

RTI Direct Reading



Revision 5

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1. Introduction

RTI Direct Reading (DR) is the supporting software to the RTI's 3rd generation ADCP3 systems. The RTI-DR is a PC program providing real-time user interface to RTI's direct reading ADCPs, through a cable between ADCP and PC. The ADCP has the additional capability to operational from external power and to receive data from external devices. The software supports a wide variety of ADCP deployments including surface and subsurface fixed or moving platforms.

The RTI-DR program provides a user interface for communicating with and configuring an ADCP, deploying the system, real-time data collection, data processing and display using RTI's advanced ADCP3 platform. The real-time data includes all ADCP3 measurements including vertical profile of water currents, echo intensity, correlation etc. It can also measure depth, bottom velocity, and other parameters. This manual is designed to guide users to work with RTI-DR ADCP systems.

System Requirements

RTI Direct Reading for PC requires the following specifications for the PC:

Windows Vista or newer with .NET framework 4.7

1 GHz processor or faster

1 GB RAM

1 GB hard disk space

1024 x 768 or higher screen resolution

Installation

To install the DR software on the PC, run the installer "DirectReading.x.x.x._Installer_Datetime.exe" from the RTI provided CD or memory stick, then follow the installation wizard instructions and keep the default settings. After installed, you should see the "Direct Reading" program icon on your desktop. Double click the icon to start the DR program. You are now ready to use the DR software.

Contact Us

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2. Terminology

- **Ping**: a single or multiple sequence of pulse transmission used for echo reception and signal processing.
- **Ping time**: the time taken (in seconds) by the ADCP to complete one Ping. It includes system wake up and initialization time, transmit time, receive time, data processing time and data recording time.
- Water Profile Time Between Pings (*CWPTBP*): the time (in seconds) interval between water profile pings. This is the time interval between the start of a water profile ping and the start of the next water profile ping for each frequency.
- **Subsystem**: a subsystem if a frequency with its unique hardware properties such as transducer type, number of beams, beam angle, slanted beam or vertical beam, etc. Each subsystem has an unique id called "<u>subsystem code</u>" (refer to Section 3) that can be recognized in the firmware. Each subsystem has a default configuration like bin size, bin number, number of pings, time between pings, etc., the user can change the default settings to fulfil his/her specific application goals. An RTI ADCP instrument can have single or multiple subsystems depends on the hardware. A subsystem can have one or more different configurations in a deployment. The serial number of the instrument will tell you how many subsystems and what subsystems you have on that particular ADCP.
- Pings per subsystem (P): the number of pings in each subsystem for a deployment.
- Group (G): the collection of one or more subsystems operating sequentially one after the other. For example, *G*{*ABC*} is a group of three independent subsystems *A*, *B* and *C*.
- Group Time (GT): the duration time taken (in seconds) for completing one group pings.
- Group Interval (GI): the time interval (in seconds) between groups.
- Subsystems per group (*M*): number of subsystems in one group (1 = < M <= 12). It will be automatically selected when you chose the instrument.
- **Ensemble**: a group of data collection of single or multiple subsystem groups over a certain time period (usually averaged) that ADCP outputs. It can include measured current profiles, correlation and echo intensity, bottom track velocities, pitch/roll, heading BIT results, and other user selectable data. The ensemble can contain the single ping data over the ensemble interval, or it can contain the averaged data from multiple groups.
- Ensemble Interval (CEI): the time interval (in seconds) between ensembles.
- Groups per ensemble or Group Number (GN): the number of groups to be averaged in ensemble interval (GN >= 1).
- **Output Time** (*OT*): the time (in seconds) spent to output data ensemble from ADCP to user's PC through a serial port.

3. Subsystem

ADCP3 system serial number starts with SN07 in which "07" identified as ADCP3, followed by a 15-bit sequence of subsystem ids. The subsystems used for ADCP3 are listed below:

Code#	Description
0	Reserve
А	Spare
В	1.2 MHz 4 beam 20 deg piston
С	600 kHz 4 beam 20 deg piston
D	300 kHz 4 beam 20 deg piston
Е	150 kHz 4 beam 20 deg piston
F	75 kHz 4 beam 20 deg piston
G	Spare
Н	Spare
Ι	1.2 MHz 4 beam 20 deg piston, 45 degree heading offset
J	600 kHz 4 beam 20 deg piston, 45 degree heading offset
Κ	300 kHz 4 beam 20 deg piston, 45 degree heading offset
L	Spare
М	Spare
Ν	1.2 MHz 1 beam vertical piston
0	600 kHz 1 beam vertical piston
Р	300 kHz 1 beam vertical piston
Q	150 kHz 1 beam vertical piston
R	Spare
S	Spare
Т	Spare
U	1.2 MHz 4 beam 20 deg piston, doughnut hole
V	600 kHz 4 beam 20 deg piston, doughnut hole
W	300 kHz 4 beam 20 deg piston, doughnut hole
Х	Spare
Y	Spare
Ζ	Spare
а	Spare
b	1.2 MHz 4 beam 30 deg array
c	600 kHz 4 beam 30 deg array
d	300 kHz 4 beam 30 deg array
e	150 kHz 4 beam 30 deg array
f	75 kHz 4 beam 30 deg array
g	38 kHz 4 beam 30 deg array
h	Spare
i	Spare
j	Spare
k	Spare
1	Spare

m	Spare
n	1.2 MHz 1 beam vertical array
0	600 kHz 1 beam vertical array
р	300 kHz 1 beam vertical array
q	150 kHz 1 beam vertical array
r	75 kHz 1 beam vertical array
S	38 kHz 1 beam vertical array
t	Spare
u	1.2 MHz 4 beam 30 deg array doughnut hole
v	600 kHz 4 beam 30 deg array doughnut hole
W	300 kHz 4 beam 30 deg array doughnut hole
Х	150 kHz 4 beam 30 deg array doughnut hole
У	Spare
Z	Spare

4. Grouping

A group (Figure I) is a collection of one or more subsystem pings operating sequentially one after the other within an ensemble interval. Each subsystem can have bottom track (BT) pings and water profile (WP) pings. Figure I shows a group of three subsystems A, B and C, each colored bar on the time axis is a ping (BT ping or WP ping) measured in seconds. Each subsystem begins with one BT ping followed by one or more WP pings. The sum of all the ping time is Group Time (GT).

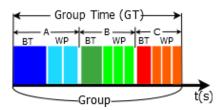


Figure I. Group

One or more group pings in an ensemble interval will be averaged into a data ensemble and will be outputted by the ADCP.

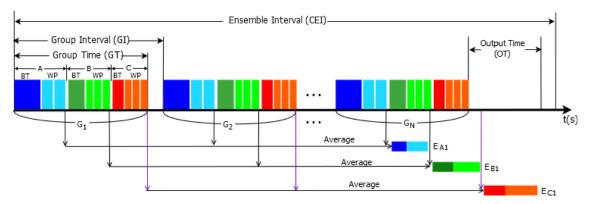


Figure II. Grouping

The example of Figure II has three subsystems *A*, *B* and *C*, usually represents two different frequencies and a vertical beam in a piston ADCP. There are total *N* groups in the ensemble interval in Figure II and each group has three subsystems *A*, *B* and *C*. Each subsystem starts with one BT ping followed by multiple WP pings. After subsystem *A* pings completed in group *N* during ensemble interval, all the subsystem *A* pings will be averaged and outputted as data ensemble E_{A1} . Same thing for subsystems *B* and *C*, all the subsystem *B* pings will be averaged and outputted as one data ensemble E_{B1} and all the subsystem *C* pings will be averaged and outputted as one data ensemble E_{C1} when completed pinging in group *N*.

The Ensemble Interval (*CEI*) is the time interval (in seconds) set to complete all the *N* group pings. It includes Pinging Time and Data Output Time, and is defined as

$$CEI \ge GI * GN + OT \tag{Eq. 1}$$

Where, GI is group interval in seconds, it is the time interval between groups in an ensemble. GT is group time which is the time taken for completing all the pings in the group, it is defined as in Eq. 2.

$$GT = \sum_{i=1}^{M} (BTPT_i + TBP_i * P_i)$$
 (Eq. 2)

in which, $BTPT_i$ and TBP_i are bottom track ping time and water profile time between pings for subsystem *i*, respectively. They are the required time for the ADCP to complete the BT ping and WP ping for that frequency. P_i is the number of water profile pings in subsystem *i*. *M* is the number of subsystems in the group. In Figure I and Figure II, M = 3 because there are three subsystems *A*, *B* and *C*.

OT is data ensemble output time, it is the time that needed to output data ensemble from ADCP to PC through a serial port. There will be an overlap of pinging time and outputting time for multiple frequency systems. In Figure II, after the completion of pinging and averaging subsystem A in the last group, ADCP can start outputting the ensemble of subsystem A while subsystem B is pinging. Same thing for subsystem B and subsystem C, after the completion of subsystem B in last group of the ensemble, ADCP starts outputting subsystem B ensemble while still doing the subsystem C pinging. The actual outputting time OT depends on the actual ensemble size of each subsystem and the baud rate of the serial port. In the best case that uses a fast baud rate, the output of first subsystem completes before the end of second subsystem pinging, that is, it can start outputting the second subsystem data immediately when it finishes pinging and so on. Then, the overall outputting time is the time to output the last subsystem ensemble, it is defined as

$$OT = \frac{\text{Last Ensemble (bytes)}}{\text{Baudrate/10 (bytes/second)}}$$
(Eq. 3)

And,

$$CEI \ge GI * GN + \frac{Last Subsystem Ensemble (bytes)}{Baudrate/10 (bytes/second)}$$

$$\ge GT * GN + OT$$

$$(Eq. 4)$$

In the worst case that using a slow baud rate, the outputting time is longer than pinging time and *OT* is defined as the sum of the ensemble outputting time of each subsystem.

$$OT = \sum_{i=1}^{M} \frac{Subsystem \, i \, Ensemble \, (bytes)}{Baudrate/10 \, (bytes/second)}$$
(Eq. 5)

And

$$CEI \ge GI * (GN - 1) + PT + OT$$

$$\ge GT * (GN - 1) + PT + OT$$

$$\Sigma^{M} Ei$$

$$= \sum_{i=1}^{M} (BTPT_{i} + TBP_{i} * P_{i}) * (GN - 1) + (BTPT_{1} + TBP_{1} * P_{1}) + \frac{\sum_{i=1}^{M} Ei}{Baudrate / 10}$$

Where, PT is the pinging time of first subsystem and is defined as

$$PT = BTPT_1 + TBP_1 * P_1$$

5. Pinging Scheme

There are two pinging schemes in grouping the different frequency pings together: the uniform group pinging and the burst group pinging.

5.1 Uniform Group Pinging

In uniform group pinging (Figure III), each ensemble all the groups are evenly placed within the ensemble interval. So, $GI \ge GT$.

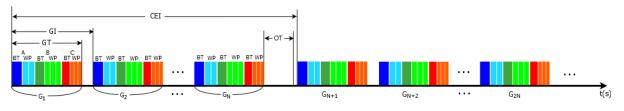


Figure III. Uniform Group Pinging

5.2 Burst Group Pinging

In burst group pinging (Figure IV), a sequence of groups will ping immediately one after another in the beginning of each ensemble. After that, it may have a sleep time before the next ensemble. In this scheme, GI = GT dependents on the group time.

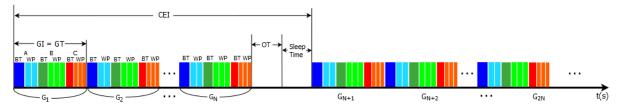


Figure IV. Burst group pinging

6. System Overview

RTI-DR (Figure 1) is a highly integrated program that allows the user to work with RTI ADCPs like communicating with ADCP, configurating an ADCP, deploying a system, downloading data from ADCP, viewing live data or playing back the existing data collected from RTI ADCPs. The large menu icons on the top of the program window are the shortcuts to start each main function. The **Deploy** and the **Download** functions require the user to connect an RTI ADCP to the PC through a serial port. While it's no need to have an ADCP available in order to **Plan** a deployment or **Playback** data from a file. We will explain all the functions in detail in the following sections. The **Terminal** window allows the user to talk directly to ADCP using commands through serial communications.

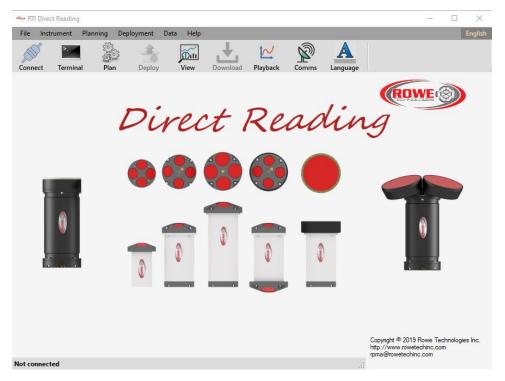


Figure 1. RTI Direct Reading

The user can choose the language between "English" and "Chinese" by clicking the "English" menu on the top right corner of the program or by clicking the "Language" icon from the tool bar of the program.

7. Connect to ADCP

Connect is used to connect to the ADCP by selecting correct serial port and baud rate (Figure 2). The "Refresh" button will scan for all the available serial ports on the user's computer that connected to ADCP and find the baud rate for the that COM port. The "Find Baudrate" button will find the baud rate that the selected COM port uses.

