JSF DATA FILE DESCRIPTION

0004824_REV_1.20

March 2016

EdgeTech
4 Little Brook Road
West Wareham, MA 02576

Tel: (508) 291-0057
Fax: (508) 291-2491
www.EdgeTech.com

The information, figures, and specifications in this manual are proprietary and are issued in strict confidence on condition that they not be copied, reprinted, or disclosed to a third party, either wholly or in part, without the prior, written consent of EdgeTech. Any reproduction of EdgeTech supplied software or file sharing is strictly prohibited.

©Copyright 2016 by EdgeTech. All rights reserved.

CUSTOMER SERVICE

Customer service personnel at EdgeTech are always eager to hear from users of our products. Your feedback is welcome, and is a valuable source of information which we use to continually improve these products. We encourage you to contact EdgeTech Customer Service to offer any suggestions or to request technical support:

E-mail:	service@edgetech.com
Mail:	4 Little Brook Road West Wareham, MA 02576
Telephone:	(508) 291-0057
Facsimile:	(508) 291-2491
24-Hour Emergency Technical Support Line:	(508) 942-8043

For more information please go to www.EdgeTech.com.

ABOUT THIS DOCUMENT

Purpose of this Document

The purpose of this document is to describe the messages of common interest to those reading and processing JSF files. Although this document discusses the latest messages, some components may be periodically upgraded or updated. Therefore, the information in this document is subject to change and should be used for reference only.

License Statement

The JSF File Format Description is not covered by any license. It is being provided to you to facilitate reading and processing the JSF files produced by EdgeTech's sonar products and systems. This document is the property of EdgeTech and is being provided with limited rights to its use.

Limitation of Liability

In no event will EdgeTech be liable for any damages, claims, or costs whatsoever arising from this agreement and/or your use of this document, or any component thereof, including and without limitation: any consequential, indirect, incidental damages; or any lost profits or lost savings, even if a representative has been advised of the possibility of such loss, damages, claims, or costs; or for any claim by any third party. EdgeTech reserves the right to update the documentation without notice at any time.

Distribution

EdgeTech does not grant the right to give away, sell, license, re-package, or otherwise distribute any portion of this document without the written permission of EdgeTech, Inc.

Revision History

REV	DESCRIPTION	DATE	APPROVAL
1.20	Updated to include latest messages and reformatted for easier reading	03/08/2016	LB

WARRANTY DISCLAIMER

EdgeTech provides this document to you without any express or implied warranties of any kind, including, but not limited to: any implied warranties of merchantability or fitness for a particular purpose. EdgeTech makes no representations or warranties of any kind with respect to any support services it may render to you.

EdgeTech does not warrant that the document will meet your requirements, or that the document contains no defects or errors. You assume full responsibility for the selection, possession, performance, and proper installation and use of this document for verifying the results obtained therefrom.

EdgeTech is under no obligation to provide any support under this license agreement, including upgrades or future versions of the document, or any portions thereof, to developer, end user, or to any other party.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 OVERVIEW

EdgeTech's native file format is stored to a binary file with the extension *.JSF. The JSF file has been in use for over 10 years and is recorded by default by most EdgeTech topsides running the *Discover* and *JStar* acquisition programs.

This document describes the most common messages found in EdgeTech's JSF files and is not intended to be a complete description of all messages contained within. This document should also be used in conjunction with the **JSFdefs.h** header file to properly read, store, and process JSF files.

1.1 A Typical JSF File

Sonar data is recorded on a per-channel basis: a single frequency side scan system has two messages per ping–one for port (channel 0) and one for starboard (channel 1). Other types of data, such as those coming from a motion reference unit (MRU) providing pitch, roll, and heave, have their own specific message and similarly have a single message per reading set. Different types of data will have different message numbers as identified by the Message Type field. A typical file might contain the following messages as depicted in EdgeTech's JSF File Viewer Utility (**FIGURE 1-1**).

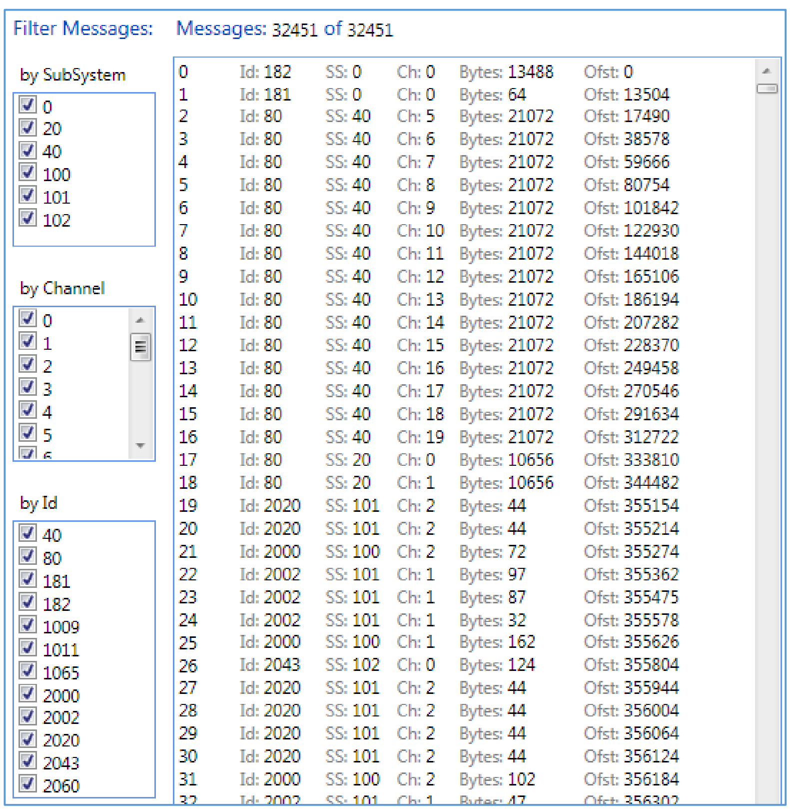

Figure 1-1: Utility Showing Typical Messages Contained within a JSF File

1.2 Byte Ordering

The byte ordering of 16-bit and 32-bit value is important since the JSF format is stored using little endian (Intel) format for binary data, where the least significant bytes are stored first. This is the native format for Intel x86 computers and compatibles. If data is read on a big endian machine (such as most Sun Workstations), the user should byte reverse the data so that the 2 bytes of a 16-bit value are flipped, and the 4 bytes of a 32-bit value are flipped (i.e., bytes 0, 1, 2, 3 become bytes 3, 2, 1, 0).

