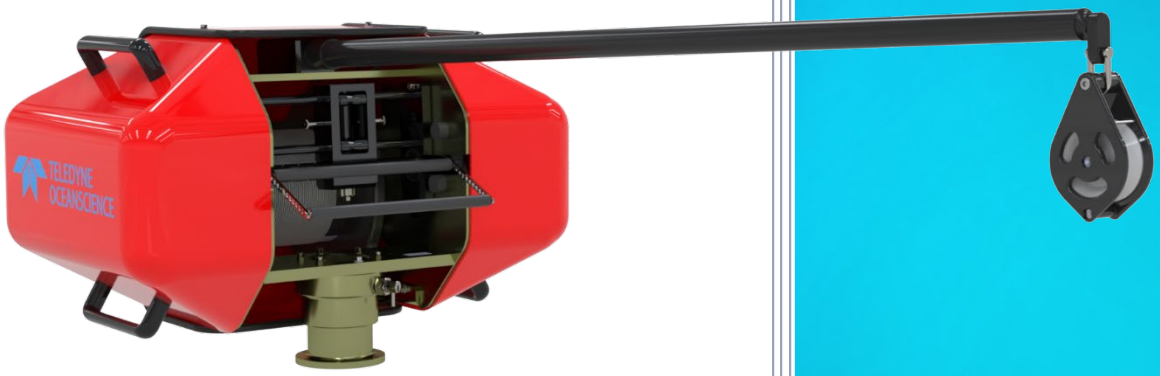
rapidCAST™

User's Guide



TELEDYNE
MARINE
Everywhereyoulook™

P/N 95J-8000-00 (July 2023)

https://www.teledynemarine.com/rdi

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Revision History

July 2023

- Updated website address.

June 2023

- Updated Motor Control Cable installation.

April 2023

- Added shims use to Installing and Connecting the Probe.
- Added wearing the strap cutter to the Safety section.
- Updated Table 5. Tools and Spares Kit 6001751.
- New cover picture.

February 2023

- Updated EAR statement.
- Deployment Guide is downloaded.

April 2022

- 95Z-6007-00 replaces the 90J-8000-00 CD.

December 2021

- Added warnings about operating the winch with the joystick in Local Control.
- Interface Module drawing and connections updated. Probe and Antenna connectors were removed.

September 2021

- Added links to download software, documentation, and videos.
- Updated the RapidCAST USB RS-485 Driver.

February 2021

- Added callout for tension arm encoder to Figure 1 Overview.
- Added turning on Telemetry logging to checklists and casting procedure.
- Added warning about creep during joystick operation.
- Added dock station should be used only to bring the probe on and off the boat.
- Added Spare Hardware Kit table.

- Added purchasing information on splicing needles on Loop Splice page.
- Added tension arm setting to checklist.
- Added tension arm zero position adjustment to maintenance procedures.
- Updated Dive Table screen capture.
- Added Preventative Maintenance section.
- Updated Maintenance procedures.

December 2018

- Added symptoms of having the ports incorrectly set to the Resolving Fault Conditions section.
- Added how to replace the Levelwind Reversing Screw to the Maintenance section.
- Added Checklists to the Performing Your First Cast section.
- Added a Deployment Guide.

March 2018

- Added Depth versus Speed table to specifications.

February 2018

- Added the Export Administration Regulations (EAR) statement.
- Corrected inventory list part numbers.
- Corrected part number for shackle on Figure 46.

March 2017

- Updated the Lockout procedure.
- Updated the RapidCAST Interface tour.
- Updated Maintenance procedures with table showing the spare parts kit 71JK6004-00.
- Added instructions for Disassembly and Packing.
- Added the outline installation drawings to Appendix A.

October 2016

- Added Replacing the Spool to the maintenance procedures.
- Updated the tension arm calibration.

May 2016

- Updated manual to include changes from rapidCAST Interface software version 1.5.1.
- Added Line Properties, Line Management, and Checking for Line Fouling sections.
- Updated Adjusting the LevelWind Position.
- Updated the Profiling Capability specification from 500m at 8 kts to >500m at 5 kts.
- Updated phone numbers.

April 2016

- Revised most assembly drawings and figures.
- Updated Resolving Fault Conditions.

- Added Appendix A – Installation Drawings.

September 2015

- Initial release.

NOTES

Introduction

Dear Valued Customer,

Thank you for purchasing your rapidCAST™ system. Teledyne RD Instruments has a support team in place to assist you with understanding, operating, and deploying your rapidCAST system. Included with your system is documentation regarding the setup and deployment of the rapidCAST. We strongly encourage you to thoroughly read through this documentation to maximize your user experience.

Technical Support

If you have technical issues or questions involving a specific application or deployment, contact:

Phone: +1 (858) 842-2600

Email: rdifs@teledyne.com

If you have technical issues or questions involving a specific application or deployment with your instrument, contact our Field Service group:

Teledyne RD Instruments	Teledyne RD Instruments Europe
14020 Stowe Drive Poway, California 92064	2A Les Nertieres 5 Avenue Hector Pintus 06610 La Gaude, France
Phone +1 (858) 842-2600	Phone +33(0) 492-110-930
Sales – rdisales@teledyne.com	Sales – rdie@teledyne.com
Field Service – rdifs@teledyne.com	Field Service – rdiefs@teledyne.com

Client Services Administration – rdicsadmin@teledyne.com

Web: https://www.teledynemarine.com

For all your customer service needs including our emergency 24/7 technical support, call +1 (858) 842-2700

Self-Service Customer Portal

Use our online customer portal at https://www.teledynemarine.com/support/RDI/technical-manuals to download manuals or other Teledyne RDI documentation.

Teledyne Marine Software Portal

Teledyne RD Instruments Firmware, software, and Field Service Bulletins can be accessed only via our Teledyne Marine software portal.

To register, please go to https://tm-portal.force.com/TMsoftwareportal to set up your customer support account. After your account is approved, you will receive an e-mail with a link to set up your log in credentials to access the portal (this can take up to 24 hours).

Once you have secured an account, use the Teledyne Marine software portal to access this data with your unique username and password.

If you have an urgent need, please call our Technical Support hotline at +1-858-842-2700.

Sales

Our products are available from Teledyne RD Instruments directly or from representatives throughout the world. Please contact us for more information:
E-mail: rdisales@teledyne.com

Videos

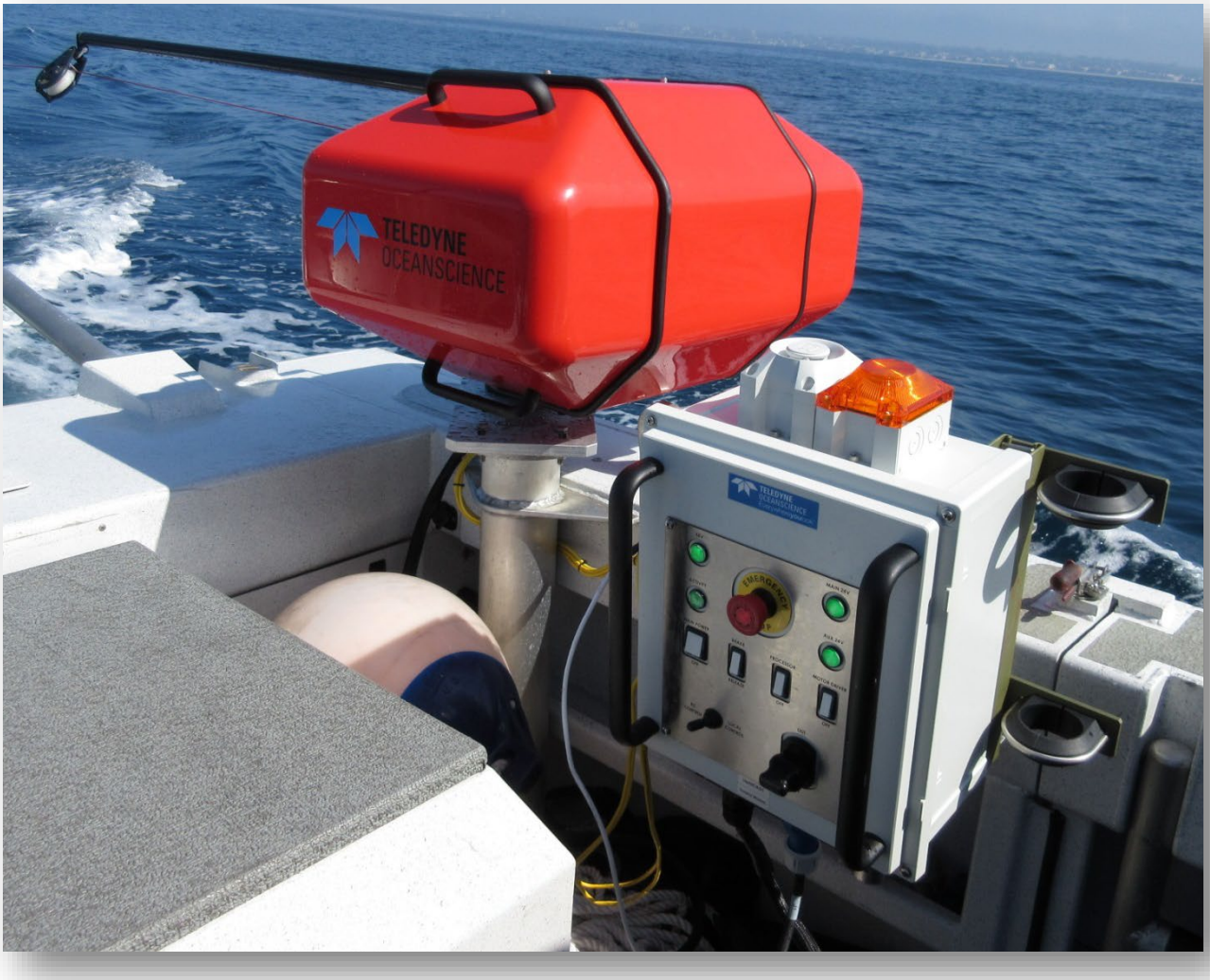
Additional training support is available via videos on https://www.teledynemarine.com/support/RDI/technical-manuals

