SerialInstruments NMEA Data Formats:

The files collected in the SerialInstruments directory consist of raw data strings coming directly from the instruments and devices making the measurements.

Non-GPS data is prepended by a Unix timestamp (in epoch time) generated by the server. All times are in terms of UTC.

Feeds not listed below are binary.

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bd982-1-gps (Trimble dual-antenna BD982 GPS position and heading)

Standard HDT, RMC, GGA, VTG, and ZDA strings, prepended with the talker GN (mixed GPS and GLONASS data). Also PTNL for heading information and data quality.

See data/met/docs/MetAcq.pdf for the format of the HDT, RMC, GGA, VTG, and ZDA strings.

TTTTTTTTTT.TTT $PTNL,VHD,HHMMSS.SS,MMDDYY,AAA.AAA,aaa.aaa,VVV.VVV,vvv.vvv,R.RRR,r.rrr,II.NN,P.PM*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$PTNL,VHD	= heading information message ID
HHMMSS.SS	= UTC of position in HHMMSS.SS format
MMDDYY	= date in MMDDYY format
AAA.AAA	= azimuth
aaa.aaa	= azimuth/time
VVV.VVV	= vertical angle
vvv.vvv	= vertical/time
R.RRR	= range
r.rrr	= range/time
II	= GPS quality indicator (0 = fix not available or invalid; 1 = autonomous GPS fix; 2 = RTK float solution; 3 = RTK fix solution; 4 = differential, code phrase only solution (DGPS); 5 = SBAS solution – WAAS/EGNOS/MSAS; 6 = RTK float 3D network solution; 7 = RTK fixed 3D network solution; 8 = RTK float 2D network solution; 9 = RTK fixed 2D network solution; 10 = OmniSTAR HP/XP solution; 11 = Omnistar VBS solution; 12 = location RTK; 13 = beacon DGPS)
NN	= number of satellites used in solution P.P = position dilution of precision
cc	= checksum

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bgm-3-gravity (shipboard BGM-3 gravimeter counts)

TTTTTTTTTT.TTT SS:XXXXXX ff

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
SS	= counting frequency by 0.25-second interval (*e.g.*, 04 = 1 sec [1Hz])
XXXXXX	= raw counts
ff	= status (00 = no error; 01 = platform DNV; 02 = sensor DNV; 03 = both DNV)

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em122-cb-depth (depth beneath EM122 transducer)

TTTTTTTTTT.TTT $KIDPT,dddd.dd,o.oo,mmmmm.m*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
dddd.dd	= depth (meters)
o.oo	= offset (meters)
mmmmm.m	= maximum range (meters) – 12000
cc	= checksum

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em712-cb-depth (depth beneath EM712 transducer)

TTTTTTTTTT.TTT $KODPT,dddd.dd,o.oo,mmmmm.m*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
dddd.dd	= depth (meters)
o.oo	= offset (meters)
mmmmm.m	= maximum range (meters) – 12000
cc	= checksum

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fa30-ais (Furuno FA-30 AIS ship presence)

TTTTTTTTTT.TTT !AIVDX,n,s,,C,XXXXX,0*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
AIVDX	= AIVDM: data from another vessel, AIVDO: data from our own vessel
n	= number of sentences
s	= sentence number
C	= AIS channel (A or B)
XXXXX	= encoded AIS data; each ASCII character corresponds to 6 binary bits
0*	= end of AIS data marker
cc	= checksum

TTTTTTTTTT.TTT $PFEC,T,XXXXX*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
PFEC	= Furuno proprietary sentence
T	= LBK, AIcmd, idatr, ident, idfnc, pidat, pireq (proprietary sentence types)
XXXXX	= proprietary sentence information
cc	= checksum

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hemisphere-gyro (Hemisphere V104S GPS Compass position and heading)

Standard HDT, RMC, GGA, VTG, and ZDA strings, prepended with the talker GP (Global Positioning System (GPS)) for position strings, and HE (Heading Sensor: gyro, north seeking) for heading strings.

See data/met/docs/MetAcq.pdf for the format of the HDT, RMC, GGA, VTG, and ZDA strings.

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hipap-nmea (HiPAP underwater acoustic positioning system output strings)

PSIMSSB (position), PSIMSNS (gyro, attitude), and PSIMLBP (LBL) strings.

