WinFrog Device Group:	**USBL**
Device Name/Model:	**MDL FANBEAM (Precise)**
Device Manufacturer:	**Measurement Devices Ltd. (MDL)** Silverburn Crescent Bridge of Don Industrial Estate Aberdeen AB23 8EW, Scotland, UK Tel: +44 (0)1224 246700 Fax: +44 (0)1224 824987 sales@mdl.co.uk
Device Data String(s) Output to WinFrog:	Target ID, Range(m), Bearing(deg clockwise from Bow of Vessel) (DD RRRR.RR BBB.BB <CR> <LF>)
WinFrog Data String(s) Output to Device:	Nil
WinFrog .raw Data Record Type(s):	Type 309

DEVICE DESCRIPTION:

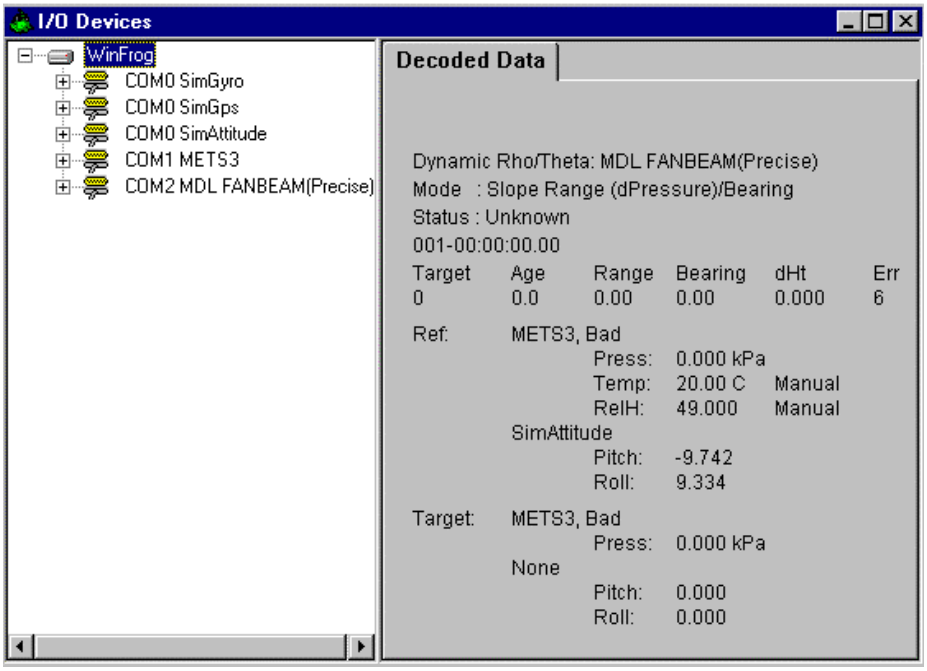
The MDL Fanbeam is a laser radar system used primarily for repetitive, positioning and tracking of marine vessels, seismic gun arrays, and structures. The system consists of a laser-scanning unit with a Universal Control Unit (USU). The Manufacturer insists that the system is: easy to set up, operates very well for distances under 1500 metres, provides consistent accuracy, utilizes safe targets, and requires little maintenance.

The addition of the '(Precise)' option allows you to add relative height differencing capabilities. This height difference is used to reduce the observed slope range to the horizontal. Additional Devices can be added to the system to enable this operation. Additional Devices include an Attitude Device and an Elevation Device. The Attitude device is not required to use this option, however, without an Elevation Device, this driver provides no additional benefit over the standard MDL Fanbeam driver. The only Elevation Device presently in Winfrog is the METS3 PRESSURE. Refer to the documentation for the METS3 PRESSURE device for more information.

