IMAGENEX TECHNOLOGY CORP.

Set Up and Configuration of the Imagenex Model 881A/L-GS Gyro Stabilized Scanning Sonar (Serial / Ethernet Version)

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Figures and Tables

Acronyms and Abbreviations

Acronym	Meaning
UDP	User Datagram Protocol
ROV	Remotely Operated Vehicle
VDC	Volts Direct Current
PC	Personal Computer
USB	Universal Serial Bus

1.0 Introduction

The Model 881A-GS and 881L-GS (hereafter called 881A/L-GS) are advanced gyro-stabilized, high-resolution scanning sonar systems that have been designed to provide simple, reliable, and accurate representation of underwater targets. The 881A-GS is a serial device and the 881L-GS is connected via ethernet. Gyro stabilization means that the sonar is capable of crystal-clear visualization from moving ROVs without the blurring effects of host vehicle rotation. An advanced, low drift gyro is integrated directly into the sonar head, so the sonar can now compensate for vehicle motion in real time with accuracy and stability. Gyro stabilization is very useful to ROV pilots when working in close proximity to targets.

The Sonar is interfaced via Serial (RS-232 or RS-485) or Ethernet depending on the model (881A-GS – serial and 881L-GS – ethernet).

Both units deliver a high level of performance with the 881L-GS ethernet unit able transfer data at a higher rate which leads to improved range resolution.

The 881A/L-GS sonar comes with a free Windows™ program that is used to interface with the sonar, control settings, log and play back data.

2.0 Getting Started

The following points describe the set-up procedure:

- Physically mount the sonar. Refer to Section 2.1 for details.
- Ensure 24 VDC @ 1 A minimum power supply is off.
- Configure the network card's IP address (see Sections 3.4.2 and 3.4.1) or Comm port when using 881L and 881A respectively.
- Connect the RJ45 connector to the PC's network port or cable to the PC's Comm port (881L and 881A respectively).
- Plug the underwater connector to the sonar.
- Deploy to stable, flat location.
- Power up the 881A/L-GS.
- Wait for gyro calibration to complete. The sonar, upon power up will calibrate the motor, delay for 30 seconds and automatically perform a gyro calibration. No communication to the gyro sub-system is available at this time.
- Launch the Win881AL_GS.exe program.
- Verify the local latitude and declination setting (see Section 3.5.8) and adjust if necessary.

2.1 Hardware Installation

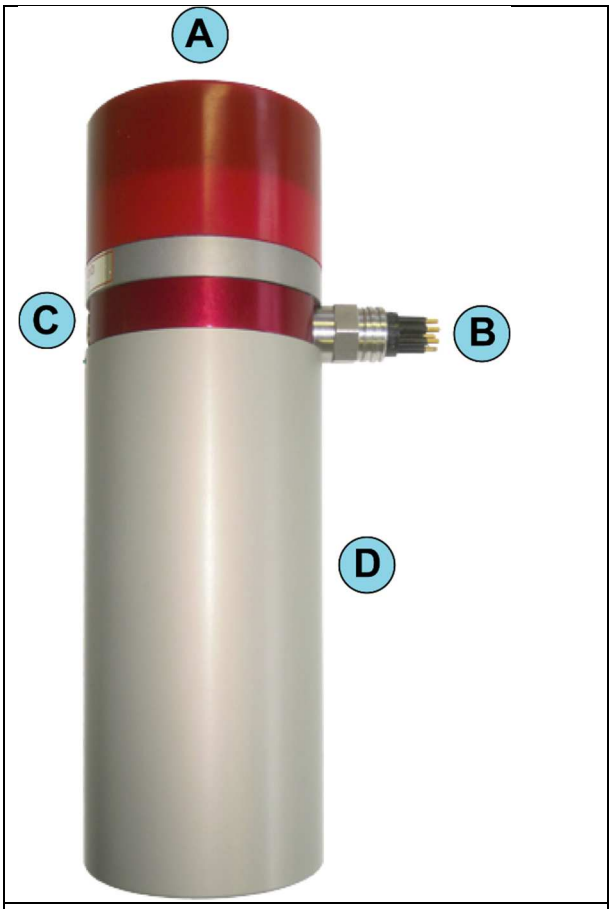


Figure 2-1 External View

A: Transducer. FRAGILE. This area must not be obstructed. Do not attach any brackets or fastenings to this area.