🥌 SerialConn	ect		×
COM Serial P	ort Setttings		
COM Port:	COM14	~	Refresh
Baud Rate:	921600	~	Find Baudrate
Connect	[Cancel	

Figure 2. SerialConnect Window

8. Terminal

The **Terminal** window is used to talk to ADCP directly through serial port. It allows the user to set and change serial communications with ADCP or GPS. Click the **Terminal** $\stackrel{\frown}{=}$ icon from the tool bar to open Terminal window (Figure 3).

Terminal [COM14: 921600]	- 🗆 X
	Serial Pot Settings COM Port: COM14 Baud Rate: \$221600 Data Bis: 8 Perty: None StopBas: 1
	DisConnect SET TIME Cancel XModem Command Fle
START STOP BREAK CSHOW SLEEP FORCE BREAK CDEFAULT Clear Data Mode • Text • •	import Cmd Send Cmd Clear
GPS NEMA Record GPS Select Port COM Port: COM14 V Baud Rate: (15200 V Clear GPS NEMA	Compass Calibration Compass Connect Compass Disconnect BT Settings Vessel Speed Ref. (BT v Heading Ref. Internal Compass v Heading Offset v

Figure 3 Terminal Window

9. Planning

This is the place to plan a deployment. Click the icon from tool bar to open **Planning** window and start planning. The planning steps will guide the user through the procedure of how to configure the instrument for a deployment. An ADCP is not required during planning. But you the user can check the ADCP configuration is an ADCP is connected to the PC.

anning - Project 6 rument			Instr	ument				S	Summary		-	
10 7 5	Single Frequency		Pis	ton		Pha	ed Array*	Instrument SN				
	(kHz)	4 B S	4BS+V	4BL	4BL+V	PAS	PAL	FW				
	38						0	ADCP				
llation	75	0	0	0	0	0	0	Deployment				
	150	0	0	0	0	0	0	Deployment Length (days) Ensemble Interval (s)				
	300	0	0	0	0		0	Groups per Ensemble				
	600	0	0	0	0		0	Group Interval (s)				
DCP Config	1200	0	0	0	0			Battery Capacity				
	Dual Frequency	-	-	-	-			Internal Recorder (GB)				
d Config	(kHz)	8BS	8BS+V	8BL	8BL+V	PAS	PAL		SBeams 1	SBeams 2	VBeam 1	VBe
	38 / 150						0	Settings	obcumo 1	obcuma 2	Pocon 1	
re Config	38 / 300						0	Frequency (kHz)				
	75 / 300	0	0	0	0		0	Number of Beams				
	150 / 600		0	0	0		0	Acoustic Power				
	300 / 1200	0	0	0	0		0	PA Vertical Beam Bandwidth				
	600 / 1200	0	0	0	0		0	Number of Cells				
								Depth Cell Size (m)				
		-						Maximum Velocity (m/s)				
							Reset	Pings per Subsystem <				
	Data Output				Input Vo	ltage			SBeams 1	SBeams 2	VBeam 1	VBe
	Direct Reading	C) Self Conta	nined	O Rang	-	~	Performance				
	R\$232	~ `	Internal Sto			Input (Vpc)		Estimated Range (m)				
	RS485	~			User	input (vice)		Configured Range (m)				
	O R\$422	~						Vel. Precision Single Ping (m/s) Vel. Precision Ensemble (m/s)				
								Number of Ensembles (total)				
	_							Ensemble Data Recorded (MB)				
	Battery		~		ernal Record		~	Single Ping Data Recorded (MB)				
	Pressure Rating (m)			High Cap	acity Record	er (GB)		Total Data Recorded (MB)				
								Data Recorder Percent Used (%) Battery Energy Used (watts)				
3)						Next	•	Total Energy Used (watts)				
								Battery Packs Needed				

Figure 4 Planning Window

The Planning window (Figure 4) is organized into three parts: the control panel in the left that has three planning step buttons, three function buttons and a picture of the selected instrument the user is working on; in the middle of the window is content of the settings parameters of each step; the right column is the Summary of the configuration and the predicted performance of the settings. Any changes of the settings in each step will be reflected in the Summary.

9.1 Planning Steps

Step 1. Instrument

The first step of Planning is to choose an ADCP from the instrument table for the deployment. The instrument table consist of all the RTI ADCP3 products that are designed and developed to operate from a frequency range of 38 kHz to 2.4 MHz with single and dual frequency mode of operation, transducer type can be piston or phased array, size can be large or small. The information button icon ① on the right top corner of the table explains the names of the instruments (Figure 5).

🥯 Instrur	🖘 Instrument Detail						
Every Phased Array instrument has an in-built vertical beam							
ID	Description		^				
4BS	4 Beam Small, Piston						
4BS+V	4 Beam Small with Vertical beam, Piston						
4BL	4 Beam Large, Piston						
4BL+V	4 Beam Large with Vertical beam, Piston						
8BS	8 Beam Small, Piston						
8BS+V	8 Beam Small with Vertical beam, Piston						
8BL	8 Beam Large, Piston						
8BL+V	8 Beam Large with Vertical beam, Piston						
PAS	Phased Array Small						
PAL	Phased Array Large		×				
<		>					

Figure 5. Instrument Description

After selecting an ADCP from the table, the ADCP information such as subsystems, frequency, transducer type etc. and the default ADCP settings along with the predicated performance results will be shown in the Summary column on the right side of the window (Figure 6). On the Instrument page, the user can also setup other hardware parameters like battery, pressure rating, input voltage, the internal recorder size and does it have the high capacity recorder or not.

For Direct Reading applications, the user also need to select how to output data from ADCP to PC by choosing from RS232/RS485 port and RS422 port. For Self-Contained applications, the data collected by ADCP will be saved on the SD card inside of the ADCP and there is no data output to PC.

g - Project									_			
nt			Instr	ument			0		Summary			
	a. 1.5		Pie	ton		Phase	ed Array*	Instrument				
	Single Frequency (kHz)	4BS	4BS+V	4BL	4BL+V	PAS	PAL	SN ()7DB000000000	00005500A000	000000	
	38	100	100.1	102		0	0	ADCP 3	300/1200 kHz 20) deg. Piston Sm	all	
	75	0	0	0	0	0	0	Deployment				
1	150	0	0	0	0	0	0		I 10			
Ŀ	300	0	0	0	0		0					
Ŀŀ		0	0	0	0		0		0.00			
	600	-	-	-	-		-		None			
	1200	0	0	0	0		0		32 GB			
	Dual Frequency (kHz)	8BS	8BS+V	8BL	8BL+V	PAS	PAL	<				>
	38 / 150					0	0		SBeams 1	SBeams 2	VBeam 1	VBea
	38 / 300						0	Settings				
1 -	75 / 300	0	0	0	0		0	Frequency (kHz) Acoustic Power	300 High	1200 High		
Ŀ					~		-	Number of Beams	nign 4	nign 4		
	150 / 600	0	0	0	0	0	0	PA Vertical Beam	-	-		
	300 / 1200	۲	0	0	0		0	Bandwidth	BB1 (50%)	BB1 (50%)		
	600 / 1200	\circ	0	0	0		0	Water Profile	On	On		
								Number of Cells	30	20		
L								Depth Cell Size (m)	4	1		
Ŀ				-			Reset	Maximum Velocity (m/s)	5.0	5.0		3
							ineset	-	SBeams 1	SBeams 2	VBeam 1	VBea
l	Data Output				Input Vo	-		Performance				
L	Direct Reading		Self Conta Internal Store		Rang	je (V _{DC})	12-24 🗸	Estimated Range (m)	100	14		
Ŀ	RS232 Disable	~	internal Stu	laye	 User 	Input (Vpc)	12 🔹	Configured Range (m)	120	20		
Ŀ	RS485 RTI Binar	y ~						Vel. Precision Single Ping (m/s)	0.113	0.113		
	O RS422	\sim						Vel. Precision Ensemble (m/s)	0.113	0.113		
ŀ								Number of Ensembles (total)	17280			
	Battery		None ~	Inte	ernal Record	er (CP)	32 GB 🗸	Ensemble Data Recorded (MB)		29.47		
	Pressure Rating (m)				acity Record	· · · <u>–</u>		Single Ping Data Recorded (ME				
	Pressure Rating (m)		300 ~	nign Cap	acity necord	er (GD)	None ~	Total Data Recorded (MB)	68.16			
								Data Recorder Percent Used (% Battery Energy Used (watts)	6) 0.21 % 2.429	0.365		
						Next		Total Energy Used (watts)	2.429	0.305		
						TOAL T		Battery Packs Needed	2./34			

Figure 6. Planning Window - Instrument Page

After done with the instrument, click **Next** button or click the **2**. **Sensors** button on the left side of the window to go to next step - **Sensors** page.

Step 2. Sensors

The second step is to set up sensor source and environmental parameters for the deployment.

strument	Sen	ISOFS		Summary			
ensors	Speed Of Sound (CWSSC d)	Transducer Depth (CWSSC b)	Instrument SN 0	7DB000000000	00005500A000	000000	
tup	Calculated	○ Calculated	FW			000000	
rup	External Sensor	External Sensor CTD	ADCP 3	00/1200 kHz 20	deg. Piston Sm	all	
	0	O User Input (m) 0.5 ≑	Deployment				
	- · · · · · · · · · · · · · · · · · · ·	O User Input (m)	Deployment Length (days) 1				
	Backup/Fixed Value (m/s) 1500.00			0			
			Groups per Ensemble	-			
	Salinity (CWS)	Water Temperature (CWSSC a)		0.00			
	Ocean (ppt) 35	Sensor CWT		None			
d ADCP Config	Fresh Water (ppt) 0	O User Input (°C) 0.0 ≑		2 GB			
	O User Input (ppt) 0.00 ♀		<	200			
oad Config				SBeams 1	SBeams 2	VBeam 1	VBe
	Heading Offsets (CHO)	Heading Source (CHS)	Settings				
we Config	○ Heading Offset 0.00 ♀	No Heading	Frequency (kHz)	300	1200		
	○ Ship Heading Offset 0.00 ♀	Internal Compass	Acoustic Power	High	High		
	○ Tilt Heading Offset 0.00 ♀	External	Number of Beams	nign 4	nign 4		
		O External	PA Vertical Beam	4	4		
		Tilt Sensor Source (CTS)	Bandwidth	BB1 (50%)	BB1 (50%)		
			Water Profile	On	On 01		
		O No Tilt	Number of Cells	30	20		
		Internal Compass	Depth Cell Size (m)	4	1		
		 External 	Maximum Velocity (m/s)	5.0	5.0		
			<	5.0	5.0		
				SBeams 1	SBeams 2	VBeam 1	VBe
			Performance				
			Estimated Range (m)	100	14		
			Configured Range (m)	120	20		
			Vel. Precision Single Ping (m/s)	0.113	0.113		
			Vel. Precision Ensemble (m/s)	0.113	0.113		
			Number of Ensembles (total)	17280			
			Ensemble Data Recorded (MB)		29.47		
			Single Ping Data Recorded (MB)				
			Total Data Recorded (MB)	68.16			
			Data Recorder Percent Used (?				
-			Battery Energy Used (watts)	2.429	0.365		
	Here Back	Next 🔿	Total Energy Used (watts)	2.794			

Figure 7. Sensors Page

Speed Of Sound: Sets the speed of sound value used for ADCP data processing. The speed of sound values is used by ADCP to scale velocity data, depth cell size and range to the bottom.

• Calculated: ADCP calculates speed of sound using the values of measured transducer depth, water temperature and salinity. The following equation is used to compute the speed of sound:

 $C = 1449.2 + 4.6T - 0.055T^{2} + 0.00029T^{3} + (1.34 - 0.01T) * (S - 35) + 0.016D$

Where:

T is the temperature in °C S is salinity in parts per thousand (‰) D is the depth in meters

- External Sensor: using an external device for the value of speed of sound.
- User Input: a fixed value of speed of sound (in meters per second) input by the user.

The Backup / Fixed value is necessary in the situations when none of the three above options is available.

Transducer Depth: Sets the way how to get ADCP transducer depth.

- Calculated: ADCP calculates transducer depth using the values of the built-in pressure sensor (if presents). If a pressure sensor is not available, the ADCP uses the CTD command setting.
- External Sensor: uses an external pressure sensor for the calculation of transducer depth.
- User Input: uses the user input value (in meters) from CTD command for the transducer depth.

Salinity: Sets the water salinity value.

The salinity of 0 is for fresh water, 35 for ocean or saltwater, or any other user-input value between 0 and 35 ppt.

Water Temperature: Sets the water temperature value.

It can the readings from a sensor or a user input values saved in the CWT command.

Heading Source: Selects the heading source for ENU transformations.

- No Heading: means there is no heading data available.
- Internal Compass: the heading data is from an internal compass reading.
- External: ADCP will use the heading data obtained from an external GPS's \$xxHDT string.

Tilt Source: Selects the tilt source for ENU transformations.

- No Tilt: no tilts.
- Internal Compass: uses the tilt data from an internal compass reading.

Heading Offsets: Sets the heading offsets.

- Heading Offset (+-180 deg): the offset that is used to correct the heading that ADCP has either from ADCP's PNI compass or from user's GPS heading. This offset will be added to the compass or GPS heading prior to being used within the system and then output.
- Ship Heading Offset (+-180 deg): system to ship heading offset. This will align the instrument axes and the ship axes.
- Tilt Heading Offset (+-180 deg): system to PNI compass tilt heading offset. This will align ADCP Beam 0 and the PNI compass tilt axes.

Which offset to use and how to use these offsets depends on the real applications. Following are the applications that show how to set these offsets:

Application 1. Uses PNI compass for magnetic north (SC or DR).

