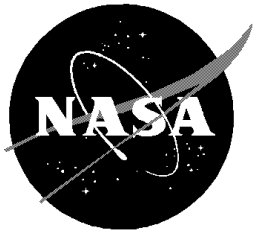
NSTS 21000-A04
Revision H

Standard Integration Plan Annex No. 4 Command and Data Requirements

March 2000



National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

DESCRIPTION OF CHANGES TO

BLANK BOOK

STANDARD INTEGRATION PLAN ANNEX NO. 4

COMMAND AND DATA REQUIREMENTS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
REV A	General revision	12/00/79	All
REV B	General revision/02/05/82 B-14093-2		All
	Note: Error Correction, Word One code correction	04/05/82	B-89
REV C	General revision/B14093-3;-4	07/15/82	All
1	Update Sections 2.0 and 5.0/ B14093-5	11/23/82	1,3
REV D	General revision/B14093-6 (DCRs: 25779A, 25781*, 25782, 25783C, 25784B, 25785, 25787, 25793C, 25924, 25928A, 35083)	10/26/83	All
REV E	General revision/B14093-8	02/01/85	All
	Document number changed from JSC 14093 to JSC 21000-A04 per CR B21000-A04-9 dated 05/01/86		
1	Change to Signature Sheet/ B21000-A04-9	07/25/86	Signature page

DESCRIPTION OF CHANGES (CONCLUDED)

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
REV F	General revision/A21000-A04-10	05/15/87	All
	Document number changed from JSC 21000-A04 to NSTS 21000-A04 per CR G00051 dated 02/20/87		
	Errata change to Table 8 and Figure E-9. Master lost in printing process.	09/03/87	E-23,E-24
REV G	General revision/B21000-A04-012	06/20/91	All
1	Update appendices B and C and correct section 7.12 as per CR 012/B21000-A04-014	03/09/95	B-7,C-31A, C-33,C-40, C-41,C-43, C-44,C-110
REV H	General revision/B21000-A04-0018	03/10/00	All
	Errata to correct signature	05/09/00	
1	Update appendices B, C, and F/ B21000-A04-0019	03/08/01	B-7,C-32, C-33,C-39, C-40,C-42, C-44,C-45, C-94,F-7, F-18

Note: Dates reflect latest signature date of CRs received by PILS.

NSTS 21000-A04
Annex 4

BLANK BOOK ANNEX NO. 4

STANDARD INTEGRATION PLAN

COMMAND AND DATA REQUIREMENTS

MARCH 10, 2000

Approved by:

Signed by William J. Moon, dated 03/10/00	Signed by Darrell E. Stamper, dated 03/10/00
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FLIGHT AVIONICS DIVISION, MANAGER	APPLICATION TOOLS PASS BUILD & RECONFIGURATION, MANAGER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

FOREWORD

This document defines the format and content of the payload data required for the Space Shuttle Program (SSP) elements to integrate a payload into the flight and ground operations. The annexes required and scheduled for submittal of a specific payload are identified in the basic Payload Integration Plan (PIP) for the payload. The user is requested to provide the data defined and return the completed data to the SSP annex manager identified.

The SSP annex manager will perform the following tasks:

a. Review the data for SSP Implementation.

b. Contact the user if there are any questions or if further negotiation is required.

c. Publish the annex.

SPACELAB DISCLAIMER

Spacelab modules have been removed from the National Aeronautics and Space Administration (NASA) flight manifest. However, some Spacelab hardware interfaces (e.g., Pallets, Flex Multiplexer/Demultiplexer) will continue to be implemented on future missions. All sections and data elements pertaining to Shuttle-Spacelab module interfaces should be disregarded until further notice.

Signed by
Manager, Mission Integration Office

CONTENTS

FIGURES

1.0 INTRODUCTION

This document defines the requirements levied on a payload for submission of command and telemetry data to the National Aeronautics and Space Administration (NASA) Lyndon B. Johnson Space Center (JSC). In case of variation between this document and the Payload Integration Plan (PIP), the PIP shall take precedence. Any requirements that are not within the scope of the PIP will not be considered binding on the NASA for implementation.

The NSTS-21000-A04 is a reference document which is used extensively by both payload data suppliers and JSC payload engineers. As a result, payload data suppliers may find that this document contains information and/or instructions beyond the scope of their needs.

Data submittals, as well as questions or comments on these data requirements, shall be directed to the Flight Avionics Division, DL.

2.0 DATA SUBMISSION REQUIREMENTS

The command and telemetry requirements are specified by the payload representative. Data submittals may be either in the card image format (see appendix C) or in the annex 4 tabular format (see appendix F). Cross reference information is provided in appendix F. This cross reference information provides a correlation between the annex 4 data tables and the card image records.

Data submitted in the card image format may be transmitted electronically or via diskette. The Flight Avionics Division should be contacted for assistance.

The Flight Avionics Division has developed a Personal Computer (PC)-based data collection tool. This software tool provides a means for data collection with audit capability. In addition, the tool provides on-screen help. The payload representative may receive a copy of the tool with supporting documentation in accordance with the Pre-Cargo Integration Review (CIR) template. Contact the Flight Avionics Division or the Space Shuttle Level II Program Office for the availability of these tools.

2.1 Standard/Optional Services

Standard and optional software services are documented in the Space Shuttle System Payload Accommodations, NSTS 07700, Volume XIV Appendix 3. Services and prices should be negotiated with the Space Shuttle Program Office prior to data submittal. The general standard services listed below are presented as a guide:

a. Up to 40 telemetry parameters (quarter bay allocation)

   Telemetry data streams which are not according to Space Shuttle Program (SSP) telemetry standards (see appendix A) may incur an optional service charge or may not be implemented. **The use of the block mode format is not encouraged and must be discussed with the Program Office before implementation.**

b. Up to 40 command functions (quarter bay allocation)

c. One Payload Data Interleaver (PDI) port (quarter bay allocation)

d. Payload Multiplexer/Demultiplexer (MDM) (quarter bay allocation)

   8 DOL (Discrete Output Low)
   8 DIL (Discrete Input Low)
   4 DOH (Discrete Output High)
   2 AID (Analog Input Differential)

2.2 Parameter Identification

All command and telemetry parameters are recognized by the SSP via a Measurement/Stimulus Identifier (MSID). This identifier must be created as described in appendix B.

3.0 REQUIREMENTS INTEGRATION

A typical sequence of activities to integrate a customer's software requirements into the Shuttle flight software is presented in figure 3-1. All activities are scheduled according to a generic template which is designed for the support of the

Integrated Hardware/Software Review (IH/SR) and Cargo Integration Review (CIR). The integration process is discussed in detail by the Space Shuttle System Payload Accommodations, NSTS 07700, Volume XIV.

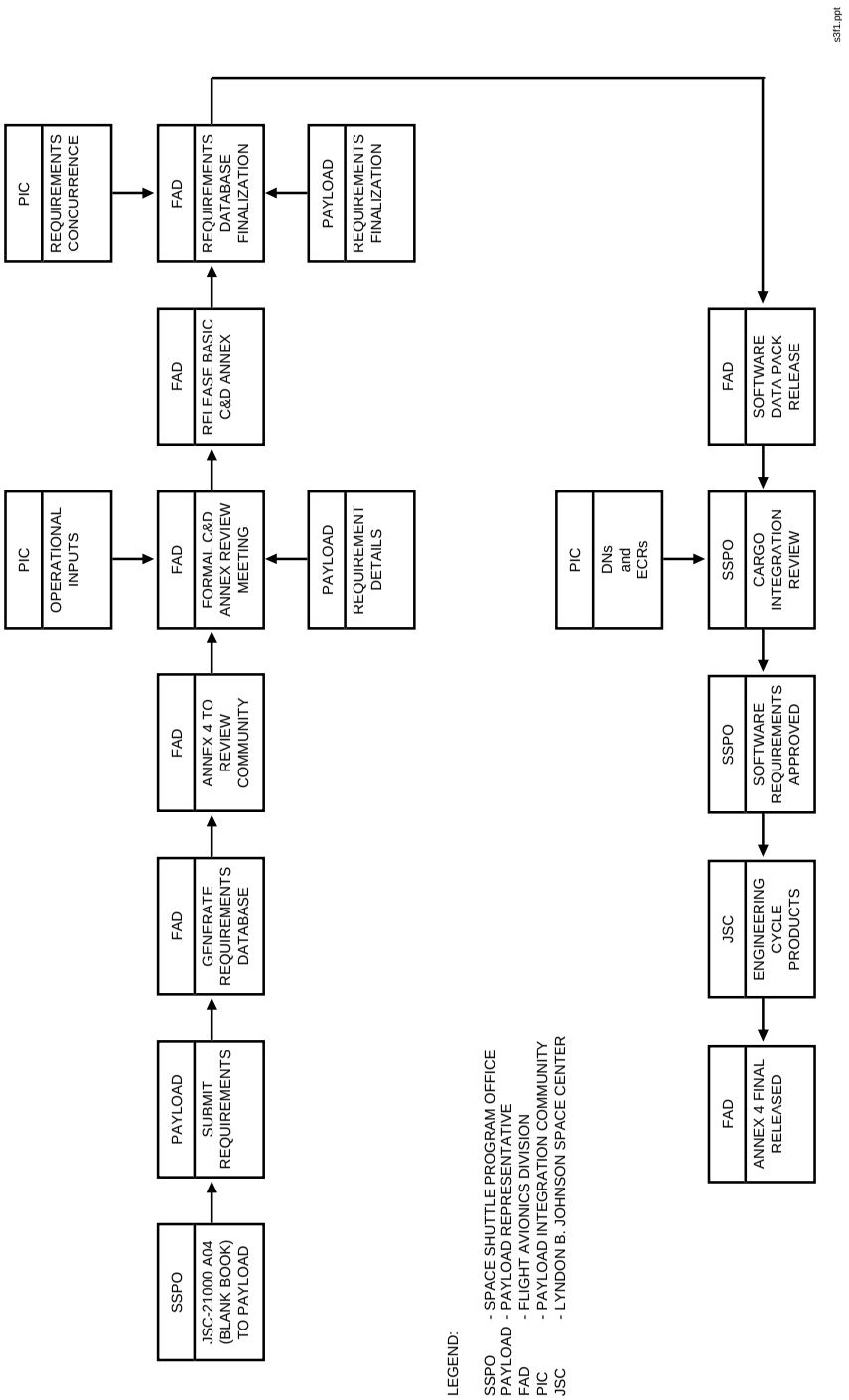


Figure 3-1.- Typical requirements integration process.

4.0 APPLICABLE DOCUMENTS

The following documents are applicable to the specification and implementation of payload commands and data.

a. Space Shuttle System Payload Accommodations, NSTS 07700, Volume XIV.

b. Shuttle Orbiter/Cargo Standard Interfaces, ICD 2-19001.

c. Space Shuttle Telemetry and Command Data Characteristics Handbook, NSTS 08118, Volumes I and II.

d. POCC Capabilities Document, Payload Support Capabilities Description: MCC, JSC PCC, Remote POCC Interface, NSTS 21063-POC-CAP.

APPENDIX A

SSP TELEMETRY STANDARDS

1.0 SSP TELEMETRY STANDARDS

This section describes conventions and ground rules that are used by the Space Shuttle Program (SSP) at National Aeronautics and Space Administration (NASA) Lyndon B. Johnson Space Center (JSC). The purpose of this section is to document the standards and conventions that define the structure of the flight reconfiguration data base systems.

The following is the order in which information is provided in this section:

a. Standards for telemetry data stream structure description

b. The SSP telemetry system capabilities

c. Telemetry data base limitations

1.1 SSP Telemetry Description Standard

This section specifies the SSP standards for describing telemetry data stream structure.

Both NASA-Payload Data Interleaver (PDI) and NASA-Independent Data Link (IDL) support symmetrical data stream structures. Data streams are described in both standards in terms of words and frames. The basic unit is the data word.

In general, the following ground rules apply:

a. All data stream structures are composed of words and at least one type of frame.

b. If a data stream is composed of only data words and a single frame, then the frame is called a major frame.

c. If a data stream is composed of data words and two types of frames, then the smaller frame is called a minor frame and the larger frame is called a major frame.

d. If a data stream is composed of data words and three types of frames, then the smallest frame is called a minor frame, the next larger is called a subframe, and the largest frame is called a major frame. This can occur in NASA-IDL only.

The following parameters are used to define the basic structure of a data stream:

a. Bit labeling - A bit is a binary digit which has two logical values of 0 and 1. **The SSP assumes positive logic. Bits within a word are labeled from left to right. The first bit position within a word is numbered as bit 0. Bit 0 is the first bit transmitted within a word and is the most significant bit.** Figure A-0 illustrates this labeling convention graphically.

b. Word length - The basic unit in the data stream structure is the data word. The word length is expressed in bits per word. **Words in NASA-PDI must be 8 bits long. Words in NASA-IDL may be any length up to 64 bits. Words are always numbered with word 1 first.**

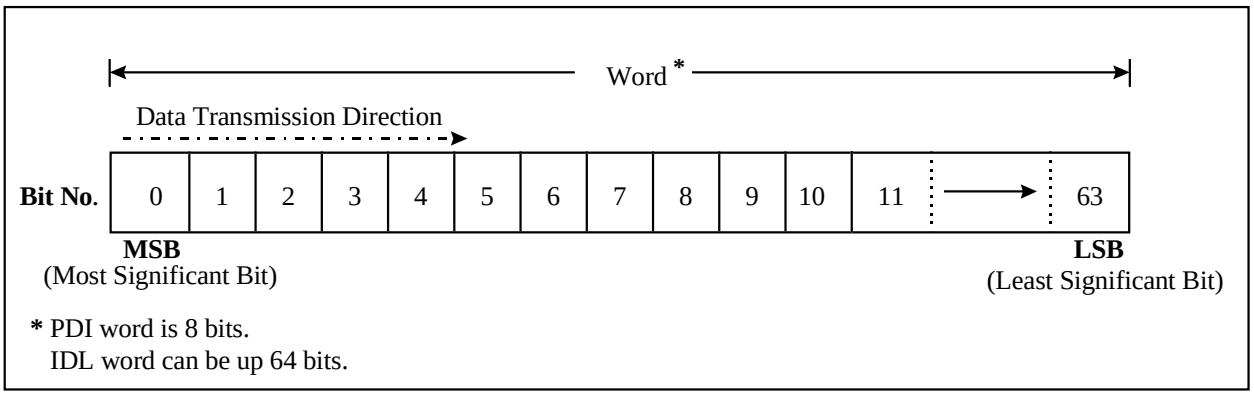


Figure A-0.- Shuttle Data Word Format

c. Minor frame length - The next unit in the basic structure is the minor frame. Minor frames are expressed in words per minor frame. If there are no minor frames then the major frame is the next unit. **Minor frames are always numbered with minor frame 0 first.**

d. Subframe length - If minor frames are present, then, the next unit that may exist in the structure is the subframe. Subframes are expressed in minor frames per subframe. If there are no subframes, then, this parameter is not used. Subframes only exist in NASA-IDL data streams. **Subframes are always numbered with subframe 0 first**.

e. Major frame length - The largest unit in the structure is the major frame. Major frames are expressed in words per major frame, minor frames per major frame, or in subframes per major frame, depending on data stream structure. Major frames appear in all types of data structures.

The common graphical representation of data stream structure is shown in figure A-1. It is very similar to a cartesian coordinate system (two dimensional for NASA-PDI and three dimensional for NASA-IDL).

1.1.1 Data Stream Rate.- (expressed in bits per second) - This parameter provides a relationship between a single bit and time. Once the basic data stream structure has been defined (as previously noted) and the data stream rate is specified, all other relationships with time are established.

1.1.2 Synchronization.- Synchronization is a procedure used to apply precise timing to minor and major frames of a telemetry data stream, such that parameters can be identified at the same period each frame. These parameters are coincident in time, phase, rate, etc. To synchronize a continuous data stream, other characteristics must be provided. The following items are necessary to complete the description of the data stream structure. However, it is not necessary to provide all of the following, only those characteristics applicable to the particular data stream being described.

a. Sync information - Sync information can be expressed for minor frames or major frames. Sync information for subframes is not allowed. Identification of subframes may be done only with counters. The sync identifies the beginning or ending of a major frame or minor frame to the PDI.

    1. Sync value (expressed in hex characters) - This element is the representation of the actual bit pattern of the sync word; for example, "EB90".

    2. Sync start bit (expressed as a bit number) - This parameter specifies the start bit within the sync start word on which the actual sync pattern starts. This parameter is always the first bit (bit 0) for both NASA-PDI and NASA-IDL. If a sync pattern extends into the next word slot, it must continue with the MSB of that word (bit 0).

    3. Sync start word (expressed as a word number) - This parameter specifies the word number (in the frame for which this sync applies) on which the sync begins. If the sync is greater than one word in length, then the sync pattern must continue in the next word.

    4. Sync start frame (expressed as a frame number) - This parameter specifies the frame number in which the sync pattern first appears. This parameter is always in units of the next smaller frame (i.e., major frame sync start frame - minor frame 0). Normally, the sync pattern is in the first or last frame.

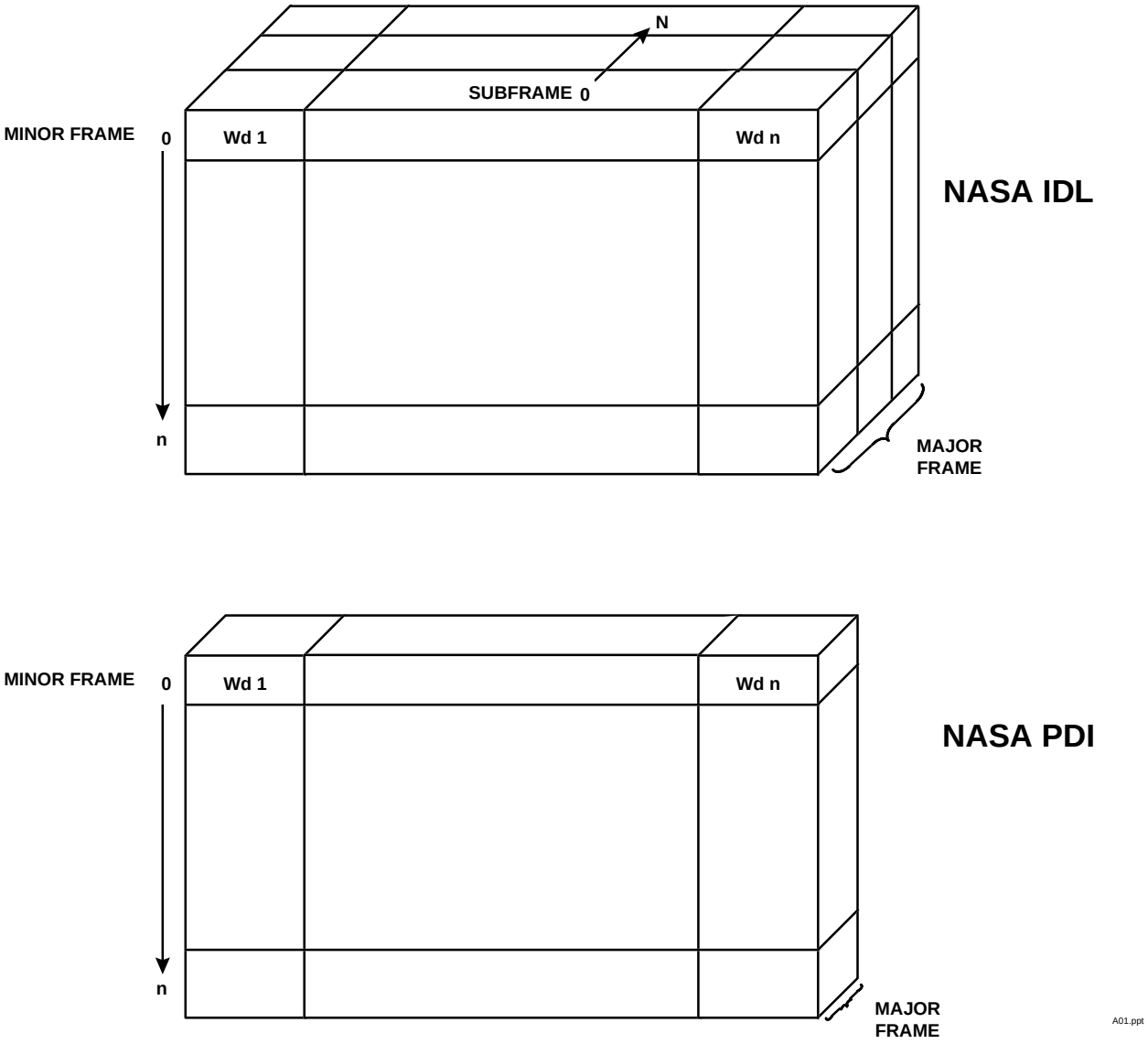


Figure A-1.- Data stream structure.

5. Sync length (expressed as a number of bits) - This is the length of the sync pattern in bits. For NASA-PDI and NASA-IDL, all syncs must fall on a word boundary (i.e., sync start bit must be zero).

6. Sync first/last indicator (expressed as a code F or L) - This code is used by the PDI compiler to indicate whether the sync appears in the first words of the frame or in the last words of the frame. This field applies to NASA-PDI formats only.

b. Counter information - Counter information can be expressed only for minor frames and subframes. The value of the counter is expressed in the number of minor frames or subframes from the beginning of a major frame. The counter will appear in the same location in every minor frame or subframe.

1. Counter initial value (expressed in decimal) - This element specifies the value of the counter for the first frame (frame zero). The counter will appear in the same location in every minor frame or subframe.

2. Counter direction (expressed as up or down) - This element specifies the sign of the counter increment. If the direction specifies up, then the sign attached to the increment will be positive. If the direction is down, then the sign attached to the increment will be negative. All counters increment by one.

3. Counter start word (expressed as a word number) - This element specifies the word number (in the frame for which this counter applies) on which the counter begins. If a counter is greater than one word in length, then the counter must continue in the next word.

4. Counter start bit (expressed as a bit number) - This element is the start bit of the counter within the counter start word. For NASA-PDI and NASA-IDL, the counter start bit is always bit zero.

5. Counter length (expressed as number of bits) - This element specifies the length of the counter in bits. For NASA-PDI and NASA-IDL, all counters must fall on a word boundary (i.e., counter start bit must be zero). All 8 bits of the word (16 bits if two words long) must be for the counter only.

1.1.3 Format Mode.- The above paragraphs detailed the terminology used to describe a data stream. All of these elements are not required to describe every data stream. The format mode is used to indicate the actual structure that applies

for a particular data stream. The format mode determines which of the above fields should be filled out to describe the data stream. The type of data stream that applies in each case is shown in figures A-2 through A-5.

1.1.4 Parametric Data.- When a data stream's basic structure has been completely described, it is then possible to describe the parametric data appearing in the data stream. The NASA-PDI and NASA-IDL assume a symmetrical format structure. Therefore, it is possible to describe the addresses (locations in the matrix) of parametric data using a convention that describes the first location of a parameter and a fixed interval of time between samples.

The following specifications will completely describe the location(s) of a parameter in a data stream:

a. Telemetry start bit (expressed as bit number) - The first bit in the word is numbered zero. This number identifies the bit in a word in which the parameter begins.

b. Start word (expressed as word number) - The first word in the frame is numbered one. This number identifies the word within the smallest frame in this data stream in which the parameter appears. This value cannot change from one major frame to the next. This element will always be the lowest numbered word in which a parameter appears.

c. Start frame (expressed as frame number) - The first frame is numbered zero. This is the first minor frame in which a parameter appears. This element is only applicable for data streams with minor frames.

d. Start subframe (expressed as subframe number) - The first subframe is numbered zero. This is the first subframe in which a parameter appears. This element is only applicable for data streams with subframes. This element only applies for the NASA-IDL standard.

e. Telemetry actual response rate (expressed in samples per major frame) - This is the rate that a parameter repeats in a major frame. Valid rates may allow subcommutated, commutated and supercommutated data for NASA-IDL data streams but only commutated data for NASA-PDI data streams. Shown in figure A-6 is an example of each type of data sampling. Commutation is the process of sequential data sampling, on a repetitive timesharing basis, of multiple data sources for transmitting or recording, or both, on a single channel, or in a data stream.

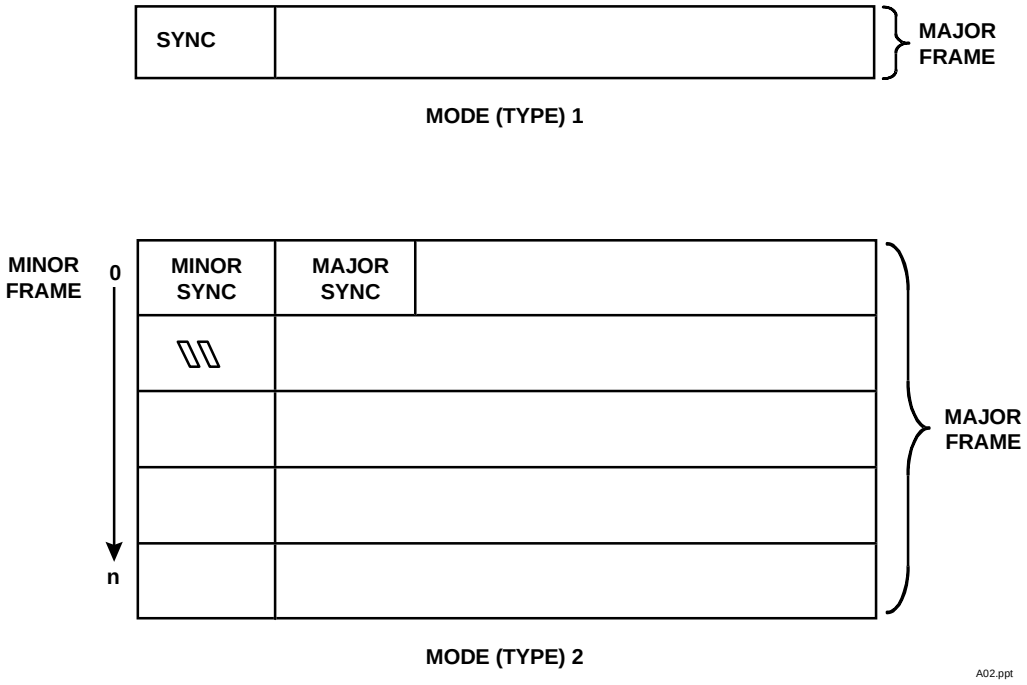


Figure A-2.- Data stream - modes (types) 1 and 2.

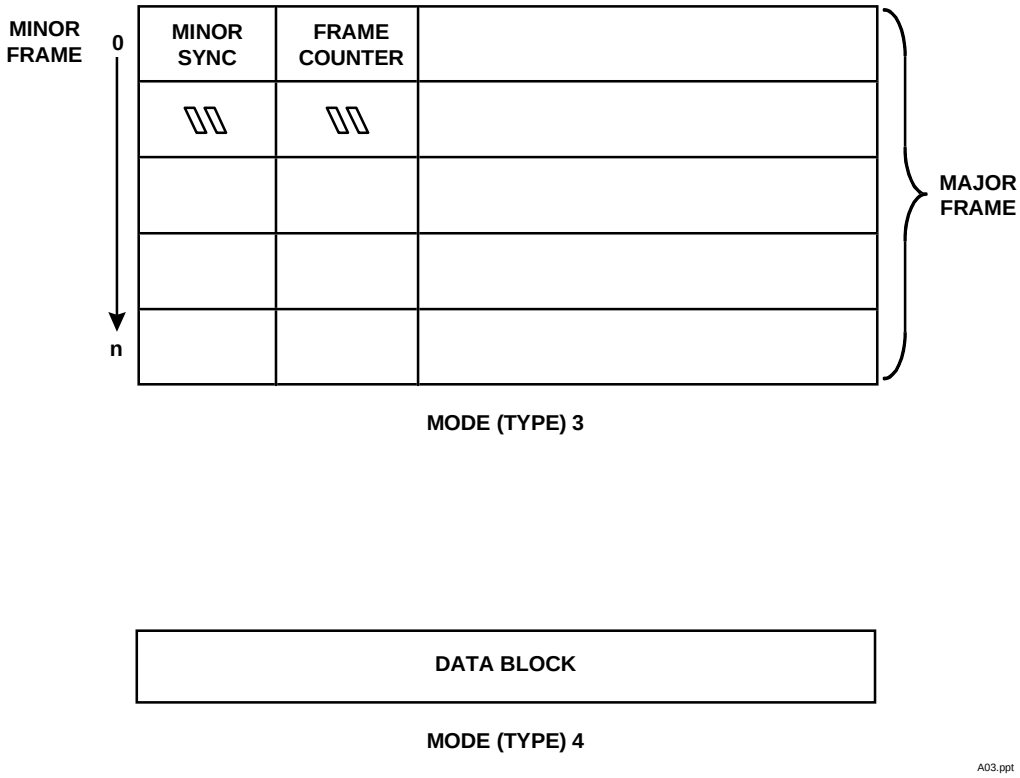


Figure A-3.- Data stream - modes (types) 3 and 4.

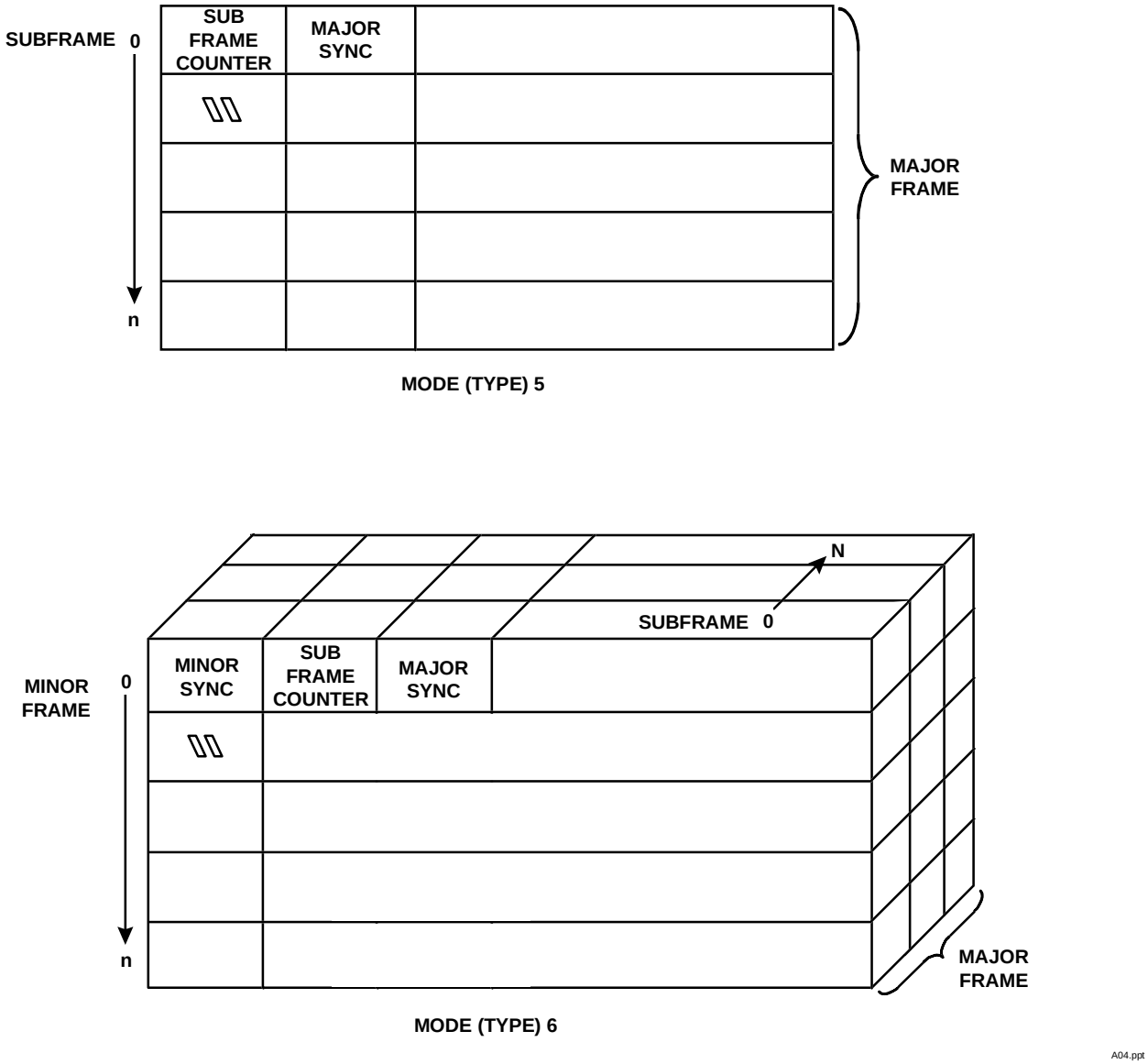


Figure A-4.- Data stream - modes (types) 5 and 6.

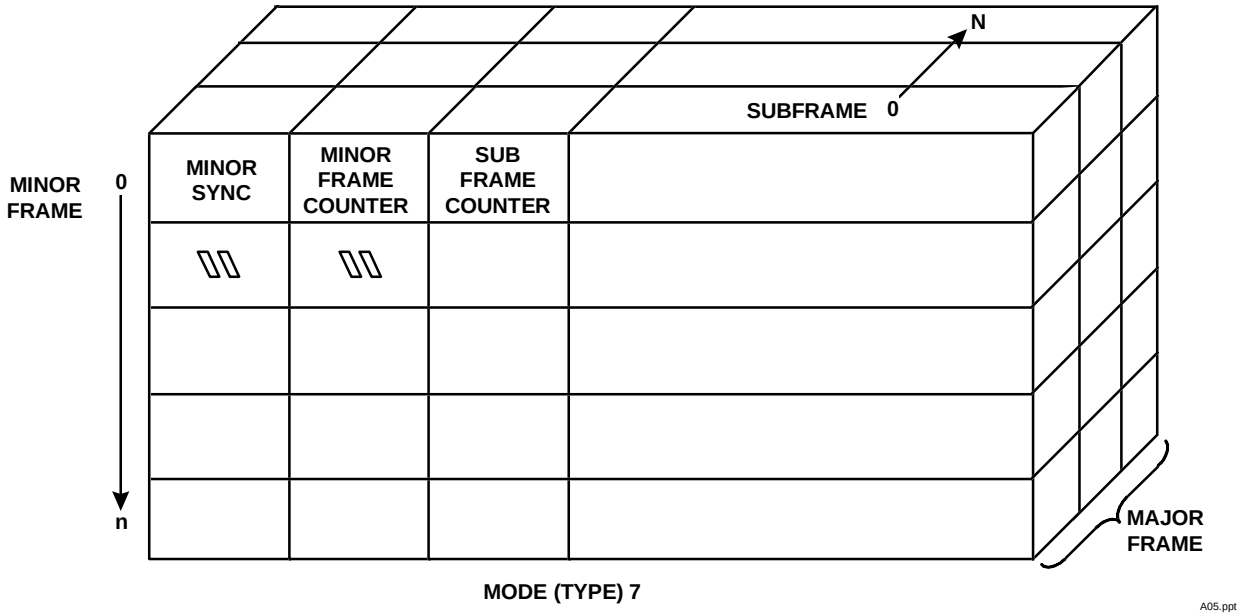


Figure A-5.- Data stream - mode (type) 7.

In the figure, parameter a_1 is commutated at a rate of 12 samples per major frame. **A parameter is considered commutated if it occurs in every major frame, but not necessarily every minor frame**.

Parameter b is supercommutated at a rate of 48 samples per major frame. A parameter is considered supercommutated if its telemetry actual response rate is greater than its data stream's minor frame rate. **It is also considered supercommutated if it appears more than once per minor frame in modes 2 and 3, or the parameter appears more than once per major frame in mode 1**.

Parameter c_1 is subcommutated at a rate of two samples per major frame. **A parameter is considered subcommutated if it does not appear in each subframe or major frame. A parameter must have the same telemetry actual response rate in each major frame in order to be decommutated (pulled out of the telemetry stream)**.

The available sample rates (samples per major frame) for a data stream may be determined as described below. There is a limit of seven sample rates per data stream.

For NASA-IDL:

(X*Y*Z)/I = ASR (Available Sample Rate), where ASR is an integer

I = Integer value, 1 <= I <= (X*Y*Z)

Mode 1
- X = Number of words per major frame
- Y = 1
- Z = 1

Mode 2, 3
- X = Number of words per minor frame
- Y = Number of minor frames per major frame
- Z = 1

Mode 4
- Block mode - Not applicable

Mode 5
- X = Number of words per subframe
- Y = Number of subframes per major frame
- Z = 1

Mode 6, 7
- X = Number of words per minor frame
- Y = Number of minor frames per subframe
- Z = Number of subframes per major frame (Subcom depth)

For NASA-PDI:

X/I = ASR (Available Sample Rate) where ASR is an integer
I = Integer value, 1 <= I <= X

Mode 1
ASR = 1

Mode 2, 3
X = Number of minor frames per major frame

Once the data stream structure is specified, then any parameter can be decommutated. In the example of figure A-6, the following applies:

Parameter	Start word	Start frame	Start subframe	TLM rate
a_1	1	0	0	12
a_2	1	1	0	12
b	2	0	0	48
c_1	10	0	0	2
c_2	10	0	1	2
d	10	1	0	12
e	10	2	0	4
f_1	10	4	0	1
f_2	10	4	1	1
f_3	10	4	2	1
f_4	10	4	3	1

If the bit rate is 1.92 kbps, the word size is 8 bits/word; the minor frame length is 10 words per minor frame; the subframe length is 6 minor frames per subframe, then the major frame length is 4 subframes per major frame; the major frame rate is 1 major frame/second and then:

$$\text{The time between samples for } a_1 = \frac{1}{12 \text{ samples/major frame X 1 major frame/sec}}$$

$$= 1/12 \text{ sec}$$

1.1.5 Data Cycle Period.- Data cycle period is the time required to telemeter at least one complete sample of every referenced parameter in the data stream.

