



IMAGENEX TECHNOLOGY CORP.

MODEL 831L

PIPE PROFILING SONAR

(ETHERNET VERSION)

USER MANUAL

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Acronyms and Abbreviations

Acronym	Definition
VDC	Volts Direct Current
ASCII	American Standard Code for Information Interchange
BMP	Windows™ Bitmap
GPS	Global Positioning System
IP	Internet Protocol
LF	Line Feed
CR	Carriage Return
PC	Personal Computer
RAM	Random Access Memory
ROV	Remotely Operated Vehicle
TP	Transportation Protocol
UDP	User Datagram Protocol
USB	Universal Serial Bus

1. INTRODUCTION

The Model 881L is an advanced mechanical scanning, high-frequency, high-resolution pipe profiling sonar system that has been designed to provide simple, reliable, and accurate representation of inner bores of fluid filled pipes and cavities. The 831L is connected via ethernet and the sonar is therefor able to transfer data at a higher rate which leads to improved range resolution. It is designed to work horizontally with the sonar scanning vertically, but may be orientated vertically, with sonar scanning horizontally. However, in this configuration (dropped vertically) the pitch and roll sensor will not be able to work.

The sonar comes 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	2.25 MHz
Transducer	Profiling type, fluid compensated
Range Resolution	0.5mm
Maximum Operating Depth	1000m
Transducer Beam Width	1.4° Conical
Minimum Detectable Range	50 mm (6")
Table 1 General Features	

2. GETTING STARTED

The following bullet points describe the set-up procedure of the 831L:

- Physically mount the sonar or connect it to the down-pipe payout arrangement. Do not clamp the sonar anywhere on the red polyurethane section as detailed below (See Figure 1 External View)
- Connect the supplied underwater cable to the sonar Subconn MCIL8F connector (see APPENDIX C Cable Diagram (831L) for cable pin-out).
- Ensure 24VDC (1A minimum) power supply is off.
- Connect the cable counter system (if relevant) to the PC serial port.
- Configure the network card's IP address. (see Sections 3.9.2 System > IP Address)
- Connect the RJ45 connector to the PC's network port.
- Power up the 831L.
- Launch the PipeSonarL_vxxxx.exe program (where xxxx is the latest version), and commence operations.

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.
- 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 a cable counter is used an available RS-232 port is used. If no COM port is present on the PC, an RS-232 to USB adaptor is used. The UC-232A USB to RS-232 from ATEN appears to work well.

Refer to Document Number 410-013. 'USB Converters and the Windows OS' for important information on USB <--> RS232 and USB <--> RS485 Converters running on Windows operating systems (available on the Imagenex Corp website <https://imagenex.com/support>).