In this application, all these offsets should be set to 0 (ZERO). The PNI heading will be the heading that will be used in system data processing and outputting.

<u>Application 2</u>. Same as Application 1 but need to correct declination.

In this case, use Heading Offset for correcting the declination. <u>Application 3</u>. PNI compass is not aligned with ADCP Beam 0. In this case, use Tilt Heading Offset to align PNI compass tilt axes and ADCP axes. <u>Application 4</u>. Uses external heading devices either GPS or GYRO for heading. In this case, use Heading Offset to line up ADCP instrument to North. <u>Application 5</u>. ADCP is mounted on a ship but not aligned. In this case, use Ship Heading Offset to line up ADCP instrument axes and the ship axes.

Step 3. Setup

The last step is to set up the ADCP parameters for the deployment such as ensemble interval, bandwidth, water profile pings and bottom track pings. A predicted performance of the setting

is calculated based on the parameter values chosen by the user. The question mark 2 will refer to "Rowe Technologies Grouping Scheme" and the two pinging schemes. The green check sign 2 tells the user that the settings are a valid setup, while the red cross sign 2 indicates the setup is not valid.

🗢 Planning - Project 1	66						_	
1. Instrument	?	Setup	Valid Setup		Summary			
2. Sensors	I. Deployment Settings		valiu Setup	Instrument				
	Deployment Length (days)	1 + Recording Data	Ensemble ~	SN 0	7DB000000000	0000SS00A000	0000000	
	Ensemble Interval (HH:mm:ss.hh) 00:00:10		921600 ~	FW				
	Groups Per Ensemble		2020/01/10.15:42:06 +	ADCP 3	00/1200 kHz 20	deg. Piston Sm	nall	
Installation	Pinging Scheme Uniform	Start Time		Deployment				
	Finging Schenie	*	Autostart Now	Deployment Length (days) 1				
	DB Slanted Beams	Slanted Beams		Ensemble Interval (s) 1	0			
	II. Instrument	1200		Groups per Ensemble 1				
	riequency (kriz)			1 1	0.00			
Read ADCP Config	Acoustic Power High ~	High ~			None			
	III. Water Current Profile				2 GB			
Load Config	ON/OFF	ON/OFF		<				>
Load Coning	Bandwidth BB1 (50%)	BB1 (50%) V			SBeams 1	SBeams 2	VBeam 1	VBean
Save Config	Number of Cells 30			Settings				
Save Coning	Depth Cell Size (m) 4.0			Frequency (kHz)	300	1200		
	Maximum Velocity (m/s) 5.0	5.0 🜩		Acoustic Power	High	High		
	Pings Per Subsystem 1	1÷		Number of Beams	4	4		
	Range Tracking Off	· Off ~		PA Vertical Beam				
				Bandwidth	BB1 (50%)	BB1 (50%)		
				Water Profile	On	On		
				Number of Cells	30	20 1		
	IV. Bottom Track	Auto ~		Depth Cell Size (m) Maximum Velocity (m/s)	4 5.0	5.0		
				<	5.0	5.0		>
	Bottom Track MaxDepth (m) 300.0	60.0 🜩			SBeams 1	SBeams 2	VBeam 1	VBean
	V. Output Data				Spearins 1	Spearins 2	vbediii i	vbean
	SubSystem A SubSystem B			Performance				
	Water Profile	_	_	Estimated Range (m)	100 120	14 20		
	Beam Velocity Amplitude	Ensemble	MMEA	Configured Range (m) Vel. Precision Single Ping (m/s)	0.113	0.113		
	Instrument Velocity Correlation	Ancillary	Profile Engineering	Vel. Precision Ensemble (m/s)	0.113	0.113		
	Earth Velocity Range Tracking	System Settings	BT Engineering	Number of Ensembles (total)	17280	0.115		
	Beam Vel. Good Ping Earth Vel. Good P	ing Bottom Track		Ensemble Data Recorded (MB)		29.47		
				Single Ping Data Recorded (MB				
				Total Data Recorded (MB)	68.16			
				Data Recorder Percent Used (%	s) 0.21 %			
				Battery Energy Used (watts)	2.429	0.365		
	Back		Bave Save	Total Energy Used (watts)	2.794			
				Battery Packs Needed	-			
	Ready			<				>

Figure 8. Setup Page

I. Deployment Settings

- Deployment Length (days): the number of days the deployment will last.
- **Ensemble Interval**: the time interval (in seconds) between data ensembles. It's in the format of *HH:mm:ss.hh*.
- Groups Per Ensemble: the number of subsystem groups in one ensemble.
- **Pinging Scheme**: how the pings will be organized either using Uniform Group Pinging or using Burst Group Pinging.
- **Recording Data**: to record data in the format of Ensemble, Ensemble and Single Ping, or No Recording.
- **Baud Rate**: choose the serial port baud rate for outputting data from ADCP to user PC. This value will be used to compute the data output time.
- **Start Time**: the first ping time, i.e., the time to start pinging. You can click the **Now** button to use current computer time.

II. Instrument

This part shows instrument subsystem frequencies of the selected instrument and the acoustic power that is associated with each frequency. The frequency cannot be changed, it is for display purpose only. There are five options for the acoustic power for each frequency: "High", "Medium 1-3" and "Low".

III. Water Current Profile

This is the place to setup parameters for water current profile pings including bandwidth, bin number, bin size, maximum velocity, number of pings per subsystem, and to on/off range tracking. For each subsystem, the user can choose to turn on and off the water current profile ping by checking/unchecking the ON/OFF checkbox on top of each frequency.

- Water Profile **ON/OFF**: to turn ON / OFF water current profile ping for each frequency. In the column of each frequency's setup, if the ON/OFF checkbox is checked, the water profile ping for that frequency is turned on, and all the water profile ping parameters in that frequency's column will be enabled, otherwise, all the water profile ping parameters for that frequency will be disabled.
- **Bandwidth**: the bandwidth of water profile ping. There are six options of the bandwidth:
 - Broadband 1 (BB1): 50 % of the frequency
 - Broadband 2 (BB2): 25 % of the frequency
 - Broadband 3 (BB3): 12.5 % of the frequency
 - Broadband 4 (BB4): 6.25 % of the frequency
 - Broadband 5 (BB5): 3.125 % of the frequency
 - Narrowband (NB): 6.125 % of the frequency
- **Number of Cells**: the number of cells.
- **Depth Cell Size** (**m**): the vertical size of individual cells in the profile, in meters. A larger cell size transmits more energy for a given power level.

- **Maximum Velocity (m/s)**: the maximum current velocity (5.0 m/s by default) can be measured in the profile.
- **Pings Per Subsystem**: number of pings in each subsystem to be averaged together in the ensemble before output.
- **Range Tracking**: water profile range tracking.
 - Off: turn water profile range tracking off.
 - On: turn water profile range tracking on, set the first bin and last bin that are used to look between for a valid amplitude target. Search window is between First Bin and Last Bin.

IV. Bottom Track

To setup the bottom track ping parameters for each frequency.

- **Bottom Track**: to set up bottom track mode for that frequency
 - On: bottom track is ON
 - Off: bottom track is OFF
 - Auto: the system will automatically switch between ON and OFF depending on the measurements and the physical environment of the bottom.
- **Bottom Track Max Depth (m)**: set the maximum depth in meters to search for the bottom. Set up appropriate of this value will reduce the amount of time in the search algorithm.

V. Output Data

To choose what kind of data the user wants to include in the data ensemble that will be outputted by ADCP. In the RTI binary format, these data types will be stored in the specific part of the RTI data ensemble identified by its unique 7 digits ID in the format of E0000XX. Usually the default setup is good unless you want to have a smaller size of the data ensemble to save the recorder space.

- 1) Water current profile data
 - Beam velocity (E000001)
 - Instrument velocity (E000002)
 - Earth velocity (E00003)
 - Amplitude (E000004)
 - Correlation (E000005)
 - Beam velocity good ping (E000006)
 - Earth velocity good ping (E000007)
 - Range tracking (E000015)

- 2) Bottom track data
 - Bottom track (E000010)
- 3) System settings and ancillary information of ensemble
 - Ensemble (E000008)
 - Ancillary (E000009)
 - System setup (E000014)
 - NMEA (E000011)
- 4) Engineering data
 - Profile engineering (E000012)
 - Bottom track engineering (E000013)

9.2 Predicted Performance

The Summary section of Planning reflects the current user settings for a deployment and the predicted performance of the deployment based on the settings. Any changes of the instrument and parameter values in the planning will result in the refresh of the Summary contents. It's recommended that you to keep checking the performance results during planning, to make sure the configuration of the ADCP better serves your goal of deployment.

The following content items are for water current profile pings.

- Estimated Range (*m*): the default profiling range for each frequency based on typical setup (bandwidth, acoustic, bin size and bin number).
- Configured Range (m): the user configured range for each frequency, equals to bin size times number of bins.
- Vel. Precision Single Ping (*m/s*): velocity standard deviation of single ping
- Vel. Precision Ensemble (*m/s*): velocity standard deviation of ensemble
- Number of Ensembles (total): the total ensemble that will be collected during the deployment
- Ensemble Data Recorded (*MB*): the recorded ensembles in MB on the SD card. This is the space that will be needed to save the recorded ensembles on the ADCP SD card.
- Single Ping Data Recorded (*MB*): the single ping data recorded (MB) on the SD card
- Total Data Recorded (*MB*): the total data recorded (MB) on the SD card including ensemble data and single ping data
- **Battery Energy Used** (*watts*): the batter energy in watts will be used for the entire deployment if battery is the only power supply.

- **Total Energy Used** (*watts*): the total energy in watts will be used for fulfilling the length of the deployment. This includes electric energy and acoustic energy that will be used during the deployment.
- **Data Recorder Percent Used** (%): the percentage of space that will be used by the collected data on the SD card
- **Battery Packs Needed**: how many battery packs are needed for the deployment if battery is the only supply.

9.3 Button functions

There are three button functions the user can use in planning of the deployment:

- **Read ADCP Config**: if your computer has connected to an ADCP vis a serial port, this button can be used to check the ADCP information and settings. When clicked the button, the software will first try to connect to the ADCP by checking all available serial ports and baud rates, if successfully connected to the ADCP through a serial port, the program will read ADCP information such as serial number, firmware version, system frequency and transducer type along with the settings of ADCP and display them in the Summary.
- Load Config: Load an existing deployment configuration from a file saved on PC and display the settings in all the three pages of Planning.
- **Save Config**: save the current settings to a file.

10. Deploy

The procedure of deploying an instrument. The Deploy function needs the ADCP to be connected to the PC. Click "Connect" icon to connect to ADCP by selecting correct serial port and baud

rate (Figure 2). After connected to ADCP, the "Deploy" button icon will be enabled. Click it to open Deployment page (Figure 9).

🥗 RTI Direct Reading						_		×
File Instrument Plan	nning Deployment Data	Help						
Connect Terminal	Plan Deploy	View Download	Playback Comms					
	Deployment Page		Instrument					^
		a	SN FW					
Start Time 2	2020/01/14,08:50:17 🚖 Now	Change	ADCP					
	ocal 🔿 TimeZone	SET TIME	Deployment					
	~	ADCP Clock	Deployment Length (days)					
Location			Ensemble Interval (s)					~
Lat	Lon	SET	ê				2	>
Mounted O Look	king Up 🔿 Looking Down			SBeams 1	SBeams 2	VBeam 1	VBe	ea 🔨
0 200.0			Settings					
Check ADCP Setting		A	Frequency (kHz)					
Final Check			Acoustic Power Number of Beams					
			PA Vertical Beam					
Zero Pressure Sensor			Bandwidth					
Format SD Card			Water Profile					
Select Configuration			Number of Cells					
			Conth Call Size (m))	•
Edit Configuration				SBeams 1	SBeams 2	VBeam 1	VBe	ea ^
Send to ADCP		~	Performance					
			Estimated Range (m)					
Upload File	Start Stop	Record Data	Configured Range (m)					
opidad Tile	Statt	Record Data	Vel. Precision Single Ping (m/s) Vel. Precision Ensemble (m/s)					
			Number of Ensembles (total)					
		Home	Ensemble Data Recorded (MB)					~
		b	<				3	*
Connected [COM14 : 9216	5001			.:				

Figure 9. Deployment Page

• Set **Start Time** of pinging, i.e. the first ping time. By default, it will show the user's computer clock time when the Deployment page is open. Adjust the time to the desired deployment start time. Click "**Now**" button will set the time to the current computer time. After set or changed the start time, click "Change" button to set the start time on ADCP.



• Set Time: to set ADCP clock. The user can set the ADCP clock to UTC time, Local time or any Time Zone time choosing from the dropdown menu. After selected, click "SET TIME" button to set the clock on ADCP. The result will be shown in the message box underneath (Figure 10). The "ADCP Clock" button allows the user to check what the current clock time on ADCP. This will read ADCP time and show it in the message box (Figure 10).

