



IMAGENEX TECHNOLOGY CORP.

MODEL 881A/L-GS

GYRO STABILIZED SCANNING SONAR

(SERIAL / ETHERNET VERSION)

USER MANUAL

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Table of Contents

1.	Introduction	10
2.	Getting Started.....	12
2.1.	Hardware Installation	13
2.1.1.	Personal Computer	13
2.1.2.	Sonar Considerations	14
2.2.	Software Setup	15
2.3.	Interface	16
2.3.1.	Shortcut Buttons	17
2.3.2.	File Playback.....	18
2.3.3.	Sonar Settings	18
2.3.4.	Additional Information	19
2.3.5.	Acquiring Targets.....	20
2.3.6.	Heading, Range, Bearing	21
2.3.7.	Compass Tape Display.....	22
2.3.8.	ROV Overlay.....	22
3.	Software Menus.....	23
3.1.	File	23
3.1.1.	File > Connect to Sonar Head	23
3.1.2.	File > Open File to Playback.....	23
3.1.3.	File > Plot data from UDP	23
3.1.4.	File > Record Start (Stop)... / Copy Start (Stop).....	23
3.1.5.	Set Record Directory	23

3.1.6.	File > Auto Save File Names	23
3.1.7.	File > Auto File Size	23
3.1.8.	File > Convert 81R File to xyz	24
3.1.9.	File > Save Screen	24
3.1.10.	File > Exit	24
3.2.	View	24
3.2.1.	View > Hold	24
3.2.2.	View > Reverse	24
3.2.3.	View > Clear Screen	24
3.2.4.	View > Zoom Factor	24
3.2.5.	View > Zoom In	25
3.2.6.	View > Zoom Out	25
3.2.7.	View > Grid	25
3.2.8.	View > Range Marker	25
3.2.9.	View > Color Indicator	25
3.2.10.	View > Compass Display	25
3.2.11.	View > ROV OverlayToggles the ROV Overlay on / off (see Figure 8 ROV Overlay).	25
3.2.12.	View > Main Toolbar	25
3.2.13.	View > Mini Settings Bar	25
3.2.14.	View > Show Sonar Settings	26
3.3.	Color Table	26
3.4.	System	27
3.4.1.	System > Choose COM Ports	27

3.4.2.	System > IP Address	27
3.4.3.	System > Diagnostics	27
3.4.4.	System > Sound Velocity	27
3.4.5.	System > Sonar Orientation	28
3.4.6.	System > Sonar Type	30
3.5.	Options.....	30
3.5.1.	Options > Units	30
3.5.2.	Options > Measure Target.....	30
3.5.3.	Options > RealTime Play Speed	31
3.5.4.	Options > Enable Gyro	31
3.5.5.	Options > Calibrate Gyro	31
3.5.6.	Options > Enable Gyro Auto Bias.....	32
3.5.7.	Options > Set Heading Reference	33
3.5.8.	Options > Calibrate Compass.....	33
3.5.9.	Options > Calibrate Motor.....	34
3.5.10.	Options > Local Lat / Compass Declination.....	34
3.6.	Profile.....	34
3.6.1.	Profile > Off	34
3.6.2.	Profile > Points Only	34
3.6.3.	Profile > Low Mix	34
3.6.4.	Profile > Medium Mix	34
3.6.5.	Profile > High Mix.....	34
3.6.6.	Profile > Point Size	35

3.6.7.	Profile > Zero Down	35
3.6.8.	Profile > Profile Min Range	35
3.6.9.	Profile > Auto Profile > Horizontal Scan (Borehole).....	35
3.7.	GPS	38
3.7.1.	GPS > Enabled	38
3.7.2.	GPS > Track Plotter.....	38
3.7.3.	GPS > Erase GPS Tracks	38
3.7.4.	GPS > Zoom In	39
3.7.5.	GPS > Zoom Out	39
3.8.	Video.....	39
3.8.1.	Video > Open Video Window.....	39
3.8.2.	Video > Record Video Frames to File.....	39
3.9.	Help.....	39
3.9.1.	Help > Help...	39
3.9.2.	Help > About...	39
4.	Additional Documentation.....	40
APPENDIX A	Hot Keys	41
APPENDIX B	Cable Diagram (881L and 881A).....	43
APPENDIX C	Spec Sheets.....	46

Figures

Figure 1 External View	14
Figure 2 Software User Interface (File Playback).....	16
Figure 3 Sonar Settings	18
Figure 4 Additional Information.....	19
Figure 5 Acquiring Targets	21
Figure 6 Bottom Left	21
Figure 7 Compass Tape Display	22
Figure 8 ROV Overlay	22
Figure 9 Transducer Up.....	28
Figure 10 Transducer Down.....	28
Figure 11 Zero Down.....	35
Figure 12 Auto Profile	38

Tables

Table 1 General Features.....11

Table 2 Adapters13

Table 3 External Hardware.....14

Table 4 Shortcut Buttons17

Table 5 Playback Control18

Table 6 Reference Table20

Table 7 Color Table26

Table 8 Conventions.....30

Table 9 Additional Document40

Acronyms and Abbreviations

Acronym	Definition
ASCII	American Standard Code for Information Interchange
dB	Decibel
ES	Echo Sounder
GB	Gigabyte
GPS	Global Positioning System
GS	Gyro Stabilized
IP	Internet Protocol
kHz	Kilohertz
m/s	Meters per second
MHz	Megahertz
NMEA	National Marine Electronics Association
PC	Personal Computer
RAM	Random Access Memory
ROV	Remotely Operated Vehicle
TB	Terabytes
UDP	User Datagram Protocol
USB	Universal Serial Bus
VDC	Volts Direct Current

1. INTRODUCTION

The Model 881A-GS and 881L-GS (hereafter called 881A/L-GS) are advanced mechanical scanning, gyro-stabilized, high-resolution imaging or profiling 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. Both units contain a magnetic compass and a gyro that work together to deliver a robust heading reference even in areas of high magnetic interference.

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

A profiling version of the 881A-GS has been tailored for use in a borehole surveying role and contains features for auto scanning boreholes (see 3.6.9 Profile > Auto Profile > Horizontal Scan (Borehole)...).

Both sonars contain a pitch and roll sensor that is used to apply pitch and roll values to the sonar data when creating an XYZ output.

The sonars come with a free Windows® program that is used to interface with the sonar, control settings, log and play back data.

The general features are:

Frequency	310 kHz, 675 kHz, or 1 MHz (standard default settings) -Other frequencies can be selected through programmable software configurations (Tunable from 280 kHz to 1.1 MHz in 5 kHz steps)
Transducer	Imaging type, fluid compensated
Range Resolution	1 m – 4 m: 2 mm (0.08") 5 m & up: 10 mm (0.4")
Maximum Operating Depth	1000 m (3000 m available)
Transducer Beam Width	310 kHz: 4° x 40° 675 kHz: 1.8° x 20° 1 MHz: 0.9° x 10°
Minimum Detectable Range	150 mm (6")
Table 1 General Features	

2. GETTING STARTED

The following bullet points describe the set-up procedure:

- Physically mount the sonar. Refer to Section 2.1.2 Sonar Considerations for details.
- Ensure 24 VDC (1A minimum) power supply is off.
- Configure the network card's IP address or COM port when using 881L-GS and 881A-GS respectively. (see Sections 3.4.2 System > IP Address and 3.4.1 System > Choose COM Ports)
- 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 into the sonar.
- Deploy to a stable, flat location.
- Power up the 881A/L-GS.
- Wait for the gyro calibration process to be completed. Upon power up, the sonar will automatically calibrate the motor, pause 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_vxxxx.exe program.
- Verify the local latitude and declination setting (see 3.5.10 Options > Local Lat / Compass Declination) and adjust if necessary.

