Using the RTKDuo
positionning system
with AQUA-CAD & BricsCad

User Manual

RTKDuo buoy for ROV georeferenced Positionning

Document History

Document name	Version	Release note
RTKDuo_and_AQUACAD_v01.pdf	**001**	Document created
RTKDuo_and_AQUACAD_v02.pdf	**002**	Introduction of barometer functions (atmospheric pressure measurements), history of environmental parameters (tide, atmospheric pressure), using AQUA-CAD V09.06
RTKDuo_and_AQUACAD_v03.pdf	**003**	Some modifications/improvements, new features associated to AQUA-CAD V09.07 version
RTKDuo_and_AQUACAD_v04.pdf	**004**	Minor changes
RTKDuo_and_AQUACAD_v05.pdf	**005**	Minor changes

Summary

1   Software installation

Using the RTKDuo positioning system with AQUA-CAD and BricsCad requires the following software and driver installation:

- AQUA-CAD Version 9.06 or higher,

- BricsCad V13 / 32 bits version only (the 32 bits version works on 64bits processor), BricsCad is an Autocad (R) clone used for the 3D navigation display, but user can work with it's own navigation software (sending position through NMEA strings in AQUA-CAD). BricsCad software requires an activation key from PLSM.

- Survey Interface USB driver (file «**RTK_Duo_Buoy.inf**»),

- optional (if simulation mode used): VSPE (Virtual Serial Port Emulator),

- optional (if network RTK required): NTRIP Client Lefebure,

AQUA-CAD, BricsCad, VSPE and NTRIP Client are simply installed by running the install .exe or .msi file. They are compatible with : Windows XP (Service Pack 3 required), Windows 7 and 10.

Survey Interface USB driver installation:

To install the Survey Interface USB driver on Windows XP and 7:

- copy the **RTK_Duo_Buoy.inf** file on the HDD,

- plug the Survey Interface USB cable and connect the main supply,

- lets Windows detect the new hardware and indicate to Windows the file path of the RTK_Duo_Buoy.inf file,

To install the Survey Interface USB driver on Windows 10, please follows the procedure to install an unsigned driver.

2 RTKDuo System Configurations

Two configurations may be envisaged :

- the near-shore configuration : the Survey Interface is set up on a fixed point (ROV pilot from the shore during dam survey for instance), the GNSS receiver inside the Survey Interface acts as the RTK reference Base,

- the offshore configuration : the Survey Interface is set up on a moving point (ROV pilot from a vessel or construction work from a barge), then external RTK correction must be provided to the System by a customer's RTK Base + radio-modem, or by using RTK network corrections (NTRIP through cellular modem for instance), in this configuration it is possible to use the GNSS receiver inside the Survey Interface as a second rover with dual antenna to measure a heading and position the vessel,

these two configurations are described hereafter.

2.1 Near-shore RTKDuo configuration

The near-shore configuration appears below:
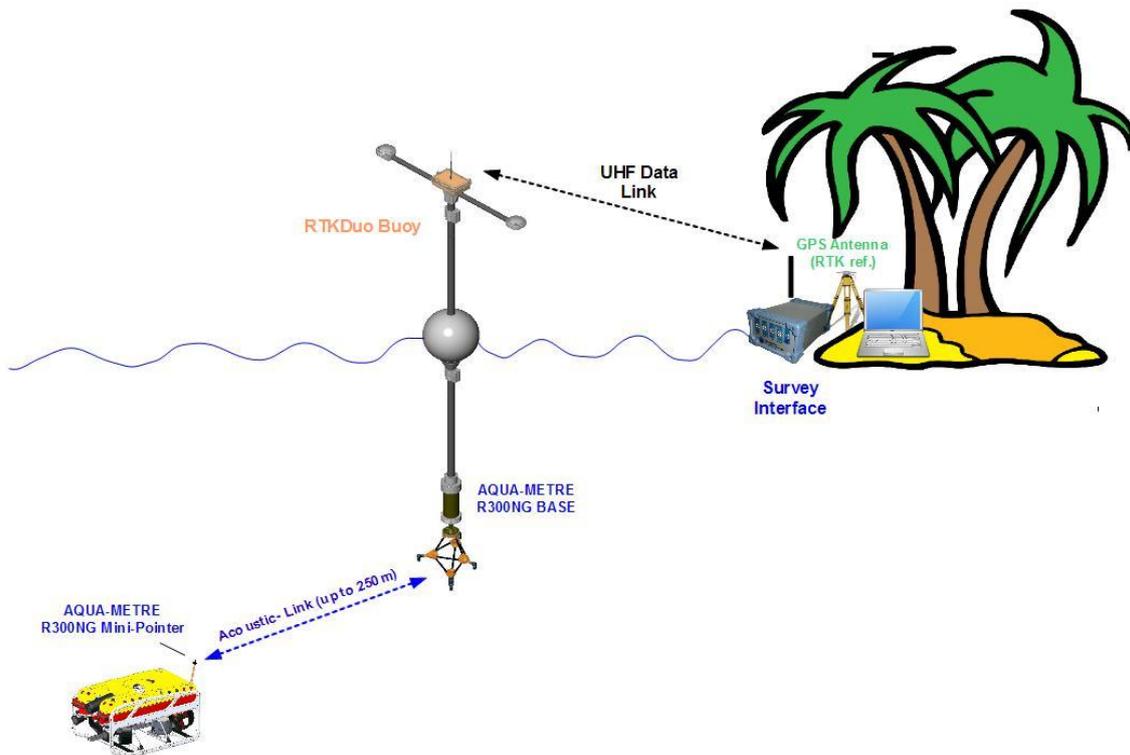
RTKDuo near-shore configuration (dam or bridge survey typically)

The system is managed from a fixed location, thus, the GNSS receiver inside the Survey Interface is set up as a RTK Reference Base in order to generate local RTCM corrections that are sent to the RTKDuo buoy. The GNSS reference antenna must be set up in an open sky location, in order to get the maximum number of satellites in view. If the GNSS position of the reference antenna is known, it will be input in AQUA-CAD and the system will directly deliver georeferenced underwater position. When working on a local cartographic system (not official like UTM, Lambert,...), the antenna may be set up on an arbitrary location and AQUA-CAD provides a way to identify the transformation between the geographic and local cartographic systems (see later in this document).

The Survey Interface communicate with the RTKDuo buoy through an UHF data link.

The R300-NG MiniPointer is supplied by its internal batteries (autonomy: 5 days of 10 working hours + sleeping mode between working periods), no need to connect it to the ROV system (however, it can be optionally supplied by the ROV in case of permanent installation).

The RTKDuo buoy is moored close to the survey area in order to lower the positioning errors, the dual antenna GNSS receiver inside the RTKDuo buoy works as a rover + heading.

2.2   Offshore RTKDuo configuration

The offshore configuration appears below:
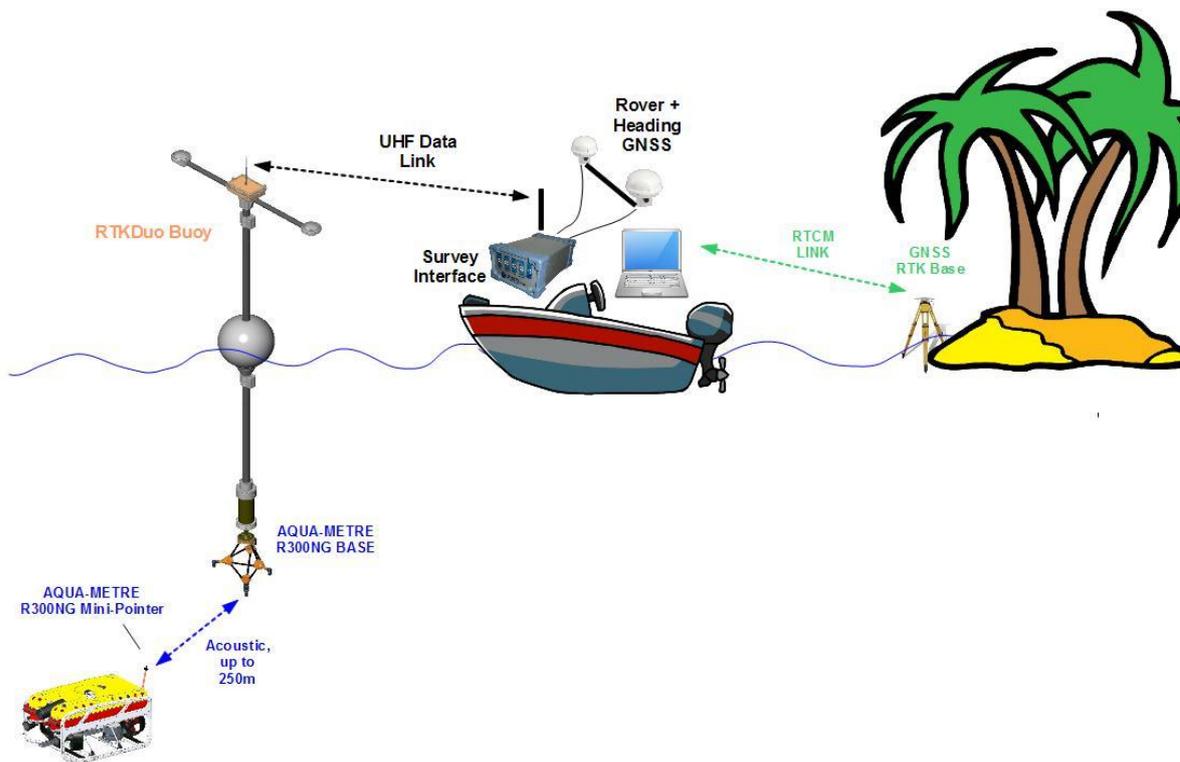
RTKDuo offshore configuration (dam or bridge survey typically)

The system is managed from a moving point (a vessel, barge,...), thus, the GNSS receiver inside the Survey Interface can not be used as a RTK reference Base, external RTCM corrections must be provided by the user from an external RTK base station on the shore, or from network RTK (NTRIP protocol, availability depends on the location) using cellular communications.

When using external RTCM corrections, it is possible to set up the GNSS receiver of the Survey Interface as a rover + heading (if two antennas are connected) and use it to position the vessel (available since AQUA-CAD version V09.05 and RTKDuo firmware version V0114, check availability with PLSM).

Note that an offshore survey from a steady location like a jack up barge may be sometime considered as a near shore configuration.

