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HPR 400 Binary Communication Protocol

This document describes the binary telegrams transmitted from the Operator Station in the Kongsberg Simrad HiPAP / HPR 400 systems. It also describes some of the Ascii sentences transmitted from and received by the Operator Station.

The Ascii sentences complying with the NMEA 0183 rules are described in the Kongsberg Simrad note 160045, “NMEA 0183 Sentences”.

Document revisions

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Contents

Document history

(The information on this page is for internal use)

Rev. A Original issue.
Earlier, the HPR 400 binary protocol document was distributed as an unofficial document, not included in the manuals. The last unofficial document was "Communication Protocol V2.1" - file name SWTS013.H / 94.11.17.

1 INTRODUCTION

This note is a technical documentation that may be changed. Please contact Kongsberg Simrad before implementing the reception of telegrams to assure that the note matches the SW version in the actual HiPAP / HPR system to be interfaced.

1.1 Definitions

The following abbreviations are used in this document:

APOS	Acoustic Positioning Operator Station, the "new" Operator Station.
BYTE	8 bit data
HiPAP	High Precision Acoustic Positioning
HPR	Hydroacoustic Positioning Reference system
HSC 400	HPR 400 System Controller, the "old" Operator Station.
LBL	Long Base Line
ms	Milliseconds
REAL	32 bit floating point data
REAL_64	64 bit floating point data
ROV	Remotely Operated Vehicle
SSBL	Super Short Base Line
TD	Transducer
TP	TransPonder
WORD_16	16 bit data

APOS is the new Operator Station with the Windows Man Machine Interface. It replaces the older HSC 400. All telegrams are not yet implemented in the APOS.

HPR 400 and HiPAP are two different types of transceivers. They may both be connected to either an HSC 400 or to an APOS Operator Station. In either case, the telegrams are delivered by the Operator Station, and the format is independent of the physical units involved.

Later in the note, the term **The system** means the HiPAP / HPR 400 system. The term **The Operator Station** is used as a common term for HSC 400 and APOS.

The binary telegrams and the ascii sentences are the transmitted to the Com ports and to the ethernet as specified in the configuration menus in the Operator Station. The same telegram may be configured to be sent to many, to one or to none destinations.

The following “terms” are used:

X - POSITION	Athwart ship distance to transponder, positive direction towards starboard.
Y - POSITION	Fore and Aft ship distance to transponder, positive direction forward.
Z - POSITION	The transponder depth, positive direction downwards.
SLANT RANGE	The distance to the transponder.
COURSE	Vessels heading, 0 - 360 degrees, positive direction turning clockwise.
ROLL	Vessels roll, -180 -, 0, - 180 degrees, positive direction is vessels port side up.
PITCH	Vessels pitch, -180 -, 0, - 180 degrees, positive direction is bow up.

Positive vessel y-axis is forward, positive vessel x axis is towards starboard and positive vessel z-axis is downwards. This is a left-hand coordinate system.

2 GENERAL TELEGRAM FORMAT

The binary telegrams transmitted on asynchronous serial lines follow the same general format with telegram heading and telegram tail. The contents of the data block depends on the message type, as described for each message.
The telegrams transmitted on ethernet have another heading, as described in 2.4 and 2.5.

Index	Content	Size
000	Start character	BYTE
001	Block length N	WORD_16
003	Message type	BYTE
004	Destination	BYTE
005	Data Block with N bytes	
N+5	Sumcheck	WORD_16
N+7	Stop character	BYTE

Start character The start character is 55 hex.

Block length The block length defines the length of the data block.

Message type The message type defines the message transmitted. It is a number between 1 and 255.

Destination The destination defines the device to which this telegram is transferred. It is not in use, and it is always set to 0.

Data block The data block contains the message itself.
The length N depends on the Message type. The data block for the different message types are explained in the next chapters.

Sumcheck The sumcheck is the 16 bit sum of all bytes in the telegram, except the sumcheck itself and the stop character. The sum is calculated by byte+byte addition.

Stop character The stop character is equal to 0AAH.

Note ! *The start character and the stop character are not unique. They may also occur as data within the telegram.*

2.1 Time of telegram transmission

The time delay between the end of one telegram and the start of the next one is at least 30 ms. It separates the telegrams.

2.2 The floating point data format

Both 32 bits and 64 bits floating formats are used in the telegrams. They are coded according to the IEEE standard 754. 32 bits floating numbers use the single precision data format. They are named REAL throughout the note. 64 bits floating numbers use the double precision data format. They are named REAL_64 throughout the note.