🐡 RTI Direct Reading						- 1	- ×
File Instrument Planning Deployment Data	Help						
Connect Terminal Plan Deploy	View Download		Playback Comms				
Deployment Page			Instrument				^
Start Time 2020/01/14.08:57:42 🔃 No	w Change		SN FW				
<u> </u>			ADCP				
UTC UCal TimeZone	SET TIME		Deployment				
(ADCP Clock		Deployment Length (days)				
Location Lat Lon	SET		Ensemble Interval (s)				~
Mounted	JEI	-	C III		1	1	>
C Looking Up C Looking Dow	n			SBeams 1	SBeams 2	VBeam 1	VBea ^
			Settings				
Check ADCP Setting STIME+		\sim	Frequency (kHz) Acoustic Power				
2020/01/14 09:42:38.18 Final Check STIME 2020/01/14,17:42:55+			Number of Beams				
Zero Pressure Sensor			PA Vertical Beam				
			Bandwidth				
Format SD Card			Water Profile				
Select Configuration			Number of Cells				~
Edit Configuration			<				>
				SBeams 1	SBeams 2	VBeam 1	VBea ^
Send to ADCP		\sim	Performance				
			Estimated Range (m) Configured Range (m)				
Upload File Start Stop	Record Data		Vel. Precision Single Ping (m/s)				
			Vel. Precision Ensemble (m/s)				
			Number of Ensembles (total)				
	Home		Ensemble Data Recorded (MB)				>
Connected [COM14:921600]		D		:			,

Figure 10. Deploy Message Box

In the message box, it first shows ADCP time as a result of clicking "ADCP Clock" button, it then shows the result of clicking the "SET TIME" button which sets ADCP clock to UTC time.

- Location: set the latitude (-90 ~ 90 degree) and longitude (-180 ~ 180 degree) of the deployment location.
- Mounted: the orientation of how the instrument mounted.
- Check ADCP Setting: this is the same as in the Planning, it will read ADCP information and settings and show them in the summary column (Figure 11).

🖘 RTI Direct Reading	- 🗆 ×
File Instrument Planning Deployment Data Help	
Connect Terminal Plan Deploy View Download	Playback Comms
Deployment Page Start Time 2020/01/14.09:50:57 Now Change	Instrument ^ SN 07DB00000000000000000000000000000000000
O UTC ● Local O TimeZone SET TIME (UTC-12:00) International Date Line West ✓ ADCP Clock Location Lot SET	Deployment Deployment Length (days) 1 Ensemble Interval (s) 0.5
Mounted O Looking Up O Looking Down	SBeams 1 SBeams 2 VBeam 1 VBea Settings Frequency (kHz) 300 1200
Check ADCP Setting Checking ADCP SettingsDone!	Acoustic Power High Number of Beams 4 4 PA Vertical Beam
Format SD Card Select Configuration	Bandwidth BB2 (25%) Water Profile On Off Number of Cells 30
Edit Configuration	< >> >>
Send to ADCP	Performance
Upload File Start Stop Record Data	Estimated Range (m) 100 Configured Range (m) 60 Vel. Precision Single Ping (m/s)
Home b Connected (COM14:921600)	Ensemble Data Recorded (MB)

Figure 11. Deploy – Check ADCP Setting

- **Final Check**: before any deployment, it is strongly recommended to undergo a diagnostic test to ensure that the various components are working as intended. This will check ADCP information, pressure sensor, temperature sensor, compass, international recorder, beam check, transmitter and receiver test, sample pinging test etc. (not implemented)
- Zero Pressure Sensor: this will first check if the pressure sensor is installed in the instrument, if it is installed, it will set the pressure value to ZERO. Otherwise, it will show "Sensor NOT installed" in the message box.

Check ADCP Setting	Sensor NOT installed	^
Final Check		
Zero Pressure Sensor		
Format SD Card		
Select Configuration		
Edit Configuration		
Send to ADCP		V

• Format SD Card: this will delete all the data files stored on the SD card of the ADCP to make spaces for the new deployment. There will be a warning message to ask the user if she/he really want to do this. Make sure you downloaded all the data files from the ADCP to your PC before clicking the "Yes" button to avoid losing your data. And be patient to wait until it finished formatting the card.

Warning		×
Are	you sure that you want to Format SD Card?	
	Yes No	
DCP Setting	DSFORMAT+	^
I Check	0:SysConf.bin	
ssure Sensor	SD card Format Started	
t SD Card	Total Space: 31.166976000 GB SD card Format Finished	
onfiguration	Restore System Files 0:SysConf.bin	
nfiguration	0:help.txt	
to ADCP		
	Are DCP Setting I Check ssure Sensor t SD Card onfiguration	Are you sure that you want to Format SD Card? Yes No Ves No DCP Setting DSFORMAT+ Backup System Files 0:SysConf bin Ohelp bt SD card Format Started SD card SD card Format Started Total Space: 31.166976000 GB SD card Format Finished Restore System Files 0:SysConf bin Ohelp.bt

• Select Configuration: select a deployment configuration from an existing configuration file on the computer. The Configuration file is in JSON format. After loading the configuration file, the configurations will be shown in the summary column on the right (Figure 12).

🖘 RTI Direct Reading				- [⊐ ×
File Instrument Planning Deployment Data Help					English
Connect Terminal Plan Deploy View Download	Playback Comms	A Language			
Deployment Page	Instrument				^
	SN FW	07DBP0000000	0000LLL0A0000	000000	
	ADCP	300/1200 kHz 20	deg. Piston Lar	ge, V 300 kH	Ηz
UTC O Local O TimeZone SET TIME	Deployment				
ADCP Clock	Deployment Length (days)	2			
Location Lat Lon SET	Ensemble Interval (s)	1.06			~
Mounted	<				>
C Looking Up C Looking Down		SBeams 1	SBeams 2	VBeam 1	VBea ^
	Settings Frequency (kHz)	300	1200	300	
Check ADCP Setting	Number of Beams	4	4	1	
Final Check	Acoustic Power	High	Medium 1	High	
Zero Pressure Sensor	PA Vertical Beam			No	
Format SD Card	Bandwidth Number of Cells		BB2 (25%) 26	BB1 (50% 36	.)
	Depth Cell Size (m)		1	4	
Select Configuration	Mavimum Valocitu (m./e)		5.0	5.0	× *
Edit Configuration		SBeams 1	SBeams 2	VBeam 1	VBea ^
Send to ADCP	V Performance	obcano	obcano 2	v beam v	1000
	Estimated Range (m)		20	125	
	Configured Range (m)		26	144	
Upload Commands Start Stop Record Data	vol. i roololori olingio i ling (i		0.080		
	Vel. Precision Ensemble (m/ Number of Ensembles (total		0.080		
Home	Ensemble Data Recorded (548.64	289.79	~
	b <				>
C:\Users\rma\Documents\RTI\Direct Reading\Config\ADCPConfig.json		.1			

Figure 12. Select Configuration

• Edit Configuration: this will allow the user to make changes of the configuration, click the "Edit Configuration" button will direct the user to the **Planning** window (Figure 13) Setup page with the selected configuration. After edition, the user can save the edited configuration to the same file or save it to a new file. After edition, the user needs to go back to the Deploy page to load the edited configuration to the deploy page.

🖘 C:\Users\rma\Docu	uments\RTI\Direct Reading\Co	onfig\ADCPConfig.j	son							-	o x
1. Instrument	. ?		Setup	,	alid Setup			Summary			
2. Sensors	I. Deployment Settings			```			Instrument				^
	Deployment Length (days)		2 ÷ Rec	cording Data	Ensemble	\sim	SN	07DBP0000000	0000LLL0A000	0000000	
3. Setup	Ensemble Interval (HH:mm:ss	.hh) 00:00:01 🚖	. 6 🜩 🛛 🗛	ud Rate	921600	1	FW				
	Groups Per Ensemble		1.4	aumato	2020/01/30,12:05:10		ADCP	300/1200 kHz 2) deg. Piston La	nge, V 300 k Hz	
4. Installation	Pinging Scheme	Uniform	Sta			ow	Deployment				
	ringing Scheme	Childhi	•		Autostart	ow	Deployment Length (days)	2			
	DBP0	Slanted Beams	Slanted Beams	Vertical Be	am			1.06			
	II. Instrument	300	1200	300				1			
	Frequency (kHz)	High ~	Medium 1 V	High			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.04			
Read ADCP Config	Acoustic Power	- ingir		riigii			Battery Capacity	None			
	- III. Water Current Profile	ON/OFF	ON/OFF	ON/OFF				32 GB			~
Load Config	Bandwidth	BB1 (50%)	BB2 (25%)	BB1 (50%)	~		<	00 4		100 4	>
	Number of Cells	1	26 \$		\$			SBeams 1	SBeams 2	VBeam 1	VBean ^
Save Config	Depth Cell Size (m)	0.0 👙	1.0 0)÷		Settings				
							Frequency (kHz)	300	1200	300	
	Maximum Velocity (m/s)	2.0 ≑	5.0 🜩				Number of Beams Acoustic Power	4	4	1	
	Pings Per Subsystem	1 🜲	1		1+		PA Vertical Beam	High	Medium 1	High No	
	Range Tracking	Off ~	On ~	Off	~		Bandwidth		BB2 (25%)	BB1 (50%)	_
			First Bin 4 🜩				Number of Cells		26	36	
			Last Bin 12 🌩				Depth Cell Size (m)		1	4	
	IV. Bottom Track						Maximum Velocity (m/s)		5.0	5.0	
	Bottom Track	Off ~	Off 🗸	On	~		Pings per Subsystem		1	1	~
	Bottom Track MaxDepth (m)	0.0 🜩	0.0 ≑	300	0\$		<				>
								SBeams 1	SBeams 2	VBeam 1	VBean ^
	V. Output Data						Performance				
	SubSystem A SubSystem B : Water Profile	SubSystem C					Estimated Range (m)		20	125	
		Amplitude	Ensemi	ble	NMEA		Configured Range (m)		26	144	
		Correlation	Ancillar	У	Profile Engineering		Vel. Precision Single Ping (m/s)	0.080		
		Range Tracking	System	Settings			Vel. Precision Ensemble (m/s)		0.080		
	Beam Vel. Good Ping	Earth Vel. Good Ping	Bottom	Track			Number of Ensembles (total)	326038	540.04	200 70	
							Ensemble Data Recorded (MB Single Ping Data Recorded (M	·	548.64	289.79	
							Total Data Recorded (MB)	838.43			
							Data Recorder Percent Used (
							Battery Energy Used (watts)		5.099	18.829	
	— Back			E	Save		Total Energy Used (watts)	23.928			
							Battery Packs Needed	-			~
	Ready						<				>

Figure 13. Edit Configuration in Planning window

• Send to ADCP: when the user is satisfied with the configuration showing on the Deployment page, the user can click "Send to ADCP" button to send the configuration / commands to ADCP. The Message Box will tells if it is successfully sent to ADCP (Figure 14) or an error message if it failed.

Final Check	Commands sent to ADCP!	^
Zero Pressure Sensor		
Format SD Card		
Select Configuration		
Edit Configuration		
Send to ADCP		Ŷ

Figure 14. Configuration was sent to ADCP

• Start: click the Start button to start pinging / deployment. If the "Start Time" hasn't arrive, ADCP will in sleep mode and it will show how much time left in the format of ddd hh:mm:ss as shown in Figure 15.

Final Check	Configuration written to NAND START+	^
Zero Pressure Sensor	ddd hh:mm:ss	
Format SD Card	Sleep 029 23:53:10	
Select Configuration		
Edit Configuration		
Send to ADCP		4

Figure 15. System started but in sleep mode

The ADCP will immediately start pining if the scheduled Start Time is current or in the past, the user will see the outputting data in the message box (Figure 16). Now, the user can click the "View" icon for to open the Display window to see the live data display (Figure 17). Keep the "Deployment Page" open if it is pinging to keep receiving data from ADCP. The user can switch to Terminal window also when ADCP is pinging in order to continue receiving data.

👄 RTI Direct Reading								- [<
File Instrument P	lanning Deployment Data	Help								
Connect Terminal		View Download	1	Playback Comms						
	Deployment Page 2020/01/14,09:50:57 Image Local TimeZone	Change SET TIME		Instrument SN FW ADCP Deployment	00.0	07.24 Nov 6 2	0000SS00B000 2019 08:16:31 deg. Piston Sm			^
Location Lat	TC-12:00) International Date Line West v	ADCP Clock		Deployment Length (days) Ensemble Interval (s)	1 0.5				>	~
Mounted O Lo Check ADCP Setting		???B???	^	Settings Frequency (kHz)		SBeams 1 300	SBeams 2	VBeam 1	VBea	^
Final Check	= B7?7B7?7B			Acoustic Power Number of Beams PA Vertical Beam		High 4	4			Ì
Format SD Card Select Configuration		f&?D??A'???u>::?		Bandwidth Water Profile Number of Cells		BB2 (25%) On 30	Off			~
Edit Configuration	_ mT????????????????????????????????????	?G:??H::?@::? ???u>::?	J	Nenth Cell Size (m) «		SBeams 1	SBeams 2	VBeam 1	> VBea	^
Send to ADCP	B::::::::::??:????????????:::+Ar? +AJBIA?vIANIAIXIA?IIA??+AjvIA]?IA		~	Performance Estimated Range (m)		100	obcana z	v bodin 1	VDC	
Upload File	Start	Record Dat	а	Configured Range (m) Configured Range (m) Vel. Precision Single Ping (m. Vel. Precision Ensemble (m/s Number of Ensembles (total)		60				
Connected [COM14:92	16001	Home	b	Ensemble Data Recorded (M	1B)	,			>	۷
connected [COM14:92	1000]									

Figure 16. System started pinging

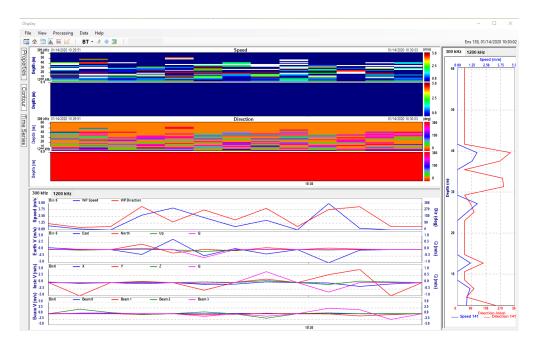


Figure 17. Live data

• **Stop:** to stop ping (Figure 18).

