Internet Engineering Task Force
Internet-Draft
Intended status: Informational
Expires: 22 June 2026

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19 December 2025

eXtensible Stateless Equipment Data Exchange
draft-guy-xfsp-03

Abstract

This document presents a binary IP-based protocol to facilitate interoperable communications between electronic equipment on a platform. The protocol is UDP-based, stateless, and multicast. Messages consist of a common header followed by a series of parameters and related attributes. The parameters are always informational, e.g., indicating airspeed is 150 kts, but parameter attributes can be set to indicate intent, e.g., this parameter contains a new user selected value such as an instruction that deploys the landing gear. Although initially designed for avionics, it can be applied to other platform domains as well. This document defines the core protocol and a method to extend it to meet any domain specific needs.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

Historically, avionics and other networked equipment platforms have used private protocols for device interconnection but the trend is towards open communication leveraging standard hardware. There have been various stages in the evolution of device interconnection from point-to-point analog communication to digital serial protocols, to bus-based solutions and currently IP-based over ethernet.

One of the concerns with all of these protocols in this industry is that extensive testing is required, so developing a common protocol and library with its extensive test cases will improve time to market, product quality and safety, and lower cost.

The eXtensible Stateless Equipment Data Exchange, XSEDE, is such an IP-based protocol which provides a common means that facilitates parameter communication between networked equipment. It is an open protocol which typically operates by sending binary-encoded data in UDP packets using common Multicast over Ethernet. Typical implementation environments contain legacy networks such as CAN bus and components that have various levels of certification, e.g., levels per DO-178 [DO-178C]. This approach allows the networked platform to function as a collection of safety-critical microservices with XSEDE at the hub. XSEDE can flexibly drive multiple displays and unify all the subsystems all at the control of the system integrator.

Parameters generally fall into two separate categories: schedule-driven and event-driven. Schedule-driven parameters are those that are sent periodically by the nodes in the system. One example could be the current heading might be reported by a sensor at 10hz. These parameters have a logical expiration time associated with how long they are valid, for example, 250ms. Another example could be the current air temperature or even the current value of the pilot’s desired heading (heading bug.) Event driven parameters are those that occur in response to an external stimuli, e.g., a pilot action on a switch, or an autopilot deciding to change the heading due to reaching an intermediate waypoint. These parameters do not have a logical expiration time associated with how long they are valid.

1.1. Basic Properties

XSEDE is a simple and compact protocol which uses a fast marshaling approach. Parameters may be coalesced, size and time permitting, into a single message to make transport more efficient. The message layout considers four octet alignment issues which can affect performance, especially on ARM-based architectures and pads to maintain efficiency. All messages are sent to all receivers so that the protocol is stateless and only the recipient controls whether a parameter will be processed. Since avionics software is subject to intensive testing and validation, XSEDE is designed to be deterministic with the fewest number of formal requirements required for implementation while still permitting the addition of new data formats and parameters through an extensible data model. The parameter identifier is designed to allow for either global data model additions so all nodes are aware or local data model additions if the parameter is only relevant to a subset of nodes.

User and System selected events can exhibit two distinct behaviors: an event that causes an immediate change, e.g., a radio frequency change, and those changes in which a change may take time to be reflected by the system, e.g., selecting a new flap position. In the

former case, only one parameter is defined: a request would set the confidence field to USERSEL (or SYSSEL). At the same time, the radio would periodically report with the current setting. In the latter case, these settings are implemented with a pair of parameters, a request (REQ suffix) and a current state Parameter that has no specific suffix. For example, FLAPREQ and FLAPPOS (See Section 4.7) where the first indicates the requested value and the second indicates the actual value.

An example of the stateless nature of the protocol can be seen when comparing sample use cases of a few parameters (See Section 4.7). The first example is a simple system with a user interface node and a radio control node where the user interface node sends a COMFREQ parameter in an XSEDE message to set the radio frequency. The time for the frequency change to be reported is generally negligible, so a COMFREQ parameter with a confidence of USERSEL/SYSSEL for setting the frequency and a COMFREQ parameter with a confidence of RAW from the radio control node for reporting the current frequency is usually sufficient. The second example is a system with a user interface node and a flap control node where the user interface node would send a FLAPREQ parameter and then report the FLAPPOS parameter sent by the flap control node to inform the pilot of the current state of the flaps. This allows the user interface to be able to set a requested flap state without having to worry about the transition period for a given systems flaps while not precluding the ability to generate a CAS message if the flaps do not change position in a specific amount of time.

1.2. Drawbacks

XSEDE is a UDP-based protocol so packet delivery is not guaranteed. XSEDE is typically run on a purpose built network within a specific aircraft or other high reliability networks, therefore the ‘best-effort‘ nature of UDP is not of grave concern. Application-level behavior is implemented to ensure critical requests are executed. Since the protocol is stateless, it relies on the requestor to monitor status to ensure an action was taken. For example, if a request to put the landing gear down is made, the requesting application must watch reports of the landing gear position and alert if the request is not satisfied in a timely manner. However, you would be able to see if your request was correctly interpreted by a report, periodic or in response to the event, by the responsible nodes. Notably, the protocol does not contain the concept of incrementing or decrementing a value, just setting a specific value. A user interface which is designed to increment and decrement a value based on a user turning a knob, for example, must track the current value and when an increment is detected, transmit the new, incremented value with the appropriate confidence (most likely

USERSEL). If two or more applications are monitoring the same knob from two different computers, they each would be able to redundantly send the same new value without affecting the behavior whether one, two or more such applications were concurrently running.

1.3. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

Message:
: is the basic unit of communication in XSEDE.

Node:
: is a device or process that implements XSEDE.

Parameter:
: is the task specific payload contained in a message.

Attribute Format:
: are the simple and structured data types associated with a parameter attribute.

Attributes:
: are the values associated with a parameter.

Dictionary:
: is a set of allowed values associated with an attribute, parameter, or message field.

Source ID:
: Refers to the unique number which identifies the node, by convention with the upper octet representing the computer and the lower octet representing the application number within that computer.

2. Overview of XSEDE Protocol

The eXtensible Stateless Equipment Data Exchange is designed to operate on an integrated local network and comprises instruments, displays, sensors, and actuators performing various functions. XSEDE messages are sent to every node on the network. XSEDE messages are currently in one of three classes: Maintenance, Operational and Raw.

Maintenance and Operational messages consist of a header followed by a series of parameters. Parameters always represent information, a message is purely a collection of parameters. However, the confidence field must be interpreted to determine intent, i.e., the SYSSEL and USERSEL confidence levels MUST be interpreted by responsible nodes to affect changes on the relevant items.

XSEDE is stateless. There is no required protocol level response to any command, however, informational responses may be made. For instance, a command to change the radio frequency of a certain radio may generate a application-level response indicating the new radio frequency. All XSEDE messages go to all nodes which ignore messages by checking for relevant parameters by identifier.

Raw XSEDE messages consist of a message header which specifies the length of the raw data, followed by that raw data. Raw data is classified as MIL-STD-1553, CANbus, digital samples, GDL90 data [GDL90], or other serial or streaming unframed data.

Each node in XSEDE is assigned a source ID. These Source IDs MUST be unique within the XSEDE network. The Source ID and the message number uniquely identify the message and are contained in the message header. Message IDs created by a node MUST be monotonically increasing. A receiving node MUST ignore all duplicate messages. The Source ID and a message number are used to ensure messages are processed in order and only once. Messages MUST be processed in order skipping any missing messages and MUST only be processed once. Senders and Receivers must account for integer overflow in message numbers. There is no retry mechanism at the protocol level; Missing and out-of-order messages SHALL be considered lost and if received out of order, a message MUST be ignored.

In addition to the Source ID and Message Number, The XSEDE message header also contains the message class, the Message Operation ID, Flags, [DO-178C] the confidence level currently for Avionics, and the payload length.

For best performance, an XSEDE goal is to not send IP datagrams that have to be fragmented. Packets which exceed the MSS size will be fragmented. To achieve this goal XSEDE messages SHOULD be less than the network Maximum Segment Size (MSS) size in length. On a modern Ethernet network, IEEE 802.3 [IEEE8023] specifies a standard maximum payload size of 1500 bytes. The size of the fixed IPv4 header is 20 bytes [RFC0791] or in IPv6 the fixed header is 40 bytes [RFC2640] UDP headers consume 8 bytes, [RFC0768] the XSEDE header Section 4.1 uses 12 bytes leaving 1460 bytes for parameters or 1440 bytes on an IPv6 network.

3. xfsdatamodel

The xfsdatamodel tag is the root element for the XSEDE XML datamodel. The following subsections show the descendant elements and their attributes.

3.1. structures

3.1.1. structure

Attribute	Mandatory	Definition	Default
name	Yes	Mandatory name for this parameter format which may only contain lower case letters a-z, underscore ('_') and digits 0-9 after the first non-digit character.	No
definition	No	Human readable description of the purpose of this item.	No

Table 1: structure

3.1.1.1. int8 - 8-bit two's complement signed integer

Attribute	Mandatory	Definition	Default
length	No	If specified, this field is actually an array of this length. Note that charrays can have a length of zero only if at the end of a structure, implying there will be a buffer immediately following.	No
divisor	No	If specified, the the value of this field is divided by this to obtain a (floating point) number of units.	No
minval	No	The minimum valid value can be found in this field	No
maxval	No	The maximum valid value can be	No

		found in this field	
clowval	No	The value below which caution should be exercised can be found in this field	No
chighval	No	The value above which caution should be exercised can be found in this field	No
units	No	What units (e.g. seconds, pounds, etc) is this field provided in? The units must exist in the param_units dictionary.	No
interpret	No	If specified, interpret this field using the given Dictionary	No
defrange	No	If specified, references a predefined range for interpretation of the value.	No

Table 2: int8

3.1.1.2. uint8 - 8-bit unsigned integer

Attribute	Mandatory	Definition	Default
length	No	If specified, this field is actually an array of this length. Note that charrays can have a length of zero only if at the end of a structure, implying there will be a buffer immediately following.	No
divisor	No	If specified, the the value of this field is divided by this to obtain a (floating point) number of units.	No
minval	No	The minimum valid value can be found in this field	No

maxval	No	The maximum valid value can be found in this field	No
clowval	No	The value below which caution should be exercised can be found in this field	No
chighval	No	The value above which caution should be exercised can be found in this field	No
units	No	What units (e.g. seconds, pounds, etc) is this field provided in? The units must exist in the param_units dictionary.	No
interpret	No	If specified, interpret this field using the given Dictionary	No
defrange	No	If specified, references a predefined range for interpretation of the value.	No

Table 3: uint8

3.1.1.3. int16 - 16-bit two’s complement signed integer

Attribute	Mandatory	Definition	Default
length	No	If specified, this field is actually an array of this length. Note that charrays can have a length of zero only if at the end of a structure, implying there will be a buffer immediately following.	No
divisor	No	If specified, the the value of this field is divided by this to obtain a (floating point) number of units.	No
minval	No	The minimum valid value can be found in this field	No

maxval	No	The maximum valid value can be found in this field	No
clowval	No	The value below which caution should be exercised can be found in this field	No
chighval	No	The value above which caution should be exercised can be found in this field	No
units	No	What units (e.g. seconds, pounds, etc) is this field provided in? The units must exist in the param_units dictionary.	No
interpret	No	If specified, interpret this field using the given Dictionary	No
defrange	No	If specified, references a predefined range for interpretation of the value.	No

Table 4: int16

3.1.1.4. uint16 - 16-bit unsigned integer

Attribute	Mandatory	Definition	Default
length	No	If specified, this field is actually an array of this length. Note that charrays can have a length of zero only if at the end of a structure, implying there will be a buffer immediately following.	No
divisor	No	If specified, the the value of this field is divided by this to obtain a (floating point) number of units.	No
minval	No	The minimum valid value can be	No

		found in this field	
maxval	No	The maximum valid value can be found in this field	No
clowval	No	The value below which caution should be exercised can be found in this field	No
chighval	No	The value above which caution should be exercised can be found in this field	No
units	No	What units (e.g. seconds, pounds, etc) is this field provided in? The units must exist in the param_units dictionary.	No
interpret	No	If specified, interpret this field using the given Dictionary	No
defrange	No	If specified, references a predefined range for interpretation of the value.	No

Table 5: uint16

3.1.1.5. int32 - 32-bit two’s complement signed integer

Attribute	Mandatory	Definition	Default
length	No	If specified, this field is actually an array of this length. Note that charrays can have a length of zero only if at the end of a structure, implying there will be a buffer immediately following.	No
divisor	No	If specified, the the value of this field is divided by this to obtain a (floating point) number of units.	No

minval	No	The minimum valid value can be found in this field	No
maxval	No	The maximum valid value can be found in this field	No
clowval	No	The value below which caution should be exercised can be found in this field	No
chighval	No	The value above which caution should be exercised can be found in this field	No
units	No	What units (e.g. seconds, pounds, etc) is this field provided in? The units must exist in the param_units dictionary.	No
interpret	No	If specified, interpret this field using the given Dictionary	No
defrange	No	If specified, references a predefined range for interpretation of the value.	No

Table 6: int32

3.1.1.6. uint32 - 32-bit unsigned integer

Attribute	Mandatory	Definition	Default
length	No	If specified, this field is actually an array of this length. Note that charrays can have a length of zero only if at the end of a structure, implying there will be a buffer immediately following.	No
divisor	No	If specified, the the value of this field is divided by this to obtain a (floating point) number of units.	No

minval	No	The minimum valid value can be found in this field	No
maxval	No	The maximum valid value can be found in this field	No
clowval	No	The value below which caution should be exercised can be found in this field	No
chighval	No	The value above which caution should be exercised can be found in this field	No
units	No	What units (e.g. seconds, pounds, etc) is this field provided in? The units must exist in the param_units dictionary.	No
interpret	No	If specified, interpret this field using the given Dictionary	No
defrange	No	If specified, references a predefined range for interpretation of the value.	No

Table 7: uint32

3.1.1.7. charray - 8-bit ISO-8859 encoded character string, NUL (0) terminated

Attribute	Mandatory	Definition	Default
length	Yes	If specified, this field is actually an array of this length. Note that charrays can have a length of zero only if at the end of a structure, implying there will be a buffer immediately following.	No
name	Yes	Mandatory name for this	No

		parameter format which may only contain lower case letters a-z, underscore ('_') and digits 0-9 after the first non-digit character.	
definition	No	Human readable description of the purpose of this item.	No

Table 8: charray

3.1.1.8. struct - A previously defined structure

Attribute	Mandatory	Definition	Default
struct	Yes		No
name	Yes	Mandatory name for this parameter format which may only contain lower case letters a-z, underscore ('_') and digits 0-9 after the first non-digit character.	No
definition	No	Human readable description of the purpose of this item.	No

Table 9: struct

3.1.1.9. starray - Array of another previously defined structure

Attribute	Mandatory	Definition	Default
struct	Yes	If specified, references a predefined range for interpretation of the value.	No
length	Yes	If specified, this field is actually an array of this length. Note that charrays can have a length	No

		of zero only if at the end of a structure, implying there will be a buffer immediately following.	
name	Yes	Mandatory name for this parameter format which may only contain lower case letters a-z, underscore ('_') and digits 0-9 after the first non-digit character.	No
definition	No	Human readable description of the purpose of this item.	No

Table 10: starray

3.1.2. paramformat

Attribute	Mandatory	Definition	Default
value	Yes	This is the integer ID that is used to uniquely identify a parameter format	No
bufferlen	No	For parameter formats which end in a charray of length zero, this is the maximum number of character bytes that any parameter could contain.	No
minval	No	The minimum valid value can be found in this field	No
maxval	No	The maximum valid value can be found in this field	No
clowval	No	The value below which caution should be exercised can be found in this attribute	No
chighval	No	The value below which caution should be exercised can be	No

		found in this attribute	
name	Yes	Mandatory name for this parameter format which may only contain lower case letters a-z, underscore ('_') and digits 0-9 after the first non-digit character.	No
definition	No	Human readable description of the purpose of this item.	No

Table 11: paramformat

3.2. dictionaries

3.2.1. dictionary

Attribute	Mandatory	Definition	Default
default	No	If specified, use this name for any value that is not defined in the dictionary. If unspecified, "UNKNOWN" is used.	UNKNOWN
emptyok	No	If set to "true", an empty string is considered an encoding of zero rather than an error and a zero value is an empty name unless zero is otherwise defined.	false
issigned	No	If set to "true", all value fields for dictionary entries are considered to be 32-bit signed integers. Otherwise all dictionary entry values are considered 32-bit unsigned integers.	false
mask	No	If defined, this integer is used as a default mask for the interpretation of non-flag values.	No

numbersok	No	If set to true, bare numbers that do not have named values are permissible.	FALSE
immutable	No	If set to true, this dictionary may not be modified by a future dictionary load.	false
separator	No	If defined, this integer is used as a default mask for the interpretation of non-flag values.	|
class	No	For dictionaries of message subclasses, this specifies the msgcl field from the msg_class dictionary for which this set of subclasses applies	No
minval	No	The minimum valid value for the dictionary if set (otherwise all possible values of the underlying datatype are assumed valid).	No
maxval	No	The minimum valid value for the dictionary if set (otherwise all possible values of the underlying datatype are assumed valid).	No
type	No	Marked external to indicate that there is implementation needed to perform the translation.	No
name	Yes	Mandatory name for this parameter format which may only contain lower case letters a-z, underscore ('_') and digits 0-9 after the first non-digit character.	No
definition	No	Human readable description of the purpose of this item.	No

Table 12: dictionary

3.2.1.1. entry

Attribute	Mandatory	Definition	Default
value	Yes	Mandatory unique value in the form of a signed or unsigned 32-bit number which may be specified with an optional shift left and in parenthesis.	No
format	No	Required for the db_param dictionary to indicate what the param_format of the parameter is.	No
interpret	No	For the db_param if specified, interpret the given database parameter using the specified dictionary.	No
units	No	For db_param if specified, the units of measure for the given database parameter	No
divisor	No	For db_param if specified, the value should be divided by this number to determine the (floating point) number of units.	No
flag	No	If specified with a value of "true", the value is treated as a flag that is combined with other values. Any value formed with a shift is assumed to be a flag by default.	false
mask	No	If specified, this 32-bit mask is applied to the	false

		value before comparison with the given value.	
body	No	For Maintenance Messages specifies the ‘structure‘ associated with the body of this maintenance message.	false
a661encoding	No	Used for ARINC-661 parameters in A661 dictionaries as a hint to how the data is encoded for ARINC-661.	false
name	Yes	Mandatory name for this parameter format which may only contain lower case letters a-z, underscore (’_’) and digits 0-9 after the first non-digit character.	No
definition	No	Human readable description of the purpose of this item.	No

Table 13: entry

3.3. ranges

3.3.1. range

Attribute	Mandatory	Definition	Default
minval	Yes	The minimum value for the range.	No
maxval	Yes	The maximum value that the range can have.	No
mindisp	Yes	The minimum value when displaying a value interpreted with the range versus the minimum value that the range can have.	No

maxdisp	Yes	The maximum value when displaying a value interpreted with the range versus the maximum value that the range parameter can have.	No
divisor	No	For a range the value to divide the ranged parameter by prior to interpreting the value.	No
wrap	No	A Boolean flag where true indicates that values greater than the maxval of the range should wrap circularly starting at the minval of the range.	No
numticks	No	How many subdivisions of the range there should be (i.e. the number of tick marks to make in a gauge).	No
name	Yes	Mandatory name for this parameter format which may only contain lower case letters a-z, underscore ('_') and digits 0-9 after the first non-digit character.	No
definition	No	Human readable description of the purpose of this item.	No

Table 14: range

3.3.1.1. tick

Attribute	Mandatory	Definition	Default
color	Yes	The specific color to display at the specified value.	No
value	Yes	The specific value at which a specified color should be displayed.	No

Table 15: tick

3.4. params

3.4.1. param

Attribute	Mandatory	Definition	Default
value	Yes	This is the 21-bit identifier field that will be have the length in 11-bits prepended to form the total parameter identifier.	No
format	Yes	What the parameter format special structure describes how to interpret the data.	No
units	No	What units (i.e. lbs, degrees Fahrenheit, or Knots) the value is given in specified in a special param_units dictionary.	No
defrange	No	The default range to be used to determine if the parameter is valid when examined.	No
divisor	No	The divisor that is applied to the value of this parameter before it is sent as an XSEDE message.	No
length	No	For variable length parameter formats, what the length of the variable portion is in Bytes.	No
interpret	No	Default dictionary to be used to interpret the value of the parameter.	No
range	No	Boolean value that is used	No

		to signal that a range parameter should be generated in conjunction with the default non-range parameter.	
unitnum	No	A human readable interpretation for what a unit number means for the parameter. For example, a parameter for the source of music in an airplane might explain the unit number is representative of which audio panel in the aircraft.	No
subunitnum	No	A human readable interpretation for what a subunit number means for the parameter. For example, a parameter for the source of music in an airplane might explain the standard mapping of the subunit number to crew, passengers, or the audio panel as a whole.	No
name	Yes	Mandatory name for this parameter format which may only contain lower case letters a-z, underscore ('_') and digits 0-9 after the first non-digit character.	No
definition	No	Human readable description of the purpose of this item.	No

Table 16: param

4. Message Format

4.1. Message Header

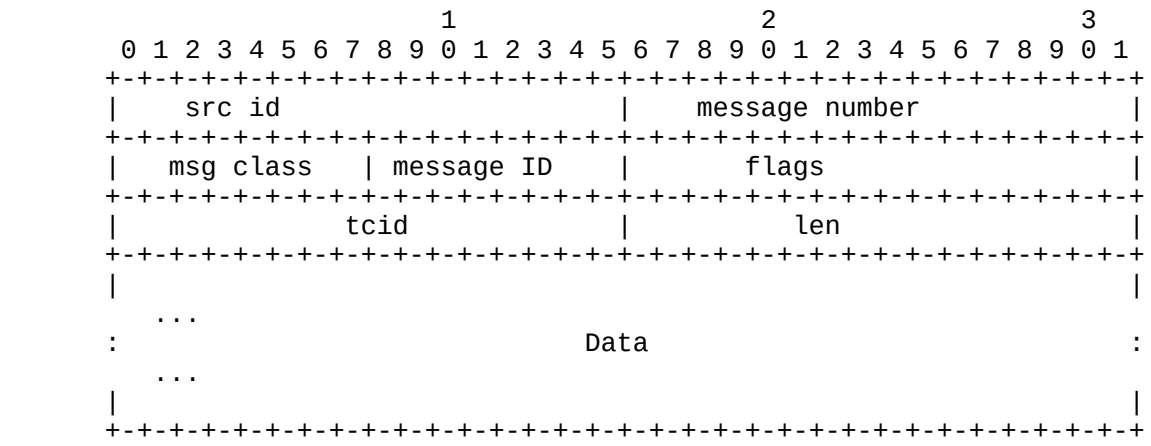

Figure 1: Message Header Format

XSEDE messages are formatted as shown in the above diagram and consist of the following fields:

src id:
UINT16; locally configured source ID. Must be unique on network.

message number:
UINT16; monotonically increasing message number.

msg class:
UINT8; The message class. See Table 17

message ID:
UINT8; msg-op; See Table 19.

flags:
UINT16; See Table 21.

tcid:
t-NONE; See Table 22.

len:
UINT16 ; length of all parameters or raw data in octets. Note: Operational and Maintenance class messages shall always have a length that is a factor or 4.

data:
1*(parameter) / *(OCTET) ; raw data may be arbitrary length sequence of octets.

4.1.1. Message Header Dictionaries

This section defines the dictionaries used in the message header. See Section 4.1.

Table 17, below, shows the values defined in the msg-class Dictionary. These options represent the XFS common data bus message classes.

Name	Value	Definition
MAINT	%d2	Maintenance Message
OP	%d3	Operational Message
RAW	%d4	Access to raw data stream (e.g. RS-232, RS-485, ARINC-429, etc)

Table 17: msg-class Dictionary

Table 18, below, shows the values defined in the msg-maint Dictionary. These options represent the Message subclasses for maintenance message class.

Name	Value	Definition
MXREQ	%d1	Request maintenance mode for a specific CPU (or all if cpu is empty)
MXCHAL	%d2	Authentication challenge
MXAUTH	%d3	Authentication response
MXACCEPT	%d4	Accept authentication request
MXDENY	%d5	Deny maintenance mode
MXREADY	%d6	Ready for update or diagnostic
DOUPDATE	%d7	User Requests System Update. Note CPU is requestor
UPDREQ	%d8	Request Update for given Device
UPDSTAT	%d9	Status of Update
DODIAG	%d10	User Requests System Update. Note CPU is requestor. Salt is type of diagnostic.
DIAGREQ	%d11	Request diagnostic for given Device.
DIAGSTAT	%d12	Status of Update

Table 18: msg-maint Dictionary

Table 19, below, shows the values defined in the msg-op Dictionary. These options represent the Message subclasses for operational message class.

Name	Value	Definition
SUBFLDATA	%d1	Subscribe to Aircraft Flight Data Params
FLIGHTDATA	%d2	Flight Data Info
DEVSTATUS	%d3	Device Status
GDL90	%d4	GDL-90 Format Messages without framing, FCS or escape characters
SUBMSGCLID	%d5	Subscribe to Specific Message Class and ID

Table 19: msg-op Dictionary

Table 20, below, shows the values defined in the msg-raw Dictionary. These options represent the Message subclasses for raw message class.

Name	Value	Definition
SERIALRX	%d1	Serial raw data stream receive from end device
SERIALTX	%d2	Serial raw data stream transmit to end device
SPIRX	%d5	Raw SPI bus receive from end device
SPITX	%d6	Raw SPI bus transmit to end device
ARINC429RX	%d7	Raw ARINC-429 bus receive from end device
ARINC429TX	%d8	Raw ARINC-429 bus transmit to end device
MIL1553RX	%d9	Raw MIL-STD-1553 received from end device
MIL1553TX	%d10	Raw MIL-STD-1553 bus transmit to end device

ECBRX	%d11	Raw XFS ECB control receive from end device
ECBTX	%d12	Raw XFS ECB control transmit to end device
GPIORX	%d13	Raw XFS ECB control receive from end device
GPIOTX	%d14	Raw XFS ECB control transmit to end device
ADCRX	%d15	Analog/Digital Converter receive from end device
DACTX	%d16	Digital/Analog Converter transmit to end device
CANBUSRX	%d17	Raw CAN bus receive from end device
CANBUSTX	%d18	Raw CAN bus transmit to end device
DATAGRAMRX	%d19	Raw Datagram receive from end device
DATAGRAMTX	%d20	Raw Datagram transmit to end device

Table 20: msg-raw Dictionary

Table 21, below, shows the values defined in the msg-flag-cert Dictionary. These options represent the Message and parameter certification level tracking.

Name	Value	Definition
EXPERIMENTAL	%d0	Experimental
LEVEL-E	%d1	DO-178 Level E
LEVEL-D	%d2	DO-178 Level D
LEVEL-C	%d3	DO-178 Level C
LEVEL-B	%d4	DO-178 Level B
LEVEL-A	%d5	DO-178 Level A

Table 21: msg-flag-cert Dictionary

Table 22, below, shows the values defined in the tcid Dictionary. These options represent the XFS transcoder ID values.

Name	Value	Definition
NONE	%d0	No transcoder ID is required or asserted
DEFAULT	%d65536	Pseudo-value to represent global default

Table 22: tcid Dictionary

4.2. Message Parameter Format

The section defines the elements common to all XSEDE parameters.

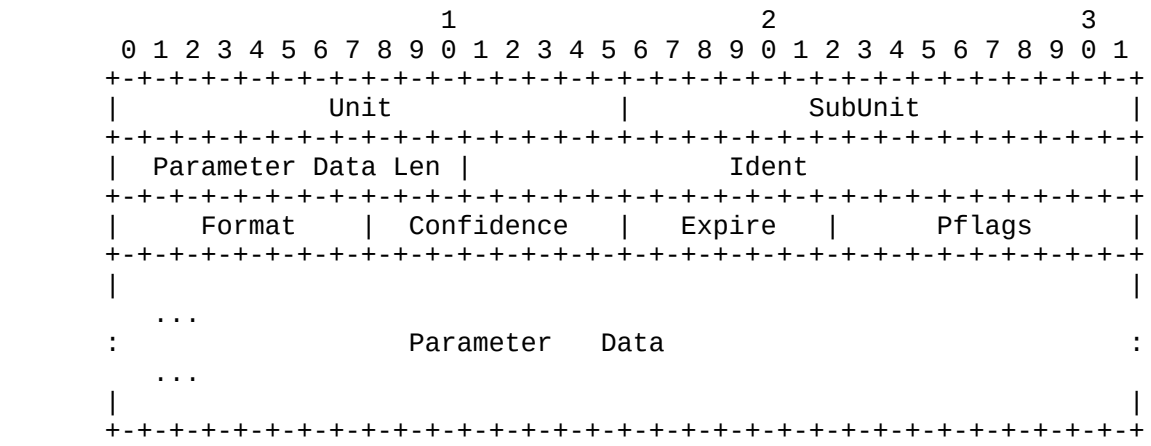

Figure 2: Message Parameter Format

Unit:
UINT16 If appropriate, which unit this parameter applies (e.g., Engine #1).

SubUnit:
UINT16; If appropriate, which subunit this parameter applies (e.g., Engine #2, Cylinder #3).

Parameter Ident:
UINT32; This attribute is the composite of the length and a parameter specific identifier.

Nodes MUST compare this value as a whole to their known parameters; that is to say, an Ident with a different length is a different parameter. This same Ident with a different length situation commonly occurs when sending range parameters but it also can happen when parameter definitions are updated.

If the combined value does not match a known parameter/length pair, the parameter data length MUST be determined, then padded to a multiple of four, and the parameter MUST be ignored.

Len: 11 bits; Parameter Data Length in octets. This value MUST reflect the usable length of the parameter data, not including padding, however, the parameter itself MUST be padded to a length that is a multiple of four octets to maintain proper word alignment.

Ident: 21 bits; XSEDE Parameter Identifier. See Section 4.7.

Format:
param_format (OCTET): Format of Parameter Data. See Section 4.3.

Confidence:
param_confidence (OCTET): Confidence of data element. See Table 23.

Expire:
OCTET; Time to live. %x00 to not expire. See Section 4.2.2 for encoding.

Pflags:
msg_flag_cert(OCTET) Reserved Flags, bottom three bits are certification level of data. See Table 21

Parameter Data:
*(OCTET) quadword padded payload.

4.2.1. Parameter Header Dictionaries

Table 23, below, shows the values defined in the param-confidence Dictionary. These options represent the XFS common bus parameter format confidence levels.