B: Connector. Ensure locking sleeve is used. Do not bend pins.

C: Oil filling port. Do not remove. Represents moving transducer Zero position.

D: Electronics bottle. Use this area to mount the sonar.

2.2 Software Setup

The latest version of the Win881AL_GS.exe program is available from the Imagenex Technology website (https://imagenex.com/interior-page/software-download). The installation of the software on the PC is straightforward. It can be installed in its own directory, and run by double clicking, or you can create a shortcut from the desktop for it. It is not recommended that the “New Program Wizard” nor any other installation program be used.

If present, a Win881AL.INI file will be read and the settings from the previous time the application was run will be used.

2.3 Interface

Controls:

	Connect to a physical sonar head
	Open a File play-back session
	Start / Stop recording an 81R data file
	Scan in polar mode which means the sonar will do 360° rotations. Direction (CW / CCW) is toggled by clicking Rev.
	Scan in a sector defined by the Sector setting.
	Displays a Side Scan type image showing intensity of return.
	Pauses Real Time or Playback
	Changes the sweep direction. Toggles clockwise / counterclockwise
	Refreshes display
	Restore default zoom and pan.
	Zoom in display.
	Zoom out display.
	Ruler. Measures distance in metres or feet (depending on Options > Units selection) on the display.
	Opens a diagnostics window.
	Opens a window with speed keys and other settings (See Appendix A)

Table 2-2 Toolbar Options

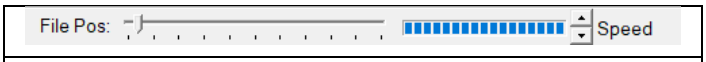


Figure 2-3 File Pos and Speed Control

Used during Playback and allows the user to adjust the playback speed and File position (see Figure 2-3 File Pos and Speed Control above)

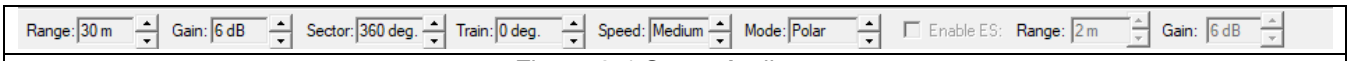


Figure 2-4 Sonar Attributes

Used to control various sonar attributes. Only available in Real Time (see Figure 2-4 Sonar Attributes above)

Range: Set the maximum range of target detection. Maximum 200m.
Gain: Set the sonar gain. Max 40 db. Adjust until display optimized.
Sector: Define the scan sector (0° – 360°).
Train: Allows for the rotation of the sector set above around the centre
Speed: Define the scan speed of the sonar. (Slow – Fastest).
Mode: Polar / Sector / Side Scan, as described in Table 2-2 Toolbar Options.
Enable ES: Not used for the 881A/L-GS.
Range: Not used for the 881A/L-GS.
Gain: Not used for the 881A/L-GS.