The REAL format occupies 4 contiguous bytes of memory, (32 bits).

SIGN	EXPONENT		SIGNIFICANT	
31	30	23	22	0

Sign Sign = 0 if value is positive or zero
Sign = 1 if value is negative.

Exponent The exponent field contains a value offset by 127. The actual exponent can be obtained from the exponent field by subtracting 127. The field is zero if the REAL value is zero.

Significant The byte with the lowest address contains the least significant 8 bits of the significant, and the byte in the highest address contains the sign and the 7 most significant bits of the exponent.

The REAL_64 format occupies 8 contiguous bytes of memory as shown below. The explanation of the fields is similar to the explanation for REAL, except that the exponent is biased with 1023 instead of 127.

SIGN	EXPONENT		SIGNIFICANT	
63	62	52	51	0

2.3 The serial line format

The serial line format is:

Baud rate: Selectable between 300 and 38400 baud.
The default value is 9600 baud.
Parity: none
Data bits: 8
Stop bits: 1

The least significant byte (bit 0-7) is transmitted first in both WORD_16s, REALs and REAL_64s, followed by the more significant bytes.

2.4 The ethernet format

When the telegrams are sent to external units via ethernet, they are sent as an UDP message. They can be sent as individual messages or as broadcast messages.

The telegram contains the "Message type" and the "Data Block" in addition to the UDP blocks.

Index	Content	Size
0	Message type	BYTE
1	Data block with N bytes	

The meaning of the "Message Type" and the "Data Block" is as described in the start of the chapter for the serial lines.

2.5 The Simrad ADP ethernet header

The Simrad ADP header consists of 16 bytes. They replace the message type in the normal header explained above. The Simrad ADP header is only used when explicitly requested in the Operator Station menus.

3 TELEGRAMS SENT FROM THE OPERATOR STATION

3.1 Message 1, Transponder position data

The position message telegram contains SSBL transponder position data and sensor data related to the position measurement. It is transmitted each time a new position is calculated.

Block content	**Size**
Tp_index	WORD_16
Operation_mode	BYTE
Sync_mode	BYTE
Tp_type	BYTE
Tp_operation	BYTE
Pos_data_form	BYTE
Reply_status	BYTE
Filt_X_pos	REAL
Filt_Y_pos	REAL
Filt_Z_pos	REAL
X_pos	REAL
Y_pos	REAL
Z_pos	REAL
Slant_range	REAL
P_course	REAL
P_roll	REAL
P_pitch	REAL
Td_beam	BYTE
Td_type	BYTE
Td_num	WORD_16
Diagnostic	WORD_16
Stand_dev	REAL
Instr_data (*)	REAL

Tp_index defines the Tp for which the position is valid.
It is a number from 1 to 298. The indexes below 100 are for the low frequency Tps (The Axx Tps), the indexes between 100 and 200 are for the medium frequency Tps (The Bxx Tps), and the indexes between 200 and 298 are for the high frequency Tps (The Cxx Tps).

Examples: A02 is coded with Tp_index 2.
B01 --"-- 101.
B56 --"-- 156.

Operation_mode Contains the Operation mode of the transceiver.
00 equals standard navigation mode.
01 " simulated position test mode. (Training)

Sync_mode Contains the synchronization mode of the transceiver.
0 equals No synchronization.
1 " Sequence sync.
2 " Interrogation sync.

Tp_type Defines the transponder type:
000 equals transponder
001 " depth transponder
002 " inclinometer transponder
003 " diff. incl. transponder
004 " compass transponder
005 " acoustic control transponder
006 " beacon
007 " depth beacon
010 " responder drive 1
011 " responder drive 2
012 " responder drive 3
013 " responder drive 4

Tp_operation Defines the operation mode of the transponder:
000 equals fixed standard transponder
001 " mobile -------"----------

Pos_data_form Defines the position coordinate format:
Bit 0 = 0 vessel oriented, cartesian.
Bit 0 = 1 north oriented, cartesian.
Bit 3 = 1 Ping count data valid
The coordinates are normally vessel oriented, that is bit 0 is 0.

Reply_status Defines the transponder reply status. When the whole byte is zero, the reply is ok.

