

Appendix B

Q-MIPS™ File Format

Isis and VISTA support a number of file formats: Q-MIPS, BAC, GAC, and XTF. Each has distinct advantages. This appendix explains the structure and use of the Q-MIPS format.

B.1 General Description

The Q-MIPS file format is perhaps the mostly widely known and used file format for VISTA and other applications capable of displaying sidescan data imagery. Q-MIPS-style data files are stored in binary format. Each data file consists of a 1024-byte file header followed by ping records. Each ping record consists of a number of imagery channels followed by a 256-byte footer record.

The following format description is current for Q-MIPS™ version 6.69, Q-MIPS/DSP™ version 1.16 and Isis™. Both Isis and TrakMap™ use this same data format. Q-MIPS and Q-MIPS/DSP are limited to four sonar channels and eight imagery channels at 1024 pixels per channel (four raw, four corrected).

Table B-5 on page -14 and Table B-6 on page -20 describe each field in the header and footer structures respectively. For specific C-language header and footer structures used by Q-MIPS (and Q-MIPS/DSP) and Isis, refer to **UPDATES.DOC** and **QMIPSFMT.H** respectively. These files are included with every software release.

B.2 Header and Footer Data

For Q-MIPS systems, you can set some of the values in the header and footer in the configurable files called **QMIPS.DAT** and **SONAR.DAT**. Refer to Appendix A of the Q-MIPS User's Manual for descriptions of these files. Isis relies on setup configurations saved in the binary **ISIS.CFG** file for many of these values. You can change many of the startup defaults loaded from the **QMIPS.DAT**, **SONARS.DAT** and **ISIS.CFG** files without quitting and re-starting the Q-MIPS or Isis program. Generally, display-related parameters can be changed on-the-fly during collection. The current destination file must be closed before changing most acquisition- and storage-related parameters from the menus.

Many other values are controlled by strings received over RS-232 serial interfaces from the navigation system and/or any serial device. Refer to Appendix E of the *Q-MIPS User's Manual* or "Serial Interfaces" (Appendix F) of this manual for descriptions of the values that can be set in this manner. Navigation telemetry values are replicated in their respective fields from ping

to ping until a new navigation string is received at the serial port. Then the values present in the string are used to update the appropriate fields in the footer. If desired, the Q-MIPS or Isis system time can be synchronized to the time indicated in the telemetry string.

All binary data are stored according to the Intel representation scheme. This is an important distinction if you plan to read or write Q-MIPS-style data using Motorola-based, MIPS-based, or SPARC-based platforms.

B.3 Imagery Data

Regardless of how many samples are collected per channel per ping, the data are decimated (or replicated) to be stored at 1024 pixels per channel per ping by Q-MIPS or the user-specified number of pings by Isis. For a discussion of available decimation methods, refer to the description of the **ch1_sampleScheme** field under the heading Channel 1 Sonar Parameters in Table B-6 on page -20.

Isis can save both 8-bit and 16-bit data in Q-MIPS format.

B.3.1 8-bit data

Each sample is an unsigned 8-bit value with a range of 0-255. Assuming that the DSP card in Isis still has a factory jumper-setting configuration, the input range is ± 5 volts. During the conversion from 16-bit to 8-bit, the sign bit is omitted. So 0-255 represents a voltage range of 0...5 volts or 0...-5 volts depending on the original input signal. Note that for side scan, the important quality to log is the *magnitude* of the signal from zero, not the actual signed voltage.

B.3.2 16-bit data

The A/D converter on the Isis DSP card samples at 18 bits, with the 16 most significant bits being available for storage. With 16 bits being saved, the entire sample is logged. Each sample is a signed value.

16 bits represent -32768 to +32767. This corresponds to an input voltage range of -5 to +5 volts. To convert a sample from the Q-MIPS file, use the following formula:

$$\text{volts} = \langle \text{sample} / 32768 \rangle \bullet 5$$

Equation B-1. Formula for converting a Q-MIPS sample to 16-bit format

Note that the actual range is actually -5 volts to +4.9998 volts.