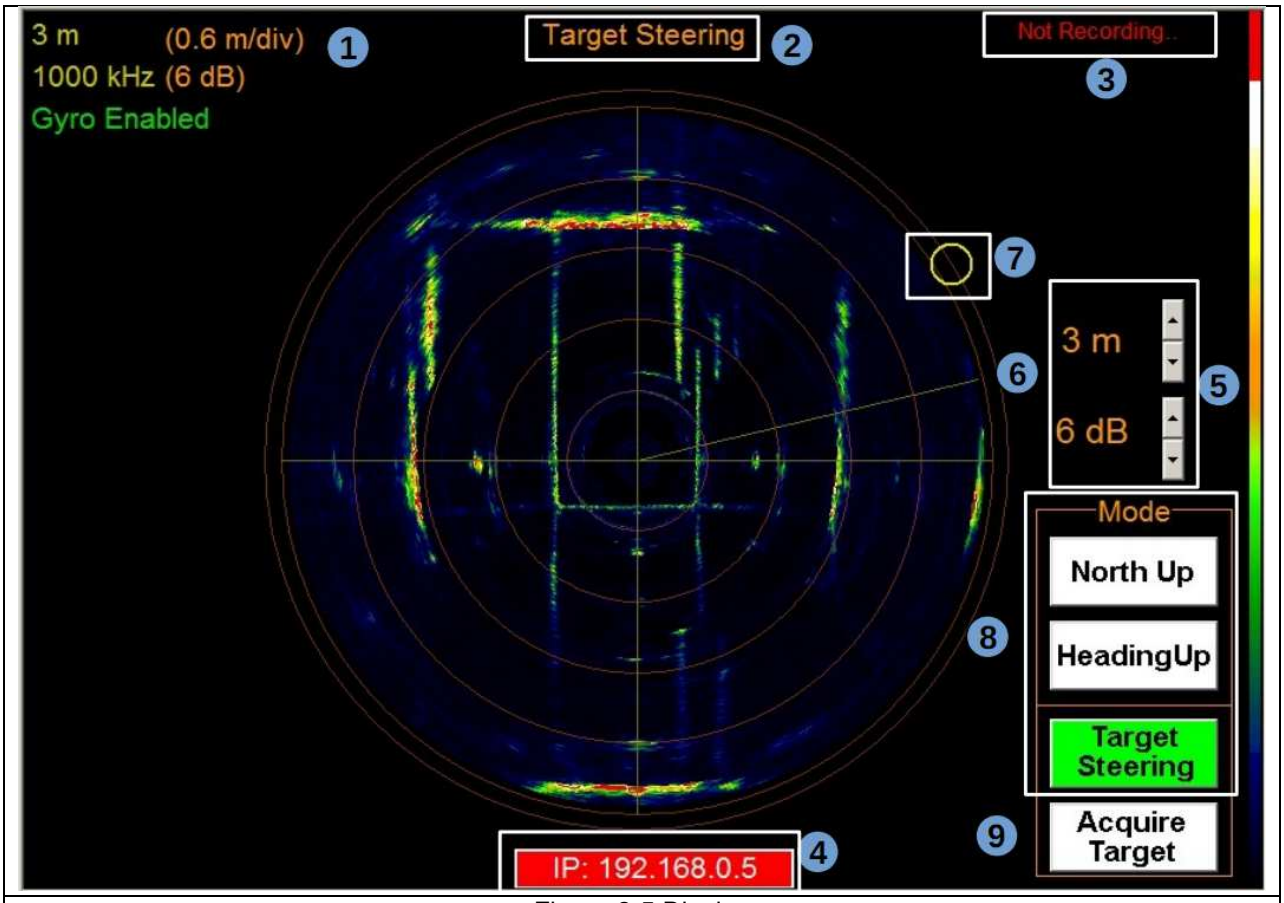


Figure 2-5 Display

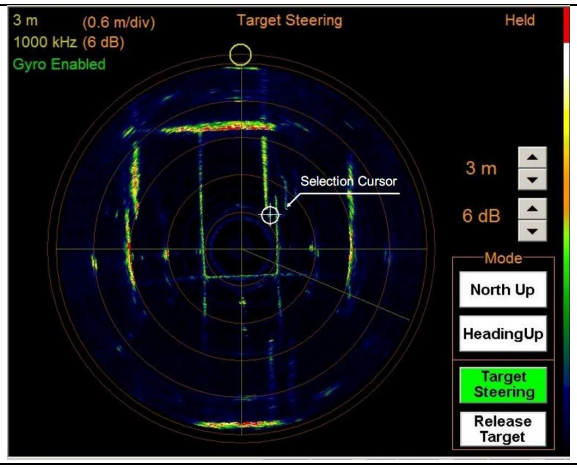
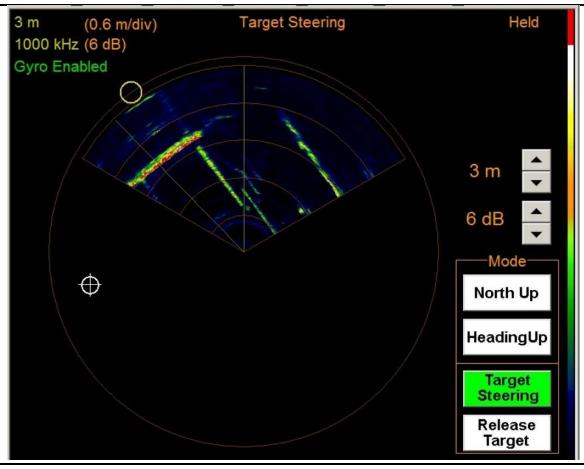
Ref	Description
1	Display current acoustic range and frequency of sonar in yellow. Displays grid scale and current gain in orange. Gyro enabled / disabled in green
2	Displays only when Gyro Stabilized Image is enabled. One of: North Up, Heading Up, or Target Steering.
3	Displays “Not Recording” or “Recording...”
4	Displays “No Connection” when communication to the sonar is interrupted. Steps between IP address and connection status
5	Quick setting for sonar range and gain (if Gyro Enabled selected)
6	Current transducer position for the “ping”
7 and 8	<u>Sonar position indicator:</u> The yellow circle indicates the current sonar unit heading independent of the transducer position: • In North Up mode, the circle will remain at the heading of the sonar unit. It will rotate around the perimeter of the sonar image which remains stationary in a North Up orientation. • In Heading Up mode, the circle will remain stationary at the top of the screen, while the sonar image rotates. • In Target Steering mode, the circle will transverse around the perimeter of the sonar image which remains stationary
9	<u>Gyro Stabilized Image mode selection</u> If Target Steering Mode selected, the user can ***Acquire Target*** which allows the user to select a target location. The scanning sector will then be centred on the selected target and rotated to place the target at the top of the display. (See Figure 2-7 Acquire Target below for details).

Table 2-6 Toolbar Options

Acquire Target