2.3 Survey Interface set up
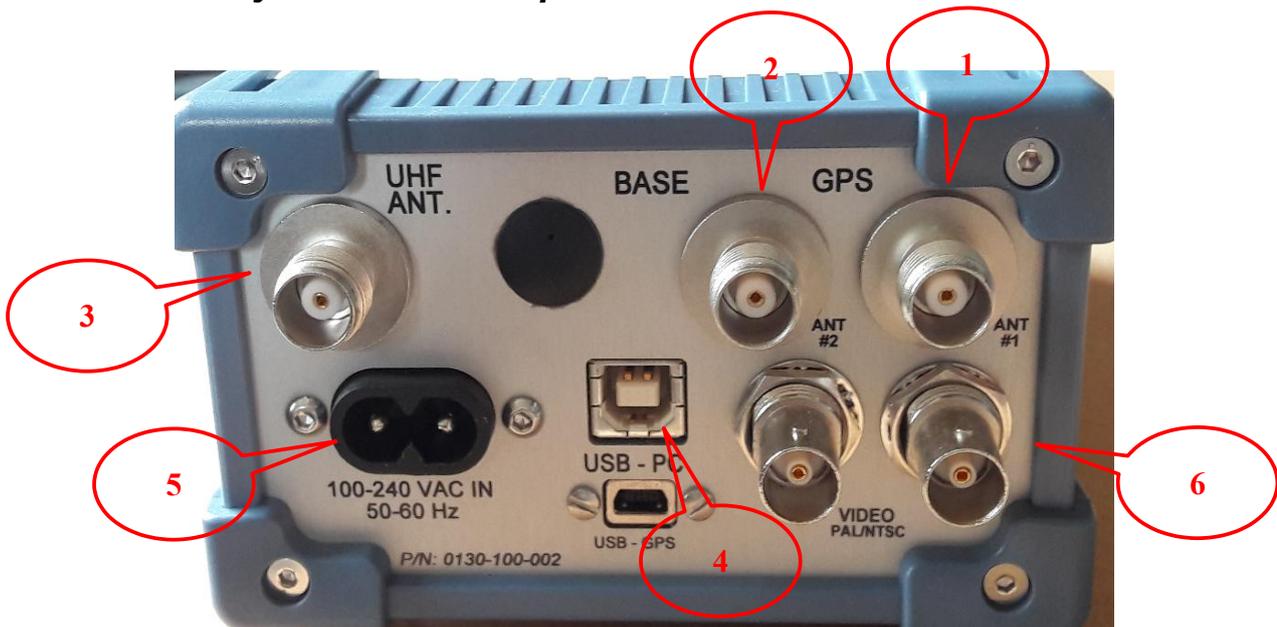
To set up the Survey Interface:

- Connect the main GNSS antenna (Tallysman TW3740 recommended) on connector **(1)**,

- Connect the second GNSS antenna if rover + heading mode is expected (Tallysman TW3740 recommended) on connector **(2)**,

- Connect the radio-modem UHF antenna on connector **(3)**, three radio-modem types may be delivered: 868MHz (for EEC), 915MHz (USA and CANADA) and 2,4GHz (international ISM band), please check that the antenna type matches the frequencies band,

- Connect the USB 2.0 **(4)** to your survey PC (A to B type USB cable provided),

- then, the Survey Interface may be powered through the main supply connector **(5)** (90-260VAC, power less than 8W),

- the two BNC connectors **(6)** are used for video overlay (input raw video, PAL or NTSC, output same signal + video overlay).

2.4 RTKDuo buoy set up
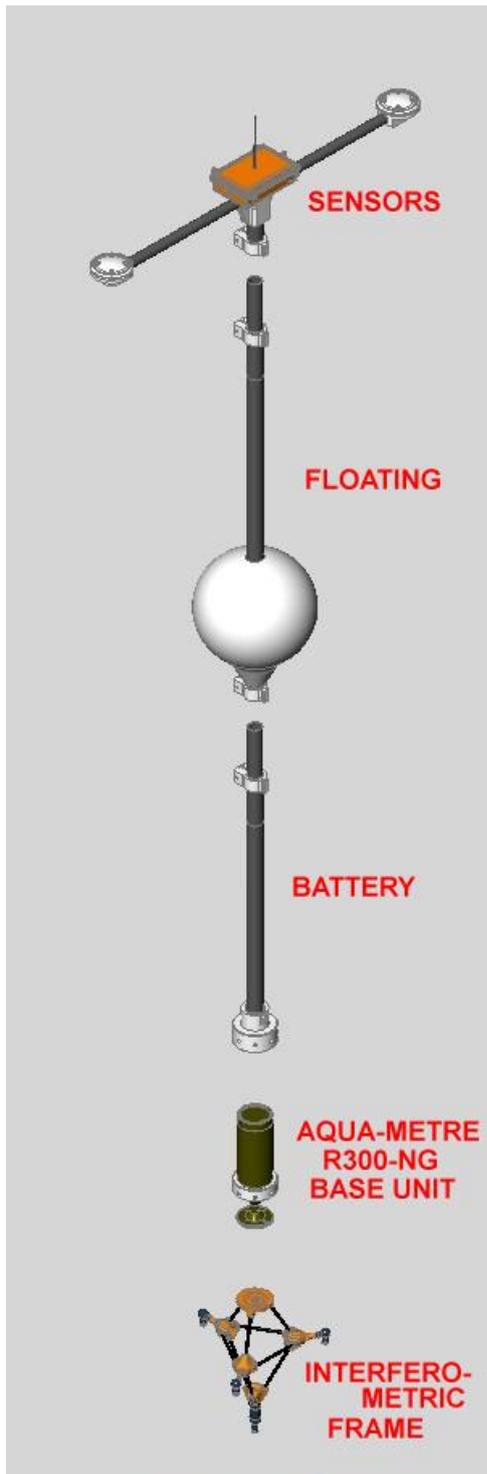
The RTKDuo buoy is made of three main sections:

- the sensors section on top,

- the floating section in the middle,

- the battery section on the bottom,

Each section is attached to another section using a special junction with alignment pin, secure screw and security pin as shown below:
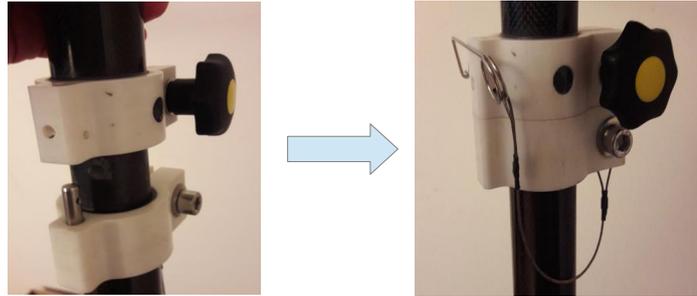

To assemble these sections:

- plug the sensors section on top of the floating section, the spiral cable and connector are inserted inside the tube,

- connect the MCIL8-MP connector of the sensors section on the bulkhead located on top of the battery section,

- then plug the battery section into the floating section

DO NOT FORGET THE SECURITY PINS ON EACH JUNCTION!

When the three sections are assembled, the Base unit must be attached to the bottom of the battery section. Take care to the alignment pin on the bottom of the Base Unit housing, it must be plugged first before screwing the plastic sleeve. The connector attached to the battery section will be plugged on the Base unit, there is a risk of confusion with the interferometric bulkhead (the interferometric bulkhead is clearly indicated by a label, see photo below). Then attach the interferometric frame to the mechanical interface on the Base unit housing, take care to the alignment pin and check that there is no dust that may affect the frame levelling.
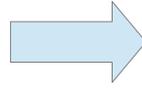
VERY IMPORTANT:

The interferometric frame is a critical and fragile piece of equipment. It is highly recommended to attach it on the RTKDuo buoy at the very last time (just before mooring the buoy will be perfect). Do not manoeuvre the RTKDuo buoy with the interferometric frame attached, or only by two people in order to prevent the frame from being damaged.

RTKDuo buoy assembled, ready for mooring

Mooring the RTKDuo buoy:

Do not attached the mooring line directly on the RTKDuo floating but use a separate small buoy as shown below:
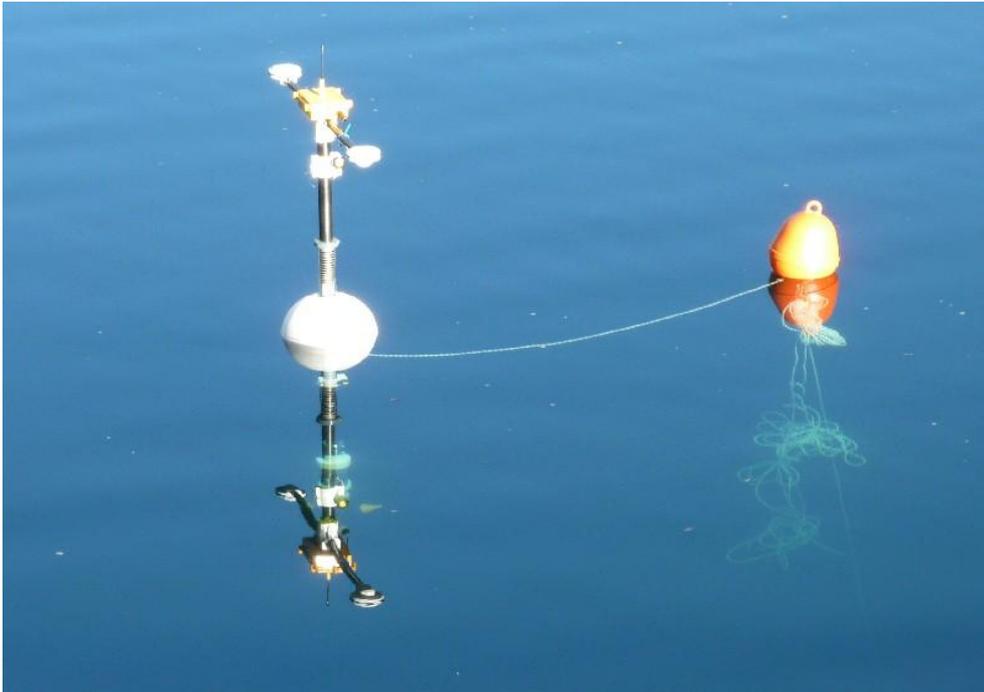
RTKDuo buoy attached to a small buoy that support the mooring line

To switch on the RTKDuo buoy, simply plug the ON/OFF connector into the sensors section box bulkhead . When plugged, the sensors box will bip one time before starting initialization.

The RTKDuo buoy is activated when the Survey Interface is powered (detection of the radio link beacon), then to put the RTKDuo in sleeping mode, just power off the Survey Interface.

2.5   MiniPointeur R300-NG set up

MiniPointer installation:

The MiniPointer R300-NG must be installed vertically when using the simple hydrophone that must stay clear of any obstacle in order to guarantee a direct line of sight between the hydrophone and the RTKDuo buoy. When using the internal compass, for ROV positioning for instance, the MiniPointer R300-NG X axis must be oriented along the vehicle forward axis (that corresponds to the ON/OFF bulkhead connector oriented at the back of the ROV).

Note for dam survey by ROV: the MiniPointer must be installed at the back of the ROV to maximise the distance between the hydrophone and the concrete wall of the dam. Care must be taken also to offset the hydrophone from the ROV floating that constitutes an acoustic wave reflector.

Mini-Pointer R300-NG
(hydrophone connected)
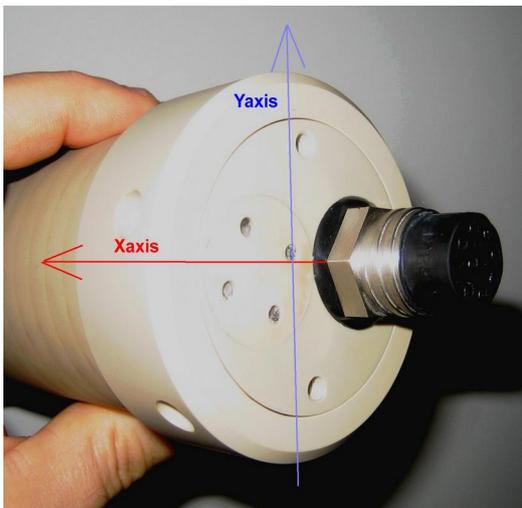
Mini-Pointer R300-NG
X and Y axis

Mini-Pointer R300-NG
on ROV FALCON
SEAEYE

Full acoustic configuration:

This configuration corresponds to a MiniPointer without any electrical connexion with the ROV, it is fully powered by internal battery and communicate only through acoustic network.

To activate the MiniPointer in this mode, just plug the ON/OFF connector, after about 15s the MiniPointer will bip shortly two times, that indicates an initialisation with no error/failure detected, it will then enter in sleeping mode waiting for wake up to save the battery.

In this mode, all communications are made through the acoustic network.

Wired configuration:

The MiniPointer may be interfaced to a spare RS232 serial link and also powered by the ROV's supply (24V, 50mA), this feature is particularly interesting when a permanent installation is expected, no more battery charge required.

