”. Hybrid: “ANA/SCO”. “PCM/SCO”.

MODULATION SENSE	M-x\BB2	Specify the modulation sense: “POS” - indicates that an increasing voltage results in an increase in frequency. “NEG” - indicates that a decreasing voltage results in an increase in frequency. MFS 3.
COMPOSITE LPF BANDWIDTH	M-x\BB3	Give the low pass bandwidth of the composite waveform (3 dB cutoff frequency), in kHz. MFS 6.
Baseband Signal		
BASEBAND SIGNAL TYPE	M-x\BSG1	Type of baseband data. MFS 3. “PCM”. “ANA” (Analog). “OTH” (Other). “NON” (None).
Low-Pass Filter		
BANDWIDTH	M-x\BSF1	Specify low pass filter bandwidth (3 dB cutoff frequency), in kHz. MFS 6.
TYPE	M-x\BSF2	Specify the filter type. MFS 2. “CA” (Constant amplitude). “CD” (Constant delay). “OT” (Other, define in the comments).
Baseband Data Link Type		
PCM		
DATA LINK NAME	M-x\BB\DLN	Specify the data link name for PCM data format. MFS 32.
Analog		
MEASUREMENT NAME	M-x\BB\MN	Give the measurand name. MFS 32.
Subcarriers		
NUMBER OF SUBCARRIERS	M-x\SCO\N	Specify the number of subcarriers on this data link. MFS 2.
IRIG Subcarriers		
NUMBER OF SCOS	M-x\SI\N	Specify the number of IRIG subcarriers. MFS 2.
SCO NUMBER	M-x\SI1-n	Give the IRIG channel number for the subcarrier. MFS 5.
SCO #N DATA TYPE	M-x\SI2-n	Specify the type of data on the subcarrier. MFS 3. “PCM”. “ANA” (Analog). “OTH” (Other).
MODULATION SENSE	M-x\SI3-n	Specify the modulation sense: “POS” - indicates that an increasing voltage results in an increase in frequency. “NEG” - indicates that a decreasing voltage results in an increase in frequency. MFS 3.
Low-Pass Filter		
BANDWIDTH	M-x\SIF1-n	Specify the low pass filter cutoff frequency (3 dB), in kHz. MFS 6.
TYPE	M-x\SIF2-n	Specify the filter type. MFS 2. “CA” (Constant amplitude). “CD” (Constant delay). “OT” (Other, define in the comments).
Data Link Type		
PCM		
DATA LINK NAME	M-x\SI\DLN-n	Specify the data link name for PCM data formats. MFS 32.

Analog		
MEASUREMENT NAME	M-x\SI\MN-n	Give the measurand name. MFS 32.
NOTE: Repeat the above for each IRIG subcarrier on this carrier.		
OTHER	M-x\SO	Are there nonstandard subcarriers? "Y" (Yes). "N" (No). Define in the comments. MFS 1.
REFERENCE CHANNEL	M-x\RC	Frequency of reference channel in kHz, if applicable. MFS 6.
Comments		
COMMENTS	M-x\COM	Provide the additional information requested or any other information desired. MFS 3200.

9.5.6 Digital Data Attributes (P, D, B, S)

The digital data attributes are separated into four groups containing PCM-related attribute information. The PCM Format Attributes group (P) is described in item a below. The PCM Measurement Description Attributes, contained in (D), are described in item b. Item c depicts the MIL-STD-1553 or ARINC 429 Bus Data Attributes (B). Item d describes the Message Data Attributes (S).

a. PCM Format Attributes (P). The PCM Format Attributes group contains the information required to decommutate the PCM data stream. Operations of both Class I and Class II are included. Limited information is incorporated for class II operations. Figure 9-6 presents the flow and summary of the information required. In general, only standard methods of synchronization have been included except for cases where considerable application is already in place. Inclusion should not be taken to mean that the nonstandard approaches are better or desired. Table 9-7 contains the PCM Format Attributes. The group defines and specifies the frame format and the information necessary to set up the PCM decommutation. Refer to Chapter 4 for the definition of terms (such as major and minor frames and subframes) and word numbering conventions.

Figure 9-6. PCM Format Attributes Group (P)				Code Name
DATA LINK NAME - 9-48				(P-d\DLN)
9-48	***Input Data**			
		PCM CODE		(P-d\D1)
		BIT RATE		(P-d\D2)
		ENCRYPTED		(P-d\D3)
		POLARITY		(P-d\D4)
		AUTO-POLARITY CORRECTION		(P-d\D5)
		DATA DIRECTION		(P-d\D6)
		DATA RANDOMIZED		(P-d\D7)
		RANDOMIZER LENGTH		(P-d\D8)
9-48	***Format**			
		TYPE FORMAT		(P-d\TF)
			COMMON WORD LENGTH	(P-d\F1)
			WORD TRANSFER ORDER	(P-d\F2)
			PARITY	(P-d\F3)

CHANGE

					PARITY TRANSFER ORDER	(P-d\F4)
					CRC	(P-d\CRC)
					CRC CHECK WORD STARTING BIT	(P-d\CRCCB)
					CRC DATA START BIT	(P-d\CRCDB)
					CRC DATA NUMBER OF BITS	(P-d\CRCDN)
9-49			***Minor Frame**			
				NUMBER OF MINOR FRAMES IN MAJOR FRAME		(P-d\MF\N)
					NUMBER OF WORDS IN A MINOR FRAME	(P-d\MF1)
					NUMBER OF BITS IN A MINOR FRAME	(P-d\MF2)
				SYNC TYPE		(P-d\MF3)
9-49					***Synchronization Pattern**	
						LENGTH (P-d\MF4)
						PATTERN (P-d\MF5)
9-50	***Synchronization Criteria**					
		IN SYNC CRITERIA				(P-d\SYNC1)
			SYNC PATTERN CRITERIA			(P-d\SYNC2)
9-50		***Out of Synchronization Criteria**				
			NUMBER OF DISAGREES			(P-d\SYNC3)
			SYNC PATTERN CRITERIA			(P-d\SYNC4)
			FILL BITS			(P-d\SYNC5)
9-50	***Minor Frame Format Definition**					
		WORD NUMBER				(P-d\MFW1-n)
			NUMBER OF BITS IN WORD			(P-d\MFW2-n)
9-50		***Subframe Synchronization**				
			NUMBER OF SUBFRAME ID COUNTERS			(P-d\ISF\N)
			SUBFRAME ID COUNTER NAME			(P-d\ISF1-n)
			SUBFRAME SYNC TYPE			(P-d\ISF2-n)
9-50				***ID Counter**		
					SUBFRAME ID COUNTER LOCATION	(P-d\IDC1-n)
9-51					ID COUNTER MSB STARTING BIT LOCATION	(P-d\IDC3-n)
					ID COUNTER LENGTH	(P-d\IDC4-n)
					ID COUNTER TRANSFER ORDER	(P-d\IDC5-n)
					ID COUNTER INITIAL VALUE	(P-d\IDC6-n)
					INITIAL COUNT MINOR FRAME NUMBER	(P-d\IDC7-n)
					ID COUNTER END VALUE	(P-d\IDC8-n)
					END COUNT MINOR FRAME NUMBER	(P-d\IDC9-n)
					COUNT DIRECTION	(P-d\IDC10-n)
9-51		***Asynchronous Embedded Format**				
			NUMBER OF ASYNCHRONOUS EMBEDDED FORMATS			(P-d\AEF\N)
				DATA LINK NAME		(P-d\AEF\DLN-n)
				SUPERCOM		(P-d\AEF1-n)

				LOCATION DEFINITION	(P-d\AEF2-n)
				LOCATION	(P-d\AEF3-n-w)
				INTERVAL	(P-d\AEF4-n)
				WORD LENGTH	(P-d\AEF5-n-w)
				MASK	(P-d\AEF6-n-w)
				SUBCOMMUTATED	(P-d\AEF7-n-w)
				START FRAME	(P-d\AEF8-n-w-m)
				FRAME INTERVAL	(P-d\AEF9-n-w-m)
				END FRAME	(P-d\AEF10-n-w-m)
9-52		***Format Change**			
			***Frame Format Identifier**		
				LOCATION	(P-d\FFI1)
				MASK	(P-d\FFI2)
9-53			***Measurement List Change**		
				NUMBER OF MEASUREMENT LISTS	(P-d\MLC\N)
				FFI PATTERN	(P-d\MLC1-n)
				MEASUREMENT LIST NAME	(P-d\MLC2-n)
9-53		OR	***Format Structure Change**		
				NUMBER OF FORMATS	(P-d\FSC\N)
				FFI PATTERN	(P-d\FSC1-n)
				DATA LINK ID	(P-d\FSC2-n)
9-53		***Alternate Tag And Data**			
			NUMBER OF TAGS		(P-d\ALT\N)
			NUMBER OF BITS IN TAG		(P-d\ALT1)
			NUMBER OF BITS IN DATA WORD		(P-d\ALT2)
			FIRST TAG LOCATION		(P-d\ALT3)
			SEQUENCE		(P-d\ALT4)
9-53		***Asynchronous Data Merge Format**			
			NUMBER OF ASYNCHRONOUS DATA MERGE FORMATS		(P-d\ADM\N)
				DATA MERGE NAME	(P-d\ADM\DMN-n)
				MASK AND PATTERN	(P-d\ADM\MP-n)
				OVERHEAD MASK	(P-d\ADM\OHM-n)
				FRESH DATA PATTERN	(P-d\ADM\FDP-n)
				DATA OVERFLOW PATTERN	(P-d\ADM\DOP-n)
				STALE DATA PATTERN	(P-d\ADM\SDP-n)
				USER DEFINED PATTERN	(P-d\ADM\UDP-n)
				SUPERCOM	(P-d\ADM1-n)
				LOCATION DEFINITION	(P-d\ADM2-n)
				LOCATION	(P-d\ADM3-n-w)
				INTERVAL	(P-d\ADM4-n)
				DATA LENGTH	(P-d\ADM5-n)
				MSB LOCATION	(P-d\ADM6-n)
				PARITY	(P-d\ADM7-n)
				SUBCOMMUTATED	(P-d\ADM8-n-w)

		START FRAME	(P-d\ADM9-n-w-m)
		FRAME INTERVAL	(P-d\ADM10-n-w-m)
		END FRAME	(P-d\ADM11-n-w-m)
	***Comments**		
9-55		COMMENTS	(P-d\COM)
***Heading Only - No Data Entry**			

Table 9-7. PCM Format Attributes Group (P)

Parameter	Code Name	Definition
DATA LINK NAME	P-d\DLN *RO-CH10*	Identify the data link name consistent with the mux/mod group. MFS 32.
Input Data		
PCM CODE	P-d\D1 *RO-CH10*	Define the data format code. MFS 6. “NRZ-L”. “NRZ-M”. “NRZ-S”. “RNRZ-L”. “BIO-M”. “BIO-L”. “BIO-S”. “OTHER”. A randomized PCM stream can be specified as: “P-d\D1=NRZ-L” and “P-d\D7=Y”; or “P-d\D1=RNRZ-L” and “P-d\D7” is ignored.
BIT RATE	P-d\D2 *RO-CH10*	Data rate in bits per second. Scientific notation may be used. MFS 32.
ENCRYPTED	P-d\D3	“E” (Data is encrypted). “U” (Data is unencrypted). If the data is encrypted, provide details in comments. MFS 1.
POLARITY	P-d\D4 *RO-CH10*	Data polarity. “N” (Normal). “I” (Inverted). MFS 1.
AUTO-POLARITY CORRECTION	P-d\D5	Is automatic polarity correction to be used? “Y” (Yes). “N” (No). MFS 1.
DATA DIRECTION	P-d\D6	Time sequence of data. “N” (Normal). “R” (Reversed). MFS 1.
DATA RANDOMIZED	P-d\D7 *RO-CH10*	“Y” (Yes). “N” (No). Randomization algorithm is specified in “RANDOMIZER LENGTH” (P-d\D8). MFS 1.
RANDOMIZER LENGTH	P-d\D8 *RO-CH10*	Specify the randomizer length. MFS 3. “STD” (15 bits, per Appendix D). “OTH” (Other, define in comments). “N/A” (Not applicable).
Format		
TYPE FORMAT	P-d\TF *RO-CH10*	Type of PCM format. MFS 4. “ONE” (Class I). “TWO” (Class II). “BUS”. “1553” (1553 bus). “ALTD” (Alternate tag and data). “OTHR” (Other, describe in comments).
COMMON WORD LENGTH	P-d\F1 *RO-CH10-PAK*	Number of bits in common word length. MFS 2.

Table 9-7. PCM Format Attributes Group (P)

Parameter	Code Name	Definition
WORD TRANSFER ORDER	P-d\F2 *RO-CH10-PAK*	Define the default for the first bit transferred in normal time sequence. MFS 1. "M" (MSB). "L" (LSB).
PARITY	P-d\F3 *RO-CH10-PAK*	Normal word parity. MFS 2. "EV" (Even). "OD" (Odd). "NO" (None).
PARITY TRANSFER ORDER	P-d\F4	Parity bit location. MFS 1. "L" (Leads word). "T" (Trails word).
CRC	P-d\CRC	Specifies what type of cyclic redundancy code is to be used. MFS 1. "A" (CRC-16-ANSI). "C" (CRC-16-CCITT). "E" (CRC-32-ANSI). "N" (None).
CRC CHECK WORD STARTING BIT	P-d\CRCCB	The starting bit number in the minor frame where the CRC check word begins. The CRC check word must occupy contiguous bits of the minor frame even if the check word crosses word boundaries. The check word shall always be inserted MSB first. MFS 5.
CRC DATA START BIT	P-d\CRCDB	The starting bit number in the minor frame of the data used in the CRC calculation. MFS 5.
CRC DATA NUMBER OF BITS	P-d\CRCDN	The number of data bits used in the CRC calculation. The data being checked may span 2 minor frames but is never longer than a single minor frame. Minor frame fill bits are never used as part of a CRC calculation. MFS 5.
Minor Frame		
NUMBER OF MINOR FRAMES IN MAJOR FRAME	P-d\MF\N *RO-CH10-PAK*	Number of minor frames in a major frame. MFS 3.
NUMBER OF WORDS IN A MINOR FRAME	P-d\MF1 *RO-CH10-PAK*	Specifies the number of words in a minor frame, as defined in Chapter 4, Paragraph 4.3 (the minor frame synchronization pattern is always considered as one word, regardless of its length). MFS 4.
NUMBER OF BITS IN A MINOR FRAME	P-d\MF2 *RO-CH10-PAK*	Number of bits in a minor frame including minor frame synchronization pattern. MFS 5.
SYNC TYPE	P-d\MF3	Define minor frame synchronization type. MFS 3. "FTP" (Fixed pattern). "OTH" (Other).
Synchronization Pattern		
LENGTH	P-d\MF4 *RO-CH10-PAK*	Specify the minor frame synchronization pattern length in number of bits. MFS 2.