2.1.2. Sonar Considerations

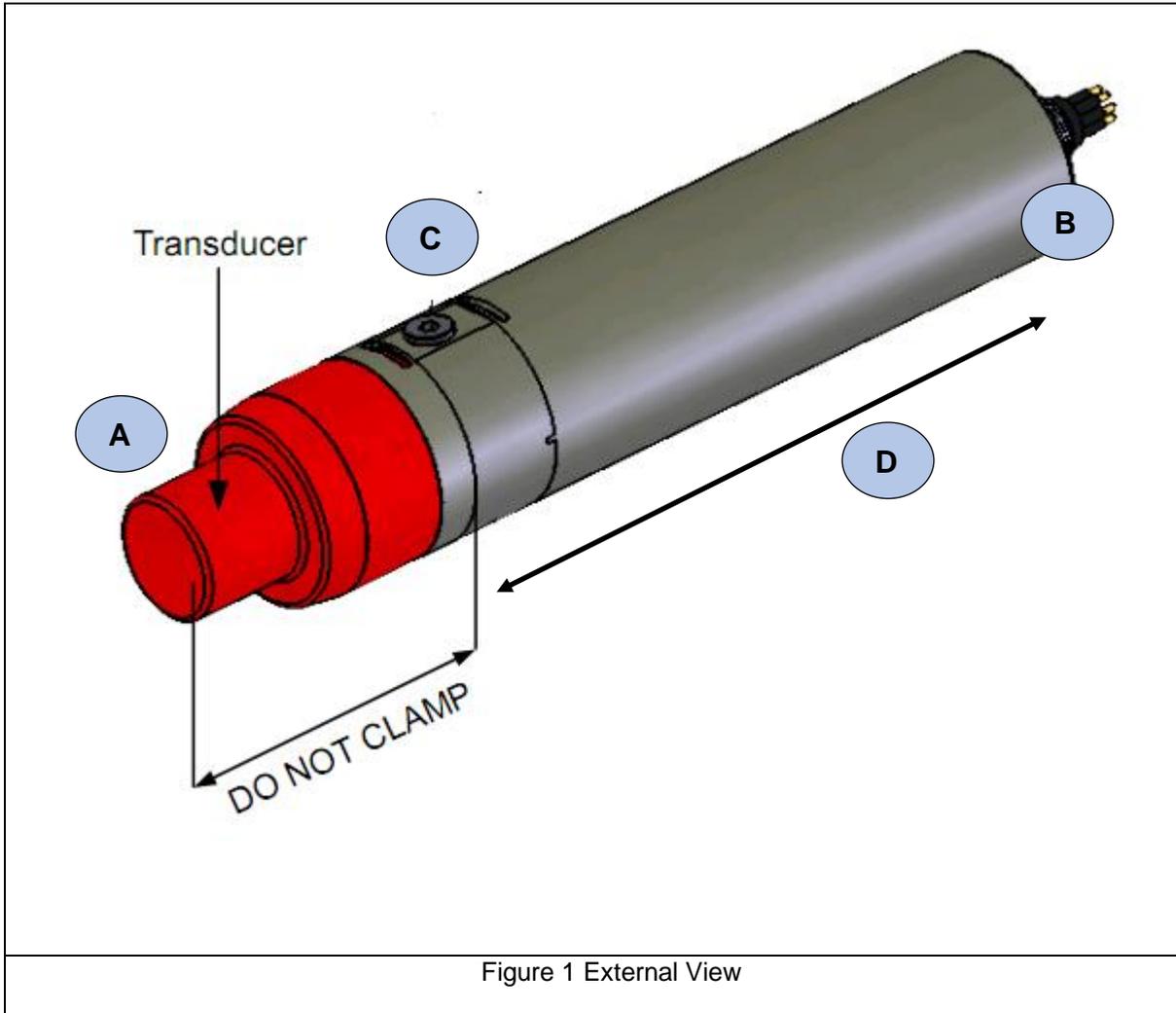


Figure 1 External View

A	FRAGILE. 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 transducer <u>down</u> position.
D	Use this area to mount the sonar.
Table 2 External Hardware	

2.2. SOFTWARE SETUP

The latest version of the Win831L 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 by the creation of a shortcut on 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