DEVICE CONFIGURATION INSTRUCTIONS:

Baud Rate: 9600
Data Bits: 8
Stop Bits: 1
Parity: N
RS-232C data communication

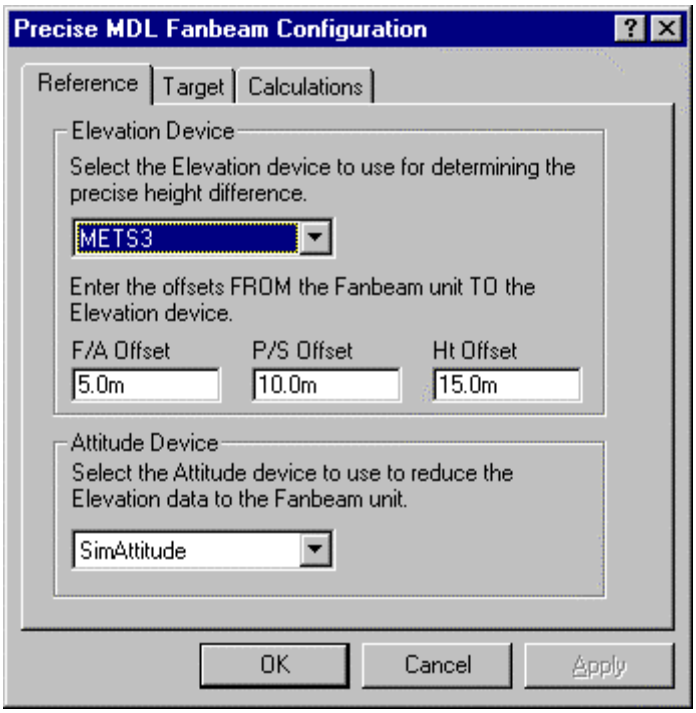
WINFROG I/O DEVICES > CONFIG OPTIONS:
The MDL FANBEAM (Precise) device is accessed via the USBL device types. The Hydrophone and Beacon sub-devices are added along with the MDL FANBEAM (Precise) device. The Elevation and MDL FANBEAM (Precise) options must be initiated in order for the 'Precise' option to be beneficial.



The Device Window provides information regarding the MDL Fanbeam data, and the associated attitude and barometric data used in the reduction. The information includes:

- Device name
- Operation mode
- Julian day and time of data input
- Target ID age of data, horizontal range, bearing, height difference and error code
- Reference unit data
- Name of the Elevation device
- Pressure in kilo Pascal's or elevation in the Distance units
- Temperature in Celsius, and the source, Manual or Device
- Relative Humidity and the source, Manual or Device
- Name of the Attitude device
- Pitch
- Roll
- Target unit data
- Name of the Elevation device
- Pressure in kiloPascals, or elevation in the distance units
- Name of the Attitude device
- Pitch
- Roll

Configuring the device brings up the Precise MDL Fanbeam Configuration dialog box. The following configuration options are available from the I/O Devices Window, under the MDL FANBEAM (Precise) option:



Reference:

In the Elevation Device section, use the dropdown list box to select the desired source of either absolute elevation or pressure data. The offset from the MDL Fanbeam Reference unit to the device enables the reduction of the heighting data, to the Fanbeam unit.

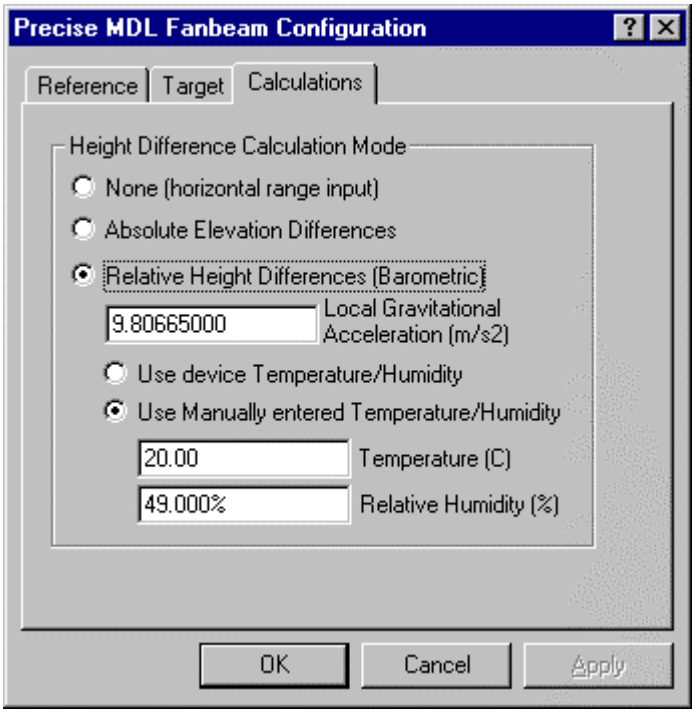
In the Attitude Device section, an Attitude device may (or may not) be selected for use in reducing the previously mentioned offsets, to the vertical.