Name	Value	Definition
HIGH	%d100	Confirmed known value
USERSEL	%d90	User selected value at runtime
SYSSEL	%d80	System selected value at runtime
INTENTSEL	%d70	User has indicated intent to make a change for this value, but it has not yet been confirmed
UNANIMOUS	%d50	Redundant data available and is rationalized
RATIONAL	%d40	Data being rationalized from other data sources with normal sources ignored
VOTED	%d30	Data is redundantly verified from identical instruments
SMOOTHED	%d20	Smoothed/filtered version of raw data
RAW	%d10	Raw, unchecked data
ESTIMATE	%d5	Rough estimation
USELESS	%d0	Value is missing or expected invalid and supplied for debugging ONLY

Table 23: param-confidence Dictionary

The msg_flag_cert Dictionary is also used. See Table 21 for its definition.

4.2.2. Expire Encoding

Information provided in messages have a limited usability lifetime or time-to-live. The Expire field is used to indicate how long the associated parameter is valid. It is an eight-bit field that is split into an exponent and mantissa to provide the maximum range and precision within this small space. The upper four bits represent the the mantissa and the lower four bits represent the exponent. If the

value of the Expire field is %x00, the value MUST be interpreted to mean "the parameter does not expire," otherwise the expiry time value MUST be determined by the following formula:

Expiration (milliseconds) = (16 + M) * 2^E which can be implemented with (0x10 | M) << E

This approach give us the range of 17 to 1015880 milliseconds (about 17 minutes) with 0x00 reserved as "No Expiration."

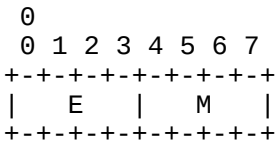

Figure 3: Message Parameter Format

For example, an expiry value of %x31 gives a mantissa of 0001 and an exponent of 0011 yielding a value of (16 + 1) * 2^E ms or 128 milliseconds.

Another example, a value of %x7F which decomposes to a mantissa of 1111 and an exponent of 0111 yielding a value of (16 + 15) * 2^7 ms, or 3968 milliseconds.

The minimum value of %x01 which decomposes to a mantissa of 0001 and an exponent of 0000 yielding a value of (16 + 1) * 2^0 ms, or 17 milliseconds.

The maximum value of %xFF which decomposes to a mantissa of 1111 and an exponent of 1111 yielding a value of (16 + 15) * 2^15 ms, or 1015808 milliseconds, which is about 17 minutes.

A final example, %x00 which is a special case for "No Expiration."

4.3. Parameter Attribute Formats

The various attributes associated with parameters occur as both simple types, such as Integers and compound structures, such as Waypoints. This section defines the attribute formats that are used in XSEDE.

4.3.1. BOOL Parameter Format

Boolean Format

Parameter Identifier: %d1

Length: 4

Structure:

Item	Type	Description
bool-value	boolean	Zero for false, 1 for true, all others undefined

Table 24: BOOL Parameter Format

Table 25, below, shows the values defined in the boolean Dictionary. These options represent the Nominal boolean values.

Name	Value	Definition
FALSE	%d0	False
TRUE	%d1	True

Table 25: boolean Dictionary

4.3.2. UINT Parameter Format

Unsigned 32-bit Integer Format

Parameter Identifier: %d2

Length: 4

Structure:

Item	Type	Description
uint-value	uint32	32-bit Unsigned Value

Table 26: UINT Parameter Format

4.3.3. WAYPOINT Parameter Format

Waypoint on a Flight Plan

Parameter Identifier: %d3

Length: 80

Structure:

Item	Type	Description
label	12*12(OCTET)	Name of waypoint
lat	int32	Latitude of waypoint * 10,000,000
lon	int32	Longitude of waypoint * 10,000,000
lonlen	int32	Length of degree of longitude for this lattitude in meters
alt	int32	Altitude associated with waypoint in 0.1ft
minalt	int32	Logical Minimum for Fix Crossing in 0.1ft
maxalt	int32	Logical Maximum Altitude for Fix Crossing in 0.1ft
speed	int32	Target indicated airspeed
magadj	uint32	Original (VOR) or Current (GPS) Magnetic Deviation in 0.01 degrees of NAVAID
inbound	uint16	Inbound course in 0.01 degrees
outbound	uint16	Outbound course in 0.01 degrees
freq	uint32	Frequency if this is a NAV AID
wtype	fms-waypoint	Type of waypoint
ctype	fms-container	Type of container

flags	fms-flag	Flags for the waypoint / leg
cumete	uint32	Cumulative ETE from active waypoint in 0.01 seconds
cumdis	uint32	Cumulative distance from active waypoint in 0.001 nm
container	16*16(OCTET)	What container is this waypoint a part of (e.g. V431, ILS-18L, etc)

Table 27: WAYPOINT Parameter Format

Table 28, below, shows the values defined in the fms-waypoint Dictionary. These options represent the Flight management system waypoint types.

Name	Value	Definition
UNKNOWN	%d0	Unknown or unspecified
GS	%x80	Glideslope component
DME	%x40	DME Component
TACAN	%x20	TACAN Component
VOR	%d1	VOR Component
LOC	%d2	Localizer component
NDB	%d3	NDB component
LDA	%d4	LDA Component
SDF	%d5	SDF Component
FIX	%d6	Generic RNAV Fix
ILS	%d7	Complete ILS system
AIRPORT	%d8	An Airport
DIRECTFROM	%d9	Starting point of a direct to
WEATHER	%d10	Weather reporting station only

Table 28: fms-waypoint Dictionary

Table 29, below, shows the values defined in the fms-container Dictionary. These options represent the Flight management system container types.

Name	Value	Definition
UNKNOWN	%d0	Unspecified or unknown container
NONE	%d1	No container
VICTOR	%d2	VOR Airway
JET	%d3	Jet Airway
AMBER	%d4	Amber Airway
BLUE	%d5	Blue Airway
GREEN	%d6	Green Airway
RED	%d7	Red Airway
Q	%d8	RNAV Q Routes
T	%d9	RNAV T Routes
STAR	%d10	Standard Arrival Procedure
DP	%d11	Standard Departure Procedure
APP	%d12	Instrument Approach
RWY	%d13	Airport Runway Surface Selection

Table 29: fms-container Dictionary

Table 30, below, shows the values defined in the fms-flag Dictionary. These options represent the Flight management system waypoint and leg flags.

Name	Value	Definition
NONE	%d0	No flags or leg type known
LEGTYPE-VA	%d1	Heading to Altitude
LEGTYPE-VD	%d2	Heading to DME Distance
LEGTYPE-VI	%d3	Heading to Next Leg Intercept

LEGTYPE-VM	%d4	Heading to Manual Termination
LEGTYPE-VR	%d5	Heading to Radial Termination
LEGTYPE-CA	%d6	Course to an Altitude
LEGTYPE-CD	%d7	Course to a DME Distance
LEGTYPE-CI	%d8	Course to Next Leg Intercept
LEGTYPE-CR	%d9	Course to Radial Termination
LEGTYPE-CF	%d10	Course to a Fix
LEGTYPE-TF	%d11	Tracking Between Two Fixes
LEGTYPE-DF	%d12	Direct to a Fix
LEGTYPE-FA	%d13	Course from a Fix to an Altitude
LEGTYPE-FC	%d14	Course from a Fix to an Along Track Distance
LEGTYPE-FD	%d15	Course from a Fix to a DME Distance
LEGTYPE-FM	%d16	Course from a Fix to a Manual Termination
LEGTYPE-AF	%d17	Constant DMA Arc to a Fix
LEGTYPE-HF	%d18	Hold to a Fix
LEGTYPE-HA	%d19	Hold to an Altitude
LEGTYPE-HM	%d20	Hold to a Manual Termination
LEGTYPE-IF	%d21	Initial Fix
LEGTYPE-PI	%d22	Procedure Turn to Intercept
LEGTYPE-RF	%d23	Radius to a Fix
LEGTYPE-MASK	%xff	Mask with which to retrieve leg type
FLYOVER	%x01.00	If not present, fly by

DISC	%x02.00	If present, Discontinuity before current waypoint
ACTIVE	%x04.00	If present, this is the active waypoint
OBS	%x08.00	If present, waypoint allows OBS to be set
FAF	%x10.00	If present, waypoint is final approach fix or after
SUSPEND	%x20.00	FMS sequencing is suspended at this waypoint
LAST	%x40.00	This waypoint is the last one in the flight plan

Table 30: fms-flag Dictionary

4.3.4. STRING Parameter Format

String of characters (may not have NULL termination)

Parameter Identifier: %d4

Length: length(data) + 0

Structure:

Item	Type	Description
string-value	*(OCTET)	Optionally NUL terminated ISO-8559-1 String

Table 31: STRING Parameter Format

4.3.5. CASMSG Parameter Format

CAS Message

Parameter Identifier: %d5

Length: length(data) + 4

Structure:

Item	Type	Description
level	cas-msglvl	CAS level
rsvd	uint8	Reserved, set to 0
flags	cas-msgflag	CAS related flags
label	*(OCTET)	Label for CAS Message

Table 32: CASMSG Parameter Format

Table 33, below, shows the values defined in the cas-msglvl Dictionary. These options represent the Message levels for CAS messages and checklist items.

Name	Value	Definition
CLEAR	%d0	Clear a previously issued CAS message -- issue from system only
DEBUG	%d1	In-system debugging output only
LOG	%d2	Log to system log, but do not display
MAINT	%d3	Display only for maintenance purposes
STATUS	%d4	Aircraft system status only
ADVISORY	%d5	Advisory, flight crew should be aware, may require later crew response
CAUTION	%d6	Caution, requires immediate flight crew awareness and later response
WARNING	%d7	Warning, requires immediate awareness and response.
COMMENT	%d10	Checklist Comment Associated with Previous Item
UNCHKITEM	%d11	Unchecked Checklist Item
CHKITEM	%d12	Checked Checklist Item
CHKBRANCH	%d13	Checklist Branch Choice
PASS	%d14	Built-in Test (BIT) Item passed
INPROG	%d15	Built-in Test (BIT) Item in progress
NOTREQST	%d16	Built-in Test (BIT) Item not yet requested
INCOMPLT	%d17	Built-in Test (BIT) Item test did not complete
FAIL	%d18	Built-in Test (BIT) Item failed

Table 33: cas-msglvl Dictionary

Table 34, below, shows the values defined in the cas-msgflag Dictionary. These options represent the Additional flags associated with CAS messages.

Name	Value	Definition
NONE	%d0	No additional flags
AUTO	%x01	Item is automatically checked/unchecked or the test is automatically executed

Table 34: cas-msgflag Dictionary

4.3.6. NULL Parameter Format

NULL format

Parameter Identifier: %d7

4.3.7. SINT Parameter Format

Signed 32-bit Integer Format

Parameter Identifier: %d9

Length: 4

Structure:

Item	Type	Description
sint-value	int32	Signed 32-bit two’s complement value

Table 35: SINT Parameter Format

4.3.8. BUS Parameter Format

Bus and Electronic Circuit Breaker Format

Parameter Identifier: %d10

Length: length(data) + 24

Structure:

Item	Type	Description
state	ecb-state	State of Bus (in terms of ECB)
ecbflags	ecb-flag	Flags regarding ECB state
involts	int16	Input Volts on Bus
drawamps	int16	Current draw on bus
maxamps	int16	Max Amps on bus
champs	int16	Caution high amps
clamps	int16	Caution low amps
minamps	int16	Minimum amps on bus (could be -)
outvolts	int16	Output Volts on Bus
maxvolts	int16	Max volts
chvolts	int16	Caution high voltage
clvolts	int16	Caution low voltage
minvolts	int16	Minimum low voltage
label	*(OCTET)	Label for BUS Message (System/Item)

Table 36: BUS Parameter Format

Table 37, below, shows the values defined in the ecb-state Dictionary. These options represent the Electronic circuit breaker status.

Name	Value	Definition
UNKNOWN	%d0	Circuit is in an unknown condition
OFF	%d1	Circuit is turned off
ON	%d2	Circuit is turned on
UNDERCUR	%d3	Circuit is on, <100ma current drawn
RESET	%d4	Request Reset
FORWARD	%d5	ECB is active logical FWD direction
REVERSE	%d6	ECB is active logical REV direction
TARGET	%d7	ECB is set by target, not ON/OFF
BRAKELOW	%d8	ECB is set by target, not ON/OFF
SHORTED	%d128	Short Circuit
OVERCUR	%d129	Overcurrent (but not short circuit)
OVERVOL	%d130	Overvoltage situation
DISABLED	%d131	Disabled by state-fault
RUNAWAY	%d132	Disabled due to runaway (trim/flaps)
COLLARED	%d133	Should not reset in flight
JAMMED	%d134	Mechanical Jam detected
PULLED	%d135	Pulled
BACKFLOW	%d136	Disabled due to reverse current flow

Table 37: ecb-state Dictionary

Table 38, below, shows the values defined in the ecb-flag Dictionary. These options represent the Electronic circuit breaker parameter flags.

Name	Value	Definition
INPUTVOLTS	%x01	Input Volts field is valid

Table 38: ecb-flag Dictionary

4.3.9. RANGE Parameter Format

Range description format

Parameter Identifier: %d11

Length: 36

Structure:

Item	Type	Description
numticks	uint16	How many ticks are there
dispunits	param-units	Specifier for units for display
minval	int32	Minimum valid value
maxval	int32	Maximum valid value
mindisp	int32	Where display starts (values lower than this are clipped)
maxdisp	int32	Where display stops (values higher tha this are clipped)
ticks	starray	Actual tick data

Table 39: RANGE Parameter Format

Table 40, below, shows the values defined in the param-units Dictionary. These options represent the Units for the encoding and translation of XFS parameters.

Name	Value	Definition
UNSPEC	%x00	Units not specified
INHG	%x00.01	Use inches of Hg for BARO/MANPRES
FT	%x00.02	Use feet for altitude
NM	%x00.03	Use nautical miles for distance
C	%x00.04	Use celcius for temperature
LBFT	%x00.05	Use pound-feet for torque
S	%x00.06	Use seconds for time
A	%x00.07	Use amps for current
V	%x00.08	Use volts for voltage
LB	%x00.09	Use pounds for weight
IN	%x00.0a	Use inches for distance
FPM	%x00.0b	Use feet per minute for rate of climb/descent
LBPH	%x00.0c	Pounds per Hour for fuel flow
DEGPS	%x00.0d	Degrees per second for attitude change
DEG	%x00.0e	Degrees for attitude
G	%x00.0f	G force for load
RGBA	%x00.10	8888 RGBA Value
MHZ	%x00.11	Megahertz for Frequency
PCENT	%x00.12	Percent of Maximum
KT	%x00.13	Knots for Speed
NMPLB	%x00.14	Nautical Miles per Pound
KTPS	%x00.15	Knots per second
MACH	%x00.16	Speed of sound

CPM	%x00.17	Count per minute
PPM	%x00.18	Parts per million
LPM	%x00.19	Liters Per Minute
KW	%x00.1a	Kilowatt
AH	%x00.1b	Amp Hour
GAL	%x00.1c	Gallons of volume
NMPGAL	%x00.1d	Nautical Miles per Gallon
GPH	%x00.1e	Gallons per Hour for fuel flow
MEMS	%x00.1f	Mantissa/Exponent Milliseconds (2^E)*(M+16)
HPA	%x80.01	Use Hecto pascals for BARO
M	%x80.02	Use meters for altitude
SM	%x80.03	Use statute miles for distance
F	%x80.04	Use fahrenheit for temperature
NWM	%x80.05	Use Newton Meters for torque
PSI	%x80.06	Use PSI for MANPRES
MPH	%x80.07	Use miles per hour for speed
SMPLB	%x80.08	Statute Miles per Pound
MIN	%x80.09	Minutes
HR	%x80.0a	Hours
HP	%x80.0b	Use Horsepower for power
KG	%x80.0c	Use kilograms at earth gravity for weight
L	%x80.1c	Liters of volume
LPH	%x00.1e	Liters per Hour for fuel flow
UL	%xff.ff	Unitless

Table 40: param-units Dictionary

4.3.10. GPIO Parameter Format

GPIO summary format

Parameter Identifier: %d12

Length: 12

Structure:

Item	Type	Description
features	uint32	4-bit Feature (XFS_GPIO_FEATURE_*) x 8
outmodes	uint32	4-bit Output modes (XFS_GPIO_OUTPUT_*) x 8
inmodes	uint16	2-bit Input modes (XFS_GPIO_INPUT_*) x 8
flags	uint16	Reserved for future use

Table 41: GPIO Parameter Format

4.3.11. APP Parameter Format

APP status format

Parameter Identifier: %d13

Length: length(data) + 52

Structure:

Item	Type	Description
state	scb-state	State of application*
rsvd	uint8	Reserved bits
appflags	scb-flag	Flags regarding app
avgcpu	uint16	Average OS CPU time utilization (of allocated amount) over last second (0=unknown, 1=minimal, 65535=all)
hwcpu	uint16	High water OS CPU time utilization (of allocated amount, 0=unknown, 1=minimal, 65535=all)
stackused	uint16	Portion of stack used (0=unknown, 1=minimal, 65535=all)
heapused	uint16	Portion of heap used (0=unknown, 1=minimal, 65535=all)
netused	uint16	Portion of network used (0=unknown, 1=minimal, 65535=all)
otherused	uint16	Worst case portion of any other limited resources (0=unknown, 1=minimal, 65535=all)
ivcsw	uint32	Involuntary context switches
aircraftid	16*16(OCTET)	Aircraft Identifier
swrev	16*16(OCTET)	Software Version Identifier
label	*(OCTET)	Name of APP

Table 42: APP Parameter Format

Table 43, below, shows the values defined in the scb-state Dictionary. These options represent the Software circuit breaker states.

Name	Value	Definition
UNKNOWN	%d0	State of software is unknown
STARTING	%d1	Application is in startup phase
RUNNING	%d2	Application is running
STOPPING	%d3	Stopping has been requested
RESTART	%d4	Restart Application (PULL + RESET + START)
RESET	%d5	Allow application to be started
HUNG	%d6	Application is running but is no longer responsive
DEGRADED	%d127	Application is running in a degraded mode
STOPPED	%d128	Application is stopped
STARTFAIL	%d129	Application failed startup
RUNAWAY	%d130	Application has a runaway loop
OVERCPU	%d131	Application is using excessive CPU while in RUNNING state
OVERMEM	%d132	Application terminated due to memory overrun
EXCEPTION	%d133	Application terminated due to runtime exception
ENDED	%d134	Application ended without error or request
ENDERROR	%d135	Application ended with error condition
PULLED	%d136	Application should not be allowed to run until reset
COLLARED	%d137	Should not reset in flight

Table 43: scb-state Dictionary

Table 44, below, shows the values defined in the scb-flag Dictionary. These options represent the Software Circuit Breaker Flags.

Name	Value	Definition
NONE	%d0	Application running within normal paramters
HIGHMEM	%x01	Application has used unexpectedly high portion of memory
HIGHCPU	%x02	Application has used unexpectedly high portion of CPU
HIGHBW	%x04	Application has used unexpectedly high portion of network bandwidth

Table 44: scb-flag Dictionary

4.3.12. UPDATE Parameter Format

Aircraft Update Progress

Parameter Identifier: %d15

Length: length(data) + 56

Structure:

Item	Type	Description
aircraftid	16*16(OCTET)	Aircraft Identifier
progress	uint32	Progress
progflags	msg-cmd-updstat-flag	Progress Flags
activity	32*32(OCTET)	Description of current activity
label	*(OCTET)	Name of CPU being updated

Table 45: UPDATE Parameter Format

Table 46, below, shows the values defined in the msg-cmd-updstat-flag Dictionary. These options represent the Maintenance mode status update flags.

Name	Value	Definition
SUCCESS	%x01	Update is complete and successful
ERROR	%x02	Error during update

Table 46: msg-cmd-updstat-flag Dictionary

4.3.13. SERVO Parameter Format

Position with flags to interpret whether servo should be engaged, disengaged or left alone and whether active

Parameter Identifier: %d16

Length: 8

Structure:

Item	Type	Description
servopos	int32	None
servomode	afcs-servo	None

Table 47: SERVO Parameter Format

Table 48, below, shows the values defined in the afcs-servo Dictionary. These options represent the Servo engagement flags.

Name	Value	Definition
ENGAGE	%x80.00.00.00	If present in engagement request, along with 'ENGAGED' value, set engagment status
ENGAGED	%d1	For requests, retain current engagement state, for status, present if currently engaged
DISENGAGED	%d0	If engaged, disengage and for status, currently disengaged

Table 48: afcs-servo Dictionary

4.3.14. DBASE Parameter Format

Database Information

Parameter Identifier: %d17

Length: 92

Structure:

Item	Type	Description
crc	uint32	32-bit CRC of database file
name	16*16(OCTET)	Name of database (e.g. com)
supplier	16*16(OCTET)	Who supplied the database
region	16*16(OCTET)	What region is the data valid for
cycle	16*16(OCTET)	What cycle
valid	12*12(OCTET)	What data begins data validity YYYY-MM-DD
expires	12*12(OCTET)	After which data is data expired YYYY-MM-DD

Table 49: DBASE Parameter Format

4.3.15. DATETIME Parameter Format

Date and Time with internal values normalized to be consistent

Parameter Identifier: %d18

Length: 20

Structure:

Item	Type	Description
epochsec	uint32	Number of seconds since the epoch of Jan 1, 2025 or zero for dates predating the epoch, without consideration of leap seconds
timems	uint32	Number of milliseconds since midnight
flags	uint16	Reserved time-related Flags
year	int16	Year
yday	uint16	Day of year beginning with 1
mon	month	Month of year
mday	uint8	Day of month beginning with 1
wday	weekday	Day of week
hour	uint8	Number of whole hours since midnight
min	uint8	Number of whole minutes past the most recent whole hour
sec	uint8	Number of whole seconds past the most recent whole minute with 60 used for a leap second

Table 50: DATETIME Parameter Format

Table 51, below, shows the values defined in the month Dictionary. These options represent the Months of the year.

Name	Value	Definition
JAN	%d0	January
FEB	%d1	February
MAR	%d2	March
APR	%d3	April
MAY	%d4	May
JUN	%d5	June
JUL	%d6	July
AUG	%d7	August
SEP	%d8	September
OCT	%d9	October
NOV	%d10	November
DEC	%d11	December

Table 51: month Dictionary

Table 52, below, shows the values defined in the weekday Dictionary. These options represent the Days of the week.

Name	Value	Definition
SUN	%d0	Sunday
MON	%d1	Monday
TUE	%d2	Tuesday
WED	%d3	Wednesday
THU	%d4	Thursday
FRI	%d5	Friday
SAT	%d6	Saturday

Table 52: weekday Dictionary

4.4. Native Structures

4.4.1. Structures

This section defines the default structures that are used for translating between XSEDE and other protocol interfaces.

4.4.1.1. config-entry-hdr-structure

rlen(2 bytes): Record Length
flags(2 bytes): Record Flags
dtype(2 bytes): Data Type

4.4.1.2. msg-cmd-mxreq-structure

cpu(32 bytes): CPU for which maintenance mode is being requested
aircraftid(16 bytes): Aircraft ID for which MX mode is being requested

4.4.1.3. msg-cmd-updreq-structure

cpu(32 bytes): CPU for which maintenance mode is being requested
aircraftid(16 bytes): Aircraft ID for which MX mode is being requested
tftpserver(4 bytes): TFTP Server IP Address

4.4.1.4. msg-cmd-diagreq-structure

cpu(32 bytes): CPU for which maintenance mode is being requested
aircraftid(16 bytes): Aircraft ID for which MX mode is being requested
tftpserver(4 bytes): TFTP Server IP Address for results
diag(32 bytes): Requested Diagnostic Name

4.4.1.5. msg-cmd-mxchal-structure

cpu(32 bytes): CPU for which maintenance mode authentication is being requested
aircraftid(16 bytes): Aircraft ID for which MX mode is being requested
salt(32 bytes): Salt which must be signed

4.4.1.6. msg-cmd-mxauth-structure

cpu(32 bytes): CPU for which maintenance mode authentication is being requested
aircraftid(16 bytes): Aircraft ID for which MX mode is being requested
salt(32 bytes): Salt which must be signed
sig(64 bytes): Signed SHA1 signature of cpu ^ salt ^ aircraftid

4.4.1.7. msg-cmd-updstat-structure

cpu(32 bytes): CPU for which maintenance mode is being requested
aircraftid(16 bytes): Aircraft ID for which MX mode is being requested
activity(32 bytes): Description of current activity
progress(4 bytes): Progress in 1/1000 of one percent
progflags(4 bytes): Flags for progress status

4.4.1.8. msg-sub-msg-structure

mclass(1 bytes): Message Class
mclid(1 bytes): Class Specific Message ID (or 0 for any message id for the given class)
rsvd(2 bytes): Reserved for future use

4.4.1.9. suip-frame-structure

cmd(2 bytes): Command
addr(2 bytes): Peripheral Address
data(variable-size bytes): Data

4.4.1.10. cantun-rxdata-structure

seqno(2 bytes): None

data(1 bytes): None

4.4.1.11. cantun-txstatus-structure

flags(2 bytes): None

4.4.1.12. cantun-rxstatus-structure

rxseqno(2 bytes): Last Received sequence number (0-16383), if high bit is 1, message is from perspective of CPU
txseqno(2 bytes): Next to transmit sequence number (0-16383)
lastrx(2 bytes): Time since last received message (0-65535)
rxmiss(2 bytes): Count of sequence mismatches (0-65535)

4.4.1.13. cantun-txdata-structure

seqno(2 bytes): When transmitting, the top two bits are reserved for beginning and end bits to be sure whole messages are transferred
data(1 bytes): None

4.4.1.14. cantun-txflags-health-structure

seqno(2 bytes): None
status(1 bytes): Aircraft Status
data(1 bytes): None

4.4.1.15. cantun-rxflags-health-structure

seqno(2 bytes): None
volts(2 bytes): Input Voltage
temp(1 bytes): Temperature in degrees C relative to -80C

4.4.1.16. cantun-rxflags-ecb-structure

seqno(2 bytes): None
volts(2 bytes): Volts on Bus in 0.1 volts
drawamps(2 bytes): Current draw in 0.1 amps on bus
state(1 bytes): Current state of ECB
flags(1 bytes): Flags on ECB

4.4.1.17. cantun-rxstatus-ecb-structure

nominalamps(2 bytes): Nominal Max Current draw in 0.1 amps on bus
hardamps(2 bytes): Absolute Max Current draw in 0.1 amps on bus
nominalrevamps(2 bytes): Nominal reverse max amps
hardrevamps(2 bytes): Nominal reverse max amps

4.4.1.18. cantun-txflags-ecb-structure

seqno(2 bytes): None
nominalmaxamps(2 bytes): Nominal max amps
hardmaxamps(2 bytes): Hard maximum Amps
state(1 bytes): State
flags(1 bytes): None

4.4.1.19. cantun-txdata-ecb-structure

seqno(2 bytes): None
posreq(2 bytes): Requested position (0-1000) top 6 bits reserved

4.4.1.20. cantun-rxdata-ecb-structure

seqno(2 bytes): None
posreq(2 bytes): Currently requested position (0-1000) top 6 bits reserved
posact(2 bytes): Actual current position (0-1000) top 6 bits reserved

4.4.1.21. cantun-rxflags-gpio-structure

seqno(2 bytes): None
inputmodes(2 bytes): Detected input modes (XFS_GPIO_INPUT_*) (8 total)
outputmodes(4 bytes): Each port output mode (XFS_GPIO_OUTPUT_*) (8 total)

4.4.1.22. cantun-txflags-gpio-structure

seqno(2 bytes): None
isanalog(1 bytes): Which ports we wish to receive analog values?
isreset(1 bytes): Which ports should have faults reset
outputmodes(4 bytes): Each port output mode (8 total)

4.4.1.23. cantun-rxdata-gpio-structure

seqno(2 bytes): None
rxdata(2 bytes): Recieved data - Bit 15 if last entry, bits 14-12 are pin # (0-7), bits 0-11 are value 0-4095, up to 3 entries

4.4.1.24. cantun-txdata-gpio-structure

seqno(2 bytes): None
txdata(2 bytes): Transmitted PWM/DAC value - Bit 15 reserved, bits 14-12 are pin # (0-7), bits 0-11 are value 0-4095, up to 3 entries

4.4.1.25. cantun-rxdata-ar429-structure

seqno(2 bytes): None
flags(2 bytes): Reserved
arinc429(4 bytes): ARINC 429 Word

4.4.1.26. cantun-txdata-ar429-structure

seqno(2 bytes): None
flags(2 bytes): Reserved
arinc429(4 bytes): ARINC 429 Word

4.4.1.27. cantun-rxflags-config-structure

seqno(2 bytes): None
cmd(1 bytes): None
flags(1 bytes): None
moduleid(4 bytes): Globally unique module ID

4.4.1.28. cantun-txflags-config-structure

seqno(2 bytes): None
cmd(1 bytes): None
flags(1 bytes): None
moduleid(4 bytes): Globally unique module ID

4.4.1.29. cantun-txdata-config-structure

seqno(2 bytes): None
data(6 bytes): For Console, commands to be issued to device. For Flash, actual flash data

4.4.1.30. cantun-rxdata-config-structure

seqno(2 bytes): None
data(6 bytes): For Console, output from device. For Flash, acknowledge receipt by seqno

4.4.1.31. ethertun-can-structure

canid(4 bytes): CAN ID and related fields
dlc(1 bytes): Length of data (0-8 bytes)
srcbus(1 bytes): Globally Unique Source Bus Number
seqno(2 bytes): Sequence Number 0 - 0x3fff
data(8 bytes): Encapsulated CAN data

4.4.1.32. ethertun-arinc429-structure

srcbus(1 bytes): Globally Unique Source Bus Number
flags(1 bytes): Flags reserved for future use
seqno(2 bytes): Sequence Number
words(4 bytes): Encapsulated ARINC429 data

4.4.1.33. ethertun-serial-structure

srcbus(1 bytes): Globally Unique Source Serial Bus Number
flags(1 bytes): Flags reserved for future use
seqno(2 bytes): Sequence Number 0 - 0x3fff
data(variable-size bytes): Encapsulated Serial data

4.4.1.34. ethertun-gpio-structure

seqno(2 bytes): Sequence number unique to source IP/PORT combo
pinno(1 bytes): Pin Number
outmode(1 bytes): Output modes (XFS_GPIO_OUTPUT_*)
value(4 bytes): Analog or digital value

4.4.1.35. ethertun-ts-can-structure

canid(4 bytes): CAN ID and related fields
dlc(1 bytes): Length of data (0-8 bytes)
srcbus(1 bytes): Globally Unique Source Bus Number
seqno(2 bytes): Sequence Number
origts(4 bytes): Original Relative Timestamp
data(8 bytes): Encapsulated CAN data

4.4.1.36. milstd1553-etherhdr-structure

flags(2 bytes): Reserved for flags
seqno(2 bytes): Sequence number of 14 bits

4.4.1.37. milstd1553-hdr-structure

flags(2 bytes): Frame Flags
modecode(1 bytes): Class of message transaction
wordcount(1 bytes): Number of actual words (0-32)
rtaddr1(1 bytes): Remote Terminal Address (first cmd)
subaddr1(1 bytes): Remote Terminal Function Subaddress (first cmd)
status1(2 bytes): Remote Terminal Status (first cmd)
rtaddr2(1 bytes): Remote Terminal Address (second cmd)
subaddr2(1 bytes): Remote Terminal Function Subaddress (second cmd)
status2(2 bytes): Remote Terminal Status (second cmd)
data(2 bytes): 0-32 words of data

4.4.1.38. datagram-gpio-msg-structure

value(4 bytes): Interpreted value of GPIO (e.g. DAC/ADC/PWM)
outmodes(4 bytes): 4-bit Output modes (XFS_GPIO_OUTPUT_*) x 8
inmodes(2 bytes): 2-bit Input modes (XFS_GPIO_INPUT_*) x 8

4.4.1.39. msg-structure

srcaddr(2 bytes): Identifier of transmitting source, typically computer ID in upper 8 bits and microservice ID in lower 8 bits
mseqno(2 bytes): Sequence number of message.
mclass(1 bytes): Message Class
mclid(1 bytes): Message ID
flags(2 bytes): Message flags, bottom 3 bits reserved for cert level
tcid(2 bytes): If multiple pathways exist for identical data, which pathway are we
len(2 bytes): Length of message in bytes -- note that it could be shorter than available data due to alignment issues
data(variable-size bytes): Data (typically PARAMs)

4.4.1.40. msg-log-hdr-structure

relts(4 bytes): Relative timestamp since startup

4.4.1.41. qar-datagram-log-hdr-structure

relts(4 bytes): Relative timestamp since startup
flags(2 bytes): Reserved for potential future flags for packet
length(2 bytes): Length of packets in bytes

4.4.1.42. param-common-structure

unit(2 bytes): If appropriate, which unit this parameter applies to (e.g. Engine #1)
subunit(2 bytes): If appropriate, which subunit this parameter applies to (e.g. Engine #2, Cylinder #3)
ident(4 bytes): XFS Parameter Identifier
format(1 bytes): Format of data element
confidence(1 bytes): Confidence of data element
ttl(1 bytes): Time to live in milliseconds encoded using the MEMS encoding
pflags(1 bytes): Reserved Flags, bottom 3 bits are certification level of data

4.4.1.43. param-range-tick-structure

flags(2 bytes): Flags if any

color(2 bytes): See tick color definition
value(4 bytes): Value *above* which the tick should apply (except blue)
label(8 bytes): Name associated with label

4.5. Parameter Ranges

All parameter attributes values are typed, but some are further constrained to certain ranges. The ranges may limit in both value and display purposes. The display 'ticks' can define various classifications such as a green, yellow, or red range. Furthermore, ranges can change over time. For instance, good oil pressure for a cold engine may be normally higher than that for a warm engine and a special parameter can be broadcast to indicate a range change. Table 39 defines the RANGE parameter format.

