Release Date: _____/_____/_____/	Marshall Space Flight Center **SPECIFICATION/DOCUMENT CHANGE INSTRUCTION** Spec./Doc. No. MSFC-DOC-1949	Page 7 Copy No.:

Change No./Date	SCN/DCN No./Date	CCBD No./Date	Replacement Page Instructions
018/ 5/8/00	022/ 5/8/00	HM3-00-2463/ 3/17/00	Replace Volume 4, pages 4-15, 4-16, 4-23, 4-24, 4-35, 4-36, 4-39, and 4-40.
		HM3-00-2479/ 3/20/00	Revised Volume 5, pages 2-33, 2-34, 2-43, 2-44; 3-1 and 3-2; 4-3, 4-4, 4-9, 4-10, 4-15, and 4-16; A-3 thru A-6; H-3 and H-4; and I-9 thru I-12.
		HM3-00-2515/ 3/20/00	Add Volume 5, Appendix J, pages J-1 thru J-30.
			Replace Volume 5 Table of Contents, pages v thru viii; and xiii and xiv.
	026/ 5/8/00	HM3-00-2534/ 4/7/00	Replace Volume 6, pages 6-45 and 6-46; 6-121 thru 6-166; 8-27, 8-28, 8-35, 8-36; 8-49 thru 8-64.
			Replace Table of Contents, Volume 6, pages xi, xii, xxix, xxx, xxxi, xxxii, xxxiii, xxxiv, xxxv, and xxxvi.
			Add Form 4140 (S/DCI), page 7.
019/ 6/9/00	022R1/ 6/9/00	HM3-00-2490/ 12/3/99	Replace Volume 1, pages 1-1 and 1-2.
			Replace Volume 4, pages 1-1 and 1-2.
			Replace Form 4140 (S/DCI), page 7.
020/ 10/16/00	027/ 10/16/00	HM3-00-2570/ 8/4/00	Replace Volume 3, pages 3-1 thru 3-24.
		HM3-00-2602/ 8/14/00	Replace Volumes 4 and 6 in their entirety. These are being replaced without DCN bars.
	028/ 10/16/00	HM3-00-2616/ 9/8/00	Replace Volume 5, pages 2-6, 2-7; 2-17, 2-18; 2-49, 2-50, 4-5, 4-6, 4-9, 4-10; 4-13 thru 4-22, 4-25, 4-26, J-3, J-4; and J-9 thru J-12.
			Replace Form 4140 (S/DCI), page 7.
		HM3-00-2641/ 10/10/00	Add Form 4140 (S/DCI), page 8.

MSFC - Form 4140 (Revised September 1990) NOTE: After revising the document, file this sheet in document preceding table of contents.

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August 1998

MSFC HOSC Database Definitions

Volume 1

Telemetry Databases

Revision C

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MSFC Huntsville Operations Support Center (HOSC) Telemetry and Command Database Definition

Volume 1

Telemetry Databases

Revision C

August 1998

PREPARED FOR

Information Processing Branch (EO37)
Missions Systems Division
Mission Operations Laboratory
Science and Engineering Directorate
Marshall Space Flight Center

PREPARED UNDER:

NASA UMS Contract #NAS8-44000

Approved By:

_____ _____

Chris Sims
Database Engineering Branch
EO38

Date

_____ _____

Ann R. McNair, Assistant Director
Mission Operations Laboratory
EO01

Date

MSFC Huntsville Operations Support Center (HOSC) Telemetry and Command Database Definition

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1.0 INTRODUCTION

This volume describes the telemetry database that the Huntsville Operations Support Center (HOSC) system requires for telemetry processing. This database is used to input flight-specific configuration data into a HOSC database that will generate the necessary tables for the HOSC real-time systems to process and display telemetry data. The Project/Mission Manager for each support activity is responsible for supplying this database to the HOSC.

Data can be supplied to the HOSC through a HOSC-supported network or system media. The database must either be a set of relational database tables produced through Enhanced HOSC System (EHS) supported Relational Database Management System (RDBMS) software or an American Standard Code for Information Interchange (ASCII) text file as specified by this volume in Section 3.

1.1 PURPOSE

The purpose of this volume is to provide a description of the Marshall Space Flight Center (MSFC) HOSC Telemetry Database that supports MSFC-managed/supported missions.

1.2 SCOPE

This volume defines the database structures required to support HOSC standard telemetry processing requirements, as specified in MSFC Payload Operations Control Center (POCC), Telemetry Format Standard (MSFC-STD-1274). This volume is intended to replace the telemetry database portion of the MSFC POCC Telemetry and Command Database Definition, MSFC-DOC-1149B, effective January 1, 1997. The MSFC HOSC will continue to accept data in the MSFC-DOC-1149B format after this date, but the internal HOSC database structure will be in compliance with MSFC-DOC-1949.

1.3 REFERENCE DOCUMENTS

The following documents were used as reference material for preparing this volume:

MSFC-STD-1274A	MSFC POCC Telemetry Format Standard (TDM), Volume 1, May 1990
MSFC-STD-1274B	MSFC POCC Telemetry Format Standard (Packet), Volume 2, December 15, 1992
MSFC-STD-2535	Command Format Standard
MSFC-DOC-1149B	MSFC POCC Telemetry and Command Database Definition, November 1994
CCSDS-102.0	Packet Telemetry, January 1987
CCSDS 301.0-B-1	Time Code Formats, Blue Book, January 1987
FSCM No. 11982	GRO Data Base Definition, No. D099644, Rev D
530-ICD-NCCDS/MSFC	Interface Control Document between the Marshall Space Flight Center and the Goddard Space Flight Center Network Control Center Data System, June 1992
NSTS-21063-DOC-CAP	POCC Capabilities Document, Appendix B, October 1991

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2.0 TELEMETRY DATABASE TABLES

The Telemetry Database (TDB) is a relational database that consists of the following tables:

- Telemetry System
- Owner
- Block
- Block Format
- Packet
- Packet Format
- Subset
- Subset Format
- TDM
- TDM Format
- Stream ID
- Measurement
- MSID Sampling
- MSID Location
- Counter
- Polynomial Calibration
- Point Pair
- State Code
- Calibration Switch
- Limit
- Limit Switch
- Expected State
- Expected State Switch
- Control Group
- Group Content
- GSE MSID
- GSE Packet

The following sections describe the columns of each TDB table. Column type definitions are defined in Appendix B. Appendix C contains legal characters and special characters.

The following summary of the tables is provided to give the reader an overview before proceeding into the details of the content of each table.

The Telemetry System table is used to differentiate one project TDB from another. It contains data relevant to the project and mission, the particular revision of the database, and historical dates for the revision. This table is stored with the TDB so that it can be retrieved from backups and restored in case of system faults.

The Owner table is used to cross-reference an owner identifier (ID) to a text description of the owner. Owners are a means by which telemetry measurements and streams are grouped so that privileges associated with the telemetry definition can be established. The authorized owner of the telemetry data can be several users who have the ability to view proprietary data or to

update the definition of the telemetry data. A user may be a spacecraft subsystem or payload, a HOSC console position, or anything else that the project wishes to use.

Several tables describe different types of telemetry streams. Telemetry standards for time division multiplexed (TDM) streams are defined in the MSFC-STD-1274A, Volume 1. Telemetry standards for packetized streams are defined in the MSFC-STD-1274B, Volume 2. Some types of streams can be encapsulated into other stream structures. The Block and Block Format tables are used to describe 4800-bit data blocks. The Packet and Packet Format tables describe Consultative Committee for Space Data System (CCSDS) packets. The Subset and Subset Format tables describe subsets that are embedded in packets or other subsets. The TDM and TDM Format tables describe streams that have a major frame/minor frame structure. Project streams will not normally require using all of these tables to define the telemetry streams. For example, a NASA Communication (NASCOM) block would be described using the Block, Block Format, Packet and Packet Format tables. Depending on the type of stream being processed, it is mandatory that appropriate tables be supplied. The Block Format, Packet Format, Subset Format and TDM Format tables contain the data that can change from format to format in a description of the Block, Packet, Subset, or TDM tables, respectively. The Stream ID table is used to define a Huntsville Operations Support Center (HOSC)-unique stream number for each format and stream.

The Measurement table is used to describe general information about each measurement. Each measurement in the database is accessed by using a measurement/stimulus identifier (MSID) name. The general information for a measurement includes a technical name, a descriptor, and an owner ID. General calibration or conversion information consists of a data type, calibration type, engineering units, low and high raw counts, and total data length. Low and high counts are not used by the real-time system, and are provided for information only. Other attributes of a measurement can be dependent on the real-time value of other measurements. For example, a measurement can be activated or deactivated, based on a counter or a range measurement. Also, other measurements can determine which calibration set, limit set, or expected state set is to be used.

The MSID Sampling table is used to define the parameter composition and the sampling composition of a measurement for each format of the data stream. The parameter composition defines the information required to define a single sample of data for a measurement. For example, a sample may be a number of contiguous bits, or a sample may require several non-contiguous syllables. Each of the syllables will consist of contiguous bits. The sampling composition defines the information required to define all the samples, such as sample rate and the offset to the next sample. This table also contains the information for a counter dependent or range dependent measurement for each format of the data stream.

The MSID Location table is used to define the location of the first sample for each format of the data stream. If a measurement is bit contiguous, only one syllable is required; otherwise, multi-syllables are required. This table contains the start word/octet, start bit, and data length of each syllable.

The Counter table is used to define the characteristics of a counter measurement. Within the different types of telemetry streams, various counters may be described that are used in the construction of the data stream. For example, a TDM data stream requires a minor frame

counter for checking data quality, and a major frame counter for counter dependent sampled data. A packet may require a counter for determining the sequence of data reception.

The Polynomial Calibration table is used to define the polynomial coefficients that are used to calibrate the measurement. The Point Pair table is used to define point pairs for line segments that are used to calibrate the measurement. The State Code table is used to convert a discrete measurement to a state code text. A measurement may have an entry in only one of these tables. The calibration type in the Measurement table defines which of these tables to use.

The Calibration Switch, Limit Switch, and Expected State Switch tables are used for switching between different sets of calibration, limit, or expected state data. Switching is based on the real-time value of the switch measurement. The switch measurement for each of these tables is found in the Measurement table.

The Limit table is used to describe caution and warning limits for a non-discrete measurement. The Expected State table is used to describe an expected state for a measurement that has state codes defined in the State Code table. Both of these tables are used to notify an application process of an unexpected or out-of-limit condition.

The Control Group and Group Content tables are used to describe a list of measurements whose set of expected states or limits should be activated based on a predefined time, or on a control measurement. The Control Group table defines the activation conditions for each group, and the Group Content table defines the measurements in each group.

The GSE MSID table contains the list of measurements, along with the location and the number of samples for each measurement, for each unique Ground Support Equipment (GSE) packet.

The GSE Packet table contains the definitions of each of the GSE packets.

Other constraints that apply to these tables are described in more detail in the sections devoted to each table. Column values that are required from the user must be provided by the user, and no system defaults are provided. Column values that are required by the system must be provided through one of the following means: the user provides that value, the system provides a default value, or the system derives a default value from other data that has been provided.

Table 2.0-1 is a summary of the columns contained in the TDB tables.

Table 2.0-1. Telemetry Database Tables Summary

TABLE NAME	COLUMN NAME
Telemetry	PROJECT, MISSION, REVISION, DELIVERED_DATE, PRE_RELEASE_DATE, BASELINE_DATE
Owner	OWNER_ID, DESCRIPTION
Block	BLOCK_ID, BLOCK_ID_MSID, FORMAT_ID_MSID
Block Format	BLOCK_ID, BLOCK_FORMAT_ID, FORMAT, ENCAP_STREAM_NUMBER
Packet	PACKET_ID, PROTOCOL, PACKET_ID_MSID, FORMAT_ID_MSID, TIME_MSID, SEC_HEADER, SEC_HEADER_LENGTH, CONTEXT_LVT_SIZE
Packet Format	PACKET_ID, PROTOCOL, PACKET_FORMAT_ID, FORMAT, LENGTH, UPDATE_CYCLE, DATA_CYCLE, SUBSET_FLAG

Table 2.0-1. Telemetry Database Tables Summary (Continued)

TABLE NAME	COLUMN NAME
Subset	SUBSET_ID, ENCAP_STREAM_NUMBER, SUBSET_ID_MSID, FORMAT_ID_MSID, TIME_MSID, SAMPLE_COMP, SAMPLE_RATE, DATA_CYCLE, START_OCTET, OFFSET, COUNTER_MSID, START_COUNTER_VALUE, COUNTER_OFFSET, RANGE_MSID, LOW_RANGE, HIGH_RANGE, STATE_CODE
Subset Format	SUBSET_ID, SUBSET_FORMAT_ID, FORMAT, LENGTH, SUBSET_FLAG
TDM	TDM_ID, FORMAT_ID_MSID, TIME_MSID, SYNC_PATTERN, SYNC_PATTERN_MSID, SYNC_LENGTH
TDM Format	TDM_ID, TDM_FORMAT_ID, FORMAT, BITS_PER_WORD, WORDS_PER_MINOR_FRAME, MINOR_FRAMES_PER_MAJOR_FRAME, DATA_CYCLE, MAJOR_FRAME_PERIOD, ENCAP_STREAM_NUMBER, ENCAP_BOUNDARY, ENCAP_FRAME_PER_PACKET
Stream ID	STREAM_NUMBER, STREAM_TYPE, STREAM_ID, STREAM_FORMAT_ID, PROTOCOL, STREAM_PRIORITY, STREAM_PROP, STREAM_OWNER_ID, STREAM_DESCRIPTION

Table 2.0-1. Telemetry Database Tables Summary (Continued)

TABLE NAME	COLUMN NAME
Measurement	MSID, TECHNICAL_NAME, DATA_TYPE, CALIBRATION_TYPE, ENG_UNIT, LOW_RAW_COUNT, HIGH_RAW_COUNT, TOTAL_LENGTH, PROP, COUNTER_MSID, RANGE_MSID, CALIBRATION_SWITCH_MSID, CALIBRATION_DEFAULT_SET_NUM, LIMIT_SWITCH_MSID, LIMIT_DEFAULT_SET_NUM, ES_SWITCH_MSID, ES_DEFAULT_SET_NUM, OWNER_ID, DESCRIPTION, EHS_HEADER_FLAG, LIMIT_LRVT_LOCATION EM_ERROR_DESCRIPTION
MSID Sampling	MSID, STREAM_NUMBER, PAR_COMP, SAMPLE_PER_GROUP, GROUP_SAMPLE_OFFSET, SAMPLE_COMP, SAMPLE_RATE, OFFSET, START_COUNTER_VALUE, COUNTER_OFFSET, LOW_RANGE, HIGH_RANGE, STATE_CODE, CONTEXT_PACKET_ID, CONTEXT_LVT_LOCATION, CONTEXT_PROTOCOL
MSID Location	MSID, STREAM_NUMBER, SYLLABLE_NUMBER, START_MINOR_FRAME, START_WORD, START_BIT, LENGTH

Table 2.0-1. Telemetry Database Tables Summary (Continued)

TABLE NAME	COLUMN NAME
Counter	MSID, STREAM_NUMBER, INIT_VALUE, END_VALUE, WRAP_AROUND_FLAG, DIR, DELTA, COUNTER_TYPE
Polynomial Calibration	MSID, CALIBRATION_SET_NUM, ENG_UNIT_LOW, ENG_UNIT_HIGH, DEG, COEF0, COEF1, COEF2, COEF3, COEF4, COEF5, COEF6, COEF7, COEF8, COEF9
Point Pair	MSID, CALIBRATION_SET_NUM, SEQUENCE_NUM, RAW_COUNT, ENG_UNIT_VALUE
State Code	MSID, CALIBRATION_SET_NUM, SEQUENCE_NUM, LOW_RAW_COUNT, HIGH_RAW_COUNT, STATE_CODE
Calibration Switch	MSID, CALIBRATION_SET_NUM, LOW_RANGE, HIGH_RANGE, STATE_CODE
Limit	MSID, LIMIT_SET_NUM, CAUTION_LOW, CAUTION_HIGH, WARNING_LOW, WARNING_HIGH, DELTA, TOLER, EM_ALL_SAMP_FLAG

Table 2.0-1. Telemetry Database Tables Summary (Continued)

TABLE NAME	COLUMN NAME
Limit Switch	MSID, LIMIT_SET_NUM, LOW_RANGE, HIGH_RANGE, STATE_CODE
Expected State	MSID, ES_SET_NUM, EXPECTED_STATE, TOLER, EM_ALL_SAMP_FLAG
Expected State Switch	MSID, ES_SET_NUM, LOW_RANGE, HIGH_RANGE, STATE_CODE
Control Group	GROUP_ID, PROJECT_EM, TIME_TYPE, START_TIME, STOP_TIME, CONTROL_MSID, CONTROL_LOW, CONTROL_HIGH, CONTROL_CODE, DELAY_TIME, OWNER_ID
Group Content	GROUP_ID, MSID, MSID_SET_NUM, DELAY_TIME
GSE MSID	GSE_PACKET_ID, MSID, START_OCTET, SAMPLE_RATE
GSE Packet	GSE_PACKET_ID, PARITY, BAUD_RATE, BYTE_SWAP, PROJECT_USER, LENGTH

The TDB described by this document is based on the "relational" database model. In a relational database, the objects, or "things," about which data are kept are called entities. Each table in the TDB contains data about a single type of entity. Some of the tables contain data about telemetry characteristics such as the Measurement table. Other tables contain data about the relationships between the entities that are represented by the other tables. For example, the MSID Location table contains data about the relationship between the measurements in the Measurement table and the streams in the Stream ID table. Regardless of whether the table contains data about telemetry characteristics, look-up values, or relationships, all of the data for each occurrence of the entity represented by the table is located in a single row of the table.

Each table in the TDB contains one or more columns that make up the "primary key" for that table. The set of values in the primary key columns of a table must be unique for each row in the table. Therefore, the primary key can be used to locate the data for any given occurrence of the corresponding entity. Some of the tables in the TDB have a primary key that is only one column while other tables have several columns that make up the primary key. The columns in the primary key must not contain null values. For example, the data for a particular measurement can be located in the Measurement table by using a value for the MSID column which is the primary key for that table. See Table 2.0-2 for the Telemetry Database Primary Keys.

Table 2.0-2. Telemetry Database Primary Keys

TABLE NAME	PRIMARY KEY
Telemetry System	PROJECT, MISSION, and REVISION
Owner	OWNER_ID
Block	BLOCK_ID
Block Format	BLOCK_ID and BLOCK_FORMAT_ID
Packet	PACKET_ID and PROTOCOL
Packet Format	PACKET_ID, PROTOCOL, and PACKET_FORMAT _ID
Subset	SUBSET_ID
Subset Format	SUBSET_ID and SUBSET_FORMAT_ID
TDM	TDM_ID
TDM Format	TDM_ID and TDM_FORMAT_ID
Stream ID	STREAM_NUMBER
Measurement	MSID
MSID Sampling	MSID and STREAM_NUMBER
MSID Location	MSID, STREAM_NUMBER, and SYLLABLE_NUMBER
Counter	MSID and STREAM_NUMBER
Polynomial Calibration	MSID and CALIBRATION_SET_NUM
Point Pair	MSID, CALIBRATION_SET_NUM, and SEQUENCE_NUM
State Code	MSID, CALIBRATION_SET_NUM, and SEQUENCE_NUM
Calibration Switch	MSID and CALIBRATION_SET_NUM
Limit	MSID and LIMIT_SET_NUM
Limit Switch	MSID and LIMIT_SET_NUM
Expected State	MSID and ES_SET_NUM
Expected State Switch	MSID and ES_SET_NUM
Control Group	GROUP_ID
Group Content	GROUP_ID and MSID
GSE MSID	GSE_PACKET_ID and MSID
GSE Packet	GSE_PACKET_ID

In a relational database, a “foreign key” is one or more columns in one table that references columns in another table. To insert or update a row in a table that contains a foreign key, the set of new values for the foreign key columns must already exist in the referenced columns of the other table. However, some of the rows may not contain values in the foreign key columns. A foreign key can be used to enforce data integrity by requiring a set of columns to contain valid values based on the values in the referenced table. A foreign key can also be used to show the relationships that exist between the entities represented by the two tables. The columns that are referenced by a foreign key must contain unique sets of values for each row in the referenced table. Because of this restriction on foreign keys, some tables contain common columns that are not foreign keys, but which represent a relationship between the tables. Each table can contain any number of foreign keys and any number of columns that are common with other tables. Therefore, complicated relationships among a set of entities can be represented in the corresponding table. See Table 2.0-3 for the Telemetry Database foreign keys.

Table 2.0-3. Telemetry Database Foreign Keys

TABLE	FOREIGN KEY(S)	REFERENCE TABLE	REFERENCE COLUMN(S)
Block	BLOCK_ID_MSID	Measurement	MSID
	FORMAT_ID_MSID	Measurement	MSID
Block Format	BLOCK_ID	Block	BLOCK_ID
	ENCAP_STREAM_ NUMBER	Stream ID	STREAM_NUMBER
Packet	PACKET_ID_MSID	Measurement	MSID
	FORMAT_ID_MSID	Measurement	MSID
	TIME_MSID	Measurement	MSID
Packet Format	PACKET_ID and PROTOCOL	Packet	PACKET_ID and PROTOCOL
Subset	ENCAP_STREAM_ NUMBER	Stream ID	STREAM_NUMBER
	SUBSET_ID_MSID	Measurement	MSID
	FORMAT_ID_MSID	Measurement	MSID
	TIME_MSID	Measurement	MSID
	COUNTER_MSID	Measurement	MSID
	COUNTER_MSID	Counter	MSID
	RANGE_MSID	Measurement	MSID
Subset Format	SUBSET_ID	Subset	SUBSET_ID
TDM	FORMAT_ID_MSID	Measurement	MSID
	TIME_MSID	Measurement	MSID
	SYNC_PATTERN_ MSID	Measurement	MSID
TDM Format	TDM_ID	TDM	TDM_ID
	ENCAP_STREAM_ NUMBER	Stream ID	STREAM_NUMBER
Stream ID	STREAM_OWNER_ ID	Owner	OWNER_ID
Measurement	COUNTER_MSID	Measurement	MSID
	RANGE_MSID	Measurement	MSID
	CALIBRATION_ SWITCH_MSID	Measurement	MSID
	LIMIT_SWITCH_ MSID	Measurement	MSID
	ES_SWITCH_MSID	Measurement	MSID
	OWNER_ID	Owner	OWNER_ID
MSID Sampling	MSID	Measurement	MSID
	STREAM_NUMBER	Stream ID	STREAM_NUMBER

Table 2.0-3. Telemetry Database Foreign Keys (Continued)

TABLE	FOREIGN KEY(S)	REFERENCE TABLE	REFERENCE COLUMN(S)
MSID Location	MSID	Measurement	MSID
	MSID and STREAM_NUM	MSID Sampling	MSID and STREAM_NUM
	STREAM_NUMBER	Stream ID	STREAM_NUMBER
Counter	MSID	Measurement	MSID
	STREAM_NUMBER	Stream ID	STREAM_NUMBER
Polynomial Calibration	MSID	Measurement	MSID
Point Pair	MSID	Measurement	MSID
State Code	MSID	Measurement	MSID
Calibration Switch	MSID	Measurement	MSID
Limit	MSID	Measurement	MSID
Limit Switch	MSID	Measurement	MSID
	MSID and LIMIT_SET_NUM	Limit	MSID and LIMIT_SET_NUM
Expected State	MSID	Measurement	MSID
Expected State Switch	MSID	Measurement	MSID
	MSID and ES_SET_NUM	Expected State	MSID and ES_SET_NUM
Control Group	CONTROL_MSID	Measurement	MSID
	OWNER_ID	Owner	OWNER_ID
Group Content	GROUP_ID	Control Group	GROUP_ID
	MSID	Measurement	MSID
GSE MSID	GSE_PACKET_ID	GSE Packet	GSE_PACKET_ID
	MSID	Measurement	MSID
GSE Packet	GSE_OWNER_ID	Owner	OWNER_ID

Entity Relationship (E-R) diagrams provide a graphical method of representing the relationships among a set of entities and their corresponding tables in a relational database. Rectangles are used in an E-R diagram to represent an entity and its corresponding table. Arrows between the rectangles are used to represent the relationships. In the database tables, these relationships can be represented by foreign keys or by common columns in the tables. Only the significant relationships between entities are represented in the E-R diagrams. The relationships with look-up tables and the foreign keys that are only used to enforce data validation are not shown. Otherwise, the E-R diagrams would contain so many rectangles and arrows that the significant relationships would be obscured. Each relationship in an E-R diagram can be either one-to-one, one-to-many, or many-to-many. For example, a single owner can own many packets but each packet can only have one owner. This is an example of a one-to-many relationship. In the E-R diagram in this document, a single arrowhead is used to represent a "one" side of a relationship and a double arrowhead is used to represent a "many" side.

Since the TDB contains data about many types of entities that are related in different ways, several E-R diagrams are included in the rest of this section to illustrate these relationships.

Figure 2.0-1 is an E-R diagram which shows the relationships between TDB owners and different types of telemetry streams. A single owner can own many streams but each stream only has one owner. Each stream is related to an owner through the STREAM_OWNER_ID column in the Stream ID table. This diagram also indicates that each block, packet, subset, or TDM stream can have many formats. Each of these formats has a unique stream number in the Stream ID table.

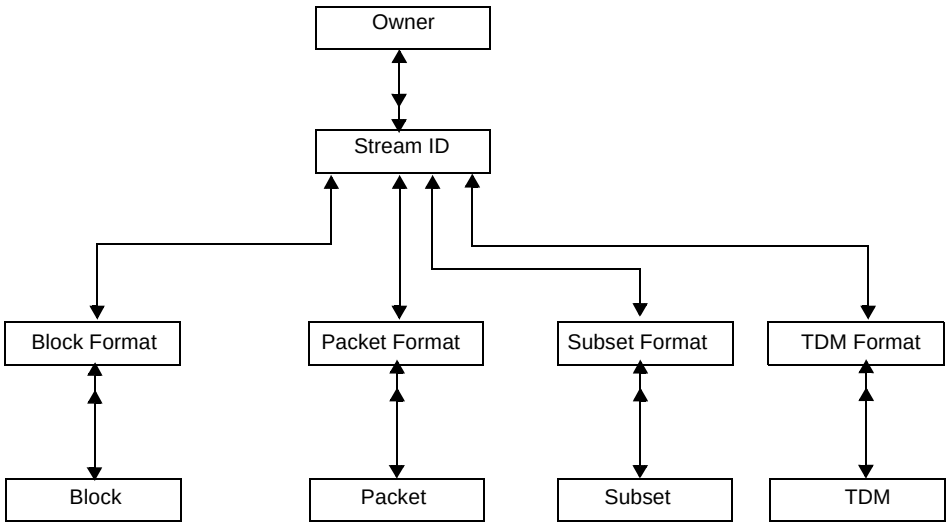


Figure 2.0-1. Relationship Between Owners and Telemetry Streams

Figure 2.0-2 shows the relationship between different types of telemetry streams. These relationships are represented by the columns that contain encapsulation stream numbers in the TDB tables. TDM streams and blocks are capsulated into packets. A single TDM stream or block is encapsulated into a single packet. Therefore, there is a one-to-one relationship between TDM streams and packets and between blocks and packets. All of the formats for a particular TDM stream or block must be encapsulated into the same packet. A subset can be encapsulated into a single packet, and a packet can contain many subsets. Therefore, there is a one-to-many relationship between packets and subsets. Subsets can also be encapsulated into other subsets.

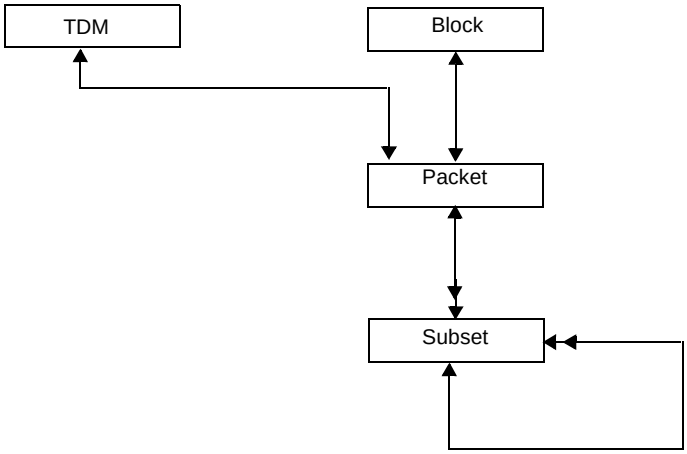


Figure 2.0-2. Relationship Between Telemetry Stream Types

Figure 2.0-3 shows the relationship between owners, measurements, sampling data, counters, location data, GSE data, and streams. A single owner can own many measurements, but each measurement has a single owner. The MSID Sampling, MSID Location, and GSE MSID tables are used to represent the many-to-many relationship between measurements in the Measurement table and streams in the Stream ID table. A single measurement can be in multiple streams and each stream contains multiple measurements. Therefore, each measurement and stream can be related to many rows in the MSID Sampling table, the MSID Location table, and the GSE MSID table. However, each row in these tables is related to a single measurement and a single stream. Since a measurement can have multiple syllables, a single measurement can also have multiple locations in the same single stream. The Counter table contains the data which define the way a particular measurement counts for a give stream. The same measurement can have different counter data for different streams and a given stream can contain many counter measurements.

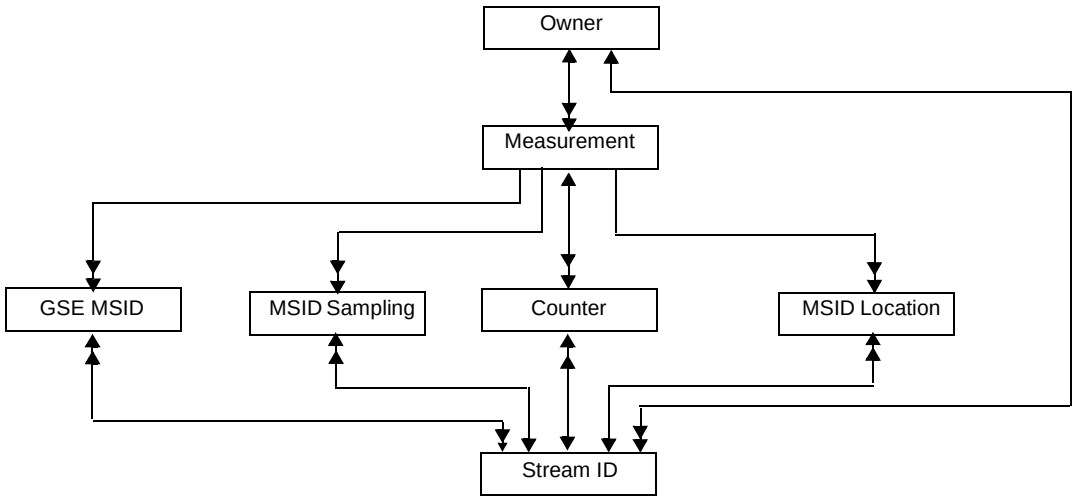


Figure 2.0-3. Relationship Between Owners, Measurements, Counters, and Telemetry Streams

Figure 2.0-4 shows the relationship between a measurement and calibration data. A single measurement can have multiple sets of calibration data in either the Polynomial Calibration, Point Pair, or State Code table. However, each measurement can only have one of these types of calibration data. Each set of calibration data for a given measurement has a unique calibration set number. If a measurement uses calibration switching, then its row in the Measurement table will have an entry in the CALIBRATION_SWITCH_MSID column and the measurement will have rows in the Calibration Switch table. Each row in the Calibration Switch table actually defines a single range or a state code for the calibration switch MSID. Therefore, there is a one-to-many relationship between the rows in the Measurement table and the rows in the Calibration Switch table. The real-time value of the calibration switch MSID is used with the ranges or state codes in the Calibration Switch table to select a calibration set number for the measurement that is using calibration switching. Multiple measurements can switch calibration sets using the same calibration switch MSID and each measurement can use a different set of ranges or state codes for the calibration switch MSID. If a measurement does not use calibration switching, then the default calibration set number for the measurement is used to select a set of calibration data.