Bit 0 and 1 contains information about timeouts.
Value 1 means timeout on the first pulse, value 2 means timeout on the second pulse and value 3 means timeout on the third pulse.
Bit 2 set Ambiguity error X angle.
Bit 3 set Ambiguity error Y angle.
Bit 4 set Reply rejected by the software filter.
Bit 5 set VRU or gyro error. The position is calculated with zero course and/or zero roll and pitch. The VRU and/or gyro error is reported in the DIAGNOSTIC parameter.

Filt_X_pos The filtered x - position coordinates of the transponder. Transponders horizontal athwart ship distance from reference point. A meter value in REAL format.

Filt_Y_pos The filtered y - position coordinates of the transponder. Transponders horizontal fore and aft ship distance from reference point. A meter value in REAL format.

Filt_Z_pos: (Depth) The filtered z - position coordinates of the transponder. Transponders vertical distance from reference point. A meter value in REAL format.

X_pos The raw x - position coordinates of the transponder. Transponders horizontal athwart ship distance from reference point. A meter value in REAL format.

Y_pos The raw y - position coordinates of the transponder. Transponders horizontal fore and aft ship distance from reference point. A meter value in REAL format.

Z_pos: (Depth) The raw z - position coordinates of the transponder. Transponders vertical distance from reference point. A meter value in REAL format.

Slant_range The direct raw slant range from the vessel's transducer to the transponder. A meter value in REAL format.

P_course The vessels course at the time of transponder position measurement. A value in REAL format, 0 to 360 degrees.

P_roll The vessels roll at the time of transponder position measurement. A value in REAL format, +/-180 degrees.

P_pitch The vessels pitch at the time of transponder position measurement. A value in REAL format, + / -180 degrees.

Td_beam Defines the transducer beam, 0=wide, 1=narrow.

Td_type defines the transducer type.

0	equals	30 kHz	wide beam only
1	"	30 kHz	wide / medium beam
2	"	30 kHz	wide / narrow beam
3	"	30 kHz	PMT-300, wide / wide extended baseline.
4	"	15 kHz	wide / medium
5	"	30 kHz	LBL
6	"	15 kHz	LBL
7	"	30 kHz	SSBL NMT-301
8	"	30 kHz	SSBL tracking td-er
9	"	30 kHz	HiPAP

Td_num defines the transducer number 1 to 4 used in the positioning.

Diagnostic Defines the transceiver hardware status.

Error information	Error index
15 8	7 0

The least significant byte of this WORD_16 parameter contains an index, defining one error. If there are more than one error, the index will alter between the error indexes. The most significant byte of the parameter contains additional information for the error reported by the index.

The error indexes are reserved according to the following plan:

1 to 31	General errors
32 to 63	Application specific errors
64 to 255	Debug diagnostics.

The General errors are:

1	HW reset
2	Fatal transceiver error
3	VRU error
4	Gyro error
5	External serial line error
6	Transmitter error
7	DSP error
8	Tracking td error

When the Operator unit receives an error index, it is displayed together with the additional information. The additional information is displayed as a hex number. The meaning of the

numbers is explained in the Operator's manual.

Stand_dev The expected accuracy of the position. It is based on the covariance data calculated for the SSBL position. It is equal to the statistical sum of the major and minor semiaxes of the error ellipse displayed around the position.

Instr_data (*) This is only used if any of the below cases are true:
If the message contains data from a Inclinometer transponder, (Tp_type = 2 or 3), the first two reals contain the Inclination of the transponder. The first contains X inclination and the second contains the Y inclination.
If the message contains data from a compass transponder, (Tp_type = 4), the first real in Instr_data contains the heading of the compass transponder.
If the message contains data from a depth transponder, (Tp_type = 1), the first real in Instr_data contains the depth measured by the transponder.
If bit 3 in Pos_data_form is set, the first real in Instr_data contains the ping count from the transponder with resolution million ping.
If Td_type is tracking td, the last real value contains the tracking td angle.

3.1.1 Example

Telegram:

```
55 3a 00 01 00 94 00 01 00 00 00 00 00 fc
e4 c9 42 72 46 6e c2 47 cd 80 40 bb ed c9
42 25 85 6e c2 c2 cc 8c 40 80 5b e8 42 00
00 00 00 00 00 00 00 00 00 00 00 01 01 02
00 00 00 58 5c 00 40 b0 11 aa
```

The data block of the telegram decoded:

```
 TpOmSmTtToPfSt      X         Y        Z
148 1 0 0 0 0 0   100.95    -59.57    4.03
                  100.96    -59.63    4.40

Rang   Crs Roll Pitc TbTtT#Diag  Std
116    0.0 0.00 0.00  1 1 2   0 2.01
```

3.2 Message 2, LBL position

The LBL position telegram contains a position relative to the origin of the Tp array. The position is of the vessel or of another object. The telegram is transmitted each time a new position is calculated. If the Transponder array is north oriented, the coordinates are relative to true North, else they are relative to local north.