2.1. HARDWARE INSTALLATION

2.1.1. Personal Computer

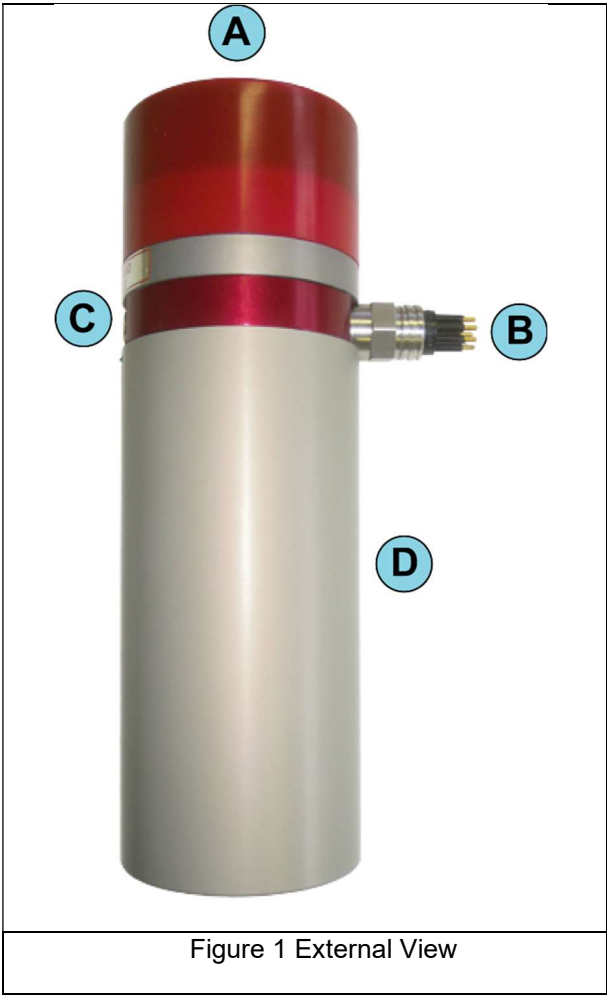
The minimum requirements for the user supplied PC are:

- Intel i5 or equivalent
- Windows® 7
- 8 GB RAM
- Minimum software screen resolution is 1024 x 768
- 1 TB Hard drive
- If an 881L-GS is used – an available discreet Gigabit Ethernet port, supported by a Realtek PCIE GBE family chipset (not an FE family chipset) must be used. If an external Ethernet to USB adapter is used, a high specification USB 3.0 Gigabit Ethernet Adapter is recommended. The TP-LINK Model UE300 appears to work well.
- If an 881A-GS is used – an available RS-485 or RS-232 (depending on the type of receiver) port is required. If no COM port is present on the PC, an RS-485 to USB adaptor or an RS-232 to USB adaptor is used. The following are recommended models of such adaptors:

Protocol	Recommended Adaptor
RS-485	Model 2104 USB to RS-485 from Sealevel Systems
RS-232	UC-232A USB to RS-232 from ATEN
Table 2 Adapters	

Refer to Document Number 410-013. 'USB Converters and the Windows OS' for important information on USB <--> RS-232 and USB <--> RS-485 Converters running on Windows® operating systems (available on the Imagenex website <https://imagenex.com/support>).

2.1.2. Sonar Considerations



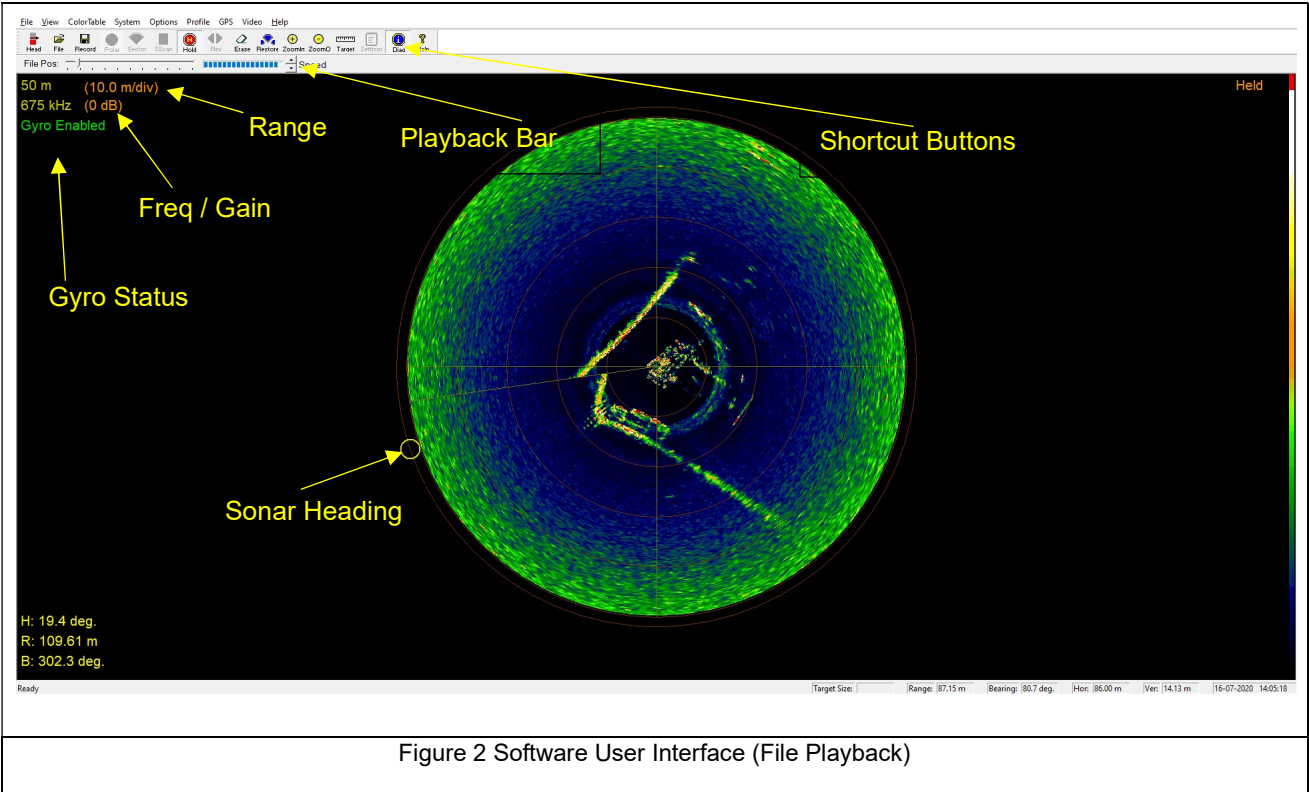
A	<u>FRAGILE</u> . This area must not be obstructed. Do not attach any brackets or fastenings to this area.
B	Ensure locking sleeve is used. Do not bend pins.
C	Do not remove. Represents moving transducer zero position.
D	Use this area to mount the sonar.
Table 3 External Hardware	

2.2. SOFTWARE SETUP


















The latest version of the Win881AL_GS program is available from the Imagenex Technology Corp. 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.

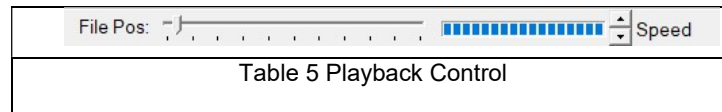
2.3. INTERFACE



2.3.1. Shortcut Buttons

 Head	Connect to a physical sonar head.
 File	Open a File play-back session.
 Record	Start / Stop recording an 81R data file.
 Polar	Scan in polar mode which means the sonar will do 360° rotations. Direction (C/W CC/W) is toggled by clicking  Rev.
 Sector	Scan in a sector defined by the Sector setting.
 SScan	Displays a Side Scan type image showing intensity of return.
 Hold	Pauses real-time or playback.
 Rev	Changes the sweep direction. Toggles clockwise / counter-clockwise.
 Erase	Clears the display.
 Restore	Restore default zoom and pan.
 ZoomIn	Zoom in display.
 ZoomOut	Zoom out display.
 Ruler	Ruler. Measures distance in meters or feet (depending on Options > Units selection) on the display.
 Settings	Display Settings dialog box.
 Diagnostics	Opens a diagnostics window.
 Help	Opens a window with speed keys and other settings (See Appendix A).
Table 4 Shortcut Buttons	

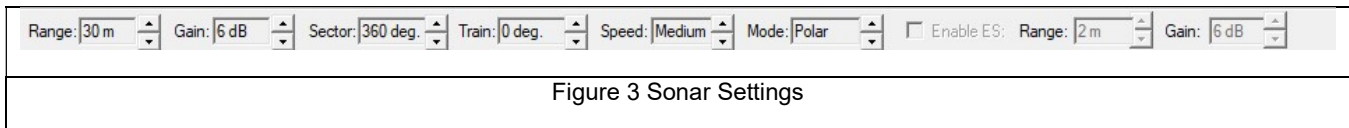
2.3.2. File Playback



Used during playback and allows the user to adjust the playback speed and file position.

