

LNAV

Name	LNav
Also Known As	Long Navigation Data
Type	Binary – Sonardyne
Input / Output / Log	Output
Source	INS / AHRS
Length	Fixed, 90 bytes
Multiplex Message ID	224

1.1.1 Description

The long navigation (LNav) data message is the generic navigation output from Lodestar INS / AHRS. The message is essentially the combination of the Nav and NavQual message

The LNAV message can be sourced from either AHRS or INS. If the SRC is set to AHRS then the orientation fields will be populated with AHRS data, if the INS is also initialised the other message fields will also be populated. If the source selected is INS all fields are sourced from INS.

All data is transmitted LSB first

1.1.2 Format

Byte#	Field name	Units	Optional	Data Type	Notes
1-6/6	timeTag	10 ⁻⁶ seconds	No	Uint48	System time
6-10/4	Lat	2 ⁻³¹ × 90 deg	Yes, see Note 11	Int32	Latitude, Note 1
11-14/4	Lon	2 ⁻³¹ × 180 deg	Yes, see Note 11	Int32	Longitude, Note 2
15-18/4	Depth	10 ⁻³ metres	Yes, see Note 11	Int32	Depth below sea level, Note 3
19-20/2	Altitude	10 ⁻² metres	Yes, see Note 11	Uint16	Height above seabed, Note 4
21-22/2	Roll	2 ⁻¹⁵ × 180 deg	No	Int16	Note 5
23-24/2	Pitch	2 ⁻¹⁵ × 180 deg	No	Int16	Note 6
25-26/2	Heading	2 ⁻¹⁵ × 180 deg	No	Uint16	Note 7
27-28/2	vFwd	10 ⁻³ m/s	Yes, see Note 11	Int16	Vehicle Fwd-velocity
29-30/2	vStbd	10 ⁻³ m/s	Yes, see Note 11	Int16	Vehicle Stbd-velocity
31-32/2	vDwn	10 ⁻³ m/s	Yes, see Note 11	Int16	Vehicle Dwn-velocity
33-34/2	wFwd	10 ⁻² deg/s	No	Int16	Angular rate about Vehicle Fwd axis
35-36/2	wStbd	10 ⁻² deg/s	No	Int16	Angular rate about Vehicle Stbd axis
37-38/2	wDwn	10 ⁻² deg/s	No	Int16	Angular rate about Vehicle Dwn axis

39-40/2	aFwd	10^{-3} m/s ²	No	Int16	Vehicle Fwd-acceleration
41-42/2	aStbd	10^{-3} m/s ²	No	Int16	Vehicle Stbd-acceleration
43-44/2	aDwn	10^{-3} m/s ²	No	Int16	Vehicle Dwn-acceleration
45-48/4	posMajor	Metres	Yes, see Note 11	Float32	Horizontal position 1 σ error ellipse (Note 8): - semi-major axis
49-52/4	posMinor	Metres	Yes, see Note 11	Float32	- semi-minor axis
53-56/4	dirPMajor	Degrees	Yes, see Note 11	Float32	- direction of semi-major axis
57-60/4	stdDepth	Metres	Yes, see Note 11	Float32	1 σ depth error
61-64/4	stdLevN	Degrees	Yes, see Note 11	Float32	1 σ level error about North (Note 9)
65-68/4	stdLevE	Degrees	Yes, see Note 11	Float32	1 σ level error about East (Note 9)
69-72/4	stdHeading	Degrees	Yes, see Note 11	Float32	1 σ heading error
73-76/4	velMajor	m/s	Yes, see Note 11	Float32	Horizontal velocity 1 σ error ellipse (Note 10): - semi-major axis
77-80/4	velMinor	m/s	Yes, see Note 11	Float32	- semi-minor axis
81-84/4	dirVMajor	Degrees	Yes, see Note 11	Float32	- direction of semi-major axis
85-88/4	velDown	m/s	Yes, see Note 11	Float32	1 σ down velocity error
89-90/2	Status	N/A	No	Bit16	Note 12

Note 1 – Latitude, north is positive. 0.5cm resolution.

Note 2 – Longitude, east is positive. 1cm resolution at equator.

Note 3 – Depth, down is positive.

Note 4 – Height above seabed as measured by the DVL, contains the last valid altitude received from the DVL.

Note 5 – Roll is the angle between the Stbd-axis and horizontal. Roll is positive when Stbd is pointed below the horizontal (starboard down).

Note 6 – Pitch is the angle between the Fwd-axis and horizontal. Pitch is positive when Fwd is pointed above the horizontal (bow up).

Note 7 – Heading is the angle between North and projection of the Fwd-axis onto the horizontal (measured about the down direction).

Note 8 –

- Horizontal position 1DRMS = $\sqrt{\text{posMajor}^2 + \text{posMinor}^2}$
- CEP(50%) $\approx 0.589 \times (\text{posMajor} + \text{posMinor})$
- Error ellipse (1 σ) is 39.4% probability (i.e. 39.4% likelihood that true value is within ellipse)
- 95% percent probability error ellipse is $2.447 \times 1\sigma$ error ellipse

Note 9 – Roll & pitch 1 σ $\approx \max(\text{stdLevN}, \text{stdLevE})$ for roll, pitch $\ll 45\text{deg}$.

Note 10 – Velocity RMS = $\sqrt{\text{velMajor}^2 + \text{velMinor}^2}$

Note 11 – Will be populated with zero values if data unavailable (e.g. INS is not initialised / DVL data invalid)

Note 12 - The status bits are described below (if bit = 0 then status is OK):

Status bit#	Field name	Note / bit set
0	bOrientationStatus	Orientation Invalid (e.g. AHRS not OK or unsettled)
1	bPosStatus	Position (& Velocity) Invalid (e.g. INS not OK or not



Software Design Specification

This form is part of the Project Control Formset.

		initialised)
2	bAltitudeStatus	0 indicates that the altitude field has been updated in this message compared to the last time the LNAV message was sent. 1 indicates that the altitude data is either old (no update from DVL since last LNAV message sent) or invalid.
4	bOrientationSource	0 indicates Orientation source = AHRS, 1 indicates Orientation source = INS
5	bSubseaUSBLUsed	0 indicates data received and some or all used within the last second, otherwise 1
6	bDepthUsed	0 indicates data received and some or all used within the last second, otherwise 1
7	bDVLUsed	0 indicates data received and some or all used within the last second, otherwise 1
8	bLBLUsed	0 indicates data received and some or all used within the last second, otherwise 1
9	bZUPTUsed	0 indicates data received and some or all used within the last second, otherwise 1
10	bXPOSUsed	0 indicates data received and some or all used within the last second, otherwise 1
11	bGPSUsed	0 indicates data received and some or all used within the last second, otherwise 1
12	bZMDUsed	0 indicates data received and some or all used within the last second, otherwise 1
13	bUSBLUsed	0 indicates data received and some or all used within the last second, otherwise 1
14-15	Not Used	Reserved for future use