

**Lars Thrane A/S**  
**Tracking Protocol Simplified**

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**Revision history**

Rev.	Date	Section	Description / Remarks	Initials
1.02	2020-12-09	1, 3	Fix error in Table 3 ("43h" -> "C3h") Tracking can now be disabled (CQ, CA)	KK
1.01	2019-04-16	3	Remote Management (CQ, CA, RQ, RA, TQ messages)	KK
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**Table of Contents**

1 Position Report - Binary..... 3

2 Position Report - Text..... 8

3 Remote Management..... 10

3.1 Message format..... 10

3.2 Tracking Configuration ..... 11

3.3 Requesting Position Report ..... 13

3.4 Trigger Position Report..... 15

**List of Figures**

Figure 1 Position Report Binary message definition ..... 3

Figure 2 Position Report Text encoding example..... 8

Figure 3 NULL value example ..... 8

**List of Tables**

Table 1 Position Report Binary field description ..... 4

Table 2 Position Report Binary field encoding ..... 6

Table 3 Position Report Binary encoding example..... 7

Table 4 Position Report Binary decoding example..... 7

Table 5 Position Report Text message definition ..... 9

Table 6 Message header definition ..... 10

Table 7 Tracking message types ..... 10

Table 8 CQ and CA and message body definition..... 12

Table 9 CQ message encoding example ..... 12

Table 10 RQ message body definition ..... 14

Table 11 RQ message encoding example 1 ..... 14

Table 12 RQ message encoding example 2 ..... 14

Table 13 TQ message encoding example ..... 15

## 1 Position Report - Binary

The binary version of the Position Report is designed to fit into the SBD minimum billable message size of 10 bytes but can be extended to increase data resolution and carry additional information (for future use).

**The receiver must be able to receive binary encoded Position Reports of sizes larger than 10 bytes. If a Position Report contains more than 10 bytes, the extra bytes must be ignored by the receiver.**

The bit positions within a byte is counted least significant bit from 0 to most significant bit 7. Fields spanning multiple bytes are encoded big-endian (most significant byte first).

Below is the binary encoding of the Position Report.

7	6	5	4	3	2	1	0		
Reserved (1b)	GNSS Flag	Time [22-17]						0	
Time [16-9]								1	
Time [8-1]								2	
Time [0]	N/S	Latitude [17-12]						3	
Latitude [11-4]								4	
Latitude [3-0]				E/W	Longitude [18-16]				5
Longitude [15-8]								6	
Longitude [7-0]								7	
COG								8	
SOG								9	
Extension(s)								10	
								...	
								N	

Figure 1 Position Report Binary message definition

**Lars Thrane A/S**  
**Tracking Protocol Simplified**

Name	Description
Reserved	This bit is reserved for future use. It must be encoded 1b.  If 0b is received, the message is not a valid binary Position Report and must be ignored by the receiver.
GNSS Flag	Indicates precision (quality) of the GNSS data. The precision can be either Good or Bad.  The precision is deemed Good when having 3D fix and the horizontal accuracy is within 50 meters.
Time	Time when data was sampled, and Position Report generated.
N/S	Latitude North / South indication.
Latitude	Latitude in WGS84.
E/W	Longitude East / West indication.
Longitude	Longitude in WGS84.
COG	Course Over Ground.
SOG	Speed Over Ground.
Extension	Zero or more bytes. Must be ignored by the receiver.

*Table 1 Position Report Binary field description*

**Lars Thrane A/S**  
**Tracking Protocol Simplified**

Name	Size	Unit	Description
GNSS Flag	1 bit	N/A	Precision (quality) of GNSS data.  0b = Good  1b = Bad
Time	23 bit	60 s	Unsigned integer representing minutes since UTC 2018-01-01T00:00:00Z not accounting for leap seconds (a day always contain 86400 seconds).  The value 7FFFFFFh indicates time is unknown.  Conversion to Unix time: Unix time = 1514764800 + (Time * 60)  The time will wrap at 2033-12-13T10:06:00Z.
N/S	1 bit	N/A	0b = North  1b = South  This bit shall be ignored by the receiver if position is unknown.
Latitude	18 bit	$\frac{3}{8738}$ deg	Unsigned integer representing $\frac{3}{8738}$ fractions of a degree from 0 to 90 degrees. This gives a precision better than 38.2 meters.  The range 3FFFDh to 3FFFEh is reserved.  The value 3FFFFh indicates position is unknown.
E/W	1 bit	N/A	0b = East  1b = West  This bit shall be ignored by the receiver if position is unknown.
Longitude	19 bit	$\frac{3}{8738}$ deg	Unsigned integer representing $\frac{3}{8738}$ fractions of a degree from 0 to 180 degrees. This gives a precision better than 38.2 meters.  The range 7FFF9h to 7FFFEh is reserved.  The value 7FFFFh indicates position is unknown.
COG	8 bit	$\frac{3}{2}$ deg	Unsigned integer representing 0.0 to 358.5 degrees in steps of 1.5 degree.  The range F0h to FEh is reserved.  The value FFh indicates COG is unknown.
SOG	8 bit	$\frac{1}{5}$ knot	Unsigned integer representing 0.0 to 50.6 knots in steps of 0.2 knots.