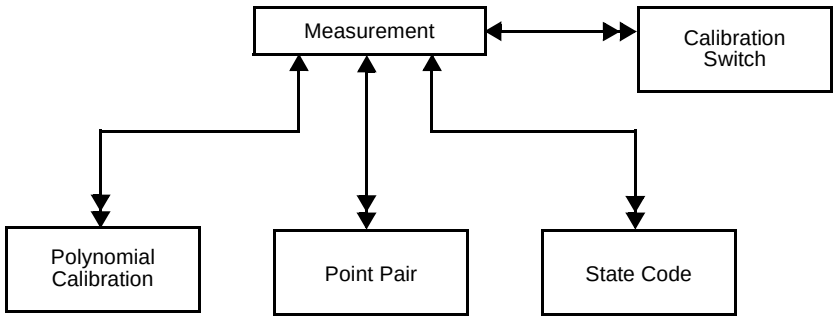


Figure 2.0-4. Relationship Between Measurement and Calibration Data

Figure 2.0-5 shows the relationship between control groups, measurements, expected states, and limits. One owner can own many control groups but each control group can only belong to a single owner.

A control group can contain many measurements and a single measurement can be in many control groups. This many-to-many relationship between control groups and measurements is represented by the Group Content table. Each row in the Group Content table is related to one control group and to one measurement but many rows in the Group Content table can be related to one control group or to one measurement. If a measurement is a discrete, it can have many expected states; otherwise, it can have many sets of limits.

If a measurement uses expected state switching, then its row in the Measurement table will have an entry in the ES_SWITCH_MSID column and the measurement will have rows in the Expected State Switch table. Each row in the Expected State Switch table actually defines a single range or a state code for the expected state switch MSID. Therefore, there is a one-to-many relationship between the rows in the Measurement table and the rows in the Expected State Switch table. There is also a one-to-many relationship between the rows in the Expected State table and the rows in the Expected State Switch table. The real-time value of the expected state switch MSID is used with the ranges or the state codes in the Expected State Switch table to select an expected state set number for the measurement that is using expected state switching. This value is used to select an expected state set from the Expected State table. Multiple measurements can switch expected state sets using the same expected state switch MSID and each measurement can use a different set of ranges or state codes for the expected state switch MSID. If a measurement does not use expected state switching, then the default expected state set number for the measurement is used to select an expected state set.

If a measurement uses limit switching, then its row in the Measurement table will have an entry in the LIMIT_SWITCH_MSID column and the measurement will have rows in the Limit Switch table. Each row in the Limit Switch table actually defines a single range or a state code for the limit switch MSID. Therefore, there is a one-to-many relationship between the rows in the Measurement table and the rows in the Limit Switch table. There is also a one-to-many relationship between the rows in the Limit table and the rows in the Limit Switch table. The real-time value of the limit switch MSID is used with the ranges or the state codes in the Limit Switch table to select a limit set number for the measurement that is using limit switching. This value is used to select a set of limits from the Limit table. Multiple measurements can switch limits based on a single limit switch MSID and each measurement can use a different set of ranges or state codes for the limit switch MSID. If a measurement does not use limit switching, then the default limit set number for the measurement is used to select a set of limits.

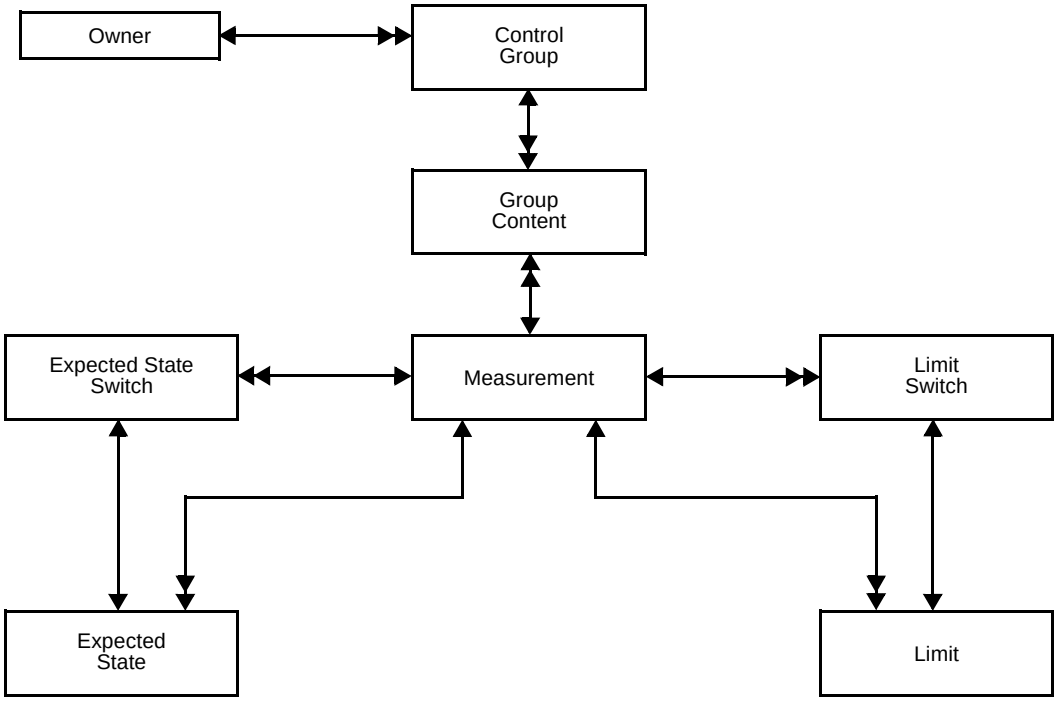


Figure 2.0-5. Relationship Between Measurements and Limit Sensing Data

Figure 2.0-6 shows the relationship between GSE packets, and GSE measurements.
A GSE packet can contain many measurements. A measurement can be in many GSE packets.

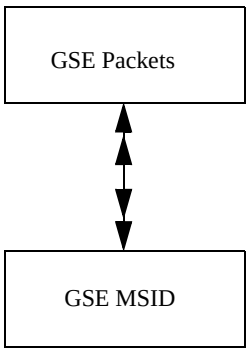


Figure 2.0-6. Relationship Between GSE Packets and GSE Measurements

2.1 TELEMETRY SYSTEM TABLE

The Telemetry System table is required to accomplish configuration control of the telemetry database. PROJECT is an acronym, an abbreviation, or a name of the project. MISSION is an acronym, an abbreviation, or a name of the mission or increment. The PROJECT and MISSION are used for internal identification of the TDB. The REVISION is the identifier of the revision of the TDB, and is changed each time a new version of this TDB is created. DELIVERED_DATE is the date that this revision is delivered. PRE_RELEASE_DATE is the date that this revision is pre-released. BASELINE_DATE is the date that this revision is baselined. DELIVERED_DATE, PRE_RELEASE_DATE and BASELINE_DATE are used for determining the state of the particular revision.

See the Telemetry System table, Table 2.1-1, for detailed information. Figure 2.1-1 is a guide to populating the Telemetry System table.

Table 2.1-1. Telemetry System Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
PROJECT	4	character	Acronym, abbreviation, or name of the project NOTE: Provided by HOSC personnel.
MISSION	4	character	Acronym, abbreviation, or name of the mission. NOTE: Provided by HOSC personnel.
REVISION	4	character	Revision identifier. NOTE: Provided by HOSC personnel.
DELIVERED_DATE	20	timestamp	Date this revision is delivered. NOTE: Added by HOSC software when the database is delivered.
PRE_RELEASE_ DATE	20	timestamp	Date this revision is pre-released. NOTE: Added by HOSC software when the database is released.
BASELINE_DATE	20	timestamp	Date this revision is baselined. NOTE: Added by HOSC software when the database is baselined.

The following examples depict the type of data used to populate the Telemetry System table:

EXAMPLE 1:

PROJECT	= SL
MISSION	= AST1
REVISION	= 0001
DELIVERED_DATE	= 21-JAN-1993 12:03:15
PRE_RELEASE_DATE	= 01-MAR-1993 15:22:04
BASELINE_DATE	= 10-OCT-1993 22:20:59

EXAMPLE 2:

PROJECT	= STS
MISSION	= 056
REVISION	= 0012
DELIVERED_DATE	= 076-FEB-1993 08:00:14
PRE_RELEASE_DATE	= 11-MAY-1993 11:45:10
BASELINE_DATE	= 15-OCT-1993 23:59:58

Figure 2.1-1. Example Entries for Telemetry System Table

2.2 OWNER TABLE

The Owner table is used to cross-reference an ID to a text description of the owner. Owners are a means by which telemetry measurements, data streams, GSE packets, and any other telemetry data are grouped so that privileges associated with the telemetry definition can be established. The authorized owner of the telemetry data can be several users who have the ability to view proprietary data or to update the definition of the telemetry data. A user may be a spacecraft subsystem or payload, a HOSC console position, or anything else that the project wishes to use.

OWNER_ID is the identifier of the owner, and is used to control the ability to update the telemetry data with which they are associated. This is accomplished by associating users in the HOSC to the appropriate owner identifiers. DESCRIPTION is the text description of the owner.

Suppose that a particular mission includes a set of measurements that are used to monitor the electrical subsystem on the spacecraft. The owner identifier “ELECTRICAL” is entered into the Owner table along with an appropriate description. Each of the measurements used to monitor the electrical subsystem is assigned an owner identifier of “ELECTRICAL” in the Measurement table (see Section 2.13). In the HOSC, groups of users that are given the authority to update these electrical subsystem measurements are associated with this owner ID for the mission. Only these authorized users can produce updated copies of the electrical subsystem telemetry definitions, which may be submitted for approval and incorporation into a subsequent revision of the database. Such approval is required since telemetry data for the measurement are configuration controlled.

See the Owner table, Table 2.2-1, for detailed information. Figure 2.2-1 is a guide to populating the Owner table.

Table 2.2-1. Owner Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
OWNER_ID	20	character	Unique identifier that indicates the owner of measurements, data streams, GSE packets, or any other telemetry data. NOTE: Must be provided by the project/ mission manager.
DESCRIPTION	100	character	Text description.

The Owner table contains an OWNER_ID which is associated with an owner descriptor. The following examples will depict how to populate the columns of the Owner table:

EXAMPLE 1:	
OWNER_ID	= BBXRT
DESCRIPTION	= Broad Band X-ray Telescope
EXAMPLE 2:	
OWNER_ID	= HUT
DESCRIPTION	= Hopkins Ultraviolet Telescope
EXAMPLE 3:	
OWNER_ID	= BCS
DESCRIPTION	= Brags Crystal Spectrometer
EXAMPLE 4:	
OWNER_ID	= ACIS
DESCRIPTION	= AXAF CCD Imaging Spectrometer

Figure 2.2-1. Example Entries for Owner Table

2.3 BLOCK TABLE

The Block table contains information required by the MSFC HOSC to acquire and process 4800-bit blocks. Each block is identified using the source ID from the block header. An MSID is assigned to the block ID so that the location of the ID can be looked up in the MSID Sampling table (see Section 2.14) and MSID Location table (see Section 2.15). If a format for the block is applicable, it can be specified along with an MSID to use for cross-referencing to MSID Sampling and MSID Location tables information.

See the Block table, Table 2.3-1, for detailed information. Figure 2.3-1 is a guide to populating the Block table.

Table 2.3-1. Block Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
BLOCK_ID	2	hexadecimal	Hexadecimal representation of a unique identifier for a 4800-bit block. NOTE: Must be provided by the project/mission manager.
BLOCK_ID_ MSID	20	character	MSID used to look up the location of the block ID within the block. NOTE: Must be provided by the project/mission manager.
FORMAT_ID_ MSID	20	character	MSID used to look up the location of the format of a block. NOTE: Must be provided by the project/mission manager.

The following is an example of how to populate the Block table for trajectory data:

EXAMPLE 1:	
BLOCK_ID	= 19
BLOCK_ID_MSID	= V91M1001P
FORMAT_ID_MSID	= V91M1002P

Figure 2.3-1. Example Entries for Block Table

2.4 BLOCK FORMAT TABLE

The Block Format table contains the information required by MSFC HOSC to process unique formats for a 4800-bit block of data. BLOCK_ID, along with the BLOCK_FORMAT_ID, uniquely defines a block format. BLOCK_FORMAT_ID is the two-character ID that corresponds to the hexadecimal downlinked FORMAT data in the block. The block will be encapsulated in a packet for internal HOSC routing. ENCAP_STREAM_NUMBER is the HOSC-unique stream number identifying the stream and format of the packet used to transmit the block (see Stream ID table, section 2.12).

See the Block Format table, Table 2.4-1, for detailed information. Figure 2.4-1 is a guide to populating the Block Format table

Table 2.4-1. Block Format Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
BLOCK_ID	2	hexadecimal	Hexadecimal identifier for the 4800-bit block. NOTE: Must be provided by project/ mission manager.
BLOCK_FORMAT_ID	2	character	The format identifier of the block. NOTE: Must be provided by project/ mission manager.
FORMAT	4	hexadecimal	Hexadecimal representation of the format ID of the block. NOTE: Must be provided by project/ mission manager.
ENCAP_STREAM_ NUMBER	4	integer	Identifies the unique stream number used to transmit the block. NOTE: Derived by a HOSC database application program.

The following are examples of how to populate the Block Format table for trajectory data:

EXAMPLE 1:	
BLOCK_ID	= 19
BLOCK_FORMAT_ID	= 01
FORMAT	= 008C
ENCAP_STREAM_NUMBER	= 25
EXAMPLE 2:	
BLOCK_ID	= 19
BLOCK_FORMAT_ID	= 02
FORMAT	= 003A
ENCAP_STREAM_NUMBER	= 25

Figure 2.4-1. Example Entries for Block Format Table

2.5 DELETED

2.6 PACKET TABLE

The Packet table contains the information required by MSFC HOSC to process a telemetry data packet. The MSFC packet construction standard is documented in MSFC-STD-1274B, Volume 2, MSFC HOSC Telemetry Format Standard (Packet). Segmentation of CCSDS packets is not supported. The packet identification is determined using the Application Process Identifier (APID) from the packet primary header. For Space Station Program (SSP), the program will assign the APID; for other encapsulated data, HOSC will assign the ID.

PACKET_ID and PROTOCOL uniquely identify a packet. PACKET_ID_MSID is the measurement name that is used to determine the location of the packet ID within the packet. FORMAT_ID_MSID is the measurement name that is used to determine the location of the packet format ID within the packet. Packet formats allow for the definition of different parameter compositions and sampling compositions for each unique packet format. TIME_MSID is the measurement name that is used to determine the location of an embedded time within the packet. Whenever an MSID is used to determine the location of the data in a stream, the MSID Sampling table (see Section 2.14) and MSID Location table (see Section 2.15) should be referenced.

SEC_HEADER indicates whether a secondary header is used. If a secondary header is used, SEC_HEADER_LENGTH is the length of the header in octets.

If a data stream contains measurements that are counter dependent or range dependent, then a table of the last values of these context dependent measurements must be maintained by the real-time system for the packet that contained the measurements. A HOSC database application program will derive the Last Value Table (LVT) location of each context dependent measurement (see MSID Sampling table, Section 2.14) and the maximum size of the context dependent LVT for this packet. CONTEXT_LVT_SIZE contains the maximum size, in bytes, of the LVT for this packet.

See the Packet table, Table 2.6-1, for detailed information. Figure 2.6-1 is a guide to populating the Packet table.

Table 2.6-1. Packet Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
PACKET_ID	4	integer	APID from CCSDS packet Primary Header or HOSC assigned. NOTE: Must be provided by project/mission manager.
PROTOCOL	1	character	Indicates the EHS protocol of the packet. “C” - CCSDS packet. “P” - Pseudo telemetry packet “T” - Encapsulated TDM packet “B” - Encapsulated Block packet “D” - TDS Packet NOTE: Must be provided by project/mission manager.
PACKET_ID_ MSID	20	character	MSID used to look up the location of the packet ID within a packet. NOTE: Must be provided by project/mission manager.
FORMAT_ID_ MSID	20	character	MSID used to look up the location of the packet format ID within a packet. NOTE: Must be provided by project/mission manager.
TIME_MSID	20	character	MSID used to look up the location of an embedded time within the packet. NOTE: Must be provided by project/mission manager.
SEC_HEADER	1	character	Indicates whether a secondary header is contained within the packet. “Y” - Packet contains secondary header. “N” - Packet contains no secondary header. NOTE: Must be provided by project/mission manager.
SEC_HEADER_LENGTH	4	integer	Indicates the length, in octets, of the secondary header. NOTE: Must be provided by project/mission mang.
CONTEXT_ LVT_SIZE	6	integer	The maximum size, in bytes, of the context dependent LVT for the packet ID. The byte size is derived by a HOSC database application program.

The following is an example of how to populate the Packet table:

EXAMPLE 1:	
PACKET_ID	= 1001
PROTOCOL	= C
PACKET_ID_MSID	= P01Q1001A
FORMAT_ID_MSID	= P01Q1002A
TIME_MSID	= P01W1003A
SEC_HEADER	= Y
SEC_HEADER_LENGTH	= 6
CONTEXT_LVT_SIZE	=

Figure 2.6-1. Example Entries for Packet Table

2.7 PACKET FORMAT TABLE

The Packet Format table contains the information required by MSFC HOSC to process a unique format for a packet. PACKET_ID and PROTOCOL, along with PACKET_FORMAT_ID, uniquely defines a packet format. PACKET_FORMAT_ID is the three-character ID that corresponds to the hexadecimal downlinked FORMAT data in the packet. LENGTH indicates the length of the packet in octets for this format ID.

UPDATE_CYCLE is the number of packets to be received per second. UPDATE_CYCLE will be used for data system timers to determine when displayed data is stale. DATA_CYCLE indicates how many packets must be received to include a sample of every measurement in a packet format. UPDATE_CYCLE, in conjunction with the DATA_CYCLE value, distinguishes between current data and stale data.

When subsets are contained within the format of a packet, the SUBSET_FLAG must be set.

See the Packet Format table, Table 2.7-1, for detailed information. Figure 2.7-1 is a guide to populating the Packet Format table.

Table 2.7-1. Packet Format Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
PACKET_ID	4	integer	APID from CCSDS packet Primary Header or HOSC assigned. NOTE: Must be provided by the project/mission manager.
PROTOCOL	1	character	Indicates the protocol of the packet. “C” - CCSDS packet. “P” - Pseudo telemetry packet. “T” - Encapsulated TDM packet. “B” - Encapsulated Block packet. “D” - TDS Packet NOTE: Must be provided by the project/mission manager.
PACKET_FORMAT_ID	3	character	The format identifier of the packet. NOTE: Must be provided by the project/mission manager.
FORMAT	4	hexadecimal	Hexadecimal representation of the format ID of the packet. NOTE: Must be provided by the project/mission manager.
LENGTH	6	integer	Indicates the length of the packet in octets. NOTE: Must be provided by the project/mission manager.
UPDATE_CYCLE	8	floating point	An estimate of the number of packets per second to be received. NOTE: Must be provided by the project/mission manager.
DATA_CYCLE	2	integer	Number of packets required to include at least one sample of every measurement in a format. Note: Must be provided by the project/mission manager.
SUBSET_FLAG	1	character	Indicates that subsets are contained in this packet. “Y” - Yes, contains subsets. “N” - No, does not contain subsets. NOTE: Must be provided by the project/mission manager.

The following are examples of how to populate the Packet Format table:

EXAMPLE 1:	
PACKET_ID	= 1001
PROTOCOL	= C
PACKET_FORMAT_ID	= 0A
FORMAT	= 01FA
LENGTH	= 2320
UPDATE_CYCLE	= 2.0
DATA_CYCLE	= 1
SUBSET_FLAG	= Y
EXAMPLE 2:	
PACKET_ID	= 1001
PROTOCOL	= C
PACKET_FORMAT_ID	= 0B
FORMAT	= 01FC
LENGTH	= 2320
UPDATE_CYCLE	= 2.0
DATA_CYCLE	= 1
SUBSET_FLAG	= Y

Figure 2.7-1. Example Entries for Packet Format Table

2.8 SUBSET TABLE

The Subset table contains information required by MSFC HOSC to process a subset within a packet, or a subset within another subset. SUBSET_ID contains the subset identification of the downlinked subset. ENCAP_STREAM_NUMBER is the HOSC-unique stream number (see Stream ID table, Section 2.12) identifying the stream and format of the packet or subset used to transmit the subset. SUBSET_ID_MSID is the measurement name that is used to determine the location of the subset identification within the subset. FORMAT_ID_MSID is the measurement name that is used to determine the location of the format ID within the subset. SUBSET_ID and the format ID uniquely defines the format for the subset. TIME_MSID is the measurement name that is used to determine the location of an embedded time within the subset. Whenever an MSID is used to determine the location of the data in a stream, the MSID Sampling table (see Section 2.14) and MSID Location table (see Section 2.15) should be referenced.

SAMPLE_COMP defines the subset sampling composition of the subset ID. Sampling compositions are defined and explained in MSFC-STD-1274B, Volume 2, MSFC HOSC Telemetry Format Standard (Packet). SAMPLE_RATE defines the estimated number of non-random subsets to be received in every packet or subset. The rate determines when displayed data is considered stale. DATA_CYCLE is defined to be the number of subsets required to include at least one sample of every measurement in the non-random subset. START_OCTET is the location of the start octet of the non-random subset within a packet or another subset. OFFSET is the offset in octets to the next occurrence of the subset for a super sampled subset. OFFSET is required only for super sampled subsets.

If SAMPLE_COMP for a subset is counter dependent, a measurement within the same data set (i.e., packet or parent subset) is used to determine if this subset is active. For example, if a subset is counter dependent on a measurement that counts from 0 to 7, the subset is active on the counts of 1,3,5,7 if the initial count is 1 and the delta count is 2. COUNTER_MSID is the measurement name of the counter, START_COUNTER_VALUE is the initial count, and COUNTER_OFFSET is the delta counts.

If SAMPLE_COMP for a subset is range dependent, a measurement within the same data set (i.e., packet or parent subset) is used to determine if this subset is active. Over a long period of time, different “phases” for this subset may occur. For example, as long as the range dependent measurement is within a specified range of 15.1 to 21.8, the subset is active. RANGE_MSID is the range dependent measurement name. LOW_RANGE and HIGH_RANGE, or STATE_CODE are used to determine if this subset is active. When the RANGE_MSID value is greater than LOW_RANGE and less than or equal to HIGH_RANGE, or equal to STATE_CODE, then this subset is active.

See the Subset table, Table 2.8-1, for detailed information. Figure 2.8-1 is a guide to populating the Subset table.

Table 2.8-1. Subset Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
SUBSET_ID	4	integer	Identifier of the subset. NOTE: Must be provided by the project/ mission manager.
ENCAP_STREAM_NUMBER	4	integer	Identifies the unique stream number used to transmit the subset. NOTE: Derived from a HOSC database application program.
SUBSET_ID_MSID	20	character	MSID used to look up the location of the subset ID of a subset within a packet. NOTE: Must be provided by the project/ mission manager.
FORMAT_ID_MSID	20	character	MSID used to look up the location of a format ID within the subset. NOTE: Must be provided by the project/ mission manager.
TIME_MSID	20	character	MSID used to look up the location of an embedded time within the subset.
SAMPLE_COMP	1	character	Sampling composition describes how the subset is arranged. "N" - Normal sampling or once per subset. "S" - Super sampling or multiple samples in every subset. "C" - Counter dependent sampling. "R" - Range dependent sampling. "D" - Random sampling. NOTE: Must be provided by the project/ mission manager.
SAMPLE_RATE	3	integer	Number of non-random subsets received per packet or subset for this format. NOTE: Must be provided by the project/ mission manager.
DATA_CYCLE	2	integer	Number of subsets required to include at least one sample of every measurement in a non-random subset format. NOTE: Must be provided by the project/ mission manager.

Table 2.8-1. Subset Table (Continued)

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
START_OCTET	5	integer	Start octet for first occurrence of a non-random subset. NOTE: Must be provided by the project/ mission manager.
OFFSET	5	integer	Offset in octets to the next occurrence of a super sampled subset within a subset or packet.
COUNTER_MSID	20	character	Measurement name of counter to be used for counter dependent sampling.
START_COUNTER_VALUE	4	integer	Initial value of the counter for this subset.
COUNTER_OFFSET	4	integer	Delta value of the counter for this subset.
RANGE_MSID	20	character	Measurement name to be used for range dependent sampling.
LOW_RANGE	16	floating point	Low end of the range in engineering units of the range measurement for a range dependent subset.
HIGH_RANGE	16	floating point	High end of the range in engineering units of the range measurement for a range dependent subset.
STATE_CODE	12	character	State code of the range measurement for a range dependent subset.

The following is an example of how to populate the Subset table:

EXAMPLE 1:	
SUBSET_ID	= 2001
ENCAP_STREAM_NUMBER	= 1
SUBSET_ID_MSID	= S01Q1001A
FORMAT_ID_MSID	= S01Q1002A
TIME_MSID	= S01W1003A
SAMPLING_COMP	= N
SAMPLE_RATE	= 1.0
DATA_CYCLE	= 1
START_OCTET	= 7
OFFSET	=
COUNTER_MSID	=
START_COUNTER_VALUE	=
COUNTER_OFFSET	=
RANGE_MSID	=
LOW_RANGE	=
HIGH_RANGE	=
STATE_CODE	=

Figure 2.8-1. Example Entries for Subset Table

2.9 SUBSET FORMAT TABLE

The Subset Format table contains the information required by MSFC HOSC to process unique formats for a telemetry subset within a packet, or a subset within another subset. SUBSET_ID, along with the SUBSET_FORMAT_ID, uniquely defines a subset format. A random subset can have only one format per subset ID. SUBSET_FORMAT_ ID is the three-character ID that corresponds to the hexadecimal downlinked FORMAT data in the subset. LENGTH indicates the length of the subset in octets for this format ID.

When subsets are contained within a format of a subset, the SUBSET_FLAG must be set. Non-random subsets can be embedded up to three levels deep within subsets (i.e., four levels deep including the packet level). A random subset can not be embedded within another subset. See the Subset Format table, Table 2.9-1, for detailed information. Figure 2.9-1 is a guide to populating the Subset Format table.

Table 2.9-1. Subset Format Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
SUBSET_ID	4	integer	Identifier of the subset. NOTE: Must be provided by the project/mission manager.
SUBSET_FORMAT_ID	3	character	The format identifier of the subset. NOTE: Must be provided by the project/mission manager.
FORMAT	4	hexadecimal	Hexadecimal representation of the format ID of the subset. NOTE: Must be provided by the project/mission manager.
LENGTH	4	integer	Indicates length of this format of the subset in octets. NOTE: Must be provided by the project/mission manager.
SUBSET_FLAG	1	character	Indicates that subsets are contained in this subset. “Y” - Yes, contains subsets. “N” - No, does not contain subsets. NOTE: Must be provided by the project/mission manager.

The following are examples of how to populate the Subset Format table:

EXAMPLE 1:	
SUBSET_ID	= 2001
SUBSET_FORMAT_ID	= A1
FORMAT	= 800F
LENGTH	= 1000
SUBSET_FLAG	= Y
EXAMPLE 2:	
SUBSET_ID	= 2001
SUBSET_FORMAT_ID	= A2
FORMAT	= 801A
LENGTH	= 1000
SUBSET_FLAG	= Y

Figure 2.9-1. Example Entries for Subset Format Table

2.10 TDM TABLE

The TDM table contains the information required by MSFC HOSC to process a TDM telemetry data stream. The MSFC TDM construction standard is documented in MSFC-STD-1274B, Volume 1, MSFC HOSC Telemetry Format Standard (TDM). TDM_ID is the stream identifier of the TDM stream. FORMAT_ID_MSID is the measurement name that is used to determine the location of the format ID within the stream. TDM_ID and the format ID uniquely defines the format for the stream. TIME_MSID is the measurement name that is used to determine the location of an embedded time within the stream. Whenever an MSID is used to determine the location of the data in a stream, the MSID Sampling table (see Section 2.14) and MSID Location table (see Section 2.15) should be referenced.

SYNC_PATTERN is the hexadecimal representation of the pattern used by hardware to lock onto an incoming stream. SYNC_PATTERN_MSID is the measurement name that is used to determine the location of the sync pattern in the stream. SYNC_LENGTH indicates the length of the sync pattern.

See the TDM table, Table 2.10-1, for detailed information. Figure 2.10-1 is a guide to populating the TDM table.

Table 2.10-1. TDM Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
TDM_ID	4	character	Identifier of the TDM stream. NOTE: Must be provided by the project/mission manager.
FORMAT_ID_MSID	20	character	MSID used to look up the location of the format ID within the stream. NOTE: Must be provided by the project/mission manager.
TIME_MSID	20	character	MSID used to look up the location of an embedded time within the stream. NOTE: Must be provided by the project/mission manager.
SYNC_PATTERN	16	hexadecimal	Hexadecimal representation of the data stream sync pattern. NOTE: Must be provided by the project/mission manager.
SYNC_PATTERN_MSID	20	character	MSID used to look up the location of the sync pattern within the stream. NOTE: Must be provided by the project/mission manager.
SYNC_LENGTH	3	integer	Length of the sync pattern in bits. NOTE: Must be provided by the project/mission manager.

The following is an example of how to populate the TDM table:

EXAMPLE 1:	
TDM_ID	= EC
FORMT_ID_MSID	= L71M1003P
TIME_MSID	= L71W3165A
SYNC_PATTERN	= FAF320
SYNC_PATTERN_MSID	= L71M1001P
SYNC_LENGTH	= 24

Figure 2.10-1. Example Entries for TDM Table

2.11 TDM FORMAT TABLE

The TDM Format table contains the information required by MSFC HOSC to process a telemetry data stream for a unique format. TDM_ID, along with TDM_FORMAT_ID, defines this unique TDM format. TDM_FORMAT_ID is the three-character ID that corresponds to the hexadecimal downlinked FORMAT data in the data stream. BITS_PER_WORD defines the size of the addressing word for determining the word location within a minor frame. Addressing can be either by byte (8 bits) or word (16 bits). WORDS_PER_MINOR_FRAME indicate the number of bytes or words in each minor frame. MINOR_FRAMES_PER_MAJOR_FRAME indicates the number of minor frames in each major frame. DATA_CYCLE indicates the number of major frames that are required to include at least one sample of every measurement for this format. MAJOR_FRAME_PERIOD indicates the number of seconds required to receive an entire major frame of data.

All TDM data streams will be encapsulated in packets for distribution within the HOSC processing facility. When the stream is encapsulated into a packet, the unique stream number must be provided by the System. ENCAP_STREAM_NUMBER is the HOSC-unique stream number (see Stream ID table, Section 2.12) identifying the stream and format of the packet used to transmit the TDM stream. Likewise, ENCAP_BOUNDARY and ENCAP_FRAME_PER_ PACKET must be provided by the System. This information describes how many minor frames or major frames are encapsulated in each packet. For further explanation of encapsulation of TDM data streams, see MSFC-STD-1274B, Volume 2, Telemetry Format Standard (Packet).

See the TDM Format table, Table 2.11-1, for detailed information. Figure 2.11-1 is a guide to populating the TDM Format table.

Table 2.11-1. TDM Format Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
TDM_ID	4	character	Unique identifier for a TDM stream. NOTE: Must be provided by the project/mission manager.
TDM_FORMAT_ID	3	character	Unique identifier for a format. NOTE: Must be provided by the project/mission manager.
FORMAT	4	hexadecimal	Hexadecimal representation of the downlinked format ID pattern. NOTE: Must be provided by the project/mission manager.
BITS_PER_WORD	2	integer	Indicates bits per word. NOTE: Must be provided by the project/mission manager.
WORDS_PER_ MINOR_FRAME	4	integer	Indicates words per minor frame. NOTE: Must be provided by the project/mission manager.
MINOR_FRAMES_PER_MAJOR_ FRAME	4	integer	Indicates minor frames per major frame. NOTE: Must be provided by the project/mission manager.
DATA_CYCLE	2	integer	Number of major frames required to include at least one sample of every measurement in a format. NOTE: Must be provided by the project/mission manager.
MAJOR_FRAME_ PERIOD	8	floating point	Indicates the number of seconds required to receive an entire major frame of data. NOTE: Must be provided by the project/mission manager.
ENCAP_STREAM_NUMBER	4	integer	Identifies the unique stream number in which the TDM stream is encapsulated.

Table 2.11-1. TDM Format Table (Continued)

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
ENCAP_BOUNDARY	1	character	Indicates whether the TDM stream is encapsulated on a minor frame or a major frame boundary within a packet. “F” - minor frame boundary, hence ENCAP_FRAME_PER_ PACKET is the number of minor frames. “M” - Major frame boundary, hence ENCAP_FRAME_PER_ PACKET is the number of major frames. NOTE: Derived by a HOSC database application program.
ENCAP_FRAME_ PER_PACKET	4	integer	Number of major or minor frames encapsulated in a packet (see ENCAP_BOUNDARY). NOTE: Derived by a HOSC database application program.