Parameters that have a default range have that range described in the next section. The default range will be displayed in tabular format. Many parameters have default and unchangeable ranges, while others have dynamic ranges. Parameters that have dynamic ranges use a parameter that only differs in the length portion of the Parameter Data Len & Ident attribute. and having a RANGE attribute as its payload. The receiving node MUST distinguish between the value and the range parameters by examining the length portion of the parameter's attribute. Should a parameter attribute value be outside the permitted range. the value MUST be ignored.

In the style of the next section, a generic range parameter is defined below:

4.5.1. Sample Range Parameter

Parameter ID: Same as main parameter.
Unit Usage: Same as main parameter.
SubUnit Usage: Same as main parameter.
Length: RANGE Length - 24 decimal plus tick data length.
Format: RANGE (See Table 39.)

4.5.2. Ranges

This section defines the default attribute ranges that are used in XSEDE.

4.5.2.1. SERVO Range Default

Minimum Value: -100000
Maximum Value: 100000
Minimum Display Value: -100000

Maximum Display Value: 100000
Divisor: 1000

4.5.2.2. ROLL Range Default

Minimum Value: -18000
Maximum Value: 17999
Minimum Display Value: -18000
Maximum Display Value: 17999
Divisor: 100

4.5.2.3. PITCH Range Default

Minimum Value: -9000
Maximum Value: 8999
Minimum Display Value: -9000
Maximum Display Value: 9000
Divisor: 100

4.5.2.4. PERCENT Range Default

Minimum Value: 0
Maximum Value: 100
Minimum Display Value: 0
Maximum Display Value: 100
Divisor: 1

4.5.2.5. THOUPERCENT Range Default

Minimum Value: 0
Maximum Value: 100000
Minimum Display Value: 0
Maximum Display Value: 100000
Divisor: 100

4.5.2.6. HDG Range Default

Minimum Value: 100
Maximum Value: 36099
Minimum Display Value: 1
Maximum Display Value: 36000
Divisor: 100

4.5.2.7. OBS Range Default

Minimum Value: 1000
Maximum Value: 360000
Minimum Display Value: 0

Maximum Display Value: 360000
Divisor: 1000

4.5.2.8. DEVIATION Range Default

Minimum Value: -1000
Maximum Value: 1000
Minimum Display Value: -1000
Maximum Display Value: 1000
Divisor: 1

4.5.2.9. FLAPS Range Default

Minimum Value: -1000
Maximum Value: 1000
Minimum Display Value: -1000
Maximum Display Value: 1000
Divisor: 1

4.5.2.10. BRIGHTNESS Range Default

Minimum Value: 0
Maximum Value: 2000
Minimum Display Value: 0
Maximum Display Value: 2000
Divisor: 1

4.5.2.11. COMFREQ Range Default

Minimum Value: 11800000
Maximum Value: 13699999
Minimum Display Value: 11800000
Maximum Display Value: 13699999
Divisor: 100000

4.5.2.12. NAVFREQ Range Default

Minimum Value: 10800000
Maximum Value: 11799999
Minimum Display Value: 10800000
Maximum Display Value: 11799999
Divisor: 100000

4.6. Dictionary Types

This section declares the initial set of XSEDE dictionaries. Each dictionary is defined by a name and short definition. It contains a set of entries that represent the name value mappings of the dictionary. There are some primitive dictionaries without entries that specify the format of the data (i.e. octal or hex)

4.6.1. numbersok - Options for whether bare numbers are acceptable

FALSE (0) : Bare numbers are not permitted
TRUE (1) : Bare numbers are permitted and in output strings are represented in decimal form
OCTAL (2) : Bare numbers are permitted and in output strings are represented in octal
HEX (3) : Bare numbes are permitted and in output strings are represented in hexadecimal

4.6.2. ttl_mems - Convert times to their closest 8-bit mantissa-exponent representation

NEVER (0) : Does not expire
DEFAULT (256) : Use default value if specified elsewhere

4.6.3. none - Generic unsigned 32-bit value

4.6.4. signedval - Generic signed 32-bit value

4.6.5. hex - Hexadecimal representation

4.6.6. octal - Octal representation

4.6.7. component_feature - Flags that specified requested features or actions of a component

REQUEST_TIMESLOT ((1U << 0)) : Request a timeslot (if supported)
REQUEST_REALTIME ((1U << 1)) : Request hard realtime (if supported)
NEED_CONFIGURE ((1U << 2)) : Component is launching in config mode
NEED_DUMP ((1U << 3)) : At first run, perform dump instead of normal operation
NEED_FORK ((1U << 4)) : At first run, become a background process (if supported)
NEED_KILL ((1U << 5)) : Kill off a running version of the component (if supported)
SKIP_LOADCONFIG ((1U << 6)) : Skip normal configuration loading
HAS_TOUCH ((1U << 7)) : Application is running with an active touch interface

HIDECMDLINE ((1U << 8)) : Hide command line outputs
NOECHO ((1U << 9)) : Disable echo of received characters

4.6.8. component_debug - Component debugging flags

RXDUMP ((1U << 0)) : Enable dumping of received messages from the XFS Bus by this component
TXDUMP ((1U << 1)) : Enable dumping of messages transmitted to the XFS Bus from this component

4.6.9. agg_feature - Features associated with aggregated applications

NONE (0) : No selected features
PULLED ((1 << 0)) : Pulled
COLLARED ((1 << 1)) : Should not be reset in flight
AUTOSTART ((1 << 2)) : Automatically start on reboot if not pulled/collared
AUTORESET ((1 << 3)) : Reset from pulled or tripped state on reset

4.6.10. canid - CAN ID special flags and numbers

EFF ((1U << 31)) : Extended Frame Flag
RTR ((1U << 30)) : Remote Transmission Request
ERR ((1U << 29)) : Error Message

4.6.11. msg_cmd_updstat_flag - Maintenance mode status update flags

SUCCESS ((1U << 0)) : Update is complete and successful
ERROR ((1U << 1)) : Error during update

4.6.12. mm_apt_layer - Types of airports to display within layering of airport information

PRIVATE ((1U << 0)) : Display private airports
WATER ((1U << 1)) : Display sea ports
HELI ((1U << 2)) : Display heliports
MILITARY ((1U << 3)) : Display military airfields

4.6.13. mm_tlayer - Topology, raster and related static mapping layers

NONE (0) : No Layers Enabled
TOPO ((1U << 0)) : Topography
TERRAIN ((1U << 1)) : Terrain warnings
OBSTACLES ((1U << 2)) : Obstacles
TRAFFIC ((1U << 3)) : Traffic
VFR ((1U << 4)) : VFR Chart
LOALT ((1U << 5)) : Low Altitude IFR
HIALT ((1U << 6)) : High Altitude IFR

CALLSIGNS ((1U << 7)) : Traffic Callsigns
VORS ((1U << 8)) : VOR Stations
FIXES ((1U << 9)) : RNAV Fixes
WATER ((1U << 10)) : Detailed Water

4.6.14. mm_wlayer - Dynamic weather layers for maps

NONE (0) : No Layers Enabled
NEXRAD ((1U << 0)) : NEXRAD Radar Overlay
WIND ((1U << 1)) : Wind Data
LIGHTNING ((1U << 2)) : Lightning Overlay
ICING ((1U << 3)) : Icing Forecast
TURB ((1U << 4)) : Turbulence Forecast
CLOUDS ((1U << 5)) : Cloud Tops Forecast

4.6.15. mm_alayer - DO-358A AIRMET and SIGMET layers for mapping

NONE (0) : No Layers Enabled
TFR ((1U << 0)) : Temporary Flight Restriction
TURB ((1U << 1)) : Turbulence
LLWS ((1U << 2)) : Low Level Wind Shear
SFC ((1U << 3)) : Strong Surface Winds
ICING ((1U << 4)) : Icing Conditions
FRZLVL ((1U << 5)) : Lowest Freezing Level
IFR ((1U << 6)) : Instrument Flight Conditions
MTN ((1U << 7)) : Mountain Obscuration
CONVSIG ((1U << 17)) : Convective Sigmet

4.6.16. mm_param - Parameters for rendering of moving maps

SCALE (0x0001) : Map Scale in pixels per degree lat
CLAT (0x0002) : Center map at this lattitude -- 0x80000000 to track aircraft
CLON (0x0003) : Center map at this longitude -- 0x80000000 to track aircraft
APTLAYER (0x0004) : Bitmask of XFS_MM_APT_LAYER_* for what to display
WIDTH (0x0005) : Width in pixels of map
HEIGHT (0x0006) : Height in pixels of map
TLAYERS (0x0007) : Topography/Obstacle/Terrain/Traffic layers
WLAYERS (0x0008) : Weather Layers layers
ALTSEL (0x0009) : Altitude sel for Winds etc -- 0x80000000 to track current altitude
ALAYERS (0x000a) : AIRMET/SIGMET layers
AUTOTRACK (0x80000000) : AutoTrack value for tracking aircraft position and altitude

4.6.17. efb_param - Parameters for rendering of georeferenced procedures

SCALE (0x0001) : EFB Scale in relative pixels where 1000 is 1:1 pixel scaling
CLAT (0x0002) : Center map at this lattitude -- 0x80000000 to track aircraft
CLON (0x0003) : Center map at this longitude -- 0x80000000 to track aircraft
FIXNAME (0x0004) : Name of fix for which information is desired
WIDTH (0x0005) : Width in pixels of EFB Content
HEIGHT (0x0006) : Height in pixels of EFB Content
PAGE (0x0007) : Name of page within EFB
TARGET (0x0008) : Page specific target within EFB page

4.6.18. sv_param - Parameters for rendering of synthetic vision

WIDTH (0x0001) : Width in pixels of view
HEIGHT (0x0002) : Height in pixels of view

4.6.19. unit - XFS parameter unit values

ANY (0xffff) : Any Unit

4.6.20. unitmask - Mask of unit values

NONE (0) : No units selected
1 ((1U << 0)) : Unit 1 selected
2 ((1U << 1)) : Unit 2 selected
3 ((1U << 2)) : Unit 3 selected
4 ((1U << 3)) : Unit 4 selected
5 ((1U << 4)) : Unit 5 selected
6 ((1U << 5)) : Unit 6 selected
7 ((1U << 6)) : Unit 7 selected
8 ((1U << 7)) : Unit 8 selected
9 ((1U << 8)) : Unit 9 selected
10 ((1U << 9)) : Unit 10 selected
11 ((1U << 10)) : Unit 11 selected
12 ((1U << 11)) : Unit 12 selected
13 ((1U << 12)) : Unit 13 selected
14 ((1U << 13)) : Unit 14 selected
15 ((1U << 14)) : Unit 15 selected
16 ((1U << 15)) : Unit 16 selected
17 ((1U << 16)) : Unit 17 selected
18 ((1U << 17)) : Unit 18 selected
19 ((1U << 18)) : Unit 19 selected
20 ((1U << 19)) : Unit 20 selected
21 ((1U << 20)) : Unit 21 selected

22 ((1U << 21)) : Unit 22 selected
23 ((1U << 22)) : Unit 23 selected
24 ((1U << 23)) : Unit 24 selected
25 ((1U << 24)) : Unit 25 selected
26 ((1U << 25)) : Unit 26 selected
27 ((1U << 26)) : Unit 27 selected
28 ((1U << 27)) : Unit 28 selected
29 ((1U << 28)) : Unit 29 selected
30 ((1U << 29)) : Unit 30 selected
31 ((1U << 30)) : Unit 31 selected
32 ((1U << 31)) : Unit 32 selected

4.6.21. subunit - XFS parameter subunit values

ANY (0xffff) : Any Subunit

4.6.22. preset - XFS Preset Frequency

MANUAL (0) : Manual Tuning (no preset)
LAST (0xfffe) : Last selected frequency

4.6.23. tcid - XFS transcoder ID values

NONE (0) : No transcoder ID is required or asserted
DEFAULT (65536) : Pseudo-value to represent global default

4.6.24. suip_id - SUIP Identifier

NONE (0) : No SUIP ID for the actuator
TOUCH (0xffff) : SUIP Via Touch

4.6.25. boolean - Nominal boolean values

FALSE (0) : False
TRUE (1) : True

4.6.26. ruleresult - Return values for XFS rules

CLEAR (0) : Rule evaluates as false
SET (1) : Rule evaluates as true
UNKNOWN (-1) : Insufficient information to evaluate rule

4.6.27. alignment - Horizontal and vertical geometric alignments

HMASK (0x0f) : Horizontal alignment mask
HCENTER (0x01) : Horizontally centered
LEFT (0x02) : Left aligned
RIGHT (0x03) : Right aligned

VMASK (0xf0) : Vertical alignment mask
VCENTER (0x10) : Vertically centered
BOTTOM (0x20) : Bottom aligned
TOP (0x30) : Top aligned

4.6.28. engstate - States of engines

UNKNOWN (0x00) : Engine Status Unknown
OFF (0x01) : Engine is Off
DRYMOTOR (0x02) : Engine Starting
STARTING (0x03) : Engine Starting
RUNNING (0x04) : Engine Running Normally
FLAMEOUT (0x05) : Engine Flamed Out / Failure
SHUTDOWN (0x06) : Engine Shutting Down
SHUTOFF (0x07) : Engine Shut Off
MODE_MASK (0xff) : Mask for Engine State
FLAG_IGNITION ((1U << 8)) : Ignition On
FLAG_FUEL ((1U << 9)) : Fuel Shutoff Open
FLAG_STARTER ((1U << 10)) : Starter On
FLAG_GENERATOR ((1U << 11)) : Generator On
FLAG_BLEED ((1U << 12)) : Bleed Air On
FLAG_FIRE ((1U << 16)) : Fire Present
FLAG_EXTINGUISH ((1U << 17)) : Extinguisher Dispensed

4.6.29. pid_state - States of proportional-integral-derivative control logic

UNKNOWN (0x00) : PID Status Unknown
SETTLED (0x01) : PID Settled On Desired Value
CONVERGING (0x02) : PID Oscillating With Decreasing Amplitude
OSCILLATING (0x03) : PID Oscillating With Constant Amplitude
DIVERGING (0x04) : PID Oscillating With Increasing Amplitude

4.6.30. shape - Shapes for use in vector drawings

NONE (0x00) : No shape
OVAL (0x01) : Oval Shape
LINE (0x02) : Line Shape
TRIANGLE (0x03) : Triangle Shape
DIAMOND (0x04) : Diamond Shape
PENTAGON (0x05) : Pentagon Shape
HEXAGON (0x06) : Hexagon Shape
SEPTAGON (0x07) : Septagon/Heptagon Shape
OCTAGON (0x08) : Octagon Shape
NONAGON (0x09) : Nonagon/Enneagon Shape
DECAGON (0x0A) : Decagon Shape

4.6.31. ldggear - Status of retractable landing gear

UNKNOWN (0x0000) : Gear Status Unknown
DOWN (0x0001) : Landing Gear Down
UP (0x8000) : Landing Gear Up
FLAG_FAILED ((1U << 16)) : Landing Gear System is Failed

4.6.32. brake - Status of wheel brakes

UNKNOWN (0x0000) : Brake Status Unknown
NONE (0x0001) : Brakes not pressed
MAX (0x8000) : Max Braking
PARK ((1U << 16)) : Parking Brake Engaged
FLAG_FAILED ((1U << 17)) : Brake System is Failed

4.6.33. ecbunit - ECB unit numbers

TYPE_MASK (0xf000) : Mask for ECB type flag
TYPE_ECB (0x0000) : Generic ECB
TYPE_BUS (0x1000) : Bus
TYPE_GENALT (0x2000) : Starter/Generator/Alternator
TYPE_BATT (0x3000) : Battery

4.6.34. icing_flag - Status of ice detection, anti-ice and deicing systems

ENGINE ((1U << 0)) : Engine Deicing/Anticing On
AIRFRAME ((1U << 1)) : Airframe Deicing/Anticing On
INSEP ((1U << 2)) : Inertial Separator Activated
PITOT ((1U << 3)) : Pitot/Static Heat Activated
PROPHEAT ((1U << 4)) : Propeller Heat Activated
WINDHEAT ((1U << 5)) : Windshield Heat Activated
CARBHEAT ((1U << 6)) : Carb Heat Activated
CARBICEDET ((1U << 14)) : Carb Icing Detected
ICEDET ((1U << 15)) : Icing Detected
ENGINE_FAIL ((1U << 16)) : Engine Deicing/Anticing Failed
AIRFRAME_FAIL ((1U << 17)) : Airframe Deicing/Anticing Failed
INSEP_FAIL ((1U << 18)) : Inertial Separator Failed
PITOT_FAIL ((1U << 19)) : Pitot/Static Heat Failed
PROPHEAT_FAIL ((1U << 20)) : Propeller Heat Failed
WINDHEAT_FAIL ((1U << 21)) : Windshield Heat Failed
CARBHEAT_FAIL ((1U << 22)) : Carb Heat Failed
CARBICEDET_FAIL ((1U << 30)) : Carb Icing Detection Failed
ICEDET_FAIL ((1U << 31)) : Icing Detection Failed

4.6.35. cantun - CAN tunneling 29-bit address special fields

TUNNEL ((1U << 28)) : Tunneled Data

DEVMASK (0xff00000) : Mask for what type of device
DEV_SERIAL (0x0100000) : RS-232/422/485 Serial Port
DEV_CONFIG (0x0200000) : Configuration Commands
DEV_HEALTH (0x0300000) : Health Status
DEV_AR429 (0x0400000) : ARINC-429
DEV_MIL1553 (0x0500000) : MIL-STD-1553
DEV_ECB (0x0600000) : Electronic Circuit Breaker
DEV_GPIO (0x0700000) : GPIO’s
DEV_CANBUS (0x0800000) : Reserved for possible CAN in CAN tunneling
OPMASK (0xf0000) : Mask for what operation on device
OPTXMASK (0x10000) : Operation is a transmit operation
OP_RXDATA (0x00000) : Received from peripheral
OP_TXDATA (0x10000) : Transmit to peripheral
OP_RXSTATUS (0x20000) : Status Information Reply
OP_TXSTATUS (0x30000) : Transmitted Status Information Request
OP_RXFLAGS (0x40000) : Current received flags + status (48 bits total)
OP_TXFLAGS (0x50000) : Set transmit flags + status (48 bits total)
SEQNO_FLAG_BEGIN ((1U << 15)) : Beginning of a whole message (Transmit)
SEQNO_FLAG_END ((1U << 14)) : End of a whole message
SEQNO_MASK (0x3fff) : Max Sequence number

4.6.36. cantun_cmd - CAN configuration commands

ACK (0x01) : Or’d with command for response
DISCOVER (0x02) : Each unit sends a reply with its ID in response to a discover
CONCONSOLE (0x04) : Connect Console
DISCONSOLE (0x06) : Disconnect Console

4.6.37. cantun_txstatus_flag - CPU to non-CPU communication of status

RESETMISS ((1U << 0)) : Reset miss counters
CPUSEL ((1U << 15)) : Count with respect to CPU

4.6.38. config_type - XFS configuration file value data types

SINT (1) : 32-bit signed 2’s complement integer
UINT (2) : 32-bit unsigned integer
STRING (3) : Optionally null terminated string
FLOAT (4) : IEEE 754 floating point number
IPADDR (5) : 32-bit IPv4 IP address
SIGNATURE (255) : System specific cryptographic signature
OBJECTBEG (256) : Begin an object definition
OBJPTRBEG (257) : Begin pointer to an object
OBJECTSEP (258) : Separates entries in an array

OBJECTEND (259) : Ends an entry for an object or object pointer

4.6.39. config_perm - XFS configuration file value permissions

MANDATORY ((1U << 16)) : Must be specified
DELEGATE ((1U << 8)) : Allow delegating permission to level in bits 7-0
VENDOR (200) : Avionics Vendor
FACTORY (150) : Aircraft Manufacturer
OWNER (125) : Aircraft Owner
MAINT (100) : Aircraft Maintenance Facility
SYSTEM (90) : Saved Aircraft State
DATA (75) : Navigational Data
USER (50) : Pilot
INHERIT (1) : Object parameters inherit from object permission
UNSET (0) : Permission has not been established

4.6.40. msg_class - XFS common data bus message classes

MAINT (2) : Maintenance Message
OP (3) : Operational Message
RAW (4) : Access to raw data stream (e.g. RS-232, RS-485, ARINC-429, etc)

4.6.41. ac_status - XFS aircraft state

GND (0) : Non flight mode
FLIGHT (1) : Aircraft in flight
MAINT (2) : Aircraft is in maintenance mode

4.6.42. msg_op - Message subclasses for operational message class

SUBFLDATA (1) : Subscribe to Aircraft Flight Data Params
FLIGHTDATA (2) : Flight Data Info
DEVSTATUS (3) : Device Status
GDL90 (4) : GDL-90 Format Messages without framing, FCS or escape characters
SUBMSGCLID (5) : Subscribe to Specific Message Class and ID

4.6.43. msg_raw - Message subclasses for raw message class

SERIALRX (1) : Serial raw data stream receive from end device
SERIALTX (2) : Serial raw data stream transmit to end device
SPIRX (5) : Raw SPI bus receive from end device
SPITX (6) : Raw SPI bus transmit to end device
ARINC429RX (7) : Raw ARINC-429 bus receive from end device
ARINC429TX (8) : Raw ARINC-429 bus transmit to end device
MIL1553RX (9) : Raw MIL-STD-1553 received from end device

MIL1553TX (10) : Raw MIL-STD-1553 bus transmit to end device
ECBRX (11) : Raw XFS ECB control receive from end device
ECBTX (12) : Raw XFS ECB control transmit to end device
GPIORX (13) : Raw XFS ECB control receive from end device
GPIOTX (14) : Raw XFS ECB control transmit to end device
ADCRX (15) : Analog/Digital Converter receive from end device
DACTX (16) : Digital/Analog Converter transmit to end device
CANBUSRX (17) : Raw CAN bus receive from end device
CANBUSTX (18) : Raw CAN bus transmit to end device
DATAGRAMRX (19) : Raw Datagram receive from end device
DATAGRAMTX (20) : Raw Datagram transmit to end device

4.6.44. msg_maint - Message subclasses for maintenance message class

MXREQ (1) : Request maintenance mode for a specific CPU (or all if cpu is empty)
MXCHAL (2) : Authentication challenge
MXAUTH (3) : Authentication response
MXACCEPT (4) : Accept authentication request
MXDENY (5) : Deny maintenance mode
MXREADY (6) : Ready for update or diagnostic
DOUPDATE (7) : User Requests System Update. Note CPU is requestor
UPDREQ (8) : Request Update for given Device
UPDSTAT (9) : Status of Update
DODIAG (10) : User Requests System Update. Note CPU is requestor. Salt is type of diagnostic.
DIAGREQ (11) : Request diagnostic for given Device.
DIAGSTAT (12) : Status of Update

4.6.45. msg_flag_cert - Message and parameter certification level tracking

EXPERIMENTAL (0) : Experimental
LEVEL_E (1) : DO-178 Level E
LEVEL_D (2) : DO-178 Level D
LEVEL_C (3) : DO-178 Level C
LEVEL_B (4) : DO-178 Level B
LEVEL_A (5) : DO-178 Level A

4.6.46. msg_source_flag - Flags for XFS message sources

ALWAYSXMIT ((1U << 0)) : Transmit all parameters even if confidence is useless
COPYSELF ((1U << 1)) : Process this message as a received message as well
DEBUGONLY ((1U << 2)) : This message is only used only for debugging and not normal operation

IMMPREBUF ((1U << 3)) : Immediately prebuffer parameters within this message even before transmission

4.6.47. param_source_flag - Flags for individual parameter sources within XFS message sources

ALWAYSVALID ((1U << 0)) : Parameter source has a fixed value
TRIGGERXMIT ((1U << 1)) : Candidate for triggering message transmission

4.6.48. param_confidence - XFS common bus parameter format confidence levels

HIGH (100) : Confirmed known value
USERSEL (90) : User selected value at runtime
SYSSEL (80) : System selected value at runtime
UNANIMOUS (50) : Redundant data available and is rationalized
RATIONAL (40) : Data being rationalized from other data sources with normal sources ignored
VOTED (30) : Data is redundantly verified from identical instruments
SMOOTHED (20) : Smoothed/filtered version of raw data
RAW (10) : Raw, unchecked data
ESTIMATE (5) : Rough estimation
USELESS (0) : Value is missing or expected invalid and supplied for debugging ONLY

4.6.49. endian - CPU endian formats

HOST (0) : Host Endian Byte Order
LITTLE (1) : Little Endian Byte Order
BIG (2) : Big Endian Byte Order

4.6.50. datagram_direction - Datagram Direction Types

UNKNOWN (0) : Unknown or unspecified direction type
SOURCE (1) : We are a source of information for this connection
DESTINATION (2) : We are a destination of information for this connection
BIDIRECTIONAL (3) : We are both a source and destination of information for this connection

4.6.51. param_units - Units for the encoding and translation of XFS parameters

UNSPEC (0x0) : Units not specified
INHG (0x0001U) : Use inches of Hg for BARO/MANPRES
FT (0x0002U) : Use feet for altitude

NM (0x0003U) : Use nautical miles for distance
C (0x0004U) : Use celcius for temperature
LBFT (0x0005U) : Use pound-feet for torque
S (0x0006U) : Use seconds for time
A (0x0007U) : Use amps for current
V (0x0008U) : Use volts for voltage
LB (0x0009U) : Use pounds for weight
IN (0x000aU) : Use inches for distance
FPM (0x000bU) : Use feet per minute for rate of climb/descent
LBPH (0x000cU) : Pounds per Hour for fuel flow
DEGPS (0x000dU) : Degrees per second for attitude change
DEG (0x000eU) : Degrees for attitude
G (0x000fU) : G force for load
RGBA (0x0010U) : 8888 RGBA Value
MHZ (0x0011U) : Megahertz for Frequency
PCENT (0x0012U) : Percent of Maximum
KT (0x0013U) : Knots for Speed
NMPLB (0x0014U) : Nautical Miles per Pound
KTPS (0x0015U) : Knots per second
MACH (0x0016U) : Speed of sound
CPM (0x0017U) : Count per minute
PPM (0x0018U) : Parts per million
LPM (0x0019U) : Liters Per Minute
KW (0x001aU) : Kilowatt
AH (0x001bU) : Amp Hour
GAL (0x001cU) : Gallons of volume
NMPGAL (0x001dU) : Nautical Miles per Gallon
GPH (0x001eU) : Gallons per Hour for fuel flow
MEMS (0x001fU) : Mantissa/Exponent Milliseconds (2^E)*(M+16)
HPA (0x8001U) : Use Hecto pascals for BARO
M (0x8002U) : Use meters for altitude
SM (0x8003U) : Use statute miles for distance
F (0x8004U) : Use fahrenheit for temperature
NWM (0x8005U) : Use Newton Meters for torque
PSI (0x8006U) : Use PSI for MANPRES
MPH (0x8007U) : Use miles per hour for speed
SMPLB (0x8008U) : Statute Miles per Pound
MIN (0x8009U) : Minutes
HR (0x800aU) : Hours
HP (0x800bU) : Use Horsepower for power
KG (0x800cU) : Use kilograms at earth gravity for weight
L (0x801cU) : Liters of volume
LPH (0x001eU) : Liters per Hour for fuel flow
UL (0xffffU) : Unitless

