

## 1. DATA LINK CHARACTERISTICS

The STANDARD, INSTRUM and CUSTOM modes of the GSSIP share many of the same characteristics. All configurations are described in this section with the differences noted.

**3.1 GSSIP Definition.** The GSSIP provides a capability to transfer data and commands between an INTER and a RCVR. An INTER is user-supplied peripheral equipment which operates within the constraints of the GSSIP.

For a definition of the standard implementation of GSSIP using RS-232 and RS-422 electrical characteristics on an HD-15 connector, refer to ICD-GPS-154.

**3.1.1 Baud Rate.** For the purpose of this document, baud is defined as the serial data transmission rate of signal elements (bits) per second. In the STANDARD mode, the interface transmits and receives data at 9.6 kilobaud. In the INSTRUM mode, the interface transmits data at 76.8 kilobaud and receives data at 19.2 kilobaud. The CUSTOM mode allows independent selection of baud rates for the receive and transmit components of the interface.

The 9600 in/out baud is referred to as the STANDARD configuration. The 19200 baud in/76800 baud out configuration is referred to as the INSTRUM configuration.

**3.1.1.1 Logic Levels Convention.** The interchange circuits transferring data signals across the interface point will hold "marking" (defined as logic 1) or "spacing" (defined as logic 0) conditions for the total nominal duration of each signal element.

**3.1.2 GSSIP Messages.** Two types of messages occur on the interface: (1) data messages and (2) command messages.

**3.1.2.1 Data Messages.** Data messages include header and data words for transfer to or from the RCVR. The data portion of these messages may contain commands to the RCVR. These commands may be distinguished in this ICD by their association with a specific message ID.

**3.1.2.2 Command Messages.** Command messages are used to request specific information from the RCVR or are output from the RCVR as acknowledge (ACK)/negative acknowledge (NAK) messages. Header-only-messages are used for the transfer of this type of command. These commands are distinguished by their association with the specific set of commands discussed below (connect, disconnect, request, ACK, NAK, etc.) They are not associated with a specific message ID, but may be used with all message IDs.

**3.1.3 Message Format.** The data and commands transmitted using GSSIP are formatted into messages. Messages contain a header portion and may or may not contain a data portion. The maximum number of words a message may contain is 518 (five header portion words and 513 data portion words). The header portion contains four header words plus one header checksum #1 word (words 1 through 5). The data portion may contain a maximum of 512 data words (words 6 through 5+N, where 1 ≤ N ≤ 512) plus one data checksum #2 word. See Figure 3-1 for an example Message Format. The data portion of those messages present in the Baseline and Revision A of this document will not

exceed 100 words. See Tables B-1, B-2, and B-11 for a list of affected messages.

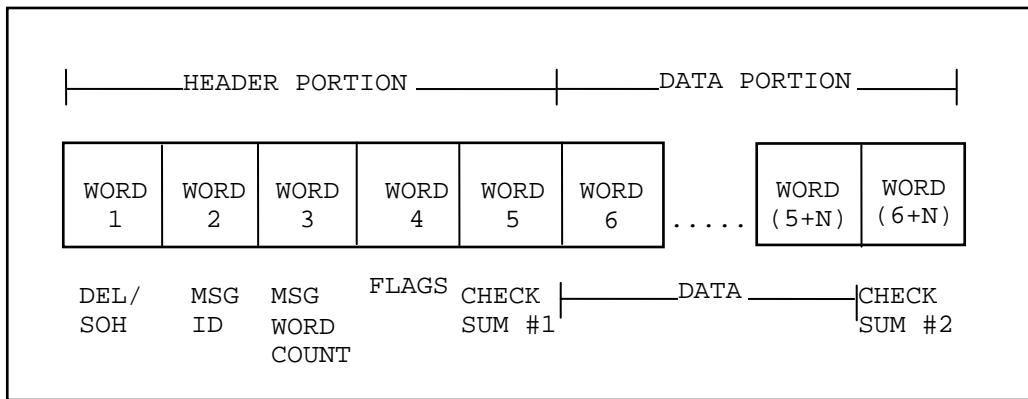


Figure 3-1. GSSIP Message Format

A message word length is 16 bits. However, the GSSIP transmits data in 8-bit groups (bytes). Thus, two bytes are required in order to make up one message word. Only whole 16-bit data words may be transmitted or received. The number of bytes is always even, double the number of data words.