Each pixel of imagery will require either one or two bytes of disk storage depending on whether the data are saved at 8 or 16 bits per pixel. The number of bits per pixel is specified for Q-MIPS in the QMIPS.DAT file and for Isis using the **Record Setup** command.

Isis and Q-MIPS can store imagery in any combination of raw and corrected for each of up to four analog channels. A corrected channel has had the water column removed and has been slant-range corrected so that the displayed waterfall record approximates a “map-view” of the data.

If both raw and corrected data are saved by Isis or Q-MIPS, 1024 raw pixels are saved followed by 1024 corrected pixels for each channel. All specified types for channel 1 (raw and/or corrected) are saved first. Then all types for channel 2 and so on. The complete order for up to the Q-MIPS maximum of eight imagery channels is shown below. Remember, when a channel is not present or a data type (raw or corrected) is not to be saved, it is omitted. That is, no padding is done. Fewer imagery channels results in fewer bytes stored per ping.

Table B-1. Relationship in Q-MIPS of channel to data type to location

Channel	Data Type	Read or Write	Location
CH1	RAW	Write only	Port
CH1	CORRECTED	Write or Read	Port
CH2	RAW	Write only	Starboard
CH2	CORRECTED	Write or Read	Starboard
CH3	RAW	Write only	Port or Subbottom
CH3	CORRECTED	Write or Read	Port or Subbottom
CH4	RAW	Write only	Starboard or Subbottom
CH4	CORRECTED	Write or Read	Starboard or Subbottom

Port channels are stored in pixel order (reverse chronological order) from far range to nadir and starboard channels are stored from nadir to far range (chronological order). This convention matches the left-to-right orientation for the waterfall display on the Q-MIPS high-resolution imagery display. The ping imagery data are followed by the footer for each ping.

Subbottom pings are normally received asynchronously with respect to side scan pings, down-sampled differently, and stored with the nearest side scan ping. A subbottom channel is termed the asynchronous channel and must be received on the last (highest number) channel present. The asynchronous ping rate is generally slower than the side scan ping rate so the data are replicated ping-by-ping until a new asynchronous ping is received.

When computing the size of Q-MIPS format files to estimate survey storage media requirements or throughput rates, use the equations shown in Equation B-2 on page 10 and Equation B-3 on page 10:

$$\text{BPP} = \text{NIC} \bullet \text{PPC} \bullet \left(\frac{\text{BPX}}{8} \right) + \text{PFS in bytes}$$

Equation B-2. Calculating bytes per ping

$$\text{File Size} = 1024 + (\text{NP} \bullet \text{BPP}) \text{ in bytes}$$

Equation B-3. Calculating file size using bytes per ping

where, in Equation B-3, the meaning of the variables are shown in: Table B-2.

Table B-2. Variables for calculating bytes per ping

BPP	=	Bytes per ping
NIC	=	imagery channels being saved (raw and corrected)
NP	=	number of pings stored in file
PPC	=	pixels per channel per ping (always 1024 for Q-MIPS)
PFS	=	ping footer size = 256
BPX	=	bits per pixel (user-defined as 8 or 16)

For example, a data file written by Q-MIPS with 3 pings of raw and corrected imagery for each of two sidescan channels at eight bits per pixel would be configured as follows:

Table B-3. Sample configuration illustrating file size

Size of Data in Bytes	Description
[1024]	Q-MIPS Header
[1024] [1024] [1024] [1024] [256]	Ping 1, Four channels, 1024 bytes each; Q-MIPS footer
[1024] [1024] [1024] [1024] [256]	Ping 2
[1024] [1024] [1024] [1024] [256]	Ping 3

The size all the data would occupy are 14080 bytes [(1024 x 13) + (256 x 3)].

B.4 Binary Data Representation

The Q-MIPS format header and footer structures are made up of fields in six number representation schemes or types. For each type shown in Table B-4 on page -11, the type definition from the C-language Q-MIPS source code is shown in parentheses and the range of numbers that can be represented by that type is shown in brackets.

Note: Q-MIPS and Isis will never store a 12-bit value in a 12-bit field. All sonar values are stored as 8 or 16 bit.