Block content	Size
Sequence_number	WORD_16
Time_header (7)	BYTE
Interrogation_age	WORD_16
Tp_array	BYTE
Td_num	BYTE
Pos_east	REAL_64
Pos_north	REAL_64
Depth	REAL
Hor_err_ellipse_direction	REAL
Hor_err_ellipse_major	REAL
Hor_err_ellipse_minor	REAL
Z_standard_deviation	REAL
Pos_type	BYTE
Pos_status	BYTE
P_course	REAL
P_roll	REAL
P_pitch	REAL
Diagnostic	WORD_16

Sequence_number The sequence number is incremented for each LBL interrogation. It is reset each time LBL positioning is started. Range 0 - 65535.

Time_header See subchapter below.

Interrogation_age Time since interrogation of transponder array. The resolution is 1ms.

Tp_array When the LBL position is calculated in Navigation mode, it contains the Tp array number in use (1 and upwards).
When the position is calculated in Training mode, it contains 255.

Td_num Defines the transducer number in use.

1 to 4	means td 1 to 4 on transceiver	1
5 to 8	"	2
9 to 12	"	3
13 to 16	"	4

0 has a special meaning. Then the position is calculated based on measurements on more than one transducer.

Pos_east
Pos_north The East and North coordinate of the position in meters. Positive East value is towards east, and positive North value is towards north.
The coordinates are either local coordinates or global UTM coordinates.

Depth The depth coordinate in meters. Positive value is downwards. It is the vertical distance from the sea level to the reference point of the object being positioning.

Hor_err_ellipse_direction Each LBL position has an one sigma error ellipse associated with it. The direction is the angle in degrees between the north axis and the major axis of the ellipse.

Hor_err_ellipse_major The major semiaxis of the error ellipse.

Hor_err_ellipse_minor The minor semiaxis of the error ellipse.

Z_standard_deviation The standard deviation of the depth.

Pos_type

0	-	Position of the vessel
1	-	Position of ROV1
:		:
16	-	Position of ROV16
17	-	Position of TP range Position no 1
:		:
20	-	Position of TP range Position no 4

Bit 7 is 0 if the coordinates are local. It is set if the they are UTM coordinates.

Pos_status This variable tells the status of the position calculation. The statuses with an asterisk in the table below are so serious that no position is contained in the telegram.

0	Ok position.
1	The measured ranges match badly the calculated position. The range residuals are big.
2	The position calculation did converge in the horizontal plane, but not vertically.
3	The calculation of the interrogation time in MuLBL mode did not converge.
16*	Too few ranges are measured.
17*	The position calculation does not converge.
18*	Internal HPR computation error.
19*	No initial position is calculated.

P_course An average of course read at the time of pulse arrival.

P_roll An average of roll read at the time of pulse arrival.

P_pitch An average of pitch read at the time of pulse arrival.

Diagnostic See Message 1, Transponder position data.

3.2.1 Time Header

The format of the Time_header is:

Block content	Size	Index	Resolution	Range
Day	BYTE	0	1 Day	1-31
Month	BYTE	1	1 Month	1-12
Year	BYTE	2	1 Year	0-99
Hours	BYTE	3	1 Hour	0-23
Minutes	BYTE	4	1 Minute	0-59
Seconds	BYTE	5	1 Second	0-59
1/100th seconds	BYTE	6	1/100 second	0-100

It defines the clock when the position is valid.

3.2.2 Example

Telegram:

```
55 41 00 02 00 08 00 18 07 62 0d 2b 23 4a
f8 0a ff 02 7a a5 cf f8 d3 fc 68 40 3d e2
a3 fb 5d 14 59 c0 70 01 9c c0 ef b3 a8 41
ff 3a 07 3e da a1 fc 3d ca 39 18 3e 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00
50 17 aa
```

The data block of the telegram decoded:

```
Seqno ddmmyyhhmmss.hh  Age Ar Td      East
    8 240798134335,74 2808 ff  2    199.90

  North   Depth Dir Major Minor Dsigm Pt Ps
-100.32   -4.88  21  0.13  0.12  0.15  0  0

Crs  Roll Pitch Diag
0.0  0.00  0.00    0
```

3.3 Message 4, LBL Ranges

The LBL_ranges message contains raw measured ranges to the transponders, and VRU and compass data. This Message is transmitted just after the Message 2 (LBL position). The two messages have the same sequence number.

