9 DATAGRAM FORMATS

9.1 Introduction

The communication between the EM multibeam echo sounder and external devices is performed through an interchange of *datagrams*. These datagrams are described in this document.

The following datagram types are included:

- Output datagrams
  Datagrams generated by the echo sounder.
- Position input
  Data received from external positioning systems.
- External clock input
  Data received from external timing generators.
- Sound speed input
  Measured data uploaded from a sound speed profile probe or sound speed profiles prepared on an external computer.
- Remote request input

9.2 Description of the datagrams

The message part of the datagram is divided into several data fields, each consisting of one or more data bytes. The message part is described according to this form:

Description	Res	Units	Format	Bytes		Valid range	Note
				#	Σ		

Message contents and definitions

- **Description** – Short-form description of a data field.
- **Res** – Resolution
- **Units**

  Defines how to interpret the contents of a data field. The contents are described either by function or by units of measurement. A field may contain one or more units.

- **Format**

  Defines the coding of each unit. Two coding methods are used: *ASCII* and *Binary*.

Note !

This document uses a number and a lower case h to describe a hexadecimal value.
Example: 02h is equal to 2 in hexadecimal representation.

- **ASCII** (American Standard Code for Information Interchange)

  √ **Byte ordering**

  ASCII values are transmitted with the most significant byte first, for example.:

  Transmitted value 1234 = 31h32h33h34h

  Byte 1: 31h
  Byte 2: 32h
  Byte 3: 33h
  Byte 4: 34h

  √ **Signed / unsigned values**

  ASCII numeric values may be signed or unsigned. A signed value has a + (positive) or a – (negative) in its first byte. The value is signed if the table field *valid range* includes both positive and negative values.

  √ **Decimals**

  ASCII numeric values may be with or without decimals. The decimal point may be included or a decimal point may be implied by the format description.

- **Binary**

  √ **Byte ordering**

  Binary values are transmitted with the least significant byte first, for example:

  Transmitted value: 1234 = 04D2h

  Byte 1: D2h
  Byte 2: 04h

  √ **Signed / unsigned values**

  Binary values may be signed or unsigned. A signed negative value is given in two's complement representation. Unsigned values may use all bits for positive representation of a number. The value is signed if the field *valid range* includes both positive and negative values.

- **Bytes**

  The bytes field gives the number of bytes for one unit in the column marked #, and the total number of bytes for a field in the column marked Σ.

- **Valid range**

  The valid range field defines a unit's valid range in the format defined by the *format* field. Text enclosed by <> is used for describing the contents and not the actual value (i.e. <TEXT> is a text string consisting of any character in the current format). ␣ is used as notation for a space.

- **Note**

  Corresponds to notes applicable to the table, which you will find listed directly below the table.

9.3 Output datagrams

Introduction

The data generated by the EM multibeam echo sounders are transmitted in a stream of individual *datagrams* to a logging system. Each datagram is described in this document.

The datagrams may be logged on internal or external logging systems.

The different datagrams are:

- Start datagram
- Stop datagram
- Parameter datagram
- Position datagrams
- Sound speed profile datagram
- Depth datagrams
- Sonar Image amplitude datagram
- Sonar Image amplitude and phase datagram
- Amplitude datagram
- Heave datagram

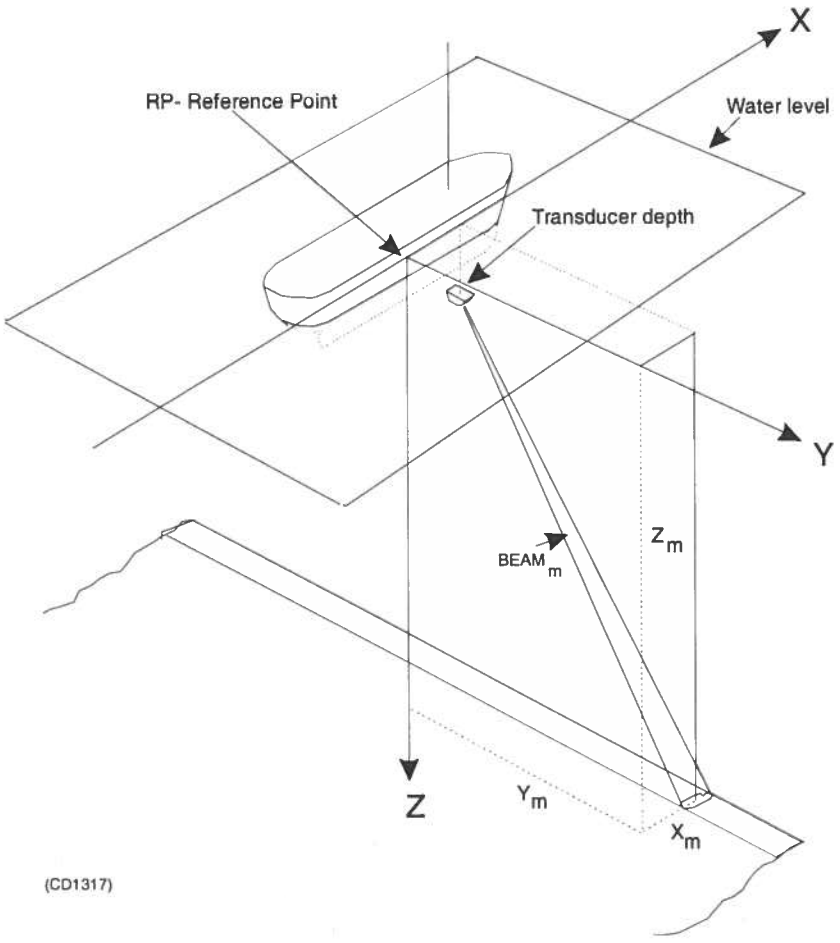
All EM multibeam output datagrams have the following structure:

Byte 1:	STX	02h
Byte 2:	Message type	xxh
Byte 3 to (n+2): ...	Message	n*xxh
Byte (n+3):	ETX	03h
Byte (n+4):	LSB of checksum	xxh
Byte (n+5):	MSB of checksum	xxh

The various datagrams are identified by the datagram type. The amount of data in a datagram and its meaning is defined by this type. The *checksum* is the arithmetic sum of all "n" data bytes (from and including byte 3 to and including byte (n+2)).

Datagrams are time tagged with the echo sounder clock unless otherwise noted.

The coordinate system used is shown in the figure on page 171. The horizontal origo is at the positioning system's reference point and vertically it is at the water line. The coordinate system is right-handed with respect to angular rotation direction except regarding the EM 100.



Start, Stop and Parameter output

Note !

The contents of the start, stop and parameter datagrams are identical; only the message type distinguishes the different datagrams.