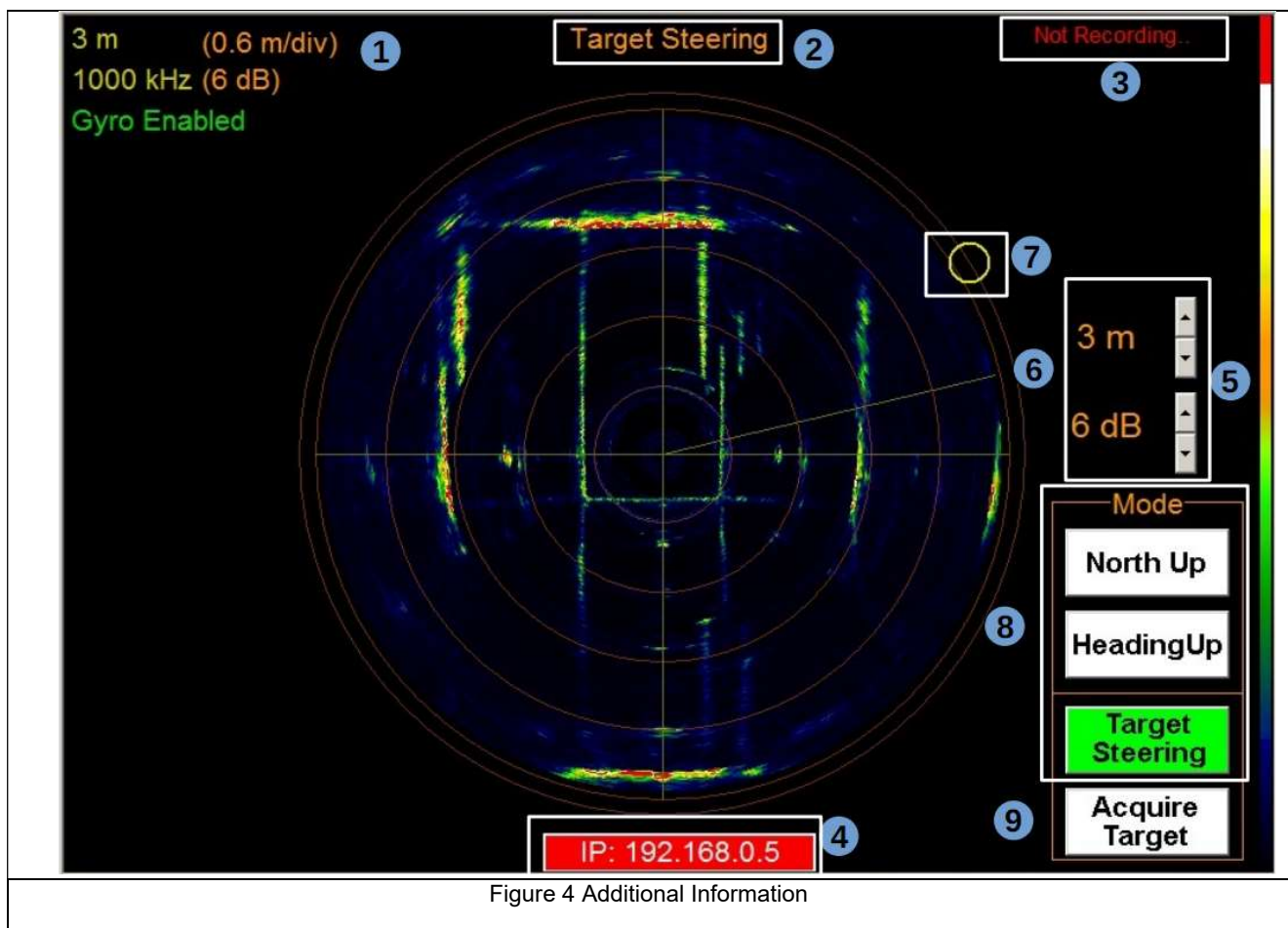
2.3.3. Sonar Settings

Used to control various sonar attributes. Only available in real-time mode:



- **Range:** Set the maximum range of target detection. (1 – 200 m).
- **Gain:** Set the sonar gain. (0 – 40 dB). Adjust until display optimized.
- **Sector:** Define the scan sector (0° – 360° in 3° increments).
- **Train:** Allows for the rotation of the sector (set above) around the centre (0° – 360° in 3° increments).
- **Speed:** Define the scan speed of the sonar. (Slow – Fastest).
- **Mode:** Polar / Sector / Side Scan, as described in 3.2.7 View > Grid.
- **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.


2.3.4. Additional Information

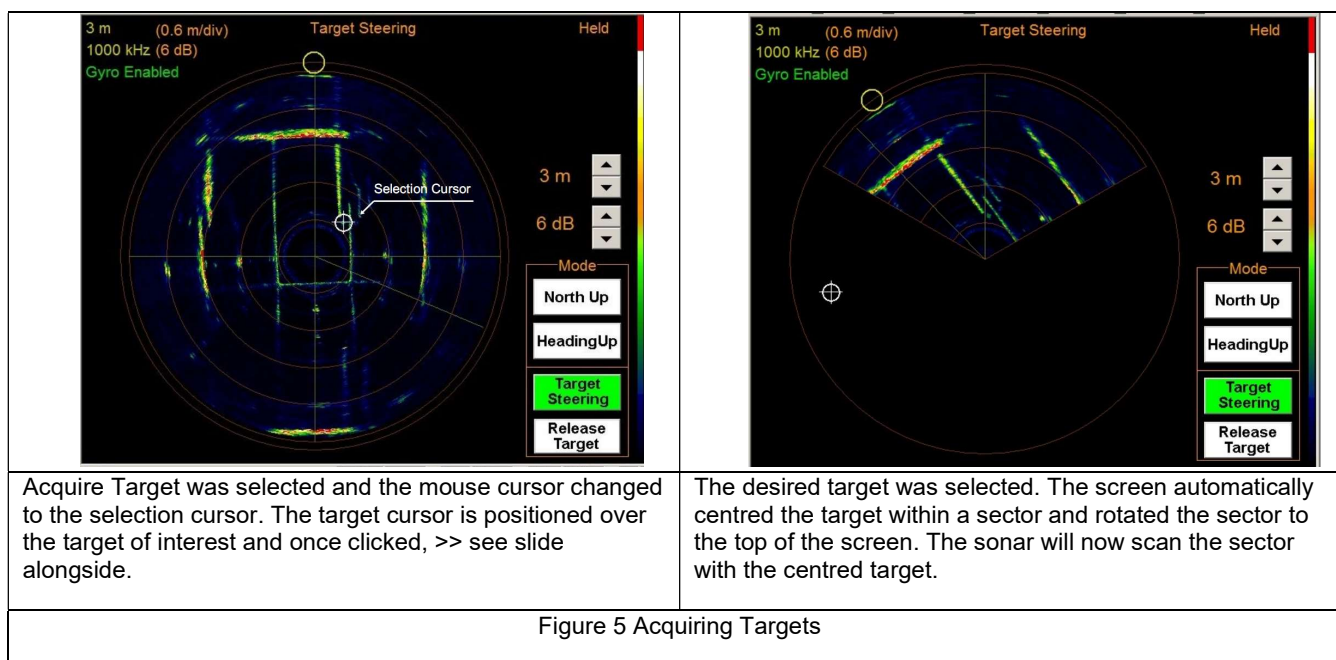


Ref	Description
1	Display current acoustic range and frequency of sonar in yellow. Displays grid scale and current gain in orange. Gyro enabled / disabled in green.
2	Displays only when Gyro Stabilized Image is enabled. One of: North Up, Heading Up, or Target Steering.
3	Displays “Not Recording” or “Recording...”
4	Displays “No Connection” when communication to the sonar is interrupted. Steps between IP address and connection status (If 881L-GS used).
5	Quick setting for sonar range and gain (if Gyro Enabled selected).
6	Current transducer position for the “ping”.
7 and 8	<p>Sonar position indicator:</p> <p>The yellow circle indicates the current sonar unit heading independent of the transducer position.</p> <p>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.</p> <p>In Heading Up mode, the circle will remain stationary at the top of the screen, while the sonar image rotates.</p> <p>In Target Steering mode, the circle will transverse around the perimeter of the sonar image which remains stationary. Used in conjunction with Acquire Target (see 9 below)</p>
9	<p>Gyro Stabilized Image mode selection</p> <p>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 2.3.5 Acquiring Targets below for details).</p>
Table 6 Reference Table	

2.3.5. Acquiring Targets

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

- Ensure the gyro is enabled and in “Target Steering” mode. The sonar 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 is centred within the sector:



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

2.3.6. Heading, Range, Bearing

The following data appears bottom left of the display:



H: Sonar heading.

