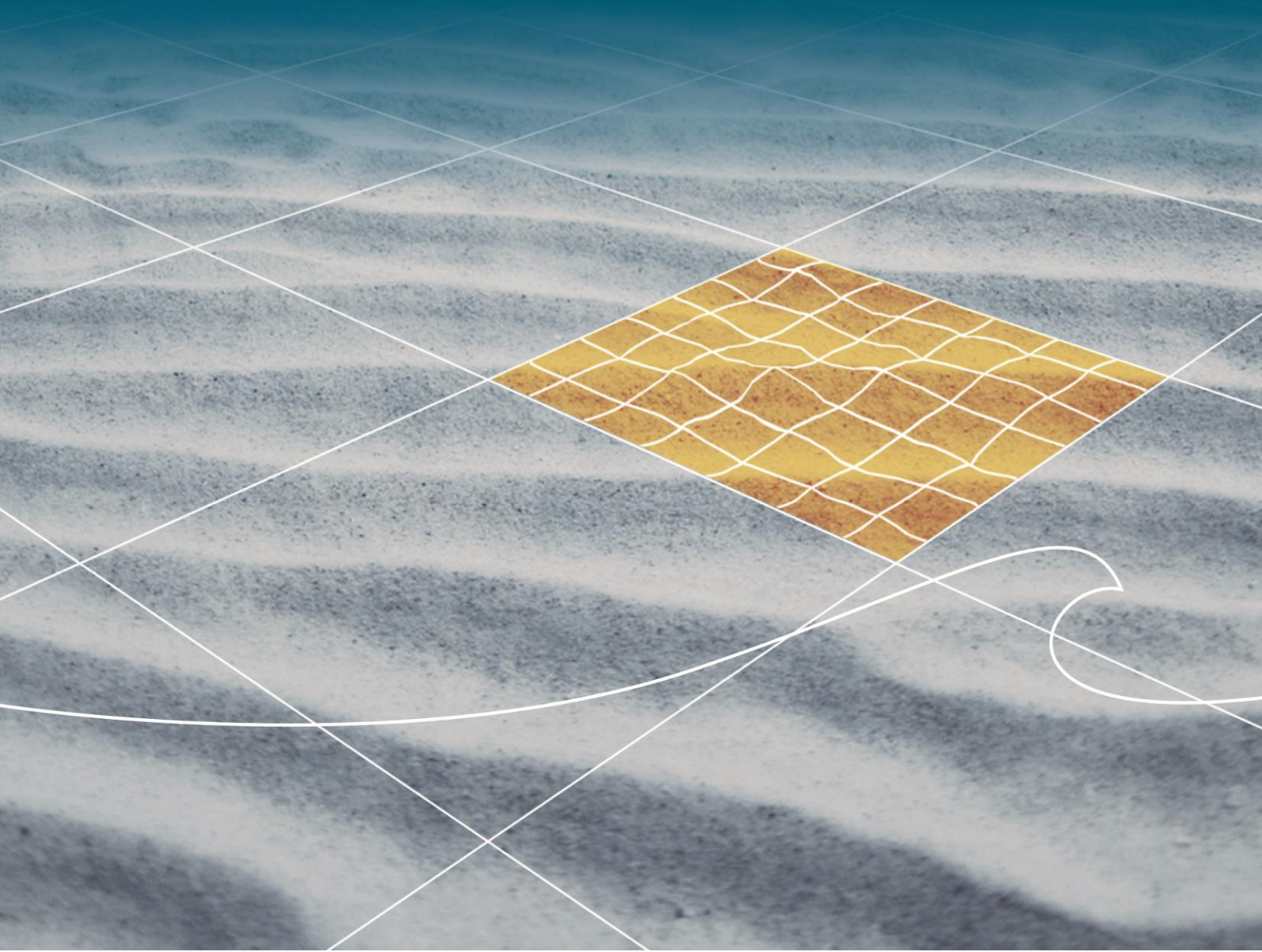
EIVA
MARINE SURVEY SOLUTIONS

NAVIPAC 4.5

INSTRUMENT PARAMETERS



Contents

1 Introduction

This document describes the various parameters defined for most instrument interfaces in the NaviPac configuration tool.

For general parameters such as IO, offsets etc please refer to Help on the program itself.
It is important to notice

- You must select a valid I/O setting for the import as it otherwise might block the entire navigation process
  - COM Serial interfaces using build in or adapter ports
  - UDP Network broadcast messages UDP/IP
  - TCP Network server using TCP/IP
  - ATTU EIVA ATTU unit sending time tagged data on network
- The offsets may be specified as numbers (XYZ) or by selection a POI (Point of interest). Offsets are always defined as offset from CRP (local zero point – Common Reference Point) to the instrument
- String details is extremely important as it defines how NaviPac identifies a string and how many updates per second we allocate space for. Default values are normally OK – but it is a good place to start when performing troubleshooting!

All items are handled via the property selection observed at the instrument properties (default right part of the window) after selecting an instrument:

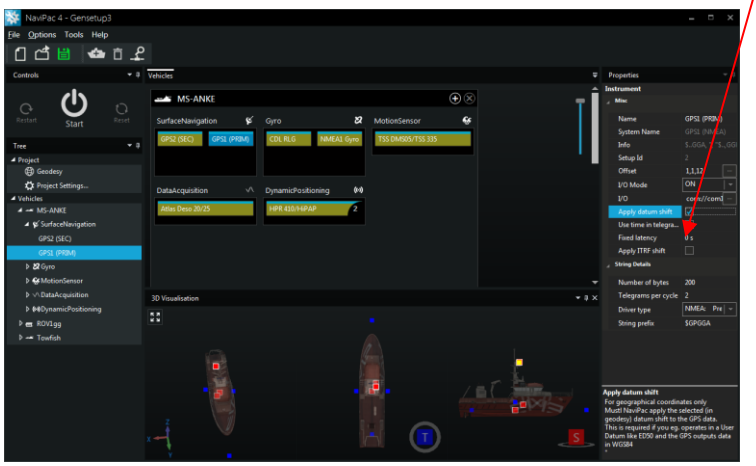


Figure 1 NaviPac config – instrument editing

2 GPS

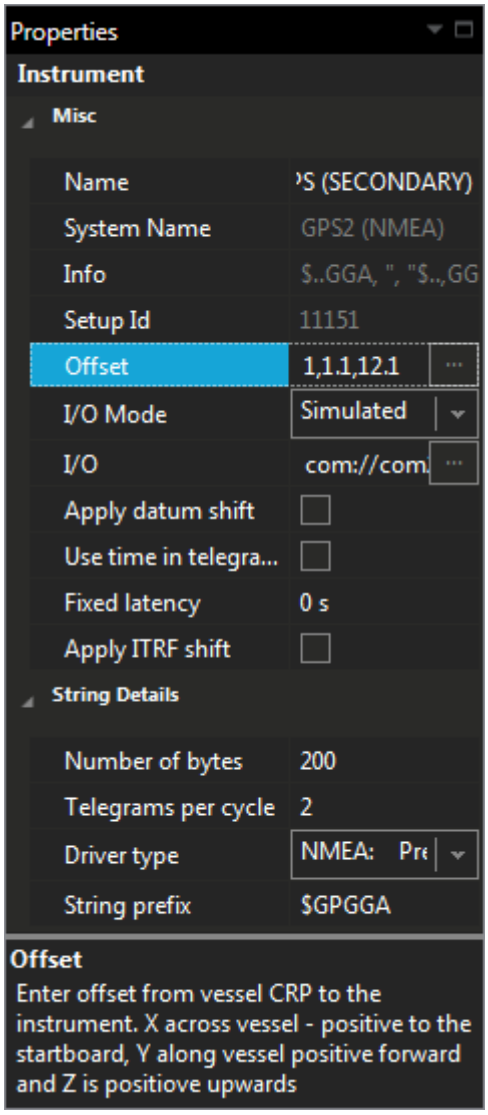


Figure 2 Detailed parameters for GPS receivers

- Apply datum shift:
  Shall NaviPac apply a datum shift (from WGS84 to User Datum) or shall we use the position directly.

- Use time in telegram
  Shall NaviPac use the timestamp in the position telegram (eg. NMEA GGA) to determine when the position is valid. This requires that the NaviPac PC somehow is synchronized in time with the GPS clock. This can be either via special time input or network time server. Please see document on *Timing Principles in NaviPac* (Manual 16)
- Use age in telegram
  Shall NaviPac use the data age given out by the GPS (eg. UKOOA GPS format or Ashtech RTK GPS) and compensate for this latency. Please see document on *Timing Principles in NaviPac* (Manual 16)
- Fixed latency
  Here the operator may enter a fixed data latency in seconds.
- Apply ITRF Shift
  Shall NaviPac include time based datum shift parameters to account for the situation where the datum shift is changing over time? The basic NaviPac datum shift parameters will be adjusted daily using the “speed of change” parameters based on the reference date.
  This type of datum shift can, for example, be relevant in North America where the use of ITRF to NAD83 is widely used and in Europe to shift from ITRF to EUREF89.
  Please note that this field only will be visible is ITRF is enabled globally

3 Gyro

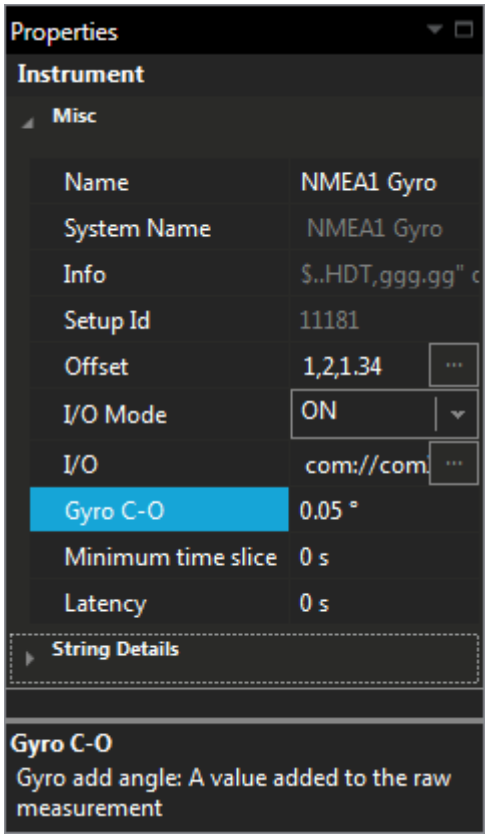


Figure 3 Detailed setup for gyro and heading sources

- C-O
  Gyro add value – a value added to the raw instrument reading
- Minimum time slice
  Data down-sampling. If data density is closer than entered interval then data is down-sampled.
- Latency
  If the gyro has a known data delay then the latency can be entered here
- SeaPath format:
  Only for Seapath Gyro. Select the data source (binary EM1000, binary EM3000 or ASICC PSXN)

3.1 Gyro from RTK

This gyro will be calculated by NaviPac based on the two primary RTK GPS's antennas as the difference between observed baseline and defined baseline

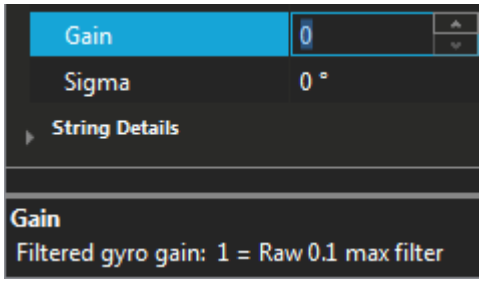


Figure 4 Special setup for RTK GPS based heading

- Gain
  The system may add a smoothing filter to the calculated gyro. Gain is the smoothing factor 1 defines no filter and the lower value the more smooth,
- Sigma
  Defines a spike detection value. Jumps above entered value is discarded