Table 9-7. PCM Format Attributes Group (P)

Parameter	Code Name	Definition
PATTERN	P-d\MF5 *RO-CH10-PAK*	Define minor frame synchronization pattern in bits (1s and 0s) with the left-most bit as the first bit transmitted. "X" may be used to indicate a "don't care" bit. MFS 33.
Synchronization Criteria		
IN-SYNC CRITERIA	P-d\SYNC1	This specifies the desired criteria for declaring the system to be in sync. "0" (First good sync). Number of good sync patterns (1 or greater). "NS" (Not specified). MFS 2.
SYNC PATTERN CRITERIA	P-d\SYNC2	Number of bits that may be in error in the synchronization pattern MFS 2.
Out of Synchronization Criteria		
NUMBER OF DISAGREES	P-d\SYNC3	Specifies the desired criteria for declaring the system out of sync. Number of bad sync patterns, (1 or greater). "NS" (Not specified). MFS 2.
SYNC PATTERN CRITERIA	P-d\SYNC4	Number of bits that may be in error in the synchronization pattern. MFS 2.
NEW FILL BITS	P-d\SYNC5	Max number of fill bits between end of frame and next sync pattern that can be ignored. Default is 0. MFS 5.
Minor Frame Format Definition		
WORD NUMBER	P-d\MFW1-n *RO-CH10-PAK*	Word position #n in a minor frame, or for class II systems, the position in the defined frame. Word position 1 follows the synchronization pattern. MFS 4.
NUMBER OF BITS IN WORD	P-d\MFW2-n *RO-CH10-PAK*	The number of bits in word position #n. If default value, do not include. MFS 2.
NOTE: The above pair set must be defined for all words that have a length other than the common word length. Therefore, all word positions not included in the above will have the common word length as a default value.		
Subframe Synchronization		
NUMBER OF SUBFRAME ID COUNTERS	P-d\ISF\N *RO-CH10-PAK*	Specify the number of subframe ID counters defined within the minor frame. MFS 2.
SUBFRAME ID COUNTER NAME	P-d\ISF1-n *RO-CH10-PAK*	Specify the subframe ID counter name. MFS 32.
SUBFRAME SYNC TYPE	P-d\ISF2-n *RO-CH10-PAK*	Define the subframe synchronization type. MFS 2. "ID" (ID counter). "OT" (Other, define in comments).
ID Counter		
SUBFRAME ID COUNTER LOCATION	P-d\IDC1-n *RO-CH10-PAK*	If ID counter is designated as the subframe sync type, give the minor frame word position of the counter. MFS 4.

Table 9-7. PCM Format Attributes Group (P)

Parameter	Code Name	Definition
ID COUNTER MSB STARTING BIT LOCATION	P-d\IDC3-n *RO-CH10-PAK*	Specify the bit location of the ID counter MSB within the word. MFS 2.
ID COUNTER LENGTH	P-d\IDC4-n *RO-CH10-PAK*	Specify the subframe ID counter length, number of bits. MFS 2.
ID COUNTER TRANSFER ORDER	P-d\IDC5-n *RO-CH10-PAK*	Specify whether the MSB or LSB is transferred first. MFS 1. "M" (MSB). "L" (LSB). "D" (Default) (as specified in WORD TRANSFER ORDER, defined above in this table).
ID COUNTER INITIAL VALUE	P-d\IDC6-n *RO-CH10-PAK*	Specify the initial value of the ID counter. MFS 3.
INITIAL COUNT MINOR FRAME NUMBER	P-d\IDC7-n *RO-CH10-PAK*	Specify the minor frame number associated with the initial count value. MFS 3.
ID COUNTER END VALUE	P-d\IDC8-n *RO-CH10-PAK*	Specify the end value of the ID counter. MFS 3.
END COUNT MINOR FRAME NUMBER	P-d\IDC9-n *RO-CH10-PAK*	Specify the minor frame number associated with the end count value. MFS 3.
COUNT DIRECTION	P-d\IDC10-n *RO-CH10-PAK*	Specify the direction of the count increment. "INC" (Increasing). "DEC" (Decreasing). MFS 3.
Asynchronous Embedded Format		
NUMBER OF ASYNCHRONOUS EMBEDDED FORMATS	P-d\AEF\N	Specify the number of asynchronous embedded formats. MFS 2.
DATA LINK NAME	P-d\AEF\DLN-n	Provide the data link name for this asynchronous embedded format. Repeat name and the following entries for the second format, as appropriate. A separate data link definition must be provided for each asynchronous embedded format. MFS 32.
SUPERCOM	P-d\AEF1-n	If the asynchronous format is not supercommutated, enter "NO". Otherwise, enter the number of host minor frame words that are used. MFS 3.
LOCATION DEFINITION	P-d\AEF2-n	If supercommutated, specify how the word locations are defined. MFS 2. "FI" (First word and interval). "EL" (Every location). "CW" (Contiguous words). "NA" (Not applicable).

Table 9-7. PCM Format Attributes Group (P)		
Parameter	**Code Name**	**Definition**
LOCATION	P-d\AEF3-n-w	Specify the first word within the minor frame that contains the asynchronous embedded format identified. For the method when every word location is defined, repeat this entry for each word position applicable. For the first word and interval method, include the next entry to define the interval. MFS 4.
INTERVAL	P-d\AEF4-n	Specify the interval to be used to define the asynchronous embedded format locations. MFS 4.
WORD LENGTH	P-d\AEF5-n-w	Specify the number of embedded bits in this host word location. MFS 2.
MASK	P-d\AEF6-n-w	If the asynchronous portion of the word is shorter than the word length, then provide the binary mask required to indicate which bits are used (1s used, 0s not used). Left-most bit corresponds to the MSB. MFS 64.
SUB-COMMUTATED	P-d\AEF7-n-w	If this embedded format is not subcommutated (and appears in every minor frame), enter "NO"; otherwise, enter the number of definitions to follow, m. MFS 2.
START FRAME	P-d\AEF8-n-w-m	When the embedded format is subcommutated, enter the first minor frame number this embedded format appears in. If this field is missing, the default value "1" is assumed. Repeat m number of times. MFS 3.
FRAME INTERVAL	P-d\AEF9-n-w-m	When the embedded format is subcommutated, enter the interval between minor frames that this embedded format appears in. If this field is missing, the default value "1" is assumed. Repeat m number of times. MFS 3.
END FRAME	P-d\AEF10-n-w-m	When the embedded format is subcommutated, enter the last minor frame number this embedded format appears in. If this field is missing, the last minor frame is assumed. Repeat m number of times. MFS 3.
Format Change		
Frame Format Identifier		
LOCATION	P-d\FFI1	Specify the position in the minor frame that contains the frame format identification (FFI) word. If more than one word location, provide the details in the comments. MFS 4.
MASK	P-d\FFI2	If the FFI is shorter than the word length, then provide the binary mask required to indicate which bits are used. Leftmost bit corresponds to the MSB. MFS 64.

Table 9-7. PCM Format Attributes Group (P)

Parameter	Code Name	Definition
Measurement List Change		
NUMBER OF MEASUREMENT LISTS	P-d\MLC\N	Specify the number of measurement lists that are required to be selected. If none, enter "NO". Otherwise, enter the number, n. MFS 2.
FFI PATTERN	P-d\MLC1-n	Specify the FFI pattern that corresponds to the measurement list (1s and 0s). This entry and the next are an ordered pair. MFS 16.
MEASUREMENT LIST NAME	P-d\MLC2-n	Specify the measurement list name. MFS 32.
Format Structure Change		
NUMBER OF FORMATS	P-d\FSC\N	Specify the number of formats to be defined. MFS 2.
FFI PATTERN	P-d\FSC1-n	Specify the FFI pattern that corresponds to the format that is defined. This entry and the next are an ordered pair. MFS 16.
DATA LINK ID	P-d\FSC2-n	Identify the format that corresponds to this FFI code. MFS 32.
Alternate Tag And Data		
NUMBER OF TAGS	P-d\ALT\N	Specify the number of tag/data pairs to be included within the minor frame. MFS 3.
NUMBER OF BITS IN TAG	P-d\ALT1	Specify the number of bits that are in the tag. MFS 2.
NUMBER OF BITS IN DATA WORD	P-d\ALT2	Specify the number of bits that are in the common data word. MFS 2.
FIRST TAG LOCATION	P-d\ALT3	Identify the location of the start of the first tag location in terms of bits, with the first bit position after the synchronization pattern being number 1. MFS 2.
SEQUENCE	P-d\ALT4	If the tag/data word sequence is tag, then data enter "N" for normal. If the data precedes the tag, enter "R" for reversed. MFS 1.
Asynchronous Data Merge Format		
NUMBER OF ASYNCHRONOUS DATA MERGE FORMATS	P-d\ADM\N	Specify the number of asynchronous data merge formats. MFS 2.
DATA MERGE NAME	P-d\ADM\DMN-n	Provide the data merge name for this asynchronous data merge format. This can be used to identify the source of the data merge format, as appropriate. Use the comments field to describe this data source for the asynchronous data merge format. MFS 32.

Table 9-7. PCM Format Attributes Group (P)

Parameter	Code Name	Definition
MASK AND PATTERN	P-d\ADM\MP-n	If the asynchronous data merge format uses the overhead bits as recommended in Chapter 4, enter "N". Otherwise enter "Y" and specify the overhead mask and patterns. Default is "N" (Chapter 4). MFS 1.
OVERHEAD MASK	P-d\ADM\OHM-n	If "MASK AND PATTERN" is "Y", provide the mask of the overhead bits in binary. Left-most bit corresponds to the MSB. MFS 64.
FRESH DATA PATTERN	P-d\ADM\FDP-n	If "MASK AND PATTERN" is "Y", provide the pattern for fresh data in binary. Left-most bit corresponds to the MSB. MFS 64.
DATA OVERFLOW PATTERN	P-d\ADM\DOP-n	If "MASK AND PATTERN" is "Y", provide the pattern for data overflow in binary. Left-most bit corresponds to the MSB. MFS 64.
STALE DATA PATTERN	P-d\ADM\SDP-n	If "MASK AND PATTERN" is "Y", provide the pattern for stale data in binary. Left-most bit corresponds to the MSB. MFS 64.
USER DEFINED PATTERN	P-d\ADM\UDP-n	If "MASK AND PATTERN" is "Y", provide the pattern for user defined in binary. Left-most bit corresponds to the MSB. MFS 64.
SUPERCOM	P-d\ADM1-n	If the asynchronous data merge format is not super-commutated, enter "NO". Otherwise, enter the number of host minor frame words that are used. MFS 3.
LOCATION DEFINITION	P-d\ADM2-n	If supercommutated, specify how the word locations are defined. MFS 2. "FI" (First word and interval). "EL" (Every location). "CW" (Contiguous words). "NA" (Not applicable).
LOCATION	P-d\ADM3-n-w	Specify the first word within the minor frame that contains the asynchronous data merge format identified. For the method when every word location is defined, repeat this entry for each word position applicable. For the first word and interval method, include the next entry to define the interval. MFS 4.
INTERVAL	P-d\ADM4-n	Specify the interval to be used to define the asynchronous data merge format locations. MFS 4.
DATA LENGTH	P-d\ADM5-n	Specify the number of data bits used in this data merge format. MFS 2.
MSB LOCATION	P-d\ADM6-n	Provide the MSB position within the host minor frame location. MFS 2.
PARITY	P-d\ADM7-n	If used, specify the parity information. "EV" (Even). "OD" (Odd). "NO" (None). MFS 2.

Table 9-7. PCM Format Attributes Group (P)		
Parameter	**Code Name**	**Definition**
SUB-COMMUTATED	P-d\ADM8-n-w	If this data merge format is not subcommutated (and appears in every minor frame), enter "NO"; otherwise, enter the number of definitions to follow, m. MFS 2.
START FRAME	P-d\ADM9-n-w-m	When the data merge format is subcommutated, enter the first minor frame number this data merge format appears in. If this field is missing, the default value "1" is assumed. Repeat m number of times. MFS 3.
FRAME INTERVAL	P-d\ADM10-n-w-m	When the data merge format is subcommutated, enter the interval between minor frames that this data merge format appears in. If this field is missing, the default value "1" is assumed. Repeat m number of times. MFS 3.
END FRAME	P-d\ADM11-n-w-m	When the data merge format is subcommutated, enter the last minor frame number in which this data merge format appears. If this field is missing, the last minor frame is assumed. Repeat m number of times. MFS 3.
Comments		
COMMENTS	P-d\COM	Provide the additional information requested or any other information desired. MFS 6400.

b. PCM Measurement Description Group (D). Figure 9-7 and Table 9-8 contain the PCM measurement descriptions. The descriptions define each measurand or data item of interest within the frame format specified in the PCM attributes. Table 9-8 includes the measurement name, which links the measurement to the Data Conversion Attributes group.

NOTE	Beginning with RCC IRIG 106-09, it is recommended that the "Word and Frame" location type be used instead of the other six traditional location types. Additionally, when using Word and Frame, it is recommended to avoid the use of subframes (as defined in the Subframe Definitions section of the PCM Format Attributes group in RCC IRIG 106-09 and previous releases) and locate measurements by word number and frame number within the major frame. As of the release of RCC IRIG 106-11, the other six location types and subframes have been removed.