1.3 Reading a JSF File

Reading a JSF file does not take much coding. Sample C code for reading an entire JSF file is given below. All or any part thereof is free to use.

```
void readFile(char *fileName)
{
  FILE *fid;
  int i;
  SonarMessageHeaderType hdr; /* Basic 16-byte message header */

  fid = fopen(fileName, "rb");
   if (fid == NULL) return;

  while(!feof(fid))
  {
    if (fread(&hdr, sizeof(hdr), 1, fid) != 1) break;
    if (hdr.startOfMessage != SONAR MESSAGE HEADER START)
    {
      printf("Invalid file format\n"); break;
    }
    for(i = 0; i < hdr.byteCount; i++)
    {
      if (getc(fid) == EOF)
      {
        printf("Invalid file format\n");
        break;
      }
    }
    printf("Message Type %d\n", hdr.sonarMessage);
  }
  fclose(fid);
}
```

Figure 1-2: Example C Code for Reading a JSF File

2.0 FILE FORMAT DEFINITION

The JSF file is made up of several types of messages, each beginning with a 16-byte header indicating the type of data to follow and its size. This section describes the message header along with some of the potential messages contained within a single JSF file.

2.1 Message Header

The header identifies the type and size of the message, as well as the originating subsystem and channel. The header format is given in *Table 2-1*.

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 1	Marker for the Sync/Start of Header (always 0x1601) This serves as a sanity check during file processing.	UINT16
2	Protocol Version (e.g.0xD). The protocol level indicates which revision of this specification was used to write that message. Messages of differing protocol levels may be interspersed in the same file. Protocol level changes may involve additional messages or changes to the non-public portion of the interface.	UINT8
3	Session Identifier The session identifier is used for internal routing and can be ignored.	UINT8
4 – 5	Message Type (e.g. 80 = Acoustic Return Data) This field defines the type of data to follow. Some data formats of interest are detailed in the following sections. If this field contains an unwanted or unknown (i.e. not defined) type, use the Size of the Message (bytes 12– 15) to skip over the data to the next message header. The message protocol is used for command and control as well as data.	UINT16
6	Command Type 2 = Normal data source The command type field can normally be ignored when reading JSF files as this parameter may only be of interest during real time operation.	UINT8

BYTE OFFSETS	DESCRIPTION	SIZE
7	Subsystem Number The subsystem number determines the source of data; common subsystem assignments are: Sub-Bottom (SB) = 0 Low frequency data of a dual frequency side scan = 20 High frequency data of a dual frequency side scan = 21 Very High frequency data of a tri-frequency side scan = 22 Raw Serial/UDP/TCP data =100 Parsed Serial/UDP/TCP data =101 Standard side scan systems are single or dual frequency. When more than two side scan frequencies are present, the subsystem number begins at 20 and increases with increasing acoustic center frequencies.	UINT8
8	Channel for a Multi-Channel Subsystem For Side Scan Subsystems: 0 = Port 1 = Starboard For Serial Ports: this will be the logical port number, which often differs from the physical COM port in use. Single channel Sub-Bottom systems channel is 0.	UINT8
9	Sequence Number	UINT8
10 – 11	Reserved	UINT16
12 – 15	Size of following Message in Bytes The byte count is the number of bytes until the start of the next message header. This is the amount of additional data to read if processing the current message, or the amount of data to skip over if the current message is not of interest.	UINT32

Table 2-1: 16-byte Message Header Template

2.2 Acoustic Messages

This section describes two of the possible acoustic messages in the JSF file. The Sonar Data Message (Type 80) is the preferred message.

2.2.1 Message Type 80: Sonar Data Message (jsfdefs.h)

The Sonar Data Message consists of a single channel ping of data (receiver sounding period) for a single channel (e.g. port side of low frequency side scan subsystem). Most side scan subsystems have two channels of data: port and starboard. Most sub-bottom subsystems have a single channel of data. Which fields have data present depends on the system used and data acquisition procedures. In addition, this message may contain data from multiple non-acoustic sensors. Non-acoustic data contained in this message normally is not time interpolated.

EdgeTech strongly recommends that if high positional or situational accuracy is required, the individual sensor messages should be processed instead (see sub-section2.4 AUXILIARY MESSAGES). Otherwise, this may be the only message that needs to be interpreted in a JSF file if the level of accuracy is sufficient. The Validity Flag field (byte 30-31) indicates which auxiliary fields are populated. By convention, if a value is not present, the field is set to 0.

A Sonar Data Message consists of a 240 byte header followed by the actual acoustic sample data. This 240-byte header is described in the table below.

