



853 ES with Data Logger
445-076 JANUARY 2011-REVISED MAY 2017

IMAGENEX MODEL 853

SCIENTIFIC ECHO SOUNDER with DATA LOGGER

APPLICATIONS:

- Seaglider Installation
- ROV, AUV & UUV
- Offshore Oil & Gas
- Surveying
- Scientific Research
- Fisheries Research

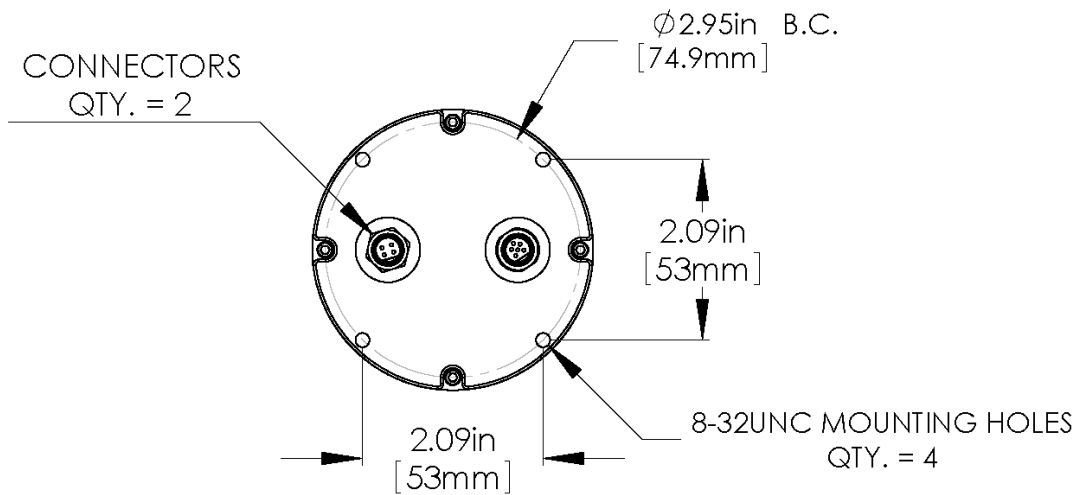
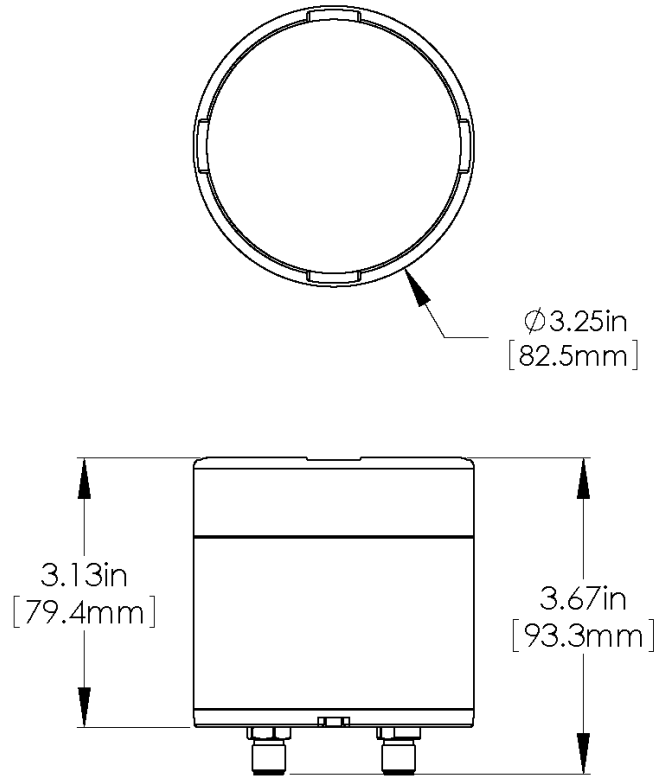
FEATURES:

- Programmable
- High performance
- Low power
- Simple set-up and installation
- Digital telemetry
- 25, 50 or 100 m operation
- Compact size
- Communication format available to user
- USB Data download