Refer to the AQUA_METRE R300-NG user manual to set up this wired configuration.

Simple hydrophone installation:

To attach the simple hydrophone, simply plug the hydrophone connector into the top bulkhead and then gently screw the flexible mini-mast.

**Mini-Pointer R300-NG, simple hydrophone installation**

To switch on a MiniPointer using its internal battery, just plug the ON/OFF dummy connector:

3   Using the RTKDuo system with AQUA-CAD

The AQUA-CAD software manages different configurations of the AQUA-METRE
R300-NG/R3000-NG system, it is coupled with the BricsCad software (AutoCad clone) for the
display of 3D survey in real time.

3.1   Choice of the mode at start up

When launching AQUA-CAD version 9.06 (or higher), user must select between two modes: the
general purpose mode and the specific "Spool & Jumper Metrology" mode:
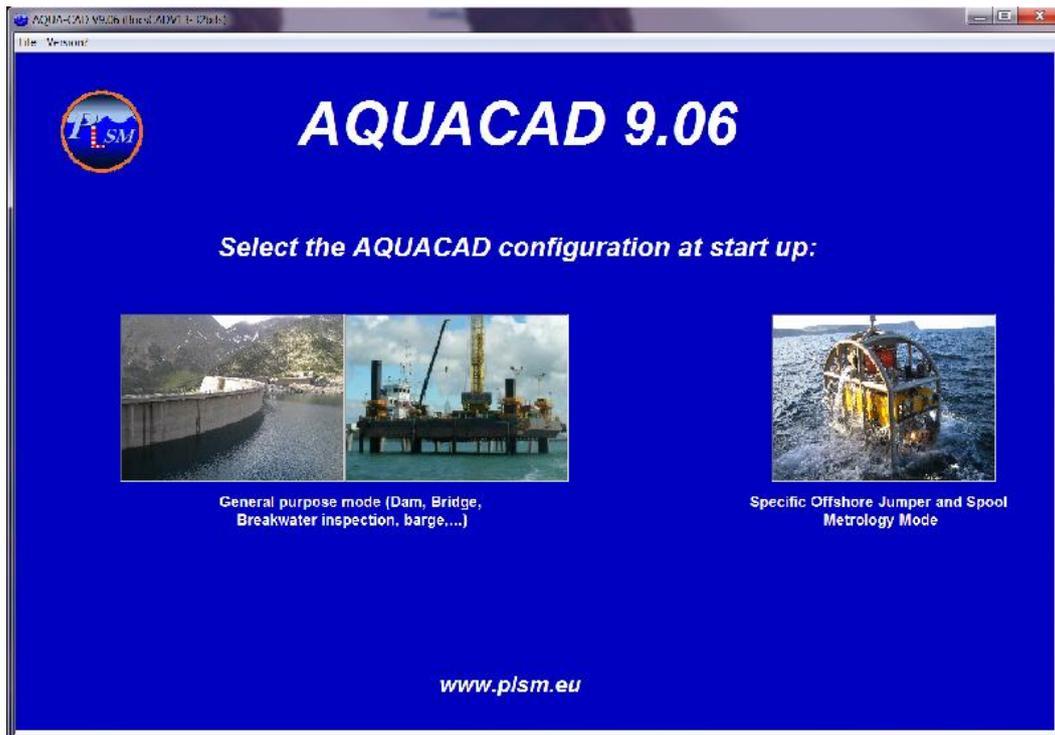

Simply make your choice by clicking on the image.

The "Spool & Jumper Metrology" mode is dedicated to a specific offshore oil application, this mode
is described in a separate document.

3.2 AQUACAD sub-windows

At start up, the main windows is displayed:
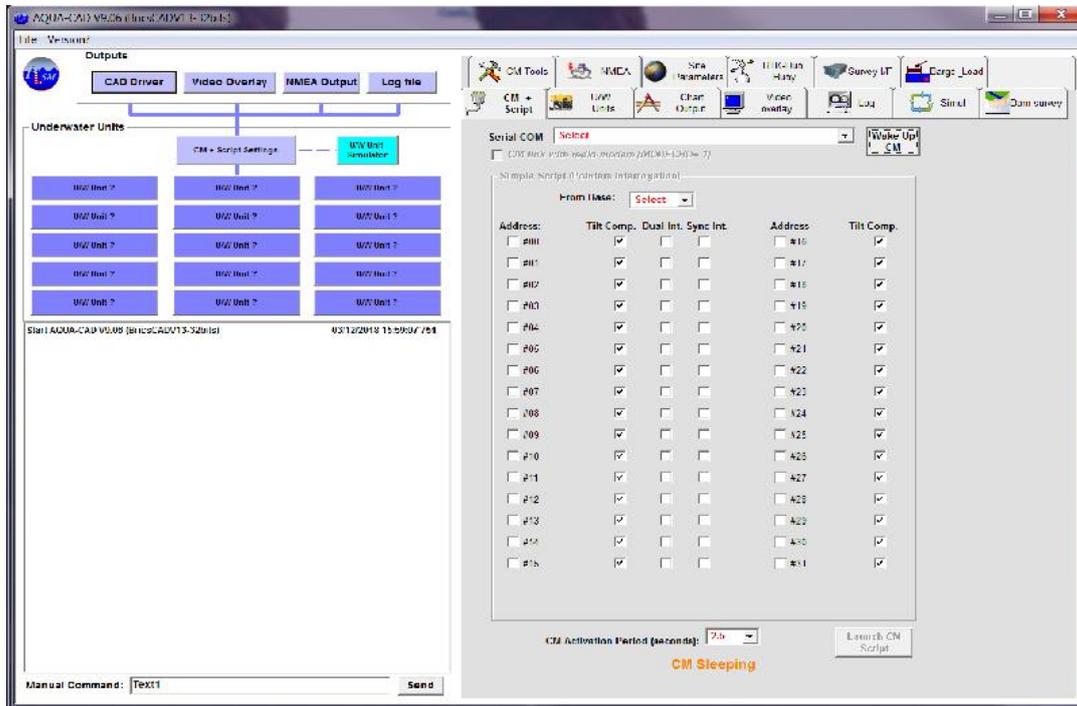
Main AQUACAD window

On the left side, one can find:
- in the bottom, the log window where all command sent and incoming answers are reported (may be saved in a log file, see later in this document),
- in the middle, 15 boxes associated to the Underwater Units used in the AQUA-METRE configuration, the one on top-centre is named Communication Master (CM) and is the unit linked to AQUA-CAD through a serial communication port (RS232).
- in the top, 4 buttons that correspond to AQUA-CAD outputs: CAD driver, Video Overlay, NMEA output and Log file, it is also possible to access to these functions from the tabs on the right side,

on the right side, the sub-window displayed depends on the active tab:
- the window "CM + Script" to set up the different pointers to interrogate,
- the Underwater Units settings window, to get or set parameters associated to units (the current U/W Unit displayed depends on the chosen box on the left side)
- the CAD driver setting window to manage the link with BricsCad,
- the video overlay setting window to manage the overlay unit,
- the survey site parameter window to manage different parameters like sound speed, water density, tide,...
- the RTKDuo buoy window to manage the RTK reference and get RTK status,
- the Survey Interface window to set and get Survey Interface parameters,
- the « Dam Survey », only used for dam survey like job
- the log file window to set up and start a main or secondary log file,
- the NMEA window ,
- the CM Tools window (to access embedded firmware upgrade tools),
- the simulation window, to simulate different scenarios

To get access to these windows, simply click on the associated tab.

3.3 Using AQUACAD with the RTKDuo buoy system

### 3.3.1 AQUA-CAD launch and CM link activation

The RTKDuo system is supposed to be set up according previous chapter, the Survey Interface is powered and attached to the PC that run AQUA-CAD through the USB interface.

Launch AQUA-CAD in "General Purpose" mode.

Select the «CM + Script Settings» window:
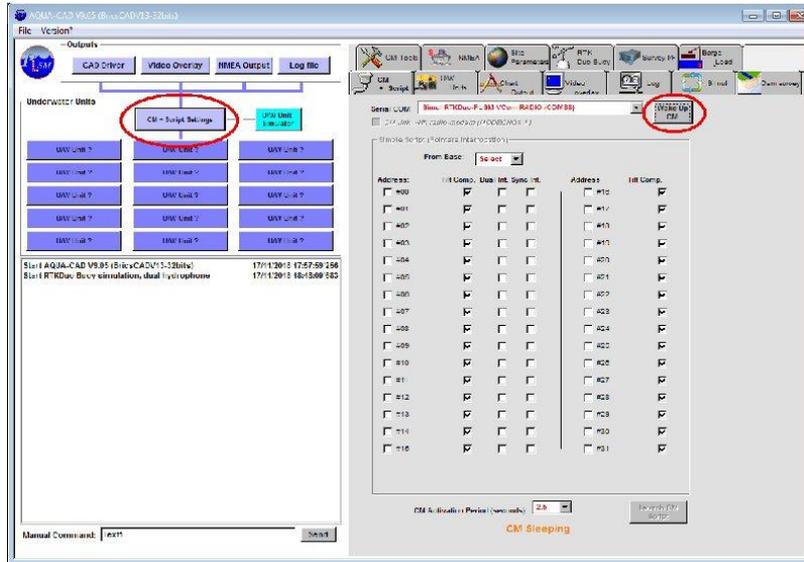
Check that the default COM port is the one associated to the RTKDuo radio link (port COM named: «PLSM VCom RADIO...»), then click the button « Wake Up CM », after up to one minute (if the RTKDuo buoy is in sleeping mode, it takes 45s to exit the sleeping mode) the RTKDuo box will be displayed and the CM unit box associated to the Base unit coloured in yellow.
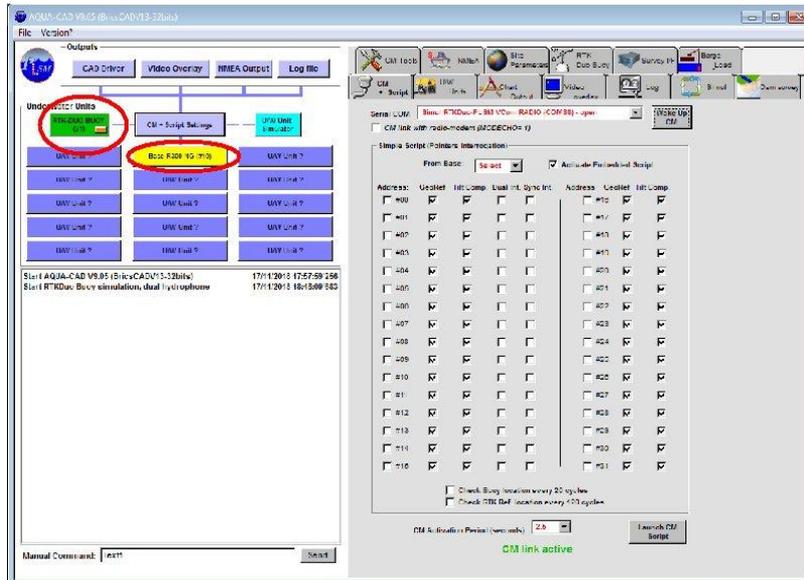
The yellow color of the Base Unit means that the unit is wake up but not initialised, to initialise it just click the Base box, the U/W Unit setting sub-window is then displayed, click on the button «Init Unit» to start the initialisation. At the end of initialisation, the Base Unit box turn to green color:
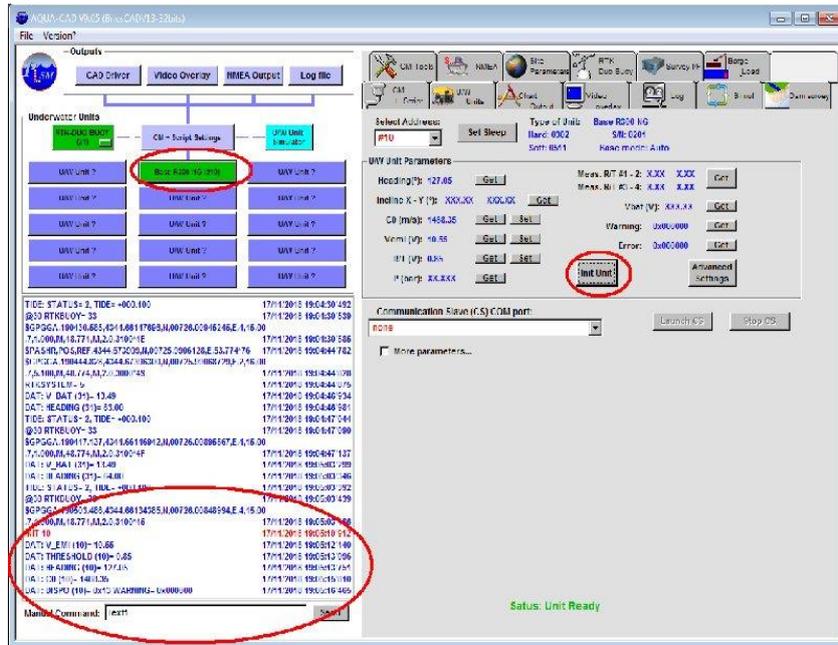
The Base Unit has been initialised, all initialisation messages are reported in the log sub-window.