In the STANDARD mode, a byte is transmitted within a 10-bit character. The 10-bit character is transmitted as follows: start bit first, followed by 8 bits of data, and the stop bit. The character format is presented in Figure 3-2. Refer to APPENDIX A for a description of transmission order.

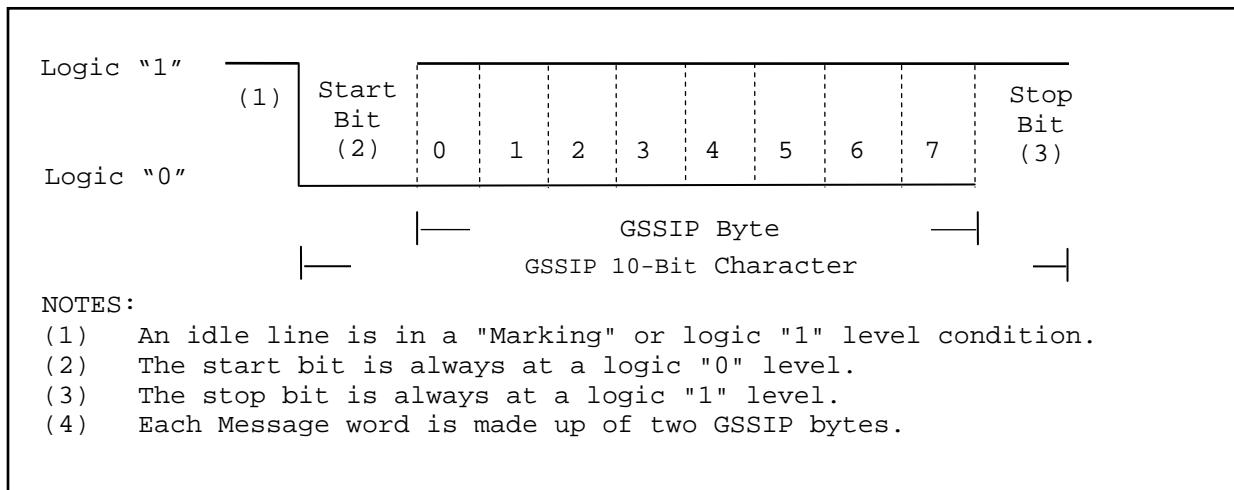


Figure 3-2. STANDARD GSSIP Character Format

In the INSTRUM mode, a byte is transmitted within an 11-bit character. The 11-bit character is transmitted as follows: start bit first, followed by 8 bits of data, the parity bit, and the stop bit. The character format is presented in Figure 3-3. Refer to APPENDIX A for a description of transmission order.

Data can be transmitted or received in the CUSTOM configuration either as an eleven-bit character (odd or even parity) or as a ten-bit character (no parity). The user defines whether parity is even or odd, which results in an eleven bit character, or no parity, which results in a ten-bit character. The CUSTOM configuration allows the user to define the transmit and receive parities independently. Refer to Message 5031 for details on CUSTOM configuration setup. Special attention should be given to Note 6 of Message 5031.