TTTTTTTTTT.TTT $PSIMSSB,ttttt.ttt,TTT,A,eee,s,o,f,xxxx.xxxxxx,yyyyy.yyyyy,zz.zzz,q.q,m,,*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$PSIMSSB	= Kongsberg HiPAP position string
ttttt.ttt	= time (hhmmss.sss) UTC
TTT	= transponder ID code
A	= status (A = ok, V = not ok)
eee	= error code (NRy = no reply, AmX = ambiguity in X direction, AmY = ambiguity in Y direction, Rej = position rejected by SW filter, Mi2 = second pulse of the Tp reply missing, Mi3 = third pulse of Tp reply missing, Pre = no position measured, VRU = VRU error, GYR = gyro error, ATT = attitude sensor error, ExD = external depth used in position calculation, ExM = external depth not received, ??? = unknown error)
s	= coordinate system (C = Cartesian, P = polar, U = UTM, R = radians
o	= orientation (H = vessel head up, N = north, E = East)
f	= filter (M = Measured, F = Filtered, P = Predicted)
xxxx.xxxxx	= x coordinate (depends on coordinate system used)
yyyyy.yyyyy	= y coordinate (depends on coordinate system used)
zz.zzz	= depth (meters)
q.q	= expected accuracy
m	= additional information (N = none, C = compass, I = inclinometer, D = depth, T = Time from transponder to transducer, V = velocity)
cc	= checksum

TTTTTTTTTT.TTT $PSIMSNS,tttttt.ttt,TTT,P,D,r.rr,p.pp,hhh.hh,eee.ee,ff,a.aa,,MMMM*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$PSIMSNS	= Kongsberg HiPAP gyro/attitude string
tttttt.ttt	= time (hhmmss.sss) UTC
TTT	= transponder ID code/position item
P	= transceiver number
D	= transducer number
r.rr	= roll (degrees)
p.pp	= pitch (degrees)
h.hh	= heave
eee.ee	= heading (degrees)
f	= parameters used in calculation as a hexadecimal digit: Bit 0-1 (positioning type): 0 = no positioning; 1 = SSBL, 2 = LBL, 3 = special Bit 2-3 (deskew): 0 = deskew off, 1 = deskew Vessel, 2 = deskew transponder Bit 4 (fixed/mobile flag): 0 = fixed, 1 = mobile (SSBL) Bit 5 (time in UTC): 1 = true Bit 6 (sound velocity profile used): 1 = true Bit 7 (time sync'd against external clock for APOS and stations): 1 = true
a.aa	= time age (seconds from valid position time to generation of this sentence)
MMMM	= master (M) or slave (S) and APOS ID number (121 = OS1, 122 = OS2)
cc	= checksum

TTTTTTTTTT.TTT $PSIMLBP,tttttt.ttt,A,T,sss,C,xxxx.xxxxx,yyyyy.yyyyy,zz.zzz,a.a,i.i,d.d,r.r*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$PSIMLBP	= Kongsberg LBL string
tttttt.ttt	= time (hhmmss.sss) UTC
A	= transponder array
T	= type of item positioned
sss	= state (A = ok, RES = residuals of the measurement too large, NVC = position calculation does not converge vertically, NOC = position calculation does not converge horizontally, FER = too few replies to calculate position, CER = computational error when calculating position, NG1 = no geographic position)
C	= coordinate system (C = Cartesian N/E, L = Cartesian E/N, U = UTM N/E, E = UTM E/N)
xxxx.xxxxx	= x coordinate (depends on coordinate system used)
yyyyy.yyyyy	= y coordinate (depends on coordinate system used)
zz.zzz	= depth (meters)
a.a	= major axis of the error ellipse
i.i	= minor axis of the error ellipse
d.d	= direction of the major axis of the error ellipse
r.r	= root mean square of the normalized residuals of the measurements (less than 1 = measurements more accurate than expected)
cc	= checksum

hydrins-gps (iXBlue Hydrins MRU position; GPS antennas from Trimble BD982)

Standard GGA, VTG, GLL, GST, and ZDA strings, prepended with the talker GP (Global Positioning System (GPS)) for position strings

See data/met/docs/MetAcq.pdf for the format of the GGA, VTG, GLL, and ZDA strings.

TTTTTTTTTT.TTT $GPGST,tttttt.tt,r.rrr,x.xxx,a.aaa,nnn.nnn,a.aaa,l.lll,h.hhh*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$GPGST	= position error statistics string
tttttt.tt	= time (hhmmss.ss) UTC
r.rrr	= RMS value of the pseudorange residuals
x.xxx	= error ellipse semi-major axis 1 sigma error (meters)
a.aaa	= error ellipse semi-minor axis 1 sigma error (meters)
nnn.nnn	= error ellipse orientation, degrees from true north
a.aaa	= latitude 1 sigma error (meters)
l.lll	= longitude 1 sigma error (meters)
h.hhh	= height 1 sigma error (meters)
cc	= checksum

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hydrins-navbho (iXBlue Hydrins MRU position, attitude, and heading; GPS antennas from Trimble BD982)

Standard PASHR (attitude), HDT, GGA, VTG, GST, and ZDA strings, prepended with the talker PH (iXBlue) for position strings, and HE (Heading Sensor: gyro, north seeking) for heading strings.