4.6.52. param_copy_result - Possible return results from copying parameters from/to network format

SUCCESS (0) : Parameter copied/loaded properly
UNKNOWN_PARAM ((1U << 0)) : Parameter not known
UNKNOWN_FORMAT ((1U << 1)) : Parameter format not known
MISMATCH_FORMAT ((1U << 2)) : Parameter format does not match what we expect its format to be
MISSING ((1U << 3)) : Source of parameter (e.g. config file) is missing or empty
CHKSUMFAIL ((1U << 4)) : Source of parameter had failed checksum
DESIGNFAIL ((1U << 5)) : Design of parameter system contains an error
IMPROPER_FORMAT ((1U << 6)) : Conversion of parameter from ASCII source encountered syntactical error
UNIMPLEMENTED ((1U << 7)) : This method of copying a parameter is not implemented
POS_NOT_FOUND ((1U << 8)) : Position not found
IO_ERROR ((1U << 9)) : I/O Error
SHORT_SRC ((1U << 10)) : Insufficient data in source parameter
SHORT_DST ((1U << 11)) : Insufficient data in destination parameter

4.6.53. cas_msglvl - Message levels for CAS messages and checklist items

CLEAR (0) : Clear a previously issued CAS message -- issue from system only
DEBUG (1) : In-system debugging output only
LOG (2) : Log to system log, but do not display
MAINT (3) : Display only for maintenance purposes
STATUS (4) : Aircraft system status only
ADVISORY (5) : Advisory, flight crew should be aware, may require later crew response
CAUTION (6) : Caution, requires immediate flight crew awareness and later response
WARNING (7) : Warning, requires immediate awareness and response.
COMMENT (10) : Checklist Comment Associated with Previous Item
UNCHKITEM (11) : Unchecked Checklist Item
CHKITEM (12) : Checked Checklist Item
CHKBRANCH (13) : Checklist Branch Choice
PASS (14) : Built-in Test (BIT) Item passed
INPROG (15) : Built-in Test (BIT) Item in progress
NOTREQST (16) : Built-in Test (BIT) Item not yet requested
INCOMPLT (17) : Built-in Test (BIT) Item test did not complete
FAIL (18) : Built-in Test (BIT) Item failed

4.6.54. cas_msgflag - Additional flags associated with CAS messages

NONE (0) : No additional flags

AUTO ((1U << 0)) : Item is automatically checked/unchecked or the test is automatically executed

4.6.55. sched_period - Schedule periods with special meanings

10MS (10000) : Every task should run at least once per 10ms
1MS (1000) : Every task should run at least once per 1ms
100US (100) : Every task should run at least once per 100uS
30FPS (33333) : Thirty Frames per Second

4.6.56. tick_color - Color values for ticks within range parameters

GREEN (0) : Green Area
YELLOW (1) : Yellow Area
RED (2) : Red Area
WHITE (3) : White Area
CLEAR (4) : Empty / no color
BLUE (5) : Blue line -- does not change color above

4.6.57. com_state - State of communication radio

IDLE (R) : Ready to Receive (Idle)
RX (r) : Active receiving
TX (T) : Active transmitting
STUCK (S) : Stuck Mic
FAULT (F) : Fault

4.6.58. com_target - COM Radio Target Destination

INAIR (0) : Radio used primarily for in-air communication
GROUND (1) : Radio used primiarly for on/to-ground communication
BOTH (2) : Radio used equally for in-air and on-ground communication

4.6.59. ics_mode - State of intercom system

PILOT (P) : Pilot Isolate
CREW (C) : Crew Isolate
ALL (A) : All
FEATUREMASK (0xff00) : Mask for intercom features
POSITIONAL ((1U << 8)) : Positional dynamic audio

4.6.60. xpdr_mode - Transponder mode and flags

UNKNOWN (0) : Unknown
MODEMASK (0x7f) : Mask for mode
STANDBY (O) : Standby
GND (G) : On Ground

AIR (A) : Air/Altitude Reporting
FLAG_IDENT ((1U << 7)) : IDENT Active

4.6.61. traffic_type - Traffic threat categorization

NONTHREAT (0) : Non Threatening
PROXIMITY (1) : Proximity
ADVISORY (2) : Advisory
RESOLUTION (3) : Resolution

4.6.62. nav_flag - Navigational flag states

BACKCOURSE ((1U << 0)) : NAV receiver is flying a localizer back course
LOCDETECT ((1U << 1)) : The NAV receiver is detecting a localizer
FROM ((1U << 2)) : The FROM flag is detected from a VOR
TO ((1U << 3)) : The TO flag is detected from a VOR
GSI_SFLAG ((1U << 4)) : The glideslope superflag is present
GSI_VALID ((1U << 5)) : The glideslope signal is being received and is valid
NAV_SFLAG ((1U << 6)) : The NAV super flag is present
NAV_VALID ((1U << 7)) : The localizer or VOR signal is being received and is valid
FAULT ((1U << 8)) : Fault detected

4.6.63. weightbal_station - Weight and balance station types

HULL (1) : This station corresponds to the basic empty aircraft
FUEL (2) : This station is a fuel tank. Its weight will be in XFS_PARAM_FUELWT
PASSENGER (3) : This station contains a passenger
BAGGAGE (4) : This station contains baggage or cargo

4.6.64. weightbal_category - Aircraft operational categories

NORMAL (1) : Normal Category
UTILITY (2) : Utility Category
ACROBATIC (3) : Acrobatic Category
COMMUTER (4) : Commuter Category

4.6.65. weightbal_status - Weight and balance status

OK (0) : Weight and balance is OK
FWD ((1U << 0)) : Balance is forward of minimum CG for this weight
AFT ((1U << 1)) : Balance is aft of maximum CG for this weight
OVWTSTATN ((1U << 2)) : One or more stations are overweight
OVERMGTOW ((1U << 3)) : Weight exceeds maximum gross takeoff weight

OVERMLW ((1U << 4)) : Weight exceeds max landing weight
OVERZFW ((1U << 5)) : Weight exceeds max zero fuel weight

4.6.66. flight_state - Status of aircraft within flight profile

UNKNOWN (0) : The state of the aircraft is not known
OFF (1) : The aircraft is completely powered down
HIBERNATE (2) : Minimal aircraft systems online not visible to the pilot
PREFLIGHT (3) : Minimal aircraft systems for pilot interaction online
ENGINE_START (4) : Engine(s) are preparing to start or are starting
PRETAXI (5) : Engine(s) are started, awaiting pre-taxi items
TAXI (6) : Aircraft is ready or in process of taxiing
RUNUP (7) : Aircraft is ready for, or in process of performing runup
READY (8) : Aircraft is ready for and positioned just short of takeoff
TAKEOFF (9) : Aircraft is in process of performing takeoff
AFTER_TAKEOFF (10) : Aircraft is airborne immediately but not yet configured for normal climb
DEPARTURE (11) : Aircraft is on a standard instrument departure
CLIMB (12) : Aircraft is climbing but not on an instrument departure
CRUISE (13) : Aircraft is at final cruise
DESCENT (14) : Aircraft is descending not on a standard arrival
ARRIVAL (15) : Aircraft is on a standard arrival
APPROACH (16) : Aircraft is on an instrument approach procedure
VISUAL (17) : Aircraft is flying a visual traffic pattern
MISSED (18) : Aircraft is executing a missed approach
SHUTDOWN (19) : Aircraft engines are shutting down or have shut down
SECURE (20) : Aircraft systems are shutting down or reconfiguring for preflight

4.6.67. nav_gps - Global positioning system status

UNKNOWN (0) : GPS Navigation is in unknown state
ENROUTE (1) : GPS Navigation is in Enroute state
TERMINAL (2) : GPS Navigation is Terminal state
LNAV (3) : GPS Navigation is in Lateral Navigation State
LNAVVNAV (4) : GPS Navigation is Lateral and Vertical NAV state
LP (5) : GPS Navigation is in Localizer Performance state
LPV (6) : GPS Navigation is in Localizer Performance/Vertical state

4.6.68. ecb_state - Electronic circuit breaker status

UNKNOWN (0) : Circuit is in an unknown condition
OFF (1) : Circuit is turned off
ON (2) : Circuit is turned on
UNDERCUR (3) : Circuit is on, <100ma current drawn
RESET (4) : Request Reset
FORWARD (5) : ECB is active logical FWD direction
REVERSE (6) : ECB is active logical REV direction
TARGET (7) : ECB is set by target, not ON/OFF
BRAKELOW (8) : ECB is set by target, not ON/OFF
SHORTED (128) : Short Circuit
OVERCUR (129) : Overcurrent (but not short circuit)
OVERVOL (130) : Overvoltage situation
DISABLED (131) : Disabled by state-fault
RUNAWAY (132) : Disabled due to runaway (trim/flaps)
COLLARED (133) : Should not reset in flight
JAMMED (134) : Mechanical Jam detected
PULLED (135) : Pulled
BACKFLOW (136) : Disabled due to reverse current flow

4.6.69. ecb_flag - Electronic circuit breaker parameter flags

INPUTVOLTS ((1U << 0)) : Input Volts field is valid

4.6.70. scb_state - Software circuit breaker states

UNKNOWN (0) : State of software is unknown
STARTING (1) : Application is in startup phase
RUNNING (2) : Application is running
STOPPING (3) : Stopping has been requested
RESTART (4) : Restart Application (PULL + RESET + START)
RESET (5) : Allow application to be started
HUNG (6) : Application is running but is no longer responsive
DEGRADED (127) : Application is running in a degraded mode
STOPPED (128) : Application is stopped
STARTFAIL (129) : Application failed startup
RUNAWAY (130) : Application has a runaway loop
OVERCPU (131) : Application is using excessive CPU while in
RUNNING state
OVERMEM (132) : Application terminated due to memory overrun
EXCEPTION (133) : Application terminated due to runtime exception
ENDED (134) : Application ended without error or request
ENDERROR (135) : Application ended with error condition
PULLED (136) : Application should not be allowed to run until
reset
COLLARED (137) : Should not reset in flight

4.6.71. afcs_fd_mode - Vertical, lateral and yaw modes of flight director

VERT_MASK (0xff) : Vertical modes mask
LAT_MASK (0xff00) : Lateral modes mask
YAW_MASK (0xff000000) : Yaw modes mask
PITCH ((1U << 0)) : Activate pitch mode
VS ((1U << 1)) : Activate vertical speed mode
FLC ((1U << 2)) : Activate indicated airspeed mode / flight level change
PRF ((1U << 3)) : Activate angle of attack / performance mode
ALT ((1U << 4)) : Arm Altitude mode
VNAV ((1U << 5)) : Arm vertical nav mode
GP ((1U << 6)) : Arm approach mode vertical portion
FLARE ((1U << 7)) : Arm flare mode
ROLL ((1U << 8)) : Activate wing leveler mode
HDG ((1U << 9)) : Activate heading mode
NAV ((1U << 10)) : Arm navigation mode
APPR ((1U << 11)) : Arm approach mode
YD ((1U << 24)) : Fixed Yaw Damper
SLIP ((1U << 25)) : Activate slip mode (adjustable YD)
SLIPAPPR ((1U << 26)) : Activate approach slip mode (adjustable YD)

4.6.72. afcs_ap_mode - Vertical, lateral and yaw modes of autopilot and throttle

VERT_MASK (0xff) : Vertical modes mask
LAT_MASK (0xff00) : Lateral modes mask
THROT_MASK (0xff0000) : Throttle modes mask
YAW_MASK (0xff000000) : Yaw modes mask
PITCH ((1U << 0)) : Pitch mode
EPPITCH ((1U << 1)) : Pitch mode only for envelope protection
ROLL ((1U << 8)) : Roll mode
EPROLL ((1U << 9)) : Roll mode only for envelope protection
SPD ((1U << 16)) : Activate autothrottle speed tracking
EPSPD ((1U << 17)) : Autothrottle only for envelope protection (SPD mode)
AOA ((1U << 18)) : Activate autothrottle AoA tracking
EPAOA ((1U << 19)) : Autothrottle only for envelope protection (AOA mode)
TOGA ((1U << 20)) : Activate takeoff / go-around throttle
EPTOGA ((1U << 21)) : Autothrottle only for envelope protection (TOGA mode)
YAW ((1U << 24)) : Yaw mode
EPYAW ((1U << 25)) : Yaw envelope protection

4.6.73. afcs_servo - Servo engagement flags

ENGAGE ((1U << 31)) : If present in engagement request, along with 'ENGAGED' value, set engagment status
ENGAGED (1) : For requests, retain current engagement state, for status, present if currently engaged
DISENGAGED (0) : If engaged, disengage and for status, currently disengaged

4.6.74. fms_flag - Flight management system waypoint and leg flags

NONE (0) : No flags or leg type known
LEGTYPE_VA (1) : Heading to Altitude
LEGTYPE_VD (2) : Heading to DME Distance
LEGTYPE_VI (3) : Heading to Next Leg Intercept
LEGTYPE_VM (4) : Heading to Manual Termination
LEGTYPE_VR (5) : Heading to Radial Termination
LEGTYPE_CA (6) : Course to an Altitude
LEGTYPE_CD (7) : Course to a DME Distance
LEGTYPE_CI (8) : Course to Next Leg Intercept
LEGTYPE_CR (9) : Course to Radial Termination
LEGTYPE_CF (10) : Course to a Fix
LEGTYPE_TF (11) : Tracking Between Two Fixes
LEGTYPE_DF (12) : Direct to a Fix
LEGTYPE_FA (13) : Course from a Fix to an Altitude
LEGTYPE_FC (14) : Course from a Fix to an Along Track Distance
LEGTYPE_FD (15) : Course from a Fix to a DME Distance
LEGTYPE_FM (16) : Course from a Fix to a Manual Termination
LEGTYPE_AF (17) : Constant DMA Arc to a Fix
LEGTYPE_HF (18) : Hold to a Fix
LEGTYPE_HA (19) : Hold to an Altitude
LEGTYPE_HM (20) : Hold to a Manual Termination
LEGTYPE_IF (21) : Initial Fix
LEGTYPE_PI (22) : Procedure Turn to Intercept
LEGTYPE_RF (23) : Radius to a Fix
LEGTYPE_MASK (0xff) : Mask with which to retrieve leg type
FLYOVER ((1U << 8)) : If not present, fly by
DISC ((1U << 9)) : If present, Discontinuity before current waypoint
ACTIVE ((1U << 10)) : If present, this is the active waypoint
OBS ((1U << 11)) : If present, waypoint allows OBS to be set
FAF ((1U << 12)) : If present, waypoint is final approach fix or after
SUSPEND ((1U << 13)) : FMS sequencing is suspended at this waypoint
LAST ((1U << 14)) : This waypoint is the last one in the flight plan

4.6.75. fms_waypoint - Flight management system waypoint types

UNKNOWN (0) : Unknown or unspecified
GS ((1U << 7)) : Glideslope component
DME ((1U << 6)) : DME Component
TACAN ((1U << 5)) : TACAN Component
VOR (1) : VOR Component
LOC (2) : Localizer component
NDB (3) : NDB component
LDA (4) : LDA Component
SDF (5) : SDF Component
FIX (6) : Generic RNAV Fix
ILS (7) : Complete ILS system
AIRPORT (8) : An Airport
DIRECTFROM (9) : Starting point of a direct to
WEATHER (10) : Weather reporting station only

4.6.76. fms_waypoint_subunit - Special subunits used within the FMS

FIRST (1) : Starting waypoint of flight plan
FIRSTAP (65530) : First airport within flight plan
PREV (65531) : Starting waypoint of the active leg (if leg is not a direct to)
NEXT (65532) : Ending waypoint of the active leg
LASTAP (65533) : Final airport of flight plan if more than one airport in plan
LAST (65534) : Final waypoint of flight plan

4.6.77. fms_airport - Flight management system airport types

UNKNOWN (0) : Unknown type of airport
AIRPORT (1) : An actual airport
BALLOON (2) : A Balloonport
SEAPLANE (3) : A Seaplane Base
GLIDER (4) : A Glider Port
HELIPORT (5) : A Heliport
ULTRALIGHT (6) : Ultralight Field
FLAG_CUSTOMS ((1U << 8)) : Customs Available
FLAG_TOWER ((1U << 9)) : Tower Available
FLAG_PUBLIC ((1U << 10)) : Public Use
FLAG_CLOSEDIND ((1U << 11)) : Closed Indefinitely
FLAG_CLOSEDPERM ((1U << 12)) : Closed Permenantly
FLAG_JETA ((1U << 13)) : JET-A Available
FLAG_100LL ((1U << 14)) : 100LL Available
FLAG_MOGAS ((1U << 15)) : Oxygen Available
FLAG_BEACON ((1U << 16)) : Beacon Present
FLAG_AFMAJOR ((1U << 17)) : Major Airframe
FLAG_AFMINOR ((1U << 18)) : Minor Airframe

FLAG_PPMAJOR ((1U << 19)) : Powerplant Major
FLAG_PPMINOR ((1U << 20)) : Powerplant Minor
FLAG_OXYGEN ((1U << 21)) : Oxygen Available
FLAG_MILITARY ((1U << 22)) : Military

4.6.78. fms_rwy - Flight management system runway parameters and flags

SURF_UNKNOWN (0) : Unknown Surface
SURF_ASPHALT ((1U << 0)) : Asphalt
SURF_CONC ((1U << 1)) : Concrete
SURF_SNOW ((1U << 2)) : Snow
SURF_ICE ((1U << 3)) : Ice
SURF_MATS ((1U << 4)) : Mats
SURF_TREATED ((1U << 5)) : Oiled
SURF_GRAVEL ((1U << 6)) : Gravel
SURF_TURF ((1U << 7)) : Grass / Sod
SURF_DIRT ((1U << 8)) : Natural Soil
SURF_WATER ((1U << 9)) : Water Runway
SURF_OTHER ((1U << 10)) : Wood
SURF_MATERIAL_MASK (0x7ff) : Mask for surface material
SURF_EXCL ((1U << 11)) : Excellent Condition
SURF_GOOD ((1U << 12)) : Good Condition
SURF_FAIR ((1U << 13)) : Fair Condition
SURF_POOR ((1U << 14)) : Poor Condition
SURF_FAILED ((1U << 15)) : Failed Condition
SURF_COND_MASK (0xf800) : Mask for surface material
LIGHTS_HIGH ((1U << 16)) : Edge Lights High
LIGHTS_MED ((1U << 17)) : Medium Edge Lights
LIGHTS_LOW ((1U << 18)) : Low Edge Lights
LIGHTS_NSTD ((1U << 19)) : Non-Standard
LIGHTS_NONE ((1U << 20)) : No Edge Lights
LIGHTS_OTHER ((1U << 21)) : Other edge lights
RIGHT_HAND ((1U << 22)) : Right Hand Traffic

4.6.79. fms_container - Flight management system container types

UNKNOWN (0) : Unspecified or unknown container
NONE (1) : No container
VICTOR (2) : VOR Airway
JET (3) : Jet Airway
AMBER (4) : Amber Airway
BLUE (5) : Blue Airway
GREEN (6) : Green Airway
RED (7) : Red Airway
Q (8) : RNAV Q Routes
T (9) : RNAV T Routes
STAR (10) : Standard Arrival Procedure
DP (11) : Standard Departure Procedure

APP (12) : Instrument Approach
RWY (13) : Airport Runway Surface Selection

4.6.80. fms_airspace - Flight management system airspace types and flags

CLASS_A (A) : Class A Airspace
CLASS_B (B) : Class B Airspace
CLASS_C (C) : Class C Airspace
CLASS_D (D) : Class D Airspace
AGLFLAG ((1U << 20)) : If present in positive numbers, Airspace is relative to ground level
AAFLAG ((1U << 21)) : If present, in positive number, airspace is capped by the airspace above

4.6.81. osk_key - On screen keyboard keys

0 (48) : Character 0
1 (49) : Character 1
2 (50) : Character 2
3 (51) : Character 3
4 (52) : Character 4
5 (53) : Character 5
6 (54) : Character 6
7 (55) : Character 7
8 (56) : Character 8
9 (57) : Character 9
A (65) : Character A
B (66) : Character B
C (67) : Character C
D (68) : Character D
E (69) : Character E
F (70) : Character F
G (71) : Character G
H (72) : Character H
I (73) : Character I
J (74) : Character J
K (75) : Character K
L (76) : Character L
M (77) : Character M
N (78) : Character N
O (79) : Character O
P (80) : Character P
Q (81) : Character Q
R (82) : Character R
S (83) : Character S
T (84) : Character T
U (85) : Character U

V (86) : Character V
W (87) : Character W
X (88) : Character X
Y (89) : Character Y
Z (90) : Character Z
PREV (60) : Previous position or <
NEXT (62) : Next position or >
DEG (127) : Degrees
DIRECTTO (128) : Direct To
ENT (129) : Enter

4.6.82. chart_type - Instrument procedure and airport chart/diagram types

APPROACH (1) : Instrument Approach
DEPARTURE (2) : Instrument Departure
ARRIVAL (3) : Instrument Arrival
DIAGRAM (4) : Airport Diagram
HOTSPOT (5) : Hot Spot
LAHSO (6) : Land and Hold Short
ALTMIN (7) : Alternate Minimums
OBSDEP (8) : Obstacle Departure Procedure
DEPAAU (9) : Departure / Attention All Users
SUPPLEMENT (255) : Supplemental Data

4.6.83. db_param - Database parameter identifiers and formats

FORMAT_MASK ((0xffU << 24)) : Mask for Format portion
FORMAT_INT ((0 << 24)) : 32-bit 2’s complement signed integer
FORMAT_FLOAT ((1U << 24)) : IEEE 754 floating point number
FORMAT_STRING ((2U << 24)) : Optionally NULL terminated string
AIRPORT (0) : Airport Name
SERVICE (1) : Service name (e.g. ATIS, AWOS, TOWER, APPROACH, DEPARTURE, CENTER, CLEARANCE, GROUND)
FREQKHZ_DEPRECATED (2) : Frequency in Khz
COMMENT (3) : Comment associated with Frequency
PHONE (4) : Phone number
SECONDARY (5) : If a value is secondary, it’s priority (lower is higher priority)
FIXNAME (6) : Name of Fix
LATITUDE (7) : Latitude
FLAGS (8) : Generic flags
CONTAINER (9) : Name of airway, arrival, star or other container
CTYPE (10) : Type of container
WTYPE (11) : Type of FIX/Waypoint
INBOUND (12) : Inbound magnetic course
OUTBOUND (13) : Outbound magnetic course in
MAGADJ (14) : Magnetic Adjustment

ALTITUDE (15) : Altitude (MSL)
LONGNAME (16) : Full name of fix or airport or airspace
LONGITUDE (17) : Longitude
APTTYPE (18) : Type of landing facility
OPCOUNT (19) : Operations Count per year
CITY (20) : Associated City
STATE (21) : Associated State
COUNTRY (22) : Associated Country
RWYNAME (23) : Runway Name
RWYSIZE (24) : Length in bottom 20 bits, Width in top 12 bits
RWYLAT (25) : Lat of runway End
RWYLON (26) : Lon of runway End
RWYTHRS (27) : Displaced Threshold
RWYSURF (28) : Runway Surface
RWYALIGN (29) : Runway true alignment (in degrees)
RWYELV (30) : Runway threshold elevation
FLOOR (31) : Signed integer altitude floor in feet
CEIL (32) : Altitude ceiling in feet
AIRNAME (33) : Name / Class of airspace
ALTAGL (34) : Altitude (AGL)
OBSLIGHT (35) : Obstacle Lighting (from DOF)
MOCA (36) : Minimum Crossing Altitude
MCA (37) : Minimum Crossing Altitude
MCAR (38) : Minimum Crossing Altitude (Reverse)
MEA (39) : Minimum Enroute Altitude
MEAR (40) : Minimum Enroute Altitude (Reverse)
GMEA (41) : (GNSS) Minimum Enroute Altitude
GMEAR (42) : (GNSS) Minimum Enroute Altitude (Reverse)
MAXAA (43) : Maximum Authorized Altitude
CLONGNAME (44) : Long Name of container
PROCNAME (45) : Procedure or Chart Name
CHARTTYPE (46) : Type of Chart
IMAGENAME (47) : Image Name for Procedure
TOP (48) : Top location in 1/10000 of a percent of full scale
RIGHT (49) : Right location in 1/10000 of a percent of full scale
BOTTOM (50) : Bottom location in 1/10000 of a percent of full scale
LEFT (51) : Left location in 1/10000 of a percent of full scale
XLOC (52) : X location in 1/10000 of a percent of full scale
YLOC (53) : Y location in 1/10000 of a percent of full scale
ORIENTATION (54) : Orientation in 1/10000 of a degree
PROXIMITY (55) : Proximity of closest neighbor
FREQMHZ (56) : Frequency

4.6.84. db_hashfunc - Database hash functions

IDENT (1) : Alphanumeric Identifier
INT (2) : Integer Number

4.6.85. devtype - XFS device types

MCP (1) : Master Control Program
ADC (2) : Air Data Computer Only
AHRS (3) : Attitude Heading Reference System Only
ADAHRS (4) : ADC and AHRS Combined
SIM (5) : Simulated Data
DSU (6) : Data Storage Unit -- Records Data
FD (7) : Flight Director
AP (8) : Automatic Pilot
FMS (9) : Flight Management System
PDU (10) : Power Distribution Unit
TRIGGER (11) : Event Trigger Unit
QAR (12) : Quick Access Recorder
UI (13) : User Interface Device (but not flight display)
COM (14) : Communication Radio
NAV (15) : Navigation Radio
AUDIOPANEL (16) : Audio Panel
XPDR (17) : Transponder
DAU (18) : Data Acquisition Unit (e.g. Engine)
XFD (19) : Generic Flight Display
SYNSENSOR (20) : Synthetic Sensor
EFIS (21) : Integrated Standby EFIS
OVERLAY (22) : Display overlay (e.g. System or Moving Map)
SERVO (23) : Generic Servo Unit
AIRFRAME (24) : Airframe specific description
GPIO (25) : Generic GPIO Interface
BRIDGE (26) : Protocol Bridge
PROPGOV (27) : Propeller Governor control
DATALINK (28) : Generic Data Link
HAT (29) : Device for measuring height above terrain

4.6.86. suip_cmd - Serial User Interface Protocol commands

DATATX (0x0001) : Send data to specific address.
LONGPRESSTIME (0x0002) : How many milliseconds for a Long press (16-bit unsigned value in data)
GENINC (0x0003) : Generic Encoder Increase
GENDEC (0x0004) : Generic Encoder Decrease
GENPUSH (0x0005) : Generic Encoder or Button Push
GENLONGPUSH (0x0006) : Generic Encoder or Button Long Push
GENRELEASE (0x0007) : Generic Encoder or Button Release
IDENTREQ (0x000c) : Identify Device connected
IDENTREP (0x000d) : Return identity to CPU (data is null terminated string)
BRIGHTNESS (0x000e) : Addr is which device to change brightness (0 for all), data is 16 bits 0 (dark) to 65535 (bright)

ISALIVE (0x000f) : Periodic message sent to indicate link is alive. Address is 0
CONFIG (0x0010) : Device specific configuration. Address is device specific
QUERY (0x0011) : Device specific query. Address is device specific
REPLY (0x0012) : Device specific reply. Address is device specific
DEBUG (0x0000) : Fake message which has debug info in it

4.6.87. touch_event - Touch event activities

UNASSIGNED (0) : Touch event has not been assigned yet
ORPHAN (1) : Touch did not begin within target
LOST (2) : Touch did not remain within target
ABANDON (3) : Touch released outside target
PRESS (4) : Pressing on a touch surface
DRAG (5) : Drag to a new location
PINCH (6) : Two related touches dragged to new positions
RELEASE (255) : Releasing from a touch surface

4.6.88. gpio_output - General purpose I/O output states

NULL (0x00) : NO, GPIO port not available / not installed
FLOAT (0x01) : FL, No pull up or pull down
PULLDOWN (0x02) : PD, pulldown ~ 2.2k
PULLUP (0x03) : PU, pullup ~ 2.2k
LOW (0x04) : OL, Drive output value low
HIGH (0x05) : OH, Drive output value high
PULL_PWM (0x06) : PP, Drive output as PWM/DAC through pullup/down
PWM (0x07) : PW, Drive output as PWM/DAC
FAULT ((1U << 3)) : OF, Fault condition (Rx only), Clear fault (Tx only)

4.6.89. gpio_input - General purpose I/O input states

NULL (0x00) : NI, GPIO port not available / not installed
LOW (0x01) : IL, Read value is low
HIGH (0x02) : IH, Read value is high
FAULT (0x03) : IF, Fault condition (Rx only), Clear fault (Tx only)

4.6.90. gpio_feature - General purpose I/O feature flags

ANALOG ((1U << 0)) : Is analog requested

4.6.91. gdl90_event - GDL-90 event Codes

INVALID (0) : Invalid sequence
BADCHECKSUM (1) : Checksum invalid
OTHER (2) : Other event - with raw data
HEARTBEAT (3) : Heartbeat event
OWNSHIP (4) : Ownship event (see traffic portion)
TRAFFIC (5) : Traffic event
GEOALT (6) : Geo Altitude for Ownship
UPLINK (7) : Generic Uplink Event

4.6.92. gdl90_emergency - GDL-90 Emergency and priority codes

NONE (0) : No emergency
GENERAL (1) : General unspecified emergency
MEDICAL (2) : Medical emergency
MINIMUM_FUEL (3) : Minimum fuel
NORDO (4) : No Communications
HIJACK (5) : Unlawful interference
DOWNED (6) : Downed aircraft

4.6.93. gdl90_emitter - GDL-90 Traffic Emitter Category

NO_INFO (0) : No information available
LIGHT (1) : Under 15,500 lbs
SMALL (2) : 15,500 lbs to 75,000 lbs
LARGE (3) : 75,000 to 300,000 lbs
HIGH_VORTEX (4) : B757 etc
HEAVY (5) : Over 300,000 lbs
MANUEVERABLE (6) : Over 5G acceleration
ROTORCRAFT (7) : Rotary Wing Aircraft
GLIDER (9) : Glider or Sailplane
AIRSHIP (10) : Lighter than air
SKYDIVER (11) : Sky diver or parachutist
ULTRALIGHT (12) : Ultralight / Hang Glider
UAV (14) : Unmanned aircraft
SPACE (15) : Space / Transatmospheric vehicle
EMERGENCY (17) : Surface / emergency vehicle
SERVICE (18) : Surface / service vehicle
POINTOBSTACLE (19) : Point Obstacle (including tethered balloon)
CLUSTEROBSTACLE (20) : Cluster of obstacles
LINEOBSTACLE (21) : Line of obstacles