- Message type:
  - 85h (Start)
  - 86h (Stop)
  - 87h (Parameter)
- Number of data bytes: 421

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Date	1 1 1 –	DD–days MM–months YY–years field separator	ASCII ASCII ASCII ASCII	2 2 2 1	7	1 – 31 1 – 12 0 – 99 ,	
Time	1 1 1 0.01 –	HH–hours MM–minutes SS–seconds hh–seconds field separator	ASCII ASCII ASCII ASCII ASCII	2 2 2 2 1	9	0 – 23 0 – 59 0 – 59 0 – 99 ,	
Positioning system type	– 1 –	header system code field separator	ASCII ASCII ASCII	4 1 1	6	PIS= 0 – 9 ,	
Positioning system time delay	– 0.1 –	header seconds field separator	ASCII ASCII ASCII	4 5 1	10	PTD= ±59.9 ,	
Motion sensor roll offset	– 0.01 –	header degrees field separator	ASCII ASCII ASCII	4 5 1	10	MSR= ±9.99 ,	
Motion sensor pitch offset	– 0.01 –	header degrees field separator	ASCII ASCII ASCII	4 5 1	10	MSP= ±9.99 ,	
Motion sensor heading offset	– 0.01 –	header degrees field separator	ASCII ASCII ASCII	4 5 1	10	MSG= ±9.99 ,	
EM 100 transducer depth	– 0.1 –	header metres field separator	ASCII ASCII ASCII	8 5 1	14	EM100TD= ±99.9 ,	
EM 100 transducer fore–and–aft offset	– 0.1 –	header metres field separator	ASCII ASCII ASCII	8 5 1	14	EM100TX= ±99.9 ,	
EM 100 transducer athwartships offset	– 0.1 –	header metres field separator	ASCII ASCII ASCII	8 5 1	14	EM100TY= ±99.9 ,	
EM 12 transducer depth	– 0.1 –	header metres field separator	ASCII ASCII ASCII	7 5 1	13	EM12TD= ±99.9 ,	
EM 12 transducer fore–and–aft offset	– 0.1 –	header metres field separator	ASCII ASCII ASCII	7 5 1	13	EM12TX= ±99.9 ,	
EM 12 transducer athwartships offset	– 0.1 –	header metres field separator	ASCII ASCII ASCII	7 5 1	13	EM12TY= ±99.9 ,	

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
EM 1000/950 transducer depth	– 0.1 –	header metres field separator	ASCII ASCII ASCII	9 5 1	15	EM1000TD= ±99.9 ,	
EM 1000/950 transducer fore-and-aft offset	– 0.1 –	header metres field separator	ASCII ASCII ASCII	9 5 1	15	EM1000TX= ±99.9 ,	
EM 1000/950 transducer athwartships offset	– 0.1 –	header metres field separator	ASCII ASCII ASCII	9 5 1	15	EM1000TY= ±99.9 ,	
Spare	–	–	ASCII	80	80	spaces	
BDU software version	– – –	header annotation field separator	ASCII ASCII ASCII	4 4 1	9	BDU= 1.00 – 9.99 ,	
OPU software version	– – –	header annotation field separator	ASCII ASCII ASCII	4 4 1	9	OPU= 1.00 – 9.99 ,	
Responsible Operator	– – –	header annotation field separator	ASCII ASCII ASCII	3 8 1	12	RO= ,	
Planned line	– 1 –	header line number field separator	ASCII ASCII ASCII	13 4 1	18	PLANNED-LINE= 0-9999 ,	
Survey line	– 1 –	line header line number field separator	ASCII ASCII ASCII	12 4 1	17	SURVEY-LINE= 0 – 9999 ,	
Comment	– –	header annotation	ASCII ASCII	8 80	88	COMMENT: "Keyboard characters"	

Simrad 86 position output

Note !

This datagram must not be confused with the Simrad 86 position input datagram (described on page 192) from positioning systems. This output format will only be used if the input format is Simrad 86, Microfix or Motorola.

- Message type: 83h
- Number of data bytes: .. 28

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Time	1 1 1 0.01	HH–hours MM–minutes SS–seconds hh–seconds	ASCII ASCII ASCII ASCII	2 2 2 2	8	0 – 23 0 – 59 0 – 59 0 – 99	
Ship's position UTM Northing UTM Easting	 0.1 0.1	 metres metres	 ASCII ASCII	 8 8	16	 0 – 99999999 0 – 99999999	1
Spare	–	–	binary		4	0	

Notes

1 The UTM position given by the positioning system. The data has leading zeros.

Simrad 90 position output

Note !

This datagram must not be confused with the Simrad 90 position input datagram (described on page 188) from positioning systems. This output format will be used if the input format is not Simrad 86, Microfix or Motorola.

- Message type: 93h
- Number of data bytes: .. 90

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Date	1 1 1 –	DD–days MM–months YY–years field separator	ASCII ASCII ASCII ASCII	2 2 2 1	7	1 – 31 1 – 12 0 – 99 ,	1
Time	1 1 1 0.01 –	HH–hours MM–minutes SS–seconds hh–seconds field separator	ASCII ASCII ASCII ASCII ASCII	2 2 2 2 1	9	0 – 23 0 – 59 0 – 59 0 – 99 ,	1
Latitude	1 0.0001 – –	degrees minutes North/South field separator	ASCII ASCII ASCII ASCII	2 7 1 1	11	0 – 89 0 – 59.9999 N or S ,	2
Longitude	1 0.0001 – –	degrees minutes East/West field separator	ASCII ASCII ASCII ASCII	3 7 1 1	12	0 – 179 0 – 59.9999 E or W ,	2
UTM Northing	0.1 –	metres field separator	ASCII ASCII	1 1 1	12	0 – 999999999.9 ,	2

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
UTM Easting	0.1 -	metres field separator	ASCII ASCII	9 1	10	0 - 9999999.9 ,	2
UTM zone no	1 -	zone number field separator	ASCII ASCII	2 1	3	1 - 60 ,	
UTM zone longitude	1 0.0001 - -	degrees minutes East/West field separator	ASCII ASCII ASCII ASCII	3 7 1 1	12	0 - 179 0 - 59.9999 E or W ,	2
System	1 -	- field separator	ASCII ASCII	1 1	2	0 - 2 ,	3
Q factor	1 -	- field separator	ASCII ASCII	1 1	2	0 - 9 ,	4
Speed	0.1 -	m/s field separator	ASCII ASCII	4 1	5	0 - 99.9 ,	5
Line heading	0.1	degrees	ASCII	5	5	0 - 359.9	6

Notes

1 Time of position measurement. It is the time from the echo sounder clock when the position arrives minus the positioning system time delay if time tagging has been set to internal. If set to external, the time is that provided in the position input datagram minus the time delay.