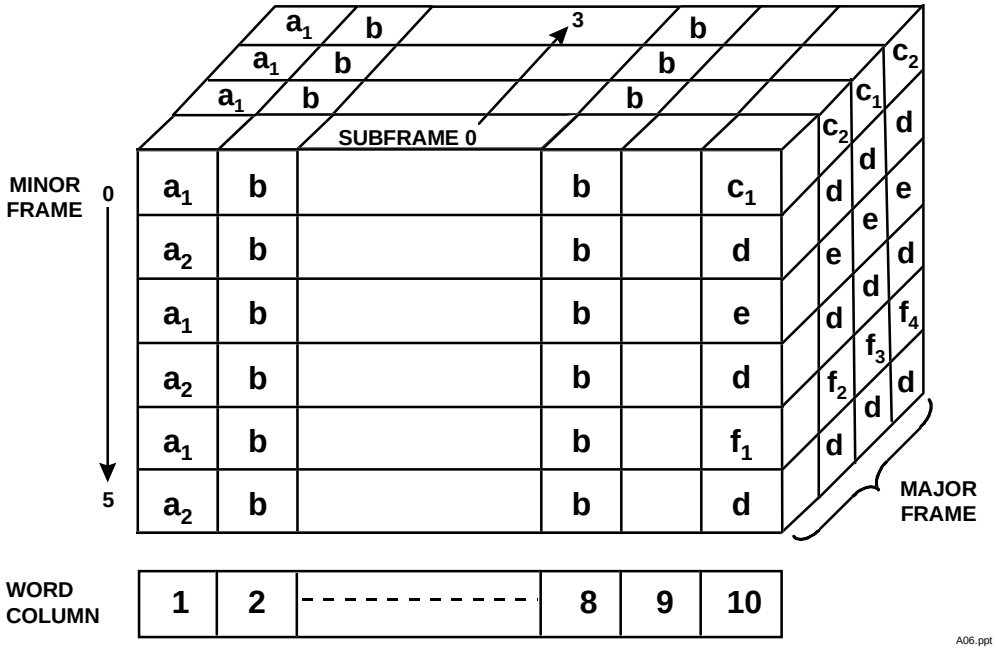


Figure A-6.- Example of sub, super, and regular commutation.

1.1.6 Inverted Measurements.- **The SSP standard assumes that all telemetry systems transmit and/or receive data with the MSB first**. On a parameter by parameter basis this assumption can be reversed to assume least significant bit first; however, this must be done for each parameter in the data stream to be decommutated even if it is true for the entire data stream. The specification of inverted measurements is described in appendix C (see TJ card column 41).

1.2 Basic SSP Telemetry Capabilities

The Orbiter telemetry systems offer capabilities for downlinking General Purpose Computer (GPC) data, Operational Instrumentation (OI) data, and PDI data. These systems also have the capability to receive and retransmit data for attached and detached payloads.

This section briefly describes the Orbiter data streams. All descriptions herein use the standards described in Section 1.1. The following types of data streams are covered in this section:

a. Downlink (OI) data stream (NASA-IDL)

b. Downlist (GPC) data stream (NASA-IDL)

c. PDI data stream (NASA-PDI)

d. Payload independent data stream (NASA-IDL)

e. Payload reconstructed data stream (NASA-IDL)

1.2.1 Downlink Data Stream.- The Orbiter Operational Downlink (OD) data stream is the primary data stream used to telemeter data from the Orbiter to the ground. It can be made up of up to three parts (reference figure A-7) the OI downlink, PDI windows, and the GPC downlist. The OI portion of the downlink is assigned on a parameter basis to minor frames in the downlink. For the PDI windows, several words from each minor frame are reserved for each active PDI Decommutator Control Memory (DCM) (up to 4 PDI windows per downlink format) and the PDI data is inserted as an independent set of data. The GPC downlist is inserted into a set of reserved words in every minor frame in the same fashion as the PDI data, to conclude the minor frame. The size of the three parts of the downlink is constant for a particular downlink format.

The different downlink formats are controlled by Telemetry Format Loads (TFLs) and all have the same basic data stream structure. **The TFL is the actual code loaded into the Pulse Code Modulation Master Unit (PCMMU) to allow telemetry to be transmitted to the ground**. Each TFL has a unique operational instrumentation data composition and a unique set of windows for PDI and GPC data. However, the actual assignment of a GPC downlist to a window or a PDI format to a window is not fixed by the TFL.

The actual assignment of a GPC downlist or a PDI format to a particular window may change without changing the TFL, **since the TFL only restricts the size and location of the windows and not the composition**. This assignment is called a downlink configuration and a downlink configuration Identification (ID) is assigned for each configuration. This downlink configuration ID is not required by the PCMMU since the processes that fetch the window data and the processes that fill the windows in the downlink are independent. Downlink configuration IDs are required for ground processing and are also used to set up the PDI compiler.

There are two data rates available for the OD, a Low Data Rate (LDR) of 64 kbps and a High Data Rate (HDR) of 128 kbps. Normally, only HDR will contain payload data. There is one structural change in the downlink between the two rates. The LDR has a minor frame length that is half that of the HDR minor frame. The following is a summary of the basic structure of the Orbiter downlink. Where two values are given, the first value is for the HDR data stream and the second value is for the LDR data stream. Figure A-8 is a graphical representation of the basic data stream structure.

a. Word length = 8 bits

b. Minor frame length = 160 words or 80 words

c. Major frame length = 100 minor frames

d. Subframe depth = N/A

e. Data stream rate = 128 kbps or 64 kbps

f. Sync information - Minor frame

    1. Sync value = FAF320

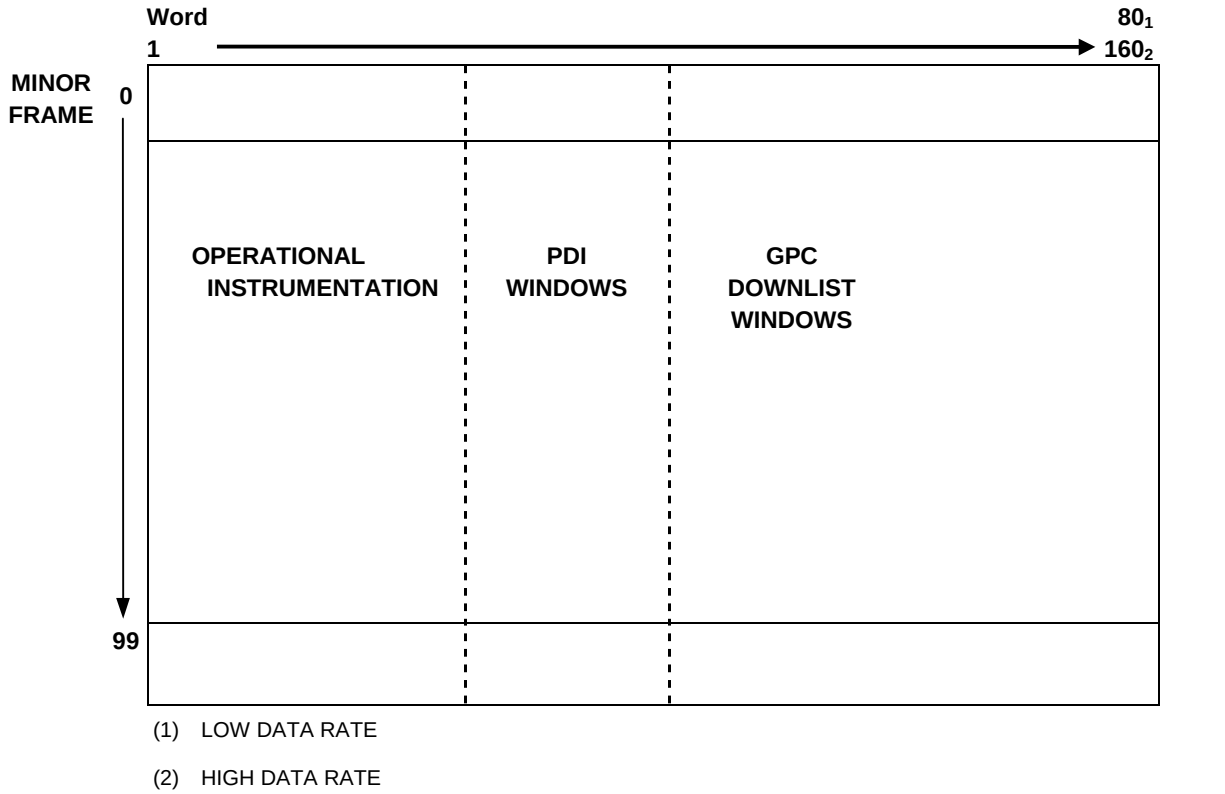


Figure A-7.- Operational downlink data structure.

2. Sync start word = Word 1

3. Sync start frame = N/A

4. Sync start bit = Bit 0

5. Sync length = 24 bits

g. Counter information - Minor frame

1. Counter initial value = 0

2. Counter direction = Up

3. Counter start word = Word 4

4. Counter start bit = Bit 0

5. Counter length = 8 bits

h. Data cycle period = 1 sec

1.2.2 Downlist Data Stream.- **The downlist is the data stream that is used to transmit data from the GPC**. The GPC inserts data into a memory (GPC toggle buffer) in the PCMMU where the data is accessed address by address and inserted into the minor frame words which were reserved for this particular GPC. The size of the area reserved or the GPC window bandwidth must remain constant for each window in a particular TFL. It is possible to route a GPC to a different GPC's window (providing the two downlist bandwidths are compatible) without a TFL change. This change would, however require a downlink configuration to change (reference section 1.2.1 above). A change in the amount of bandwidth used by a particular GPC is accomplished by shortening or lengthening the downlist minor frame. All of the other attributes of the downlist data stream structure remain the same. The following is a description of the basic structure of the GPC downlist. A graphical representation of this basic structure is shown in figure A-9.

a. Word length = 16 bits

b. Minor frame length = 128 words maximum (variable)

c. Data cycle (major frame) length = 50 minor frames

d. Subframe depth = N/A

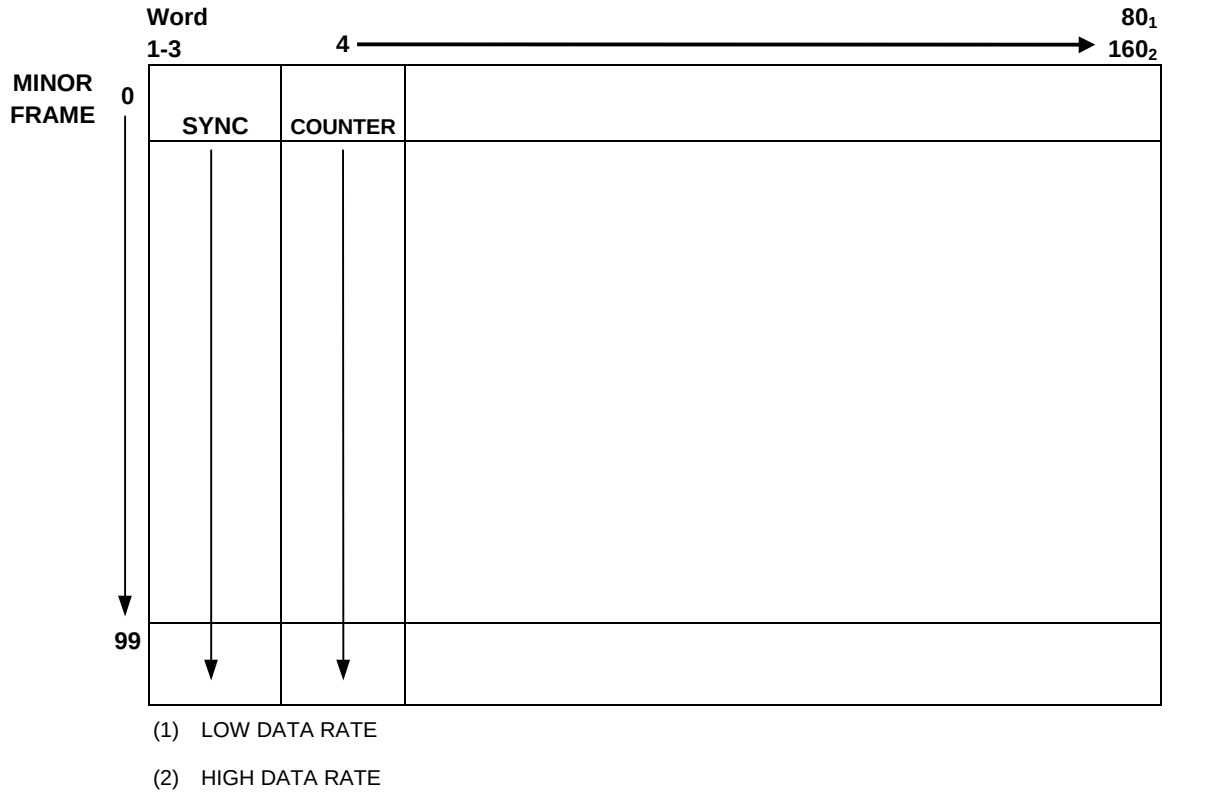


Figure A-8.- Basic downlink data stream structure.

e. Data stream rate = 51.2 kbps maximum (varies with minor frame length)

f. Data cycle (major frame) period = 2 sec

g. Sync information - Minor frame

    1. Sync value = EB90

    2. Sync start word = Word 1

    3. Sync start frame = N/A

    4. Sync start bit = Bit 0

    5. Sync length = 16 bits

h. Counter information - Minor frame

    1. Counter initial value = 0

    2. Counter direction = Up

    3. Counter start word = Word 2

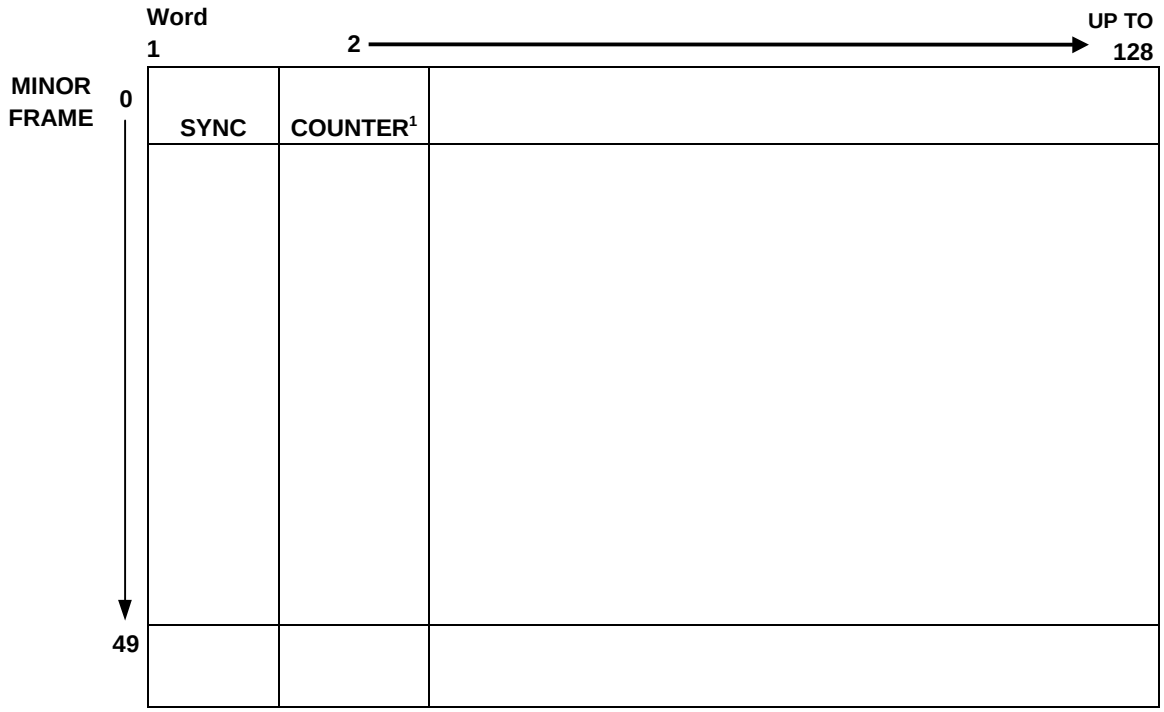
    4. Counter start bit = Bit 2*

    5. Counter length = 6 bits*

*This data is in violation of the NASA-IDL standard, which states that counters will start on word boundaries and the length will be a multiple of the number of bits in a word.

1.2.3 PDI Data Streams.- The PDI data streams may originate in an attached or a detached payload. The data stream is telemetered to the Orbiter so that data may be decommutated for Orbiter GPC use or for throughput in the PDI windows of the Orbiter downlink. The NASA-PDI standard is used to describe PDI input data streams since the PDI can only recognize data streams with four basic structures. Payload customers supply all data necessary to fully describe any data streams that will interface with the SSP. If the data stream contains subcommutated data, there are three options for describing the data.

a. If no subcommutated data is required onboard for GPC processing (display, Fault Detection and Annunciation (FDA), scaling, etc.) or for ground processing in the Mission



(1) COUNTER IS NONSTANDARD (COUNTER IS IN BITS 2-7 OF WORD NUMBER 2)

.5 MAJOR FRAMES PER SECOND

a09.doc

Figure A-9.- Basic GPC downlist data stream structure.

Control Center (MCC), then the NASA-IDL subframe can take the place of the NASA-PDI major frame. This in effect shortens the data cycle of the data stream to one NASA-IDL subframe and ignores the subcommutated data.

b. If a subcommutated parameter is needed onboard, the frame sizes may be adjusted (within certain limits specified below) in order to allow the PDI to decommutate data. Whenever this happens, it is necessary to describe the data stream twice: once to describe the data stream as it actually appears (NASA-IDL) and once to describe it for the PDI (NASA-PDI).

c. If no data is required onboard for GPC processing (display, FDA scaling, etc.) or for ground processing in the MCC, then the NASA-IDL standard can be used.

For example:

a. Actual independent data stream description (NASA-IDL):

   1. Major frame length = 2 subframes

   2. Subframe length = 100 minor frames

   3. Minor frame length = 50 words

b. Parameter "A" has the following attributes in the independent data stream:

   1. Start word = 10

   2. Start frame = 50

   3. Start subframe = 1 (first subframe is always "0")

   4. Telemetry rate = 1 sample/major frame

c. PDI data stream description (NASA-PDI):

   1. Major frame length = 200 minor frames

   2. Subframe length = N/A

   3. Minor frame length = 50 words

d. This same parameter "A" has the following PDI data stream attributes:

1. Start word = 10

2. Start frame = 150

3. Start subframe = N/A

4. Telemetry rate = 1 sample/major frame

The description of the basic structures that the PDI can handle are provided in NSTS 07700, Volume XIV, Attachment 1 (ICD 2-19001).

1.2.3.1 Telemetry Format (PDI) Mode (Type) 1: The PDI mode 1 will handle data streams that have a single frame repetitive pattern. In this mode, there is only a single type of frame in the structure. Using the NASA-PDI telemetry standard, these frames are called major frames. Minor frames do not exist for this type of basic data stream structure. Figure A-2 is a graphical representation of this structure. The following is a description of mode 1 data streams:

a. Word length = 8 bits

b. Minor frame length = N/A (blank)

c. Major frame length = 8 to 1024 words

d. Data stream rate = .010 kbps to 64 kbps

e. Sync information - Major frame

1. Sync value = 00 to FFFFFFFF

2. Sync start word = Less than major frame length

3. Sync F/L indicator = F (first words) or L (last words in the frame)

4. Sync start frame = N/A (blank)

5. Sync length = 8, 16, 24, or 32 bits

f. Counter information - N/A

1. Counter initial value = N/A (blank)

2. Counter direction = N/A (blank)

3. Counter start word = N/A (blank)

4. Counter start bit = N/A (blank)

5. Counter length = N/A (blank)

g. Data cycle period - Must be equal to major frame period

1.2.3.2 Telemetry Format (PDI) Mode (Type) 2: The PDI mode 2 will handle data streams that have minor frames and major frames. The minor frames are identified by a sync pattern. A major frame sync pattern identifies the major frame. Figure A-2 shows a graphical representation of this format mode. The following is a description of mode 2 data streams:

a. Word length = 8 bits

b. Minor frame length = 8 to 1024 words

c. Major frame length = 2 to 256 minor frames

d. Data stream rate = .010 kbps to 64 kbps

e. Sync information - Minor frame

1. Sync value = 00 to FFFFFFFF

2. Sync start word = Less than minor frame length

3. Sync F/L indicator = F or L

4. Sync length = 8, 16, 24, or 32 bits

f. Sync information - Major frame

1. Sync value = 00 to FF

2. Sync start word = Less than minor frame length

3. Sync start frame = First minor frame (F) or last minor frame (L)

4. Sync length = 8 bits

g. Counter information - N/A

1. Counter initial value = N/A (blank)

2. Counter direction = N/A (blank)

3. Counter start word = N/A (blank)

4. Counter start bit = N/A (blank)

5. Counter length = N/A (blank)

1.2.3.3 Telemetry Format (PDI) Mode (Type) 3: The PDI mode 3 will handle data streams that have major frames, minor frames, and a minor frame counter. The minor frame counter indicates which minor frame is presently being read and the counter initial value serves as a major frame sync. Figure A-3 is a graphical representation of this structure. The following is a description of mode 3 data streams:

a. Word length = 8 bits

b. Minor frame length = 8 to 1024 words

c. Major frame length = 2 to 256 minor frames

d. Data stream rate = .010 kbps to 64 kbps

e. Sync information - Minor frame

1. Sync value = 00 to FFFFFFFF

2. Sync start word = Less than minor frame length

3. Sync F/L indicator = F or L

4. Sync start frame = N/A (all minor frames contain sync)

5. Sync length = 8, 16, 24, or 32 bits

f. Counter information - Minor frame

1. Counter initial value = Any value between 0 - 255

2. Counter direction = Up or down

3. Counter start word = Less than minor frame length

4. Counter length = 8 bits

1.2.3.4 Telemetry Format (PDI) Mode (Type) 4 (Block Mode): The PDI mode 4 (block mode) does not recognize any data stream structure. This mode of the PDI is used only to throughput payload data to the Orbiter downlink to be telemetered to the ground systems. If a requirement to have a data stream processed by SSP ground systems exists, a description of the data stream is supplied as a NASA-IDL format (reference section 1.2.4.1). Otherwise, the throughput data stream basic structure is not described. Although the PDI does not recognize an existing data stream structure, it must build a structure so that the data may be inserted into the downlink. It does this by attaching a sync to the beginning of every block of data. The pattern of this sync, as well as the size of the data block, must be specified for input to the PDI compiler. The PDI applied sync pattern must be different from the embedded PDI block mode sync pattern. Figure A-3 shows the graphical representation of this type of data stream. The following is a description of the data that must be specified as PDI compiler input:

a. Word length = 8 bits

b. Output data block length = 12 to 1030 words (including PDI applied sync (1-4 words) and 6 8-bit appended status words). Must be an even number of words

c. Data block rate = 1 to 200 blocks/second

d. Sync information = Data block sync (applied by the PDI)

1. Sync length = 8 to 32 bits

2. Sync value = 00 to FFFFFFFF

3. Data rate = .010 kbps to 64 kbps

1.2.4 Other Data Streams.-

1.2.4.1 Independent Data Links (NASA-IDL): Independent data links are used as mentioned above (to specify a more complete structure for payload data stream) and also to specify the structure of a data stream that will only be used during ground checkout or recorded during flight. Since ground decommutation capabilities at NASA John F. Kennedy Space Center (KSC) are not as limited as the PDI's capabilities, the NASA-IDL terminology should be used. Measurements with a data length greater than 8 bits can only be defined in an independent data stream.

1.2.4.2 Reconstructed Data Streams: Another type of data stream structure is called "payload reconstructed" data streams. These reconstructed data streams are PDI data streams that have had word columns stripped out. When word columns are stripped out, the basic structure of the data stream is changed. In these cases, another description of the "new" basic data stream structure is developed. These types of descriptions are only used for payload data streams that use the word column decom capability of PDI to reduce the throughput data stream's bandwidth.

1.2.4.3 Payload Interrogator/Payload Signal Processor Input Data Streams: These data streams are described by the PDI input format that is specified as indicated above. If the Payload Interrogator (PI)/Payload Signal Processor (PSP) is to be used, however, the description of the data must be provided to the flight software so that PSP configuration data may be stored on the flight mass memory for use during the mission. To accomplish this, the PDI format data is translated into a set of PSP configuration message codes. The PSP sync hex value must contain trailing zeroes in the PSP configuration message.

1.2.4.4 Spacelab Telemetry Buffer: Spacelab has a unique interface with the SSP data base systems since Spacelab telemetry is accessed directly by the PCMMU. There are two Telemetry Buffers (TMBs) that the PCMMU accesses, one for the Experiment Computer (EXC) and one for the Subsystem Computer (SSC). The PCMMU fetches all of both telemetry buffers with the universal fetch prom. The actual parameter that appears in a particular TMB address may change from flight to flight. The NASA Marshall Space Flight Center (MSFC) provides a Payload Data Tape (PDT) for each flight which contains the actual TMB location of each parameter. This data is used by the PDI compiler to formulate the telemetry format loads for the flight (reference section 1.2.1).

The TMB address for each parameter is placed in the telemetry start word field of the payload data tape. The telemetry format ID field is used on the PDT to indicate whether the parameter is in the EXC TMB or the SSC TMB. The required rate field is used to indicate the rate at which the TMB is updated for each parameter. The MSFC provides the format IDs (EXCN and SSCN) as a part of the nonparametric data (TA cards) on the PDT, but no other data stream description data is provided.

Spacelab character data may exceed 16 bits for a single message. Since this would not in general be assembled in order by ground systems at JSC, another field has been used to indicate the order in which to reassemble the message. The Bus Terminal Unit (BTU) word number field contains the position of each 16 bit parameter within the character data message.

A complete description of the conventions for describing these data streams is provided in section 1.3.

1.3 Telemetry Data Element Use

1.3.1 Nonparametric (Non-MSID related) Data Element Use.- The following matrix defines the applicability of the data stream structure fields that are used by the SSP. Wherever the value of this field is predetermined, that value is shown. An asterisk (*) is used to indicate that the contents of a field depends on the particular data stream being described. The definitions of data field names are provided in appendix C.

NONPARAMETRIC DATA ELEMENT TABLE

Data Field Name	PDI Mode 1	PDI Mode 2	PDI Mode 3	Block Mode 4	INDEP Data Stream	Recons Data Stream	SL Tlm Buffer
TLM FORMAT ID	*	*	*	*	*	*	*
TLM FORMAT INDICATOR	8	8	8	8	5	4	9
FORMAT MODE	1	2	3	4	*	*	
PDI PORTS 1, 2, AND 3	*	*	*	*			
FLT PHASE	*	*	*	*	*	*	

NONPARAMETRIC DATA ELEMENT TABLE (Continued)

Data Field Name	PDI Mode 1	PDI Mode 2	PDI Mode 3	Block Mode 4	INDEP Data Stream	Recons Data Stream	SL Tlm Buffer
REQ WINDOW SIZE	*	*	*	*		*	
TLM BANDWIDTH	*	*	*	*		*	
BIT RATE TOLERANCE	*	*	*	*		*	
TLM DATA CODE	*	*	*	*	*	*	
BITS PER WORD	8	8	8		*	8	
WORDS PER FRAME OR OUTPUT DATA BLOCK	*	*	*	*	*	*	
FRAMES/FRAME OR DATA BLOCK SEC		*	*	*	*	*	
MAJOR FRAME PERIOD	*	*	*		*	*	
DATA CYCLE PERIOD	*	*	*		*	*	
BIT RATE	*	*	*	*	*	*	
SYNC HEX VALUE	*	*	*	*	*	*	
SYNC F/L INDICATOR	*	*	*		*	*	
SYNC START WORD	*	*	*		*	*	
SYNC LENGTH**	*	*	*				
MAJ FRAME SYNC F/L INDICATOR		*			*	*	
MAJ FRAME SYNC HEX VALUE		*			*	*	
MAJ FRAME SYNC WORD NUMBER		*			*	*	

NONPARAMETRIC DATA ELEMENT TABLE (Concluded)

Data Field Name	PDI Mode 1	PDI Mode 2	PDI Mode 3	Block Mode 4	INDEP Data Stream	Recons Data Stream	SL Tlm Buffer
MIN FRAME COUNTER U/D INDICATOR			*		*	*	
MINOR FRAME COUNTER INITIAL VALUE			*		*	*	
MINOR FRAME COUNTER WORD NUMBER			*		*	*	
SUBFRAME COUNTER U/D INDICATOR					*	*	
SUBFRAME COUNTER INITIAL VALUE					*	*	
SUBFRAME COUNTER WORD NUMBER					*	*	
AVAILABLE SAMPLE RATES	*	*	*		*	*	
SUBCOM DEPTH					*	*	

**Contents of a field depends on the particular data stream being described.

1.3.2 Parametric (MSID Related) Data Element Use.- The following matrix defines the applicability of the parametric telemetry data stream fields. Wherever the value of this field is predetermined, that value is shown. An asterisk (*) is used to indicate that the contents of a field depend on the particular data stream which contains the measurement.

PARAMETRIC (MSID RELATED) DATA ELEMENT TABLE

Data Field Name	PDI Mode 1	PDI Mode 2	PDI Mode 3	Block Mode 4	INDEP Data Stream	Recons Data Stream	SL Tlm Buffer
TLM FORMAT ID	*	*	*	*	*	*	*
TLM FORMAT IND	8	8	8	8	5	4	9
TLM REQUIRED RESPONSE RATE	*	*	*			*	*
TLM LOW BIT RATE INDICATOR							
TLM FIRST WORD	*	*	*		*	*	*
TLM FIRST SUBFR					*	*	
TLM FIRST FRAME	*	*	*		*	*	
TLM ACTUAL RATE	*	*	*		*	*	
TLM START BIT	*	*	*		*	*	*

*For a detailed description of these and other parametric data elements, refer to appendix C.

APPENDIX B

PAYLOAD MEASUREMENT/STIMULUS IDENTIFICATION FORMAT

1.0 GENERAL

The following will establish the definitions used in the identification of measurements and stimuli associated with Spacelab, upper stage, or payload elements.

1.1 Measurement (Telemetry)

The term measurement is defined as any signal which is needed, directly or indirectly, to provide data to the flightcrew, ground crew or flight computers regarding a parameter pertaining to the state, performance or condition of a hardware element, software computations or expendables. Each measurement is given a unique identification number to identify its signal source.

1.2 Stimulus (Command)

The term stimulus is defined as a signal which is generated by the flightcrew (manual controls), flight General Purpose Computers (GPCs) or Ground Support Equipment (GSE), including Launch Processing System (LPS) and Radio Frequency (RF) uplink, for the purpose of stimulating or initiating an action by a hardware or software element. Each stimulus is given a unique identification number to identify the signal destination.

1.3 Measurement/Stimulus Identification (MSID) Number

Each measurement or stimulus has an identification number that will be unique throughout the Space Shuttle Program (SSP). A number consists of six fields. Fields 1 through 5 establish a unique identification. Field 6 provides supplementary information. The identification number is alphanumeric. These fields are identified as follows:

Field number	1	2	3	4	5	6
Character	P	45	T	2222	T	*

The characters for each field are defined in accordance with the following paragraphs.

1.3.1 Field Number 1.- Character one is an alphabetical character identifying Spacelab, a payload or an upper stage. Only characters related to these cargo elements are identified here. Total SSP character identification can be found in the master measurement list (reference Shuttle Data Integration Plan, Vol. III, STSOC-PD-001166).

The following characters have been reserved for use by payload elements:

L - Spacelab: A general purpose orbiting laboratory for manned and automated activities in the Orbiter payload bay in near-Earth orbit. It includes both module and pallet sections, which can be used separately or in several combinations. It also includes hardware, software, interface hardware, Operations and Maintenance Documents (OMD), Support Equipment (SE) and Spacelab experiments.

P - Payload, Payload Carrier or Experiment: The total complement of specific instruments, space equipment, support hardware and software, consumables and procedures carried in the Orbiter for the performance of discrete activities in space.

U - Upper Stage: A propulsive system, carried into orbit in the Orbiter payload bay, designed to deliver payloads into orbits and trajectories beyond the capabilities of the Shuttle. Includes hardware, software, interface hardware, OMD, and SE.

1.3.2 Field Number 2.- Characters two and three are numerical and designate the cargo element subsystem. This designator will be assigned by National Aeronautics and Space Administration (NASA)/Lyndon B. Johnson Space Center (JSC) in the Payload Integration Plan (PIP).

1.3.3 Field Number 3.- Character four is alphabetical and identifies the instrumentation type. If the identification number is for a stimulus, the fourth character will be a "K". The characters assigned to instrumentation types are as follows:

A - Acceleration
B - Phase (electrical)
C - Current
D - Vibration
E - Power
F - Frequency
N - Resistance or Camera
P - Pressure
Q - Quantity/Humidity
R - Rate
S - Switch Scan
T - Temperature

G - Force/Stress/Strain
H - Position/Attitude
J - Logic Status
K - Stimulus (a)
L - Velocity
M - Multi-data (b)
U - Undefined or Binary Coded Decimal (BCD) counts or binary
V - Voltage
W - Time
X - Discrete Event
Y - Acoustics

a. Any stimulus terminating or generated within the System Management (SM) GPC may be monitored. If such a stimulus is to be monitored, the appropriate measurement data fields will be filled out. Stimuli that are monitored will appear in both the measurements and stimuli sections of the Command and Data Annex.

b. Multi-data are serial digital channel designators and may be associated with parent words and wire MSIDs.

1.3.4 Field Number 4.- Characters 5 through 8 are numerical sequential. **Characters 5 through 8 shall be unique for each MSID created within a payload except in those cases when wire/parent/grandparent MSIDs are assigned or when a parameter is defined in both a Payload Data Interleaver (PDI) and independent data stream.** For a discussion of these exceptions, reference section 1.4.

1.3.5 Field Number 5.- Character nine is alphabetical and identifies the type of signal routing relative to data processing within the vehicle avionics. Multiple designations may be noted for a unique measurement.

Data Routing Code Matrix:

Analog	Event (discrete)	Digital (serial)	Data Routing
A	E	D	Operational Flight Instrumentation
C	X	B	SM GPC
R	U	L	RF Uplink
V	Y	J	System Management/Payload
-	-	P	Parent Word

Note: For a detailed description of the codes for the signal type, see table A.4, SIGNAL TYPE - MSID CHARACTER 9 of the Shuttle Data Integration Plan (DIP), Vol. III - JSC 18206.

1.3.5.1 Operational Flight Instrumentation (OFI) Data: A signal that is generated by the cargo element and routed through one of the following:

a. Operational Instrumentation (OI)/Multiplexer/Demultiplexer (MDM) to the Orbiter Pulse Code Modulation (PCM) Telemetry (TLM) system

b. PDI to the Orbiter PCM TLM system

c. Hardwired between the cargo element and the Orbiter PCM system without utilizing an MDM/PDI

1.3.5.2 SM GPC Data: A payload signal that is essential to vehicle safety, control and performance and is routed through one of the following:

a. Instrumentation measurements/stimuli signal to/from MDMs supporting the Orbiter SM GPC

b. A signal generated by Orbiter SM GPC software

1.3.5.3 RF Uplink Data: A signal transmitted from a ground station to the vehicle and routed through the Network Signal Processor (NSP) to the GPC and respective Bus Terminal Unit (BTU) to the commanded cargo element.

1.3.5.4 System Management/Payload Data: A signal that is generated by Orbiter payload management computer software or cargo element hardware and routed through a payload BTU or payload MDM.

1.3.5.5 Parent Word Data: Parent words are identified by a unique measurement/stimulus number to facilitate data processing only. A parent word is any 8-, 16-, 24-, 32-, 48-, or 64-bit word within a serial digital or discrete channel that contains more than one signal or function (e.g., a grouping of event measurements) within its bit structure.

1.3.5.6 Redundant Signal Routing: Where a signal is redundantly routed, a unique MSID shall be assigned for each redundant measurement/stimuli.

1.3.6 Field Number 6.- Character ten may be an asterisk (*) which identifies the second path for a signal that is dual routed or an alpha character which identifies software routing. It may also identify hardware measurements (V = Backup Flight System

(BFS) payload parameter) that are used as inputs for the BFS and are downlisted. This character may be blank.

Note: The tenth character may also be modified by respective NASA and contractor test facilities to support data processing in regard to ground signal paths or data link access rates. The modification of the MSID will be the responsibility of the test support organization. The MSID so modified will not be binding upon flight or other data supporting organizations. To avoid confusion of modified MSID data (related to a specific supporting organization) all data transmitted or documented and forwarded to other organizations shall be limited to only the MSID characters specified within the Master Measurement List (MML).

1.4 MSID Assignment

1.4.1 Measurement MSID Assignment.- The MSIDs are organized as follows:

a. Grandparent MSIDs - Required for character data, a grandparent MSID represents the total character data set parameter. A grandparent MSID has a fourth character of "U" and a ninth character of "P".

b. Parent MSIDs - For character data, 1 to 99 characters can be assigned per grandparent. Each parent will contain a subset of the entire character dataset. Parent words will be identified by a unique MSID. Each parent word is 16-bits long. A parent MSID will contain the same submeasurement MSID in the same order in all formats. No single parent MSID will be assigned to more than one grandparent.

   For noncharacter data, parent words will be identified by a unique MSID. For serial I/O data, each parent word is modulo 16-bits and represents 16 to 64 bits. **For digital payload MDM channels, a parent word is 16 bits in length. For PDI data, a parent MSID is required for discretes and digital parameters less than 8 bits in length**. The guidelines for assigning MSIDs to parameters are illustrated in figure B-1.

   A parent MSID has a fourth character of "M" and a ninth character of "P".

c. Submeasurements - For character data, each character will be represented by 1 submeasurement and will be 1 to 64 bits in length. Each submeasurement will be assigned to one parent. Unused bits will not be specified.

   For noncharacter data, assignments of submeasurement to parents is illustrated in figure B-1.

d. Wire MSIDs - A MSID of the form M-J is required to represent the serial I/O channel being used. Parents and submeasurements that reflect this channel are assigned to this wire MSID. Wire MSIDs are not used for digital channels.