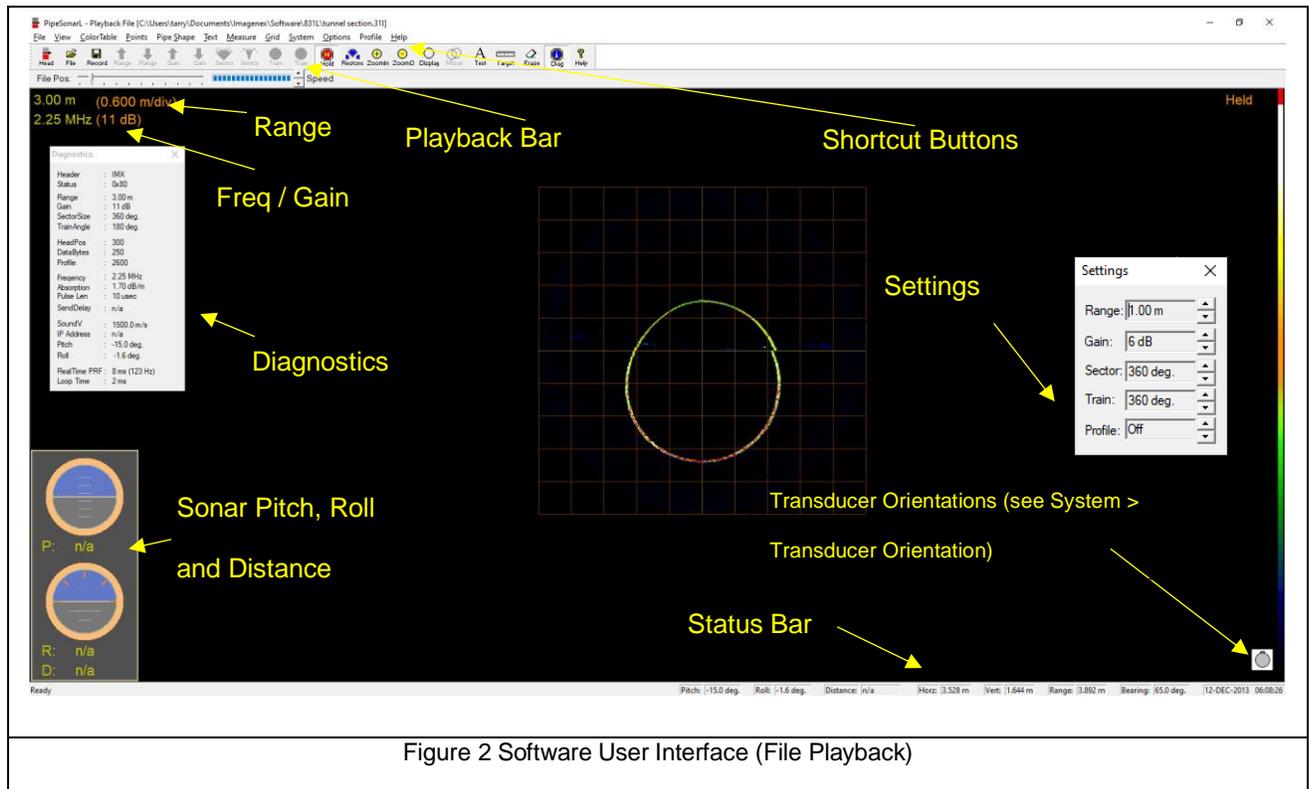


Figure 2 Software User Interface (File Playback)

2.3.1. Shortcut Buttons

 Head	Connect to a physical sonar head.
	Open a file play-back session.
	Start / Stop recording an 31L data file.
 Range	Increase sonar range.
 Range	Decrease sonar range.
 Gain	Increase sonar gain.
 Gain	Decrease sonar gain.
 Sector	Increase sonar sector around train zero point.
 Sector	Decrease sonar sector around train zero point.
 Train	Train left. Rotates head zero point to the left
 Train	Train right. Rotates head zero point to the right
 Hold	Pauses real-time or playback.
 Restore	Restore default zoom and pan.
 ZoomIn	Zoom in display.
 ZoomO	Zoom out display.
 Display	Displays a circle whose attributes can be set (see 3.5 Pipe Shape).
 Move	Allows moving of circle described above
 Text	Allows text to be added to the screen whose attributes can be defined (see 3.6 Text). Click Text > Delete to clear.
	Ruler. Measures distance in metres or feet (depending on Options > Units selection) on the display. See 3.7 Measure) Click Measure > Erase to clear.
 Erase	Refreshes display, clearing any text or measurements on the screen. Doesn't currently clear data only text and measurements
 Diag	Display Diagnostics dialog box.