2 Position given by the positioning system. The UTM data have leading zeros. The UTM zone longitude field is valid only if East/West is set to E or W.

3 Determines the coordinate system which is valid.

0 = latitude/longitude
1 = UTM Northern hemisphere
2 = UTM Southern hemisphere

4 The Q factor may or may not be meaningful, dependent upon survey practice. If meaningful, it is related to positioning standard deviation as follows:

9 = <1 m
8 = <3 m
7 = <10 m
6 = <30 m
5 = <100 m
4 = <300 m
3 = <1000 m
2 = <3000 m
1 = <10000 m
0 = not valid position

5 The speed is usually a well filtered value giving the ship speed relative to the seabed.

6 The line heading is usually the expected heading of the survey line or it may be a filtered actual course made good.

Sound speed profile output

Note !

This datagram is used by the Operator Unit with software version 3.5x and later versions. For older sound sound profile datagrams no longer supported, see previous versions of this manual, or contact Kongsberg Simrad if a description is required.

- Message type: 9Ah
- Number of data bytes: .. 416

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Date	1 1 1	DD-days MM-months YY-years	ASCII ASCII ASCII	2 2 2	6	1 - 31 1 - 12 0 - 99	
Time	1 1 1 0.01	HH-hours MM-minutes SS-seconds hh-seconds	ASCII ASCII ASCII ASCII	2 2 2 2	8	0 - 23 0 - 59 0 - 59 0 - 99	
No. of valid values	1	-	binary	2	2	1 - 100	1
100 occurrences of: depth sound speed	 1 0.1	 metres m/s	 binary binary	 2 2	40 0	 0 - 12000 14000 - 17000	

The sound speed profile datagram is issued every time the sound speed profile is changed.

Notes

1 The sound speed profile datagram consists of 100 pairs of depth and corresponding sound speed values. The "No. of valid values" determines the number of depth and sound speed values in this table which are valid (always starting with the first pair).

EM 100 depth output

- Message type: 84h
- Number of data bytes: .. 145

Description	Res.	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Time	1 1 1 1	HH–hours MM–minutes SS–seconds hh–hundredths	ASCII ASCII ASCII ASCII	2 2 2 2	8	0 – 23 0 – 59 0 – 59 0 – 99	
32 occurrences of : depth transverse position	 0.075 0.1	 metres metres	 binary binary	 2 2	128	 0 – 65535 –32768 – 32767	
Heading	0.1	degrees	binary	2	2	0 – 3599	1
Roll angle	0.2	degrees	binary	1	1	–128 – 127	1
Pitch angle	0.1	degrees	binary	1	1	–128 – 127	1
Heave	0.1	metres	binary	1	1	–128 – 127	1
Transducer relative position	0.1	metres	binary	2	2	–32768 – 32767	6
Transducer pitch	0.1	degrees	binary	1	1	–128 – 127	4
Version	0.1	-	binary	1	1	10 – 255	7

Notes

1 Time of measurement, when the sound was transmitted into the water.

2 Alongtrack sounding position must be calculated using sounding depth, transducer pitch and transducer relative position.

3 Positive roll angles when the starboard side is above the horizontal plane.

4 Positive pitch angles when the bow is below the horizontal plane (unique definition for the EM 100). The transducer pitch is used to calculate alongtrack displacement relative to the transducer position. With a hull unit the transducer pitch is different from the vessel pitch.

5 Positive heave value when the transducer is lower than the normal horizontal level.

6 The position of the transducer fore–and–aft & relative to the reference point. Positive values when the transducer is forward of the reference point.

7 Operator Unit software version.

EM 1000 and EM 950 depth output

- Message type: 97h
- Number of data bytes: . . 692

Description	Res.	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Date	1 1 1	DD–day MM–month YY–year	ASCII ASCII ASCII	2 2 2	6	1 – 31 1 – 12 0 – 99	
Time	1 1 1 0.01	HH–hours MM–minutes SS–seconds hh–seconds	ASCII ASCII ASCII ASCII	2 2 2 2	8	0 – 23 0 – 59 0 – 59 0 – 99	
Ping number	1	–	binary	2	2	0 – 65535	11
Operational mode	1	–	binary	1	1	1 – 13	1
Ping quality factor	1	–	binary	1	1	–60 – 60	2
Depth below keel	0.02	metres	binary	2	2	0 – 65535	3
Heading	0.1	degrees	binary	2	2	0 – 3599	4
Roll angle	0.01	degrees	binary	2	2	– 2100 – 2100	4
Pitch angle	0.01	degrees	binary	2	2	– 2100 – 2100	4
Transducer pitch angle	0.01	degrees	binary	2	2	– 2100 – 2100	5
Heave	0.01	metres	binary	2	2	– 1000 – 1000	4
Sound speed	0.1	m/s	binary	2	2	14000 – 17000	6
60 occurrences of : depth acrosstrack distance alongtrack distance range reflectivity quality factor heave	 0.02 0.1 0.1 0.00005 0.5 – 0.1	 metres metres metres seconds dB – metres	 binary binary binary binary binary binary binary	 2 2 2 2 1 1 1	660	 0 – 65535 – 32768 – 32767 – 32768 – 32767 – 32768 – 32767 – 128 – 0 0 – 255 –100 – 100	 7 8 9 10

Notes

1

Mode ID	Coverage	beam spacing	pulse length	beams per ping
1	60°	equiangle	2 ms	48
2	120°		0.7 ms	48 with interlacing
3	150°		0.2 ms	60 with interlacing
4	Channel	mixed		
5	150°	equidistant		
6	140°			
7	128°			
8	120°		0.7 ms	48 with interlacing
9	104°			
10	88°			
11	70°		2 ms	48
12	Port bank	mixed	0.2 ms	60 with interlacing
13	Starboard bank			
14	75°	equidistant		

2 The ping quality factor shows the number of beams which have a sufficient echo strength to be accepted for bottom tracking and/or detection.

3 The measured depth in the most vertical beam.

4 The heading, roll, pitch, and heave are the sensor values at the ping transmit time, plus any offset values entered into the echo sounder. The heading is the reference (x-axis) for the right handed coordinate system in which alongtrack (x) and acrosstrack (y) distances and depths (z) are given. Thus:

- Roll angle is positive when the port side is above the horizontal plane.
- Pitch angle is positive when the bow is above the horizontal plane.
- Heave value is positive when the transducer is lower than its normal draft.

5 This is the transducer pitch relative to the ship coordinate system (the sum of the given ship and transducer pitch is the transducer pitch relative to the vertical).

6 The sound speed at the transducer depth, either measured or set by the operator.

7 The range is the two-way pulse travel time measured from the transducer.

8 The reflectivity is the maximum of filtered backscattering strength through each beam (corrected for sounder parameters).