The 881A/L-GS has the ability to select a target of interest, and automatically centre on and scan about a target on screen. The procedure is as follows:

- Ensure the gyro is enabled and in “Target Steering” mode. The image will perform a full polar scan.
- Select the button “Acquire Target”. The mouse cursor will change to
- Select desired target on screen. The screen will automatically change to a top sector view, sector size defaults to 120°and the target centred within the sector:

	
Acquire Target was selected and the mouse cursor changed to the selection cursor. The target cursor is positioned over the target of interest and once clicked, >> see slide alongside.	The desired target was selected. The screen automatically centred the target within a sector and rotated the sector to the top of the screen. The sonar will now scan the sector with the centred target.
Figure 2-7 Acquire Target	

To return, select “Release Target” to remove the sector restrictions and train angle.

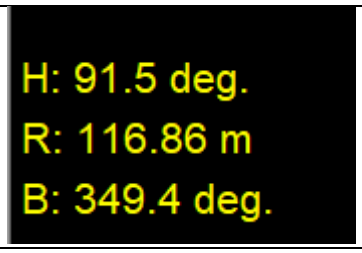


Figure 2-8 Bottom Left

See Figure 2-8 Bottom Left above.
H: Sonar heading
R: Range of the cursor
B: Bearing of the cursor

Latitude and Longitude data (if a GPS is interfaced) is displayed below this Heading, Range and Bearing data

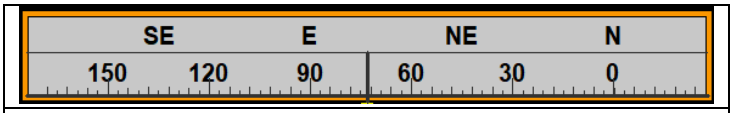


Figure 2-9 Compass Display

See Figure 2-9 Compass Display above. Displays the current heading as a moving display if View > Compass Display is selected.

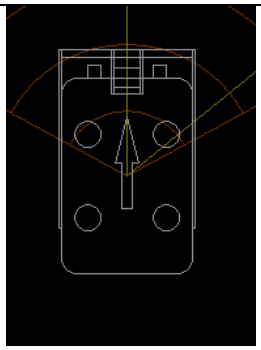


Figure 2-10 ROV Overlay

See Figure 2-10 ROV Overlay above. Displays the current heading as a moving display if View > ROV Overlay is selected. Size can be adjusted by using the Z speed key, which toggles through various size options.