 Help	Opens a window with speed keys and other settings (See Appendix A).
Table 3 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:

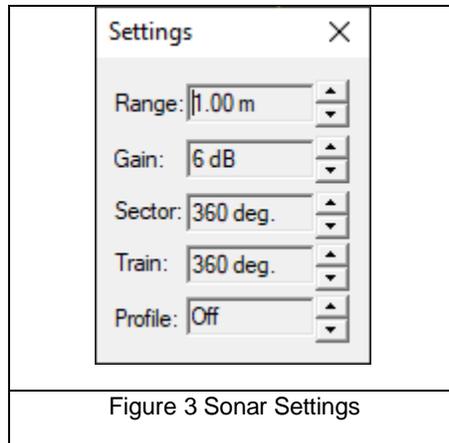
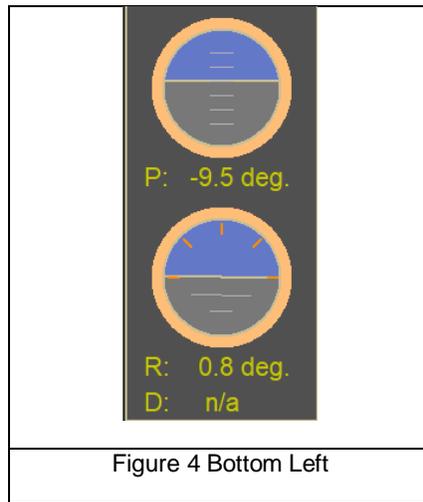


Figure 3 Sonar Settings

- **Range:** Set the maximum range of target detection. (0.125m - 6m).
- **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 9° increments).
- **Profile:** Define the profile display (High Mix, Medium Mix, Low Mix, Points Only or Off).

2.3.4. Pitch, Roll and Depth

The following graphic appears bottom left of the main display:



P: Sonar pitch (+ve pitch bow up).

R: Sonar roll (+ve starboard down).

D: Distance. Only updated if the external Orientation Input (see 3.9.1 System > COM Port Setup) is enabled so that cable payout can be monitored.

Note that the pitch and roll may be derived from either the integrated pitch and roll sensor, or from external sources through an Inuktun string unit. Selection for the P and R source are made in 3.2.13 View > Use External Pitch / Roll Data. If external pitch and roll are selected, the Inuktun string must be enabled in 3.9.1 System > COM Port Setup.

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 > 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 831L is 31L.

3.1.4. File > Set Record Directory

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

3.1.5. File > Convert .31L to XYZ

Converts an .31L 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 cable payout value of the Inuktun string if enabled (see 3.9.1 System > COM Port Setup). 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>

3.1.6. File > Auto Save File Names

Select the file name set automatically as Win831L DD-MMM-YYYY HHMMSS.31L.

3.1.7. File > Auto File Size

Realtime only.

Select the file size to be limited to 1 – 4 Gbytes. 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 > Enable UDP XYZ Output

Enables the output of the format DD-MMM-YYYY,HH:MM:SS.mmm,X.XXX,Y.YYY,Z.ZZZ<CR><LF>, to an IP address and UDP port specified. The UDP port is edited in the PipesonarL.ini associated with the executable and the following tags are relevant:

Output UDP Address=xxx.xxx.xxx.xxx

Output UDP Port=xxxx

Edit the xxxs for a valid IP address and UDP port.

3.1.9. File > Enable UDP Range / Bearing Output

Enables the output of the format Date,Time,Pitch,Roll,Distance,Range,Bearing, to an IP address and UDP port specified. The UDP port is edited in the PipesonarL.ini associated with the executable and the following tags are relevant:

Output UDP Address=xxx.xxx.xxx.xxx

Output UDP Port=xxxx

Example:

DD-MMM-YYYY,HH:MM:SS.mmm,ppp.ppp,rrr.rrr,ddd.ddd,RRR.RRR,BBB.BBB<CR><LF>

where,

DD = day

MMM = month

YYYY = year

HH = hours

MM = minutes

SS = seconds

mmm = milliseconds

ppp.ppp = pitch angle in degrees

rrr.rrr = roll angle in degrees

ddd.ddd = distance in meters

RRR.RRR = range in meters

BBB.BBB = bearing in degrees

3.1.10. File > Save Screen

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

3.1.11. 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 > Clear Image

Refreshes screen and clears the current profile image. Any circle, text and measurements that are on the screen will remain.