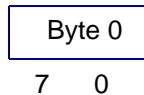
Table B-4. Data representation types for Q-MIPS™ headers and footers

Data Types	Type Definitions and Possible Range of Values
SHORT	signed, two's complement integer two bytes INT format [-32,768 to 32,767] or four bytes LONG [-2,147,483,648 to 2,147,483,647] format
USHORT	unsigned integer two bytes WORD format [0 to 65,535] or four bytes DWORD format [0 to 4,294,967,296]
FLOAT	floating point number in IEEE single precision standard four-byte format FLOAT format [-38 to 38]
DOUBLE	IEEE double precision standard eight-byte DOUBLE format [10^{-308} to 10^{308}]
CHAR	signed character one byte CHAR format [-128 to 127]; can be interpreted by ASCII code or as an 8-bit signed integer
BYTE	unsigned character one byte BYTE format [0 to 255]; can be interpreted by ASCII code or as an 8-bit unsigned integer

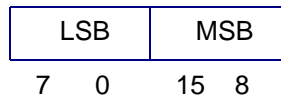
The exact byte and word ordering for each of these types and the IEEE floating point formats are described below. Any unused fields are filled with zeros, that is, each bit within the field will be a zero (as opposed to a one). The integers will return the value 0, the floating point numbers will return the value 0.0, and the characters will return the value 0 or the null character “\0” depending on how they are interpreted. In Table B-5 on page -14 and Table B-6 on page -20, which describe the complete header and footer formats respectively, one column indicates the type for each field.

The Q-MIPS format data are stored according to the Intel processor scheme for representation of numbers in memory. This is described below. If a number is represented by N bytes from most significant (MSB, Byte N-1) to least significant (LSB, Byte 0), and $N \times 8$ bits from bit $N \times 8 - 1$ (MSB) to bit 0 (LSB), the stored bytes are found in the order described below. The bits within each byte are always in order from most significant (bit 7) to least significant (bit 0). All Intel 80x86 chips are Little Endian.

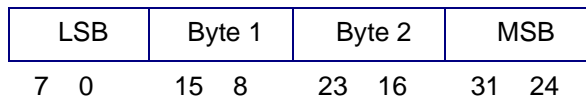
1-Byte Character



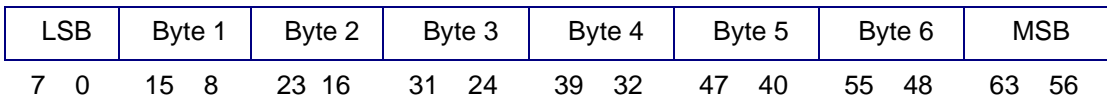
2-Byte Integer



4-Byte Number — Integer or Floating Point



8-Byte Number — Integer or Floating Point



Integer numbers are organized exactly as above, where each bit has a unique significance equal to two raised to the power equal to the number of the bit position.

Floating point numbers are represented according to the IEEE Standard floating point formats described next. The formats are described in bit order from MSB to LSB. Remember that the bytes are “out of order” as described above according to the Intel processor number representation convention.

4-Byte IEEE Floating Point Number

s	exponent	2^{-1}	2^{-2}	fraction	2^{-23}
31	30 23	22			0

$$\text{value} = (-1)^s \times 1.\text{fraction} \times 2^{\text{exponent} - 127}$$

8-Byte IEEE Floating Point Number

s	exponent	2^{-1}	2^{-2}	fraction	2^{-52}
63	62 52	51			0

$$\text{value} = (-1)^s \times 1.\text{fraction} \times 2^{\text{exponent} - 1023}$$

Table B-5 on page -14 and Table B-6 on page -20 specify the formats for the Q-MIPS header and footer structures respectively. Character fields that contain more than one byte are arrays of characters interpreted as strings of text such as the name of the sonar or the software revision. In the Q-MIPS data format, only characters are arranged in arrays. The different sizes (in bytes) of the integer and float fields indicates their different precisions as described above. In order to save space and save you some reading time, two footnote symbols have been used to represent information common to many of the fields. The symbols are defined below and appear at the bottom of each of the tables.