HARDWARE SPECIFICATIONS:	
FREQUENCY	120 kHz or Optional 300 kHz
TRANSDUCER	Conical
TRANSDUCER BEAM WIDTH	10°
TRANSDUCER SOURCE LEVEL	210 dB re 1 μ Pa @ 1 m (nominal)
TRANSDUCER RECEIVE SENSITIVITY	-180 dB re 1 V/ μ Pa (nominal)
RECEIVE BANDWIDTH	10 kHz
PULSE LENGTH	100 μ s
MAXIMUM INPUT LEVELS	with 20 dB Gain: 35 mV _{RMS} with 40 dB Gain: 3.5 mV _{RMS}
NOISE FLOOR	with 40 dB Gain: -96 dB re 1 V _{RMS}
RANGE BINS	200
DATA STORAGE	200 Days before Download
MIN. DETECTABLE RANGE	0.5 m
MAX. DETECTABLE RANGE	100 m
MAX. OPERATING DEPTH	1000 m
MAX. CABLE LENGTH	15 m (RS-232), 3 m (USB)
TELEMETRY/ PROGRAMMING INTERFACE	RS-232 Serial Interface @ 115.2 kbps (or as ordered)
DOWNLOAD INTERFACE	USB
CONNECTORS	Impulse IEW55-1004-BCR / IEW55-1006-BCR
POWER SUPPLY	9 – 32 VDC at less than 0.25 Watts (Glider mode only)
TEMPERATURE	-5 to +35 °C (operational) -40 to +50 °C (storage)
DIMENSIONS	See drawing
WEIGHT: In Air	~ 1 kg (2.2 lbs)
In Water	~ 0.55 kg (1.2 lbs)
MATERIALS	6061-T6 Aluminum, PVC
FINISH	Hard Anodize

SOFTWARE SPECIFICATIONS:	Programming/Download/Viewing program: Win853.exe
WINDOWS™ OPERATING SYSTEM	Windows™ XP, Vista, 7, 8, 10
MODES	Normal (interrogate to ping) Glider (one ping every 4 seconds) Stand Alone (one ping per second)
RANGE SCALES	25 m, 50 m, 100 m
FILE FORMAT	(filename).853
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	853-000-140
300 kHz	Option	-049

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IMAGENEX TECHNOLOGY CORP.

MODEL 853 SCIENTIFIC ECHO SOUNDER WITH DATA LOGGER

SERIAL INTERFACE SPECIFICATION (v1.03)

OVERVIEW

The Model 853 Scientific Echo Sounder is a self contained, programmable digital echo sounder with built in flash memory data storage. Programmable parameters include operating mode, acoustic range scale, receiver gain, dive number, dive type and ping timestamp. The unit is powered from 24VDC and is programmed using an RS-232 serial communications port connected to the power/data connector. Recorded echo sounder data can be downloaded from the internal SD flash memory card via the self powered USB connector.

The 853 has three operating modes, “Normal”, “Glider” and “Stand Alone”:

In Normal mode, the echo sounder pings when requested by the serial interface. The settings for each ping are based on the current programmable range and gain settings. The ping rate is dependent on the interrogation rate of the serial interface.

In Glider mode, the programmable settings for range and gain are used, in addition, the echo data can be sampled periodically via the serial interface. Echo data from each ping is stored to the internal flash memory. The ping rate is once every four seconds.

In Stand Alone mode, the echo sounder runs unattended using the programmable range and gain settings. Echo data is stored on a ping by ping basis to the internal flash memory. The ping rate is once per second.

The Switch Data Command (described below) is used for programming the unit and requesting echo data. To program the unit or request echo data, the Switch Data Command string is sent via a serial command program at a baud rate of **9600 bps, No Parity, 8 Data Bits and 1 Stop Bit** (other baud rates are available).

When the Switch Data command is accepted, the 853 responds with a 256 byte IKX Return Data packet or an 18 byte ILX Return Data packet. A message type of IKX must be selected to change any of the programmable settings.