3.3.2   MiniPointer(s) wake up

When the MiniPointer operates from battery, it enters directly in sleeping mode after initialisation when switched on. To wake it up: click on a free U/W Unit box (in blue), select the address of the MiniPointer you want to wake up (all addresses must be identified before units are immersed), then click on the "Wake Up" button to start sending the ping to the selected Unit address. It may last up to 1 minute before the unit replies to ping and wake up.
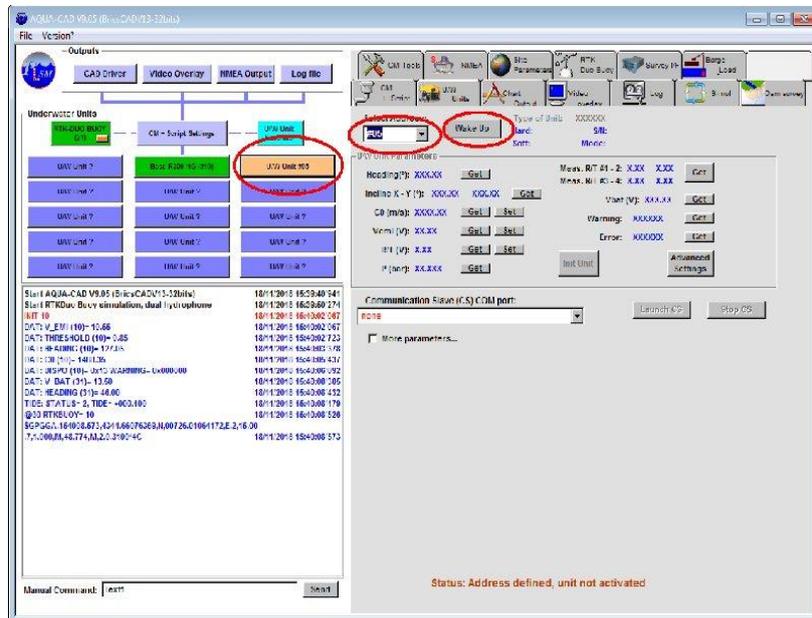

When wake up from acoustic, the MiniPointer will automatically start an initialisation and report its status by acoustic messages. The U/W unit box will then turn green if initialisation is ok.

3.3.3 ROV parameters Settings

This chapter described all parameters that define the way the MiniPointer is installed on an ROV, do not pay attention to this chapter if you do not intend to work with an ROV.

When the MiniPointer has been initialised, click on the "More Parameters" option to display the sub-window with ROV parameters:
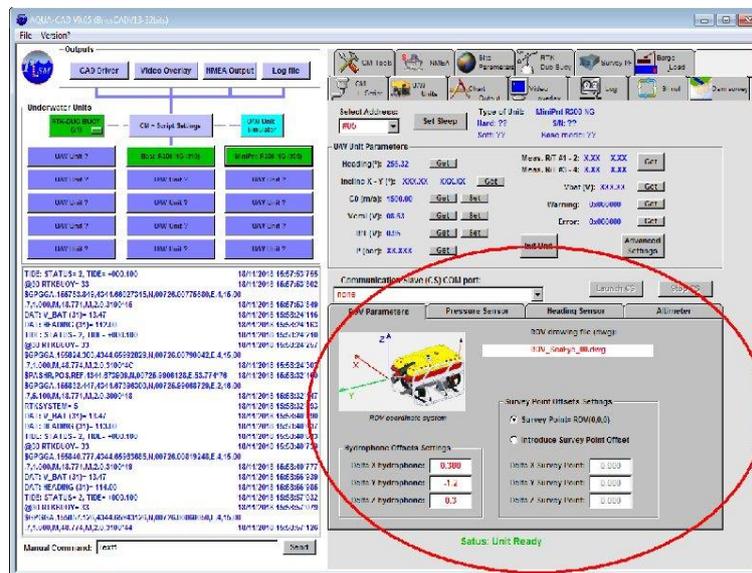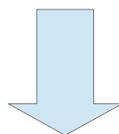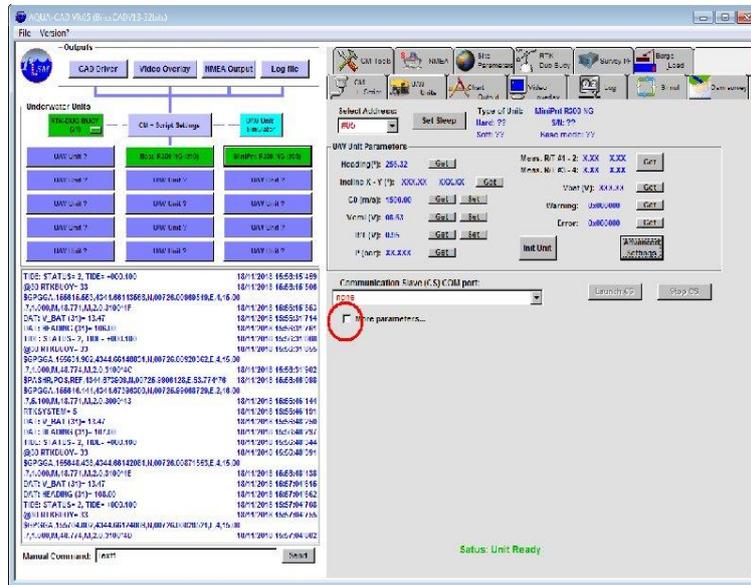
Four tabs are available in a sub-window:

ROV Parameters tab:

User can define in this sub-window: the ROV file name (CAD 3D .dwg file), the offsets of the hydrophone in the ROV frame coordinate system, the origin being the survey point in front of the camera (distance from the camera depends on the water visibility).

A survey point may also be defined here, it will replace the ROV origin if activated.

Heading sensor tab:
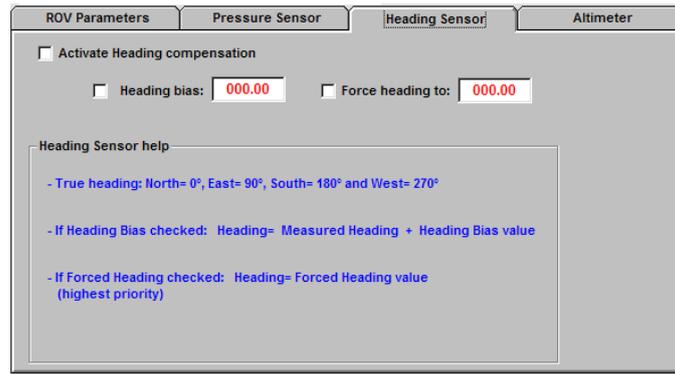
In this sub-window, user can activate the heading sensor compensation, introduce a heading bias (in case the MiniPointer has not been properly oriented on the ROV), or force the heading to a constant value. Note that if you work with a local custom cartographic projection not oriented to geographic true north, you may have to introduce a bias to get the right ROV orientation in the CAD drawing.

Pressure sensor tab:
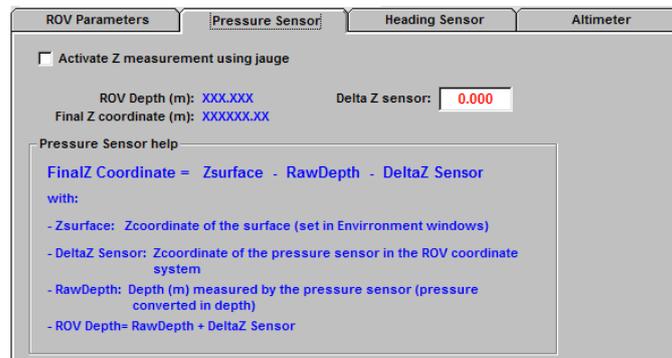
In this sub-window, user can activate the Z measurement using the pressure sensor (very useful to counter acoustic ray bending when working in high thermocline environment). Just check the option "Activate Z measurement using jauge" and define the DeltaZ sensor which is the Z coordinate of the sensor in the ROV frame coordinate system (the pressure sensor is located on the bottom of the MiniPointer housing).

Altimeter tab:
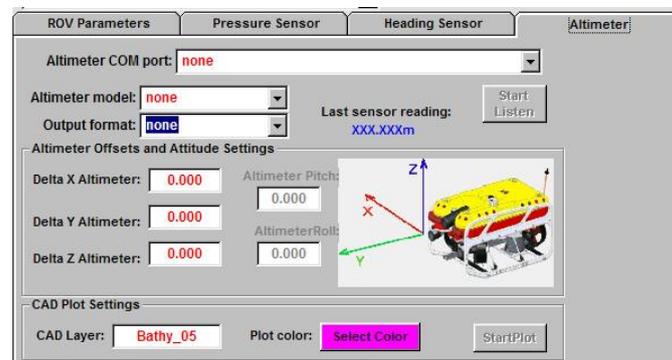
Here, user can define an optional altimeter sensor input for bathymetry by ROV (contact PLSM if you need to set up this function)

3.3.4 Setting the RTK source of corrections

The GNSS receiver inside the RTKDuo buoy needs to collect RTK corrections in RTCM format (2.2, 2.3 and 3.1 formats supported). Two sources of corrections may be selected: the Survey Interface working as the RTK reference station, or an external RTK station (when working offshore for instance).