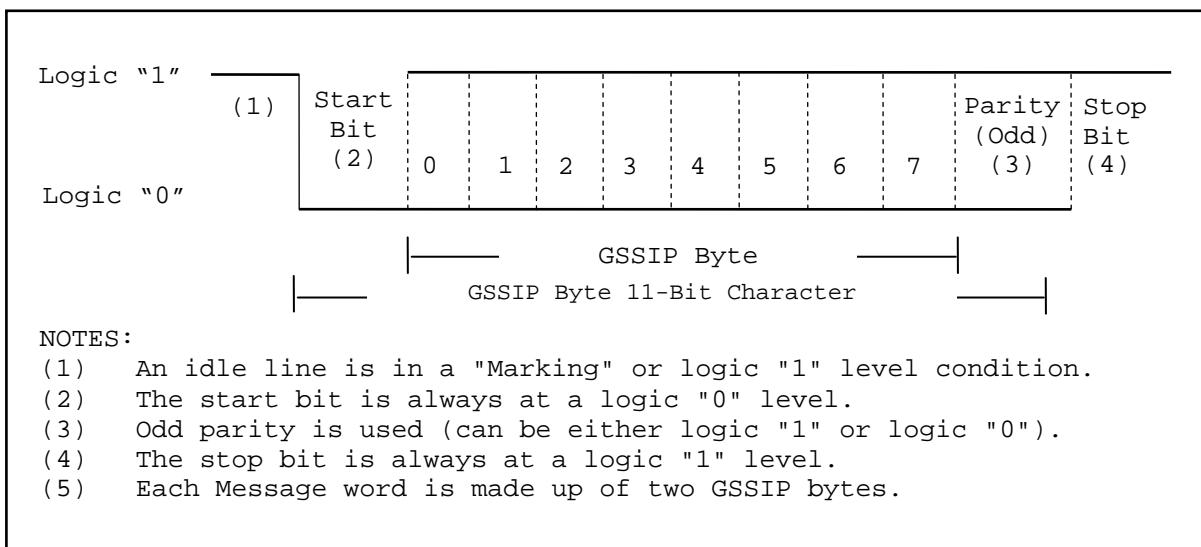


Figure 3-3. INSTRUM GSSIP Character Format

The maximum period of time between the interface characters (inter-character gap) in the same message may not exceed the character gaps listed in Table 3-1 measured from the trailing edge of the stop bit of the first character to the leading edge of the start bit of the following character. During this period of time, the interface is held in the "marking" (level "1") state. The minimum period of time between characters that are the ending and beginning characters of two messages (inter-message gap) is listed in Table 3-1, and is measured from the trailing edge of the stop bit of the final checksum of the first message to the leading edge of the start bit of the Data Escape Link (DEL)/Start of Header (SOH) word of the following message. The interface is in the "marking" (level "1") state during this time.

Table 3-1. Inter-Character and Inter-Message Gaps

Baud Rate	Maximum Inter-Character Gap		Minimum Inter-Message Gap	
	10 bit Character (ms)	11 bit Character (ms)	10 bit Character (ms)	11 bit Character (ms)
75	666.67	733.33	1333.33	1466.67
150	333.33	366.67	666.67	733.33
300	166.67	183.33	333.33	366.67
600	83.33	91.67	166.67	183.33
1200	41.67	45.83	83.33	91.67
2400	20.83	22.92	41.67	45.83
4800	10.42	11.46	20.83	22.92
9600	5.21	5.73	10.42	11.46
19200	2.60	2.86	5.21	5.73
38400	1.30	1.43	2.60	2.86
76800	0.65	0.72	1.30	1.43
115200	0.43	0.48	0.87	0.95
230400	0.22	0.24	0.43	0.48

Note: For any baud rate, the maximum inter-character gap is 5 character times and the minimum inter-message gap is 10 character times. On input, no action shall be taken to verify the cumulative inter-character gap of messages received. As long as the inter-character gap between any two characters does not exceed the allowed maximum, received messages shall not be rejected on the basis of inter-character gap. These rules apply even when a RCVR implements baud rates other than those identified in the table above.

The sending INTER's protocol will allow for one retransmission of any message that is negative acknowledged or has timed out. This allows the RCVR to control the rate of commands that occur over the interface at any given time.

**3.1.3.1 Header Description.** The five message words of the header portion of a message are: DEL/SOH word, message ID word, message word count word, flags word, and checksum #1 word. The transmission order of the header words is described in APPENDIX A. The header words are described in the following paragraphs.

**3.1.3.1.1 Word 1, DEL/SOH.** Message word 1 of the GSSIP message header contains a 16-bit field composed of the DEL and SOH bytes and is defined below:

DEL - An 8-bit constant with a value of 255 decimal (binary "11111111") forming the first byte (Start Byte) of message word 1 of the header. In addition, the DEL constant is also used to reestablish interface synchronization.