**Lars Thrane A/S**  
**Tracking Protocol Simplified**

			The value FEh indicates SOG is $\geq 50.8$ knots. The value FFh indicates SOG is unknown.
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*Table 2 Position Report Binary field encoding*

## Lars Thrane A/S Tracking Protocol Simplified

Below is an example of an encoded binary Position Report and resulting decoded values.

	7	6	5	4	3	2	1	0	
C3h	1	1	0	0	0	0	1	1	0
52h	0	1	0	1	0	0	1	0	1
B0h	1	0	1	1	0	0	0	0	2
A7h	1	0	1	0	0	1	1	1	3
B1h	1	0	1	1	0	0	0	1	4
70h	0	1	1	1	0	0	0	0	5
8Eh	1	0	0	0	1	1	1	0	6
16h	0	0	0	1	0	1	1	0	7
20h	0	0	1	0	0	0	0	0	8
01h	0	0	0	0	0	0	0	1	9

*Table 3 Position Report Binary encoding example*

Name	Encoded value		Decoded value
	Binary	Hex	
Reserved	1b	1h	-
GNSS Flag	1b	1h	Bad
Time	00001101010010101100001b	06A561h	2018-10-30T11:13:00Z
N/S	0b	0h	North
Latitude	100111101100010111b	27B17h	55.819295 degrees
E/W	0b	0h	East
Longitude	0001000111000010110b	08E16h	12.488212 degrees
COG	00100000b	20h	48.0 degrees
SOG	00000001b	01h	0.2 knots

*Table 4 Position Report Binary decoding example*

## 2 Position Report - Text

The text format uses a key/value paradigm. The following example is the corresponding text encoding of the binary encoding example.

LT=T;M=P;D=1540897980,1,55.81929,12.48821,48.0,0.2

Figure 2 Position Report Text encoding example

Key/value pairs are separated by a semicolon. The semicolon cannot occur in the key or value.

The key and value part are separated by an equality sign. The equality sign cannot occur in the key or value part.

The value part is a list of values separated by a comma. The comma cannot occur in the key or value.

If a value is unknown (e.g. in case of lost fix), it is encoded as the special NULL value, which is an empty string. This is the case if the satellite terminal loses GNSS fix:

LT=T;M=P;D=1540815347,,,,,

Figure 3 NULL value example

The table below defines the fields of the Position Report. The *Presence* column indicates Mandatory (M) or Optional (O) presence of the key/value pair. The Value Index indicates the position (with base 0) in the list of values within a key/value pair. The NULL column indicates whether a value can have the NULL value.

Key	Presence	Value Index	Type	NULL	Description
LT	M	0	String	No	Lars Thrane A/S application. Must be encoded "T".
M	M	0	String	No	Message type. Must be encoded "P".
D	M	0	Integer	Yes	Time when data was sampled, and Position Report generated. Unix time encoded as seconds.
		1	Integer	Yes	GNSS Flag – see definition in Table 1. Encoded as zero or one: 0: Good 1: Bad
		2	Decimal	Yes	Latitude in reference to WGS84. Encoded as a signed decimal degree in the range [-90;+90].
		3	Decimal	Yes	Longitude in reference to WGS84. Encoded as a signed decimal degree in the range [-180;+180].



**Lars Thrane A/S**  
**Tracking Protocol Simplified**

		4	Decimal	Yes	Course over Ground. Encoded in decimal degrees in the range [0;360[.
		5	Decimal	Yes	Speed over Ground. Encoded in decimal knots. It can not be negative.
VI	0	0	String	No	Vessel ID User defined.

*Table 5 Position Report Text message definition*

### 3 Remote Management

Remote management enables instrumentation of the terminal over the satellite link using SMS and E-mail. During installation of the terminal, remote management must have been enabled **and** a password entered using the web server in the terminal. Remote management can **not** be enabled from remote.

#### 3.1 Message format

Remote management messages are encoded in clear text and follow the key/value paradigm described in chap. 2.

All messages contain a common header and a message specific body.

Key	Presence	Value Index	Type	NULL	Description
LT	M	0	String	No	Lars Thrane A/S application. Must be encoded "T" (tracking).
M	M	0	String	No	Message type. See Table 7.
PW	O	0	String	No	Remote management password. Must be included in messages sent to the terminal.

Table 6 Message header definition

The table below lists the messages defined by the tracking application. The *Direction* column indicates whether the message can be sent from the terminal (MO) or from remote (MT).