🖘 RTI Direct Reading					_	0 X
File Instrument Pl	anning Deployment Data Help					
Connect Terminal	Plan Deploy View Download	Playback Comms				
	Deployment Page 2020/01/14,09:50:57 + Now Change Local O TimeZone SET TIME	FW C)7DB000000000)0.07.24 Nov 6 2 300/1200 kHz 20	019 08:16:31		^
Location Lat	C-12:00) International Date Line West V ADCP Clock Lon SET	Deployment Length (days) 1).5			>
Mounted O Loo	oking Up O Looking Down	Settings	SBeams 1	SBeams 2	VBeam 1	VBea ^
Check ADCP Setting	, Copyright (c) 2018 Rowe Technologies Inc. All rights	Frequency (kHz) Acoustic Power	300 High	1200		
Final Check	reserved. Direct Reading DP300 DP1200	Number of Beams PA Vertical Beam	4	4		
Zero Pressure Sensor Format SD Card	SN: 07DB000000000000SS00B0000888888 FW: 00.07.24 Nov 6 2019 08:16:31	Bandwidth Water Profile	BB2 (25%) On	Off		
Select Configuration	STOP+	Number of Cells	30	-		~
Edit Configuration		<	SBeams 1	SBeams 2	VBeam 1	> VBea ^
Send to ADCP		Performance				
Upload File	Stop Record Data	Estimated Range (m) Configured Range (m) Vel. Precision Single Ping (m/s) Vel. Precision Ensemble (m/s)	100 60			
	Home	Number of Ensembles (total) Ensemble Data Recorded (MB)				>
Connected [COM14:92]	1600]					

Figure 18. Stop pinging

• **Record Data**: to save data to PC when ADCP is pinging (Figure 19). Data will be saved in the "\Documents\RTI\Direct Reading\Data" folder. Click it again to stop recording.

🐡 RTI Direct Reading				-		×
File Instrument Planning Deployment Data Help						
💉 🔚 🎄 🏦 🛃						
Connect Terminal Plan Deploy View Download	Playback Comms					•
Deployment Page		7DB000000000	000550080000	888888		
Start Time 2020/01/14.09:50:57 🔄 Now Change		0.07.24 Nov 62				
O UTC Local O TimeZone SET TIME		300/1200 kHz 20	deg. Piston Sm	all		
(UTC-12:00) International Date Line West V	Deployment					
Location						
Lat Lon SET).5				\checkmark
Mounted	2					>
C Looking Up C Looking Down		SBeams 1	SBeams 2	VBeam	1	VBea ^
	Settings					
Check ADCP Setting @::?@::?@?????????????????????????????	Frequency (kHz)	300	1200			
B:::::::::???????????:::??A3 I?D? D:IRT????????????????????????????????????	Acoustic Power Number of Beams	High 4	4			
??G:??H:?@:?	PA Vertical Beam	-	-			
Zero Pressure Sensor A::IA::?A??????????@::?@::?@::??u>::? B::::::::???????????::B:::::::f&?D::F::?	Bandwidth	BB2 (25%)				
Format SD Card @??	Water Profile	On	Off			
Select Configuration	Number of Cells	30				
Select Configuration B	Nenth Cell Size (m)	2				> [×]
Edit Configuration ::::::::::::::::::::::::::::::::::::		SBeams 1	SBeams 2	VBeam	1	VBea ^
Send to ADCP	Performance	obcanis	obcuma z	VBCam	·	VDCu
	Estimated Range (m)	100				
	Configured Range (m)	60				
Upload File Start Stop Stop Recording	Vel. Precision Single Ping (m/s)					
	Vel. Precision Ensemble (m/s)					
	Number of Ensembles (total)					
Home	Ensemble Data Recorded (MB)					×
Connected [COM14:921600]	<					>

Figure 19. Recording data on PC

- Upload Commands: to upload command file to ADCP. this is for experts only.
- Home: go back to the program Home page.

11. Download

To download data from ADCP. The icon will be enabled if it is connected to ADCP, click it will direct the user to the **Download** page (Figure 20).

🖘 RTI Direct Reading	- 0	×
File Instrument Planning Deployment Data Help		
Connect Terminal Plan Deploy View	Download Playback Comms	
	Select All	
	Refresh File Name Date Time Size (MB) A0000001.ens 2020/01/14 10:31:26 2.877 A0000002.ens 2020/01/14 10:37:20 3.784	<
Download Progress	CancelS	
	DownloadS	~
	Total Space 31166.976 MB Used Space 6.713 MB	
	: Download Dir C:\Users\ma\Documents\RTI Brow	vse
	sec retries % tries bps bytes	
Connected [COM14:921600]		

Figure 20. Download page

The user can choose the files to download by checking the boxes in front of the file name or select all the files to download. The "Download Progress" box will show the downloading progress (Figure 21).

∞ RTI Direct Readin	g							_		×
File Instrument	Planning	Deployment	Data Help							
Connect Termin	nal Pla	n Deploy	View	Download	Playback	Comms				
				R	lefresh	☐ File Name ☑ A000001 ☑ A0000002	.ens 2020/01/14 10)	^
Download Progre	:55			С	ancelS					
				Do	wnloadS					~
Total Downloads			0/2			Total Space	31166.976 MB	Used Space	6.713 MB	
A0000001.ens			77% Complete	:		Download D	ir C:\Users\rma\Docu	ments\RTI		Browse
A0000001.ens C					77.1	sec ret % trie ops byt		Но	ome	
Connected [COM14	: 921600]									

Figure 21. Downloading

12. Playback

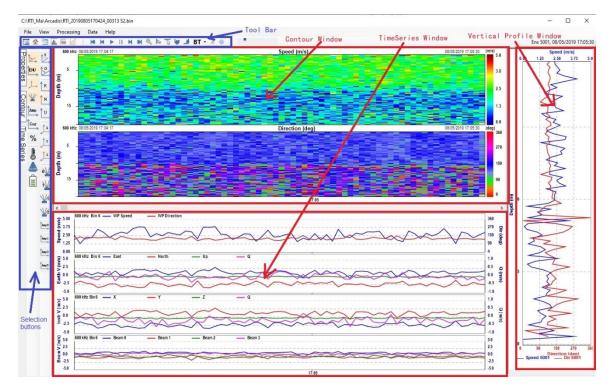
Playback is designed for displaying and post-processing the data from a file.

12.1 Main page

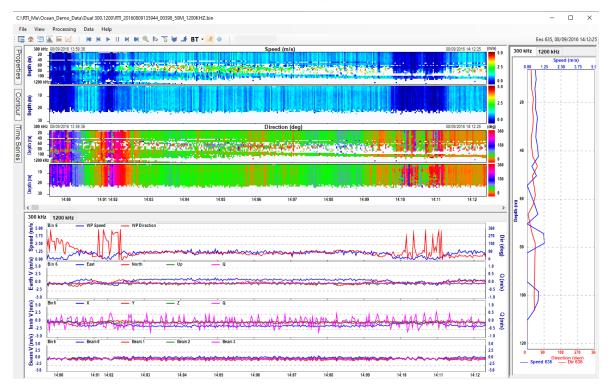
The **Display** user interface can be started by clicking the **Playback** icon from tool bar or by choosing **Data** > **Playback** from the main menu on the top of the home page. After loading the selected data file to the program, the Display window will show up (Figure 22). The user can open more than one **Display** window for loading different data files to view or compare at

the same time. Just click the **Playback** $\stackrel{[a]{}}{\overset{[a]{}}}{\overset{[a]{}}{\overset{[a]{}}}{\overset{[a]{}}{\overset{[a]{}}}{\overset{[a]{}}{\overset{[a]{}}{\overset{[a]{}}{\overset{[a]{}}}{\overset{[a]{}}{\overset{[a]{}}}{\overset{[a]{}}}{\overset{[a]{}}}{\overset{[a]{}}}{\overset{[a]{}}}}}}}}}}}}}}}}}}}}}}}}} }$

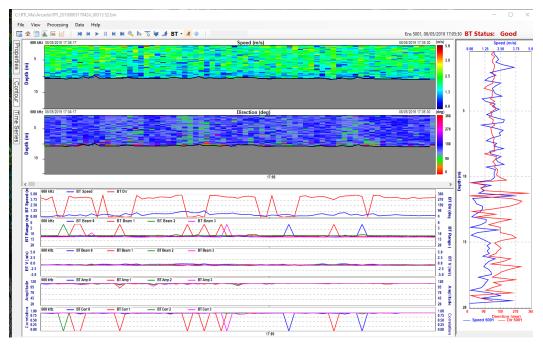
There are five main parts of the display window: the Tool Bar on the top of the window, the Selection Buttons on the left side of the window, and the three plotting areas are in the middle and right. The three plotting areas are Contour Plotting Area, TimeSeries Plotting Area, and the Vertical Profile Plotting Area as shown in Figure 22 (a). For dual frequencies, the two frequencies are both shown in the Display as shown in Figure 22 (b). When BT is turned ON, the boat speed and velocity will be subtracted from the raw data, and the TimeSeries window will be bottom track data plots such as boat speed and direction, BT range, BT velocity (Beam/Earth/Instrument), Amplitude, Correlation etc. Figure 22 (c).



a) Single frequency



b) dual frequency



c) BT is ON

Figure 22. Display user interface

• Tool bar: contains buttons 🖾 🏠 🔝 📠 🖻 🔟 to switch between pages including the Home page 🏝, plain text Data page 🛄, Contour page 🖾, Timeseries plot 🏁 page and Vertical profile display page 🗹. The Open file 🖾 button allows user to open a different data file.

:\RTI_Ma\Arcadis\F	RTI_20190805170424_003	13 S2.bin																-		
File View Pro	ocessing Data Help																			
i 🕿 🛅 🚠 🖻	ē 🗹 🕴 🕷 🕨 🕨	II M M 🤇	🖉 🗠 🖉 I	🖉 🍠 BT	• 🦧 🌞 📋									E	ns 4931, 08/	05/2019 17:	04:17 BT	Status:	Good	L
IO kHz 🗸 Se	tup								Curren	t Profile										
Ens#	4931 🔨		Rang	e																
	5/2019 17:04:17	Beam 0	Beam 1	Beam 2 10.14	Beam 3	Bin #	Depth (m)	Speed (m/s)	Direction (deg)	~ E	N	U	Q	Amp B0	Amp B1	Amp B2	Amp B3	Corr B0	Corr B1	
Svs.Status	Good Status	Beam Velocity			1	0.47	3.146	134.26	2.253	-2.196	-0.557	0.207	85.5	82.2	81.3	87.3	0.81	0.69		
SN	00313					2	0.67	3.309	94.31	3.300	-0.249	-0.704	0.002	89.0	89.4	95.1	97.9	0.47	0.54	1
FW	0263	Beam 0	Beam 1	Beam 2	Beam 3	3	0.87	2.434	153.17	1.099	-2.172	-0.042	0.143	106.5	105.3	107.6	109.8	0.61	0.61	
	600 kHz 4 beam	0.13	0.01	-0.04	0.10	4	1.07	2.530	174.04	0.263	-2.517	-0.130	-0.117	112.1	109.9	110.5	111.7	0.52	0.64	
	< >	Instrument Velocity			5	1.27	2.139	158.25	0.793	-1.987	-0.102	-0.032	112.0	108.0	110.1	113.8	0.64	0.65		
		X	Y	Z	Q	6	1.47	2.361	143.16	1.415	-1.889	-0.122	0.163	112.3	109.9	112.8	112.8	0.67	0.69	
	Down	0.17	-0.20	0.05	0.02	7	1.67	2.804	142.86	1.693	-2.235	0.001	0.090	113.3	108.1	111.9	111.8	0.73	0.59	
# of Beams	4	Earth Velocity			8	1.87	1.803	162.51	0.542	-1.720	0.131	0.021	112.1	108.4	112.2	110.2	0.54	0.60		
# of Bins	100	East	North	Up	Error	9	2.07	2.407	154.42	1.039	-2.171	0.135	0.027	111.7	108.8	110.9	108.8	0.56	0.59	
	0.2	-0.21	0.18	-0.03	0.02	10	2.27	2.443	157.30	0.943	-2.254	-0.200	0.015	111.0	109.2	110.3	110.7 112.2	0.51	0.56	
	0.47	SNR				12	2.47	3.308	171.25	0.503	-3.269	-0.069	-0.002	111.0	110.0	110.1	111.4	0.59	0.70	
	5166.36	Beam 0	Beam 1	Beam 2	Beam 3	13	2.07	2.582	167.20	0.572	-2.517	-0.050	-0.002	110.2	108.9	110.5	110.1	0.33	0.72	
	5166.96	41.28	40.36	40.97	44.26	14	3.07	2.331	126.87	1.865	-1.398	-0.003	-0.199	110.2	109.4	110.6	108.9	0.60	0.71	
D Pings	4	41.20	Ampl			15	3.27	2.226	189.30	-0.360	-2.197	-0.064	0.026	108.4	107.1	109.1	107.9	0.61	0.68	
A Pings	4		· · ·			16	3.47	1.530	151.73	0.725	-1.347	0.088	0.189	108.4	106.7	108.9	107.5	0.69	0.63	
		Beam 0	Beam 1	Beam 2	Beam 3	17	3.67	2.169	162.09	0.667	-2.064	0.080	-0.127	107.9	106.2	107.2	106.0	0.57	0.67	
eed Of Sou	1505 15	117.80			18	3.87	1.947	164.86	0.508	-1.879	-0.157	0.183	107.3	105.8	108.0	105.0	0.70	0.65		
Salinity (ppt)	0	Correlation			19	4.07	2.067	182.68	-0.096	-2.064	-0.021	0.017	108.8	107.2	108.5	106.9	0.71	0.72		
ater Temp (28.39	Beam 0	Beam 1	Beam 2	Beam 3	20	4.27	1.617	145.52	0.916	-1.333	-0.065	-0.156	106.3	106.4	105.2	107.0	0.60	0.65	
	37.52	0.98	1.00	1.00	0.99	21	4.47	1.730	163.54	0.490	-1.659	-0.171	-0.002	104.0	106.1	106.6	107.0	0.64	0.66	
stem Temp						22	4.67	1.956	156.36	0.784	-1.792	0.168	-0.249	104.3	105.0	105.9	104.8	0.53	0.66	
str. Depth (m)	0.000					23	4.87	1.707	156.17	0.690	-1.562	0.299	0.014	104.9	106.6	105.4	106.4	0.69	0.62	
ressure (Pa)	0.000					24	5.07	2.113	169.85	0.372	-2.080	0.126	0.119	104.2	106.9	104.7	105.5	0.64	0.59	
						25	5.47	1.650	163.59	0.013	-1.583	0.299	0.274	102.5	106.8	104.2	103.9	0.65	0.60	
						20	5.67	1.396	174.80	0.127	-1.391	0.299	0.166	103.0	106.7	104.0	103.7	0.66	0.60	
leading (deg)	0.000					28	5.87	1.188	200.58	-0.417	-1.112	0.131	-0.119	103.8	107.4	102.7	102.4	0.74	0.74	
	4.708					29	6.07	2.111	172.40	0.279	-2.093	-0.071	0.171	104.7	106.8	104.1	102.8	0.78	0.65	
	-177.950					30	6.27	1.745	164.50	0.466	-1.681	0.027	0.039	104.6	106.4	100.7	101.4	0.79	0.71	
						31	6.47	2.230	150.35	1.103	-1.938	-0.088	-0.008	102.8	103.9	102.5	101.7	0.60	0.60	
						32	6.67	2.340	161.68	0.736	-2.222	0.011	-0.239	100.1	104.4	102.7	101.8	0.43	0.67	
leading (deg)	240.00					33	6.87	1.906	171.95	0.267	-1.887	0.083	0.109	101.0	104.3	102.2	100.2	0.62	0.70	
Latitude	38°41'5.25 N					34	7.07	1.470	178.31	0.043	-1.469	0.250	-0.007	102.1	104.3	102.4	99.4	0.68	0.66	
Longitude						<													_	1