9 The upper bit in the beam quality factor indicates whether amplitude (0) or phase (1) detection has been used.

- **Amplitude** – lower 6 bits indicate the number of amplitude samples used to calculate the detection point (0 – 63).
- **Phase**
  - √ the lower 6 bits are:

$$64 \frac{variance\ of\ the\ curve\ fit\ with\ phase\ versus\ time}{maximum\ limit\ allowed}$$

    The maximum limit depends on the slope of the phase curve.
  - √ the next upper bit indicates whether a first (0) or second (1) order curve fit has been used.

10 Measured at reception time in each beam.

11 Ping number is odd when interlaced beams are shifted towards port.

EM 12 depth output

- Message type:
  - 94h ..... Starboard
  - 95h ..... Port
  - 96h ..... Centre system
- Number of data bytes: 923

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Date	1 1 1	DD-day MM-month YY-year	ASCII ASCII ASCII	2 2 2	6	1 – 31 1 – 12 0 – 99	
Time	1 1 1 0.01	HH-hours MM-minutes SS-seconds hh-seconds	ASCII ASCII ASCII ASCII	2 2 2 2	8	0 – 23 0 – 59 0 – 59 0 – 99	
Ping number	1	-	binary	2	2	0 – 65535	
Resolution	1	-	binary	1	1	1 – 2	1
Ping quality factor	1	-	binary	1	1	21 – 81	2
Depth below keel	0.1/0.2	metres	binary	2	2	0 – 65535	3
Heading	0.1	degrees	binary	2	2	0 – 3599	4

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Roll angle	0.01	degrees	binary	2	2	−2100 – 2100	4
Pitch angle	0.01	degrees	binary	2	2	−2100 – 2100	4
Heave	0.01	metres	binary	2	2	−1000 – 1000	4
Sound speed	0.1	m/s	binary	2	2	14000 – 17000	5
Mode	1	–	binary	1	1	1 – 8	6
Spare	–	–	binary	1	1		
81 occurrences of :					891		
depth	0.1/0.2	metres	binary	2		0 – 65535	
acrosstrack distance	0.2/0.5	metres	binary	2		-32768 – 32767	
alongtrack distance	0.2/0.5	metres	binary	2		-32768 – 32767	
range	0.2/0.8	msec	binary	2		-32768 – 32767	7
reflectivity	0.5	dB	binary	1		-128 – 0	8
quality factor	–	–	binary	1		0 – 255	9
heave	0.1	metres	binary	1		-100 – 100	10

Notes

1 Where two resolution values are given (e.g. 0.1/0.2), this factor determines which is valid, i.e. 1 for high resolution, 2 for low.

2 The ping quality factor shows the number of beams which have accepted bottom detections.

3 The measured depth in the most vertical beam.

4 The heading, roll, pitch, and heave are the sensor values at the ping transmit time, plus any offset values entered into the echo sounder. The heading is the reference (x-axis) for the right handed coordinate system in which alongtrack (x) and acrosstrack (y) distances and depths (z) are given. Thus:

- Roll angle is positive when the port side is above the horizontal plane.
- Pitch angle is positive when the bow is above the horizontal plane.
- Heave value is positive when the transducer is lower than its normal draft.

5 The sound speed at the transducer depth, either measured or set by operator.

6

Mode ID	Coverage	Beam spacing	Pulse length
1	120° or 150°	equiangle	Short (2 ms)
2	120° or 150°		Long (10 ms)
3	120° or 150°	equidistant	Short (2 ms)
4	120° (EM 12S) 150° (EM 12D)		Long (10 ms)
5	105° single 140° dual		
6	90° single 128° dual		
7	114° dual		
8	98° dual		

7 The range is the two way pulse travel time measured from the transducer.

8 The reflectivity is the maximum of the filtered backscattering strength through each beam (corrected for echo sounder parameters).

9 The upper bit in the beam quality factor indicates whether amplitude (0) or phase (1) detection has been used.

- **Amplitude** - lower 6 bits indicate the number of amplitude samples used to calculate the detection point (0 - 63).
- **Phase**

  √ the lower 6 bits are:

  $$64 \frac{variance\ of\ the\ curve\ fit\ with\ phase\ versus\ time}{maximum\ limit\ allowed}$$

  The maximum limit depends on the slope of the phase curve.

  √ the next upper bit indicates whether a first (0) or second (1) order curve fit has been used.

10 Measured at reception time in each beam.

Sonar image amplitude output

- Message type:
  - C8h . . . . . Port side of EM 12D
  - C9h . . . . . Starboard side of EM 12D
  - CAh . . . . . EM 12S, EM 1000 and EM 950
- Number of data bytes: 551

Description	Res.	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Date	1 1 1	DD–day MM–month YY–year	ASCII ASCII ASCII	2 2 2	6	1 – 31 1 – 12 0 – 99	
Time	1 1 1 0.01	HH–hours MM–minutes SS–seconds hh–seconds	ASCII ASCII ASCII ASCII	2 2 2 2	8	0 – 23 0 – 59 0 – 59 0 – 99	
Ping number	1	–	binary	2	2	0 – 65535	
Range to normal incidence	1	ms	binary	2	2	0–32767	1
BS difference used in TVG	0.5	dB	binary	1	1	–128 – 127	11
Number of datagrams	1	–	binary	1	1	1 – 81	2
Datagram number	1	–	binary	1	1	1 – 81	3
Number of beams	1	–	binary	1	1	1 – 75	4
Number of beams occurrences of : beam number frequency samples in beam beam centre sample	 1 1 1 1	 – – – –	 binary binary binary binary	 1 1 2 2	6–450	 1 – 81 0 – 3 1 – 523 1 – 523	 5 6 7 8
Number of beams occurrences of : Number of samples in beam occurrences of : amplitude	 0.5	 dB	 binary	 1	1–523	 –128 – 0	 9
Possible occurrences of : spare	 –	 –	 binary	 1	0–522	 0	10

Notes

1 The two-way travel time to normal incidence used in the echo sounder to calculate incidence angle dependence of backscattering amplitudes. Resolution is mode- and echo sounder-dependant, but is ¼ of that used in the depth datagrams for detected beam ranges:

EM 12, shallow ..... 0.8 ms
EM 12, deep ..... 3.2 ms
EM 1000 and EM 950 ..... 0.2 ms

2 The amount of Sonar Image data for one ping may be larger than the maximum allowed in one datagram. The number of datagrams (typically 5–10) defines how many are provided with this particular ping.

3 Defines the datagram position in the datagram sequence for one ping.

4 The number of beams represented in the current datagram.

5 Defines the current beam.

6 Frequency for the current beam:

0 = 12.67 kHz
1 = 13.00 kHz
2 = 13.33 kHz
3 = 95 kHz

7 The number of samples in the current beam.

8 The sample number of the centre beam sample in the current beam, i.e. the x,y,z given in the depth datagram for this beam, is the position of this sample.