- † **Single dagger:** This field is for storage only and is not used in any Q-MIPS or Isis calculations.
- ‡ **Double dagger:** This field is set to the value received over the serial navigation interface (specified in navigation template) or among telemetry from various digital towfish. If a value is not received, the field remains zero.

Table B-5. Q-MIPS header format description (Sheet 1 of 6)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
Format and Revision				
0000	fileFormat	1	BYTE	50 for Q-MIPS files, 1 for old S-MIPS files.
0001	systemType	1	BYTE	0 is Q-MIPS, 84 is Q-MIPS/DSP, 202 is Isis.
0002	softwareRev	6	BYTE	Null-terminated string, e.g. "6.61\0" or "Isis" for Isis-recorded files.
0008	spare1	20	BYTE	Not currently used, all zeros.
Digitizer Parameters				
0028	sampleRate	2	USHORT	[0...750], Q-MIPS digitizing rate in ksamples/ second; not valid for Isis—set to 20.
0030	numImageryChannels	2	USHORT	[1...8], number of channels; up to 4 Q-MIPS channels, raw and/or processed; up to 4 Isis channels.
0032	bitsPerPixel	2	USHORT	[8 or 16], Q-MIPS analog data are limited by 12-bit resolution of A/D converter; Isis analog and all digital data can be 16-bit.
0034	pixelsPerChannelPerPing	2	USHORT	Always 1024 for files created by Q-MIPS; [0...65535] for Isis

Table B-5. Q-MIPS header format description (Sheet 2 of 6)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
0036	speedOfSoundInWater	4	FLOAT	Sound velocity divided by two in meters/sec loaded from QMIPS.DAT; specified with Isis Speed of Sound command; usually 750.
0040	noLongerUsed	4	FLOAT	Was initial sonar signal divisor in Q-MIPS version 5.19 and earlier. Not currently used, zeros.
0044	asyncChannelNumber	2	USHORT	[0...4] for Q-MIPS, 0 if no async channel. The async channel must be the last (highest number) channel collected; not used by Isis.
0046	numSonarChannels	2	USHORT	[1...4], number of analog sonar channels being digitized. In Q-MIPS, divide sample rate by this number to get the per-channel sampling rate.
0048	ch1_processingAvailable	2	USHORT	[0...3], indicates the presence of, and processing applied to, each of the four input channels: <ul style="list-style-type: none"> • 0: not present; • 1: raw only; • 2: corrected only; • 3: both raw and corrected.
0050	ch2_processingAvailable	2	USHORT	
0052	ch3_processingAvailable	2	USHORT	
0054	ch4_processingAvailable	2	USHORT	

Table B-5. Q-MIPS header format description (Sheet 3 of 6)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
Navigation System Parameters				
0056	navLatency ^a	2	USHORT	latency of navigation, in ms.
0058	navSystemName	100	BYTE	Not currently used, all null chars (0). Prior to version 6.00, set to SERIAL_INPUT for serial port nav. Could also be QUILS II, SONARDYNE, or NOTHING in older versions.
0158	projectionType	12	BYTE	Not currently used, all null chars (0).
0170	spheriodType	2	BYTE	Not currently used, all null chars (0).
0182	zone	2	USHORT	Not used, all zeros (was UTM zone).
0184	originLat	4	FLOAT	Origin of the local coordinate system in decimal degrees for conversion from nav system.
0188	originLong	4	FLOAT	northings and eastings to Latitude and Longitude; not currently used, all zeros.
0192	offsetLat	4	FLOAT	Offset of the local coordinate system in meters from origin; not currently used; all zeros.
0196	offsetLong	4	FLOAT	
0200	navUnits	2	USHORT	[0...3], units for nav data, 0: meters, 1: feet, 2: yards, 3: degrees (Latitude & Longitude); feet and yards are not currently used.