- Line Operation Videos download
- Probe Operation Videos download

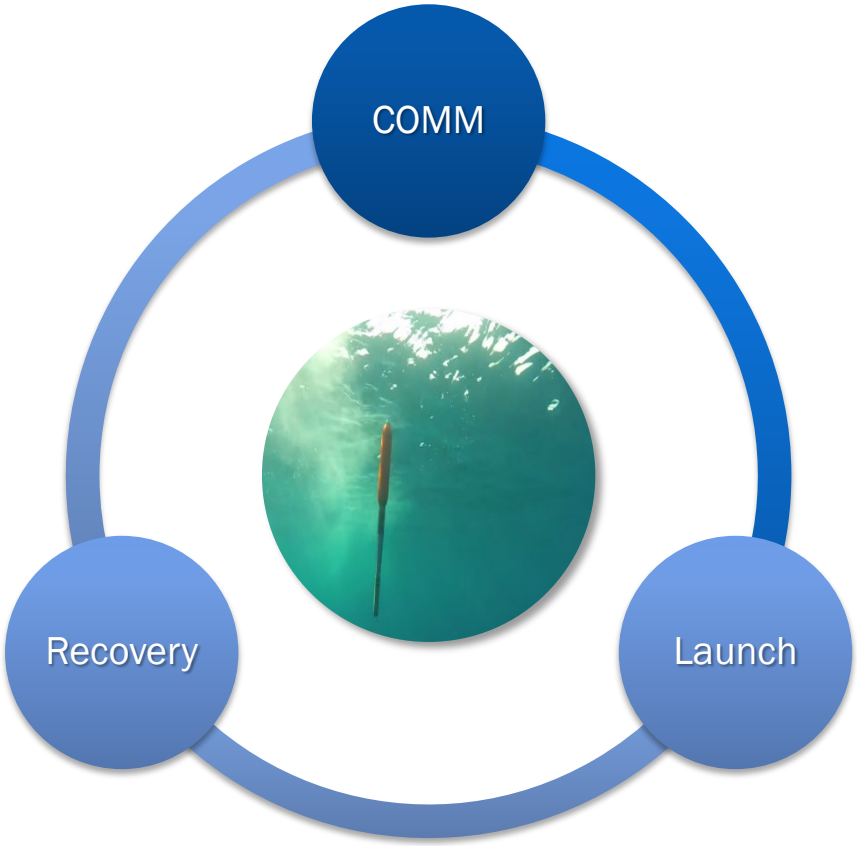
The rapidCAST delivers a probe to a user-specified target depth while the vessel is underway and retrieves the probe automatically. Using an entirely new active tension management system, payout behavior is precisely controlled to ensure the probe depth is always known - even without a conducting cable! Data transfer is achieved using an automated Bluetooth connection.

rapidCAST provides:

- A **Tension Control System** that allows the probe to fall freely under the influence of gravity even when the probe is tethered to the winch.
- Line tension is measured in real-time, and the rotation speed of the spool is quickly modulated to minimize tugging on the probe.
- If tension rises above the setpoint, the spool speeds up, and if tension falls below the setpoint, the spool slows down until equilibrium is restored.
- The Tension Control System prevents the ship from dragging the probe and ensures that the probe falls freely despite surface disturbances such as waves, swells, heaving, pitching, and rolling.



rapidCAST Overview



THE RAPIDCAST OVERVIEW INCLUDES THE FOLLOWING:

- Terminology
- Mechanical Requirements
- Electrical Requirements
- Performance Specifications and Operational Limits

Terminology

Use this section to learn the terms that will be used throughout the manual.

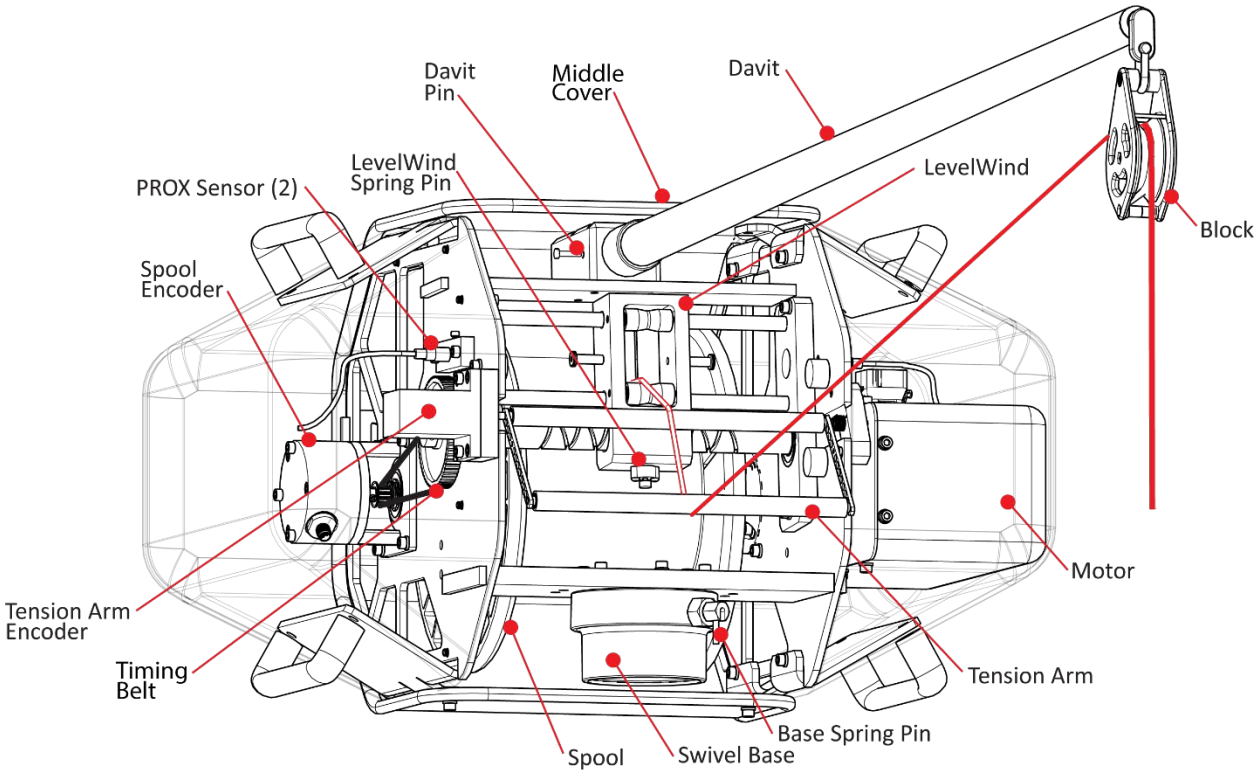


Figure 1. rapidCAST Winch Assembly Overview

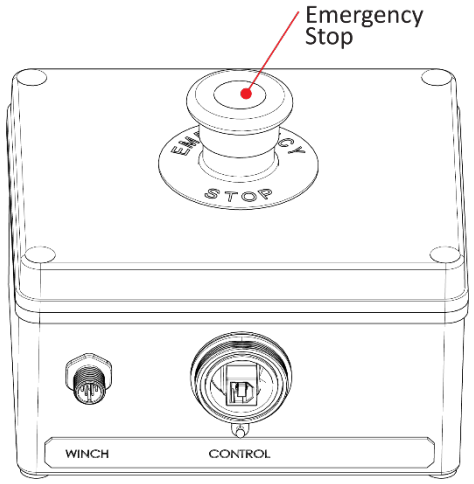


Figure 2. Interface Module Overview

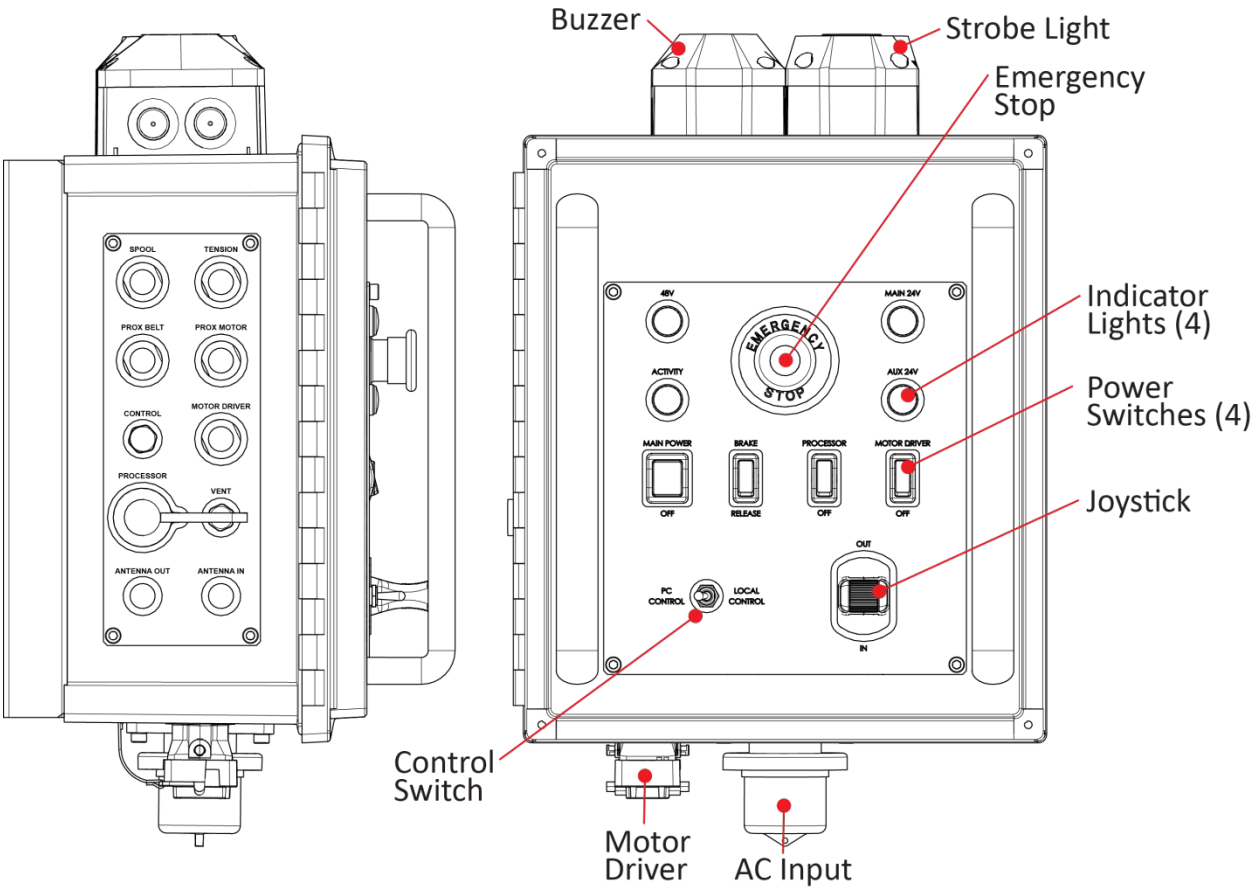


Figure 3. Control Module Overview

If the winch is run from the joystick (**Local Control**) for casts, the closed loop control fail safes are overridden and the user could damage the winch. **Always perform casts with the winch in PC Control.**

- The top four connectors are latching non-threaded push-pull types.
- The Control and Antenna connectors are threaded and screw on.
- Ensure that connectors are fully-seated; otherwise, water resistance may be compromised!
- Connectors circled in red are used only in special circumstances and are normally left disconnected. Make sure the caps are on during a deployment to protect the connectors.