OPERATION

On power-up, the echo sounder defaults to Normal mode and waits for a Switch Data Command from the serial interface. If a Glider or Stand Alone mode command is sent, the unit will ping immediately then write the 256 byte IKX ping return data to a file on the SD card (see filename details below). It will continue to ping once every four seconds (Glider mode) or once per second (Stand Alone mode). Successive Glider mode or Stand Alone mode pings are appended to the file until a new filename is issued. Sending a Normal mode command tells the unit to stop recording.

New for version 1.03:

The files are now stored in a sub-directory named "ES853" on the SD card with a maximum file limit of 65536.

New for version 1.02:

853 Echo Sounders are now available with the standard frequency of 120kHz or with an optional frequency of 300kHz. Byte 11 of the 'IKX' Echo Sounder Return Data packet reflects the configured frequency (0=120kHz, 1=300kHz).

Byte 5 of the Switch Data Command is now reserved and must have a value of 0.

The file creation timestamps written to the SD card now contain the correct date and time fields from the the Switch Data Command.

New for version 1.01:

The filename is no longer an automatically generated sequential number. It is now derived from the following two new fields (bytes 9-11) of the Switch Data Command:

“Dive Number”

“Dive Type”

The filename takes the form:

ESnnnnnT.853, where:

nnnnn = Dive Number (1 to 32767)

T = Dive Type (A = descent, B = ascent)

Dive number must be incremented by the user to create new filenames.

A timestamp has been added to the ping header. The date and time must be sent to the unit using the appropriate fields in the Switch Data Command. The 853 will keep track of the time until the next command. Each ping header in the file will contain a unique time.

SWITCH DATA COMMAND

The 853 accepts up to 27 bytes of switch data from the serial interface and must see the switch data header (2 bytes: **0xFE** and **0x44** HEX) in order to process the switches. The unit will stop accepting switch data when it sees the termination byte (**0xFD** HEX). The termination byte must be present to process the switches.

Note: the Termination Byte is the only switch value allowed to have a value of 0xFD. All other switches should be set higher or lower than 0xFD (253 Decimal) so they are not interpreted as a termination byte!

Byte #	Description							
0 – 7	0xFE	0x44	Head ID	Range	Gain	Reserved 0	Pulse Length	Mode
8 – 15	Message Type	Dive No. HI	Dive No. MID	Dive No. LO	Day	Month	Year HI	Year LO
16 – 23	Hours	Minutes	Seconds	MSec HI	MSec LO	Reserved 0	Reserved 0	Reserved 0
24 – 26	Switch Delay	Reserved 0	Term. 0xFD					

BYTE DESCRIPTIONS

Note: All Byte values are shown in decimal unless noted with a '0x' (hexadecimal) prefix.

- Byte 0 **Switch Data Header (1st Byte)**
Always **0xFE** (254 decimal)
- Byte 1 **Switch Data Header (2nd Byte)**
Always **0x44** (68 decimal)
- Byte 2 **Head ID**
0x1D only (29 decimal)
- Byte 3 **Range**
0 = 25 Meters → for future use
1 = 50 Meters → for future use
2 = 100 Meters
- Byte 4 **Gain**
1 = 20dB
2 = 40dB

SWITCH DATA COMMAND (con't)

- Byte 5 **Reserved**
Always 0
- Byte 6 **Pulse Length**
0 = 100 microseconds
- Byte 7 **Operating Mode**
0 = Normal mode
Each ping requires a separate Switch Data Command to be sent. Ping rate is dependent on the interrogation rate of the commanding program and the acoustic range time of the ping. Echo data is not stored to the internal flash memory in Normal mode.
- 1 = Glider mode
Ping rate is once every four seconds, ILX serial data can be sampled at any time. Echo data is stored to the internal flash memory every ping.
- 2 = Stand Alone
For unattended echo sounder operation, ping rate is once per second. ILX serial data can be sampled at anytime. Echo data is stored to the internal flash memory every ping.
- Byte 8 **Message Type**
0 = 256 byte standard 'IKX' return
1 = 18 byte sample 'ILX' return
- Byte 9-11 **Dive Number and Dive Type**
Increment Dive Number to create a new file.
All pings are appended to the file until a new filename is created.
Filename: ESnnnnnT.853