Table B-5. Q-MIPS header format description (Sheet 4 of 6)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
Site Parameters				
0202	diveNumber	2	USHORT	All fields in this section are currently not in use. They are all set to 0.
0204	blockNumber	2	USHORT	
0206	trackNumber	2	USHORT	
0208	runNumber	2	USHORT	
0210	spare4[100]	100	BYTE	
Annotation				
0310	operatorAnnotation	100	BYTE	Not currently used, all null chars (0).
0410	sonarName	40	BYTE	Sonar name from SONARS.DAT for Q-MIPS; "Isis Analog Server" for Isis.
Sonar Parameters				
0450	triggerDirection	2	USHORT	Sonar trigger edge direction for Q-MIPS, 1: positive-going, 0: look for level, -1: negative-going, from SONARS.DAT or Record Mode set-up; not used by Isis.
0452	triggerMagnitude	4	USHORT	Sonar trigger threshold in A/D units (2.4mV) for Q-MIPS, from SONARS.DAT or Record Mode set-up; not used by Isis.

Table B-5. Q-MIPS header format description (Sheet 5 of 6)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
0456	triggerWidth	4	FLOAT	Duration of sonar trigger in seconds for Q-MIPS, from SONARS.DAT or Record Mode set-up; not used by Isis.
0460	ch1_frequency	2	USHORT	Sonar carrier frequency in kHz from SONARS.DAT for Q-MIPS; defaults to 100 for Isis.†
0462	ch2_frequency	2	USHORT	
0464	ch3_frequency	2	USHORT	
0466	ch4_frequency	2	USHORT	
0468	ch1_horizBeamAngle	4	FLOAT	Sonar 3dB narrow beam width in degrees from SONARS.DAT. Used in mensuration and zoom display correction; not currently used by Isis.
0472	ch2_horizBeamAngle	4	FLOAT	
0476	ch3_horizBeamAngle	4	FLOAT	
0480	ch4_horizBeamAngle	4	FLOAT	
Storage File Name				
0484	thisFileName[45]	45	CHAR	Original path name of current destination file.
0529	reserved2	1	CHAR	Unused, the null character (0).
More Sonar Parameters				
0530	ch1_halfWaveRectify	2	USHORT	Boolean, 1: channel is half-wave rectified, 0: this channel is not rectified; set to 0 for Isis.
0532	ch2_halfWaveRectify	2	USHORT	
0534	ch3_halfWaveRectify	2	USHORT	
0536	ch4_halfWaveRectify	2	USHORT	

Table B-5. Q-MIPS header format description (Sheet 6 of 6)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
0538	ch1_tiltAngle	4	FLOAT	Sonar transducer tilt angle down from horizontal in degrees, from SONARS.DAT. Used in beam angle compensation; defaults to 30 for Isis
0542	ch2_tiltAngle	4	FLOAT	
0546	ch3_tiltAngle	4	FLOAT	
0550	ch4_tiltAngle	4	FLOAT	
0554	ch1_beamWidth_3dB	4	FLOAT	Sonar 3dB fan (vertical) beam width in degrees from SONARS.DAT. Used in beam angle compensation; defaults to 50 for Isis
0558	ch2_beamWidth_3dB	4	FLOAT	
0562	ch3_beamWidth_3dB	4	FLOAT	
0566	ch4_beamWidth_3dB	4	FLOAT	
0570	ch1_realSampleRate	4	FLOAT	Used in DSP only.
0574	ch2_realSampleRate	4	FLOAT	
0578	ch3_realSampleRate	4	FLOAT	
0582	ch4_realSampleRate	4	FLOAT	
Reserved Space				
0586	spare5[438]	454	BYTE	Unused; all zeros.

a. Isis version 2.14 and later

† For storage only, not used in any Q-MIPS calculations.

‡ Set to the value received from navigation system or digital towfish; otherwise zero.