The following are examples of how to populate the TDM Format table:

EXAMPLE 1:	
TDM_ID	= EC
TDM_FORMAT_ID	= AA
FORMAT	= 0020
BITS_PER_WORD	= 16
WORDS_PER_MINOR_ FRAME	= 160
MINOR_FRAMES_PER_ MAJOR_FRAME	= 20
DATA_CYCLE	= 8
MAJOR_FRAME_PERIOD	= 1.0
ENCAP_STREAM_NUMBER	= 19
ENCAP_BOUNDARY	= M
ENCAP_FRAME_PER_ PACKET	= 1
EXAMPLE 2:	
TDM_ID	= EC
TDM_FORMAT_ID	= BB
FORMAT	= 002A
BITS_PER_WORD	= 16
WORDS_PER_MINOR_ FRAME	= 160
MINOR_FRAMES_PER_ MAJOR_FRAME	= 20
DATA_CYCLE	= 8
MAJOR_FRAME_PERIOD	= 1.0
ENCAP_STREAM_NUMBER	= 19
ENCAP_BOUNDARY	= M
ENCAP_FRAME_PER_ PACKET	= 1

Figure 2.11-1 Example Entries for TDM Format Table

2.12 STREAM ID TABLE

The Stream ID table contains the STREAM_NUMBER and STREAM_TYPE for each of the streams and formats for this database. STREAM_ID contains the PACKET_ID, BLOCK_ID, SUBSET_ID or TDM_ID of the stream identified by the STREAM_NUMBER. STREAM_FORMAT_ID contains the PACKET_FORMAT_ID, BLOCK_FORMAT_ID, SUBSET_FORMAT_ID or the TDM_FORMAT_ID for the stream and format being identified. PROTOCOL contains the packet protocol when the stream is a packet. STREAM_PRIORITY is the priority in which streams should be processed, if any streams contain the same subset or the same measurements. If all measurements in the stream have data privacy constraints, the proprietary data flag STREAM_PROP should be set. STREAM_OWNER_ID defines the owner of the stream. STREAM_DESCRIPTION is a text description of any additional information that may be needed for the stream.

See the Stream ID table, Table 2.12-1, for detailed information. Figure 2.12-1 is a guide to populating the Stream ID table. It should be noted that a user must supply a unique set of stream numbers for all formats of all streams. Different sources of data can contain the identical stream numbers, but numbers must be unique within each source. When the different sources are merged into the integrated tables, if duplicate stream numbers exist, the database developer will renumber the stream numbers to resolve the conflicts. Streams numbers are only a convenient method of tying measurements to formats of streams. Stream numbers are also used to tie streams to other streams of possibly a different structure.

Table 2.12-1. Stream ID Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
STREAM_NUMBER	4	integer	Unique number identifying the stream and format. NOTE: Must be provided by the project/mission manager.
STREAM_TYPE	1	character	Indicates the type of data stream. “B” - Block. “P” - Packet. “S” - Subset. “T” - TDM. NOTE: Must be provided by the project/mission manager.
STREAM_ID	4	character	Identifier of the stream. NOTE: Must be provided by the project/mission manager.
STREAM_FORMAT_ID	3	character	Unique format identifier of the stream. NOTE: Must be provided by the project/mission manager.
PROTOCOL	1	character	Indicates the protocol of a packet. “C” - indicates a CCSDS packet. “G” - indicates GSE packet. “P” - indicates a pseudo-telemetry packet. “B” - indicates an encapsulated Block packet. “T” - indicates an encapsulated TDM stream. “D” - indicates a TDS packet.
STREAM_PRIORITY	2	integer	Priority of the stream format. NOTE: Must be provided by the project/mission manager.
STREAM_PROP	1	character	Indicates the stream has proprietary data. “Y” - Yes, contains proprietary data. “N” - Does not contain proprietary data. NOTE: Must be provided by the project/mission manager.
STREAM_OWNER_ ID	20	character	Unique identifier that indicates the owner of the stream. NOTE: Must be provided by the project/mission manager.
STREAM_DESCRIPTION	250	character	Text description of the stream being defined.

The following are examples of how to populate the Stream ID table:

EXAMPLE 1:

STREAM_NUMBER	= 1
STREAM_TYPE	= P
STREAM_ID	= 1001
STREAM_FORMAT_ID	= AA
PROTOCOL	= C
STREAM_PRIORITY	=
STREAM_PROP	= N
STREAM_OWNER_ID	= BBXRT
STREAM_DESCRIPTION	= Sample packet stream

EXAMPLE 2:

STREAM_NUMBER	= 3
STREAM_TYPE	= S
STREAM_ID	= 2001
STREAM_FORMAT_ID	= AA
PROTOCOL	=
STREAM_PRIORITY	=
STREAM_PROP	= Y
STREAM_OWNER_ID	= ACIS
STREAM_DESCRIPTION	= Sample subset stream

EXAMPLE 3:

STREAM_NUMBER	= 19
STREAM_TYPE	= T
STREAM_ID	= EC
STREAM_FORMAT_ID	= AA
PROTOCOL	=
STREAM_PRIORITY	=
STREAM_PROP	= N
STREAM_OWNER_ID	= ASTRO-2
STREAM_DESCRIPTION	= Sample TDM stream

EXAMPLE 4:

STREAM_NUMBER	= 23
STREAM_TYPE	= B
STREAM_ID	= 19

Figure 2.12-1. Example Entries for Stream ID Table

EXAMPLE 4 (Cont.):	
STREAM_FORMAT_ID	= 01
PROTOCOL	=
STREAM_PRIORITY	=
STREAM_PROP	= N
STREAM_OWNER_ID	= STS-77_OPS
STREAM_DESCRIPTION	= Sample block stream

Figure 2.12-1. Example Entries for Stream ID Table (Continued)

2.13 MEASUREMENT TABLE

The Measurement table contains general information required by MSFC HOSC to process a measurement. MSID is the measurement name of the parameter. Each measurement in the database is accessed in only one manner, and that is by using an MSID name. TECHNICAL_NAME is a short user-friendly name for the measurement. DATA_TYPE defines how the data is represented and how the data is to be processed (see MSFC-STD-1274 for valid data types). CALIBRATION_TYPE indicates the type of calibration or conversion required to process the raw data for the measurement (polynomial, point pair, or state code). Polynomial and point pair calibration can only be performed on a measurement that has a data type of floating point, or that has a data type of integer with a total length less than or equal to 32 bits. State conversion can only be performed on a measurement with a data type equal to a discrete. ENG_UNIT is the engineering units label for the measurement (see Appendix D for valid engineering units). LOW_RAW_COUNT and HIGH_RAW_COUNT are the minimum and maximum raw counts, respectively. Low and high raw counts are not used by the real-time system, and are provided for information only. TOTAL_LENGTH is the total number of bits for the measurement, unless the data is string data. For string data, the total length is the total number of bytes. If the measurement has data privacy constraints, the proprietary data flag PROP must be set.

A measurement can have the following sampling compositions: normal, super, counter dependent, or range dependent. COUNTER_MSID is the measurement name of a parameter that is evaluated in real time to determine if a counter dependent measurement is active. Likewise, RANGE_MSID is the measurement name of a parameter that is evaluated in real time to determine if a range dependent measurement is active. Sampling compositions are defined in MSFC-STD-1274B, Volume 2, MSFC HOSC Telemetry Format Standard (Packet). The counter and the range limits for each of these measurements are defined in the MSID Sampling table (see Section 2.14).

A measurement can have switch calibration sets, each that are based on the value of another switch measurement. Depending on a measurements data type, a measurement can have limits sets, or expected state sets, each that are based on the value of another switch measurement. It should be noted that switching is not a normal case, but is an enhancement to the real-time system. Switching is not required by the system, and can be used at the discretion of a project.

CALIBRATION_SWITCH_MSID is the measurement name of a parameter that is evaluated in real time to determine which calibration set is to be used. The value of the switch measurement is evaluated against the data in the Calibration Switch table (see Section 2.20). CALIBRATION_DEFAULT_SET_NUM is the default set number for the calibration set. If multiple calibration sets are available, but no CALIBRATION_SWITCH_MSID is specified, the system will use the default set for calibration processing. Calibration and conversion sets are defined in the Polynomial Calibration table (see Section 2.17), the Point Pair table (see Section 2.18), and the State Code table (see Section 2.19).

LIMIT_SWITCH_MSID is the measurement name of a parameter that is evaluated in real time to determine which limits set is to be used. The value of the switch measurement is evaluated against the data in the Limit Switch table (see Section 2.22). LIMIT_DEFAULT_SET_NUM is the default set number for the limits set. If multiple limits sets are available, but no

LIMIT_SWITCH_MSID is specified, the system will use the default set for limits processing. Limits sets are defined in the Limit table (see Section 2.21).

ES_SWITCH_MSID is the measurement name of a parameter that is evaluated in real time to determine which expected state is to be used for a measurement that has state codes. The value of the switch measurement is evaluated against the data in the Expected State Switch table (see Section 2.24). ES_DEFAULT_SET_NUM is the default set number for the expected state. If multiple expected state sets are available, but no ES_SWITCH_MSID is specified, the system will use the default set for expected state processing. Expected state sets are defined in the Expected State table (see Section 2.23).

The OWNER_ID is the owner of the measurement. DESCRIPTION may contain any additional text that needs to be associated with a measurement. EHS_HEADER_FLAG indicates whether the measurement is included in the EHS header data, or is included in the user data.

If a measurement can be limit sensed, then the last value of the parameter must be maintained by the real-time system. A HOSC database application program will derive the Last Refresh Value Table (LRVT) location for the measurement. LIMIT_LRVT_LOCATION contains the starting byte location of the LRVT. EM_ERROR_DESCRIPTION is the text of the error message for the Exception Monitor error.

See the Measurement table, Table 2.13-1, for detailed information. Figure 2.13-1 is a guide to populating the Measurement table.

Table 2.13-1. Measurement Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name assigned to the parameter. NOTE: Must be provided by the project/mission manager.
TECHNICAL_NAME	59	character	Text description.
DATA_TYPE	5	character	Data type of the parameter (see MSFC-STD-1274). NOTE: Must be provided by the project/mission manager.
CALIBRATION_ TYPE	2	character	Indicates the calibration/conversion processing: “PC” - Polynomial Calibration. “PP” - Point Pair Calibration. “SC” - State Code Conversion. “N” - No processing. NOTE: Must be provided by the project/mission manager.
ENG_UNIT	10	character	Engineering units associated with the parameter (see Appendix D for valid entries.)
LOW_RAW_COUNT	12	integer	Decimal number corresponding to the minimum expected binary count. Does not apply to floating points or character strings. NOTE: Must be provided by the project/mission manager.
HIGH_RAW_COUNT	12	integer	Decimal number corresponding to the maximum expected binary count. Does not apply to floating points or character strings. NOTE: Must be provided by the project/mission manager.

Table 2.13-1. Measurement Table (Continued)

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
TOTAL_LENGTH	3	integer	Length of the parameter. If the data is defined to be string data, then TOTAL_LENGTH contains the number of characters/bytes in the parameter; otherwise TOTAL_LENGTH column contains the number of bits in a parameter. NOTE: Must be provided by the project/mission manager.
PROP	1	character	Indicates the measurement may contain proprietary data. "Y" - Yes, contains proprietary data. "N" - No, does not contain proprietary data.
COUNTER_MSID	20	character	Measurement name for a counter parameter that is used for counter dependent sampling.
RANGE_MSID	20	character	Measurement name for a range parameter that is to be used for range dependent sampling.
CALIBRATION_ SWITCH_MSID	20	character	Measurement name of parameter to be used to perform switching between sets of calibration. If blank, no calibration switching is performed.
CALIBRATION_DEFAULT_SET_NUM	2	integer	Set number of default calibration set.
LIMIT_SWITCH_ MSID	20	character	Measurement name of parameter to be used to perform switching between sets of limits. If blank, no limit switching is performed.
LIMIT_DEFAULT_ SET_NUM	2	integer	Set number of default limit set.
ES_SWITCH_MSID	20	character	Measurement name of parameter to be used to perform switching of expected states. If blank, no expected state switching is performed.
ES_DEFAULT_SET_NUM	2	integer	Set number of default expected state set.
OWNER_ID	20	character	Unique identifier that indicates the authorized owner of measurements. NOTE: Must be provided by the project/mission manager.
DESCRIPTION	250	character	Text description of the measurement.

Table 2.13-1. Measurement Table (Continued)

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
EHS_HEADER_ FLAG	1	character	Indicates whether the measurement is included in the EHS header, or is included in the user data. "H" - Measurement is in the EHS header data. "U" - Measurement is in the user data.
LIMIT_LRVT_LOCATION	6	integer	The starting byte location of the limit sensing LRVT for the database revision. A HOSC database application program will derive the LRVT location of the measurement.
EM_ERROR_DESCRIPTION	60	character	Text description of the Exception Monitor error message.

The following are examples of how to populate the Measurement table:

EXAMPLE 1:	
MSID	= B55T1201A
TECHNICAL_NAME	= LEFT SRB TEMP 1201
DATA_TYPE	= IUNS
CALIBRATION_TYPE	= PC
ENG_UNIT	= DEGF
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 255
TOTAL_LENGTH	= 8
PROP	= N
COUNTER_MSID	= B55Q004A
RANGE_MSID	=
CALIBRATION_SWITCH_ MSID	=
CALIBRATION_DEFAULT_SET_NUM	= 1
LIMIT_SWITCH_MSID	= B55M2008P
LIMIT_DEFAULT_SET_ NUM	= 1
ES_SWITCH_MSID	=
ES_DEFAULT_SET_NUM	=
OWNER_ID	= STS_SRB
DESCRIPTION	= Counter Dependent Temp with Limit Switch
EHS_HEADER_FLAG	= U
LIMIT_LRVT_LOCATION	=
EM_ERROR_DESCRIPTION	=
EXAMPLE 2:	
MSID	= L71C1247A
TECHNICAL_NAME	= COUNTER MSID
DATA_TYPE	= IUNS
CALIBRATION_TYPE	=
ENG_UNIT	=
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 7
TOTAL_LENGTH	= 3
PROP	= Y
COUNTER_MSID	=
RANGE_MSID	=
CALIBRATION_SWITCH_ MSID	=

Figure 2.13-1. Example Entries for Measurement Table

EXAMPLE 2 (Cont.):		
CALIBRATION_DEFAULT_SET_NUM	=	
LIMIT_SWITCH_MSID	=	
LIMIT_DEFAULT_SET_ NUM	=	
ES_SWITCH_MSID	=	
ES_DEFAULT_SET_NUM	=	
OWNER_ID	=	ASTRO-2
DESCRIPTION	=	Counter MSID from 0 to 7
EHS_HEADER_FLAG	=	U
LIMIT_LRVT_LOCATION	=	
EM_ERROR_DESCRIPTION	=	

Figure 2.13-1. Example Entries for Measurement Table (Continued)

2.14 MSID SAMPLING TABLE

The MSID Sampling table contains the information that describes the parameter composition type and the arrangement of the measurement samples in a telemetry stream. The parameter location is defined in the MSID Location table (see Section 2.15). Since data for a measurement can be in different streams, and can be in different formats for each stream, the information for each unique stream must be defined in this table. MSID is the measurement name of the parameter to be extracted from a stream. STREAM_NUMBER is a unique HOSC number (see Stream ID table, Section 2.12) identifying the stream and format of the telemetry stream. PAR_COMP defines the parameter composition type for a sample of the measurement. Possible parameter compositions are bit contiguous (typical), bit non-contiguous (multisyllable), bit contiguous group, and bit non-contiguous group. See the MSFC-STD-1274 document for detailed information on parameter composition. SAMPLE_PER_GROUP defines the number of samples per group for group parameters. GROUP_SAMPLE_OFFSET is used for parameter composition and defines the bit offset from the first bit of the first occurrence of a bit non-contiguous group parameter to the first bit of the next occurrence of the parameter in the group. The bit offset must be the same for all occurrences in the group.

SAMPLE_COMP defines how multiple samples for a defined parameter composition are arranged in the stream. Possible sampling compositions are normal, super, counter dependent, and range dependent. Normal sampling contains only one sample per data stream, whether a major frame, a packet, or a subset. Super sampling contains more than one sample per data stream. Counter dependent sampling indicates that a counter measurement is used to determine if the measurement is available in the stream. Range dependent sampling indicates that a range measurement is used to determine if the measurement is available in the stream.
SAMPLE_RATE is the sample rate of the defined parameter composition in samples per data stream. OFFSET is used for sampling composition and defines the offset, in words or octets, from the first occurrence of the parameter to the next occurrence of the parameter for super sampling. The offset must be the same for all samples of the parameter.

START_COUNTER_VALUE is the starting value that is compared with the real-time value of a counter to determine when a counter dependent measurement is available.
COUNTER_OFFSET is the value to be added to the starting value to determine all the additional counts when the measurement is available. For example, if the initial value is 1 and the delta is 2, data for the counter dependent measurement will be available when the counter is 1, 3, 5, 7, etc.

A range dependent measurement is available based on the real-time value of a range parameter in the data stream. The value of the range parameter is evaluated against either a range of values or a state code. If the range is based on a range of values, then LOW_RANGE and HIGH_RANGE are the low and high values for the range. An example for a range of values is low is 5.1 and high is 12.2. The measurement will be available when the range value is greater than 5.1 and less than or equal to 12.2. If the range is based on a state code, then STATE_CODE is the state code for the range. An example for a range state code is “ON.” The measurement will be available when the range value is equivalent to “ON.”
If a measurement is counter dependent or range dependent, then the last value of the context dependent parameter must be maintained by the real-time system for the packet that contained the measurement. A HOSC database application program will derive the LVT location of the

measurement for the packet. CONTEXT_PACKET_ID is the packet ID of the packet that contains the measurement. CONTEXT_LVT_LOCATION contains the starting byte location of the LVT. CONTEXT_PROTOCOL is the packet protocol of the packet that contains the measurement.

See the MSID Sampling table, Table 2.14-1, for detailed information. Figure 2.14-1 is a guide to populating the MSID Sampling table. See Table 2.14-2, Old TDM POCC Sample Types Versus New Tables, as to how to implement the MSFC-DOC-1149B Sample Types in the new tables.

Table 2.14-1. MSID Sampling Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name assigned to the parameter. NOTE: Must be provided by the project/mission manager.
STREAM_NUMBER	4	integer	Unique number identifying the stream and format. NOTE: Must be provided by the project/mission manager.
PAR_COMP	2	character	Indicates the parameter composition of the measurement. “T” - Bit-contiguous typical. “MS” - Bit non-contiguous multisyllable. “BG” - Bit contiguous group parameter. “NG” - Bit non-contiguous group parameter. NOTE: Must be provided by the project/mission manager.
SAMPLE_PER_ GROUP	3	integer	Number of samples in a group.
GROUP_SAMPLE_ OFFSET	7	integer	Offset in bits to the next occurrence of a sample in a non-contiguous group.

Table 2.14-1. MSID Sampling Table (Continued)

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
SAMPLE_COMP	1	character	Sampling composition that describes how samples of a parameter are arranged in the stream. "N" - Normal occurrence or once per major frame, packet, or subset. "S" - Super occurrence or more than once per major frame, packet, or subset. "C" - Counter dependent sampling. "R" - Range dependent sampling. NOTE: Must be provided by the project/ mission manager.
SAMPLE_RATE	3	integer	Rate of parameter samples in samples per data stream. NOTE: Must be provided by the project/mission manager.
OFFSET	6	integer	Words/octets to the next occurrence of a super sampled parameter.
START_COUNTER_VALUE	4	integer	Start value for first valid occurrence of a counter dependent parameter.
COUNTER_OFFSET	4	integer	Counter delta value to add to the start value to derive all other valid occurrences of a counter dependent parameter.
LOW_RANGE	16	floating point	Low end of the range in engineering units of the range measurement for a range dependent parameter.
HIGH_RANGE	16	floating point	High end of the range in engineering units of the range measurement for a range dependent parameter.
STATE_CODE	12	character	State code of the range measurement for a range dependent parameter.
CONTEXT_PACKET_ID	4	integer	The packet ID of the packet that contains the counter dependent or range dependent parameter.
CONTEXT_LVT_ LOCATION	6	integer	The starting byte location of the context LVT for the packet ID. A HOSC database application program will derive the LVT location of the parameter for the packet.
CONTEXT_PROTOCOL	1	character	The protocol of the packet that contains the counter dependent or range dependent parameter.

The following examples depict how to populate the MSID Sampling table:

EXAMPLE 1:	
MSID	= R23D9382D
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_PER_GROUP	=
GROUP_SAMPLE_OFFSET	=
SAMPLE_COMP	= S
SAMPLE_RATE	= 10
OFFSET	= 125
START_COUNTER_VALUE	=
COUNTER_OFFSET	=
LOW_RANGE	=
HIGH_RANGE	=
STATE_CODE	=
CONTEXT_PACKET_ID	=
CONTEXT_LVT_LOCATION	=
CONTEXT_PROTOCOL	=
EXAMPLE 2:	
MSID	= R23D9382A
STREAM_NUMBER	= 2
PAR_COMP	= MS
SAMPLE_PER_GROUP	=
GROUP_SAMPLE_OFFSET	=
SAMPLE_COMP	= R
SAMPLE_RATE	= 1
OFFSET	=
START_COUNTER_VALUE	=
COUNTER_OFFSET	=
LOW_RANGE	= 0.25
HIGH_RANGE	= 5.26
STATE_CODE	=
CONTEXT_PACKET_ID	=
CONTEXT_LVT_ LOCATION	=
CONTEXT_PROTOCOL	=

Figure 2.14-1. Example Entries for MSID Sampling Table

2.15 MSID LOCATION TABLE

The MSID Location table contains the information that is required by MSFC HOSC to define the start location of a measurement for each stream and format defined in the MSID Sampling table. MSID is the measurement name of the parameter to be extracted. STREAM_NUMBER is a unique HOSC number identifying the stream and format of the telemetry stream. SYLLABLE_NUMBER is the number of each syllable required to compose the parameter. All parameter compositions, except for multisyllable, will have only one syllable. Multisyllable measurements will have as many syllables, in ascending syllable number, as is required to define the total data length. START_MINOR_FRAME is the minor frame of the first sample for a TDM stream. START_MINOR_FRAME is not applicable for packet, block, or subset streams. START_WORD is the word location of the syllable within the minor frame of a TDM stream. (NOTE: a word for TDM can be 8 bits or 16 bits as defined in the TDM Format table). For the other data streams, START_WORD for the syllable is always an 8-bit word location (i.e., start octet). START_BIT is the starting bit within the word. LENGTH is the length of the syllable. The sum of lengths for each syllable must be equal to the total length as defined in the Measurement table. LENGTH is defined to be the number of bits per syllable for all data types, except for string data. For string data types, the LENGTH is defined to be the number of bytes per syllable.

See the MSID Location table, Table 2.15-1 for detailed information. Figure 2.15-1 is a guide to populating the MSID Location table.

Table 2.15-1. MSID Location Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name assigned to the parameter. NOTE: Must be provided by the project/ mission manager.
STREAM_NUMBER	4	integer	Unique stream number identifying the stream and format. NOTE: Must be provided by the project/ mission manager.
SYLLABLE_NUMBER	2	integer	Indicates the order in which the pieces of a multisyllable parameter are to be reassembled. NOTE: Must be provided by the project/ mission manager.
START_MINOR_ FRAME	4	integer	Indicates the number of the first minor frame number that contains this parameter (used for TDM streams only). NOTE: Must be provided by the project/ mission manager.
START_WORD	6	integer	Indicates the start word within a minor frame for TDM, or the start octet within a packet, block, or subset. NOTE: Must be provided by the project/ mission manager
START_BIT	2	integer	Indicates the start bit number within the word or octet. NOTE: Must be provided by the project/ mission manager
LENGTH	3	integer	Indicates the length of the syllable. The length for this measurement depends on the data type. For string data types, LENGTH contains the number of characters in the syllable; otherwise, LENGTH contains the number of bits in the syllable. NOTE: Must be provided by the project/ mission manager

The following are examples of how to populate the MSID Location table. Example 1 defines a 48-bit multisyllable measurement for a TDM stream. Example 2 defines a 12-bit typical measurement for a packet or a subset.

EXAMPLE: 1			
MSID	= R23D1928C	R23D1928C	R23D1928C
STREAM_NUMBER	= 2	2	2
SYLLABLE_NUMBER	= 1	2	3
START_MINOR_FRAME	= 3	4	5
START_WORD	= 5	5	5
START_BIT	= 0	0	0
LENGTH	=1 6	16	16
EXAMPLE 2:			
MSID	= R23D3245A		
STREAM_NUMBER	= 1		
SYLLABLE_NUMBER	= 1		
START_MINOR_FRAME	=		
START_WORD	= 139		
START_BIT	= 4		
LENGTH	= 12		

Figure 2.15-1. Example Entries for MSID Location Table

2.16 COUNTER TABLE

The Counter table contains characteristics about counter measurements within a data stream. Packet data streams have packet counters and subset data streams can have subset counters. TDM data streams have minor frame counters and can have major frame counters for counter dependent sampling composition. Other counters may be specified if necessary.

MSID is the measurement name of the counter downlinked in the data stream. STREAM_NUMBER is a unique HOSC number (see Stream ID table, Section 2.12) identifying the stream and format of the telemetry stream. If a measurement is counter dependent, then the measurement and the counter measurement must be contained in the same data stream. INIT_VALUE is the initial value of the counter when it starts counting. END_VALUE is the ending value of the counter. WRAP_AROUND_FLAG indicates whether the counter counts past major frame and/or data cycle boundaries. DIR indicates the direction (increment/decrement) of the counter, and DELTA indicates the delta between counts. The COUNTER_TYPE is used to determine what type of processing a particular counter supports.

See the Counter table, Table 2.16-1, for detailed information. Figure 2.16-1 is a guide to populating the Counter table.

Table 2.16-1. Counter Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name assigned to the telemetered parameter. NOTE: Must be provided by the project/mission manager.
STREAM_NUMBER	4	integer	Unique number identifying the stream and format. NOTE: Must be provided by the project/mission manager.
INIT_VALUE	4	integer	Initial counter value. NOTE: Must be provided by the project/mission manager.
END_VALUE	4	integer	Ending counter value. NOTE: Must be provided by the project/mission manager.
WRAP_AROUND_ FLAG	1	character	Indicates whether the counter wraparound. “W” - Wraparound counter. “N” - Not a wrap around counter. Example: For 8 minor frames/major frame and 4 major frames/data cycle, a minor frame wraparound counter would count from 1 to 32. NOTE: Must be provided by the project/mission manager.
DIR	1	character	Indicates the direction of the counter. “+” - Counter increments. “-” - Counter decrements. NOTE: Must be provided by the project/mission manager.
DELTA	2	integer	Indicates the counter delta between successive occurrences of a counter in a stream. NOTE: Must be provided by the project/mission manager.

Table 2.16-1. Counter Table (Continued)

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
COUNTER_TYPE	3	character	Indicates the type of counter. “B” - Block counter. “P” - Packet counter. “S” - Subset counter. “MIN” - Minor frame counter. “MAJ” - Major frame counter. “N” - General Counter to be used for counter dependent sampling composition. NOTE: Must be provided by the project/mission manager.

The following examples show how to populate the Counter table. Example 1 defines a counter dependent exception monitoring counter that counts from 1 to 15 by +2. Example 2 defines a minor frame counter that counts from 0 to 19 by +1.

EXAMPLE 1:

MSID	= L71Q1247A
STREAM_NUMBER	= 3
INIT_VALUE	= 1
END_VALUE	= 15
WRAP_AROUND_FLAG	= Y
DIR	= +
DELTA	= 2
COUNTER_TYPE	= N

EXAMPLE 2:

MSID	= L71Q1276A
STREAM_NUMBER	= 5
INIT_VALUE	= 0
END_VALUE	= 19
WRAP_AROUND_FLAG	= N
DIR	= +
DELTA	= 1
COUNTER_TYPE	= MIN

Figure 2.16-1. Example Entries for Counter Table

2.17 POLYNOMIAL CALIBRATION TABLE

The Polynomial Calibration table contains the information that is required to calibrate a measurement using the polynomial calibration equation. This table is used when the calibration type in the Measurement table (see Section 2.13) equals "PC." The polynomial equation that converts raw counts (cnts) to engineering units (eu) is as follows:

$$eu = COEF0 + (cnts \times COEF1) + (cnts^2 \times COEF2) + (cnts^3 \times COEF3)$$

$$+ (cnts^4 \times COEF4) + (cnts^5 \times COEF5) + (cnts^6 \times COEF6)$$

$$+ (cnts^7 \times COEF7) + (cnts^8 \times COEF8) + (cnts^9 \times COEF9)$$

MSID is the measurement name of the parameter to be calibrated. Multiple calibration sets can be defined, and switching can be controlled as defined in the Calibration Switch table (see Section 2.20). If switching is not being used and multiple calibration sets are defined, the set number can be changed in real time by changing the default set number in the Measurement table (see Section 2.13) in the real-time local table. CALIBRATION_SET_NUM is a unique number for each calibration set. ENG_UNIT_LOW and ENG_UNIT_HIGH are the engineering units that correspond to the low and high raw count definition in the Measurement table. Low and high engineering units are not used by the real-time system, and are provided for information only. Note that ENG_UNIT_LOW can be greater than ENG_UNIT_HIGH for a negative coef1. DEG is the degree of the polynomial equation, and defines the number of required non-null coefficients. The number of valid coefficients must be equal to degree+1. Polynomial calibration can only be performed on parameters with a data type of integer or floating point. Note that a discrete integer data type cannot be calibrated. COEF0 through COEF9 are the calibration coefficients.

See the Polynomial Calibration table, Table 2.17-1, for detailed information. Figure 2.17-1 is a guide to populating the Polynomial Calibration table.

Table 2.17-1. Polynomial Calibration Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name assigned to the parameter that is to be calibrated. NOTE: Must be provided by the project/ mission manager.
CALIBRATION_SET_NUM	2	integer	Identifies the polynomial calibration set number for the measurement that is to be calibrated. NOTE: Must be provided by the project/ mission manager.
ENG_UNIT_LOW	16	floating point	Engineering units that correspond to the low raw counts for the measurement.
ENG_UNIT_HIGH	16	floating point	Engineering units that correspond to the high raw counts for the measurement.
DEG	1	integer	Defines the degree of the polynomial equation. NOTE: Must be provided by the project/ mission manager.
COEF0	16	scientific notation	Polynomial coefficient 0. NOTE: Must be provided by the project/ mission manager.
COEF1	16	scientific notation	Polynomial coefficient 1. NOTE: Must be provided by the project/ mission manager.
COEF2	16	scientific notation	Polynomial coefficient 2.
COEF3	16	scientific notation	Polynomial coefficient 3.
COEF4	16	scientific notation	Polynomial coefficient 4.
COEF5	16	scientific notation	Polynomial coefficient 5.
COEF6	16	scientific notation	Polynomial coefficient 6.
COEF7	16	scientific notation	Polynomial coefficient 7.
COEF8	16	scientific notation	Polynomial coefficient 8.
COEF9	16	scientific notation	Polynomial coefficient 9.