Message type	Direction	Name
CA	MO	Configuration answer
CQ	MT	Configuration request
P	MO	Position report
RA	MO	Position report answer
RQ	MT	Position report request
TQ	MT	Trigger request

Table 7 Tracking message types

There is no mechanism to respond to unknown or erroneous messages.

### 3.2 Tracking Configuration

Using the CQ message, the tracking configuration can be fetched or updated from remote. The terminal will respond with the CA message.

The table below defines the fields of the CQ and CA message body (the two messages share the same message body definition).

Key	Presence	Value Index	Type	NULL	Description
TO	M	0	String	Yes	Transport protocol used for sending tracking reports: SBD: Short Burst Data SMS: Short Message Service EMAIL: E-mail  If NULL, tracking is disabled.
		1	String	Yes	The encoding of the value depends on the previous value.  <u>SBD:</u> The value must be the special NULL value (empty string).  <u>SMS:</u> The phone number to send the SMS to. The number should include the international call prefix (00 or +).  <u>EMAIL:</u> The email address to send the E-mail to.  <b>Important:</b> The E-mail address must be no longer than 30 character and must not include the underscore ('_') character.
F	M	0	String	No	Position report format: LT-B: Lars Thrane binary (chap. 1); SBD only LT-T: Lars Thrane text (chap. 2); SMS, EMAIL only LT-H: Lars Thrane human readable; SMS, EMAIL only ST: Sirius Track binary; SBD only
O	O	n	String	Yes	List of position report format options: L: Include HTTP map link; LT-H only V: Include Vessel ID; LT-T, LT-H only  If the O key pair is absent or if assigned the NULL value, all options are cleared.

## Lars Thrane A/S Tracking Protocol Simplified

VI	O	0	String	Yes	Vessel ID can be up to 15 characters long. Valid characters include letters, digits and the space character.  If the VI key is absent or if assigned the NULL value, the Vessel ID is cleared.
T	M	n	String	Yes	List of reporting triggers: D: Distance P: Power event (power on) T: Time  If the T key is assigned the NULL value, all triggers are disabled.
TT	O	0	Integer	Yes	Time trigger interval. Unit is minutes.
TD	O	0	Decimal	Yes	Distance trigger interval. Unit is nautical miles.
		1	Integer	Yes	Minimum time interval. Unit is minutes.

*Table 8 CQ and CA and message body definition*

To fetch the current tracking configuration of the terminal, send the CQ message with an empty body (this is a special case that does not follow the definition in Table 8):

LT=T;M=CQ;PW=123456

*Table 9 CQ message encoding example*

### 3.3 Requesting Position Report

Using the RQ message, a position report can be requested from remote. The terminal will respond with the RA message.

Requesting Position Report works independently of the tracking configuration. Hence, it is possible to request sending a position report to another destination and in another format than defined in the tracking configuration – even when tracking is disabled.

In response to an RQ message, the terminal sends the RA message. The message body of the RA message is equal to the Position Report (chap. 2). The RA message is either sent back to the originator of the RQ message or – if the optional TO field is present - to the destination requested.

The table below defines the fields of the RQ message body.

Key	Presence	Value Index	Type	NULL	Description
TO	O	0	String	No	Transport protocol used for sending the Report Answer: SBD: Short Burst Data SMS: Short Message Service EMAIL: E-mail  If field is absent, the Report Answer will be sent using the same transport protocol as the Report Request was received.
		1	String	Yes	The encoding of the value depends on the previous value.  <u>SBD:</u> The value must be the special NULL value (empty string).  <u>SMS:</u> The phone number to send the SMS to. The number should include the international call prefix (00 or +).  <u>EMAIL:</u> The email address to send the E-mail to.  <b>Important:</b> The E-mail address must be no longer than 30 character and must not include the underscore ('_') character.
F	M	0	String	No	Position report format: LT-B: Lars Thrane binary (chap. 1); SBD only LT-T: Lars Thrane text (chap. 2); SMS, EMAIL only LT-H: Lars Thrane human readable; SMS, EMAIL only ST: Sirius Track binary; SBD only

**Lars Thrane A/S**  
**Tracking Protocol Simplified**

O	O	n	String	Yes	List of position report format options: L: Include HTTP map link; LT-H only V: Include Vessel ID; LT-T, LT-H only
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*Table 10 RQ message body definition*

To request a position report in human readable format, send the following RQ message:

LT=T;M=RQ;PW=123456;F=LT-H

*Table 11 RQ message encoding example 1*

If adding the TO field, it is possible to have the response sent to another destination (e.g. local@example.com):

LT=T;M=RQ;PW=123456;TO=EMAIL,local@example.com;F=LT-H

*Table 12 RQ message encoding example 2*

### **3.4 Trigger Position Report**

The TQ message is used for manually triggering sending of a position report according to the tracking configuration. If tracking is disabled, the request is silently ignored.

The TQ message does not affect any triggers enabled in the tracking configuration.

The TQ message has an empty message body:

LT=T;M=TQ;PW=123456

*Table 13 TQ message encoding example*