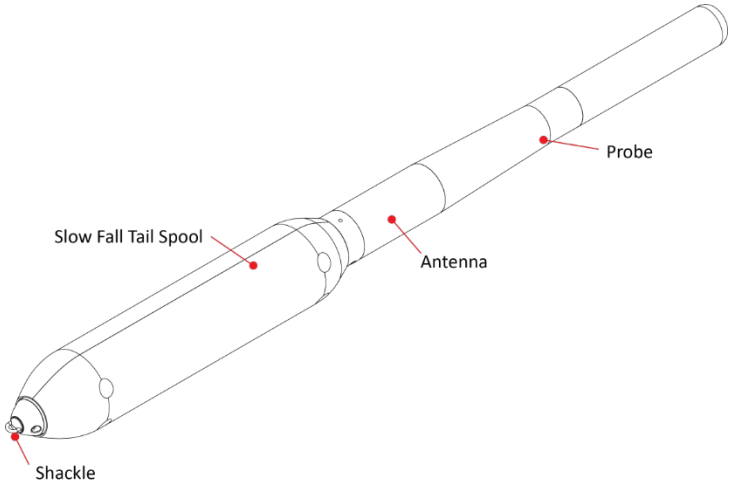


Figure 4. Probe Assembly Overview

Mechanical Requirements

Mounting Requirements: The ideal deployment location is in the center of the vessel, with deployment directly over the aft rail, but other locations may be possible. The swivel base should be mounted within 24 inches of the aft rail. Teledyne RD Instruments can provide designs for mounting options if necessary. Installation of a serial cable running from the rapidCAST electronic control module to the survey PC is required. As the probe uses wireless Bluetooth telemetry, no cabling is required for data download.

The figure below depicts mounting and cable clearance requirements. Routing of the winch power and data cables must be taken into consideration. The bolt circle should be oriented as shown below because the swivel base has built in stops to control the rotation of the winch, see Figure 6. The mounting platform should be able to withstand a moment of 70ft-lbs with little to no deflection. Below the mounting platform, a 3.0-inch clearance is required for cable routing. Straight down cable routing is shown in RED. Sideways cable routing is also possible if there is a minimum 3.0-inch clearance, shown in BLUE.

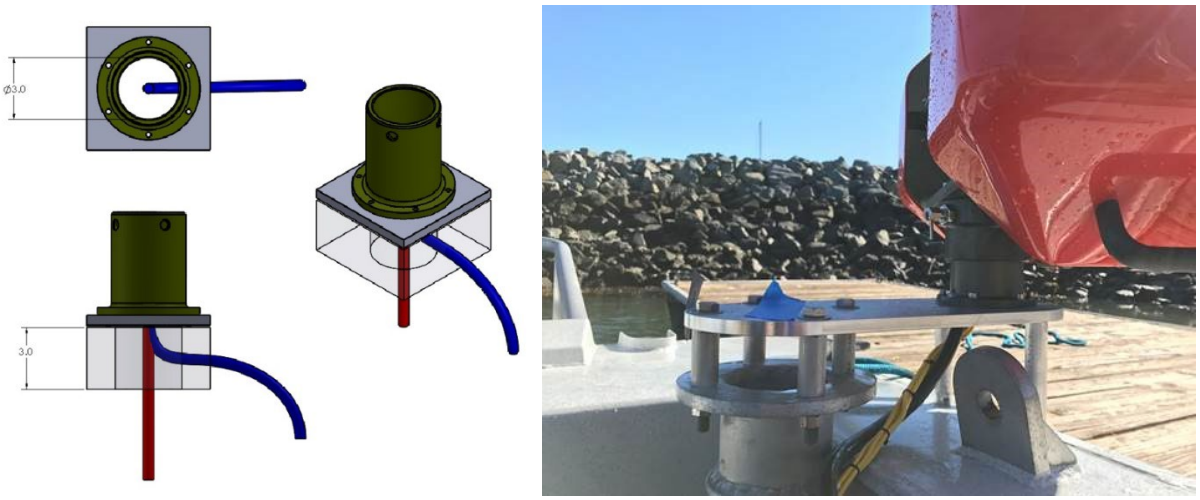


Figure 5. Cable Clearance Requirements

See Appendix A - Installation Drawings for a detailed Pipe Mount Installation Drawing.

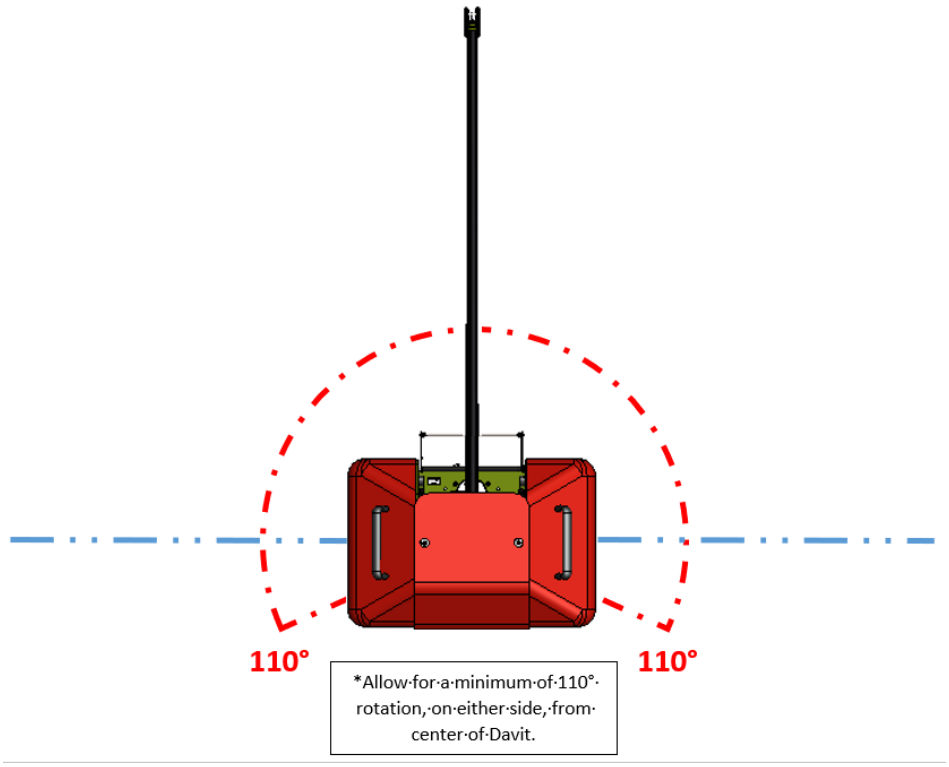


Figure 6. Mounting Requirements

During operations on board the Winch much be rotated by 110° to handle the probe safely.

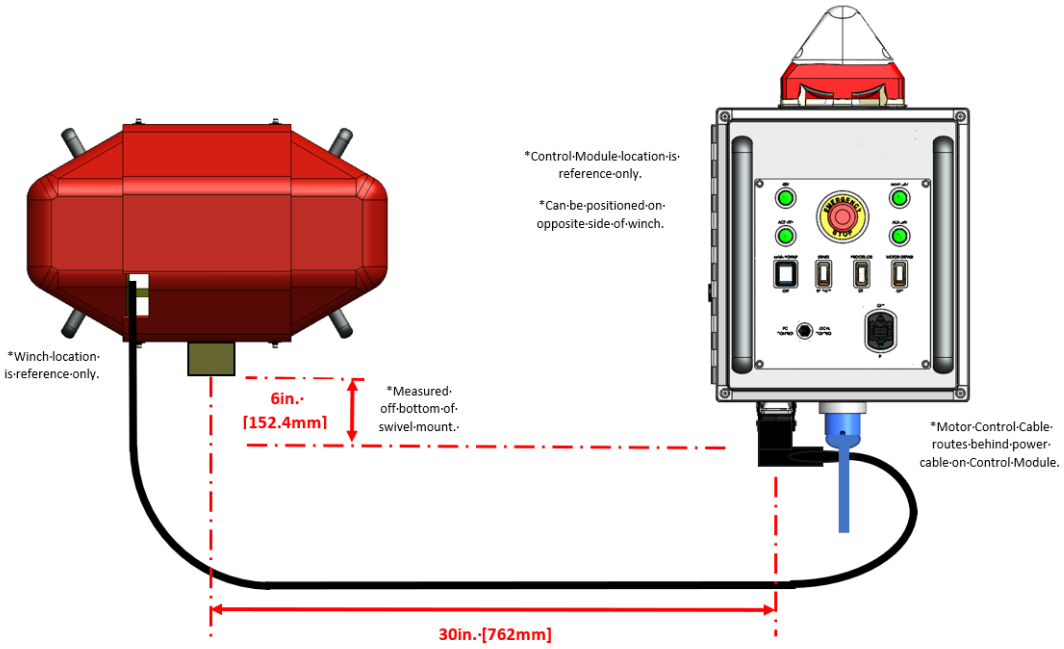


Figure 7. Motor Control Cable Installation

Profiling Depth: The nominal specification is 500m at 8kts, which requires ~1500m of line. As the vessel speed decreases, the achievable cast depth increases up to the maximum pressure rating of the probe for long stationary casts. As very deep casts are much longer in duration, the vessel cannot be moving appreciably as this will waste available line to account for the movement of the ship. As the vessel speed increases above 8kts, the achievable depth decreases to maintain the profiler in a safe condition during recovery (low line tension). The maximum vessel speed under normal operation is 12kts. The motor rpm and braking time may be adjusted by the user to suit the survey conditions.