Byte 9							Byte 10							Byte 11									
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	T	0	0	0	0	HI	0	MID							0	LO							
Dive Type (T = 0 or 1)							Dive Number (1 to 32767)																

Dive Type (T):
0 = A = Descent
1 = B = Ascent

Dive Number (nnnnn):
1 to 32767

SWITCH DATA COMMAND (con't)

Byte 9 = [(Dive Type & 0x01)<<6] | [(Dive Number & 0x00C000)>>14]

Byte 10 = (Dive Number & 0x003F80)>>7

Byte 11 = Dive Number & 0x00007F

Bytes 12 through 20 contain the interrogation timestamp. The 853 will add the 'ping' time offset to this timestamp as well as automatically increment the time by 1 or 4 seconds each ping depending on the mode (Stand Alone or Glider).

Byte 12 **Day**
1 to 31

Byte 13 **Month**
1 to 12

Byte 14-15 **Year**
2012 and higher

Byte 14								Byte 15							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	Year (HI)							0	Year (LO)						

Byte 14 = (Year & 0x3F80)>>7

Byte 15 = Year & 0x7F

Byte 16 **Hours**
0 to 23

Byte 17 **Minutes**
0 to 59

Byte 18 **Seconds**
0 to 59

Byte 19-20 **Milliseconds**
0 to 999

Byte 19								Byte 20							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	Milliseconds (HI)							0	Milliseconds (LO)						

Byte 19 = (Milliseconds & 0x3F80)>>7

Byte 20 = Milliseconds & 0x7F

SWITCH DATA COMMAND (con't)

- Byte 21-23 **Reserved**
Always 0
- Byte 24 **Switch Delay**
The echo sounder can be commanded to pause (from 0 to 510 msec)
before sending its return data to allow the commanding program
enough time to setup for serial reception of the return data.
0 to 255 in 2 msec increments
Byte 24 = delay_in_milliseconds/2
Do not use a value of 253!
- Byte 25 **Reserved**
Always 0
- Byte 26 **Termination Byte**
The echo sounder will stop looking for Switch Data when it sees this byte.
Always **0xFD** (253 decimal)

RETURN DATA

After a Switch Data Command, the 853 replies with a serial return data packet. The packet size depends on the value of “Message Type” (Byte 8 of the Switch Data Command). The standard return (Message Type = 0) is a 256 byte “IKX” packet consisting of a 55 byte header, 200 range bins of echo data and a termination byte value of 0xFC. Each range bin contains a 7-Bit logarithmic value referenced to a 1 Volt peak-peak signal, in the form $20 * \text{LOG}(\text{signal level}/1\text{V peak-peak})$. Signals from 1 microvolt to 1 volt peak-peak are represented, giving a span of 120dB (0 to -120dB).

Note: all numbers are negative but are stored as a positive value (i.e. -120dB is stored as 120)

Byte #	Header Description									
0 to 9	ASCII 'I'	ASCII 'K'	ASCII 'X'	Head ID 0x1D	Serial Status	Ping Number HI	Ping Number MID-HI	Ping Number MID-LO	Ping Number LO	Range
10 to 19	Gain	Frequency	Pulse Length	Mode	Ping Rate HI	Ping Rate LO	Reserved 0	Reserved 0	Reserved 0	Dive No. HI
20 to 29	Dive No. MID	Dive No. LO	Day	Month	Year HI	Year LO	Hours	Minutes	Seconds	MSec HI
30 to 39	MSec LO	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0
40 to 49	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0
50 to 54	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0					

Byte #	Echo Data Description
55 to 254	Logarithmic Echo Data (200 range bins) signal level = $10^{-(\text{range bin value}/20)}$ volts peak-peak

Byte #	Termination Description
255	Terminator 0xFC

Note: in Glider and Stand-Alone modes, the 256 byte IKX data packet is stored to the internal flash memory after each ping

RETURN DATA (con't)

IKX HEADER BYTE DESCRIPTION

Note: All Byte values are shown in decimal unless noted with a '0x' prefix.