The following examples show how to populate the Polynomial Calibration table:

EXAMPLE 1:			
MSID	= L71V8372A	L71V8372A	L71V8372A
CALIBRATION_SET_NUM	= 1	2	3
ENG_UNIT_LOW	= -5.0560	-5.0685	-5.1013
ENG_UNIT_HIGH	= +5.0165	+5.0805	+5.1242
DEG	= 1	1	1
COEF0	= 0.000	+0.0259	+0.0315
COEF1	= +0.0395	+0.0398	+0.0401
COEF2	=		
COEF3	=		
COEF4	=		
COEF5	=		
COEF6	=		
COEF7	=		
COEF8	=		
COEF9	=		
EXAMPLE 2:			
MSID	= V41P1154A		
CALIBRATION_SET_NUM	= 1		
ENG_UNIT_LOW	= 2.31197		
ENG_UNIT_HIGH	= 989.644		
DEG	= 2		
COEF0	= 2.31197		
COEF1	= 4.13153		
COEF2	= -0.7288E+03		
COEF3	=		
COEF4	=		
COEF5	=		
COEF6	=		
COEF7	=		
COEF8	=		
COEF9	=		

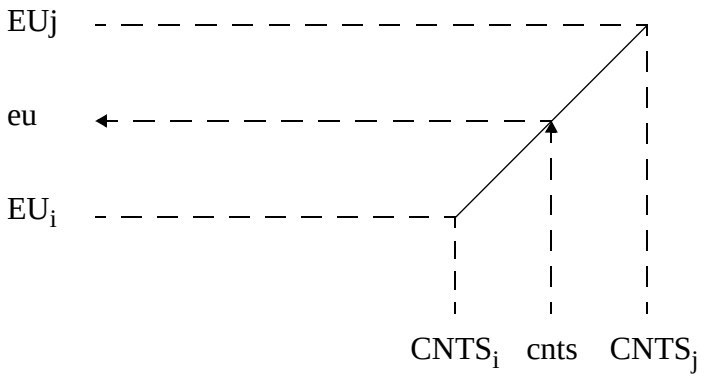
Figure 2.17-1. Example Entries for Polynomial Calibration Table

2.18 POINT PAIR TABLE

The Point Pair table contains the information that is required to calibrate a measurement using a series of linear segments. This table is used when the calibration type in the Measurement table (see Section 2.13) equals "PP." The linear segments are defined by a pair of points for each segment. Each point consists of a raw count value and a corresponding engineering units value. The linear segment equation that converts raw counts (cnts) to engineering units (eu) is as following:

$$eu = \frac{EU_j - EU_i}{CNTS_j - CNTS_i} X (cnts - CNTS_i) + EU_i$$

where $CNTS_i$ and EU_i are point pair i.
and $CNTS_j$ and EU_j are point pair j.



MSID is the measurement name of the parameter to be calibrated. Multiple calibration sets can be defined, and switching can be controlled as defined in the Calibration Switch table (see Section 2.20). If switching is not being used and multiple calibration sets are defined, the set number can be changed in real time by changing the default set number in the Measurement table (see Section 2.13) in the real-time local table. CALIBRATION_SET_NUM is a unique number for each calibration set. SEQUENCE_NUM is a unique number for each point pair within a calibration set. RAW_COUNT is the raw counts value and ENG_UNIT_VALUE is the corresponding engineering units value for the point pair. The maximum number of point pairs per set is 21. Linear segment calibration can only be performed on parameters with a data type of integer. Note that a discrete integer data type cannot be calibrated.

See the Point Pair table, Table 2.18-1, for detailed information. Figure 2.18-1 is a guide to populating the Point Pair table.

Table 2.18-1. Point Pair Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name assigned to the telemetered parameter that is to be calibrated. NOTE: Must be provided by the project/ mission manager.
CALIBRATION_SET_NUM	2	integer	Identifies the point pairs set number for the measurement that is to be calibrated. NOTE: Must be provided by the project/ mission manager.
SEQUENCE_NUM	2	integer	Identifies the unique sequence number for each point pair within a calibration set number. NOTE: Must be provided by the project/mis-sion manager.
RAW_COUNT	12	integer	Raw counts, including sign. NOTE: Must be provided by the project/ mission manager.
ENG_UNIT_VALUE	16	floating point	Engineering units that correspond to the raw counts. NOTE: Must be provided by the project/ mission manager.

The following examples show how to populate the Point Pair table:

EXAMPLE 1:					
MSID	= L71C67A	L71C67A	L71C67A	L71C67A	L71C67A
CALIBRATION_SET_ NUM	= 1	1	1	1	1
SEQUENCE_NUM	= 1	2	3	4	5
RAW_COUNT	= 0	25	52	133	184
ENG_UNIT_VALUE	= 12.0	13.85	16.90	22.0	19.66
EXAMPLE 2:					
MSID	= XX3456A	XX3456A	XX3456A	XX3456A	
CALIBRATION_SET_ NUM	= 2	2	2	2	
SEQUENCE_NUM	= 1	2	3	4	
RAW_COUNT	= -256	-108	119	255	
ENG_UNIT_VALUE	= -25.0	-13.8	10.9	23.2	

Figure 2.18-1. Example Entries for Point Pair Table

2.19 STATE CODE TABLE

The State Code table contains the information that is required to calibrate a measurement using discrete state code conversion. This table is used when the calibration type in the Measurement table (see Section 2.13) equals "SC." MSID is the measurement name of the parameter to be converted. State code conversion can only be performed on parameters with a data type of discrete integer. Multiple calibration sets can be defined, and switching can be controlled as defined in the Calibration Switch table (see Section 2.20). If switching is not being used and multiple calibration sets are defined, the set number can be changed in real time by changing the default set number in the Measurement table in the real-time local table. CALIBRATION_ SET_NUM is a unique number for each calibration set. SEQUENCE_NUM is a unique number for each state code within a calibration set. LOW_RAW_ COUNT and HIGH_RAW_COUNT are the low and high counts of the range that is associated with the STATE_CODE. If the value of the measurement is greater than or equal to the low counts and less than or equal to the high counts, STATE_CODE is the text state code for the measurement. The maximum number of state codes per set is 32.

See the State Code table, Table 2.19-1, for detailed information. Figure 2.19-1 is a guide to populating the State Code table.

Table 2.19-1. State Code Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name assigned to the parameter that is to be converted. NOTE: Must be provided by the project/ mission manager.
CALIBRATION_SET_NUM	2	integer	Identifies the state code set number for the measurement that is to be converted. NOTE: Must be provided by the project/ mission manager.
SEQUENCE_NUM	2	integer	Identifies the unique sequence number for each state code within a calibration set number. NOTE: Must be provided by the project/ mission manager.
LOW_RAW_COUNT	8	integer	Low raw counts of state code conversion range. NOTE: Must be provided by the project/ mission manager.
HIGH_RAW_ COUNT	8	integer	High raw counts of state code conversion range. NOTE: Must be provided by the project/ mission manager.
STATE_CODE	12	character	State code of the parameter when the data is within the state code conversion range. NOTE: Must be provided by the project/ mission manager.

The following examples show how to populate the State Code table:

EXAMPLE 1:

MSID	= L77XWZ	L77XWZ	L77XWZ	L77XWZ	L77XWZ
CALIBRATION_SET_NUM	= 1	1	1	1	1
SEQUENCE_NUM	= 1	2	3	4	5
LOW_RAW_COUNT	= 0	1	3	5	7
HIGH_RAW_COUNT	= 0	2	4	6	7
STATE_CODE	= CLOSED	OPENING	OPEN	CLOSING	LATCHED

EXAMPLE 2:

MSID	= L77XWZ	L77XWZ	L77XWZ
CALIBRATION_SET_NUM	= 2	2	2
SEQUENCE_NUM	= 1	2	3
LOW_RAW_COUNT	= 0	1	2
HIGH_RAW_COUNT	= 0	1	2
STATE_CODE	= CLOSED	OPEN	LATCHED

Figure 2.19-1. Example Entries for State Code Table

2.20 CALIBRATION SWITCH TABLE

The Calibration Switch table contains the information that is required to determine which set of calibration data is to be used for a measurement. It should be noted that switching is not a normal case, but is an enhancement to the real-time system. Switching is not required by the system, and can be used at the discretion of a project. If switching is not used, then the calibration switch measurement in the Measurement table (see Section 2.13) should be null. MSID is the measurement name of the parameter that requires calibration switching. CALIBRATION_ SET_NUM is a unique number for each calibration set to be used according to switch activation. The calibration or conversion information for each set number is defined in the Polynomial Calibration table (see Section 2.17), the Point Pair table (see Section 2.18), or the State Code table (see Section 2.19), depending on the calibration type. If the calibration switch measurement in the Measurement table is not null, then the switch measurement will be used to determine which calibration set is to be used. There are two methods for determining the calibration set to be used in real-time processing. The first method is to evaluate the switch measurement against a range of values defined by LOW_RANGE and HIGH_RANGE. If the value of the switch measurement is greater than the LOW_RANGE and is less than or equal to the HIGH_RANGE, the set number is used. The second method is to evaluate the switch measurement against a state code defined by STATE_CODE. If the state codes match, the set number is used. If no set number is determined, then the default set number is used.

See the Calibration Switch table, Table 2.20-1, for detailed information. Figure 2.20-1 is a guide to populating the Calibration Switch table.

Table 2.20-1. Calibration Switch Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name of the measurement that is to be calibrated. NOTE: Must be provided by the project/ mission manager.
CALIBRATION_SET_NUM	2	integer	Identifies the calibration set number for the measurement that is to be calibrated. NOTE: Must be provided by the project/ mission manager.
LOW_RANGE	16	floating point	Low end of the range in engineering units of the Calibration Switch Measurement. NOTE: Must be provided by the project/ mission manager.
HIGH_RANGE	16	floating point	High end of the range in engineering units of the Calibration Switch Measurement. NOTE: Must be provided by the project/ mission manager.
STATE_CODE	12	character	State code of the Calibration Switch Measurement. NOTE: Must be provided by the project/ mission manager.

The following are examples of how to populate the Calibration Switch table. Example 1 defines the calibration sets for an analog switch measurement. Example 2 defines the calibration sets for a discrete switch measurement.

EXAMPLE 1:				
MSID	=	L71Q9388D	L71Q9388D	L71Q9388D
CALIBRATION_SET_NUM	=	1	2	3
LOW_RANGE	=	12.0	25.3	33.2
HIGH_RANGE	=	25.3	33.2	45.9
STATE_CODE	=			
EXAMPLE 2:				
MSID	=	L71X9238E	L71X9238E	
CALIBRATION_SET_NUM	=	1	2	
LOW_RANGE	=			
HIGH_RANGE	=			
STATE_CODE	=	OFF	ON	

Figure 2.20-1. Example Entries for Calibration Switch Table

2.21 LIMIT TABLE

The Limit table contains the information that is required to determine the caution and warning limits to be used for a measurement. MSID is the measurement name of the parameter that is to be limit sensed. Limit sensing can only be performed on parameters with a data type of integer or floating point. Note that a discrete integer cannot have limits. Multiple limit sets can be defined, and switching can be controlled as defined in the Limit Switch table (see Section 2.22). If switching is not being used and multiple calibration sets are defined, the set number can be changed in real time by changing the default set number in the Measurement table (see Section 2.13) in the real-time local table. If the limit switch measurement in the Measurement table is not null, the set numbers in this table must match the set numbers defined in the Limit Switch table. LIMIT_SET_NUM is a unique number for each limit set. CAUTION_LOW and CAUTION_HIGH, and WARNING_LOW and WARNING_HIGH define the values that determine the limit violation for a measurement. If the value of the measurement is less than or equal to the WARNING_LOW, then a “low warning” condition exists. If the value is greater than the WARNING_LOW and less than or equal to the CAUTION_LOW, then a “low caution” condition exists. If the value is greater than or equal the CAUTION_HIGH and less than the WARNING_HIGH, then a “high caution” condition exists. If the value is equal to or greater than the WARNING_HIGH, then a “high warning” condition exists.

DELTA specifies a maximum delta value expected to occur between successive samples of a measurement. The delta value is in engineering units for a calibrated parameter, but can be in counts for an uncalibrated parameter. The delta value is used to issue notification when a maximum rate has been exceeded.

TOLER contains the number of consecutive limit violations that are to be tolerated before user notification procedures are initiated. The EM_ALL_SAMP_FLAG specifies whether the first sample or all samples of the measurement are to be tested for limit violations for exception monitoring.

See the Limit table, Table 2.21-1, for detailed information. Figure 2.21-1 is a guide to populating the Limit table.

Table 2.21-1. Limit Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name assigned to the parameter that is to be limit sensed. NOTE: Must be provided by the project/mission manager.
LIMIT_SET_NUM	2	integer	Identifies the limit set number for the measurement that is to be limit sensed. NOTE: Must be provided by the project/mission manager.
CAUTION_LOW	16	floating point	Low end of the caution range in engineering units for the measurement. NOTE: Must be provided by the project/mission manager.
CAUTION_HIGH	16	floating point	High end of the caution range in engineering units for the measurement. NOTE: Must be provided by the project/mission manager.
WARNING_LOW	16	floating point	Low end of the warning range in engineering units for the measurement. NOTE: Must be provided by the project/mission manager.
WARNING_HIGH	16	floating point	High end of the warning range in engineering units for the measurement. NOTE: Must be provided by the project/mission manager.
DELTA	16	floating point	A change in engineering units between two successive samples for the measurement. The change is an absolute value.
TOLER	2	integer	Number of consecutive limit violations to be tolerated before user notification.
EM_ALL_SAMP_ FLAG	1	character	Indicates whether all samples or only the first sample is used for exception monitoring. “A” - All samples. “F” - First sample. “N” - This parameter is not used for exception monitoring.

The following examples show how to populate the Limit table:

EXAMPLE 1:					
MSID	=	L71Q5849A	L71Q5849A	L71Q5849A	L71Q5849A
LIMIT_SET_NUM	=	1	2	3	4
CAUTION_LOW	=	12.0	11.8	11.6	11.25
CAUTION_HIGH	=	14.5	14.1	13.9	13.86
WARNING_LOW	=	9.6	9.6	9.9	10.15
WARNING_HIGH	=	21.7	21.7	20.5	19.75
DELTA	=	0.45	0.45	0.25	0.20
TOLER	=	10	5	2	1
EM_ALL_SAMP_FLAG	=	F	F	A	A
EXAMPLE 2:					
MSID	=	L71Q5823A			
LIMIT_SET_NUM	=	1			
CAUTION_LOW	=	-12.1			
CAUTION_HIGH	=	-8.2			
WARNING_LOW	=	-14.5			
WARNING_HIGH	=	-5.5			
DELTA	=	0.75			
TOLER	=	10			
EM_ALL_SAMP_FLAG	=	A			

Figure 2.21-1. Example Entries for Limit Table

2.22 LIMIT SWITCH TABLE

The Limit Switch table contains the information that is required to determine which set of limits is to be used for a measurement. It should be noted that switching is not a normal case, but is an enhancement to the real-time system. Switching is not required by the system, and can be used at the discretion of a project. If switching is not used, then the limit switch measurement in the Measurement table (see Section 2.13) should be null. MSID is the measurement name of the parameter that requires limit switching. LIMIT_SET_NUM is a unique number for each limit set to be used according to switch activation. The limits information for each set number is defined in the Limit table (see Section 2.21). If the limit switch measurement in the Measurement table is not null, then the switch measurement is used to determine which limits set is to be used. There are two methods for determining the limit set to be used in real-time processing. The first method is to evaluate the switch measurement against a range of values defined by LOW_RANGE and HIGH_RANGE. If the value of the switch measurement is greater than LOW_RANGE and is less than or equal to HIGH_RANGE, then the set number is used. The second method is to evaluate the switch measurement against a state code defined by STATE_CODE. If the state codes match, then the set number is used. If no set number is determined, then the default set number is used.

See the Limit Switch table, Table 2.22-1, for detailed information. Figure 2.22-1 is a guide to populating the Limit Switch table.

Table 2.22-1. Limit Switch Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name of the measurement that is to be limit sensed. NOTE: Must be provided by the project/mission manager.
LIMIT_SET_NUM	2	integer	Identifies the limit set number for the measurement that is to be limit sensed. NOTE: Must be provided by the project/mission manager.
LOW_RANGE	16	floating point	Low end of the range in engineering units for the Limit Switch Measurement. NOTE: Must be provided by the project/mission manager.
HIGH_RANGE	16	floating point	High end of the range in engineering units for the Limit Switch Measurement. NOTE: Must be provided by the project/mission manager.
STATE_CODE	12	character	State code of the Limit Switch Measurement. NOTE: Must be provided by the project/mission manager.

The following examples show how to populate the Limit Switch table. Example 1 defines the limit sets for an analog switch measurement. Example 2 defines the limit sets for a discrete switch measurement.

EXAMPLE 1:				
MSID	=	K67J9876D	K67J9876D	K67J9876D
LIMIT_SET_NUM	=	1	2	3
LOW_RANGE	=	0.0	35.6	49.9
HIGH_RANGE	=	35.5	49.8	53.2
STATE_CODE	=			
EXAMPLE 2:				
MSID	=	K67X3987E	K67X3987E	K67X3987E
LIMIT_SET_NUM	=	1	2	3
LOW_RANGE	=			
HIGH_RANGE	=			
STATE_CODE	=	CLOSED	OPENING	LATCHED

Figure 2.22-1. Example Entries for Limit Switch Table

2.23 EXPECTED STATE TABLE

The Expected State table contains the information that is required to determine the expected state for a measurement. MSID is the measurement name of the parameter that requires expected state sensing. Expected state sensing can only be performed on parameters with a discrete data type. Multiple expected state sets can be defined, and switching can be controlled as defined in the Expected State Switch table (see Section 2.24). If switching is not being used and multiple expected state sets are defined, the set number can be changed in real-time by changing the default set number in the Measurement table (see Section 2.13) in the real time local table. If the expected state switch measurement in the Measurement table is not null, the set numbers in this table must match the set numbers defined in the Expected State Switch table. ES_SET_NUM is a unique number for each expected state set. EXPECTED_STATE is the expected state code for the set number.

TOLER contains the number of consecutive expected state violations that are to be tolerated before user notification procedures are initiated. EM_ALL_SAMP_FLAG specifies whether the first sample or all samples of the measurement are to be tested for expected state violations for exception monitoring.

See the Expected State table, Table 2.23-1, for detailed information. Figure 2.23-1 is a guide to populating the Expected State table.

Table 2.23-1. Expected State Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name assigned to the parameter that is to be sensed for an expected state. NOTE: Must be provided by the project/mission manager.
ES_SET_NUM	2	integer	Identifies the expected state code set number for the measurement that is to be sensed for an expected state. NOTE: Must be provided by the project/mission manager.
EXPECTED_STATE	12	character	Expected state code for the set number. NOTE: Must be provided by the project/mission manager.
TOLER	2	integer	Number of consecutive expected state violations to be tolerated before user notification.
EM_ALL_SAMP_ FLAG	1	character	Indicates whether all samples or only the first sample is used for exception monitoring. "A" - All samples. "F" - First sample. "N" - This parameter is not used for exception monitoring.

The following examples show how to populate the Expected State table:

EXAMPLE 1:			
MSID	= L71X6735E	L71X6735E	L71X6735E
ES_SET_NUM	= 1	2	3
EXPECTED_STATE	= OPEN	CLOSED	LATCHED
TOLER	= 10	5	1
EM_ALL_SAMP_FLAG	= F	F	A
EXAMPLE 2:			
MSID	= L71X7625E		
ES_SET_NUM	= 1		
EXPECTED_STATE	= ON		
TOLER	= 5		
EM_ALL_SAMP_FLAG	= A		

Figure 2.23-1. Example Entries for Expected State Table

2.24 EXPECTED STATE SWITCH TABLE

The Expected State Switch table contains the information that is required to determine which expected state set number is to be used for a measurement. It should be noted that switching is not a normal case, but is an enhancement to the real-time system. Switching is not required by the system, and can be used at the discretion of a project. If switching is not used, then the expected state switch measurement in the Measurement table (see Section 2.13) should be null. MSID is the measurement name of the parameter that requires expected state switching. ES_SET_NUM is a unique number for each expected state set to be used according to switch activation. The expected state information for each set number is defined in the Expected State table (see Section 2.23). If the expected state switch measurement in the Measurement table is not null, then the switch measurement is used to determine which expected state set is to be used. There are two methods for determining the expected state set to be used in real-time processing. The first method is to evaluate the switch measurement against a range of values defined by LOW_RANGE and HIGH_RANGE. If the value of the switch measurement is greater than LOW_RANGE and is less than or equal to HIGH_RANGE, the set number is used. The second method is to evaluate the switch measurement against a state code defined by STATE_CODE. If the state codes match, the set number is used. If no set number is determined, then the default set number is used.

See the Expected State Switch table, Table 2.24-1, for detailed information. Figure 2.24-1 is a guide to populating the Expected State Switch table.

Table 2.24-1. Expected State Switch Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
MSID	20	character	Measurement name of the measurement that is to be sensed for an expected state. NOTE: Must be provided by the project/mission manager.
ES_SET_NUM	2	integer	Identifies the expected state set number for the measurement that is to be sensed for an expected state. NOTE: Must be provided by the project/mission manager.
LOW_RANGE	16	floating point	Low end of the range in engineering units for the Expected State Switch Measurement. NOTE: Must be provided by the project/mission manager.
HIGH_RANGE	16	floating point	High end of the range in engineering units for the Expected State Switch Measurement. NOTE: Must be provided by the project/mission manager.
STATE_CODE	12	character	State code of the Expected State Switch Measurement. NOTE: Must be provided by the project/mission manager.

The following examples indicate how to populate the Expected State Switch table. Example 1 defines the expected state sets for an analog switch measurement. Example 2 defines the expected state sets for a discrete switch measurement.

EXAMPLE 1:			
MSID	= K67J9876H	K67J9876H	K67J9876H
ES_SET_NUM	= 1	2	3
LOW_RANGE	= 0.0	35.5	49.8
HIGH_RANGE	= 35.5	49.8	53.2
STATE_CODE	=		
EXAMPLE 2:			
MSID	= K67D3987J	K67D3987J	K67D3987J
ES_SET_NUM	= 1	2	3
LOW_RANGE	=		
HIGH_RANGE	=		
STATE_CODE	= OPEN	CLOSING	LATCHED

Figure 2.24-1. Example Entries for Expected State Switch Table

2.25 CONTROL GROUP TABLE

The Control Group table contains the information that is required to describe the conditions under which activation and deactivation take place for a group of limit/expected state sensed measurements.

GROUP_ID is the unique identifier for a group of measurements. PROJECT_EM indicates if a group is to be centrally exception monitored at the project level. A group can be activated and deactivated by a start and stop time, or by the value of another control measurement. TIME_TYPE indicates whether the start and stop times are Greenwich Mean Time (GMT) or Mission Elapsed Time (MET). START_TIME and STOP_TIME are the activate time and deactivate time, respectively. CONTROL_MSID is the measurement name of the parameter used to control activation and deactivation. The control parameter must be evaluated in real time against either a range or a state code. CONTROL_LOW and CONTROL_HIGH are the low and high values if the control measurement has a range. If the value of the control measurement is greater than the low value and less than or equal to the high value, the group is active. CONTROL_ CODE is the state code if the control measurement has an integer discrete data type. If the state code of the control measurement is equal to the control state code, the group is active. DELAY_TIME is the amount of time that activation can be delayed once a control condition is met. Deactivation occurs when the control conditions no longer exist.

OWNER_ID defines the owner of the group.

See the Control Group table, Table 2.25-1, for detailed information. Figure 2.25-1 is a guide to populating the Control Group table.

Table 2.25-1. Control Group Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
GROUP_ID	2	character	Identifier used to uniquely identify a group of measurements to be collectively activated for exception monitoring/limit/expected state sensing. NOTE: Must be provided by the project/mission manager.
PROJECT_EM	1	character	Indicates whether the group is to be centrally exception monitored. “Y” - Centrally monitored. “N” - Not centrally monitored. NOTE: Must be provided by the project/mission manager.
TIME_TYPE	3	character	Type of time used to activate and deactivate a group of measurements. “GMT” - Greenwich Mean Time “MET” - Mission Elapsed Time.
START_TIME	15	time2	Time to activate a group of measurements for exception monitoring/limit/expected state sensing.
STOP_TIME	15	time2	Time to deactivate a group of measurements for exception monitoring/limit/expected state sensing.
CONTROL_MSID	20	character	Measurement name of the parameter used to activate and deactivate a group of measurements for exception monitoring/limit/expected state sensing.
CONTROL_LOW	16	floating point	Low end of the range in engineering units for the control measurement.
CONTROL_HIGH	16	floating point	High end of the range in engineering units for the control measurement.
CONTROL_CODE	12	character	State code of the discrete control measurement.
DELAY_TIME	8	time1	Delay time for activation of a group of measurements for exception monitoring/limit sensing.
OWNER_ID	20	character	Unique identifier that indicates the authorized owner of the group. NOTE: Must be provided by the project/mission manager.

The following examples show how to populate the Control Group table:

EXAMPLE 1:	
GROUP_ID	= A1
PROJECT_EM	= Y
TIME_TYPE	= GMT
START_TIME	= 95/123/01:25:00
STOP_TIME	= 95/123/05:00:05
CONTROL_MSID	=
CONTROL_LOW	=
CONTROL_HIGH	=
CONTROL_CODE	=
DELAY_TIME	=
OWNER_ID	= BBXRT
EXAMPLE 2:	
GROUP_ID	= C1
PROJECT_EM	= N
TIME_TYPE	=
START_TIME	=
STOP_TIME	=
CONTROL_MSID	= L31C5472A
CONTROL_LOW	= 10.0
CONTROL_HIGH	= 20.5
CONTROL_CODE	=
DELAY_TIME	= 00:05:00
OWNER_ID	= ACIS

Figure 2.25-1. Example Entries for Control Group Table

2.26 GROUP CONTENT TABLE

The Group Content table contains the information that defines the contents of each limit or expected state sensed group. GROUP_ID is the unique group identifier. MSID is the measurement name of the parameter included in the group. MSID_SET_NUM is the set number of the expected state set or the limits set, depending on the data type of the measurement. If MSID_SET_NUM is null, then the limit set number or the expected state set number will be derived from either the switch measurement or the default set number for the measurement. DELAY_TIME is the amount of time that activation can be delayed for the measurement once the group has been activated. Deactivation occurs when the group is no longer active.

See the Group Content table, Table 2.26-1, for detailed information. Figure 2.26-1 is a guide to populating the Group Content table.

Table 2.26-1. Group Content Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
GROUP_ID	2	character	Identifier used to uniquely identify a group of measurements to be collectively activated for exception monitoring/limit sensing. NOTE: Must be provided by the project/mission manager.
MSID	20	character	Measurement name of the parameter in the group. NOTE: Must be provided by the project/ mission manager.
MSID_SET_NUM	2	integer	Identifies which expected state set or limits set is to be used for the measurement when this group is activated. NOTE: Must be provided by the project/mission manager.
DELAY_TIME	8	time1	Delay time used to activate a measurement for exception monitoring/limit sensing.

The following examples show how to populate the Group Content table:

EXAMPLE 1:

GROUP_ID	= A1
MSID	= W31C5342A
MSID_SET_NUM	= 1
DELAY_TIME	= 00:05:00

EXAMPLE 2:

GROUP_ID	= C1
MSID	= W31C4372A
MSID_SET_NUM	= 2
DELAY_TIME	=

Figure 2.26-1. Example Entries for Group Content Table

2.27 DELETED

2.28 DELETED

2.29 EXPECTED STATE SENSING AND LIMIT SENSING LOGIC

The purpose of this section is to explain the order of precedence for determining which set number is to be used for expected state sensing or limit sensing. If a measurement has a data type of discrete integer, then the state codes for the measurement will be monitored for an expected state as defined by an expected state set number. If a measurement has a data type of integer or floating point, then the converted or calibrated value for the measurement will be monitored for caution and warning limits as defined by a limit set number. Note that a set number for an MSID will be either an expected state set number or a limit set number.

If a measurement is contained in any control groups and none of the control groups are active, then no sensing is performed. If any control group containing the measurement is active, then the sensing set number is derived from the Group Content table set number (see Section 2.26). If MSID_SET_NUM is not null, then the set number is used as either the expected state set or the limit set depending on the data type. If MSID_SET_NUM is null, then the set number will be derived from either the switch measurement or the default set number for the measurement.

If the limit switch measurement in the Measurement table (see Section 2.13) is not null, then the switch measurement is used to determine which limit set number is to be used (see Section 2.22). If the expected state switch measurement in the Measurement table is not null, then the switch measurement is used to determine which expected state set number is to be used (see Section 2.24). If no set number is derived, then either the limit default set number or the expected state default set number is to be used. If no default set number exists, then no sensing is performed.

If the measurement is not contained in any control group, then the set number will be derived from either the switch measurement or the default set number for the measurement as discussed in the previous paragraph.

2.30 GSE MSID TABLE

The GSE MSID table contains the measurement information that is required by MSFC HOSC to define the list of measurements, along with the location and the number of samples for each measurement, for each unique GSE packet. GSE_PACKET_ID is the packet identifier from the packet primary header. MSID is the measurement name of the parameter to be included in the GSE packet. START_OCTET is the starting octet location of the first sample in the GSE packet. SAMPLE_RATE is the number of contiguous samples of the measurement in the GSE packet.

See the GSE MSID table, Table 2.30-1 for detailed information. Figure 2.30-1 is a guide to populating the GSE MSID table.

Table 2.30-1. GSE MSID Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
GSE_PACKET_ID	4	integer	APID from GSE packet Primary Header or HOSC assigned. NOTE: Must be provided by project/mission manager.
MSID	20	character	Measurement name assigned to the GSE packet. NOTE: Must be provided by project/mission manager.
START_OCTET	5	integer	Indicates the starting octet of the first sample in the GSE packet. NOTE: Must be provided by the project/mission manager.
SAMPLE_RATE	3	integer	Indicates the number of contiguous samples in the GSE packet. NOTE: Must be provided by the project/mission manager.

The following are examples of how to populate the GSE MSID table. Example 1 defines a measurement in the GSE packet that has only one sample. Example 2 defines a measurement in the GSE packet that has 10 contiguous samples.

EXAMPLE 1:	
MSID	= R23D1928C
GSE_PACKET_ID	= 1004
START_OCTET	= 55
SAMPLE_RATE	= 1
EXAMPLE 2:	
MSID	= R23D3245A
GSE_PACKET_ID	= 1004
START_OCTET	= 139
SAMPLE_RATE	= 10

Figure 2.30-1. Example Entries for the GSE MSID Table

2.31 GSE PACKET TABLE

The GSE Packet table contains the packet information that is required by MSFC HOSC to process a GSE data packet. The MSFC packet construction standard is documented in MSFC-STD-1247B, Volume 2, MSFC HOSC Telemetry Format Standard (Packet). The packet identification is determined using the APID from the packet primary header.

GSE_PACKET_ID uniquely identifies the GSE packet. PARITY, BAUD_RATE, BYTE_SWAP and LENGTH indicate the transmission characteristics of the GSE packet. PROJECT_USER indicates whether the GSE packet is maintained at a project or user level.

See the GSE Packet table, Table 2.31-1 for detailed information. Figure 2.31-1 is a guide to populating the GSE Packet table.

Table 2.31-1. GSE Packet Table

COLUMN NAME	MAXIMUM COLUMN LENGTH	COLUMN TYPE	DESCRIPTION
GSE_PACKET_ID	4	integer	APID from GSE packet Primary Header or HOSC assigned. NOTE: Must be provided by the project/mission manager.
PARITY	1	character	Parity for a GSE packet. “E” - Indicates even parity. “O” - Indicates odd parity. “N” - Indicates no parity. NOTE: Must be provided by the project/mission manager.
BAUD_RATE	4	floating point	Baud rate in kilobits per second (kbps) for a GSE packet. NOTE: Must be provided by the project/mission manager.
BYTE_SWAP	1	character	Indicates the GSE packet is byte swapped. “Y” - Yes, byte swapped. “N” - Not byte swapped. NOTE: Must be provided by the project/mission manager.
PROJECT_USER	1	character	Indicates the GSE packet is maintained at project level or user level. “P” - Project level. “U” - User level. NOTE: Must be provided by the project/mission manager.
LENGTH	6	integer	Indicates the length of the GSE packet in octets. NOTE: Must be provided by the project/mission manager.
GSE_OWNER_ID	20	character	Unique identifier that indicates the owner of the GSE packet.

The following are examples of how to populate the GSE Packet table:

EXAMPLE 1:	
GSE_PACKET_ID	= 1004
PARITY	= E
BAUD_RATE	= 19.2
BYTE_SWAP	= Y
PROJECT_USER	=U
LENGTH	= 206
GSE_OWNER_ID	= ASTRO_2

Figure 2.31-1. Example Entries for the GSE Packet Table

3.0 HOSC STANDARD INPUT FORMATS

The following sections define the formats in which the data defined in Section 2.0 of this document may be submitted to the Mashall Space Flight Center (MSFC) Huntsville Operations Support Center (HOSC).

3.1 ASCII TEXT FILES

ASCII text files may be submitted to populate the tables of the HOSC database. The rules for formatting these ASCII text files are as follows:

1. A separate file must be submitted for each table in Section 2.0 of this document, or a subset thereof, as agreed upon by the HOSC and the Project/Mission Manager.
2. The data for each row in a table must be terminated by a semicolon (;).
3. Each data value must be delimited by a comma (,).
4. *White space* is defined as one or more spaces, or horizontal tab characters. White space between data values is ignored.
5. If data value contains white space, comma, or semicolon characters, then it must be enclosed in quotation marks (“).
6. If a data value contains quotation marks, then double quotation marks (“”) must be used. When the data value is inserted into the database, the extra quotation marks will be removed from the data.
7. The ASCII text file can contain carriage control and line feed characters between data values and embedded within a data value. In other words, a text editor can be used to create an ASCII text file such that a single data value can *line wrap*. The carriage control and line feed characters will be removed before the data is inserted into the database.
8. Blank lines between data values are ignored.