Target:

The configuration for the Fanbeam Target is the same as that for the Reference unit.

Calculations:

The Calculations configuration options are shown below.



You may select from the following 'Calculation' options:

- ***None (horizontal range input):*** If selected, the Fanbeam range is assumed to be the horizontal range, and the data is converted to XY with Z=0
- ***Absolute Elevation Differences*:** If selected, the data from the selected Elevation devices are used to determine the difference in height between the Target and the Reference unit.
- ***Relative Height Differences (Barometric)*:** If selected, the pressure data from the selected Elevation devices are used to calculate a relative height difference between the Target and Reference unit.
- ***Local Gravitational Acceleration (m/s^2):*** Set for the height differencing algorithms.
- ***Use Device Temperature/Humidity:*** The temperature and relative humidity read by the Elevation device are used in the height differencing algorithms.
- ***Use Manually entered Temperature/Humidity:*** Allows you to enter values for temperature (Celsius), and Relative Humidity (%) in the provided fields. These values are used in the height differencing algorithms.

Device Operation:

The selected Elevation and Attitude devices are checked for new data, only if required.

The MDL target ID, range and bearing input is decoded.

If **no** height differencing is being performed, the range is assumed to be horizontal and along with the bearing data, it is reduced to Vehicle referenced XY offsets. The Z is made equal to 0.

If height differencing is being performed, the height difference between associated elevation devices at the Target and Reference units is determined. This is performed either by:

- subtracting the elevation at the Reference Unit from the elevation at the Target Unit, or,
- applying the respective Target and Reference pressures, temperature, relative humidity and gravitational constant in an algorithm to calculate the height difference.

Note: if the temperature and relative humidity are to be obtained for the Elevation device, the values from the Reference unit are used.

Once the height difference between the Elevation devices are calculated, the respective offsets, corrected for pitch and roll (if Attitude devices have been selected), are applied to obtain the height difference between the actual Fanbeam Reference and Target units. This height difference is used with the slope range to calculate a horizontal range, which is then used with the bearing data to calculate Vehicle referenced XY. The Z value is set equal to the height difference.

WINFROG VEHICLE TEXT WINDOW > CONFIGURE VEHICLE DEVICES > DEVICE > EDIT OPTIONS:

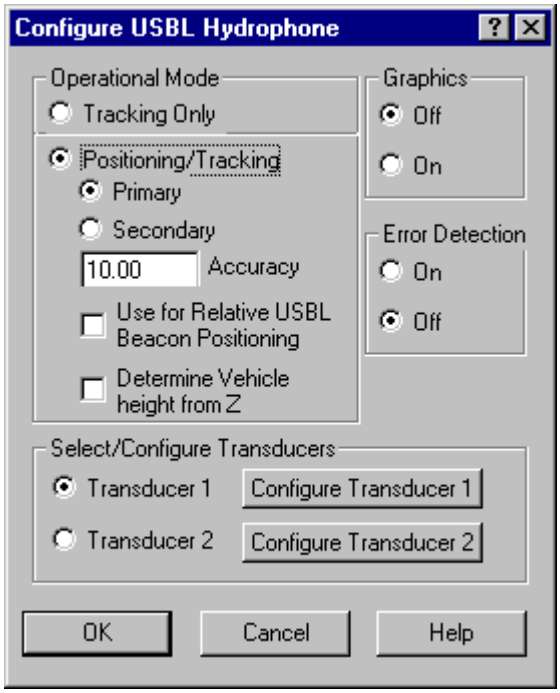
The USBL Hydrophone is usually added to the master vehicle.