1.4.2 Command/Stimuli MSID Assignment.- The guideline of the criteria in assigning of MSIDs for stimuli to payloads is shown below. The Command and Data Annex will define the relationship between the keyboard MSID, the command configuration MSID, the parent, and wire MSID as appropriate.

a. The keyboard MSID (required for indexed commands only) will be a P93 (payload), U93 (Upper Stage), or L93 (Spacelab). These MSIDs will be individually assigned by NASA for each payload.

b. A payload MSID beginning with the payload ID (e.g., U09, P10, L72, etc.,) will be used to identify each unique command configuration between the GPC and BTU. **The MSID's fourth character will be a "K" and the ninth character will be a "J".**

c. The digital uplink command MSIDs will carry the same MSID number as the unique command configuration, except the ninth character will be assigned as defined in paragraph 1.3.5.

d. For discrete commands, BTU output wires will have the same MSID that is assigned to the command configuration's "high state" or commanded function, except the ninth character will be a "Y".

Examples of the MSIDs for BTU, GPC, and payload interfaces are respectively illustrated by figures B-2, B-3, and B-4.

1.4.3 MSID Change Criteria.- This table specifies the ground rules for changing MSIDs. The MSID shall be changed when the following data associated with an MSID is changed:

a. TLM LINK ID (Telemetry Link ID)

The table below illustrates a required MSID change due to a change from the original Tlm Link Id. to a new Tlm Link Id. For a detailed description of Tlm Link Id., refer to card type "TJ" - Telemetry Data Requirements Card in appendix C.

New Link Id.	Original Tlm Link Id.							
	9	D	J	N	P	R	U	X
9	-	X	-	-	-	-	-	-
D	X	-	X	X	X	X	X	-
J	-	X	-	-	-	-	-	-
N	-	X	-	-	-	-	-	-
P	-	X	-	-	-	-	-	-
R	-	X	-	-	-	-	-	-
U	-	X	-	-	-	-	-	-
X	-	-	-	-	-	-	-	-

X = Denotes MSID change required.

b. DATA TYPE

If DATA TYPE changes from AMB, AMU to any other type
If DATA TYPE changes from BD to any other type
If DATA TYPE changes from any other type to BD
If DATA TYPE changes from BCD, BCH to any other type
If DATA TYPE changes from any other type to BCD, BCH
If DATA TYPE changes from DUC to any other type
If DATA TYPE changes from any other type to DUC
If DATA TYPE changes from DPL, HPL, SPL to any other type (changes within this group are not allowed)
If DATA TYPE changes from any other type to DPL, FPL, HPL, SPL

c. BTU CARD TYPE

If BTU CARD TYPE changes from SIO to any other type
If BTU CARD TYPE changes from any other type to SIO

d. BTU NO. BITS (BTU Number of Bits)

If BTU NO. BITS changes

e. BTU NO. WDS (BTU/SIO Number of Words)

If BTU NO. WDS changes

f. BTU NAME

If BTU name changes from FLX to any other type
If BTU name changes from any other type to FLX

g. NOMENCLATURE

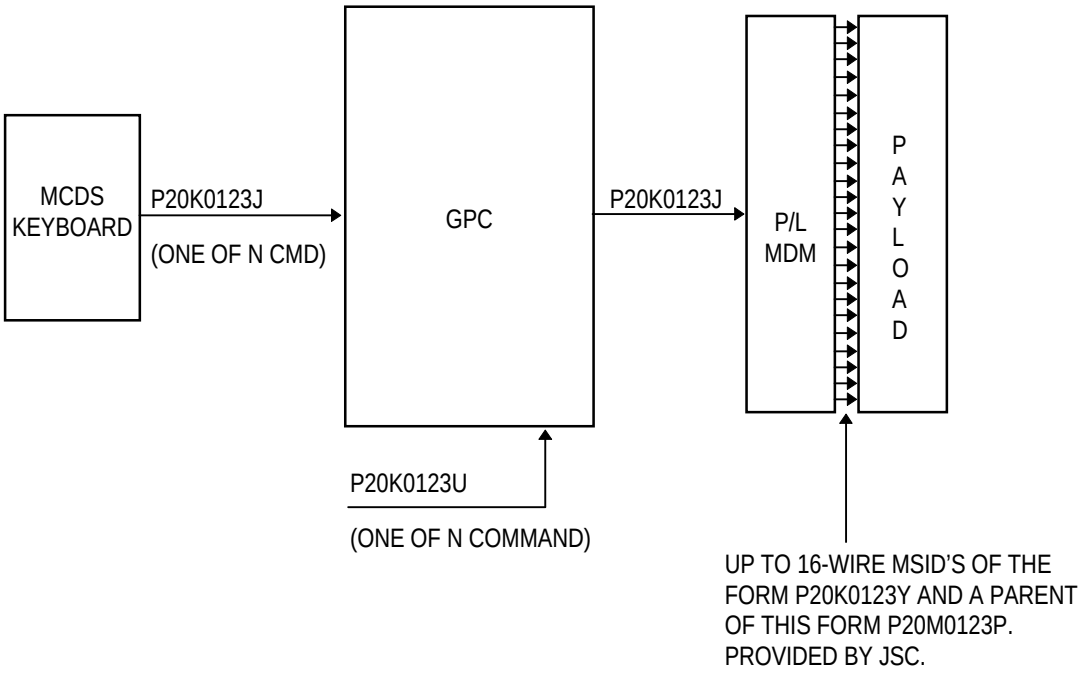
If the function described in the nomenclature changes (This does not include enhancement of description.)

Parameter Categorization

Source	8 bit analog / 8 bit analog	8 bit analog / Event / Digital (Discrete) (Serial)	Event / Digital (Discrete) (Serial)	Event (Discrete)	Digital (Serial)	10 bit analog	Character
MDM (SIO)	Wire MSID (M-J) Parent MSID (M-P)	Wire MSID (M-J) Parent MSID (M-P)	Wire MSID (M-J) Parent MSID (M-P)	Wire MSID (M-J) Parent MSID (M-P)	Wire MSID (M-J) Parent MSID (M-P)	N/A	Grandparent (U-P) Parent MSID (M-P)
MDM (DIL/DIH)	N/A	N/A	N/A	Parent MSID (M-P)	N/A	N/A	N/A
MDM (DOL/ DOH)	N/A	N/A	N/A	Wire MSID (K-Y) Parent MSID (M-P)	N/A	N/A	N/A
MDM (AID)	N/A	N/A	N/A	N/A	N/A	Wire and Parent MSID not required	N/A
PDI (Modes 1,2,3)	N/A	N/A	Parent MSID (M-P)	Parent MSID (M-P)	Parent MSID (M-P) (Required if Measurement data length less than 8 bits.)	N/A	N/A
PDI (IDL) (Modes 5,6,7)	Parent MSID not required	Parent MSID (M-P)	Parent MSID (M-P) (Digital and event measurement data length combination must be less than or equal to the format word size.)	Parent MSID (M-P)	Parent MSID (M-P) (Required if Measurement data length is less than the format word size)	N/A	N/A

b01.doc

Figure B-1.- Wire/parent/grandparent MSID requirement summary.

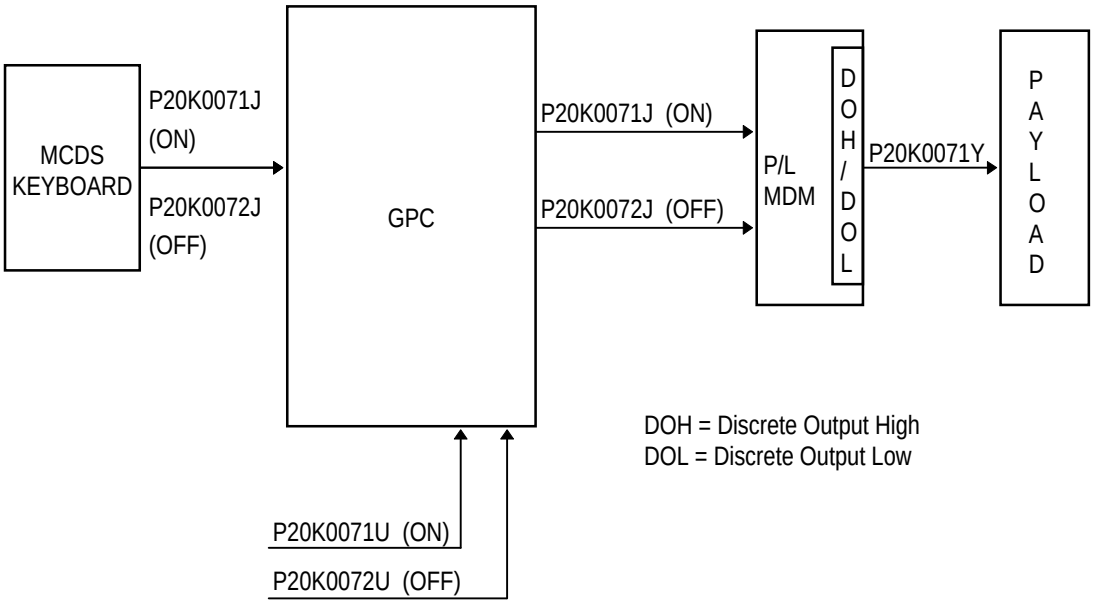


The P20K0123J MSID represents a command originating from the MCDS keyboard. The command is then routed from the GPC to the Payload MDM, and finally to the Payload to perform a specific function.

The P20K0123U MSID represents a command originating from a ground facility (e.g., MCC, POCC). The command is sent to the GPC, the Payload MDM and Payload.

b02.doc

Figure B-2.- MDM parallel transfer channel.



The P20K0071J MSID represents the “ON” condition for specific command originating from the MCDS keyboard.

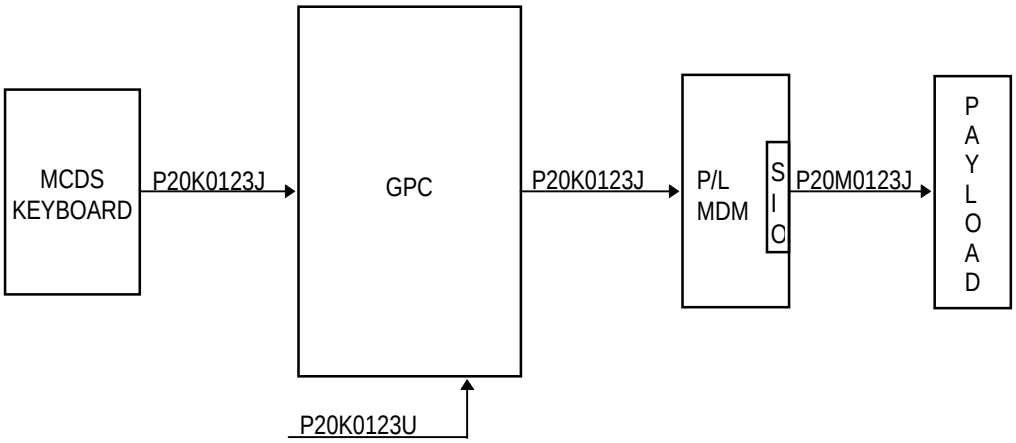
The P20K0072J MSID represents the “OFF” condition for specific command originating from the MCDS keyboard.

The P20K0071Y MSID represents the physical MDM wire which routes the discrete command. Provided by JSC.

The P20K0071U and P20K0072U MSIDs represent the “ON” and “OFF” conditions for the same keyboard commands, but these commands originate from a ground facility (e.g., MCC, POCC). These commands are sent to the GPC, the Payload MDM and Payload.

b03.doc

Figure B-3.- MDM discrete command.



The P20K0123J MSID represents a command originating from the MCDS keyboard. The command is then routed from the GPC to the Payload MDM, and finally to the Payload to perform a specific function.

The P20K0123U MSID represents a command originating from a ground facility (e.g., MCC, POCC). The command is sent to the GPC, the Payload MDM and Payload.

b04.doc

Figure B-4.- Serial transfer channel.

APPENDIX C

PAYLOAD DATA TAPE DESCRIPTION

1.0 GENERAL DESCRIPTION

The Payload Data Tape (PDT) defines the command, measurement, and telemetry stream requirements necessary to configure the National Aeronautics and Space Administration (NASA) Lyndon B. Johnson Space Center (JSC) payload data base system. The PDT is available to the payload customer via several product media. Types of media include the following: a dataset cataloged on the Software Production Facility (SPF), CD-ROM, cartridge tape, diskette, and paper report (listing).

2.0 FILE STRUCTURE

Payload data is organized on the PDT in four files per payload unit (table C-1). Each file is composed of 1 or more 80-character records in card image format (tables C-2 through C-4).

2.1 File 1 (Predefined Onboard Commands)

Record 1 will always be occupied by an AA (payload header) card. The purpose of the AA card is to identify both the payload and the primary payload contact. Position 2 will always be occupied by a CA (command file header) card. A single CA card is required at the beginning of each command file on the tape. If no predefined onboard commands exist, then this will be the only other card in the file.

When predefined onboard commands are present, positions 3 through N1 will be occupied by some combination of CB, CC, CD, CE, CF, CL, CR, and CV cards. Each command will be represented by one CC, one CD, and one (optional) CE card, followed by the appropriate CF, CL, CR, and CV cards. One CR or CV card may exist for each command (CR and CV cards are mutually exclusive). The maximum number of CL cards per command is 8 (CL cards are mutually exclusive with CR and CV cards).

2.2 File 2 (Predefined and Buildable Ground Uplink Commands)

Record 1 will always be occupied by a CA card. If no predefined ground commands exist, then this will be the only card in the file.

Records 2 through N2 may contain some combinations of CB, CC, CD, CE, CL, CM, and CR cards. Each predefined ground command will have one CC, one CD, and one (optional) CE card, followed by the appropriate CL, CM, and CR cards. Up to eight CL cards may exist per command. Buildable commands will be provided with variable data defined by a "V"; where each "V" represents four information bits.

2.3 File 3

Record 1 will always be occupied by a CA card. This will be the only card in the file.

2.4 File 4 (Telemetry Format and Measurements)

Records 1 through N4 contain some combination of TA, TB, and TC cards. One TA and one TB card are required for each Payload Reconstructed (PLR), Independent (IND), and Payload Data Interleaver (PDI) format. At least one TC card is also required for each PDI format. The maximum number of TC cards per format is 74. If no PLR, IND, or PDI formats exist for the payload, then no TA, TB, or TC cards will be present and file 4 will begin with a TI card. If file 4 is empty, then a single TA card will be present.

Records N4+1 through N5 may be occupied by some combination of TI, TJ, TK, TL, TM, TN, TP, TQ, TR, TS, and TT cards. One TI, one TJ, and one (optional) TK card will exist for each telemetry measurement, followed by the appropriate TL, TM, TN, TP, TQ, TR, TS, and TT cards. One TL card is required for each measurement with Caution and Warning (C&W) limits. One TM card is required for each measurement with alert limits. There could be up to 3 TP and 3 TQ cards for each TM card. One TN card is needed for each measurement requiring a Cathode-Ray Tube (CRT) fault summary page message. One TR card is required for each analog measurement; if third degree calibration of the measurement is necessary, then one TS card is also required. The maximum number of TT cards per measurement is 99.

3.0 CARD IMAGE FORMATS

The card image formats on the PDT are defined in section 4.0. Tables C-5 and C-6 relate PDT telemetry field content for the TA, TB, TC, and TT cards to telemetry format modes and telemetry format indicators.

3.1 Payload Header (AA Card)

The payload header card identifies the payload and primary payload contact. Tables C-5 and C-6 relate PDT telemetry field content for the TA, TB, TC, and TT cards to the telemetry format modes and telemetry format indicators. A separate payload header card will be supplied for each payload on the tape.

3.2 Command Cards

Command data appears on the PDT in the form of CA, CB, CC, CD, CE, CF, CL, CM, CR, and CV cards. All command data is contained in the first 3 files.

3.2.1 Command File Header (CA Card).- The command file header card marks the beginning of each command file on the PDT. There will always be three of these cards per payload.

3.2.2 Command Payload Signal Processor Configuration/Bus Terminal Unit/Standard Serial Interface Description (CB Card).- The CB card may be used to define a Payload Signal Processor (PSP) configuration message (columns 1-21, 51) and/or Standard Serial Interface (SSI) (columns 22-50). The PSP configurations stored in the Orbiter flight software always appear in file 1; uplinked configurations appear in file 2. The total number of configurations (summed across both files) cannot exceed 5. A total of eight SSI descriptions are allowed in flight software. The SSI descriptions appear only in file 1. The payload supplier may provide PSP and SSI information on separate sets of CB cards (up to five cards for PSP descriptions and up to eight cards for SSI descriptions), or he/she may combine PSP and SSI data on a single set (eight maximum) of CB cards.

3.2.3 Command Master Measurement List Data (CC Card).- One CC card is required for each command. It describes the Master Measurement List (MML) data for that command. The CC cards may appear in files 1 and 2.

3.2.4 Command Data Requirements (CD Card).- The CD card defines data requirements for a command. Each command in files 1 and 2 must have a CD card.

3.2.5 Command User Identification (CE Card).- The CE card contains related Measurement/Stimuli Identification (MSID) information for a command. It is an optional card. One may exist per command.

3.2.6 Keyboard to Command/Stimuli Identification (CF Card).- The CF card ties a Payload command to a keyboard MSID, index ID and CRT nomenclature for the keyboard MSID. CF cards appear only in file 1.

3.2.7 Command Prestored Data Load (CL Card).- The CL card defines buildable and prestored command loads sent to the SSI, Serial Input/Output (SIO), or PSP. Up to eight CL cards may exist per command load. Each CL card may contain up to nine command words, except for the last (eighth) card, which may contain only one. The maximum number of command words available on eight cards is 64 for PSP and 32 for SSI interfaces.

3.2.8 Command Multiple Real-time Command Data (CM Card).- The CM card defines a ground uplink Multiple Real-Time Command (MRTC). An MRTC may consist of up to 10 Real-Time Commands (RTCs), all of which are contained on a single CM card. The CM cards appear only in file 2.

3.2.9 Command Discrete Data (CR Card).- The CR card describes discrete commands with predefined data values. One CR card is required for each of these commands. CR cards appear only in files 1 and 2. Discrete commands in file 2 are called RTCs.

3.2.10 Command Analog Data (CV Card).- The CV card defines calibration coefficients for analog commands. One CV card is required for each analog command. The CV cards exist only in file 1.

3.3 Telemetry Cards

Telemetry data appears on the PDT in the form of TA, TB, TC, TI, TJ, TK, TL, TM, TN, TP, TQ, TR, TS, and TT cards. All telemetry data is contained in the fourth file.

3.3.1 Telemetry Data Stream Structure 1 (TA Card).- A single TA card is required for each PLR, IND, and PDI format. (Refer to Tables C-5 and C-6.)

3.3.2 Telemetry Data Stream Structure 2 (TB Card).- One TB card is also required for each PLR, IND, and PDI format. (Refer to Tables C-5 and C-6.)

3.3.3 Telemetry PDI Format Requirements (TC Card).- The TC card defines PDI decommutation requirements. At least one TC card is required for each PDI format, along with a TA and TB card. The maximum number of TC cards per format is 74.

3.3.4 Telemetry Master Measurement List (TI Card).- One telemetry MML card is required for each measurement to cover the following requirements:

a. Onboard display (via Multiplexer/Demultiplexer (MDM), PDI, or Spacelab Telemetry Buffer (TMB))

b. Downlink in Operational Instrumentation (OI)

c. PDI toggle buffers (only if JSC/KSC processing required)

d. Independent data streams

e. Downlist

f. Fault Detection and Annunciation (FDA)

3.3.5 Telemetry Data Requirements (TJ Card).- The TJ card provides telemetry data information. One TJ card is required for each TI card.

3.3.6 Telemetry User Identification (TK Card).- The TK card contains related MSID information for a telemetry measurement. It is an optional card. Required for discrete MSIDs since the parent MSID is defined on this card. One may exist per measurement.

3.3.7 Telemetry Payload Management 1 (TL Card).- One TL card is required for each measurement containing payload management requirements if the C&W limits are defined. Refer to table C-7.

3.3.8 Telemetry Payload Management 2 (TM Card).- One TM card is required for each telemetry measurement with Systems Management (SM) alert limits. Up to three sets of limits may be defined on this card. Refer to table C-7.

3.3.9 Telemetry Fault Message Text (TN Card).- The TN card links a payload measurement to a CRT fault summary page message. It contains the major and minor field message texts. Up to two TN cards may be present for each measurement. Refer to table C-7.

3.3.10 Telemetry Precondition 1 (TP Card).- One TP card is required for preconditions for each limit set. There may be up to three TP cards per TM card. There must be at least two alert limit sets in order to have alert preconditions. Refer to table C-7.

3.3.11 Telemetry Precondition 2 (TQ Card).- One TQ card is required for each limit set when there are four measurements in the precondition expression. There may be up to three TQ cards per TM card. Refer to table C-7.

3.3.12 Telemetry Calibration 1 (TR Card).- The TR card defines scaling coefficients which are used to convert analog measurements from Pulse Code Modulation (PCM) counts to engineering units (the conversion process is called calibration). One TR card will be present for each analog measurement.

3.3.13 Telemetry Calibration 2 (TS Card).- One TS card will exist in file 4 for each analog measurement which requires third, fourth, or fifth order calibration. The TS card defines the third, fourth, and fifth polynomial scaling coefficients (A_3, A_4, and A_5).

3.3.14 Telemetry Format (TT Card).- The TT card provides the information necessary to locate a measurement within a downlist or telemetry format. Multiple TT cards (1 per format, up to a maximum of 99) may exist for each measurement. (Refer to tables C-5 and C-6.)

Table C-1.- PAYLOAD DATA TAPE FILE NAMES

File	Content
1	Predefined Onboard Commands
2	Predefined and Buildable Ground Uplink Commands
3	(Unused, but must contain CA card)
4	Telemetry Format and Measurements

Table C-2.- PAYLOAD DATA TAPE CARD NAMES

Card Type	Function
AA	Payload Header
CA	Command File Header
CB	Command and Telemetry PSP Configuration/SSI Description
CC	Command MML Data
CD	Command Data Requirements
CE	Command User Identification
CF	Keyboard to Command/Stimuli Identification
CL	Command Prestored and Buildable Data Load
CM	Command MRTC Data
CR	Command Discrete Data
CV	Command Analog Data
TA	Telemetry Data Stream Structure 1
TB	Telemetry Data Stream Structure 2
TC	Telemetry PDI Format Requirements
TI	Telemetry MML
TJ	Telemetry Data Requirements
TK	Telemetry User Identification
TL	Telemetry Payload Management 1
TM	Telemetry Payload Management 2
TN	Telemetry Fault Message Text
TP	Telemetry Precondition 1
TQ	Telemetry Precondition 2
TR	Telemetry Calibration 1
TS	Telemetry Calibration 2
TT	Telemetry Format Requirements

Table C-3.- PAYLOAD DATA TAPE FILE STRUCTURE

File	Card position	Card type
1	1	AA
1	2	CA
1	3 through N1	CB, CC, CD, CE, CF, CL, CR, CV
2	1	CA
2	2 through N2	CB, CC, CD, CE, CL, CM, CR
3	1	CA
4	1 through N4	TA, TB, TC
4	N4+1 through N5	TI, TJ, TK, TL, TM, TN, TP, TQ, TR, TS, TT

Table C-4.- PAYLOAD DATA TAPE CARD TYPE VERSUS FILE NUMBER MATRIX

Card type	File number			
	1	2	3	4
AA	*			
CA	*	*	*	
CB	*	*		
CC	*	*		
CD	*	*		
CE	*	*		
CF	*			
CL	*	*		
CM		*		
CR	*	*		
CV	*			
TA				*
TB				*
TC				*
TI				*
TJ				*
TK				*
TL				*
TM				*
TN				*
TP				*
TQ				*
TR				*
TS				*
TT				*

Table C-5.- TELEMETRY FORMAT MODE/INDICATOR TO PDT FIELD CROSS REFERENCE
DATA STREAM FORMAT CHARACTERISTICS

Format mode							Format indicator			PDT field			
1	2	3	4	5	6	7	4	5	8	CRD	COL	LNTH	Content
X	X	X	X	X	X	X		X		TA	02	04	TLM FORMAT ID
X	X	X	X				X		X				TLM FORMAT ID
X	X	X	X	X	X	X		X		TA	06	01	TLM FORMAT INDICATOR
X	X	X	X				X		X				TLM FORMAT INDICATOR
X	X	X	X	X	X	X		X		TA	07	01	FORMAT MODE
X	X	X	X				X		X				FORMAT MODE
X	X	X	X						X	TA	10	01	FIRST PDI PORT
X	X	X	X	X	X	X		X		TA	11	08	FLIGHT PHASES
X	X	X	X				X		X				FLIGHT PHASES
X	X	X	X				X		X	TA	30	03	REQUIRED WINDOW SIZE
X	X	X	X				X		X	TA	33	05	TLM BANDWIDTH
X	X	X	X				X	X	X	TA	38	04	BIT RATE TOLERANCE
X	X	X	X	X	X	X		X		TA	42	04	TLM DATA CODE
X	X	X	X				X		X				TLM DATA CODE
X	X	X		X	X	X		X		TA	46	02	BITS PER WORD
X	X	X					X		X				BITS PER WORD
X							X	X	X	TA	48	04	MAJOR FRAME LENGTH
	X	X			X	X		X					MINOR FRAME LENGTH
	X	X					X		X				MINOR FRAME LENGTH
			X					X	X				OUTPUT DATA BLOCK LENGTH
				X				X					SUBFRAME LENGTH
	X	X		X				X		TA	52	03	MAJOR FRAME LENGTH
	X	X					X		X				MAJOR FRAME LENGTH
			X					X	X				DATA BLOCK RATE
					X	X		X					SUBFRAME LENGTH

Table C-5.- TELEMETRY FORMAT MODE/INDICATOR TO PDT FIELD CROSS REFERENCE
DATA STREAM FORMAT CHARACTERISTICS (Continued)

Format mode							Format indicator			PDT field			
1	2	3	4	5	6	7	4	5	8	CRD	COL	LNTH	Content
X	X	X		X	X	X		X		TA	55	05	MAJOR FRAME PERIOD
X	X	X					X		X				MAJOR FRAME PERIOD
X	X	X		X	X	X		X		TA	60	05	DATA CYCLE PERIOD
X	X	X					X		X				DATA CYCLE PERIOD
X	X	X	X	X	X	X		X		TA	65	12	BIT RATE
X	X	X	X				X		X				BIT RATE
X	X	X	X	X	X	X		X		TB	02	04	TLM FORMAT ID
X	X	X	X				X		X				TLM FORMAT ID
X	X	X	X	X	X	X		X		TB	06	01	TLM FORMAT INDICATOR
X	X	X	X				X		X				TLM FORMAT INDICATOR
X				X				X		TB	07	01	MAJOR FRAME SYNC LENGTH
X							X		X				MAJOR FRAME SYNC LENGTH
	X	X			X	X		X					MINOR FRAME SYNC LENGTH
	X	X					X		X				MINOR FRAME SYNC LENGTH
			X					X	X				BLOCK SYNC LENGTH
X	X	X	X	X	X	X		X		TB	08	01	SYNC TYPE
X	X	X	X				X		X				SYNC TYPE
X				X				X		TB	09	08	MAJOR FRAME SYNC HEX VALUE
X							X		X				MAJOR FRAME SYNC HEX VALUE
	X	X			X	X		X					MINOR FRAME SYNC HEX VALUE
	X	X					X		X				MINOR FRAME SYNC HEX VALUE
			X					X	X				BLOCK SYNC HEX VALUE
X				X				X		TB	17	01	MAJOR FRAME SYNC FIRST/LAST IND.
X							X		X				MAJOR FRAME SYNC FIRST/LAST IND.
	X	X			X	X		X					MINOR FRAME SYNC FIRST/LAST IND.
	X	X					X		X				MINOR FRAME SYNC FIRST/LAST IND.
X	X			X	X		X	X	X	TB	18	04	MAJOR FRAME SYNC START WORD
	X	X			X	X		X					MINOR FRAME SYNC START WORD
	X	X					X		X				MINOR FRAME SYNC START WORD

Table C-5.- TELEMETRY FORMAT MODE/INDICATOR TO PDT FIELD CROSS REFERENCE
DATA STREAM FORMAT CHARACTERISTICS (Continued)

Format mode							Format indicator			PDT field			
1	2	3	4	5	6	7	4	5	8	CRD	COL	LNTH	Content
				X				X					SUBFRAME SYNC START WORD
	X				X			X		TB	22	01	MAJOR FRAME SYNC FIRST/LAST IND.
	X						X		X				MAJOR FRAME SYNC FIRST/LAST IND.
	X				X			X		TB	23	02	MAJOR FRAME SYNC HEX VALUE
	X						X		X				MAJOR FRAME SYNC HEX VALUE
	X				X			X		TB	25	04	MAJOR FRAME SYNC WORD NUMBER
	X						X		X				MAJOR FRAME SYNC WORD NUMBER
		X				X		X		TB	29	01	MINOR FRAME COUNTER UP/DOWN IND.
		X					X		X				MINOR FRAME COUNTER UP/DOWN IND.
		X				X		X		TB	30	03	MINOR FRAME COUNTER INITIAL VALUE
		X					X		X				MINOR FRAME COUNTER INITIAL VALUE
		X				X		X		TB	33	04	MINOR FRAME COUNTER WORD NUMBER
		X					X		X				MINOR FRAME COUNTER WORD NUMBER
				X	X	X		X		TB	37	01	SUBFRAME COUNTER UP/DOWN INDICATOR
				X	X	X		X		TB	38	02	SUBFRAME COUNTER INITIAL VALUE
				X	X	X		X		TB	40	04	SUBFRAME COUNTER WORD NUMBER
X	X	X	X						X	TB	44	01	SECOND PDI PORT
X	X	X	X						X	TB	45	01	THIRD PDI PORT
X	X	X		X	X	X		X		TB	46	03	AVAILABLE SAMPLE RATE 1
X	X	X					X		X				AVAILABLE SAMPLE RATE 1
X	X	X		X	X	X		X		TB	49	03	AVAILABLE SAMPLE RATE 2
X	X	X					X		X				AVAILABLE SAMPLE RATE 2
X	X	X		X	X	X		X		TB	52	03	AVAILABLE SAMPLE RATE 3
X	X	X					X		X				AVAILABLE SAMPLE RATE 3

Table C-5.- TELEMETRY FORMAT MODE/INDICATOR TO PDT FIELD CROSS REFERENCE
DATA STREAM FORMAT CHARACTERISTICS (Continued)

Format mode							Format indicator			PDT field			
1	2	3	4	5	6	7	4	5	8	CRD	COL	LNTH	Content
X X	X X	X X		X	X	X	 X	X	 X	TB	55	03	AVAILABLE SAMPLE RATE 4 AVAILABLE SAMPLE RATE 4
X X	X X	X X		X	X	X	 X	X	 X	TB	58	03	AVAILABLE SAMPLE RATE 5 AVAILABLE SAMPLE RATE 5
X X	X X	X X		X	X	X	 X	X	 X	TB	61	03	AVAILABLE SAMPLE RATE 6 AVAILABLE SAMPLE RATE 6
X X	X X	X X		X	X	X	 X	X	 X	TB	64	03	AVAILABLE SAMPLE RATE 7 AVAILABLE SAMPLE RATE 7
					X	X		X		TB	71	03	SUBCOM DEPTH
X	X	X	X						X	TC	02	04	TLM FORMAT ID
X	X	X	X						X	TC	06	01	TLM FORMAT INDICATOR
X	X	X	X						X	TC	09	04	TOGGLE BUFFER SIZE
X	X	X	X						X	TC	13	06	PAYLOAD DOWNLINK FRAME SIZE
X	X	X							X	TC	21	04	START WORD NUMBER
X	X	X							X	TC	25	04	NUMBER OF CONSECUTIVE WORDS
X	X	X							X	TC	29	04	START WORD NUMBER
X	X	X							X	TC	33	04	NUMBER OF CONSECUTIVE WORDS
X	X	X							X	TC	37	04	START WORD NUMBER
X	X	X							X	TC	41	04	NUMBER OF CONSECUTIVE WORDS
X	X	X							X	TC	45	04	START WORD NUMBER
X	X	X							X	TC	49	04	NUMBER OF CONSECUTIVE WORDS
X	X	X							X	TC	53	04	START WORD NUMBER

Table C-5.- TELEMETRY FORMAT MODE/INDICATOR TO PDT FIELD CROSS REFERENCE
DATA STREAM FORMAT CHARACTERISTICS (Concluded)

Format mode							Format indicator			PDT field			
1	2	3	4	5	6	7	4	5	8	CRD	COL	LNTH	Content
X	X	X							X	TC	57	04	NUMBER OF CONSECUTIVE WORDS
X	X	X							X	TC	61	04	START WORD NUMBER
X	X	X							X	TC	65	04	NUMBER OF CONSECUTIVE WORDS
X	X	X							X	TC	69	04	START WORD NUMBER
X	X	X							X	TC	73	04	NUMBER OF CONSECUTIVE WORDS

Table C-6.- TELEMETRY FORMAT MODE/INDICATOR TO PDT FIELD CROSS REFERENCE
PARAMETRIC FORMAT CHARACTERISTICS

Format mode							Format indicator							PDT fields			
1	2	3	4	5	6	7	1	2	3	4	5	8	9	CRD	COL	LNTH	Content
							X	X	X				X	TT	01	10	MSID
X	X	X		X	X	X					X						MSID
X	X	X								X		X					MSID
							X	X	X				X	TT	11	04	TLM FORMAT ID
X	X	X		X	X	X					X						TLM FORMAT ID
X	X	X								X		X					TLM FORMAT ID
							X	X	X				X	TT	15	01	TLM FORMAT INDICATOR
X	X	X		X	X	X					X						TLM FORMAT INDICATOR
X	X	X								X		X					TLM FORMAT INDICATOR
							X							TT	16	04	REQUIRED PDI DECOM RATE
								X	X								REQUIRED PCMMU TOGGLE BUFFER RATE
		X															MINIMUM DOWNLINK FORMAT RATE
													X				REQUIRED PCMMU DATA RAM RATE
X	X	X		X	X	X					X			TT	20	04	TLM ACTUAL RESPONSE RATE
X	X	X								X		X					TLM ACTUAL RESPONSE RATE
X										X	X	X		TT	24	04	WORD NUMBER IN FIRST MAJOR FRAME
	X	X			X	X					X						WORD NUMBER IN FIRST MINOR FRAME
	X	X								X		X					WORD NUMBER IN FIRST MINOR FRAME
				X	X	X					X						WORD NUMBER IN FIRST SUBFRAME
	X	X			X	X					X			TT	28	03	FIRST MINOR FRAME
	X	X								X		X					FIRST MINOR FRAME
				X	X	X					X			TT	31	03	TLM FIRST SUBFRAME
							X							TT	57	01	TLM LOW BIT RATE INDICATOR
X	X	X		X	X	X					X			TT	59	02	FORMAT START BIT

Table C-7.- RELATIONSHIP BETWEEN THE TL, TM, TN, TP, AND TQ CARDS

ALARM CLASS			
CRITICAL*	ALERT*		
CLASS 2	CLASS 3	CLASS 4	CLASS 0
BACKUP C&W: TL	ALERT: TM	GPC DETECTED ERRORS: TM	LIMIT SENSING: TM
MESSAGE: TN	MESSAGE: TN	MESSAGE: TN	NO MESSAGE
NO PRECONDITIONS	PRECOND1: TP(01)** PRECOND2: TP(02) PRECOND3: TP(03)	PRECOND1: TP(01)** PRECOND2: TP(02) PRECOND3: TP(03)	PRECOND1: TP(01)** PRECOND2: TP(02) PRECOND3: TP(03)

***A measurement may have both Alarm Classes Critical and Alert.**
**There must be at least two limits sets shown on the TM card to have precondition steering, and each limit set must have one Precondition card (TP).

Note: The TQ card is a continuation of the TP card when four measurements are required for the precondition expressions.

4.0 TAPE HEADER CARD FORMAT

4.1 Card Type "AA" - Payload Header Card

The payload header card contains basic information pertinent to payload definition. A separate payload header card will be supplied for each payload on the tape. Refer to figure C-1 for the general layout. Spare columns may contain data on NASA JSC-supplied tapes.

Column	Element	Description
1-2	BLANK	
3-10	PAYLOAD CONFIGURATION NAME (PCN)	Unique alphanumeric abbreviation for the payload. May be repeated for separate flights. Must be unique on a single flight. Left justified. Provided by payload supplier and JSC. Required field. Must not be blank.
11-12	SPARE	
13-15	PAYLOAD NUMBER	Number (004-089) assigned to the payload by Payload Integration Plan (PIP). Integer. Right justified. Leading zeros. Must not be blank.
16-21	SPARE	
22-27	DATE	Date of the release of this tape version. Format MMDDYY. Provided by payload supplier and JSC. Leading zeros.
28-43	CONTACT	The name of a payload contact in case of any questions or problems. Left justified. Provided by payload supplier and/or JSC.
44-53	PHONE	The phone number of the above contact. Area code followed by 7-digit number. Provided by payload supplier and JSC.
54-60	SPARE	

Column	Element	Description
61-69	NSTS PIP DOCUMENT NUMBER	The NSTS PIP Document number of the Payload Command and Data Annex to be generated. Alphanumeric. Provided by payload supplier.
70-72	SM OPS ASSIGNMENT	SM Operations (OPS) to which payload is assigned. Left justified. Alphanumeric. Provided by JSC at mission integration. SM2 = SM OPS 2 SM4 = SM OPS 4 BTH = Both SM OPS 2 and 4 VEH = Vehicle data
73-76	SPARE	
77-78	CARD TYPE	"AA"
79-80	BLANK	

BLANK	PAYLOAD CONFIGURATION NAME (PCN)	SPARE	PAYLOAD NUMBER	SPARE	DATE	CONTACT	PHONE	SPARE	NSTS PIP DOCUMENT NUMBER	SM OPS * ASSIGNMENT	SPARE	AA	BLANK
1 2	3 4 5 6 7 8 9 10	11 12	13 14 15	16 17 18 19 20 21	22 23 24 25 26 27	28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43	44 45 46 47 48 49 50 51 52 53	54 55 56 57 58 59 60	61 62 63 64 65 66 67 68 69	70 71 72	73 74 75 76	77 78	79 80

* Provided by JSC

c01.ppt

Figure C-1.- Tape header card layout "AA" card (80-column format).