The Project/Mission Manager must also provide a list which specifies the actual name of the submitted file that corresponds to each applicable table in Section 2.0 of this document. This list should include a record for each table listed in Table 2.0-1 of this volume. Each record will consist of the table name as it appears in the TABLE NAME column of Table 2.0-1, followed by a comma (,) and the actual name of the ASCII file corresponding to that table. Spaces or tabs after the comma are optional. For optional tables that are not included in the export file, the value “n/a” should be used in place of the exported table name to indicate that the table is not included. For example:

```
Packet, packet
Packet Format, pkt_fmt
TDM, n/a
TDM Format, n/a
Measurement, msid
```

This list should be provided in an ASCII text file with the name TDBLIST.TXT. The following tables must be provided:

> Stream_ID, Owner, MSID, MSID Location, MSID Sampling, and at least one of the stream type tables (packet, subset, tdm) and its associated stream format table (packet format, subset format, tdm format).

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4.0 VALIDATION RULES

The following sections specify the validation rules for the database tables (defined in Section 2.0 of this volume) that will be applied by the Huntsville Operations Support Center (HOSC) software to any data submitted to a HOSC telemetry database. The validation rules are divided into three categories: database level, table level, and column level.

Database level validation rules involve data in more than one table. The foreign key rules specified in Section 2.0 of this volume are database level rules. However, some database level validation rules cannot be expressed as foreign keys because they represent relationships between the non-key columns of two or more tables. Other rules may not represent a relationship between tables but may apply to many different columns containing similar data. These columns may be in the same table or in different tables. A validation rule of this type can be specified as a database level rule to avoid the redundant expression of the rule for each column to which it applies. The database level rules for this volume are defined in Section 4.1.

Table level validation rules involve the data in multiple columns of a single table. The table level validation rules for the tables defined in this volume are listed in Section 4.2.

Finally, column level validation rules apply to the data in a specific column of a single table. The column level validation rules for the tables defined in this volume are listed in Section 4.3.

Notice that primary key and foreign key rules are specified in Section 2.0 of this volume and are not repeated in the following sections. These rules will also be applied by the HOSC software to any data submitted to a HOSC telemetry database.

4.1 DATABASE LEVEL VALIDATION RULES

Database level validation rules involve data in more than one table. The foreign key rules specified in Section 2.0 of this volume are database level rules. However, some database level validation rules cannot be expressed as foreign keys because they represent relationships between the non-key columns of two or more tables. Other rules may not represent a relationship between tables but may apply to many different columns containing similar data. These columns may be in the same table or in different tables. A validation rule of this type can be specified as a database level rule to avoid the redundant expression of the rule for each column to which it applies. The database level rules for this volume are defined in Table 4.1-1.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database

	VALIDATION RULE
1.	Column type “character” must conform to the rules specified in Appendix B.
2.	Column type “integer” must conform to the rules specified in Appendix B.
3.	Column type “hexadecimal” must conform to the rules specified in Appendix B.
4.	Column type “scientific notation” must conform to the rules specified in Appendix B.
5.	Column type “floating point” must conform to the rules specified in Appendix B.
6.	Column type “time1” must conform to the rules specified in Appendix B.
7.	Column type “time2” must conform to the rules specified in Appendix B.
8.	Column type “timestamp” must conform to the rules specified in Appendix B.
9.	For a BLOCK_ID and BLOCK_FORMAT_ID value in the Block Format table, if the STREAM_TYPE value in the Stream ID table is “B”, then a STREAM_ID and STREAM_FORMAT_ID value in the Stream ID table must match the BLOCK_ID and BLOCK_FORMAT_ID value in the Block Format table.
10.	For a BLOCK_ID and BLOCK_FORMAT_ID value in the Block Format table, if a STREAM_NUMBER value in the Stream ID table matches the ENCAP_STREAM_NUMBER value in the Block Format table, then the STREAM_TYPE value in the Stream ID table must be “P” and the PROTOCOL value must be “B”.
11.	DELETED.
12.	DELETED.
13.	For a PACKET_ID and PROTOCOL value in the Packet table, if the STREAM_TYPE value in the Stream ID table is “P”, then a STREAM_ID and PROTOCOL value in the Stream ID table must match the PACKET_ID and PROTOCOL value in the Packet table.
14.	For a PACKET_ID, PROTOCOL, and PACKET_FORMAT_ID value in the Packet Format table, if the STREAM_TYPE value in the Stream ID table is “P”, then a STREAM_ID, PROTOCOL, and STREAM_FORMAT_ID value in the Stream ID table must match the PACKET_ID, PROTOCOL, and PACKET_FORMAT_ID value in the Packet Format table.
15.	For a PACKET_ID, PROTOCOL, and PACKET_FORMAT_ID value in the Packet Format table, if the SUBSET_FLAG value in the Packet Format table is “N”, then an ENCAP_STREAM_NUMBER value in the Subset table must not match a STREAM_NUMBER value in the Stream ID table corresponding to the PACKET_ID, PROTOCOL, and PACKET_FORMAT_ID value.
16.	DELETED.
17.	For a SUBSET_ID and SUBSET_FORMAT_ID value in the Subset Format table, if the STREAM_TYPE value in the Stream ID table is “S”, then a STREAM_ID and STREAM_FORMAT_ID value in the Stream ID table must match the SUBSET_ID and SUBSET_ FORMAT_ID value in the Subset Format table.
18.	For a SUBSET_ID and SUBSET_FORMAT_ID value in the Subset Format table, if the SUBSET_FLAG value in the Subset Format table is “N”, then an ENCAP_STREAM_NUMBER value in the Subset table must not match a STREAM_NUMBER value in the Stream ID table corresponding to the SUBSET_ID and SUBSET_FORMAT_ID value.
19.	For a SUBSET_ID value in the Subset table, if a STREAM_NUMBER value in the Stream ID table matches the ENCAP_STREAM_NUMBER value in the Subset table, then the STREAM_TYPE value must be "P" and the PROTOCOL value must be "C" in the Stream ID table or the STREAM_TYPE value must be "S" in the Stream ID table.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database (Cont.)

	VALIDATION RULE
20.	For a TDM_ID and TDM_FORMAT_ID value in the TDM Format table, if the STREAM_TYPE value in the Stream ID table is “T”, then a STREAM_ID and STREAM_FORMAT_ID value in the Stream ID table must match the TDM_ID and TDM_ FORMAT_ID value in the TDM Format table.
21.	For the STREAM_NUMBER values in the Stream ID table, the values must be sequential beginning with 1.
22.	For a TDM_ID and TDM_FORMAT_ID value in the TDM Format table, a STREAM_ NUMBER value in the Stream ID table must match the ENCAP_STREAM_NUMBER value in the TDM table and the STREAM_TYPE value in the Stream ID table must be “P” and the PROTOCOL value must be “T”.
23.	DELETED.
24.	For an MSID value in the Measurement table, if the CALIBRATION_TYPE value in the Measurement table is “PC”, then an MSID value in the Polynomial Calibration table must match the MSID value in the Measurement table.
25.	For an MSID value in the Measurement table, if the CALIBRATION_TYPE value in the Measurement table is “PP”, then an MSID value in the Point Pair table must match the MSID value in the Measurement table.
26.	For an MSID value in the Measurement table, if the CALIBRATION_TYPE value in the Measurement table is “SC”, then an MSID value in the State Code table must match the MSID value in the Measurement table.
27.	For an MSID value in the Measurement table, if the CALIBRATION_TYPE value in the Measurement table is “N”, then no MSID value in the Polynomial Calibration, the Point Pair, or the State Code tables can match the MSID value in the Measurement table.
28.	DELETED.
29.	For an MSID value in the Measurement table, the TOTAL_LENGTH value in the Measurement table must equal the sum of the LENGTH values for all syllables in the MSID Location table for each unique STREAM_NUM value in the MSID Location table.
30.	For an MSID value in the Measurement table, if the COUNTER_MSID value in the Measurement table is not NULL, then the START_COUNTER_VALUE and COUNTER_OFFSET values in the MSID Sampling table must not be NULL for at least one STREAM_NUMBER value in the MSID Sampling table.
31.	For an MSID value in the Measurement table, if the COUNTER_MSID value in the Measurement table is NULL, then the START_COUNTER_VALUE and COUNTER_OFFSET values in the MSID Sampling table must be NULL for all STREAM_NUMBER values in the MSID Sampling table.
32.	For an MSID value in the Measurement table, if the RANGE_MSID value in the Measurement table is not NULL, then the LOW_RANGE and HIGH_RANGE values, or the STATE_CODE value in the MSID Sampling table must not be NULL for at least one STREAM_NUMBER value in the MSID Sampling table.
33.	For an MSID value in the Measurement table, if the RANGE_MSID value in the Measurement table is NULL, then the LOW_RANGE, the HIGH_RANGE, and the STATE_CODE values in the MSID Sampling table must be NULL for all STREAM_NUMBER values in the MSID Sampling table.
34.	For an MSID value in the Measurement table, if the CALIBRATION_SWITCH_MSID value in the Measurement table is not NULL, then at least two sets in the Calibration Switch table matching the MSID value in the Measurement table must exist.
35.	For an MSID value in the Measurement table, if the CALIBRATION_SWITCH_MSID value in the Measurement table is NULL, then no MSID value in the Calibration Switch table can match the MSID value in the Measurement table.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database (Cont.)

	VALIDATION RULE
36.	For an MSID value in the Measurement table, if the CALIBRATION_SWITCH_MSID value in the Measurement table is not NULL and the CALIBRATION _TYPE in the Measurement table is “PC”, then the number of sets in the Polynomial Calibration table for the MSID value must be greater than or equal to the number of sets in the Calibration Switch table for the MSID value.
37.	For an MSID value in the Measurement table, if the CALIBRATION_SWITCH_MSID value in the Measurement table is not NULL and the CALIBRATION _TYPE in the Measurement table is “PP”, then the number of sets in the Point Pair table for the MSID value must be greater than or equal to the number of sets in the Calibration Switch table for the MSID value.
38.	For an MSID value in the Measurement table, if the CALIBRATION_SWITCH_MSID value in the Measurement table is not NULL and the CALIBRATION _TYPE in the Measurement table is “SC”, then the number of sets in the State Code table for the MSID value must be greater than or equal to the number of sets in the Calibration Switch table for the MSID value.
39.	For an MSID value in the Measurement table, if the CALIBRATION_SWITCH_MSID value in the Measurement table is not NULL and the DATA_TYPE value for the calibration switch MSID value in the Measurement table is “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, or “FVAX”, then the LOW_RANGE and HIGH_RANGE values in the Calibration Switch table must not be NULL.
40.	For an MSID value in the Measurement table, if the CALIBRATION_SWITCH _MSID value in the Measurement table is not NULL and the DATA_TYPE value for the calibration switch MSID value in the Measurement table is “IDIS”, then the STATE_CODE value in the Calibration Switch table must not be NULL.
41.	For an MSID value in the Measurement table, if the CALIBRATION_DEFAULT_SET_NUM value in the Measurement table is not NULL and the CALIBRATION _TYPE in the Measurement table is “PC”, then the CALIBRATION_DEFAULT_SET_NUM value must be less than or equal to the number of entries in the Polynomial Calibration table for the MSID value.
42.	For an MSID value in the Measurement table, if the CALIBRATION_DEFAULT_SET_NUM value in the Measurement table is not NULL and the CALIBRATION _TYPE in the Measurement table is “PP”, then the CALIBRATION_DEFAULT_SET_NUM value must be less than or equal to the number of entries in the Point Pair table for the MSID value.
43.	For an MSID value in the Measurement table, if the CALIBRATION_DEFAULT_SET_NUM value in the Measurement table is not NULL and the CALIBRATION _TYPE in the Measurement table is “SC”, then the CALIBRATION_DEFAULT_SET_NUM value must be less than or equal to the number of entries in the State Code table for the MSID value.
44.	For an MSID value in the Measurement table, if the DATA_TYPE value in the Measurement table is “IDIS”, then no MSID value in the Limit table can match the MSID value in the Measurement table.
45.	For an MSID value in the Measurement table, if the DATA_TYPE value in the Measurement table is “IDIS”, then no MSID value in the Limit Switch table can match the MSID value in the Measurement table.
46.	For an MSID value in the Measurement table, if the LIMIT_DEFAULT_SET_NUM value in the Measurement table is not NULL, then an MSID value in the Limit table must match the MSID value in the Measurement table.
47.	For an MSID value in the Measurement table, if the LIMIT_DEFAULT_SET_NUM value in the Measurement table is not NULL, then no set in the Expected State table matching the MSID value in the Measurement table can exist.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database (Cont.)

	VALIDATION RULE
48.	For an MSID value in the Measurement table, if the LIMIT_SWITCH_MSID value in the Measurement table is not NULL, then two or more sets in the Limit table matching the MSID value in the Measurement table must exist.
49.	For an MSID value in the Measurement table, if the LIMIT_SWITCH_MSID value in the Measurement table is NULL and two or more sets in the Limit table match the MSID value in the Measurement table, then the LIMIT_DEFAULT_SET_NUM must not be NULL.
50.	For an MSID value in the Measurement table, if the LIMIT_SWITCH_MSID value in the Measurement table is NULL and only one set in the Limit table matches the MSID value in the Measurement table, then the LIMIT_DEFAULT_SET_NUM must be “1”.
51.	DELETED.
52.	For an MSID value in the Measurement table, if the LIMIT_SWITCH _MSID value in the Measurement table is not NULL, then two or more sets in the Limit Switch table matching the MSID value in the Measurement table must exist.
53.	For an MSID value in the Measurement table, if the LIMIT_SWITCH _MSID value in the Measurement table is NULL, then no set in the Limit Switch table matching the MSID value in the Measurement table can exist.
54.	DELETED.
55.	For an MSID value in the Measurement table, if the LIMIT_SWITCH _MSID value in the Measurement table is not NULL and the DATA_TYPE value for the limit switch MSID value in the Measurement table is “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, or “FVAX”, then the LOW_RANGE and HIGH_RANGE values in the Limit Switch table must not be NULL for the MSID value in the Measurement table.
56.	For an MSID value in the Measurement table, if the LIMIT_SWITCH _MSID value in the Measurement table is not NULL and the DATA_TYPE value for the limit switch MSID value in the Measurement table is “IDIS”, then the STATE_CODE value in the Limit Switch table must not be NULL for the MSID value in the Measurement table.
57.	For an MSID value in the Measurement table, if the LIMIT_DEFAULT_SET_NUM value in the Measurement table is not NULL, then the LIMIT_DEFAULT_SET_NUM value must be less than or equal to the number of sets in the Limit table for the MSID value in the Measurement table.
58.	For an MSID value in the Measurement table, if the DATA_TYPE value in the Measurement table is “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL” or “FVAX”, then no MSID value in the Expected State table can match the MSID value in the Measurement table.
59.	For an MSID value in the Measurement table, if the DATA_TYPE value in the Measurement table is “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FMIL”, “FIBM”, “FMIL”, “FNTL” or “FVAX”, then no MSID value in the Expected State Switch table can match the MSID value in the Measurement table.
60.	For an MSID value in the Measurement table, if the ES_DEFAULT_SET_NUM value in the Measurement table is not NULL, then an MSID value in the Expected State table must match the MSID value in the Measurement table.
61.	For an MSID value in the Measurement table, if the ES_DEFAULT_SET_NUM value in the Measurement table is not NULL, then no set in the Limit table matching the MSID value in the Measurement table can exist.
62.	For an MSID value in the Measurement table, if the ES_SWITCH_MSID value in the Measurement table is not NULL, then two or more sets in the Expected State table matching the MSID value in the Measurement table must exist.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database (Cont.)

	VALIDATION RULE
63.	For an MSID value in the Measurement table, if the ES_SWITCH_MSID value in the Measurement table is NULL and two or more sets in the Expected State table match the MSID value in the Measurement table, then the ES_DEFAULT_SET_NUM must not be NULL.
64.	For an MSID value in the Measurement table, if the ES_SWITCH_MSID value in the Measurement table is NULL and only one set in the Expected State table matches the MSID value in the Measurement table, then the ES_DEFAULT_SET_NUM must be “1”.
65.	DELETED.
66.	For an MSID value in the Measurement table, if the ES_SWITCH_MSID value in the Measurement table is not NULL, then two or more sets in the Expected State Switch table matching the MSID value in the Measurement table must exist.
67.	For an MSID value in the Measurement table, if the ES_SWITCH _MSID value in the Measurement table is NULL, then no set in the Expected State Switch table matching the MSID value in the Measurement table can exist.
68.	DELETED.
69.	For an MSID value in the Measurement table, if the ES_SWITCH _MSID value in the Measurement table is not NULL and the DATA_TYPE value for the expected state switch MSID value in the Measurement table is “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, or “FVAX”, then the LOW_RANGE and HIGH_RANGE values in the Expected State Switch table must not be NULL for the MSID value in the Measurement table.
70.	For an MSID value in the Measurement table, if the ES_SWITCH _MSID value in the Measurement table is not NULL and the DATA_TYPE value for the expected state switch MSID value in the Measurement table is “IDIS”, then the STATE_CODE value in the Expected State Switch table must not be NULL for the MSID value in the Measurement table.
71.	For an MSID value in the Measurement table, if the ES_DEFAULT_SET_NUM value in the Measurement table is not NULL, then the ES_DEFAULT_SET_NUM value must be less than or equal to the number of sets in the Expected State table for the MSID value in the Measurement table.
72.	For an MSID value in the MSID Sampling table, if the PAR_COMP value in the MSID Sampling table is “MS” for the STREAM_NUMBER value in the MSID Sampling table, then two or more MSID and STREAM_NUMBER values in the MSID Location table must match the MSID and STREAM_NUMBER values in the MSID Sampling table.
73.	DELETED.
74.	For an MSID value in the MSID Sampling table, if the PAR_COMP value in the MSID Sampling table is “T”, “BG”, or “NG” for the STREAM_NUMBER value in the MSID Sampling table, then only one MSID and STREAM_NUMBER value in the MSID Location table can match the MSID and STREAM_NUMBER value in the MSID Sampling table.
75.	For an MSID value in the MSID Sampling table, if the CONTEXT_PACKET_ID and CONTEXT_PROTOCOL values in the MSID Sampling table is not NULL, then the CONTEXT_PACKET_ID and CONTEXT_PROTOCOL values in the MSID Sampling table must match a PACKET_ID and PROTOCOL values in the Packet table.
76.	For an MSID value in the MSID Location table, if the STREAM_NUMBER value in the MSID Location table equals a STREAM_NUMBER value in the Stream ID table, and the STREAM_TYPE value in the Stream ID table is “T”, then the START_MINOR_FRAME value in the MSID Location table must not be NULL.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database (Cont.)

	VALIDATION RULE
77.	For an MSID value in the MSID Location table, if the STREAM_NUMBER value in the MSID Location table equals a STREAM_NUMBER value in the Stream ID table, and the STREAM_TYPE value in the Stream ID table is not “T”, then the START_MINOR_FRAME value in the MSID Location table must be NULL.
78.	For an MSID value in the MSID Location table, if the STREAM_NUM value in the MSID Location table equals the STREAM_NUM value in the Stream ID table, and the STREAM_TYPE value in the Stream ID table is “T”, and the STREAM_ID and STREAM_FORMAT_ID values in the Stream ID table matches the TDM_ID and TDM_FORMAT_ID values in the TDM Format table, and the BITS_PER_WORD value in the TDM Format table is “8”, then the START_WORD value for the STREAM_NUM value in the MSID Location table must be less than 1026.
79.	For an MSID value in the MSID Location table, if the STREAM_NUM value in the MSID Location table equals the STREAM_NUM value in the Stream ID table, and the STREAM_TYPE value in the Stream ID table is “T”, and the STREAM_ID and STREAM_FORMAT_ID values in the Stream ID table matches the TDM_ID and TDM_FORMAT_ID values in the TDM Format table, and the BITS_PER_WORD value in the TDM Format table is “16”, then the START_WORD value for the STREAM_NUM value in the MSID Location table must be less than 513.
80.	DELETED.
81.	For an MSID value in the MSID Location table, if the STREAM_NUM value in the MSID Location table equals the STREAM_NUM value in the Stream ID table, and the STREAM_TYPE value in the Stream ID table is “P”, and PROTOCOL value is “C”, then the START_WORD value for the STREAM_NUM value in the MSID Location table must be less than 65,535.
82.	For an MSID value in the MSID Location table, if the STREAM_NUM value in the MSID Location table equals the STREAM_NUM value in the Stream ID table, and the STREAM_TYPE value in the Stream ID table is “P”, and PROTOCOL value is “T”, then the START_WORD value for the STREAM_NUM value in the MSID Location table must be less than 64,991.
83.	For the SYLLABLE_NUMBER values in the MSID Location table, the values must be sequential beginning with 1.
84.	For the CALIBRATION_SET_NUM values in the Polynomial Calibration table, the values must be sequential beginning with 1.
85.	For the CALIBRATION_SET_NUM values in the Point Pair table, the values must be sequential beginning with 1.
86.	For the SEQUENCE_NUM values for each CALIBRATION_SET_NUM value in the Point Pair table, the values must be sequential beginning with 1.
87.	For the CALIBRATION_SET_NUM values in the State Code table, the values must be sequential beginning with 1.
88.	For the SEQUENCE_NUM values for each CALIBRATION_SET_NUM value in the State Code table, the values must be sequential beginning with 1.
89.	For an MSID value in the State Code table, the LOW_RAW_COUNT and HIGH_RAW_COUNT values in the State Code table cannot be equal for any different SEQUENCE_NUM value for each CALIBRATION_SET_NUM value in the State Code table.
90.	For an MSID value in the Measurement table, if the DATA_TYPE value in the Measurement table is “IDIS” and the TOTAL_LENGTH value in the Measurement table is less than 5, then the maximum number of state codes for each CALIBRATION_SET_ NUM value in the State Code table must be less than or equal to the value of 2 raised to the power of the TOTAL_LENGTH value.
91.	DELETED.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database (Cont.)

	VALIDATION RULE
92.	DELETED.
93.	DELETED.
94.	DELETED.
95.	DELETED.
96.	DELETED.
97.	DELETED.
98.	DELETED.
99.	DELETED.
100.	DELETED.
101.	For the LIMIT_SET_NUM values in the Limit table, the values must be sequential beginning with 1.
102.	For the ES_SET_NUM values in the Expected State table, the values must be sequential beginning with 1.
103.	For a GROUP_ID value in the Control Group table, if the CONTROL_MSID value in the Control Group table is not NULL and the DATA_TYPE value for the control group MSID value in the Measurement table is “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, or “FVAX”, then the CONTROL_LOW and CONTROL_HIGH values in the Control Group table must not be NULL for the CONTROL_MSID value.
104.	For a GROUP_ID value in the Control Group table, if the CONTROL_MSID value in the Control Group table is not NULL and the DATA_TYPE value for the control group MSID value in the Measurement table is “IDIS”, then the CONTROL_CODE value in the Control Group table must not be NULL for the CONTROL_MSID value.
105.	For an MSID value in the Group Content table, if the MSID_SET_NUM value in the Group Content table is not NULL and the DATA_TYPE value for the group MSID value in the Measurement table is “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, or “FVAX”, then the MSID_SET_NUM value in the Group Content table must match a LIMIT_SET_NUM in the Limit table.
106.	For an MSID value in the Group Content table, if the MSID_SET_NUM value in the Group Content table is not NULL and the DATA_TYPE value for the group MSID value in the Measurement table is “IDIS”, then the MSID_SET_NUM value in the Group Content table must match an ES_SET_NUM in the Expected State table.
107.	For an MSID value in the Group Content table, if the MSID_SET_NUM value in the Group Content table is NULL and the DATA_TYPE value for the group MSID value in the Measurement table is “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, or “FVAX”, then the LIMIT_SWITCH_MSID value or the LIMIT_DEFAULT_SET_NUM value for the group MSID value in the Measurement table must not be NULL.
108.	For an MSID value in the Group Content table, if the MSID_SET_NUM value in the Group Content table is NULL and the DATA_TYPE value for the group MSID value in the Measurement table is “IDIS”, then the ES_SWITCH_MSID value or the ES_DEFAULT_SET_NUMBER value for the group MSID value in the Measurement table must not be NULL.
109.	DELETED.
110.	For an MSID value in the GSE MSID table, the SAMPLE_RATE value in the GSE MSID table must be less than or equal to the SAMPLE_RATE value in the MSID Sampling table for the MSID value with a PAR_COMP value equal to “T” or “MS”.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database (Cont.)

	VALIDATION RULE
111.	For an MSID value in the GSE MSID table, the SAMPLE_RATE value in the GSE MSID table must be less than or equal to the SAMPLE_RATE value in the MSID Sampling table multiplied by the SAMPLE_PER_GROUP value in the MSID Sampling table for the MSID value with a PAR_COMP value equal to “BG” or “NG”.
112.	DELETED.
113.	For a PACKET_ID, PROTOCOL, and PACKET_FORMAT_ID value in the Packet Format table, if the SUBSET_FLAG value in the Packet Format table is "N", then an ENCAP_STREAM_NUMBER value in the Subset table must not match a STREAM_NUMBER value in the Stream ID table corresponding to the PACKET_ID, PROTOCOL, and PACKET_FORMAT_ID.
114.	For a SUBSET_ID and SUBSET_FORMAT_ID value in the Subset Format table, if the SUBSET_FLAG value in the Subset Format table is "N", then an ENCAP_STREAM_NUMBER value in the Subset table must not match a STREAM_NUMBER value in the Stream ID table corresponding to the SUBSET_ID and SUBSET_FORMAT_ID value.
115.	For an OWNER_ID value in the Owner table, the OWNER_ID value must match an OWNER_ID value in the Stream ID, Measurement, Control Group and/or EM Error Description table(s).
116.	For a STREAM_NUMBER value in the Stream ID table, the STREAM NUMBER value must match a STREAM NUMBER value in the MSID Location table.
117.	For an MSID value in the Measurement table, the MSID value must match an MSID value in the MSID Location table.
118.	For a SUBSET_ID value in the Subset table, if the COUNTER_MSID value is not NULL in the Subset table and the COUNTER_TYPE value is "N" in the Counter Table, then the START_COUNTER_VALUE value in the Subset table must be greater than or equal to the INIT_VALUE value in the Counter table or the modulus of the (INIT_VALUE value in the Counter table + END_VALUE value in the Counter table + 1), COUNTER_OFFSET value in the Subset table) is zero (0).
119.	For MSID and STREAM_NUMBER values in the MSID Sampling table, if the COUNTER_MSID value is not NULL in the Measurement table and the COUNTER_TYPE value in the Counter table is "N" or "MAJ", if the STREAM_TYPE value in the Stream ID table is "T" in the Stream ID table, then the START_COUNTER_VALUE value in the MSID Sampling table must be greater than or equal to the INIT_VALUE value in the Counter table or the modulus of the (INIT_VALUE value in the Counter table + END_VALUE value in the Counter table + 1), COUNTER_OFFSET value in the MSID Sampling table) is zero (0) where the MSID value in the MSID Sampling table must match the COUNTER_MSID value in the Measurement table.
120.	For an MSID value in the Measurement table, if a COUNTER_MSID value is not NULL in the Measurement table, then the COUNTER_MSID value must match an MSID value in the Counter table.
121.	For a SUBSET_ID value in the Subset table, if a COUNTER_MSID value is not NULL in the Subset table, then the COUNTER_MSID value must match an MSID value in the Counter table.
122.	DELETED.
123.	DELETED.
124.	DELETED.
125.	For an MSID value in the Measurement table, if the ES_SWITCH_MSID value is NULL and the ES_DEFAULT_SET_NUM value is NULL in the Measurement table, then an MSID value in the Expected State table cannot match the MSID value in the Measurement table.
126.	DELETED.
127.	DELETED.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database (Cont.)

	VALIDATION RULE
128.	For MSID and STREAM_NUMBER values in the MSID Sampling table, the MSID and STREAM_NUMBER values in the MSID Sampling table must match the MSID and STREAM_NUMBER values in the MSID Location table.
129.	For an MSID value in the Measurement table, if the LIMIT_SWITCH_MSID value is NULL and the LIMIT_DEFAULT_SET_NUM value is NULL in the Measurement table, then an MSID value in the Limit table cannot match the MSID value in the Measurement table.
130.	For Group ID and MSID values in the Group Content table, the MSID value in the Group Content table must match an MSID value in either the Limit or Expected State table.
131.	For a TDM_ID value in the TDM table, the SYNC_PATTERN_MSID value cannot be NULL.
132.	For MSID and STREAM_NUMBER values in the MSID Location table, if the STREAM_TYPE value is "B" in the Stream ID table and the DATA_TYPE value in the Measurement table is a string, then the START_WORD value in the MSID Location table plus LENGTH value in the MSID Location table minus 1 must be less than or equal to 600.
133.	For MSID and STREAM_NUMBER values in the MSID Location table, if the STREAM_TYPE value is "B" in the Stream ID table and the DATA_TYPE value in the Measurement table is not a string, then the START_WORD value in the MSID Location table plus ceiling of LENGTH value in the MSID Location table divided by 8 must be less than or equal to 600.
134.	For MSID and STREAM_NUMBER values in the MSID Location table, if the STREAM_TYPE value is "P" in the Stream ID table and the DATA_TYPE value in the Measurement table is a string, then the START_WORD value in the MSID Location table plus LENGTH value in the MSID Location must be less than or equal LENGTH value in the Packet Format table.
135.	For an MSID and STREAM_NUMBER values in the MSID Location table, if the STREAM_TYPE value is "P" in the Stream ID table and the DATA_TYPE value in the Measurement table is not a string, then the START_WORD value in the MSID Location table plus ceiling of LENGTH value in the MSID Location divided by 8 must be less than or equal LENGTH value in the Packet Format table.
136.	For an MSID and STREAM_NUMBER values in the MSID Location table, if the STREAM_TYPE value is "S" in the Stream ID table and the DATA_TYPE value in the Measurement table is a string, then the START_WORD value in the MSID Location table plus LENGTH value in the MSID Location must be less than or equal LENGTH value in the Subset Format table.
137.	For MSID and STREAM_NUMBER values in the MSID Location table, if the STREAM_TYPE value is "S" in the Stream ID table and the DATA_TYPE value in the Measurement table is not a string, then the START_WORD value in the MSID Location table plus ceiling of LENGTH value in the MSID Location divided by 8 must be less than or equal LENGTH value in the Subset Format table.
138.	For MSID and STREAM_NUMBER values in the MSID Location table, if the STREAM_TYPE value is "T" in the Stream ID table and BITS_PER_WORD value in the TDM table is 16 and DATA_TYPE value in the Measurement table is a string, then twice the START_WORD value in the MSID Location table plus LENGTH value in the MSID Location table must be less than or equal to twice the WORDS_PER_MINOR_FRAME value in the TDM table.
139.	For MSID and STREAM_NUMBER values in the MSID Location table, if the STREAM_TYPE value is "T" in the Stream ID table and BITS_PER_WORD value in the TDM table is 16 and DATA_TYPE value in the Measurement table is not a string, then twice the START_WORD value in the MSID Location table plus ceiling of LENGTH value in the MSID Location table divided by 8 must be less than or equal to twice the WORDS_PER_MINOR_FRAME value in the TDM table.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database (Cont.)