Figure 23. Data Page

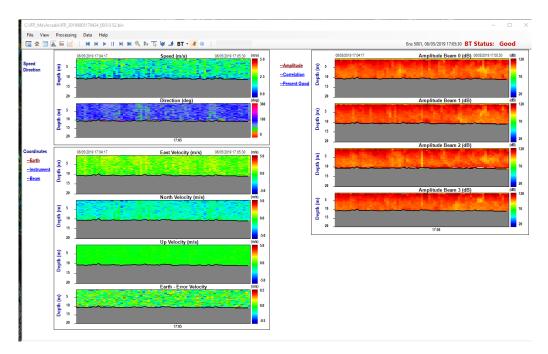


Figure 24. Contour Page

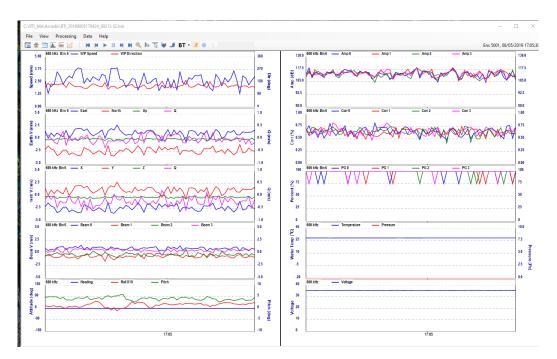


Figure 25. TimeSeries Page

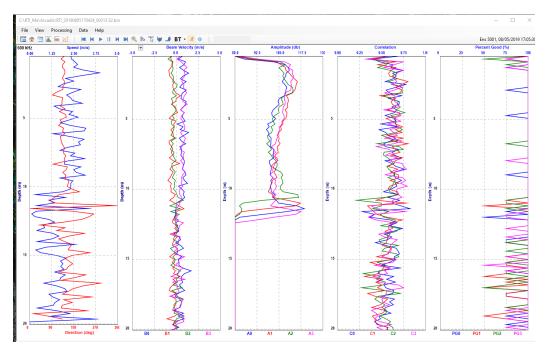


Figure 26. Vertical Profile Page

- Control bar: contains buttons
 Image: Im
 - Zoom In: You can select an area on the contour plot to zoom in that area. To do this, put your mouse on the spot on the contour plot, hold the mouse button and drag the mouse. You will see a rectangle on the contour plot. Hold the mouse key and drag the rectangle to select the area you want to zoom in and release the mouse key. The selected area will be zoomed in and shown in the plot window (Figure 27). Click the magnifier icon store to zoom it out.

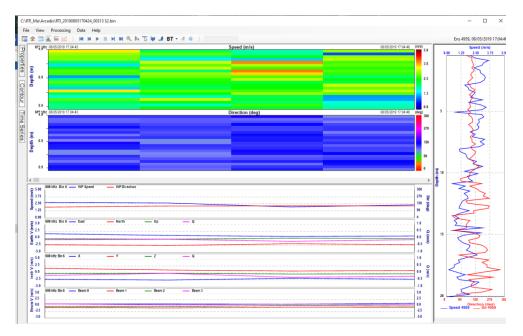


Figure 27. Zoom In

- **Pick Ensemble** : pick ensembles from the contour image. The picked ensembles will be shown on the Vertical Profile Window. Click the button from the tool bar to enable ensemble picker. You will see a white vertical line on the contour image, move the white line to the ensemble on the contour plot then click. That ensemble will be selected, and the profile file of the ensemble will be shown in the Vertical Profile Window on the right (Figure 28). You can select as many ensembles as you can. Click the button to clear the selected ensembles. Unclick the button to disable ensemble picker.

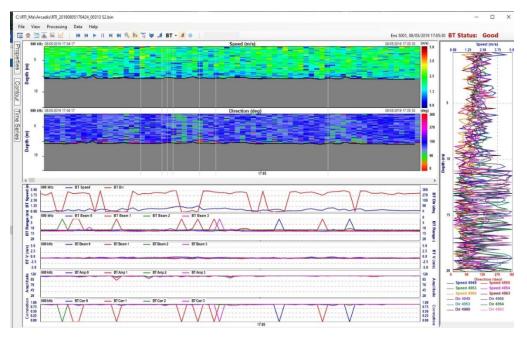


Figure 28. Ensemble Picker

- **Pick TimeSeries** : pick different bins from the contour plot and show timeseries of the picked bins on the TimeSeries plots (Figure 29). You can only select bins from one contour plot. In doing so,

First, click button to enable timeseries picker.

Second, click "Contour" button on the left and select only one item, for example \tilde{v}

Speed , from the contour item buttons.

Third, click "TimeSeries" button on the left to unselect all the item buttons from

the first column, then select the same item (Speed) on the second column. This way, both the Contour Area and the TimeSeries Area of the home page will only show Speed plots.

Fourth, now you will see a white horizontal line on the Speed contour plot. click will select that bin data, the selected bin timeseries plot will be shown in the TimeSereis Plotting Area. Move mouse on the contour to different depth to select more bins. Figure 29 shows the result of the selected bin timeseries plots.

Click dutton on the tool bar to clear the selected timeseries plots. Unclick button to disable TimeSeries Picker.

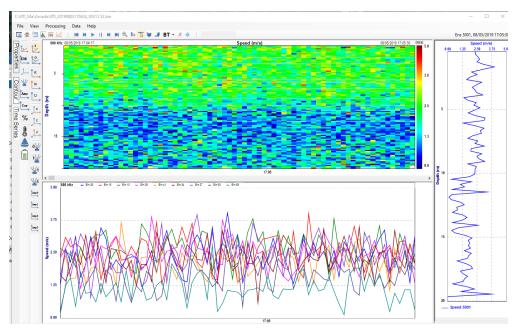


Figure 29. Timeseries Picker

- **Bottom Track Reference** ^{BT}: the reference to calculate boat velocity. It has four options:
 - None: no reference
 - BT: use speed and direction collected by ADCP bottom track data
 - GPS VTG: use the speed and direction measured by external GPS VTG data string.
 - GPS GGA: use the speed and direction measured by external GPS GGA data string.

Water current meter mounted underneath the vessel hull will measure the water speed and direction relative to the vessel, i.e. the vessel speed through water. However, what the navigation crew typically is interested in is the net ocean current speed and direction relative to ground. This is obtained by connecting the vessel Gyro and DGPS and subtract the vessel speed over ground from the peed through water value. What RTI Direct Reading software does, is to collect real-time "raw" current profile data and heading, pitch, roll from ADCP with speed and heading data from external inputs like DGPS/Gyro. The corrected values, or difference between the two, represent the net ocean current relative to ground.

In RTI DR software, when BT is ON, the vessel velocity will be taken off from the ocean current speed and velocity display. The user can also choose what reference (None, BT, GPS VTG, GPS GGA) he/she will use to calculate the vessel velocity.

- Mark Bad Below Bottom⁴: the current data collected by ADCP usually are bad or not valid bellow the bottom depth, so, the user can choose to show or

not show the bad data below bottom line when analyzing the data. This can be done by turning ON and OFF the "Mark Bad Below Bottom" button in the tool bar. It requires the to turn on the BT button first in order to use the "Mark Bad Below

Bottom" button. When *is* ON, it's clear to see the bottom line and the real ocean current data.

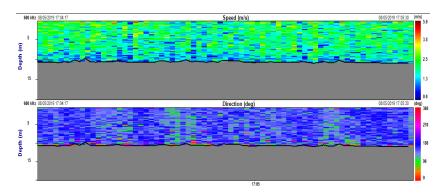


Figure 30. Bottom Track is ON

- **Display Settings** : to set up some parameters for post processing data.
- Left-Side Buttons: there are three buttons on the left-side of the window:
 - **Properties**: show some properties of the data such as ADCP frequency (s), serial number, firmware version, subsystems, datetime, ensemble number, environmental information and ADCP configurations.

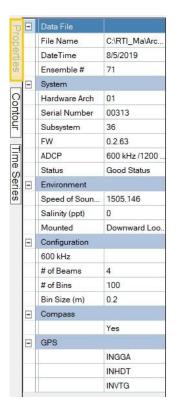


Figure 31. Properties Button

- **Contour**: the button items that the user can choose to be shown in the Contour Plotting Area. i.e. select which contents you want to see in the contour plotting area. Please note, the contents in the vertical profile window will also change if the contour plotting area contents change. The selectable contour items are as follow:
 - o Speed / Direction
 - Coordinates velocity
 - Earth Coord (ENUQ)
 - Instrument Coord (XYZQ)
 - Beam Coord (B0, B1, B2, B3)
 - o Amplitude
 - Correlation
 - Good Ping

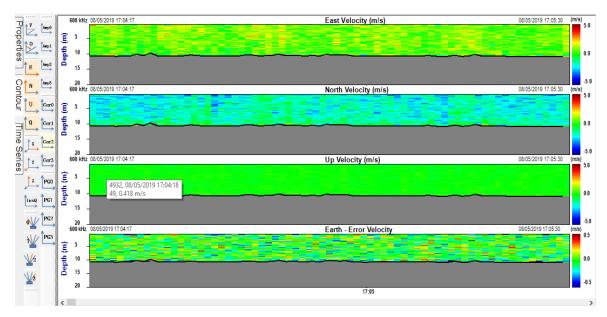


Figure 32. Select items to be shown in the Contour Plotting Window

- **TimeSeries:** select the button items to be plotted in the TimeSeries Window. The contents of this button will be different when BT is ON and OFF, so does the TimeSeries plotting window.
 - BT is OFF: this will show water current profile data (Figure 33). The data contains boat speed and boat velocity.
 - Speed/Dir
 - Velocity (Earth/Instr/Beam)
 - Amplitude
 - Correlation
 - HRP
 - System information such as water temperature and pressure
 - Battery voltage

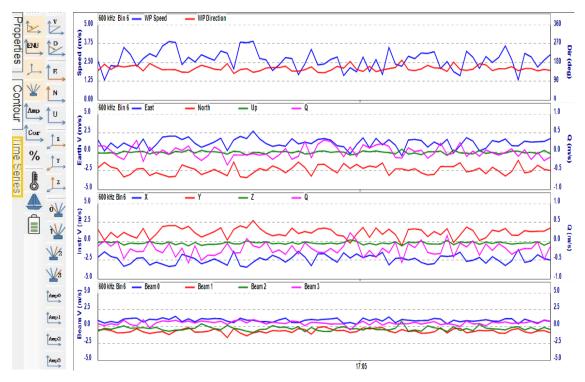


Figure 33. TimeSeries Button when BT is OFF and TimeSeries plots

- BT is ON: this will show the ADCP bottom track data (Figure 34)
 - BT Speed/Dir
 - BT Range
 - BT Velocity (Earth/Instr/Beam)
 - Amplitude
 - Correlation
 - SNR
 - HPR



Figure 34. TimeSeries Button when BT is ON and TimeSeries plots

- **Contour window**: the color-filled plots of data. The default display in Contour window is Speed and Direction but user can choose whatever data he / she wants to view from the extended **Contour** selection buttons on the left side of the **Display** window.
- **Timeseries plot window**: the timeseries plots of data. The default timeseries plots in the Timeseries plot window are Speed and Direction, Earth Velocity, Instrument Velocity and Beam Velocity, similarly, user can choose other data by clicking the buttons in the extended **Timeseries** selection buttons on the left side of the **Display** window. The Timeseries plot window can only display up to four timeseries plots, if it is more than four plots, the oldest plot will be removed from the window. For dual frequency, each frequency has a tabpage in the Timeseries plot window.
- Vertical profile: the vertical profile of data plots. The content of vertical profile display depends on what kind of data you chose in the Contour window. It is only the vertical plot of the same data in the contour window. For dual frequency, each frequency has a tabpage in the Vertical Profile window.
- **Properties button**: Properties button contains the information about the data and the instrument that collected the data (Figure 35).