9 This table contains the amplitude data for one or more beams, as defined by the number of beams. Each beam contains a varying number of data samples, as defined by the number of samples in a beam.

10 To obtain a fixed length, the surplus of the datagram is filled with zeros.

11 The difference between the assumed backscatter coefficient at normal incidence and at oblique incidence used to "flatten" the amplitudes near normal incidence. In the second datagram of the sequence for one ping, the assumed backscatter coefficient at normal incidence is given.

Sonar image amplitude & phase output

- Message type:
  - CBh ..... Port side of EM 12D
  - CCh ..... Starboard side of EM 12D
  - CDh ..... EM 12S, EM 1000 and EM 950
- Number of data bytes: 1465

Description	Res.	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Date	1 1 1	DD–day MM–month YY–year	ASCII ASCII ASCII	2 2 2	6	1 – 31 1 – 12 0 – 99	
Time	1 1 1 0.01	HH–hours MM–minutes SS–seconds hh–seconds	ASCII ASCII ASCII ASCII	2 2 2 2	8	0 – 23 0 – 59 0 – 59 0 – 99	
Ping number	1	–	binary	2	2	0 – 65535	
Range to normal incidence	1	ms	binary	2	2	0–32767	1
BS difference used in TVG	0.5	dB	binary	1	1	–128 – 127	11
Number of datagrams	1	–	binary	1	1	1 – 81	2
Datagram number	1	–	binary	1	1	1 – 81	3
Number of beams	1	–	binary	1	1	1 – 81	4
Number of beams occurrences of :					6–486		
beam number	1	–	binary	1		1 – 81	5
frequency	1	–	binary	1		0 – 2	6
samples in beam	1	–	binary	2		1 – 479	7
beam centre sample	1	–	binary	2		1 – 479	8
Number of beams occurrences of :					3–1437		
Number of samples in beam occurrences of :							
amplitude	0.5	dB	binary	1		–128 – 0	9
phase	0.05	degrees	binary	2		– 3600 – 3600	
Possible occurrences of :					0–1434		10
spare	–	–	binary	1			

Notes

1 The two–way travel time to normal incidence used in the echo sounder to calculate incidence angle dependence of backscattering amplitudes. Resolution is mode– and echo sounder–dependant, but is ¼ of that used in the depth datagrams for detected beam ranges:

EM 12, shallow ..... 0.8 ms

EM 12, deep ..... 3.2 ms

EM 1000 and EM 950 ..... 0.2 ms

2 The amount of Sonar Image data for one ping may be larger than the maximum of one datagram. The number of datagrams (typically 5–10) defines the number of datagrams representing one ping.

3 Defines the datagram position in the datagram sequence for one ping.

4 The number of beams represented in the current datagram.

5 Defines the current beam.

6 Frequency for the current beam:

0 = 12.67 kHz
1 = 13.00 kHz
2 = 13.33 kHz
3 = 95 kHz

7 The number of samples in the current beam.

8 The sample number of the centre beam sample in the current beam, i.e. the x,y,z given in the depth datagram for this beam, is the position of this sample.

9 This table contains the amplitude and electrical phase data for one or more beams, as defined by the number of beams. Each beam contains a varying number of data samples, as defined by the number of samples in a beam.

The electrical phase (Θ) may be converted to angle of arrival relative to beam centre (Φ) and thus the position on the seabed:

$$\Phi = 0.255 \cdot \lambda / \cos \Phi_b$$

where c is the transducer sound speed, f is the beam frequency and Φ_b the beam angle relative to the perpendicular on the receiver transducer array. Thus this datagram contains all the data needed for assessment of the local acrosstrack slopes on the seabed.

The above information is valid for the EM 12. Contact Kongsberg Simrad if you require the formula valid for another EM multibeam echo sounder.

10 To obtain a fixed length, the surplus of the datagram is filled with zeros.

11 The difference between the assumed backscatter coefficient at normal incidence and at oblique incidence used to "flatten" the amplitudes near normal incidence. In the second datagram of the sequence for one ping, the assumed backscatter coefficient at normal incidence is given.

EM 100 amplitude output

Note !

This datagram is supported by Operator Unit software version 3.5x and higher.

- Message type: 89h
- Number of data bytes: . . 48

Notes

1 Refer to EM multibeam echo sounder technical system description (results of bottom detection processing chapter).

Filtered heave output

Note !

This datagram is only applicable for the EM 1000 and EM 950 multibeam echo sounders used with the Hippy 120C VRU.

- Message type: 92h
- Number of data bytes: .. 1024

Description	Res.	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Date	1 1 1	DD–day MM–month YY–year	ASCII ASCII ASCII	2 2 2	6	1 – 31 1 – 12 0 – 99	1
Time	1 1 1 0.01	HH–hours MM–minutes SS–seconds hh–seconds	ASCII ASCII ASCII ASCII	2 2 2 2	8	0 – 23 0 – 59 0 – 59 0 – 99	1
Spare	–	–	binary	8	8	–	
500 occurrences of : heave difference	0.01	metres	binary	2	1000	– 2000 – 2000	2

The delay between the measurement of the heave (unfiltered heave output) and the filtered heave output is 77.2 seconds with a Hippy 120C.

Notes

1 Time–tags the oldest sample (sample #1) of the 500 heave difference samples.

2 Equals the digitally filtered heave output minus the unfiltered heave output. The data are sampled every 0.1 second (10 Hz).

9.4 Position input

General

The EM multibeam echo sounder supports input from a range of positioning systems. This document describes the datagram formats accepted by the EM multibeam echo sounder.

Positioning datagrams are accepted on the RS–232 serial line *port P3* on the multiport connection box supplied with the Operator Unit.

Recommended serial port set-up is (except where noted):

- 1200 baud
- 8 data bits
- 1 stop bit
- no parity

This baud rate is high enough for the accuracy required and the necessary throughput, and it is low enough to avoid errors which might occur due to computer workload.

Simrad 90 position input

This input format is supported on systems with Operator Unit software version 3.1 and higher. It is the recommended format with the EM multibeam echo sounder.

Note !

This datagram must not be confused with the Simrad 90 position output datagram (described in section on page 174).