If the vessel retains a nominal forward motion to prevent entangling of the line in the ship propeller, the maximum profile depth is then limited by the amount of line on the rapidCAST spool and the probe pressure rating of 2000m.

Line Type: Hollow Spectra line of 500lb breaking strength with an 800lb leader.

Line Length: The maximum amount of line that can be loaded is about 3000m. Typically, 1500m is used. Line length does not directly correlate to maximum cast depth underway. This depends on ship speed because the total line paid out is a product of ship movement and probe depth.

Electrical Requirements

Input Voltage: 90 — 264 VAC RMS, Single Phase

Input Frequency: 47 — 63 Hz

Max Current: (at 115 VAC Input): 16 A

Max Current: (at 230 VAC Input): 10 A

Inrush Current: (Cold Start): 50 A, Typical

Power Connectors

The rapidCAST system ships with 2 power cables, offering flexibility in the connectors used for power.

- Part Number 7000625 - 100-ft Power Cable Terminated with IEC 60309 250V 16A, 6H, Blue P+N+E Plug, that mates to IEC 60309 250V 16A, 6H, Blue P+N+E Socket
- Part Number 7000652 - 5-ft Cable Adapter Terminated with NEMA 5-15P Plug, that mates to NEMA 5-15R Receptacle

Power Cable Connections

The diagram below shows how the power cables may be connected.

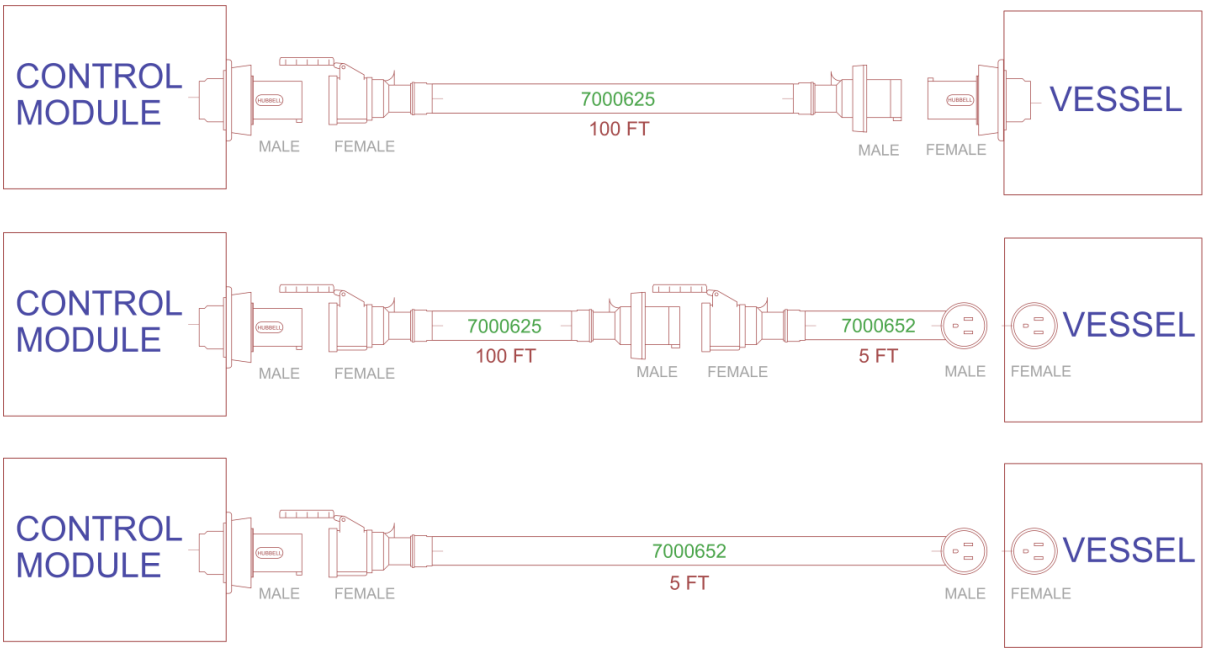


Figure 8. Power Cable Connections

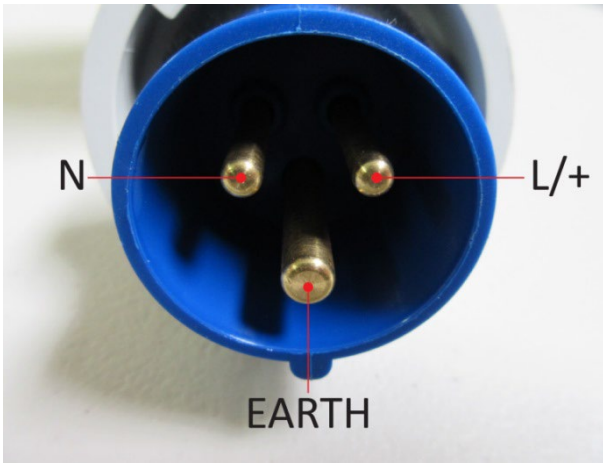


Figure 9. 7000625 Cable Plug/Termination

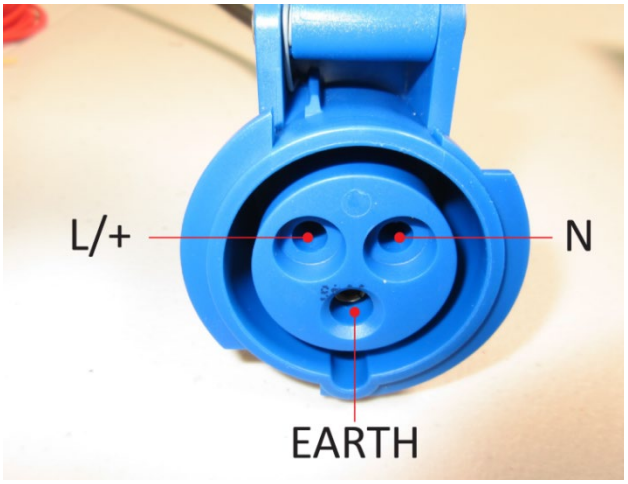


Figure 10. 60309 Vessel Socket / Receptacle/ Outlet

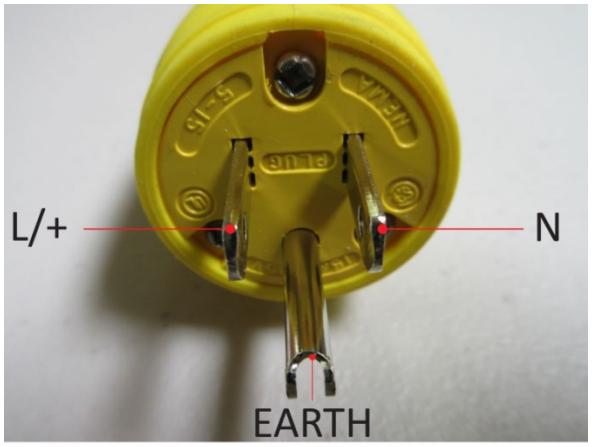


Figure 11. 7000652 Cable Plug/Termination

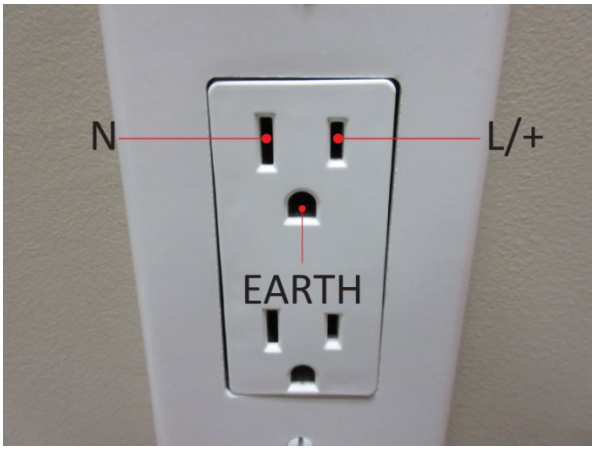
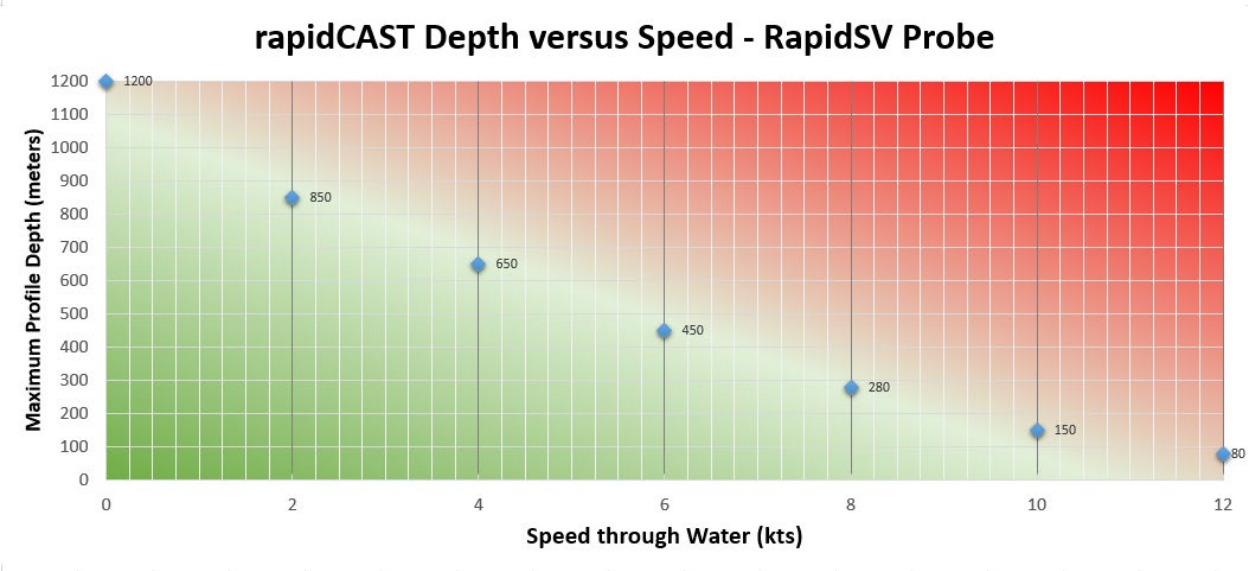