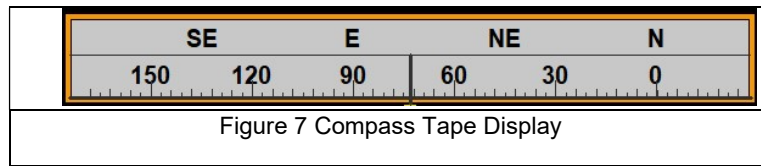
R: Range of the cursor from centre.

B: Bearing of the cursor.

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

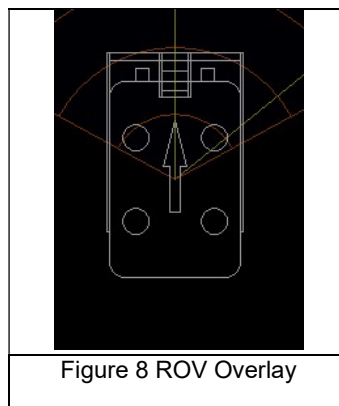
2.3.7. Compass Tape Display

Enable View > Compass Display. Displays the current heading as a moving tape display:



2.3.8. ROV Overlay

Displays the ROV overlay if View > ROV Overlay is selected. Size can be adjusted by using the Z speed key, which toggles through various size options.



3. SOFTWARE MENUS

3.1. FILE

3.1.1. File > 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 box.

3.1.3. File > Plot data from UDP

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

3.1.4. File > Record Start (Stop)... / Copy Start (Stop)...

Record Start (Stop) - Realtime only.

Copy Start (Stop) - Playback only.

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

3.1.5. Set Record Directory

Specify the directory in which you wish to save files. If nothing is specified, the program saves the copied / recorded files to the directory from which the software was run.

3.1.6. File > Auto Save File Names

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

3.1.7. File > Auto File Size

Realtime only.

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

3.1.8. File > Convert 81R File to xyz...

Converts an 81R data file to an ASCII text XYZ file. X and Y are the output from a polar to rectangular conversion, and z is calculated from the Auto Profile settings (see 3.6.9 Profile > Auto Profile). X,Y and Z values are corrected for pitch and roll. An Open File dialog box is shown and a file is selected, which is replayed and an XYZ file generated in the background. Realtime mode will stop during this process. The XYZ is formatted as dd-mm-yyyy<tab>hh:mm:ss<tab>X<tab>Y<tab>Z<cr><lf>. If no Auto Profile 'Payout Increment' was set, or no 'Sonar Elevation' adjusted, the Z components of the file will be whatever is set in the 'Sonar Elevation' text box in the Auto-Profile window. Note that the XYZ file will always be in meters regardless of the units selected in 3.5.1 Options > Units.

3.1.9. File > Save Screen

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

3.1.10. File > Exit

Writes all settings to the Win881AL.INI file that is kept in the same location as the 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

Realtime only.

Changes the sweep direction. Toggles clockwise / counter-clockwise.

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 grids.

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 / off.

3.2.10. View > Compass Display

Toggles the Compass Tape on / off (see Figure 7 Compass Tape Display).

3.2.11. View > ROV OverlayToggles the ROV Overlay on / off (see Figure 8 ROV Overlay).

3.2.12. View > Main Toolbar

Toggles the Main Toolbar on / off.

3.2.13. View > Mini Settings Bar

Realtime only.

Toggles the Mini Settings Bar (top of display) on / off (see Figure 3 Sonar Settings).

3.2.14. View > Show Sonar Settings

Realtime only.

Toggles a display window on / off that shows various sonar settings and allows the setting of the head ID. The head IDs have been programmed into the sonar at default 16. Care should be taken when changing this value as it may lead to loss of communication. Other sonar attributes may be changed here but care should be taken when changing items in the Manual Frequency Setup box as this may adversely affect image quality.

3.3. COLOR TABLE

Allows various colour combinations 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 colours 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 7 Color Table	

3.4. SYSTEM

3.4.1. System > Choose COM Ports

Realtime only.

Allows for the configuration of communication ports:

If an 881A-GS is being used, the sonar communication port parameters are set in the Sonar Head section. The Sonar Head configuration is not relevant with 881L-GS 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: NMEA \$HEHDT)

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

3.4.2. System > IP Address

881L-GS Only. Select sonar from the 3.4.6 System > Sonar Type menu.

Realtime only.

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.

3.4.3. System > Diagnostics

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

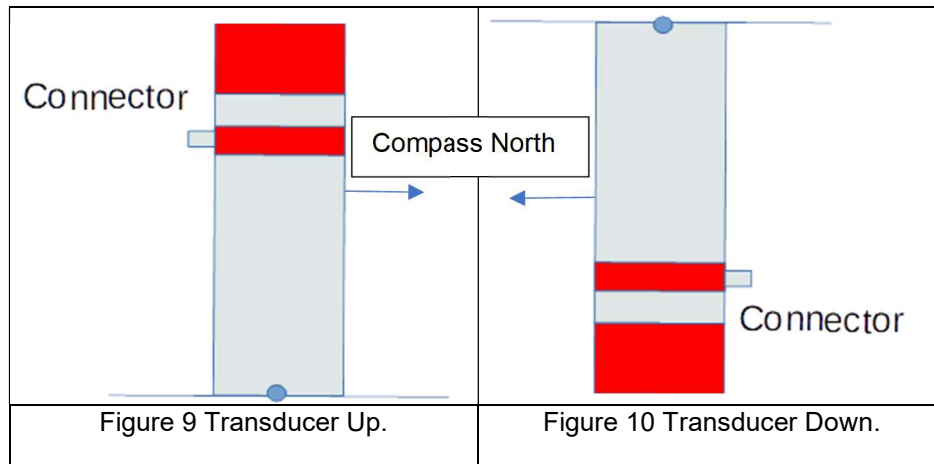
3.4.4. System > Sound Velocity

Opens a window that allows for the manual input of sound velocity between 1400 m/s and 16000 m/s. Default is 1500 m/s.

3.4.5. System > Sonar Orientation

Realtime only.

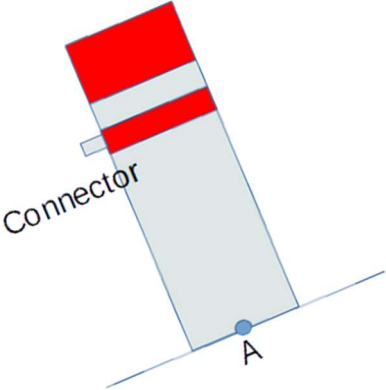
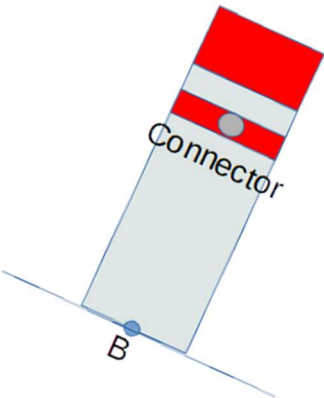
Select Up if sonar orientated with red polyurethane housing (transducer) towards the top and Down if inverted. (See Figure 9 and Figure 10). Note that although the unit is rotated through 180° the pitch, roll and heading sensors will be corrected for sign conversion in both orientations.