Figure 9-7. PCM Measurement Description Group (D)			Code Name
DATA LINK NAME - 9-56			(D-x\DLN)
9-57	NUMBER OF MEASUREMENT LISTS		(D-x\ML\N)
	MEASUREMENT LIST NAME		(D-x\MLN-y)
	NUMBER OF MEASURANDS		(D-x\MN\N-y)
	MEASUREMENT NAME		(D-x\MN-y-n)
		PARITY	(D-x\MN1-y-n)
		PARITY TRANSFER ORDER	(D-x\MN2-y-n)

		MEASUREMENT TRANSFER ORDER			(D-x\MN3-y-n)
9-57		***Measurement Location**			
			MEASUREMENT LOCATION TYPE		(D-x\LT-y-n)
			***Word And Frame**		
				SUBFRAME ID COUNTER NAME	(D-x\IDCN-y-n)
				NUMBER OF MEASUREMENT LOCATIONS	(D-x\MML\N-y-n)
				NUMBER OF FRAGMENTS	(D-x\MNF\N-y-n-m)
				WORD POSITION	(D-x\WP-y-n-m-e)
				WORD INTERVAL	(D-x\WI-y-n-m-e)
				END WORD POSITION	(D-x\EWP-y-n-m-e)
9-57				FRAME POSITION	(D-x\FP-y-n-m-e)
				FRAME INTERVAL	(D-x\FI-y-n-m-e)
				END FRAME POSITION	(D-x\EFP-y-n-m-e)
				BIT MASK	(D-x\WFM-y-n-m-e)
				FRAGMENT TRANSFER ORDER	(D-x\WFT-y-n-m-e)
				FRAGMENT POSITION	(D-x\WFP-y-n-m-e)
	OR		***Tagged Data**		
				NUMBER OF TAG DEFINITIONS	(D-x\TD\N-y-n)
				TAG NUMBER	(D-x\TD2-y-n-m)
				BIT MASK	(D-x\TD3-y-n-m)
				FRAGMENT TRANSFER ORDER	(D-x\TD4-y-n-m)
				FRAGMENT POSITION	(D-x\TD5-y-n-m)
			***Relative**		
				NUMBER OF PARENT MEASUREMENTS	(D-x\REL\N-y-n)
				PARENT MEASUREMENT	(D-x\REL1-y-n-m)
				BIT MASK	(D-x\REL2-y-n-m)
				FRAGMENT TRANSFER ORDER	(D-x\REL3-y-n-m)
				FRAGMENT POSITION	(D-x\REL4-y-n-m)
	***Comments**				
9-59		COMMENTS			(D-x\COM)
***Heading Only - No Data Entry**					

NEW

Table 9-8. PCM Measurement Description Group (D)

Parameter	Code Name	Definition
DATA LINK NAME	D-x\DLN	Provide the data link name. MFS 32.
NUMBER OF MEASUREMENT LISTS	D-x\ML\N	Specify the number of measurement lists to be provided. MFS 2.
MEASUREMENT LIST NAME	D-x\MLN-y	Provide the measurement list name associated with the following attributes. The following information will have to be repeated for each measurement list identified in the PCM Format Attributes group. MFS 32.

Table 9-8. PCM Measurement Description Group (D)

Parameter	Code Name	Definition
NUMBER OF MEASURANDS	D-x\MN\N-y	Specify the number of measurands included within this measurement list. MFS 7.
MEASUREMENT NAME	D-x\MN-y-n	Measurand name. MFS 32.
PARITY	D-x\MN1-y-n	Specify parity. MFS 2. "EV" (Even). "OD" (Odd). "NO" (None). "DE" (Minor frame default) (as specified in PARITY, defined in Table 9-7).
PARITY TRANSFER ORDER	D-x\MN2-y-n	Parity bit location. MFS 1. "L" (Leads word). "T" (Trails word). "D" (Minor frame default) (as specified in PARITY TRANSFER ORDER, defined in Table 9-7).
MEASUREMENT TRANSFER ORDER	D-x\MN3-y-n	"M" (MSB first). "L" (LSB first). "D" (Default) (as specified in WORD TRANSFER ORDER, defined in Table 9-7). MFS 1.
Measurement Location		
MEASUREMENT LOCATION TYPE	D-x\LT-y-n	Specify the nature of the location of this measurand. MFS 4. "WDFR" (Word and frame). "TD" (Tagged data). "REL" (Relative).
Word And Frame		
SUBFRAME ID COUNTER NAME	D-x\IDCN-y-n	Specify the subframe ID counter name (ISF1) that applies to this measurement (needed only if the PCM format contains multiple ID counters). MFS 32.
NUMBER OF MEASUREMENT LOCATIONS	D-x\MML\N-y-n	Specify the number of location definitions to follow for this measurement. MFS 4.
NUMBER OF FRAGMENTS	D-x\MNF\N-y-n-m	Number of word positions that each fragmented measurement location occupies. Enter "1" if this measurement is not fragmented. MFS 1.
WORD POSITION	D-x\WP-y-n-m-e	Specify the minor frame word position of this measurement location or fragment. MFS 4.
WORD INTERVAL	D-x\WI-y-n-m-e	Specify the interval that is the offset from the first word position and each subsequent word position. An interval of zero indicates that there is only one word position being defined. MFS 4.
END WORD POSITION	D-x\EWP-y-n-m-e	Specify the last minor frame word position of this measurement location or fragment. If not present, default is the end of the minor frame, according to the word interval. If word interval is zero, end word position is not used. MFS 4.
FRAME POSITION	D-x\FP-y-n-m-e	Specify the frame location of this measurement location or fragment. MFS 3.

Table 9-8. PCM Measurement Description Group (D)

Parameter	Code Name	Definition
FRAME INTERVAL	D-x\FI-y-n-m-e	Specify the interval that is the offset from the first frame location and each subsequent frame location. An interval of zero indicates that there is only one frame location being defined. MFS 3.
END FRAME POSITION	D-x\EFP-y-n-m-e	Specify the last frame location of this measurement location or fragment. If not present, default is the end of the major frame, according to the frame interval. If frame interval is zero, end frame position is not used. MFS 3.
BIT MASK	D-x\WFM-y-n-m-e	Binary string of 1s and 0s to identify the bit locations used in each measurement location or fragment. If the full word is used, enter "FW". Left-most bit corresponds to the MSB. MFS 64.
FRAGMENT TRANSFER ORDER	D-x\WFT-y-n-m-e	"M" (MSB first). "L" (LSB first). "D" (Default) (as specified in WORD TRANSFER ORDER, defined in Table 9-7). MFS 1.
FRAGMENT POSITION	D-x\WFP-y-n-m-e	A number from 1 to N specifying the position of this fragment within the reconstructed binary data word. 1 corresponds to the most significant fragment. Each fragment position from 1 to N must be specified only once. MFS 1.
NOTE: Measurement word length, fragment transfer order, and fragment position attributes do not apply when the "number of fragments" attribute for a measurement is 1.		
Tagged Data		
NUMBER OF TAG DEFINITIONS	D-x\TD\N-y-n	Specify the number of tag definitions, N. If not fragmented, enter "1". MFS 4.
TAG NUMBER	D-x\TD2-y-n-m	The expected tag number from the input data stream. MFS 10.
BIT MASK	D-x\TD3-y-n-m	Binary string of 1s and 0s to identify the bit locations in a word position that are assigned to this tagged data measurement. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the MSB. MFS 64.
FRAGMENT TRANSFER ORDER	D-x\TD4-y-n-m	"M" (MSB first). "L" (LSB first). "D" (Default) (as specified in WORD TRANSFER ORDER, defined in Table 9-7). MFS 1.
FRAGMENT POSITION	D-x\TD5-y-n-m	A number from 1 to N specifying the position of this fragment within the reconstituted binary data word. 1 corresponds to the most significant fragment. Each fragment position from 1 to N must be specified only once. MFS 1.

Table 9-8. PCM Measurement Description Group (D)

Parameter	Code Name	Definition
		Relative
NUMBER OF PARENT MEASUREMENTS	D-x\REL\N-y-n	Specify the number of parent measurements, N. If not fragmented, enter "1". MFS 2.
PARENT MEASUREMENT	D-x\REL1-y-n-m	If fragmented, all parent measurements must be at same data rate. MFS 32.
BIT MASK	D-x\REL2-y-n-m	Binary string of 1s and 0s to identify the bit locations in a word position that are assigned to this relative measurement. If the full word is used for this measurement, enter "FW". Leftmost bit corresponds to the MSB. MFS 64.
FRAGMENT TRANSFER ORDER	D-x\REL3-y-n-m	"M" (MSB first). "L" (LSB first). "D" (Default) (as specified in WORD TRANSFER ORDER, defined in Table 9-7). MFS 1.
FRAGMENT POSITION	D-x\REL4-y-n-m	A number from 1 to N specifying the position of this fragment within the reconstituted binary data word. 1 corresponds to the most significant fragment. Each fragment position from 1 to N must be specified only once. MFS 1.
		Comments
COMMENTS	D-x\COM	Provide the additional information requested or any other information desired. MFS 3200.

NOTE: This group will contain a repetition of the above information until each measurement has been defined. Any word position not included will be treated as a spare channel or a "don't care" channel. Information will not be processed for these "spare" channels. Note that measurement list changes and format changes that are a part of class II systems are included in the above, since the key to the measurement definition is the data link name (format) and the measurement list.

c. Bus Data Attributes (B). Figure 9-8 and Table 9-9 describe bus-originated data formats. The Bus Data Attributes group defines the attributes of a MIL-STD-1553 data acquisition system that is compliant with Chapter 8 or an ARINC 429 data acquisition system that is consistent with the specification of ARINC 429 bus data. The primary components of this group are the recording description and message content definition. The former defines the method by which the data were recorded on the tape such as track spread versus composite. The latter consists of the message identification information and the measurement description set. The message identification information defines the contents of the control word that identifies each bus message. The measurement description set describes the measurement attributes and contains the measurement name that links the measurand to the Data Conversion Attributes group (C).

Mode codes are described in the message identification information. If the Subterminal Address field contains 00000 or 11111, the information in the Data Word Count/Mode Code field is a mode code and identifies the function of the mode code. If the mode code has associated data words, they are described in this section of the attributes. If the bus

message is a remote terminal to remote terminal transfer, both the transmit command and the receive command are used to identify the message.

	Figure 9-8. Bus Data Attributes Group (B)	Code Name
	DATA LINK NAME - 9-61	(B-x\DLN)
	TEST ITEM	(B-x\TA)
	BUS PARITY	(B-x\BP)
	NUMBER OF BUSES	(B-x\NBS\N)
	BUS NUMBER	(B-x\BID-i)
	BUS NAME	(B-x\BNA-i)
	BUS TYPE	(B-x\BT-i)
	*** User-Defined Words**	
	USER-DEFINED WORD 1 MEASUREMENT	(B-x\UMN1-i)
	PARITY	(B-x\U1P-i)
	PARITY TRANSFER ORDER	(B-x\U1PT-i)
	BIT MASK	(B-x\U1M-i)
	TRANSFER ORDER	(B-x\U1T-i)
	USER-DEFINED WORD 2 MEASUREMENT	(B-x\UMN2-i)
	PARITY	(B-x\U2P-i)
	PARITY TRANSFER ORDER	(B-x\U2PT-i)
	BIT MASK	(B-x\U2M-i)
	TRANSFER ORDER	(B-x\U2T-i)
	USER-DEFINED WORD 3 MEASUREMENT	(B-x\UMN3-i)
	PARITY	(B-x\U3P-i)
	PARITY TRANSFER ORDER	(B-x\U3PT-i)
	BIT MASK	(B-x\U3M-i)
	TRANSFER ORDER	(B-x\U3T-i)
9-63	***Recording Description**	
	NUMBER OF TRACKS	(B-x\TK\N-i)
	TRACK SEQUENCE	(B-x\TS-i-k)
9-63	***Message Content Definition**	
	NUMBER OF MESSAGES	(B-x\NMS\N-i)
	MESSAGE NUMBER	(B-x\MID-i-n)
	MESSAGE NAME	(B-x\MNA-i-n)
	COMMAND WORD ENTRY	(B-x\CWE-i-n)
	COMMAND WORD	(B-x\CMD-i-n)
	REMOTE TERMINAL NAME	(B-x\TRN-i-n)
	REMOTE TERMINAL ADDRESS	(B-x\TRA-i-n)
	SUBTERMINAL NAME	(B-x\STN-i-n)
	SUBTERMINAL ADDRESS	(B-x\STA-i-n)
	TRANSMIT/RECEIVE MODE	(B-x\TRM-i-n)
	DATA WORD COUNT/MODE CODE	(B-x\DWC-i-n)
	SPECIAL PROCESSING	(B-x\SPR-i-n)
9-64	***ARINC 429 Message Definition**	
	ARINC 429 LABEL	(B-x\LBL-i-n)

				ARINC 429 SDI CODE	(B-x\SDI-i-n)
9-64		***RT/RT Receive Command List**			
			RECEIVE COMMAND WORD ENTRY		(B-x\RCWE-i-n)
			RECEIVE COMMAND WORD		(B-x\RCMD-i-n)
			REMOTE TERMINAL NAME		(B-x\RTRN-i-n)
			REMOTE TERMINAL ADDRESS		(B-x\RTRA-i-n)
			SUBTERMINAL NAME		(B-x\RSTN-i-n)
			SUBTERMINAL ADDRESS		(B-x\RSTA-i-n)
			DATA WORD COUNT		(B-x\RDWC-i-n)
9-65		***Mode Code**			
			MODE CODE DESCRIPTION		(B-x\MCD-i-n)
			MODE CODE DATA WORD DESCRIPTION		(B-x\MCW-i-n)
9-65		***Measurement Description Set**			
			NUMBER OF MEASURANDS		(B-x\MN\N-i-n)
				MEASUREMENT NAME	(B-x\MN-i-n-p)
				MEASUREMENT TYPE	(B-x\MT-i-n-p)
				PARITY	(B-x\MN1-i-n-p)
				PARITY TRANSFER ORDER	(B-x\MN2-i-n-p)
9-65		***Measurement Location**			
			NUMBER OF MEASUREMENT LOCATIONS		(B-x\NML\N-i-n-p)
				MESSAGE WORD NUMBER	(B-x\MWN-i-n-p-e)
9-65				BIT MASK	(B-x\MBM-i-n-p-e)
				TRANSFER ORDER	(B-x\MTO-i-n-p-e)
				FRAGMENT POSITION	(B-x\MFP-i-n-p-e)
	***Comments**				
9-66		COMMENTS			(B-x\COM)
*Heading Only - No Data Entry					

Table 9-9. Bus Data Attributes Group (B)

Parameter	Code Name	Definition
DATA LINK NAME	B-x\DLN	Identify the data link name consistent with the Multiplex/Modulation group. The PCM format of the data stream shall be defined in the PCM Format Attributes group. MFS 32.
TEST ITEM	B-x\TA	Test item description in terms of name, model, platform, or identification code that contains the data acquisition system. MFS 16.
BUS PARITY	B-x\BP	Specify whether the MSB of the 1553 words is a parity bit. If parity is used, it must be odd parity, as specified in Chapter 8, Paragraph 8.2.2. MFS 2. “OD” (Odd). “NO” (None).