	VALIDATION RULE
140.	For MSID and STREAM_NUMBER values in the MSID Location table, if the STREAM_TYPE value is "T" in the Stream ID table and BITS_PER_WORD value in the TDM table is 8 and DATA_TYPE value in the Measurement table is a string, then START_WORD value in the MSID Location table plus LENGTH value in the MSID Location table must be less than or equal to WORDS_PER_MINOR_FRAME value in the TDM table.
141.	For MSID and STREAM_NUMBER values in the MSID Location table, if the STREAM_TYPE value is "T" in the Stream ID table and BITS_PER_WORD value in the TDM table is 8 and DATA_TYPE value in the Measurement table is not a string, then START_WORD value in the MSID Location table plus ceiling of LENGTH value in the MSID Location table divided by 8 must be less than or equal to WORDS_PER_MINOR_FRAME value in the TDM table.
142.	For a STREAM_NUMBER value in the Stream ID table, if the STREAM_TYPE value in the Stream ID table is "P" and SUBSET_FLAG value is "Y" in the Packet Format table, then the LENGTH value in the Subset Format table cannot exceed the LENGTH value in the Packet Format table.
143.	For a STREAM_NUMBER value in the Stream ID table, if the STREAM_TYPE value in the Stream ID table is "P" and SUBSET_FLAG value is "Y" in the Packet Format table, then that packet format cannot contain Subsets embedded 3 levels deep.
144.	For a STREAM_NUMBER value in the Stream ID table, if the STREAM_TYPE value in the Stream ID table is "S" and SUBSET_FLAG value is "Y" in the Subset Format table, then the LENGTH value in the Subset Format table of the embedded Subsets cannot exceed the LENGTH value in the Subset Format table of the parent Subset.
145.	For an MSID value in the Calibration Switch table, if the DATA_TYPE value in the Measurement table is an integer in the Measurement table, then the RANGES cannot overlap.
146.	For a GROUP_ID value in the Control Group table, the GROUP_ID value must match the GROUP_ID value in the Group Content table.
147.	For an MSID value in the Measurement table, if the RANGE_MSID value in the Measurement table is not NULL and the DATA_TYPE value for the range MSID value in the Measurement table is “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, or “FVAX”, then the STATE_CODE values in the MSID sampling table must be NULL for the MSID value in the Measurement table.
148.	For an MSID value in the Measurement table, if the RANGE_MSID value in the Measurement table is not NULL and the DATA_TYPE value for the range MSID value in the Measurement table is “IDIS”, then the LOW_RANGE and HIGH_RANGE values in the MSID sampling table must be NULL for the MSID value in the Measurement table.
149.	For an MSID value in the Measurement table, if the RANGE_MSID value in the Measurement table is not NULL, then the DATA_TYPE value for the range MSID value in the Measurement table must equal “IDIS”, “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, OR “FVAX”.
150.	For an MSID value in the Counter table, the DATA_TYPE value for the MSID value in the Measurement table must equal “IUND”.
151.	For an MSID value in the Measurement table, if the COUNTER_MSID value in the Measurement table is not NULL, then the COUNTER_MSID, RANGE_MSID, CALIBRATION_SWITCH_MSID, LIMIT_SWITCH_MSID, and ES_SWITCH_MSID values must be NULL for the counter MSID value in the Measurement table.

Table 4.1-1. Database Level Validation Rules for the Telemetry Database (Cont.)

	VALIDATION RULE
152.	For an MSID value in the Measurement table, if the RANGE_MSID value in the Measurement table is not NULL, then the COUNTER_MSID, RANGE_MSID, CALIBRATION_SWITCH_MSID, LIMIT_SWITCH_MSID, and ES_SWITCH_MSID values must be NULL for the range MSID value in the Measurement table.
153.	For an MSID value in the Measurement table, if the CALIBRATION_SWITCH_MSID value in the Measurement table is not NULL, then the COUNTER_MSID, RANGE_MSID, CALIBRATION_SWITCH_MSID, LIMIT_SWITCH_MSID, ES_SWITCH_MSID values must be NULL for the calibration switch MSID value in the Measurement table.
154.	For an MSID value in the Measurement table, if the LIMIT_SWITCH_MSID value in the Measurement table is not NULL, then the COUNTER_MSID, RANGE_MSID, CALIBRATION_SWITCH_MSID, LIMIT_SWITCH_MSID, ES_SWITCH_MSID values must be NULL for the limit switch MSID value in the Measurement table.
155.	For an MSID value in the Measurement table, if the ES_SWITCH_MSID value in the Measurement table is not NULL, then the COUNTER_MSID, RANGE_MSID, CALIBRATION_SWITCH_MSID, LIMIT_SWITCH_MSID, ES_SWITCH_MSID values must be NULL for the expected switch MSID value in the Measurement table.
156.	For an MSID value in the MSID Location table, if the STREAM_NUMBER value in the MSID Location table equals the STREAM_NUMBER value in the Stream ID table, and the STREAM_TYPE value in the Stream ID table is “P” or “S”, then the START_BIT value in the MSID Location table must be greater than or equal to 0 and less than or equal to 7.
157.	For a TDM_ID value in the TDM Format table , if the PROJECT value in the Telemetry System table is “AXAF” and the TDM_ID value in the TDM Format table is “VCDU”, “STS”, or “ACA”, then the ENCAP_BOUNDARY value in the TDM Format table must be “F”.
158.	For a TDM_ID value in the TDM Format table, if the PROJECT value in the Telemetry System table is “AXAF” and the TDM_ID value in the TDM Format table is “VCDU” or “ACA”, then the ENCAP_FRAME_PER_PACKET value in the TDM Format table must be “4”.
159.	For a TDM_ID value in the TDM Format table, if the PROJECT value in the Telemetry System table is “AXAF” and the TDM_ID value in the TDM Format table is “STS”, then the ENCAP_FRAME_PER_PACKET value in the TDM Format table must be “1”.
160.	For a TDM_ID value in the TDM Format table, if the TDM_ID value in the TDM Format table is “VCDU” or “ACA”, then the PROJECT value in the Telemetry System table must be “AXAF”.
161.	For an MSID and ES_STATE_NUM value in the Expected State table, an EXPECTED_STATE value in the Expected State table must match a STATE_CODE value in the State Code table for the MSID and ES_SET_NUM value.
162.	For an MSID value in the Control Group table, if the CONTROL_CODE value in the Control Group table is not NULL, then the CONTROL_CODE value in the Control Group table must match a STATE_CODE value in the State Code table for the set number.

4.2 TABLE LEVEL VALIDATION RULES

Table level validation rules involve the data in multiple columns of a single table. The table level validation rules for the tables defined in this volume are specified in the following sections.

4.2.1 Telemetry System Table

The table level validation rules for the Telemetry System table are defined in Table 4.2.1-1

Table 4.2.1-1. Table Level Validation Rules for the Telemetry System Table

	VALIDATION RULE
1.	The DELIVERED_DATE value must not be NULL if a PRE_RELEASE_DATE value is not NULL.
2.	The DELIVERED_DATE value must be less than the PRE_RELEASE_DATE value.
3.	The PRE_RELEASE_DATE value must be NULL if the DELIVERED_DATE value is NULL.
4.	The PRE_RELEASE_DATE value must not be NULL if the BASELINE_DATE value is not NULL.
5.	The PRE_RELEASE_DATE value must be less than the BASELINE_DATE value.
6.	The BASELINE_DATE value must be NULL if the PRE_RELEASE_DATE value is NULL.
7.	DELETED.

4.2.2 Owner Table

No table level validation rules for the Owner table are defined.

4.2.3 Block Table

No table level validation rules for the Block table are defined.

4.2.4 Block Format Table

The table level validation rules for the Block Format table are defined in Table 4.2.4-1

Table 4.2.4-1. Table Level Validation Rules for the Block Format Table

	VALIDATION RULE
1.	The BLOCK_ID value, along with the FORMAT value, must be unique within the Block Format table.

4.2.5 Deleted

4.2.6 Packet Table

The table level validation rules for the Packet table are defined in Table 4.2.6-1.

Table 4.2.6-1. Table Level Validation Rules for the Packet Table

	VALIDATION RULE
1.	DELETED.
2.	DELETED.
3.	If the SEC_HEADER value is “Y”, then the SEC_HEADER_LENGTH value must not be NULL.
4.	If the SEC_HEADER value is “N”, then the SEC_HEADER_LENGTH value must be NULL.

4.2.7 Packet Format Table

The table level validation rules for the Packet Format table are defined in Table 4.2.7-1.

Table 4.2.7-1. Table Level Validation Rules for the Packet Format Table

	VALIDATION RULE
1.	The PACKET_ID value, along with the PROTOCOL and FORMAT values, must be unique within the Packet Format table.
2.	DELETED.
3.	DELETED.
4.	If the PROTOCOL value is “C”, then the LENGTH value must be less than or equal to 65535.
5.	If the PROTOCOL value is “T”, then the LENGTH value must be less than or equal to 262,918.
6.	If the PROTOCOL value is “B”, then the LENGTH value must be less than or equal to 1118.
7.	If the PROTOCOL value is “D”, then the LENGTH value must be less than or equal to 367.
8.	If the PROTOCOL value is “P”, then the decimal value of the hexidecimal FORMAT value must be equal to the PACKET_ID value.

4.2.8 Subset Table

The table level validation rules for the Subset table are defined in Table 4.2.8-1.

Table 4.2.8-1. Table Level Validation Rules for the Subset Table

	VALIDATION RULE
1.	If the SAMPLE_COMP value is “N”, “C”, or “R”, then the SAMPLE_RATE value must be 1.0.
2.	If the SAMPLE_COMP value is “D”, then the SAMPLE_RATE value must be NULL.
3.	If the SAMPLE_COMP value is “S”, then the SAMPLE_RATE value must be greater than 1.0.
4.	If the SAMPLE_COMP value is “N”, “C”, or “R”, then the DATA_CYCLE value must not be NULL.
5.	If the SAMPLE_COMP value is “D”, then the DATA_CYCLE value must be NULL.
6.	If the SAMPLE_COMP value is “N”, “S”, “C”, or “R”, then the START_OCTET value must not be NULL.
7.	If the SAMPLE_COMP value is “D”, then the START_OCTET value must be NULL.
8.	If the SAMPLE_COMP value is “S”, then the OFFSET value must not be NULL.
9.	If the SAMPLE_COMP value is “N”, “C”, “R”, or “D”, then the OFFSET value must be NULL.
10.	If the SAMPLE_COMP value is “C”, then the COUNTER_MSID value must not be NULL.
11.	If the SAMPLE_COMP value is “N”, “S”, “R”, or “D”, then the COUNTER_MSID value must be NULL.
12.	If the COUNTER_MSID value is not NULL, then the RANGE_MSID value must be NULL.
13.	If the COUNTER_MSID value is not NULL, then the START_COUNTER_VALUE and COUNTER_OFFSET values must not be NULL.
14.	If the COUNTER_MSID value is NULL, then the START_COUNTER_VALUE and COUNTER_OFFSET values must be NULL.
15.	If the SAMPLE_COMP value is “R”, then the RANGE_MSID value must not be NULL.
16.	If the SAMPLE_COMP value is “N”, “S”, “C”, or “D”, then the RANGE_MSID value must be NULL.

Table 4.2.8-1. Table Level Validation Rules for the Subset Table (Cont.)

	VALIDATION RULE
17.	If the RANGE_MSID value is not NULL, then the COUNTER_MSID value must be NULL.
18.	If the RANGE_MSID value is not NULL, then the LOW_RANGE value, or the HIGH_RANGE value, or the STATE_CODE value must not be NULL.
19.	If the RANGE_MSID value is NULL, then the LOW_RANGE, HIGH_RANGE, and STATE_CODE values must be NULL.
20.	If the LOW_RANGE value or the HIGH_RANGE value is not NULL, then the STATE_CODE value must be NULL.
21.	If the STATE_CODE value is not NULL, then the LOW_RANGE and HIGH_RANGE values must be NULL.
22.	If the LOW_RANGE and HIGH_RANGE values are not null, the HIGH_RANGE value must be greater than the LOW_RANGE value.

4.2.9 Subset Format Table

The table level validation rules for the Subset Format table are defined in Table 4.2.9-1.

Table 4.2.9-1. Table Level Validation Rules for the Subset Format Table

	VALIDATION RULE
1.	The SUBSET_ID value, along with the FORMAT value, must be unique within the Subset Format table.

4.2.10 TDM Table

No table level validation rules for the TDM table are defined.

4.2.11 TDM Format Table

The table level validation rules for the TDM Format table are defined in Table 4.2.11-1.

Table 4.2.11-1. Table Level Validation Rules for the TDM Format Table

	VALIDATION RULE
1.	The TDM_ID value, along with the FORMAT value, must be unique within the TDM Format table.
2.	If the ENCAP_BOUNDARY value is “M”, then the ENCAP_FRAME_PER_PACKET value multiplied times the MINOR_FRAMES_PER_MAJOR_FRAME value must be less than or equal to 256.
3.	If the ENCAP_BOUNDARY value is “F”, then the ENCAP_FRAME_PER_PACKET value must be less than or equal to 256.
4.	If the TDM_ID value is “OI”, then the BITS_PER_WORD value must be equal to 8.
5.	If the TDM_ID value is “G1H”, “G1L”, “G2H”, “G2L”, “G3H”, or “G3L”, then the BITS_PER_WORD value must be equal to 16.

4.2.12 Stream ID Table

The table level validation rules for the Stream ID table are defined in Table 4.2.12-1.

Table 4.2.12-1. Table Level Validation Rules for the Stream ID Table

	VALIDATION RULE
1.	If the STREAM_TYPE value is “P”, then the PROTOCOL must not be NULL.
2.	If the STREAM_TYPE value is not “P”, then the PROTOCOL must be NULL.
3.	If the STREAM_TYPE value is “B”, then the STREAM_ID value must be hexadecimal.
4.	If the STREAM_TYPE value is “P”, then the STREAM_ID value must be equal to a decimal 0 to 2047.
5.	If the STREAM_TYPE value is “S”, then the STREAM_ID value must be a positive decimal number.
6.	If the STREAM_TYPE value is “T”, then the STREAM_ID value must be alphanumeric. All letters must be uppercase.
7.	DELETED.

4.2.13 Measurement Table

The table level validation rules for the Measurement table are defined in Table 4.2.13-1.

Table 4.2.13-1. Table Level Validation Rules for the Measurement Table

	VALIDATION RULE
1.	DELETED.
2.	If the CALIBRATION_TYPE value is “SC”, then the DATA_TYPE value must be “IDIS”.
3.	If the CALIBRATION_TYPE value is “PC”, then the valid DATA_TYPE values are “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, and “FVAX”.
4.	If the CALIBRATION_TYPE value is “PP”, then the valid DATA_TYPE values are “IMAG”, “IUNS”, “ITWO”, and “ITWOW”.
5.	If the CALIBRATION_TYPE value is “N”, then the DATA_TYPE value may be any valid entry in MSFC-STD-1274B, except for “IDIS”.
6.	If the DATA_TYPE value is “IUND”, then the CALIBRATION_TYPE value must be “N”.
7.	If the DATA_TYPE value is “IDIS”, “IMAG”, “IUNS”, “ITWO”, “ITWOW”, then the LOW_RAW_COUNT and HIGH_RAW_COUNT values must not be NULL.
8.	If the LOW_RAW_COUNT value is NULL, then the HIGH_RAW_COUNT value must be NULL.
9.	If the HIGH_RAW_COUNT value is NULL, then the LOW_RAW_COUNT value must be NULL.
10.	The LOW_RAW_COUNT value must be less than the HIGH_RAW_COUNT value.
11.	If the DATA_TYPE value is “SASC”, “SASCB”, “SEBC”, “SUND” or “TDMS”, then the TOTAL_LENGTH value is the number of bytes.
12.	If the DATA_TYPE value is “IDIS”, “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, “FVAX”, “TECI”, “TECS”, “TEHS”, “TGMT”, “TGPC”, “TOOI”, “TTSM”, or “TTWO”, then the TOTAL_LENGTH value is the number of bits.
13.	If the COUNTER_MSID value is not NULL, then the RANGE_MSID value must be NULL.
14.	If the RANGE_MSID value is not NULL, then the COUNTER_MSID value must be NULL.

Table 4.2.13-1. Table Level Validation Rules for the Measurement Table (Cont.)

15.	If the CALIBRATION_SWITCH_MSID value is not NULL, then the CALIBRATION_TYPE value must be “PC”, “PP”, or “SC”.
16.	If CALIBRATION_SWITCH_MSID value is not NULL, then the CALIBRATION_DEFAULT_ SET_NUMBER value must not be NULL.
17.	If LIMIT_SWITCH_MSID value is not NULL, then the ES_ SWITCH_MSID must be NULL.
18.	If ES_SWITCH_MSID value is not NULL, then the LIMIT_SWITCH_MSID must be NULL.
19.	For an MSID value in the Measurement table, if the DATA_TYPE value in the Measurement table is “IDIS”, then the LIMIT_SWITCH_MSID value and the LIMIT_DEFAULT_SET_NUM value in the Measurement table must be NULL.
20.	For an MSID value in the Measurement table, if the DATA_TYPE value in the Measurement table is “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FIBM”, “FMIL”, “FNTL”, “FSPL”, or “FVAX”, then the ES_SWITCH_MSID value and the ES_DEFAULT_SET_NUM value in the Measurement table must be NULL.
21.	For an MSID value in the Measurement table, if the DATA_TYPE value in the Measurement table is “IUNS” or “IDIS”, then the LOW_RAW_COUNT value in the Measurement Table must be greater than or equal to 0.
22.	For an MSID value in the Measurement table, if the DATA_TYPE value is “IDIS”, “IMAG”, “IUNS”, “ITWO”, “ITWOW”, “FEEE”, “FMIL”, “FIBM”, “FNTL”, or “FVAX”, then the LIMIT_LVRT_LOCTION value must not be equal to zero.
23.	For an MSID value in the Measurement table, if the DATA_TYPE value is “IDIS”, then the LOW_RAW_COUNT and the HIGH_RAW_COUNT values must be greater than or equal to 0 and less than or equal to one less than the value of 2 raised to the power of the TOTAL_LENGTH value.
24.	If the CALIBRATION_TYPE value is “PC”, “PP”, or “SC”, then the CALIBRATION_DEFAULT_SET_NUM value must not be NULL.
25.	If the CALIBRATION_TYPE value is “N”, then the CALIBRATION_DEFAULT_SET_NUM value must be NULL.
26.	If the DATA_TYPE value is “IDIS”, then the CALIBRATION_TYPE must be “SC”.

4.2.14 MSID Sampling Table

The table level validation rules for the MSID Sampling table are defined in Table 4.2.14-1.

Table 4.2.14-1. Table Level Validation Rules for the MSID Sampling Table

	VALIDATION RULE
1.	If the PAR_COMP value is “T” or “MS”, then the SAMPLE_PER_GROUP and GROUP_SAMPLE_OFFSET values must be NULL.
2.	If the PAR_COMP value is “NG”, then the SAMPLE_PER_GROUP and GROUP_SAMPLE_OFFSET values must not be NULL.
3.	If the SAMPLE_COMP value is “N”, “C”, or “R”, then the SAMPLE_RATE must be 1.0.
4.	If the SAMPLE_COMP value is “S”, then the SAMPLE_RATE must be greater than 1.0.
5.	If the SAMPLE_COMP value is “S”, then the OFFSET value must not be NULL.
6.	If the SAMPLE_COMP value is “N”, “C”, or “R”, then the OFFSET value must be NULL.
7.	If the START_COUNTER_VALUE value or the COUNTER_OFFSET value is not NULL, then LOW_RANGE, HIGH_RANGE, and STATE_CODE values must be NULL.
8.	If the START_COUNTER_VALUE value is not NULL, then the COUNTER_OFFSET value must not be NULL.
9.	If the COUNTER_OFFSET value is not NULL, then the START_COUNTER_VALUE value must not be NULL.
10.	If the LOW_RANGE value is not NULL, then the HIGH_RANGE value must not be NULL.
11.	If the HIGH_RANGE value is not NULL, then the LOW_RANGE value must not be NULL.
12.	If the LOW_RANGE and HIGH_RANGE values are not NULL, then the HIGH_RANGE value must be greater than the LOW_RANGE value.
13.	If the LOW_RANGE and the HIGH_RANGE values, or the STATE_CODE value is not NULL, then START_COUNTER_VALUE and COUNTER_OFFSET values must be NULL.
14.	If the LOW_RANGE value and the HIGH_RANGE value is not NULL, then the STATE_CODE value must be NULL.
15.	If the STATE_CODE value is not NULL, then the LOW_RANGE and HIGH_RANGE values must be NULL.
16.	If the SAMPLE_COMP value is “C” or “R”, then the CONTEXT_PACKET_ID, CONTEXT_PROTOCOL and CONTEXT_LVT_LOCATION values must not be NULL.
17.	If the SAMPLE_COMP value is “N” or “S”, then the CONTEXT_PACKET_ID, CONTEXT_PROTOCOL and CONTEXT_LVT_LOCATION values must be NULL.
18.	If the SAMPLE_COMP value is “C”, then the START_COUNTER_VALUE and COUNTER_OFFSET values must not be NULL.
19.	If the SAMPLE_COMP value is “C”, then the LOW_RANGE, HIGH_RANGE, and STATE_CODE values must be NULL.
20.	If the SAMPLE_COMP value is “R”, then the LOW_RANGE and HIGH_RANGE values or the STATE_CODE value must not be NULL.
21.	If the SAMPLE_COMP value is “R”, then the START_COUNTER_VALUE and COUNTER_OFFSET values must be NULL.
22.	If the SAMPLE_COMP value is “N” or “S”, then the START_COUNTER_VALUE, COUNTER_OFFSET, LOW_RANGE, HIGH_RANGE, and STATE_CODE values must be NULL.
23.	If the PAR_COMP value is “BG”, then the SAMPLE_PER_GROUP value must not be NULL.
24.	If the PAR_COMP value is “BG”, then the GROUP_SAMPLE_OFFSET value must be NULL.

4.2.15 MSID Location Table

No table level validation rules for the MSID Location table are defined.

4.2.16 Counter Table

The table level validation rules for the Counter table are defined in Table 4.2.16-1.

Table 4.2.16-1. Table Level Validation Rules for the Counter Table

	VALIDATION RULE
1.	If the DIR value is "+", then the END_VALUE value must be greater than the INIT_VALUE value.
2.	If the DIR value is "-", then the INIT_VALUE value must be greater than the END_VALUE value.

4.2.17 Polynomial Calibration Table

The table level validation rules for the Polynomial Calibration table are defined in Table 4.2.17-1.

Table 4.2.17-1. Table Level Validation Rules for the Polynomial Calibration Table

	VALIDATION RULE
1.	The ENG_UNIT_HIGH value must be greater than the ENG_UNIT_LOW value.
2.	DELETED.
3.	DELETED.
4.	The DEG value must be equal to the number of not NULL coefficient values minus one.

4.2.18 Point Pair Table

The table level validation rules for the Point Pair table are defined in Table 4.2.18-1.

Table 4.2.18-1. Table Level Validation Rules for the Point Pair Table

	VALIDATION RULE
1.	For a CALIBRATION_SET_NUM value, the maximum number of point pairs is 21.
2.	For a CALIBRATION_SET_NUM value, the minimum number of point pairs is 2.
3.	For a CALIBRATION_SET_NUM value, the RAW_COUNT value must not be equal to another RAW_COUNT value.

4.2.19 State Code Table

The table level validation rules for the State Code table are defined in Table 4.2.19-1.

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Table 4.2.19-1. Table Level Validation Rules for the State Code Table

	VALIDATION RULE
1.	For a CALIBRATION_SET_NUM value, the maximum number of state codes is 32.
2.	The LOW_RAW_COUNT value must be less than or equal to the HIGH_RAW_COUNT value.
3.	For a CALIBRATION_SET_NUM value, only one STATE_CODE value may be blank.
4.	There must be at least two entries per CALIBRATION_SET_NUM.

4.2.20 Calibration Switch Table

The table level validation rules for the Calibration Switch table are defined in Table 4.2.20-1.

Table 4.2.20-1. Table Level Validation Rules for the Calibration Switch Table

	VALIDATION RULE
1.	If the LOW_RANGE value or the HIGH_RANGE value is not NULL, then the STATE_CODE value must be NULL.
2.	If the STATE_CODE value is not NULL, then the LOW_RANGE and HIGH_RANGE values must be NULL.
3.	If the LOW_RANGE value is not NULL, then the HIGH_RANGE value must not be NULL.
4.	If the HIGH_RANGE value is not NULL, then the LOW_RANGE value must not be NULL.
5.	If the LOW_RANGE and HIGH_RANGE values are not null, the HIGH_RANGE value must be greater than the LOW_RANGE value.

4.2.21 Limit Table

The table level validation rules for the Limit table are defined in Table 4.2.21-1.

Table 4.2.21-1. Table Level Validation Rules for the Limit Table

	VALIDATION RULE
1.	The CAUTION_LOW value or the CAUTION_HIGH value or the WARNING_LOW value or the WARNING_HIGH value must not be NULL.
2.	For the limits that are not NULL, the WARNING_LOW value must be less than the CAUTION_LOW, CAUTION_HIGH, and WARNING_HIGH values, the CAUTION_LOW value must be less than the CAUTION_HIGH and WARNING_HIGH values, and the CAUTION_HIGH value must be less than the WARNING_HIGH value.

4.2.22 Limit Switch Table

The table level validation rules for the Limit Switch table are defined in Table 4.2.22-1.

Table 4.2.22-1. Table Level Validation Rules for the Limit Switch Table

	VALIDATION RULE
1.	If the LOW_RANGE value or the HIGH_RANGE value is not NULL, then the STATE_CODE value must be NULL.
2.	If the STATE_CODE value is not NULL, then the LOW_RANGE and HIGH_RANGE values must be NULL.
3.	If the LOW_RANGE value is not NULL, then the HIGH_RANGE value must not be NULL.
4.	If the HIGH_RANGE value is not NULL, then the LOW_RANGE value must not be NULL.
5.	If the LOW_RANGE and HIGH_RANGE values are not null, the HIGH_RANGE value must be greater than the LOW_RANGE value.

4.2.23 Expected State Table

No table level validation rules for the Expected State table are defined.

4.2.24 Expected State Switch Table

The table level validation rules for the Expected State Switch table are defined in Table 4.2.24-1.

Table 4.2.24-1. Table Level Validation Rules for the Expected State Switch Table

	VALIDATION RULE
1.	If the LOW_RANGE value or the HIGH_RANGE value is not NULL, then the STATE_CODE value must be NULL.
2.	If the STATE_CODE value is not NULL, then the LOW_RANGE and HIGH_RANGE values must be NULL.
3.	If the LOW_RANGE value is not NULL, then the HIGH_RANGE value must not be NULL.
4.	If the HIGH_RANGE value is not NULL, then the LOW_RANGE value must not be NULL.
5.	If the LOW_RANGE and HIGH_RANGE values are not null, the HIGH_RANGE value must be greater than the LOW_RANGE value.

4.2.25 Control Group Table

The table level validation rules for the Control Group table are defined in Table 4.2.25-1.

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Table 4.2.25-1. Table Level Validation Rules for the Control Group Table

	VALIDATION RULE
1.	If the TIME_TYPE value is not NULL, then the CONTROL_MSID, CONTROL_LOW, CONTROL_HIGH, and CONTROL_CODE values must be NULL.
2.	If the TIME_TYPE value is not NULL, then the START_TIME value must not be NULL.
3.	If the START_TIME and STOP_TIME values are not NULL, then the STOP_TIME value must be greater than the START_TIME value.

Table 4.2.25-1. Table Level Validation Rules for the Control Group Table (Cont.)

	VALIDATION RULE
4.	If the CONTROL_MSID value is not NULL, then the TIME_TYPE, START_TIME, and STOP_TIME values must be NULL.
5.	If the CONTROL_MSID value is not NULL, then the CONTROL_LOW value, or the CONTROL_HIGH value, or the CONTROL_CODE value must not be NULL.
6.	If the CONTROL_LOW value or the CONTROL_HIGH value is not NULL, then the CONTROL_CODE value must be NULL.
7.	If the CONTROL_CODE value is not NULL, then the CONTROL_LOW and CONTROL_HIGH values must be NULL.
8.	If the CONTROL_LOW and CONTROL_HIGH values are not null, then the CONTROL_HIGH value must be greater than the CONTROL_LOW value.

4.2.26 Group Content Table

No table level validation rules for the Group Content table are defined.

4.2.27 Deleted

4.2.28 Deleted

4.2.29 GSE MSID Table

No table level validation rules for the GSE MSID table are defined.

4.2.30 GSE Packet Table

No table level validation rules for the GSE Packet table are defined.

4.3 COLUMN LEVEL VALIDATION RULES

Column level validation rules apply to the data in a specific column of a single table. These rules are divided into standard column level rules and specific column level rules.

The standard column level validation rules are a fixed set of standard validation rules which can be defined for any column of any table. An individual standard rule may not apply to a particular column and there may be many columns that have no standard rules. Standard column level rules include minimum and maximum values, default values, and valid values.

The specific column level validation rules for a specific column are those column level rules that cannot be expressed as standard rules. A single column may have many specific validation rules or there may not be any specific rules for a given column.

The column level validation rules for the tables defined in this volume are specified in the following sections.

4.3.1 Telemetry System Table

The standard column level validation rules for the Telemetry System table are defined in Table 4.3.1-1. The specific column level validation rules for the Telemetry System table are defined in Table 4.3.1-2.

Table 4.3.1-1. Standard Column Level Validation Rules for the Telemetry System Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
PROJECT				“AXAF”,“ISS”, “SL”,“STS”

Table 4.3.1-2. Specific Column Level Validation Rules for the Telemetry System Table

COLUMN NAME	VALIDATION RULE
MISSION	All letters in the value must be uppercase with no embedded blanks.
REVISION	All letters in the value must be uppercase with no embedded blanks.

4.3.2 Owner Table

No standard column level validation rules have been defined for the Owner table. The specific column level validation rules for the Owner table are defined in Table 4.3.2-1.

Table 4.3.2-1. Specific Column Level Validation Rules for the Owner Table

COLUMN NAME	VALIDATION RULE
OWNER_ID	All letters in the value must be uppercase with no embedded blanks.
OWNER_ID	Value must be non-blank.

4.3.3 Block Table

No standard column level validation rules have been defined for the Block table. The specific column level validation rules for the Block table are defined in Table 4.3.3-1.

Table 4.3.3-1. Specific Column Level Validation Rules for the Block Table

COLUMN NAME	VALIDATION RULE
BLOCK_ID_MSID	Value must not be NULL.
FORMAT_ID_MSID	Value must not be NULL.

4.3.4 Block Format Table

No standard column level validation rules have been defined for the Block Format table. The specific column level validation rules for the Block Format table are defined in Table 4.3.4-1.

Table 4.3.4-1. Specific Column Level Validation Rules for the Block Format Table

COLUMN NAME	VALIDATION RULE
BLOCK_FORMAT_ID	Value must be alphanumeric. All letters in the value must be uppercase with no embedded blanks.
FORMAT	Value must not be NULL.
ENCAP_STREAM_ NUMBER	Value must not be NULL.

4.3.5 Deleted

4.3.6 Packet Table

The standard column level validation rules for the Packet table are defined in Table 4.3.6-1. The specific column level validation rules for the Packet table are defined in Table 4.3.6-2.

Table 4.3.6-1. Standard Column Level Validation Rules for the Packet Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
PACKET_ID	0	2047	0	
PROTOCOL				“C”,“G”,“P”,“T”, “B”, “D”
SEC_HEADER			“N”	“N”,“Y”
SEC_HEADER_LENGTH	1		NULL	
CONTEXT_LVT_SIZE	1		NULL	

Table 4.3.6-2. Specific Column Level Validation Rules for the Packet Table

COLUMN NAME	VALIDATION RULE
PACKET_ID_MSID	Value must not be NULL.
FORMAT_ID_MSID	Value must not be NULL.
TIME_MSID	Value must not be NULL.
PROTOCOL	Value must not be NULL.

4.3.7 Packet Format Table

The standard column level validation rules for the Packet Format table are defined in Table 4.3.7-1. The specific column level validation rules for the Packet Format table are defined in Table 4.3.7-2

Table 4.3.7-1. Standard Column Level Validation Rules for the Packet Format Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
PACKET_ID	0	2047	0	
PROTOCOL				“C”,“G”,“P”, “T”, “B”, “D”
SUBSET_FLAG			“N”	“N”,“Y”
LENGTH	1			

Table 4.3.7-2. Specific Column Level Validation Rules for the Packet Format Table

COLUMN NAME	VALIDATION RULE
PACKET_FORMAT_ID	Value must be alphanumeric. All letters in the value must be uppercase with no embedded blanks.
FORMAT	Value must not be NULL.
LENGTH	Value must not be NULL.
UPDATE_CYCLE	Value must not be NULL.
DATA_CYCLE	Value must not be NULL.

4.3.8 Subset Table

The standard column level validation rules for the Subset table are defined in Table 4.3.8-1. The specific column level validation rules for the Subset table are defined in Table 4.3.8-2.