N = total number of return bytes

Byte 0 - 2 **Imagenex Return Data Header**
ASCII 'IKX'

Byte 3 **Head ID**
Always 0x1D

Byte 4 **Serial Status**
Bit 0 - 0
Bit 1 - 0
Bit 2 - 0
Bit 3 - 0
Bit 4 - 0
Bit 5 - 0
Bit 6 - 1 = Switches Accepted
Bit 7 - 1 = Character Overrun

Byte 5-8 **Ping Number**
Increments by one every ping

Byte 5		Byte 6		Byte 7		Byte 8	
7	6-0	7	6-0	7	6-0	7	6-0
0	HI	0	MID-HI	0	MID-LO	0	LO
Ping Number							

$$\text{Ping Number} = [(\text{Byte 5} \& 0x7F) \ll 21] \mid [(\text{Byte 6} \& 0x7F) \ll 14] \mid [(\text{Byte 7} \& 0x7F) \ll 7] \mid (\text{Byte 8} \& 0x7F)$$

Byte 9 **Range**
0 = 25 Meters
1 = 50 Meters
2 = 100 Meters

Byte 10 **Gain**
1 = 20dB
2 = 40dB

RETURN DATA (con't)

Byte 11 **Frequency**
 0 = 120kHz
 1 = 300kHz

Byte 12 **Pulse Length**
 0 = 100 microseconds

Byte 13 **Mode**
 0 = Normal mode
 1 = Glider mode
 2 = Stand Alone mode

Byte 14-15 **Ping Rate**
 Repetition rate in milliseconds

Byte 14								Byte 15							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0								0							
Ping Rate (HI)								Ping Rate (LO)							

Ping Rate = [(Byte 14 & 0x7F)<<7] | (Byte 15 & 0x7F), in milliseconds

Byte 16-18 **Reserved**
 Always 0

Byte 19-21 **Dive Number and Dive Type**

Byte 19								Byte 20								Byte 21							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0								0								0							
T								HI								LO							
Dive Type (T = 0 or 1)								Dive Number (1 to 32767)															

Dive Type = (Byte 19 & 0x40)>>6
 Dive Number = [(Byte 19 & 0x03)<<14] |
 [(Byte 20 & 0x7F)<<7] |
 (Byte 21 & 0x7F)

Bytes 22 through 30 contain the current ping timestamp:

Byte 22 **Day**
 1 to 31

RETURN DATA (con't)

Byte 23 **Month**
1 to 12

Byte 24-25 **Year**
2012 and higher

Byte 24								Byte 25							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0								0							
Year (HI)								Year (LO)							

$$\text{Year} = [(\text{Byte 24} \& 0x7F) \ll 7] \mid (\text{Byte 25} \& 0x7F)$$

Byte 26 **Hours**
0 to 23

Byte 27 **Minutes**
0 to 59

Byte 28 **Seconds**
0 to 59

Byte 29-30 **Milliseconds**
0 to 999

Byte 29								Byte 30							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0								0							
Milliseconds (HI)								Milliseconds (LO)							

$$\text{Milliseconds} = [(\text{Byte 29} \& 0x7F) \ll 7] \mid (\text{Byte 30} \& 0x7F)$$

Byte 31-54 **Reserved**
Always 0

Byte 55-254 **Logarithmic Echo Data**
200 range bins
signal level = $10^{-(\text{range bin value}/20)}$ volts peak-peak

Byte 255 **Termination Byte**
0xFC

RETURN DATA (con't)

The following is the description of the 18 byte ILX packet which is output in response to a Switch Data Command string with Message Type = 1. This output contains 8 range bins of echo data covering the first 40 meters in range, each range bin contains a 5m sample.