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	TimeSince1970 Ping Time in seconds since the start of time-based time function (midnight 1/1/1970) The time of the start of the ping of data represented by the following trace data is the Ping Time. This time stamp is only valid for data recorded in Protocol Revision 8 and above, this field is zero in prior protocol versions.	INT32
4 – 7	Starting Depth (window offset) in Samples	UINT32
8 – 11	Ping Number (increases with each ping)	UINT32
12 – 15	Reserved	2 x INT16

BYTE OFFSETS	DESCRIPTION	SIZE
16 – 17	MSBs – Most Significant Bits – High order bits to extend 16 bits unsigned short values to 20 bits. The 4MSB bits become the most significant portion of the new 20 bit value. Bits 0 – 3: Start Frequency Bits 4 – 7: End Frequency Bits 8 – 11: Samples in this Packet Bits 12 – 15: Mark Number (added in protocol version 0xA) The Most Significant Bits fields are used to extend 16 bit integers to 20 bits. These are added as needed when the range of possible values exceeds what can be stored in a 16 bit integer. The simplest way to use these additional bits is to treat the value as a 32 bit integer, the existing value becomes the least significant 16 bits, and the MSB field becomes the next most significant 4 bits with the most significant 12 bits set to zeros.	UINT16
18 – 19	LSB – Extended precision Low order bits for fields requiring greater precision. Bits 0-7: Sample Interval- - Sample interval fractional component Bits 8-15: Course- - fractional portion of course (Added in protocol version 0xB)	UINT16
20 – 21	LBS2 – Extended precision Low order bits for fields requiring greater precision. Bits 0 – 3: Speed - sub fractional speed component (added in protocol version 0xC). Bits 4 – 13: Sweep Length in Microsecond, from 0 - 999 (added in protocol version 0xD). Bits 14 – 15: Reserved	UINT16
22 – 27	Reserved	3 x INT16
28 – 29	ID Code (always 1) 1 = Seismic Data	INT16

BYTE OFFSETS	DESCRIPTION	SIZE
30 – 31	Validity Flag Validity flags bitmap: Bit 0: Lat Lon or XY valid Bit 1: Course valid Bit 2: Speed valid Bit 3: Heading valid Bit 4: Pressure valid Bit 5: Pitch roll valid Bit 6: Altitude valid Bit 7: Reserved Bit 8: Water temperature valid Bit 9 : Depth valid Bit 10: Annotation valid Bit 11: Cable counter valid Bit 12: KP valid Bit 13: Position interpolated Bit 14: Water sound speed valid	UINT16
32 – 33	Reserved	UINT16
34 – 35	Data Format 0 = one short per sample - envelope data. The total number of bytes of data to follow is 2 * samples. 1 = two shorts per sample - stored as real (one short), imaginary (one short). The total number of bytes of data to follow is 4 * samples. 2 =one short per sample - before matched filter. The total number of bytes of data to follow is 2 * samples. 9 = two shorts per sample - stored as real (one short), imaginary (one short), - prior to matched filtering. This is the code for unmatched filtered analytic data, whereas value 1 is intended for match filtered analytic data. The total number of bytes of data to follow is 4 * samples. **NOTE:** Values greater than 255 indicate that the data to follow is compressed and must be decompressed prior to use. For more detail refer to the **JSF Decompression Description** for more information.	INT16
36 – 37	Distance from Antenna to Tow point in Centimeters Sonar Aft is Positive	INT16

BYTE OFFSETS	DESCRIPTION	SIZE
38 – 39	Distance from Antenna to Tow Point in Centimeters Sonar to Starboard is Positive.	INT16
40 – 43	Reserved	2 x INT16

Table 2-1: Message Type 80 Data Format Block

BYTE OFFSETS	DESCRIPTION	SIZE
44 – 47	Kilometers of Pipe See Validity Flag (bytes 30 – 31).	FLOAT32
48 – 79	Reserved	16 x INT16
80 – 83	Longitude in 10000 * (Minutes of Arc) or X in Millimeters or in Decimeters. See Validity Flag (bytes 30 – 31) and Coordinate Units (bytes 88 - 89). **NOTE:** Unless the Validity Flag Bit 13 “Position Interpolated” is set, the position stored in message 80 is the value recorded by Discover and is not the sonar’s position. It is the last navigation position received prior to pinging and Layback is not applied.	INT32
84 – 87	Latitude in 10000 * (Minutes of Arc) or Y in Millimeters or in Decimeters. See Validity Flag (bytes 30 – 31) and Coordinate Units (bytes 88 - 89). **NOTE:** Unless the Validity Flag Bit 13 “Position Interpolated” is set, the position stored in message 80 is the value recorded by Discover and is not the sonar’s position. It is the last navigation position received prior to pinging and Layback is not applied.	INT32
88 – 89	Coordinate Units 1 = X, Y in millimeters 2 = Latitude, longitude in minutes of arc times 10000 3 = X, Y in decimeters	INT16

Table 2-2: Message Type 80 Navigation Data Block

BYTE OFFSETS	DESCRIPTION	SIZE
90 – 113	Annotation String (ASCII Data)	24 x UINT8
114 – 115	Samples **NOTE:** For protocol versions 0xA and above, the MSB1 field should include the MSBs (Most Significant Bits) needed to determine the number of samples. See bits 8-11 in bytes 16-17. Field MSB1 for MSBs for large sample sizes.	UINT16
116 – 119	Sampling Interval in Nanoseconds **NOTE:** For protocol versions 0xB and above, see the LSBs field should include the fractional component needed to determine the sample interval. See bits 0-7 in bytes 18-19. Field LSB1 for LSBs for increased precision.	UINT32
120 – 121	Gain Factor of ADC	UINT16
122 – 123	User Transmit Level Setting (0 – 100%).	INT16
124 – 125	Reserved – Do Not Use	INT16
126 – 127	Transmit Pulse Starting Frequency in daHz (decaHertz, units of 10Hz). **NOTE:** For protocol versions 0xA and above, the MSB1 field should include the MSBs (Most Significant Bits) needed to determine the starting frequency of transmit pulse. See Bits 0-3 in byte 16-17. Field MSB1 for MSBs for large transmit pulse.	UINT16
128 – 129	Transmit Pulse Ending Frequency in daHz (decaHertz, units of 10Hz). **NOTE:** For protocol versions 0xA and above, the MSB1 field should include the MSBs (Most Significant Bits) needed to determine the starting frequency of transmit pulse. See bits 4-7 in byte 16-17. Field MSB1 for MSBs for large transmit pulse.	UINT16
130 – 131	Sweep Length in Milliseconds. See bytes 18-19 for LSBs (Least Significant Bits), LSB2 bits 4 - 13 contain the microsecond portion (0 - 999). LSB2 part was added in protocol version 0xD, and was previously 0.	UINT16
132 – 135	Pressure in Milli PSI (1 unit = 1/1000 PSI) See Validity Flag (bytes 30-31)	INT32
136 – 139	Depth in Millimeters (if not = 0) See Validity Flag (bytes 30-31).	INT32