Table B-6. Q-MIPS footer format description (Sheet 1 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
Date and Time				
0000	day	1	BYTE	[1...31], day of the month.
0001	month	1	BYTE	[1...12], month of the year.
0002	year	1	BYTE	[0...99], year within the century.
0003	hour	1	BYTE	[0...23], hour of the day, 24-hour time.
0004	minute	1	BYTE	[0...59], minute within the hour.
0005	seconds	1	BYTE	[0...59], seconds within the minute.
0006	thousandsSeconds	2	USHORT	[0...999], thousandths of seconds. Time is kept by Q-MIPS or Isis system clock which can be synchronized to the nav system time at each nav fix (use AB in template).
Magnetometer Readings				
0008	magX	4	FLOAT	Magnetometer reading on x, y, and z axes,
0012	magY	4	FLOAT	units are not specified, the value provided by
0016	magZ	4	FLOAT	the telemetry is stored with no conversion. †‡

Table B-6. Q-MIPS footer format description (Sheet 2 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
Ping Number, Ship Speed, Asynchronous Window Offset and Auxiliary Storage				
0020	pingNumber	4	USHORT	Ping number starts at 1 in each Q-MIPS file, 0 in each Isis file and is incremented automatically. Max = 4.29×10^9 .
0024	asyncByteOffset	2	USHORT	When non-zero in Q-MIPS, indicates the presence of a unique asynchronous ping being stored with this ping, when 0 indicates the most recent asynchronous ping (if any) is being replicated; not used by Isis
0026	shipSpeed	2	USHORT	Speed of ship in knots multiplied by 100.‡
0028	auxVal1	4	FLOAT	Auxiliary telemetry values, user-defined; displayed in Isis Sensors box. †‡
0032	auxVal2	4	FLOAT	
0036	auxVal3	4	FLOAT	
0040	auxVal5	4	FLOAT	
Digitizer Parameters				
0044	auxAltitude	4	FLOAT	Altitude in meters from subbottom sensor if provided in nav telemetry (DSP, Isis) or from bottom detect on array processor (Q-MIPS).
0048	triggerChannel	2	USHORT	[1...4], Channel on which the sonar trigger is to be detected, from QMIPS.DAT.

Table B-6. Q-MIPS footer format description (Sheet 3 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
0050	altSource	2	USHORT	Altitude source for water column removal and correction for slant range, 0: telemetry, 1-4: water column detection channel, 5: manual entry by user, set in QMIPS.DAT or by user.
0052	waterColumn	4	USHORT	Number of samples in the water column as determined from altSource.
0056	triggerPeriod	4	USHORT	Number of samples in the trigger period determined from ping to ping by Q-MIPS.
0060	ch1_signalDivisor	2	USHORT	Chan 1 signal divisor •100. Set to 1 for Isis. For Q-MIPS, raw, signed, 12-bit, digitized sample is divided by this and truncated to 8 bits for display. The sign bit is dropped. The default divisor of 8 fits the 11-bit unsigned value into an unsigned 8-bit value. Value of 1 leaves the samples unchanged.
Towfish Telemetry				
0062	telemFishDepth	4	FLOAT	Depth of sonar source below sea level in meters.‡
0066	telemFishHeading	4	FLOAT	Magnetic heading of fish in degrees.‡
0070	telemFishPitch	4	FLOAT	Fish pitch in degrees, positive nose up.‡
0074	telemFishRoll	4	FLOAT	Fish roll in degrees, positive is defined as starboard down.‡

Table B-6. Q-MIPS footer format description (Sheet 4 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
0078	telemFishAlt	4	FLOAT	Fish altitude above the sea floor in meters, from navigation telemetry or manual entry, takes precedence over auxAltitude. In Isis this is the tracked altitude.‡
0082	telemSbotAlt	4	FLOAT	Subbottom sensor altitude above the sea floor in meters. Not used by Isis.‡
0086	telemSpeedLog	4	FLOAT	Vehicle speed in meters per second from electromotive impeller speed log.‡
0090	soundVelocity	2	USHORT	One-way sound velocity multiplied by 30. Not used by Isis.‡
Channel 1 Sonar Parameters and Sampling Rate				
0092	ch1_floatRawRange	4	FLOAT	Higher resolution raw maximum slant range in meters. Used in DSP and Isis; not Q-MIPS.
0096	ch1_delayRange	4	FLOAT	Channel delay in meters, entered in Q-MIPS DIGITIZER menu in seconds and converted to meters. Not used in Isis.
0100	ch1_bandWidth	2	USHORT	Sonar channel bandwidth in kHz. Not used in Isis.‡