3.2 Constructed gyro

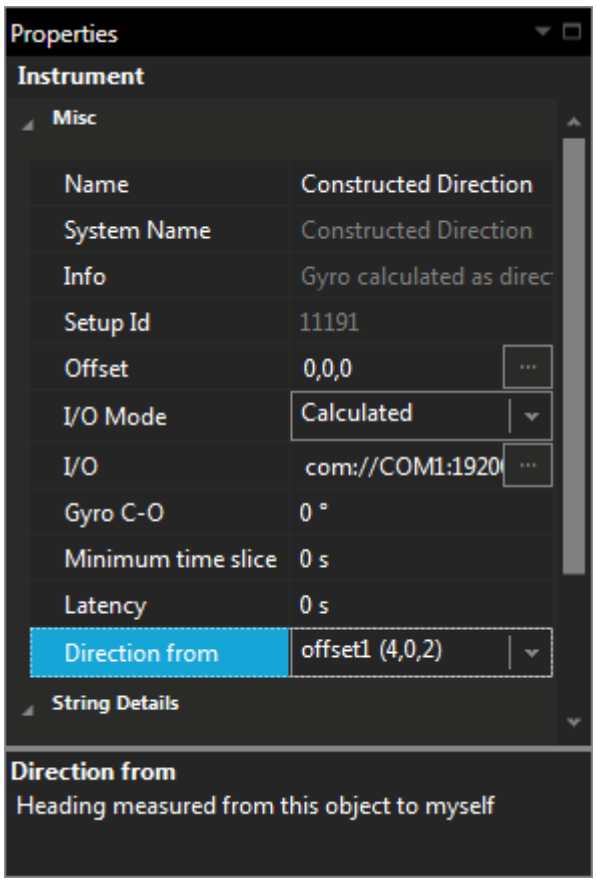


Figure 5 Special setup for constructed gyro

This gyro will be calculated by NaviPac as the direction from selected object (Direction from) to the object where the gyro is defined (Location)

3.3 User defined gyro

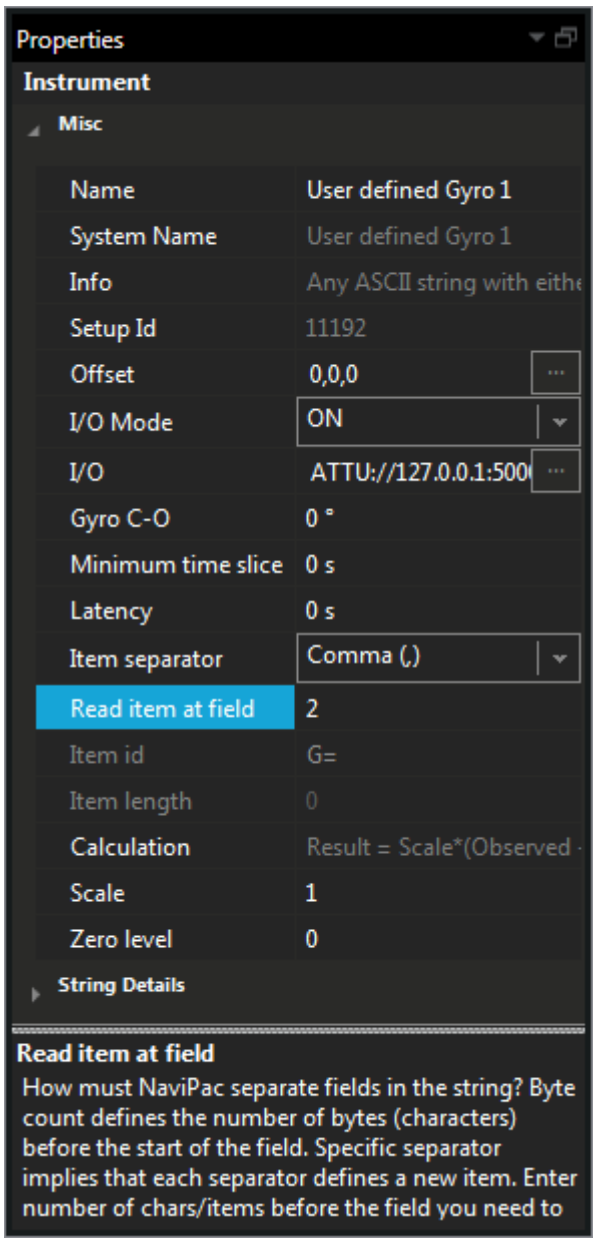


Figure 6 Additional setup for user defined gyro input

For the user defined gyro the operator must specify how and where to read the data

- Item separator:
  How shall NaviPac divide the string into items – eg. By counting bytes, comma separated or using special item identifier (the above)
- Read item at field:
  Which item (separated) or byte (byte count) shall NaviPac read from. Note first item is called number 0
- Item id;
  A special search pattern to identify where to read the value. The number will be read just after this text.
- Item length:
  For byte count only – how many characters must we read in the string. This can be very important if the string in action just gives a continuous set of numbers without any separation. Enter 0 to ignore this,
- Scale:
  Shall the resulting gyro be scaled – eg. If input is in radians. See note in dump on the calculation.
- Zero level:
  Do we need an offset (before scaling) – eg.is data is from some A/D converter. See note in dump on the calculation.

4 Motion Sensor

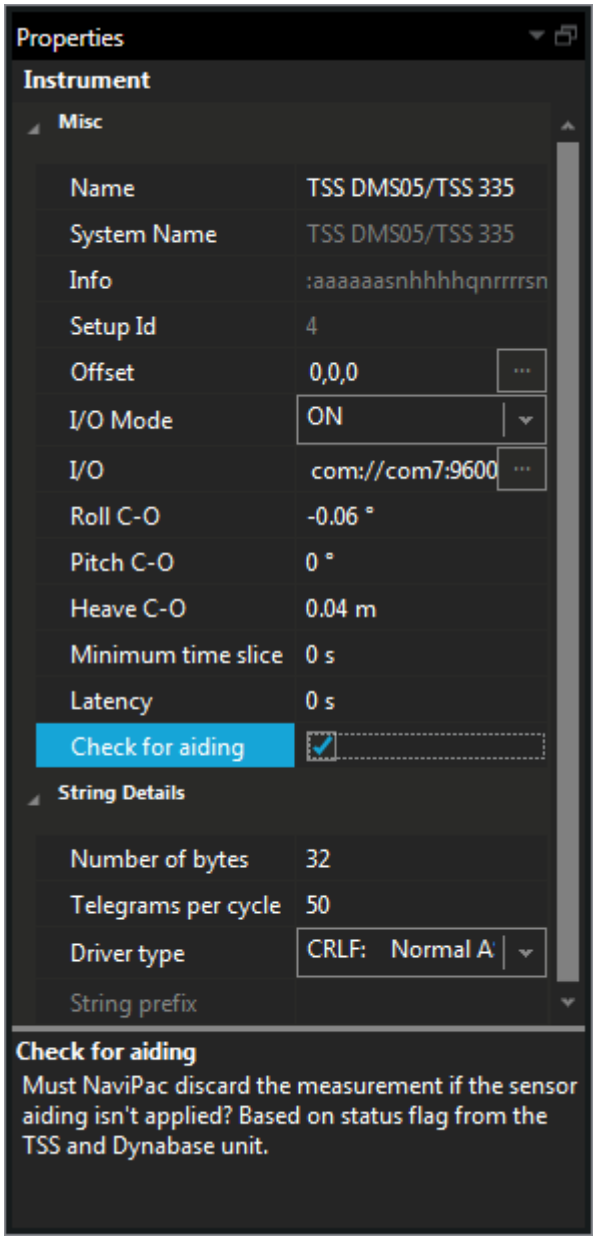


Figure 7 General setup for motion sensor input

The number of parameters may differ depending on the selected unit

- Roll, Pitch and Heave C-O
  Data add value – a value added to the raw instrument reading
- Minimum time slice
  Data down-sampling. If data density is closer than entered interval then data is down-sampled.
- Latency
  If the data has a known data delay then the latency can be entered here. Eg. For Octans.
- SeaPath format:
  Only for Seapath Gyro. Select the data source (binary EM1000, binary EM3000 or ASICC PSXN)
- Reverse Heave:
  Shall NaviPac reverse the heave sign? NaviPac uses positive above datum.
  Seen for SeaPath
- Check for aiding:
  TSS and Atlas Dynabase: Shall NaviPac flag invalid if motion system isn't aided

4.1 User defined motion sensor

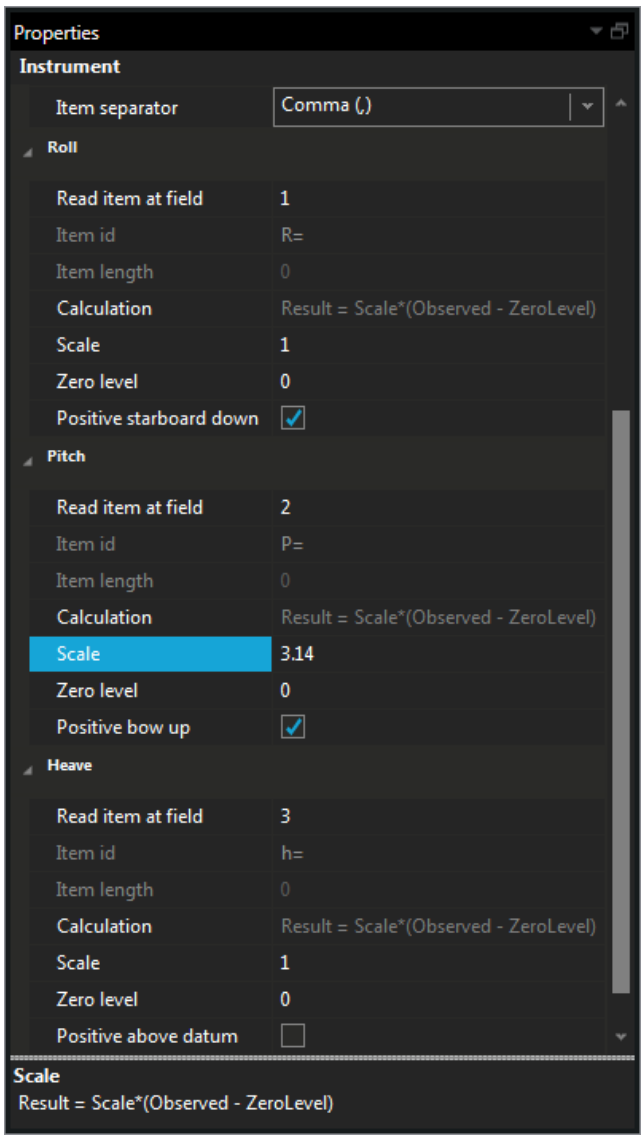


Figure 8 Additional setup for user defined motions sensors

For the user defined gyro the operator must specify how and where to read the data

- Item separator:
  How shall NaviPac divide the string into items – eg. By counting bytes or by comma separated (the above)
- Read item at field:
  Which item (separated) or byte (byte count) shall NaviPac read from. Note first item is called number 0. Goes for roll, pitch and heave. -1 indicates that NaviPac must ignore the item.
- Item id;
  A special search pattern to identify where to read the value. The number will be read just after this text.
- Item Length:
  For byte count only – how many characters must we read in the string. This can be very important if the string in action just gives a continuous set of numbers without any separation. Enter 0 to ignore this.
- Scale:
  Shall the resulting gyro be scaled – eg. If input is in radians. See note in dump on the calculation. Goes for roll, pitch and heave.
- Zero level:
  Do we need an offset (before scaling) – eg.is data is from some A/D converter. See note in dump on the calculation. Goes for roll, pitch and heave.
- Positive starboard down
  Is roll positive starboard down (default) or starboard up?
- Postive bow up
  Is pitch positive bow up (default) or bow down?
- Positive above datum
  Is heave positive above datum (default) or below datum?