In every case, display the RTKDuo window setting by clicking on the corresponding tab:
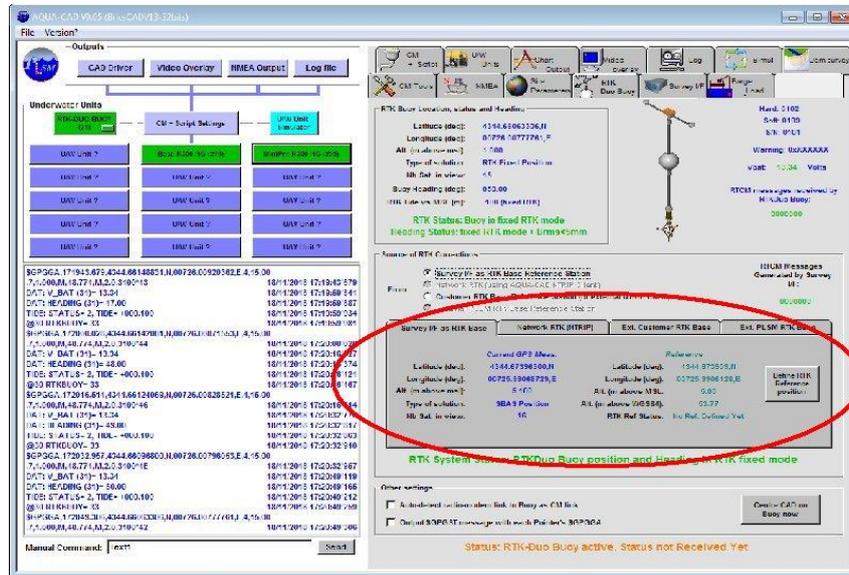
Four tabs in the middle allow to select and parameter the RTK source, two of them are active in AQUA-CAD V09.05: the "Survey I/F as RTK Base" tab and the "Ext. Customer RTK Base", they are described hereafter.

3.3.4.1 Survey Interface working as the RTK reference station

Chose the "Survey I/F as RTK Base" tab if you want to set up an RTK Base station using the GNSS receiver inside the Survey Interface.
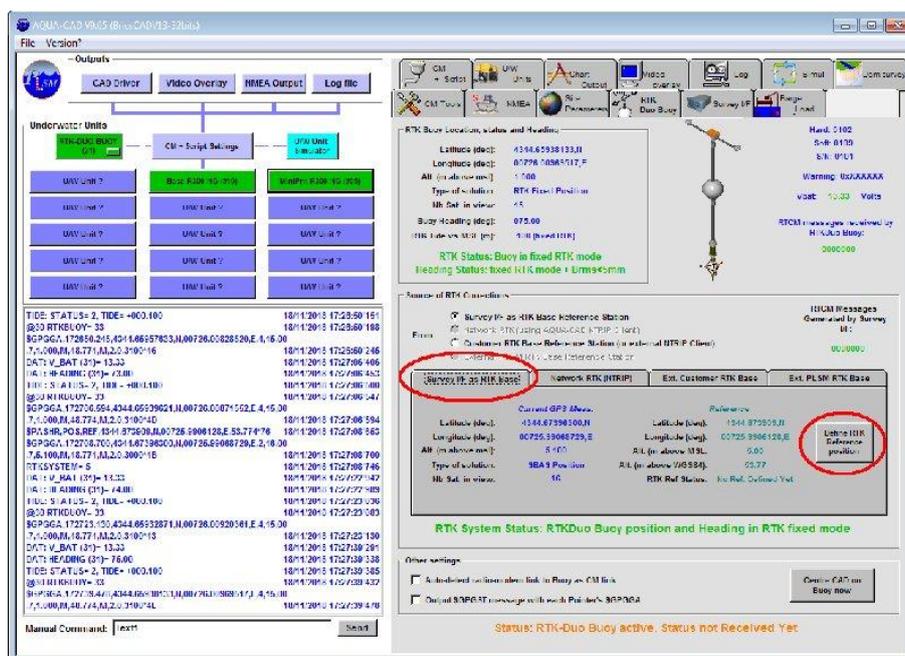
Click on the "Define RTK Reference Position" button, the following sub-window will be displayed in order to define the RTK reference position:
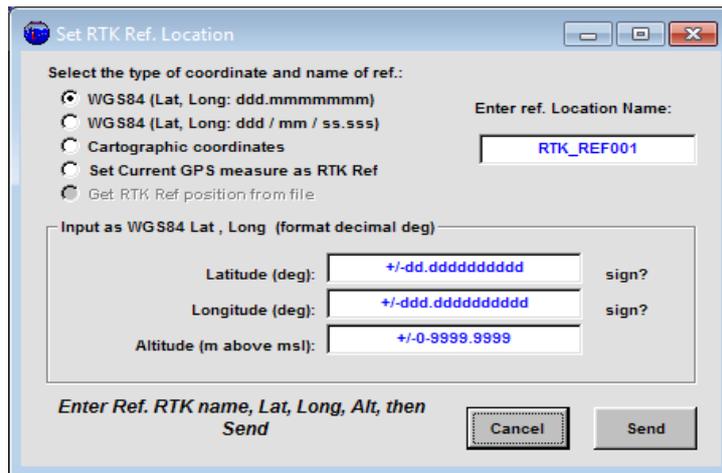
User can define the RTK reference position in different format or system:

- in decimal WGS84 latitude and longitude, + altitude above the geoid (mean sea level),

- in degree/minute/second WGS84 latitude and longitude, + altitude above the geoid (mean sea level),

- in cartographic coordinates (several projections available), + altitude above the geoid (mean sea level),

These three formats suppose that the GNSS antenna is located on an already surveyed point. If the antenna position is not known and user wants to work on a local custom cartographic system, then just set the RTK reference location as the current GNSS measurement.

3.3.4.2   Using external RTCM corrections

Chose the "Ext. Customer RTK Base" tab if you want to receive RTCM corrections from an external RTK reference station:
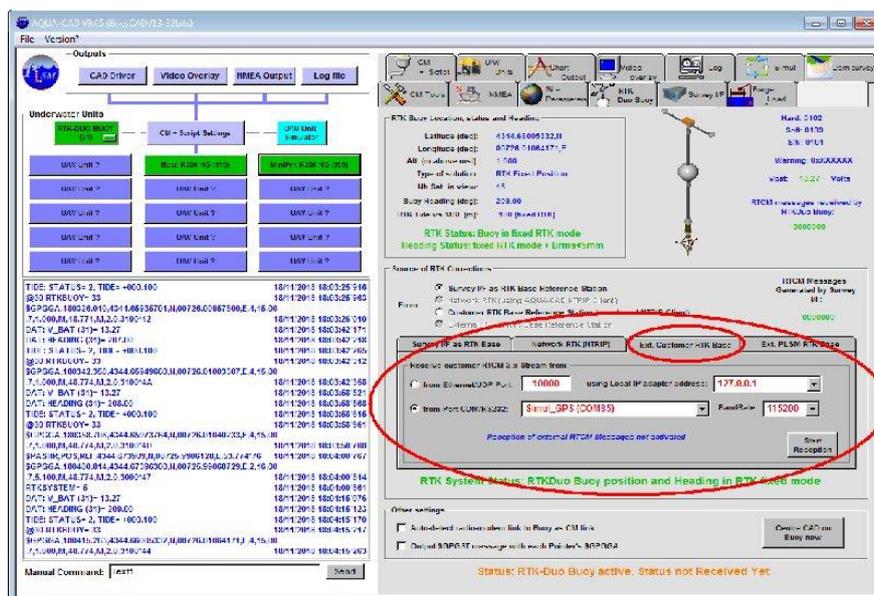

The external RTCM messages must be transmitted to AQUA-CAD through an RS232 serial COM port or through a network UDP port. When port parameters are set (COM port number and baudrate, or UDP IP address and port number), just click on the "Start Reception" button to activate the reception of external RTCM messages.

User can check that external RTCM messages are received (RTCM message number is displayed and updated).

The RTCM messages received by AQUA-CAD are automatically transmitted to the Survey Interface, and then transmitted to the RTKDuo buoy. If the GNSS receiver of the Survey Interface is set in rover+heading mode, the RTCM messages are also sent to it (dual rover mode).

3.3.5   CAD Settings

3.3.5.1   *Choice of the Cartographic projection*

Before using the BricsCad tool for display, the way the geographic coordinates are associated to the cartesian coordinate system of BricsCad must be defined, this is done by choosing a type of cartographic projection. To chose it, display the CAD Output window, and the RTK-BUOY tab in the sub-window:
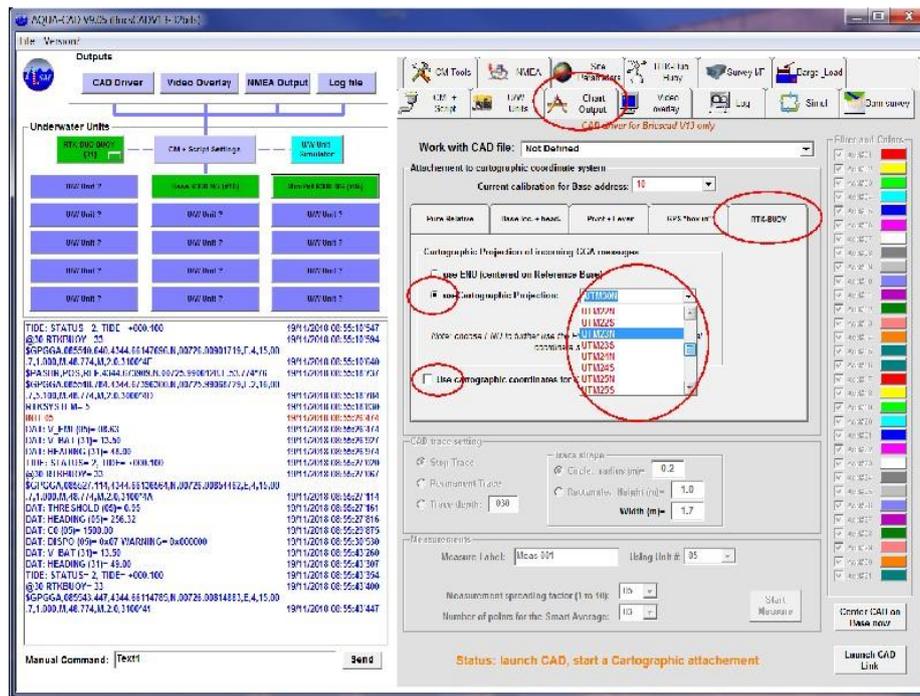
Check the "Use cartographic Projection" and select your local type of cartographic projection in the drop down list (please contact PLSM if the type of projection you plan to use is not in the list).

Also check the "Use cartographic coordinates for CAD" in order to use this type of cartographic projection in the CAD file.

3.3.6   Start the link with the CAD file

To use the BricsCad tool for display, the link between AQUA-CAD and BricsCad must be first establish. Just click on the "Launch CAD Link" button, AQUA-CAD will then look for a BricsCad instance to link to. If BricsCad is not already running on the same machine, then it will be automatically launched.
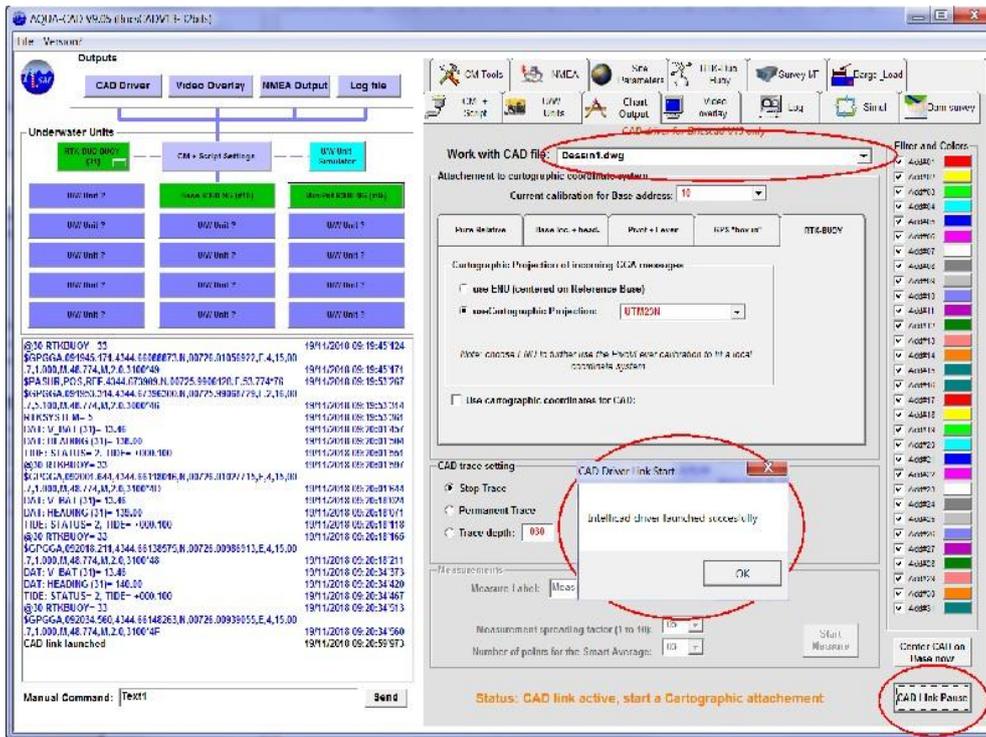
A short message is display to confirm that BricsCad link is active. The list of all drawings opened in BricsCad is available on the top of the window, user can select the specific drawing he wants to link to.