The oil fill port represents the zero reference for the compass, gyro sensors and pitch and roll sensors.

Note that the pitch, roll and heading sensors although rotated through 180°, are auto corrected for Transducer Up, Transducer Down orientations. They are not corrected for the Zero Down orientation and should be ignored.

Table 8 Conventions below details the conversion:

Orientation	Axis	Convention (Compass North = Forward)	Diagram
Transducer Up	Pitch - Rotating around axis A (into the page)	+ = Pitch Up	
	Roll – Rotating around Axis B (into the page)	+ = Starboard Down	

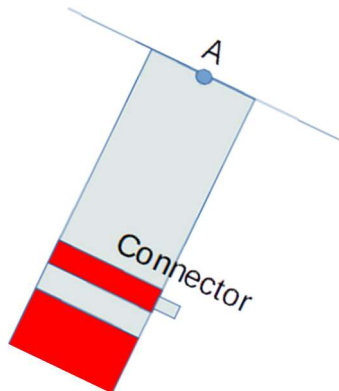
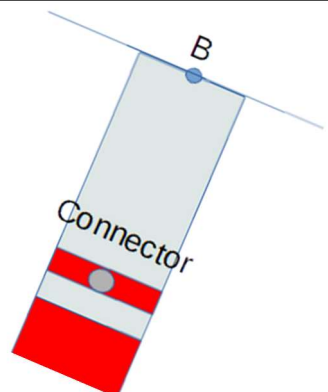
Transducer Down	Pitch - Rotating around axis A (into the page)	+ = Pitch Up	
	Roll – Rotating around Axis B (into the page)	+ = Starboard Down	
Zero Down	Pitch	Not applicable	
	Roll	Not applicable	

Table 8 Conventions

3.4.6. System > Sonar Type

Realtime only.

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

Meters or feet can be selected as the units used.

3.5.2. Options > Measure Target

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

3.5.3. Options > RealTime Play Speed

Playback only.

Limits the playback speed to the same speed as what was used when data was acquired.

3.5.4. Options > Enable Gyro

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

3.5.5. 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 to recalibrate the motor (auto mode) or to remove the accumulated drift (in manual mode).

Automatic Gyro Calibration

The user program incorporates an automatic gyro biasing feature. This mode continuously re-biases the gyro in real time accommodating for temperature fluctuations and internal drift. See Section 3.5.6 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.

Follow the procedure below:

- 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 remains completely stationary and at constant temperature during gyro calibration. Any movement will cause undesirable drift in the gyro.

3.5.6. Options > Enable Gyro Auto Bias

Realtime only.

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 3.5.5 Options > Calibrate Gyro.

3.5.7. Options > Set Heading Reference

Realtime only.

Manual and Automatic are generally used when the sonar is used in borehole survey applications, and not when it is used, for example, as an imager mounted on an ROV. If the sonar is used as an imager, Disable should be selected.

Allows the user to define the heading reference to be used.

- **Manual:** This mode should be used if the magnetic compass readings are adversely affected by a strong magnetic field. Uncheck "Enable Gyro Auto Bias" (see 3.5.6 Options > Enable Gyro Auto Bias) as this function uses the magnetic compass to aid the gyro. Rotate the sonar to the heading = 0° (true north) and click OK. Only gyro angles (i.e. no magnetic values) are used for image stabilization and the generation of XYZ output files.
- **Automatic:** This mode can be used when there is no magnetic interference in the area, but magnetic interference may or may not be anticipated. After pressing OK, the current magnetic heading will be used as the reference and the gyro will then provide heading input to sense any rotation of the sonar. All subsequent scans will therefore be relative to magnetic north and through the application of declination (see 3.5.10 Options > Local Lat / Compass Declination), true north is calculated. Image stabilization and XYZ points (if generated) are calculated relative to this true north reference. Gyro drift will make the heading spuriously vary over time and the Enable Gyro Auto Bias function (see 3.5.6 Options > Enable Gyro Auto Bias) can be used to reduce gyro drift. After the area of magnetic interference has passed (or periodically if no magnetic interference is present), the reference should be reset so as to eliminate the drift inherent in the gyro.
- **Disable:** This mode is used for general imaging applications where the auto-profile function is not required.

3.5.8. Options > Calibrate Compass

Realtime only.

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

3.5.9. Options > Calibrate Motor

Realtime only.

Calibrates the motor and realigns the sonar head position relative to the transducer position.

This can be done periodically to remove unwanted drift.

3.5.10. Options > Local Lat / Compass Declination

Realtime only.

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 > Off

Only image data is displayed (i.e. no profile points).

3.6.2. Profile > Points Only

Only generated profile points are displayed and no image data is visible.

3.6.3. Profile > Low Mix

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

3.6.4. Profile > Medium Mix

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

3.6.5. Profile > High Mix

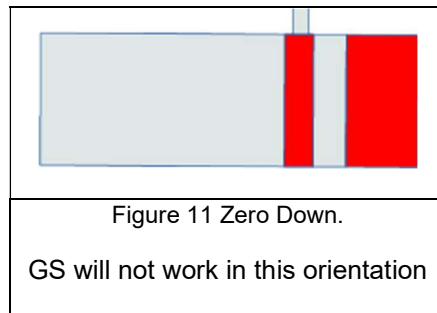
Image data is displayed at the normal intensity along with the generated profile points.

3.6.6. Profile > Point Size

Choose small, medium or large.

3.6.7. Profile > Zero Down

To enable plotting of profile data with the zero reference of the sonar transducer pointing vertically down (see Figure 11 below) rather than pointing horizontally (Figure 9 and Figure 10). This allows plotting targets in their correct orientation. Note that the GS component will not work if the sonar is mounted horizontally (as shown in the sketch below – zero down):



Note that Zero Down mode should only be used when the sonar is mounted horizontally.

3.6.8. Profile > Profile Min Range

Realtime only.

Set the minimum range (0-25 m) here. Useful to eliminate spurious returns that occur close to the transducer.

3.6.9. Profile > Auto Profile > Horizontal Scan (Borehole)...

Realtime only.

881A-GS Profiler Only.

Used to generate the Z (depth) component of the XYZ files via an auto increment function. This allows the user to set the expected depth increment for successive scans and if the sonar is paid out to these increments, a realistic profile will be generated of the internal surface of the borehole.

The magnetic compass should not be used for this mode and all heading information should be generated by the gyro using Manual or Automatic, depending on environment (see 3.5.7 Options > Set Heading Reference).

This will set a reference angle which is used for subsequent scans to minimize heading changes during the generation of the XYZ output files.

The sonar should be running in North Up mode. The procedure detailed below should be followed prior to commencing auto profile scans.

- Power up the sonar head and immerse in the water for 5-10 minutes to acclimate to ambient temperature.
- Calibrate the compass if geographical location has changed.
- Calibrate the gyro. See 3.5.5 Options > Calibrate Gyro. During the calibration, ensure the following:
 - Gyro Biasing Delay=30 set in the Win881AL_GS.ini configuration file.
 - The sonar has acclimated to the ambient water temperature and that it remains stationary during calibration.
 - If the gyro is still drifting after the acclimation time, reset the power to the sonar head → this will automatically re-calibrate the gyro.
- Set Heading Reference as required (see 3.5.7 Options > Set Heading Reference).

A typical deployment procedure is detailed below:

- An 81R file logging session is started.
- The sonar is lowered on a marked cable to some predetermined depth.
- Auto Profile Enabled is checked (see Figure 12).
- The predetermined sonar elevation is set in Sonar Elevation text box (for example -5 (minus represents down)).
- A Payout Increment is entered which represents the desired depth increments of the scans (for example 1 (m)).
- Once at depth, the user clicks OK and a scan will be made. An XYZ, BMP and 81R file are generated (if the relevant checkboxes are checked). Z will be logged as 5 m. Once the scan is complete, the Auto Profile dialog automatically opens to make the next scan. Sonar Elevation will say 6 m
- The sonar is lowered by the increment length (1 m) and the user clicks OK. The Auto Profile dialog box closes and the next scan is made and (for example) 6 m will be logged as the depth in the XYZ and 81R files.
- The process is repeated until the mission is complete, and the depth at each scan is incremented by the Payout Increment and the Sonar Elevation textbox is automatically updated with the most current depth.
- Once the end of the survey has been reached, the 81R file logging session should be stopped.