Table B-6. Q-MIPS footer format description (Sheet 5 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
0102	ch1_sampleScheme	2	USHORT	[1...5] For storage, digitized samples are decimated to 1024 samples per channel per ping using one of five methods defined as 1: average, 2: maximum, 3: minimum, 4: rms, or 5: none (meaning the first sample in the group to be downsampled is taken). The method is defined for each channel in QMIPS.DAT. Another parameter, <i>screen</i> downsample (0: skip, 1: average, 2: maximum, 3: minimum) is not stored but is also defined in QMIPS.DAT and may be changed from the keyboard. Set to 2 in Isis.
0104	ch1_rawRange	2	USHORT	Raw maximum slant range in meters, stored even if only processed imagery is saved, zero if channel is not present. On any asynchronous channel, this holds the async range.
0106	ch1_initialGain	1	BYTE	Initial channel gain. †‡
0107	reservedForFloatSamp	2	USHORT	Sample rate in Hz used in DSP only.
0108	ch1_gain	1	BYTE	Channel gain. †‡
0110	sampleRate	2	USHORT	Aggregate sample rate in kHz, set by user in Q-MIPS record mode setup. Not used in Isis.
0112	ch1_correctedRange	2	USHORT	Single-side range of corrected channel in meters, zero if corrected data are not saved. On any asynchronous channel, this holds the async delay in meters multiplied by 100. Not currently used in Isis.

Table B-6. Q-MIPS footer format description (Sheet 6 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
Channel 2 Sonar Parameters				
0114	ch2_floatRawRange	4	FLOAT	Higher resolution raw maximum slant range in meters. Used in DSP and Isis; not Q-MIPS.
0118	ch2_delayRange	4	FLOAT	Channel delay in meters, entered in Q-MIPS DIGITIZER menu in seconds and converted to meters. Not used in Isis.
0122	ch2_bandWidth	2	USHORT	Sonar channel bandwidth in kHz. Not used in Isis.†
0124	ch2_sampleScheme	2	USHORT	[1...5] See ch1_sampleScheme description.
0126	ch2_rawRange	2	USHORT	See ch1_rawRange description.†
0128	ch2_initialGain	1	BYTE	Initial channel gain.†‡
0129	ch2_gain	1	BYTE	Channel gain.†‡
0130	oceanTide	2	USHORT	Ocean tide in meters multiplied by 100.
0132	ch2_signalDivisor	2	USHORT	Signal divisor multiplied by 100, see under Digitizer Parameters ch1_signalDivisor.
0134	ch2_correctedRange	2	USHORT	See ch1_correctedRange description.

Table B-6. Q-MIPS footer format description (Sheet 7 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
Channel 3 Sonar Parameters and Range to Fish				
0136	ch3_floatRawRange	4	FLOAT	Higher resolution raw maximum slant range in meters. Used in DSP and Isis; not Q-MIPS.
0140	ch3_delayRange	4	FLOAT	Channel delay in meters, entered in Q-MIPS DIGITIZER menu in seconds and converted to meters.
0144	ch3_bandWidth	2	USHORT	Sonar channel bandwidth in kHz.‡
0146	ch3_sampleScheme	2	USHORT	[1...5] See ch1_sampleScheme description.
0148	ch3_rawRange	2	USHORT	See ch1_rawRange description.
0150	ch3_initialGain	1	BYTE	Initial channel gain.†‡
0151	ch3_gain	1	BYTE	Channel gain.†‡
0152	range_to_fish	2	USHORT	Distance to fish in meters multiplied by 10.‡
0154	ch3_signalDivisor	2	USHORT	Signal divisor multiplied by 100, see under Digitizer Parameters ch1_signalDivisor.
0156	ch3_correctedRange	2	USHORT	See ch1_correctedRange description