BYTE OFFSETS	DESCRIPTION	SIZE
140 – 141	Sample Frequency of the Data in hertz **NOTE:** For all data types EXCEPT RAW (Data Format = 2) this is the sampling frequency of the data. For RAW data, this is one-half the sample frequency of the data ($F_S/2$). All values are modulo 65536. Use this in conjunction with the Sample Interval (Bytes 114-115) to calculate correct sample rate.	UINT16
142 – 143	Outgoing Pulse Identifier	UINT16
144 – 147	Altitude in Millimeters A zero implies not filled. See Validity Flag (Bytes 30-31)	INT32
148 – 151	Sound Speed in Meters per Second. See Validity Flag (Byte 30-31).	FLOAT
152 – 155	Mixer Frequency in Hertz For single pulses systems this should be close to the center frequency. For multi pulse systems this should be the approximate center frequency of the span of all the pulses.	FLOAT

Table 2-3: Message Type 80 Pulse Information Block

BYTE OFFSETS	DESCRIPTION	SIZE
156 – 157	Year Data Recorded (CPU time) e.g. 2009. The Ping Time can also be determined from the Year, Day, Hour, Minute and Seconds as per bytes 156 to 165. Provides 1 second level accuracy and resolution. See Bytes 0-3 these 2 time stamps are equivalent and identical. For most purposes this should not be used. For higher resolution (milliseconds) use the Year, and Day values of bytes 156 to 159, and then use the milliSecondsToday value of bytes 200-203 to complete the timestamp. System time is set to UTC, regardless of time zone. This time format is backwards compatible with all older Protocol Revisions	INT16
158 – 159	Day (1 – 366) (should not be used)	INT16
160 – 161	Hour (see Bytes 200-203) (should not be used)	INT16
162 – 163	Minute (should not be used)	INT16
164 – 165	Second (should not be used)	INT16
166 – 167	Time Basis (always 3)	INT16

Table 2-4: Message Type 80 CPU Time Block

The trace data is transmitted as 16 bit integers in block floating point format per message. This saves bandwidth and storage space while preserving dynamic range. The weighting factor MUST be applied to each of the 16 bit integer values to restore the original floating point value.

BYTE OFFSETS	DESCRIPTION	SIZE
168 – 169	Weighting Factor for Block Floating Point Expansion -- defined as 2 to N Volts for LSB. All data MUST be scaled by 2^{-N}, where N is the Weighting Factor. (See Equation 2-1, on page 2-8)	INT16
170 – 171	Number of Pulses in the Water	INT16

Table 2-5: Message Type 80 Weighting Factor Block

Each of the data samples then needs to be scaled by the weighting factor, N, according to the equation below:

$$ScaledDataSample = DataSample \times 2^{-N}$$

Equation 2-1

The following Compass Heading, Pitch and Roll fields contain useful information about the attitude of the sonar.

BYTE OFFSETS	DESCRIPTION	SIZE
172 – 173	Compass Heading (0 to 359.99) in units of 1/100 Degree. See Validity Flag (bytes 30-31). The Compass heading is the magnetic heading of the towfish. If a Gyro sensor is properly interfaced to the DISCOVER Topside Acquisition Unit with a valid NMEA HDT message, this field will contain the Gyro heading, relative to True North.	UINT16
174 – 175	Pitch [(degrees / 180.0) * 32768.0] maximum resolution. Positive values indicate bow up. See Validity Flag (bytes 30-31).	INT16
176 – 177	Roll [(degrees / 180.0) * 32768.0] maximum resolution. Positive values indicate port up. See Validity Flag (bytes 30-31).	INT16
178 – 179	Reserved	INT16

Table 2-6: Message Type 80 Orientation Sensor Data Block

Also, the trigger source is determined from this block.

BYTE OFFSETS	DESCRIPTION	SIZE
180 – 181	Reserved	INT16
182 – 183	Trigger Source 0 = Internal 1 = External 2 = Coupled	INT16
184 – 185	Mark Number 0 = No Mark See bytes 16 –17 fields MSB1 for MSBs (Most Significant Bits) for large values (> 655350).	UINT16

Table 2-7: Message Type 80 Trigger Information Block

The following **Position Fix Hour**, **Position Fix Minutes**, and **Position Fix Seconds** fields (bytes 186-193) contain the time of the last position fix. If bit 13 is set (i.e. position interpolated) in **Validity Flag** (byte 30-31), this will be the same as the CPU and ping time.

BYTE OFFSETS	DESCRIPTION	SIZE
186 – 187	Position Fix Hour (0 – 23) **NOTE:** the NAV time is the time of the latitude and longitude fix.	INT16
188 – 189	Position Fix Minutes (0 – 59) **NOTE:** the NAV time is the time of the latitude and longitude fix.	INT16
190 – 191	Position Fix Seconds (0 – 59) **NOTE:** the NAV time is the time of the latitude and longitude fix.	INT16
192 – 193	Course in Degrees (0 to 359.9) Starting with protocol version 0x0C two digits of fractional degrees are stored in LSB1. Fractional portion in LSBs (Least Significant Bits). See bytes 18 – 19.	INT16
194 – 195	Speed – in Tenths of a Knot Starting with protocol version 0x0C one additional digit of fractional knot (1/100) is stored in LSB2. For an additional fractional digit, see LSB2 (bytes 20 -21).	INT16
196 – 197	Position Fix Day (1 – 366)	INT16
198 – 199	Position Fix Year	INT16