SOH - An 8-bit constant with a value of 129 decimal (binary "10000001") forming the second byte of message word 1 of the header.

3.1.3.1.2 Word 2, Message ID. Message word 2 forms a 16-bit field that indicates a particular message ID. A message ID of zero indicates the Universal Reset Message. The Universal Reset Message is used for the transmission of flags when no valid message ID is available (i.e., ready/not ready and resynchronize). The legal range for the message ID field is 0 to 65,535. (Refer to Tables B-1, B-2, and B-11 for a list of valid Msg IDs contained in this ICD).

3.1.3.1.3 Word 3, Word Count. Message word 3 forms a 16-bit field that indicates the number of message words contained in the data portion of the message excluding the checksum #2 word. A value of zero in this field indicates that it is a header-only-message. The legal range for the word count field is 0 to 512, 16-bit words. On input, this field will be used to determine the number of data words contained in the message and to locate the data checksum. RCVRs and INTERs shall not restrict processing of message data to the message word counts indicated in this ICD or any previous revisions. Words unrecognized by the RCVR or INTER may be ignored. The RCVR and INTER shall accept and process messages received of the length defined in Tables B-1, B-2, and B-11. RCVRs or INTERs designed in a way that limits message growth by restricting or hard coding word count shall be considered non-compliant with this ICD.

Table 3-2. Header Flag Word Logic Diagram

	F	L	A	G	S	R	C	A	N	N	H	M	A	I	C	V	D	I	N	
ACK/NAK CMD	Not Ready	0	X	X	X	X	X	X	X	X	R	D	I	O	C	C	R	I	N	
Test Mode	1	1	X	X	X	X	X	X	X	X	J	D	N	N	N	Q	S	S	S	S
RESYNC CMD	1	0	1	X	X	X	X	X	X	X	K	C	T	C	C	S	P	P	P	P
ACK/NAK Msg	1	0	0	1	X	X	X	X	X	X	A	E	A	E	E	M	A	A	A	A
Receive ACK	1	0	0	0	1	0	X	X	X	X	T	C	C	T	C	S	R	R	R	R
Receive NAK	1	0	0	0	0	1	X	X	X	X	A	T	A	T	T	G	E	E	E	E
CMD Handshake	1	0	0	0/1	0	0	1	0/1	0	0	0	0	0	0	0	0	X	X	X	X
Connect CMD	1	0	0	0/1	0	0	0	0	0	0	0	0	1	0	0	0	X	X	X	X
Disconnect CMD	1	0	X	0/1	0	0	0	0	0	0	0	0	0	1	0	0	X	X	X	X
Request Msg	1	0	0	0/1	0	0	0	0	0	0	0	0	0	0	1	X	X	X	X	X
Bit No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0				

Note: The flag word is structured such that the condition of the more significant bits (flags) may preempt the reading of the bits with lower significance. For example, if the TEST MODE flag bit is set (indicating that the RCVR or INTER is in the test mode), then the lower flags are not required to be evaluated.

X = Don't Care - State of flag is ignored.

0 = Flag must be clear.

1 = Flag must be set.

0/1 = Flag may be clear or set as required.

**3.1.3.1.4 Word 4, Flags.** Message word 4 forms a 16-bit field containing protocol and message-related flags. This field provides flag bits necessary for protocol operation. A logic "1" indicates that the flag is "set". Refer to Table 3-2 for a logic diagram of the GSSIP flags.

The flags are defined below (Input/Output is in reference to the RCVR):