4.6.94. gdl90_traffic_alert - GDL-90 Traffic Alert Status

NONE (0) : No alert active for target
ALERT (1) : Alert active for target

4.6.95. gdl90_traffic_addr - GDL-90 Traffic Address Type

ADSB_ICAO (0) : ICAO Assigned
ADSB_SELF (1) : Self Assigned
TISB_ICAO (2) : ICAO Assigned
TISB_TRACK_FILE (3) : Track File ID
SURFACE_VEHICLE (4) : Surface Vehicle
GROUND_STATION_BEACON (5) : Ground Station Beacon

4.6.96. gdl90_heartbeat_status1 - GDL-90 Heartbeat First Status Byte Bitmask

GPS_POS_VALID ((1U << 7)) : Position is available for ADS-B Tx
GDL90_MAINT_REQD ((1U << 6)) : GDL 90 Maintenance is Required
IDENT_TALKBACK ((1U << 5)) : IDENT Talkback
ADDR_TALKBACK ((1U << 4)) : Address Type Talkback
GPS_BATT_LOW ((1U << 3)) : GPS Battery Low
RATCS ((1U << 2)) : ATC Services Talkback
UAT_INITIALIZED ((1U << 0)) : GDL90 is initialized

4.6.97. gdl90_heartbeat_status2 - GDL-90 Heartbeat Second Status Byte Bitmask

CSA_REQUESTED ((1U << 6)) : CSA has been requested
CSA_NOT_AVAILABLE ((1U << 5)) : CSA not available at this time
UTC_TIMING_VALID ((1U << 0)) : UTC timing is valid

4.6.98. gdl90_track_status - GDL-90 status of traffic track value

INVALID (0) : trackheading field is meaningless
TRUETRACK (1) : trackheading field represents true track
MAGHDG (2) : trackheading field represents magnetic heading
TRUEHDG (3) : trackheading field represents true heading

4.6.99. fisb_event - Datalink FIS-B (SRT-047 or DO-358) events

CNEXRAD (1) : CONUS NEXRAD
RNEXRAD (2) : Regional NEXRAD
GENTEXT (3) : Generic Text
SUA (4) : Special Use Airspace Status
ICINGLOW (5) : Low Level Forecast Icing Product
ICINGHIGH (6) : High Level Forecast Icing Product
TURBLOW (7) : Low Level Forecast Turbulence
TURBHIGH (8) : High Level Forecast Turbulence
LIGHTNING (9) : Lightning
CLOUDTOPS (10) : Cloud Tops
GAIRMET (11) : Graphical AIRMET Outline
SIGMETOUTLINE (12) : SIGMET Outline
SIGMETTEXT (13) : SIGMET Text
AIRMETOUTLINE (14) : AIRMET Outline

AIRMETTEXT (15) : AIRMET Text
NOTAMOUTLINE (16) : NOTAM/TFR Outline
NOTAMTEXT (17) : NOTAM/TFR Text
CWAOUTLINE (18) : Center Weather Advisory Outline
CWATEXT (19) : Center Weather Advisory Text

4.6.100. fisb_geometry - SRT-047/DO-358 datalink FIS-B geometries

3DPG_MSL (3) : 3D Polygon MSL Altitude
3DPG_AGL (4) : 3D Polygon AGL Altitude
CP_MSL (7) : Circular Prism MSL Altitude
CP_AGL (8) : Circular Prism AGL Altitude
3DPT_AGL (9) : 3D Point AGL Altitude
3DPT_MSL (10) : 3D Point MSL Altitude
3DPL_MSL (11) : 3D Polyline MSL Altitude
3DPL_AGL (12) : 3D Polyline AGL Altitude

4.6.101. gblock_res - SRT-047/DO-358 Global Block Resolution

HIGH (1) : High Resolution (1x)
MEDIUM (5) : Medium Resolution (5x)
LOW (9) : Low Resolution (9x)

4.6.102. hid_event - Human Interface Device Events

NONE (0) : No event has occured. Should still be called frequently if no other events happen
ICC (1) : Inner Counter Clockwise
IC (2) : Inner Clockwise
OCC (3) : Outer Counter Clockwise
OC (4) : Outer Clockwise
KPUSH (5) : Push on knob
BPUSH (6) : Button Push
KREL (7) : Knob Release
BREL (8) : Button Release

4.6.103. ethertun_dlc - Special data length field parameters for ethernet tunnel of CAN

TIMESTAMP ((1U << 7)) : Timestamp field present

4.6.104. analog_avg_feature - Features for analog averaging

NONE (0) : Normal Average
HEADING (1) : Average range 0-360 with wrapping
PITCH (2) : Average range -90.0 to 90.0 with wrapping
ROLL (3) : Average range -180.0 to 180.0 with wrapping

4.6.105. milstd1553 - Maximum sequence number for MIL-STD-1553 over ethernet

SEQNO_MASK (0x3fff) : Max Sequence number

4.6.106. milstd1553_frame_flag - Frame flags for MIL-STD-1553 frames

STATUS1 ((1U << 0)) : Status1 is Valid
STATUS2 ((1U << 1)) : Status2 is Valid
ADDR1 ((1U << 2)) : Rtaddr1 and Subaddr1 are Valid
ADDR2 ((1U << 3)) : Rtaddr2 and Subaddr2 are Valid
MODECODE ((1U << 4)) : Modecode is Valid
MAILBOX ((1U << 15)) : Treat this message as a mailbox prototype

4.6.107. milstd1553_rtaddr - Remote terminal addresses for MIL-STD-1553

TRANSMIT ((1U << 7)) : This command has transmit bit set (if not present, receive bit)
MASK (0x1f) : Mask for station vs flags
ALL (0x1f) : All Stations
UNSPEC (0x20) : RT is unspecified

4.6.108. milstd1553_subaddr - Subaddresses for remote terminals for MIL-STD-1553

MODECODE0 (0x0) : Mode Code (0)
MODECODE31 (0x1f) : Mode Code (31)
UNSPEC (0x20) : Subaddress is unspecified

4.6.109. milstd1553_modecode - MIL-STD-1553 special mode codes

DYNBUSCTRL (0x00) : Dynamic Bus Control
SYNC (0x01) : Synchronize
TXSTATW (0x02) : Transmit Status Word
SELFTEST (0x03) : Initiate Self Test
TXSD (0x04) : Transmitter Shutdown
OVTXSD (0x05) : Override Transmitter Shutdown
INHIBIT (0x06) : Inhibit Terminal Flag
OVINHIBIT (0x07) : Override Inhibit Terminal Flag
RESET (0x08) : Reset Remote Terminal
TXVECTW (0x10) : Transmit Vector Word
SYNCWDATA (0x11) : Synchronize (with Data) (R)
TXLASTCW (0x12) : Transmit Last Command Word
TXBITW (0x13) : Transmit BIT Word
SELTXSD (0x14) : Selected Transmitter Shutdown (R)
OVSELTXSD (0x15) : Override Selected Transmitter Shutdown (R)
UNSPEC (0x20) : Mode code is unspecified

4.6.110. milstd1553_status - MIL-STD-1553 status bits

RTMASK (0x1f) : Mask for station vs flags
MSGERROR ((1U << 15)) : Message Error
INSTRMNT ((1U << 14)) : Instrumentation
SVCREQ ((1U << 13)) : Service Request
BRDCSTRX ((1U << 9)) : Broadcast Received
BUSY ((1U << 8)) : Busy
SUBSYSFLAG ((1U << 7)) : Subsystem Flag
DYNBUSCTRLAC ((1U << 6)) : Dynamic Bus Control Accept
TERMFLAG ((1U << 5)) : Terminal Flag

4.6.111. arinc429_speed - ARINC-429 baud rates

FAST (100000) : ARINC-429 High Speed
SLOW (12500) : ARINC-429 Low Speed

4.6.112. arinc429_bcd - ARINC-429 Binary Coded Decimal

PLUS ((0 << 29)) : SSM Positive Number
NCD ((1 << 29)) : SSM No Computed Data
FT ((2 << 29)) : SSM Functional Test
MINUS ((3 << 29)) : SSM Negative Number

4.6.113. arinc429_dd - ARINC-429 Discrete Data

NORM ((0 << 29)) : SSM Normal Operation
NCD ((1 << 29)) : SSM No Computed Data
FT ((2 << 29)) : SSM Functional Test
FAIL ((3 << 29)) : SSM Failure Warning

4.6.114. arinc429_bnr - ARINC-429 Binary Number

FAIL ((0 << 29)) : SSM Failure Warning
NCD ((1 << 29)) : SSM No Computed Data
FT ((2 << 29)) : SSM Functional Test
NORM ((3 << 29)) : SSM Normal Operation
PLUS ((0 << 28)) : SM Positive Number
MINUS ((1 << 28)) : SM Negative Number

4.6.115. canaero_datatype - CANAERO datatypes and encodings

NODATA (0) : No data type
ERROR (1) : Emergency event data type
FLOAT (2) : Single precision IEE-754
LONG (3) : 2’s complement integer
ULONG (4) : Unsigned integer
BLONG (5) : Collection of 32 individual bits

SHORT (6) : 2’s complement short integer
USHORT (7) : Unsigned 16-bit integer
BSHORT (8) : Collection of 16 individual bits
CHAR (9) : 2’s complement char integer
UCHAR (10) : unsigned 8-bit integer
BCHAR (11) : Collection of 8 individual bits
SHORT2 (12) : 2 x 2’s complement short integer
USHORT2 (13) : 2 x unsigned 16-bit integer
BSHORT2 (14) : 2 x collection of 16 individual bits
CHAR4 (15) : 4 x 2’s complement char integer
UCHAR4 (16) : 4 x unsigned 8-bit
BCHAR4 (17) : 4 x collection of 8 individual bits
CHAR2 (18) : 2 x 2’s complement char integer
UCHAR2 (19) : 2 x unsigned 8-bit integer
BCHAR2 (20) : 2 x collection of 8 individual bits
MEMID (21) : Memory ID for upload/download
CHKSUM (22) : Checksum for upload/download
ACHAR (23) : ASCII Character
ACHAR2 (24) : 2x ASCII Character
ACHAR4 (25) : 4x ASCII Character
VARIABLE3 (100) : 17 to 24-bits of signed 2’s complement integer
UVARIABLE3 (101) : 17 to 24-bits of unsigned integer

4.6.116. parambuf_interpflag - Parameter buffer interpretation flags

NONE (0) : No interpretation flags
STRICT ((1U << 0)) : Confidence must exactly match minconfidence
CROSSFILL ((1U << 1)) : Crossfill equivalent values from appropriate better scoring peers
PROMISC ((1U << 2)) : Interpret from all sources and do not attach to a single one
OPTIONAL ((1U << 3)) : The presence of this parameter is not required for normal operation

4.6.117. parambuf_flag - Parameter buffer state flags

NONE (0) : No flags
VALID ((1U << 0)) : Set to true by receive logic when paramter buffer is valid
UPDATED ((1U << 1)) : Set by receive logic when paramter buffer has been updated
LINKED ((1U << 2)) : When this flag is set, this parameter buffer has been linked in a parameter set

4.6.118. serial_dbits - Serial Data Bits

DB8 (0) : Eight Data Bits
DB7 (1) : Seven Data Bits

4.6.119. serial_parity - Serial Data Parity

NONE (0) : No Parity Bit
ODD (1) : Odd Parity Bit
EVEN (2) : Even Parity Bit

4.6.120. serial_sbits - Serial Stop Bits

SB1 (0) : One Stop Bit
SB2 (1) : Two Stop Bits

4.6.121. link_state - Serial Interface Link State

DISCONNECTED (-1) : Interface is currently not connected
STATELESS (0) : Interface does not track state
CONNECTED (1) : Interface is currently connected

4.6.122. object_factory_flag - Object Factory Flags

VIRTUAL ((1 << 0)) : Virtual objects cannot be directly instantiated -- only their non-virtual children
OSSPECIFIC ((1 << 1)) : Objects defined within the operating system abstraction may be absent or have different parameters on other O/S selections
OPTIONAL ((1 << 2)) : Optional object factories can be ignored if their parent object types have no registered factory
REGISTERED ((1 << 3)) : If present, this object factory has been registered within the list of valid object types
FOUNDLINEAGE ((1 << 4)) : If present, this object factory has found its full lineage up to the root OBJECT parent

4.6.123. scb_flag - Software Circuit Breaker Flags

NONE (0) : Application running within normal paramters
HIGHMEM ((1 << 0)) : Application has used unexpectedly high portion of memory
HIGHCPU ((1 << 1)) : Application has used unexpectedly high portion of CPU
HIGHBW ((1 << 2)) : Application has used unexpectedly high portion of network bandwidth

4.6.124. priv_proto - Privacy Protocols

NONE (0) : No privacy protocol
DES (1) : Data Encryption Standard
AES (2) : 128-Bit Advanced Encryption Standard
AES192 (3) : 192-Bit Advanced Encryption Standard
AES256 (4) : 256-Bit Advanced Encryption Standard

4.6.125. crc16_poly - CRC-16 Polynomials

POSTXOR ((1 << 16)) : XOR Block data after table lookup rather than before (nonstandard for GDL-90)
CCITT (0x1021) : GDL-90 (when in conjunction with POSTXOR flag), CRC-16 CCITT
ANSI (0x8005) : ANSI X3.28, USB, MODBUS and others

4.6.126. a661_widgetid - ARINC-661 Widget IDs

NOWIDGET (0) : No selected widget

4.6.127. a661_layerid - ARINC-661 Layer IDs

4.6.128. a661_color - ARINC-661 Color Indices

4.6.129. a661 - ARINC-661 Special Values

FALSE (0x00) : False
TRUE (0x01) : True
UNSELECTED (0x00) : Not selected
SELECTED (0x01) : Selected
TRUE_WITH_VALIDATION (0x02) : True and Validated
BEGIN_BLOCK (0xB0) : Start keyword opening a runtime block of information
END_BLOCK (0xD0) : Keyword ending a block of runtime information
CMD_SET_PARAMETER (0xCA02) : Set a parameter on a widget
CMD_UA_REQUEST (0xCA03) : Set parameter
NOTIFY_WIDGET_EVENT (0xCC01) : Received Widget Event
NOTIFY_LAYER_EVENT (0xCC02) : Received Layer Event
NOTIFY_EXCEPTION (0xCC03) : Received Exception Event
REQ_LAYER_ACTIVE (0xDA01) : Request a layer become active
REQ_LAYER_INACTIVE (0xDA02) : Request a layer become inactive
REQ_LAYER_VISIBLE (0xDA04) : Request a layer become the visible layer
REQ_CURSOR_ON_WIDGET (0xDA05) : Request cursor be snapped to a widget
REQ_FOCUS_ON_WIDGET (0xDA03) : Request focus be snapped to a widget
ERR_BAD_COMMAND (0xF001) : Erroneous command
ERR_PROCESS_OVERLOAD (0xF006) : Inability to complete processing
ERR_RENDERING_OVERLOAD (0xF007) : Inability to complete rendering
ERR_SET_ABORTED (0xF003) : Erroneous set command
ERR_UA_REQUEST_ABORTED (0xF004) : Erroneous UA Request
NOTE_CYCLIC_ACTIVATION (0xDC82) : Periodic Indication that Layer is Active
NOTE_LAYER_IS_ACTIVE (0xDC02) : Layer Activated by CDS and Reinitialize Data

NOTE_LAYER_IS_INACTIVE (0xDC03) : Layer Deactivated by CDS
NOTE_REINIT_LAYER_DATA (0xDC01) : CDS Requests Data Layer Initialization
NOTE_CONNECTOR_DATA (0xDC86) : Parametric Data Update
EVT_ANIMATION_STATUS_CHANGE (0xE509) : Animation Status has completed (1 byte)
EVT_CLICKED (0xE1D1) : Item has been clicked
EVT_CURSOR_ENTER (0xE300) : Cursor enters active area
EVT_CURSOR_EVENT (0xE305) : Event from cursor event extension
EVT_CURSOR_EXIT (0xE320) : Cursor exits active area
EVT_CURSOR_INSIDE (0xE310) : Cursor inside active area
EVT_CURSOR_POS_CHANGE (0xE010) : Cursor position has changed
EVT_GESTURE_DIR_FLICK (0xE508) : Direction of one or more points quickly moved in a direction
EVT_DOUBLE_CLICKED (0xE1D2) : Double click event
EVT_GESTURE_DRAG (0xE506) : One or more points move in a direction
EVT_EDITBOX_OPENED (0xE110) : Edit box has been opened for entry
EVT_FIRST_VIS_ENTRY_CHANGE (0xE020) : First visible entry in a list has changed
EVT_GESTURE_FLICK (0xE507) : Velocity of one or more points quickly moved in a direction
EVT_FRAME_POS_CHANGE (0xE030) : Change in X/Y Position of Frame
EVT_GESTURE_DOUBLE_TAP (0xE502) : Two taps in quick succession and close proximity
EVT_GESTURE_TAP (0xE501) : Single tap and release
EVT_INCREMENT (0xE006) : Device Increment
EVT_ITEM_SYNCHRONIZATION (0xE150) : Map Item Synchronization
EVT_ITEM_IN_BOUNDS (0xE141) : List of in-bounds map items
EVT_ITEM_OUT_OF_BOUNDS (0xE140) : List of out-of-bounds map items
EVT_KEY (0xE005) : Virtual Keyboard KeyPress
EVT_MULT_SELECTION (0xE058) : Multiple entry list (extension) selection entry
EVT_OFFSCREEN (0xE0E0) : Map element has gone off screen
EVT_ONSCREEN (0xE0E1) : Map element has come on screen
EVT_GESTURE_PINCH (0xE504) : Pinch Gesture
EVT_POPUP_CLOSED (0xE040) : Popup menu or button closed
EVT_POPUP_PANEL_CLOSED (0xE120) : Popup panel closed
EVT_GESTURE_PRESS_AND_HOLD (0xE503) : Area pressed and held
EVT_PRESSED (0xE1D3) : Area pressed
EVT_RELEASED (0xE1D4) : Area released
EVT_RIGHT_CLICKED (0xE1D5) : Area right clicked
EVT_GESTURE_ROTATE (0xE505) : Rotation gesture
EVT_SEL_ENTRY_CHANGE (0xE050) : Selection entry has changed
EVT_SELECTION (0xE060) : Item has been selected
EVT_SELECTION_MAP (0xE068) : Map location has been selected
EVT_STATE_CHANGE (0xE070) : Item state has changed
EVT_STRING_CHANGE (0xE080) : String value has been changed but not confirmed or aborted

EVT_STRING_CHANGE_ABORTED (0xE090) : String value change has been canceled
EVT_STRING_CONFIRMED (0xE0A0) : String value change has been confirmed
EVT_TABBED_PANEL_CHANGE (0xE0B0) : Selected tabbed panel has changed
EVT_TOUCH (0xE500) : A touch has taken place
EVT_VALUE_CHANGE (0xE0C0) : Slider value has changed
EVT_VISIBLE_CHILD (0xE0D0) : Visible child within paging container has changed
EVT_VISIBLE_CHILD_INDEX (0xE0D1) : Index of visible child within paging container has changed
EVT_WATCHDOG_EXPIRED (0xE200) : Watchdog has expired
EVT_WATCHDOG_NORMAL (0xE210) : Watchdog status is normal
EVT_ANY (0xFFFF) : XFS-Specific Any Event
STRING (0xB490) : String value parameter
STRING_ARRAY (0xB4A0) : Collection of NUL-separated and terminated string values parameter
SELECTED_ENTRY (0xB430) : Selected entry within a list
NUMBER_OF_ENTRIES (0xB2A0) : Number of entries within a list
VISIBLE_CHILD (0xB540) : Visible child page/mutex container
ENTRY_VALID (0xB570) : Entry has been validated when non-zero
COLOR_INDEX (0xB160) : Index of Color to be used for border
FILL_INDEX (0xB1E0) : Index of Color to be used for fill
ENABLE (0xB180) : Enable for interaction
VALUE (0xB520) : Floating Point Numeric Value
START_ANGLE (0xB480) : 32-bit signed numeric value for starting angle
END_ANGLE (0xB1B0) : 32-bit signed numeric value for ending angle
VISIBLE (0xB530) : Is widget visible
INNER_STATE_CHECK (0xB244) : Is toggle checked
INNER_STATE_TOGGLE (0xB258) : Is toggle selected
EN_DEFSTR (0xBA11) : Collins Extension for Edit Number to show default string
SIZE_X (0xB450) : Width of widget
SIZE_Y (0xB460) : Height of widget

4.6.130. com_secmode - Communication Security Mode

TD (1) : TD
PT (2) : Plain Text
CT (7) : Cypher Text
INVALID (8) : Invalid Reserved
RV (14) : RV

4.6.131. com_band - Communication Band

UNKNOWN (0) : Unknown communication band

VHFFM (1) : Very High Frequency with Frequency Modulation
VHFAM (2) : Very High Frequency Amplitude Modulation
UHFFM (3) : Ultra High Frequency
UHFAM (4) : Ultra High Frequency
P25A (5) : Project 25 Analog
P25D (6) : Project 25 Digital
P25T (7) : Project 25 Trunk Mode
TSM (8) : Trellisware Scalable Mobile Ad-hoc NETworking
SATCOM (9) : Satellite Communication
SINCGARS (10) : SINCGARS Frequency Hop Frequencies
HFAM (11) : High Frequency Ampltitude Modulation

4.6.132. com_bandmask - Supported Communication Band Mask

VHFFM ((1 << 0)) : Very High Frequency with Frequency Modulation
VHFAM ((1 << 1)) : Very High Frequency with Amplitude Modulation
UHFFM ((1 << 2)) : Ultra High Frequency with Frequency Modulation
UHFAM ((1 << 3)) : Ultra High Frequency with Amplitude Modulation
P25A ((1 << 4)) : Project 25 Analog
P25D ((1 << 5)) : Project 25 Digital
P25T ((1 << 6)) : Project 25 Trunk Mode
TSM ((1 << 7)) : Trellisware Scalable Mobile Ad-hoc NETworking
SATCOM ((1 << 8)) : Satellite Communication
SINCGARS ((1 << 9)) : SINCGARS Frequency Hop Frequencies
HFAM ((1 << 10)) : High Frequency

4.6.133. com_sqlmode - Communication Squelch Mode

UNKNOWN (0) : Unknown Squelch Mode
NONE (1) : Squelch Off
SNR (2) : Signal to Noise Ratio
TONE (3) : FM Military Tone Squelch System
CTCSS (4) : Continuous Tone Coded Squelch System
DCS (5) : Digital Code Squelch
NAC (6) : Network Access Code P25 Trunk Mode

4.6.134. com_scgopmode - SINCGARS Operational Mode

UNKNOWN (0) : Unknown SINCGARS Mode
SINGLECHANNEL (1) : Single channel mode is active
FREQHOP (2) : Frequency hoping is active
FREQHOPMASTER (3) : Frequency hop and is master

4.6.135. percent - Percentage Value

4.6.136. graphic_prim - Graphic Primative

POINTS (0) : Vertices in space

LINES (1) : Lines between pairs of vertices
LINE_LOOP (2) : Connect all vertices into a closed loop
LINE_STRIP (3) : Connect all vertices into a single line
TRIANGLES (4) : Triangles between sets of three vertices
TRIANGLE_STRIP (5) : Connect all vertices into a single strip of triangles
TRIANGLE_FAN (6) : Connect all vertices into a fan of triangles

4.7. Parameter Types

This section declares the initial set of XSEDE parameters. Each parameter is defined by a name and a short description. This is followed by the numeric parameter ID. Next, the meanings of the unit and subunit fields are provided, if applicable. and finally the parameter data format and a reference to the appropriate table defining the parameter attribute type.

4.7.1. GOAROUND - Go around requested

Parameter ID: %x00.00.00
Unit Usage: None
SubUnit Usage: None
Format: BOOL (See Table 24.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.2. P-ALT - Pressure Altitude

Parameter ID: %x00.00.01
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: FT multiplied by 10.

4.7.3. T-ALT - True Altitude

Parameter ID: %x00.00.02
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: FT multiplied by 10.

4.7.4. IAS - Indicated Airspeed

Parameter ID: %x00.00.03
Unit Usage: Source ID
SubUnit Usage: None

Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.5. CAS - Calibrated Airspeed

Parameter ID: %x00.00.04
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.6. CASMSG - Crew Alerting System Message

Parameter ID: %x00.00.05
Unit Usage: CAS System ID
SubUnit Usage: None
Format: CASMSG (See Table 32.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.7. THROTPOS - Throttle position

Parameter ID: %x00.00.06
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.8. INAIR - Are we in the air (vs. on the ground)

Parameter ID: %x00.00.07
Unit Usage: None
SubUnit Usage: None
Format: BOOL (See Table 24.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.9. BARO - Current barometric setting

Parameter ID: %x00.00.08
Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Units: INHG multiplied by 1000.

4.7.10. CLTPOS - Collective Position

Parameter ID: %x00.00.09
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.11. CLTPOSREQ - A/P Requested Collective Position

Parameter ID: %x00.00.0a
Unit Usage: None
SubUnit Usage: None
Format: SERVO (See Table 47.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.12. MAGHDG - Magnetic Heading

Parameter ID: %x00.00.0b
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: HDG (See Section 4.5.2.6.)
Units: DEG multiplied by 100.

4.7.13. MAGCRS - Magnetic Course (via RNAV)

Parameter ID: %x00.00.0c
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: HDG (See Section 4.5.2.6.)
Units: DEG multiplied by 100.

4.7.14. TRUECRS - True Course (via RNAV)

Parameter ID: %x00.00.0d
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: HDG (See Section 4.5.2.6.)
Units: DEG multiplied by 100.

4.7.15. MAGDTK - Desired Course (via RNAV)

Parameter ID: %x00.00.0e
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: HDG (See Section 4.5.2.6.)
Units: DEG multiplied by 100.

4.7.16. TRUEDTK - Desired course (via RNAV)

Parameter ID: %x00.00.0f
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: HDG (See Section 4.5.2.6.)
Units: DEG multiplied by 100.

4.7.17. LAT - Current position latitude

Parameter ID: %x00.00.10
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: DEG multiplied by 10000000.

4.7.18. LON - Current position longitude

Parameter ID: %x00.00.11
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: DEG multiplied by 10000000.

4.7.19. RNAVALT - Altitude measured by RNAV

Parameter ID: %x00.00.12
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: FT multiplied by 10.

4.7.20. ROLL - Current degrees of roll, -18000 being being upside down towards left, 18000 being upside down to the right

Parameter ID: %x00.00.13
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: ROLL (See Section 4.5.2.2.)
Units: DEG multiplied by 100.

4.7.21. PITCH - Current degrees of pitch, 9000 being straight up, -9000 being straight down

Parameter ID: %x00.00.14
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: PITCH (See Section 4.5.2.3.)
Units: DEG.

4.7.22. YAW - Yaw/Inclination as measured in G force

Parameter ID: %x00.00.15
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: G multiplied by 10000.

4.7.23. FUELWTTOT - Computed remaining fuel

Parameter ID: %x00.00.16
Unit Usage: Fuel System ID/0=Sum of all
SubUnit Usage: 0 = current total, 1 = total at end of flight
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: LB multiplied by 100.

4.7.24. RNAVHFOM - Horizontal Figure of Merit

Parameter ID: %x00.00.17
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: M multiplied by 100.

4.7.25. RNAVVFOM - Vertical Figure of Merit

Parameter ID: %x00.00.18
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: M multiplied by 100.

4.7.26. RNAVHPL - Horizontal Protection Level

Parameter ID: %x00.00.19
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: M multiplied by 100.

4.7.27. RNAVVPL - Vertical Protection Level

Parameter ID: %x00.00.1a
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: M multiplied by 100.

4.7.28. IASRT - Indicated Airspeed Rate of Change

Parameter ID: %x00.00.1b
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: KTPS multiplied by 100.

4.7.29. KBDSEL - Activate the named on-screen keyboard or none if empty

Parameter ID: %x00.00.1c
Unit Usage: Display
SubUnit Usage: None
Format: STRING (See Table 31.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.30. KEYPRESS - Send the FMS encoded key press to the given display

Parameter ID: %x00.00.1d
Unit Usage: Display

SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using osk_key dictionary (See Table 53.)

Table 53, below, shows the values defined in the osk-key Dictionary. These options represent the On screen keyboard keys.

Name	Value	Definition
0	%d48	Character 0
1	%d49	Character 1
2	%d50	Character 2
3	%d51	Character 3
4	%d52	Character 4
5	%d53	Character 5
6	%d54	Character 6
7	%d55	Character 7
8	%d56	Character 8
9	%d57	Character 9
A	%d65	Character A
B	%d66	Character B
C	%d67	Character C
D	%d68	Character D
E	%d69	Character E
F	%d70	Character F
G	%d71	Character G
H	%d72	Character H
I	%d73	Character I

J	%d74	Character J
K	%d75	Character K
L	%d76	Character L
M	%d77	Character M
N	%d78	Character N
O	%d79	Character O
P	%d80	Character P
Q	%d81	Character Q
R	%d82	Character R
S	%d83	Character S
T	%d84	Character T
U	%d85	Character U
V	%d86	Character V
W	%d87	Character W
X	%d88	Character X
Y	%d89	Character Y
Z	%d90	Character Z
PREV	%d60	Previous position or <
NEXT	%d62	Next position or >
DEG	%d127	Degrees
DIRECTTO	%d128	Direct To
ENT	%d129	Enter

Table 53: osk-key Dictionary

4.7.31. SURFPOS - Position of arbitrary control surface

Parameter ID: %x00.00.1e
Unit Usage: Surface Type
SubUnit Usage: Surface Type Subassembly
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.32. SURFREQ - Requested control surface position

Parameter ID: %x00.00.1f
Unit Usage: Surface Type
SubUnit Usage: Surface Type Subassembly
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.33. SURFTORQUE - Aerodynamic torque applied to a control surface relative to movement

Parameter ID: %x00.00.20
Unit Usage: Surface Type
SubUnit Usage: Surface Type Subassembly
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: LBFT multiplied by 100.

4.7.34. SURFFORCE - Aerodynamic force applied to a control surface relative to movement

Parameter ID: %x00.00.21
Unit Usage: Surface Type
SubUnit Usage: Surface Type Subassembly
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: LB multiplied by 100.

4.7.35. WINDSPD - Wind Speed

Parameter ID: %x00.00.22
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.36. WINDBRG - True Bearing from which wind blows

Parameter ID: %x00.00.23
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: HDG (See Section 4.5.2.6.)
Units: DEG multiplied by 100.