Byte #	Header Description								
0 to 8	ASCII 'I'	ASCII 'L'	ASCII 'X'	Head ID 0x1D	Serial Status	Ping Number HI	Ping Number MID-HI	Ping Number MID-LO	Ping Number LO

Byte #	Echo Data Description
9-16	Logarithmic Echo Data (8 range bins) signal level = $10^{-(\text{range bin value}/20)}$ volts peak-peak

Byte #	Termination Description
17	Terminator 0xFC

ILX HEADER BYTE DESCRIPTION

Note: All Byte values are shown in decimal unless noted with a '0x' prefix.
N = total number of return bytes

Byte 0 - 2 **Imagenex Return Data Header**

ASCII 'ILX'

Byte 3 **Head ID**

Always 0x1D

Byte 4 **Serial Status**

Bit 0 - 0

Bit 1 - 0

Bit 2 - 0

Bit 3 - 0

Bit 4 - 0

Bit 5 - 0

Bit 6 - 1 = Switches Accepted

Bit 7 - 1 = Character Overrun

RETURN DATA (con't)

Byte 5-8 **Ping Number**
 Increments by one every ping

Byte 5		Byte 6		Byte 7		Byte 8	
7	6-0	7	6-0	7	6-0	7	6-0
0	HI	0	MID-HI	0	MID-LO	0	LO
Ping Number							

$$\text{Ping Number} = [(\text{Byte 5} \& 0x7F) \ll 21] \mid [(\text{Byte 6} \& 0x7F) \ll 14] \mid [(\text{Byte 7} \& 0x7F) \ll 7] \mid (\text{Byte 8} \& 0x7F)$$

Byte 9-16 **Logarithmic Echo Data**
 8 range bins
 signal level = $10^{-(\text{range bin value}/20)}$ volts peak-peak

Byte 17 **Termination Byte**
0xFC

Imagenex Model 853 Care Guide and Environmental Specification

This document describes general care for the Imagenex Model 853 Scientific Echo Sounder with Data Logger and its' operating environmental specifications including depth and temperature.

General Care and Usage

Model 853 Echo Sounders are designed to be operated in many types of operating environments. However to prolong the life of the equipment, simple maintenance is required.

Routine Maintenance

Fresh Water Rinse

After each immersion of the underwater unit, rinse the echo sounder thoroughly in fresh water. This will prevent the accumulation of salt or other contamination, and help prevent corrosion of the aluminum and / or stainless steel parts.

Clean Transducer Face

The black epoxy transducer face should be cleaned with a detergent solution such as dishwashing liquid to remove any oil, grease, or other deposits which may reduce the acoustic performance of the unit.

Clean and Lubricate Connectors

The cables and connectors should be washed and coated with a **thin** film of silicon grease to protect the rubber. The connectors should be protected from prolonged exposure to sunlight, ozone, solvents, hydrocarbon greases, and oils to avoid deterioration of the rubber.

Underwater Unit Storage

After being thoroughly cleaned and dried, the underwater unit should be stored in a dry, stable location to prevent moisture corrosion and damage from impact.

Cable Storage

The cables should be protected from prolonged exposure to sunlight, ozone, solvents, hydrocarbon greases, and oils to avoid deterioration of the rubber.

<p>Do not use any solvents on the cables or underwater unit as they will compromise the physical integrity of the echo sounder.</p>
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Service

There are no user serviceable components in the echo sounder and as such all repairs must be directed to:

<p>Imagenex Technology Corp. 209-1875 Broadway Street Port Coquitlam, BC, Canada V3C 4Z1</p> <p>Tel : (604)944-8248 Fax : (604)944-8249 web: www.imagenex.com email: imagenex@shaw.ca</p>
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Safety

Before each use, inspect the transducer face for impact damage. Inspect the connectors on both the echo sounder and the cables for any damage such as bent or broken pins, or cuts in the cable. Ensure that the mating connections are secure and that the locking sleeves are in place.