3.2.2. View > Hold

Pause the display of sonar data.

3.2.3. View > Reverse

Realtime only.

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

3.2.4. View > Restore Image

Restores the previously set graphics view. Undoes the most recent changes.

3.2.5. View > Zoom Factor

Changes the factor by which the display is zoomed in or out (50, 75, 100, 125, 150, 175, 200, 300%).

3.2.6. View > Zoom In



Shortcut button: ZoomIn

Zooms in by the factor specified in Zoom Factor.

3.2.7. View > Zoom Out



Shortcut button: ZoomO

Zooms out by the factor specified in Zoom Factor.

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 > Diagnostics

Displays / hides the Diagnostics window.

3.2.10. View > Sonar Settings

Realtime only.

Displays a window for setting Range, Gain, Sector, Train and Profile.

3.2.11. View > Background Color

Allows for the change of background color through a color palette.

3.2.12. View > Display Pitch / Roll / Distance

Displays a window showing the current orientation and distance of the sonar. See 2.3.4 Pitch, Roll and Depth.

3.2.13. View > Use External Pitch / Roll Data

The above window may be updated from an internal pitch and roll sensor, or from an external input from a COM port. The Inkutun string has fields that contain the pitch and roll (and distance) and this string may be used to update the program pitch and roll. See 3.9.1 System > COM Port Setup

3.3. COLOR TABLE

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

Used to change the sonar data color palettes for the sonar images. The 831 L GS uses a color table to represent echo data strength (amplitude). For example, the Normal High intensity color table maps the echo data amplitude to 256 colors 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 color 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 colors as Norm Hi, but uses a lower color 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 5 Color Table	

3.4. POINTS

3.4.1. Points > Points Color

Allows for the change of points color through a color palette.

3.4.2. Points > Small / Medium / Large

Specify the desired point size.

3.5. PIPE SHAPE

3.5.1. Pipe Shape > Circle / Horse Shoe

Define the pipe shape for the display drawn when using the  toolbar button. This sets an overlay on the screen according to the attributes set in the rest of the menu (like diameter), whose shape is either a circle or horseshoe shape. The diameter or width is set, depended on whether a circle or horseshoe is selected. See (3.5.4 Pipe Shape > Pipe Diameter).

3.5.2. Pipe Shape > Move Shape

Only available if a shape is on the screen. Toggle on / off for the dragging of the shape to the desired position.

3.5.3. Pipe Shape > Line Color

Allows for the change of shape line color through a color palette.

3.5.4. Pipe Shape > Pipe Diameter

Changes the pipe diameter (or horse shoe shape).

3.5.5. Pipe Shape > Display Overlay

Toggle display of overlay shape (as defined in Circle / Horse Shoe) on / off

3.6. TEXT

Shortcut button: 

3.6.1. Text > Input...

Allow text to be written to the screen and can be used in conjunction with File > Save Screen to associate user comments with scans.

3.6.2. Text > Delete

Delete all text from the screen

3.6.3. Text > Text Color

Allows for the change of text color through a color palette.

3.6.4. Text > Small / Medium / Large / Larger / Largest

Change the font size.

3.7. MEASURE

Shortcut buttons 

3.7.1. Measure > Add

Click first point, then move rubber band to second point and click. The dimension will then be annotated onto the screen.

3.7.2. Measure > Delete

Delete all annotated measurements from the screen.

3.7.3. Measure > Line Color

Allows for the change of measure line color through a color palette.