Table 2-8: Message Type 80 NMEA Navigation Data Block

BYTE OFFSETS	DESCRIPTION	SIZE
200 – 203	Milliseconds Today (Since Midnight) Use with seconds since 1970 to get time to the milliseconds (time of Ping).	UINT32
204 – 205	Maximum Absolute Value of ADC Samples in this Packet	UINT16
206 – 207	Reserved	INT16
208 – 209	Reserved	INT16
210 – 215	Sonar Software Version Number - ASCII	6 x INT8
216 – 219	Initial Spherical Correction Factor in Samples times 100. A value of -1 indicates that the spherical spreading is disabled.	INT32

BYTE OFFSETS	DESCRIPTION	SIZE
220 – 221	Packet Number Each ping starts with packet 1	UINT16
222 – 223	ADC Decimation * 100 times	INT16
224 – 225	Reserved	INT16
226 – 227	Water Temperature in Units of 1/10 Degree C. See Validity Flag (bytes 30-31).	INT16
228 – 231	Layback Distance to the sonar in meters.	FLOAT32
232 – 235	Reserved	INT32
236 – 237	Cable Out in Decimeters See Validity Flag bytes 30-31).	UINT16
238 – 239	Reserved	UINT16

Table 2-9: Message Type 80 Miscellaneous Data Block

Sonar trace data follows the 240-byte header and consists of 16 bit integer values. The number of integers to be read can be found by multiplying the number of samples in the trace (bytes 114-115) by the number of integers per sample for the data type used (1 or 2). Furthermore, doubling this yields the byte size of the data section. This should exactly match the preceding Message Header byte count (bytes 12 –15) less the header size of 240.

2.2.2 Message Type 82: Side Scan Data Message (sidescandefs.h)-Legacy

Side Scan Data Messages (Type 82) are no longer used but are described here for historical purposes. While configuring *Sonar* to generate these messages is still possible, new systems are not configured in this manner. If the user's sonar system is storing Side Scan Data Messages (Type 82), the configuration should be changed to store Sonar Data Messages (Type 80) instead.

Side Scan Data Messages (Type 82) are never stored by EdgeTech's *Discover Acquisition Program*, and are only encountered in data stored by *Sonar*. Data recorded by *Sonar* are almost always recorded in a compressed format, rendering it unusable without further processing. Please refer to the **JSF Decompression Description** for more information.

A Side Scan Data Message (Type 82) is similar to a Sonar Data Message (Type 80) as it contains the exact same acoustic data. Originally the Side Scan Data Message (Type 82) was intended for Side Scan data only but it's been used to store Sub-Bottom data as well. The system configuration determines which type of data is actually present. Each Side Scan Data Message has an 80 byte header, the content of which is defined below. As with Sonar Data Messages, unused fields should be set to 0.

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 1	Subsystem The subsystem number determines the source of data; common subsystem assignment are: Sub-Bottom (SB) = 0 Low frequency data of a dual frequency side scan = 20 High frequency data of a dual frequency side scan = 21 Very High frequency data of a tri-frequency side scan = 22 Raw Serial/UDP/TCP data = 100 Parsed Serial/UDP/TCP data = 101 Standard side scan systems are single or dual frequency. When more than two side scan frequencies are present, the subsystem number for side scan frequencies begins at 20 and increases with increasing acoustic center frequencies.	UINT16
2 – 3	Channel for a Multi-Channel Subsystem For Side Scan Subsystems: 0 = Port 1 = Starboard For Serial Ports: this is the logical port number, which often differs from physical COM Port in use. Single Channel Sub-Bottom systems channel is 0.	UINT16
4 – 7	Ping Number (increments with each ping period)	UINT32

BYTE OFFSETS	DESCRIPTION	SIZE
8 – 9	Packet Number (1..n, each ping starts with packet 1)	UINT16
10 – 11	Trigger Source (0 = internal, 1 = external)	UINT16
12 – 15	Samples in this Packet	UINT32
16 – 19	Sample Interval in Nanoseconds of Stored Data	UINT32
20 – 23	Starting Depth (window offset) in Samples	UINT32
24 – 25	Weighting Factor (defines 2 to N Volts) See Equation 3-1, page 2-8.	INT16
26 – 27	Gain Factor of ADC	UINT16
28 – 29	Maximum Absolute Value for ADC Samples for this Packet	UINT16
30 – 31	Range Setting (in decameters, meters times 10)	UINT16
32 – 33	Unique Pulse Identifier	UINT16
34 – 35	Mark Number (0 = no mark)	UINT16
36 – 37	Data Format 0 = one short per sample - envelope data the total number of bytes of data to follow is 2 * samples 1 = two shorts per sample - stored as real (one short), imaginary (one short), the total number of bytes of data to follow is 4 * samples **NOTE:** Values greater than 255 indicate that the data to follow is compressed and must be decompressed prior to use. For more detail refer to the **JSF Decompression Description** for more information.	UINT16
38	Number of Simultaneous Pulses in the Water	UINT8
39	Reserved	UINT8

Table 2-10: Message Type 82 Data Block

BYTE OFFSETS	DESCRIPTION	SIZE
40 – 43	Milliseconds Today	UINT32
44 – 45	Year	INT16
46 – 47	Day of year (1 – 366)	UINT16
48 – 49	Hour of day (0 – 23)	UINT16
50 – 51	Minute (0 – 59)	UINT16
52 – 53	Second (0 – 59)	UINT16

Table 2-11: Message Type 82 Computer Date / Time Data Block

BYTE OFFSETS	DESCRIPTION	SIZE
54 – 55	Compass Heading in Minutes (0 – 359.9) x 60	UINT16
56 – 57	Pitch (scale by 180 / 32768 to get degrees, bow up is positive)	INT16
58 – 59	Roll (scale by 180 / 32768 to get degrees, port up is positive)	INT16
60 – 61	Heave in Centimeters	INT16
62 – 63	Yaw in Minutes	INT16
64 – 67	Pressure in Units of 1/1000 PSI	UINT32
68 – 69	Temperature in Units of 1/10 of a Degree Celsius	INT16
70 – 71	Reserved	INT16
72 – 75	Altitude in Millimeters (or -1 if no valid reading)	INT32
76 – 79	Reserved	4 x UINT8

Table 2-12: Message Type 82 Auxiliary Sensor Information Block

Sonar trace data follows the 80-byte header and consists of 16 bit integer values. The number of integers to be read can be found by multiplying the number of samples in the trace (bytes 12-15) by the number of integers per sample for the data type used (1 or 2).