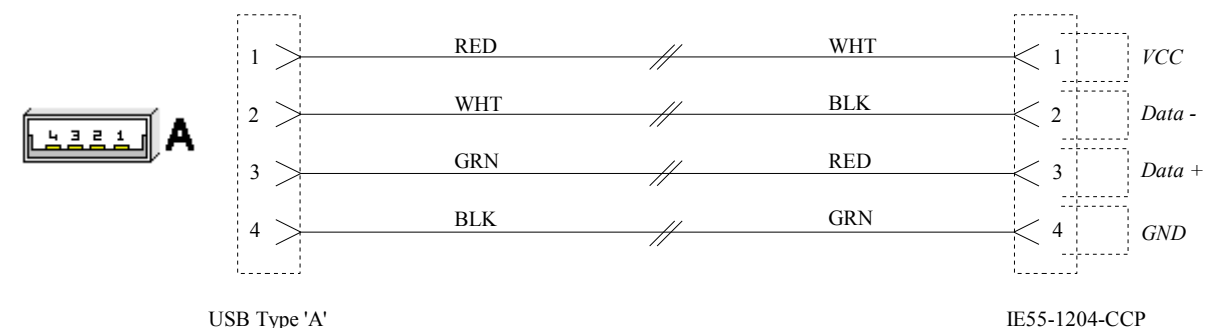
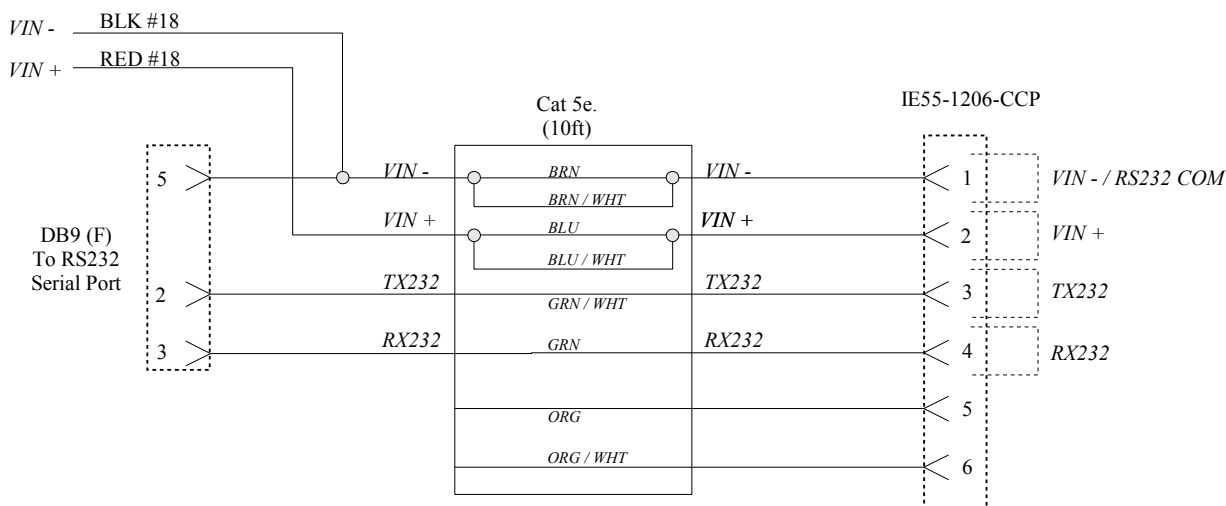
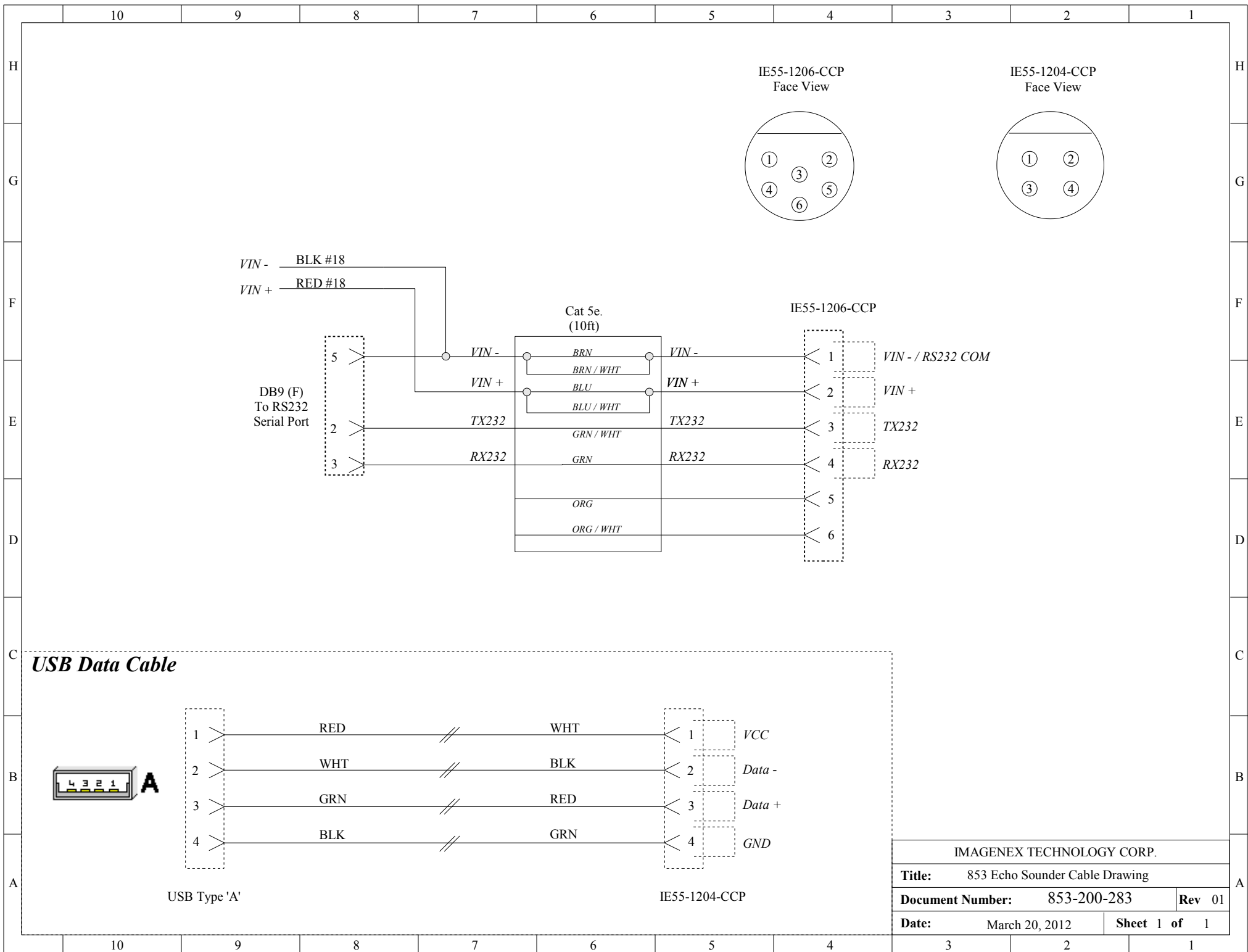
Operational Environmental Specification

While the Model 853 is designed to operate in a wide variety of environments, there are limitations.

Table 1 - Model 853 (853-000-140) Environmental Specification

	Minimum	Maximum	Units
Temperature	-5	35	°C
Depth	0	1000	m
Storage	-40	50	°C
Salinity ¹	0	40	ppt

¹The operation specification on Salinity is for acoustic properties only (i.e. the speed of sound in the medium). Salinity has no effect on mechanical operations if the unit is thoroughly cleaned after use.



IMAGENEX TECHNOLOGY CORP.	
Title:	853 Echo Sounder Cable Drawing
Document Number:	853-200-283
Date:	March 20, 2012
Rev	01
Sheet	1 of 1