5 Doppler Velocity Log

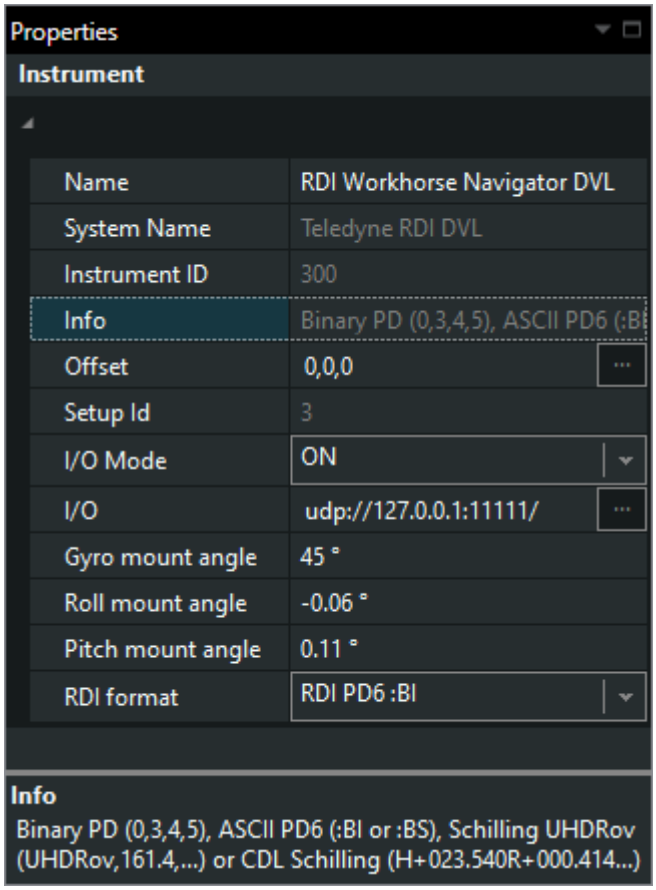


Figure 9 Detailed setup for DVL input

- RDI Format
  For Teledyne RDI DVL only.
  Select between the formats that NaviPac supports (various RDO formats and special Schilling variants)
- Gyro mount angle
- Roll mount angle
- Pitch mount angle
  Rotation mount angles for the DVL

Please note that there are no string details for Teledyne RDI DVL, as this is handled by the format selection.

6 Data acquisition

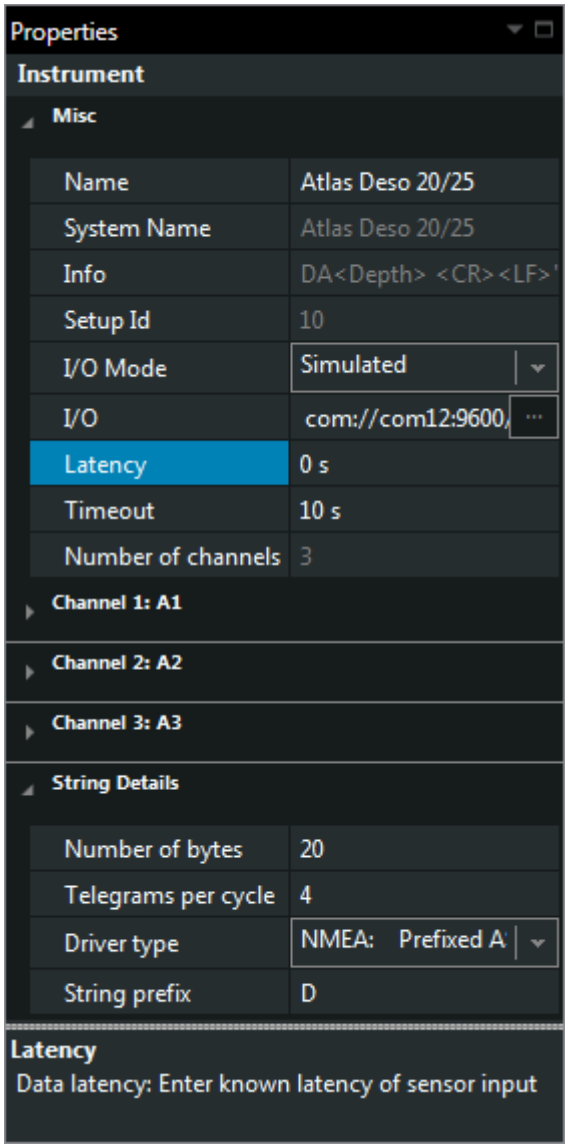


Figure 10 General setup of data acquisition input

- Latency
  If the data has a known data delay then the latency can be entered here.

- String prefix:
  Here you may enter string prefix which determines that only strings starting with this sub-string will be used. See notes on GPS
- Timeout
  Enter how many seconds NaviPac must wait before generating an alarm in case of missing data. Default is 10 seconds
- Number of channels
  read only field showing how many data items the driver supports

6.1 User defined data acquisition

Please note that user defined acquisition drivers may be re-used multiple times, but it is important that they are having exact same characteristics – string layout, scale etc.

Definition of free drivers is partly done on the instrument level and on the channel level – see section 6.3.

- Item separator:
  How shall NaviPac divide the string into items – eg. By counting bytes or by comma separated etc (User defined acquisition)

6.2 MAG G-880

Includes special scaling and offset for depth and altitude calculations

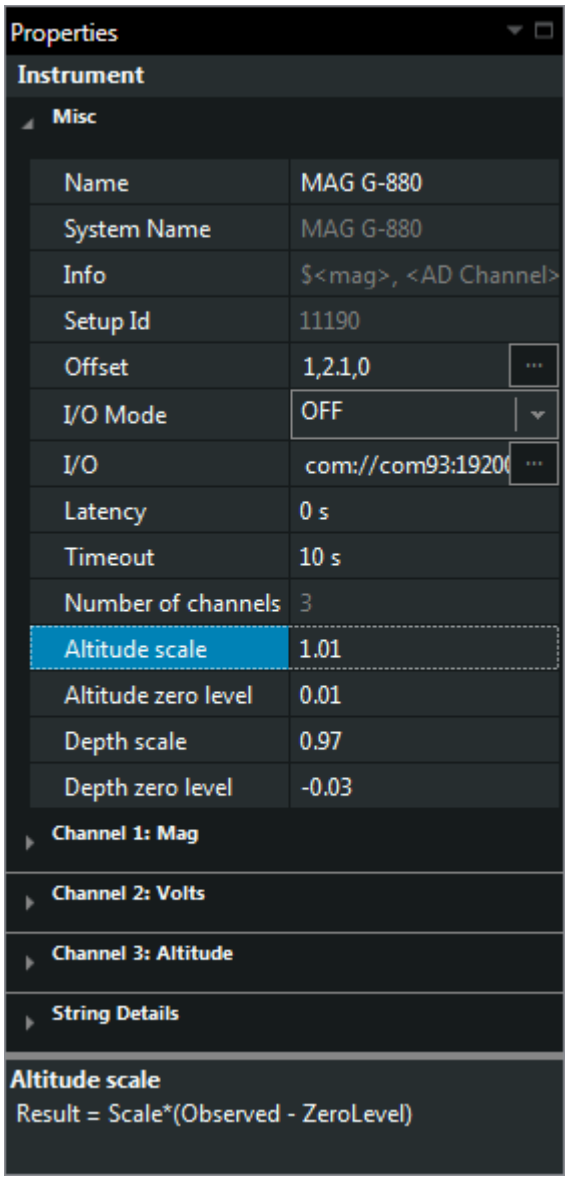


Figure 11 Special setup for magnetometer input

- Scale:
  Shall the resulting data be scaled – eg. If input is in cm.
- Zero level:
  Do we need an offset (before scaling).

6.3 Channel selection

Each acquisition input supports up to three channels – each channel must be defined individually.

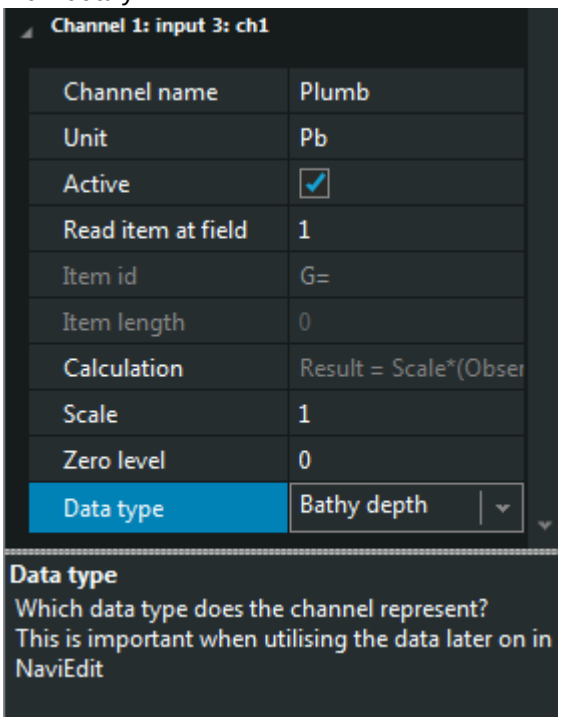


Figure 12 General channel (data source) selection

- Name
  User defined name of the data type. Please note that NaviPac requires unique naming – i.e. you must not use the same name twice
- Active
  Shall NaviPac use this channel or not
- Unit
  For display only – data unit
- Read item at field
  For user defined input: Which field shall NaviPac read. Note the first field is numbered 0.

- Item id;
  For user defined input : A special search pattern to identify where to read the value. The number will be read just after this text.
- Item length:
  For user defined input - byte count only: How many characters must we read in the string. This can be very important if the string in action just gives a continuous set of numbers without any separation. Enter 0 to ignore this.
- Scale:
  Shall the resulting data be scaled – eg. If input is in radians. (User defined acquisition).
- Zero level:
  Do we need an offset (before scaling) – eg.is data is from some A/D converter. (User defined acquisition).
- Data type
  For user defined input – identify the data type (echosounder, bathy, magnetometer or other). This has heavily influence on the usage in NaviEdit and various data outputs

6.4 Super acquisition inputs

NaviPac version 3.8.3 and onwards support a new type of data acquisition input's which allows assignment of up to 20 parameters to each input. The user defined version of this includes a huge series of parameters to define this:

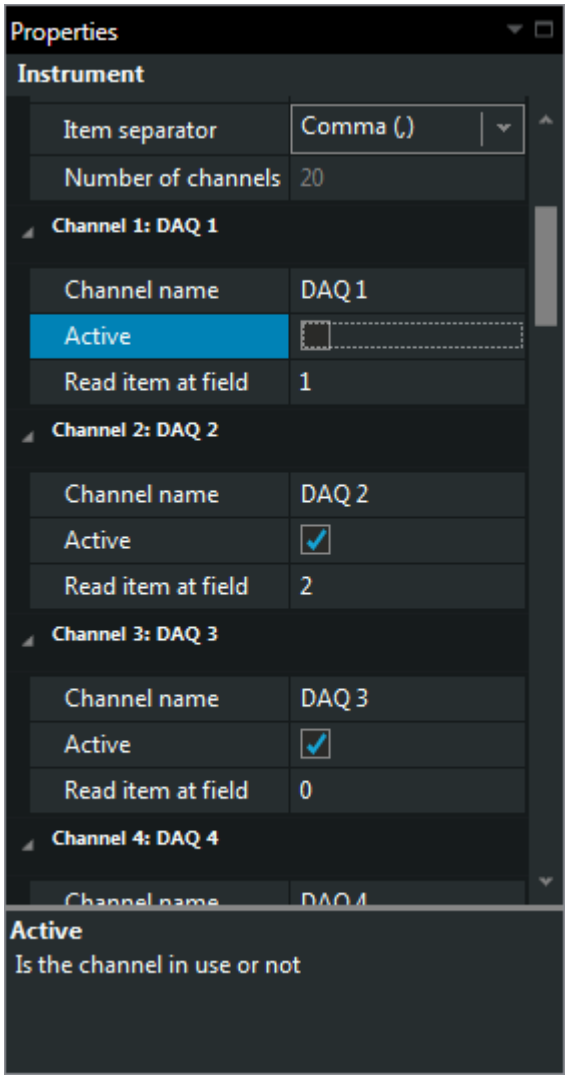


Figure 13 Special 20 channel input

- Number of channels
  Defines the number of active channels (1-20)
- Item separator
  Defines how to separate items (comma, space, semicolon, colon, tab or byte count)
- Channel *n* Item
  For each channel define the item number to read (or first byte in the string)

- Channel *n* Name
  A user defined name for the item
- Channel *n* Active
  is the channel in use or not

7 Point of interest

The POI (former known as User Defined Offsets) defines points at an vehicle

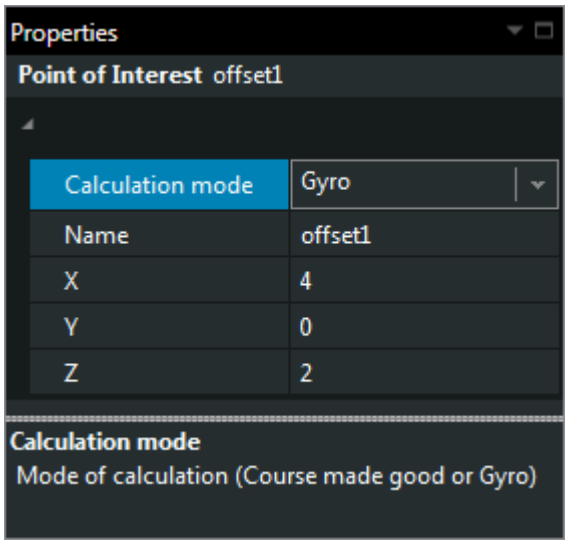


Figure 14 Definition of user defined offsets

- Offsets
  Specify the XYZ offset (the 3D arm) from the mother object to me.
  X: Positive starboard
  Y: Positive front
  Z: Positive up
- Calculation mode
  Select how the offset is calculated
  - Gyro
    The arm is roll, pitch and gyro corrected using gyro (required) and motion data (optional) from the primary sensors

- CMG
  The arm is gyro corrected using the calculated course (known as CMG or COG) and motion corrected using the primary roll/pitch sensor.
- Drag
  The object is considered to be dragged (pulled) in a chain after the mother object. Will give a smooth position, as the relative heading between object and mother are kept stable.
  Defined as Dynamic Position: Dragged offset
- Depth compensated Drag
  Same as drag – but compensated for depth below mother object.
  The input is treated as cable out information and the layback is calculated using simple triangle (Pythagoras) calculation of depth and cable out.
  Defined as Dynamic Position: Dragged offset

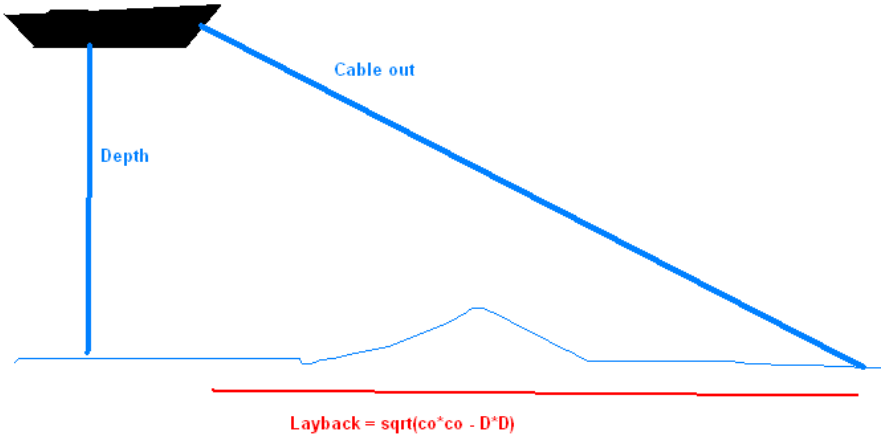


Figure 15 The triangular calculation

- Relative Positon
  The target is calculated a mid point between two other vehicles based on defined relative distance
  Defined as Dynamic Position: Relative Offset
- Circular Average – currently not available
  Similar to secondary. Calculates a new position based on two input's as the input is the range from both objects to the new and the resulting position is the circular crossing of the two – using the solution behind them. The resulting heading is defined as average of the two directions from new to old.

8 Dynamic positioning

NaviPac supports a series of what we call dynamic positioning – that is positioning of external or UW vessels. Some properties are defined at instrument level at both the main vessel (eg USBL) and the vehicle in use while other just are defined as instruments on the vehicle (eg range/bearing system)

8.1 USBL Position

The USBL data will be defined both on the vessel (mounting and io) and on the target vehicle

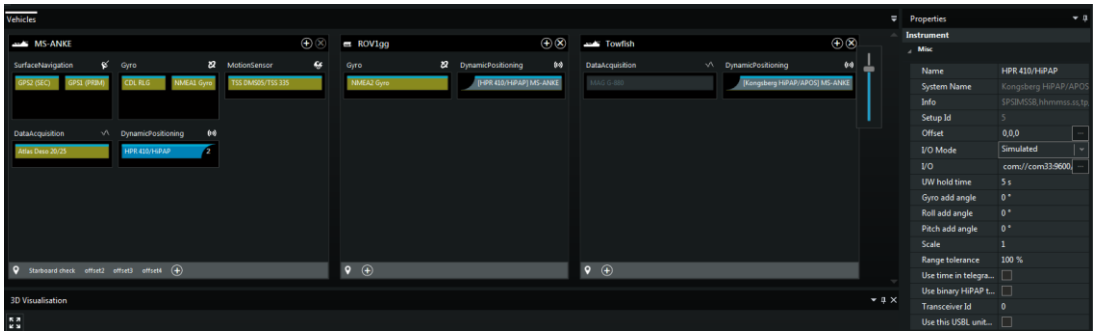


Figure 16 Vessel part of USBL configuration

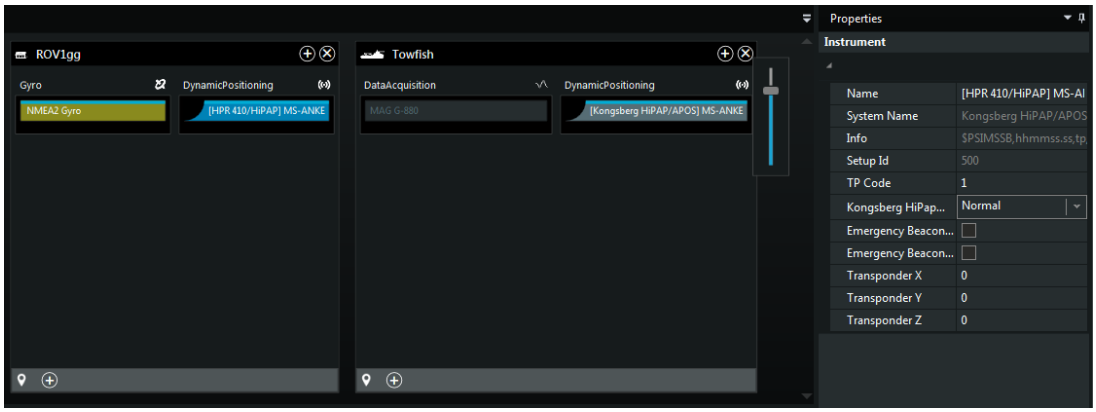


Figure 17 Vehicle part of the USBL configuration

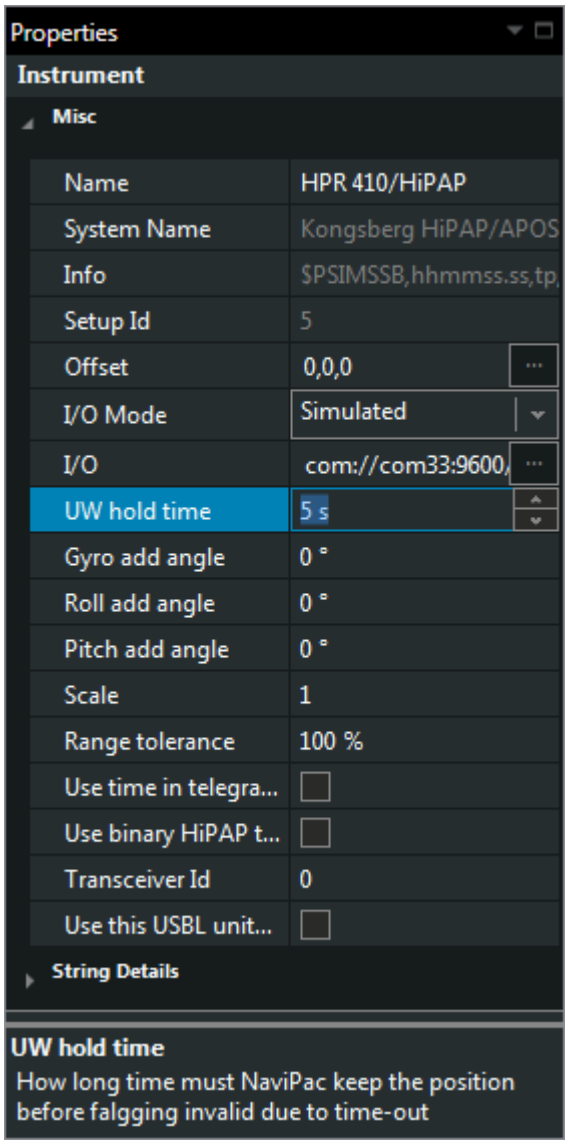


Figure 18 Definition of an ultra-short baseline system

- UW hold time
  How long time shall NaviPac keep the USBL position before flagging it invalid, i.e. the object state changes to red.

- Gyro add angle
  Horizontal mount error of the USBL system. Found in USBL calibration
  Note can also be entered in most USBL systems – do not enter both places!
- Roll add angle
  Vertical (XZ) mount error of the USBL system. Found in USBL calibration.
  Note can also be entered in most USBL systems – do not enter both places!
- Pitch add angle
  Vertical (YZ) mount error of the USBL system. Found in USBL calibration.
  Note can also be entered in most USBL systems – do not enter both places!
- Scale
  Gives scale factor for raw USBL range – due to wrong sound velocity or similar. Found in USBL calibration.
- Range tolerance
  Shall NaviPac check and de-spike data? The data tolerance (% of total range) defines how big a window we shall allow. 100% results in use all data. If you are on 700-meter range and have defined a tolerance of 2%, then jumps in data bigger than 14 meter are removed.
- Use time in telegram
  Shall we use the time in the Kongsberg HiPap string to determine age of USBL data? Require that both systems is synchronised to GPS and PPS.
  This entry is disabled for non Kongsberg systems.
- Use binary HiPap telegram
  Shall NaviPac read binary (HPR300 and HiPap) or ASCII (HiPap NMEA etc) from the Kongsberg system.
  This entry is disabled for non-Kongsberg systems.
- Transceiver id
  For Kongsberg dual transceiver only. Select transceiver number. See section in data formats for details
- Use this USBL unit for differential USBL
  NaviPac 3.5 patch 4 utilises a simple differential USBL function. The operator may use one or two objects as reference in the USBL setup. He must enter the known coordinates (X, Y, Z) in a special online window (pops up automatically) and NaviPac monitors hereafter the error between measured and entered. These values are then applied directly to all objects (or more correct copy of all objects) positioned by this USBL system – and thus delivering a solution similar to differential GPS.