Block content	Size
Sequence_number	WORD_16
Range_age (8)	WORD_16
Tp_array	BYTE
Td_num	BYTE
Operation_mode	BYTE
Sync_mode	BYTE
Pos_type	BYTE
Reply_status (8)	BYTE
Range (8)	REAL
P_course	REAL
P_roll	REAL
P_pitch	REAL
Diagnostic	WORD_16

Range_age, reply_status and range consist of a list with 8 entries, one for each transponder.

Sequence_number The sequence number is incremented for each LBL interrogation. It is reset each time LBL positioning is turned ON. Range 0 - 65535.

Range_age Time since reception of the range. Resolution 1ms.

Tp_array When the LBL position is calculated in Navigation mode, it contains the Tp array number in use (1 and upwards).
When the position is calculated in Training mode, it contains 255.

Td_num Defines the transducer number in use.

1 to 4	means td 1 to 4 on transceiver	1
5 to 8	"	2
9 to 12	"	3
13 to 16	"	4

Operation_mode See Message 1, Transponder position data.

Sync_mode contains the synchronization mode of the transceiver.

0	equals	No synchronization.
1	"	Sequence sync.
2	"	Interrogation sync.

Pos_type

0	-	Position of the vessel
1	-	Position of ROV1
:		:
16	-	Position of ROV16
17	-	Position of TP range Position no 1
:		:
20	-	Position of TP range Position no 4

Reply_status_n Defines the reply status. When bit 0 to 5 are zero, the measurement is OK.

Bit 0 and 1 contains information about timeouts.
Value 1 means timeout on the first pulse, value 2 means timeout on the second pulse and value 3 means timeout on the third pulse.

Bit 2 set Ambiguity error or angle rejected X angle.
Bit 3 set Ambiguity error or angle rejected Y angle.
Bit 4 set Range rejected by the software filter.
Bit 5 set Vru or gyro error. The position is calculated with zero course and/or zero roll and pitch. The VRU and/or gyro error is reported in the DIAGNOSTIC parameter.

Bit 6 and 7 contain information about what is measured. The contents of the two bits are either 00 (no measurement), 80H (only the range is measured) or C0H (both the range and the directions are measured).

Bit 7 set The range is measured OK.
Bit 6 set The SSBL directions are measured OK.

Range_n The measured range to the transponders.

P_course An average of course read at the time of pulse arrival.

P_roll An average of roll read at the time of pulse arrival.

P_pitch An average of pitch read at the time of pulse arrival.

Diagnostic See Message 1, Transponder position data.

3.4 Message 5, Location data

Location data contains information about a transponder location including the result from the last calibration calculation. The telegram is transmitted on request. There is one telegram for each location in use.

Block content	Size
Location	BYTE
Serial_no	WORD_16
Tp_index	WORD_16
Init_east	REAL_64
Init_north	REAL_64
Init_depth	REAL
Init_ell_dir	REAL
Init_ell_major	REAL
Init_ell_minor	REAL
Init_depth_StdDev	REAL
Cal_status	BYTE
Cal_east	REAL_64
Cal_north	REAL_64
Cal_depth	REAL
Cal_ell_dir	REAL
Cal_ell_major	REAL
Cal_ell_minor	REAL
Cal_depth_StdDev	REAL

Location Defines the location number for which the telegram contains data. On the HSC 400 Operator Station, it is a number between 1 and 99.

Serial_no Each transponder has a unique serial number, which is defined in this parameter. Serial number 0 means that the transponder is not in use in the array.

Tp_index See message 1, Transponder position data.

Init_east
Init_north
Init_depth Contain the initial position of the transponder.

Init_ell_dir
Init_ell_major
Init_ell_minor Contain the direction, major axis and minor axis of the 1 error ellipse around the calibrated Tp position when the Cal_status is 1.

Init_depth_StdDev Contains the standard deviation of the calibrated depth.

Cal_status Tells whether the transponder position is calibrated or not. 0 means not calibrated, 1 means calibrated.