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character	–	Start of Sentence	ASCII	1	1	␣	
Address	– –	address field separator	ASCII ASCII	5 1	6	0–9 and A–Z ,	
Date	1 1 1 –	DD–days MM–months YY–years field separator	ASCII ASCII ASCII ASCII	2 2 2 1	7	1 – 31 1 – 12 0 – 99 ,	
Time	1 1 1 0.01 –	HH–hours MM–minutes SS–seconds hh–seconds field separator	ASCII ASCII ASCII ASCII ASCII	2 2 2 2 1	9	0 – 23 0 – 59 0 – 59 0 – 99 ,	
Latitude	1 0.001 – –	degrees minutes North/South field separator	ASCII ASCII ASCII ASCII	2 7 1 1	11	0 – 90 0 – 59.9999 N or S ,	
Longitude	1 0.001 – –	degrees minutes East/West field separator	ASCII ASCII ASCII ASCII	3 7 1 1	12	0 – 180 0 – 59.9999 E or W ,	
UTM Northing	0.1 –	metres field separator	ASCII ASCII	11 1	12	0 – xxxxxxxxx.x ,	
UTM Easting	0.1 –	metres field separator	ASCII ASCII	9 1	10	0 – xxxxxxx.x ,	
UTM zone no	1 –	time zone field separator	ASCII ASCII	2 1	3	1 – 60 ,	
UTM zone longitude	1 0.001 – –	degrees minutes East/West field separator	ASCII ASCII ASCII ASCII	3 7 1 1	12	0 – 180 0 – 59.9999 E or W ,	1
System	1 –	field separator	ASCII ASCII	1 1	2	0 – 2 ,	2
Q factor	1 –	– field separator	ASCII ASCII	1 1	2	0 – 9 ,	3
Speed	0.1 –	m/s field separator	ASCII ASCII	4 1	5	0 – 99.9 ,	4
Line heading	0.1 –	degrees field separator	ASCII ASCII	5 1	6	0 – 360.0 ,	5
Termination	– –	Carriage Return Line Feed	ASCII ASCII	1 1	2	0Dh 0Ah	

Notes

1 The UTM zone longitude field is only valid if East/West is set to E or W.

2 Determines which coordinate system is valid:

0 = lat./long.
1 = UTM Northern hemisphere
2 = UTM Southern hemisphere

3 The Q factor should be related to positioning standard deviation as follows:

9 = <1m
8 = <3m
7 = <10m
6 = <30m
5 = <100m
4 = <300m
3 = <1000m
2 = <3000m
1 = <10000m,
0 = not valid position

4 This speed may be used in the Quality Assurance Unit and the Sonar Imaging Unit. It should be a filtered ship speed relative to the seabed.

5 This line heading may be used in the Sonar Imaging Unit. It should be the expected survey line heading or a filtered actual course made good.

NMEA 0183 position input

The GLL datagram without time is supported on systems with Operator Unit software version 3.3 and higher. The GGA datagram is supported on systems with Operator Unit software version 3.6 and higher.

GLL format

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character	–	Start of Sentence	ASCII	1	1	␣	
Address	– – –	talker identifier sentence formatter field separator	ASCII ASCII ASCII	2 3 1	6	0–9 and A–Z GLL ,	
Latitude	1 variable –	degrees minutes field separator	ASCII ASCII ASCII	2 3–n 1	6–n	0 – 90 0 – 59.99 ,	1
Hemisphere	– –	North/South field separator	ASCII ASCII	1 1	2	N or S ,	
Longitude	1 variable –	degrees minutes field separator	ASCII ASCII ASCII	3 3–n 1	7–n	0 – 180 0 – 59.99 ,	1
Hemisphere	–	East/West	ASCII	1	1	E or W	
Checksum	– –	delimiter –	ASCII ASCII	1 2	3	*	2
Termination	– –	Carriage Return Line Feed	ASCII ASCII	1 1	2	0Dh 0Ah	

GGA format

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character	–	Start of Sentence	ASCII	1	1	␣	
Address	– – –	talker identifier sentence formatter field separator	ASCII ASCII ASCII	2 3 1	6	0–9 and A–Z GGA ,	
Time	1 1 1 – 1 –	HH–hours MM–minutes SS–seconds separator hh–hundredths field separator	ASCII ASCII ASCII ASCII ASCII ASCII	2 2 2 0–1 0–2 1	6–10	0–23 0–59 0–59 . 0–99 ,	1
Latitude	1 variable –	degrees minutes field separator	ASCII ASCII ASCII	2 3–n 1	6–n	0 – 90 0 – 59.99 ,	1
Hemisphere	– –	North/South field separator	ASCII ASCII	1 1	2	N or S ,	
Longitude	1 variable –	degrees minutes field separator	ASCII ASCII ASCII	3 3–n 1	7–n	0 – 180 0 – 59.99 ,	1

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Hemisphere	–	East/West	ASCII	1	1	E or W	
Quality indicator	1 –	– field separator	ASCII ASCII	1 1	2	0–2 ,	2
Used satellites	1 –	– field separator	ASCII ASCII	2 1	3	not limited ,	2
HDOP	variable –	– field separator	ASCII ASCII	n 1	n+1	not limited ,	2
Antenna altitude	variable – – –	metres field separator metres field separator	ASCII ASCII ASCII ASCII	n 1 1 1	n+3	not limited , M ,	2
Geoidal separation	variable – – –	metres field separator metres field separator	ASCII ASCII ASCII ASCII	n 1 1 1	n+3	not limited , M ,	2
Age of DGPS data	variable –	seconds field separator	ASCII ASCII	n 1	n+1	not limited ,	2
DGPS station ID	1	–	ASCII	4 1	5	0–1023 ,	2
Checksum	– –	delimiter –	ASCII ASCII	1 2	3	*	2
Termination	– –	Carriage Return Line Feed	ASCII ASCII	1 1	2	0Dh 0Ah	

Notes

1 The length depends on the precision available.

2 Optional; the fields are not used by the multibeam echo sounder. See NMEA 0183 manual for description.

Simrad 86 position input

Note ! *This datagram must not be confused with the Simrad 86 position output datagram (described on page 174).*

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character	–	Start of TeXt	ASCII	1	1	02h	
Message type	–	–	ASCII	1	1	41h	
Time Delay	0.01	seconds	ASCII	4	4	0 – 9999	1
Ship's position UTM Northing UTM Easting	 0.1 0.1	 metres metres	 ASCII ASCII	 8 8	16	 0 – 99999999 0 – 99999999	2

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Spare	–	–	ASCII	8	8	␣ or 0	
Stop character	–	End of TeXt	ASCII	1	1	03h	
Checksum	– –	LSB MSB	binary binary	1 1	2	0 – 65356 0 – 65356	

Notes

1 Time delay of position measurement from actual measurement until transmitted to the EM multibeam echo sounder. Leading zeros (ASCII - 30h) should be added. It is applied to the time tag of the Simrad 86 output datagram.

2 UTM positions (in dm) at the antenna or at the reference point of the positioning system. Leading zeros (ASCII – 30h) must be added.

Motorola position input

The format is in accordance with the remote x and y format from Motorola Falcon 484.

Only the position data in the datagram are used by the EM multibeam echo sounder. The 19 field separators (commas) before the position data are in accordance with the Motorola format. The remainder of the datagram has no significance except for the stop character.