<u>BIT NO.</u>	<u>FLAG DESCRIPTION</u>
0	Spare: Input - Ignored by the RCVR. Output - Always set to "0".
1	Spare: Input - Ignored by the RCVR. Output - Always set to "0".
2	Spare: Input - Ignored by the RCVR. Output - Always set to "0".
3	Spare: Input - Ignored by the RCVR. Output - Always set to "0".
4	Request Message Flag: Input - Indicates a command to the RCVR from an INTER to output the specified message one time over the interface. Refer to paragraph 3.2.1.5.3. Output - Always set to "0".
5	Disconnect Message Flag: Input - Indicates a command to the RCVR from an INTER to disconnect and discontinue transmitting the specified message. The RCVR will disconnect all messages (Universal Reset) if the Message ID is set to zero while this flag is set. Refer to paragraph 3.2.1.5.2. Output - Always set to "0".
6	Connect Message Flag: Input - Indicates a command to the RCVR from an INTER to connect the specified message and output it repetitively at the scheduled update rate. (Up to 40 messages may be connected at one time.) Refer to paragraph 3.2.1.5.1. Output - Always set to "0".
7	Invalid Data Flag: Input - If this bit is set by the INTER, the message is ignored by the RCVR. Output - Indicates that an error has rendered the data contained in the RCVR transmitted message to be questionable. 0 = data valid, 1 = data invalid.

BIT NO.    FLAG DESCRIPTION (continued)

- 8      Command Reject Flag:  
      Input - Indicates that a command to the INTER from a RCVR has been rejected ("1") or accepted ("0"). Ignored by the RCVR if the Handshake Flag is not set. Refer to paragraph 3.2.1.3.  
      Output - Indicates that a command to the RCVR from an INTER has been rejected ("1") or accepted ("0"). Refer to paragraph 3.2.1.3.
- 9      Handshake Flag:  
      Input - Indicates that the INTER has responded to a command from the RCVR. The state of the Command Reject Flag indicates whether the command has been accepted or rejected.  
      Output - Indicates that the RCVR-transmitted-message is a response to an INTER command. The state of the Command Reject Flag indicates whether the command has been accepted or rejected. Refer to paragraph 3.2.1.3.
- 10     Negative Acknowledge Flag:  
      Input - Indicates that a RCVR-transmitted-message, with the Acknowledge Request Flag set, has been received by an INTER with data errors. The receipt of a Negative Acknowledge Flag by the RCVR will cause the RCVR to retransmit the message in error. Refer to paragraph 3.2.1.2.  
      Output - Indicates that an INTER-transmitted-message, with the Acknowledge Request Flag set, has been received by the RCVR with data errors. The receipt of a Negative Acknowledge Flag by an INTER will cause the INTER to retransmit the message in error. Refer to paragraph 3.2.1.2.
- 11     Acknowledge Flag:  
      Input - Indicates that a RCVR-transmitted-message, with the Acknowledge Request Flag set, has been received by an INTER correctly. Refer to paragraph 3.2.1.2.  
      Output - Indicates that an INTER-transmitted-message, with the Acknowledge Request Flag set, has been received by the RCVR correctly. Refer to paragraph 3.2.1.2.
- 12     Acknowledge Request Flag:  
      Input - Indicates that the message being transmitted by an INTER requires acknowledgment from the RCVR. Refer to paragraph 3.2.1.2.  
      Output - Indicates that the message being transmitted by the RCVR requires acknowledgment from the INTER. Refer to paragraph 3.2.1.2.
- 13     Resynchronization (RESYNC) Flag:

Input - Indicates that the INTER has lost synchronization, and RESYNC of the interface should be initiated by the RCVR.  
Refer to paragraph 3.2.1.5.4.

Output - Always set to "0".

BIT NO.    FLAG DESCRIPTION (continued)

14      Test Mode Flag:

- Input - Indicates that a test is in progress and that the test INTER will be issuing link commands to the RCVR. No INTER (except the test INTER) can use the interface while the Test Mode Flag is set. This flag is rarely utilized.
- Output - Echo of the state of the Test Mode Flag of the last received message.

15      Ready Flag:

- Input - The Ready Flag set to "1" indicates that the INTER is ready to receive a message. If set to "0", the RCVR will wait for 100 ms to allow the INTER time to become ready.
- Output - The Ready Flag set to "1" indicates that the RCVR is ready to receive a message. The Ready Flag set to "0" indicates that the RCVR is not ready to receive a message, and the INTER will wait 100 ms to allow the RCVR to become ready.