Figure 12. Vessel Socket/Receptacle/Outlet

Performance Specifications and Operational Limits

Winch	Length	48cm (18.89")
	Length with Davit	200cm (78.74")
	Width	71cm (27.95")
	Height	46cm (18.11")
	Weight	36kg (79.36 lbs.)
	Input Voltage	48 VDC/ 2.0 kW
	Line Capacity	3000m
	Construction	Aluminum/Delrin/Titanium/Stainless Steel
	Probe Recovery Speed	0.5-2m/s (1.5-6.6 fps)
	Mount	Swivel base (12cm diameter)
	Hardware	Stainless Steel
Control Module	Weight	14kg (30.86 lbs.)
	Length	52cm (20.47")
	Width	34cm (13.34")
	Height	29cm (11.42")
	Input Power	90-264 VAC (47-63 Hz)
	Output Power	48 VDC
Davit	Length	160cm (63")
	Diameter	5cm (2")
	Weight	1.18kg (2.6 lbs.)
Valeport rapidSV Probe	Length (with tail spool)	111cm (43.70")
	Diameter	5cm (1.96")
	Weight (in air) (without tail spool)	4.48kg (9.87 lbs.)
	Internal Memory	1000 casts
	Depth Rating	2000m
	Pressure	Resolution ±0.001% range Accuracy ±0.05% range Range 0-200 dBar
	Temperature (if fitted)	Resolution 0.001C Accuracy ±0.01C Range -5 to 35C
	Sound Velocity	Resolution 0.001m/s Accuracy ±0.02m/s Range 1375 - 1900m/s
	Profiling Capability	>500 m at 5 kts or deeper at slow speeds (see Table 1, page 12)

Table 1. rapidCAST Depth versus Speed



The table above applies to the RapidSV probe. Call for details on other probes.

Each standard spool is delivered with 1954 meters of line, of which 1700 meters can be used for normal operation (see Line Properties, page 32). Typically, only 1200 meters of line are used.

Deployments less than 100 meters deep:

- The buoyancy tailspool can be used. In this configuration, the probe will fall at approximately 3 m/sec.

The following general specification applies:

- Boat speed relative

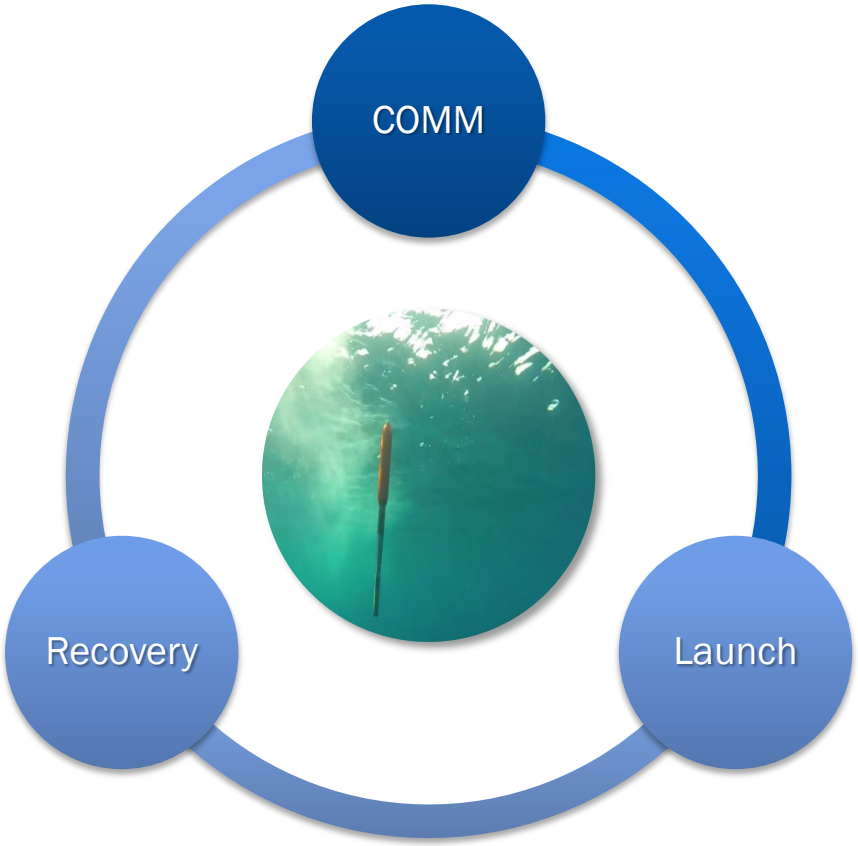
Deployment greater than 100 meters deep:

- The buoyancy tailspool CANOT be used. In this configuration use the plain tailspool, the probe will fall at approximately 4 m/sec.

Quick Review

	
Check that you know the Terminology used	Reference Figure 1 through Figure 4.
Check that the boat meets the Mechanical and Electrical Requirements	Reference page 6 to 8.

Installation



INSTALLATION INCLUDES THE FOLLOWING STEPS:

- Unpacking the rapidCAST system
- Installing the RapidCAST Control Software
- Learning Cable Connections and Switch Functions
- Mounting the Winch
- Verifying Probe Communications

Unpacking the rapidCAST system

Included with the rapidCAST:

Table 2. Inventory

Packed in transit case:	Part Number	Description	Quantity
6001752: CASE, TRANSIT, RCAST, WINCH	6001417	ASSY, WINCH, RAPIDCAST	1 each
	7000625	CABLE, AC POWER, RCAST, 30.5M	1 each
	7000652	CABLE, AC POWER, RCAST, 1.5M	1 each
	75JK6001-00	Documentation kit contains instructions for downloading the software and manuals	1 each
	9002211	CABLE, RF, TNC STRAIGHT PLUG, LMR400, 40M	1 each
9002104: CASE, TRANSIT, RCAST, DAVIT	71J-5001-00	ASSY, DAVIT, RCAST, W/PULLEY	1 each
	9002209	SHOULDER STRAP, DAVIT CASE, RCAST	1 each
6001754: CASE, TRANSIT, RCAST, CONTROL MODULE	6001427	ASSY, CONTROL MODULE, RAPIDCAST	1 each
	6001432	ASSY, INTERFACE MODULE, RAPIDCAST	1 each
	8000592	MOUNT, PIPE FLANGE, RCAST	1 each
	6001436	ASSY, PROBE BRACKET, RCAST	2 each
	6001751	KIT, TOOLS AND SPARES, RCAST	1 each
	7000650	CABLE, TELEMETRY AND CONTROL, RCAST	1 each
	6000617	SET, TAILSPOOL W/BULKHEAD, RCAST/UCTD	1 each
	6000630	SET, TAILSPOOL W/BULKHEAD, RCAST/UCTD, W/BUOYANCY MODULE	1 each
	8000112	TRAINING PROBE, RCAST/UCTD	1 each
	9002212	CABLE, RF, TNC STRAIGHT PLUG, LMR400, 5M	1 each
	9002173	ANTENNA, 2.4 GHz 8dBi FLAT PATCH W/ TNC CONNECTOR	1 each

Safety

Important Safety Warnings

Do not put your hands inside the frame unless the system is Locked Out.

Always assume the system is live.

When in doubt use Emergency Stop.

Stand clear of line, do not stand in loops or wrap line around your hand. Always wear the strap cutter included in the tools and spare parts kit 6001751.

Wear gloves when handling the Davit. The Davit is made from carbon fiber and may cause splinters.

Important Deployment Warnings

Never go past the maximum line payout.

Line is taped on the spool. Never get into the bottom RED layer or you will lose a probe.

If the winch cannot pull the line in or the brake is not working, STOP the vessel immediately.

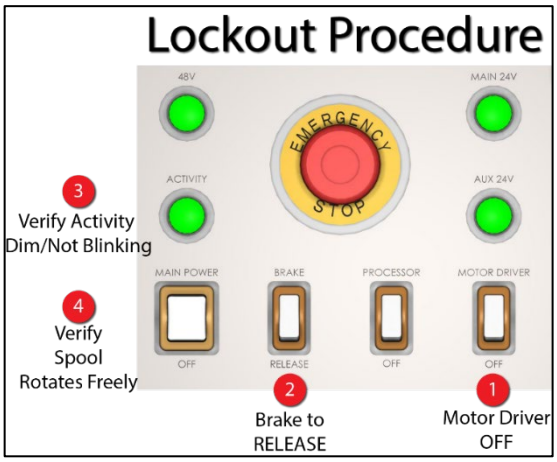
If the winch is run from the joystick (**Local Control**) for casts, the closed loop control fail safes are overridden and the user could damage the winch. **Always perform casts with the winch in PC Control.**

Lockout Procedure

To lock out the system:

1. Switch Motor Driver OFF.
2. Switch Brake to RELEASE.
3. Check to ensure Activity Light is Dim/Not blinking.
4. Check to see if the spool rotates freely.

The system is now SAFE.



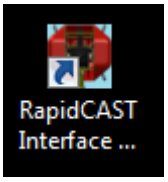
Installing the rapidCAST Interface Software

The rapidCAST documentation and software are downloaded.

5. Follow the instruction sheet on downloading TRDI software and manuals.
6. Software is available on https://tm-portal.force.com/TMsoftwareportal. Install *RapidCAST Interface* and *USB RS-485 Driver*.
7. Use our online customer portal at https://www.teledynemarine.com/support/RDI/technical-manuals to download manuals or other Teledyne RDI documentation. Download the rapidCAST Guide. PDF versions of all rapidCAST documentation including this deployment guide are available for download.

To install the drivers and software:

1. Install the RapidCAST Interface software by double-clicking on the *RapidCAST Interface X.xx.exe* file (where *X.xx* is the version number). Administrator access is required to properly install the software. A desktop icon is added: Double-click to run the software.