Description	Res.	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character	–	Start of TeXt	ASCII	1	1	02h	
19 occurrences of : data field separator	 – –	 – separator	 ASCII ASCII	≥19 ≥0 1		 not limited ,	
Position	0.1 – 0.1	X-Coordinate separator Y-Coordinate	ASCII ASCII ASCII	3–9 1 3–9	7–19	±9999999.9 , ±9999999.9	1
Other data	–	–	ASCII		≥0	not used	
Stop character	–	End of TeXt	ASCII	1	1	03h	

Notes

1 Position coordinates are right justified and leading zeros are suppressed. Negative values are indicated with a minus.

Microfix position input

The format is according to Racal Microfix documentation.

Recommended serial port set-up:

- 9600 baud
- 7 data bits
- 2 stop bits
- even parity

The output consists of up to three lines.

The first line contains a four-digit event number, the time and the X-Y coordinates in either lat/long or UTM format.

The second and third lines contain range information, but are ignored by the EM multibeam echo sounder.

Example:

```
EVENT:1234 TIME:12-34-56 X= 1234567.8 Y= 12345678.9

12 123456.7 23 222222.4 06 123423.7 30 45333.0

08  3453.0 03  67890.5 09 45 3661.1 21  598.9
```

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Event	– 1 –	header event number field separator	ASCII ASCII ASCII	6 4 2	12	EVENT: 0 - 9999 ␣␣	
Time	– 1 – 1 – 1 –	header hours separator minutes separator seconds field separator	ASCII ASCII ASCII ASCII ASCII ASCII ASCII	5 2 1 2 1 2 2	15	TIME: 0 - 23 - 0 - 59 - 0 - 59 ␣␣	
Position	– 0.1 – – 0.1	header X-Coordinate separator header Y-Coordinate	ASCII ASCII ASCII ASCII ASCII	3 10 2 3 11	29	X=␣ 0-99999999.9 ␣␣ Y=␣ 0-999999999.9 ␣␣	1)
End of line	– –	Carriage Return Line Feed	ASCII ASCII	1 1	2	Dh Ah	
Range information	–	–	ASCII		≥0	not used	

Notes

1 The output format of the coordinates depends on the "Coords" option selected on the "CMU Set-Up" page. This option should be set to **TM GRID OUTPUT**.

Position coordinates are right justified and leading zeros are suppressed. Negative values are indicated with a minus, positive values with a space.

Thus a typical output would be:
X=␣␣␣␣␣22334.4
Y=␣␣␣1234567.8

Trimble position input

This format is only included for Kongsberg Simrad test purposes.

RWSLOD

This special format is used by Rijkswaterstaat of Holland only.

9.5 External clock input

Introduction

An external master clock may be interfaced to synchronize the internal clock of the echo sounder with external equipment. Clock synchronization is accepted on the RS-232 serial line *port P6* on the multiport connection box supplied with the Operator Unit.

Navitronic SDC-4 external clock input

This input format is supported on systems with Operator Unit software version 2.0 and higher.

Recommended serial port set-up:

- 600 baud
- 7 data bits
- 1 stop bit
- even parity

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Time	1 1 1 1	Julian day hours minutes seconds	ASCII ASCII ASCII ASCII	3 2 2 2	9	0 - 999 0 - 23 0 - 59 0 - 59	
Termination	- -	Carriage Return Line Feed	ASCII ASCII	1 1	2	Dh Ah	

WEMPE 20018 external clock input

This input format is supported on systems with Operator Unit software version 2.0 and higher.

Recommended serial port set-up:

- 600 baud
- 7 data bits
- 2 stop bits
- even parity

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character	–	Start of TeXt	ASCII	1	1	02h	
GMT time	– 1 1 1	header hours minutes seconds	ASCII ASCII ASCII ASCII	1 2 2 2	7	U 0 – 23 0 – 59 0 – 59	
GMT date	– 1 1 1	header days months years	ASCII ASCII ASCII ASCII	1 2 2 2	7	D 1 – 31 1 – 12 0 – 99	
Local time	– 1 1 1	header hours minutes seconds	ASCII ASCII ASCII ASCII	1 2 2 2	7	L 0 – 23 0 – 59 0 – 59	
Local date	– 1 1 1	header days months years	ASCII ASCII ASCII ASCII	1 2 2 2	7	D 1 – 31 1 – 12 0 – 99	
Termination	– –	Carriage Return Line Feed	ASCII ASCII	1 1	2	Dh Ah	
Stop character	–	End of TeXt	ASCII	1	1	03h	

NMEA 0183 ZDA external clock input

This input format is supported on systems with Operator Unit software version 3.1 and higher.

Recommended serial port set-up:

- 4800 baud
- 8 data bits
- 1 stop bit
- no parity

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character	–	Start of Sentence	ASCII	1	1	$	
Address	– – –	talker identifier sentence formatter field separator	ASCII ASCII ASCII	2 3 1	6	0-9 and A-Z ZDA ,	
Time	1 1 1 – 0.01 –	hours minutes seconds separator seconds field separator	ASCII ASCII ASCII ASCII ASCII ASCII	2 2 2 0–1 0–2 1	7–10	0 – 23 0 – 59 0 – 59 , 0–99 ,	

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Date	1 – 1 – 1 –	days separator months separator years field separator	ASCII ASCII ASCII ASCII ASCII ASCII	2 1 2 1 4 1	11	1 – 31 , 1 – 12 , 0 – 9999 ,	
Time zone	– 1	East/West time zone	ASCII ASCII	1 2	3	␣ or – 0 – 12	1
Termination	– –	Carriage Return Line Feed	ASCII ASCII	1 1	2	Dh Ah	

Notes

1 ␣ = West
– = East

IFREMER external clock input

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character	–	Start of Sentence	ASCII	1	1	$	
Address	– –	address field separator	ASCII ASCII	5 1	6	0–9 and A–Z ,	
Date	1 – 1 – 1 –	day separator month separator year field separator	ASCII ASCII ASCII ASCII ASCII ASCII	2 1 2 1 2 1	9	1 – 31 / 1 – 12 / 0 – 99 ,	
Time	1 – 1 – 1 – 0.1	hours separator minutes separator seconds separator seconds	ASCII ASCII ASCII ASCII ASCII ASCII ASCII	2 1 2 1 2 1 1	10	0 – 23 : 0 – 59 : 0 – 59 , 0–9	
Termination	– –	Carriage Return Line Feed	ASCII ASCII	1 1	2	Dh Ah	

Trimble external clock input

This format is for Kongsberg Simrad test purposes only.