Cal_east
Cal_north
Cal_depth Contain the calibrated position of the transponder when the Cal_status is 1.

Cal_ell_dir
Cal_ell_major
Cal_ell_minor Contain the direction, major axis and minor axis of the 1 error ellipse around the calibrated Tp position when the Cal_status is 1.

Cal_depth_StdDev Contains the standard deviation of the calibrated depth.

3.5 Message 6, Base_lengths

Base_lengths contains a measured baselength and the standard deviation. It is transmitted for each baseline that is measured. The telegram is transmitted on request.

Block content	Size
Tp_array	BYTE
Master_loc	BYTE
Slave_loc	BYTE
Status	BYTE
No_of_measures	BYTE
Base_length	REAL
StandardDev	REAL
Propagation_time	REAL

Tp_array The Tp array in which the baseline is measured.

Master_loc The location number of the master location.

Slave_loc The location number of the slave location.

Status Contains the status of the baselength measurement in the telegram.

- 1 means that the measurement is in use.
- 2 means that the measurement is excluded.
- 128 means that the baselength in the telegram is the statistical combination of many measurements.

No_of_measures The number of measurements on which the Base Length and the Standard deviation is calculated.

Base_length The actual distance from the master to the slave.

StandardDev The standard deviation is zero when the No_of_measurements is 1. When the Status is 1 or 2 and the No_of_measurements is bigger than, 1 the telegram contains the mean value based on a set of measurements done by the transponder in the Master location. Then the standard deviation is calculated by the transponder, and is the standard deviation of the measurements. When the Status is 128, the standard deviation is the standard deviation of the total set of measurements. Then the standard deviation of the measurements is divided with the square root of No_of_measurements.

Propagation_time The propagation time in seconds for the acoustic pulse from the Master to the Slave location. This value is the one measured. The Base_length is calculated by using this value and the actual sound velocity profile.
The baseline may derive from another source than an acoustic measurement. Then the propagation time is 0.0 s.

3.6 Syledis STR4 telegram

The format of the ascii string is:

Ysyyyyyyy.y_Xsxxxxxxx.x_<cr><lf>

where s is the sign (+ or -), yyyyyyy.y is the northing, xxxxxxx.x is the easting, and _ is space.
The coordinates are sent with leading zeros, and the sign is always sent.

The telegram is transmitted each time a new LBL position is calculated.

3.6.1 Example

The LBL position has north coordinate equal to -59.1 m and east coordinate equal to 99.9 m. The asci sentence is:

```
Y-0000059.1 X+0000099.9
```

4 TELEGRAMS RECEIVED BY THE OPERATOR STATION

4.1 Depth telegrams

A depth telegram is sent from a depth sensor to the Operator Unit. The depth may be used for a transponder positioned in SSBL or for an ROV positioned in LBL. The format is 8 databits and no parity. The baudrate is selected in a menu in the Operator Unit. The electrical format is decided by the COM port pcb, and it may be either Current loop, RS232 or RS422
The following depth telegrams are implemented:

4.1.1 Ulvertech format

The telegram contains the depth and the altitude. The altitude is not used by the Operator Unit. The depth is in either m or cm. The telegram format is the same. The resolution is set in the Operator Unit menus, which, of course, must match the settings in the depth sensor. The format is ascii.

Content	**Explanation**
Depth	The depth in metres or centimetres. The decimal point and the associated decimal-fraction are optional. The max number of characters is 10.
,	Separator.
Altitude	The altitude. The decimal point and the associated decimal-fraction are optional. The max number of characters is 10.
<CR><LF>	Carriage return and line feed as terminator.

As an example, the telegram **45.78,23.4<CR><LF>** contains the depth 45.78 m or 45.78 cm.

The choice between the m and cm format is selectable in the menus in the Operator Station.

4.1.2 Subsea offshore format

The telegram contains the depth. It is in either m or cm. The telegram format is the same. The resolution is set in the Operator Unit menus, which, of course, must match the settings in the depth sensor. The format is ascii.

Content	Explanation
space	The first character is an ascii space.
00	The next two characters are ascii 0.
,	Separator.
xxx	The depth coded with 3 hexadecimal digits. The hex digits a to f may be in either upper case or in lower case. 800 means zero. Hex values greater than 800 is coded as positive values. FFF means + 2047 m or cm.
<CR><LF>	Carriage return and line feed as terminator.

As an example, the telegram **00,900<CR><LF>** contains the depth 256 m or cm.