Table 9-9. Bus Data Attributes Group (B)

Parameter	Code Name	Definition
NUMBER OF BUSES	B-x\NBS\N	Specify the number of buses included within this data link. If parity is used, the maximum is 8 buses, and if parity is not used, the maximum is 16 buses, as specified in Chapter 8, Paragraph 8.2.3. MFS 2.
BUS NUMBER	B-x\BID-i	Enter the bus number as a binary string. MFS 4.
BUS NAME	B-x\BNA-i	Specify the bus name. MFS 32.
BUS TYPE	B-x\BT-i	Specify the bus type. MFS 8. "1553" (1553 bus). "A429" (ARINC 429 bus).
User-Defined Words		
USER-DEFINED WORD 1 MEASUREMENT	B-x\UMN1-i	Specify the measurement name associated with the content ID label (bits 5-8) value of "0010". MFS 32.
PARITY	B-x\U1P-i	Specify parity. MFS 2. "EV" (Even). "OD" (Odd). "NO" (None).
PARITY TRANSFER ORDER	B-x\U1PT-i	Parity bit location. MFS 1. "L" (Leads word). "T" (Trails word).
BIT MASK	B-x\U1M-i	Binary string of 1s and 0s to identify the bit locations that are assigned to this measurement in the word identified above. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the MSB. MFS 16.
TRANSFER ORDER	B-x\U1T-i	"MSB". "LSB". "DEF" (Default) (as specified in WORD TRANSFER ORDER, defined in Table 9-7). MFS 3.
USER-DEFINED WORD 2 MEASUREMENT	B-x\UMN2-i	Specify the measurement name associated with the content ID label (bits 5-8) value of "0011". MFS 32.
PARITY	B-x\U2P-i	Specify parity. MFS 2. "EV" (Even). "OD" (Odd). "NO" (None).
PARITY TRANSFER ORDER	B-x\U2PT-i	Parity bit location. MFS 1. "L" (Leads word). "T" (Trails word).
BIT MASK	B-x\U2M-i	Binary string of 1s and 0s to identify the bit locations that are assigned to this measurement in the word identified above. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the MSB. MFS 16.
TRANSFER ORDER	B-x\U2T-i	"MSB". "LSB". "DEF" (Default) (as specified in WORD TRANSFER ORDER, defined in Table 9-7). MFS 3.
USER-DEFINED WORD 3 MEASUREMENT	B-x\UMN3-i	Specify the measurement name associated with the content ID label (bits 5-8) value of "0100" (valid only for 1553, when response time is not used). MFS 32.

Table 9-9. Bus Data Attributes Group (B)

Parameter	Code Name	Definition
PARITY	B-x\U3P-i	Specify parity. MFS 2. "EV" (Even). "OD" (Odd). "NO" (None).
PARITY TRANSFER ORDER	B-x\U3PT-i	Parity bit location. MFS 1. "L" (Leads word). "T" (Trails word).
BIT MASK	B-x\U3M-i	Binary string of 1s and 0s to identify the bit locations that are assigned to this measurement in the word identified above. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the MSB. MFS 16.
TRANSFER ORDER	B-x\U3T-i	"MSB". "LSB". "DEF" (Default) (as specified in WORD TRANSFER ORDER, defined in Table 9-7). MFS 3.
Recording Description		
NUMBER OF TRACKS	B-x\TK\N-i	Enter the number of tape tracks used to record data. Any entry greater than one indicates that the data has been spread across multiple tracks. MFS 2.
TRACK SEQUENCE	B-x\TS-i-k	In these entries, give the sequence order of tape tracks that should be used to recover the data stream in the correct order. The order given should correspond to the actual skew of the data on the tape. MFS 3.
Message Content Definition		
NUMBER OF MESSAGES	B-x\NMS\N-i	The number of messages to be defined. MFS 8.
MESSAGE NUMBER	B-x\MID-i-n	The message number that contains the following data. MFS 8.
MESSAGE NAME	B-x\MNA-i-n	Specify the message name. MFS 32.
COMMAND WORD ENTRY	B-x\CWE-i-n	Method used to specify the command word: "W" - enter the entire command word in the "COMMAND WORD" attribute. "F" - enter the command word fields separately in the "REMOTE TERMINAL ADDRESS", "SUBTERMINAL ADDRESS", "TRANSMIT/RECEIVE MODE", and "DATA WORD COUNT/MODE CODE" attributes. Default is "F". MFS 1.
COMMAND WORD	B-x\CMD-i-n	Specify the entire command word for this message in hexadecimal. MFS 4.
REMOTE TERMINAL NAME	B-x\TRN-i-n	Enter the name of the remote terminal that is sending or receiving this message. For RT/RT, specify the sending remote terminal name. MFS 32.
REMOTE TERMINAL ADDRESS	B-x\TRA-i-n	Specify the five-bit remote terminal address for this message. MFS 5.

Table 9-9. Bus Data Attributes Group (B)

Parameter	Code Name	Definition
SUBTERMINAL NAME	B-x\STN-i-n	Enter the name of the subterminal that is sending or receiving this message. MFS 32.
SUBTERMINAL ADDRESS	B-x\STA-i-n	Specify the five-bit subterminal address for this message. Use "X" to indicate a "don't care" value. MFS 5.
TRANSMIT/ RECEIVE MODE	B-x\TRM-i-n	Indicate if this command word is a transmit or receive command. For RT/RT, specify transmit. "1" (Transmit). "0" (Receive). MFS 1.
DATA WORD COUNT/MODE CODE	B-x\DWC-i-n	Enter the number of data words as a binary string, using "X" to indicate a "don't care" value. If the subterminal address indicates a mode code, enter the mode code value as a binary string. MFS 5.
SPECIAL PROCESSING	B-x\SPR-i-n	Provide any special processing requirements pertaining to this message. MFS 200.
ARINC 429 Message Definition		
ARINC 429 LABEL	B-x\LBL-i-n	Specify the eight-bit ARINC 429 label for this message. MFS 8.
ARINC 429 SDI CODE	B-x\SDI-i-n	Specify the two-bit ARINC 429 SDI code for this message. MFS 3. "ALL" (All SDI). "0" (SDI code 0). "1" (SDI code 1). "2" (SDI code 2). "3" (SDI code 3).
RT/RT Receive Command List		
RECEIVE COMMAND WORD ENTRY	B -x\RCWE-i-n	Method used to specify the receive command word: "W" - enter the entire command word in the "RECEIVE COMMAND WORD" attribute. "F" - enter the command word fields separately in the "REMOTE TERMINAL ADDRESS", "SUBTERMINAL ADDRESS", and "DATA WORD COUNT" attributes. Default is "F". MFS 1.
RECEIVE COMMAND WORD	B-x\RCMD-i-n	Specify the entire receive command word for this RT/RT message in hexadecimal. MFS 4.
REMOTE TERMINAL NAME	B-x\RTRN-i-n	Enter the name of the remote terminal that is receiving this RT/RT message. MFS 32.
REMOTE TERMINAL ADDRESS	B-x\RTRA-i-n	Specify the five-bit remote terminal address for this RT/RT message. MFS 5.
SUBTERMINAL NAME	B-x\RSTN-i-n	Enter the name of the sub-terminal that is receiving this RT/RT message. MFS 32.
SUBTERMINAL ADDRESS	B-x\RSTA-i-n	Specify the five-bit subterminal address for this RT/RT message. Use "X" to indicate a "don't care" value. MFS 5.

Table 9-9. Bus Data Attributes Group (B)

Parameter	Code Name	Definition
DATA WORD COUNT	B-x\RDWC-i-n	Enter the number of data words as a binary string, using "X" to indicate a "don't care" value. Exclude status and time words. An RT/RT message cannot contain a mode code. MFS 5.
Mode Code		
MODE CODE DESCRIPTION	B-x\MCD-i-n	Describe the function or action associated with this mode code. MFS 200.
MODE CODE DATA WORD DESCRIPTION	B-x\MCW-i-n	If the mode code has an associated data word following the mode code command, provide a complete description of the data word. MFS 200.
Measurement Description Set		
NUMBER OF MEASURANDS	B-x\MN\N-i-n	Specify the number of measurands. MFS 7.
MEASUREMENT NAME	B-x\MN-i-n-p	Measurand name. MFS 32.
MEASUREMENT TYPE	B-x\MT-i-n-p	Content identification. MFS 1. "D" (Data word). "C" (Command word). "S" (Status word). "T" (Time word).
PARITY	B-x\MN1-i-n-p	Specify parity. MFS 2. "EV" (Even). "OD" (Odd). "NO" (None).
PARITY TRANSFER ORDER	B-x\MN2-i-n-p	Parity bit location. MFS 1. "L" (Leads word). "T" (Trails word).
Measurement Location		
NUMBER OF MEASUREMENT LOCATIONS	B-x\NML\N-i-n-p	If this measurement is contained in one word, enter "1". If this measurement is fragmented, enter the number of fragments. MFS 2.
MESSAGE WORD NUMBER	B-x\MWN-i-n-p-e	Enter the data word number within a message that contains the measurement or the fragmented measurand. MFS 3.
BIT MASK	B-x\MBM-i-n-p-e	Binary string of 1s and 0s to identify the bit locations that are assigned to this measurement in the word identified above. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the MSB. MFS 64.
TRANSFER ORDER	B-x\MTO-i-n-p-e	"MSB". "LSB". "DEF" (Default) (as specified in WORD TRANSFER ORDER, defined in Table 9-7). MFS 3.
FRAGMENT POSITION	B-x\MFP-i-n-p-e	A number from 1 to N specifying the position of this fragment within the reconstructed binary data word. 1 corresponds to the most significant fragment. Each fragment position from 1 to N must be specified only once. MFS 1.

Table 9-9. Bus Data Attributes Group (B)		
Parameter	**Code Name**	**Definition**
NOTE: Repeat the above to describe each fragment of a fragmented word. The transfer order indicates whether to transpose the order of the bit sequence or not (LSB indicates to transpose the bit sequence).		
Comments		
COMMENTS	B-x\COM	Provide the additional information requested or other information desired. MFS 3200.

d. Message Data Attributes (S). The Message Data Attributes are presented graphically in Figure 9-9 and specified in Table 9-10. The information contained within this group is used to describe the characteristics and measurement locations within data streams as described by the UART, Message, Ethernet, and IEEE-1394 Chapter 10 channel data types.

	Figure 9-9. Message Data Attributes Group (S)	Code Name
	DATA LINK NAME - 9-67	(S-d\DLN)
	TEST ITEM	(S-d\TA)
	NUMBER OF STREAMS	(S-d\NS\N)
	STREAM NAME	(S-d\SNA-i)
	MESSAGE DATA TYPE	(S-d\MDT-i)
	MESSAGE DATA LAYOUT	(S-d\MDL-i)
	MESSAGE ELEMENT SIZE	(S-d\MES-i)
	MESSAGE ID LOCATION	(S-d\MIDL-i)
	MESSAGE LENGTH	(S-d\MLEN-i)
	MESSAGE DELIMITER	(S-d\MDEL-i)
	MESSAGE DELIMITER LENGTH	(S-d\MDLEN-i)
	FIELD DELIMITER	(S-d\FDEL-i)
	DATA ORIENTATION	(S-d\DO-i)
9-68	***Message Content Definition**	
	NUMBER OF MESSAGES	(S-d\NMS\N-i)
	MESSAGE ID	(S-d\MID-i-n)
	MESSAGE DESCRIPTION	(S-d\MNA-i-n)
	NUMBER OF FIELDS	(S-d\NFLDS\N-i-n)
	FIELD NUMBER	(S-d\FNUM-i-n-m)
	FIELD START	(S-d\FPOS-i-n-m)
	FIELD LENGTH	(S-d\FLEN-i-n-m)
9-68	***Measurement Description Set**	
	NUMBER OF MEASURANDS	(S-d\MN\N-i-n)
	MEASUREMENT NAME	(S-d\MN-i-n-p)
	PARITY	(S-d\MN1-i-n-p)
	PARITY TRANSFER ORDER	(S-d\MN2-i-n-p)
	DATA TYPE	(S-d\MBFM-i-n-p)
	FLOATING POINT FORMAT	(S-d\MFPF-i-n-p)
	DATA ORIENTATION	(S-d\MDO-i-n-p)

9-69		***Measurement Location**		
			NUMBER OF MEASUREMENT LOCATIONS	(S-d\NML\N-i-n-p)
			MESSAGE FIELD NUMBER	(S-d\MFN-i-n-p-e)
			BIT MASK	(S-d\MBM-i-n-p-e)
			TRANSFER ORDER	(S-d\MTO-i-n-p-e)
			FRAGMENT POSITION	(S-d\MFP-i-n-p-e)
9-69	***Comments**			
		COMMENTS		(S-d\COM)
*Heading Only - No Data Entry				

Table 9-10. Message Data Attributes Group (S)

Parameter	Code Name	Definition
DATA LINK NAME	S-d\DLN	Identify the data link name consistent with the Recorder-Reproducer group. MFS 32.
TEST ITEM	S-d\TA	Test item description in terms of name, model, platform, or identification code that contains the data acquisition system. MFS 16.
NUMBER OF STREAMS	S-d\NS\N	Specify the number of message data streams included within this data link. MFS 2.
STREAM NAME	S-d\SNA-i	Specify the message data stream name (subchannel name or same as data link name if no subchannel). MFS 32.
MESSAGE DATA TYPE	S-d\MDT-i	Data type - “ASCII” or “BINARY”. MFS 8.
MESSAGE DATA LAYOUT	S-d\MDL-i	“DELIMITED” (Data layout [ASCII data type only]). “FIXED” (ASCII or binary data types). MFS 11.
MESSAGE ELEMENT SIZE	S-d\MES-i	Element size in number of bits. MFS 2.
MESSAGE ID LOCATION	S-d\MIDL-i	Message ID field number. MFS 4.
MESSAGE LENGTH	S-d\MLEN-i	Message length in number of message elements (fixed data layout only). MFS 8.
MESSAGE DELIMITER	S-d\MDEL-i	Message delimiter - “CRLF” or “CR” or “LF” or hex value (delimited layout only). MFS 6.
MESSAGE DELIMITER LENGTH	S-d\MDLEN-i	Message delimiter length in number of message elements (delimited layout only). MFS 2.
FIELD DELIMITER	S-d\FDEL-i	Field delimiter - “,” or “|”, or “blank” or “tab”, or hex value (delimited layout only). MFS 10.
NOTE: A field is a set of elements determined by the number of elements or elements between field delimiters. A message consists of one or more fields, which can be fixed or variable length.		
DATA ORIENTATION	S-d\DO-i	Data orientation. MFS 1. Binary data type only. “L” (Little endian). “B” (Big endian)