Table 4.3.8-1. Standard Column Level Validation Rules for the Subset Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
SAMPLE_COMP				“C”,“N”,“R”,“S”,“D”
COUNTER_OFFSET	2		NULL	
START_COUNTER_ VALUE	0		NULL	
SAMPLE_RATE	1			
DATA_CYCLE	1			
OFFSET	1			

Table 4.3.8-2. Specific Column Level Validation Rules for the Subset Table

COLUMN NAME	VALIDATION RULE
SUBSET_ID	Value must not be negative.
ENCAP_STREAM_NUMBER	Value must not be NULL.
SUBSET_ID_ MSID	Value must not be NULL.
FORMAT_ID_ MSID	Value must not be NULL.
SAMPLE_COMP	Value must not be NULL.
DATA_CYCLE	Value must not be NULL.
SAMPLE_RATE	Value must not be NULL.

4.3.9 Subset Format Table

The standard column level validation rules for the Subset Format table are defined in Table 4.3.9-1. The specific column level validation rules for the Subset Format table are defined in Table 4.3.9-2.

Table 4.3.9-1. Standard Column Level Validation Rules for the Subset Format Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
SUBSET_FLAG			“N”	“N”,“Y”
LENGTH	1			

Table 4.3.9-2. Specific Column Level Validation Rules for the Subset Format Table

COLUMN NAME	VALIDATION RULE
SUBSET_ID	Value must not be negative.
SUBSET_FORMAT_ID	Value must be alphanumeric. All letters in the value must be uppercase with no embedded blanks.
FORMAT	Value must not be NULL.
LENGTH	Value must not be NULL.
SUBSET_FLAG	Value must not be NULL. All letters in value must be uppercase.

4.3.10 TDM Table

The standard column level validation rules for the TDM table are defined in Table 4.3.10-1. The specific column level validation rules for the TDM table are defined in Table 4.3.10-2.

Table 4.3.10-1. Standard Column Level Validation Rules for the TDM Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
SYNC_LENGTH				“8”,“16”,“24”,“32”

Table 4.3.10-2. Specific Column Level Validation Rules for the TDM Table

COLUMN NAME	VALIDATION RULE
TDM_ID	Value must be alphanumeric. All letters in the value must be uppercase with no embedded blanks.
FORMAT_ID_ MSID	Value must not be NULL. All letters in value must be uppercase with no embedded blanks.
SYNC_PATTERN	Value must not be NULL. All letters in value must be uppercase with no embedded blanks.
SYNC_PATTERN_ MSID	Value must not be NULL. All letters in value must be uppercase with no embedded blanks.
SYNC_LENGTH	Value must not be NULL. All letters in value must be uppercase with no embedded blanks.

4.3.11 TDM Format Table

The standard column level validation rules for the TDM Format table are defined in Table 4.3.11-1. The specific column level validation rules for the Block table are defined in Table 4.3.11-2.

Table 4.3.11-1. Standard Column Level Validation Rules for the TDM Format Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
BITS_PER_WORD			“16”	“8”,“16”
WORDS_PER_ MINOR_FRAME	5	1134		
MINOR_FRAMES_ PER_MAJOR_ FRAME	1	256		
DATA_CYCLE	1			
ENCAP_STREAM_ NUMBER	1	9999	NULL	
ENCAP_ BOUNDARY			“M”	“F”,“M”
ENCAP_FRAME_PER_PACKET	1		1	

Table 4.3.11-2. Specific Column Level Validation Rules for the TDM Format Table

COLUMN NAME	VALIDATION RULE
TDM_ID	Value must be alphanumeric. All letters in the value must be uppercase with no embedded blanks.
TDM_FORMAT_ID	Value must be alphanumeric. All letters in the value must be uppercase with no embedded blanks.
FORMAT	Value must not be NULL.
BITS_PER_WORD	Value must not be NULL.
WORDS_PER_ MINOR_FRAME	Value must not be NULL.
MINOR_FRAMES_PER_MAJOR_ FRAME	Value must not be NULL.
DATA_CYCLE	Value must not be NULL.

Table 4.3.11-2. Specific Column Level Validation Rules for the TDM Format Table

COLUMN NAME	VALIDATION RULE
DATA_CYCLE	Value must be greater than zero.
MAJOR_FRAME_ PERIOD	Value must not be NULL.
MAJOR_FRAME_ PERIOD	Value must be greater than zero.
ENCAP_ BOUNDARY	Value must not be NULL.
ENCAP_FRAME_ PER_PACKET	Value must not be NULL.
FORMAT	All letters in value must be uppercase with no embedded blanks.

4.3.12 Stream ID Table

The standard column level validation rules for the Stream ID table are defined in Table 4.3.12-1. The specific column level validation rules for the Stream ID table are defined in Table 4.3.12-2.

Table 4.3.12-1. Standard Column Level Validation Rules for the Stream ID Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
STREAM_NUMBER	1	99	1	
STREAM_TYPE				“B”,“P”, “S”,“T”
PROTOCOL			NULL	“C”,“G”,“P”,“T”, “B”, “D”, NULL
STREAM_ PRIORITY	1		NULL	
STREAM_PROP			“N”	“N”,”Y”

Table 4.3.12-2. Specific Column Level Validation Rules for the Stream ID Table

COLUMN NAME	VALIDATION RULE
STREAM_TYPE	Value must not be NULL.
STREAM_ID	Value must not be NULL.
STREAM_ID	Value must be alphanumeric. All letters in the value must be uppercase with no embedded blanks.
STREAM_ FORMAT_ID	Value must not be NULL.
STREAM_ FORMAT_ID	Value must be alphanumeric. All letters in the value must be uppercase with no embedded blanks.
STREAM_PROP	Value must not be NULL.
STREAM_OWNER_ID	Value must not be NULL.
STREAM_OWNER_ID	Value must be alphanumeric. All letters in the value must be uppercase with no embedded blanks.
PROTOCOL	All letters in value must be uppercase.

4.3.13 Measurement Table

The standard column level validation rules for the Measurement table are defined in Table 4.3.13-1. The specific column level validation rules for the Measurement table are defined in Table 4.3.13-2.

Table 4.3.13-1. Standard Column Level Validation Rules for the Measurement Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
CALIBRATION_ TYPE			“N”	“PC”,“PP”,”SC”, “N”
LOW_RAW_COUNT	-2147483648	2147483646	NULL	
HIGH_RAW_COUNT	-2147483647	2147483647	NULL	
PROP			“N”	“N”,“Y”
CALIBRATION_DEFAULT_SET_ NUM	1	32	NULL	
LIMIT_DEFAULT_SET_NUM	1	32	NULL	
ES_DEFAULT_SET_NUM	1	32	NULL	
LIMIT_LRVT_LOCATION	1		NULL	
EHS_HEADER_FLAG			“U”	“U”, “H”

* NOTE: Full raw count range of -2147483650 to +2147483649 can not be used due to Oracle limitation.

Table 4.3.13-2. Specific Column Level Validation Rules for the Measurement Table

COLUMN NAME	VALIDATION RULE
MSID	Value must not be blank.
MSID	All characters must be uppercase with no embedded blanks.
TECHNICAL_NAME	Value must not be NULL.
DATA_TYPE	Value must not be NULL.
DATA_TYPE	Value must be uppercase.
CALIBRATION_ TYPE	Value must not be NULL.
TOTAL_LENGTH	Value must not be NULL.
TOTAL_LENGTH	Value must be positive.
PROP	Value must not be NULL.
OWNER_ID	Value must not be NULL.

4.3.14 MSID Sampling Table

The standard column level validation rules for the MSID Sampling table are defined in Table 4.3.14-1. The specific column level validation rules for the MSID Sampling table are defined in Table 4.3.14-2.

Table 4.3.14-1. Standard Column Level Validation Rules for the MSID Sampling Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
PAR_COMP			“T”	“T”,“MS”,“BG”,“NG”
SAMPLE_PER_ GROUP	1		NULL	NULL
GROUP_SAMPLE_ OFFSET	1		NULL	NULL
SAMPLE_COMP			“N”	“N”,“S”,“C”,“R”
SAMPLE_RATE				
OFFSET	1		NULL	NULL
START_COUNTER_ VALUE	0		NULL	NULL
COUNTER_OFFSET	2		NULL	NULL
CONTEXT_PACKET_ID	0	2047	NULL	NULL
CONTEXT_LVT_LOCATION	1		NULL	NULL
CONTEXT_PROTOCOL			NULL	“G”, “P”, “T”, “B”, “D”

Table 4.3.14-2. Specific Column Level Validation Rules for the MSID Sampling Table

COLUMN NAME	VALIDATION RULE
PAR_COMP	Value must not be NULL.
SAMPLE_COMP	Value must not be NULL.
SAMPLE_RATE	Value must not be NULL.

4.3.15 MSID Location Table

The standard column level validation rules for the MSID Location table are defined in Table 4.3.15-1. The specific column level validation rules for the MSID Location table are defined in Table 4.3.15-2.

Table 4.3.15-1. Standard Column Level Validation Rules for the MSID Location Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
SYLLABLE_NUMBER	1		1	
START_MINOR_ FRAME	0	255	NULL	NULL
START_WORD	1		1	
START_BIT	0	63	0	
LENGTH	1		1	

Table 4.3.15-2. Specific Column Level Validation Rules for the MSID Location Table

COLUMN NAME	VALIDATION RULE
START_WORD	Value must not be NULL.
START_BIT	Value must not be NULL.
LENGTH	Value must not be NULL.

4.3.16 Counter Table

The standard column level validation rules for the Counter table are defined in Table 4.3.16-1. The specific column level validation rules for the Counter table are defined in Table 4.3.16-2.

Table 4.3.16-1. Standard Column Level Validation Rules for the Counter Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
WRAP_AROUND_ FLAG			“W”	“N”,“W”
DIR			“+”	“+”,“-”
DELTA	1		1	
COUNTER_TYPE			“N”	“B”, “P”,“S”,“MIN”, “MAJ”,“N”

Table 4.3.16-2. Specific Column Level Validation Rules for the Counter Table

COLUMN NAME	VALIDATION RULE
INIT_VALUE	Value must not be NULL.
END_VALUE	Value must not be NULL.
DELTA	Value must not be NULL.

4.3.17 Polynomial Calibration Table

The standard column level validation rules for the Polynomial Calibration table are defined in Table 4.3.17-1. The specific column level validation rules for the Polynomial Calibration table are defined in Table 4.3.17-2.

Table 4.3.17-1. Standard Column Level Validation Rules for the Polynomial Calibration Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
CALIBRATION_ SET_NUM	1	32	1	
DEG	1	9		

Table 4.3.17-2. Specific Column Level Validation Rules for the Polynomial Calibration Table

COLUMN NAME	VALIDATION RULE
DEG	Value must not be NULL.
ENG_UNIT_LOW	Value must not be NULL.
ENG_UNIT_HIGH	Value must not be NULL.
COEF0	Value must not be NULL.
COEF1	Value must not be NULL.

4.3.18 Point Pair Table

The standard column level validation rules for the Point Pair table are defined in Table 4.3.18-1. The specific column level validation rules for the Point Pair table are defined in Table 4.3.18-2.

Table 4.3.18-1. Standard Column Level Validation Rules for the Point Pair Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
CALIBRATION_ SET_NUM	1	32	1	
SEQUENCE_NUM	1	21	1	

Table 4.3.18-2. Specific Column Level Validation Rules for the Point Pair Table

COLUMN NAME	VALIDATION RULE
RAW_COUNT	Value must not be NULL.
ENG_UNIT_VALUE	Value must not be NULL.

4.3.19 State Code Table

The standard column level validation rules for the State Code table are defined in Table 4.3.19-1. The specific column level validation rules for the State Code table are defined in Table 4.3.19-2.

Table 4.3.19-1. Standard Column Level Validation Rules for the State Code Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
CALIBRATION_ SET_NUM	1	32	1	
SEQUENCE_NUM	1	32		
STATE_CODE			“ ”	

Table 4.3.19-2. Specific Column Level Validation Rules for the State Code Table

COLUMN NAME	VALIDATION RULE
LOW_RAW_ COUNT	Value must not be NULL.
HIGH_RAW_ COUNT	Value must not be NULL.
STATE_CODE	Value must not be NULL.

4.3.20 Calibration Switch Table

The standard column level validation rules for the Calibration Switch table are defined in Table 4.3.20-1. No specific column level validation rules for the Calibration Switch table are defined.

Table 4.3.20-1. Standard Column Level Validation Rules for the Calibration Switch Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
CALIBRATION_ SET_NUM	1	32	1	

4.3.21 Limit Table

The standard column level validation rules for the Limit table are defined in Table 4.3.21-1. No specific column level validation rules for the Limit table are defined.

Table 4.3.21-1. Standard Column Level Validation Rules for the Limit Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
LIMIT_SET_NUM	1	32	1	
EM_ALL_SAMP_ FLAG			“N”	“A”,“F”,“N”

4.3.22 Limit Switch Table

The standard column level validation rules for the Limit Switch table are defined in Table 4.3.22-1. No specific column level validation rules for the Limit Switch table are defined.

Table 4.3.22-1. Standard Column Level Validation Rules for the Limit Switch Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
LIMIT_SET_NUM	1	32	1	

4.3.23 Expected State Table

The standard column level validation rules for the Expected State table are defined in Table 4.3.23-1. The specific column level validation rules for the Expected State table are defined in Table 4.3.23-2.

Table 4.3.23-1. Standard Column Level Validation Rules for the Expected State Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
ES_SET_NUM	1	32	1	
EM_ALL_SAMP_ FLAG			“N”	“A”,“F”,”N”

Table 4.3.23-2. Specific Column Level Validation Rules for the Expected State Table

COLUMN NAME	VALIDATION RULE
EXPECTED_ STATE	Value must not be NULL.

4.3.24 Expected State Switch Table

The standard column level validation rules for the Expected State Switch table are defined in Table 4.3.24-1. No specific column level validation rules for the Expected State Switch table are defined.

Table 4.3.24-1. Standard Column Level Validation Rules for the Expected State Switch Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
ES_SET_NUM	1	32	1	

4.3.25 Control Group Table

The standard column level validation rules for the Control Group table are defined in Table 4.3.25-1. The specific column level validation rules for the Control Group table are defined in Table 4.3.25-2.

Table 4.3.25-1. Standard Column Level Validation Rules for the Control Group Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
PROJECT_EM			“N”	“N”,“Y”
TIME_TYPE			NULL	“GMT”,“MET”, NULL

Table 4.3.25-2. Specific Column Level Validation Rules for the Control Group Table

COLUMN NAME	VALIDATION RULE
GROUP_ID	Value must be alphanumeric. All letters in the value must be uppercase.
PROJECT_EM	Value must not be NULL.
OWNER_ID	Value must not be NULL.

4.3.26 Group Content Table

The standard column level validation rules for the Group Content table are defined in Table 4.3.26-1. The specific column level validation rules for the Group Content table are defined in Table 4.3.26-2.

Table 4.3.26-1. Standard Column Level Validation Rules for the Group Content Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
MSID_SET_NUM	1	32	NULL	

Table 4.3.26-2. Specific Column Level Validation Rules for the Group Content Table

COLUMN NAME	VALIDATION RULE
GROUP_ID	Value must be alphanumeric. All letters in the value must be uppercase.

4.3.27 Deleted

4.3.28 Deleted

4.3.29 GSE MSID Table

The standard column level validation rules for the GSE MSID table are defined in Table 4.3.29-1. The specific column level validation rules for the GSE MSID table are defined in Table 4.3.29-2.

Table 4.3.29-1. Standard Column Level Validation Rules for the GSE MSID Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
GSE_PACKET_ID	0	2047	0	
START_OCTET	1			
SAMPLE_RATE	1		1	

Table 4.3.29-2. Specific Column Level Validation Rules for the GSE MSID Table

COLUMN NAME	VALIDATION RULE
START_OCTET	Value must not be NULL.
SAMPLE_RATE	Value must not be NULL.

4.3.30 GSE Packet Table

The standard column level validation rules for the GSE Packet table are defined in Table 4.3.30-1. The specific column level validation rules for the GSE Packet table are defined in Table 4.3.30-2.

Table 4.3.30-1. Standard Column Level Validation Rules for the GSE Packet Table

COLUMN NAME	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE	VALID VALUES
GSE_PACKET_ID	0	2047	0	
PARITY				“E”, “O”, “N”
BAUD_RATE			1	“76.8”, “56.0”, “38.4”, “19.2”, “9.6”, “4.8”, “2.4”
BYTE_SWAP				“N”, “Y”
PROJECT_USER				“P”, “U”
LENGTH	1			

Table 4.3.30-2. Specific Column Level Validation Rules for the GSE Packet Table

COLUMN NAME	VALIDATION RULE
PARITY	Value must not be NULL.
BAUD_RATE	Value must not be NULL.
BYTE_SWAP	Value must not be NULL.
PROJECT_USER	Value must not be NULL.
LENGTH	Value must not be NULL.

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APPENDIX A

ABBREVIATIONS AND ACRONYMS

APPENDIX A - ABBREVIATIONS AND ACRONYMS

ACIS	AXAF CCD Imaging Spectrometer
APID	Application Process Identification
ASCII	American Standard Code for Information Interchange
AXAF	Advanced X-ray Astrophysics Facility
BBXRT	Broad Band X-ray Telescope
BCS	Brags Crystal Spectrometer
BDC	Binary Coded Decimal
CAL	Calibration
CCSDS	Consultative Committee for Space Data System
CDB	Command Database
CHK	Checksum
CMD	Command
CNT	Count Time (Shuttle Launch)
COEF	Coefficient
CRC	Cyclic Redundancy Code
DBCG	Database Coordination Group
DECAL	Decalibration
DOC	Document
EBCDIC	Extended Binary Coded Decimal Interchange Code
ECIO	Experiment Computer Input/Output
ECOS	Experiment Computer Operating System
EHS	Enhanced HOSC System
EM	Exception Monitor
ENG	Engineering
E-R	Entity Relationship

EXP	Expected
GMT	Greenwich Mean Time
GPC	General Purpose Computer
GSE	Ground Support Equipment
HEX	Hexadecimal
HOSC	Huntsville Operations Support Center
HUT	Hopkins Ultraviolet Telescope
I/O	Input/Output
IBM	International Business Machines
ID	Identifier
IEEE	Institute of Electrical and Electronics Engineers
INIT	Initial
ISS	International Space Station
KSC	Kennedy Space Center
LRVT	Last Refresh Value Table
LSB	Least Significant Bit
LVT	Last Value Table
MIN	Minimum
MAX	Maximum
MDM	Multiplexer/Demultiplexer
MET	Mission Elapsed Time
MRTC	Multiple Real-time Command
MSB	Most Significant Bit
MSFC	Marshall Space Flight Center

MSID	Measurement Stimulus/Identifier
MTU	Master Timing Unit
NASA	National Aeronautics and Space Administration
NASCOM	NASA Communication System
OCDB	Operational Command Database
OD	Operational Downlink
OI	Operational Instrumentation
PAYCOM	Payload Commander
PC	Polynomial Coefficient
PL	Payload
POCC	Payload Operations Control Center
PP	Point Pair
PSP	Payload Signal Processor
RI	Record Identification
RDBMS	Relational Database Management System
REV	Revision
RTC	Real-time Command
S/S	Samples per Second
SCIO	Subsystem Computer Input/Output
SCNT	Simulated Count
SL	Spacelab
SPC	Stored Program Command
SSI	Standard Serial Input/Output
SSP	Space Station Program

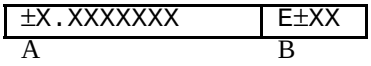
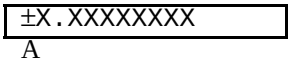
TBD	To Be Determined
TDB	Telemetry Database
TDM	Time Division Multiplexing
THRU	Throughput
TLM	Telemetry
VAR	Variable
VERIF	Verifier
ZWC	Zero Word Count

APPENDIX B

COLUMN TYPE DEFINITIONS

APPENDIX B - COLUMN TYPE DEFINITIONS

This appendix defines the column types used in the table descriptions of this volume.

COLUMN TYPE	DESCRIPTION
character	ASCII text characters as specified in Appendix C.
integer	Member of the set of decimal whole numbers (.. -2, -1, 0, 1, 2...). No decimal point allowed.
hexadecimal	Valid characters are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F.
scientific notation	A number of the following format:  A: Mantissa • sign is optional (positive is assumed) • decimal point may float • length may vary • no embedded blanks B: Exponent (optional) • sign is required • immediately follows the last digit of the mantissa • no embedded blanks
floating point	A number of the following format:  A: Mantissa • sign is optional (positive is assumed) • decimal point may float • length may vary • no embedded blanks
time1	Valid date of the following format: HH:MM:SS HH two-digit hour of the day (00-23) MM two-digit minute of the hour (00-59) SS two-digit second of the minute (00-59) Examples: 10:05:34 22:58:03
time2	Valid date of the following format: YY:DDD:HH:MM:SS YY last two-digits of the year (00-99) DDD three-digit Julian date of the year (001-366) HH two-digit hour of the day (00-23) MM two-digit minute of the hour (00-59) SS two-digit second of the minute (00-59) Examples: 95:123:10:05:34 03:103:22:58:03

<table>
<tr><th>COLUMN TYPE</th><th>DESCRIPTION</th></tr>
<tr><td>timestamp</td><td>Valid date/time value of the following format:

<table>
<tr><td>DD-MMM-YYYY</td><td>HH:MM:SS</td></tr>
<tr><td>A</td><td>B</td></tr>
</table>
A: Date
DD two-digit day of the month (01-31)
MMM first three letters of the month (e.g., JAN, FEB, MAR)
YYYY four-digit year (e.g., 1995)

B: Time
HH two-digit hour of the day (00-23)
MM two-digit minute of the hour (00-59)
SS two-digit second of the minute (00-59)

There should be one blank space between the date and the time.

Examples: 03-JAN-1995 10:05:34
21-MAY-2003 22:58:03</td></tr>
</table>

APPENDIX C

LEGAL CHARACTERS

APPENDIX C - LEGAL CHARACTERS

This appendix defines the legal characters that can be input into the tables defined in this volume when the user supplies database information.

UPPER CASE	LOWER CASE	DIGITS	SPECIAL CHARACTERS	
A	a	0		blank/NULL
B	b	1	:	colon
C	c	2	.	period
D	d	3	,	comma
E	e	4	"	quotation mark
F	f	5	'	apostrophe
G	g	6	&	ampersand
H	h	7	;	semicolon
I	i	8	!	exclamation point
J	j	9	_	underline
K	k			
L	l		=	equal sign
M	m		-	minus sign
N	n		+	plus sign
O	o			
P	p		/	slash
Q	q		>	greater than
R	r		<	less than
S	s			
T	t		#	number sign
U	u		@	commercial at
V	v		(	left parenthesis
W	w		)	right parenthesis
X	x		$	dollar mark
Y	y			
Z	z			

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APPENDIX D

ENGINEERING UNIT ABBREVIATIONS

APPENDIX D - ENGINEERING UNIT ABBREVIATIONS

This appendix defines the legal engineering unit values that may be assigned to the telemetry fields in the engineering units field of the Measurement table.

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
ABSORBANCE	ABSORPTION UNITS	AU
ABSORBED DOSE	GRAY	GRAY
	RADIATION ABSORBED DOSES	RADAD
ABSORBED DOSE RATE	MILLI-RADIANS PER MINUTE	MRADPM
ACCLERATION (ANGULAR)	DEGREE/SEC/SEC	DEGSS
	RADIANS/SEC/SEC	RADSS
ACCELERATION (LINEAR)	FEET/SEC/SEC	FTSS
	GRAVITY	G
	INCH PER SECOND SQUARED	INPSEC2
	METERS/SEC/SEC	MSS
ACOUSTIC IMPEDANCE	PASCAL SECONDS PER CUBIC METER	PASPM3
ACTIVITY (OF A RADIONUCLIDE)	BECQUEREL	BQ
AMOUNT	KILOMOLE	KMOL
	MICROMOLE	UMOL
	MILLIMOLE	MMOL
	MOLE	MOL
ANGLE OR ELECT PHASE	ARC MINUTES	AMIN
	ARC SECONDS	ASEC
	DEGREES	DEG
	MICRORADIANS	URAD
	MILLIRADIANS	MRAD
	RADIANS	RAD
ANGULAR MOMENTUM	FOOT POUND SECONDS	FTLBSEC
ANGULAR RATE/ ATTITUDE RATE ERROR	DEGREE PER HOUR	DEGPHR

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
ANGULAR VELOCITY	DEGREES/SEC	DEGPS
	RADIANS/SEC	RADPS
	REVOLUTIONS/MIN	RPM
	REVOLUTIONS/SEC	RPS
AREA	SQUARE CENTIMETERS	CM2
	SQUARE DECIMETERS	DM2
	SQUARE KILOMETERS	KM2
	SQUARE METERS	M2
	SQUARE MILLIMETERS	MM2
ATTITUDE RATE NOISE	DEGREES SQUARED PER SECOND CUBED	DEG2PSEC3
BANDWIDTH	BITS PER SECOND	BPS
BRIGHTNESS	MAGNITUDE INTENSITY	MI
CAPACITANCE	FARAD	FAR
	MICROFARAD	UFAR
	MILLIFARAD	MFAR
	NANOFARAD	NFAR
	PICOFARAD	PFAR
CHARGE	AH	AH
	COULOMB	C
	KILOCOULOMB	KC
	MEGACOULOMB	MGC
	MICROAH	UAH
	MICROCOULOMB	UC
	MILLIAH	MAH
	MILLICOULOMB	MC
	NANOCOULOMB	NC
	PICOCOULOMB	PC
CHARGE DENSITY	COULOMB/SQUARE METER	CPM2
COEFFICIENT OF HEAT TRANSFER	WATT/SQUARE METER KELVIN	WPM2K
CONCENTRATION	MICROGRAMS PER MILLIMETER	UGPMM
	PARTS PER BILLION	PPB
CONCENTRATION OF SUBSTANCE	MOLE/CUBIC METER	MOLPM3

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
CONDUCTANCE	KILOSIEMENS	KSIE
	MICROSIEMENS	USIE
	MILLISIEMENS	MSIE
	SIEMENS	SIE
CONDUCTIVITY	KILOSIEMENS/METER	KSIEPM
	MICRO-MHOS PER CENTIMETER	UMHOSPCM
	SIEMENS/METER	SIEPM
COUNTS/QUANTITY	COUNTS	CNTS
CURRENT	AMPERES	AMP
	MICROAMPERES	UAMP
	MILLIAMPERES	MAMP
	NANOAMPERES	NAMP
	PICOAMPERES	PAMP
CURRENT DENSITY	AMPS/SQUARE METER	AMPPM2
DATA RATE	KILOBITS PER SECOND	KBPS
DENSITY	GRAMS PER CUBIC CENTIMETER	GPC3
	KILOGRAMS PER CUBIC METER	KGPM3
DIFFERENTIAL PRESS/SEAL LEAK	POUNDS PER SQUARE INCH DIFFERENTIAL	PSID
DOSE EQUIVALENT	ROTOGEN EQUIVALENT MAN	REM
	SIEVERTS	SV
	THOUSAND POUNDS FORCE	KLBF
	THOUSAND REV PER MINUTE	KRPM
	THOUSANDS FEET	KFT
EFFECTIVE DRAG AREA	FEET SQUARED	FT2
ELECTRIC DIPOLE MOMENT	COULOMB METER	CM
ELECTRIC FIELD STRENGTH	VOLT/METER	VPM
ELECTRIC POLARIZATION	COULOMB/SQUARE METER	CPM2
	KILOCOULOMB/SQUARE METER	KCPM2
	MICROCOULOMB/SQUARE METER	UCPM2
	MILLICOULOMB/SQUARE METER	MCPM2
ELECTROMAGNETIC MOMENT	AMPS SQUARE METERS	AMPM2
ELECTROMOTIVE FORCE	MILLIVOLTS DIRECT CURRENT	MVDC

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
ENERGY	ELECTRON VOLT	EV
	GIGA ELECTRON VOLT	GEV
	GIGAJOULES	GJ
	JOULES	J
	KILO ELECTRON VOLT	KEV
	KILOJOULES	KJ
	KILOWATT HOURS	KWH
	MEGA ELECTRON VOLT	MGEV
	MEGAJOULES	MGJ
	MILLIJOULES	MJ
	TERAJOULES	TJ
FLOW RATE	CUBIC METERS/SEC	M3PS
	GALLONS/MIN	GPM
	LITERS/SEC	LPS
	MILLILITER PER HOUR	MLPHR
	POUND PER HOUR	LBPHR
FORCE	KILONEWTONS	KNEW
	MEGANEWTONS	MGNEW
	MICRONEWTONS	UMEW
	MILLINEWTONS	MNEW
	NEWTONS	NEW
	POUNDS FORCE	LBF
FREQUENCY	GIGAHERTZ	GHZ
	HERTZ (CYCLES/SEC)	HZ
	KILOHERTZ	KHZ
	KILOPULSES/SEC	KPPS
	MEGAHERTZ	MHZ
	PULSES/SEC	PPS
	TERAHERTZ	THZ
HEAT CAPACITY	JOULE/KELVIN	JPK
HUMIDITY	PERCENT	PCT
ILLUMINANCE	LUX	LX

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
INDUCTANCE	HENRY	H
	MICROHENRY	UH
	MILLIHENRY	MH
	NANOHENRY	NH
	PICOHENRY	PH
IRRADIANCE	WATT/SQUARE METER	WPM2
LENGTH OR DISTANCE	ASTRONOMIC UNIT	AU
	CENTIMETERS	CM
	FEET	FT
	INCHES	IN
	KILOMETERS	KM
	METERS	M
	MICROMETERS	UM
	MILE	MI
	MILLIMETERS	MM
	NANOMETERS	NM
	NAUTICAL MILES	NAUTM
	PARSEC	PS
	PICOMETERS	PM
	YARD	YD
LIGHT EXPOSURE	LUX SECOND	LUXS
LINEAR CURRENT DENSITY	AMPS/METER	AMPPM
	AMPS/MILLIMETER	AMPPMM
LINEAR DIMENSIONS	INTENSITY	INTENS
LINEAR ENERGY TRANS	KILO-ELECTRON VOLTS PER MICRON	KEVPMICRON
LINEAR EXPANSIONCOEFFICIENT	1/KELVIN	ONEPK
LUMINANCE	CANDELS/SQUARE METER	CDPM2
LUMINOSITY	CANDELA	CD
LUMINOUS EFFICACY	LUMENS/WATT	LUMPW
LUMINOUS EXCITANCE	LUMENS/SQUARE METER	LUMPM2
LUMINOUS FLUX	LUMENS	LUM
MAGNETIC DIPOLE MOMENT	WEBER METER	WBM

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
MAGNETIC FLUX	MILLIWEBER	MWB
	WEBER	WB
MAGNETIC INDUCTION	MICROTESLA	UTES
	MILLITESLA	MTES
	NANOTESLA	NTES
	TESLA	TES
MAGNETIC VECTOR POTENTIAL	WEBER/METER	WBPM
MAGNETIZATION	AMPS/METER	AMPPM
MASS	ATOMIC MASS UNIT	U
	GRAIN	GR
	GRAMS	GM
	HUNDRED-WEIGHT	CWT
	KILOGRAMS	KG
	MICROGRAMS	UG
	MILLIGRAMS	MG
	OUNCE	OZ
	POUNDS MASS	LBM
	TON	TON
	TONNE	TONNE
MECHANICAL IMPEDANCE	NEWTON SECOND/METER	NWSPM
MOLALITY OF SOLUTE	MOLE/KILOGRAM	MOLPKG
MOLAR HEAT CAPACITY	JOULE/MOLE KELVIN	JPMOLK
MOLAR INTERNAL ENERGY	JOULE/MOLE	JPMOL
	KILOJOULE/MOLE	KJPMOL
MOLAR MASS	GRAM/MOLE	GPMOL
	KILOGRAM/MOLE	KGPMOL
MOLAR VOLUME	CUBIC METER/MOLE	M3PMOL
	LITER/MOL	LPMOL
MOMENTUM	KILOGRAMS METER PER SECOND	KGMPS
MOMENTUM (ANGULAR)	KILGRAMS SQUARE METERS PER SEC	KGM2PS
MOMENT OF INERTIA	KILOGRAMS SQUARE METERS	KGM2

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
PERMEABILITY	HENRY/METER	HPM
	MICROHENRY/METER	UHPM
	NANOHENRY/METER	NHPM
PERMITIVITY	FARAD/METER	FARPM
	MICROFARAD/METER	UFARPM
	NANOFARAD/METER	NFARPM
	PICOFARAD/METER	PFARPM
POUNDS SECOND	POUNDS SECOND	LBSEC
POWER	GIGAWATTS	GW
	KILOWATTS	KW
	MEGAWATTS	MGW
	MICROWATTS	UW
	MILLIGRAVITY	MGEE
	MILLIWATTS	MW
	WATTS	W