The Beacon is usually added to the ROV, towed equipment, or structure fixed to the seafloor. With this last option, you can position the Hydrophone from the Beacon (target). For this, you must define a Xponder File (*.XPT) in Winfrog, and ‘fix’ the Beacons’ position. See chapter 5 of the WinFrog User’s Guide for more information on setting up *.XPT files.

The device configuration also allows you to select/add an **ELEVATION** data type device for both the Target and Reference unit, complete with three-dimensional offsets; and, an **ATTITUDE** data type device. These two devices will enable the reduction of the previously mentioned offsets, to the vertical. You can also select the actual relative height calculation method.

1. Configuration of the USBL Hydrophone.

Once the MDL FANBEAM Hydrophone has been added to the appropriate vehicle's device list it must be edited to suit the application. In the vehicle's Devices list, highlight the USBL, MDL FANBEAM, USBL HYDROPHONE then click the Edit button. The Configure USBL Hydrophone dialog box appears as seen below.



Operational Mode:
As mentioned above, USBL systems can be used for tracking of remote vehicles or for positioning of the main vehicle to which the hydrophone is attached. Select **Tracking Only** if relative tracking of a structure/vessel is desired.

Select **Positioning/Tracking** and **Primary** if you want to position the Master Vessel relative to a stationary (fixed) beacon. The beacon must be located on the stationary (fixed) object, as defined in a working XPONDER (.XPT) file. Select the **Secondary** radio button if this is not the primary positioning source (i.e. if this is a comparison position), or if you are setting up for a USBL Calibration. Note as well that if you are setting up for a USBL Calibration, the Hydrophone should also be specified as a Secondary positioning device. See chapter 20 of the WinFrog Users Guide for more information on USBL Calibrations.

If **Positioning/Tracking** is selected, you can also specify **Use for Relative USBL Beacon Positioning.** This feature controls the use of the USBL positioning of the hydrophone from a fixed beacon for application to relative USBL Beacon positioning. In this mode, the difference between the hydrophone position as determined directly from observation to fixed beacon is compared to the hydrophone position determined from other positioning sources (e.g. DGPS). This difference is then applied to the position determined for any tracked beacon. The concept is that any

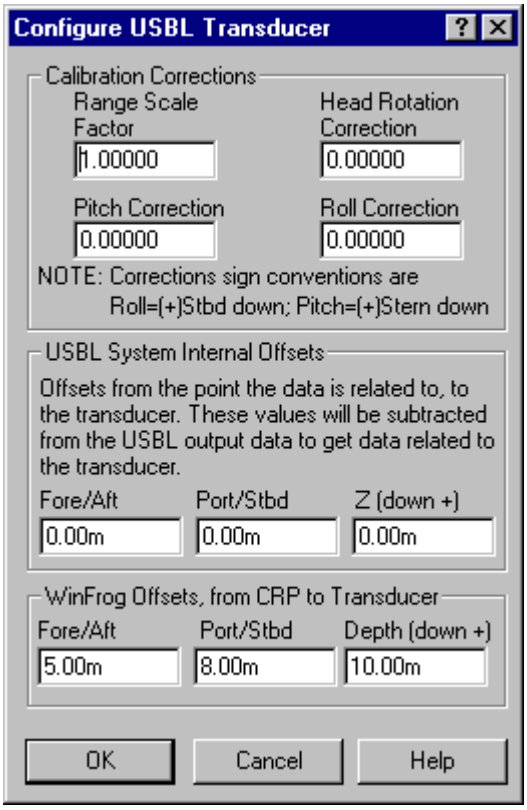
inherent errors due to local conditions, both environmental and mechanical, are cancelled out. This is independent of the Primary/Secondary setting.

Note: the default value for the Positioning Accuracy is 10m. It is not recommended to set this value below 7m. In Tracking Mode, the accuracy setting is in the Beacon configuration dialog.

Graphics:
Selecting the On radio button will display the device name and a square at the location of the total station, within the Graphics and Bird's Eye windows.

Error Detection:
By enabling this option, error detection codes are included in the Raw Files. This option is mainly for post project QC analysis and future development.