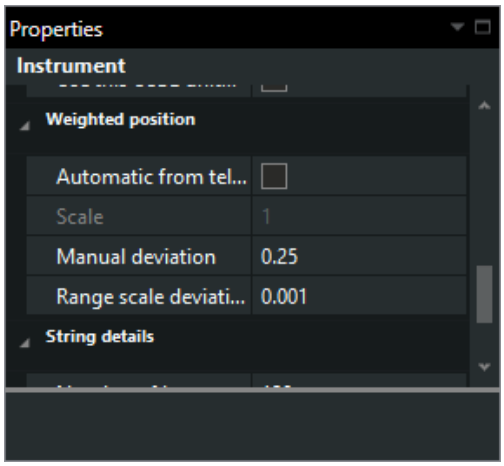


Figure 19 Dynamic positioning – weighting

The position weighting enables the operator to control how NaviPac combines multiple position items into on solution based on reverse standard deviation

- Automatic from telegram
  Use the standard deviation read from the input telegram – eg. Kongsberg $PSIMSSB
- Scale
  For automatic – scale the value read from telegram.
- Manual deviation
- Range scale deviation
  Non-automatic. Define the deviation as a constant plus a fraction of the range

8.1.1 Target

For each selected vehicle, the following parameters must be defined.

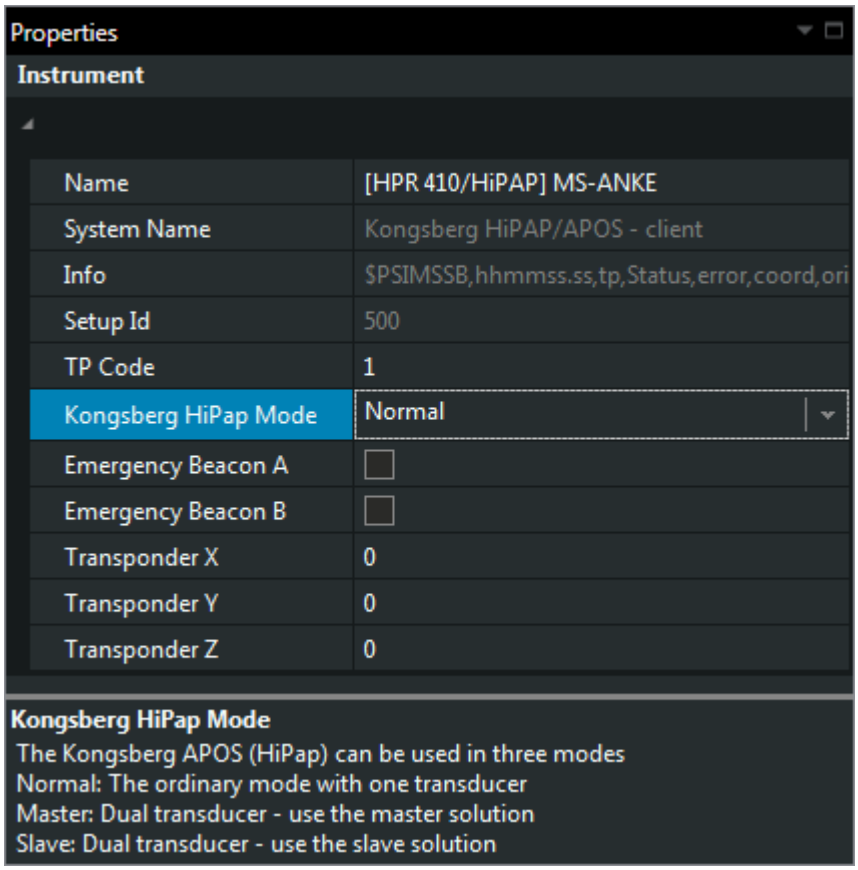


Figure 20 Definition of the USBL target(s)

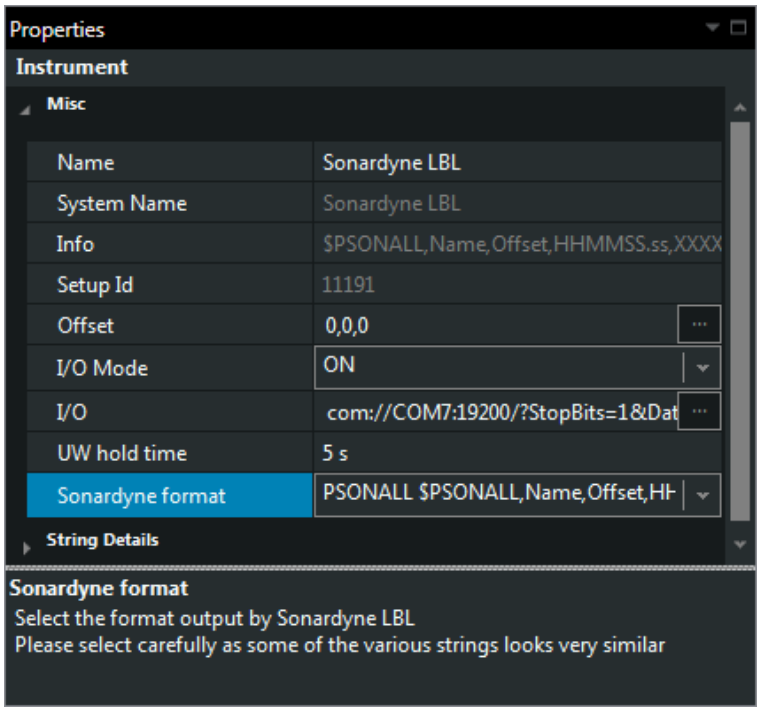
- Name
  Identifies the position source
- TP Code
  Select the transponder number defined for this object. It must correspond to the selection on the USBL system.
- Kongsberg mode (For HiPAP/APOS only)
  - Normal
  - Master
  - Slave
    Is the USBL part of a dual head solution – and is this data measured from master, slave or ordinary input.
- Emergency A

- Emergency B
  Kongsberg only (For HiPAP/APOS only) – special beacon
- Transponder offsets
  If the required position calculated for this object is different from the transponder position (eg. you just need the CRP and not the raw observed position), then the operator must specify the X,Y,Z offset here.
  Please note that these values are treated as ordinary antenna offsets, ie. Defined as offset from CRP to the transponder.
  CRP = raw TP - Offsets(3D compensated).
  Note that this requires as minimum a gyro and preferable a motion sensor is attached to the object!
  This can also be obtained by specifying an user-defined offset on the object.

8.2 LBL Position

The position output is assumed to be a final computed position (in grid components or latitude/longitude) and NaviPac just assign that to internal objects.

The LBL data will be defined both on the vessel (mounting and io) and on the target vehicle



- UW hold time
  How long time shall NaviPac keep the USBL position before flagging it invalid, i.e. the object state changes to red.
- Sonardyne Format
  Select the output format from Sonardyne APS3. Supports Stolt Offshore 1 and 2, Geoconsult and special Pharos formats:
  - Mode1="FXT;time,E east, N,north,D depth,A error,H heading,T id" ->Geoconsult
  - Mode2="FXT;delay,TARGET SINGL TRAK,E east, N north,D depth,A error,H heading" -> Stolt Offshore 1
  - Mode3="FXT;ttttt.tt,m,Eeeeeee.ee,Nnnnnnnn.nn,Ddddd.dd,Axx.xx,Hhhh.h ->Stolt Offshore 2
  - EIVA/Pharos = [2]"FXTNP;ID,HH:MM:SS.ss,LL.LL,Eeeeeeeee.ee,Nnnnnnnnn.nn,Dddddd.dd,Saaa.aa,Maaa.aa,Taaa.aa,Paaa.aa,Hhhh.h<cr><lf>"

[2] This is called Fusion in newer Sonardyne systems

- PSONALL
  $PSONALL,Name,Offset,HHMMSS.ss,XXXXXXXXX.xx,YYYYYYYYY.yy,DDDD.dd,HHH.hh,CCC.cc,T,PP.PP,RR.RR,VVV.vv,AAA.A,BBB.B*hh

8.2.1 Target

For each selected vehicle (an object assigned to a transponder/responder) the following parameters must be defined.

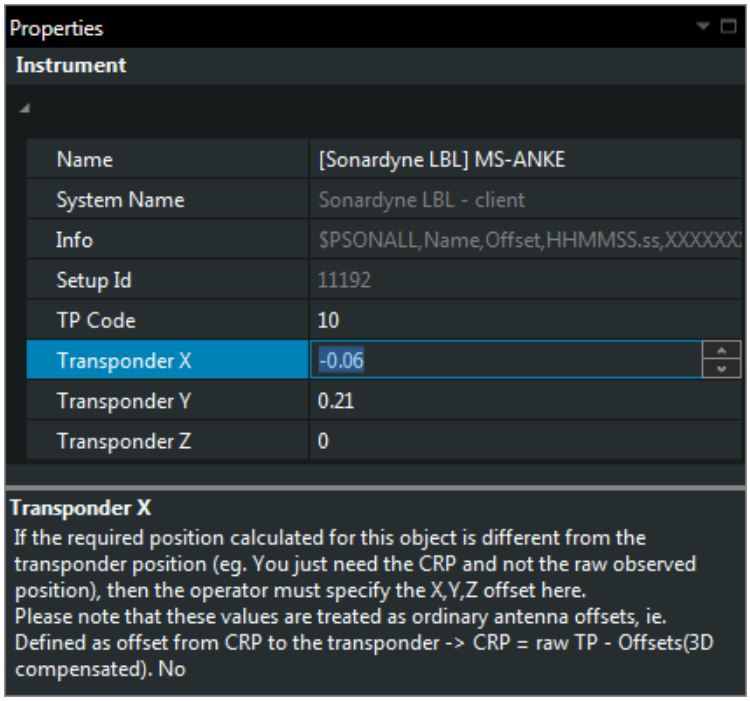


Figure 21 Definition of LBL targets

- Name
  Identifies the position source
- TP Code
  Select the transponder number defined for this object. It must correspond to the selection on the LBL system.
- Transponder offsets
  If the required position calculated for this object is different from the transponder position (eg. you just need the CRP and not the raw observed position), then the operator must specify the X,Y,Z offset here.

Please note that these values are treated as ordinary antenna offsets, ie. Defined as offset from CRP to the transponder.

CRP = raw TP - Offsets(3D compensated).

Note that this requires as minimum a gyro and preferable a motion sensor is attached to the object!

This can also be obtained by specifying a user-defined offset on the object.

8.3 Remote Dynamic Objects

The position output is assumed to be a final computed position (in grid components or latitude/longitude) and NaviPac just assign that to internal objects. NaviPac supports a series of formats like NaviPac, WinFrog, IMCA, Apache, QPS Pseudo NMEA, Tracs etc.

The remote position data will be defined both on the vessel (mounting and io) and on the target vehicle

8.3.1 Target

For each selected vehicle (an object assigned to a identification number) the following parameters must be defined.