Important: do not close the current drawing AQUA-CAD is linked to, it will lead to an AQUA-CAD crash.

In this window, it is also possible to select or deselect the Pointer addresses to display and chose the colour associated to each address.

3.3.7 Site parameters setting

3.3.7.1 Density and G parameter Setting

In order to convert pressure measurements to Z coordinate, some environmental parameters must be defined:

For the **density** estimation, user must enter:

- the average water temperature (in degree Celsius)

- the salinity (in gram per litre),

- the average working pressure (in bars, not the main parameter however),

For the **gravity factor** estimate:

- the latitude and longitude (this is automatically set when receiving the first $GGA message from the RTKDuo buoy),
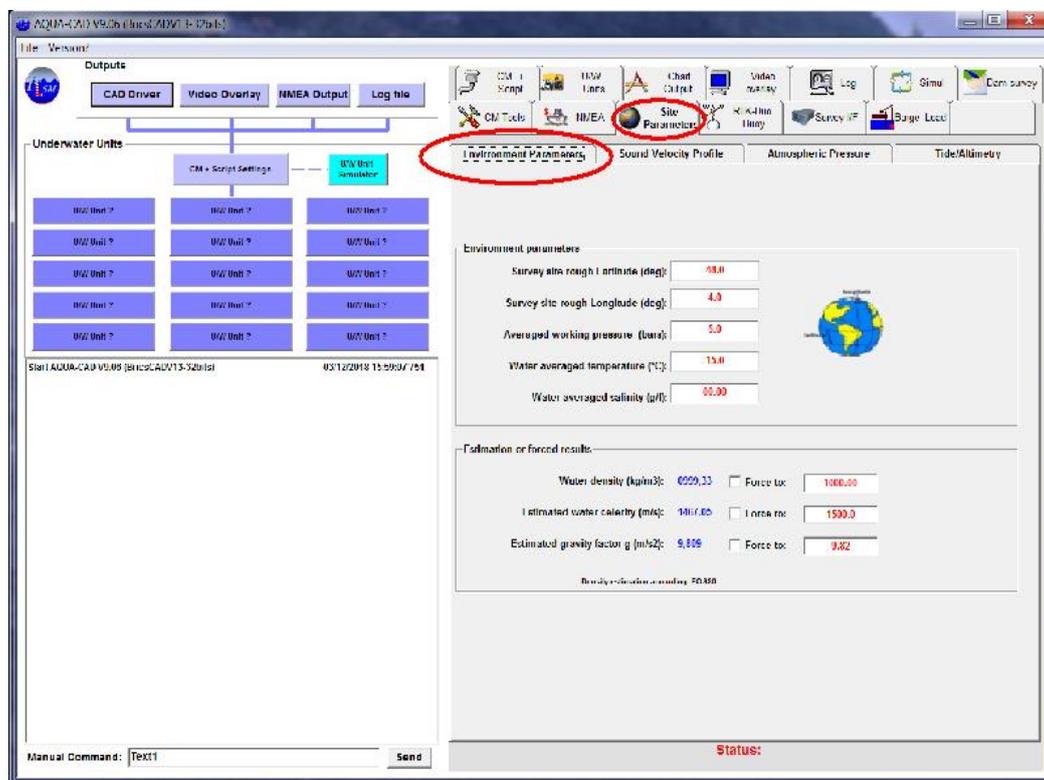
Environment Parameters Setting

When these parameters are defined, an estimation of the water density, water sound's celerity and G factor are computed and display in the bottom of the sub-window. These estimations are used by AQUA-CAD and can be checked by user. They can be forced to user value if required.

3.3.7.2   *Water Surface Altitude parameter & History Setting*

The water surface altitude is a key parameter when using the pressure sensor of a MiniPointer to measure the Z coordinate. This altitude is the reference altitude when converting pressure measurement to depth, then Z coordinate (Zcoordinate= Reference altitude – depth).

To define this reference water surface altitude, user can enter a fixed value or use the RTK Tide reported by the buoy and bias-calibrated at the beginning of the survey (for the calibration: wait for RTK tide availability that may take several minutes, enter the known tide in the constant value box, then select "Defined by RTK Tide and bias" option and click on the "Calc Bias" button to identify the bias between the RTK Tide and the actual tide of the site).

Tide/Altimetry Setting and history

The final water surface altitude is displayed at the bottom of the Tide/Altimetry sub-window, the raw RTKTide is also displayed for information (the same value as the one in the RTKDuo window).

A history graph of the last 24 hours is also displayed for information. It is updated every 5 mn or in case of parameter change.

A record of the last 15 days Tide level is also automatically stored in a text file (see "Application Install Folder"\Envir\Tide\TideLog.txt).

3.3.7.3 *Atmospheric pressure Setting and recording*

The atmospheric pressure measurement and recording are used to compensate the atmospheric variations between the MiniPointer activation and the present time. When switched on, the MiniPointer performs an initialisation process that includes a pressure reference (current absolute pressure measurement associated to the Z=water surface= 0.0m), this process allows to work near sea level as well as in a lake at high altitude without any calibration. This reference pressure measured before diving is stored in the MiniPointer flash memory and used if the MiniPointer is wake up underwater several hours or days after switch on. Then, it is necessary to take into account the atmospheric variations between this reference time/pressure and current pressure sensor use (1 hPa, or 1mb, is equivalent to 1cm).

The user can just select between an automatic atmospheric pressure measurement and a value input manually:

*Atmospheric Pressure Setting and history*

A history graph of the last 24 hours is also displayed for information. It is updated every 15 mn or in case of parameter change.

A record of the last 15 days of atmospheric pressure is also automatically stored in a text file (see "Application Install Folder"\Envir\Patmos\PatmosLog.txt).

3.3.7.4 *Sound Velocity Setting*

(will be addressed in the next issue)

3.3.8 Barge and Frame Settings

Select this window to define a Barge (the vessel from which the system is operated) and a frame to be positioned, the frame being a structure associated to up to four Pointers (it may be a gravel levelling tool for instance, or just a load to drop down at a specific location like a mattress).

3.3.8.1 Barge Setting

This sub-window allows to define the Barge parameters:
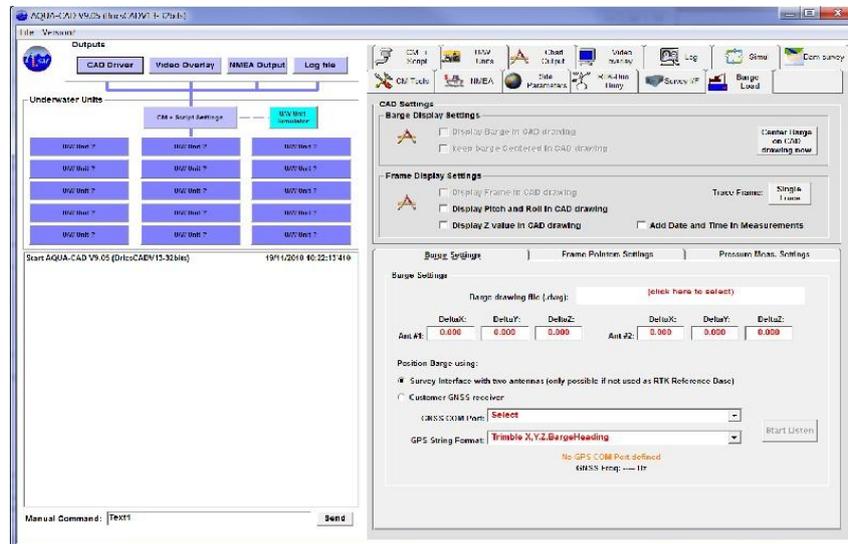
\- the name of the CAD drawing definition file of the Barge,

\- the GNSS antennas offsets according the barge CAD drawing,

the barge may be positioned by:

  - the Survey Interface GNSS receiver with dual antenna, set in rover + heading mode,

  - an external GNSS receiver that send the position and heading of the barge,

3.3.8.2 Frame Setting

This sub-window allows to define the Frame parameters:
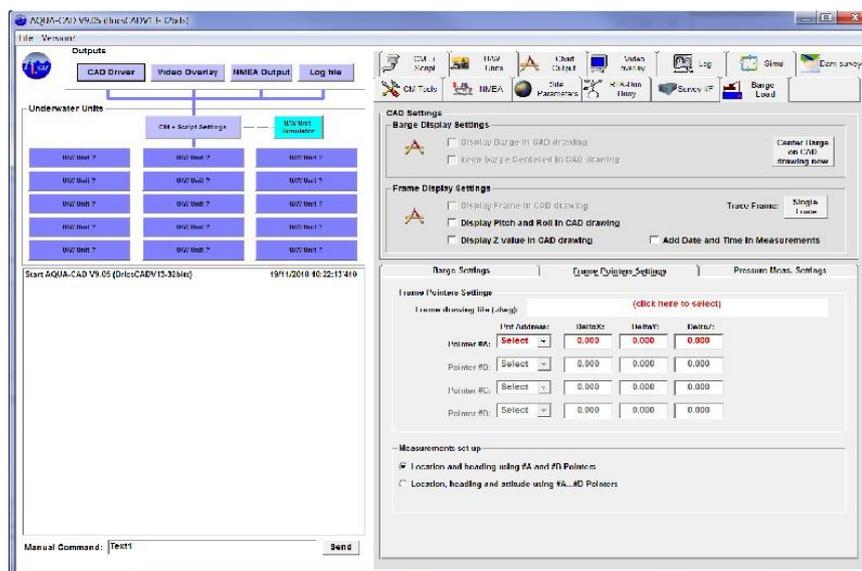
- the name of the CAD drawing definition file of the Frame,

- the addresses and offsets of Pointer's hydrophones according the Frame CAD drawing,