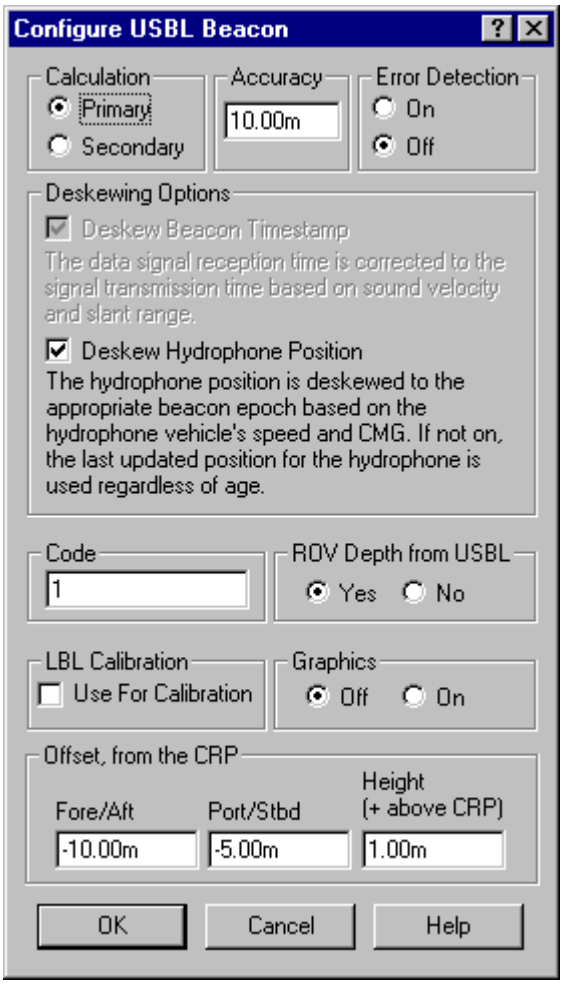
Select/Configure Transducers:
Two unit locations can be configured for use. Click Configure Transducer 1 or Configure Transducer 2 as required. The Configure USBL Transducer dialog box appears as seen below.



Calibration Corrections:
These values do not apply for MDL FANBEAM operation. Set values as displayed above.

Offsets:
The offsets from the point the data is related to, to the transducer, are set to zero for MDL operation as offsets either cannot be configured into the unit, or are not required. The WinFrog Offsets, from CRP to Transducer are set to similar values as would be applied to any device offset in WinFrog. In the above example, the instrument is located 5 (m) fore, 8 (m) starboard and 10 (m) below the CRP.

2. Configuration of the USBL Beacon



Calculation:
Set Calculation to Primary if the target is to be used for positioning the vehicle to which it is attached.

Accuracy
This value is used by WinFrog to weight the use of different positioning devices in solving a single vehicle's position. The lower the accuracy value entered, the more accurate it is deemed to be, and hence the more weight that will be applied to it in comparison to the other devices.

Error Detection:
By setting Error Detection to 'On', errors are written to a file for post processing.

Deskewing Options

Deskew Beacon Timestamp
This option is for future development.

Deskew Hydrophone Position
When positioning the beacon (target), WinFrog uses the last calculated position for the associated USBL Hydrophone (instrument) to determine the tracked target's position. Depending on the vehicle's Kalman filter and Dead Reckoning settings, the position of the instrument may be up to 1 second old.
It is recommended that this deskewing option be enabled to remove positional inaccuracies associated with this latency.

Code:
Set code to 1.

ROV Depth from USBL:
By setting this to Yes, the target height will be calculated.

LBL Calibration:
No calibration within Winfrog is required for operation of the MDL FANBEAM.

Graphics:
By setting the Graphics to On, a square and label will be displayed for the target location.

Offsets:
The Offsets are applied from CRP (of the structure/vessel) to the target Location. These values are set similar to values that would be applied to any device offset within WinFrog. For the above example, the target is located 10 (m) aft, 5 (m) port, and 1 (m) below the CRP.

CONFIGURATION DETAILS:

A MDL FANBEAM Laser Unit was not available for this documentation.

Ranging can be gated in the instrument using the minimum and maximum range settings in the unit.

Refer to documentation on the METS3 Pressure Sensor for information on the use of this device.

Refer to documentation on the various attitude sensors for information on their input to WinFrog.