Furthermore, doubling this yields the byte size of the data section. This should exactly match the preceding 16 byte Message Header byte count (bytes 12 –15) less the header size of 80.

2.3 Other Messages

There are other messages contained within the JSF file other than acoustic records. For example, there are system and timestamp information messages and sometimes a padding message is also included. These structures are defined in the following subsections.

2.3.1 Message Type 182: System Information

The system information message contains details of the system used to acquire data. This message is normally present at the beginning of a JSF file, and may be repeated if configuration parameters change.

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	System Type	INT32
4 – 7	Low Rate I/O Enabled Option (0 = disabled)	INT32
8 – 11	Version Number of Sonar Software used to Generate Data	INT32
12 – 15	Number of Subsystems Present in this Message	INT32
16 – 19	Number of Serial Port Devices Present in this Message	INT32
20 – 23	Serial Number of Tow Vehicle used to Collect Data	INT32
24 – End	Reserved	

Table 2-13: Message Type 182 System Information

The size of the System Information Message is subject to change, as more detailed information may be added in future versions of the software. The byte count in the message header should be used to determine the total size of the structure and jump over to the next message in the file.

2.3.2 Message Type 426: File Timestamp Message

Timestamp messages, if present, are often found at the beginning and end of a file. They contain the following fields:

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	Time in Seconds since 1/1/1970	INT32
4 – 7	Milliseconds in the Current Second	INT32

Table 2-14: Message Type 426 File Timestamp

2.3.3 Message Type 428: File Padding Message

A file padding message is sometimes found at the end of the file. In some implementations files are padded to optimize the write process. These messages should be ignored.

2.4 Auxiliary Messages

The JSF file may also contain auxiliary data messages from various sensors depending on the configuration. These auxiliary messages are but not limited to NMEA strings, attitude records, pressure readings, Doppler Velocity Log (DVL) data, cable counter data, kilometer of pipe information, and container messages. These data blocks are described in the subsections below.

2.4.1 Message Type 2002: NMEA String

A NMEA string consists of a time stamp followed by an ASCII string as read from a GPS, Gyro, or other device. Each message is a single string excluding the <CR>/<LF>.

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	Time in Seconds since 1/1/1970	INT32
4 – 7	Milliseconds in the Current Second	INT32
8	Source 1 = Sonar 2 = Discover 3 = ETSI	UINT8
9 – 11	Reserved	3 x UINT8
12 – to Message Length	NMEA String Data	Remaining Length x INT8

Table 2-15: Message Type 2002 NMEA String

2.4.2 Message Type 2020: Pitch Roll Data

A pitch roll message consists of a single reading from a pitch roll sensor such as a Seatex MRU, TSS or OCTANS device. Not all devices provide all data for the defined structure. Use the Validity Flags to determine which fields are populated.

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	Time in Seconds since 1/1/1970	INT32
4 – 7	Milliseconds in the Current Second	INT32
8 – 11	Reserved – Do Not Use	4 x UINT8

BYTE OFFSETS	DESCRIPTION	SIZE
12 – 13	Acceleration in X Multiply by (20 * 1.5) / (32768) to get Gs	INT16
14 – 15	Acceleration in Y Multiply by (20 * 1.5) / (32768) to get Gs	INT16
16 – 17	Acceleration in Z Multiply by (20 * 1.5) / (32768) to get Gs	INT16
18 – 19	Rate Gyro in X Multiply by (500 * 1.5) / (32768) to get Degrees/Sec	INT16
20 – 21	Rate Gyro in Y Multiply by (500 * 1.5) / (32768) to get Degrees/Sec	INT16
22 – 23	Rate Gyro in Z Multiply by (500 * 1.5) / (32768) to get Degrees/Sec	INT16
24 – 25	Pitch Multiply by (180.0 / 32768.0) to get Degrees Bow up is positive	INT16
26 – 27	Roll: Multiply by (180.0 / 32768.0) to get Degrees. Port up is positive	INT16
28 – 29	Temperature in Units of 1/10 of a Degree Celsius	INT16
30 – 31	Device specific info. This is device specific info provided for Diagnostic purposes.	UINT16
32 – 33	Estimated Heave in Millimeters. Positive is Down.	INT16
34 – 35	Heading in units of 0.01 Degrees (0…360)	UINT16
36 – 39	Data Validity Flags Bit 0: Ax Bit 1: Ay Bit 2: Az Bit 3: Rx Bit 4: Ry Bit 5: Rz Bit 6: Pitch Bit 7: Roll Bit 8: Heave Bit 9: Heading Bit 10: Temperature Bit 11: Device Info Bit 12: Yaw	INT32
40 – 41	Yaw in units of 0.01 Degrees (0…360)	INT16

BYTE OFFSETS	DESCRIPTION	SIZE
42 – 43	Reserved	INT16

Table 2-16: Message Type 2020 Pitch Roll

2.4.3 Message Type 2060: Pressure Sensor Reading

This message exists in the data stream if a pressure sensor is installed on the sonar system. While pressure sensors may be configured in different units, the default is PSI absolute. Use the Validity Flags to determine which fields are populated.