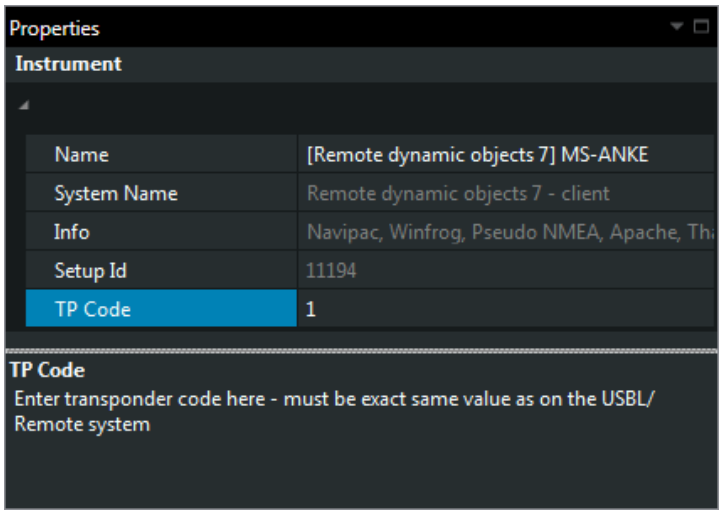


Figure 22 Definition of target for remote navigation input

- Name
  identification of position source
- TP Code
  Select the code number defined for this object. It must correspond to the selection in the outputting system.
  For IMCA outputs please note that a mapping between IMCA name and NaviPac numbers has to be defined. This is done in the Options, Survey Parameters menu.

8.4 Total station from vessel to target

The total stations like AGA, Leica and similar are always defined as measurements from the main vessel (vehicle 0) to the target. The total station is assumed to be oriented in vessel coordinate system – but has possibility to add mounting corrections for some units.

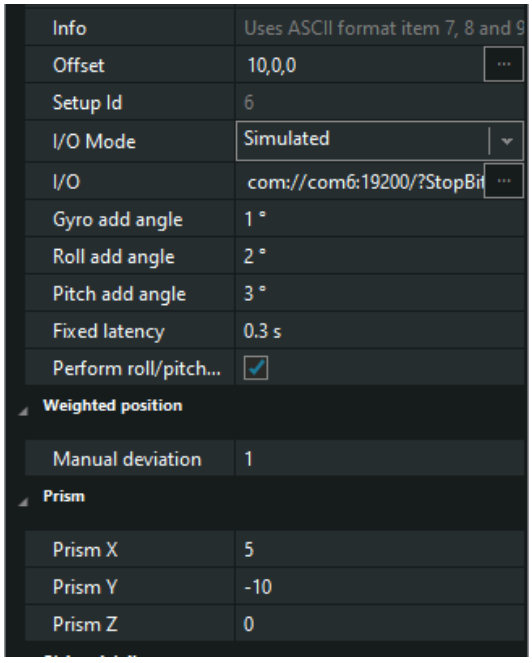


Figure 23 Leica total station

- Offset
  identification of offset on the main vessel to the tracking device
- Prism
  Offsets of the prisms on the target. Requires that you have as minimum gyro on the target vehicle

- Mount angles
  Mounting correctio of the total station relative to vessel coordinate system
- Perform roll/pitch correction
  Shall NaviPac compensate the measurements from the unit for roll/pitch from the main vessel MRU
- Weighting
  When using multiple prisms -possible to weight them individually

8.5 Total station from fixed location to target

You may also use a total station mounted on a fixed location and tracking a prism on the target. This will be a 2D position solution, Here you must enter the coordinates of the fixed location – and the output is assumed to be related to north.

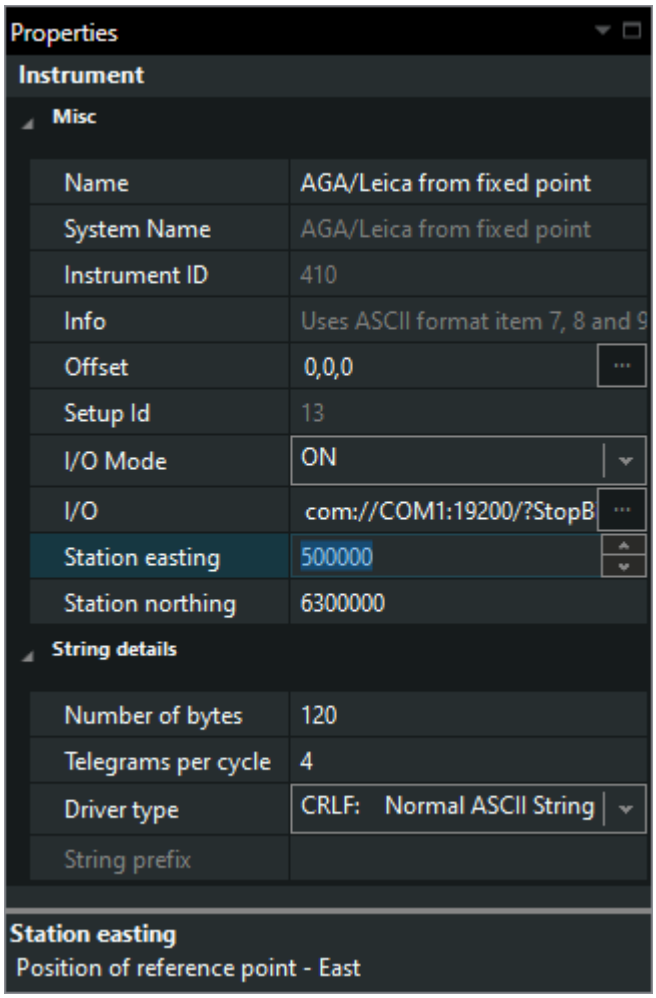


Figure 24 Leica from fixed location

9 Data outputs

NaviPac has many specialised outputs. Most setup should be self-explainable – some very special. Some inputs covers multiple position vehicles – than can either be performed via section of multiple vehicles or adding the output to more vehicles (eg data to external nav system)

This section covers most general items.

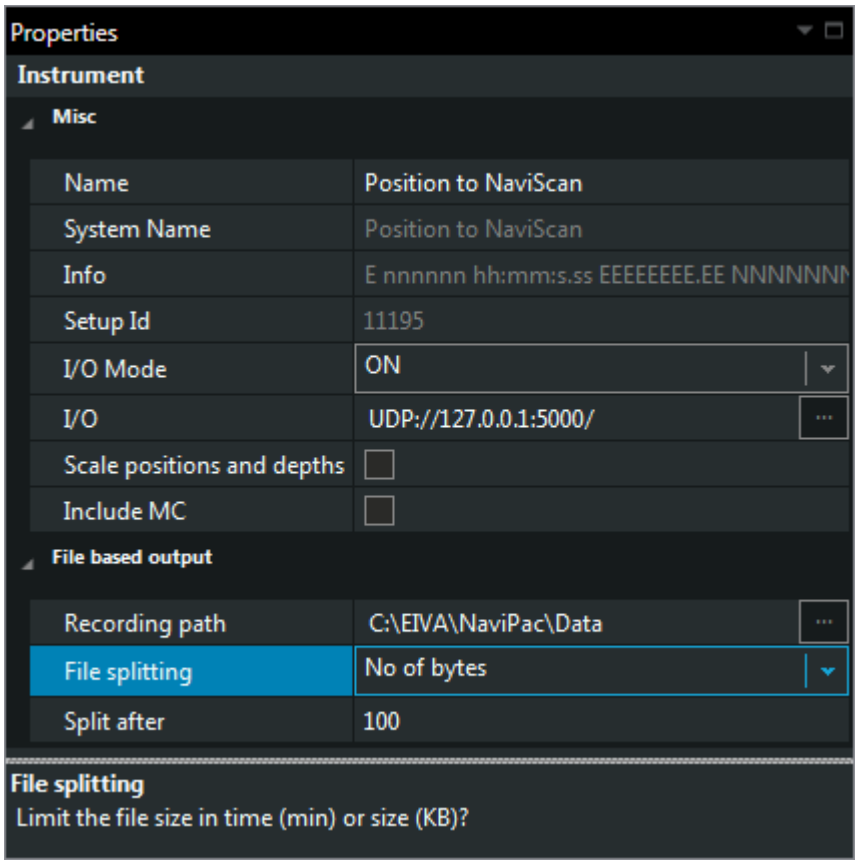


Figure 25 General definition of data output

- Scale positions and depths
  If you are operating in non-metric system then you may control if the output shall be in metric or in user selected data unit. (Future use)
- File information
  If data is output to a file then you may select name, path and size

9.1 NMEA

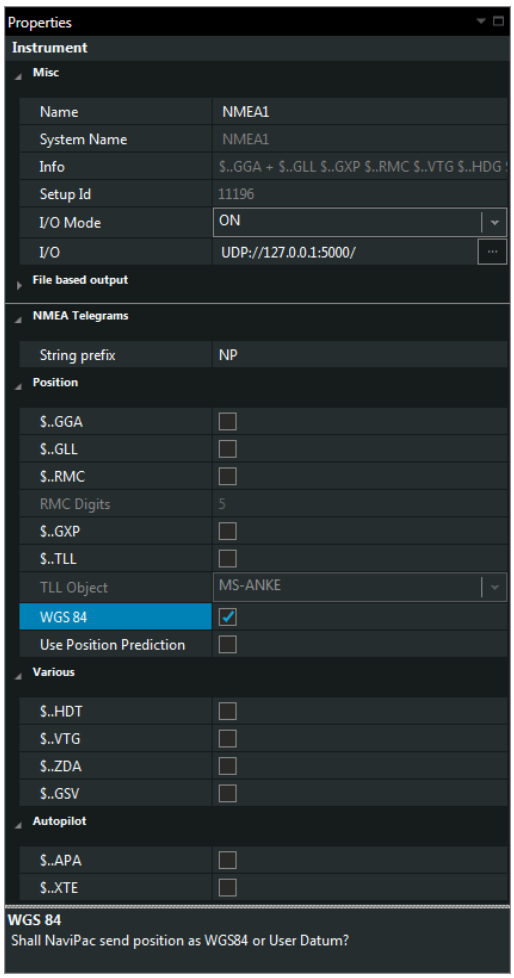


Figure 26 Special setup of NMEA data output

- String prefix
  Enter the two character to put in between the $ and the first ID (The NMEA TALKER)
- Position
  Select between various positions formats. You may select 0, 1 or more as you need.

- Datum
  Shall NaviPac output position in user datum (default) or WGS84
- Use Position Prediction
  Shall NaviPac extrapolate the position to real-time predicted value?
- TLL Object
  The target output may represent another object (eg. Towed vehicle) than the primary selected)

- Various
  Select between various auxillian formats. You may select 0, 1 or more as you need.
- Autopilot
  Select between various runline status data formats. You may select 0, 1 or more as you need.

9.2 User defined outputs

User defined outputs has been re-enabled in NaviPac4.5 – and works similar to the solution in NaviPac 3. Please see dedicated manual on user defined outputs for details.