Additional information is displayed in the bottom of the interface toolbar.

3.0 Software Menus

3.1 File

3.1.1 Connect to Sonar Head

Select data source to be from the sonar head and viewed in real-time.

3.1.2 File > Open File to Playback

Data can be replayed from a previously recorded file from the Open File Dialog.

3.1.3 File > Plot data from UDP

Specify a data source as an .81R data file that is received through a UDP port.

3.1.4 File > Record Start (Stop)

Toggles the record state on and off. Recording is done as per the settings below. The file format for an 881A/L-GS is .81R.

3.1.5 File > Auto Save File Names

Select the file name set automatically as Win881AL DD-MMM-YYYY HHMMSS.81R.

3.1.6 File > Auto File Size

Select the file size to be limited to 1 – 4Gbytes. If selected, data will be logged to the max file size and a new file will be created to continue logging.

3.1.7 File > Save Screen

Opens a dialog that allows for the saving of a BMP file of the current screen.

3.1.8 File > Exit

Writes all settings to the Win881AL.INI file that is kept in the same location as executable file and closes the program. The next time the program is started, the system will load these settings from the .ini file.

3.2 View

3.2.1 View > Hold

Pause the display of sonar data.

3.2.2 View > Reverse

Changes the sweep direction. Toggles clockwise / counterclockwise.

3.2.3 View > Clear Screen

Clears the screen of historical data.

3.2.4 View > Zoom Factor

Changes the factor by which the display is zoomed in or out (50, 75, 100, 125, 150, 175, 200%).

3.2.5 View > Zoom In

Zooms in by the factor specified in Zoom Factor.

3.2.6 View > Zoom Out

Zooms out by the factor specified in Zoom Factor.

3.2.7 View > Grid

Choose between None, Rectangular, and Polar.

3.2.8 View > Range Marker

Displays / hides the range, frequency, and gain information on the top left of the display.

3.2.9 View > Color Indicator

Toggles the colour bar on and off.

3.2.10 View > Compass Display

Toggles the Compass Bar on and off (see Figure 2-9 Compass Display).

3.2.11 View > ROV Overlay

Toggles the ROV Overlay on and off (see Figure 2-10 ROV Overlay).

3.2.12 View > Main Toolbar

Toggles the Main Toolbar on and off (see Table 2-2 Toolbar Options).

3.2.13 View > Mini Settings Bar

Toggles the Mini Settings Bar (top of display) on and off (see Figure 2-4 Sonar Attributes).

3.2.14 View > Show Sonar Settings

Toggles a display window on / off that shows various Sonar settings.

3.3 Color Table

Allows various colour combinations (background and scan) to be selected.

Used to change the sonar data colour palettes for the sonar images. The 881A/L-GS uses a colour table to represent echo data strength (amplitude). For example, the Normal High intensity colour table maps the echo data amplitude to 256 colours ranging from black (low strength level) through blue, green, orange, yellow, white, and red (highest strength level).

The Color Table menu offers the following options:

Normal High	Standard colour table used for mapping the echo data amplitude to 256 colors ranging from black (low level), through blue, green, orange, yellow, white, and red (highest level).
Normal Low	Same colours as Norm Hi, but uses a lower colour intensity.
Green	256 shades of green.
Grey	256 shades of grey (white on black).
Reverse Grey	256 shades of grey (black on white).
Brown/Yellow	256 mixed shades of brown and yellow.
Green/Blue	256 mixed shades of green and blue.
Green/Yellow	256 mixed shades of green and yellow.
Blue	256 shades of blue.

Table 3-1 Colour Options

3.4 Systems

3.4.1 System > Choose COM Ports

Allows for the configuration of communication ports:

If an 881A-GS is being used, the communication port parameters are set in the Sonar Head section. The Sonar Head configuration is not relevant with 881L as it is connected via ethernet.