An alternative deployment procedure is detailed below:

- The sonar is lowered to the desired depth and the payout depth entered into the Sonar Elevation textbox.
- An 81R file logging session is started.
- Auto Profile Enable is checked (see Figure 12), but a value of 0.00 is entered into the Payout Increment textbox.
- The user clicks OK to complete a scan and the Auto Profile dialog box closes. The Z value now logged in the XYZ and 81R file is that entered in the Sonar Elevation textbox.
- After the scan and when the Auto Profile dialog box reappears, the Sonar Elevation is changed by the user to the second desired payout value and the sonar is paid out to that depth.
- The user clicks OK to complete a scan. The value logged in the XYZ and 81R files is now the new Sonar Elevation value previously entered.
- The process is repeated until the mission is complete and the depth at each scan (in the XYZ and .81R file) becomes the Sonar Elevation value.
- Once the end of the survey has been reached, the 81R file logging session should be stopped.

Before each scan, ensure the sonar has settled down after lowering to a new depth.

Do not re-calibrate compass, gyro or motor between scans.

To terminate the process, uncheck Auto Profile Enable and click OK, or click Cancel.

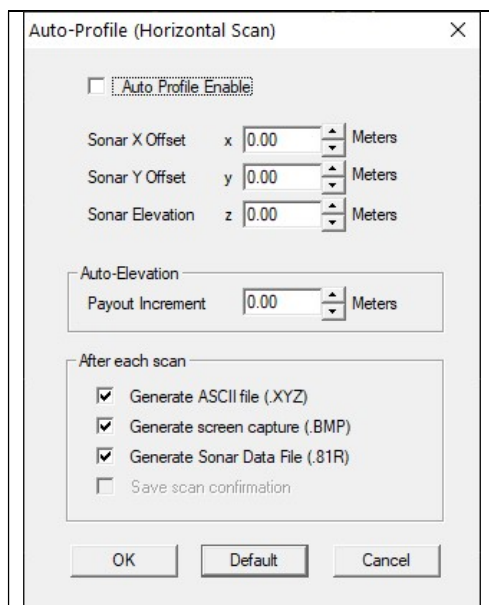


Figure 12 Auto Profile

3.7. GPS

3.7.1. GPS > Enabled

Realtime only.

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

3.7.2. GPS > Track Plotter

Realtime only.

Displays a window showing the historical track of the sonar. Only if GPS Enabled.

3.7.3. GPS > Erase GPS Tracks

Realtime only.

Clears the historical track of the sonar.

3.7.4. GPS > Zoom In

Realtime only.

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

3.7.5. GPS > Zoom Out

Realtime only.

Zooms out on the track plot. Meters / 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

Realtime only.

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

3.8.2. Video > Record Video Frames to File

Realtime only.

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 Section 3.1.7 File > Auto File Size

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 revision which should be quoted during any support queries.

4. ADDITIONAL DOCUMENTATION

Document Number	Description
410-013	USB Converters and the Windows OS
430-054	881L Ethernet Troubleshooting Guide
Table 9 Additional Document	

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.

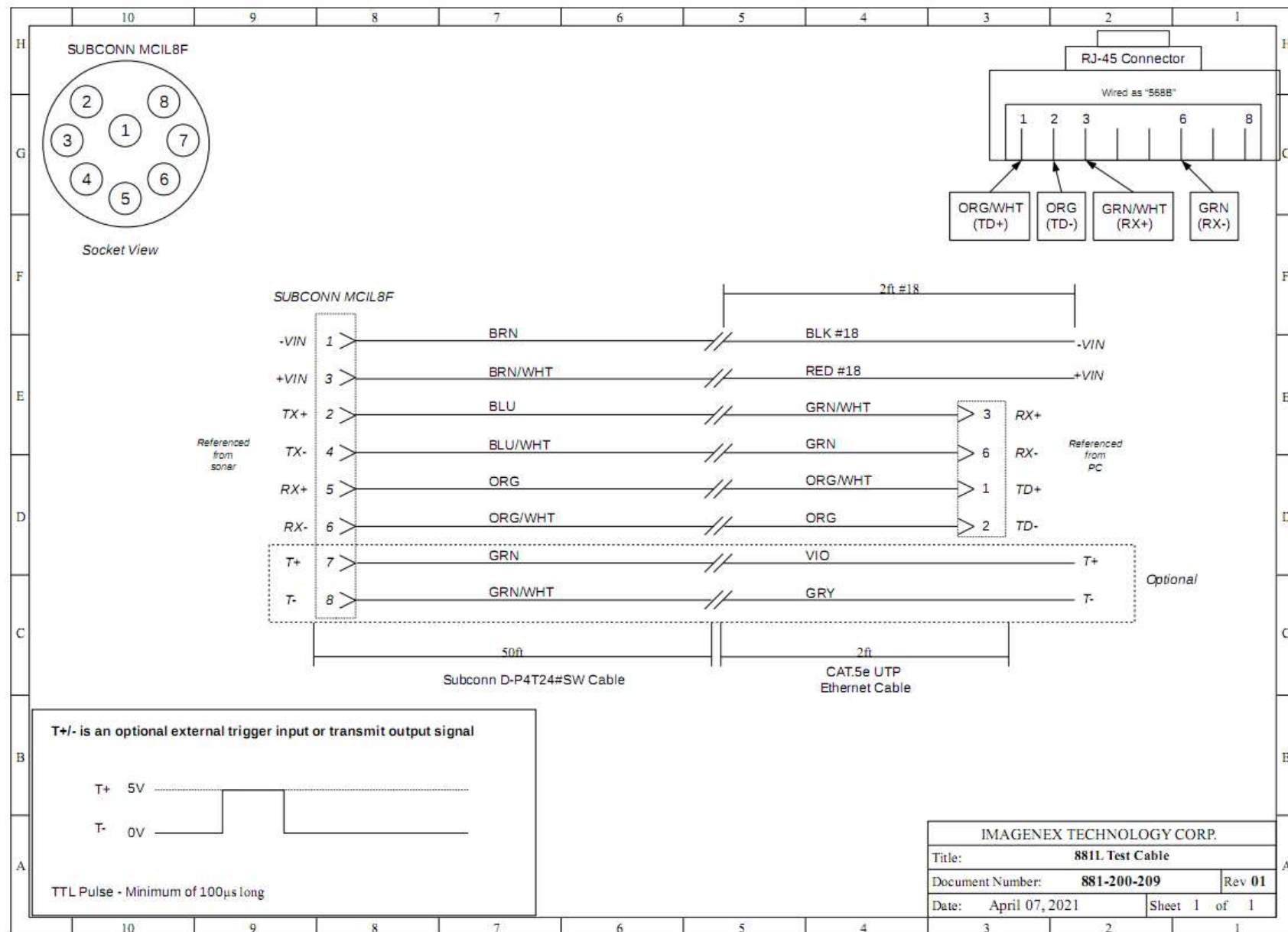
Hold	h, H	Operation Held.
Reverse	Space	Reverse Scan Direction.
Clear the screen	c, C	Clear Sonar Image.