3.8. GRID

3.8.1. Grid > None / Rectangular Grid / Polar Grid

Choose a presentation of grid from:

- None: No grid.
- Rectangular: Equally dimension X and Y grid.
- Polar: Concentric circles.

3.8.2. Grid > Grid Color

Allows for the change of grid line color through a color palette.

3.8.3. Grid > Solid Line / Dotted Line / Dashed Line

Select line style.

3.9. SYSTEM

3.9.1. System > COM Port Setup

Realtime only.

Open a dialog box for the serial setting of an optional Orientation Input. Click enable and enter COM port, baud rate and sentence type.

The expected input format is as follows:

Inuktun: \$PITCH±DD.D,ROLL±DDD.D,DIST±DDDD.DD<CR><LF>

Cable Count: \$<space>DD.D,meter where DD.D is metres along track.

Note that if Cable Counter selected, there is no external orientation information.

3.9.2. System > IP Address

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.

3.9.3. System > Diagnostics

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

3.9.4. System > Show System Settings

See 3.2.10 View > Sonar Settings.

3.9.5. System > Minimum Range

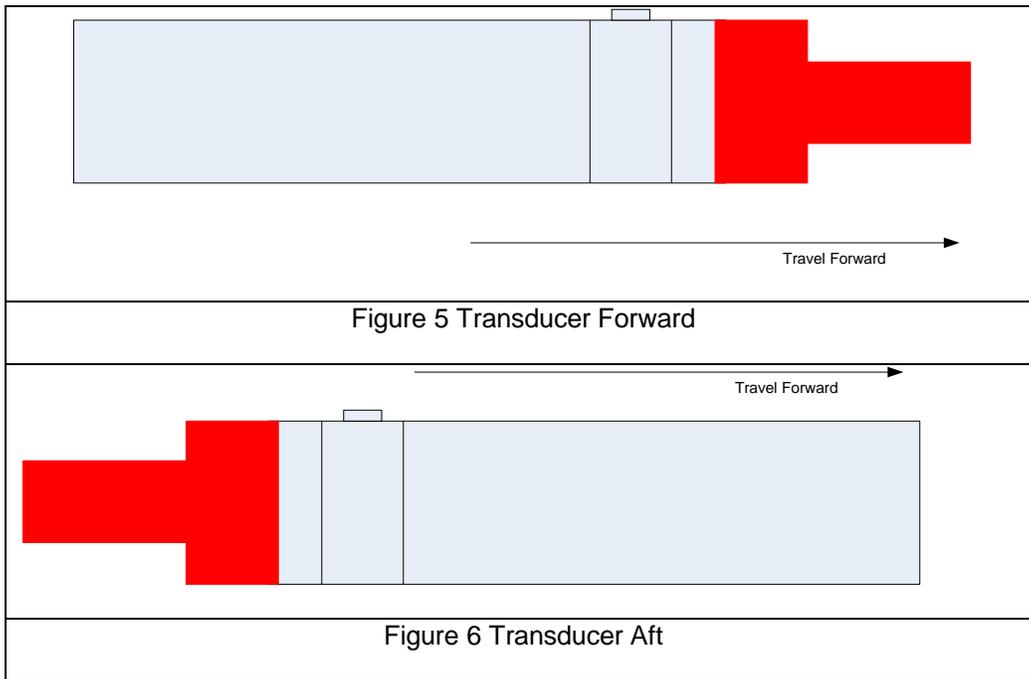
Allows for the setting of a minimum range. If a range is measured that is closer to the sonar head than this range, the range is not plotted and not recorded. This should be used with caution so as not to eliminate wanted data.

3.9.6. System > Sound Velocity

If the sound velocity is known, it is set here. Ranges are calculated according to the sound velocity set.