5.0 COMMAND HEADER CARD FORMAT

5.1 Card Type "CA" - Command File Header Card

One "CA" card (figure C-2) is required for each command file on the tape. There will be one file for the onboard commands, one file for ground uplink commands and one spare file. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-75	SPARE	
76	FILE NO.	File number on this tape. Integer. Provided by payload supplier and JSC. 1 = Onboard 2 = Predefined and buildable ground commands 3 = File 3 header
77-78	CARD TYPE	"CA"
79-80	DELTA LOADER PCC	Delta Loader Process Control Characters (PCC) "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

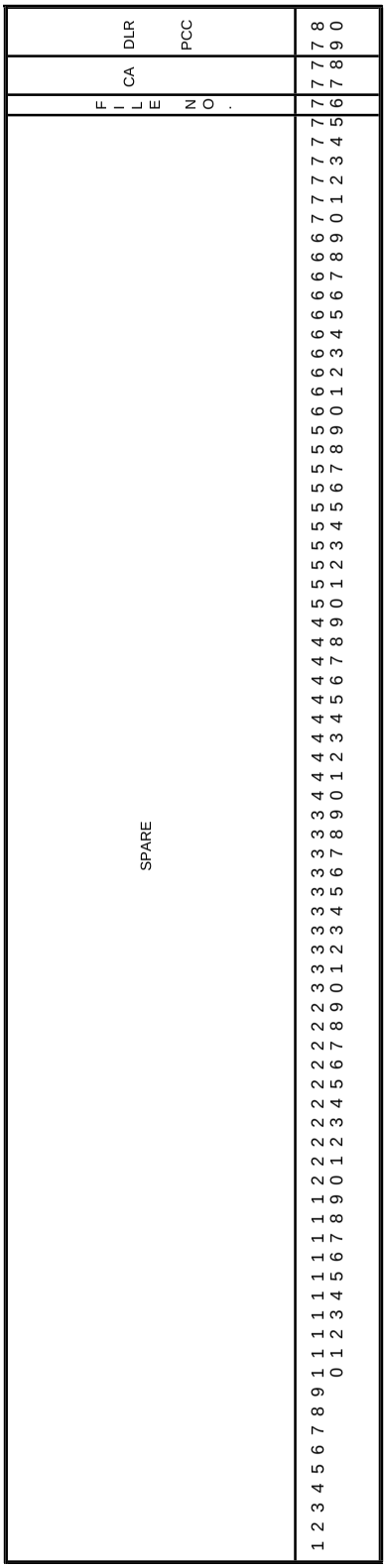


Figure C-2.- Command card layout -- "CA" card (80-column format).

6.0 COMMAND DATA CARD FORMATS

The "CB" card is used to define the PSP configurations and SSI definitions. There will be up to eight PSP configurations and SSI descriptions defined for each payload in files 1 and 2 of this tape.

The remaining command data card types on this tape for command data are CC, CD, CE, CF, CL, CM, CR, and CV. Each command will have one "CC" and one "CD" card followed by card(s) defining data content. The categories of cards to follow the CC and CD are as follows.

CMD Type	Card Type
Analog (Onboard)	CV
Discrete	CR
Digital Loads	CL-N, where N less than or equal to 01 or is greater than or equal to 08
MRTC (Ground)	CM

6.1 Card Type "CB" - PSP Configuration/SSI Description Card

One card type "CB" (figure C-3) is required for each PSP configuration Identification (ID) or SSI ID required for a mission. If the payload customer requires the PSP to support telemetry or commands only, JSC will provide default values for the unused portion of the configuration message.

Column	Element	Description
1	PSP CONFIGURATION MESSAGE ID	Identifier for the data in the configuration message. On an unintegrated tape, this field will contain a pseudo configuration ID (A-E, provided by the payload supplier). On an integrated tape, this field will contain a real ID (1-5, provided by JSC). If data field is blank, then columns 2-21 and column 51 must be blank. If the payload supplier provides a real configuration message ID, rather than a pseudo ID, then the JSC will convert the real ID to a pseudo ID.

Column	Element	Description
2-3	PSP COMMAND DATA RATE	Code used in the PSP configuration message to specify the bit rate of the payload command. Right justified. Integer. Provided by payload supplier. 4 = 125/16 bps 5 = 125/8 bps 6 = 125/4 bps 7 = 125/2 bps 8 = 125 bps 9 = 250 bps 10 = 500 bps 11 = 1 kbps 12 = 2 kbps
4	PSP COMMAND DATA CODE	Code used in the PSP configuration message to indicate the type of modulation used for the subcarrier of the command signal. Integer or blank. Provided by payload supplier. 1 = NRZ-L 2 = NRZ-M 3 = NRZ-S
5	PSP COMMAND SUBCARRIER IDLE	Code used in the PSP configuration message to indicate the modulation for an idle subcarrier. Integer or blank. Provided by payload supplier. 0 = Unmodulated 1 = Modulated with alternate one-zero pattern.
6	PSP COMMAND UMBILICAL SELECTION	Code used to specify the payload umbilical to be selected for commands through the PSP. For detached payloads, a dummy umbilical number (1-5 or A-E) must be specified. Alphanumeric. Provided by JSC. On an unintegrated tape a pseudo ID of A through E will be provided. On an integrated tape the following codes will be provided: 1 = Umbilical 1 2 = Umbilical 2 3 = Umbilical 3 4 = Umbilical 4 5 = Umbilical 5

Column	Element	Description
7	PSP TELEMETRY RATE	Code used to specify the telemetry bit rate received by the PSP. Integer. Provided by payload supplier. 1 = 1 kbps 2 = 2 kbps 3 = 4 kbps 4 = 8 kbps 5 = 16 kbps
8	PSP TELEMETRY DATA CODE	Code used to specify the telemetry data waveform. Integer. Provided by payload supplier. 1 = Bi-phase - L 2 = Bi-phase - M 3 = Bi-phase - S 4 = NRZ-L 5 = NRZ-M 6 = NRZ-S
9-12	PSP TELEMETRY FRAME LENGTH	Integer (1-1024) used to specify the number of 8-bit telemetry words in a frame. Does not include the frame sync code. Right justified. Provided by payload supplier.
13	PSP TELEMETRY SYNC WORD LENGTH	Code used to specify the number of bits in the frame sync word. Integer. Provided by payload supplier on input and derived by JSC PDT generator on output. 1 = 8 bits 2 = 16 bits 3 = 24 bits 4 = 32 bits
14-21	PSP TELEMETRY FRAME SYNC WORD	Up to eight hexadecimal characters used to specify the bit pattern of the frame sync word. If the data is specified, it must be 2, 4, 6, or 8 hex characters. May be blank. Left justified with trailing zeros. Provided by payload supplier.

Column	Element	Description
22-25	BTU NAME	Identification of the type and number of the BTU. Blank for detached payloads. Alphanumeric. The payload supplier provides the following codes: PF01 = Payload Forward MDM 1 (Real ID) PF02 = Payload Forward MDM 2 (Real ID) FXSA-FXSE = Single Port Flex MDM (Pseudo ID) FXPA-FXPE = Dual Port Flex MDM (Pseudo ID) SCAA-SCAD = Sequence Control Assembly (SCA) (Pseudo ID) JSC provides the following codes: FLX1-FLX5 = Flex MDM (Real ID) SCA1-SCA4 = Sequence Control Assembly (SCA) (Real ID) If the payload supplier provides a real BTU name, rather than a pseudo name, then the JSC PDT loader program will automatically convert the real name to a pseudo name. Real flex MDM names will be converted to single port flex pseudo names by the loader.
26-27	BTU BUS NUMBER	Binary code representing bus assignment for single port Flex MDMs or the BTU type for dual port devices (must agree with BTU name in columns 22-25). This field is blank if the BTU ID field (columns 22-25) contains PF01, PF02, or is blank. 00 = Flex pair 01 = SCA 10 = PL1 11 = PL2 Codes 00 and 01 are derived by JSC PDT generator program. JSC provides codes 10 and 11 (for a single port flex only).
28-29	BTU MIA ADDRESS	Integer address of the BTU 06, 09, 10 (PF01), 12 (PF02), 15, 29, 30. Leading zeros. Blank for payload supplier tapes. This data is defined at the Cargo Integration Review (CIR); supplied by JSC on integrated products and blank on unintegrated products.

Column	Element	Description
30	SSI ID	Identification of the standard serial interface. On an unintegrated tape, this field will contain a pseudo ID (A-H, provided by the payload supplier). On an integrated tape, this field will contain a real ID (1-8, provided by JSC). If data field is blank, then columns 22-50 must be blank. If the payload supplier provides a real SSI ID, rather than a pseudo ID, then the JSC PDT loader program will automatically convert the real ID to a pseudo ID upon input to the MRB.
31-32	SSI CHANNEL TYPE	Coded description of the SSI channel type. Left justified. Derived by JSC PDT generator program. S = Single input, single output, or single input and single output sharing the same module and channel. D = Dual inputs and single output, or single input and single output which do not share the same module and channel. SS = SSUS SCA.
33-35	SSUS ID	Number (1-4) of the Spinning Solid Upper Stage (SSUS) which uses the SSI. This field is blank when the SSI channel type (columns 31-32) is not SS. Left justified. Integer. Provided by JSC. Blank for unintegrated products and payload supplier tapes.
36-38	SSI TRANSACTION TYPE	Description of the transaction type. Left justified. Derived by JSC PDT generator program from columns 39-50. IN = Input OUT = Output BTH = Both input and output
39-40	SSI INPUT MODULE ADDRESS NUMBER 1	Input transaction 1 module address within the BTU (00-15). Leading zero. May be blank. Provided by JSC.

Column	Element	Description
41-42	SSI INPUT CHANNEL ADDRESS NUMBER 1	Input transaction 1 channel address within the BTU (00-03). Leading zero. May be blank. Provided by JSC.
43-44	SSI INPUT MODULE ADDRESS NUMBER 2	Input transaction 2 module address within the BTU (00-15). Leading zero. May be blank. Provided by JSC.
45-46	SSI INPUT CHANNEL ADDRESS NUMBER 2	Input transaction 2 channel address within the BTU (00-03). Leading zero. May be blank. Provided by JSC.
47-48	SSI OUTPUT MODULE ADDRESS	Output transaction module address (00-15) within the BTU. Leading zero. May be blank. Provided by JSC.
49-50	SSI OUTPUT CHANNEL ADDRESS	Output transaction channel address (00-03) within the BTU. Leading zero. May be blank. Provided by JSC.
51	PSP PORT MODE	Code indicating the PSP port. Provided by payload supplier. 0 = Umbilical (attached) 1 = Payload Interrogator (detached)
52-76	SPARE	
77-78	CARD TYPE	"CB"
79-80	CARD NUMBER/ DELTA LOADER PCC	Two integer numbers (01-08). Leading zeros. Delta Loader PCC "@@" symbol used only for card deletion. Provided by payload supplier or JSC.

Figure C-3.- Command card layout - "CB" card (80-column format).

PSP											BTU			SSI												PSP PORT MODE	SPARE	CB	01 . . 08 DLR PCC
CONF MSG ID	DATA RATE	DATA CODE	SUBCARRIER IDLE	*UMBILICAL SEL	TLM RATE	TLM DATA CODE	TLM FRAME LTH	*TLM SYNC WD LTH	TLM FRAME SYNC WORD	BTU NAME	BUS NO.	MIA ADDR	* SSI ID	* CHANNEL TYPE	* SSUS ID	* TRAN TYPE	IN 1 ADDR MOD	IN 1 ADDR CH	IN 2 ADDR MOD	IN 2 ADDR CH	OUT ADDR MOD	OUT ADDR CH						
1	2 3	4	5	6	7	8	9 10 11 12	13	14 15 16 17 18 19 20 21	22 23 24 25	26 27	28 29	30	31 32	33 34 35	36 37 38	39 40	41 42	43 44	45 46	47 48	49 50	51	52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76	77 78	79 80

* Provided by JSC

c03.ppt

6.2 Card Type "CC" - Command MML Data

One card type "CC" (figure C-4) is required for each command and describes the MML data for that command.

Column	Element	Description
1-10	MSID	Command identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11-12	NO. OF WORDS	The number of 16-bit command data words required to define the data for this command. This field is required and is valued as shown below only for SSI, PSP, and Spacelab commands. The PDT generator places a "00" in the field for PSP reinitialization commands. Integer. Leading zeros. Provided by payload supplier. PSP CMDS 01-64 PL CMDS 01-64 SSI CMDS 01-32 SL CMDS 01-31 Discrete CMDS Blank PSP INIT CMDS 00
13-20	DATA RANGE UNITS	Standard engineering units for analog commands. Refer to appendix E. For discrete and serial digital commands, this field will always contain "EVENT". Left justified. Alphanumeric. Provided by payload supplier.
21-54	SYSTEMS NOMENCLATURE	Unique alphanumeric name for the command. **The nomenclature should reflect the sense of the data range high.** Left justified. Provided by payload supplier.
55	GPC INPUT, OUTPUT, COMPUTE	Alphabetic code for the command. O = Output from the General Purpose Computer (GPC) C = Computed in the GPC. Derived by JSC PDT generator program.

Column	Element	Description
56-76	DSM TITLE	Short description of the onboard function accomplished by this command. Alphanumeric. Left justified. Provided by JSC. Blank for buildable commands.
	Table deleted	
77-78	CARD TYPE	"CC"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise.

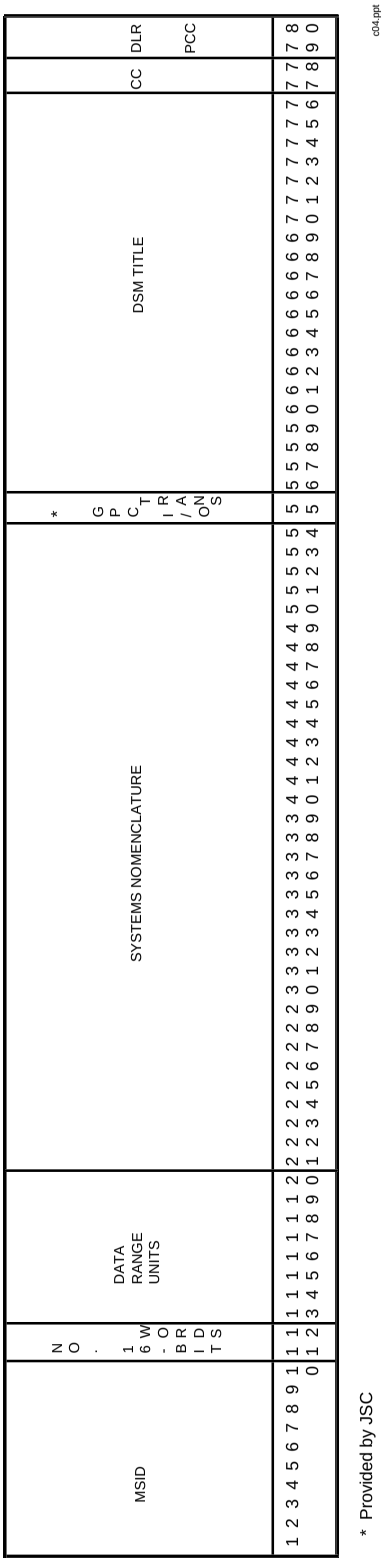


Figure C-4.- Command card layout -- "CC" card (80-column format).

6.3 Card Type "CD" - Command Data Requirements Card

One "CD" card (figure C-5) is required for each command to define requirements. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Command identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11-18	FLIGHT PHASES	Flight phases in which the command is required. Up to six flight phases may be requested. One column per phase. Provided by payload supplier and JSC.
(11)		L = Ground Checkout (Prelaunch - For definition refer to PIP.) **This phase is not applicable for Payload Control Indicators (PCIs)**.
(12)		A = Ascent (For software purposes, ascent is defined as starting at T-20 minutes.)
(13)		Blank
(14)		O = Orbit (Payload attached)
(15)		Blank
(16)		E = Entry
(17)		F = (Unused)
(18)		S = Orbit (Payload detached)
19-23	DATA RANGE LOW	For analog commands, this is the low value of the data range available for this command compatible with the scaling coefficients. For discrete commands, it defines the condition equivalent to binary zero. If the condition for binary zero is not defined, this field should be blank. Reference appendix E. For serial digital commands, this field should be blank. Right justified. Alphanumeric. Provided by payload supplier.

Column	Element	Description
24-28	DATA RANGE HIGH	For analog commands, this is the high value of the range compatible with the scaling coefficients. For discrete commands, it defines the condition equivalent to binary one. If the condition for binary one is not defined, this field should be blank. **This should be the same as the sense of the command nomenclature.** Reference appendix E. For serial digital commands, it defines the condition equivalent to the end item function for this command. **This should be the same as the sense of the command nomenclature.** Reference appendix E. Right justified. Alphanumeric. Provided by payload supplier.
29-34	SPARE	
35-36	SSI or PSP CONFIGURATION MESSAGE ID	Standard Serial Interface or Payload Signal Processor configuration message ID. This field is only used for command types QQ and SS (reference columns 58-60). On an unintegrated tape, this field will contain a pseudo ID (A-H if SSI or A-E if PSP). Provided by the payload supplier. On an integrated tape, this field will contain a real ID (01-08 if SSI channels or 01-05 if PSP. Provided by JSC. The SSI ID must match the SSUS ID: For this reason SSI ID 1, 2, 3, or 4 are reserved for PAM spacecraft. Other payloads having SSI requirements shall be assigned SSI IDs 5, 6, 7, or 8. However, in the case where PAMs are not manifested on the same mission SSI IDs 1, 2, 3, or 4 may be assigned to other payloads. Alphanumeric. Pseudo IDs are left justified.

Column	Element	Description
		If the payload supplier provides a real SSI or PSP configuration message ID, rather than a pseudo ID, the JSC PDT Loader program will automatically convert the real ID to a pseudo ID. On both unintegrated and integrated tapes, this field will contain "00" for PSP reinitialization commands (configuration message ID zero).
37-38	SPARE	
39-42	BTU NAME	Alphanumeric abbreviation. Left justified. On an unintegrated tape, this field will contain a pseudo name provided by the payload supplier: PF01-PF02 = Payload Forward MDM FXPA-FXPE = Dual Port Flex MDM FXSA-FXSE = Single Port Flex MDM SCAA-SCAD = Sequence Control Assembly EXC = Spacelab Experiment Computer SSC = Spacelab Subsystem Computer On an integrated tape, this field will contain a real name provided by JSC: PF01-PF02 = Payload Forward MDM FLX1-FLX5 = Flex MDM SCA1-SCA4 = Sequence Control Assembly EXC = Spacelab Experiment Computer SSC = Spacelab Subsystem Computer If the payload supplier provides a real BTU name, rather than a pseudo name, then the JSC PDT loader program will automatically convert the real name to a pseudo name.
43-45	BTU CARD TYPE	Code identifying the Input/Output (I/O) card types. Alphanumeric. Provided by payload supplier. This field will be blank if columns 39-42 are blank.

Column	Element	Description
		AOD - Analog Output Differential DOH - Discrete Output High (28 V dc) DOL - Discrete Output Low (5 V dc) PUH - Pulsed Discrete Output High (28 V dc) PUL - Pulsed Discrete Output Low (5 V dc) SIO - Serial Input/Output
46-47	BTU MIA ADDRESS	Multiplexer Interface Adapter address assigned to a BTU. Valid values are: 06, 09, 10 (PF01), 12 (PF02), 15, 29, and 30. Leading zeros. Integer. This field will be blank if columns 39-42 are blank.
48-49	BTU CARD LOCATION	Number (00-15) defining the location (slot number) assigned to a given I/O card in a BTU. Leading zeros. Integer. Provided by payload supplier. This field will be blank if columns 39-42 are blank.
50-51	BTU CHANNEL NUMBER	A number (00-15) identifying the channel on the corresponding BTU module card that is assigned to the signal. Leading zeros. Integer. Provided by payload supplier. This field will be blank if columns 39-42 are blank.
52-53	BTU START BIT NUMBER	(Required for wire ("K-Y") and parent ("M-P") MSIDs only.) Number (00-63) identifying the starting bit of the actual signal within the parent word from a BTU or SIO module. a. If the card type is DOH, DOL, PUL, or PUH, the range is 00-15. b. If the card type is AOD use 00. c. If the card type is SIO use 00-63 unless a serial wire MSID is used, then the field is blank. Blank if 39-42 are blank. Leading zeros. Provided by payload supplier.

Column	Element	Description
54-55	BTU NUMBER OF BITS	(Required for "K-Y" wire and "M-P" parent MSIDs only.) Number of bits (01-64) in actual signal. a. If card type is DOH, DOL, PUL, or PUH, the range is 1-16. b. If the card type is AOD the only value is 10. c. If the card is SIO the range is 1-64 unless a wire MSID is used in which case this field is blank. Blank if 39-42 are blank. Leading zeros. Provided by payload supplier.
56-57	BTU WORD NUMBER	Number (00-31) specifying the location (in words) of a command in a serial data stream going to a BTU channel. Leading zeros. Provided by payload supplier.
58-60	COMMAND TYPE	Alphanumeric code indicating the type of command. Left justified. Provided by payload supplier. Onboard and Uplink Command Types: QQ - PSP Load SS - Standard Serial I/O Load D - Discrete Command HP - Hardware Pulsed Commands CN - GPC Constants Update Command GP - Command generated by GPC SG - Standard GN&C SSC - Spacelab Subsystem Computer EXC - Spacelab Experiment Computer CI - Process Control Indicator Command (JSC supplied) AD - Process Activation/Deactivation Command (JSC supplied) Uplink Command Type Only: AMB - Analog Uplink Command DUC - Digital Uplink Command (Command with set and reset masks) MR - Multiple Real Time Command

Column	Element	Description
		Onboard Command Type Only: SP - Software Pulsed Discrete AC - Analog Command BD - Binary Discrete (Wire MSID "K-Y")
61	RF UPLINK	An X in this field indicates that the command originates on the ground and is uplinked to the Orbiter. The command is sent to the payload via the Orbiter avionics. May be blank. Derived by JSC PDT generator program.
62	PCS CHANNELIZATION FLAG	Code indicating that this command is used in a PCS sequence. Provided by JSC. Valid entries are: O - Output to a PCS sequence B - Both an output and input to a PCS sequence Valid for parent MSIDs only.
63	POCC HAZARDOUS COMMAND FLAG	Indicates that the contents of this command may initiate a function considered hazardous. MCC must be given verification that the request to uplink this command is valid. Supplied by JSC and customer. Valid entry is "H".
64	SAFING FLAG	This flag, when set, prevents prestored commands (MCC-H) from being executed. The flag may be reset only during the mission by an approved source. Provided by JSC. S = Safing flag set N = Safing flag not set
65-69	DIGITAL SELECT MATRIX (DSM) NUMBER	The ground command identifier which is entered on a ground console to cause a specific command, or series of commands, to be transmitted to the Orbiter (uplinked). Blocks of DSM numbers are assigned to a payload by JSC. For MCC use only. Four digit integer (right justified) for discrete commands. Blank for buildable commands. Five digit integer for loads (format: XXXYY). The following rules apply:

Column	Element	Description
		1. All payloads (except Spacelab) DSM numbers are assigned as follows: Loads - 8XXYY, 7XXYY, and 133YY where XX = 00-12 and YY = 01-50 RTC - 1100-1499 - 1550-3999 - 4067-5999 - 7000-8999 - 9500-9998 Optimal to use 8000 series 2. Spacelab DSM numbers are assigned as follows: * - 6XXYY where XX = 00-99 and YY = 01-50 ** - 6XXX where XXX = 000-979 *Number of command data words is greater than 5. **Number of command data words is less than or equal to 5.
Table deleted		
70	DSM TYPE	Code indicating the type of DSM ground command. Provided by JSC. F = Discrete output, RTC (discrete command) M = Multiple Real-Time Command (MRTC) L = Load (serial digital commands) B = Buildable commands
71-74	SPARE	

Column	Element	Description
75-76	BTU NUMBER OF WORDS	Number of 16-bit words (01-32) defined in the SSI Output Channel. Leading zeros. Integer. Blank columns 58-60 is not SS. Provided by payload supplier.
77-78	CARD TYPE	"CD"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used for card deletion. Blank otherwise.

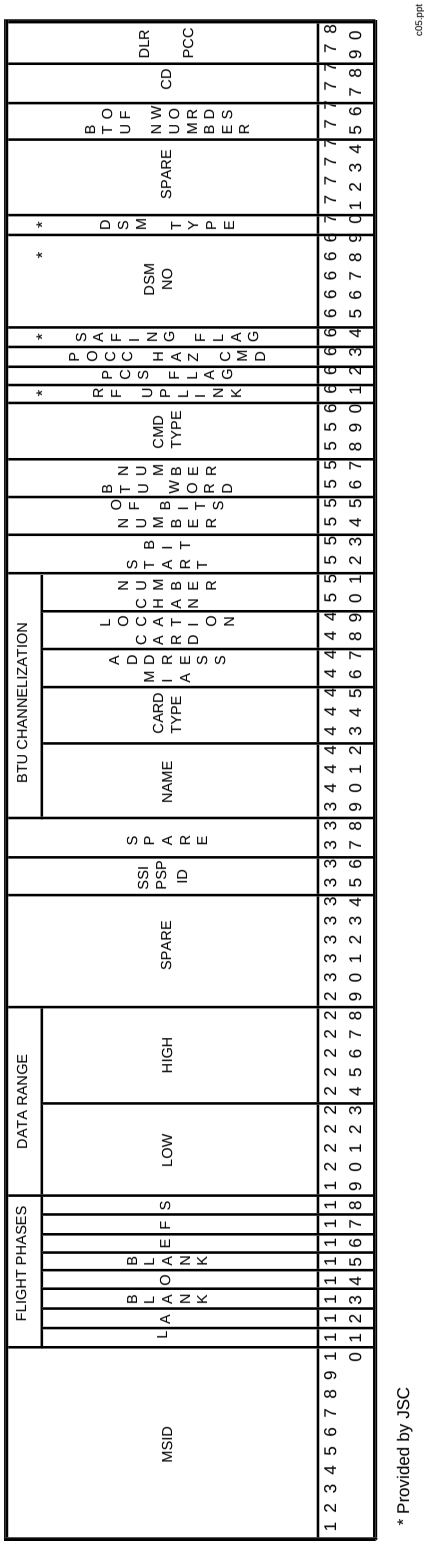


Figure C-5.- Command card layout -- "CD" card (80-column format).

6.4 Card Type "CE" - Command User Identification Card

One "CE" card (figure C-6) can be required for a command. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Command identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11-20	PAYLOAD USER ID	User identification number if different from MSID. For MSIDs assigned by the user that JSC must change, the user supplied MSID will appear here. Left justified. May be blank. Alphanumeric. Provided by payload supplier.
21-30	PARENT MSID	Identification of the associated parent word describing the 16 bit discrete channel. Required for discrete commands and discrete wire MSIDs only (CMD type = HP, SP, D, DUC, or BD. Left justified. May be blank. Provided by payload supplier. Refer to appendix B.
31-40	WIRE MSID	For serial digital commands, this identifies the serial digital channel carrying this command. For discrete commands, this field represents the hardware wire that is set either high or low by this command. Not applicable to multibit discrete commands. Left justified. May be blank. Alphanumeric. Provided by payload supplier.
41-50	SID NUMBER	Spacelab User Identification Number if different from command MSID. Similar to the field in columns 11-20. Left justified. May be blank. Alphanumeric. Provided by payload supplier.
51-60	ASSOCIATED MSID	Represents the end item feedback measurement for this command. Alphanumeric. Left justified. May be blank. Provided by payload supplier.

Column	Element	Description
Item deleted		
61-76	SPARE	
77-78	CARD TYPE	"CE"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used for card deletion. Blank otherwise.

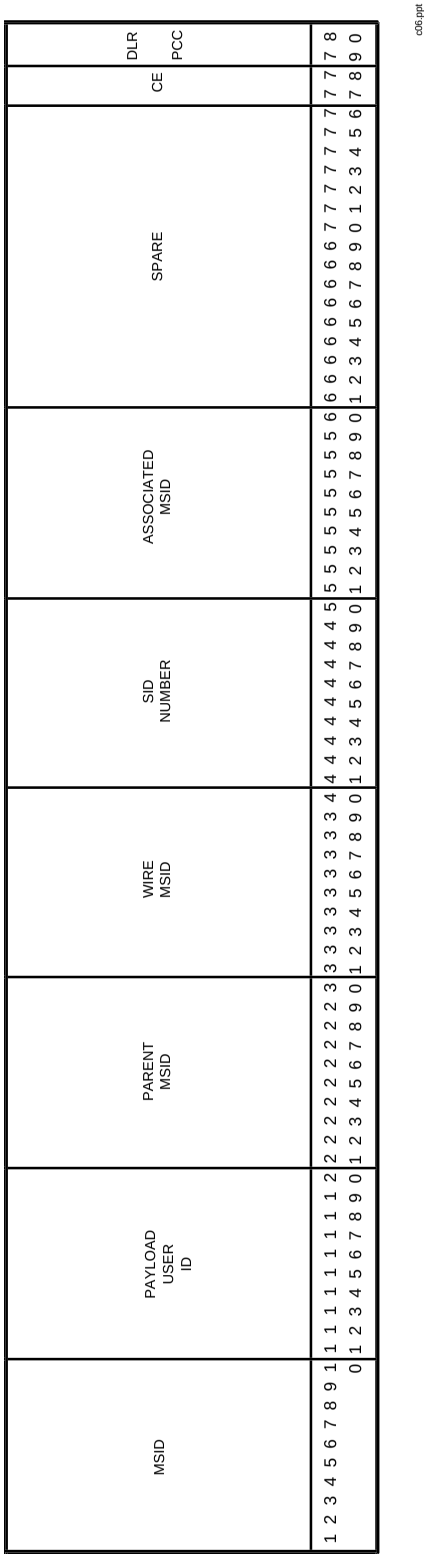


Figure C-6.- Command card layout -- "CE" card (80-column format).

6.5 Card Type "CF" - Keyboard to Command/Stimuli Identification

One "CF" card (figure C-7) can be required to associate a payload command to a keyboard MSID, index ID and CRT nomenclature for the keyboard MSID. CF cards appear in file 1 only.

Column	Element	Description
1-10	MSID	Command identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11	SPARE	
12-21	KEYBOARD MSID	Identification of the display item number used to initiate this command. Alphanumeric. Left justified. Blank for nonindexed commands. Provided by JSC.
22-23	SPARE	
24-27	INDEX ID.	Hexadecimal value (0-FFFF) of the display item index used to initiate this command. Right justified. Blank for nonindexed commands. Provided by JSC.
28	SPARE	
29-62	CRT OPERATIONAL NOMENCLATURE	Unique name for the keyboard MSID. Consists of display number and display item number for the cargo control spec item in the form: DISP=NNN,ITEM=NN Where N is an integer. This field must be valued if the CF card is present. Provided by JSC. Alphanumeric. Left justified.
63-76	SPARE	
77-78	CARD TYPE	"CF"
79-80	BLANK	

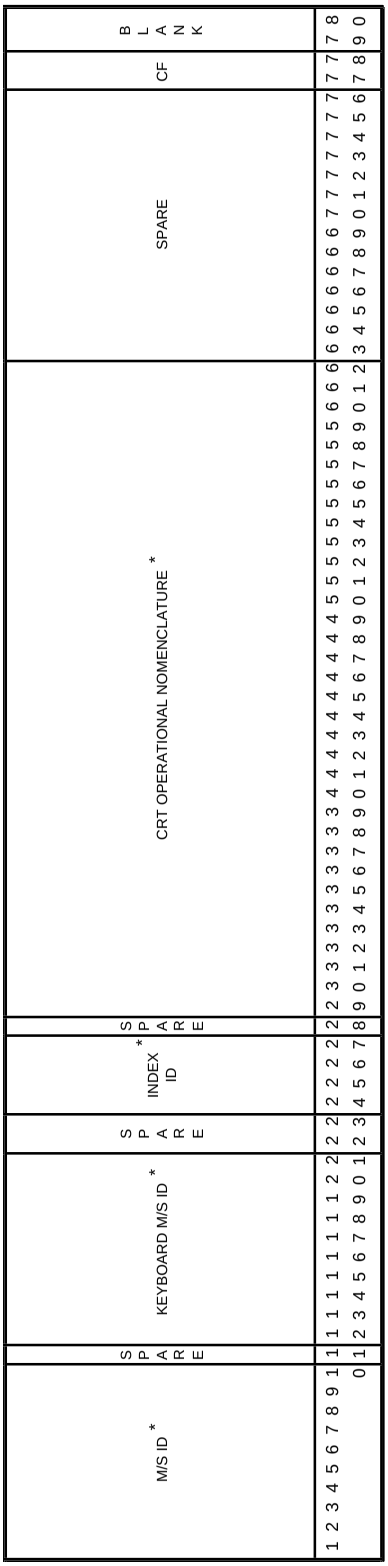


Figure C-7.- Command card layout – "CF" card (80-column format).

6.6 Card Type "CL" - Prestored and Buildable Command Data Loads

Up to 8 "CL" cards (figure C-8) can be required to define buildable and prestored command words via SSI, Spacelab SIO, or PSP. Spare columns may contain data in JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Command identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11-14	MAJOR FUNCTION	Binary code that identifies the major function to which the command is addressed. Derived by PDT generator. Valued for uplink commands only. 1000 = SM major function
15-16	OP CODE	Two digit hex code specifying the type of uplink command. 1A - Two stage 3D - Single stage Valued for uplink commands only. Provided by JSC.
17-20	DESTINATION DEPENDENT	Binary code identifying destination of command. Derived by PDT generator. Valued for uplink commands only. 0001 - PSP CONFIG MSG ID 1 0010 - PSP CONFIG MSG ID 2 0011 - PSP CONFIG MSG ID 3 0100 - PSP CONFIG MSG ID 4 0101 - PSP CONFIG MSG ID 5 0111 - SSI 1 1000 - SSI 2 1001 - SSI 3 1010 - SSI 4 1011 - SSI 5 1100 - SSI 6 1101 - SSI 7 1110 - SSI 8 1100 - SL SUBSYSTEM COMPUTER 0100 - SL EXPERIMENT COMPUTER

Column	Element	Description
21-24	CHW	Hex representation of the Orbiter command header word. Valued for uplink commands only. Derived by JSC PDT generator program by concatenation of destination, destination-dependent, and number of command data words. Blank for unintegrated products.
25-28	CDW 1	Hex representation of 16-bit command data word. Provided by payload supplier. (For Spacelab commands, this field contains the hex representation of the Spacelab command header word). Variable data for buildable commands shall be represented with the character "V".
29-32	CDW 2	Same as CDW 1.
33-36	CDW 3	Same as CDW 1.
37-40	CDW 4	Same as CDW 1.
41-44	CDW 5	Same as CDW 1.
45-48	CDW 6	Same as CDW 1.
49-52	CDW 7	Same as CDW 1.
53-56	CDW 8	Same as CDW 1.
57-60	CDW 9	Same as CDW 1.
61-65	DESTINATION	Binary code for uplink commands to identify destination. Derived by JSC PDT generator program. 10000 = PSP 01000 = SSI 00111 = Spacelab Serial Data Interface
66-76	SPARE	
77-78	CARD TYPE	"CL"
79-80	CARD NUMBER	Two integer numbers (01-08). Cards 02-08 will contain command data words 10-64, if required. Columns 11-24 and 61-76 will be blank on cards 02-08. Leading zeros. Delta Loader PCC "@@" symbol used for card deletion. Provided by payload supplier or JSC.

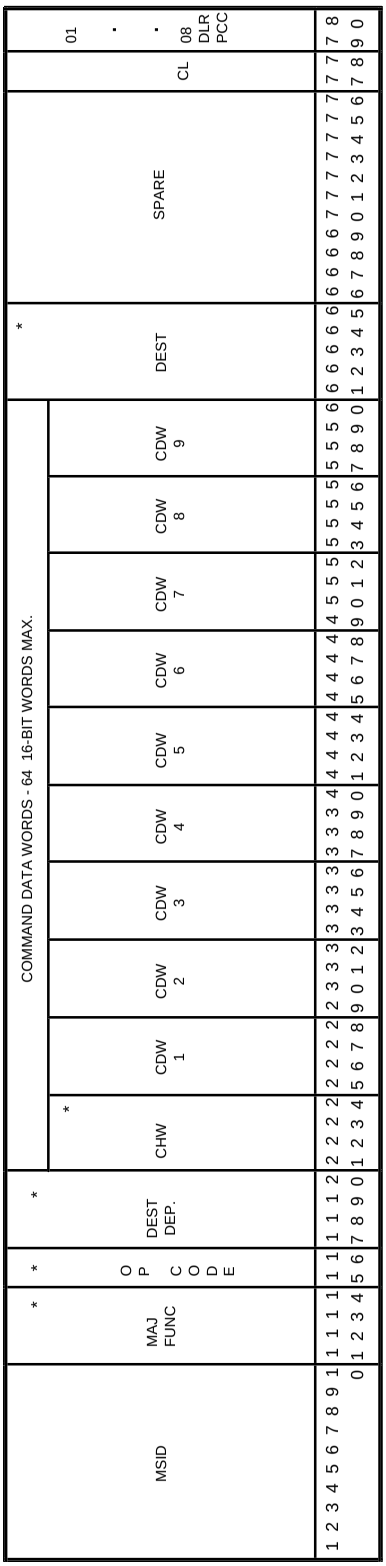


Figure C-8.- Command card layout -- "CL" card (80-column format).

6.7 Card Type "CM" - MRTC Data Card

One "CM" card (figure C-9) is required to define a MRTC. This is for ground uplink commands only. Up to 10 RTCs can be contained in a MRTC. This data is supplied by JSC. Spare columns may contain data in JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Command identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by JSC.
11-14	RTC #1	The 4-digit DSM number for the first RTC defined in the MRTC. Integer. Provided by JSC.
15	SPARE	
16-19	RTC #2	DSM number for the second RTC defined in the MRTC. Provided by JSC.
20	SPARE	
21-24	RTC #3	DSM number for the third RTC defined in the MRTC. Provided by JSC.
25	SPARE	
26-29	RTC #4	DSM number for the fourth RTC defined in the MRTC. Provided by JSC.
30	SPARE	
31-34	RTC #5	DSM number for the fifth RTC defined in the MRTC. Provided by JSC.
35	SPARE	
36-39	RTC #6	DSM number for the sixth RTC defined in the MRTC. Provided by JSC.
40	SPARE	
41-44	RTC #7	DSM number for the seventh RTC defined in the MRTC. Provided by JSC.
45	SPARE	

Column	Element	Description
46-49	RTC #8	DSM number for the eighth RTC defined in the MRTC. Provided by JSC.
50	SPARE	
51-54	RTC #9	DSM number for the ninth RTC defined in the MRTC. Provided by JSC.
55	SPARE	
56-59	RTC #10	DSM number for the tenth RTC defined in the MRTC. Provided by JSC.
60-76	SPARE	
77-78	CARD TYPE	"CM"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used for card deletion. Blank otherwise. Provided by payload supplier or JSC.