A serial heading output can be set here which will output the heading sensors heading on a serial port. (String format: $HEHDT)

A GPS serial input port can also be configured here to read GPS information. Expected format ($GPGGA)

3.4.2 System > IP Address

Allows for the configuration of the Internet Protocol (IP) address for incoming sonar data.

The statically assigned default for the sonar IP Address is 192.168.0.5 and unless a different IP address was selected at the time of ordering, this should be used and is set in the Sonar IP Address textbox.

Note: **192.168.0.1** is reserved for a network server.

(See Appendix B WINDOWS™ TCP/IP SET-UP AND TROUBLESHOOTING)

3.4.3 System > Diagnostics

Displays a window showing various diagnostic information relating to the sonar.

3.4.4 System > Sound Velocity

Opens a window that allows for the manual input of sound velocity. Default is 1500 m/s.

3.4.5 System > Sonar Orientation

Select Up if sonar orientated with transducer towards the top and down if inverted.

3.4.6 System > Sonar Type

Various models of Sonar use the same interface software. Select 881A-GS or 881L-GS depending on model.

3.5 Options

3.5.1 Options > Units

Metres or Feet can be selected as the units used.

3.5.2 Options > Measure Target

Measures distance in metres or feet (depending on Options > Units selection) on the display.

3.5.3 Options > Enable Gyro

Enables the internal gyro to be used in North Up, Heading Up, Target Steering and Acquire Target modes.

3.5.4 Options > Calibrate Gyro

All gyros are sensitive to the environment (i.e. temperature, motion, earth's rotation, etc.) and will naturally drift with time. Therefore, from time to time, it is recommended to complete a gyro calibration (in manual mode) or recalibrate the motor (auto mode) to remove the accumulated drift.

Automatic Gyro Calibration

Imagenex Gyro enabled scanning sonars now incorporate an automatic gyro biasing feature which is selectable in the user program. This mode continuously re-bias's the gyro in real time, accommodating for temperature fluctuations and internal drift. See Section 3.5.5 Options > Enable Gyro Auto Bias for enabling / disabling this mode. When first starting the sonar, the bias adjustment will be very rapid as the temperature stabilizes. While the gyro will still internally drift, the sonar image will be coherent, allowing the operator to continue to work. Note that the absolute heading will not be exact during this time as the sonar does not differentiate between induced drift and real movement. After a few minutes, re-calibrate the motor to realign the sonar and the transducer. This will reset the accumulated drift that occurred during the warmup period. It is recommended to periodically re-calibrate the motor to reset the accumulated drift.

Manual Gyro Calibration

The information below describes the manual biasing mode which may be necessary in strong magnetic field environments.

Do not calibrate the gyro until the internal temperature of the sonar has stabilized, approximately 30-60 minutes underwater.

The procedure below is followed:

- Suspend sonar operations and mount the sonar on a level stable surface or settle the ROV on a flat bottom.
- Select Options > Calibrate Gyro.
- The message Calibrating Gyro will appear. Calibration takes approximately 30 seconds.
- Once the message disappears, standard operation commences.

Note: When using manual biasing, it is ESSENTIAL that the sonar is completely stationary and at constant temperature during gyro calibration. Any movement will cause undesirable drift in the gyro.

3.5.5 Options > Enable Gyro Auto Bias

Puts the sonar into auto bias mode where the sonar will continuously re-bias the gyro in real time. Disabling this mode requires periodic manual calibration. See Section Options > Calibrate Gyro.

3.5.6 Options > Calibrate Compass

Field calibrates the internal compass. To calibrate the compass, the sonar head MUST be rotated 360º (direction is irrelevant). Check Calibrate Compass, rotate 360º, then un-check Calibrate Compass to store the settings.

3.5.7 Options > Calibrate Motor

Calibrates the motor and realigns the sonar head position relative to the transducer position.
This can be done periodically to remove unwanted drift.

3.5.8 Options > Local Lat / Compass Declination

The geographical local latitude compensates for drift caused by the Earth's rotation. Use the Local Lat / Compass Declination window to set the Latitude (0 to 90 for northern latitudes, 0 to -90 for southern latitudes) and Compass Declination (offset to magnetic north. west is negative, east is positive).