Table 9-10. Message Data Attributes Group (S)

Parameter	Code Name	Definition
Message Content Definition		
NUMBER OF MESSAGES	S-d\NMS\N-i	The number of messages to be defined. MFS 8.
MESSAGE ID	S-d\MID-i-n	Message ID value. ASCII value in quotes or hex value. MFS 32.
MESSAGE DESCRIPTION	S-d\MNA-i-n	Message description. MFS 64.
NUMBER OF FIELDS	S-d\NFLDS\N-i-n	Number of fields in the message. MFS 4.
FIELD NUMBER	S-d\FNUM-i-n-m	Specify the field number. MFS 4.
FIELD START	S-d\FPOS-i-n-m	Enter the element position of the field (only for fixed column message data layout). MFS 5.
FIELD LENGTH	S-d\FLEN-i-n-m	Enter the field length (only for fixed message data layout). If message data type is ASCII, ASCII string in field is converted to specified data type, i.e., float. If message data type is binary, field is cast as specified data type, i.e., unsigned, signed, float, ASCII, etc. MFS 5.
Measurement Description Set		
NUMBER OF MEASURANDS	S-d\MN\N-i-n	Specify the number of measurands. MFS 4.
MEASUREMENT NAME	S-d\MN-i-n-p	Measurand name. MFS 32.
PARITY	S-d\MN1-i-n-p	Normal word parity. MFS 2. “EV” (Even). “OD” (Odd). “NO” (None).
PARITY TRANSFER ORDER	S-d\MN2-i-n-p	Parity bit location. MFS 1. “L” (Leads word). “T” (Trails word).
DATA TYPE	S-d\MBFM-i-n-p	Data type. MFS 8. “ASCII”. “FLOAT”. “SIGNED”. “UNSIGNED”. “HEX” (ASCII characters 0-9, A-F). “OCTAL” (ASCII characters 0-7). “BINARY” (ASCII characters 0 and 1); If message data type is binary then only ASCII, signed, unsigned, and float are valid.
NOTE: For binary messages, the data type describes the format of the raw input data as it appears in the stream. If FLOAT is specified in a binary message, the floating point format attribute describes the specific floating point data type. For ASCII messages, FLOAT, SIGNED, and UNSIGNED define how to interpret the ASCII data for conversion to an output data type for numeric processing.		

Table 9-10. Message Data Attributes Group (S)

Parameter	Code Name	Definition
FLOATING POINT FORMAT	S-d\MFPF-i-n-p	If data type is "float", specify which floating point format will be used. Only for binary message data type. MFS 8. "IEEE_32" (IEEE 754 single precision). "IEEE_64" (IEEE 754 double precision). "1750A_32" (MIL-STD 1750A single precision). "1750A_48" (MIL-STD 1750A double precision). "DEC_32" (DEC single precision). "DEC_64" (DEC double precision). "DEC_64G" (DEC "G" double precision). "IBM_32" (IBM single precision). "IBM_64" (IBM double precision). "TI_32" (TI single precision). "TI_40" (TI extended precision). Other formats are not excluded. See Appendix O for more information.
DATA ORIENTATION	S-d\MDO-i-n-p	Data orientation. MFS 1. Binary data type only. "L" (Little endian)."B" (Big endian).
Measurement Location		
NUMBER OF MEASUREMENT LOCATIONS	S-d\NML\N-i-n-p	If this measurement is contained in one field, enter "1". If this measurement is fragmented, enter the number of fragments. MFS 2.
MESSAGE FIELD NUMBER	S-d\MFN-i-n-p-e	Enter the field number within a message that contains the measurement or the fragmented measurand. MFS 4.
BIT MASK	S-d\MBM-i-n-p-e	Binary string of 1s and 0s to identify the bit locations that are assigned to this measurement in the field identified above. If the entire field is used for this measurement, enter "FW". Left-most bit corresponds to the MSB. MFS 64.
TRANSFER ORDER	S-d\MTO-i-n-p-e	Specify if the start bit is most significant - "MSB"; least significant - "LSB". MFS 3.
FRAGMENT POSITION	S-d\MFP-i-n-p-e	A number from 1 to N specifying the position of this fragment within the reconstructed binary field. 1 corresponds to the most significant fragment. Each fragment position from 1 to N must be specified only once. MFS 1.
NOTE: Repeat the above to describe each fragment of a fragmented field. The transfer order indicates whether to transpose the order of the bit sequence or not (LSB indicates to transpose the bit sequence).		
Comments		
COMMENTS	S-d\COM	Provide the additional information requested or any other information desired. MFS 3200.

9.5.7 Data Conversion Attributes (C)

The Data Conversion Attributes group includes a definition of the method by which the raw telemetry data is to be converted to meaningful information. The sensor calibration is contained in the group for each type of sensor that uses a standard calibration curve or for each sensor or parameter that has a unique calibration requirement. The calibration information can be entered in several different formats. Provision is made to permit a test organization to convert data set entries to coefficients of an appropriate curve fit and record the derived coefficients. Figure 9-10 shows the structure of the data conversion attributes. Table 9-11 contains the detailed information required.

NOTE	For reference purposes, the following telemetry unit definitions apply: • PCM - natural binary range as indicated by binary format entry • FM (Analog) - lower band edge (-100) to upper band edge (+100).

				Figure 9-10. Data Conversion Attributes Group (C)	**Code Name**
MEASUREMENT NAME - 9-72					(C-d\DCN)
9-72	***Transducer Information**				
		TYPE			(C-d\TRD1)
		MODEL NUMBER			(C-d\TRD2)
		SERIAL NUMBER			(C-d\TRD3)
		SECURITY CLASSIFICATION			(C-d\TRD4)
		ORIGINATION DATE			(C-d\TRD5)
		REVISION NUMBER			(C-d\TRD6)
		ORIENTATION			(C-d\TRD7)
9-73		***Point of Contact**			
			NAME		(C-d\POC1)
			AGENCY		(C-d\POC2)
			ADDRESS		(C-d\POC3)
			TELEPHONE		(C-d\POC4)
9-73	***Measurand**				
		DESCRIPTION			(C-d\MN1)
		MEASUREMENT ALIAS			(C-d\MNA)
		EXCITATION VOLTAGE			(C-d\MN2)
		ENGINEERING UNITS			(C-d\MN3)
		LINK TYPE			(C-d\MN4)
9-73	***Telemetry Value Definition**				
		BINARY FORMAT			(C-d\BFM)
		***Floating Point**			
			FLOATING POINT FORMAT		(C-d\FPF)
		***Bit Weight**			
			NUMBER OF BITS		(C-d\BWT\N)
			BIT NUMBER		(C-d\BWTB-n)
			BIT WEIGHT VALUE		(C-d\BWTV-n)
9-74	***In-Flight Calibration**				
		NUMBER OF POINTS			(C-d\MC\N)

				STIMULUS	(C-d\MC1-n)
				TELEMETRY VALUE	(C-d\MC2-n)
				DATA VALUE	(C-d\MC3-n)
9-74	***Ambient Value**				
				NUMBER OF AMBIENT CONDITIONS	(C-d\MA\N)
				STIMULUS	(C-d\MA1-n)
				TELEMETRY VALUE	(C-d\MA2-n)
				DATA VALUE	(C-d\MA3-n)
9-74	***Other Information**				
				HIGH MEASUREMENT VALUE	(C-d\MOT1)
				LOW MEASUREMENT VALUE	(C-d\MOT2)
				HIGH ALERT LIMIT VALUE	(C-d\MOT3)
				LOW ALERT LIMIT VALUE	(C-d\MOT4)
				HIGH WARNING LIMIT VALUE	(C-d\MOT5)
				LOW WARNING LIMIT VALUE	(C-d\MOT6)
				INITIAL VALUE	(C-d\MOT7)
				SAMPLE RATE	(C-d\SR)
9-75	***Data Conversion**				
				DATE AND TIME RELEASED	(C-d\CRT)
				CONVERSION TYPE	(C-d\DCT)
9-75			***Engineering Units Conversion**		
9-75				***Pair Sets**	
				NUMBER OF SETS	(C-d\PS\N)
				APPLICATION	(C-d\PS1)
				ORDER OF FIT	(C-d\PS2)
				TELEMETRY VALUE	(C-d\PS3-n)
				ENGINEERING UNITS VALUE	(C-d\PS4-n)
9-75		OR	***Coefficients**		
				ORDER OF CURVE FIT	(C-d\CO\N)
9-75				DERIVED FROM PAIR SET	(C-d\CO1)
				COEFFICIENT (0)	(C-d\CO)
				N-TH COEFFICIENT	(C-d\CO-n)
		OR	***Coefficients (Negative Powers of X)**		
				ORDER	(C-d\NPC\N)
				DERIVED FROM PAIR SET	(C-d\NPC1)
				COEFFICIENT (0)	(C-d\NPC)
				N-TH COEFFICIENT	(C-d\NPC-n)
9-76		OR	***Other**		
				DEFINITION OF OTHER DATA CONVERSION	(C-d\OTH)
9-76		OR	***Derived Parameter**		
				ALGORITHM TYPE	(C-d\DPAT)
				ALGORITHM	(C-d\DPA)
				TRIGGER MEASURAND	(C-d\DPTM)
				NUMBER OF OCCURRENCES	(C-d\DPNO)

			NUMBER OF INPUT MEASURANDS	(C-d\DP\N)
			MEASURAND #N	(C-d\DP-n)
			NUMBER OF INPUT CONSTANTS	(C-d\DPC\N)
			CONSTANT #N	(C-d\DPC-n)
9-77	OR	***Discrete**		
			NUMBER OF EVENTS	(C-d\DIC\N)
			NUMBER OF INDICATORS	(C-d\DICI\N)
			CONVERSION DATA	(C-d\DICC-n)
			PARAMETER EVENT DEFINITION	(C-d\DICP-n)
9-77	OR	*** PCM Time**		
			PCM TIME WORD FORMAT	(C-d\PTM)
9-77	OR	*** 1553 Time**		
			1553 TIME WORD FORMAT	(C-d\BTM)
9-77	OR	***Digital Voice**		
			ENCODING METHOD	(C-d\VOI\E)
			DESCRIPTION	(C-d\VOI\D)
9-77	OR	***Digital Video**		
			ENCODING METHOD	(C-d\VID\E)
			DESCRIPTION	(C-d\VID\D)
	***Comments**			
9-77		COMMENTS		(C-d\COM)
*Heading Only - No Data Entry				

Table 9-11. Data Conversion Attributes Group (C)

Parameter	Code Name	Definition
MEASUREMENT NAME	C-d\DCN	Give the measurement name. MFS 32.
Transducer Information		
TYPE	C-d\TRD1	Type of sensor, if appropriate. MFS 32.
MODEL NUMBER	C-d\TRD2	If appropriate. MFS 32.
SERIAL NUMBER	C-d\TRD3	If applicable. MFS 32.
SECURITY CLASSIFICATION	C-d\TRD4	Enter the security classification of this measurand. "U" (Unclassified). "C" (Confidential). "S" (Secret). "T" (Top secret). "O" (Other) Append the following: If received telemetry signal (Counts) is classified, add "R". If expressed in engineering units, the measurand value is classified, add "E". If both are classified, add "B". MFS 2.
ORIGINATION DATE	C-d\TRD5	Date of origination of this data file. MFS 10. "DD" (Day). "MM" (Month). "YYYY" (Year). (MM-DD-YYYY)
REVISION NUMBER	C-d\TRD6	Specify the revision number of the data provided. MFS 4.
ORIENTATION	C-d\TRD7	Describe the physical orientation of the sensor. MFS 32.

Table 9-11. Data Conversion Attributes Group (C)

Parameter	Code Name	Definition
POINT OF CONTACT:		Point of contact with the organization that provided the calibration data.
NAME	C-d\POC1	MFS 24.
AGENCY	C-d\POC2	MFS 48.
ADDRESS	C-d\POC3	MFS 48.
TELEPHONE	C-d\POC4	MFS 20.
Measurand		
DESCRIPTION	C-d\MN1	Describe the parameter being measured. MFS 64.
MEASUREMENT ALIAS	C-d\MNA	Alternate measurand name. MFS 32.
EXCITATION VOLTAGE	C-d\MN2	Sensor reference voltage, in volts. MFS 10.
ENGINEERING UNITS	C-d\MN3	Define the engineering units applicable to the output data. MFS 16.
LINK TYPE	C-d\MN4	Define the source data link type. MFS 3. “ANA” (FM [analog]). “PCM”. “OTH” (Other).
Telemetry Value Definition		
BINARY FORMAT	C-d\BFM	Format of the binary information. MFS 3. “INT” (Integer). “UNS” (Unsigned Binary). “SIG” (Sign And Magnitude Binary [+=0]). “SIM” (Sign And Magnitude Binary [+=1]). “ONE” (One’s Complement). “TWO” (Two’s Complement). “OFF” (Offset Binary). “FPT” (Floating Point). “BCD” (Binary Coded Decimal). “BWT” (Bit Weight). “OTH” (Other, define in comments).
Floating Point		
FLOATING POINT FORMAT	C-d\FPF	If binary format is “FPT”, specify which floating point format will be used. MFS 8. “IEEE_32” (IEEE 754 single precision). “IEEE_64” (IEEE 754 double precision). “1750A_32” (MIL-STD 1750A single precision). “1750A_48” (MIL-STD 1750A double precision). “DEC_32” (DEC single precision). “DEC_64” (DEC double precision). “DEC_64G” (DEC “G” double precision). “IBM_32” (IBM single precision). “IBM_64” (IBM double precision). “TI_32” (TI single precision). “TI_40” (TI extended precision). Other formats are not excluded. See Appendix O for more information.
Bit Weight		
NUMBER OF BITS	C-d\BWT\N	Specify the number of bits that will have a weighted value assigned. MFS 2.