	Ê	: 🛅 🌆 🔤 🗹	N N >
τ	Ξ	Data File	
Properties		File Name	C:\RTI_Ma\Chil
enti		DateTime	1/28/2017
es		Ensemble #	1218
	Ξ	System	
Contour Time Series		Serial Number	447
렁		Subsystem	4000000000
5		FW	0.2.85
		ADCP	300 kHz
Ξ		Status	Good Status
e S	E	Environment	
er:		Speed of Soun	1483.48
es		Salinity (ppt)	0
		Mounted	Downward Loo
E	Ξ	Configuration	
		# of Beams	4
		# of Bins	85
		Bin Size (m)	1
E	Ξ	Compass	
			Yes
		GPS	

Figure 35. Properties button contents

- **Contour button:** contains the buttons (Figure 36) that for selecting what kind of data will be showing in the Contour window. The plots are organized into the following display groups:
 - Speed and Direction
 - Three coordinate system velocity:
 - Earth coordinates: East, North, Up
 - Instrument coordinates: X, Y, Z
 - Beam coordinates: Beam 0, Beam 1, Beam 2, Beam 3
 - Error velocity
 - Amplitude (4 beams)
 - Correlation (4 beams)
 - Percent Good (4 beams)

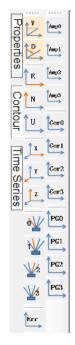


Figure 36. Contour data selection buttons

When you click any of the contour buttons, a popup window (Figure 37) will show up to let you choose the depth or the bin you want to plot.

Bin Number	
1	*
Bin Number	
1	*
	Bin Number

Figure 37. Select Bin window

• **Timeseries button:** contains the buttons (Figure 38) that for selecting what kind of data will be showing in the Timeseries plot window. The default selections include four buttons (as shown in yellow in Figure 38): Speed and direction, ENU (earth) coordinates velocity, XYZ (Instrument) coordinates velocity, and beam coordinates velocity.



Figure 38. Timeseries data selection buttons

The Timeseries buttons are organized into two columns: the left column buttons are the data type you want to plot in the timeseries plot window; the right column buttons are used in conjunction with the **Timeseries Picker** button to select particular data point from the contour plot to be plotting in the timeseries. To use the second column buttons, you first enable **Timeseries Picker** button from the Control bar by clicking it, second, you choose the buttons from the second column of Timeseries, third, use your mouse to click on any spots on the contour plot to select the data point you want to see, the timeseries lines will be shown in the Timeseries Picker button. Figure 39 shows an example of the results. Click the **Clear Timeseries Picker** button to clear the selected timeseries plots.

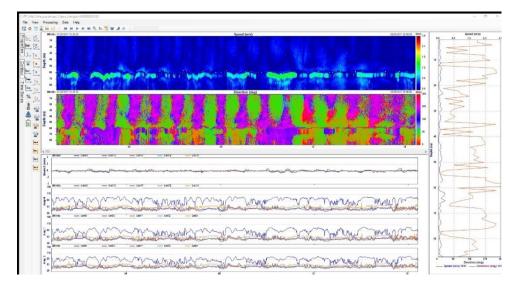


Figure 39. Timeseries picker example

12.2 Data page

Click button from the **Tool bar** menu to switch to **Data Page** (Figure 40). If it's dual frequency or more than one frequency, the dropdown menu on the left top will allow you to switch between different frequencies (Figure 41).

:\RTI_Ma\Arcadis\F	RTI_20190805170424_00	0313 S2.bin																-		
File View Pro	cessing Data He	łp																		
i 🗠 🛅 📠 🖗	<u>ям н м м</u>	н н н	a 🗅 🖓 I	🖉 🌙 ВТ	- 🧶 🔅 📋									E	ns 4931, 08/	05/2019 17:	04:17 BT	Status:	Good	
)kHz ∨ Se	tup		Bottom	Track									Curren	t Profile						
Ens#	4931 🔨		Rang	e		_														
	5/2019 17:04:17	Beam 0	Beam 1	Beam 2	Beam 3	Bin #	Depth (m)	Speed (m/s)	Direction (deg)	~ E	N	U	Q	Amp B0	Amp B1	Amp B2	Amp B3	Corr B0	Corr B1	
Sys.Status	Good Status	10.02	Beam V		11.20	1	0.47	3.146	134.26	2.253	-2.196	-0.557	0.207	85.5	82.2	81.3	87.3	0.81	0.69	Ť
SN	00313					2	0.67	3.309	94.31	3.300	-0.249	-0.704	0.002	89.0	89.4	95.1	97.9	0.47	0.54	1
FW	0 2 63	Beam 0	Beam 1	Beam 2	Beam 3	3	0.87	2.434	153.17	1.099	-2.172	-0.042	0.143	106.5	105.3	107.6	109.8	0.61	0.61	
	600 kHz 4 beam	0.13	0.01	-0.04	0.10	4	1.07	2.530	174.04	0.263	-2.517	-0.130	-0.117	112.1	109.9	110.5	111.7	0.52	0.64	
	< >		Instrume	nt Velocity		5	1.27	2.139	158.25	0.793	-1.987	-0.102	-0.032	112.0	108.0	110.1	113.8	0.64	0.65	
		X	Y	Z	Q	6	1.47	2.361	143.16	1.415	-1.889	-0.122	0.163	112.3	109.9	112.8	112.8	0.67	0.69	
Facing	Down	0.17	-0.20	0.05	0.02	7	1.67	2.804	142.86	1.693	-2.235	0.001	0.090	113.3	108.1	111.9	111.8	0.73	0.59	
	4		Earth Ve	locity		8	1.87	1.803	162.51	0.542	-1.720	0.131	0.021	112.1	108.4	112.2	110.2	0.54	0.60	
	100	East	North	Up	Error	9	2.07	2.407	154.42	1.039	-2.171	0.135	0.027	111.7	108.8	110.9	108.8	0.56	0.59	
	0.2	-0.21	0.18	-0.03	0.02	10	2.27	2.443	157.30	0.943	-2.254	-0.200	0.015	111.0	109.2	110.3	110.7	0.51	0.56	
First Bin (m)	0.47		SNE			11	2.47	2.198	151.41	1.052	-1.930	0.140	0.096	110.5	108.6	110.1	112.2	0.59	0.70	
First Ping (s)	5166.36	Beam 0	Beam 1	Ream 2		12	2.67	3.308	171.25	0.503	-3.269	-0.069	-0.002	111.0	110.2	110.5	111.4	0.59	0.72	
Last Ping (s)	5166.96		40.36	40.97	Beam 3	13	3.07	2.582	167.20	1.865	-2.517	-0.050	-0.010	110.2	108.9 109.4	110.8 110.6	110.1 108.9	0.70	0.69	
D Pings	4	41.28			44.26	14	3.07	2.331	120.87	-0.360	-1.398	-0.003	-0.199	110.2	109.4	10.6	108.9	0.60	0.68	
A Pings			Ampl	itude		16	3.47	1.530	151.73	0.725	-1.347	0.088	0.189	108.4	106.7	103.1	107.5	0.69	0.63	
Armys		Beam 0	Beam 1	Beam 2	Beam 3	17	3.67	2.169	162.09	0.667	-2.064	0.080	-0.127	107.9	106.2	107.2	101.0	0.57	0.67	
		117.80	121.39	120.10	121.40	18	3.87	1.947	164.86	0.508	-1.879	-0.157	0.183	107.3	105.8	108.0	105.0	0.07	0.65	
	1505.15		Corr	elation		19	4.07	2.067	182.68	-0.096	-2.064	-0.021	0.017	108.8	107.2	108.5	106.9	0.71	0.72	
Salinity (ppt)	0	Beam 0	Beam 1	Beam 2	Beam 3	20	4.27	1.617	145.52	0.916	-1.333	-0.065	-0.156	106.3	106.4	105.2	107.0	0.60	0.65	
ater Temp (28.39	0.98	1.00	1.00	0.99	21	4.47	1.730	163.54	0.490	-1.659	-0.171	-0.002	104.0	106.1	106.6	107.0	0.64	0.66	
	37.52					22	4.67	1.956	156.36	0.784	-1.792	0.168	-0.249	104.3	105.0	105.9	104.8	0.53	0.66	
tr. Depth (m)	0.000					23	4.87	1.707	156.17	0.690	-1.562	0.299	0.014	104.9	106.6	105.4	106.4	0.69	0.62	
ressure (Pa)	0.000					24	5.07	2.113	169.85	0.372	-2.080	0.126	0.119	104.2	106.9	104.7	105.5	0.64	0.59	
						25	5.27	1.969	179.63	0.013	-1.969	0.003	0.274	102.5	106.3	104.2	103.9	0.69	0.60	
Compass						26	5.47	1.650	163.59	0.466	-1.583	0.299	0.016	103.6	106.8	104.0	103.7	0.65	0.60	
eading (deg)	0.000					27	5.67	1.396	174.80	0.127	-1.391	0.040	0.166	103.3	106.7	103.4	103.7	0.66	0.60	
Pitch (dea)	4.708					28	5.87	1.188	200.58	-0.417	-1.112	0.131	-0.119	103.8	107.4	102.7	102.4	0.74	0.74	
Roll (deg)	-177.950					29	6.07	2.111	172.40	0.279	-2.093	-0.071	0.171	104.7	106.8	104.1	102.8	0.78	0.65	-
Koir(deg)	-177.950					30	6.27	1.745	164.50	0.466	-1.681	0.027	0.039	104.6	106.4	100.7	101.4	0.79	0.71	-
						31	6.47	2.230	150.35	1.103	-1.938	-0.088	-0.008	102.8	103.9	102.5	101.7	0.60	0.60	
						32	6.67	2.340	161.68	0.736	-2.222	0.011	-0.239 0.109	100.1	104.4	102.7	101.8	0.43	0.67	
leading (deg)	240.00					33	6.87 7.07	1.905	171.95	0.267	-1.887	0.083	-0.007	101.0	104.3	102.2	99.4	0.62	0.70	
Latitude	38*41'5.25 N					34	1.01	1.470	170.01	0.043	*1.409	0.200	-0.007	102.1	104.3	102.4	99.4	0.00	0.00	
Longitude	90°40'2 93 W					<u> </u>		_												4