Note that the Local Latitude will not take effect until a calibrate gyro process is completed.

The following website reports declination https://www.geomag.nrcan.gc.ca/calc/mdcal-en.php for a given position.

3.6 Profile

3.6.1 Profile > Points Only

Image data is not displayed. Only generated profile points are displayed.

3.6.2 Profile > Low Mix

Image data is displayed at quarter intensity along with the generated profile points.

3.6.3 Profile > Medium Mix

Image data is displayed at half intensity along with the generated profile points.

3.6.4 Profile > High Mix

Image data is displayed at the normal intensity along with the generated profile points.

3.6.5 Profile > Point Size

Choose small, medium or large.

3.6.6 Profile > Zero Down

To enable plotting of profile data with the zero reference of the sonar head pointing vertically down rather than pointing horizontally or up. This allows plotting the seafloor in its correct orientation. Note that the GS component will not work if the sonar is mounted horizontally.

3.6.7 Profile > Profile Min Range…

Set the minimum range here. Useful to eliminate spurious returns that occur too close to the transducer.

3.6.8 Profile > Auto Profile

Not used in the 881A/L-GS sonar.

3.7 GPS

3.7.1 GPS > Enable

If a GPS receiver is connected via a comm port, it may be enabled and disabled here.

3.7.2 GPS > Track Plotter

Displays a window showing the historical track of the sonar.

3.7.3 GPS > Erase GPS Tracks

Clears the historical track of the sonar.

3.7.4 GPS > Zoom In

Zooms in on the track plot. Metres / feet per division is shown in the track plot window.

3.7.5 GPS > Zoom Out

Zooms out on the track plot. Metres / feet per division is shown in the track plot window.

3.8 Video

It is possible to connect a video source to the sonar via a connected USB video frame grabber. This video is viewed in the interface window in real time using the following commands.

3.8.1 Video > Open Video Window

Allows the interfaced video camera to display in the interface window.

3.8.2 Video > Record Video Frames to File

Enable / disable the recording of video to the data files. Once File > Copy Start… (Stop…) (see Section 3.1.4) is clicked the video data will be included in the data file recording.

Note that storing video can generate very large files. The software is able to automatically split the recorded file in predefined file sizes as defined in File > Auto File Size. See Section 3.1.6

3.9 Help

3.9.1 Help > Help…

Displays a pane with hot keys. (see APPENDIX A)

3.9.2 Help > About…

Reports the software version, which should be quoted during any support queries.

APPENDIX A **HOT KEYS**

Hot Keys...

Command	Hot Key	Discription
Default 881L IP:		192.168.0.5
Default 881A COM Port:		COM1

Help	F1	Show Hot Keys Help Window
Settings	F2	Show/Hide Settings Dialog.
Diagnostics	F3	Show/Hide Diagnostics Dialog.

Hold	h, H	Operation Held.
Reverse	Space	Reverse Scan Direction.
Clear the screen	c, C	Clear Sonar Image.

Key In Range	r, R	Keyboard entry for Range Entries: 1,2,3,4,5,10,20,30,40,50,60,80,100,150,200 in meters Entries: 3,6,9,12,15,30,60,90,120,150,180,240,300,450,600 in feet
Key In Gain	g, G	Keyboard entry for Gain Entries: 1 - 40 with increment of 1
Key In Sector width	s, S	Keyboard entry for Sector width Entries: 0 - 180 with increment of 3 (sector mode) Entries: 0 - 360 with increment of 3 (polar mode)
Key In Train Angle	t, T	Keyboard entry for Train Angle Entries: 0 - 360 with increment of 3
Hot Key	Shift + '+'	Zoom In Sonar Image
Hot Key	Shift + '_'	Zoom Out Sonar Image
Hot Key	z, Z	Zoom ROV overlay

Sector Width Increase	Up	Increase Sector Width 3 degrees
Sector Width Decrease	Down	Decrease Sector Width 3 degrees
Train Angle Increase	Right	Increase Train Angle 3 degrees
Train Angle Decrease	Left	Decrease Train Angle 3 degrees

Mouse LButton Drag		Move Sonar Image

APPENDIX B **WINDOWS™ TCP/IP SET-UP AND TROUBLESHOOTING**

The Imagenex Model 881L-GS sonar system consists of an underwater sonar head connected via Ethernet directly (or indirectly) to a Windows© based computer.