Table B-6. Q-MIPS footer format description (Sheet 8 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
Channel 4 Sonar Parameters and Bearing to Fish				
0158	ch4_floatRawRange	4	FLOAT	Higher resolution raw maximum slant range in meters. Used in DSP and Isis; not Q-MIPS.
0162	ch4_delayRange	4	FLOAT	Channel delay in meters, entered in Q-MIPS DIGITIZER menu in seconds and converted to meters. Not used in Isis.
0166	ch4_bandWidth	2	USHORT	Sonar channel bandwidth in kHz. Not used in Isis. †
0168	ch4_sampleScheme	2	USHORT	[1...5] See ch1_sampleScheme description.
0170	ch4_rawRange	2	USHORT	See ch1_rawRange description.
0172	ch4_initialGain	1	BYTE	Initial channel gain. † ‡
0173	ch4_gain	1	BYTE	Channel gain. † ‡
0174	bearing_to_fish	2	USHORT	Bearing to fish in degrees multiplied by 100. ‡
0176	ch4_signalDivisor	2	USHORT	Signal divisor multiplied by 100, see under Digitizer Parameters ch1_signalDivisor.
0178	ch4_correctedRange	2	USHORT	See ch1_correctedRange description.

Table B-6. Q-MIPS footer format description (Sheet 9 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
Nav System Parameters and Additional Fish Telemetry				
0180	waterTemperature	2	USHORT	CTD water temperature frequency times 100. ††
0182	currentLineIdentifier	2	SHORT	Number or tag for current survey line. ††
0184	eventNumber	2	SHORT	Last unique event or contact number; corresponds to contacts file in Q-MIPS.
0186	auxVal6	4	FLOAT	Auxiliary telemetry value, user-defined; displayed in Isis Sensors box. ††
0190	shipLatitude	8	DOUBLE	Ship's latitude in decimal degrees. ††
0198	shipLongitude	8	DOUBLE	Ship's longitude in decimal degrees. ††
0206	navEasting	4	FLOAT	Computed fish position in meters if navUnits are m. When the navUnits are degrees, the navEasting and navNorthing fields are combined into one double-precision floating point value to hold navLatitude.
0210	navNorthing	4	FLOAT	
0214	cableTension	4	FLOAT	Cable tension in from serial port. ††
0218	conductivity	4	FLOAT	CTD Conductivity frequency. ††
0222	navFishHeading	4	FLOAT	For backward compatibility with S-MIPS files only. All zeros. Not currently used.

Table B-6. Q-MIPS footer format description (Sheet 10 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
0226	navFishSpeed	4	FLOAT	Fish speed in knots from nav telemetry or computed from navigation telemetry N and E velocities, used in imagery display calculations. If speed is not available from navigation telemetry, navFishSpeed is set to shipSpeed or calculated from point-to-point towfish position.
0230	navShipGyro	4	FLOAT	Ship's heading in degrees displayed on status monitor. ^{††}
0234	auxVal4	4	FLOAT	Auxiliary telemetry value, user-defined; displayed in Isis Sensors box. ^{††}
0238	navLongitude	8	DOUBLE	Computed fish position in decimal degrees if navUnits are degrees, otherwise zero.
0246	fishLayback	2	USHORT	Towfish layback (horizontal distance) in meters from navigation telemetry or manual entry, used in position calculations.
0248	navFixHour	1	BYTE	
0249	navFixMinute	1	BYTE	Time of the most recent navigation fix.
0250	navFixSeconds	1	BYTE	
0251	relativeBearingToFish	1	CHAR	Bearing to towfish in integral degrees off ship's course, ship to fish straight back is 000, to starboard is -090; calculated and stored only when you have entered a non-zero layback and a lateral offset (Veeder Root). Used in position calculations when non-zero. Not used in Isis.

Table B-6. Q-MIPS footer format description (Sheet 11 of 11)

Offset	Element Name	Bytes Used	Value Type	Remarks, Values, Ranges, Units, Examples, etc.
0252	julianDay	2	USHORT	Number of days since the first of the year, since Q-MIPS v5.18. Month and day are calculated from this value.†
0254	cableOut	2	USHORT	Cable out in meters from navigation telemetry, manual entry or computed as a percentage of telemetered fish layback.†

† For storage only, not used in any Q-MIPS calculations.

‡ Set to the value received from navigation system or digital towfish; otherwise zero.