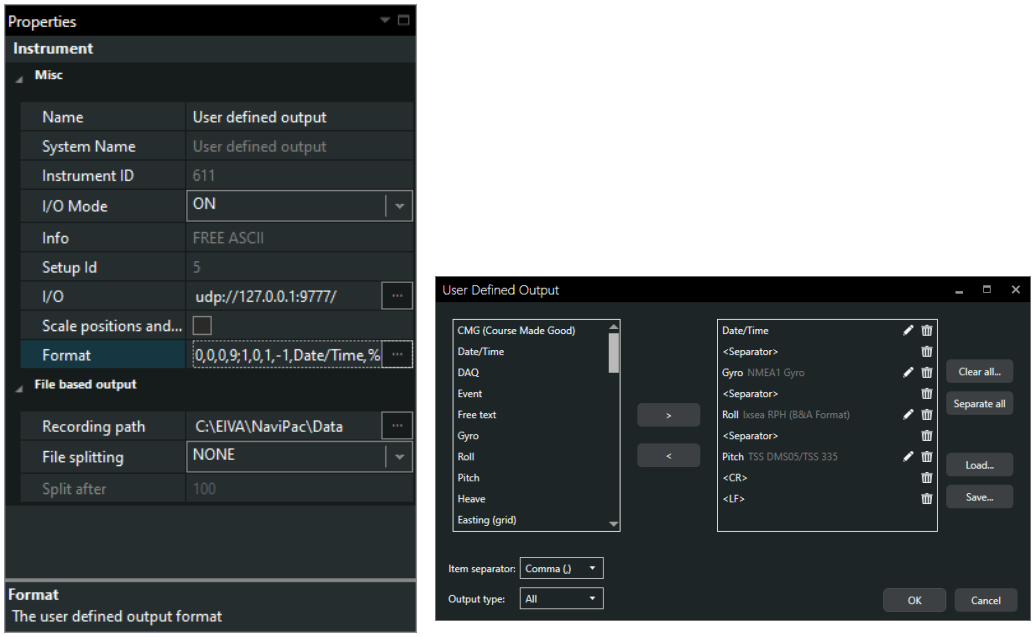


Figure 27 Details on user defined outputs

9.3 Data to NaviScan

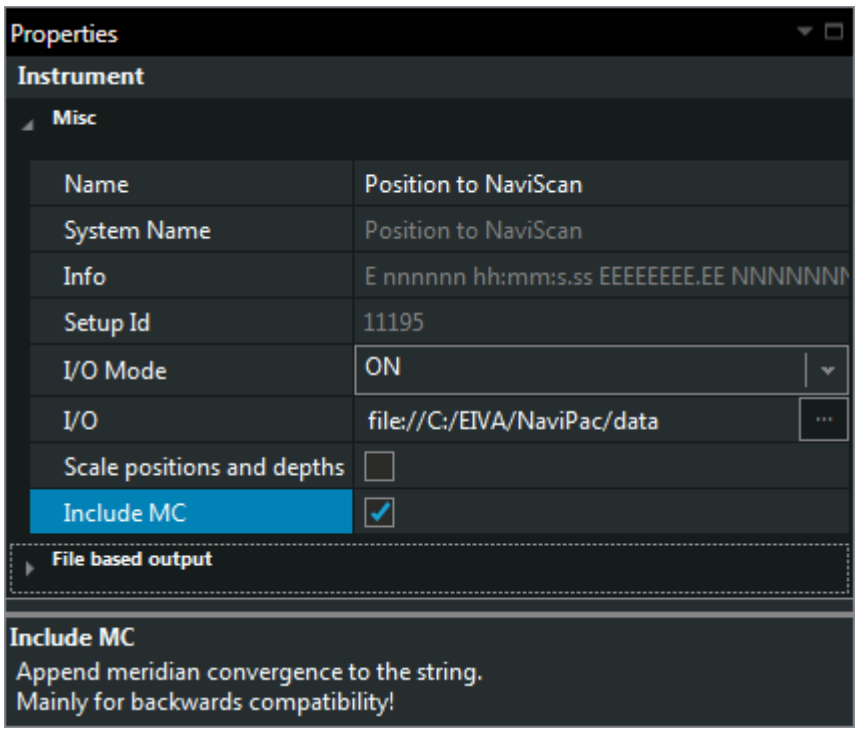


Figure 28 Special parameters for data to NaviScan

- Include MC
  Shall NaviPac send Meridian Convergence value to NaviScan. Recommended to be selected when used with older NaviScan versions

9.4 Annotation of EPC Recorders

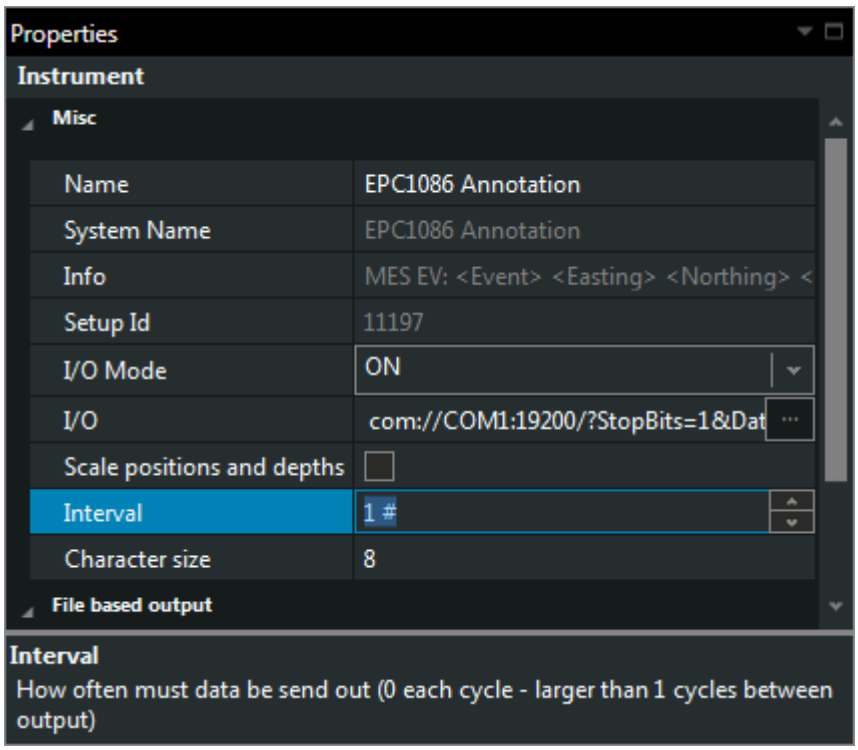


Figure 29 Special setup of EPC data annotation

- Interval
  Specify how often (event interval) the annotation must be performed.
- Character size
  Specify size of EPC characters (between 1 and 9). Changes will be applied online!

9.5 Data to external navigation system

Data to external navigation systems and similar contains multiple vehicles in same output. This is done by defining the output on each vehicle with same destination.

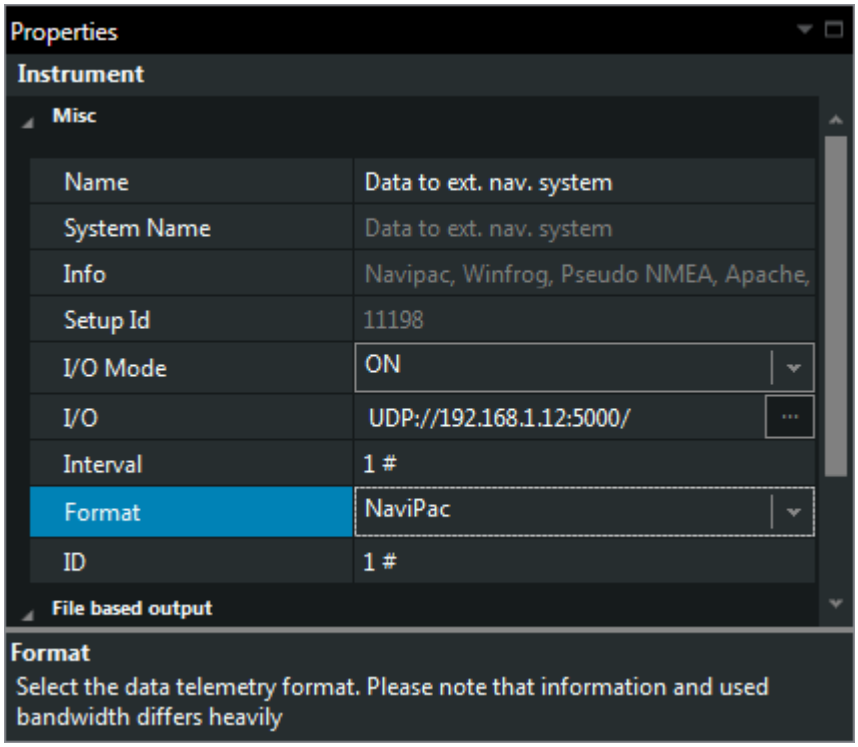


Figure 30 Selection and setup of data to external navigation systems

- **Format:**
  In this list you select what format you want to output:
  - NaviPac:
    Compressed format that is most efficient if two or more NaviPac systems exchange information. Includes position and heading.
  - WinFrog:
    Send data on the WinFrog format
  - NMEA:
    Send data on a pseudo NMEA format (header is $xxGGA and $xxHDT, where xx is the object id).

- Expanded NaviPac:
  Ordinary NaviPac format plus motion data, quality factors and data acquisition data.
- $SFPOS:
  Output of position using the Apache format
- IMCA:
  Position and heading using standard IMCA format – remember to specify IMCA ID in Survey Parameters
- NaviPac + tug State:
  The short NaviPac format plus status of primary GPS sensor (satellites, HDOP, Quality) sent every 10'Th update.
  Do also output geodesy information with low frequency.
  This in mainly used between tug's and barges.
- Sonsub $PSURP
  Position and attitude data in special Sonsub format.
- Kongsberg $PSIMSSB
  Position data in Kongsberg NMEA format – position in radians. Compatible with IxSea ROVINS/Phins.

- **Interval:**
  Here you specify the output rate, as the value is a multipla of cycles.
- **ID:**
  Unique id number (corresponding to transponder codes).

Similar dialogues are used for position to EIVA 3D, Acergy ACDAT etc.

9.6 Dual or triple object outputs

Some outputs as data to Data to Datasonics ChirpII, ROVLOG, ArcScene etc requires specification of 2 or three objects.

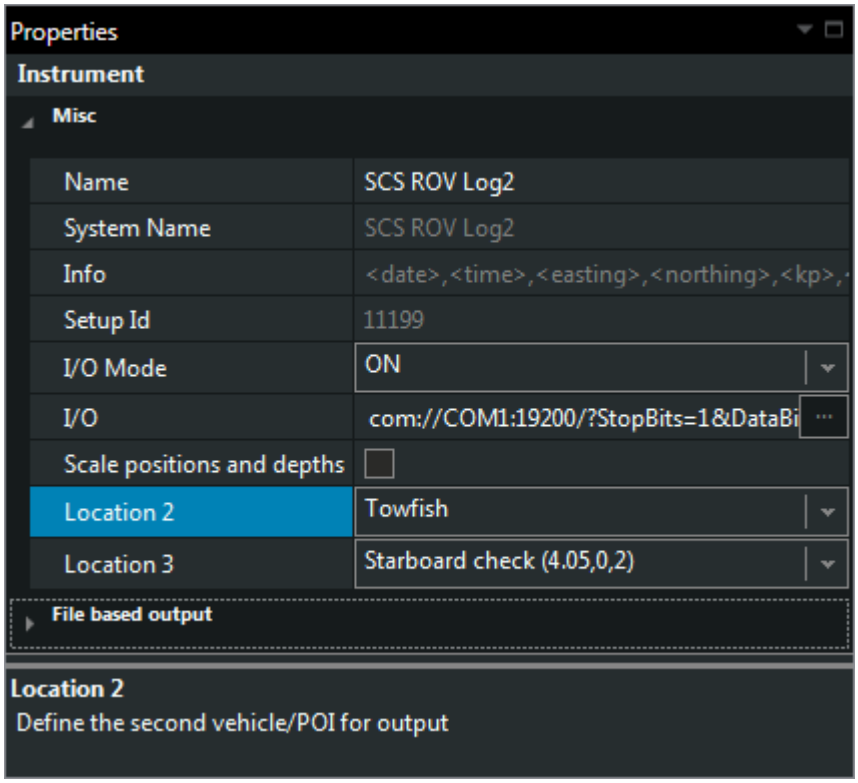


Figure 31 General handling of outputs with multiple objects

The first object is the vehicle where the output is attached to. The up to two other can be selected between vehicles and POI's