3.3.8.3 *Frame Pressure Measurements Setting*

This sub-window allows to define the pressure measurements parameters associated to the Pointers on the Frame:
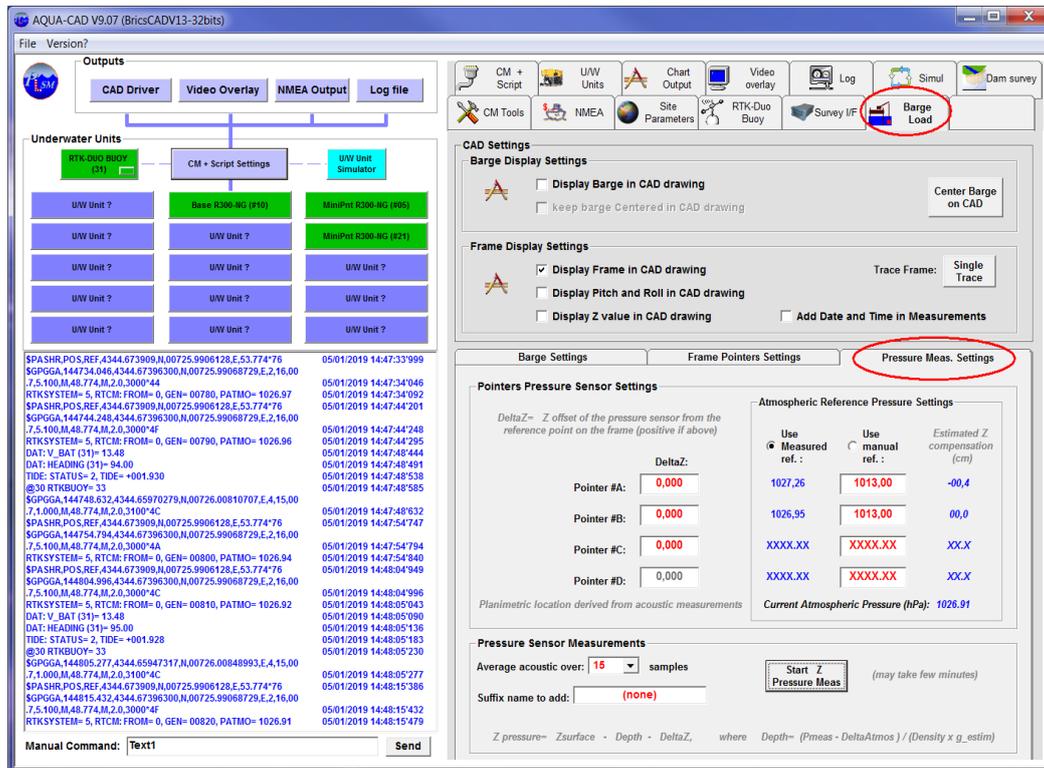
- the "DeltaZ" offsets of Pointer's pressure sensor from the point of interest (for instance: the offset between the bottom of the blade and the pressure sensor on a gravel levelling frame), this offset is positive when the pressure sensor is located above this point of interest,

- a suffix name may be added to measurements for traceability in the CAD file and log,

- the reference atmospheric pressure may be defined as automatic (coming from the MiniPointers parameters) or set manually by user, this reference pressure is the atmospheric pressure recorded when the MiniPointer was switched on, it is used to compensate for the atmospheric pressure variations,

The current atmospheric pressure is also displayed for information, it comes from the Environment setting window, it is measured by the digital barometer embedded in the Survey Interface or set manually by user.

Another parameter is displayed for user information and for each MiniPointer on the frame: the Z coordinate offset due to the atmospheric pressure variation (in cm). One hPa (mbar) variation corresponds roughly to 1cm.

To launch a Z measurement using the pressure sensor:

- the number of samples to average may be selected,

- the "Start" button actually starts the measurements.

When measurement process is engaged, a flying window is displayed to report the progress:
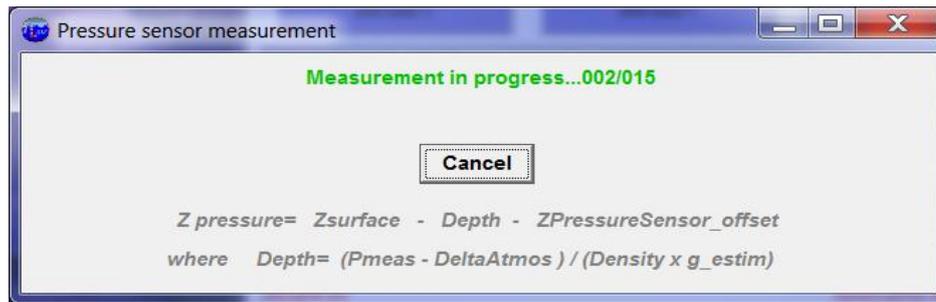
The process stops when a sufficient number of measurements have been collected, the average pressure is then computed and transform to Z coordinate according the following formulae:

$$\text{ZfinalCoordinate= Zsurface - Depth - DeltaZsensor}$$

where:

Zsurface: is the Altitude of the water surface, it may be defined as a constant value by user or as the real time RTKtide (measured by the RTKDuo buoy) minus a bias identified early in the project (see chapter 3.3.7.2),

Depth: is the depth of the pressure sensor

$$\text{Depth= 100 x (Pmeas - DeltaAtmos) / (Density x g\_estim)}$$

where:

Pmeas is the relative pressure measured by the sensor in Bars (kg/cm2), it is set to 0.0 when the MiniPointer is switched on (just above the surface)

DeltaAtmos is the atmospheric pressure variation between the time of the measure and the time when the Pointer has been switched on (making then its pressure reference),

Density is the estimated density of water, it depends on water salinity, temperature and pressure (see environmental parameters window), AQUA-CAD use the EOS80 formulae to estimate this density,

g_estim is the estimated gravity factor (m/s/s), it depends mainly on latitude and altitude (see environmental parameters window), AQUA-CAD estimates it using the following formulae:

$$g = 9.7804 + 0.0517 \cdot \sin^2(\text{latitude}) - 57.7 \cdot 10^{-6} \cdot \sin^2(2 \cdot \text{latitude}) - 3.086 \cdot 10^{-3} \cdot H$$

where :

Latitude is the geographic latitude,

H is the altitude in km.

G is about 9.81 m/s^{-2} at 45° latitude and at sea level.

DeltaZsensor: is the offset between the Pointer's pressure sensor and the point of interest of the user (the point that must be surveyed), it is counted **positive when the sensor is above this point**, negative when below this point.

After pressure measurement process completion, the results are displayed in the CAD file (at planimetric location associated to the last acoustic measurements), and in the log window (from AQUA-CAD version 9.07) with all details:

```
                                                          05/01/2019 14:35:...
REQPR 05                                                  05/01/2019 14:35:18'186
DAT: PRE (05)= 01.9995                                    05/01/2019 14:35:18'186
REQPR 21                                                  05/01/2019 14:35:19'762
DAT: PRE (21)= 01.9996                                    05/01/2019 14:35:19'762
REQPR 05                                                  05/01/2019 14:35:21'337
DAT: PRE (05)= 02.0007                                    05/01/2019 14:35:21'337
REQPR 21                                                  05/01/2019 14:35:22'913
Z Pressure Mesurement Results:                            05/01/2019 14:35:22'913
Depth(05)= 20.406 m  (Density= 0.9993  g= 9.8051)         05/01/2019 14:35:22'913
DeltaZPatmos(05)= 0.560 cm                                05/01/2019 14:35:22'929
ZSurface= 0.000 m                                         05/01/2019 14:35:22'929
Zoffset(05)= 0.000 m                                      05/01/2019 14:35:22'929
ZPressure(05)= -20.406 m                                  05/01/2019 14:35:22'944
Z Pressure Mesurement Results:                            05/01/2019 14:35:22'944
Depth(21)= 20.404 m  (Density= 0.9993  g= 9.8051)         05/01/2019 14:35:22'944
DeltaZPatmos(21)= 0.879 cm                                05/01/2019 14:35:22'944
ZSurface= 0.000 m                                         05/01/2019 14:35:22'944
Zoffset(21)= 0.000 m                                      05/01/2019 14:35:22'944
ZPressure(21)= -20.404 m                                  05/01/2019 14:35:22'944
DAT: PRE (21)= 02.0006@31 RAZSCRIPT                       05/01/2019 14:35:22'913
COMMAND NOT VALID (simulation mode)                       05/01/2019 14:35:24'005
```

User may launch a log file in order to trace these results.

3.3.9 Launching the interrogations Script

The script is the function that iterates the Pointer's interrogation, it sends interrogation commands to the Communication Master unit (CM unit) according the list of Pointer's addresses to position.
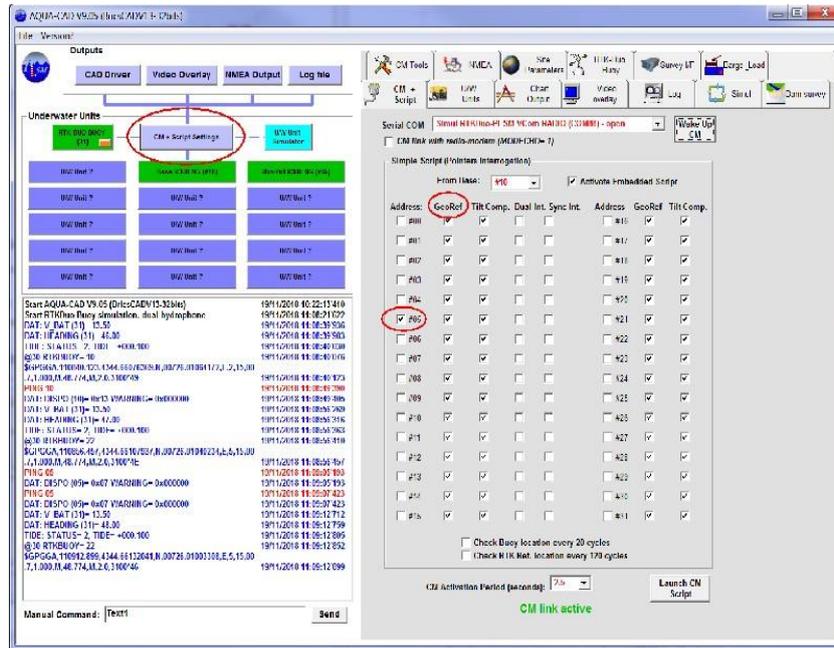
The user must select all Pointers to position (these Pointers must be active and initialised). With the RTKDuo buoy active, the "Georef" option is always checked and must remain checked to activate the geo-referenced positioning.

To start sending the interrogations commands, just click on the "Launch CM Script" button. The incoming position messages are reported in the log window, thus, user can check that the script is active and that Pointers reply.

3.3.10 Save a configuration

The AQUA-CAD configuration may be saved in an .acq (AQUA-CAD Config) file, it will save all parameters set and speed up the next use.

To save the config, chose « File » then « Save Config as... »:
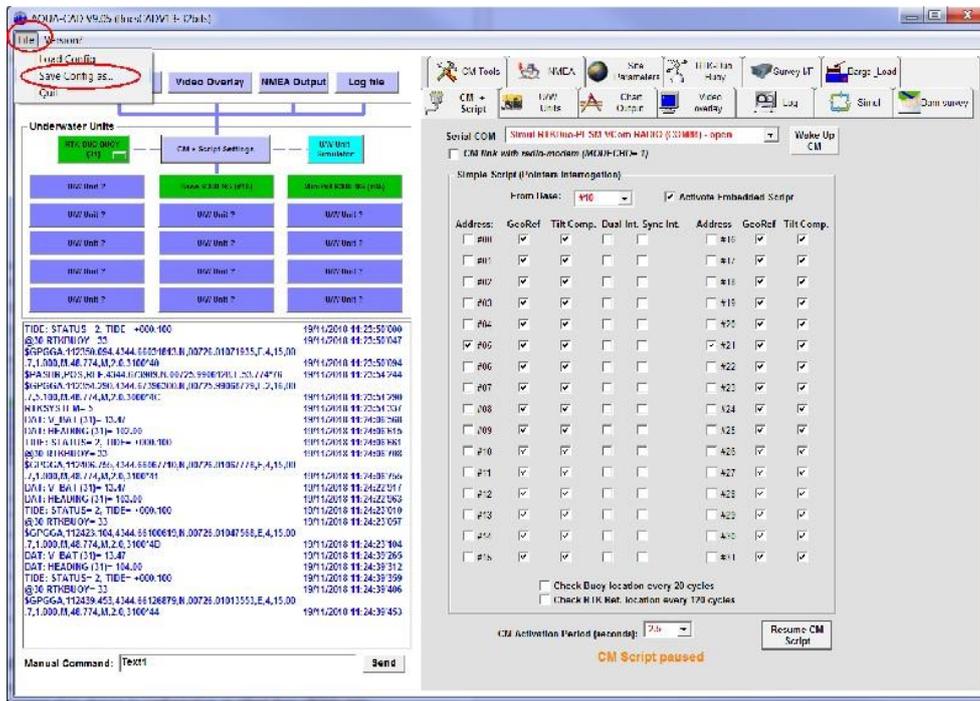
3.3.11 Load a configuration file

Before loading a configuration file, user must activate the CM link and wake up all units involved in the configuration file.