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
PRESSURE	ATMOSPHERES	ATM
	BAR	BAR
	GIGAPASCAL	GPA
	INCHES OF MERCURY	INHG
	KILOPASCAL	KPA
	MEGAHERTZ	MGHZ
	MEGAPASCAL	MGPA
	MICROBAR	UBAR
	MICROPASCAL	UPA
	MILLIBAR	MBAR
	MILLIBARS	MB
	MILLIPASCAL	MPA
	MILLIRADIANS PER SECOND	MRADPSEC
	MM OF MERCURY	MMHG
	PASCAL	PA
	POUNDS PER SQUARE INCH ABSOLUTE PER MINUTE	PSIAPMIN
	POUNDS/SQUARE FOOT	PSF
	POUNDS/SQUARE INCH	PSI
	PSI ABSOLUTE	PSIA
	PSI GAUGE	PSIG
	TORR	TORR
	VOLTS PEAK TO PEAK	VPP
QUANTITY OF LIGHT	LUMENS SEC	LUMS
RADIANCE	WATTS/STERADIAN SQUARE METER	WPSRM2
RADIANT INTENSITY	WATTS/STERADIANS	WPSR
RADIATION	CURIES	CI
	ROENTGENS	R
RATIOS	DECIBELS	DB
	FOCAL STOP	F
	PARTS PER MILLION	PPM
	PERCENT	PCT
	UNITS	UNITS

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
RELUCTANCE	1/HENRY	ONEPH
RESISTANCE	GIGAOHM	GOHM
	KILOOHM	KOHM
	MEGAOHM	MGOHM
	MILLIOHM	MOHM
	OHM	OHM
RESISTIVITY	GIGAOHM METERS	GOHMM
	KILOOHM METERS	KOHMM
	MEGAOHM METERS	MGOHMM
	MILLIOHM METERS	MOHMM
	OHM METERS	OHMM
SOLID ANGLE	STERADIAN	SR
SPECIFIC ACOUSTIC IMPEDANCE	PASCAL SECONDS PER METER	PASPM
SPECIFIC HEAT CAPACITY	JOULE/KILOGRAM KELVIN	JPKGK
SPECIFIC INTERNAL ENERGY	JOULE/KILOGRAM	JPKG
	KILOJOULE/KILOGRAM	KJPKG
	MEGAJOULE/KILOGRAM	MGJPKG
SURFACE DENSITY OF CHARGE	COULOMB/SQUARE METER	CPM2
SURFACE TENSION	MILLINEWTON/METER	MNWPM
	NEWTON/METER	NWPM
TEMPERATURE	DEGREES CENTIGRADE	DEGC
	DEGREES FAHRENHEIT	DEGF
	DEGREES KELVIN	DEGK
	DEGREES RANKIN	DEGR
TEMPERATURE RATE	DEGREE FAHRENHEIT PER MINUTE	DEGFPMIN
THERMAL CONDUCTIVITY	WATT/METER KELVIN	WPMK

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
TIME	DAYS	DAY
	HOURS	HR
	MICROSECONDS	USEC
	MILLISECONDS	MSEC
	MINUTES	MIN
	SECONDS	SEC
	YEARS	YEARS
TORQUE	FOOT POUNDS	FTLB
	INCH POUNDS	INLB
	KILONEWTON METER	KNWM
	MEGANEWTON METER	MGNWM
	MICRONEWTON METER	UNWM
	MILLINEWTON METER	MNWM
	NEWTON METER	NWM
	POUNDS FEET	LBFT
VELOCITY	FEET/SEC	FPS
	INCHES PER SECOND	INPSEC
	KILOMETERS/HOUR	KMPHR
	KILOMETERS/SEC	KMPS
	KNOTS	KT
	METERS/SEC	MPS
VELOCITY/VELOCITY (STATE VEC)	FEET PER SECOND	FTPSEC
VISCOSITY	MILLIPASCAL SECONDS	MPAS
	PASCAL SECONDS	PAS
VOLTAGE	KILOVOLTS	KV
	MICROVOLTS	UV
	MILLIVOLTS	MV
	VOLT	V
	VOLTS AC	VAC
	VOLTS DC	VDC

DIMENSION	UNIT OF MEASURE	ENGINEERING UNIT
VOLUME	CUBIC CENTIMETERS	CM3
	CUBIC DECIMETERS	DM3
	CUBIC FEET	FT3
	CUBIC MILLIMETERS	MM3
	CUBIC METERS	M3
	DAY PLUS HOURS PLUS MINUTES PLUS SECONDS	DHMS
	DECIBEL REFERENCED TO ONE MILLIWATT	DBM
	GALLONS	GAL
	LITERS	L
	MILLILITERS	ML

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APPENDIX E

GLOSSARY

APPENDIX E - GLOSSARY

Calibration	To check, adjust, or systematically standardize the graduations of a quantitative measuring instrument.
Commutation	Insertion of parameters into a TDM data stream.
Decommutation	Extraction of parameters from a TDM data stream.
Decomposition	Extraction of parameters from a non-TDM data stream.
Discrete	A parameter that has data which represents a state code text (i.e., A value of 1 is converted to “ON”, a value of 0 is converted to “OFF”).
Encapsulated	A telemetry stream that has been stashed into another telemetry stream.
Entity Relationship	The entity relationship diagram allows a user to visualize the relationships that exist among the database tables due to the existence of foreign keys and common columns. This diagram uses rectangles to represent each table and arrows to represent the relationships between the tables. The relationships are identified as one-to-one, one-to-many, or many-to-many by the number of arrowheads on each end of the arrow. The relationships to tables that are only used to look up valid values, for example the Engineering Unit table, are not shown. To reduce the complexity of the diagrams, the tables can be divided into categories and a different diagram drawn for each category.
Extraction	To remove for separate consideration.
Foreign Key	One or more columns in one table that reference columns in another table. When data is inserted or updated in the table with the foreign key, the values of the foreign key must exist in the referenced table. Otherwise, the insert or update operation is rejected.
Intra-subset Parameter	Parameter contained in a subset.
MSID	A Measurement/Stimulus Identifier (MSID) is a unique identifier assigned to a telemetered parameter.
NULL	A NULL is the lack of a value in a column. Its meaning should be “nothing,” and should be used to indicate missing, unknown or inapplicable data. A Null value should not be used to imply any other value, such as zero.
Octet	Eight (8) bits

Packet	A small package of network data that has been divided and then multiplexed onto high-capacity intermachine connections. A packet, which usually contains only a few hundred bytes of data, carries identification that enables computers on the network to determine the correct destination.
Point Pair	A method of calibrating a measurement using a set of linear segments defined by a set of point pairs.
Polynomial	An algebraic function of two or more summed terms, each term consisting of a constant multiplier and one or more variables raised to integral powers.
Primary Key	A database table consists of one or more columns whose values can be used to uniquely identify a row in the table. In other words, a table cannot have a duplicate set of values in the primary key columns.
Shotgun Parameter/Subset	A parameter or subset that is arranged in a data stream in a non-contiguous fashion.
Telemeter	To measure and transmit (data) automatically from a distant source, as from a spacecraft, or electric power grid, to a recording station for recording or display.
Telemetry	The science and technology of automatic measurement and transmission of data by wire, radio, or other means from remote sources, as from space vehicles, to a receiving station for recording and analysis.

APPENDIX F

EXAMPLES

APPENDIX F - EXAMPLES

This appendix provides examples of how to populate the database tables in selected situations. Note that the data values given in the following examples are purely fictitious and are provided as examples.

Example 1 TDM Stream

The following data define a Spacelab TDM stream for a single format.

TDM Table

TDM_ID	= EC
FORMAT_ID_MSID	= L71M1003P
TIME_MSID	= L71W3165A
SYNC_PATTERN	= FAF320
SYNC_PATTERN_MSID	= L71M1001P
SYNC_LENGTH	= 24

TDM Format Table

TDM_ID	= EC
TDM_FORMAT_ID	= A
FORMAT	= 0020
BITS_PER_WORD	= 16
WORDS_PER_MINOR_ FRAME	= 160
MINOR_FRAMES_PER_MAJOR_FRAME	= 20
DATA_CYCLE	= 8
MAJOR_FRAME_PERIOD	= 1.0
ENCAP_STREAM_NUMBER	= 2
ENCAP_BOUNDARY	= M
ENCAP_FRAME_PER_ PACKET	= 1

Stream ID Table

STREAM_NUMBER	= 1
STREAM_TYPE	= T
STREAM_ID	= EC
STREAM_FORMAT_ID	= A
STREAM_PROP	= N
STREAM_OWNER_ID	= ASTRO-2
STREAM_DESCRIPTION	= Experiment Computer Format A

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Example 2 Counter Measurement

The following data define a four bit unsigned counter measurement. Counter dependent measurements use the real-time value of the counter measurement to determine when the measurement is active.

Counter Table

MSID	= L71Q3001A
STREAM_NUMBER	= 1
INIT_VALUE	= 0
END_VALUE	= 7
WRAP_AROUND_FLAG	= N
DIR	= +
DELTA	= 1
COUNTER_TYPE	= N

Measurement Table

MSID	= L71Q3001A
TECHNICAL_NAME	= Counter Dependent Counter
DATA_TYPE	= IUNS
CALIBRATION_TYPE	= N
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 15
TOTAL_LENGTH	= 4
PROP	= N
OWNER_ID	= ASTRO-2
DESCRIPTION	= Counter Dependent Counter for Experiment 3

MSID Sampling Table

MSID	= L71Q3001A
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= N
SAMPLE_RATE	= 1

MSID Location Table

MSID	= L71Q3001A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 0
START_WORD	= 7
START_BIT	= 4
LENGTH	= 4

Example 3 Range Measurement

The following data define an 8-bit unsigned range measurement that has a single set of polynomial calibration coefficients. Range dependent measurements use the real-time value of the range measurement to determine when the measurement is active.

Measurement Table

MSID	= L71Q3002A
TECHNICAL_NAME	= Range Measurement
DATA_TYPE	= IUNS
CALIBRATION_TYPE	= PC
ENG_UNIT	= DEGC
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 255
TOTAL_LENGTH	= 8
PROP	= N
CALIBRATION_ DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Range Measurement for Experiment 3

MSID Sampling Table

MSID	= L71Q3002A
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= N
SAMPLE_RATE	= 1

MSID Location Table

MSID	= L71Q3002A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 0
START_WORD	= 8
START_BIT	= 0
LENGTH	= 8

Example 3 Range Measurement (Continued)

Polynomial Calibration Table	
MSID	= L71Q3002A
CALIBRATION_SET_ NUM	= 1
ENG_UNIT_LOW	= -10.0
ENG_UNIT_HIGH	= +25.8
DEG	= 1
COEF0	= -10.0
COEF1	= +0.140392

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Example 4 Measurement with Polynomial Calibration Coefficients

The following data define an 8-bit unsigned temperature measurement that has a single set of polynomial calibration coefficients.

Measurement Table

MSID	= L71T1001A
TECHNICAL_NAME	= Primary Recirculation Pump Temperature
DATA_TYPE	= IUNS
CALIBRATION_TYPE	= PC
ENG_UNIT	= DEGC
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 255
TOTAL_LENGTH	= 8
PROP	= N
CALIBRATION_DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Primary Recirculation Pump Temperature

MSID Sampling Table

MSID	= L71T1001A
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= N
SAMPLE_RATE	= 1

MSID Location Table

MSID	= L71T1001A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 2
START_WORD	= 89
START_BIT	= 0
LENGTH	= 8

Example 4 Measurement with Polynomial Calibration Coefficients (Continued)

Polynomial Calibration Table	
MSID	= L71T1001A
CALIBRATION_SET_ NUM	= 1
ENG_UNIT_LOW	= -0.8319
ENG_UNIT_HIGH	= +23.4959
DEG	= 2
COEF0	= -0.8319
COEF1	= +0.949575E-01
COEF2	= +0.174750E-05

Example 5 Multisyllable Measurement with Point Pair Calibration

The following data define an 8-bit multi-syllable signed temperature measurement that has a single set of point pairs. Sampling composition is super with 10 samples per major frame.

Measurement Table

MSID	= L71T1002A
TECHNICAL_NAME	= Primary Freon Pump Temperature
DATA_TYPE	= ITWO
CALIBRATION_TYPE	= PP
ENG_UNIT	= DEGC
LOW_RAW_COUNT	= -128
HIGH_RAW_COUNT	= +127
TOTAL_LENGTH	= 8
PROP	= N
CALIBRATION_ DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Primary Freon Pump Temperature

MSID Sampling Table

MSID	= L71T1002A
STREAM_NUMBER	= 1
PAR_COMP	= MS
SAMPLE_COMP	= S
SAMPLE_RATE	= 10
OFFSET	= 320

MSID Location Table

MSID	= L71T1002A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 0
START_WORD	= 25
START_BIT	= 0
LENGTH	= 4
MSID	= L71T1002A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 2
START_MINOR_FRAME	= 0
START_WORD	= 27
START_BIT	= 4
LENGTH	= 4

Example 5 Multisyllable Measurement with Point Pair Calibration (Continued)

Point Pair Table

MSID	= L71T1002A
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 1
RAW_COUNT	= -128
ENG_UNIT_VALUE	= -0.83190
MSID	= L71T1002A
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 2
RAW_COUNT	= -77
ENG_UNIT_VALUE	= +3.96790
MSID	= L71T1002A
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 3
RAW_COUNT	= -26
ENG_UNIT_VALUE	= +8.72878
MSID	= L71T1002A
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 4
RAW_COUNT	= +25
ENG_UNIT_VALUE	= +13.49878
MSID	= L71T1002A
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 5
RAW_COUNT	= +76
ENG_UNIT_VALUE	= +18.27733
MSID	= L71T1002A
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 6
RAW_COUNT	= +127
ENG_UNIT_VALUE	= +23.54383

Example 6 Measurement with State Code Conversion

Measurement Table	
MSID	= L71X1003E
TECHNICAL_NAME	= Freon Loop Primary Valve Status
DATA_TYPE	= IDIS
CALIBRATION_TYPE	= SC
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 1
TOTAL_LENGTH	= 1
PROP	= N
CALIBRATION_ DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Freon Loop Primary Valve Status
MSID Sampling Table	
MSID	= L71X1003E
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= N
SAMPLE_RATE	= 1
MSID Location Table	
MSID	= L71X1003E
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 15
START_WORD	= 35
START_BIT	= 7
LENGTH	= 1

Example 6 Measurement with State Code Conversion (Continued)

State Code Table	
MSID	= L71X1003E
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 1
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 0
STATE_CODE	= CLOSED
MSID	= L71X1003E
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 2
LOW_RAW_COUNT	= 1
HIGH_RAW_COUNT	= 1
STATE_CODE	= OPEN

Example 7 Multi-syllable Character String Measurement

The following data define a 47-character ASCII string measurement.

Measurement Table

MSID	= L71Q1004A
TECHNICAL_NAME	= Scratch Pad Line for DDS A
DATA_TYPE	= SASC
TOTAL_LENGTH	= 47
PROP	= N
OWNER_ID	= ASTRO-2
DESCRIPTION	= Scratch Pad Line for Data Display System A

MSID Sampling Table

MSID	= L71Q1004A
STREAM_NUMBER	= 1
PAR_COMP	= MS
SAMPLE_COMP	= N
SAMPLE_RATE	= 1

MSID Location Table

MSID	= L71Q1004A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 0
START_WORD	= 5
START_BIT	= 0
LENGTH	= 12

MSID	= L71Q1004A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 2
START_MINOR_FRAME	= 0
START_WORD	= 33
START_BIT	= 0
LENGTH	= 20

Example 7 Multi-syllable Character String Measurement (Continued)

MSID Location Table (Continued)	
MSID	= L71Q1004A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 3
START_MINOR_FRAME	= 0
START_WORD	= 65
START_BIT	= 0
LENGTH	= 15

Example 8 Counter Dependent Measurement

The following data define an 8-bit unsigned temperature measurement that has a single set of polynomial calibration coefficients. In addition, the measurement is counter dependent, and is active only when the real-time value of the counter measurement equals 1 and 5.

Measurement Table

MSID	= L71T2001A
TECHNICAL_NAME	= Secondary Recirculation Pump Temperature
DATA_TYPE	= IUNS
CALIBRATION_TYPE	= PC
ENG_UNIT	= DEGC
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 255
TOTAL_LENGTH	= 8
PROP	= N
COUNTER_MSID	= L71Q3001A
CALIBRATION_ DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Secondary Recirculation Pump Temperature

MSID Sampling Table

MSID	= L71T2001A
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= C
SAMPLE_RATE	= 1
START_COUNTER_VALUE	= 1
COUNTER_OFFSET	= 4

MSID Location Table

MSID	= L71T2001A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 3
START_WORD	= 83
START_BIT	= 0
LENGTH	= 8

Example 8 Counter Dependent Measurement (Continued)

Polynomial Calibration Table	
MSID	= L71T2001A
CAILBRATION_SET_ NUM	= 1
ENG_UNIT_LOW	= 0.8319
ENG_UNIT_HIGH	= +23.4959
DEG	= 2
COEF0	= 0.8319
COEF1	= +0.949575E-01
COEF2	= +0.174750E-05

Example 9 Range Dependent Measurement

The following data define an 8-bit unsigned temperature measurement that has a single set of polynomial calibration coefficients. In addition, the measurement is range dependent, and is active only when the real-time value of the range measurement is greater than 5.1 and less than or equal to 12.2.

Measurement Table

MSID	= L71T2002A
TECHNICAL_NAME	= Primary Freon Pump Temperature
DATA_TYPE	= IUNS
CALIBRATION_TYPE	= PC
ENG_UNIT	= DEGC
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 255
TOTAL_LENGTH	= 8
PROP	= N
RANGE_MSID	= L71Q3002A
CALIBRATION_ DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Primary Freon Pump Temperature

MSID Sampling Table

MSID	= L71T2002A
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= R
SAMPLE_RATE	= 1
LOW_RANGE	= 5.1
HIGH_RANGE	= 12.2

MSID Location Table

MSID	= L71T2002A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 3
START_WORD	= 84
START_BIT	= 0
LENGTH	= 8

Example 9 Range Dependent Measurement (Continued)

Polynomial Calibration Table	
MSID	= L71T2002A
CALIBRATION_SET_ NUM	= 1
ENG_UNIT_LOW	= -0.8319
ENG_UNIT_HIGH	= +23.4959
DEG	= 2
COEF0	= -0.8319
COEF1	= +0.949575E-01
COEF2	= +0.174750E-05

Example 10 Switch Measurement

The following data define an 8-bit unsigned switch measurement that has a single set of polynomial calibration coefficients. Calibration, limit, and expected state switched measurements use the real-time value of the switch measurement to determine which set number of data the measurement is to use.

Measurement Table

MSID	= L71Q3003A
TECHNICAL_NAME	= Switch Measurement
DATA_TYPE	= IUNS
CALIBRATION_TYPE	= PC
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 255
TOTAL_LENGTH	= 8
PROP	= N
CALIBRATION_ DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Switch Measurement

MSID Sampling Table

MSID	= L71Q3003A
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= N
SAMPLE_RATE	= 1

MSID Location Table

MSID	= L71Q3003A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 0
START_WORD	= 9
START_BIT	= 0
LENGTH	= 8

Polynomial Calibration Table

MSID	= L71Q3003A
CALIBRATION_SET_ NUM	= 1
ENG_UNIT_LOW	= +10.3
ENG_UNIT_HIGH	= +74.8
DEG	= 1
COEF0	= +10.3
COEF1	= +0.252941

Example 11 Measurement with Switched State Code Calibration

The following data define an 8-bit unsigned pressure measurement that has two sets of polynomial calibration coefficients. In addition, a calibration switch measurement is provided for determining from real-time data which set of calibration data is valid.

Measurement Table

MSID	= L71P2003A
TECHNICAL_NAME	= Primary Recirculation Pump Outlet Pressure
DATA_TYPE	= IUNS
CALIBRATION_TYPE	= PC
ENG_UNIT	= PSIA
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 255
TOTAL_LENGTH	= 8
PROP	= N
CALIBRATION_SWITCH_MSID	= L71Q3003A
CALIBRATION_ DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Primary Recirculation Pump Outlet Pressure

MSID Sampling Table

MSID	= L71P2003A
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= N
SAMPLE_RATE	= 1

MSID Location Table

MSID	= L71P2003A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 2
START_WORD	= 90
START_BIT	= 0
LENGTH	= 8

Example 11 Measurement with Switched State Code Calibration (Continued)

Polynomial Calibration Table	
MSID	= L71P2003A
CALIBRATION_SET_ NUM	= 1
ENG_UNIT_LOW	= 0.0
ENG_UNIT_HIGH	= +125.0
DEG	= 1
COEF0	= 0.0
COEF1	= +0.490196
MSID	= L71P2003A
CALIBRATION_SET_ NUM	= 2
ENG_UNIT_LOW	= 0.0
ENG_UNIT_HIGH	= +138.9
DEG	= 1
COEF0	= 0.0
COEF1	= +0.544706
Calibration Switch Table	
MSID	= L71P2003A
CALIBRATION_SET_ NUM	= 1
LOW_RANGE	= 12.0
HIGH_RANGE	= 45.3
MSID	= L71P2003A
CALIBRATION_SET_NUM	= 2
LOW_RANGE	= 45.3
HIGH_RANGE	= 73.2

Example 12 Measurement with Switched Point Pair Calibration

The following data define an 8-bit multi-syllable signed pressure measurement that has two sets of point pairs. In addition, a calibration switch measurement is provided for determining from real-time data which set of calibration data is valid.

Measurement Table

MSID	= L71P2004A
TECHNICAL_NAME	= Primary Freon Pump Outlet Pressure
DATA_TYPE	= ITWO
CALIBRATION_TYPE	= PP
ENG_UNIT	= PSIA
LOW_RAW_COUNT	= -128
HIGH_RAW_COUNT	= +127
TOTAL_LENGTH	= 8
PROP	= N
CALIBRATION_ SWITCH_MSID	= L71Q3003A
CALIBRATION_ DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Primary Freon Pump Outlet Pressure

MSID Sampling Table

MSID	= L71P2004A
STREAM_NUMBER	= 1
PAR_COMP	= MS
SAMPLE_COMP	= N
SAMPLE_RATE	= 1

MSID Location Table

MSID	= L71P2004A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 0
START_WORD	= 93
START_BIT	= 0
LENGTH	= 4

Example 12 Measurement with Switched Point Pair Calibration (Continued)

MSID Location Table (Continued)	
MSID	= L71P2004A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 2
START_MINOR_FRAME	= 1
START_WORD	= 93
START_BIT	= 0
LENGTH	= 4
Point Pair Table	
MSID	= L71P2004A
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 1
RAW_COUNT	= -128
ENG_UNIT_VALUE	= -0.83190
MSID	= L71P2004A
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 2
RAW_COUNT	= +26
ENG_UNIT_VALUE	= +8.72878
MSID	= L71P2004A
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 3
RAW_COUNT	= +25
ENG_UNIT_VALUE	= +13.49878
MSID	= L71P2004A
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 4
RAW_COUNT	= +127
ENG_UNIT_VALUE	= +23.54383
MSID	= L71P2004A
CALIBRATION_SET_ NUM	= 2
SEQUENCE_NUM	= 1
RAW_COUNT	= -128
ENG_UNIT_VALUE	= -0.23169

Example 12 Measurement with Switched Point Pair Calibration (Continued)

Point Pair Table (Continued)	
MSID	= L71P2004A
CALIBRATION_SET_ NUM	= 2
SEQUENCE_NUM	= 2
RAW_COUNT	= -35
ENG_UNIT_VALUE	= +8.24588
MSID	= L71P2004A
CALIBRATION_SET_ NUM	= 2
SEQUENCE_NUM	= 3
RAW_COUNT	= +42
ENG_UNIT_VALUE	= +18.22278
MSID	= L71P2004A
CALIBRATION_SET_ NUM	= 2
SEQUENCE_NUM	= 4
RAW_COUNT	= +127
ENG_UNIT_VALUE	= +25.89494
Calibration Switch Table	
MSID	= L71P2004A
CALIBRATION_SET_ NUM	= 1
LOW_RANGE	= 12.0
HIGH_RANGE	= 45.3
MSID	= L71P2004A
CALIBRATION_SET_ NUM	= 2
LOW_RANGE	= 45.3
HIGH_RANGE	= 73.2

Example 13 Measurement with Switched State Code Conversion

The following data define a 3-bit discrete measurement that has three sets of state code conversions. In addition, a calibration switch measurement is provided for determining from real-time data which set of conversion data is valid.

Measurement Table

MSID	= L71X2005E
TECHNICAL_NAME	= Freon Loop Secondary Valve Status
DATA_TYPE	= IDIS
CALIBRATION_TYPE	= SC
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 7
TOTAL_LENGTH	= 3
PROP	= N
CALIBRATION_SWITCH_MSID	= L71Q3003A
CALIBRATION_ DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Freon Loop Secondary Valve Status

MSID Sampling Table

MSID	= L71X2005E
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= N
SAMPLE_RATE	= 1

MSID Location Table

MSID	= L71X2005E
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 15
START_WORD	= 38
START_BIT	= 4
LENGTH	= 3

Example 13 Measurement with Switched State Code Conversion (Continued)

State Code Table

MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 1
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 0
STATE_CODE	= CLOSED
MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 2
LOW_RAW_COUNT	= 1
HIGH_RAW_COUNT	= 1
STATE_CODE	= OPEN
MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 2
SEQUENCE_NUM	= 1
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 0
STATE_CODE	= CLOSED
MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 2
SEQUENCE_NUM	= 2
LOW_RAW_COUNT	= 1
HIGH_RAW_COUNT	= 2
STATE_CODE	= OPEN
MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 2
SEQUENCE_NUM	= 3
LOW_RAW_COUNT	= 3
HIGH_RAW_COUNT	= 4
STATE_CODE	= LATCHED

Example 13 Measurement with Switched State Code Conversion (Continued)

State Code Table (Continued)

MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 3
SEQUENCE_NUM	= 1
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 1
STATE_CODE	= CLOSED
MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 3
SEQUENCE_NUM	= 2
LOW_RAW_COUNT	= 2
HIGH_RAW_COUNT	= 3
STATE_CODE	= OPEN
MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 3
SEQUENCE_NUM	= 3
LOW_RAW_COUNT	= 4
HIGH_RAW_COUNT	= 5
STATE_CODE	= LATCHED

Calibration Switch Table

MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 1
LOW_RANGE	= 12.0
HIGH_RANGE	= 35.3
MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 2
LOW_RANGE	= 35.3
HIGH_RANGE	= 55.2
MSID	= L71X2005E
CALIBRATION_SET_ NUM	= 3
LOW_RANGE	= 55.2
HIGH_RANGE	= 73.2

Example 14 Measurement with Switched Limits

The following data define an 8-bit unsigned pressure measurement that has a set of polynomial calibration coefficients. In addition, a limit switch measurement is provided for determining from real-time data which set of limits data is valid.

Measurement Table

MSID	= L71P4003A
TECHNICAL_NAME	= Primary Coolant Pump Outlet Pressure
DATA_TYPE	= IUNS
CALIBRATION_TYPE	= PC
ENG_UNIT	= PSIA
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 255
TOTAL_LENGTH	= 8
PROP	= N
CALIBRATION_ DEFAULT_SET_NUM	= 1
LIMIT_SWITCH_MSID	= L71Q3003A
LIMIT_DEFAULT_SET_ NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Primary Coolant Pump Outlet Pressure

MSID Sampling Table

MSID	= L71P4003A
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= N
SAMPLE_RATE	= 1

MSID Location Table

MSID	= L71P4003A
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 13
START_WORD	= 90
START_BIT	= 0
LENGTH	= 8

Example 14 Measurement with Switched Limits (Continued)

Polynomial Calibration Table	
MSID	= L71P4003A
CALIBRATION_SET_ NUM	= 1
ENG_UNIT_LOW	= 0.0
ENG_UNIT_HIGH	= +125.0
DEG	= 1
COEF0	= 0.0
COEF1	= +0.490196
Limit Table	
MSID	= L71P4003A
LIMIT_SET_NUM	= 1
CAUTION_LOW	= 0.0
CAUTION_HIGH	= 35.0
WARNING_LOW	= 0.0
WARNING_HIGH	= 40.0
MSID	= L71P4003A
LIMIT_SET_NUM	= 2
CAUTION_LOW	= 13.2
CAUTION_HIGH	= 58.1
WARNING_LOW	= 10.0
WARNING_HIGH	= 62.2
Limit Switch Table	
MSID	= L71P4003A
LIMIT_SET_NUM	= 1
LOW_RANGE	= 12.0
HIGH_RANGE	= 45.3
MSID	= L71P4003A
LIMIT_SET_NUM	= 2
LOW_RANGE	= 45.3
HIGH_RANGE	= 73.2

Example 15 Measurement with Switched Expected States

The following data define a 3-bit discrete measurement that has one set of state code conversions and three sets of expected states. In addition, an expected state switch measurement is provided for determining from real-time data which set of expected state data is valid.

Measurement Table

MSID	= L71X4005E
TECHNICAL_NAME	= Coolant Loop Secondary Valve Status
DATA_TYPE	= IDIS
CALIBRATION_TYPE	= SC
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 7
TOTAL_LENGTH	= 3
PROP	= N
CALIBRATION_SWITCH_MSID	= L71Q3003A
CALIBRATION_ DEFAULT_SET_NUM	= 1
ES_SWITCH_MSID	= L71Q3003A
ES_DEFAULT_SET_NUM	= 1
OWNER_ID	= ASTRO-2
DESCRIPTION	= Coolant Loop Secondary Valve Status

MSID Sampling Table

MSID	= L71X4005E
STREAM_NUMBER	= 1
PAR_COMP	= T
SAMPLE_COMP	= N
SAMPLE_RATE	= 1

MSID Location Table

MSID	= L71X4005E
STREAM_NUMBER	= 1
SYLLABLE_NUMBER	= 1
START_MINOR_FRAME	= 18
START_WORD	= 55
START_BIT	= 2
LENGTH	= 3

Example 15 Measurement with Switched Expected States (Continued)

State Code Table

MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 1
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 0
STATE_CODE	= CLOSED
MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 1
SEQUENCE_NUM	= 2
LOW_RAW_COUNT	= 1
HIGH_RAW_COUNT	= 1
STATE_CODE	= OPEN
MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 2
SEQUENCE_NUM	= 1
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 0
STATE_CODE	= CLOSED
MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 2
SEQUENCE_NUM	= 2
LOW_RAW_COUNT	= 1
HIGH_RAW_COUNT	= 2
STATE_CODE	= OPEN
MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 2
SEQUENCE_NUM	= 3
LOW_RAW_COUNT	= 3
HIGH_RATE_COUNT	= 4
STATE_CODE	= LATCHED

Example 15 Measurement with Switched Expected States (Continued)

State Code Table (Continued)

MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 3
SEQUENCE_NUM	= 1
LOW_RAW_COUNT	= 0
HIGH_RAW_COUNT	= 1
STATE_CODE	= CLOSED
MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 3
SEQUENCE_NUM	= 2
LOW_RAW_COUNT	= 2
HIGH_RAW_COUNT	= 3
STATE_CODE	= OPEN
MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 3
SEQUENCE_NUM	= 3
LOW_RAW_COUNT	= 4
HIGH_RAW_COUNT	= 5
STATE_CODE	= LATCHED

Calibration Switch Table

MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 1
LOW_RANGE	= 12.0
HIGH_RANGE	= 35.3
MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 2
LOW_RANGE	= 35.3
HIGH_RANGE	= 55.2
MSID	= L71X4005E
CALIBRATION_SET_ NUM	= 3
LOW_RANGE	= 55.2
HIGH_RANGE	= 73.2

Example 15 Measurement with Switched Expected States (Continued)

Expected State Table	
MSID	= L71X4005E
ES_SET_NUM	= 1
EXPECTED_STATE	= CLOSED
MSID	= L71X4005E
ES_SET_NUM	= 2
EXPECTED_STATE	= OPEN
MSID	= L71X4005E
ES_SET_NUM	= 3
EXPECTED_STATE	= LATCHED
Expected State Switch Table	
MSID	= L71X4005E
ES_SET_NUM	= 1
LOW_RANGE	= 12.0
HIGH_RANGE	= 35.3
MSID	= L71X4005E
ES_SET_NUM	= 2
LOW_RANGE	= 35.3
HIGH_RANGE	= 55.2
MSID	= L71X4005E
ES_SET_NUM	= 3
LOW_RANGE	= 55.2
HIGH_RANGE	= 73.2

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