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	Time in Seconds since 1/1/1970	INT32
4 – 7	Milliseconds in the Current Second	INT32
8 – 11	Reserved – Do Not Use	4 x UINT8
12 – 15	Pressure in Units of 1/1000th of a PSI	INT32
16 – 19	Temperature in Units of 1/1000th of Degree Celsius.	INT32
20 – 23	Salinity in Parts Per Million	INT32
24 – 27	Validity Data Flag: Bit 0: Pressure Bit 1: Temperature Bit 2: Salt PPM Bit 3: Conductivity Bit 4: Sound velocity Bit 5: Depth	INT32
28 – 31	Conductivity in Micro-Siemens per Centimeter	INT32
32 – 35	Velocity of Sound in Millimeters per Second	INT32
36 – 39	Depth in Meters	INT32
40 – 75	Reserved	9 x INT 32

Table 2-17: Message Type 2060 Pressure Sensor

2.4.4 Message Type 2080: Doppler Velocity Log Data (DVL)

This is data from a DVL (if fitted) and often includes velocity and altitude readings. Use the Validity Flag to determine which fields are populated.

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	Time in Seconds since 1/1/1970	INT32
4 – 7	Milliseconds in the Current Second	INT32
8 – 11	Reserved	4 x UINT8
12 – 15	Validity Data Flags : Bit 0: X, Y Velocity Present Bit 1: 0 = Earth Coordinates, 1= Ship coordinates Bit 2: Z (Vertical Velocity) Present Bit 3: X, Y Water Velocity Present Bit 4: Z (Vertical Water Velocity) Present Bit 5: Distance to Bottom Present Bit 6: Heading Present Bit 7: Pitch Present Bit 8: Roll Present Bit 9: Temperature Present Bit 10: Depth Present Bit 11: Salinity Present Bit 12: Sound Velocity Present Bit 31: Error Detected Rest : Reserved, Presently 0	UINT32
16 – 31	Four Integers: distance to bottom in centimeters for up to 4 beams. A value of 0 indicates an invalid or non-existing reading.	4 x INT32
32-33	X Velocity with Respect to the Bottom in millimeters per second. A positive value indicates Starboard or East.	INT16
34 – 35	Y Velocity with Respect to the Bottom in millimeters per second. A positive value indicates Forward or North.	INT16
36 – 37	Z Vertical Velocity with Respect to the Bottom in millimeters per second. A positive value indicates Upward.	INT16
38 – 39	X Velocity with respect to a water layer in millimeters per second. A positive value indicates Starboard or East.	INT16
40 – 41	Y Velocity with respect to a water layer in millimeters per second. A positive value indicates Forward or North.	INT16

BYTE OFFSETS	DESCRIPTION	SIZE
42 – 43	Z Vertical Velocity with respect to a water layer in millimeters per second. A positive value indicates Upward.	INT16
44 – 45	Depth from Depth Sensor in Decimeters	UINT16
46 – 47	Pitch in units of 0.01 of a Degree (-180 to +180). A positive value is Bow Up.	INT16
48 – 49	Roll in units of 0.01 of a Degree (-180 to +180). A positive value is Port Up.	INT16
50 – 51	Heading in units of 0.01 of a Degree (0 to 360)	UINT16
52 – 53	Salinity in 1 Part Per Thousand	UINT16
54 – 55	Temperature in units of 1/100 of a degree Celsius	INT16
56 – 57	Sound Velocity in Meters per Second	INT16
58 – 71	Reserved	7 x INT16

Table 2-18: Message Type 2080 DVL

2.4.5 Message Type 2090: Situation Message

A situation message is a composite of several motion / position sensors. This message is not commonly used. Use the Validity Flag to determine which fields are valid. The detailed data structure is shown below:

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	Time in Seconds since 1/1/1970	INT32
4 – 7	Milliseconds in the Current Second	INT32
8 – 11	Reserved	4 x UINT8
12 – 15	Validity Data Flags: Bit 0: Microsecond Time stamp Bit 1: Latitude Bit 2: Longitude Bit 3: Depth Bit 4: Heading Bit 5: Pitch Bit 6: Roll Bit 7: X Relative Position Bit 8: Y Relative Position Bit 9: Z Relative Position	UINT32

BYTE OFFSETS	DESCRIPTION	SIZE
	Bit 10: X Velocity Bit 11: Y Velocity Bit 12: Z Velocity Bit 13: North Velocity Bit 14: East Velocity Bit 15: Down Velocity Bit 16: X Angular Rate Bit 17: Y Angular Rate Bit 18: Z Angular Rate Bit 19: X Acceleration Bit 20: Y Acceleration Bit 21: Z Acceleration Bit 22: Latitude Standard Deviation Bit 23: Longitude Standard Deviation Bit 24: Depth Standard Deviation Bit 25: Heading Standard Deviation Bit 26: Pitch Standard Deviation Bit 27: Roll Standard Deviation	
16 – 19	Reserved	4 x UINT8
20 – 27	Microsecond Timestamp Use since 12:00:00 am GMT, January 1, 1970	UINT64
28 – 35	Double float: Latitude in Degrees, North is Positive	FLOAT64
36 – 43	Double float: Longitude in Degrees, East is Positive	FLOAT64
44 – 51	Double float: Depth in Meters	FLOAT64
52 – 59	Double float: Heading in Degrees	FLOAT64
60 – 67	Double float: Pitch in Degrees, Bow up is Positive	FLOAT64
68 – 75	Double float: Roll in Degrees, Port up is Positive	FLOAT64
76 – 83	Double float: X, Forward, Relative Position in Meters, Surge	FLOAT64
84 – 91	Double float: Y, Starboard, Relative Position in meters, Sway	FLOAT64
92 – 99	Double float: Z, Downward, Relative Position in Meters, Heave	FLOAT64
100 – 107	Double float: X, Forward, Velocity in Meters per Second	FLOAT64
108 – 115	Double float: Y, Starboard, Velocity in Meters per Second	FLOAT64
116 – 123	Double float: Z, Downward, Velocity in meters per Second	FLOAT64
124 – 131	Double float: North Velocity in Meters per Second	FLOAT64
132 – 139	Double float: East Velocity in Meters per Second	FLOAT64
140 – 147	Double float: Down Velocity in Meters per Second	FLOAT64