9.7 Autopilot

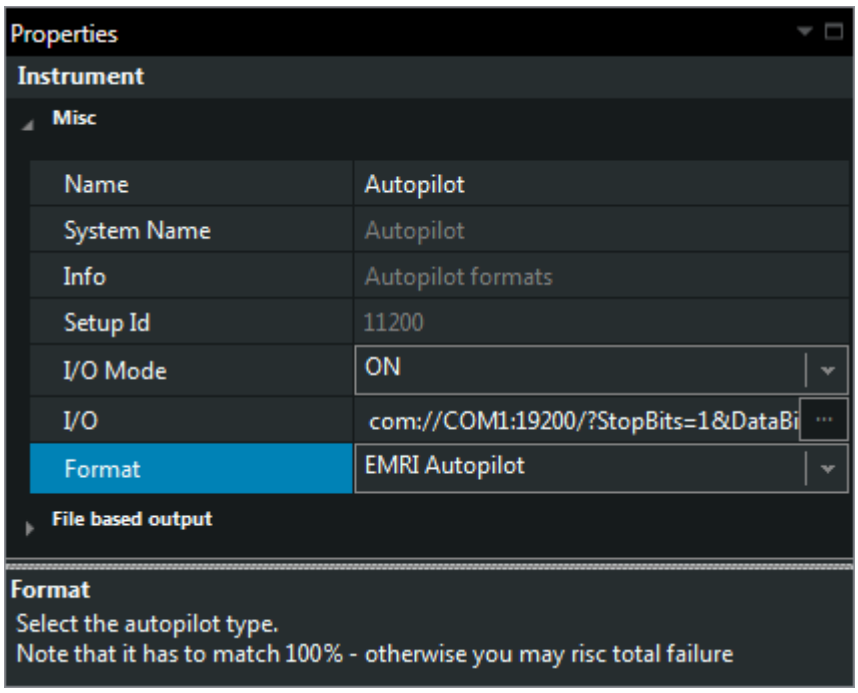


Figure 32 Detailed autopilot settings

The advanced (two way communication) autopilot allows selection of data format

- EMRI
- None – out dated
- Condor Autotrack
- Kongsberg DP
- EMRI SEM 200
- Sjöfartsverket Low speed

9.8 Data to Rob Track

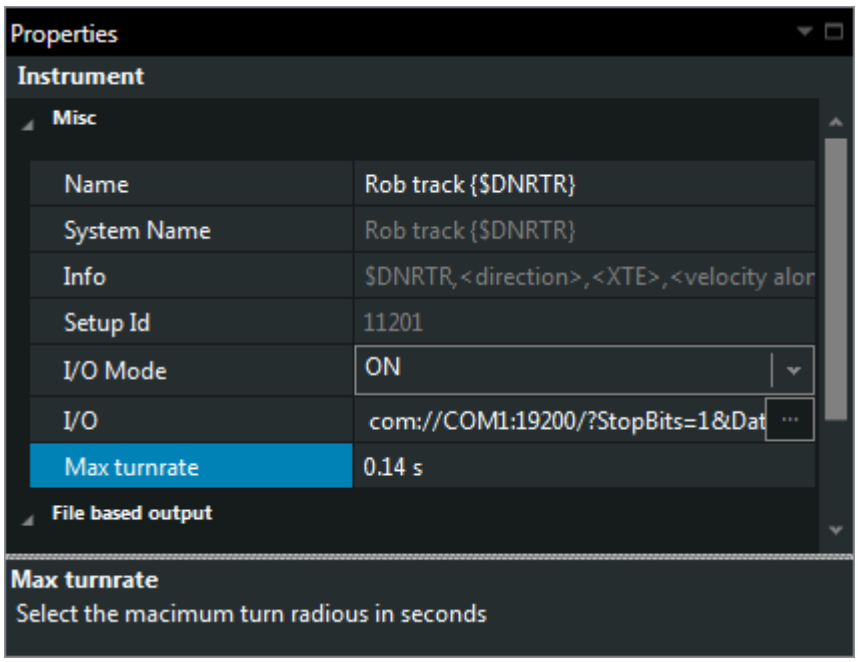


Figure 33 Special handling of Rob Track

- Max Turn rate
  Enter the maximum turn rate in seconds

9.9 DOF Subsea Pipe inspection

Not supported in the Kuda editon

9.10 Data to Geco TriAcq

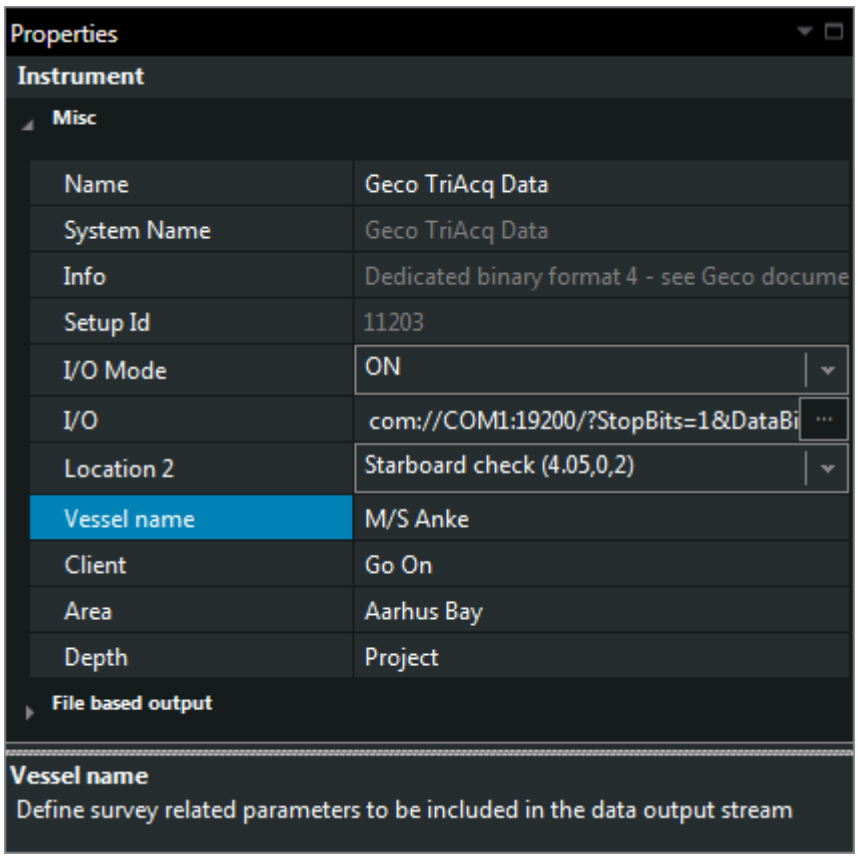


Figure 34 Selection for Geco seismic operations

Definition of a series of parameters specific for this output

9.11 Data to Coda

Most settings are handled via right mouse and Edit Special Settings. Select which data shall be used for bathy and altitude.

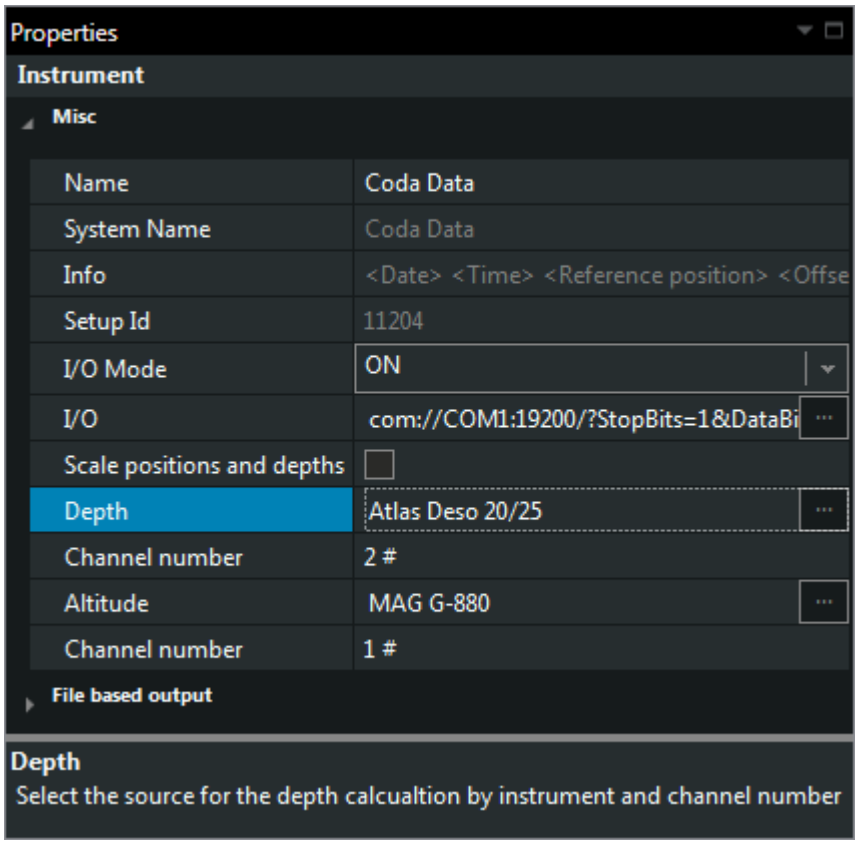
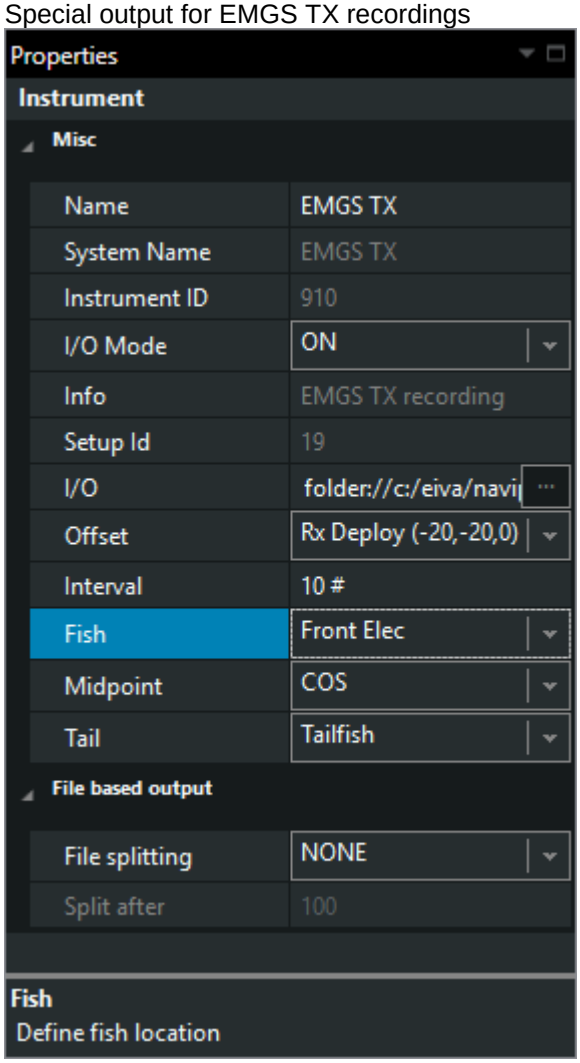


Figure 35 Data output to Coda Octopus

9.12 EMGS TX

Special output for EMGS TX recordings



Selection of the various data points in the subsea network