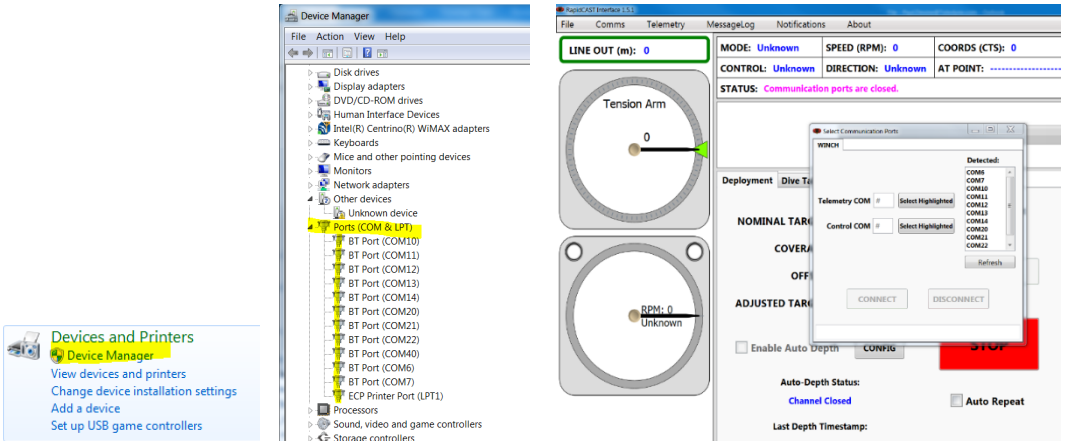
2. Connect the system and apply power. Connect the PC to the **Control** USB port of RapidCAST Interface Module, which should automatically install **two USB Serial Port devices on the PC.**

   Make note of the serial port numbers because they will be used for:

   Lower Comm port for **Telemetry**

   Higher Comm port for **Control**

3. Use the Windows® control panel device manager to identify which communication ports are available. If you have many ports as shown below and are not sure of which port is **Telemetry** or **Control**, remove the cable, wait a moment, note the list of ports, reinsert the cable and note the new ports. In the example below, COM13 and COM14 are added when the PC is connected to the Control USB port.



4. Start the RapidCAST Interface software. On the top menu, click **Comms**. Assign COM13 for **Telemetry** and COM14 for **Control**.

5. Install the USB RS-485 Driver located, specifically the RS-422/485 USB Adapter. This driver may also be downloaded from: http://www.usconverters.com/usb-to-rs422-converter-iu110. When prompted for what software to install, choose **RS-422/485 USB Adapter**. The RapidCAST Interface Module should be connected to the PC during driver installation, otherwise you may receive a "Hardware not found" error.

Software Architecture

RapidCAST encompasses two types of software: RapidCAST Motion and RapidCAST Interface.

- RapidCAST Motion is firmware that resides inside the Control Module, responsible for real-time motion control and winch operation. It exposes a text-based interface that allows the winch to be controlled via string messages. Due to the large number of messages required, however, users do not interact directly with RapidCAST Motion. When new functionality is introduced through future software releases, RapidCAST Motion can be upgraded in the field (see Updating the Winch Software).

- RapidCAST Interface is a graphical user interface that runs on a PC and is the primary method for operating the winch. It functions as a messaging and task management layer that transmits commands to RapidCAST Motion, hiding the latter's complexity behind a friendly and intuitive graphical interface.

As needs arise, Teledyne RD Instruments may modify or upgrade either the software or firmware independently of the other. Because of their message-based infrastructure, RapidCAST Motion and RapidCAST Interface must have the same *Compatibility Group* to ensure proper function. A *Compatibility Group* is simply a number that identifies whether a particular version of RapidCAST Motion or RapidCAST Interface are "speaking the same language" and are therefore fully compatible.

The *About* window (see Using the GUI Windows and Controls) identifies the software versions on the Control Module and on the PC, as well as their respective Compatibility Groups. If there is a mismatch, the **About** menu item will be red**. If there is a compatibility mismatch, the system should not be operated, and the software needs to be upgraded or downgraded until their Compatibility Groups match.**

A Tour of the RapidCAST Interface

The *Dashboard* is the top panel and gives the operator a snapshot of the winch's health and current state. Important information such as the spool's speed and rotation direction, the power-supply voltage, and brake status are reported here. The *Dashboard* keeps the user informed of the system's critical operating parameters.

The *Task Bar* is the second section. It reports the winch's current assigned task and provides a progress estimate.

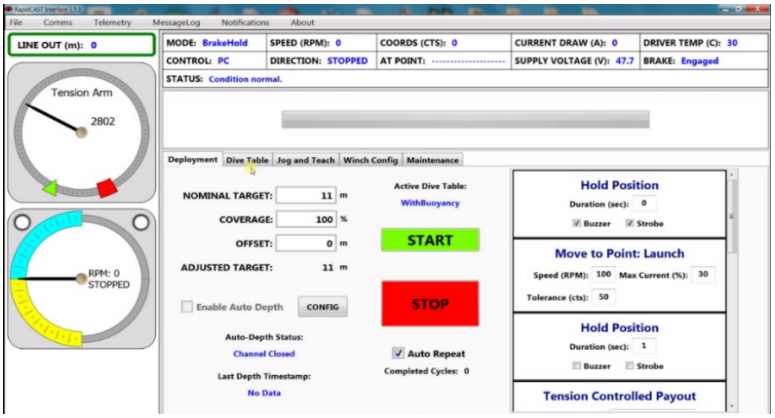
The bottom panel is the *Tab Group*, which is a collection of tabbed windows grouped according to common functionality. The Tabs are organized as follows:

- **Deployment***:* Allows the user to set deployment depth, as well as monitor and control an automated deployment.
- **Dive Table***:* Identifies the dive table used to calculate the Tension-Controlled Payout duration from a target depth. Allows the user to define the polynomial coefficients of additional dive tables and switch between them.
- **Jog and Teach***:* Allows the user to jog (move) the winch as well as define positions.
- **Winch Config***:* Allows the user to modify advanced operating parameters.
- **Maintenance***:* Contains a grouping of varied tasks associated with system maintenance, telemetry logging, and atypical activities such as software updates and health logging.

A Gauge Cluster on the left provides a graphical representation of the Tension Arm position as well as the spool's speed and rotation direction. When the Tension Arm is at its lowest position, the angular gauge in the Interface Software should show the Tension Arm pointing at the far edge of the red zone. If the Tension Arm is *not* depicted at this position when the arm is fully relaxed, calibration is needed (see Tension Arm Calibration).

The spool indicator shows the speed of the line out (blue) and line in speed (yellow). The two white circles represent the LevelWind position, and blink when the LevelWind is at the full left/right positions.

Line Out - Calculating the length of line paid out depends on how tightly the spool is packed, as well as the amount of line loaded on the spool (both of which affect the spool's effective circumference – an important variable when calculating line length). The spool's circumference decreases as more line is paid out, and though this behavior has been mathematically modelled as part of the line-length calculation, the values given by the Line Out display should still be treated as an approximation. Line length is measured relative to the encoder zero position ("home"). It may be negative if the winch has rotated inward relative to zero.



Driver Temp: Displays the temperature of the motor controller. This value will increase or decrease depending on the load applied to the motor. Note: Motor will shut down at 70C.

Supply voltage: Indicates the state of the 48V supply, which powers the Spool Motor.

Cable Connections

The system is shipped with the winch end of the cables pre-connected for ease of installation. The following is for reference.

To remove the covers (only necessary if cables are not connected on the winch end):

1. Remove the covers on the winch assembly.
2. First, remove the four (4) screws and flat washers on the top cover. Slide the top cover toward the rear of the winch to remove it.
3. Remove the fours screws and flat washers on each side cover and slide the cover down, and then pull the bottom handle to release the bottom bracket.
4. Next, slide the cover up and pull out slightly to remove it.

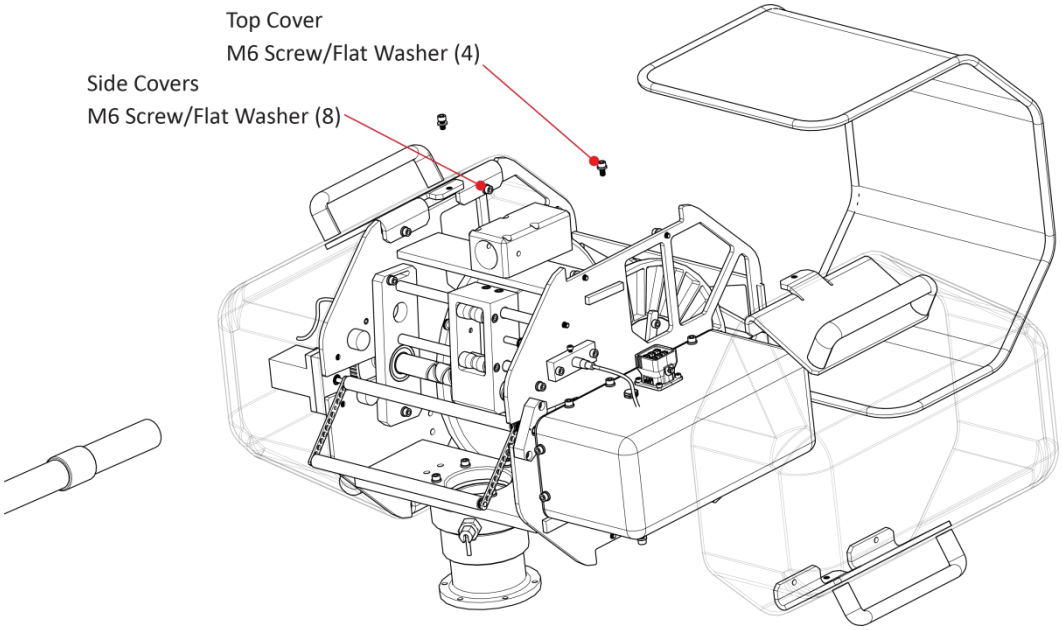


Figure 13. Removing the Winch Assembly Covers

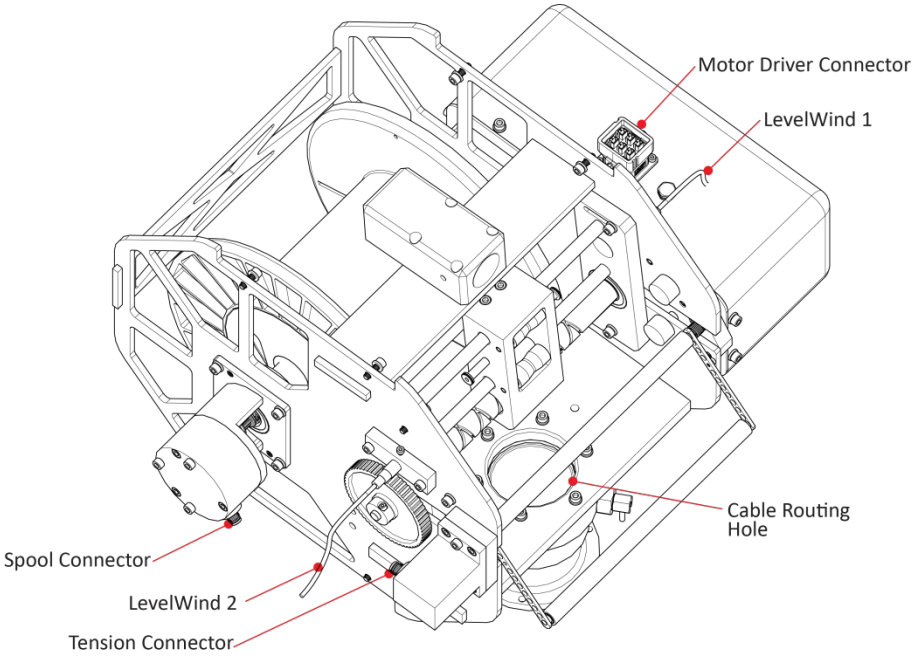


Figure 14. Winch Assembly Connectors

To Connect the Cables:

1. Route all five (5) cables through the cable routing hole. Ensure that the cables do not interfere with the motion of the spool, LevelWind, or tension arm.
2. Connect the Motor Driver cable between the Control Module and Winch. The Motor Driver connector is located under the motor side cover on top of the motor.
3. Connect the Spool cable between the Control Module and Winch. The Spool connector is located under the belt side cover.

4. Connect the Tension cable between the Control Module and Winch. The Tension connector is located under the belt side cover.
5. Connect the LevelWind PROX sensor cables between the Control Module and Winch. The LevelWind1 connector is located under the motor side cover; the LevelWind2 connector is located under the belt side cover.
6. Use Figure 13 to re-install the winch assembly covers.
7. Connect the Control cable between the Control Module and Interface Module.
8. Connect the Antenna cable between the Control Module and Interface Module. Connect the Patch antenna to the Control Module (larger vessels use Figure 15). Alternately, you can connect the Omni antenna directly to the Interface Module and omit using the 9002211 cable (smaller vessels use Figure 16).
9. Connect the AC power cable to the Control Module.

Do not connect the 9000783 USB cable to PC computer until the rapidCAST Interface software is installed and the system is powered up. See Connecting the Winch to a PC for details.

The Processor connector on the Control Module is not used for normal operation. Keep the dust cap installed.

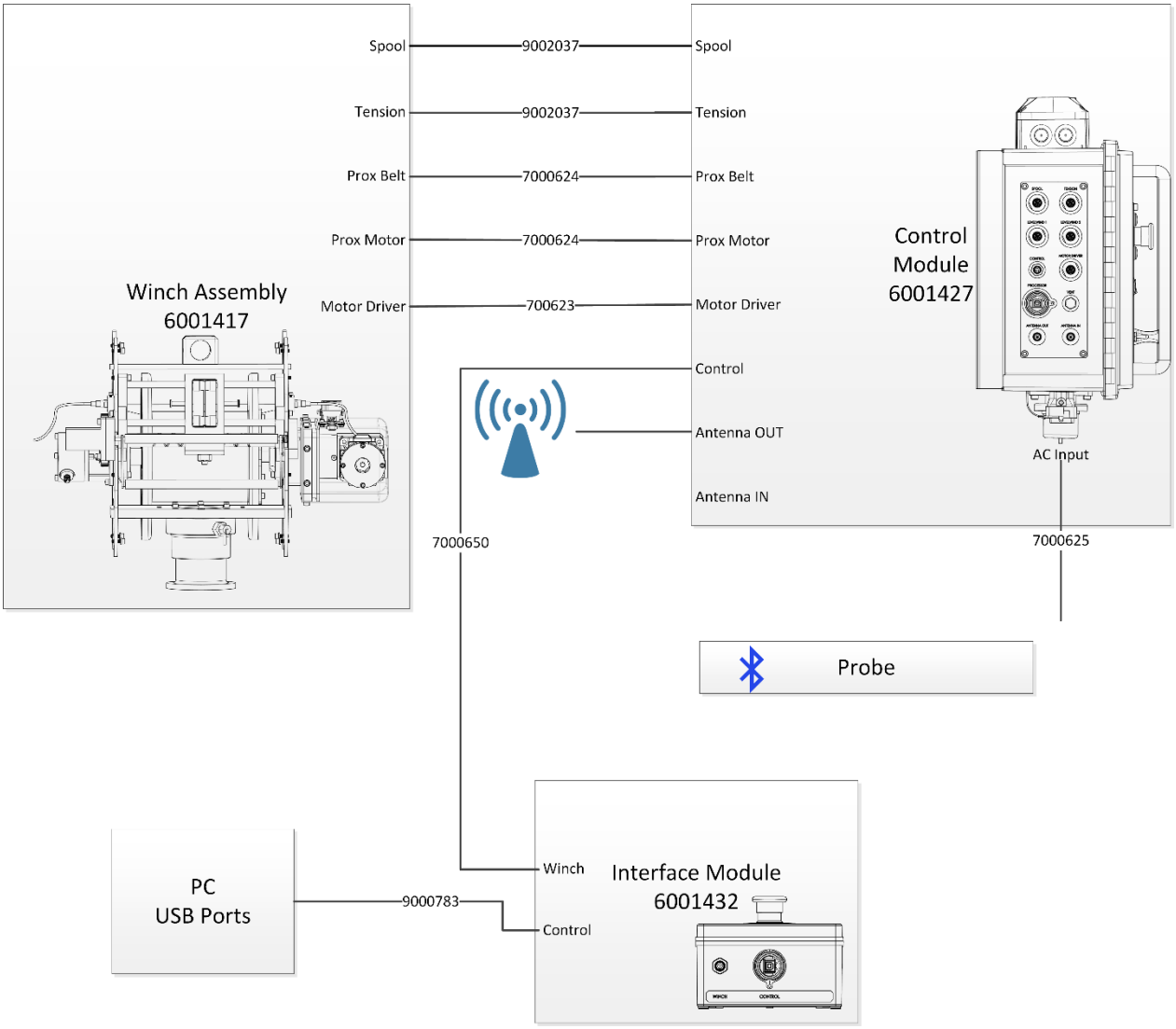


Figure 15. rapidCAST Cable Connections (Large Vessels)

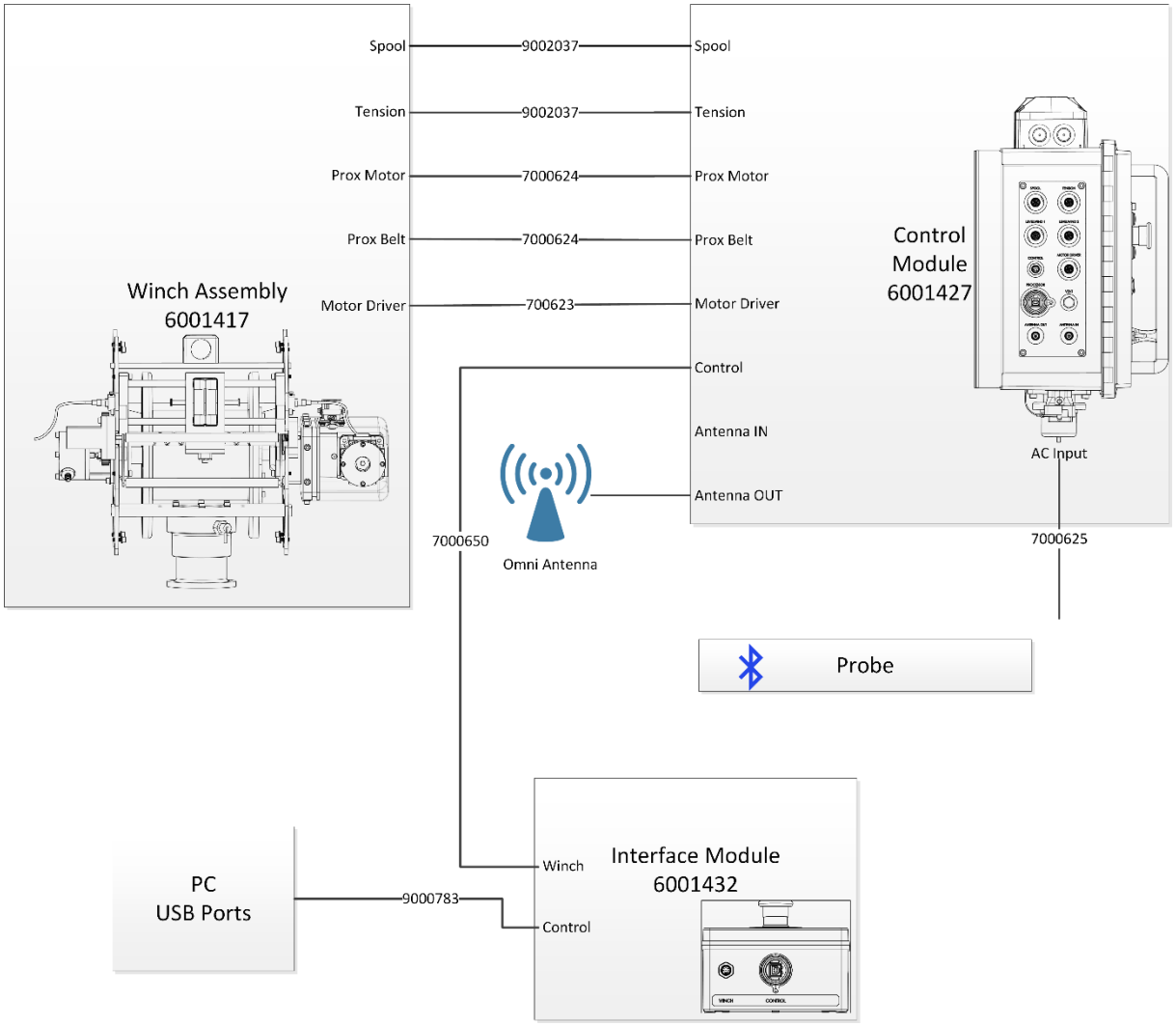


Figure 16. rapidCAST Cable Connections (Small Vessels)

Antenna Position

The rapidCAST system includes two types of antenna. The size of the vessel will determine which antenna to use.