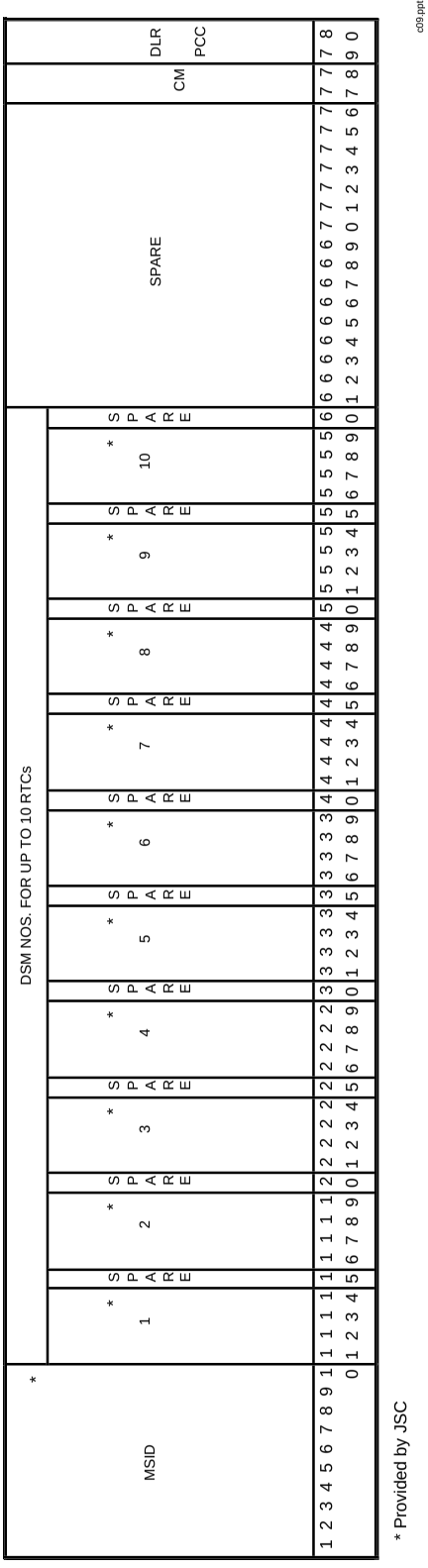


Figure C-9.- Command card layout -- "CM" card (80-column format).

6.8 Card Type "CR" - Discrete Command Data Card

One "CR" card (figure C-10) is required for each discrete command with predefined data values. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Command identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11-14	BTU RESET ADDRESS	Hex representation of a 16 bit word formed by concatenating the BTU module address, BTU channel address, and BTU number as shown below. This field is required for discrete uplink commands only. Derived by PDT generator program. Blank for unintegrated products.
	BTU MODULE ADDRESS	Bits 0-3 of the concatenated word identify the input/output module (in binary code from 0000 to 1111) where the selected channels are located.
	BTU CHANNEL ADDRESS	Bits 7 and 8 represent the channel address. 00 = 0 01 = 1 10 = 2 11 = illegal
	BTU NUMBER	The last 7 bits of the concatenated word identify the location of the BTU.

BTU Number	BTU
0001001	PF1
0001010	PF2
0001101	FLX1
0001110	FLX2
0001111	FLX3
0010000	FLX4
0010001	FLX5

Column	Element	Description

RESET ADDRESS

BITS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RSET	MOD ADDR				0	0	0	CHAN		BTU NUMBER						

15-18 BTU RESET MASK — Hex representation of the mask required to reset bits in a MDM discrete channel. For RTC commands, this field must be valued. For software pulse commands, this field is blank. Software pulse commands cannot be uplinked. For onboard hardware pulsed commands, this field is blank. For uplink hardware pulsed commands, the default value of 0000 must be provided. Provided by payload supplier.

19-22 BTU SET ADDRESS — Hex representation of a 16-bit word formed by concatenating the BTU module address, BTU channel address and BTU number as shown below. This field is required for uplink commands only. Derived by PDT generator program. Blank for unintegrated products.

BTU MODULE ADDRESS — Refer to BTU reset address definition.

BTU CHANNEL ADDRESS — Bits 7 and 8 represent the channel address.
00 = 0
01 = 1
10 = 2
11 = illegal

BTU NUMBER — Refer to BTU reset address definition.

SET ADDRESS

BITS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SET	MOD ADDR				1	0	0	CHAN		BTU NUMBER						

Column	Element	Description
23-26	BTU SET MASK	Hex representation of the mask required to set bits in a MDM discrete channel. Must be valued for uplink and onboard commands. Provided by payload supplier.
27-76	SPARE	
77-78	CARD TYPE	"CR"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC

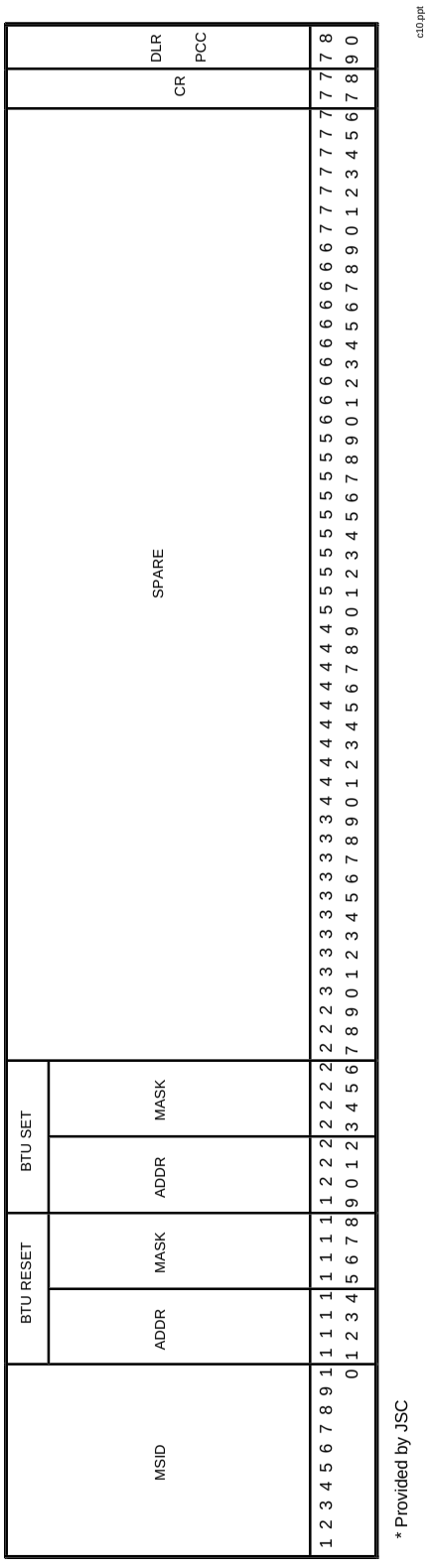


Figure C-10.- Command card layout -- "CR" card (80-column format).

6.9 Card Type "CV" - Analog Command Data Card (Onboard Only)

One "CV" card (figure C-11) is required for analog commands. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Command identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11-12	SPARE	
13-26	A_0 COEFFICIENT	A_0 calibration coefficient represented in floating point format: BNDNNNNNNNEBNN, where N = number D = decimal point E = E (separates exponent from mantissa) B = + OR - Provided by payload supplier.
27-40	A_1 COEFFICIENT	A_1 calibration coefficient in same format as columns 13-26. Provided by payload supplier.
41-76	SPARE	
77-78	CARD TYPE	"CV"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

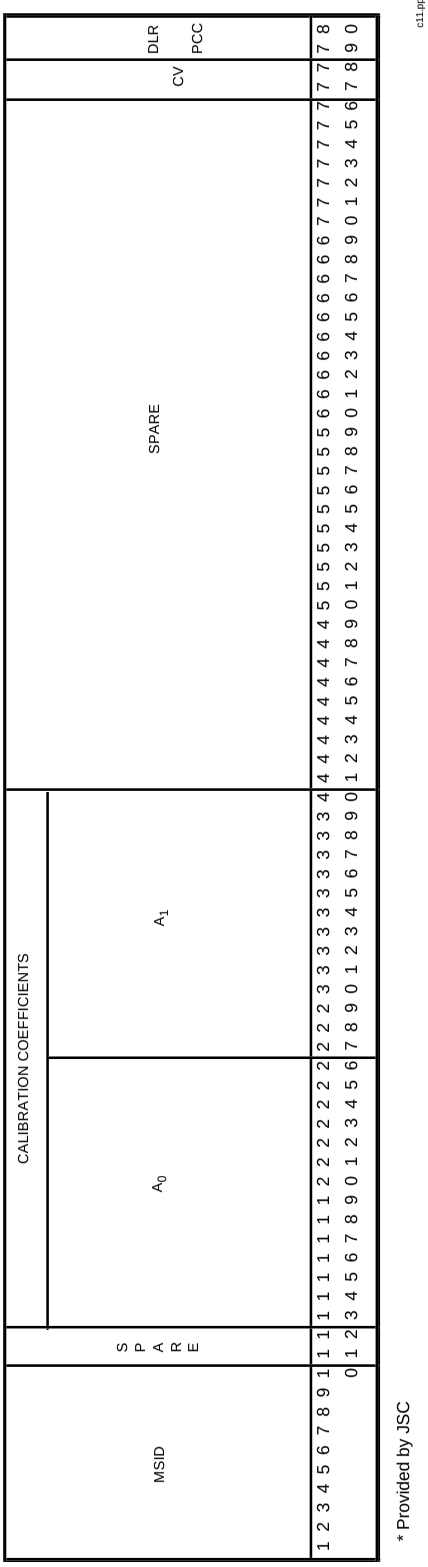


Figure C-11.- Command card layout -- "CV" card (80-column format).

7.0 TELEMETRY CARD FORMATS

The card formats on this tape for telemetry data are card types TA, TB, TC, TI, TJ, TK, TL, TM, TN, TP, TQ, TR, TS, and TT.

7.1 Card Type "TA" - Telemetry Data Stream Structure Card 1

One "TA" card (figure C-12) is required for each PLR, IND, and PDI format. This card is not required for downlist, OI, and Pulse Code Modulation Master Unit (PCMMU) fetch (Spacelab TMB) formats. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1	BLANK	
2-5	TLM FORMAT ID	Code identifying the payload data stream, whether independent of the PDI, input to the PDI or reconstructed as it leaves the PDI in the downlink. Left justified. On an unintegrated tape, the following codes will be provided by the payload supplier: PDIA-PDIZ = PDI input INDA-INDZ = Independent PLRA-PLRZ = Payload Reconstructed On an integrated tape, the following codes will be provided by JSC: 01-11, 14-19, 27-31 = PDI Formats 800-899 = Reconstructed Formats 900-999 = Payload Independent NASA-IDL descriptions of PDI input formats will be 900 plus the corresponding PDI input format ID. NASA-IDL descriptions of PDI input formats that have been reconstructed by the PDI and placed in the Operational Downlink (OD) will be 800 plus the corresponding PDI input format ID. The output data stream of a reconstructed format is different from the original input. The difference is the removal of predefined word columns. Reconstructed formats always

Column	Element	Description
		accompany a Decom Format Load (DFL) which actually contains the instructions to remove predefined word columns. **All rules that apply to the definition of PDI format modes 1, 2 and 3 also apply to reconstructed formats.** If the payload supplier elects to provide real telemetry format IDs, rather than pseudo IDs, then the JSC PDT loader program will automatically convert the real IDs to pseudo IDs.
6	TLM FORMAT INDICATOR	Code specifying the type of payload data stream. Derived by JSC PDT generator program. 4 = Payload reconstructed 5 = Payload independent stream 8 = PDI format
7	FORMAT MODE	This field contains a code for the general structure of the telemetry data stream. Provided by payload supplier. The following codes apply: 1 - Formats with only major frames and major frame sync patterns. 2 - Formats with major and minor frames. Sync patterns are used to identify both the major and minor frame. 3 - Formats with major frames and minor frames with minor frame counters and minor frame sync patterns. 4 - Block mode. No format synchronization, frames, or counters. 5 - Same as 1 with subframes and subframe counters. 6 - Same as 2 with subframes and subframe counters. 7 - Same as 3 with subframes and subframe counters.
8-9	SPARE	

Column	Element	Description
10	FIRST PDI PORT ASSIGNMENT	An integer (1-6) indicating the PDI port assignment. Ports 1-5 are attached mode and 6 is via the Payload Interrogator (PI)/PSP, detached. Provided by JSC. This field is valid for PDI format modes 1-4. May be blank. (Also see card TB column 44.)
11-18	FLIGHT PHASES	Indicates phases of the flight for which the format is required. Up to six phases may be requested. One column per phase, in the order shown below. Provided by payload supplier and JSC. Valid for all format modes and indicators.
(11)		L = Ground Checkout (Prelaunch for OI, FMT 60, and TFL 180). **This phase is not applicable for Payload Control Indicators (PCIs)**.
(12)		A = Ascent (for software purposes, ascent starts at T-20)
(13)		Blank
(14)		O = Orbit (payload attached)
(15)		Blank
(16)		E = Entry
(17)		Blank
(18)		S = Orbit (payload detached)
19-29	SPARE	
30-32	REQUIRED WINDOW SIZE	Number of word columns in the operational downlink required by this format. This field is valid for PDI formats appearing in the OD only (format modes 1-4 and format indicators 4 and 8). Blank otherwise. This field must be an even number of 8-bit words. Leading zeros. Derived by JSC as follows:
	Modes 1,2,3:	$\frac{(T+6) \times (1+B)R}{800 \times F}$ => Round up to even integer = REQUIRED WINDOW SIZE
	Mode 4:	$\frac{(T+6) \times (1+B)R}{((\text{Output Data Block Length}-6) \times 800)}$ => Round up to even integer = REQUIRED WINDOW SIZE

Column	Element	Description
		Where T = Toggle buffer size B = Bit rate tol x 0.01 R = Bit rate (bits per sec) F = Number of words input into the PDI. This is the major frame size (format mode 1) or the minor frame size (format modes 2 and 3).
33-37	TELEMETRY BANDWIDTH	The actual bandwidth in kbps required by this PDI format in the OD. Format: XXX.Y -decimal point embedded as fourth character, always fill in .Y. Derived by JSC. This information can be calculated as follows: (Required window size) x .8 This field is valid for PDI formats only (format modes 1-4 and format indicators 4 and 8). Blank otherwise.
38-41	BIT RATE TOLERANCE	A 3-digit numeric of the form X.YY identifying the bit rate tolerance allowable for the corresponding PCM input stream (expressed as a percentage). **There is a maximum allowable tolerance of 3.0 percent.** All characters (including the decimal point) must be filled in. This field is required for all formats (format modes 1-7 and format indicators 4, 5, and 8). Provided by payload supplier.
42-45	TLM DATA CODE	Abbreviation identifying the data code type of the PCM bit stream. For a PI/PSP to PDI input format, this field must be valued to Non-Return to Zero Level (NRZL). Provided by payload supplier. NRZL - Non-Return to Zero Level NRZM - Non-Return to Zero Mark NRZS - Non-Return to Zero Space BIPL - Bi-Phase Level (Manchester II) BIPM - Bi-Phase Mark BIPS - Bi-Phase Space

Column	Element	Description
46-47	BITS PER WORD	Integer indicating the size in bits of the data words. Legal values are 8, 16, 24, and 32 bits. Words in PDI and PLR formats (format indicator = 4, 8) must be 8 bits in length. Blank for format mode 4. Leading zeros. Provided by payload supplier.
48-51	WORDS PER FRAME OR OUTPUT DATA BLOCK LENGTH	Integer determined by the following table. All lengths are derived by counting 8-bit words. Leading zeros. Provided by payload supplier.

Format Mode	Field definition
1	Major frame length (includes sync - no status registers)
2	Minor frame length (includes sync - no status registers)
3	Minor frame length (includes sync - no status registers)
4	Output data block length (includes PDI added sync plus the 6 PDI status words)
5	Subframe length (includes subframe counter)
6	Minor frame length (includes sync)
7	Minor frame length (includes sync and minor frame counters)

52-54	FRAMES/MAJOR FRAME OR DATA BLOCKS/SECOND	This field indicates the number of minor frames or subframes per major frame or data blocks per second. Valid range is 002 to 256 for modes 2, 3, 5, 6, and 7. Valid range is 000 to 200 for mode 4. Unassigned integer determined by the following table. Leading zeros. Provided by payload supplier.

Column	Element	Description

Format mode	Field definition
1	Blank.
2	Major frame length (minor frames).
3	Major frame length (minor frames).
4	Data block rate (data blocks per second). This information can be calculated as follows: Data Blk sec = (Output data block length - sync length - 6) x 8 This value is rounded up to the next higher integer value.
5	Major frame length (subframes).
6	Subframe length (minor frames).
7	Subframe length (minor frames).

55-59 MAJOR FRAME PERIOD — The number of seconds required to output one major frame. Format: XXXYY, where XXX is in seconds and YY is in hundredths of a second. YY shall always be present. Right justified. Derived by JSC. Blank for format mode 4.

60-64 DATA CYCLE PERIOD — Time (in sec) required to telemeter at least one complete sample of every parameter in the data stream. Format: XXXYY, where XXX is in seconds and YY is in hundredths of a second. YY shall always be present. Right justified. Provided by payload supplier. Blank for format mode 4.

65-76 BIT RATE — Bit rate of the PCM stream. All positive, real numbers from 10 bps (bits per second) through 64000 bps are legal. All other values are illegal. The format of the bit rate is XXXXX.YYYYYY bps with the decimal point embedded as the 6th character. Leading zeros. Provided by payload supplier.

77-78 CARD TYPE — "TA"

79-80 DELTA LOADER PCC — Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

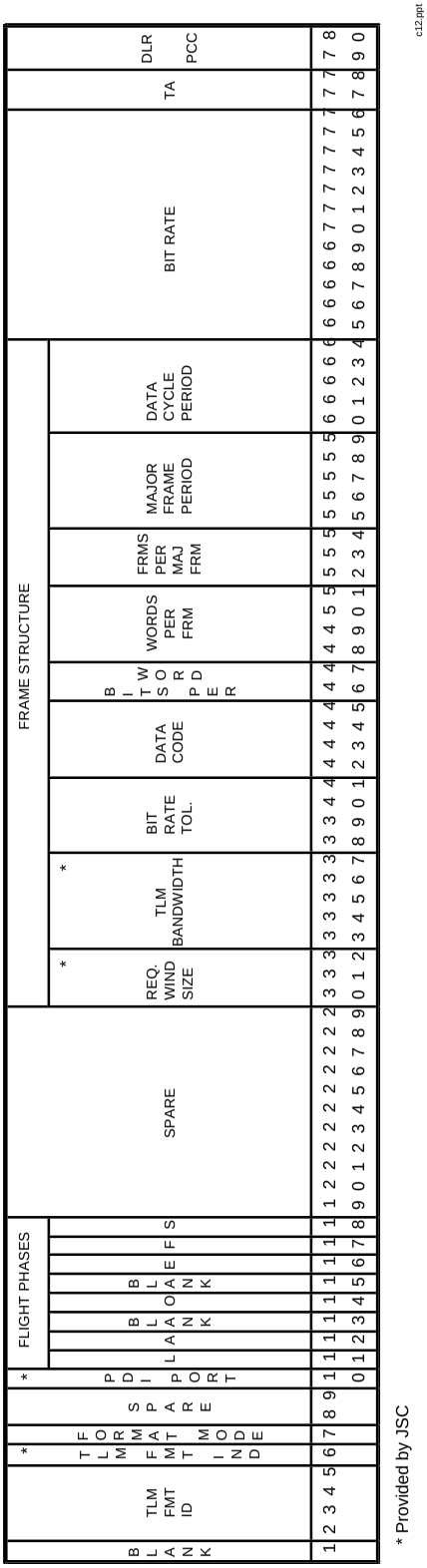


Figure C-12.- Telemetry card layout -- "TA" card (80-column format).

7.2 Card Type "TB" - Telemetry Data Stream Structure Card 2

One "TB" card (figure C-13) is required along with each "TA" card. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1	BLANK	
2-5	TLM FORMAT ID	Same as columns 2-5 on "TA" card
6	TLM FORMAT INDICATOR	Same as column 6 on TA card.
7	SYNC LENGTH	Code specifying the number of bits in the sync word defined in columns 9-16. Derived by JSC PDT generator program. 1 = 8 Bits 2 = 16 Bits 3 = 24 Bits 4 = 32 Bits
8	SYNC TYPE	Code indicating which sync pattern is defined in columns 9-21. Derived by JSC PDT generator program. Sync type / Format mode F = Minor frame sync — 2,3,6,7 M = Major frame sync — 1,5 B = Block mode sync — 4
9-16	SYNC HEX VALUE	Hex value of the sync bit pattern. Sync can be 8, 16, 24, or 32 binary bits. Left justified. Provided by payload supplier. Format mode | Field definition 1,5 | Major frame sync value 2,3,6,7 | Minor frame sync value 4 | Block sync value

Column	Element	Description
17	SYNC F/L INDICATOR	This field contains an "F" if the pattern defined in columns 9-16 is located in the first words of a frame or an "L" if it appears in the last words of a frame. Blank for format mode 4. Provided by payload supplier.
18-21	SYNC START WORD	Integer indicating the first word in the major frame (format mode 1), minor frame (format modes 2, 3, 6, and 7) or subframe (format mode 5) in which the sync pattern defined in columns 9-16 appears. Leading zeros. Blank for format mode 4. Provided by payload supplier.
22	MAJOR FRAME SYNC F/L INDICATOR	For format mode 2, this field contains an "F" if the sync pattern defined in columns 23-24 appears in the first minor frame of the major frame. The field contains an "L" if the sync pattern appears in the last minor frame of the major frame. For format mode 6, this field contains an "F" if the sync pattern defined in columns 23-24 appears in the first minor frame of the first subframe of the major frame. This field contains an "L" if the sync pattern appears in the last minor frame of the last subframe of the major frame. Blank for format modes 1, 3-5, and 7. Provided by payload supplier.
23-24	MAJOR FRAME SYNC HEX VALUE	If an "F" appears in column 22, then this field must contain the hex representation of the first 8 bits of the major frame sync word. If an "L" appears in column 22, then this field must contain the hex representation of the last 8 bits of the major frame sync word. Required for format modes 2 and 6 only. Blank otherwise. Provided by payload supplier.

Column	Element	Description
25-28	MAJOR FRAME SYNC WORD NUMBER	Number indicating the word location of major frame sync in the minor frame (word number 1 = 0001). Leading zeros. Required for format modes 2 and 6 only. Blank otherwise. Provided by payload supplier.
29	MINOR FRAME COUNTER UP/DOWN INDICATOR	Character indicating whether the Minor Frame Counter (MFC) increments up (0, 1, 2, etc.) or down (50, 49, 48, etc.). Provided by payload supplier. U = MFC increments up D = MFC increments down Required for format modes 3 and 7. Blank otherwise.
30-32	MINOR FRAME COUNTER INITIAL VALUE	Integer representing the initial value of the minor frame counter. This value must be consistent with the telemetry first frame (TT card, col. 28-30). Required for format modes 3 and 7; blank otherwise. Leading zeros. Provided by payload supplier.
33-36	MINOR FRAME COUNTER WORD NUMBER	The word number identifying the location of the minor frame counter within the minor frame (the first word of the minor frame is always labeled word 1). The most significant bit of the counter is bit 0. The least significant bit of the counter is the bits per word specified in TA card, col. 46-47 minus 1. Required for format modes 3 and 7. Leading zeros. Provided by payload supplier.
37	SUBFRAME COUNTER UP/ DOWN INDICATOR	Character indicating if the Subframe Counter (SFC) increments up or down. For Format modes 5, 6, and 7. Blank otherwise. Provided by payload supplier. U = SFC increments up D = SFC increments down
38-39	SUBFRAME COUNTER INITIAL VALUE	Integer representing the initial value of the subframe counter. This value must be consistent with the telemetry first subframe (TT card, col. 31-33). Required for format modes 5 - 7; blank otherwise. Leading zeros. Provided by payload supplier.

Column	Element	Description
40-43	SUBFRAME COUNTER WORD NUMBER	The word number identifying the location of the subframe counter within the subframe. (The first word of the subframe is always labeled word 1). The most significant bit of the counter is bit 0. The least significant bit of the counter is the bits per word specified in TA card, col. 46-47 minus 1. Required for format modes 5-7. Leading zeros. Provided by payload supplier.
44	SECOND PDI PORT ASSIGNMENT	A numeric (1-6) indicating the PDI port assignment. Ports 1-5 are attached mode; 6 is via the PI/PSP, detached. Integer. May be blank. Provided by JSC. This field is valid for PDI formats only (format modes 1-4 and format indicator 8). (Also see card TA column 10).
45	THIRD PDI PORT ASSIGNMENT	Same as above.
46-66	AVAILABLE SAMPLE RATES	Number indicating the legal sample rates (see appendix A) available for measurements in the telemetry stream. Expressed in samples per major frame. Left justified. Integer. Blank for PDI FMT 4. Provided by payload supplier.
(46-48)	AVAILABLE SAMPLE RATE 1	
(49-51)	2	
(52-54)	3	
(55-57)	4	
(58-60)	5	
(61-63)	6	
(64-66)	7	
67-70	SPARE	
71-73	SUBCOM DEPTH	Number of subframes per major frame. Required for modes 5-7. Leading zeros. Provided by payload supplier.
74-76	SPARE	
77-78	CARD TYPE	"TB"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

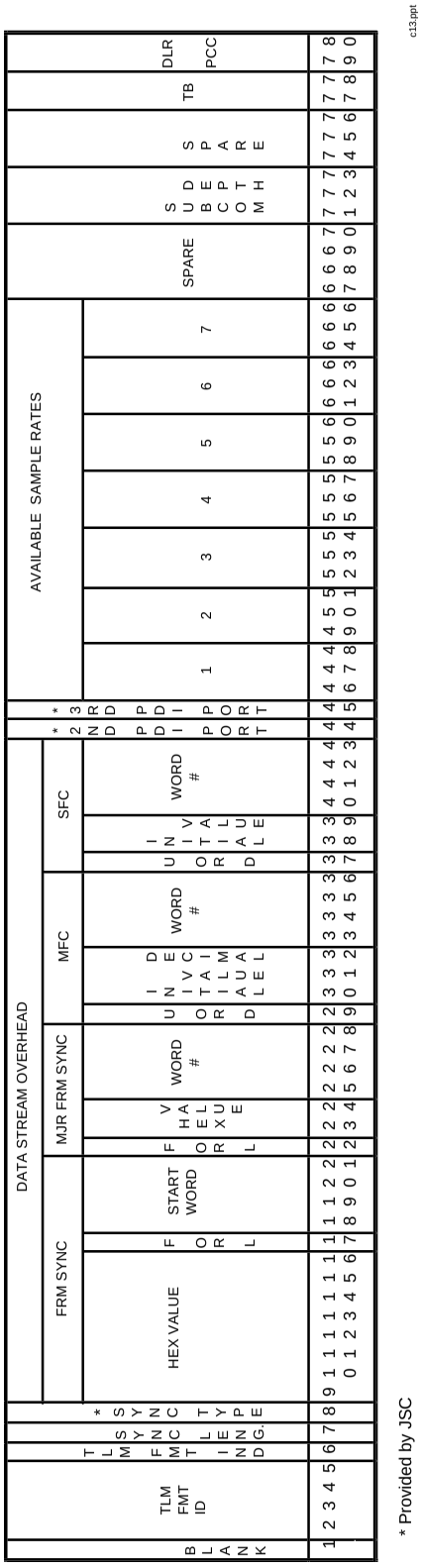


Figure C-13.- Telemetry card layout -- "TB" card (80-column format).

7.3 Card Type "TC" - PDI Format Requirements Card 1

At least one "TC" card (figure C-14) is required for each PDI format along with the "TA" and "TB" cards. Multiple "TC" cards are possible. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1	BLANK	
2-5	TLM FORMAT ID	Code identifying the payload data stream input to the PDI. Integer or alpha. Left justified. On an unintegrated tape, the following codes will be provided by the payload supplier. PDIA-PDIZ = PDI input (pseudo ID) On an integrated tape, the following codes will be provided by JSC. 01-11, 14-19, 27-31 = PDI format If the payload supplier provides real telemetry format IDs, rather than pseudo IDs, then the JSC PDT loader program will automatically convert the real IDs to pseudo IDs upon input to the MRB.
6	TLM FMT INDICATOR	Code specifying the type of telemetry stream. Derived by JSC PDT generator program. 4 = Payload reconstructed 8 = PDI format
7-8	SPARE	
9-12	TOGGLE BUFFER SIZE	The number of 8-bit payload data frame words to be decommutated into the PDI toggle buffer. The toggle buffer size can be calculated for each of the PDI format modes as follows (max 1024): Mode 1: Equals the major frame length Mode 2 and 3: Equals the minor frame length Mode 4: Equals the output data block length minus 6 Integer. Right justified. Provided by payload supplier.

Column	Element	Description
13-18	PAYLOAD DOWNLINK FRAME SIZE	The number of 8-bit payload data frame words to be downlinked. This value can be calculated for each of the PDI format modes as follows: Mode 1: Equals the major frame length Modes 2 and 3: Equals the minor frame length Mode 4: Equals the output data block length minus (number of sync hex words)/2 minus 6. Integer. Right justified. Derived by JSC.
19-20	SPARE	
21-24	START WORD NUMBER	Identifies the major frame word number (format mode 1) or the minor frame word number (format modes 2 and 3) from which decommutation of the payload data is to begin. Blank for mode 4. Integer. Leading zeros. Provided by payload supplier.
25-28	NUMBER OF CONSECUTIVE WORDS	Identifies the number of consecutive words to be decommutated from the payload data stream including the start word previously identified. Blank for mode 4. Integer. Leading zeros. Provided by payload supplier.
29-32	START WORD NUMBER	Same as Columns 21-24
33-36	NUMBER OF CONSECUTIVE WORDS	Same as Columns 25-28
37-40	START WORD NUMBER	Same as Columns 21-24
41-44	NUMBER OF CONSECUTIVE WORDS	Same as Columns 25-28
45-48	START WORD NUMBER	Same as Columns 21-24
49-52	NUMBER OF CONSECUTIVE WORDS	Same as Columns 25-28
53-56	START WORD NUMBER	Same as Columns 21-24
57-60	NUMBER OF CONSECUTIVE WORDS	Same as Columns 25-28

Column	Element	Description
61-64	START WORD NUMBER	Same as Columns 21-24
65-68	NUMBER OF CONSECUTIVE WORDS	Same as Columns 25-28
69-72	START WORD NUMBER	Same as Columns 21-24
73-76	NUMBER OF CONSECUTIVE WORDS	Same as Columns 25-28
77-78	CARD TYPE	"TC"
79-80	CARD NUMBER/ DELTA LOADER PCC	Range = 01-74. Leading zeros. Delta Loader PCC "@@" symbol used only for card deletion. Provided by payload supplier or JSC.

There can be a maximum of 74 cards for a payload with 1024 words per frame and the need to decom every other word.

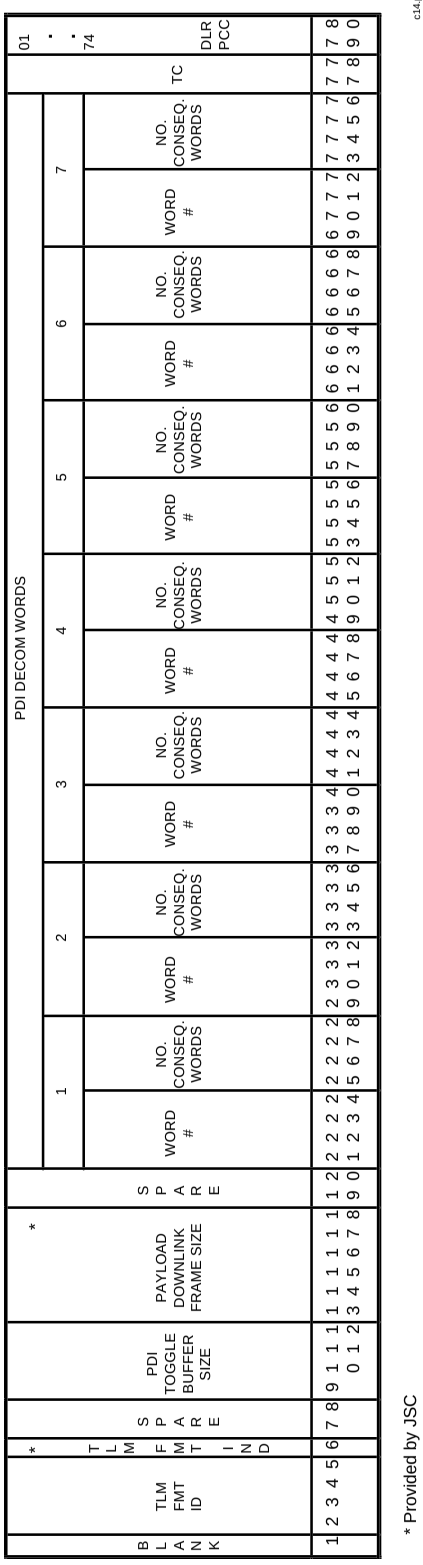


Figure C-14.- Telemetry card layout -- "TC" card (80-column format).

7.4 Card Type "TI" - Telemetry MML Card

One "TI" card (figure C-15) is required for each telemetry measurement to cover the following requirements.

a. Onboard Display (via MDM or PDI)

b. Downlist

c. Downlink in OI

d. PDI Toggle Buffers (only if JSC/KSC Processing Required)

e. Independent Data Streams

Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Measurement identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11-12	TLM DATA LENGTH	The number of bits required to define the measurement. This field is valued as follows: a. For OI measurements, the value of data length is in the range 01-08. b. For PDI measurements, the value of data length is in the range 01-08. These measurements are decommutated by the PDI (as described in the DECOM Format Load (DFL)). They must appear on a PDI (DFL) format decom description. c. For payload measurements (other than Spacelab) the data length is in the range 01-08 for 8-bit word sizes. If the payload supplier data stream is in a format that has other than 8-bit words, this field will be valued based on the size of the words in that data stream (i.e., 16-bit words - data length 01 to 16).

Column	Element	Description
		d. For Spacelab TMB data other than character data, data length is in the range 01-64. For Spacelab characters data strings, this field shall designate the number of bytes rather than bits. e. For downlist, data length is in the range 01-64. Leading zeros. Integer. Blank for parameters with sources of "SM". Provided by payload supplied.
13-20	DATA RANGE UNIT	Standard engineering units describing the measurement. For analog and digital measurements this denotes the standard engineering units compatible with the scaling coefficients and the data range. Values listed in appendix E should be used. For discrete measurements the value "EVENT" will be used. Left justified. Alphanumeric. Provided by payload supplier. **For discretes, the nomenclature should reflect the sense of the data range high**.
21-54	SYSTEMS NOMENCLATURE	Unique alphanumeric name for the measurement. **For discretes, the nomenclature should reflect the sense of the data range high.** Left justified. Provided by payload supplier.
55-70	SM CONSTANT INITIAL VALUE	Numerical value in engineering units of the SM constant. Right justified. Provided by payload supplier and/or JSC, if required.
71	PAYLOAD MANAGEMENT USE	A "P" indicates the measurement is to be acquired by the SM GPC for any process including downlist. A "B" indicates a Shuttle vehicle measurement utilized by the payload for GPC processing. Derived by JSC PDT generator program. P = Payload Management (PM) use only B = Both PM and SM use Blank = Telemetry only

Column	Element	Description
72-73	SSI ID 1	If this measurement is a part of the serial data stream for an SSI input transaction number 1, then the SSI ID must appear in the field. Blank otherwise. On an unintegrated tape, this field will contain a pseudo ID (A-H, left justified, provided by payload supplier). On an integrated tape, the field will contain a real ID (01-08, leading zeros, provided by JSC). If the payload supplier provides a real SSI ID, rather than a pseudo ID, then the JSC PDT loader program will automatically convert the real ID to a pseudo ID.
74-75	SSI ID 2	If this measurement is a part of the serial data stream for an SSI input transaction number 2, then the SSI ID must appear in this field. Blank otherwise. The description of the data entered in the field is the same as that given above for SSI ID 1.
76	GPC INPUT/OUTPUT/ COMPUTE	Alphabetic code for the measurement. Derived by JSC PDT generator program. I = Input to the GPC C = Computed within the GPC
77-78	CARD TYPE	"TI"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

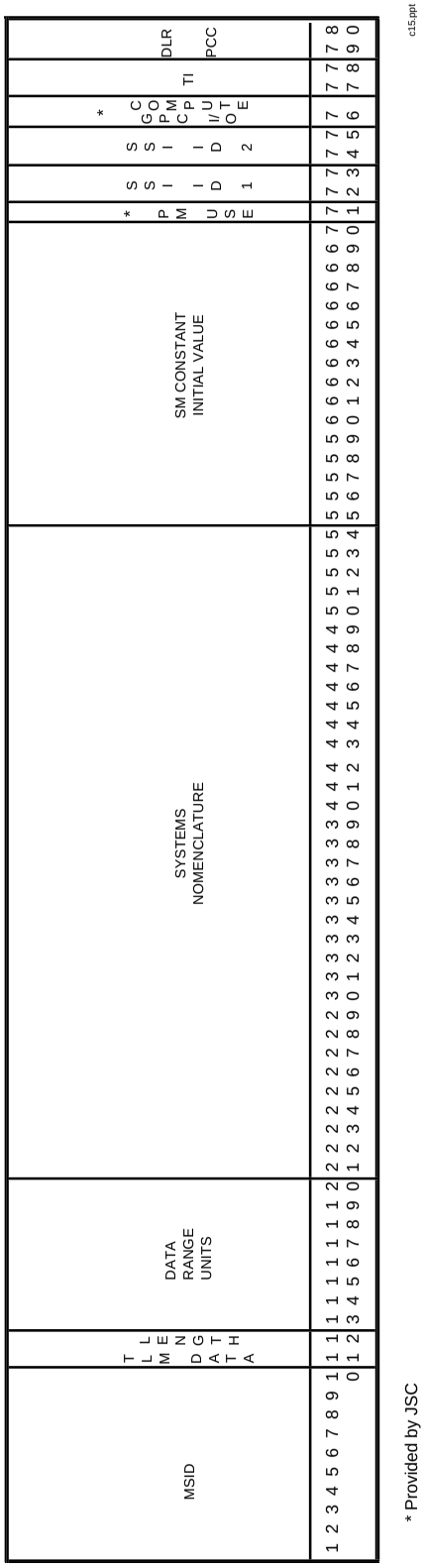


Figure C-15.- Telemetry card layout -- "TI" card (80-column format).