4.7.37. COMFREQ - Communication Frequency - If SYS/USERSEL, sets COMFREQTX and COMFREQRX. RAW should match COMFREQTX.

Parameter ID: %x00.00.24
Unit Usage: Radio ID
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: COMFREQ (See Section 4.5.2.11.)
Units: MHZ multiplied by 100000.

4.7.38. COMFREQR - Range of acceptable communication frequencies

Parameter ID: %x00.00.24
Unit Usage: Radio ID
SubUnit Usage: 0=Current Band/1+=By COM Band
Format: RANGE (See Table 39.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.39. NAVFREQ - Navigation Frequency

Parameter ID: %x00.00.25
Unit Usage: Radio ID
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: NAVFREQ (See Section 4.5.2.12.)
Units: MHZ multiplied by 100000.

4.7.40. COMVOL - Communication Volume (0-100)

Parameter ID: %x00.00.26
Unit Usage: Radio ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: PERCENT (See Section 4.5.2.4.)
Units: PCENT.

4.7.41. NAVVOL - Communication Volume (0-100)

Parameter ID: %x00.00.27
Unit Usage: Radio ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: PERCENT (See Section 4.5.2.4.)
Units: PCENT.

4.7.42. COMSQL - Communication Squelch (0-100)

Parameter ID: %x00.00.28
Unit Usage: Radio ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: PERCENT (See Section 4.5.2.4.)
Units: PCENT.

4.7.43. MUX - Selected multiplexer input or output

Parameter ID: %x00.29
Unit Usage: MUX ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.44. ICSVOL - Intercom Volume (0-100)

Parameter ID: %x00.00.2a
Unit Usage: Audio Panel Unit
SubUnit Usage: 0=System, 1=Pilot, 2=Copilot, rest are pax
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: PERCENT (See Section 4.5.2.4.)
Units: PCENT.

4.7.45. COMSTATE - COM radio state

Parameter ID: %x00.00.2b
Unit Usage: Radio ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using com_state dictionary (See Table 54.)

Table 54, below, shows the values defined in the com-state Dictionary. These options represent the State of communication radio.

Name	Value	Definition
IDLE	R	Ready to Receive (Idle)
RX	r	Active receiving
TX	T	Active transmitting
STUCK	S	Stuck Mic
FAULT	F	Fault

Table 54: com-state Dictionary

4.7.46. ICSRXCOMS - Which COM Radios to Monitor (mask)

Parameter ID: %x00.00.2c
Unit Usage: Audio Panel Unit
SubUnit Usage: 0=System, 1=Pilot, 2=Copilot, rest are pax
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.47. ICSRXNAVS - Which NAV Radios to Monitor (mask)

Parameter ID: %x00.00.2d
Unit Usage: Audio Panel Unit
SubUnit Usage: 0=System, 1=Pilot, 2=Copilot, rest are pax
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.48. ICSMODE - Intercom Mode

Parameter ID: %x00.00.2e
Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using ics_mode dictionary (See Table 55.)

Table 55, below, shows the values defined in the ics-mode Dictionary. These options represent the State of intercom system.

Name	Value	Definition
PILOT	P	Pilot Isolate
CREW	C	Crew Isolate
ALL	A	All
FEATUREMASK	%xff.00	Mask for intercom features
POSITIONAL	%x01.00	Positional dynamic audio

Table 55: ics-mode Dictionary

4.7.49. ICSTXCOMS - Which COM Radios to Transmit (mask)

Parameter ID: %x00.00.2f
Unit Usage: Audio Panel Unit
SubUnit Usage: 0=System, 1=Pilot, 2=Copilot, rest are pax
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.50. DATETIME - Date and Time

Parameter ID: %x00.00.30
Unit Usage: 0=Current Zulu Time
SubUnit Usage: None
Format: DATETIME (See Table 50.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.51. GLOAD - Current Normal to Aircraft Loading

Parameter ID: %x00.00.31
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: G multiplied by 1000.

4.7.52. RATEOFTURN - Turn Coordinator Rate Per Second

Parameter ID: %x00.00.32
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.

Units: DEG multiplied by 1000.

4.7.53. GROUNDSPEED - Groundspeed

Parameter ID: %x00.00.33
Unit Usage: Source ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.54. VSPEED - Vertical speed

Parameter ID: %x00.00.34
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: FPM multiplied by 1.

4.7.55. XPDRIDENT - XPDR Ident request (USERSELECT only). Non-standby transponders must IDENT regardless of UNIT. Used only to request IDENT, but IDENT state reported in XPDRMODE

Parameter ID: %x00.00.35
Unit Usage: Always zero
SubUnit Usage: None
Format: BOOL (See Table 24.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.56. XPDRRPS - XPDR Replies per second (normalized)

Parameter ID: %x00.00.36
Unit Usage: XPDR ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.57. XPDRSQUAWK - XPDR Squawk in octal. All transponders must change SQUAWK regardless of UNIT

Parameter ID: %x00.00.37
Unit Usage: XPDR ID (Rx Only) Zero for USERSELECT
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using octal dictionary (See Table 56.)

Table 56, below, shows the values defined in the octal Dictionary. These options represent the Octal representation.

Name	Value	Definition
octal	N/A	Octal representation

Table 56: octal Dictionary

4.7.58. XPDRMODE - XPDR Mode. Note that IDENT flag is ignored in USERSELECT condition.

Parameter ID: %x00.00.38
Unit Usage: XPDR ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using xpdr_mode dictionary (See Table 57.)

Table 57, below, shows the values defined in the xpdr-mode Dictionary. These options represent the Transponder mode and flags.

Name	Value	Definition
UNKNOWN	%d0	Unknown
MODEMASK	%x7f	Mask for mode
STANDBY	O	Standby
GND	G	On Ground
AIR	A	Air/Altitude Reporting
FLAG-IDENT	%x80	IDENT Active

Table 57: xpdr-mode Dictionary

4.7.59. NAVOBS - NAV OBS Value

Parameter ID: %x00.00.39
Unit Usage: Radio/FMS ID
SubUnit Usage: None
Format: UINT (See Table 26.)

Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: OBS (See Section 4.5.2.7.)
Units: DEG multiplied by 1000.

4.7.60. NAVBRG - Bearing to nav aid

Parameter ID: %x00.00.3a
Unit Usage: Radio/FMS ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: HDG (See Section 4.5.2.6.)
Units: DEG multiplied by 100.

4.7.61. NAVCDI - Course Deviation (-1000 to 1000)

Parameter ID: %x00.00.3b
Unit Usage: Radio/FMS ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: DEVIATION (See Section 4.5.2.8.)

4.7.62. NAVGSI - Glide Slope (-1000 to 1000)

Parameter ID: %x00.00.3c
Unit Usage: Radio/FMS ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: DEVIATION (See Section 4.5.2.8.)

4.7.63. NAVFLAGS - Navigation Flags (see XFS_NAV_FLAG_*

Parameter ID: %x00.00.3d
Unit Usage: Radio/FMS ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using nav_flag dictionary (See Table 58.)

Table 58, below, shows the values defined in the nav-flag Dictionary. These options represent the Navigational flag states.

Name	Value	Definition
BACKCOURSE	%x01	NAV receiver is flying a localizer back course
LOCDETECT	%x02	The NAV receiver is detecting a localizer
FROM	%x04	The FROM flag is detected from a VOR
TO	%x08	The TO flag is detected from a VOR
GSI-SFLAG	%x10	The glideslope superflag is present
GSI-VALID	%x20	The glideslope signal is being received and is valid
NAV-SFLAG	%x40	The NAV super flag is present
NAV-VALID	%x80	The localizer or VOR signal is being received and is valid
FAULT	%x01.00	Fault detected

Table 58: nav-flag Dictionary

4.7.64. FLAPREQ - Requested Flap Position 0 = up, 100000 = fully down, -100000 is fully negative

Parameter ID: %x00.00.3e
Unit Usage: Actuator/0=Aircraft
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.65. FLAPPOS - Flap actuator position, 0 = up, 100000 = fully down, -100000 is fully negative

Parameter ID: %x00.00.3f
Unit Usage: Actuator/0=Aircraft
SubUnit Usage: None
Format: SINT (See Table 35.)

Range: There SHALL be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.66. ECBSTAT - ECB Status change or request, see xfs_ecb.h

Parameter ID: %x00.00.40
Unit Usage: None
SubUnit Usage: None
Format: BUS (See Table 36.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.67. PTRIMREQ - Requested Pitch Trim Position (negative nose down, 0 neutral, positive nose up)

Parameter ID: %x00.00.41
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.68. PTRIMPOS - Pitch Trim Position (negative nose down, 0 neutral, positive nose up)

Parameter ID: %x00.00.42
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.69. RTRIMREQ - Requested Roll Trim Position (negative left bank, 0 neutral, positive right bank)

Parameter ID: %x00.00.43
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.70. RTRIMPOS - Roll Trim Position (negative left bank, 0 neutral, positive right bank)

Parameter ID: %x00.00.44
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)

Range: There SHALL be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.71. BUSSTAT - Status of Bus

Parameter ID: %x00.00.45
Unit Usage: None
SubUnit Usage: None
Format: BUS (See Table 36.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.72. TEMP - Arbitrary Temperature in a location

Parameter ID: %x00.00.46
Unit Usage: Location
SubUnit Usage: Sensor Number/0=Average
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.73. TAS - True Airspeed

Parameter ID: %x00.00.47
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.74. TAT - Total Air Temperature

Parameter ID: %x00.00.48
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.75. OAT - Outside Air Temperature accounting for compressibility

Parameter ID: %x00.00.49
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.76. D-ALT - Density Altitude

Parameter ID: %x00.00.4a
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: FT multiplied by 10.

4.7.77. OILPRES - Oil Pressure

Parameter ID: %x00.00.4b
Unit Usage: Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: PSI multiplied by 100.

4.7.78. OILTEMP - Oil Temp

Parameter ID: %x00.00.4c
Unit Usage: Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.79. XFDFPS - XFD Display Frames Per Second (FPS)

Parameter ID: %x00.00.4d
Unit Usage: Display
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.80. TIREPRES - Tire Pressure

Parameter ID: %x00.00.4e
Unit Usage: Bogey
SubUnit Usage: Tire
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: PSI multiplied by 100.

4.7.81. CHT - Cylinder Head Temperature

Parameter ID: %x00.00.4f
Unit Usage: Engine

SubUnit Usage: Cylinder/0=Max
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.82. EGT - Exhaust Gas Temperature

Parameter ID: %x00.00.50
Unit Usage: Engine
SubUnit Usage: Cylinder/0=Max
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.83. COOLTEMP - Coolant Temperature

Parameter ID: %x00.00.51
Unit Usage: Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.84. FUELWTFLOW - Fuel Flow by Weight

Parameter ID: %x00.00.52
Unit Usage: Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: LBPH multiplied by 100.

4.7.85. FUELPRES - Fuel Pressure

Parameter ID: %x00.00.53
Unit Usage: Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: PSI multiplied by 100.

4.7.86. FUELWT - Fuel Weight

Parameter ID: %x00.00.54
Unit Usage: Fuel Tank ID/0=Sum of all
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.

Units: LB multiplied by 100.

4.7.87. MANPRES - Manifold pressure

Parameter ID: %x00.00.55
Unit Usage: Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: INHG multiplied by 1000.

4.7.88. ENGRPM - Engine RPM

Parameter ID: %x00.00.56
Unit Usage: Engine
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.

4.7.89. PROPRPM - Propeller RPM

Parameter ID: %x00.00.57
Unit Usage: Engine
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.

4.7.90. MACH - Mach

Parameter ID: %x00.00.58
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: MACH multiplied by 10000.

4.7.91. IASBUG - Target indicated airspeed

Parameter ID: %x00.00.59
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.92. HDGBUG - Bugged Magnetic Heading

Parameter ID: %x00.00.5a

Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: HDG (See Section 4.5.2.6.)
Units: DEG multiplied by 100.

4.7.93. ALTBUG - Bugged Altitude

Parameter ID: %x00.00.5b
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: FT multiplied by 10.

4.7.94. WAYPOINT - A way point in a flight plan, subunit is position in flightplan, beginning with 1 for first waypoint. Subunit 0 is only used to indicate an empty flight plan.

Parameter ID: %x00.00.5c
Unit Usage: FMS ID
SubUnit Usage: None
Format: WAYPOINT (See Table 27.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.95. INSERT - Insert A way point in a flight plan, subunit is position in flightplan which it should become (SYSSEL/USERSEL ONLY)

Parameter ID: %x00.00.5d
Unit Usage: FMS ID
SubUnit Usage: None
Format: WAYPOINT (See Table 27.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.96. DELETE - Delete A way point in a flight plan, subunit is position in flightplan starting at 1 (SYSSEL/USERSEL ONLY). Label must match

Parameter ID: %x00.00.5e
Unit Usage: FMS ID
SubUnit Usage: None
Format: WAYPOINT (See Table 27.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.97. NOTE - Notation of something important within the quick access log or bus

Parameter ID: %x00.00.5f
Unit Usage: None
SubUnit Usage: None
Format: STRING (See Table 31.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.98. NAVGPS - GPS Mode

Parameter ID: %x00.00.60
Unit Usage: NAV radio unit or FMS Unit Number
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using nav_gps dictionary (See Table 59.)

Table 59, below, shows the values defined in the nav-gps Dictionary. These options represent the Global positioning system status.

Name	Value	Definition
UNKNOWN	%d0	GPS Navigation is in unknown state
ENROUTE	%d1	GPS Navigation is in Enroute state
TERMINAL	%d2	GPS Navigation is Terminal state
LNAV	%d3	GPS Navigation is in Lateral Navigation State
LNAVVNAV	%d4	GPS Navigation is Lateral and Vertical NAV state
LP	%d5	GPS Navigation is in Localizer Performance state
LPV	%d6	GPS Navigation is in Localizer Performance/ Vertical state

Table 59: nav-gps Dictionary

4.7.99. COMFREQTX - Transmit Communication Frequency shares range with COMFREQ

Parameter ID: %x00.00.61

Unit Usage: Radio ID
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: COMFREQ (See Section 4.5.2.11.)
Units: MHZ multiplied by 100000.

4.7.100. NAVXTK - Cross track error (negative is left)

Parameter ID: %x00.00.62
Unit Usage: FMS Unit Number
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: NM multiplied by 1000.

4.7.101. COMFREQRX - Receive Communication Frequency shares range with COMFREQ

Parameter ID: %x00.00.63
Unit Usage: Radio ID
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: COMFREQ (See Section 4.5.2.11.)
Units: MHZ multiplied by 100000.

4.7.102. BRIGHTNESS - Universal display brightness (0-1000 for night time mode, 1000-2000 for daytime modes

Parameter ID: %x00.00.64
Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: BRIGHTNESS (See Section 4.5.2.10.)

4.7.103. MANTEMP - Manifold temperature

Parameter ID: %x00.00.65
Unit Usage: Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.104. DIRECT - Go direct to a way point in a flight plan, subunit is position in flightplan starting at 1 (SYSSEL/USERSEL ONLY). Label must match

Parameter ID: %x00.00.66
Unit Usage: None
SubUnit Usage: None
Format: WAYPOINT (See Table 27.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.105. ACTIVATE - Activate leg terminating at way point in a flight plan, subunit is position in flightplan (SYSSEL/USERSEL ONLY). Label must match

Parameter ID: %x00.00.67
Unit Usage: None
SubUnit Usage: None
Format: WAYPOINT (See Table 27.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.106. MMPARAM - Moving Map parameters. Subunit is one of XFS_MM_PARAM_*

Parameter ID: %x00.00.68
Unit Usage: MOVMAP ID
SubUnit Usage: XFS_MM_PARAM_*
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.107. SERVOREQ - Requested servo position and state

Parameter ID: %x00.00.69
Unit Usage: None
SubUnit Usage: None
Format: SERVO (See Table 47.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.108. SERVOPOS - Current servo actuator position

Parameter ID: %x00.00.6a
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.109. SONICHAT - Ultrasonic rangefinder height above terrain

Parameter ID: %x00.00.6b
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: FT multiplied by 100.

4.7.110. LIDARHAT - LIDAR rangefinder height above terrain

Parameter ID: %x00.00.6c
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: FT multiplied by 100.

4.7.111. RADARHAT - Radar rangefinder height above terrain

Parameter ID: %x00.00.6d
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: FT multiplied by 100.

4.7.112. HAT - Computed height above terrain

Parameter ID: %x00.00.6e
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: FT multiplied by 100.

4.7.113. COMSTANDBY - Standby COM Frequency (same rules and range as COMFREQ)

Parameter ID: %x00.00.6f
Unit Usage: Radio ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: COMFREQ (See Section 4.5.2.11.)

4.7.114. NAVSTANDBY - Standby NAV Frequency (same rules and range as NAVFREQ)

Parameter ID: %x00.00.70

Unit Usage: Radio ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: NAVFREQ (See Section 4.5.2.12.)

4.7.115. STALLSPEED - Estimated real-time Stall speed

Parameter ID: %x00.00.71
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.116. YTRIMREQ - Requested Yaw Trim Position (negative left, 0 neutral, positive right)

Parameter ID: %x00.00.73
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.117. YTRIMPOS - Yaw Trim Position (negative left, 0 neutral, positive right)

Parameter ID: %x00.00.74
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.118. VSPEEDBUG - Vertical speed bug in fpm

Parameter ID: %x00.00.75
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.119. MUSICSRC - Music Source (0 = none)

Parameter ID: %x00.00.76
Unit Usage: Audio Panel Unit
SubUnit Usage: 0=System, 1=Pilot, 2=Copilot, rest are pax

Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.120. AOA - Angle of attack as an actual angle

Parameter ID: %x00.00.77
Unit Usage: Source
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: DEG multiplied by 1000.

4.7.121. AOAR - Angle of attack range -- should contain green (beginning of approach range), white (reference angle), yellow (approaching stall) and a red (imminent stall)

Parameter ID: %x00.00.77
Unit Usage: None
SubUnit Usage: None
Format: RANGE (See Table 39.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.122. GPIO - GPIO Input/Output

Parameter ID: %x00.00.78
Unit Usage: I/O Module
SubUnit Usage: Module Port (0 or 1-8)
Format: GPIO (See Table 41.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.123. ANALOG - Raw Analog value 0-4095

Parameter ID: %x00.00.79
Unit Usage: I/O Module
SubUnit Usage: Module Port (1-8)
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.124. PWM - PWM value 0-4095 -- subunit is port number, 1-8

Parameter ID: %x00.00.7a
Unit Usage: I/O Module
SubUnit Usage: Module Port (1-8)
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.125. XPDRACID - ICAO 24-bit Aircraft Identifier

Parameter ID: %x00.00.7b
Unit Usage: XPDR ID (Rx Only) Zero for USERSELECT
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using hex dictionary (See Table 60.)

Table 60, below, shows the values defined in the hex Dictionary. These options represent the Hexadecimal representation.

Name	Value	Definition
hex	N/A	Hexadecimal representation

Table 60: hex Dictionary

4.7.126. XPDRFLID - Up to 8-character, NULL terminated flight ID

Parameter ID: %x00.00.7c
Unit Usage: XPDR ID (Rx Only) Zero for USERSELECT
SubUnit Usage: None
Format: STRING (See Table 31.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.127. THROTREQ - Requested throttle position

Parameter ID: %x00.00.7d
Unit Usage: None
SubUnit Usage: None
Format: SERVO (See Table 47.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.128. RPMREQ - Prop governor requested RPM

Parameter ID: %x00.00.7e
Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.129. TACHTIME - Tachometer time, unit is engine

Parameter ID: %x00.00.7f
Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)

Range: There SHALL NOT be a Range Parameter for this parameter.
Units: S.

4.7.130. TOTTIME - Total aircraft time

Parameter ID: %x00.00.80
Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: S.

4.7.131. APPSTAT - Application Status / Requests

Parameter ID: %x00.00.00.81
Unit Usage: CPU ID
SubUnit Usage: Process ID
Format: APP (See Table 42.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.132. CDINAVSRC - Select index (> 0) of CDI NAV Source or 0 for none

Parameter ID: %x00.00.82
Unit Usage: Display
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.133. BRGNAVSRC - Select index (> 0) CDI BRG Source or 0 for none

Parameter ID: %x00.00.83
Unit Usage: Display
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.134. COMSEL - Select COM Radio for Tuning

Parameter ID: %x00.00.84
Unit Usage: Display
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.135. NAVSEL - Select NAV Radio for Tuning

Parameter ID: %x00.00.85
Unit Usage: Display

SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.136. MSTRCAUTN - Master Caution Active when true. Resets by SYSSEL/USERSEL with value of FALSE

Parameter ID: %x00.00.86
Unit Usage: None
SubUnit Usage: None
Format: BOOL (See Table 24.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.137. MSTRWARN - Master Warning Active when true. Resets by SYSSEL/ USERSEL with value of FALSE

Parameter ID: %x00.00.87
Unit Usage: None
SubUnit Usage: None
Format: BOOL (See Table 24.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.138. ROLLRT - Rate of change of about A/C longitudinal axis (P)

Parameter ID: %x00.00.88
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: DEGPS multiplied by 1000.

4.7.139. PITCHRT - Rate of change about A/C transverse axis (Q)

Parameter ID: %x00.00.89
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: DEGPS multiplied by 1000.

4.7.140. YAWRT - Rate of change about A/C vertical axis (R)

Parameter ID: %x00.00.8a
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: DEGPS multiplied by 1000.

4.7.141. STKPITCH - Stick Pitch Position (negative nose down, 0 neutral, positive nose up)

Parameter ID: %x00.00.8b
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.142. STKROLL - Stick Roll Position (negative left bank, 0 neutral, positive right bank)

Parameter ID: %x00.00.8c
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.143. STKYAW - Pedal Yaw Position (negative left, 0 neutral, positive right)

Parameter ID: %x00.00.8d
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)

4.7.144. BATTTEMP - Battery Temp

Parameter ID: %x00.00.8e
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.145. MOTORTEMP - Motor Temp

Parameter ID: %x00.00.8f
Unit Usage: Motor
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.146. POWERTEMP - Temp of a device supplying/converting power to a propulsion system

Parameter ID: %x00.00.90
Unit Usage: Propulsion System
SubUnit Usage: Power converter/0=Max
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.147. TORQUE - Torque

Parameter ID: %x00.00.91
Unit Usage: Motor/Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: LBFT multiplied by 100.

4.7.148. TAILNUM - Up to 8-character, NULL terminated tail number

Parameter ID: %x00.00.92
Unit Usage: None
SubUnit Usage: None
Format: STRING (See Table 31.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.149. ROLLREQ - F/D requested degrees of roll in 100 * degrees with 0 being right side up, -18000 being being upside down towards left, 18000 being upside down to the right

Parameter ID: %x00.00.93
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: ROLL (See Section 4.5.2.2.)

4.7.150. PITCHREQ - F/D requested degrees of pitch in 100 * degrees with 0 being straight ahead, 9000 being straight up, -9000 being straight down

Parameter ID: %x00.00.94
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: PITCH (See Section 4.5.2.3.)

4.7.151. YAWREQ - F/D requested G force of inclination with 0 being no yaw

Parameter ID: %x00.00.95
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: G multiplied by 10000.

4.7.152. STKPITCHREQ - A/P Requested Stick Pitch Position (negative nose down, 0 neutral, positive nose up)

Parameter ID: %x00.00.96
Unit Usage: None
SubUnit Usage: None
Format: SERVO (See Table 47.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.153. STKROLLREQ - A/P Requested Stick Roll Position (negative left bank, 0 neutral, positive right bank)

Parameter ID: %x00.00.97
Unit Usage: None
SubUnit Usage: None
Format: SERVO (See Table 47.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.154. STKYAWREQ - A/P Requested Pedal Yaw Position (negative left, 0 neutral, positive right)

Parameter ID: %x00.00.98
Unit Usage: None
SubUnit Usage: None
Format: SERVO (See Table 47.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.155. FDMODEACT - Active Flight Director Modes

Parameter ID: %x00.00.99
Unit Usage: FD Number (0 for setting values)
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using afcs_fd_mode dictionary (See Table 61.)

Table 61, below, shows the values defined in the afcs-fd-mode Dictionary. These options represent the Vertical, lateral and yaw modes of flight director.

Name	Value	Definition
VERT-MASK	%xff	Vertical modes mask
LAT-MASK	%xff.00	Lateral modes mask
YAW-MASK	%xff.00.00.00	Yaw modes mask
PITCH	%x01	Activate pitch mode
VS	%x02	Activate vertical speed mode
FLC	%x04	Activate indicated airspeed mode / flight level change
PRF	%x08	Activate angle of attack / performance mode
ALT	%x10	Arm Altitude mode
VNAV	%x20	Arm vertical nav mode
GP	%x40	Arm approach mode vertical portion
FLARE	%x80	Arm flare mode
ROLL	%x01.00	Activate wing leveler mode
HDG	%x02.00	Activate heading mode
NAV	%x04.00	Arm navigation mode
APPR	%x08.00	Arm approach mode
YD	%x01.00.00.00	Fixed Yaw Damper
SLIP	%x02.00.00.00	Activate slip mode (adjustable YD)
SLIPAPPR	%x04.00.00.00	Activate approach slip mode (adjustable YD)

Table 61: afcs-fd-mode Dictionary

4.7.156. FDMODEARM - Armed Flight Director Modes (XFS_AFCS_FD_MODE_*

Parameter ID: %x00.00.9a
Unit Usage: FD Number (0 for setting values)
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using afcs_fd_mode dictionary (See Table 61.)

4.7.157. ALTHOLDBUG - Altitude used by FD for altitude hold

Parameter ID: %x00.00.9b
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: FT multiplied by 10.

4.7.158. APMODE - Autopilot Modes

Parameter ID: %x00.00.9c
Unit Usage: AP Number (0 for setting value)
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using afcs_ap_mode dictionary (See Table 62.)

Table 62, below, shows the values defined in the afcs-ap-mode Dictionary. These options represent the Vertical, lateral and yaw modes of autopilot and throttle.

Name	Value	Definition
VERT-MASK	%xff	Vertical modes mask
LAT-MASK	%xff.00	Lateral modes mask
THROT-MASK	%xff.00.00	Throttle modes mask
YAW-MASK	%xff.00.00.00	Yaw modes mask
PITCH	%x01	Pitch mode
EPPITCH	%x02	Pitch mode only for envelope protection
ROLL	%x01.00	Roll mode
EPROLL	%x02.00	Roll mode only for envelope protection
SPD	%x01.00.00	Activate autothrottle speed tracking
EPSPD	%x02.00.00	Autothrottle only for envelope protection (SPD mode)
AOA	%x04.00.00	Activate autothrottle AoA tracking
EPAOA	%x08.00.00	Autothrottle only for envelope protection (AOA mode)
TOGA	%x10.00.00	Activate takeoff / go-around throttle
EPTOGA	%x20.00.00	Autothrottle only for envelope protection (TOGA mode)
YAW	%x01.00.00.00	Yaw mode
EPYAW	%x02.00.00.00	Yaw envelope protection

Table 62: afcs-ap-mode Dictionary

4.7.159. ICSSQL - Intercom Squelch (0-100)

Parameter ID: %x00.00.9d
Unit Usage: Audio Panel Unit
SubUnit Usage: 0=System, 1=Pilot, 2=Copilot, rest are pax
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: PERCENT (See Section 4.5.2.4.)
Units: PCENT.

4.7.160. PITCHBUG - Target pitch

Parameter ID: %x00.00.9e
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: PITCH (See Section 4.5.2.3.)
Units: DEG multiplied by 100.

4.7.161. PTSPEED - Power Turbine Speed (commonly N1)

Parameter ID: %x00.00.9f
Unit Usage: Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: PCENT multiplied by 1000.

4.7.162. GTSPEED - Gas Turbine Speed (commonly N2 or Ng)

Parameter ID: %x00.00.a0
Unit Usage: Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: PCENT multiplied by 1000.

4.7.163. TIT - Turbine Inlet Temperature

Parameter ID: %x00.00.a1
Unit Usage: Engine
SubUnit Usage: Turbo/0=Max
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.164. ITT - Inter-Turbine Temperature

Parameter ID: %x00.00.a2

Unit Usage: Engine
SubUnit Usage: Sensor/0=Average
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.165. POWER - Power under current engine and environmental conditions relative to engine design maximum

Parameter ID: %x00.00.a3
Unit Usage: Motor/Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: SERVO (See Section 4.5.2.1.)
Units: PCENT multiplied by 1000.

4.7.166. ENGSTATUS - Engine specific set of flags or values

Parameter ID: %x00.00.a4
Unit Usage: Motor/Engine
SubUnit Usage: Engine Specific
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using hex dictionary (See Table 60.)

4.7.167. CABINALT - Cabin Equivalent Altitude

Parameter ID: %x00.00.a5
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: FT multiplied by 10.

4.7.168. CABINALTREQ - Cabin Equivalent Altitude

Parameter ID: %x00.00.a6
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: FT multiplied by 10.

4.7.169. DIFFPRES - Differential Pressure

Parameter ID: %x00.00.a7
Unit Usage: None

SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: PSI multiplied by 100.

4.7.170. DIFFPRESREQ - Requested Differential Pressure

Parameter ID: %x00.00.a8
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: PSI multiplied by 100.

4.7.171. FUELTEMP - Arbitraty Temperature in a location

Parameter ID: %x00.00.a9
Unit Usage: Engine/Fuel Tank
SubUnit Usage: SubLocation/0=Average,1=Sump
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.172. ENGSTATE - Engine operating state

Parameter ID: %x00.00.aa
Unit Usage: Motor/Engine
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using engstate dictionary (See Table 63.)

Table 63, below, shows the values defined in the engstate Dictionary. These options represent the States of engines.

Name	Value	Definition
UNKNOWN	%x00	Engine Status Unknown
OFF	%x01	Engine is Off
DRYMOTOR	%x02	Engine Starting
STARTING	%x03	Engine Starting
RUNNING	%x04	Engine Running Normally
FLAMEOUT	%x05	Engine Flamed Out / Failure
SHUTDOWN	%x06	Engine Shutting Down
SHUTOFF	%x07	Engine Shut Off
MODE-MASK	%xff	Mask for Engine State
FLAG-IGNITION	%x01.00	Ignition On
FLAG-FUEL	%x02.00	Fuel Shutoff Open
FLAG-STARTER	%x04.00	Starter On
FLAG-GENERATOR	%x08.00	Generator On
FLAG-BLEED	%x10.00	Bleed Air On
FLAG-FIRE	%x01.00.00	Fire Present
FLAG-EXTINGUISH	%x02.00.00	Extinguisher Dispensed

Table 63: engstate Dictionary

4.7.173. ENGSTATEREQ - Requested Engine operating state

Parameter ID: %x00.00.ab
Unit Usage: Motor/Engine
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using engstate dictionary (See Table 63.)