This document covers the necessary setup procedures to enable your Windows© 10 based PC to communicate with the sonar.

Ethernet Cable

The included Ethernet cable specifications are:

- Cat 5e
- RJ-45
- 568B wiring scheme

If this cable needs to be replaced, ensure that the above specifications are met.

TCP/IP Setup

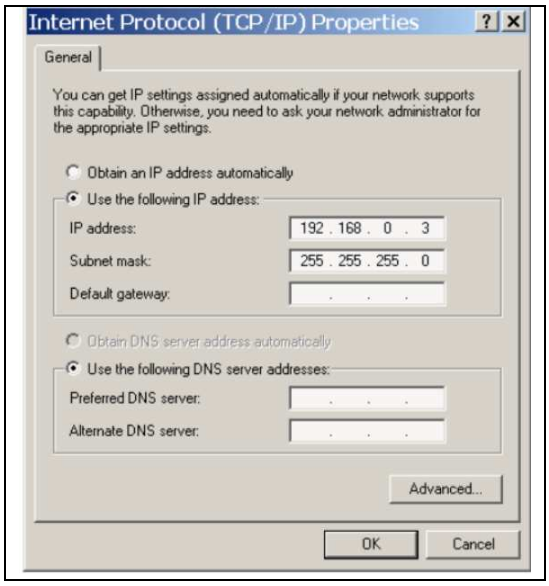
The sonar head needs to run with a static IP (Internet Protocol) address for both head and PC. The IP Address of the PC must be set to 192.168.0.X where X is any number excluding 1, 5 and 255:

IP Address	192.168.0.X
Subnet Mask	255.255.255.0

Note: the number ‘1’ is reserved for a network server ‘5’ is reserved for the 881L-GS sonar head, and 255 is reserved for broadcasting.

This is done as follows (Windows™ 10):

- Navigate to the Control Panel and double-click ‘Network and Sharing Centre’
- Click ‘Change adapter settings’
- Right-click on the Ethernet interface you wish to connect with and select ‘Properties’
- Select ‘Internet Protocol Version 4 (TCP/IPv4)’
- Click Properties
- Configure as follows and click OK:



Now the computer is on the same network as the sonar head.

When starting the Win881AL_GS program, the IP address stored in the “Win881AL.INI” file is read and a connection will be established.

The sonar head should function correctly, however, if communication does not function properly, try the suggestions listed below:

- **Disable any network bridges that are present**
  - A network bridge allows a separate port, such as “USB”, or “Firewire” to piggyback the Ethernet connection.
  - Under “Network Connections”, if there is a network bridge icon, disable it.

- **Disable any other network devices that are present on the computer**
  - Often, if there are multiple network cards present, Windows™ may communicate through an incorrect one. This is more of an issue on laptops with wireless connections.
  - Right-click on each connection and select “Disable”.

- **Under “Network Connections”, right-click on the Ethernet card and select properties. Clear unnecessary network protocols:**
  - Deselect all services except for Internet Protocol Version 4 (TCP/IPv4)

- **Remove any firewalls present**
  - Select the “Advanced” Tab. Deselect the Firewall option (if present).

- **Click ‘Configure’ (in the General tab).**
  - Set Link speed to “Auto” or “10Mbps”
  - In the ‘Advanced’ tab, select ‘Link Speed / Duplex Mode’ and set to either ‘Auto Mode’ or ‘10 Full Mode’.
  - Disable any power saving that shuts down the Ethernet card.
  - In the “Advanced” tab, select “Link Down Power Saving” and set to “Disable”.
  - In the “Power Management” tab, deselect any power saving option.

- **Repair the Ethernet connection.**
  - Windows™ remembers the hardware address for each socket. To clear the Windows™ settings, right-click on the Local Area Connection and select ‘Repair’.