Table 9-11. Data Conversion Attributes Group (C)

Parameter	Code Name	Definition
BIT NUMBER	C-d\BWTB-n	Bit number, as defined in Chapter 4, Subparagraph 4.3.1.c (MSB is bit 1). MFS 2.
BIT WEIGHT VALUE	C-d\BWTV-n	Numerical value indicated by each bit. Scientific notation may be used. To specify the sign bit, enter "S". MFS 32.
In-Flight Calibration		
NUMBER OF POINTS	C-d\MC\N	Is in-flight calibration required? "N" for no or the number of calibration points. MFS 3.
STIMULUS	C-d\MC1-n	Provide the stimulus for this calibration point. MFS 32.
TELEMETRY VALUE	C-d\MC2-n	Telemetry units value. MFS 16.
DATA VALUE	C-d\MC3-n	Engineering units value, scientific notation may be used. MFS 32.
NOTE: The above set of three entries must be repeated for each in-flight calibration point.		
Ambient Value		
NUMBER OF AMBIENT CONDITIONS	C-d\MA\N	Number of static or simulated conditions. MFS 3.
STIMULUS	C-d\MA1-n	Description of the static environment in which a non-test stimulus or simulator is the data source. MFS 32.
TELEMETRY VALUE	C-d\MA2-n	Telemetry units value for the static stimulus. MFS 16.
DATA VALUE	C-d\MA3-n	Engineering units value for the static or simulated condition. Scientific notation may be used. MFS 32.
Other Information		
HIGH MEASUREMENT VALUE	C-d\MOT1	Highest engineering unit value defined in the calibration data, scientific notation may be used. MFS 32.
LOW MEASUREMENT VALUE	C-d\MOT2	Lowest engineering unit value defined in the calibration data, scientific notation may be used. MFS 32.
HIGH ALERT LIMIT VALUE	C-d\MOT3	Highest engineering unit value expected or safe operating value of the parameter ("red"), scientific notation may be used. MFS 32.
LOW ALERT LIMIT VALUE	C-d\MOT4	Lowest engineering unit value expected or safe operating value of the parameter ("red"), scientific notation may be used. MFS 32.
HIGH WARNING LIMIT VALUE	C-d\MOT5	Highest engineering unit value expected or safe operating value of the parameter ("yellow"), scientific notation may be used. MFS 32.
LOW WARNING LIMIT VALUE	C-d\MOT6	Lowest engineering unit value expected or safe operating value of the parameter ("yellow"), scientific notation may be used. MFS 32.

Table 9-11. Data Conversion Attributes Group (C)

Parameter	Code Name	Definition
INITIAL VALUE	C-d\MOT7	Initial engineering unit value used for mode 7 measurement change event conditions for Chapter 10 recorders, scientific notation may be used. MFS 32.
SAMPLE RATE	C-d\SR	Enter the sample rate in terms of samples per second. MFS 6.
Data Conversion		
DATE AND TIME RELEASED	C-d\CRT	Date and time calibration was released. MFS 19. "MM" (Month). "DD" (Day). "YYYY" (Year). "HH" (Hour). "MI" (Minute). "SS" (Second). (MM-DD-YYYY-HH-MI-SS).
CONVERSION TYPE	C-d\DCT	Define the characteristics of the data conversion. MFS 3. "NON" (None). Engineering units: "PRS" (Pair Sets). "COE" (Coefficients). "NPC" (Coefficients [Negative Powers Of X]). "DER" (Derived). "DIS" (Discrete). "PTM" (PCM Time). "BTM" (1553 Time). "VOI" (Digital Voice). "VID" (Digital Video). "OTH" (Other). "SP" (Special Processing, enter in comments).
Engineering Units Conversion		
Pair Sets		
NUMBER OF SETS	C-d\PS\N	Specify the number of pair sets provided, n. MFS 2.
APPLICATION	C-d\PS1	Are the pair sets to be used to define a polynominal curve fit? "Y" (Yes). "N" (No). If the answer is no, then the pair sets are to be used as a "table lookup" with linear interpolation between the defined points. MFS 1.
ORDER OF FIT	C-d\PS2	Specify the order of the curve fit to be performed, m. At least 2 pair sets must be provided, and a maximum of 32 pair sets may be included. Twelve or more pair sets are recommended for a fifth order fit. MFS 2.
TELEMETRY VALUE	C-d\PS3-n	Telemetry units value MFS 16.
ENGINEERING UNITS VALUE	C-d\PS4-n	Engineering units value, scientific notation may be used. MFS 32.
NOTE: Repeat the above for the n pair sets.		
Coefficients		
ORDER OF CURVE FIT	C-d\CO\N	Specify the order of the polynominal curve fit, n. MFS 2.
DERIVED FROM PAIR SET	C-d\CO1	Were the coefficients derived from the pair set calibration data provided ("Y" or "N")? If yes, provide a point of contact in the comments. MFS 1.
COEFFICIENT (0)	C-d\CO	Value of the zero-order term (offset), scientific notation may be used. MFS 32.

Table 9-11. Data Conversion Attributes Group (C)

Parameter	Code Name	Definition
N-TH COEFFICIENT	C-d\CO-n	Value of the coefficient of the n-th power of x (first order coefficient is the equivalent of bit weight). Scientific notation may be used. MFS 32.
NOTE: Repeat until all n+1 coefficients are defined.		
Coefficients (Negative Powers of X)		
ORDER	C-d\NPC\N	Specify the order of negative power coefficients, n. MFS 2.
DERIVED FROM PAIR SET	C-d\NPC1	Were the coefficients derived from the pair set calibration data provided ("Y" or "N")? If yes, provide a point of contact in the comments. MFS 1.
COEFFICIENT (0)	C-d\NPC	Value of the zero-order term (offset), scientific notation may be used. MFS 32.
N-TH COEFFICIENT	C-d\NPC-n	Value of the coefficient of the negative n-th power of x. Scientific notation may be used. MFS 32.
NOTE: Repeat until all n+1 coefficients are defined. This section describes the conversion equation $y=c0 + c1*(1/x) + c2*(1/x^2) + \ldots + cn*(1/x^n)$, where c0, c1, c2,…,cn are the coefficients, x is the telemetry value, and y is the resulting EU value.		
Other		
DEFINITION OF OTHER DATA CONVERSION	C-d\OTH	Define other data conversion technique or special processing requirement. MFS 1000.
Derived Parameter		
ALGORITHM TYPE	C-d\DPAT	Specify whether the algorithm will be given (in C-d\DPA) as: "N" (Name of algorithm). "A" (Algorithm). See Appendix P for additional details. MFS 1.
ALGORITHM	C-d\DPA	Define the algorithm to be used in deriving the parameter. See Appendix P for additional details. MFS 1024.
TRIGGER MEASURAND	C-d\DPTM	Specify the name of the input measurand that triggers the calculation of the derived parameter. MFS 32.
NUMBER OF OCCURRENCES	C-d\DPNO	Specify how many times the trigger measurand must occur before the calculation is done. Default is 1. MFS 2.
NUMBER OF INPUT MEASURANDS	C-d\DP\N	Specify the number of input measurands used to derive this parameter. MFS 2.
MEASURAND #N	C-d\DP-n	Specify the name of the n-th input measurand. MFS 32.
NOTE: Continue until all n measurands are defined.		
NUMBER OF INPUT CONSTANTS	C-d\DPC\N	Specify the number of input constants used to derive this parameter. MFS 2.
CONSTANT #N	C-d\DPC-n	Specify the value for the n-th constant. Scientific notation may be used. MFS 32.
NOTE: Continue until all n constants are defined.		

Table 9-11. Data Conversion Attributes Group (C)		
Parameter	**Code Name**	**Definition**
Discrete		
NUMBER OF EVENTS	C-d\DIC\N	How many events are associated with this discrete field, n? MFS 2.
NUMBER OF INDICATORS	C-d\DICI\N	Number of indicators: For a PCM system, provide the number of bits used for this discrete set. For an analog channel, provide the number of levels used to define this discrete set. MFS 2.
CONVERSION DATA	C-d\DICC-n	Telemetry value, counts for PCM, percent of full scale for analog. MFS 16.
PARAMETER EVENT DEFINITION	C-d\DICP-n	Define the event for the bit or bit field in a word that corresponds to a discrete event or the percent full scale value such as switch on or off. MFS 240.
NOTE: Continue to define the events for each bit pattern or value of the discrete measurand.		
PCM Time		
PCM TIME WORD FORMAT	C-d\PTM	Specify the PCM time word format used, as defined in Chapter 4 (Paragraph 4.7). MFS 1. “H” (High-order time). “L” (Low-order time). “M” (Microsecond time).
1553 Time		
1553 TIME WORD FORMAT	C-d\BTM	Specify the 1553 time word format used, as defined in Chapter 4 (Paragraph 4.7) and Chapter 8 (Paragraph 8.3). MFS 1. “H” (High-order time). “L” (Low-order time). “M” (Microsecond time). “R” (Response time).
Digital Voice		
ENCODING METHOD	C-d\VOI\E	Specify the voice encoding method used. “CVSD”. “OTHR” (Other). MFS 4.
DESCRIPTION	C-d\VOI\D	Specify the decoding algorithm to be used. MFS 640.
Digital Video		
ENCODING METHOD	C-d\VID\E	Specify the video encoding method used. MFS 64.
DESCRIPTION	C-d\VID\D	Specify the decoding algorithm to be used. MFS 640.
Comments		
COMMENTS	C-d\COM	Provide the additional information requested or any other information desired. MFS 3200.

9.5.8 Airborne Hardware Attributes (H)

The Airborne Hardware Attributes group defines the specific configuration of airborne instrumentation hardware in use on the item under test. This group allows the same TMATS file to describe the airborne hardware as well as the telemetry attributes.

Specific information on the structure and definition of airborne hardware attributes is not included in this standard. There are far too many hardware systems to try to define them all in one group. The main purpose of identifying this group is to reserve the "H" designation for those instrumentation organizations that choose to use the TMATS standard in this way.

The only H group attributes defined in this standard are the following:

a. Test Item (code name H\TA) - specifies the item under test and ties the H group to the G group.

b. Airborne System Type (code name H\ST-n) - identifies the airborne systems being described in the current file and determines how the rest of the attributes in the H group will be interpreted.

NOTE	For anyone wishing to define an H group, it is strongly recommended that the conventions laid out in this standard be followed. The resultant document should maintain the look and feel of this standard for consistency.

9.5.9 Vendor-Specific Attributes (V)

The Vendor-Specific Attributes group provides information that is specific to a vendor. This group allows the TMATS file to include information about a particular vendor's equipment in use during a test. Detailed information about specific vendors' equipment is not included in this standard.

The only V-group attributes defined in this standard are the following:

a. Data Source ID (code name V-x\ID) - specifies the Data Source ID consistent with the General Information group and ties the V group to the G group.

b. Vendor Name (code name V-x\VN) - a three-character acronym that identifies the specific vendor and determines how the rest of the attributes in the V group are interpreted.

All other code names for vendor-specific attributes will have the form:

V-x\acr\attribute-string

where: *acr* is the three-character acronym identifying a specific vendor.

attribute-string is any attribute that applies to this vendor.

NOTE	For anyone wishing to define a V group, it is strongly recommended that the conventions laid out in this standard be followed. The resultant document should maintain the look and feel of this standard for consistency.

9.6 Data Display Standard: Data Display Markup Language

The standard format, DDML, has been developed to describe commonly used data displays. This DDML standard exists only as a collection of XSD files; it does not exist in the TMATS code name format described in Section 9.5. The DDML schema can be found here.

The following paragraphs explain the purpose, objectives, and structure of DDML, and define the global elements in the schema.

9.6.1 DDML Purpose and Objectives

The purpose of DDML is to serve as the neutral interchange language between data display languages supported by different vendors. Built on XML, DDML has been designed with the following objectives in mind:

a. To include a standard terminology for describing data display components.

b. To be robust and highly expressive in order to accommodate any data display language.

c. To be highly unified and not a loose grouping of vendor formats.

9.6.2 DDML Layered Structure

DDML is built off of a layered structure as shown on the left of Figure 9-11 below. This structure is parallel to a typical software layered architecture composed of graphics resources, visualization and user interfaces, information management, and persistence modules as shown on the right side of Figure 9-11.

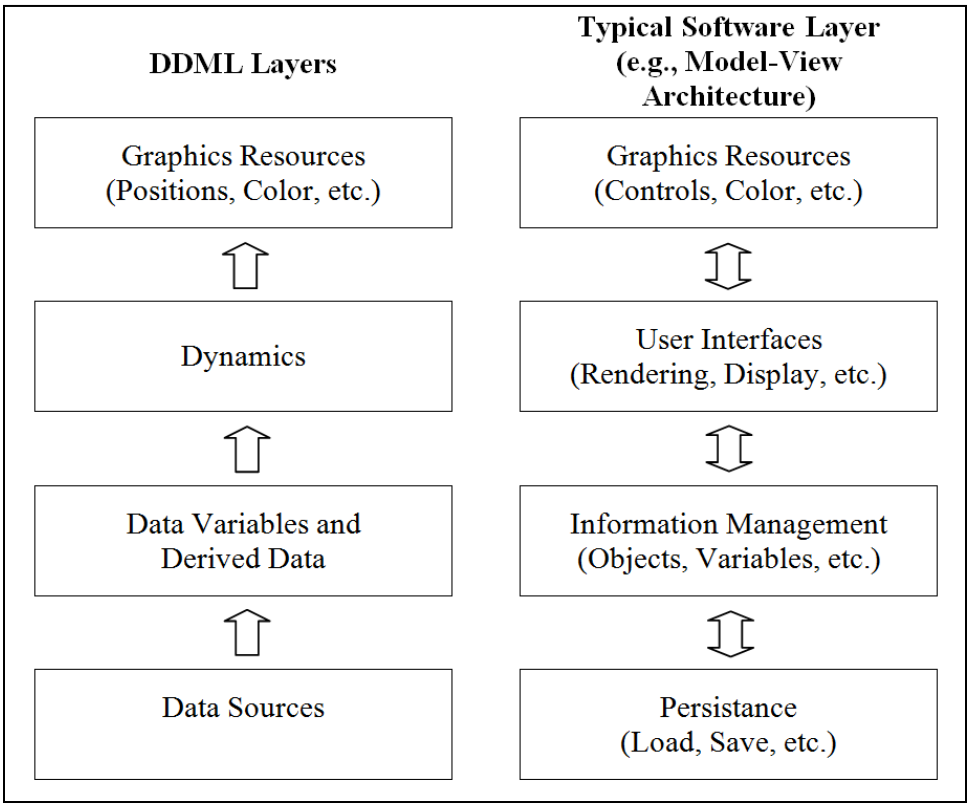

Figure 9-11. Layered Structure of DDML

Parallel to the typical software modules, DDML is also composed of layers (as depicted above in Figure 9-11) and as described below.

a. Graphics Resources. This layer is similar to "graphics resources" of a typical software tool. In DDML, this layer includes the visual components of a data display system such as sliders, plots, and strip charts as well as low-level graphic elements such as lines, rectangles, etc. Basic graphical shapes are modeled using a World Wide Web Consortium (W3C) recommended format called "Scalable Vector Graphics (SVG)."

b. Dynamics. The dynamics layer handles the behavior of an object. It manages the rules and the variable instances attached to an object.

c. Data Variables. Data variables are the links between the objects and the data sources. Data variables can be atomic or derived. Derived variables may use other derived or atomic variables in a mathematical expression.

d. Data Sources. The last layer of the DDML architecture is the Data Sources layer. This layer handles various data sources such as text files, Open Database Connectivity (ODBC), network ports, and ports on data acquisition cards.