4.7.174. BLEEDAIR - Bleed Air Level (Percent of Max)

Parameter ID: %x00.00.ac
Unit Usage: Motor/Engine
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: PCENT multiplied by 100.

4.7.175. BLEEDAIRREQ - Requested Bleed Air Level

Parameter ID: %x00.00.ad
Unit Usage: Motor/Engine
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: PCENT multiplied by 100.

4.7.176. LIGHTING - Lighting Color/Level

Parameter ID: %x00.00.ae
Unit Usage: System
SubUnit Usage: Specific
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: RGBA.

4.7.177. LIGHTINGREQ - Requested Lighting Color/Level

Parameter ID: %x00.00.af
Unit Usage: System
SubUnit Usage: Specific
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: RGBA.

4.7.178. ICING - Deicing State

Parameter ID: %x00.00.b0
Unit Usage: System/0=Aircraft
SubUnit Usage: Specific
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using icing_flag dictionary (See Table 64.)

Table 64, below, shows the values defined in the icing-flag Dictionary. These options represent the Status of ice detection, anti-ice and deicing systems.

Name	Value	Definition
ENGINE	%x01	Engine Deicing/Anticing On
AIRFRAME	%x02	Airframe Deicing/Anticing On
INSEP	%x04	Inertial Separator Activated
PITOT	%x08	Pitot/Static Heat Activated
PROPHEAT	%x10	Propeller Heat Activated
WINDHEAT	%x20	Windshield Heat Activated
CARBHEAT	%x40	Carb Heat Activated
CARBICEDET	%x40.00	Carb Icing Detected
ICEDET	%x80.00	Icing Detected
ENGINE-FAIL	%x01.00.00	Engine Deicing/Anticing Failed
AIRFRAME-FAIL	%x02.00.00	Airframe Deicing/Anticing Failed
INSEP-FAIL	%x04.00.00	Inertial Separator Failed
PITOT-FAIL	%x08.00.00	Pitot/Static Heat Failed
PROPHEAT-FAIL	%x10.00.00	Propeller Heat Failed
WINDHEAT-FAIL	%x20.00.00	Windshield Heat Failed
CARBHEAT-FAIL	%x40.00.00	Carb Heat Failed
CARBICEDET-FAIL	%x40.00.00.00	Carb Icing Detection Failed
ICEDET-FAIL	%x80.00.00.00	Icing Detection Failed

Table 64: icing-flag Dictionary

4.7.179. ICINGREQ - Requested Deicing State

Parameter ID: %x00.00.b1
Unit Usage: System/0=Aircraft
SubUnit Usage: Specific

Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using icing_flag dictionary (See Table 64.)

4.7.180. LDGGEAR - Landing Gear State

Parameter ID: %x00.00.b2
Unit Usage: Wheel/0=Aircraft
SubUnit Usage: Specific
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using ldggear dictionary (See Table 65.)

Table 65, below, shows the values defined in the ldggear Dictionary. These options represent the Status of retractable landing gear.

Name	Value	Definition
UNKNOWN	%x00.00	Gear Status Unknown
DOWN	%x00.01	Landing Gear Down
UP	%x80.00	Landing Gear Up
FLAG-FAILED	%x01.00.00	Landing Gear System is Failed

Table 65: ldggear Dictionary

4.7.181. LDGGEARREQ - Landing Gear State

Parameter ID: %x00.00.b3
Unit Usage: Wheel/0=Aircraft
SubUnit Usage: Specific
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using ldggear dictionary (See Table 65.)

4.7.182. CABINTEMP - Cabin Temperature in a zone

Parameter ID: %x00.00.b4
Unit Usage: Zone
SubUnit Usage: Sensor Number/0=Average
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.183. CABINTEMPREQ - Requested Cabin Temperature in a zone

Parameter ID: %x00.00.b5
Unit Usage: Zone
SubUnit Usage: Sensor Number/0=Average
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: C multiplied by 100.

4.7.184. CHKLIST - Checklist Item

Parameter ID: %x00.00.b6
Unit Usage: Checklist Number
SubUnit Usage: Item Number/0=Title
Format: CASMSG (See Table 32.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.185. WBARM - Arm for selected station or aircraft

Parameter ID: %x00.00.b7
Unit Usage: Configuration
SubUnit Usage: 0=total/1=total no fuel/2+=station
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.

4.7.186. WBCONFIG - Selected aircraft configuration for weight and balance

Parameter ID: %x00.00.b8
Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.

4.7.187. WBCATEGORY - Weight and balance aircraft category

Parameter ID: %x00.00.b9
Unit Usage: Configuration
SubUnit Usage: 0=total/1=total no fuel
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using weightbal_category dictionary (See Table 66.)

Table 66, below, shows the values defined in the weightbal-category Dictionary. These options represent the Aircraft operational categories.

Name	Value	Definition
NORMAL	%d1	Normal Category
UTILITY	%d2	Utility Category
ACROBATIC	%d3	Acrobatic Category
COMMUTER	%d4	Commuter Category

Table 66: weightbal-category Dictionary

4.7.188. WBSTATUS - Flags about weight and balance

Parameter ID: %x00.00.ba
Unit Usage: Configuration
SubUnit Usage: 0=total/1=total no fuel
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using weightbal_status dictionary (See Table 67.)

Table 67, below, shows the values defined in the weightbal-status Dictionary. These options represent the Weight and balance status.

Name	Value	Definition
OK	%d0	Weight and balance is OK
FWD	%x01	Balance is forward of minimum CG for this weight
AFT	%x02	Balance is aft of maximum CG for this weight
OVWTSTATN	%x04	One or more stations are overweight
OVERMGTOW	%x08	Weight exceeds maximum gross takeoff weight
OVERMLW	%x10	Weight exceeds max landing weight
OVERZFW	%x20	Weight exceeds max zero fuel weight

Table 67: weightbal-status Dictionary

4.7.189. WBWEIGHT - Aircraft or station weight

Parameter ID: %x00.00.bb
Unit Usage: Configuration
SubUnit Usage: 0=total/1=total no fuel/2+=station
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: LB multiplied by 10.

4.7.190. TASEFFWT - Fuel Economy Relative to True Airspeed and Weight

Parameter ID: %x00.00.bc
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: NMPLB multiplied by 100000.

4.7.191. GSEFFWT - Fuel Economy Relative to Groundspeed and Weight

Parameter ID: %x00.00.bd
Unit Usage: None

SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: NMPLB multiplied by 100000.

4.7.192. TIMETOEMPTY - Time to Empty

Parameter ID: %x00.00.be
Unit Usage: Engine/0=Aircraft
SubUnit Usage: 0 - smoothed, without reserve, 1 - smoothed, with reserve, 2 - without reserve, 3 - with reserve
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: S multiplied by 10.

4.7.193. DISTTOEMPTY - Distance to Empty

Parameter ID: %x00.00.bf
Unit Usage: Engine/0=Aircraft
SubUnit Usage: 0 - smoothed, without reserve, 1 - smoothed, with reserve, 2 - without reserve, 3 - with reserve
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: NM multiplied by 100.

4.7.194. FLIGHTSTATE - State of Flight

Parameter ID: %x00.00.c0
Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using flight_state dictionary (See Table 68.)

Table 68, below, shows the values defined in the flight-state Dictionary. These options represent the Status of aircraft within flight profile.

Name	Value	Definition
UNKNOWN	%d0	The state of the aircraft is not known
OFF	%d1	The aircraft is completely powered down
HIBERNATE	%d2	Minimal aircraft systems online not visible to the pilot

PREFLIGHT	%d3	Minimal aircraft systems for pilot interaction online
ENGINE-START	%d4	Engine(s) are preparing to start or are starting
PRETAXI	%d5	Engine(s) are started, awaiting pre-taxi items
TAXI	%d6	Aircraft is ready or in process of taxiing
RUNUP	%d7	Aircraft is ready for, or in process of performing runup
READY	%d8	Aircraft is ready for and positioned just short of takeoff
TAKEOFF	%d9	Aircraft is in process of performing takeoff
AFTER-TAKEOFF	%d10	Aircraft is airborne immediately but not yet configured for normal climb
DEPARTURE	%d11	Aircraft is on a standard instrument departure
CLIMB	%d12	Aircraft is climbing but not on an instrument departure
CRUISE	%d13	Aircraft is at final cruise
DESCENT	%d14	Aircraft is descending not on a standard arrival
ARRIVAL	%d15	Aircraft is on a standard arrival
APPROACH	%d16	Aircraft is on an instrument approach procedure
VISUAL	%d17	Aircraft is flying a visual traffic pattern
MISSED	%d18	Aircraft is executing a missed approach
SHUTDOWN	%d19	Aircraft engines are shutting down or have shut down

SECURE	%d20	Aircraft systems are shutting down or reconfiguring for preflight

Table 68: flight-state Dictionary

4.7.195. UPDATESTATE - Status of any update

Parameter ID: %x00.00.c1
Unit Usage: None
SubUnit Usage: None
Format: UPDATE (See Table 45.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.196. TORQUEREQ - Requested Torque

Parameter ID: %x00.00.c2
Unit Usage: Motor/Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: LBFT multiplied by 100.

4.7.197. STKPITCHFRCE - Stick Pitch Force applied by the pilot, positive value - push, negative value - pull

Parameter ID: %x00.00.c3
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: LB multiplied by 100.

4.7.198. STKROLLFRCE - Stick Roll Force applied by the pilot, positive value - roll right, negative value - roll left

Parameter ID: %x00.00.c4
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: LB multiplied by 100.

4.7.199. STKYAWFRCE - Pedal Yaw Force applied by the pilot, positive value - right rudder, negative value - left rudder

Parameter ID: %x00.00.c5
Unit Usage: None

SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: LB multiplied by 100.

4.7.200. APPITCHFRCE - Auto Pilot Pitch Force exerted on control surfaces, positive value - push, negative value - pull

Parameter ID: %x00.00.c6
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: LB multiplied by 100.

4.7.201. APROLLFRCE - Auto Pilot Roll Force exerted on control surfaces, positive value - roll right, negative value - roll left

Parameter ID: %x00.00.c7
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: LB multiplied by 100.

4.7.202. APYAWFRCE - Auto Pilot Yaw Force exerted on control surfaces, positive value - right rudder, negative value - left rudder

Parameter ID: %x00.00.c8
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: LB multiplied by 100.

4.7.203. EFBPARAM - Up to 64-character, NULL terminated parameter value

Parameter ID: %x00.00.c9
Unit Usage: EFB ID
SubUnit Usage: XFS_EFB_PARAM_*
Format: STRING (See Table 31.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.204. OILPRESCOMP - Compensated Oil Pressure

Parameter ID: %x00.00.ca
Unit Usage: Engine

SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: PSI multiplied by 100.

4.7.205. MACHBUG - Target Mach

Parameter ID: %x00.00.cb
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: MACH multiplied by 10000.

4.7.206. AOART - Angle of attack rate of change

Parameter ID: %x00.00.cc
Unit Usage: Source
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: DEG multiplied by 1000.

4.7.207. TASBUG - Target true airspeed

Parameter ID: %x00.00.cd
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.208. GSBUG - Target groundspeed

Parameter ID: %x00.00.ce
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.209. AOABUG - Bugged AOA

Parameter ID: %x00.00.cf
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.

Units: DEG multiplied by 1000.

4.7.210. ECUTIME - ECU Hours

Parameter ID: %x00.00.d1
Unit Usage: Engine
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Units: HR multiplied by 1000.

4.7.211. DBASE - Active database information

Parameter ID: %x00.00.d2
Unit Usage: CPU ID
SubUnit Usage: Process ID
Format: DBASE (See Table 49.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.212. EAS - Equivalent Airspeed

Parameter ID: %x00.00.d3
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.213. EASRT - Equivalent Airspeed Rate of Change

Parameter ID: %x00.00.d4
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: KTPS multiplied by 100.

4.7.214. EASBUG - Target equivalent airspeed

Parameter ID: %x00.00.d5
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.215. POWERREQ - Requested power as percent of engine design maximum

Parameter ID: %x00.00.d6
Unit Usage: Motor/Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: PCENT multiplied by 1000.

4.7.216. BRAKE - Wheel brake status

Parameter ID: %x00.00.d7
Unit Usage: Left=1,Right=2,No direction=0
SubUnit Usage: Specific
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using brake dictionary (See Table 69.)

Table 69, below, shows the values defined in the brake Dictionary. These options represent the Status of wheel brakes.

Name	Value	Definition
UNKNOWN	%x00.00	Brake Status Unknown
NONE	%x00.01	Brakes not pressed
MAX	%x80.00	Max Braking
PARK	%x01.00.00	Parking Brake Engaged
FLAG-FAILED	%x02.00.00	Brake System is Failed

Table 69: brake Dictionary

4.7.217. BRAKEREQ - Amount of brake requested

Parameter ID: %x00.00.d8
Unit Usage: Left=1,Right=2,No direction=0
SubUnit Usage: Specific
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using brake dictionary (See Table 69.)

4.7.218. NAVSQL - Communication Squelch (0-100)

Parameter ID: %x00.00.d9
Unit Usage: Radio ID

SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Default Range: PERCENT (See Section 4.5.2.4.)
Units: PCENT.

4.7.219. STATIONID - VOR Station ID decoded from Morse code

Parameter ID: %x00.00.da
Unit Usage: Radio ID
SubUnit Usage: None
Format: STRING (See Table 31.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.220. SVPARAM - Synthetic Vision parameters. Subunit is one of XFS_SV_PARAM_*

Parameter ID: %x00.00.db
Unit Usage: SYNVIS ID
SubUnit Usage: XFS_SV_PARAM_*
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.221. FDCDISEL - Global selection of which CDI the flight director should track

Parameter ID: %x00.00.dc
Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.222. BLOODOXY - Blood oxygen level of given seat occupant

Parameter ID: %x00.00.dd
Unit Usage: Seat position, 0=Lowest of all seats, 1=Pilot, 2=Copilot, etc
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Default Range: THOUPERCENT (See Section 4.5.2.5.)
Units: PCENT multiplied by 1000.

4.7.223. PULSE - Pulse rate of given seat occupant

Parameter ID: %x00.00.de
Unit Usage: Seat position, 0=Worst of all seats (too low or high), 1=Pilot, 2=Copilot, etc

SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Units: CPM multiplied by 1000.

4.7.224. BREATHS - Breathing rate of given seat occupant

Parameter ID: %x00.00.df
Unit Usage: Seat position, 0=Worst of all seats (too low or high), 1=Pilot, 2=Copilot, etc
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Units: CPM multiplied by 1000.

4.7.225. CARBMONOX - Carbon Monoxide levels detected by sensor

Parameter ID: %x00.00.e0
Unit Usage: Carbon Monoxide Sensor ID
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Units: PPM multiplied by 100.

4.7.226. FLOWRATE - Oxygen flow rate

Parameter ID: %x00.00.e1
Unit Usage: Seat position, 0=Worst of all seats (too low or high), 1=Pilot, 2=Copilot, etc
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Units: LPM multiplied by 100.

4.7.227. TANKPRES - Oxygen tank pressure

Parameter ID: %x00.00.e2
Unit Usage: Tank number, 0=Worst of all tanks (too low or high), 1=Tank 1, 2=Tank 2, etc
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Units: PSI multiplied by 100.

4.7.228. RNAVVS - Vertical speed computed from RNAV

Parameter ID: %x00.00.e3
Unit Usage: Source ID

SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: FPM multiplied by 1.

4.7.229. COMPRESET - Selected COM Radio Preset (0=Non-preset frequency)

Parameter ID: %x00.00.e4
Unit Usage: Radio
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Values interpreted using preset dictionary (See Table 70.)

Table 70, below, shows the values defined in the preset Dictionary. These options represent the XFS Preset Frequency.

Name	Value	Definition
MANUAL	%d0	Manual Tuning (no preset)
LAST	%xff.fe	Last selected frequency

Table 70: preset Dictionary

4.7.230. COMNAME - Name of COM Radio or Preset Frequency

Parameter ID: %x00.00.e5
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: STRING (See Table 31.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.231. NAVPRESET - Selected NAV Radio Preset (0=Non-preset frequency)

Parameter ID: %x00.00.e6
Unit Usage: Radio
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Values interpreted using preset dictionary (See Table 70.)

4.7.232. NAVNAME - Name of NAV Radio or Preset Frequency

Parameter ID: %x00.00.e7
Unit Usage: Radio

SubUnit Usage: 0=Radio/1+=Presets
Format: STRING (See Table 31.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.233. VNORTH - North component of velocity in true world coordinates

Parameter ID: %x00.00.e8
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.234. VEAST - East component of velocity in true world coordinates

Parameter ID: %x00.00.e9
Unit Usage: Source ID
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: KT multiplied by 100.

4.7.235. ENGPOWER - Current Engine Power

Parameter ID: %x00.00.ea
Unit Usage: Engine
SubUnit Usage: 0=Shaft Power/1=Input Power Consumption/2+(even)=Component Shaft Power, 3+(odd)=Component Power Consumption
Format: UINT (See Table 26.)
Range: There SHALL be a Range Parameter for this parameter.
Units: KW multiplied by 1000.

4.7.236. CHARGE - Measured remaining battery charge

Parameter ID: %x00.00.eb
Unit Usage: Battery ID/0=Sum of all
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: AH multiplied by 1000.

4.7.237. CHARGETOT - Computed remaining charge

Parameter ID: %x00.00.ec
Unit Usage: Power System ID/0=Sum of all
SubUnit Usage: 0 = current total, 1 = total at end of flight
Format: SINT (See Table 35.)

Range: There SHALL NOT be a Range Parameter for this parameter.
Units: AH multiplied by 1000.

4.7.238. RWYSEL - Select airport runway surface to waypoint that is an airport, subunit is position in flightplan (SYSSEL/USERSEL ONLY). Label must match

Parameter ID: %x00.00.ed
Unit Usage: None
SubUnit Usage: None
Format: WAYPOINT (See Table 27.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.239. COMSECMODE - Communication Security Mode

Parameter ID: %x00.00.ee
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using com_secmode dictionary (See Table 71.)

Table 71, below, shows the values defined in the com-secmode Dictionary. These options represent the Communication Security Mode.

Name	Value	Definition
TD	%d1	TD
PT	%d2	Plain Text
CT	%d7	Cypher Text
INVALID	%d8	Invalid Reserved
RV	%d14	RV

Table 71: com-secmode Dictionary

4.7.240. COMBAND - Communication Band

Parameter ID: %x00.00.ef
Unit Usage: None
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

Values interpreted using com_band dictionary (See Table 72.)

Table 72, below, shows the values defined in the com-band Dictionary. These options represent the Communication Band.

Name	Value	Definition
UNKNOWN	%d0	Unknown communication band
VHFFM	%d1	Very High Frequency with Frequency Modulation
VHFAM	%d2	Very High Frequency Amplitude Modulation
UHFFM	%d3	Ultra High Frequency
UHFAM	%d4	Ultra High Frequency
P25A	%d5	Project 25 Analog
P25D	%d6	Project 25 Digital
P25T	%d7	Project 25 Trunk Mode
TSM	%d8	Trellisware Scalable Mobile Ad-hoc NETworking
SATCOM	%d9	Satellite Communication
SNGRS	%d10	SINCGARS Frequency Hop Frequencies
HFAM	%d11	High Frequency Ampltitude Modulation
WREN	%d12	Warrior Robust Enhanced Network Narrowband

Table 72: com-band Dictionary

4.7.241. COMBANDMASK - Supported Communication Bands

Parameter ID: %x00.00.f0
Unit Usage: Radio
SubUnit Usage: None
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using com_bandmask dictionary (See Table 73.)

Table 73, below, shows the values defined in the com-bandmask Dictionary. These options represent the Supported Communication Band Mask.

Name	Value	Definition
VHFFM	%x01	Very High Frequency with Frequency Modulation
VHFAM	%x02	Very High Frequency with Amplitude Modulation
UHFFM	%x04	Ultra High Frequency with Frequency Modulation
UHFAM	%x08	Ultra High Frequency with Amplitude Modulation
P25A	%x10	Project 25 Analog
P25D	%x20	Project 25 Digital
P25T	%x40	Project 25 Trunk Mode
TSM	%x80	Trellisware Scalable Mobile Ad-hoc NETworking
SATCOM	%x01.00	Satellite Communication
SINCGARS	%x02.00	SINCGARS Frequency Hop Frequencies
HFAM	%x04.00	High Frequency

Table 73: com-bandmask Dictionary

4.7.242. COMSQLMODETX - Squelch mode for transmit

Parameter ID: %x00.00.f1
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using com_sqlmode dictionary (See Table 74.)

Table 74, below, shows the values defined in the com-sqlmode Dictionary. These options represent the Communication Squelch Mode.

Name	Value	Definition
UNKNOWN	%d0	Unknown Squelch Mode
NONE	%d1	Squelch Off
SNR	%d2	Signal to Noise Ratio
TONE	%d3	FM Military Tone Squelch System
CTCSS	%d4	Continuous Tone Coded Squelch System
DCS	%d5	Digital Code Squelch
NAC	%d6	Network Access Code P25 Trunk Mode

Table 74: com-sqlmode Dictionary

4.7.243. COMSQLMODERX - Squelch mode for receive

Parameter ID: %x00.00.f2
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Values interpreted using com_sqlmode dictionary (See Table 74.)

4.7.244. COMCTCSSTX - Frequency for CTCSS in Analog Transmit

Parameter ID: %x00.00.f3
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.245. COMCTCSSRX - Frequency for CTCSS in Analog Receive

Parameter ID: %x00.00.f4
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.246. COMDCSTX - Digital-Coded Squelch in Digital Transmit

Parameter ID: %x00.00.f5
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.247. COMDCSRX - Digital-Coded Squelch in Digital Receive

Parameter ID: %x00.00.f6
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.248. COMNACTX - Network Access Code in P25 Digital Transmit

Parameter ID: %x00.00.f7
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.249. COMNACRX - Network Access Code in P25 Digital Receive

Parameter ID: %x00.00.f8
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.250. COMSPACING - Communication Frequency Spacing

Parameter ID: %x00.00.f9
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: MHZ multiplied by 100000.

4.7.251. COMTGROUP - Active Communication Talk Group

Parameter ID: %x00.00.fa
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: UINT (See Table 26.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.252. COMTGROUPR - Range for Talk Groups

Parameter ID: %x00.00.fb
Unit Usage: Radio
SubUnit Usage: None
Format: RANGE (See Table 39.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.253. COMTGNAME - Name of Talk Group

Parameter ID: %x00.00.fc
Unit Usage: Radio
SubUnit Usage: 0=radio active talk group, 1+= talkgroup name
Format: STRING (See Table 31.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.254. COMGUARD - If true monitor guard frequency

Parameter ID: %x00.00.fd
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: BOOL (See Table 24.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.255. COMENCRYPT - If true, radio is operating in encrypted mode

Parameter ID: %x00.00.fe
Unit Usage: Radio
SubUnit Usage: 0=Radio/1+=Presets
Format: BOOL (See Table 24.)
Range: There SHALL NOT be a Range Parameter for this parameter.

4.7.256. FUELVOLTOT - Computed remaining fuel volume

Parameter ID: %x00.00.ff
Unit Usage: Fuel System ID/0=Sum of all
SubUnit Usage: 0 = current total, 1 = total at end of flight
Format: SINT (See Table 35.)
Range: There SHALL NOT be a Range Parameter for this parameter.
Units: GAL multiplied by 1000.

4.7.257. FUELVOLFLOW - Fuel Flow by Volume

Parameter ID: %x00.01.00
Unit Usage: Engine
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.

Units: GPH multiplied by 1000.

4.7.258. FUELVOL - Fuel Volume

Parameter ID: %x00.01.01
Unit Usage: Fuel Tank ID/0=Sum of all
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: GAL multiplied by 1000.

4.7.259. TASEFFVOL - Fuel Economy Relative to True Airspeed and Volume

Parameter ID: %x00.01.02
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: NMPGAL multiplied by 1000000.

4.7.260. GSEFFVOL - Fuel Economy Relative to Groundspeed and Volume

Parameter ID: %x00.01.03
Unit Usage: None
SubUnit Usage: None
Format: SINT (See Table 35.)
Range: There SHALL be a Range Parameter for this parameter.
Units: NMPGAL multiplied by 1000000.

4.7.261. BITEST - Built-In Test Status

Parameter ID: %x00.01.04
Unit Usage: Device identifier/0=Whole Aircraft
SubUnit Usage: Test Number/0=Roll up of all tests for device
Format: CASMSG (See Table 32.)
Range: There SHALL NOT be a Range Parameter for this parameter.

5. Message Transport

5.1. Message Composition

Application software on a node determines when information or raw data need to be sent onto the network. These transmissions are done as messages with raw data and messages with parameters. If subsequent information or raw data having the same message class, ID, and flags occur in a timely fashion, they MAY be coalesced into a single message.

For each parameter to be sent, the common header (See Section 4.2) for the message data items MUST be populated. In addition, the Ident and Parameter Data MUST be populated with the corresponding data as per Section 4.7. The length in the common header MUST represent the actual length of the data, however, each parameter must be padded to a size that is a multiple of four octets.

The message header MUST be populated with the corresponding data as per Section 4.1, the message number MUST be monotonically increasing with an arbitrary initial value, and then the length in the common header MUST be set equal to the sum of the padded parameter length values. Once this assembly process is complete, the message can be transmitted.

5.2. Message Transmission and Reliability

XSEDE is designed to be used with a multicast UDP protocol however, there is no requirement to do so. Each endpoint MUST specify a listening address and port number with the default being 224.0.0.69 on port 20234 for IPv4. The actual address and port number are to be chosen by the system designer / installer for their particular needs. [RFC5771] specifies IPv4 Multicast Address Assignments and SHOULD be followed.

If the XSEDE message is successfully transmitted, no further action is required. Data assurance is the responsibility of the nodes implementing the XSEDE protocol.

5.3. Message Reception & decoding

XSEDE messages are received on the address and port that was configured in the prior section. The structure of the XSEDE message is designed to for flexible deployment in different networks. A node MAY use the src id to filter messages. This can either be a node filtering its own sent messages or filtering out messages from irrelevant nodes (i.e. selecting only specific computers when playing back a QAR file). The message number allows a node to ensure that messages are not processed out of sequence or duplicated. A node SHOULD ignore any message that is received out of sequence. A node MAY use the parameter identifiers to determine what information if any is relevant for local processing. Local processing is beyond the scope of this document.

Since there is no assured message delivery, all parameter interpretations MUST be idempotent to ensure multiple interpretations, or execution results in the same outcome.

5.4. Message Signing

Since XSEDE operates on a closed network, message signing is not currently supported but may be added in the future.

6. Example Message Flows

This section illustrates XSEDE features by example. The first example controls the radio.

6.1. Adjust radio

This example sets the radio Set Radio frequency and squelch by broadcasting USERSEL parameters. If a node controlling the radio receives the request, it will respond with a result similar to the one shown afterwards.

6.1.1. Message Header

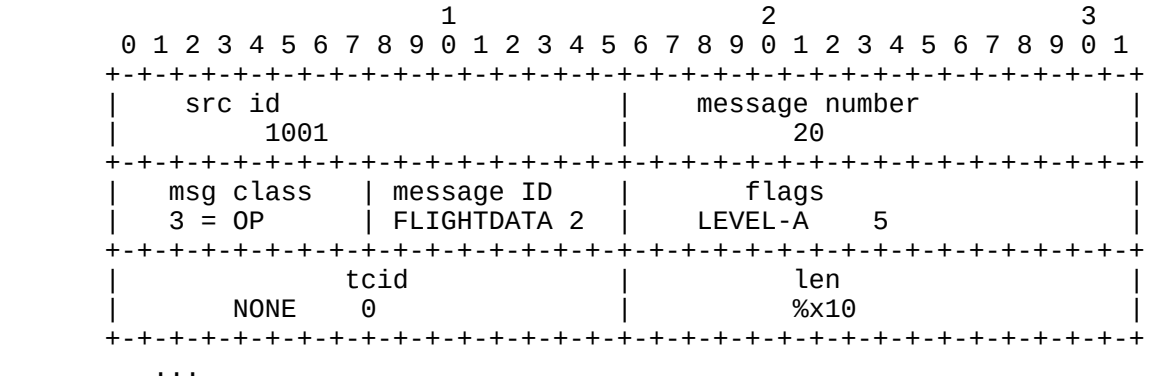

Figure 4: Message Header Format

src id:
UINT16; This value was set to 1001 decimal at installation time.

message number:
UINT16; 20 decimal for illustration purposes.

msg class:
UINT8; "OP" value 3 decimal.

message ID:
UINT8; FLIGHTDATA decimal 2

flags:
UINT16; LEVEL-A decimal 5; See Table 21.

tcid:
t-NONE; See Table 22.

len:
UINT16 ; 0x10, or decimal 16 octets.

6.1.2. Frequency Message Header

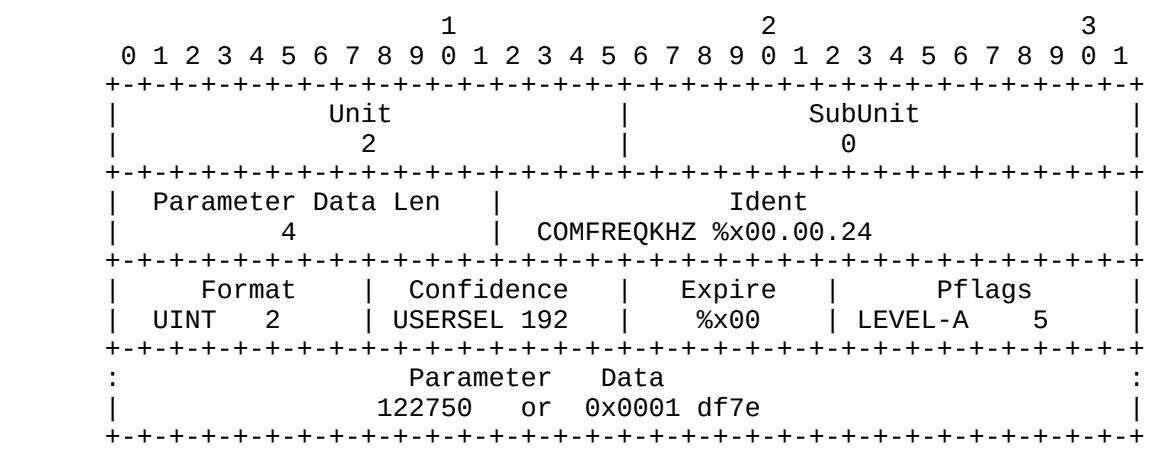

Figure 5: Setting frequency to 122.750

Unit:
UINT16; decimal 2 to match the requested radio.