Figure 40. Data Page – Single Frequency

kHz ∨ Se	etup		Bottom	Terrete									0	t Profile					
kU v	760 ^												Curren	t Profile					
kHz ns #		_	Rang								1	1	1	1	1	1	1		1
icai suu ime	5/2016 13:29:15	Beam 0 0.00	Beam 1 0.00	Beam 2	Beam 3	Bin #	Depth (m)	Speed (m/s)	Direction (deg)	~ E	N	U	Q	Amp B0	Amp B1	Amp B2	Amp B3	Corr B0	Corr B1
Svs.Status	Good Status	0.00	Beam Ve		0.00	1	4.13						0.000	66.5	66.6	69.4	0.0	0.48	0.37
SN	00454	-		,		2	6.13	1.377	230.88	-1.068	-0.869	-0.261	0.000	69.4	62.3	63.2	0.0	0.72	0.42
FW	0.2.87	Beam 0	Beam 1	Beam 2	Beam 3	3	8.13	1.495	229.33	-1.134	-0.975	-0.276	0.000	70.7	70.0	64.5	0.0	0.59	0.72
	0.2.87 300 kHz 4 beam	88.89	88.89	88.89	0.00	4	10.13	1.408	228.63	-1.057	-0.931	-0.331	0.000	65.8	72.4	68.6	0.0	0.63	0.71
	300 KHZ 4 beam		Instrume	nt Velocity		5	12.13	1.270	240.24	-1.103	-0.630	-0.273	0.000	68.4	68.5	66.8	0.0	0.61	0.69
		x	Y	Z	Q	6	14.13	1.469	236.01	-1.218	-0.821	-0.318	0.000	69.7	67.8	68.4	0.0	0.71	0.51
Facing	Down	88.89	88.89	88.89	0.00	7	16.13	1.510	241.06	-1.322	-0.731	-0.278	0.000	70.8	70.1	69.3	0.0	0.65	0.65
f of Beams	3		Earth Ve	locity		8	18.13	1.875	245.05	-1.700	-0.791	-0.263	0.000	70.2	70.4	70.1	0.0	0.62	0.77
	200	East	North	Up	Error	9	20.13	1.442	237.93	-1.222	-0.766	-0.328	0.000	71.5	68.6	67.4	0.0	0.75	0.69
	2	88.89	88.89	88.89	0.00	10	22.13	-	-	-	-	-	0.000	72.2	68.5	75.6	0.0	0.70	0.72
	4.13		SNF	2		11	24.13 26.13	1.518	249.57 246.89	-1.422	-0.530	-0.253	0.000	66.7 59.4	65.2 61.7	72.4	0.0	0.60	0.39
rst Ping (s)	1296.79	Beam 0	Beam 1	Beam 2	Beam 3	12	26.13	1.528	246.89	-1.405	-0.600	-0.238	0.000	59.4	60.3	67.8	0.0	0.48	0.63
ist Ping (s)	1296.79	0.00	0.00	0.00	0.00	14	30.13	1.426	243.64	-1.278	-0.633	-0.344	0.000	59.0	63.0	61.9	0.0	0.65	0.69
D Pings	1	0.00			0.00	15	32 13	1.357	245.04	-1.270	-0.550	-0.344	0.000	60.5	58.9	55.9	0.0	0.05	0.05
A Pinas	1		Ampl			16	34.13	1.386	250.83	-1.309	-0.455	-0.301	0.000	61.0	60.5	62.0	0.0	0.81	0.74
		Beam 0	Beam 1	Beam 2	Beam 3	17	36.13	1.145	248.63	-1.067	-0.417	-0.357	0.000	58.7	59.0	61.6	0.0	0.63	0.71
d Of Sou	1515.26	0.00	0.00	0.00	0.00	18	38.13	1.272	238.76	-1.088	-0.660	-0.399	0.000	52.7	55.9	60.7	0.0	0.32	0.50
			Corre	elation		19	40.13	1.397	237.20	-1.175	-0.757	-0.396	0.000	54.1	55.9	55.0	0.0	0.68	0.71
alinity (ppt)	35	Beam 0	Beam 1	Beam 2	Beam 3	20	42.13	1.410	240.79	-1.230	-0.688	-0.345	0.000	57.4	56.9	56.2	0.0	0.67	0.74
er Temp (17.78	0.00	0.00	0.00	0.00	21	44.13	1.604	241.10	-1.404	-0.775	-0.297	0.000	56.2	58.3	56.8	0.0	0.54	0.70
em Temp	26.73					22	46.13	1.473	247.00	-1.356	-0.575	-0.313	0.000	59.0	59.6	57.9	0.0	0.64	0.72
. Depth (m)	1.416					23	48.13	1.308	250.77	-1.235	-0.431	-0.305	0.000	60.5	56.6	59.7	0.0	0.77	0.61
	0.142					24	50.13	1.614	237.87	-1.367	-0.859	-0.342	0.000	56.5	55.7	57.9	0.0	0.62	0.68
						25	52.13	1.365	234.53	-1.112	-0.792	-0.417	0.000	52.9	53.8	53.7	0.0	0.62	0.67
Compass						26	54.13	1.235	231.33	-0.965	-0.772	-0.390	0.000	52.6	52.3	51.4	0.0	0.72	0.60
ading (deg)	32.820					27	56.13	1.336	234.01	-1.081	-0.785	-0.396	0.000	50.6	51.1	51.1	0.0	0.59	0.67
Pitch (deg)	-0.853					28	58.13 60.13	1.497	239.91 231.42	-1.295	-0.751 -0.974	-0.340	0.000	52.7 52.4	52.3 52.6	53.4 51.4	0.0	0.70	0.62
Roll (deg)	-168.854					30	60.13	1.562	231.42	-1.221	-0.974	-0.349	0.000	52.4	52.6	51.4 51.4	0.0	0.62	0.63
(ac8)						30	64.13	1.552	240.48	-1.423	-0.019	-0.334	0.000	48.8	50.3	52.4	0.0	0.67	0.61
						31	66.13	1.513	232.63	-1.202	-0.918	-0.392	0.000	48.8	47.6	52.4	0.0	0.61	0.56
						32	68.13	1.379	239.00	-1.015	-0.596	-0.463	0.000	47.4	47.0	49.2	0.0	0.47	0.47
ading (deg)	26.36					34	70.13	1.422	232.99	-1.136	-0.856	-0.406	0.000	40.5	44.6	45.4	0.0	0.43	0.55

Figure 41. Data Page – Multiple Frequency

12.3 Contour page

Click **Contour** he page button from the **Tool bar** menu to switch to **Contour Page.** Figure 42 and Figure 43 show the contour page when BT is off and when BT is on, respectively. There are four areas on the page: the *Speed and Direction* part on the left top showing the *Speed and Direction* plots, the Coordinates area on the left bottom showing velocities of three different coordinates (Beam, Earth, Instrument), the right column shows the Quality Control (QC) parameter (Amplitude, Correlation and Percent good) data. If it's dual frequency or has vertical frequency data, each frequency will have a tab page, you can use the tab page buttons

Speed Direction **E and Direction** area to choose the frequency you want to look. For vertical frequency, there are only three plots on the page: Beam 0 Velocity, Beam 0 Amplitude and Beam 0 Correlation as shown in Figure 44.

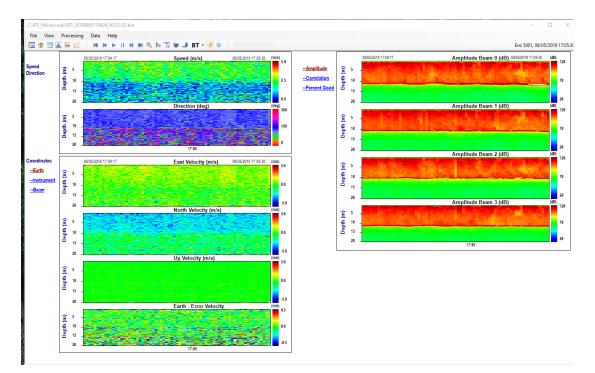


Figure 42. Contour Page with BT is OFF

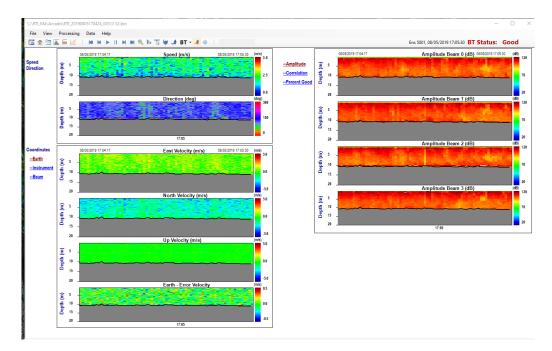


Figure 43. Contour Page with BT is ON

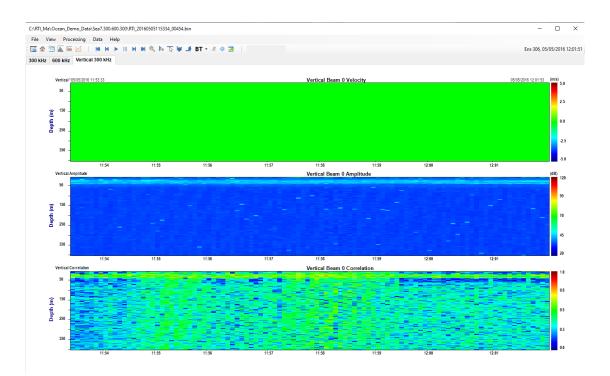


Figure 44. Vertical beam contour page

12.4 Timeseries page

Click **Timeseries** page button from the **Tool bar** menu to switch to **Timeseries Page** (Figure 45). Similarly, for dual frequency data, click the tab page buttons to switch between frequencies.

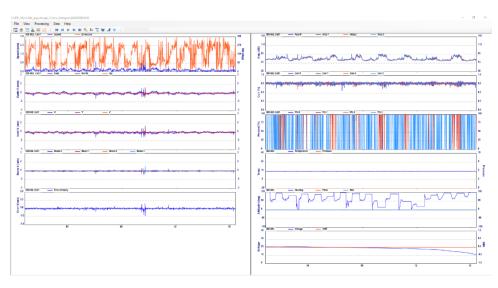


Figure 45. Timeseries page

12.5 Vertical profile page

Click **Vertical profile** 2 page button from the Tool bar menu to switch to **Vertical profile** Page (Figure 46). If it's dual frequency data, the second frequency data plots will be shown below the first frequency plots (Figure 47). For the third column of Velocity, there are three coordinates the user can choose: ENU, XYZ and Beam.

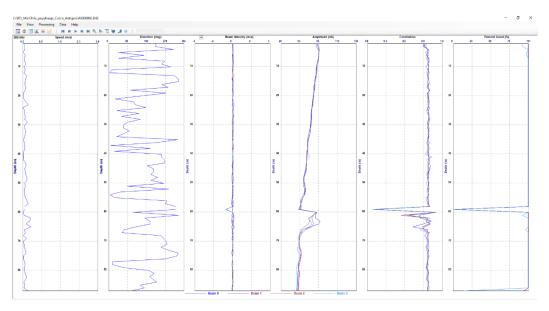


Figure 46. Vertical Profile page – Single frequency

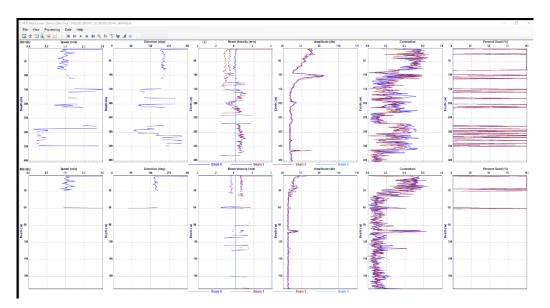


Figure 47. Vertical Profile page – Dual frequency

13. Live Data View

After deployed the system and Started pining, you can open the View page to see the live data Ώш

received from the ADCP by clicking the view icon from the tool bar. They are the same pages as the pages in **Playback** display but with the live data (Figure 48).

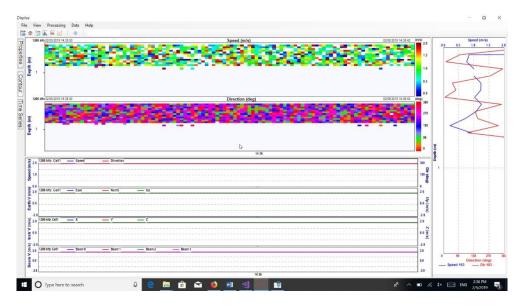


Figure 48. Live data view

14. Communication

The **Communication** window is a place for the user to change the serial baud rate on ADCP. Click communication window (Figure 49).

🖘 Communio	cation [COM14: 921600]	[F	\$\$485 : 921600]		_		×
Serial Port Set COM Port: Baud Rate: Data Bits: Parity:			Set Baud Rate ORS232/RS422 ORS485	Baud Rate 115200	~	Set]
Stop Bits:	1 v						

Figure 49. Communication Window

The "Serial Port Settings" group box shows the COM port and baud rate that are currently in use, the "Set Baud Rate" group box is to let the user to select the port (either the RS232/RS422 port or the RS485 port) to change and what baud rate it will be. The title of the window shows the current settings of the COM port and baud rate.

After clicking the "Set" button, the selected port (either RS232/RS422 or RS485) will change its baud rate to the value you choose. If you are connecting to ADCP using this port, you need to reset its baud rate in the left "Serial Port Setting" box and reconnect to it.

15. Instrument

This includes operations of the instrument such as System Check, Compass Cal and Upload Firmware.

• **System Check**: before any deployment test it is strongly recommended to undergo a functionality test to ensure that the various components are working as intended. Figure 50 shows an example of the test result. The warning information is in Yellow and any information in Red means something wrong with that component and needs attention.

🖘 SystemCheck		×
ADCP Info	\checkmark	
ADCP: DP600		
SN: 01300000000000000000000000000000000000		
FW: 00.02.120 Dec 3 2018 08:20:33		
SD Card	\checkmark	
Total Space: 7580.000 MB		
Used Space: 112.260 MB		
Pressure Sensor		
Sensor NOT installed	×.	
Sensor NOT Installed		
Compass	\checkmark	
Heading: 215.43 deg Pitch: 0.26 deg		
Roll: -179.18 deg		
Roll 175. To deg		
Temperature		
Water: 18.68 deg		
System: 30.06 deg		
-,		
Voltage		
Battery: 35.73 V		
Boost+: 2.28 V		
Boost-: -0.54 V		
	OK	
Done!		

Figure 50. System Check

- **Compass Calibration**: this starts the Compass Calibration user interface that allows perform an on-site 2D or 3D calibration of the instrument compass to remove the effect of Hard-iron objects.
- Upload Firmware: to upload new firmware to the instrument. When uploading the firmware, check to ensure that the firmware you are intending to upload is compatible to your instrument hardware, and the most recent version of the application software s also used. Incompatible firmware loads will be detected by application.
 - 1. Download the appropriate firmware from RTI website to your computer.

- 2. Click on Upload Firmware, select the firmware on your computer that you downloaded
- 3. This will result in the file being transferred to the instrument and a progress bar will be displayed (Figure 51)

×		_	nware	🖘 UploadFirmv
			ling firm.bin	Uploading
%	25			
ĺ	Done			

Figure 51. Upload Firmware