7.5 Card Type "TJ" - Telemetry Data Requirements Card

One "TJ" card (figure C-16) is always required for each "TI" card. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Measurement identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11	TLM LINK ID	Code indicating the telemetry system that will transmit the measurement data. Alphanumeric. Provided by the payload supplier and JSC. 9 = Both PDI and operational PCM System (OI) D = Downlist J = Independent Data Stream N = Toggle Buffer for downlink and Data RAM for onboard use P = PDI Toggle Buffer R = PDI Data RAM only U = Spacelab fetch or PDI in the OI window only (not in the toggle buffer) X = Onboard display only, not transmitted to the ground
12	SPARE	
13	CAUTION AND WARNING	Code used for measurements required by the alert/caution and warning system. Provided by payload supplier and JSC. Also derived by PDT generator program. 3 = FDA 7 = FDA and preconditioning
14	CRT APPLICABILITY	Code indicating onboard display of the measurement. May be blank. Provided by payload supplier and JSC. X = Displayed onboard
15-17	DATA TYPE	Alphabetic abbreviation of the measurement as represented in the GPC or PCM master unit. Values to be used are listed below. Definitions can be found in appendix D. Left justified. Provided by payload supplier.

Column	Element	Description
	AMB Analog Bipolar AMU Analog Unipolar BCD Binary Coded Decimal BCH Binary Coded Hexadecimal BD Binary Discrete BMD Bit String, Mixed Data BMS Bit String, Magnitude and Sign BSS Bit String, Fixed Point, Signed BSU Bit String, Fixed Point, Unsigned CHE EBCDIC Character Data CHU European ASCII Character Data DMD Double Word, Mixed Data DPL Double Precision Floating Point DUC Digital Uplink Command Data EMD Extended Word, Mixed Data FMD Fullword, Mixed Data FPL 2's Complement Floating Point FXS Fullword, Mixed Point, Signed FXU Fullword, Fixed Point, Unsigned HFS Halfword, Fixed Point Overflow, Signed HMD Halfword, Mixed Data HMS Halfword, Magnitude and Sign HPL Halfwords, Precision Floating Point (16 bits) HXS Halfword, Fixed Point, Signed HXU Halfword, Fixed Point, Unsigned QMD Quarter Word, Mixed Data SPL Single Precision Floating Point VAR Variable Data	
18-19	TLM START BIT	Integer number (00-15 for Spacelab fetch formats and 00-07 for all other formats) of the bit in the telemetry data word in which this measurement begins. Required for OI, PLR, PDI, and PCMMU fetch formats only (format indicator = 2, 3, 4, 8, or 9). Blank for all other formats. If a measurement appears in other formats in addition to a Spacelab fetch format, (TMB) then the Spacelab fetch format start bit number must appear in this field. Leading zeros. Provided by payload supplier.

Column	Element	Description
20-22	REQUIRED FETCH RATE	Minimum sample rate required by any onboard system (GPC, PDI, PCMMU) to update the measurement data with sufficient frequency to accurately reproduce this data. a. Data acquired by SM GPC Measurement must be acquired by the SM GPC if it is: 1. Displayed onboard 2. FDA'D 3. Used in precondition steering 4. A BTU measurement (PLMDM, FLEXMDM, SCA) 5. Used in PM special processing The required fetch rate for these measurements is the acquisition and FDA processing rate in samples per second. The table below lists the legal fetch rate values in samples per second for BTU, PDI, and Spacelab parameters. The corresponding downlist/downlink rates and FDA processing rates are also shown.

Column	Element	Description

Data source	Required fetch rate	Downlist/ link rate	FDA rate
BTU via payload data buses	0.5, 1 or 6	1 or 5	0.5 or 1
PDI/ Spacelab data via PCMMU data RAM	0.5 or 1	1*	0.5 or 1

0.5 = 1 sample/two seconds; 1 = 1 sample/second
*The downlink rate for these parameters only applies to parameters in the OI portion of the downlink.

b. Data not acquired by SM GPC: For measurements not acquired by the GPC, but that are telemetered to the ground in the OI portion of the downlink, this is the highest required rate (in samples per second) that the parameter is updated in any downlink format (PDI formats and/or OI formats). This is equal to the highest required rate on all "TT" cards for the measurement.

c. For parameters that are only downlinked in the PDI window (toggle buffer only) during flight or used only during ground checkout. This field is blank.

Right justified. Samples per second. Provided by payload supplier.

23-30 FLIGHT PHASES — Indicates which phases of the flight the measurement is required. One column per phase, in the order shown below. Provided by payload supplier.

(23) L - Ground Checkout (Prelaunch for OI, FMT 60, and TFL 180). **This phase is not valid for Process Control Indicators (PCIs)**.

(24) A - Ascent (For software purposes ascent is defined as starting at T-20 min.)

Column	Element	Description
(25) (26) (27) (28) (29) (30)		O - Orbit (payload attached) E - Entry S - Orbit (payload detached)
		SSP Data Range Low/High Logic Convention **Special note to Payload customer(s):** The convention of the SSP is that all parameters should be represented as positive logic (logic 1 is high voltage state, while logic 0 is low voltage state). If the use of negative logic (logic 1 is low voltage state) is required, the customer must discuss this requirement with the annex 4 book manager as early as possible during the requirements development process.
31-35	DATA RANGE LOW	For analog measurements this is the low value of the expected operational range compatible with the scaling coefficients. For discrete measurements it defines the condition equivalent to binary 0. If the condition for binary 0 is not defined this field should be blank. Refer to appendix E. For digital measurements it defines the condition opposite to the sense of the measurement nomenclature. If this condition is not defined this field should be blank. Refer to appendix E. For parents, this field will be blank. Right justified. Alphanumeric. Provided by payload supplier.
36-40	DATA RANGE HIGH	For analog measurements this is the high value of the expected operational range compatible with the scaling coefficients. For discrete measurements it defines the condition equivalent to binary 1. If the condition for binary 1 is not defined this field should be blank. Refer to appendix E.

Column	Element	Description
		For digital measurements it defines the condition equivalent to the sense of the measurement nomenclature. If this condition is not defined this field should be blank. Refer to appendix E. For parents this field should be blank. Right justified. Alphanumeric. Provided by payload supplier.
41	INVERTED MEASUREMENT INDICATOR	A "1" in this field indicates the measurement is transmitted least significant bit first in the data stream. Blank if data is transmitted MSB first. Provided by payload supplier.
42	PCS CHANNELIZATION FLAG	Code indicating that this parameter is used in a PCS sequence. Provided by JSC. Valid entries are: I - Input to a PCS sequence O - Output to a PCS sequence B - Both an Input and Output to a PCS sequence
43-44	CONTIGUOUS PARAMETER INDICATOR	a. For grandparents, this field will be blank. b. For parents, this field will contain an integer indicating the ordering of the parents within the grandparent. The parent containing the MSB of the grandparent will be "1". c. For children, this field will contain an integer indicating the ordering of the children within the parent. For children that cross parent boundaries, the integer indicates the order in the parent which contains the MSB of the child. The next child after the one that crosses the boundary will be numbered as though the piece of the previous child, in this parent, is numbered 1. In other words, for a child to be numbered 1, it must contain the MSB of the parent. For example, if a child starts in bit 14 of word 1 and ends in bit 3 of word 2, then the child will have a value equal to the sequence location in word 1.

Column	Element	Description
		The child starting in bit 4 of word 2 will have a value of 2.
		Integer (1-99). Right justified. May be blank. Provided by payload supplier.
45-50	SPARE	
51-54	BTU NAME	Alphanumeric abbreviation for the bus terminal unit through which the measurement is transmitted. Left justified. This field will be blank for measurements generated within the GPC system; that is, if column 76 on the "TI" card contains a "C".
		On an unintegrated tape, this field will contain a pseudo name provided by the payload supplier. PF01-PF02 = Payload Forward MDM FXPA-FXPE = Dual Port Flex MDM FXSA-FXSE = Single Port Flex MDM SCAA-SCAD = Sequence Control Assembly SSC = Spacelab Subsystem Computer EXC = Spacelab Experiment Computer PDI = Payload Data Interleaver ORB = Orbiter Operational Instrumentation
		On an integrated tape, this field will contain a real name provided by JSC. PF01-PF02 = Payload Forward MDM FLX1-FLX5 = Flex MDM SCA1-SCA4 = Sequence Control Assembly SSC = Spacelab Subsystem Computer EXC = Spacelab Experiment Computer PDI = Payload Data Interleaver ORB = Orbiter Operational Instrumentation
		If the payload supplier provides a real BTU name, rather than a pseudo name, then the JSC PDT loader program will automatically convert the real name to a pseudo name.

Column	Element	Description
55-57	BTU CARD TYPE	Code identifying BTU input/output card (module) types. Blank if BTU name provided in columns 51-54 is a non-MDM (i.e., SSC, EXC, PDI, and ORB). Left justified. Provided by payload supplier. AID - Analog Input Differential SIO - Serial Input/Output DIL - Discrete Input Low (5 volts) DIH - Discrete Input High (28 volts) DOL - Discrete Output Low (bite test 4 only) DOH - Discrete Output High (bite test 4 only)
58-59	BTU MIA ADDRESS	Multiplex Interface Adapter (MIA) address assigned to a BTU 06, 09, 10 (PF01), 12 (PF02), 15, 29, 30. Blank if BTU name provided in columns 51-54 is a non-MDM (i.e., SSC, EXC, PDI, and ORB). Leading zeros. For payload MDMs, provided by JSC. For all other BTUs, provided by payload supplier.
60-61	BTU CARD LOCATION	Number (00-15) defining the location (slot number) assigned to a given input/output module (card) in a BTU. Blank if BTU name provided in columns 51-54 is a non-MDM (i.e., SSC, EXC, PDI, and ORB). Leading zeros. Provided by payload supplier.
62-63	BTU CHANNEL NUMBER	A number (00-31) identifying the channel on the corresponding BTU I/O module (card) that is assigned to the signal. Blank if BTU name provided in columns 51-54 is a non-MDM (i.e., SSC, EXC, PDI, and ORB). Leading zeros. Provided by payload supplier.
64-65	BTU START BIT NUMBER	Number (00-63) identifying the starting bit of the actual signal within the parent word from a BTU or SIO module. a. If the card type is DOH, DOL, DIH, or DIL, use 00-15. b. If the card type is AID, use 00. c. If the card type is SIO, use 00-63 unless a serial wire MSID is used, then the field is blank. The start bit follows the shuttle standard: **Bit 0 is the MSB and bit 15 is the LSB.** Refer to figure A-0, section 1.1.

Column	Element	Description
		Blank if BTU name provided in columns 51-54 is a non-MDM (i.e., SSC, EXC, PDI, and ORB). Leading zeros. Provided by payload supplier.
66-67	BTU NUMBER OF BITS	Number of bits (01-64) in the actual signal. a. If card type is DIH, DIL, DOH, or DOL, the range is 1-16. b. If the card type is AID, the only value is 10. c. If the card type is SIO, the range is 1-64 unless a wire MSID is used in which case this field is blank. Blank if BTU name provided in columns 51-54 is a non-MDM (i.e., SSC, EXC, PDI, and ORB). Leading zeros. Provided by payload supplier.
68-69	BTU WORD NUMBER	Number (00-31) identifying the specific 16-bit data word in a serial digital stream of data words coming from a BTU channel. Blank if BTU name provided in columns 51-54 is a non-MDM (i.e., SSC, EXC, PDI, and ORB). Leading zeros. Provided by payload supplier.
70	CONCUR FLAG	Code used to convey special FDA requirements. C = Both C&W and alert limits P = Discrete measurement without FDA limits but used in a precondition expression. May be blank. Derived by JSC PDT generator program.
71-74	SOURCE	Code indicating the source of the data being acquired and used in Payload Management. Left justified. Provided by payload supplier. GNC = GN&C Parameter SS = System Software SM = Payload or System Management Measurement generated internally to GPC system. This includes Payload Control Sequence (PCS) and keyboard. PLM = BTU on PL Bus

Column	Element	Description
		PLB4 = Payload Bite Test 4 ORB = Orbiter Operational Instrumentation PDI = Payload Data Interleaver SSC = Spacelab Subsystem Computer EXC = Spacelab Experiment Computer All other codes in this field, including blanks, will indicate independent data stream formats.
75-76	BTU NUMBER OF WORDS	Number of 16-bit words (01-32) defined in the SSI input channel. Leading zeros. Integer. Blank if the BTU card type (columns 55-57) is not SIO. Provided by payload supplier.
77-78	CARD TYPE	"TJ"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

MSID	TLM LNK ID	SPARE	C-W	CRT APP	DATA TYPE	TLM START BIT	REQ FETCH RATE	FLIGHT PHASE							RANGE		INV MEAS IND	PCS FLAG	CONTIGUOUS INDICATOR	SPARE	BTU CHANNELIZATION								* CONCUR FLAG	SOURCE	BTU NO. OF WORDS	TJ	DLR PCC
								L	A	BLANK	O	BLANK	E	F	S	LOW	HIGH					NAME	CARD TYPE	MIA ADDRESS	CARD LOCATION	NUMBER	START BIT	NO. OF BITS	WORD NO.					
1 2 3 4 5 6 7 8 9 10	11	12	13	14	15 16 17	18 19	20 21 22	23	24	25	26	27	28	29	30	31 32 33 34 35	36 37 38 39 40	41	42	43 44	45 46 47 48 49 50	51 52 53 54	55 56 57	58 59	60 61	62 63	64 65	66 67	68 69	70	71 72 73 74	75 76	77 78	79 80

* Provided by JSC

c16.ppt

Figure C-16.- Telemetry card layout -- "TJ" card (80-column format).

7.6 Card Type "TK" - Telemetry User Identification Card

One "TK" card (figure C-17) can be required for a telemetry measurement. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Measurement identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11-20	PAYLOAD USER ID	User identification number if different from the MSID. For MSIDs assigned by customers that JSC must change, the customer supplied MSID will appear here. Left justified. Alphanumeric. Provided by payload supplier.
21-30	PARENT MSID	Identification of the associated parent word where the measurement is located. The parent MSID is given to the 8-, 16-, 24-, 32-, 48-, or 64-bit words containing events or mixed data. Left justified. Alphanumeric or blank. Provided by payload supplier. Refer to appendix B.
31-40	WIRE MSID	Identification of the serial digital channel carrying this measurement. Valid only for serial measurements. Blank for discrete and analog measurements. Refer to appendix B. Left justified. Alphanumeric. Provided by payload supplier.
41-50	SID NUMBER	Spacelab Software Identification (SID) Number. Spacelab user ID if different from measurement MSID. Left justified. May be blank. Alphanumeric. Provided by payload supplier.
51-60	ASSOCIATED MSID	This field identifies the subparent MSID. A subparent is used when a multibit parameter must be displayed onboard as individual bits and on the ground as a single multibit parameter. This subparent identifies the multibit parameter. Left justified. May be blank. Alphanumeric. Provided by payload supplier. Refer to appendix B.

Column	Element	Description
61-76	SPARE	
77-78	CARD TYPE	"TK"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

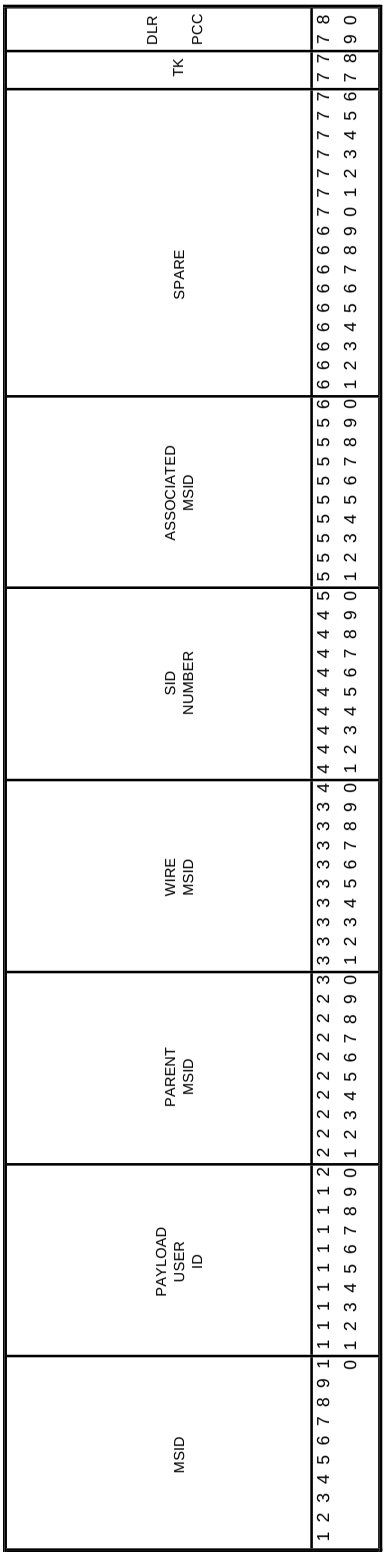


Figure C-17.- Telemetry card layout -- "TK" card (80-column format).

7.7 Card Type "TL" - Telemetry Payload Management Card 1

One "TL" card (figure C-18) is required for each measurement containing payload management requirements if the C&W limits are defined. The FDA process permits limit sense of parameters from PDI/PMU, payload BTUs, and software to provide alert and backup C&W annunciation (tones, lights, and fault messages) indicative of payload health and status. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Measurement identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier and JSC.
11-12	SPARE	
13-35	CAUTION & WARNING LIMITS	
(13)	SM ALARM CLASS CRITICAL	Specifies measurement alarm class for critical limits. May be blank. Derived by JSC PDTF generator program. 2 = C&W (payload CW indicator alarm outputs and fault messages)
(14-15)	SM ALARM CLASS INDICATOR	Specifies which C&W light is turned on by software. Right justified. May be blank. Provided by JSC. 0 = Backup C&W 15 = Payload Caution and Backup C&W
(16-17)	SM NOISE FILTER VALUE - CRITICAL	Maximum number of consecutive FDA processing samples (1-15). A parameter must be out-of-limits a consecutive number of samples before fault annunciation is enabled. After fault annunciation, this field specifies the consecutive number of samples the parameter must be back in-limits before reenabling the capability to perform fault annunciation. Right justified. Integer. Provided by payload supplier and JSC.
(18-21)	SPARE	

Column	Element	Description
(22-26)	SM CAUTION AND WARNING LOW LIMIT - CRITICAL	Specifies the lower limit for C&W annunciation. For analog parameters, this value is expressed in Engineering Units (EUs) defined for this parameter. Absence of an entry indicates a lower limit equivalent to the minimum PCM count defined for this parameter. For discrete parameters, this value (binary 0 or 1) specifies the undesired state. Right justified. Provided by payload supplier and JSC.
(27-30)	SPARE	
(31-35)	SM CAUTION AND WARNING HIGH LIMIT - CRITICAL	Specifies the upper limit for C&W annunciation. For analog parameters, this value is expressed in EUs defined for this parameter. Absence of an entry indicates an upper limit equivalent to the maximum PCM count defined for this parameter. For discrete parameters, this field is blank. Right justified. Provided by payload supplier and JSC.
36-76	SPARE	
77-78	CARD TYPE	"TL"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

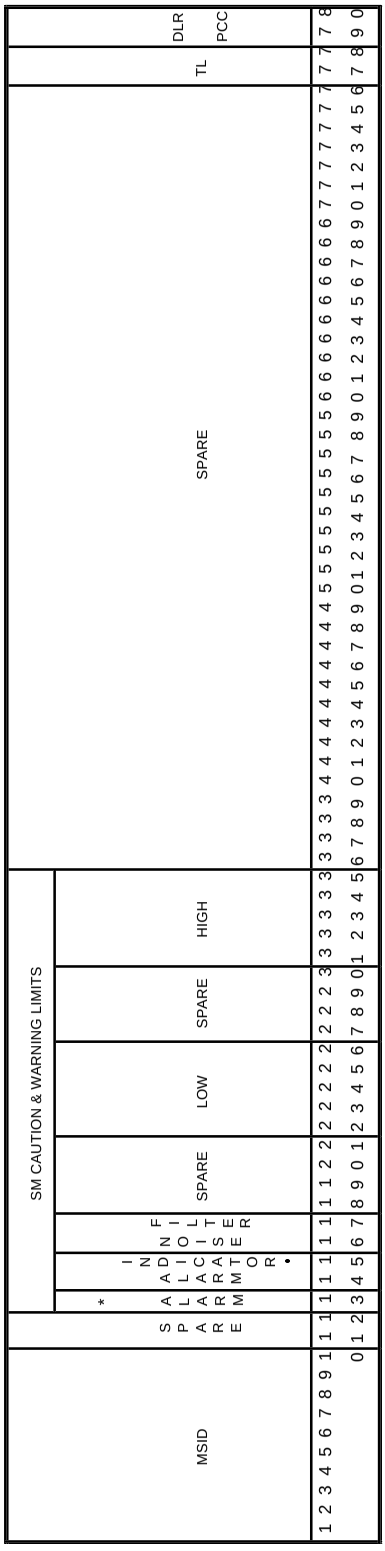


Figure C-18.- Telemetry card layout -- "TL" card (80-column format).

7.8 Card Type "TM" - Telemetry Payload Management Card 2

One "TM" card (figure C-19) is required for each measurement with alert limits. Up to three sets of limits are defined on this card. If two or three limit sets are provided, then a precondition steering equation must be provided for each limit set (see TP and TQ cards). Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Measurement identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier and JSC.
11-67	SM ALERT LIMIT SETS 1 THRU 3	
(11)	SM ALARM CLASS - ALERT	Specifies which type of alarm is turned on when an MSID has exceeded its limits. Provided by payload supplier and JSC. 3 - Alert - Alert light, alert tone outputs and fault messages 4 - GPC detected errors - fault messages only 0 - Limit sense which results in the output of a parameter status indicator with no associated fault message, alert tone, or light.
(12-13)	SM NOISE FILTER VALUE - ALERT	The maximum number of consecutive FDA processing samples (1-15); a parameter is allowed to be outside the values of its limits set before a message is displayed. Also, after fault annunciation, this field specifies the consecutive FDA processing samples the parameter must be in-limits before reenabling the capability to perform fault annunciation. For Backup Flight System (BFS) parameters, this field will always contain a "2". Right justified. Integer. Provided by payload supplier and JSC.

Column	Element	Description
(14-17)	SPARE	
(18-22)	SM LIMIT SET #1 LOW VALUE OR UNDESIRED STATE	Reference columns 22-26 on "TL" card. The inclusion of a "2" in this field indicates that the FDA state of a preconditioned discrete parameter is bypassed. Provided by payload supplier and JSC.
(23-26)	SPARE	
(27-31)	SM LIMIT SET #1 HIGH VALUE	Reference columns 31-35 on "TL" card.
(32-35)	SPARE	
(36-40)	SM LIMIT SET #2 LOW VALUE OR UNDESIRED STATE	Reference columns 22-26 on "TL" card. The inclusion of a "2" in this field indicates that the FDA state of a preconditioned discrete parameter is bypassed. Provided by payload supplier and JSC.
(41-44)	SPARE	
(45-49)	SM LIMIT SET #2 HIGH VALUE	Reference columns 31-35 on "TL" cards.
(50-53)	SPARE	
(54-58)	SM LIMIT SET #3 LOW VALUE OR UNDESIRED STATE	Reference columns 22-26 on "TL" cards. The inclusion of a "2" in this field indicates that the FDA state of a preconditioned discrete is bypassed. Provided by payload supplier and JSC.
(59-62)	SPARE	
(63-67)	SM LIMIT SET #3 HIGH VALUE	Reference columns 31-35 on "TL" cards.
68-76	SPARE	
77-78	CARD TYPE	"TM"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier and JSC.

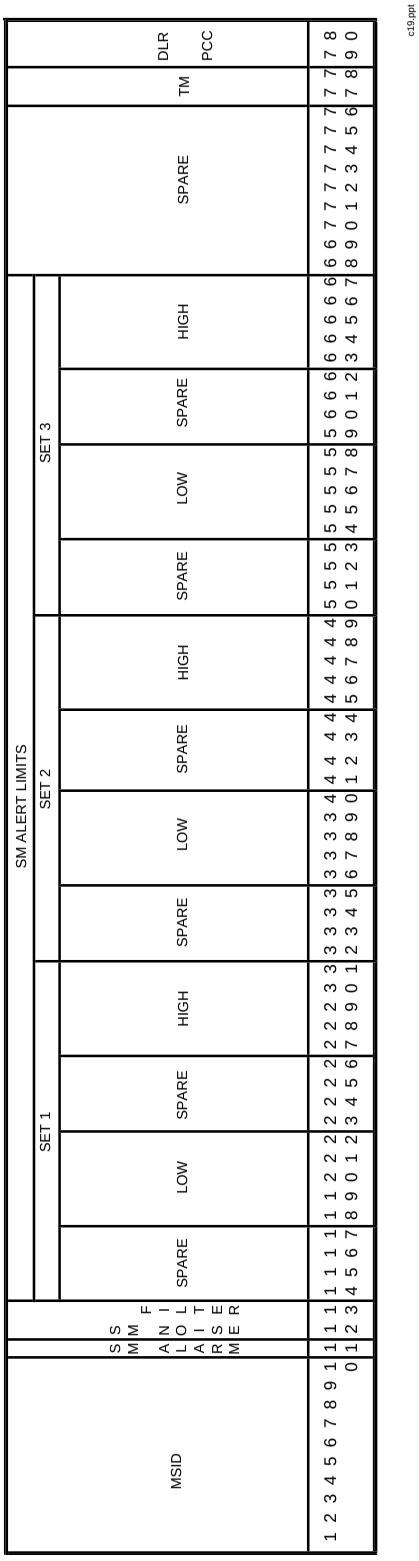


Figure C-19.- Telemetry card layout -- "TM" card (80-column format).

7.9 Card Type "TN" - Telemetry Fault Message Text Card

One "TN" card (figure C-20) is required for each measurement that is FDA'd with an alarm class 2, 3 or 4. One card is also required for any non-FDA annunciation text on a particular mission. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Measurement identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier and JSC.
11	SM MESSAGE ALARM CLASS	Code specifying the type of message text in columns 17-30 and 37-40. Provided by payload supplier and JSC. 2 = C&W 3 = Alert 4 = GPC detected errors
12-16	SPARE	
17-30	FAULT SUMMARY PAGE MESSAGE TEXT-MAJOR	Major field message text displayed on the CRT message line and fault summary page. The first four characters are reserved for the onboard display number. Left justified. The last 10 characters contain the message text. Also left justified. Alphanumeric. Provided by payload supplier and JSC.
31-36	SPARE	
37-40	FAULT SUMMARY PAGE MESSAGE TEXT-MINOR	Minor field of message text displayed on the CRT message line and fault summary page. This field may be blank. Left justified. Alphanumeric. Provided by payload supplier and JSC.
41-76	SPARE	
77-78	CARD TYPE	"TN"
79-80	CARD NUMBER/ DELTA LOADER PCC	Number (01-02). Two TN cards are required if both C&W and alert messages are needed for a single measurement. Integer. Leading zeros. Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

Figure C-20.- Telemetry card layout - "TN" card (80-column format).

			MESSAGE TEXT MAJOR						
MSID	SM ALRM	SPARE	* DISPLAY NO.	MESSAGE	SPARE	MESSAGE TEXT MINOR	SPARE	TN	01 02 DLR PCC
1 2 3 4 5 6 7 8 9 10	11	12 13 14 15 16	17 18 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40	41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76	77 78	79 80

* Provided by JSC. Only one display number can be used for each MSID.

c20.ppt

7.10 Card Type "TP" - Telemetry Precondition Card 1

One "TP" card (figure C-21) is required for each set of precondition steering equation(s). There could be 3 "TP" cards, one for each of three possible limit sets. There must be at least two limit sets, each with a precondition equation(s), for precondition steering to be used.

Precondition steering is a decision-making function which determines if conditions are met to initiate fault detection for an individual parameter. Precondition steering is executed (once per second rate) using the current values of the precondition input parameters. The capability shall exist to use a single parameter as a precondition discrete or to logically combine several parameters to obtain a single precondition discrete. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Measurement identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier and JSC.
11	SM LIMIT SET NUMBER	The number assigned to a particular set of limit values. Provided by payload supplier and JSC. 1 = Set 1 (TP01 card only) 2 = Set 2 (TP02 card only) 3 = Set 3 (TP03 card only)
12-16	LIMIT SENSE TIME DELAY	Specifies the limit sense time delay (1-32767 major cycles, where 1 major cycle = 0.96 sec) from the time that a precondition has been met (initially) to the time that fault detection is to begin, to allow for warm up, valve travel, etc. A blank means no time delay is required. Right justified. Integer. Provided by payload supplier and JSC.
17-20	SPARE	
21-36	MEASUREMENT 1 OF PRECONDITION EXPRESSION	Provided by payload supplier and JSC.

Column	Element	Description
(21)	OPEN PARENTHESIS	Open parenthesis used to allow grouping of elements in the expression or blank.
(22-31)	MSID 1	Measurement #1 in the precondition expression. Left justified.
(32-33)	STATE	The required state for the precondition measurement: For discretes, 1 or 0; for analog or digital, IL or OL (in-limit or out-of-limit). Left justified.
(34)	CLOSED PARENTHESIS	Closed parenthesis used to allow grouping of elements in the expressions as required or blank.
(35-36)	LOGICAL OPERATION	The logical operation between the corresponding precondition parameters required to satisfy the precondition solution. AN - AND Operation OR - OR Operation
37-52	MEASUREMENT 2 OF PRECONDITION EXPRESSION	Provided by payload supplier and JSC.
(37)	OPEN PARENTHESIS	Open parenthesis used to allow grouping of elements in the expression or blank.
(38-47)	MSID 2	Measurement #2 in the precondition expression. Left justified.
(48-49)	STATE	The required state for the precondition measurement: For discretes, 1 or 0; for analog or digital, IL or OL. Left justified.
(50)	CLOSED PARENTHESIS	Closed parenthesis used to allow grouping of elements in the expressions as required or blank.
(51-52)	LOGICAL OPERATION	The logical operation between the corresponding precondition parameters required to satisfy the precondition solution. AN - AND Operation OR - OR Operation

Column	Element	Description
53-68	MEASUREMENT 3 OF PRECONDITION EXPRESSION	Provided by payload supplier and JSC.
(53)	OPEN PARENTHESIS	Open parenthesis used to allow grouping of elements in the expression or blank.
(54-63)	MSID 3	Measurement #3 in the precondition expression. Left justified.
(64-65)	STATE	The required state for the precondition measurement: For discretes, 1 or 0; for analog or digital, IL or OL (in-limit or out-of-limit). Left justified.
(66)	CLOSED PARENTHESIS	Closed parenthesis used to allow grouping of elements in the expressions as required or blank.
(67-68)	LOGICAL OPERATION	The logical operation between the corresponding precondition parameters required to satisfy the precondition solution. Required only if a "4" appears in Column 69. AN - AND Operation OR - OR Operation
69	NUMBER OF MEASURE-MENTS IN PRE-CONDITION EXPRESSION	The number (1-4) of precondition expression measurements. If this field contains a 4 then a continuation card (TQ card) is required. Integer. Derived by JSC PDT generator program.
70-76	SPARE	
77-78	CARD TYPE	"TP"
79-80	CARD NUMBER/ DELTA LOADER PCC	"01", "02", "03", as required. Up to 3 "TP" cards may be required per "TM" card. Leading zeros. Integer. Delta Loader PCC "@@" symbol used only for card deletion. Provided by payload supplier or JSC.

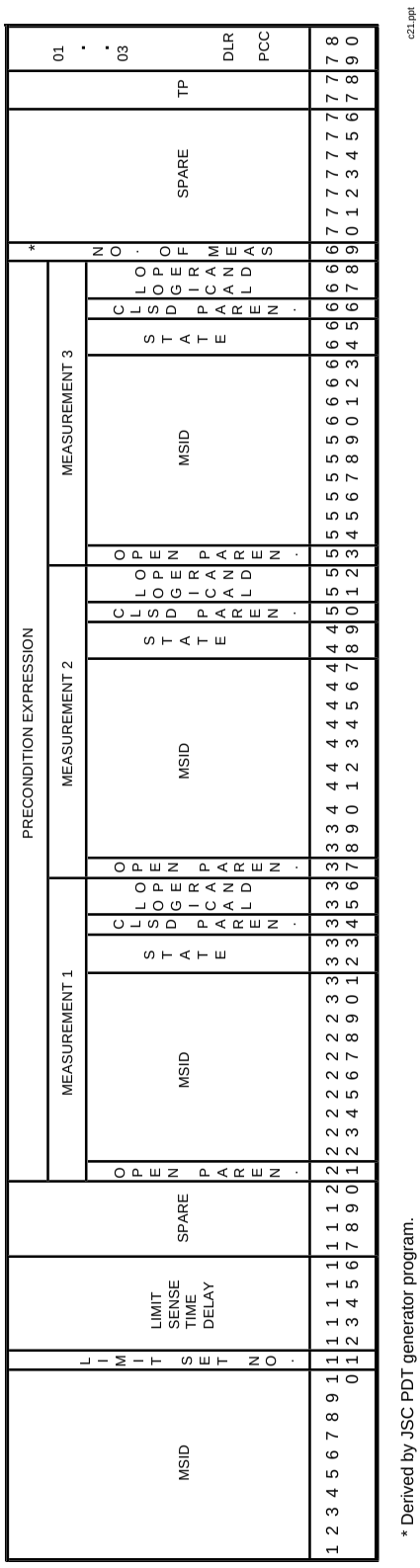


Figure C-21.- Telemetry card layout -- "TP" card (80-column format).

7.11 Card Type "TQ" - Telemetry Precondition Card 2

One "TQ" card (figure C-22) is required for precondition equations for each of three possible limit sets when there are 4 measurements in the expression. There can be up to 3 "TQ" cards. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Measurement identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier and JSC.
11	SM LIMIT SET NUMBER	The number assigned to a particular set of limit values. This number must have a matching "TP" card. Provided by payload supplier and JSC. 1 = Set 1 (TQ01 card only) 2 = Set 2 (TQ02 card only) 3 = Set 3 (TQ03 card only)
12-20	BLANK	
21-36	MEASUREMENT 4 OF PRECONDITION EXPRESSION	Provided by payload supplier and JSC.
(21)	OPEN PARENTHESIS	Open parenthesis used to allow grouping of elements in the expression or blank.
(22-31)	MSID 4	Measurement #4 in the precondition expression. Left justified.
(32-33)	STATE	The required state for the precondition measurement: For discretes, 1 or 0; for analog or digital, IL or OL (in-limit or out-of-limit). Left justified.
(34)	CLOSED PARENTHESIS	Closed parenthesis used to allow grouping of elements in the expressions as required or blank.
(35-36)	BLANK	
37-76	SPARE	
77-78	CARD TYPE	"TQ"

Column	Element	Description
79-80	CARD NUMBER/ DELTA LOADER PCC	"01", "02", "03", as required. Up to 3 "TQ" cards may be required per "TM" card. Leading zeros. Integer. Delta Loader PCC "@@" symbol used only for card deletion. Provided by payload supplier or JSC.

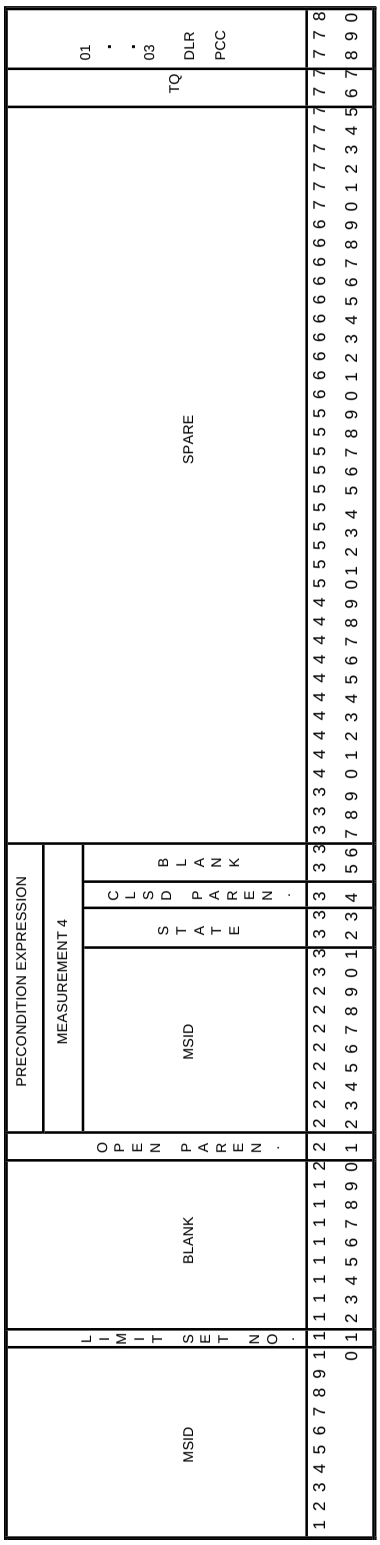


Figure C-22.- Telemetry card layout -- "TQ" card (80-column format).

7.12 Card Type "TR" - Telemetry Calibration Card 1

Scaling coefficients must be present for all analog measurements for conversion from PCM counts to EU. (Card "TR", figure C-23.)