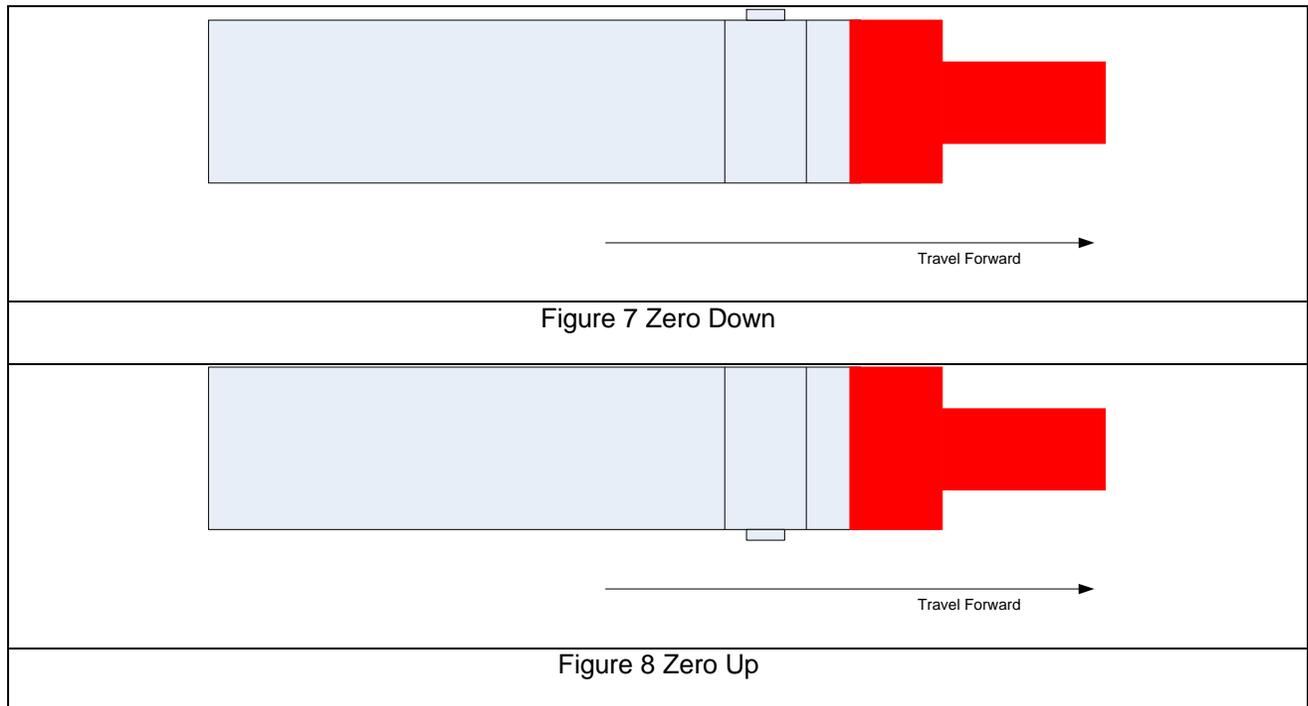
3.9.7. System > Transducer Fwd / Aft

Select according to the mounting orientation:



3.9.1. System > Zero Up / Down

Select according to the mounting orientation:



For both Transducer Fwd / Aft and Zero Up / Down, a screen graphic indicator (bottom right) shows the orientation set:

-  Transducer Fwd, Zero Up.
-  Transducer Fwd, Zero Down
-  Transducer Aft, Zero Up
-  Transducer Aft, Zero Down

3.10. OPTIONS

3.10.1. Options > Units

Metres or feet can be selected as the units used.

3.10.2. Options > Set Default Colors

Restores the background color palette to the default black. Points remain as per the selected color table color.

3.10.3. Options > Delete All Drawings

Deletes any text or measurements made on the background.

3.10.4. Options > Roll Correction

Toggles roll correction on / off. Applies measured roll to all points and plots the roll corrected data.