At each layer, the parameters used to describe each DDML element are divided into two groups: DDML sub-elements and custom parameters. DDML sub-elements make up the most common and most necessary pieces of information needed to represent each element. They are stored as named sub-elements in DDML. Custom parameters are used to store any vendor-specific information that is not explicitly defined as a DDML sub-element. These parameters are stored as DDML "param" elements.

9.6.3 DDML Global Element Glossary

The DDML element names and descriptions can be seen in Table 9-12.

Table 9-12. DDML Global Element Glossary

Element Name	Description
mathml:apply	Defined in the mathml schema and used as a sub-element of variable in DDML, defines a variable as a function of other variables.
axis	A sub-element of a display object, represents an axis of any chart-type display object. It has a sub-element axisType that can be one of two values: VALUE or TIME. Other sub-elements allow the setting of min and max values, colors, grid line properties, etc.
barchart	A display object that shows one or more variables as vertical or horizontal bars whose lengths correspond to the values.
button	A display object that consists of an image or icon that, when clicked, can assign a value to a variable.
color	A commonly-used sub-element of many DDML elements, it simply specifies the color of its parent object. All colors in DDML are stored as base-10 integers that are encoded as 0xRRGGBB.
comparisonOperator	Used in rules, defines the comparison between two values. Can be either GT (greater-than), LT (less-than), GTE (greater-than-or-equal), LTE (less-than-or-equal), EQ (equal), or NEQ (not equal).

Table 9-12. DDML Global Element Glossary

Element Name	Description
custom_parameters	A sub-element of a display object, serves as the parent element of a group of param elements that specify all of the custom (vendor-specific) parameters for a particular display object.
data_source	A pool-level data source that is available for use by any of the variables in the variable pool.
data_source_pool	Contains data_source child elements representing all of the data sources used by the various objects in the DDML file. Information about all data sources (files, db connections, etc.) is kept in the data source pool.
ddml	Root element of a DDML file describing a collection of data displays.
dial	A display object that consists of a circular or arc value axis and some sort of marker or needle that points to the current value along this axis. Example: a gauge or a compass.
display_objects	A sub-element of a model, serves as a container for all of the display objects in that model.
dynamics	A set of variable uses and rules used to define the dynamic behavior of a display object. The dynamicType sub-element describes the dynamic behavior while the variable_use and rules child elements define how variable values affect that behavior. A dynamicType of "builtin" is used for display objects that have implicit dynamic behavior, such as charts and sliders. Other possible values of dynamicType include: visibility, text, subdrawing, scale, scaleY, scaleX, rotate, relativeMoveY, relativeMoveX, pathMove, lineWidth, lineStyle, foregroundColor, fillUp, fillRight, fillLeft, fillDown, fillEffect, curveType, blink, backgroundColor, arcDirection, absoluteMoveX, absoluteMoveY, fillColor, edgeColor.
else	Part of a rule, specifies what to do if the criteria specified in the if element are false. The else element can be the parent of one or more additional rules, or can just specify a value or variable reference.
frequencyplot	A display object that is a chart in the frequency domain.
frequencyresponse	A display object that is a graph consisting of two value axes (frequency and magnitude) plotted against a single frequency axis.
grid	A table. The grid element is used to group several display objects (including other grids) together in a tabular layout. Each display sub-object's location in the grid is specified with its gridRow and gridColumn elements.
hud	A display object that resembles a typical aircraft heads-up display that consists of three vertical axes (typically used for velocity, pitch, and altitude) and one horizontal axis (typically for heading). The center vertical axis rotates according to a fifth variable (typically roll). The variable_uses in the dynamics section are applied in this order: center vertical axis rotation (roll), center vertical axis (pitch), horizontal axis (heading), right vertical axis (altitude), left vertical axis (velocity).

Table 9-12. DDML Global Element Glossary

Element Name	Description
if	Part of a rule, specifies a comparison between the current variable and some value.
map	An area of a model that displays longitude/latitude map info. The coordinates of all child objects of a map are in decimal latitude/longitude values. For distance attributes (e.g., a circle's radius), degrees latitude are used as the measurement unit.
model	A container for data displays. Typically interpreted as a single screen or "page" of display objects. The model object defines its own coordinate system with the minX, minY, maxX, maxY, xDirection, and yDirection sub-elements. All sub-objects of a model are specified in coordinates that conform to the system defined by the model.
object	A generic display object. An "object" can be any display object not specified in the DDML definition, or can be used as the top-level element in a group of sub-objects.
param	Used to specify any parameter of a DDML element that is not explicitly specified elsewhere in the schema. These are commonly referred to as "custom parameters" and are mostly used for vendor-specific information.
piechart	A circular display object that shows the values of multiple variables as a percentage slice of their sum.
project	A collection of models.
radialchart	A display object that represents variable values as distances outward from a central point. A radial chart consists of two axes: a linear value axis and a circular axis. The circular axis can be either a time axis or a value axis. The type of the circular axis is controlled by its axisType sub-element, which can have a value of either "TIME" or "VALUE". If the value is "VALUE", then a series of xyPair objects will specify how the variables are paired. In each of these xyPairs, the X-value corresponds to the value in the circular axis direction, and the Y-value corresponds to the value in the radial axis direction.
rule	Specifies a change in a property (e.g., color, visibility) when a variable reaches a certain value or range of values. The ranges of values and resulting property values are specified with if, then, and else child elements.
rules	The parent element of a group of rule elements
slider	A display object that consists of some kind of indicator or icon that slides along a single value axis. A slider can be vertical or horizontal. Example: A "gauge" in Range View or a "fader" in Data Views.

Table 9-12. DDML Global Element Glossary

Element Name	Description
stripchart	A display object that is essentially a line graph that plots values vs. time along a scrolling "paper" grid. A stripchart can be vertical or horizontal, and can scroll in any of the four directions (up, down, left, right). This is controlled by the scrollDirection sub-element. The scrollDirection element refers to the direction that the paper or background scrolls. For example, in a DataViews horizontal strip chart, the paper scrolls to the left while new values are plotted at the right edge of the graph. Thus, the scrollDirection is "left".
svg:svg	SVG is a W3C recommendation and is defined in its own schema. In DDML, the <svg> element is used as a sub-element of <object> to define a display object in terms of the basic shapes of which it is composed.
textual	A display object used for representing text and labels, including both static and dynamic text (such as annunciators). If the text is dynamic, the valuePosition sub-element specifies where the dynamic value is in relation to the static label. Use valuePosition="center" if there is no label. The valueFormat sub-element is a C printf-style format string that specifies the format of the dynamic value. For example valueFormat= "%4.2f" indicates that the value should be output as a floating-point value with a maximum width of 4 and with 2 decimal places.
then	Part of a rule, the then element specifies the value to set the attribute to if the criteria specified in the if element is true. The then element can specify either the desired value, or a reference to a variable containing the desired value.
variable	A pool-level data variable that is available for use by any of the display objects in the DDML file.
variable_pool	Contains variable child elements representing all of the variables used by the various display objects in the DDML file.
variable_use	A child of the dynamics element, variable_use is used to specify which variable from the variable pool is used. The pool_ref attribute must refer to the ID attribute of a variable element from the variable_pool.
xychart	A display object that is a line or xy scatter plot of variables in the y axis vs. other variables in the x axis. The x,y variable pairs are specified with the xyPair sub-elements.
xyPair	A sub-element of certain display objects, it describes how a chart's variable_use items are paired. Each xVar and yVar sub-element must refer to the ID of a variable_use element in the display object's dynamics section.

9.7 Instrumentation Hardware Abstraction Language

NEW

The IHAL is a standard for describing and interacting with instrumentation hardware in a vendor-neutral way. The IHAL was reviewed and adopted into IRIG 106 to serve the purpose originally intended for the Airborne Hardware Attributes (H) group described in Subsection 9.5.8, which has never been implemented. The IHAL standard consists of both an XML-based language and an Application Programming Interface (API) specification, each of which are explained in greater detail below.

The IHAL language standard exists only as an XML schema; it does not exist in the TMATS code name format described in Section 9.5. The IHAL XML language schema consists of a collection of XSD files that define the structure of valid IHAL documents. The schemas are available here. Additionally, a graphical depiction of the schema in hypertext markup language (HTML) format is available here. The HTML files are very large and will take time to download.

9.7.1 Usage of External Schemas in IHAL

The IHAL XML schema makes use of 3 external XML schemas for describing concepts outside the scope of IHAL, such as data formats and engineering units. These schemas are not included with the IHAL schema and must be retrieved from the organization that produces them. Table 9-13 lists these external schemas and the versions required for this release of IHAL.

Table 9-13. IHAL External Schemas

Standard	Version used by IHAL	Global Types/Sub-schemas used by IHAL	Organization's URL
Metadata Description Language (MDL)	0.8.12	DerivedUnitType MeasurementsType DataStreamsType	
TMATS - XML Schema	106-13	TmatsPGroup.xsd TmatsRGroup.xsd	http://www.wsmr.army.mil/RCCSite/Pages/default.aspx
eXtensible Instrumentation Definition Markup Language (XidML)	3.0	Network-TransportType	http://www.xidml.org/

9.7.2 What is the Instrumentation Hardware Abstraction Language?

The central concept in IHAL is the configurable attributes (i.e., settings) that each device exposes to the user; however, IHAL is also capable of describing the environmental and physical attributes of each device, such as its size, shape, and operating conditions.

The IHAL describes instrumentation hardware at two levels.

a. The "pool" level describes hardware according to its capabilities and configurability. The information in the IHAL pool is similar to the information found in a device's marketing or engineering data sheet. A good way to think of the pool is to understand that each device in the pool can be uniquely identified by its model number.

b. The "use" level describes a specific configuration of instrumentation hardware. At the use level, devices from the pool are put into a specific use. That is, they are connected to other devices, and their configurable attributes are set to specific values. A good way to think of the use level is to understand that each device at this level can be uniquely identified by its serial number.

9.7.3 What is the IHAL API?

The IHAL vendor web services API enables IHAL to be used not only as a language for describing instrumentation hardware, but also as a command and query language for configuring instrumentation hardware. The API defines a set of functions that an instrumentation hardware vendor can implement to provide access to their configuration engine to external users and applications. All inputs and outputs to the functions are properly-formatted IHAL XML documents.

Implementing this API allows vendors to expose the functionality of their configuration engines in a vendor-neutral way, without disclosing the inner workings of their proprietary configuration logic. In this way, vendor-neutral, 3rd-party applications can be developed to configure the hardware of any vendor who implements the IHAL API. The developers of such 3rd- (or 1st-) party applications need not understand the inner workings of each vendor's configuration engine.

9.7.4 How Can IHAL Be Used?

The potential uses of IHAL fall into two major categories: 1) IHAL as a description language, and 2) IHAL as a command language.

9.7.4.1 IHAL as a Description Language

As a vendor-neutral, human-readable language for describing instrumentation hardware, IHAL provides a means for storing a permanent record of the devices used during a test and their settings during that test. This description will remain readable and relevant even if the hardware vendors radically change their file formats or cease to exist.

Additionally, providing such descriptions enables the development of vendor-neutral tools. The capabilities of these tools can range anywhere from simple visualization (e.g., instrumentation network and configuration visualization) to complex automated reasoning (e.g., automatically selecting and configuring devices from multiple vendors based on user-defined requirements).

9.7.4.2 IHAL as a Command Language

The IHAL constructs that describe the current configuration of a device can also be used to issue a command to the device to change its configuration. When combined with the API (described above), this feature of IHAL enables multi-vendor instrumentation configuration from a single user interface without requiring vendors to share knowledge about the internal workings of their configuration engines.

9.7.5 IHAL Glossary

Below is an alphabetical list of definitions of key elements in the IHAL XML language.

A

accelerometer: A specialization of the "transducer" element for describing accelerometers (pool-level).

analogSignalConditioningCard: A specialization of the "card" element for describing analog signal conditioning cards (pool-level).

analogSignalConditioningChannel: A specialization of the "customHardwareChannel" element for describing analog signal conditioning channels (pool-level).

analogSignalConditioningFunction: A specialization of the "customFunction" element for describing analog signal conditioning.

analogSignalFilterFunction: A specialization of the "customFunction" element for describing analog signal filtering (pool-level).

analogToDigitalConversionFunction: A specialization of the "customFunction" element for describing analog-to-digital conversion.

B

bridgeSensor: A specialization of the "transducer" element for describing bridge sensors (pool-level).

busMonitorCard: A specialization of the "card" element for describing bus monitor cards.

busMonitorChannel: A specialization of the "customHardwareChannel" element for describing bus monitor channels (pool-level).

busMonitorChannelUse: A specialization of the "channelUse" element for bus monitors. This element includes an additional construct for defining a dataStreamUse associated with the channel.

busMonitorFunction: A specialization of the "customFunction" element for describing bus monitoring (pool-level).