SubUnit:
UINT16; 0 to signify the radio itself.

Parameter Data Len:
11 bits; decimal 4.

Ident:
21 bits; COMFREQKHZ - Communication Frequency, value %x00.00.24
See Section 4.7.

Format:
UINT (OCTET): decimal 2. See Section 4.3.

Confidence:
decimal 192 (OCTET): USERSEL. See Table 23.

Expire:
OCTET; Time to live. %x00 to not expire. See Section 4.2.2 for encoding.

Pflags:
LEVEL-A (OCTET) decimal 5. See Table 21

Parameter Data:
*(OCTET) value would be 122750, 0x0001 df7e.

6.1.3. Squelch Message Header

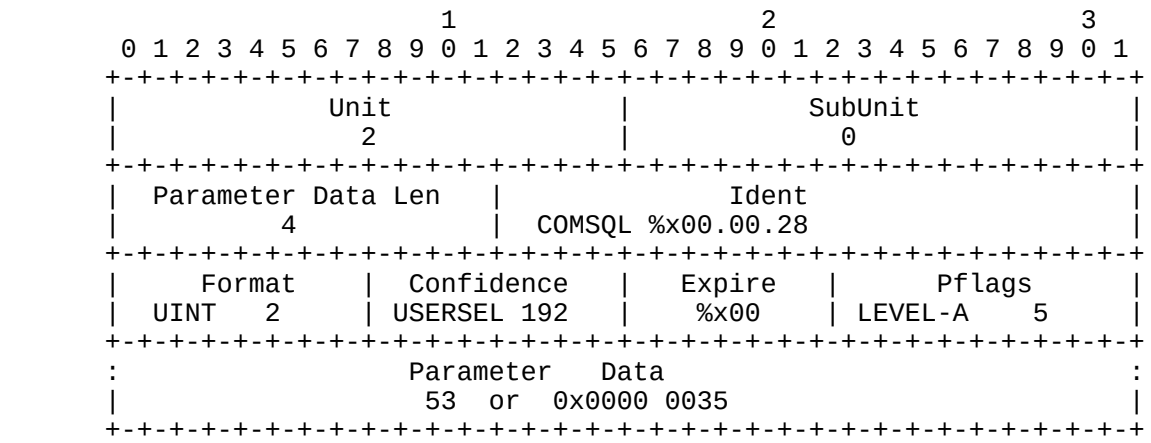

Figure 6: Setting Squelch to 53

Unit:
UINT16; decimal 2 to match the requested radio.

SubUnit:
UINT16; 0 to signify the radio itself.

Parameter Data Len:
11 bits; decimal 4.

Ident:
21 bits; COMSQL - Communication Squelch (0-100), value %x00.00.28
See Section 4.7.

Format:
UINT (OCTET): decimal 2. See Section 4.3.

Confidence:
decimal 192 (OCTET): USERSEL. See Table 23.

Expire:
OCTET; Time to live. %x00 to not expire. See Section 4.2.2 for encoding.

Pflags:
LEVEL-A (OCTET) decimal 5. See Table 21

Parameter Data:
*(OCTET) value would be 53, 0x0000 0035.

6.1.4. Radio Status Report

After the above parameters affect a change in the radio, or as part of the radio’s regularly scheduled parameter broadcast, a message like the following will be transmitted. It has almost all the same values as the original message but would likely include other parameters as well. Only the changed parameters are described.

The expire time is chosen at 2-3 times the scheduled broadcast time to ensure a fresh message is received within the valid time period should one be lost.

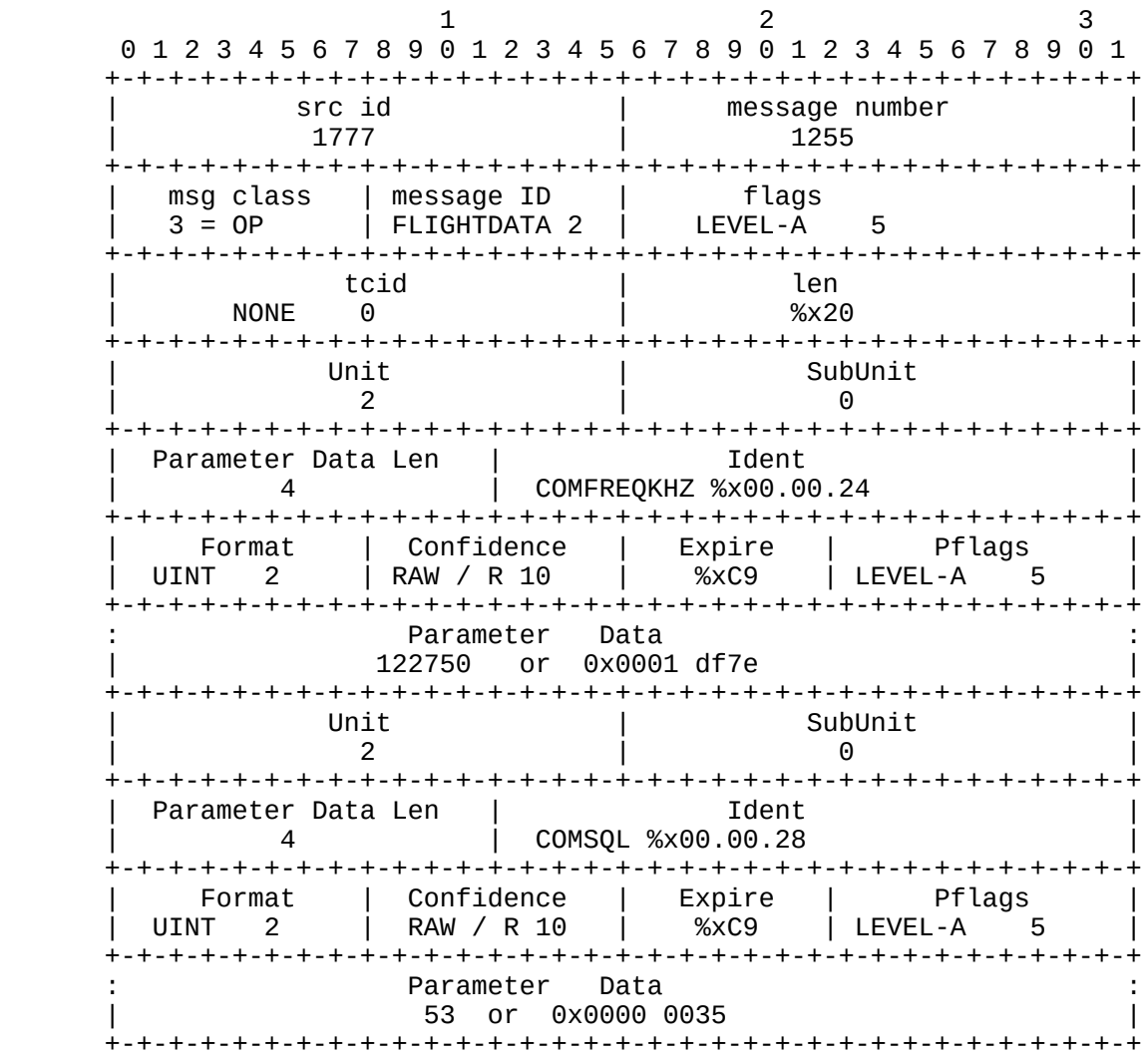

Figure 7: Radio Response Message

src id:
UINT16; This value is different than the prior message because this message is sent by the node controlling the radio. It was set to 1777 decimal at installation time.

message number:
UINT16; decimal 1255 for illustrative purposes. Note: this value is the current message sequence number for node 1777.

Confidence:
decimal 10 (OCTET): RAW / REPORTED in both parameters since this value is the actual reported value from the device. See Table 23.

Expire:
OCTET; Time to live. %xC9 to expire in about 15 seconds. See Section 4.2.2 for encoding.

6.2. Deploy Landing Gear Example

Landing Gear changes are different than radio changes in that it may take several seconds to affect a change. In this scenario, we will see a report by the node controlling the landing gear, followed by a parameter showing the user selecting a new value. Next, there will be a series of parameter broadcasts that showing the gear moving into position.

6.2.1. Initial Gear State Message

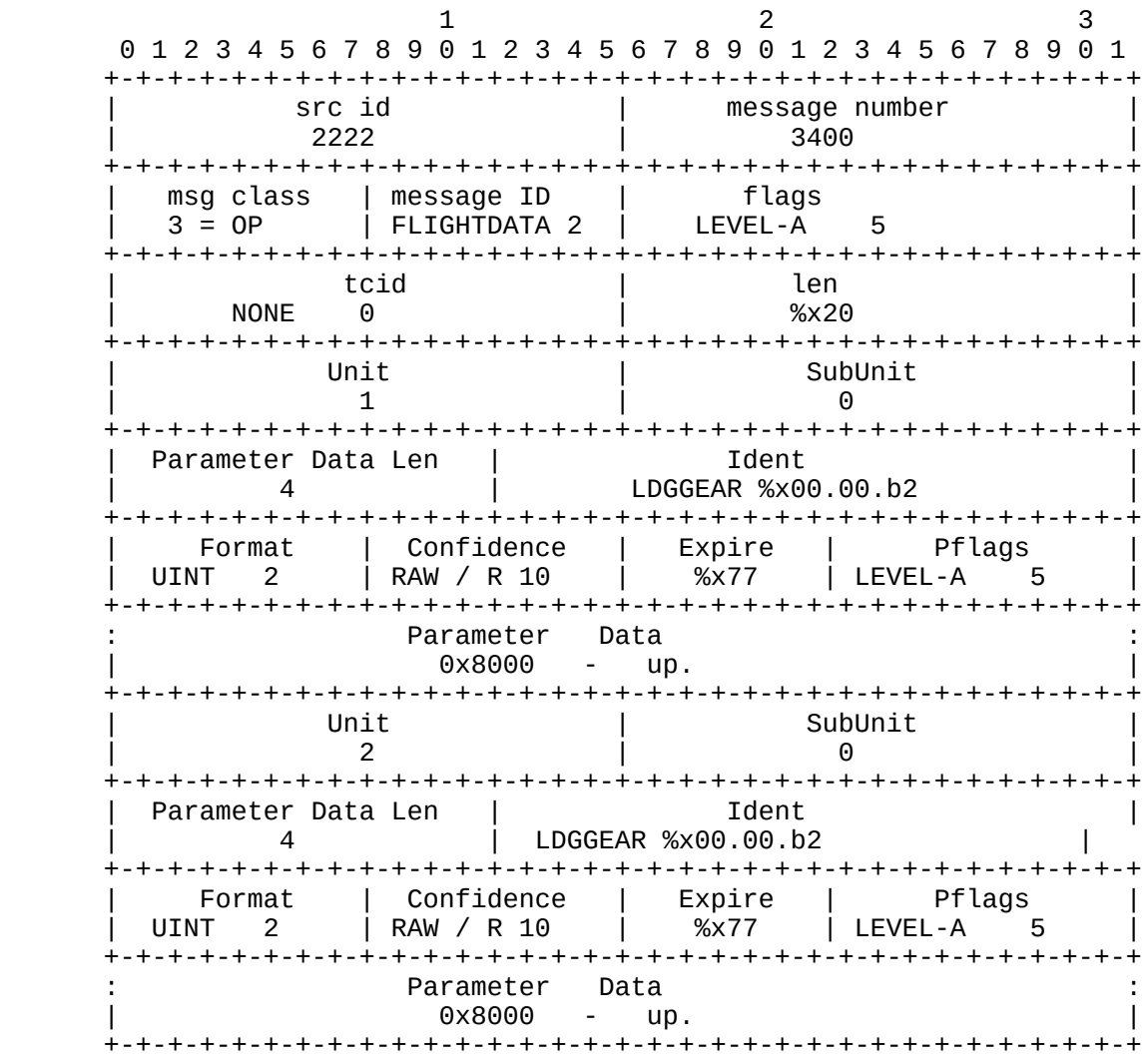

Figure 8: Initial gear state message

Above we see a periodic message indicating that each of the two landing gear are in an up position. If these were the only two landing gear, an alternative representation would be to send a single parameter with a a unit of zero to indicate all gear is in an up position. The attributes of the message are as follows:

src id:
UINT16; This value was set to 2222 decimal at installation time.

message number:
UINT16; 3400 decimal for illustration purposes.

msg class:
UINT8; "OP" value 3 decimal.

message ID:
UINT8; FLIGHTDATA decimal 2

flags:
UINT16; LEVEL-A decimal 5; See Table 21.

tcid:
t-NONE; See Table 22.

len:
UINT16 ; 0x20 octets.

Parameter (First):
Unit:
UINT16; Decimal 1 for landing gear unit 1

SubUnit:
UINT16; 0

Parameter Data Len:
11 bits; decimal 4.

Ident:
21 bits; LDGGEAR - Landing Gear State, value %x00.00.b2 See Section 4.7.

Format:
UINT (OCTET): decimal 2. See Section 4.3.

Confidence:
decimal 10 (OCTET): RAW. It is the value reported by the actuator. See Table 23.

Expire:
OCTET; Time to live. %x77 to expire in 2.9 seconds. See Section 4.2.2 for encoding.

Pflags:
LEVEL-A (OCTET) decimal 5. See Table 21

Parameter Data:
*(OCTET) value is 0x8000.

Parameter (Second):
Unit:
UINT16; Decimal 2 for landing gear unit 2

SubUnit:
UINT16; 0

Parameter Data Len:
11 bits; decimal 4.

Ident:
21 bits; LDGGEAR - Landing Gear State, value %x00.00.b2 See Section 4.7.

Format:
UINT (OCTET): decimal 2. See Section 4.3.

Confidence:
decimal 10 (OCTET): RAW. It is the value reported by the actuator. See Table 23.

Expire:
OCTET; Time to live. %x77 to expire in 2.9 seconds. See Section 4.2.2 for encoding.

Pflags:
LEVEL-A (OCTET) decimal 5. See Table 21

Parameter Data:
*(OCTET) value is 0x8000.

6.2.2. Gear Position Request

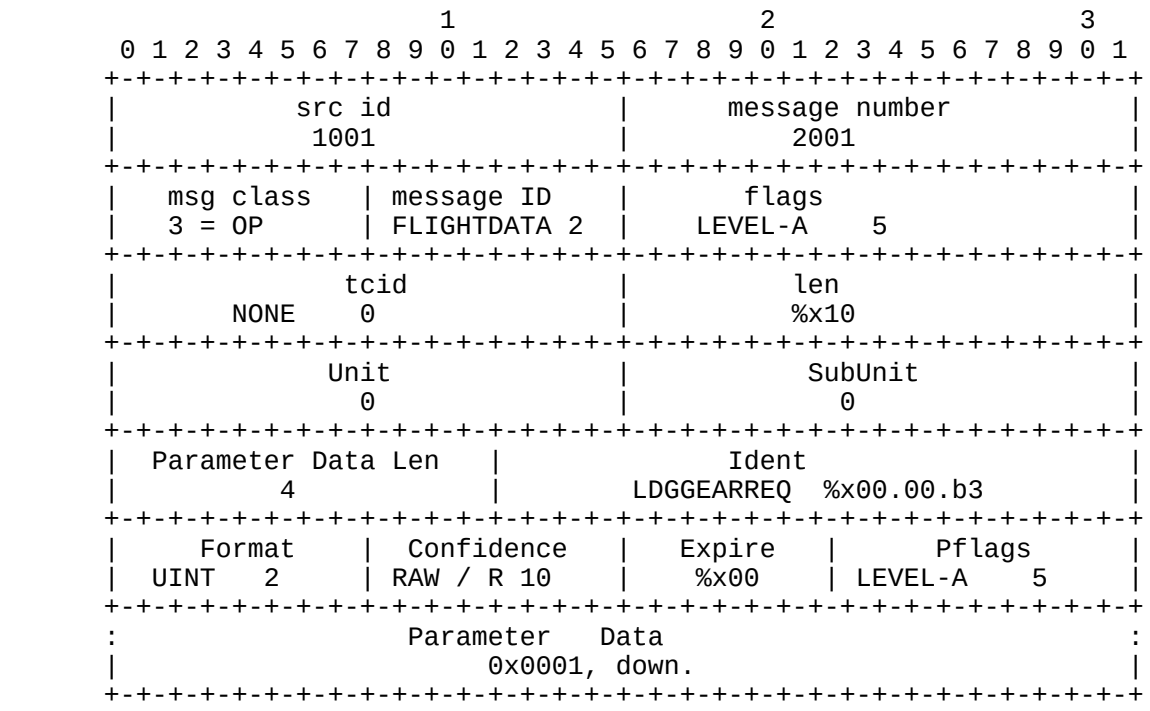

Figure 9: Request Gear Position Down

Below we see an example message that could have been made by a landing gear button.

src id:
UINT16; This value was set to 1001 decimal at installation time.

message number:
UINT16; 2001 decimal for illustration purposes.

msg class:
UINT8; "OP" value 3 decimal.

message ID:
UINT8; FLIGHTDATA decimal 2

flags:
UINT16; LEVEL-A decimal 5; See Table 21.

tcid:
t-NONE; See Table 22.

```
   len:
      UINT16 ; 0x10 or 16 decimal octets.

   Parameter (Only):
      Unit:
         UINT16; Decimal 0 for the plane’s landing gear.

      SubUnit:
         UINT16; 0

      Parameter Data Len:
         11 bits; decimal 4.

      Ident:
         21 bits; LDGGEARREQ - Landing Gear State Request, value
         %x00.00.b3 See Section 4.7.

      Format:
         UINT (OCTET): decimal 2.  See Section 4.3.

      Confidence:
         decimal 192 (OCTET): USERSEL.  See Table 23.

      Expire:
         OCTET; Time to live. %x00 to not expire.  See Section 4.2.2 for
         encoding.

      Pflags:
         LEVEL-A (OCTET) decimal 5.  See Table 21

      Parameter Data:
         *(OCTET) 0x0001, down.
```

6.2.3. First Changed Gear State Message

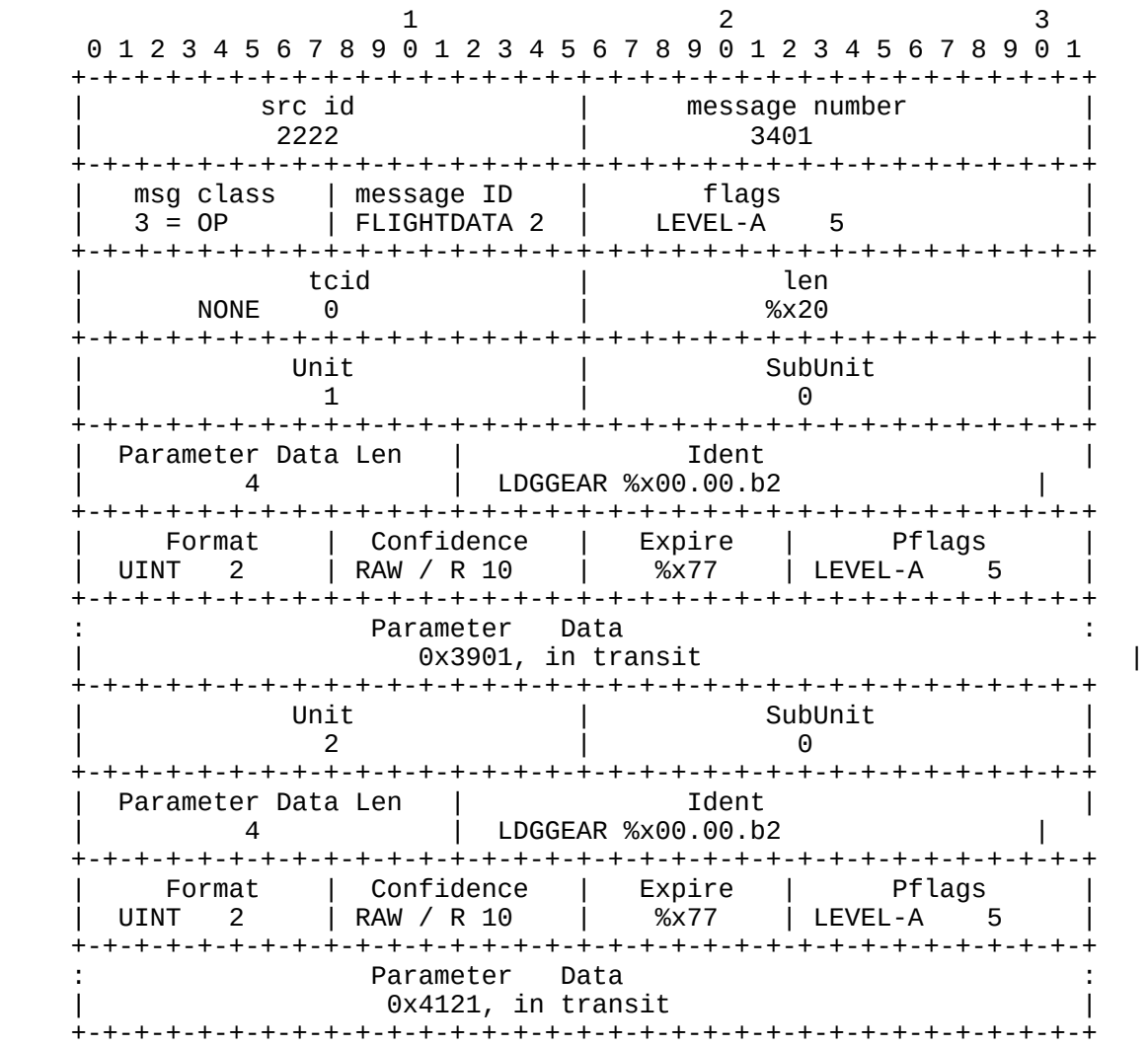

Figure 10: First Changed Gear State Message

The above message was sent while the landing gear was in transit. It shows the position values for each gear to be different, but both in transit. The expiry is set to 0x77 and about 2.9 seconds as the sending node intends to send updates at least once per second. The longer time period accounting for potential losses.

src id:
UINT16; This value was set to 2222 decimal at installation time.

```
   message number:
      UINT16; 3401 decimal for illustration purposes.

   msg class:
      UINT8; "OP" value 3 decimal.

   message ID:
      UINT8; FLIGHTDATA decimal 2

   flags:
      UINT16; LEVEL-A decimal 5; See Table 21.

   tcid:
      t-NONE; See Table 22.

   len:
      UINT16 ; 0x20 octets.

   Parameter (First):
      Unit:
         UINT16; Decimal 1 for landing gear unit 1

      SubUnit:
         UINT16; 0

      Parameter Data Len:
         11 bits; decimal 4.

      Ident:
         21 bits; LDGGEAR - Landing Gear State, value %x00.00.b2 See
         Section 4.7.

      Format:
         UINT (OCTET): decimal 2.  See Section 4.3.

      Confidence:
         decimal 10 (OCTET): RAW.  It is the value reported by the
         actuator.  See Table 23.

      Expire:
         OCTET; Time to live. %x77 to expire in 2.9 seconds.  See
         Section 4.2.2 for encoding.

      Pflags:
         LEVEL-A (OCTET) decimal 5.  See Table 21

      Parameter Data:
         *(OCTET) value is 0x3901, in transit .
```

Parameter (Second):
Unit:
UINT16; Decimal 2 for landing gear unit 2

SubUnit:
UINT16; 0

Parameter Data Len:
11 bits; decimal 4.

Ident:
21 bits; LDGGEAR - Landing Gear State, value %x00.00.b2 See Section 4.7.

Format:
UINT (OCTET): decimal 2. See Section 4.3.

Confidence:
decimal 10 (OCTET): RAW. It is the value reported by the actuator. See Table 23.

Expire:
OCTET; Time to live. %x77 to expire in 2.9 seconds. See Section 4.2.2 for encoding.

Pflags:
LEVEL-A (OCTET) decimal 5. See Table 21

Parameter Data:
*(OCTET) value is 0x4121, in transit.

6.2.4. Final Gear State Message

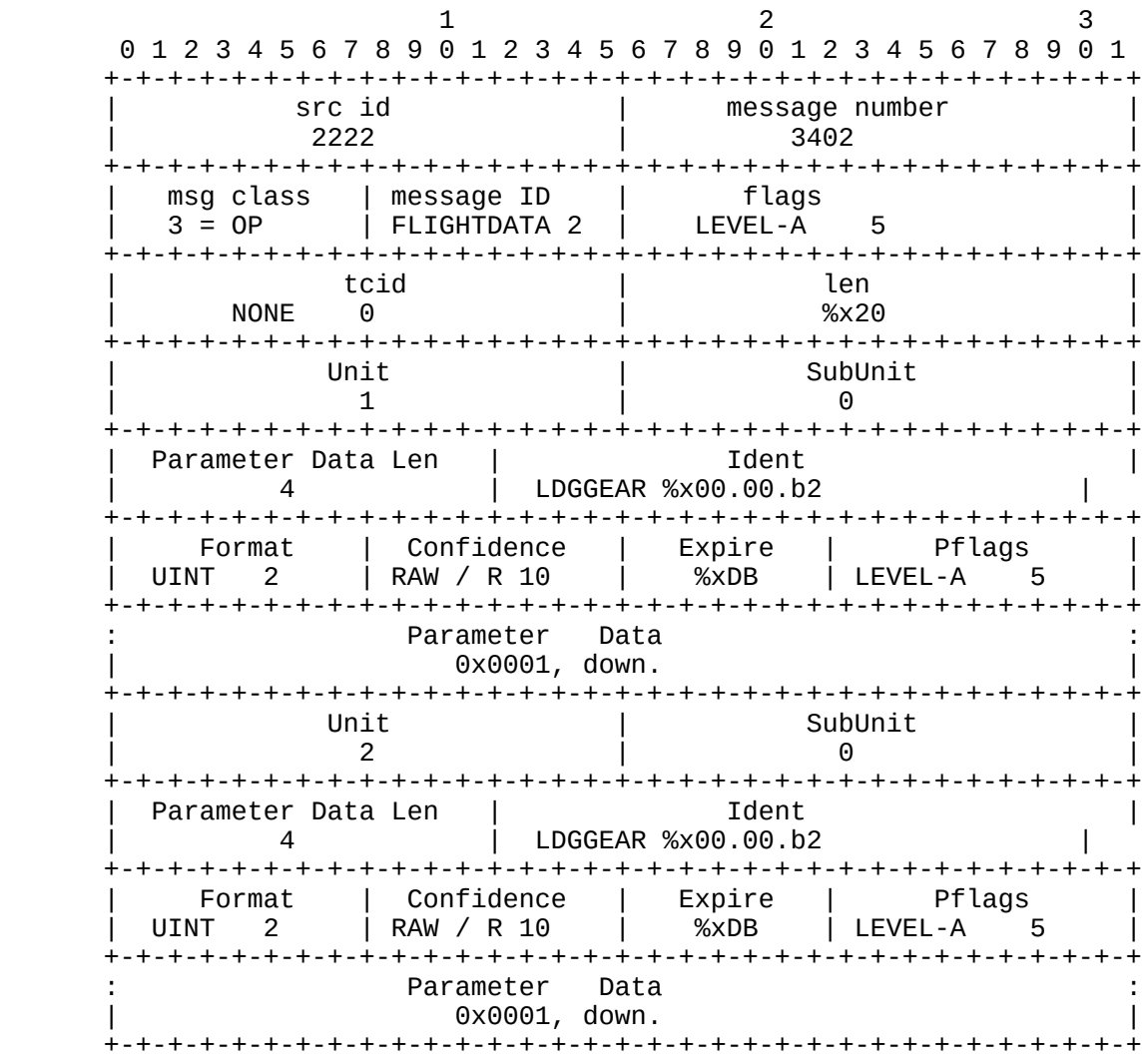

Figure 11: Final Gear State Message

The mesage above indicates that both landing gear are down (value 0x0001) and the message expiry has increased to 0xDB, or about 59 seconds. Since the gear are now in a static position, the node only intends to send updates every 20 seconds or so following the expire a message at about three times the sending frequency. In practice, to ensure delivery the long expiry should be introduced after at least one prior notification that it reached that state.

src id:
UINT16; This value was set to 2222 decimal at installation time.

message number:
UINT16; 3402 decimal for illustration purposes.

msg class:
UINT8; "OP" value 3 decimal.

message ID:
UINT8; FLIGHTDATA decimal 2

flags:
UINT16; LEVEL-A decimal 5; See Table 21.

tcid:
t-NONE; See Table 22.

len:
UINT16 ; 0x20 octets.

Parameter (First):
Unit:
UINT16; Decimal 1 for landing gear unit 1

SubUnit:
UINT16; 0

Parameter Data Len:
11 bits; decimal 4.

Ident:
21 bits; LDGGEAR - Landing Gear State, value %x00.00.b2 See Section 4.7.

Format:
UINT (OCTET): decimal 2. See Section 4.3.

Confidence:
decimal 10 (OCTET): RAW. It is the value reported by the actuator. See Table 23.

Expire:
OCTET; Time to live. %x77 to expire in 2.9 seconds. See Section 4.2.2 for encoding.

Pflags:
LEVEL-A (OCTET) decimal 5. See Table 21

Parameter Data:
*(OCTET) value is 0x0001, down.

Parameter (Second):
Unit:
UINT16; Decimal 2 for landing gear unit 2

SubUnit:
UINT16; 0

Parameter Data Len:
11 bits; decimal 4.

Ident:
21 bits; LDGGEAR - Landing Gear State, value %x00.00.b2 See Section 4.7.

Format:
UINT (OCTET): decimal 2. See Section 4.3.

Confidence:
decimal 10 (OCTET): RAW. It is the value reported by the actuator. See Table 23.

Expire:
OCTET; Time to live. %x77 to expire in 2.9 seconds. See Section 4.2.2 for encoding.

Pflags:
LEVEL-A (OCTET) decimal 5. See Table 21

Parameter Data:
*(OCTET) value is 0x0001, down.

7. IANA Considerations

This memo includes no request to IANA.

8. Security Considerations

This document should not affect the security of the Internet.

This protocol is currently designed to be deployed on an isolated private network. As such, message encryption, authenticity, and modification detection are not protocol priorities.

8.1. Interception

Message Interception is not considered a significant threat for XSEDE because there is no private data in the system.

8.2. Impersonation and MITM

Impersonation and Man in the Middle (MITM) are unlikely because normally the network is physically isolated and not routed to other networks. Strategies for signing messages are a future consideration.

8.3. Denial of Service

Due to secure installation and physical isolation, Denial of Service is not a significant concern.

9. References

9.1. Normative References

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9.2. Informative References

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