If onboard processing is required, this curve cannot be more complex than third order. If both onboard and Space Shuttle ground processing are required then the ground processing is also constrained to third order, since only a single curve can be supplied. If ground processing only is required, this curve may be up to fifth order in complexity. For continuation beyond second order use "TS" card.

The calibration coefficients apply to the following polynomial:

$$EU = (A_0 + A_1X^1 + A_2X^2 + A_3X^3 + A_4X^4 + A_5X^5)$$

where X = PCM count

Column	Element	Description
1-10	MSID	Measurement identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11-13	SPARE	
14	CALIBRATION DEGREE	Integer defining the degree of curve fit. 1 = First Order 2 = Second Order 3 = Third Order* 4 = Fourth Order* 5 = Fifth Order* *Third, fourth and fifth order will require a "TS" card. Provided by payload supplier and derived by the PDT generator.
15	SPARE	
16-21	CAL. LOW INDEPENDENT VAR.	PCM count value corresponding to the low value of data range. Integer. Right justified. Provided by payload supplier.
22-27	CAL. HIGH INDEPENDENT VAR.	PCM count value corresponding to the high value of data range. Integer. Right justified. Provided by payload supplier.

Column	Element	Description
28-41	A_0 COEFFICIENT	A_0 coefficient value. Same format as CV card, columns 13-26. Provided by payload supplier.
42-55	A_1 COEFFICIENT	A_1 coefficient value. Same format as CV card, columns 13-26. Provided by payload supplier.
56-69	A_2 COEFFICIENT	A_2 coefficient value. Same format as CV card, columns 13-26. Provided by payload supplier.
70-76	SPARE	
77-78	CARD TYPE	"TR"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

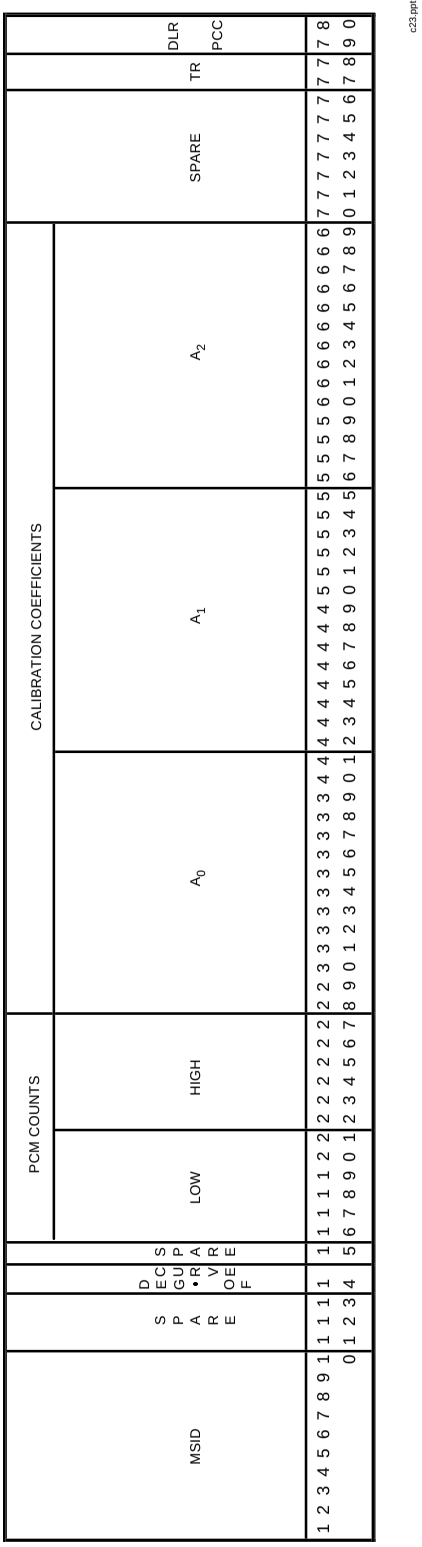


Figure C-23.- Telemetry card layout -- "TR" card (80-column format).

7.13 Card Type "TS" - Telemetry Calibration Card 2

A "TS" card (figure C-24) is a continuation of the "TR" card. It is used for specifying calibration coefficients for 3rd, 4th, and 5th order polynomials. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Measurement identification number. Alphanumeric. Left justified. Refer to appendix B. Provided by payload supplier.
11-15	SPARE	
16-29	A_3 COEFFICIENT	A_3 coefficient value. Same format as "CV" card, columns 13-26. Provided by payload supplier.
30-43	A_4 COEFFICIENT	A_4 coefficient value. Same format as "CV" card, columns 13-26. Provided by payload supplier.
44-57	A_5 COEFFICIENT	A_5 coefficient value. Same format as "CV" card, columns 13-26. Provided by payload supplier.
58-76	SPARE	
77-78	CARD TYPE	"TS"
79-80	DELTA LOADER PCC	Delta Loader PCC "@@" symbol used only for card deletion. Blank otherwise. Provided by payload supplier or JSC.

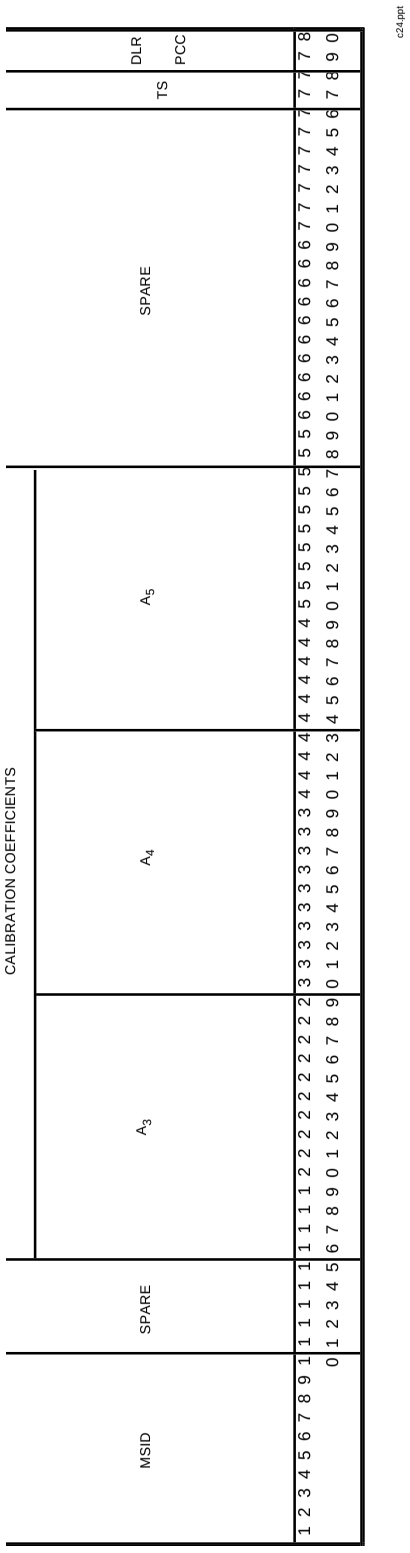


Figure C-24.- Telemetry card layout -- "TS" card (80-column format).

7.14 Card Type "TT" - Telemetry Format Requirements Card

Card "TT" (figure C-25) defines format requirements for the following:

a. OI

b. PDI

c. Independent Data Streams

d. Reconstructed Data Streams

e. Downlist

Each format definition will be contained on one "TT" card. Multiple cards can exist. The JSC will supply all format numbers prior to tape formation. Spare columns may contain data on JSC-supplied tapes.

Column	Element	Description
1-10	MSID	Measurement identification number. Left justified. Alphanumeric. Refer to appendix B. Provided by payload supplier.
11-14	TLM FORMAT ID	Code identifying the payload data stream, whether independent of the PDI, input to the PDI or reconstructed as it leaves the PDI in the downlink. Left justified. On an unintegrated tape, the following codes will be provided by the payload supplier: PDIA-PDIZ = PDI Input PLRA-PLRZ = Payload Reconstructed EXCN = Spacelab Experiment Computer SSCN = Spacelab Subsystem Computer OILA-OILZ = 64 kbps Telemetry Format Load OIHA-OIHZ = 128 kbps Telemetry Format Load INDA-INDZ = Independent BFS = BFS Ascent/Descent Downlist SM = S2/S4 Downlist VU = VU (Ground checkout) Downlist **Not applicable for Process Control Indicators (PCIs).** On an integrated tape, the following codes will be provided by JSC: 01-11, 14-19, 27-31 = PDI Input

Column	Element	Description
		12 = BFS Ascent 13 = BFS Descent 24 = S2 Downlist 25 = S4 Downlist 60 = VU Downlist **Not applicable for PCIs.** 80-89 = Assigned to KSC for unique payload independent data stream processing and will not appear in any JSC product 100-127 = 64 kbps Telemetry Format Load 128-255 = 128 kbps Telemetry Format Load 800-899 = Reconstructed Payload Format 900-999 = Payload Independent EXCN = Spacelab Experiment Computer SSCN = Spacelab Subsystem Computer NASA-IDL descriptions of PDI input formats will be 900 plus the corresponding PDI input format ID. NASA-IDL descriptions of PDI input formats that have been reconstructed by the PDI and placed in the OD will be 800 plus the corresponding PDI format ID. If the payload supplier elects to provide numeric telemetry format IDs, the JSC PDI loader program will automatically convert the numeric IDs to the above alpha characters.
15	TLM FORMAT INDICATOR	This field is used to indicate the type of telemetry stream. Derived by JSC PDT generator program. 1 = GPC (Downlist) 2 = OI/128 kbps 3 = OI/64 kbps 4 = Payload Reconstructed 5 = Payload Independent 8 = PDI Format 9 = PCMMU Fetch Requirements (i.e., Spacelab TMB)

Column	Element	Description
16-19	TLM REQUIRED RESPONSE RATE	The rate at which the MSID is extracted from the telemetry and stored in the data Random Access Memory (RAM). Leading zeros. Provided by payload supplier and JSC. Integer or blank. a. For PDI and PLR formats (TLM Format Indicator = 8 and 4), this is the required decom rate for the data RAM in the PDI in samples per major frame; for parameters that only appear in the PDI windows (PDI toggle buffer only) this field is blank. All MSIDs in the same PDI and the same word column must have the same required rate. b. For downlist formats (TLM Format Indicator = 1), this is the rate at which this MSID is required to be loaded into the PCMMU toggle buffers in samples per second. c. For payload independent formats (TLM Format Indicator = 5), this field is blank. d. For OI formats (TLM Format Indicator = 2 or 3), this is the minimum rate at which the measurement is required to appear in the downlink format in samples per second. e. For PCMMU fetch requirements (TLM Format Indicator = 9), this is the rate at which data is required to be loaded in the PCMMU data RAM in samples per second.
20-23	TLM ACTUAL RESPONSE RATE	This is the actual rate in samples per major frame that data is inserted in the telemetry format (how many times an MSID occurs in a major frame). Must be one of the valid available sample rates. Right justified. Integer or blank. Provided by payload supplier.

Column	Element	Description
		a. For PDI and PLR formats (TLM Format Indicator = 8 and 4), this is the actual rate in samples per major frame. b. For downlist formats (TLM Format Indicator = 1), this field is blank. c. For payload independent formats (TLM Format Indicator = 5), this is the actual rate in samples per major frame. d. For OI formats (TLM Format Indicator = 2 or 3), this field is blank. e. For PCMMU fetch requirements (TLM Format Indicator = 9), this field is blank.
24-27	TLM FIRST WORD OR SL TMB ADDRESS	Integer number of the first word in the major frame (format mode 1), minor frame (format modes 2, 3, 6, and 7) or subframe (format mode 5) in which the measurement appears. Blank for format mode 4. **The first word in a frame is always numbered 0001.** Refer to figure A-0 and minor frame length in section 1.1. For Spacelab (format EXCN and SSCN) this field specifies the TMB address of the MSID. Provided by payload supplier. Leading zeros.
28-30	TLM FIRST FRAME	Integer value of the first frame in which the measurement appears. Required for format modes 1, 2, 3, 5, 6, and 7. Blank otherwise. Leading zeros. For format modes 3 and 7, the value in this field must be consistent with the minor frame counter initial value ("TB" card, columns 30-32). Provided by payload supplier.
31-33	TLM FIRST SUBFRAME	Integer value of the subframe counter in the first subframe in which the measurement appears. Required for format modes 5-7. Blank otherwise. Leading zeros. Provided by payload supplier.
34-56	SPARE	
57	TLM LOW BIT RATE INDICATOR	GPC downlist low bit rate indicator. Provided by JSC.

Column	Element	Description
		0 = High Data Rate Only (applicable to SM and VU formats) 1 = High and Low Data Rate (applicable to SM formats only)
58	SPARE	
59-60	FORMAT START BIT	Integer number (00-63) of the bit in the telemetry data word in which the measurement begins. Required for independent format only (format indicator = 5). Blank for all other formats. Leading zeros. Provided by payload supplier.
61-76	SPARE	
77-78	CARD TYPE	"TT"
79-80	CARD NUMBER/ DELTA LOADER PCC	Number (01-99). **Multiple cards are necessary if more than one format is required.** Leading zeros. Integer. Provided by PDT generator. Delta Loader PCC "@@" symbol used for card deletion. Provided by payload supplier or JSC.

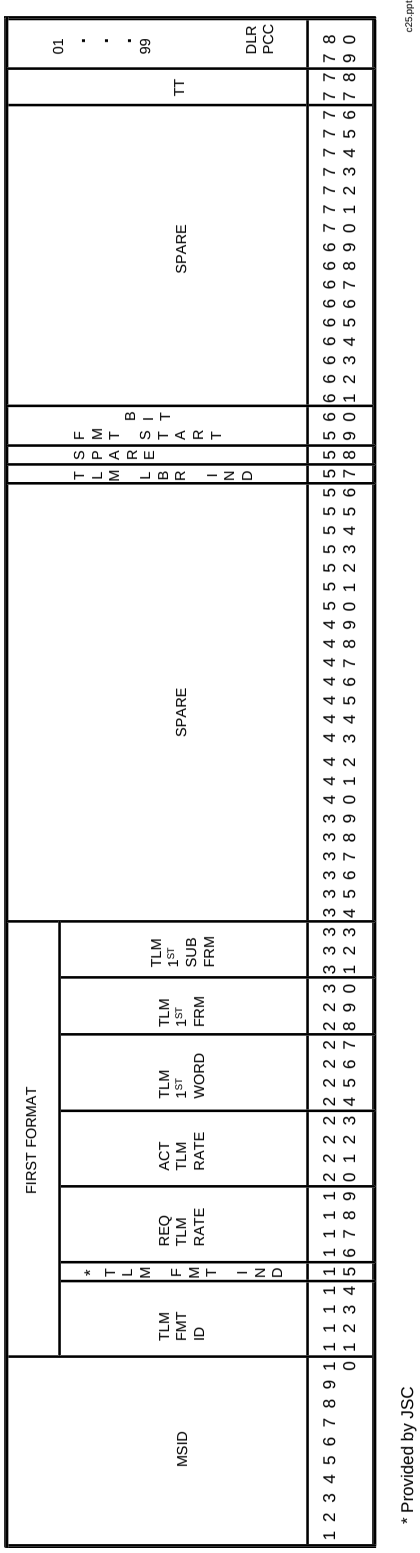


Figure C-25.- Telemetry card layout -- "TT" card (80-column format).

APPENDIX D

DATA TYPES

1.0 DEFINITIONS

Data types provide a means to interpret binary data. The definitions of the data types recognized by National Aeronautics and Space Administration (NASA) Lyndon B. Johnson Space Center (JSC) are presented.

AMB = Analog Bipolar. An 8- or 10-bit bipolar signal. Data is represented in 2's complement form. Bit 00 is the Most Significant Bit (MSB).

For an 8-bit parameter, the valid Pulse Code Modulation (PCM) range is -127 to +126 counts. Offscale low will occur at -128 counts, and offscale high will occur at +127 counts.

For a 10-bit parameter, the valid PCM range is -511 to +510. Offscale low will occur at -512 counts, and offscale high will occur at +511 counts.

AMU = Analog Unipolar. An 8- or 10-bit unipolar signal. Bit 00 is the MSB.

For an 8-bit parameter, the data is represented as an unsigned analog. The valid PCM range is +1 to +254 counts. Offscale low will occur at 0 PCM counts, and offscale high will occur at +255 counts.

For a 10-bit parameter, the data is represented in 2's complement form. The valid PCM range is +1 to +499 counts. Offscale low will occur in the PCM range of -512 to 0 counts. Offscale high will occur in the PCM range of +500 to +511 counts.

BCD = Binary Coded Decimal. A 4-bit code defining a decimal number (base = 10) in accordance with the following codes.

Binary Code	Decimal Number
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9

BCH = Binary Coded Hexadecimal. A 4-bit code defining a hexadecimal number (base = 16) in accordance with the following codes.

Binary Code	Hexadecimal Number	Decimal Equivalent
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15

BD = Binary Discrete. Parameter is a 1-bit binary 1 or 0. The location within its parent word is specified by the start bit.

BMD = Packed Bit String, Mixed Data. A contiguous bit string that contains various information. The start bit will be from 00 to 62. The number of bits will be from 02 to 64.

BMS = Bit String, Magnitude and Sign. A parameter that contains a sign bit and one to 63 magnitude bits. The most significant bit is the bit immediately to the right of the sign bit. The start bit defined the location of the sign bit within the parent word. Parameter length (number of bits) specifies the length of the parameter including the sign bit.

Bit XX = Sign 0 = Positive 1 = Negative

where: XX = 00 to 62

Note: Magnitude is always in positive binary form.

Bit XX+1 = MSB

BSS = Packed Bit String, Signed. The most significant data bit will be the bit following the sign bit. A parameter that contains a sign bit and 1 to 63 magnitude bits. The start bit will specify the location of the sign bit within the parent word. Parameter length (number of bits) will specify the length of the parameter including the sign bit.

Bit XX = Sign 0 = Positive 1 = Negative

where: XX = 00 to 62.

Note: If sign is negative, the magnitude is in two's complement form.

Bit XX+1 = MSB

BSU = Packed Bit String, Unsigned - Parameter that contains two to 63 magnitude bits. The start bit will specify the location of the most significant bit within the parent word. The number of bits will specify the length of the parameter from 02 to 64.

Bit XX = MSB

where: XX = 00 to 62.

CHE = Measurements containing 8 bits of EBCDIC. Character data measurements are submeasurements (associated with parent/ grandparent measurements) which can be assembled to define message text from the character data string.

CHU = Measurements containing 8 bits of European ASCII. Character data measurements are submeasurements (associated with parent/grandparent measurements) which can be assembled to define message text from the character data string.

DMD = Double Word, Mixed Data. A 64-bit word that contains various information. It may also be referred to as a 64-bit parent word that contains one or more embedded signals or less than 64 bits parameter length.

DPL = Double Precision Floating Point (64 bits). A floating point number consisting of an unsigned characteristic (or exponent) and a signed fraction. The quantity expressed by this number is the product of the fraction and the number 16 raised to the power of the exponent.

Bit 00 = Sign of Fraction
0 = Positive
1 = Negative

Bit 01-07 = Characteristic - A binary number with a range of 0 through 127. The exponent is derived by subtracting 64 from the characteristic. Therefore, the range of the exponent is -64 through +63.

Bit 08-63 = Fraction - binary number less than 1 with the binary point to the left of the high-order digit (between bits 7 and 8).

DUC = Digital Uplink Command. Identifies a digital uplink command as defined by an MSID and unique digital encoded data.

EMD = Extended Word, Mixed Data. A 48-bit word that contains various information. It may also be referred to as a 48-bit parent word that contains one or more embedded signals or less than 48 bits parameter length.

FMD = Fullword, Mixed Data. A 32-bit word that contains various information. It may also be referred to as a 32-bit parent word that contains one or more embedded signals or less than 32 bits parameter length.

FPL = 2's complement floating point. Measurements containing a 32-bit/64-bit floating point format. The floating point format is the same as SPL and DPL with the exception that negative values are in 2's complement form.

FXS = Fullword, Fixed Point, Signed. A 32-bit word containing a signed, fixed point number of 32 bits parameter length.

Bit 00 = Sign 0 = Positive 1 = Negative

Note: If sign is negative, the magnitude is in two's complement form.

Bit 01 = MSB

Bit 31 = LSB

FXU = Fullword, Fixed Point, Unsigned. A 32-bit word containing an unsigned, fixed point number of 32 bits parameter length.

Bit 00 = MSB

Bit 31 = LSB

HFS = Halfword, Fixed Point Overflow, Signed. A 16-bit word containing a sign bit, an overflow-bit, and 10 magnitude bits.

Bit 00 = Sign 0 = Positive 1 = Negative

Bit 01 = Overflow 1 = Overflow 0 = No overflow

Bit 02 = MSB

Bit 11 = LSB

Note: Bits 02-11 are magnitude only; the sign bit (00) indicates polarity.

HMD = Halfword, Mixed Data. A 16-bit word that contains various information. It may also be referred to as a 16-bit parent word that contains one or more embedded signals of less than 16 bits parameter length.

HMS = Halfword, Magnitude, and Sign. A 16-bit word containing a sign bit and 15 magnitude bits.

Bit 00 = Sign 0 = Positive 1 = Negative

Note: Magnitude is always in positive binary form.

Bit 01 = MSB

Bit 15 = LSB

HPL = Halfwords, Precision Floating Point (16 bits). A floating point number consisting of an unsigned characteristic (or exponent) and a signed fraction. The quantity expressed by this number is the product of the fraction and the number 16 raised to the power of the exponent.

where:

Bit 00 = Sign of fraction

Bit 0 = Positive

Bit 1 = Negative

Bit 01-07 = Characteristic-A binary number with a range of 0 through 127. The exponent is derived by subtracting 64 from the characteristic. Therefore, the range of the exponent is -64 through +63.

Bit 08-15 = Fraction-A binary number less than 1 with the binary point to the left of the high order digit (between bit 7 and 8).

HXS = Halfword, Fixed Point, Signed. A 16-bit word containing a signed, fixed point number of 16 bits parameter length.

Bit 00 = Sign 0 = Positive 1 = Negative

Note: If sign is negative, the magnitude is in two's complement form.

Bit 01 = MSB

Bit 15 = LSB

HXU = Halfword, Fixed Point, Unsigned. A 16-bit word containing an unsigned, fixed point number of 16 bits parameter length.

Bit 00 = MSB

Bit 15 = LSB

QMD = Quarter Word, Mixed Data. An 8-bit word that contains various information. It may also be referred to as an 8-bit parent word that contains one or more embedded signals of less than 8 bits parameter length.

SPL = Single Precision Floating Point (32 bits). A floating point number consisting of an unsigned characteristic (or exponent) and a signed fraction. The quantity expressed by this number is the product of the fraction and the number 16 raised to the power of the exponent.

where:

Bit 00 = Sign of Fraction
0 = Positive
1 = Negative

Bit 01-07 = Characteristic - A binary number with a range of 0 through 127. The exponent is derived by subtracting 64 from the characteristic. Therefore, the range of the exponent is -64 through +63.

Bit 08-31 = Fraction - A binary number less than 1 with the binary point to the left of the high order digit (between bit 7 and 8).

VAR = Variable Data. A 16-bit parameter that is utilized to downlink multiple data or data with variable content.

2.0 FLIGHT SOFTWARE INTERPRETATION OF DATA TYPE

This section will describe how the flight software will interpret binary digits for a parameter. This interpretation is based on the parameter's data type, data length, and the ninth character of the MSID as shown in the following tables:

A = 10-bit unipolar analog
B = 10-bit bipolar analog with sign
C = Analog parameter
D = Digital
E = Discrete
F = 8-bit signed two's complement analog
G = 8-bit unsigned analog
H = 8-bit signed analog plus magnitude
P = Parent MSID

Data type	Data length	MSID 9th character	Flt SW interpretation (onboard)
AMB	08	Don't care	F
	10	Don't care	B
AMU	08	Don't care	G
	10	Don't care	A
BCD	Don't care	Don't care	D
BCH	Don't care	Don't care	D
BD	Don't care	Don't care	E
BMD	Don't care	Don't care	D
BMS	08	Don't care	H
	Not 08	Don't care	D
BSS	08	Don't care	F
	10	Don't care	B
	Not (8 or 10)	Don't care	D
BSU	08	See note	D or G
	10	Don't care	A
	Not (8 or 10)	Don't care	D
DMD	Don't care	Don't care	D
FMD	Don't care	Don't care	D
FXS	Don't care	C	C
	Don't care	Not C	D
FXU	Don't care	C	C
	Don't care	Not C	D
HFS	Don't care	C	C
	Don't care	Not C	D
HMD	Don't care	P	P
	Don't care	Not P	D
HMS	Don't care	C	C
	Don't care	Not C	D

Data type	Data length	MSID 9th character	Flt SW interpretation (onboard)
HXS	Don't care	C	C
	Don't care	Not C	D
HXU	Don't care	C	C
	Don't care	Not C	D
QMD	Don't care	P	P
	Don't care	Not P	D
DPL	Don't care	C	C
	Don't care	Not C	D
SPL	Don't care	C	C
	Don't care	Not C	D
VAR	Don't care	Don't care	D

Note: If the A_1 coefficient is blank, then the software interpretation will be D, otherwise the interpretation will be G.

APPENDIX E

ENGINEERING UNITS AND EVENT STATE INDICATORS

1.0 ENGINEERING UNITS

To provide standardization among payloads, the Engineering Units (EUs) provided below should be utilized. The values listed are for reference only. **If the true EUs are not listed, then any meaningful abbreviation of seven characters or less preceded by an asterisk may be used.** EUs for all discretes, whether applicable to commands or telemetry, should be EVENT.

ENGINEERING UNITS

Abbreviation	Description
AMP	Ampere
ARCMIN	Arc minute
ARCS	Arc second
AU	Astronomical unit
B/F/S	British Thermal Unit (BTU) per square foot per second
C	Cycle
CDT	Count down time
CNT	Count
D	Day
D/H	Days per hours
D/H/M/S	Days per hours per minutes per seconds
DB	Decibel
DBM	Decibel referred to one milliwatt
DEG	Degree
DEG/DEG2	Degree per degree squared
DEG/HR	Degree per hour
DEG/HR/G	Degree per hour per G
DEG/S	Degree per second
DEG/S2	Degree per second squared
DEGC	Degree Celsius
DEGF	Degree Fahrenheit
DEGK	Degree Kelvin
DEGR	Degree Rankin
EVENT	Discrete/event
FT	Feet
FT/S	Feet per second
FT/S2	Feet per second squared
FT2	Square feet
FT2/S2	Feet squared per second squared
FT3	Cubic feet

ENGINEERING UNITS (Continued)

Abbreviation	Description
G	Gravity
GAL	Gallon
GAL/MIN	Gallons per minute
GHZ	Gigahertz
GM	Gram
GMT	Greenwich mean time
GP-P	Gravity peak to peak
H/MIN	Hours and Minutes
HR	Hour
HZ	Hertz
IN	Inch
IN-LB	Inch pounds
INHG	Inches of mercury column
INH20	Inches of water column
INTEGR	Integer
INTENS	Intensity
INTRVL	Interval time
KFT	Kilofeet
KFT/S	Kilofeet per second
KGAL	Kilogallon
KHZ	Kilohertz
KLBF	Kilopound force
KRPM	Kilorevolution per minute
KT	Knot
KT/S	Knots per second
KW	Kilowatts
KW/M2	Kilowatts per meter squared
LBF	Pound force
LBF/FT2	Pound force per square foot
LBF/FT/S	Pound force per square foot per second
LBM	Pound mass
LBM/HR	Pound mass per hour
LBM/FT3	Pound mass per cubic foot
LBM/S	Pound mass per second
M	Meter
M/S	Meter per second
MACH	Mach
MAMP	Milliampere
MEGAHZ	Mega hertz
MET	Mission elapsed time: days, hours, minutes, seconds

ENGINEERING UNITS (Continued)

Abbreviation	Description
MFT	Megafeet
MGM/M3	Milligrams per cubic meter
MI	Mile
MI/S	Mile per second
MIN	Minute
MIN/S	Minute plus seconds
MJ	Millijoule
MM	Millimeter
MMHG	Millimeter of Mercury
MRAD/S	Milliradian per second
MS	Millisecond
MV	Millivolt
MVAC	Millivolt AC
MVDC	Millivolt DC
ND	Non-dimensional
NM	Nautical mile
NM/FT/S2	Nautical mile per feet per second squared
NM-FT/S2	Nautical mile - feet per second squared
NULL	Null
OHM	Resistance
P	Pulse
PCT	Percent
PPM	Parts per million
PPS	Parts per second
PSI	Pounds per square inch
PSI/MIN	Pounds per square inch per minute
PSIA	Pounds per square inch absolute
PSIA/S	Pounds per square inch absolute per second
PSID	Pounds per square inch differential
PSIG	Pounds per square inch gauge
R/S/R/S	Radian per second per radian per second
RAD	Radian
RAD/S	Radian per second
RAD/S/G	Radian per second per Gravity
RAD/S2	Radian per second squared
RAD2	Radian squared
RPM	Revolution per minute
S	Second
S/FT	Second per foot
S/MS	Seconds and milliseconds
S/RAD	Seconds per radian
S2/FT	Second square per foot

ENGINEERING UNITS (Concluded)

Abbreviation	Description
SLUG	Slug
SLUGS/S	Slugs per second
SPECIAL	Special parameter decom
TORR	1/760 atmosphere
UAMP	Microamp
UG	Microgravity
UG/G	Microgravity per gravity
UGM/M3	Microgram per cubic meter
UIN	Microinch
UIN/IN	Microinch per inch
UM	Micrometer
UM/M	Micrometer per meter
UNITS	Units
US	Microsecond
VAC	Volts Alternating Current
VDC	Volts Direct Current
VP-P	Volts peak to peak
VRMS	Volts root mean square
W	Watt
1/S	Once per second

Table E-1.- EVENT STATE INDICATORS

Data Range Low/High					
BLANK	FWD	A-ON	INCR	STOW	MLS 1
BU	GMT	AA 1	INHB	SYNC	MLS 2
CH	GNC	AA 2	INIT	TDRS	MLS 3
CP	GND	AA 3	JTSN	TERM	NCMPL
GO	GPC	AA 4	KU A	TEST	NOADD
HX	INH	ABNL	LEFT	TMNY	NONEX
ID	INT	AC 1	LOAD	TRIM	NOWOW
IN	IPL	AC 2	LOCK	TRIP	NTRPT
KU	LCH	ACTV	LOST	TYPE	P/GPC
ME	LOW	ANLG	MALF	UNBL	PGE 1
MS	MAX	AUTO	MN A	UPDT	PGE 2
OK	MNL	B-ON	MN B	UPLK	POS 1
ON	NEG	BITE	NEAR	VIEW	POS 2
PL	NEX	BOTH	NEOL	VLTN	POS 3
PS	NRZ	C-ON	NORM	WEST	PULSE
SM	NZR	CH 1	NRDY	AB-ON	PURGE
TV	O/L	CH 2	OPEN	ABORT	RCVHI
UP	O/T	CH 3	OPER	ACTVT	RCVLO
A/A	O/U	CH 4	OVLD	ARMED	READY
ACQ	ODD	CLSD	OVRD	AVAIL	RESET
ACT	OFF	CNTL	PASS	CHECK	RIGHT
AC1	ONE	DECR	PEAK	CLOSE	SAFED
AC2	OPR	DEPL	PEND	CODED	SCALE
AC3	OUT	DEST	PRFM	COMPL	SEE A
AFT	P/L	DGTL	PRGM	DIRCT	SEL B
ARM	POS	DNLK	RA 1	DPOUT	SEL C
AVG	PS2	DOWN	RA 2	DTECT	SFTST
BOT	PWR	DSBL	RCDR	DISCH	SHTDN
BRT	RCV	EAST	RCVD	ENABL	SIMLT
BYP	RDY	ENBL	RDTR	ERASE	START
C/D	REL	ENGA	READ	ERROR	STDBY
C/U	REV	EVEN	RETR	EVA 1	SUPPR
CHG	RUN	EXEC	RQST	EVA 2	TAC 1
CLD	RVS	FAIL	RTST	FIRED	TAC 2
DES	SEC	FCTN	S BD	INTCH	TAC 3
DET	SEL	FIRE	SAFE	INTRG	TRACK
ENA	SIM	FLAG	SEPN	INVLD	TRANS
EOT	T/O	GOOD	SGLS	LATCH	UPPER
ERR	T/R	HALT	SLEW	LOOP1	VALID
FAR	VAR	HIGH	STAT	LOOP2	XMTHI
FRZ	XFD	ILEG	STOP	LOWER	XMTLO

Data Range Low	Data Range High
0	1
0	+1
0	100
1	0
1	2
2	1
A	B
B	A
+1	0
CL	OP
GO	NO-GO
IN	OUT
NO	YES
ON	OFF
OP	CL
100	0
ARM	SAFE
ATT	DPLY
CMD	PNL
COH	NCOH
DES	SEL
DRY	WET
ENA	INH
FIX	VAR
FWD	BACK
INH	ENA
LOW	NORM
LOW	OFF
OFF	ON
OFF	LOW
OFF	CLSD
OFF	ENBL
OFF	HIGH
OFF	OPEN
OFF	TEST
OUT	IN
PNL	CMD
RDR	COMM
RUN	STBY
SEL	DES

Data Range Low	Data Range High
SEL	FAIL
VAR	FIX
WET	DRY
YES	NO
BACK	FWD
BLUE	HAXE
BUSY	NORM
CLSD	OFF
COMM	RDR
DPLY	ATT
ENBL	OFF
FAIL	GOOD
FAIL	SEL
FULL	EMPTY
FULL	NORM
GOOD	FAIL
HAXE	BLUE
NCOH	COH
NORM	LOW
NORM	BUSY
NORM	FULL
NORM	OPEN
NORM	EMPTY
NORM	FAULT
OPEN	OFF
OPEN	NORM
OPEN	CLOSE
OPEN	NOPEN
OSC1	OCS2
OSC2	OSC1
PRGM	FIXED
SAFE	ARM
STBY	RUN
TEST	OFF
CLOSE	OPEN
EMPTY	FULL
EMPTY	NORM
FAULT	NORM
FIXED	PRGM
NCLSD	CLSO
NO-GO	GO

Data Range Low	Data Range High
NOPEN	OPEN
SEL A	SEL B
SEL B	SEL A
SEL X	SEL Y
SEL Y	SEL X
TAPEA	TAPEB
TAPEB	TAPEA

Table E-1.- EVENT STATUS INDICATORS (Concluded)

Notes:

1. The preferred event status indicator pair is “OFF-ON.” If this indicator pair is not appropriate per the measurement/stimulus title or current design, one of the above may be used as a pair or with a “blank” indicator in the opposite data range LOW or HIGH. A “blank” indicates the absence of the required status indication.

2. If no indicator pair listed is appropriate, then any descriptive abbreviation of four characters or less preceded by an asterisk may be used. In addition, if DATA TYPE is not BD. then the value in the field must be numeric and of one of the following types:

   a. Signed right justified floating decimal

   b. Signed right justified

   c. Scientific with no decimal point or fractional part of the mantissa. Must be 1 digit exp.

   d. Hexadecimal (to allow valid values for analog commands and indexed command keyboard MSIDs)

   THIS FIELD IS BLANK FOR PARENT MSIDs.

APPENDIX F

CROSS REFERENCE TABLES

ANNEX 4 TABLE TO CARD IMAGE FORMAT CROSS REFERENCE

CARD IMAGE FORMAT TO ANNEX 4 TABLE CROSS REFERENCE

1.0 GENERAL

This appendix provides several cross reference tables to aid in the development of annex 4 data submittal.

2.0 COMMAND AND DATA ANNEX TABLES

The following list identifies each table:

a. Table 1.- Basic Hardware Measurement Data (BD.PMEAS) and Basic Flight Software Measurements and Commands (BD.PFSW)

b. Table 2.- Hardware Measurement Channelization Data (CH.PMEAS) and Flight Software Channelization Data (CH.PFSW)

c. Table 3.- Measurement Calibration Data (CA.PMEAS)

d. Table 4.- Downlist Format Requirements Hardware Measurements (DL.PMEAS) and Downlist Format Requirements Flight Software Parameters (DL.PFSW)

e. Table 5.- Telemetry Decommutation Data (TL.PMEAS)

f. Table 6.- Telemetry Decommutation Data Format 9999

g. Table 7.- PDI Format Data (TF.PMSID), Telemetry Independent Format Data (TF.PMSID), and Payload Reconstructed Format Data (TF.PMSID)

h. Table 8.- Fault Detection & Annunciation (Critical) Hardware Parameters (FD.PMEAS) and Fault Detection & Annunciation (Critical) Flight Software Parameters (FD.PFSW)

i. Table 9.- Fault Detection & Annunciation (Alert) Hardware Parameters (FD.PMEAS) and Fault Detection & Annunciation (Alert) Flight Software Parameters (FD.PFSW)

j. Table 10.- Fault Detection & Annunciation (Precondition Steering) Hardware Parameters (FD.PMEAS) and Fault Detection & Annunciation (Precondition Steering) Flight Software Parameters (FD.PFSW)

k. Table 11.- Basic Command Data (BD.PCMD)

l. Table 12.- Onboard GPC Discrete Data

m. Table 13.- Onboard Stored Serial Commands (CD.PCMD)

n. Table 14.- Uplink Real-Time Commands

o. Table 15.- Uplink Load Commands (CD.PCMD)

p. Table 16.- Multiple Real-Time Commands (CD.PCMD)

q. Table 17.- Analog Onboard Command Calibration Data (CA.PFSW)

r. Table 18.- Standard Serial Interface Description Data (SC.PMSID)

s. Table 19.- Payload Signal Processor Integration Data (PS.PMSID)

2.1 Table Headers

The following header information is in common use with all the tables.

Column	Element	Description
	PAYLOAD NAME	A unique alphanumeric abbreviation for the payload. Can be repeated for separate flights. Must be unique on a single flight. Left justified. EXAMPLE: PAM-A1, TDRSS-A, etc.
	MISSION	Mission number is added by the annex table generation system.
	PAGE	Paging - The first two numbers correspond with the table number while the last three numbers reflect the continuous page numbering system.
	DATE	The date the table was produced.