3.1.3.1.5 Word 5, Checksum #1. A 16-bit checksum is used to validate the header portion of the message. The header checksum #1 is computed by summing (modulo  $2^{16}$ ) the set bits contained in header message words 1 through 4 and then complementing the sum (using 2's complement). In the binary summing of the header message words, the carry bits are ignored and only the least significant 16 bits are used as the checksum. When receiving an input message, if checksum #1 is incorrect, the RCVR will discard the message without any further processing.

3.1.3.2 Data Description. The data portion of the message can contain up to a maximum of 512 data words (words 6 through  $5+N$ , where  $1 \leq N \leq 512$ ) plus one data checksum #2 word. See Figure 3-1.

3.1.3.2.1 Words 6 to  $5+N$ , (N Data Words). These 16-bit data field message words are completely transparent to the protocol and have no restrictions on bit patterns or character groupings. The number of data message words "N", is the same number of words specified in the message word count (message word 3 in the header portion). When the message word count is zero, this field does not exist.

The maximum number of data words is 512. Data Words are not transmitted in header only messages.

3.1.3.2.2 Word  $6+N$ , Checksum #2. This 16-bit checksum field is used to validate the data portion of the message. It is transmitted as the last message word of any message containing data message words. It is computed by summing (modulo  $2^{16}$ ) the set bits contained in the data message words (words 6 to  $5+N$ , where  $1 \leq N \leq 512$ ) and then complementing the sum (using 2's complement). In the binary summing of the data message words, the carry bits are ignored and only the least significant 16 bits are used as the checksum. This word is not transmitted in header-only messages. The RCVR and INTER

shall determine the location of Checksum #2 by using word 3 (word count) of the header, and shall not use the word count indicated in the message definitions in Appendix B.

MESSAGE NAME : Differential Corrections

MESSAGE ID	:	260	INVALID FLAG	:	Never Set
DEST/SOURCE	:	GPS/INTER	DATA WORD COUNT	:	20, Note 1
INPUT/OUTPUT	:	Input	XMIT RATE	:	Note 2

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DESCRIPTION		WORD	BIT	DATA TYPE	UNITS	SCALE FACTOR
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Bytes 1 and 2 of data		1		6 of 8		
Bytes 3 and 4 of data		2		6 of 8		
Bytes 5 and 6 of data		3		6 of 8		
Bytes 7 and 8 of data		4		6 of 8		
Bytes 9 and 10 of data		5		6 of 8		
Bytes 11 and 12 of data		6		6 of 8		
Bytes 13 and 14 of data		7		6 of 8		
Bytes 15 and 16 of data		8		6 of 8		
Bytes 17 and 18 of data		9		6 of 8		
Bytes 19 and 20 of data		10		6 of 8		
Bytes 21 and 22 of data		11		6 of 8		
Bytes 23 and 24 of data		12		6 of 8		
Bytes 25 and 26 of data		13		6 of 8		
Bytes 27 and 28 of data		14		6 of 8		
Bytes 29 and 30 of data		15		6 of 8		
Bytes 31 and 32 of data		16		6 of 8		
Bytes 33 and 34 of data		17		6 of 8		
Bytes 35 and 36 of data		18		6 of 8		
Bytes 37 and 38 of data		19		6 of 8		
Bytes 39 and 40 of data		20		6 of 8		

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REMARKS: RCVRs that do not implement Local Area DGPS shall ACK, if the ACK request bit is set, and reject this message.

This ICD merely provides a mechanism to input DGPS corrections via GSSIP. Refer to Message 9 to determine if this capability is applicable to a particular RCVR.

Data is in the "6 of 8" format as defined in NATO STANAG 4392 (paragraph 2.2) or in the RTCM Paper (paragraph 2.2). See Figure A-13 for details of each word. The term "data" refers to both RTCM preamble and RTCM data. RTCM data bytes exceeding the Message 260 data limitation are sequentially appended in the data blocks of the next Message 260.

Note 1: The INTER must take the differential data, prepare it into "6 of 8" format, group it into bytes, and package it into 40 bytes per the above message description. The RCVR will only accept messages

containing 40 bytes (20 words). When there are less than 40 bytes of data, the trailing bytes will be zero filled.

Note 2: Input rate is determined by the INTER. The maximum rate is limited by the serial data port baud rate.