NERC external clock input

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character	–	Start of sentence	ASCII	1	1	0Dh	
Date	1 – 1 –	YY–year separator DDD – Julian day separator	ASCII ASCII ASCII ASCII	2 1 3 1	7	0–99 : 1–366 :	
Time	1 – 1 – 1	HH – hour separator mm – minutes separator ss – seconds	ASCII ASCII ASCII ASCII ASCII	2 1 2 1 2	8	0–23 : 0–59 : 0–59	

9.6 Sound speed input

Introduction

A sound speed profile is required if the echo sounder is to give correct measurements. The sound speed profile is usually derived from a measurement through the water column, possibly supplemented by tabulated values.

The sound speed profile may be entered into the echo sounder...

- manually,
- from a sound speed profile datagram sent from an external computer,
- uploaded directly from the measuring instrument.

All the sound speed datagrams are accepted as input on the RS-232 serial line *port P5* on the multiport connection box supplied with the Operator Unit. The Simrad Binary Sound Speed Profile datagram is also accepted via Ethernet.

Simrad binary sound speed profile input

Description	Res.	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character	–	Start of TeXt	ASCII	1	1	02h	
Message type	–	–	binary	1	1	9Ah	
Date	1 1 1	DD-days MM-months YY-years	ASCII ASCII ASCII	2 2 2	6	1 – 31 1 – 12 0 – 99	
Time	1 1 1 0.01	HH-hours MM-minutes SS-seconds hh-seconds	ASCII ASCII ASCII ASCII	2 2 2 2	8	0 – 23 0 – 59 0 – 59 0 – 99	
No. of valid values	1	–	binary	2	2	1 – 100	1
100 occurrences of: depth sound speed	 1 0.1	 m m/s	 binary binary	 2 2	400	 0 – 12000 14000 – 17000	
End character	–	End of TeXt	ASCII	1	1	03h	
Checksum	– –	LSB MSB	binary binary	1 1	2	0 – 255 0 – 255	2

Notes

1 The sound speed profile datagram consists of 100 pairs of depth and corresponding sound speed values. The "No. of valid values" determines the number of depth and sound speed values which are valid in the table, starting from the first pair.

2 The checksum is calculated as for the output datagrams (described in *Introduction* on page 170).

Simrad ASCII sound speed profile input

This datagram has the same format as that used by the Simrad EA 500 Echo Sounder.

Description	Res.	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Header	– –	– separator	ASCII ASCII	2 1	3	SV ,	
Time	1 1 1 1 –	HH-hours MM-minutes SS-seconds hh-hundredths separator	ASCII ASCII ASCII ASCII ASCII	2 2 2 2 1	9	00-23 00-59 00-59 00-99 ,	
No. of values (n)	1 –	– separator	ASCII ASCII	3 1	4	␣␣1-100 ,	1, 2
n occurrences of: depth sound speed	1 – 0.1 –	metres separator m/s separator	ASCII ASCII ASCII ASCII	5 1 6 1	n*13	␣␣␣␣1-12000 , 1400.0-1600.0 ,	2
Termination	–	Carriage Return	ASCII	1	1	0Dh	

Notes

1 The sound speed profile datagram consists of up to 100 pairs of depth and corresponding sound speed values. The "No. of valid values" determines the number of depth values and sound speed values which the datagram contains .

2 Leading spaces must be used.

Navitronic SVM-1 sound speed profile input

Recommended serial port set-up:

- 9600 baud
- 8 data bits
- 1 stop bit
- no parity

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Synchronization	–	–	ASCII	5	5	######	
Start character	–	–	ASCII	1	1	%	
Sound speed	1	average value	ASCII	5	5	0 - 99999	1
n occurrences of: sound speed	1	measured value	ASCII	5	n*5	0 - 99999	1
Termination	– –	Carriage Return Line Feed	ASCII ASCII	1 1	2	Dh Ah	

Notes

1 The given value must be used in the formula below to give the sound speed value in m/s.

$SV = A - (value\ B)$ where A = 2904.12088255
B = 0.032383946756
SV= Sound speed [m/s]

A and B are constants used internally by the NAVITRONIC SVM-1.

Example:

Byte 12:	34h
Byte 13:	33h
Byte 14:	36h
Byte 15:	36h
Byte 16:	37h
Value:	43667

Sound speed: $SV = A - (43667 * B) = 1490\ m/s$

Applied Microsystems Ltd. SVP-16

The Applied Microsystems Ltd. SVP-16 sound speed profile probe is supported in two ways:

- uploading the profile directly from the probe, or by
- uploading the profile from the PC-based Total System Software (delivered by Applied Microsystems Ltd. with the probe) in the so-called CALC format

Note that the Total System Software does not have the required upload capability, so for example a standard PC communication program must be used to perform the upload. This program must transfer the sound speed profile file (extension .REL) unchanged and without adding anything.

Note !

If the file contains more than 100 pairs of depths and sound velocities, the extra points must be removed with a standard PC editor.

Note that the probe must be armed from the PC software before deployment. Calibration data for a specific probe are used by the PC software. Thus, it is recommended to upload the probe data via the PC to achieve the highest accuracy, and only upload the probe data directly to the Operator Unit in an emergency.

The CALC format is an ASCII format with a five line header plus a variable number of lines with data as follows:

Line 1: CALC, sn, date, depthincrement, depthdisplay

Line 2: AML SOUND VELOCITY PROFILER S/N: xxxxx

Line 3: DATE:xxxxx TIME:xxxxx

Line 4: DEPTH OF SET (M): xxxx.x

Line 5: DEPTH(M) VELOCITY (M/S) TEMPERATURE (°C)

In the first line, sn is the sensor serial number , date is current date taken from computer, depthincrement is logging depth increment, and depthdisplay is depth units (meters or decibars). Line 3 gives the Julian date and time at start of sensor logging, and line 4 the pressure offset at sea level. The data in the header is not used by the EM system. Each data record contains three numbers: depth in metres, sound velocity in m/s and temperature in °C (not used by the EM system), separated by a space and terminated with a linefeed (LF). The numbers must all include a decimal point (xxx.x xxxx.x xx.xLF). The data are terminated by a line with three zeros separated by two spaces (0 0 0).

9.7 Remote request input

The Operator Unit may be requested to output a specific datagram (serial port or Ethernet). The datagrams which may be requested are the Sound Speed Profile datagram and the Start, Stop and Parameter datagram (refer to Output datagrams on page 170).

Description	Res	Units	Format	Bytes #	Bytes Σ	Valid range	Note
Start character		Start of text	Binary	1	1	02h	
Request			Binary	1	1	3Fh	
Datagram type			Binary	1	1	85h, 86h, 87h, 9ah	
Stop character		End of text	Binary	1	1	03h	
Checksum		LSB MSB	Binary	1 1	2	0–FFh 0–FFh	1

Notes

1 The checksum is calculated as for the output datagrams.