3.10.5. Options > Calibrate

Not used

3.11. PROFILE

3.11.1. Profile > Off

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

3.11.2. Profile > Points only

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

3.11.3. Profile > Low Mix

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

3.11.4. Profile > Medium Mix

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

3.11.5. Profile > High Mix

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

3.12. HELP

3.12.1. Help > Help...

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

3.12.2. Help > About PipeSonarL...

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

4. ADDITIONAL DOCUMENTATION

Document Number	Description
430-054	881L Ethernet Troubleshooting Guide
425-019	File Format Specification
425-020	Ethernet Specification
410-013	USB Converters and the Windows OS
Table 6 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 SPEC SHEETS



831L Pipe Profiling
445-081 APRIL 2009-REVISED MAY 2017

IMAGENEX MODEL 831L DIGITAL PIPE PROFILING SONAR

APPLICATIONS:

- Profiling
- Pipeline Inspection
- Scientific Research

FEATURES:

- **Ethernet**
- Programmable
- High performance
- Scans 360° in 1.3 sec (up to 1 m range)
- Low power
- 0.125 m to 6 m operation (full scale)
- Compact size
- Communication format available to user
- Built in Pitch/Roll sensor



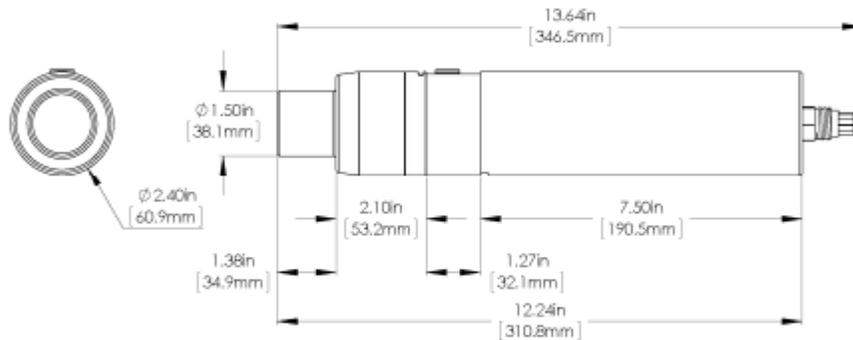
HARDWARE SPECIFICATIONS:	
FREQUENCY	2.25 MHz
TRANSDUCER	Profiling type, fluid compensated
TRANSDUCER BEAM WIDTH	1.4° conical
RANGE RESOLUTION	0.5 mm
MIN. DETECTABLE RANGE	50 mm (~ 2")
MAX. OPERATING DEPTH	1000 m
MAX. CABLE LENGTH	Standard: 100 m on CAT5e Cable length may be increased up to ~9000 m using 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	End mounted, eight conductor, wet mateable (Subconn MCBH8M-AS)
POWER SUPPLY	20 – 32 VDC at less than 5 Watts
DIMENSIONS	61 mm (2.4") diameter x 347 mm (13.64") overall length
WEIGHT: In Air	1.2 kg (2.6 lbs)
In Water	0.4 kg (0.8 lb)
MATERIALS	6061-T6 Aluminum & Polyurethane
FINISH	Hard Anodize

Specifications subject to change without notice



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SOFTWARE SPECIFICATIONS:	PipeSonarL.exe
WINDOWS™ OPERATING SYSTEM	Windows™ XP, Vista, 7, 8, 10
MODES	Polar
RANGE SCALES	0.125 m, 0.25 m, 0.50 m, 0.75 m, 1 m, 2 m, 3 m, 4 m, 5 m, 6 m
TRAIN ANGLES	Continuous rotation, 9° increments
SECTOR SIZE	0° – 351°, 9° increments, or Continuous rotation
STEP SIZE	0.9°
GRID TYPES	Polar and rectangular
FILE FORMAT	(filename).31L
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	831L-000-200
IP Address*	Option	-020

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

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APPENDIX C CABLE DIAGRAM (831L)