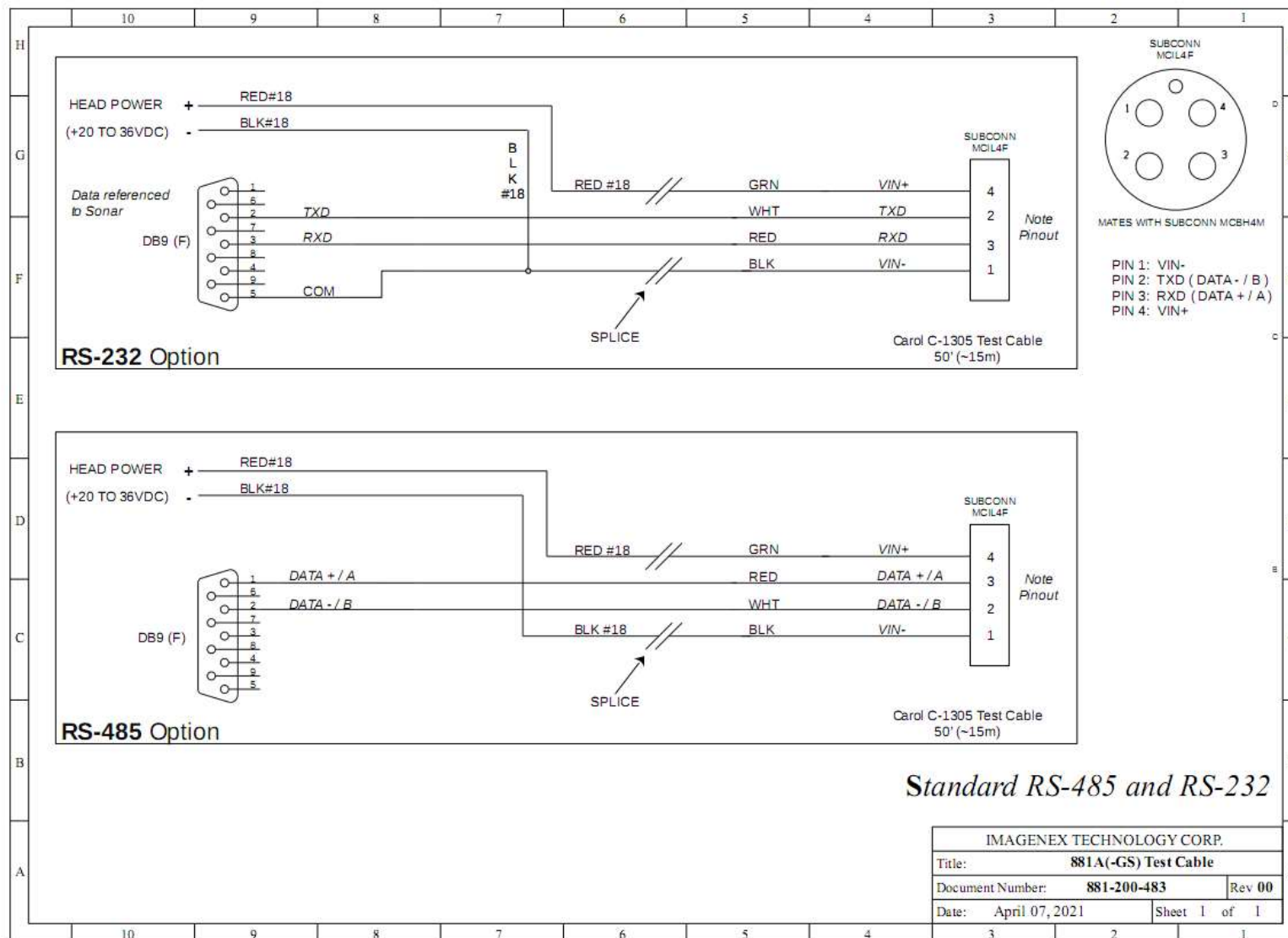
Key In Range	r, R	Keyboard entry for Range Entries: 1,2,3,4,5,10,20,30,40,50,60,80,100,150,200 in meters Entries: 3,6,9,12,15,30,60,90,120,150,180,240,300,450,600 in feet
Key In Gain	g, G	Keyboard entry for Gain Entries: 1 - 40 with increment of 1
Key In Sector width	s, S	Keyboard entry for Sector width 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 CABLE DIAGRAM (881L AND 881A)





APPENDIX C **SPEC SHEETS**



IMAGENEX MODEL 881A-GS GYRO STABILIZED MULTI-FREQUENCY IMAGING SONAR

APPLICATIONS:

- ROV, AUV, & UUV
- Manned Submersibles
- Search & Recovery
- Borehole/cave work
- Drop sonar
- Scientific Research

FEATURES:

- Serial Communications
- Programmable (format available)
- Gyro stabilized transducer steering
- Simple set-up and installation
- Full scale range from 1 m to 200 m
- Orientation module

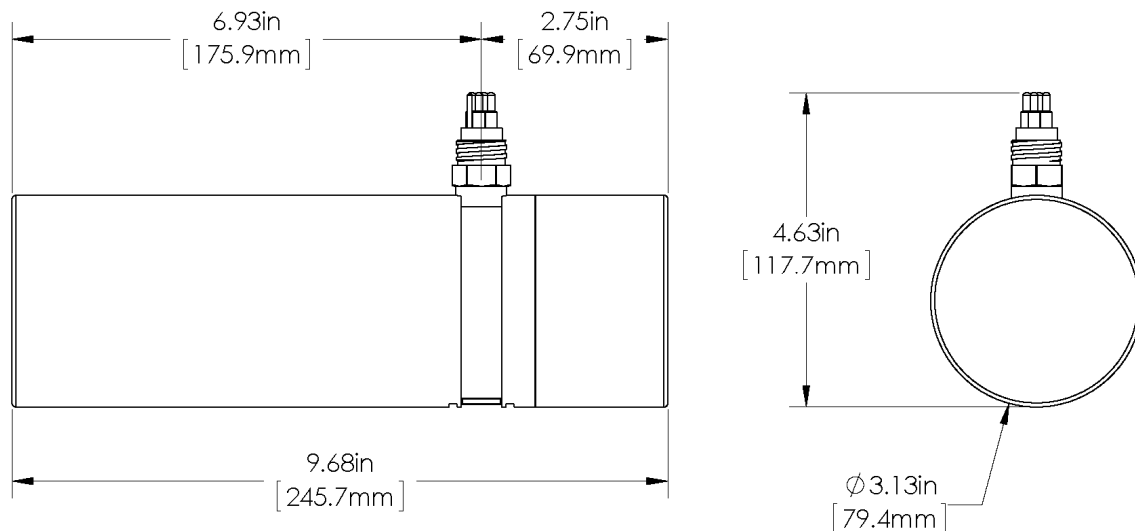
Gyro-stabilization of the Imagenex Model 881A-GS makes the high resolution 881A sonar into a system capable of crystal clear visualization of the ocean environment from moving platforms, no longer compromised by the blurring effects of host vehicle rotation. An advanced, low drift gyro is integrated directly into the sonar head, so the sonar can now compensate for vehicle motion in real time with unprecedented accuracy, stability, and robustness.

The enhanced capabilities of the 881A-GS have not compromised the performance of the 881A sonar. On short range, this sonar scans using a 2 mm range resolution, and can auto-adjust acoustic frequency and resolution to scan up to a 200 m radius, 360° surrounding area.

The Model 881A-GS still has low power, simple set-up, and small size that make it an ideal tool for large work ROV's and small inspection vehicles. On it's own it is now an amazingly simple drop sonar and borehole inspection package: just add a laptop computer and power supply and run the included Imagenex software.