BYTE OFFSETS	DESCRIPTION	SIZE
148 – 155	Double float: X Angular rate in Degrees per Second, Port Up is Positive	FLOAT64
156 – 163	Double float: Y Angular rate in Degrees per Second, Bow Up is Positive	FLOAT64
164 – 171	Double float: Z Angular rate in Degrees per Second, Starboard is Positive	FLOAT64
172 – 179	Double float: XX, Forward, Acceleration in Meters per Second Squared	FLOAT64
180 – 187	Double float: Y, Starboard, Acceleration in Meters per Second Squared	FLOAT64
188 – 195	Double float: Z, Downward, Acceleration in Meters per Second Squared	FLOAT64
196 – 203	Double float: Latitude Standard Deviation in Meters	FLOAT64
204 – 211	Double float: Longitude Standard Deviation in Meters	FLOAT64
212 – 219	Double float: Depth Standard Deviation in Meters	FLOAT64
220 – 227	Double float: Heading Standard Deviation in Degrees	FLOAT64
228 – 235	Double float: Pitch Standard Deviation in Degrees	FLOAT64
236 – 243	Double float: Roll Standard Deviation in Degrees	FLOAT64
244 – 275	Reserved	16 x UINT16

Table 2-19: Message Type 2090 Situation

2.4.6 Message Type 2091: Situation Comprehensive Message (Version 2)

This message contains a device header followed by a data block. The data block is a composite of several motion / position sensors. Use the Validity Flags to determine which fields are populated. The detailed data structure is shown below:

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	Time in Seconds since 1/1/1970	INT32
4 – 7	Milliseconds in the Current Second	INT32
8 – 11	Reserved	4 x UINT8
12 – 15	Validity Flag: Bit 0 : Timestamp Provided by the Source Valid Bit 1: Longitude Valid Bit 2: Latitude Valid Bit 3: Depth Valid Bit 4: Altitude Valid	UINT32

BYTE OFFSETS	DESCRIPTION	SIZE
	Bit 5: Heave Valid Bit 6: Velocity 1 & 2 Valid Bit 7: Velocity down Valid Bit 8: Pitch Valid Bit 9 : Roll Valid Bit 10: Heading Valid Bit 11: Sound Speed Valid Bit 12: Water Temperature Valid Others: Reserved, Presently 0.	
16	Velocity12 Directions (Velocity1 and Velocity2 Types): 0 = North and East, 1 = Forward and Starboard, 2 = +45 Degrees Rotated from Forward.	BYTE
17 – 19	Reserved	3 x BYTE
20 – 27	Timestamp (0.01 of a microsecond) Microsecond since 12:00:00AM GST, January 1, 1970. To get seconds since 1970 divide by 1e7)	UINT64
28 – 35	Latitude in Degree (North is Positive)	DOUBLE
36 – 43	Longitude in Degree (East is Positive)	DOUBLE
44 – 47	Depth in Meter (Below Water Surface)	FLOAT
48 – 51	Altitude in Meter (Above Seafloor)	FLOAT
52 – 55	Heave in Meter (Positive is Down)	FLOAT
56 – 59	Velocity1 in Meters per Second (North Velocity or Forward)	FLOAT
60 – 63	Velocity2 in Meters per Second (East Velocity or Starboard)	FLOAT
64 – 67	Velocity Down in Meter per Second (Down Velocity)	FLOAT
68 – 71	Pitch in Degrees (Bow up is Positive)	FLOAT
72 – 75	Roll in Degrees (Port is Positive)	FLOAT
76 – 79	Heading in Degrees (0 to 359.9)	FLOAT
80 – 83	Sound Speed in Meters per Second	FLOAT
84 – 87	Water Temperature (in Degrees Celsius)	FLOAT
88 – 99	Reserved	3 x FLOAT

Table 2-20: Message Type 2091 Situation Comprehensive

2.4.7 Message Type 2100: Cable Counter Data Message

Cable counter data message is defined by the table below.

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	Time in Seconds since 1/1/1970	INT32
4 – 7	Milliseconds in the Current Second	INT32
8 – 11	Reserved – Do Not Use	4 x UINT8
12 – 15	Cable Length in Meters	FLOAT32
16 – 19	Cable Speed in Meters per Second	FLOAT32
20 – 21	Cable Length Valid Flag (0 – Invalid)	INT16
22 – 23	Cable Speed Valid Flag (0 – Invalid)	INT16
24 – 25	Cable Counter Error (0 – No Error)	INT16
26 – 27	Cable Tension Valid Flag (0 – Invalid)	INT16
28 – 31	Cable Tension in Kilograms	FLOAT32

Table 2-21: Message Type 2100 Cable Counter

2.4.8 Message Type 2101: Kilometer of Pipe Data

Kilometer of Pipe data message is as follows:

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	Time in Seconds since 1/1/1970	INT32
4 – 7	Milliseconds in the Current Second	INT32
8	Source 1 = Sonar 2 = DISCOVER 3 = ETSI	BYTE
9 – 11	Reserved	3 x BYTE
12 – 15	Kilometer of Pipe (KP)	FLOAT
16 – 17	Flag (Valid KP Value)	INT16
18 – 19	Flag (KP Report Error)	INT16

Table 2-22: Message Type 2101 Kilometer of Pipe

2.4.9 Message Type 2111: Container Timestamp Message

Some messages contained within the JSF file may be generated by external entities then passed to the recording system in a message called a Container Message. These messages are only checked to see if their length matches that specified in the message header; no other type of validation is performed. Essentially, this message contains the receipt timestamp of the container message and should always precede the other desired message (e.g. 2111, then 2060).

BYTE OFFSETS	DESCRIPTION	SIZE
0 – 3	Time in Seconds since 1/1/1970	INT32
4 – 7	Milliseconds in the Current Second	INT32
8 – 11	Reserved	4 x UINT8

Table 2-23: Message Type 2111 Container