See data/met/docs/MetAcq.pdf for the format of the HDT, GGA, VTG, and ZDA strings.

See hydrins-gps above for format of GST strings.

TTTTTTTTTT.TTT $PASHR,tttttt.ttt,hhh.hh,T,r.rr,p.pp,H.HH,o.ooo,i.iii,e.eee,s,m*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$PASHR	= attitude sensor string
tttttt.ttt	= time (hhmmss.sss) UTC
hhh.hh	= heading
T	= true (heading)
r.rr	= vessel roll (degrees), positive = port up
p.pp	= vessel pitch (degrees), positive = bow up
H.HH	= heave (meters)
o.ooo	= roll angle accuracy estimate (stdev), degrees
i.iii	= pitch angle accuracy estimate (stdev), degrees
e.eee	= heading angle accuracy estimate (stdev), degrees
s	= aiding status
m	= IMU status
cc	= checksum

hydro-winch-aft (hydro winch LCI-90i winch-monitoring unit)

TTTTTTTTTT.TTT A0XRD,YYYY-MM-DDThh:mm:ss.sss,tttttttt,SSSSSSSS,ppppp.p,cccc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
0XRD	= LCI-90i winch identifier (*e.g.*, 02RD = hydro-winch-aft)
YYYY-MM-DD	= date reported by the LCI-90i unit (which may not be accurate)
hh:mm:ss.sss	= time reported by the LCI-90i unit (which may not be accurate)
tttttttt	= tension (lbs)
SSSSSSSS	= speed (m/min)
ppppp.p	= payout (m)
cccc	= checksum

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hydro-winch-fwd (hydro winch LCI90i winch-monitoring unit)

Format the same as that for the hydro-winch-aft; identifier 01RD = hydro-winch-fwd

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knudsen-3260-depth (depth below Knudsen transducer)

TTTTTTTTTT.TTT $PKELRR,RRRRR,FFFFFF,DDMMYYYY,HHMMSS.MMM,W,TkHz,EEEE.EE,F,D.DD,H.HH,S,O,T,A.A,P.PPPPP,BB.B,SSSS.S,EEEE.E,,

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
RR,RRRRR	= record number
FFFFFF	= fix indicator
DDMMYYYY	= date (day, month, year)
HHMMSS	= time (hour, minute, second)
MMM	= time (milliseconds)
W	= working units (Metres, Feet)
T	= channel frequency (3.5 or 12 kHz)
EEEE.EE	= digitized depth
F	= depth valid flag
D.DD	= draft
H.HH	= computed heave
S	= signal type (e.g., Chirp)
O	= envelope detect opt (e.g., Squarelaw)
T	= transmit power
A.A	= analog RX gain
P.PPPPP	= pulse length
BB.B	= TX blank
SSSS.S	= start depth
EEEE.E	= end depth

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sbe45-tsg (Sea-Bird SBE45 TSG values, using uncontaminated seawater from the bow pump)

TTTTTTTTTT.TTT $UWFLO,tt.tttt,c.ccccc,ss.ssss,11.111,22.222,33.333,44.444,55.555,66.666,77.777,88.888,FF.FF,ff.ff,L.LLL,l.lll

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
tt.tttt	= SBE45 TSG water temperature (degrees C)
c.ccccc	= SBE45 TSG water conductivity (mS/cm) (with slope, offset correction)
ss.ssss	= SBE45 TSG calculated salinity (PSU)
11.111	= analogue channel 1
22.222	= analogue channel 2
33.333	= analogue channel 3
44.444	= analogue channel 4
55.555	= analogue channel 5
66.666	= analogue channel 6
77.777	= analogue channel 7
88.888	= analogue channel 8
FF.FF	= flowmeter 1 (SBE45 TSG) counts/second
ff.ff	= flowmeter 2 (pCO2) counts/second
L.LLL	= flowmeter 1 (SBE45 TSG) LPM
l.lll	= flowmeter 2 (pCO2) LPM

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seaspy-magnetometer (Marine Magnetics SeaSPY magnetics)

TTTTTTTTTT.TTT *YY.JJJ/HH:MM:SS.S F:FFFFFF.FFF S:sss D:+DDD.Dm LL TTTTms Q:Qq !!!!