HARDWARE SPECIFICATIONS:	
FREQUENCY	310 kHz, 675 kHz, or 1 MHz (standard default settings) -Other frequencies can be selected through programmable software configurations (Tunable from 280 kHz to 1.1 MHz in 5 kHz steps)
TRANSDUCER	Imaging type, fluid compensated
TRANSDUCER BEAM WIDTH	310 kHz: 4° x 40° 675 kHz: 1.8° x 20° 1 MHz: 0.9° x 10°
RANGE RESOLUTION	1 m – 4 m: 2 mm (0.08") 5 m & up: 10 mm (0.4")
ORIENTATION MODULE (accuracies):	
PITCH & ROLL	± 0.1° typical
HEADING (Magnetic)	± 1.0° typical
MIN. DETECTABLE RANGE	150 mm (6")
MAX. OPERATING DEPTH	1000 m and 3000 m available
MAX. CABLE LENGTH	1000 m on typical twisted shielded pair (RS-485)
INTERFACE	RS-485 serial interface @ 115.2 kbps (or optional RS-232)
CONNECTOR	Side mounted, four conductor, wet mateable (Subconn MCBH4M-AS) Optional right angle or end mount connector
POWER SUPPLY	20 – 32 VDC at less than 7 Watts
DIMENSIONS (for both depths)	79.5 mm (3.13") diameter x 245.7 mm (9.68") length
WEIGHT: In Air	1000 m unit: 1.6 kg (3.5 lbs) 3000 m unit: TBA
In Water	1000 m unit: TBA 3000 m unit: TBA
MATERIALS	1000 m unit: 6061-T6 Aluminum & Polyurethane 3000 m unit: Titanium, Polyurethane & 300 series stainless steel
FINISH	Hard Anodize



SOFTWARE SPECIFICATIONS:	Win881AL.exe
WINDOWS™ OPERATING SYSTEM	Windows™ XP, Vista, 7, 8, 10
MODES	Sector, Polar and Side Scan
GYRO MODES	North Up, Heading Up, Target Steering
RANGE SCALES	1 m, 2 m, 3 m, 4 m, 5 m, 10 m, 20 m, 30 m, 40 m, 50 m, 60 m, 80 m, 100 m, 150 m, 200 m
TRAIN ANGLES	Continuous rotation, 3° increments
SECTOR SIZE: SECTOR MODE POLAR MODE	0° – 180°, 3° increments 0° – 357°, 3° increments, or Continuous rotation
STEP SIZES	Slow (0.3°), Medium (0.6°), Fast (0.9°), Faster (1.2°), Fastest (2.4°)
GRID TYPES	Polar and rectangular
FILE FORMAT	(filename).81R
RECOMMENDED MINIMUM COMPUTER REQUIREMENTS:	2 GHz Pentium 4 256 MB RAM 20 GB Hard Disk 1024 x 768 Screen Resolution

ORDERING INFORMATION:		
1000 m UNIT	Standard	881-000-400
3000 m UNIT	Standard	881-000-401
RS-232	Option	-006
End mount connector	Option	-009
Right angle connector	Option	-010
Gyro Stabilization	Option	-048

Product and company names listed are trademarks or trade names of their respective companies.



IMAGENEX MODEL 881L-GS GYRO STABILIZED MULTI-FREQUENCY IMAGING SONAR

APPLICATIONS:

- ROV, AUV, & UUV
- Manned Submersibles
- Search & Recovery
- Borehole/cave work
- Drop sonar
- Scientific Research

FEATURES:

- **Ethernet**
- Programmable (format available)
- Gyro stabilized transducer steering
- Simple set-up and installation
- Full scale range from 1 m to 200 m
- Orientation module

Gyro-stabilization of the Imagenex Model 881L-GS makes the high resolution 881L sonar into a system capable of crystal clear visualization of the ocean environment from moving platforms, no longer compromised by 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 unprecedented accuracy, stability, and robustness.

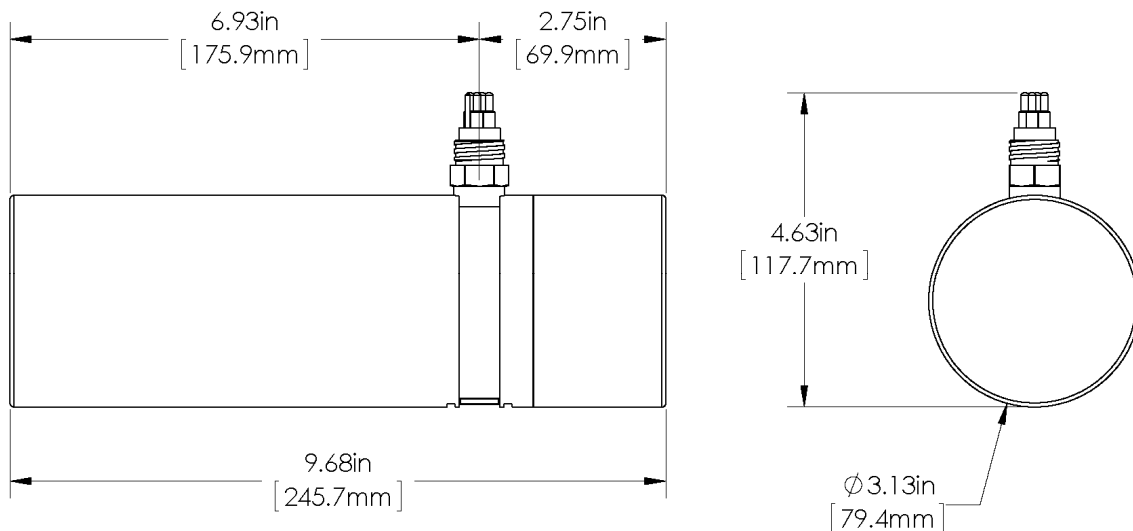
The enhanced capabilities of the 881L-GS have not compromised the performance of the 881L sonar. Using Ethernet communications, this all-in-one, high performance digital imaging sonar can still exceed 100 shots per second on short range at up to 2 mm range resolution, and can auto-adjust acoustic frequency and resolution to scan up to a 200 m radius, 360° surrounding area.

The Model 881L-GS still has low power, simple set-up, and small size that make it an ideal tool for large work ROV's and small inspection vehicles. On it's own it is now an amazingly simple drop sonar and borehole inspection package: just add a laptop computer and power supply and run the included Imagenex software.



HARDWARE SPECIFICATIONS:	
FREQUENCY	310 kHz, 675 kHz, or 1 MHz (standard default settings) -Other frequencies can be selected through programmable software configurations (Tunable from 280 kHz to 1.1 MHz in 5 kHz steps)
TRANSDUCER	Imaging type, fluid compensated
TRANSDUCER BEAM WIDTH	310 kHz: 4° x 40° 675 kHz: 1.8° x 20° 1 MHz: 0.9° x 10°
RANGE RESOLUTION	1 m – 4 m: 2 mm (0.08") 5 m & up: 10 mm (0.4")
ORIENTATION MODULE (accuracies):	
PITCH & ROLL	± 0.1° typical
HEADING (Magnetic)	± 1.0° typical
MIN. DETECTABLE RANGE	150 mm (6")
MAX. OPERATING DEPTH	1000 m and 3000 m available
MAX. CABLE LENGTH	Standard: 100 m on CAT5e Cable length may be increased up to ~9000 m using an Ethernet extender. Please enquire for more information.
INTERFACE	Standard: 10 Mbps Ethernet (10 BASE-T) using TCP/IP Bit rate may vary if an Ethernet extender is in use.
CONNECTOR	Side mounted, eight conductor, wet mateable (Subconn MCBH8M-AS) Optional right angle or end mount connector
POWER SUPPLY	20 – 32 VDC at less than 7 Watts
DIMENSIONS (for both depths)	79.5 mm (3.13") diameter x 245.7 mm (9.68") length
WEIGHT: In Air	1000 m unit: 1.8 kg (4 lbs) 3000 m unit: TBA
In Water	1000 m unit: TBA 3000 m unit: TBA
MATERIALS	1000 m unit: 6061-T6 Aluminum & Polyurethane 3000 m unit: Titanium, Polyurethane & 300 series stainless steel
FINISH	Hard Anodize

SOFTWARE SPECIFICATIONS:	Win881AL.exe
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SECTOR SIZE: SECTOR MODE POLAR MODE	0° – 180°, 3° increments 0° – 357°, 3° increments, or Continuous rotation
STEP SIZES	Slow (0.3°), Medium (0.6°), Fast (0.9°), Faster (1.2°), Fastest (2.4°)
GRID TYPES	Polar and rectangular
FILE FORMAT	(filename).81R
RECOMMENDED MINIMUM COMPUTER REQUIREMENTS:	2 GHz Pentium 4 256 MB RAM 20 GB Hard Disk 1024 x 768 Screen Resolution



ORDERING INFORMATION:		
1000 m UNIT	Standard	881-000-500
3000 m UNIT	Standard	881-000-501
End mount connector	Option	-009
Right angle connector	Option	-010
IP Address*	Option	-020
Gyro Stabilization	Option	-048

*Note: Standard IP Address is 192.168.0.5
A different IP Address may be specified upon ordering.

Product and company names listed are trademarks or trade names of their respective companies.