Then, just chose « File » then « Load Config ».

4 Maintenance

4.1 Fresh water rinsing

After use in salted or polluted water, a complete rinsing must be achieved before drying. Drying without prior rinsing would lead to salt deposit. Should it happen, dive the system in fresh water for at least one hour. Flush the water and repeat until all salt traces are dissolved (when doing so, make sure that open bulkhead connector are protected).

4.2 RTKDuo buoy battery charge

The RTKDuo buoy battery autonomy is at least 4 working days of 10 active hours (the buoy is sleeping the rest of the time). The RTKDuo buoy exits the sleeping mode when the radio-modem of the Survey Interface is powered (radio beacon active), and enters in sleeping mode when the radio-modem is switched off (radio beacon vanishes).

After 4 working days, it is necessary to charge the battery using the charger delivered with the RTKDuo buoy, to do so:

- switch the RTKDuo buoy by removing the ON/OFF connector,

- remove the Base unit from the battery section,

- remove the battery section from the rest of the buoy,

- plug the charger output into the battery section bulkhead,

- plug the battery charger main input (to 90-265 VAC),

A red led indicates the battery charge in progress, it changes to green when the charge is finished (last 2 to 6 hours depending on initial charge).

4.3 MiniPointer battery charge

Plug the charger on MiniPointer interface/charge connector, then plug the charger into the wall main AC supply (90 to 265VAC). When powered, the "ON" green led on the charger will light. After about 30 seconds of charge initialisation, the "Status" orange led will blink to confirm that the battery charge started.

Warning: The charge is automatic, provided that the battery charger is actually plugged, and the required voltage is present.

Note: The battery charger may be fitted with different plug adaptors to be used in several countries. Europe, US, UK, Australia,... Please contact PLSM (support@plsm.eu) if you don't have the right plug.

During the battery charge, the charger "Status" orange led blink every 30 seconds indicating the charge status:

1x blinking:	Charge up to 15%
2x blinking:	Charge up to 30%
3x blinking:	Charge up to 50%
4x blinking:	Charge up to 65%
5x blinking:	Charge up to 80%
6x blinking:	Charge completed

When the charge is completed, the system automatically reduce the current to a steady charge, it is recommended to unplug the battery charger.

The battery charge will not start if battery temperature is lower than 5°C or greater than 40°C.

The battery charge will stop if voltage exceed a certain limit (1.55V per cell) or last too long (maximum 12h).

4.4 Lubrication of connector and bulkhead

Before plugging any connector, make sure that no dust nor any solid particles can be entrapped inside the bulkhead or between pins. The use of lubricant is recommended for the proper contact and to ease connector insertion, PLSM recommend the following silicon oil:

Manufacturer : ELECTROLUBE, **reference** : OSL (spray),

(available at Farnell or RS Components)

other reference references from 3M may be suitable.

But silicon grease is not recommended!

(because it will accumulate in female bulkhead pin and hold dust,

it may be used however as a "better than nothing" temporary solution)

Dust protection caps are provided with the connectors, always plug them when the system is rinsed and dry.

4.5 Embedded firmware upgrade

The firmware embedded in the Base, MiniPointer, RTKDuo buoy or Survey Interface units can be upgraded through AQUA-CAD. The unit must be first connected to AQUA-CAD as the Communication Master unit (CM unit), the way to operate depends on the type of unit as explained here-below.

4.5.1 Connection to the unit

Connection to a MiniPointer or Base unit:

PLSM provide a specific tool in order to allow connection to a Base or MiniPointer R300-NG unit: the basic interface. This tool includes: an IMPULSE MCIL-8MP male wet pluggable connector, a small aluminium case with green led indicator, DC input, simple ON/OFF switch and RS232 DB9 female connector.
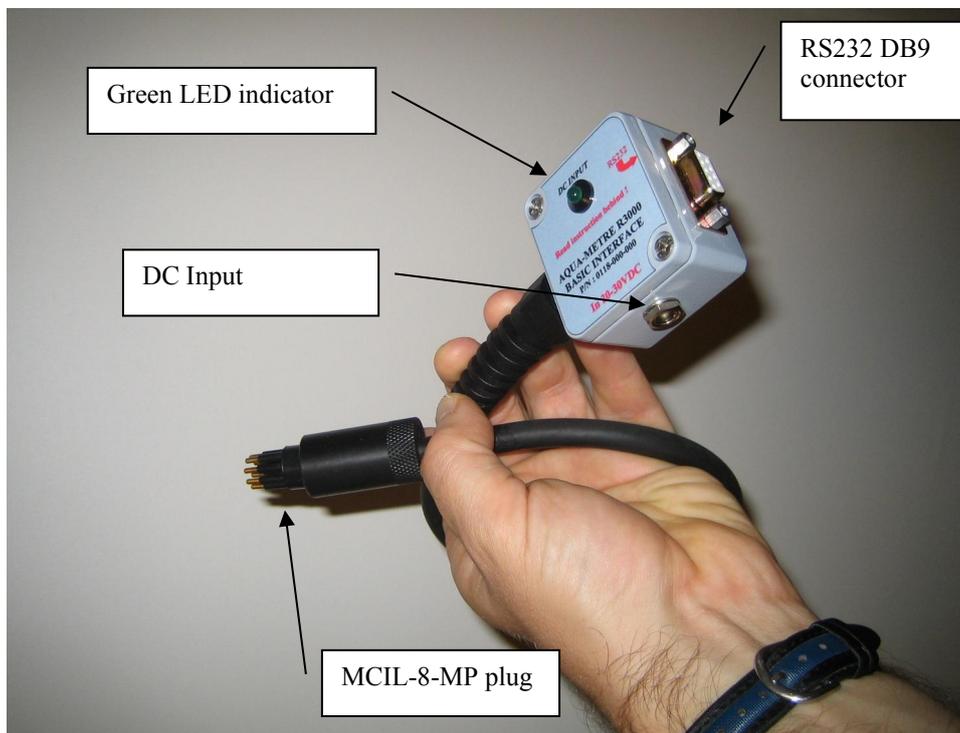
Basic Interface for R300-NG unit

To set up a connection, follow the steps:

- connect the RS232 port to a COM port available on your PC,

- plug the MCIL 8 male connector into the interface bulkhead of the unit (Base or MiniPointer),

then

- plug the AC-DC converter to the main wall supply to power and switch the unit on,

or

- use the ON/OFF switch to turn the unit on using its internal battery,

Launch AQUA-CAD and connect the CM unit using the COM port number used to connect the unit. If the unit has entered the sleeping mode, it may last up to a minute to wake up. No need to initialise the unit, the box may stay in yellow color. User can now proceed to firmware upgrade (next chapter).

Connection to a Survey interface unit:

Connect the Survey Interface USB to the PC and power the unit normally. Connect the unit as a CM to AQUA-CAD using the COM port named "PLSM VCom MONITOR" (instead of the "PLSM VCom RADIO" when using the RTKDuo system). The Survey Interface will be detected and will appeared in Yellow box, but do not try to initialise the unit, you can proceed to firmware upgrade directly (next chapter).

Connection to the sensor section of the RTKDuo buoy unit:

Just connect the Sensor Section to the PC using the special USB cable provided by PLSM (Mini-AB to USB A cable), the USB connector to be used is the one located near the ON/OFF connector. The Sensor Section will be powered by the USB and will wait for firmware upgrade commands.


Sensor Section of the RTKDuo buoy,

USB mini-AB connector for firmware upgrade

Like the Survey Interface, connect the Sensor Section as a CM to AQUA-CAD using the COM port named "PLSM VCom MONITOR". The Sensor Section will be detected and will appeared in Yellow box, but do not try to initialise the unit, you can proceed to firmware upgrade directly (next chapter).

Do not forget to screw the sealed IP68 blue cap on the USB connector when the firmware upgrade is finished to keep the unit water proof (down to 1m only if connector are protected by caps or connected).

4.5.2   Firmware upgrade

When the unit is connected as the CM unit, just open the "CM Tools" window:
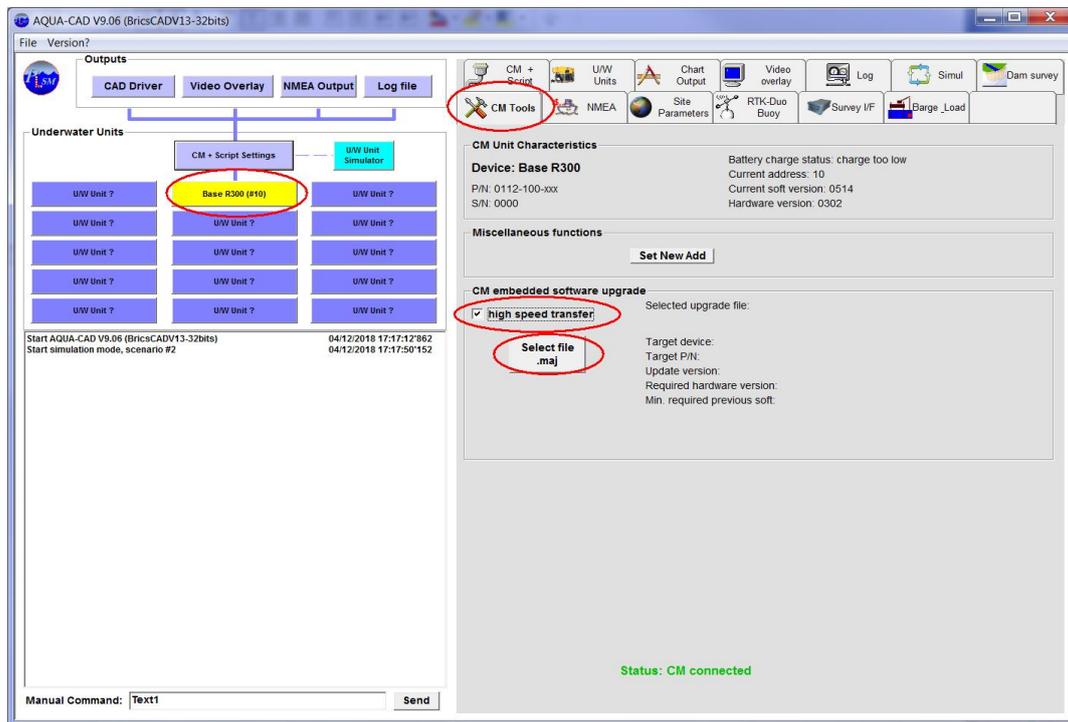
CM Tools Window for firmware upgrade

Select the "high speed transfer" option if the RS232 cable is no longer than about 10m. Then click on the "Select File .maj" button, a select folder and file floating window will be displayed. Select the firmware upgrade file transmitted by PLSM (this is a file with the extension .maj) that has been previously copied on the PC HDD. AQUA-CAD will check that the file is suited to the unit connected and prompt the user to proceed or not with the firmware upgrade.

A progress bar will show the status of the upgrade. At the end, a message will confirm or not the upgrade success.

If the upgrade is not successful, power off the unit, then on again and connect it to AQUA-CAD to check the current software version reported. Sometime an unsuccessful upgrade is reported by mistake.

Do not remove the power supply during the firmware upgrade, this may lead to a unit malfunction.