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
YY	= two-digit year
JJJ	= Julian day
HH	= hour
MM	= minute
SS.S	= seconds
FFFFFF.FFF	= magnetic field (nT)
sss	= signal strength (>80 = acceptable, >130 = excellent)
DDD.D	= depth of towfish (m)
L	= leakage sensor output (0 = no leak, 9 = leak present)
TTTT	= measurement time (ms cycling time minus 35ms, ≤ 965ms; G = measurement terminated by severe gradient
Q	= signal quality, signal strength (0-9)
q	= signal quality, amount of information available for measurement (0-9)
!!!!	= warnings (W = weak signal, G = gradient condition, P = poor reading, M = mistuned instrument)

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seapath-navbho (Seapath 330+ MRU GPS position, attitude, and heading)

Seapath attitude, ZDA, GGA, GLL, RMC, VTG, HDT, GSA, and proprietary strings, prepended with the talker PS for proprietary/attitude strings, GN (mixed GPS and GLONASS data) for GSA strings, and IN (integrated navigation) for position strings.

See data/met/docs/MetAcq.pdf for the format of the GGA, GLL, RMC, VTG, ZDA, and HDT strings.

TTTTTTTTTT.TTT $PSXN,20,o,e,a,p*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$PSXN,20	= quality assessment string
o	= horizontal (position) quality (1 is usable with UHDAS)*
e	= height quality
a	= heading quality
p	= pitch and roll quality
cc	= checksum

Quality values: 0 = normal, 1 = reduced performance, 2 = invalid data

TTTTTTTTTT.TTT $PSXN,23,r.rr,p.pp,hhh.hh,e.ee*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$PSXN,23	= attitude string
r.rr	= roll
p.pp	= pitch
hhh.hh	= heading
e.ee	= heave
cc	= checksum

TTTTTTTTTT.TTT $PSXN,26,N,ff.ffff,s.ssss,d.dddd,NNNNN*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$PSXN,26	= Seapath proprietary monitoring point string
N	= monitoring point number (if mp-no= 0, them arm from Origin to NRP is input)
ff.ffff	= arm from origin to MP/NRP in forward direction (meters)
s.ssss	= arm from Origin to MP/NRP in starboard direction (meters)
d.dddd	= arm from Origin to MP/NRP in down direction (meters)
NNNNN	= monitoring point name (if mp-no=0, thenmp-name=NRP)
v.v	= vertical dilution of precision (VDOP)
cc	= checksum

TTTTTTTTTT.TTT $GPGSA,A,F,ss,ss,ss,ss,ss,ss,ss,ss,ss,ss,ss,ss,p.p,h.h,v.v*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$GPGSA	= GPS DOP and active satellites string
A	= selection of auto/manual 2D/3D fix (A= auto, M = manual)
F	= 3D fix (1 = no fix, 2 = 2D fix, 3 = 3D fix)
ss	= PRNs of up to twelve satellites used for fix
p.p	= PDOP (dilution of precision)
h.h	= horizontal dilution of precision (HDOP)
v.v	= vertical dilution of precision (VDOP)
cc	= checksum

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sperry-gyro (Sperry Navigat X MK 1 gyro heading)

Sperry gyro heading and rate of turn data.

See data/met/docs/MetAcq.pdf for the format of the HDT strings.

TTTTTTTTTT.TTT $TIROT, RRRRR.R,S*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
$TIROT	= rate of turn string signifier
RRRRR.R	= signed rate of turn, deg/minute, to nearest 0.1 degree (negative = turn to port)
S	= status (A = data valid; V = data invalid)
cc	= checksum

$PPLAN strings also recorded.

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trawl-winch (trawl winch LCI90i winch-monitoring unit)

Format the same as that for the hydro-winch-aft; identifier 03RD = trawl-winch

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uhdas-speedlog (speedlog output from UHDAS, from the RDI OS-150)

UHDAS RDI OS-150 speed through water strings.

TTTTTTTTTT.TTT $VDVBW,FF.FF,S.SS,V,,,*cc

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
VDVBW	= speed bottom/water
FF.FF	= speed forward (negative value = speed astern)
S.SS	= speed to starboard (negative value = speed to port)
V	= water data status (A = valid, V = void)
cc	= checksum

valeport-svs (Valeport sea surface salinity values)

Valeport sea surface salinity strings, in AML format to allow it to be read by the multibeams.

TTTTTTTTTT.TTT SSSS.SS 000.00

TTTTTTTTTT.TTT	= Unix time stamp (epoch time)
SSSS.SSS	= sea surface salinity value, in m/s
000.00	= this is 0 because the unit does not have a temperature or pressure probe.