Notes:

1. The blank tables show a reference to the card type and column numbers so that the element description can be located on that card(s) image in appendix B.

2. A (-) symbol shown under the column header denotes that the element listed is found on the STAR screen(s) shown in the table title.

3. A (#) symbol shown under the column header denotes that the element listed is found on a STAR screen other than the ones listed in the table title.

3.0 ANNEX 4 DATA TABLE TO CARD IMAGE FORMAT CROSS REFERENCE

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 01 -- BASIC HARDWARE MEASUREMENT DATA(BD.PMEAS)

TABLE 01 -- BASIC FLIGHT SOFTWARE
MEASUREMENTS & COMMANDS(BD.PFSW)

MSID (OCCURRENCE)	NOMENCLATURE
CC/TI 1-10	CC/TI 21-54

SOURCE	FLT PHASE	CMD/ DATA TYPE	DATA RANGE UNIT	REQ FETCH RATE	DATA RANGE LOW	DATA RANGE HIGH	PARENT MSID	WIRE MSID	ASSOC MSID	SID NO	PL USER ID	CNST INIT VAL	CONTIG PARM IND	P C S	P M #	CRT APP	C & W #	GPC I/O #	CONCR FLAG #	DATA LENGTH ##	TLM LNK ID #
	CD 11-18	CD 58-60	CC 13-20		CD 19-23	CD 24-28		CE 31-40	CE 51-60	CE 41-50	CD 11-20										
TJ 71-74	TJ 23-30	TJ 15-17	TI 13-20	TJ 20-22	TJ 31-35	TJ 36-40	TK 21-30	TK 31-40	TK 51-60	TK 41-50	TK 11-20	TI 55-70	TJ 43-44	TJ 42	TI 71	TJ 14	TJ 13	TI 76	TJ 70	TI 11-12	TJ 11

CARD REFERENCE

SELECTION CRITERIA PMEAS: TJ SOURCE=PLM, PLB4, ORB, PDI, SSC, OR EXC.
PFSW: COMMANDS WITH COMMAND TYPE = AC, CI, CN, OR GP
AND MEASUREMENTS THAT HAVE TJ SOURCE = SM, OR GNC.

f01.ppt

Figure F-1.- Annex table 01.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 02 – HARDWARE MEASUREMENT CHANNELIZATION DATA(CH.PMEAS)

TABLE 02 – FLIGHT SOFTWARE CHANNELIZATION DATA(CH.PFSW)

MSID (OCCURRENCE)	BTU NAME	BTU CARD TYPE	BTU CARD LOC	BTU CHAN NO	BTU WD NO	BTU STRT BIT	BTU NO BITS	P C S #	REQ FETCH RATE ###	BTU MIA ADD ##	CMD/ DATA TYPE ###	BTU NO WDS ##	INV MEAS IND #	NOMENCLATURE ##########################
CC 1-10	CD 39-42	CD 43-45	CD 48-49	CD 50-51	CD 56-57	CD 52-53	CD 54-55			CD 46-47	CD 58-60	CD 75-76		CC 21-54
TI 1-10	TJ 51-54	TJ 55-57	TJ 60-61	TJ 62-63	TJ 68-69	TJ 64-65	TJ 66-67	TJ 42	TJ 20-22	TJ 58-59	TJ 15-17	TJ 75-76	TJ 41	TI 21-54

CARD REFERENCE

f02.doc

Figure F-2.- Annex table 02.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 03 -- MEASUREMENT CALIBRATION DATA(CA.PMEAS)

MSID (OCCURRENCE)	LOW IND VAR	HIGH IND VAR	COEFF A_0	COEFF A_1	COEFF A_2	COEFF A_3	COEFF A_4	COEFF A_5	DATA RANGE UNIT #########	DATA RANGE LOW ########	DATA RANGE HIGH ########	DATA TYPE ###	CURVE DEGREE #	CRT APP #
TI	TR	TR	TR	TR	TR	TS	TS	TS	TI	TJ	TJ	TJ	TR	TJ
1-10	16-21	22-27	28-41	42-55	56-69	16-19	30-43	44-57	13-20	31-35	36-40	15 - 17	14	14

CARD REFERENCE

f03.ppt

Figure F-3.- Annex table 03.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 04 – DOWNLIST FORMAT REQUIREMENTS
HARDWARE MEASUREMENTS(DL.PMEAS)

TABLE 04 – DOWNLIST FORMAT REQUIREMENTS
FLIGHT SOFTWARE PARAMETERS(DL.PFSW)

MSID (OCCURRENCE)	TLM FMT ID	REQ RSP RATE	LBR IND	DATA TYPE ###	INV MEAS IND #	BTU STRT BIT ##	DATA LENGTH ##	PARENT MSID ########	NOMENCLATURE ##########################
TI *	TT	TT	TT	TJ *	TJ	TJ	TI	TK *	TI *
1-10	11 - 14	16 - 19	57	15 - 17	41	64 - 65	11-12	21-30	21-54

CARD REFERENCE

* Only once per MSID

f04.doc

Figure F-4.- Annex table 04.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 05 -- TELEMETRY DECOMMUTATION DATA(TL.PMEAS)

MSID (OCCURRENCE)	TLM LINK ID	TLM DATA LNG	TLM STRT BIT	INV MEAS IND	SL BUF ADD	TLM FMT ID	TLM ACT RATE	TLM REQ RATE	TLM FRST FRM	TLM FIRST SBFRM	TLM FRST WD	FMT STRT BIT	TLM FORMAT IND	CONTIG PARM IND ##	PARENT MSID #########	DATA TYPE ###	NOMENCLATURE ################################
TI *	TJ *	TI *	TJ *	TJ *	TT **	TT	TT	TT	TT	TT	TT **	TT **	TT	TJ *	TK *	TJ *	TI *
			18		24	11	20	16	28	31	24	59				15	
1-10	11	11-12	-	41	-	-	-	-	-	-	-	-	15	43-44	21-30	-	21-54
			19		27	14	23	19	30	33	27	60				17	

CARD REFERENCE

* Will only print one time per MSID.
** Special logic required for format Id = EXCN or SSCN.

f05.ppt

Figure F-5.- Annex table 05.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 06 -- TELEMETRY DECOMMUTATION DATA FORMAT 9999

MSID (OCCURRENCE) ############	TLM LINK ID #	TLM DATA LNG ##	TLM STRT BIT ##	INV MEAS IND #	SL BUF ADD ####	TLM FMT ID ####	TLM ACT RATE ####	TLM REQ RATE ####	TLM FRST FRM ###	FIRST SBFRM ###	TLM FRST WD ####	FMT STRT BIT ##	FORMAT TYPE #	CONTIG PARM IND ##	PARENT MSID #########	DATA TYPE ###	NOMENCLATURE ################################
TI	TJ	TI	TJ	TJ	TT *	TT	TT	TT	TT	TT	TT *	TT	TT	TJ	TK	TJ	TI
1-10	11	11-12	18 - 19	41	24 - 27	11 - 14	20 - 23	16 - 19	28 - 30	31 - 33	24 - 27	59 - 60	15	43-44	21-30	15 - 17	21-54

CARD REFERENCE

* Special logic required for format Id = EXCN or SSCN.

f06.ppt

Figure F-6.- Annex table 06.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 07 – PDI FORMAT DATA(TF.PMSID)

ELEMENT	CARD REFERENCE TA	TB	TC
TLM FORMAT ID	2-5	2-5	
TLM FMT MODE	7		
FLT PHASE	11-18		
NO. PDI PORTS *			
FRM/MAJ FRAME **	52-54		
BIT RATE	65-76		
WDS/FRM OR DBLK	48-51		
DATA CYL PERIOD	60-64		
BIT RATE TOL	38-41		
MAJ FRM PERIOD	55-59		
BITS/WORD	46-47		
TLM DATA CODE	42-45		
SYNC LENGTH		7	
SYNC TYPE		8	
SYNC HEX VALUE		9-16	
SYNC F/L INDICATE		17	
SYNC START WORD		18-21	
MAJ F/L INDICATE		22	
MAJ FR SYNC VAL		23-24	
MAJ SYNC WORD		25-28	
MFC INIT VALUE		30-32	
MFC U/D INDICATE		29	
MFC START WORD		33-36	
SUBCOM DEPTH		71-73	
SFC START WORD		40-43	
SFC INITIAL VALUE		38-39	
SFC U/D INDICATE		37	
AVAL SAMP RATE 1		46-48	
AVAL SAMP RATE 2		49-51	
AVAL SAMP RATE 3		52-54	
AVAL SAMP RATE 4		55-57	
AVAL SAMP RATE 5		58-60	
AVAL SAMP RATE 6		61-63	
AVAL SAMP RATE 7		64-66	
PDI PORT 1	10		
PDI PORT 2		44	
PDI PORT 3		45	
TLM FORMAT IND		6	
REQD WINDOW SIZE	30-32		
TLM BANDWIDTH *	33-37		
TOG BUFFER SIZE			9-12
P/L DNLK FRM SIZE			13-18
DECOM DATA *** XXXX/YYYY			21-24, 25-28

* COMPUTED BY SM/PAYLOAD INTEGRATION PROCESSOR

** THIS VALUE IS ROUNDED TO THE NEAREST HIGHER INTEGER VALUE FOR MODE 4.

*** 2 FIELDS: START WORD NUMBER (21-24) AND NUMBER OF CONSECUTIVE WORDS (25-28); in the format XXXX/YYYY.

f07.doc

Figure F-7.- Annex table 07.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 08 -- FAULT DETECTION & ANNUNCIATION(CRITICAL)
HARDWARE PARAMETERS(FD.PMEAS)

TABLE 08 – FAULT DETECTION & ANNUNCIATION(CRITICAL)
FLIGHT SOFTWARE PARAMETERS(FD.PFSW)

	<====== CAUTION & WARNING(CRITICAL) ======>						<==== BFS ====>					
MSID (OCCURRENCE)	ALRM CLS IND	FDA LOW LMT	FDA HGH LMT	MSG TXT MAJ	MSG TXT MIN	NOISE FLTR CRT	ALRM CLS IND	FDA LOW LMT	FDA HGH LMT	FDA PROC RATE ###	CONCR FLAG #	NOMENCLATURE ##############################
TI 1-10	TL 14-15	TL 22-26	TL 31-35	TN 17-30	TN 37 - 40	TL 16-17	TL 14 - 15	TL 22 - 26	TL 31 - 35	 **	TJ 70	TI 21-54

** : DERIVED BY PRINT PROGRAM

CARD REFERENCE

f08.doc

Figure F-8.- Annex table 08.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 09 -- FAULT DETECTION & ANNUNCIATION(ALERT)
HARDWARE PARAMETERS(FD.PMEAS)

TABLE 09 -- FAULT DETECTION & ANNUNCIATION(ALERT)
FLIGHT SOFTWARE PARAMETERS(FD.PFSW)

	<========== ALERT ==========>																
MSID (OCCURRENCE)	ALRM CLS	MSG TXT MAJ	MSG TXT MIN	NOISE FLTR ALR	NBR LMT SETS	TIME DELAY	FDA LOW LMT1	FDA HGH LMT1	FDA LOW LMT2	FDA HGH LMT2	FDA LOW LMT3	FDA HGH LMT3	FDA PROC RATE ###	CONCR FLAG #	C & W #	NOMENCLATURE ################################
TI	TM/TN	TN	TN	TM		TP	TM	TM	TM	TM	TM	TM		TJ	TJ	TI
1-10	11	17-30	37 - 40	12-13	**	12-16	18-22	27-31	36-40	45-49	54-58	63-67	**	70	13	21-54

** : DERIVED BY PRINT PROGRAM

CARD REFERENCE

f09.ppt

Figure F-9.- Annex table 09.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 10 -- FAULT DETECTION & ANNUNCIATION(PRECONDITION STEERING)
HARDWARE PARAMETERS(FD.PMEAS)

TABLE 10 -- FAULT DETECTION & ANNUNCIATION(PRECONDITION STEERING)
FLIGHT SOFTWARE PARAMETERS(FD.PFSW)

MSID (OCCURRENCE)	LMT SET NO.	(	MSID1.	ST	OR/ AN	(	MSID2.	ST	)	OR/ AN	(	MSID3.	ST	)	OR/ AN	MSID4.	ST	)	FDA LOW LMT #####	FDA HGH LMT #####	NOMENCLATURE ##########
TI	TP TQ	TP	TP	TP	TP	TP	TP	TP	TP	TP	TP	TP	TP	TP	TP	TQ	TQ	TQ	TM *	TM **	TI
1-10	11	21	22-31	32 - 33	35 - 36	37	38-52	48 - 49	50	51 - 52	53	54-63	64 - 65	66	67 - 68	22-24	32 - 33	34	18-21	27-31	21-54

CARD REFERENCE

* FDA low limit corresponding to limit set no.
** FDA high limit corresponding to limit set no.

f10.ppt

Figure F-10.- Annex table 10.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 11 -- BASIC COMMAND DATA(BD.PCMD)

MSID (OCCURRENCE)	NOMENCLATURE																			
CC 1-10	CC 21-54																			
FLT PHASE	CMD TYPE	DATA RANGE UNIT	DATA RANGE LOW	DATA RANGE HIGH	PARENT MSID	WIRE MSID	ASSOC MSID	SID NO	PL USER ID	P C S	P O C C	RF UPLK #	SSI/ PSP ID ##	SAFE #	DEST DEP ####	CMD NO WDS ##	KEYBOARD MSID ##########	INDEX ID ####
CD 11-18	CD 58-60	CC 13-20	CD 19-23	CD 24-28	CE 21-30	CE 31-40	CE 51-60	CE 41-50	CE 11-20	CD 62	CD 63	CD 61	CD 35-36	CD 64	CL 17-20	CC 11-12	CF ** 12-21	CF ** 24-27

** KEYBOARD MSID: IDENTIFICATION OF THE DISPLAY ITEM NUMBER USED TO INITIATE THIS COMMAND. ALPHANUMERIC. LEFT JUSTIFIED. REFER TO JSC-18206, VOLUME III, SECTION 2.0, ELEMENT ID AA. BLANK FOR NON-INDEXED COMMANDS. PROVIDED BY JSC.

INDEX ID: HEXIDECIMAL VALUE (0-FFFF) OF THE DISPLAY ITEM INDEX USED TO INITIATE THIS COMMAND. UP TO 21 INDEX PAIRS MAY BE BLANK FOR NON-INDEXED COMMANDS. PROVIDED BY JSC.

CARD REFERENCE

f11.ppt

Figure F-11.- Annex table 11.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 12 – ONBOARD GPC DISCRETE DATA

<=== CD.PCMD ===>

MSID (OCCURRENCE)	RST MASK	SET MASK	CMD TYPE	BTU NAME ####	BTU CARD TYPE ###	BTU CARD LOC ##	BTU CHAN NO ##	BTU MIA ADD ##	PARENT MSID #########	NOMENCLATURE ################################
CC	CR	CR	CD	CD	CD	CD	CD	CD	CE	CC
1-10	15-18	23 - 26	58-60	39-42	43 - 45	48 - 49	50-51	46-47	21-30	21-54

CARD REFERENCE

f12.doc

Figure F-12.- Annex table 12.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 13 -- ONBOARD STORED SERIAL COMMANDS(CD.PCMD)

MSID (OCCURRENCE)	NO WDS	SSI/ PSP ID	<========== COMMAND DATA WORDS 1-64 ==========	CMD TYPE ###	WIRE MSID	NOMENCLATURE ##########

CC	CC	CD	CL01	CL01	CL01	CL01	CL01	CL01	CL01	CL01	CL01	CL02	CL02	CL02	CL02	CL02	CL02	CL02	CD	CE	CC
1-10	11 - 12	35 - 36	25 - 28	29 - 32	33 - 36	37 - 40	41 - 44	45 - 48	49 - 52	53 - 56	57 - 60	25 - 28	29 - 32	33 - 36	37 - 40	41 - 44	45 - 48	49 - 52	58-60	31-40	21-54

CARD REFERENCE

f13.ppt

CL01(25-28) - CL02(49-52) contain Command Data Words(CDW1-CDW16).
There can be up to 64 CDW's, so more than one line may print for an MSID.

Figure F-13.- Annex table 13.

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 14 -- UPLINK REAL-TIME COMMANDS

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

<========== CD.PCMD ==========> <========== CH.PCMD ==========>

MSID (OCCURRENCE)	DSM NO	DSM TYPE	SAFE	DSM TITLE	RST MASK	SET MASK	CMD TYPE	BTU NAME	BTU CARD TYPE	BTU CARD LOC	BTU CHAN NO	BTU STRT BIT	BTU NO BITS	PCS #	POCC #	BTU MIA ADD ##	MDM ADD RST ####	MDM ADD SET ####	NOMENCLATURE ##########
CC	CD	CD	CD	CC	CR	CR	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CR	CR	CC
1-10	65-69	70	64	56-76	15-18	23-26	58-60	39-42	43-45	48-49	50-51	52-53	54-55	62	63	46-47	11	19-22	21-54

CARD REFERENCE

f14.ppt

Figure F-14.- Annex table 14.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 15 -- UPLINK LOAD COMMANDS(CD.PCMD)

MSID (OCCURRENCE)	DSM NO	DSM TYPE	SAFE	DSM TITLE	OP CODE	MAJ FUNC	NO WDS	SSI/ PSP ID	<====== COMMAND WORDS 1-64 ======>								POCC #	CHW ####	DEST DEP ####	NOMENCLATURE ##########
CC 1-10	CD 65-69	CD 70	CD 64	CC 56-76	CL01 15-16	CL01 11-14	CC 11-12	CD 35-36	CL 25-28	CL 29-32	CL 33-36	CL 37-40	CL 41-44	CL 45-48	CL 49-52	CL 53-56	CD 63	CL01 21-24	CL01 17-20	CC 21-54

CARD REFERENCE

CL(25-28) - CL(53-56) contain Command Data Words(CDW1-CDW8).
There can be up to 64 CDW's, so more than one line may print for an MSID.

f15.ppt

Figure F-15.- Annex table 15.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 16 -- MULTIPLE REAL-TIME COMMANDS(CD.PCMD)

MSID (OCCURRENCE)	DSM NO	DSM TYPE	SAFE	DSM TITLE	DSM NO 1	DSM NO 2	DSM NO 3	DSM NO 4	DSM NO 5	DSM NO 6	DSM NO 7	DSM NO 8	DSM NO 9	DSM NO 10	POCC #	NOMENCLATURE ##########
CC 1-10	CD 65-69	CD 70	CD 64	CC 56-76	CM 11-14	CM 16-19	CM 21-24	CM 26-29	CM 31-34	CM 36-39	CM 41-44	CM 46-49	CM 51-54	CM 56-59	CD 63	CC 21-54
CARD REFERENCE																

f16.ppt

Figure F-16.- Annex table 16.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 17 -- ANALOG ONBOARD COMMAND CALIBRATION DATA(CA.PFSW)

MSID (OCCURRENCE)	COEFF A_0	COEFF A_1	DATA RANGE LOW #####	DATA RANGE HIGH #####	NOMENCLATURE ################################
CC	CV	CV	CD	CD	CC
1-10	13-26	27-40	19-23	24-28	21-54

CARD REFERENCE

f17.doc

Figure F-17.- Annex table 17.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 18 -- STANDARD SERIAL INTERFACE DESCRIPTION DATA(SC.PMSID)

SSI ID	BTU NAME	SSI BUS	MIA ADD	IN MOD ADD1	IN MOD ADD2	IN CHAN ADD1	IN CHAN ADD2	OUT MOD ADD	OUT CHAN ADD	SSUS ID	SSI CHAN TYPE ##	SSI TRAN TYPE ###
CB 30	CB 22 - 25	CB 26 - 27	CB 28 - 29	CB 39 - 40	CB 43 - 44	CB 41 - 42	CB 45 - 46	CB 47 - 48	CB 49 - 50	CB 33 - 35	CB 31-32	CB 36-38

CARD REFERENCE

f18.doc

Figure F-18.- Annex table 18.

PAYLOAD NAME ==>
DATE ==> MM/DD/YY
MISSION ==> STS-XXXX

SPACE TRANSPORTATION AUTOMATED RECONFIGURATION SYSTEM
ORBITER COMMAND & DATA ANNEX
TABLE 19 – PAYLOAD SIGNAL PROCESSOR INTEGRATION DATA(PS.PMSID)

PSP MSG ID	UPLINK IND	PSP CMD RATE	PSP CMD CODE	PSP CMD SCID	PSP UMB SEL	PSP TLM RATE	PSP TLM CODE	PSP FRM LNG	PSP SYNC WD LNG	PSP FRM SYN WORD	PSP PORT MODE
CB	**	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB
1		2-3	4	5	6	7	8	9-12	13	14-21	51

** : CODE SPECIFYING WHETHER OR NOT THE MISSION INDEPENDENT CONFIGURATION MESSAGE WILL BE UPLINKED DURING THE MISSION. THIS FIELD IS LOADED AT CARGO BAY INTEGRATION (CI) ON THE C13 PSP DATA SCREEN. BLANK FOR NOT UPLINKED, “U” FOR UPLINKED. PROVIDED BY JSC.

IF THE CB CARD IS IN FILE 2, MEANING THE MESSAGE MUST BE UPLINKED, THEN UPLINK INDICATOR WILL BE SET TO “X”.

CARD REFERENCE

f19.doc

Figure F-19.- Annex table 19.

4.0 CARD IMAGE DATA FIELDS TO ANNEX 4 DATA TABLES CROSS REFERENCE FOR COMMANDS

CROSS-REFERENCE INDEX FOR COMMANDS

Element	PDS Card	PDS Columns	C&D annex tables affected	STAR screens modified
Associated MSID	CE	51-60	1,11	BD
A_0 coefficient	CV	13-26	17	CA
A_1 coefficient	CV	27-40	17	CA
BTU card location	CD	48-49	2,12,14	CH
BTU card type	CD	43-45	2,12,14	CH
BTU channel address	CR	(reference BTU set/reset add.)		CD
BTU channel number	CD	50-51	2,12,14	CH
BTU MIA address	CB	28-29	2,12,14,18	SC
	CD	46-47	2,12,14,18	SC
BTU module address	CR	(reference BTU set/reset add.)		CD
BTU name	CB	22-25	2,18	CH,SC
	CD	39-42	2,12,14	CH,SC
BTU number	CR	(reference BTU set/reset add.)		CD
BTU number of bits	CD	54-55	2,14	CH
BTU number of words	CD	75-76	2	CD
BTU reset address[2]	CR	11-14	14	CD
BTU reset mask	CR	15-18	12,14	CD
BTU set address[2]	CR	19-22	14	CD
BTU set mask	CR	23-26	12,14	CD
BTU/SSI bus number[1]	CB	26-27	18	SC
BTU start bit number	CD	52-53	14	CH
BTU word number	CD	56-57	2	CH
Command data words 1-9	CL	25-60	13,15	CD
Command header word[2]	CL	21-24	15	BD,CD
Command type	CD	58-60	1,2,11,12,13,14	CD
Data range high	CD	24-28	1,11,17	BD
Data range low	CD	19-23	1,11,17	BD

Element	PDS Card	PDS Columns	C&D annex tables affected	STAR screens modified
Data range units	CC	13-20	1,11	BD
Destination[2]	CL	61-65		BD,CD
Destination dependent[2]	CL	17-20	11,15	CD
DSM number/Group ID	CD	65-69	14,15,16	CD
DSM title/Group Name	CC	56-76	14,15,16	CD
DSM type	CD	70	14,15,16	CD
Flight phases - command	CD	11-18	1,11	BD
GPC input, output, compute[2]	CC	55	1	CD
Index ID*	CF	24-27	11	DI
Keyboard MSID*	CF	12-21	11	DI
Major function[2]	CL	11-14	15	CD
MSID (occurrence)	CC	1-10	1,2,12,13,14,15, 16,17	All except PV, PS,TF,SC
	CD	1-10		
	CE	1-10		
	CF	1-10*		
	CL	1-10		
	CM	1-10		
No. of words	CC	11-12	11,13,15	CD
Nomenclature, CRT*	CF	29-34		DF,DI
OP code	CL	15-16	15	CD
Parent MSID	CE	21-30	11,12	BD
Payload user ID	CE	11-20	1,11	BD
PSP command data code	CB	4	19	PS
PSP command data rate	CB	2-3	19	PS
PSP command sub-carrier idle	CB	5	19	PS

Element	PDS		C&D annex tables affected	STAR screens modified
	Card	Columns		
PSP command umbilical selection	CB	6	19	PS
PSP configura-tion message ID	CB	1	19	PS
PSP port mode	CB	51	19	PS
PSP telemetry data code	CB	8	19	PS
PSP telemetry frame length	CB	9-12	19	PS
PSP telemetry frame sync word	CB	14-21	19	PS
PSP telemetry rate	CB	7	19	PS
PSP telemetry sync word length**	CB	13	19	PS
RF uplink[2]	CD	61	11	CD
RTC No. 1-10	CM	11-59	16	CD
Safing flag	CD	64	11,14,15,16	CD
SID number	CE	41-50	1,11	BD
SSI channel type[2]	CB	31-32	18	SC
SSI ID	CB	30	18	SC
SSI input channel address 1	CB	41-42	18	SC
SSI input channel address 2	CB	45-46	18	SC
SSI input module address 1	CB	39-40	18	SC
SSI input module address 2	CB	43-44	18	SC
SSI output channel address	CB	49-50	18	SC
SSI output module address	CB	47-48	18	SC
SSI/PSP configuration message ID	CD	35-36	11,13,15	BD,CD,CH,SC
SSI transaction type[2]	CB	36-38	18	SC
SSUS ID	CB	33-35	18	SC
Systems nomenclature	CC	21-54	1,2,11,12,13,14, 15,16,17	BD
Wire MSID	CE	31-40	1,11,13	BD

*Provided by JSC
**Derived by JSC PDT generator on output
[1]Derived by JSC PDT generator for codes 10 and 11
[2]Derived by JSC PDT generator program

4.1 Card Image Data Fields to Annex 4 Data Tables Cross Reference for Telemetry

CROSS-REFERENCE INDEX FOR TELEMETRY

Element	PDS Card	PDS Columns	C&D annex tables affected	STAR screens modified
Associated MSID	TK	51-60	1	BD
Available sample rates 1-7	TB	46-66	7	TF
A_0 coefficient	TR	28-41	3	CA
A_1 coefficient	TR	42-55	3	CA
A_2 coefficient	TR	56-69	3	CA
A_3 coefficient	TS	16-29	3	CA
A_4 coefficient	TS	30-43	3	CA
A_5 coefficient	TS	44-57	3	CA
Bit rate	TA	65-76	7	TF
Bit rate tolerance	TA	38-41	7	TF
Bits per word	TA	46-47	7	TF
BTU card location	TJ	60-61	2	CH
BTU card type	TJ	55-57	2	CH
BTU channel number	TJ	62-63	2	CH
BTU MIA address	TJ	58-59	2	SC
BTU name	TJ	51-54	2	BD,CH
BTU number of bits	TJ	66-67	2,4	CH
BTU number of words	TJ	75-76	2	SC
BTU start bit number	TJ	64-65	2,4	CH
BTU word number	TJ	68-69	2	CH
Calibration degree[2]	TR	14	3	N/A
Cal low inde-pendent var	TR	16-21	3	CA
Cal high inde-pendent var	TR	22-27	3	CA
Caution and warning	TJ	13	1,9	BD,FD
Caution and warning limits[2]	TL	13-35	8	FD

Element	PDS Card	PDS Columns	C&D annex tables affected	STAR screens modified
Concur flag[2]	TJ	70	1,8,9	Derived by JSC PDTG
Contiguous parameter indicator	TJ	43-44	1,5,6	BD-PMEAS
CRT applicability	TJ	14	1,3	BD
Data cycle period	TA	60-64	7	TF
Data range high	TJ	36-40	1,3	BD
Data range low	TJ	31-35	1,3	BD
Data range unit	TI	13-20	1,3	BD
Data type	TJ	15-17	1,2,3,4,5,6	BD
Fault summary page message text - Major	TN	17-30	8,9	FD
Fault summary page message text - Minor	TN	37-40	8,9	FD
First PDI port assignment	TA	10	7	TF
Flight phases -				
Measurement	TJ	23-30	1	BD
Telemetry	TA	11-18	7	TF
Format mode	TA	7	7	TF
Format start bit	TT	59-60	5,6	TL
Frames/major frame or data blocks/second	TA	52-54	7	TF
GPC input, output, compute[2]	TI	76	1	BD
Inverted measurement indicator	TJ	41	2,4,5,6	TL
Limit sense time delay	TP	12-16	9	FD
Major frame period	TA	55-59	7	TF
Major frame sync F/L indicator	TB	22	7	TF

Element	PDS Card	PDS Columns	C&D annex tables affected	STAR screens modified
Major frame sync hex value	TB	23-24	7	TF
Major frame sync word number	TB	25-28	7	TF
Measurement 1 of precondition exp	TP	21-36	10	FD,F1
Measurement 2 of precondition exp	TP	37-52	10	FD,F1
Measurement 3 of precondition exp	TP	53-68	10	FD,F1
Measurement 4 of precondition exp	TQ	21-36	10	FD,F1
Minor frame counter initial value	TB	30-32	7	TF
Minor frame counter up/down indicator	TB	29	7	TF
Minor frame counter word number	TB	33-36	7	TF
MSID	TI	1-10	1,2,3,4,5,6,8,9,10	(All except PV, PS,TF,SC)
	TJ	1-10		
	TK	1-10		
	TL	1-10		
	TM	1-10		
	TN	1-10		
	TP	1-10		
	TQ	1-10		
	TR	1-10		
	TS	1-10		
	TT	1-10		
Number of consecutive words	TC	25-28(1st)	7	TF
No. of measurements in precondition expression[2]	TP	69	N/A	N/A

Element	PDS Card	PDS Columns	C&D annex tables affected	STAR screens modified
Parent MSID	TK	21-30	1,4,5,6	BD
Payload downlink frame size	TC	13-18	7	TF
Payload management use[2]	TI	71	1	N/A
Payload user ID	TK	11-20	1	BD
Required fetch rate	TJ	20-22	1,2	BD,TL
Required window size	TA	30-32	7	TF
Second PDI port assignment	TB	44	7	TF
SID number	TK	41-50	1	BD-PFSW
SM alarm class indicator	TL	14-15	8	FD
SM alarm class - Alert	TM	11	9	FD
SM alarm class critical[2]	TL	13		Derived by JSC PDTG
SM alert limit sets 1 thru 3	TM	18-67	9	FD
SM caution and warning high limit - Critical	TL	31-35	8	FD
SM caution and warning low limit - Critical	TL	22-26	8	FD
SM constant initial value	TI	55-70	1	BD-PFSW
SM limit set number	TP TQ	11 11	10	N/A N/A
SM limit set No. 1 high value	TM	27-31	10	FD
SM limit set No. 1 low value or undesired state	TM	18-22	10	FD
SM limit set No. 2 high value	TM	45-49	10	FD

Element	PDS Card	PDS Columns	C&D annex tables affected	STAR screens modified
SM limit set No. 2 low value or undesired state	TM	36-40	10	FD
SM limit set No. 3 high value	TM	63-67	10	FD
SM limit set No. 3 low value or undesired state	TM	54-58	10	FD
SM message alarm class	TN	11		FD
SM noise filter value - Alert	TM	12-13	9	FD
SM noise filter value - Critical	TL	16-17	8	FD
Source	TJ	71-74	1	BD
SSI ID 1	TI	72-73		SC
SSI ID 2	TI	74-75		SC
Start word number	TC	21-24(1st)	7	TF
Subcom depth	TB	71-73	7	TF
Subframe counter initial value	TB	38-39	7	TF
Subframe counter up/down indicator	TB	37	7	TF
Subframe counter word number	TB	40-43	7	TF
Sync F/L indicator	TB	17	7	TF
Sync hex value	TB	09-16	7	TF
Sync length[2]	TB	7	7	N/A
Sync start word	TB	18-21	7	TF
Sync type[2]	TB	8	7	TF
Systems nomenclature	TI	21-54	1,2,4,5,6,8,9,10	BD
Telemetry band-width	TA	33-37	7	TF
Third PDI port assignment	TB	45	7	TF
TLM actual response rate	TT	20-23	5,6	TL
TLM data code	TA	42-45	7	TF
TLM data length	TI	11-12	1,5,6	TL,CH
TLM first frame	TT	28-30	5,6	TL
TLM first sub-frame	TT	31-33	5,6	TL

Element	PDS		C&D annex tables	STAR screens
	Card	Columns	affected	modified
TLM first word	TT	24-27	5,6	TL
TLM format ID	TA	02-05	7	TF
	TB	02-05		TF
	TC	02-05		TF
	TT	11-14	4,5,6	DL
TLM format indicator[2]	TA	6	7	TF
	TB	6		
	TC	6		
	TT	15	5,6	TL
TLM link ID	TJ	11	1,5,6	BD,TL
TLM low bit rate indicator	TT	57	4	DL
TLM required response rate	TT	16-19	4,5,6	TL
TLM start bit	TJ	18-19	5,6	TL
Toggle buffer size	TC	09-12	7	TF
Wire MSID	TK	31-40	1	BD
Word per frame or data block	TA	48-51	7	TF

[2]Derived by JSC PDT generator program

APPENDIX G

ACRONYMS AND DEFINITIONS

ACRONYMS

ACT	Actual
ADDR	Address
AID	Analog Input Differential
AOD	Analog Output Differential
ASCII	American Standard Code for Information Interchange
ASR	Available Sample Rate
BCD	Binary Coded Decimal
BIPL	Bi-Phase-Level
BIPM	Bi-Phase-Mark
BIPS	Bi-Phase-Space
BPS	Bits Per Second
BTU	Bus Terminal Unit
C&D	Command and Data
C&W	Caution and Warning
CAL	Calibration
CDW	Command Data Word
CHAN	Channel
CHW	Command Header Word
CIR	Cargo Integration Review
CK	Check
CMD	Command
COL	Column
CONG	Configuration
CR	Change Request
CRD	Card
CRT	Cathode-Ray Tube
DCM	Decommutator Control Memory
DEST	Destination
DFL	Decom Format Load
DIH	Discrete Input High
DIL	Discrete Input Low
DIP	Data Integration Plan
DISP	Display
DL	Downlist
DLR	Delta Loader
DNs	Discrepancy Notices
DOH	Discrete Output High
DOL	Discrete Output Low
DSM	Digital Select Matrix
EBCDIC	Extended Binary Coded Decimal Information Code
ECRs	Engineering Change Requests
EU	Engineering Unit
EXC	Spacelab Experiment Computer

F/L	First/Last
FDA	Fault Detection and Annunciation
FLT	Flight
FMT	Format
FRM	Frame
FUNC	Function
GN&C	Guidance, Navigation, and Control
GPC	General Purpose Computer
GSE	Ground Support Equipment
HDR	High Data Rate
HEX	Hexadecimal
HGH	High
I/O	Input/Output
ICD	Interface Control Document
ID	Identification
IDL	Independent Data Link
IH/SR	Integrated Hardware/Software Review
IND	Independent
INDEP	Independent
JSC	Lyndon B. Johnson Space Center
kbps	kilobits per second
KSC	John F. Kennedy Space Center
LDR	Low Data Rate
LNTH	Length
LPS	Launch Processing System
LSB	Least Significant Bit
MAJ	Major
MAX	Maximum
MCC	Mission Control Center
MCDS	Multi-Function CRT Display System
MDM	Multiplexer/Demultiplexer
MFC	Minor Frame Counter
MIA	Multiplexer Interface Adapter
MIN	Minor
MML	Master Measurement List
MOD	Module
MRB	Mission Reconfiguration Base
MRTC	Multiple Real Time Command
MSB	Most Significant Bit
MSFC	George C. Marshall Space Flight Center
MSG	Message
MSID	Measurement/Stimulus Identification

N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NO	Number
NOS	Numbers
NRZ-L	Non-Return to Zero-Level
NRZ-M	Non-Return to Zero-Mark
NRZ-S	Non-Return to Zero-Space
NSTS	National Space Transportation System
OD	Operational Downlink
OFI	Operational Flight Instrumentation
OFT	Orbital Flight Test
OI	Operational Instrumentation
OMD	Operations and Maintenance Documents
ONB	Onboard
OP	Operation
OPS	Operations
ORB	Orbiter
P/L	Payload
PAM	Payload Assist Module
PASS	Primary Avionics Software System
PC	Personal Computer
PCC	Process Control Characters
PCIs	Process Control Indicators
PCM	Pulse Code Modulation
PCMMU	Pulse Code Modulation Master Unit
PCN	Payload Configuration Name
PDI	Payload Data Interleaver
PDS	Payload Data Set
PDT	Payload Data Tape
PDTG	Payload Data Tape Generator
PFSW	Payload Flight Software
PI	Payload Interrogator
PILS	Payload Information Library System
PIP	Payload Integration Plan
PL	Payload
PLM	Payload Management
PLR	Payload Reconstructed
PM	Payload Management
PMU	PCM Master Unit
POCC	Payload Operations Control Center
PSP	Payload Signal Processor
PUH	Pulsed Discrete Output High
PUL	Pulsed Discrete Output Low
RAM	Random Access Memory
REQ	Required
REV	Revision
RF	Radio Frequency
RG	Range
RTC	Real Time Command

SCA	Sequence Control Assembly
SE	Support Equipment
sec	second
SEL	Selection
SFC	Subframe Counter
SID	Spacelab Software Identification
SIO	Serial Input/Output
SL	Spacelab
SM	Systems Management
SSC	Spacelab Subsystem Computer
SSI	Standard Serial Input/Output
SSP	Space Shuttle Program
SSUS	Spinning Solid Upper Stage
ST	Start
STAR	Space Transportation Automated Reconfiguration
SW	Software
TFL	Telemetry Format Load
TLM	Telemetry
TMB	Telemetry Buffer
TOL	Tolerance
UMB	Umbilical
VOL	Volume
VU	Vehicle Utility
Wd	Word
WDS	Words
WIND	Window

DEFINITIONS

Left Justified. The left most character of this field must be filled if the field is valued. Trailing blanks are required for values not entirely filling the field.

Leading Zeroes. All characters in this field must be filled. If the value does not entirely fill the field, the value should be right justified and zeroes added on the left.

Right Justified. The right most character of this field must be filled if the field is valued. Leading blanks are required for values not entirely filling the field.