C

calibrationTable: A use-level element for describing the calibration table associated with a particular transducer or other instrument.

card: A specialization of the "instrument" element for describing cards. A card in IHAL is an instrument that cannot operate stand-alone. It must be connected to another instrument in order to function.

channelUse: A specific implementation of a channel from the instrument pool. The channelUse description references a channel from the pool, specifies a specific channel number, and assigns values to settings on that channel.

chargeAmplifierSensor: A specialization of the "transducer" element for describing charge amplifier sensors (pool-level).

configuration: Container for multiple instrumentation graphs. Defines a single configuration or project.

connection: A use-level element used to describe a connection between two instruments in an instrumentationGraph.

currentExcitationFunction: A specialization of the "customFunction" element for describing current excitation (pool-level).

currentLoopOutputSensor: A specialization of the "transducer" element for describing current loop output sensors (pool-level).

customAttribute: A pool-level element for defining a generic attribute associated with a function. Each attribute may be either configurable or fixed, and may be either numeric, string, boolean, or reference. If configurable, the attribute element will define which values are valid. Each specialized function description in IHAL will contain specializations of the "customAttribute" element for specific attributes such as "gain", "offset", etc.

customFunction: A pool-level element for defining generic instrumentation functions that don't fit into one of the specific specializations. A function may be composed of 0 or more attributes and 0 or more sub-functions.

customHardwareChannel: A pool-level element for describing a generic hardware channel that does not fit into any of the specific specializations. A channel contains a "multiplicity" element that defines how many identical channels the device has. A channel is composed of one or more functions.

D

dataRecorderFunction: Specialization of the "customFunction" element (pool-level). This is a channel-level function for describing the recording of data from a specific source. See also recorderReproducerFunction.

dataRecordingChannel: Specialization of the "customHardwareChannel" element for describing a data recorder channel (pool-level).

dataStreamPool: Contains the global list of data streams and buses. This element makes use of constructs from the integrated Network Enhanced Telemetry (iNET) program's MDL.

dataStreamUse: A use-level element used to define which measurements from a data stream are to be sampled by a bus monitor.

dau: A specialization of the "instrument" element for describing data acquisition units (pool-level).

dauFunction: Specialization of the "customFunction" element for describing the functions performed by a data acquisition unit (pool-level).

E

errorList: Top-level container for the IHAL error schema. An errorList may be returned as a response to any API function call.

F

formatUse: A specific implementation of a data format from the instrument pool. The formatUse element references a data format from the pool, specifies a format number,

assigns values to settings associated with that format, and defines the measurements encoded in the format.

H

highLevelVoltageSensor: A specialization of the "transducer" element for describing high level voltage sensors (pool-level).

I

ihal: The top-level element in a complete IHAL description

instrument: A pool-level element for describing a device that does not fit into one of the specific specializations. The pool-level instrument element defines the physical attributes of the hardware, the functionality it provides, and the settings available.

instrumentationGraph: A set of interconnected instrumentation hardware (instrumentUse elements). Separate instrumentationGraph elements could be used to describe the airborne system vs. the ground system, for example.

instrumentPool: Container for all pool-level device descriptions. The instrumentPool contains descriptions of all available instruments.

instrumentUse: A specific implementation of an instrument from the pool. The instrumentUse description references an instrument from the pool and assigns specific values to settings.

L

lvdtrvdtSensor: A specialization of the "transducer" element for describing linear/rotary variable differential transformers (pool-level).

M

masterControllerFunction: Specialization of the "customFunction" element for describing the functionality of a master controller (pool-level).

measurementPool: Contains a global list of measurements.

P

potentiometricVoltageDivider: A specialization of the "transducer" element for describing potentiometric voltage dividers (pool-level).

programmingStatus: A use-level element that describes the current status of programming the current configuration to the physical hardware. Values may be either "COMPLETE", "IN_PROGRESS", "ERROR", or "NOT_STARTED".

R

recorderReproducer: A specialization of the "instrument" element for describing a recorder/reproducer (pool-level).

recorderReproducerFunction: A specialization of the "customFunction" element for describing the function of recording/reproducing data associated with one or more channels to/from some medium.

restrictedAttribute: A use-level element that redefines the set of valid values for a configurable attribute from the pool. Restricted attributes are used whenever the valid values for a setting change as a result of the current configuration.

resistanceSensor: A specialization of the "transducer" element for defining resistance sensors (pool-level).

rtdSensor: A specialization of the "transducer" element for describing resistance temperature detectors (pool-level).

S

setAttribute: A use-level element that assigns a value to a configurable attribute from the pool.

statusDataFunction: Specialization of the "customFunction" element for describing the function of emitting status words (pool-level).

strainGauge: A specialization of the "transducer" element for describing strain gauges (pool-level).

sstDataEncoderFunction: A specialization of the "customFunction" element for describing a serial streaming telemetry (SST) data encoder.

sstDataFormat: Pool-level concept for describing an SST format that may be created by an instrument. Formats in IHAL are similar to channels in that they have a multiplicity and are composed of functions.

sstFormatUse: A specialization of the "formatUse" element for describing PCM output formats. sstFormatUse makes use of TMATS XML constructs.

T

thermistor: A specialization of the "transducer" element for describing thermistors (pool-level).

thermocouple: A specialization of the "transducer" element for describing thermocouples (pool-level).

tmNSDataEncoderFunction: Specialization of the "customFunction" element for describing the functionality of an iNET telemetry network system (TmNS) data encoder (pool-level).

tmNSDataFormat: Pool-level concept for describing a TmNS (i.e., iNET) data format that may be created by an instrument. Formats in IHAL are similar to channels in that they have a multiplicity and are composed of functions.

transducer: A specialization of the "instrument" element for describing generic transducers (pool-level)

U

unitsPool: Container for a global list of engineering units. Units can be built by combining other units and SI units. Unit descriptions make use of constructs from the iNET program's MDL.

V

voltageAmplificationFunction: A specialization of the "customFunction" element for describing voltage amplification (pool-level).

voltageExcitationFunction: A specialization of the "customFunction" element for describing voltage excitation (pool-level).

X

xidMLNetworkDataEncoderFunction: A specialization of the "customFunction" element for describing the functionality of a non-TmNS (i.e., non-iNET) network data encoder (pool-level).

xidMLNetworkDataFormat: Pool-level concept for describing a non-TmNS (i.e., non-iNET) network data format that may be created by an instrument. Formats in IHAL are similar to channels in that they have a multiplicity and are composed of functions.

xidMLNetworkFormatUse: A specialization of the "formatUse" element for describing non-TmNS (i.e., non-iNET) network data formats. This element makes use of constructs from XidML.

9.7.6 Complete IHAL API Specification

9.7.6.1 API Implementation Requirements

The IHAL API must be implemented as a RESTful web service. All functions must have a common base path (e.g., http://10.10.1.1:8080/ihalapi/). This base path is referred to as "<Vendor API Location>" in this document.

All inputs are provided as the payload of the function call, with no named parameters or URL encoding. That is, inputs will NOT be part of the URL (e.g., http://.../?ihal=<ihal>... is NOT allowed).

9.7.6.2 Errors

All functions in the below specification may optionally return an <ihal:errorList> element instead of the defined response. The error list is intended to provide the user with a description of problems encountered if the requested function could not be performed.

9.7.6.3 API Functions

The following sections describe the functions that must be included as part of any IHAL API implementation.

9.7.6.3.1 Retrieve a Vendor's Pool

This method is used by a client to retrieve some part of a vendor's pool description. There are multiple URLs for this function to retrieve different parts of the pool, as shown in Table 9-14.

Table 9-14. Retrieve a Vendor's Pool

URL	<Vendor API Location>/pool/units to retrieve the units pool
	<Vendor API Location>/pool/instrument to retrieve the instrument pool

	<Vendor API Location>/pool/measurement to retrieve the global measurement list
	<Vendor API Location>/pool/measurement/<deviceID> To retrieve the list of measurements available to a particular device (e.g., a data encoder)
	<Vendor API Location>/pool/dataStream To retrieve the global list of data streams (e.g., buses)
	<Vendor API Location>/pool/dataStream/<deviceID> To retrieve the global list of data streams (e.g., buses) available to a particular device
HTTP Verb	GET
Function Input	None
Return Value	Complete IHAL <instrumentPool>, <unitsPool>, <measurementPool>, or <dataStreamPool> element.

9.7.6.3.2 Retrieve the List of Available Configurations

This function queries the web service for a list of existing instrumentation configurations and is described in Table 9-15.

Table 9-15. Retrieve the List of Available Configurations

URL	<vendor API Location>/configurations/
HTTP Verb	GET
Function Input	None
Return Value	A partial <ihal> specification containing 0 or more EMPTY <configuration> elements, each with only the basic required information. No pools should be returned.

9.7.6.3.3 Retrieve a Specific Configuration

This function uses the ID of a configuration returned from the previous function call to request the complete description of that configuration. It is illustrated in Table 9-16.

Table 9-16. Retrieve a Specific Configuration

URL	<vendor API Location>/configurations/<configurationID>. <configurationID> contains a unique identifier returned as the "id" attribute from a call to "Retrieve a list of Configurations"
HTTP Verb	GET
Function Input	None
Return Value	A complete IHAL <configuration> element

9.7.6.3.4 Change the Value of a Configurable Attribute

This function is used to change the values of settings on a particular device, as shown in Table 9-17. The desired settings changes are passed in via IHAL, and a description of everything that has changed as a result of these settings changes is returned as an IHAL description.

Table 9-17. Change the Value of a Configurable Attribute	
URL	<vendor API Location>/configurations/<configurationID>/ <configurationID> contains a unique identifier returned as the "id" attribute from a call to "Retrieve a list of Configurations"
HTTP Verb	PUT
Function Input	A partial <configuration> element. This element contains only the settings that the user wishes to modify.
Return Value	The impact: A partial IHAL <configuration> element containing only the new settings for everything that has changed: • The new values for the settings the user requested (may or may not match the original request) • Any additional settings that changed as a result • Any attribute "restrictions" that changed as a result

9.7.6.3.5 Create a New Configuration

This function is used to create a new configuration in the vendor's system. It is described in Table 9-18. A partial or complete IHAL "configuration" element is passed as input, and then the vendor responds with a validated "configuration" element that matches (as closely as possible) the input. The vendor may change use-level IDs.

Table 9-18. Create a New Configuration	
URL	<vendor API Location>/configurations/
HTTP Verb	POST
Function Input	A partial or complete <configuration> element.
Return Value	A validated <configuration> description that matches (as closely as possible) the input <configuration>. Use-level ID values may change.

9.7.6.3.6 Add a Device to a Configuration

This function is used to add a device from the pool to an existing configuration in the vendor's system. The function is depicted in Table 9-19. A partial or complete IHAL "instrumentUse" element is passed as input, and then the vendor responds with a valid "configuration" element that includes the new device. The vendor may change use-level IDs.

Table 9-19. Add a Device to a Configuration	
URL	<vendor API Location>/configurations/<configurationID>/devices
HTTP Verb	POST
Function Input	A partial or complete <instrumentUse> element.
Return Value	A valid <configuration> description that includes the new device. Use-level ID values may change.

9.7.6.3.7 Remove a Device from a Configuration

This function is used to remove an instrumentUse from an existing configuration in the vendor's system. It is illustrated in Table 9-20. The ID of the instrumentUse element is included

in the URL, and the HTTP "DELETE" verb tells the system to remove that device. The vendor must respond with a valid configuration description, with the device removed.

Table 9-20. Remove a Device from a Configuration	
URL	<vendor API Location>/ configurations/<configurationID>/devices/<instrumentUseID>
HTTP Verb	DELETE
Function Input	None
Return Value	A valid <configuration> description with the device removed

9.7.6.3.8 "Program" the Hardware

This function is used to tell the vendor's configuration engine to load a specific configuration onto the affected hardware. It is illustrated in Table 9-21. The vendor responds with a <configuration> description that includes updated values for the programming status.

Table 9-21. "Program" the Hardware	
URL	<vendor API Location>/ configurations/<configurationID>/programRequest
HTTP Verb	POST
Function Input	None
Return Value	A partial <configuration> description with the current programming status of affected devices updated.

9.7.6.3.9 Add a New format to a Data Encoder

This function is used to add a new data format to a data encoder. This can be either a PCM (SST) format or a non-TmNS (non-iNET) network format. The client sends a partial or complete description of the format, and the vendor's service responds with an updated <configuration> element containing ONLY items that have changed (including the addition of the new format). The function is shown in Table 9-22.

Table 9-22. Add a New Format to a Data Encoder	
URL	<vendor API Location>/ configurations/<configurationID>/<instrumentUseID>/formats
HTTP Verb	POST
Function Input	A complete or partial format "use" description (i.e., sstFormatUse or xidMLNetworkFormatUse)
Return Value	An updated <configuration> element containing the new format as well as any settings in the configuration that have changed as a result.

9.7.6.3.10 Add a Measurement to an Existing Format

This function is used to add a new measurement to an existing data format. The function is illustrated in Table 9-23. The input uses either a XidML <Mapping> element or a TMATS <Measurement> element to describe the measurement and where it should be placed in the

format. The vendor's service responds with a <configuration> element that contains a complete description of the affected format as well as any settings changes that have occurred as a result.

Table 9-23. Add a Measurement to an Existing Format	
URL	<vendor API Location>/ configurations/<configurationID>/<formatUseID>/measurements
HTTP Verb	POST
Function Input	A description of the measurement and its location in the format. This will be either a XidML <Mapping> element or a TMATS-XML <Measurement> element.
Return Value	An updated <configuration> element containing the modified format as well as any settings in the configuration that have changed as a result.

9.7.6.3.11 Remove a Measurement from a Format

This function is used to remove a measurement from an existing data format. The function is illustrated in Table 9-24. The client specifies the ID of the measurement in the URL. The vendor's service must remove ALL instances of this measurement from the specified format. The service must then respond with a <configuration> element that contains a complete description of the affected format as well as any settings changes that have occurred as a result.

Table 9-24. Remove a Measurement From a Format	
URL	<vendor API Location>/ configurations/<configurationID>/<formatUseID>/<measurementID>
HTTP Verb	DELETE
Function Input	None
Return Value	An updated <configuration> element containing the modified format as well as any settings in the configuration that have changed as a result.

References

Range Commanders Council. "IRIG Serial Time Code Formats." RCC 200-04. May be superseded by update. Available at http://www.wsmr.army.mil/RCCSITE/Pages/Publications.aspx.

****** END OF CHAPTER 9 ******