Omni Antenna – Use this antenna when the distance between the Interface Module and Control Module is less than 10 meters. See Figure 16 for cable connections.

The antenna is Omni directional (the best reception is around the antenna in a doughnut shape; do not orientate the antenna by pointing the tip of the antenna at the probe).

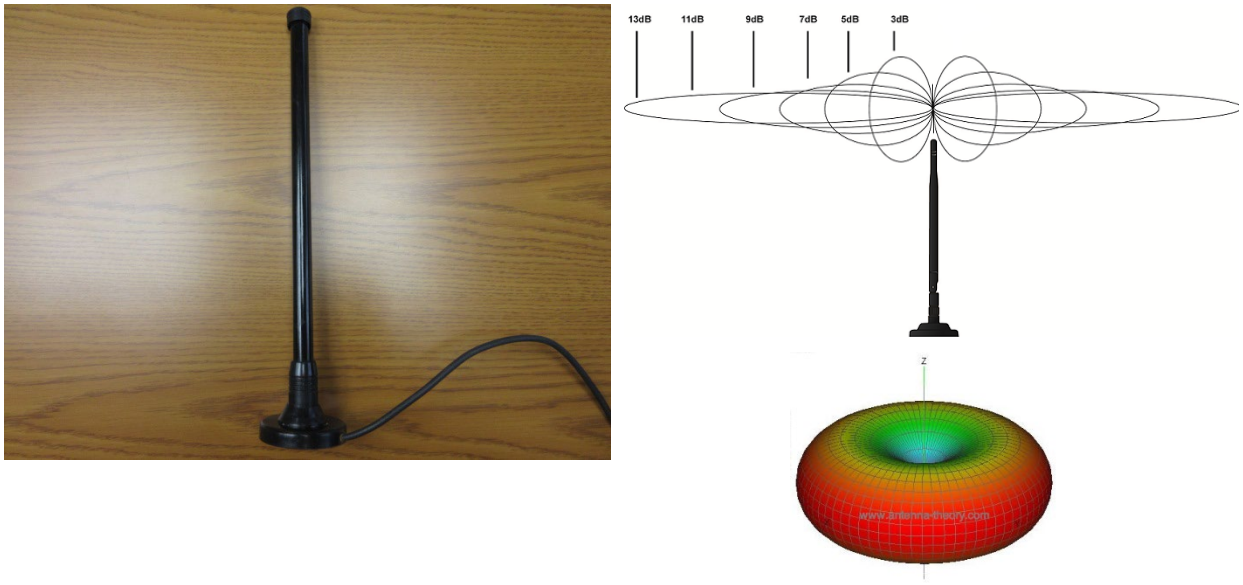


Figure 17. Omni Antenna

Patch Antenna – Use this antenna when the distance between the Interface Module and Control Module is over 10 meters. See Figure 15 for cable connections.

Orientate the antenna as shown in Figure 18. The best reception is when the probe is in the center of the approximately 30-degree cone.

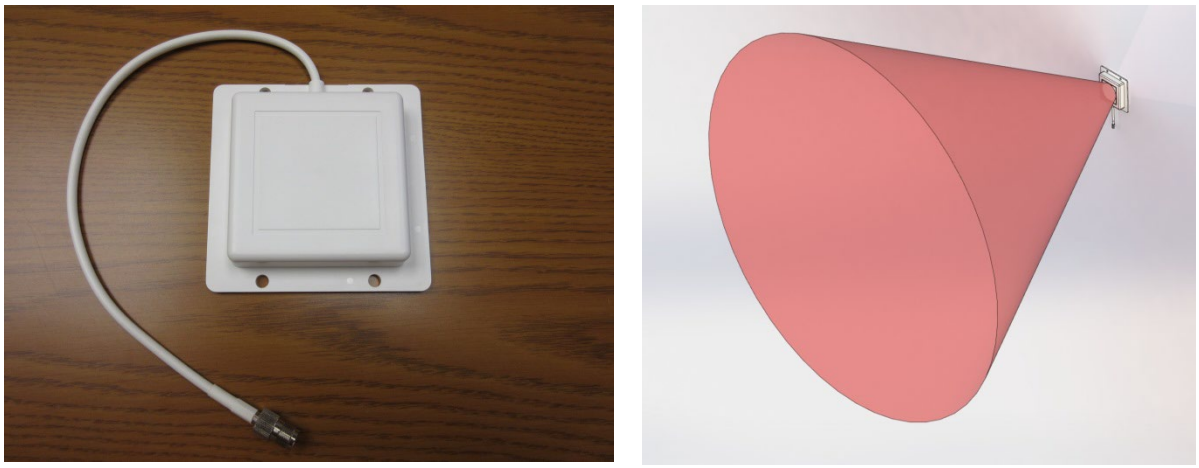


Figure 18. Patch Antenna

Switch Functions

Emergency Stop – Removes all power except the 24 VDC Auxiliary power to maintain lights. There are two emergency stop buttons; one on the Control Module and one on the Interface Module. If the emergency stop button is pushed in, turn and pull out to restore power. The rapidCAST system will reboot in a few seconds.

Main Power – Turn switch off to remove all power to the system.

Brake – Removes the 24 VDC power to the winch break motor.

Processor – Removes the 24 VDC to the Control Module processor.

Motor Driver – Removes the 48 VDC to the motor controllers.

Control Switch – The switch changes control between the PC running the rapidCAST Interface Software (**PC Control** position) and the joystick (**Local Control** position). When the switch is in:

- **PC Control** position, the Activity light will flash **two rapid blinks** and then **1 second off**
- **Local Control** position the Activity light will flash **three rapid blinks** and then **1 second off.**

Joystick – If the toggle switch is in the Local Control position, use the joystick to manually operate the winch. OUT will deploy cable; IN will retract cable. The winch is limited to 100 RPM maximum while using the joystick.

When the joystick is not actively being used, the toggle switch should be set to **PC Control** to properly engage the brake. Note that the rapidCAST may creep (slowly moving cable in/out) in the **Local Control** position.

If the winch is run from the joystick (**Local Control**) for casts, the closed loop control fail safes are overridden and the user could damage the winch. **Always perform casts with the winch in PC Control.**

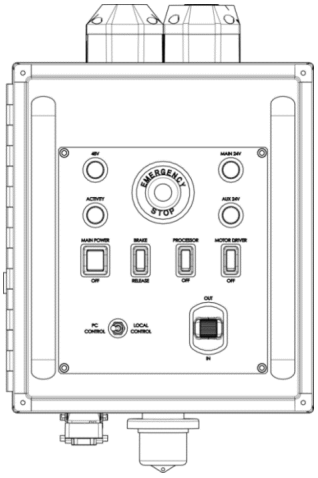


Figure 19. Control Module

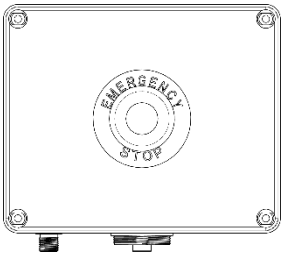


Figure 20. Interface Module

The control panel is equipped with a joystick that allows the spool to be controlled directly by an operator on deck. Local control is convenient when the user needs to operate the spool without having to coordinate with a person running the PC. The joystick is typically used when retrieving the probe out of the water and bringing it on deck, or when putting the probe back into the water. The joystick is sensitive and should be operated slowly!

LED Functions

LEDs on the Control Module provide a snapshot of power supply health and system status. *During normal operation, all LEDs should be lit*. These LEDs consist of:

48V LED (GREEN): Indicates the state of the 48V supply which powers the Spool Motor.

ON: The power supply is functioning.

OFF: The power supply is inactive. This may be due to a lack of input AC power, a power supply malfunction, the Main Power Switch being in the OFF position, the Control Cable being disconnected, or Emergency Stop being pressed.

MAIN 24V (GREEN): Indicates the state of the 24V supply which powers the Motor Brake.

ON: The power supply is functioning.

OFF: The power supply is inactive. This may be due to a lack of input AC power, a power supply malfunction, the Main Power Switch being in the OFF position, the Control Cable being disconnected, or Emergency Stop being pressed.

AUX 24V (GREEN): Indicates the state of the 24V supply which powers the Processor, the Tension Arm and Spool Encoders, the LevelWind Proximity Sensors, and other low-power digital electronics.

ON: The power supply is functioning.

OFF: The power supply is inactive. This may be due to a lack of input AC power, a power supply malfunction, or the Main Power Switch being in the OFF position.

Unlike other LEDs, this LED should remain ON even when Emergency Stop is pressed, or the Control Cable is disconnected.

ACTIVITY LED (GREEN): Indicates the state of the Motor Driver.

Slow Blink (1 Sec. On + 1 Sec. Off): The Motor Driver is powered but is not yet ready for normal operation. If the Motor Brake is released in this state, the Motor will add passive regenerative resistance to the rotation of the spool. The degree of resistance is proportional to the speed of rotation, i.e., attempts by hand to move the spool faster will result in stiffer resistance.

Single Fast Blink (0.5 Sec. On + 1.5 Sec. Off): The Motor Driver is ready for normal operation, and the winch is currently under PC control.

Three Fast Blinks (3X 0.5 Sec. On + 0.5 Sec. Off): The Motor Driver is ready for normal operation, and the winch is currently under Local (Joystick) control.

OFF: The Motor Driver is not receiving power and is therefore inactive. This may be due to a lack of input AC power, the Main Power Switch being in the OFF position, the Control Cable being disconnected, or Emergency Stop being pressed. If the Motor Brake is released while the Motor Driver is unpowered, the spool can be rotated easily with minimal resistance (regenerative braking is disabled).

EMERGENCY STOP LED (RED): Allows the Emergency Stop to be in dark environments and indicates its state.

ON: The Emergency Stop has not been pressed, and the system is ready for normal operation.

OFF: The Control Module Emergency Stop and/or Interface Module Emergency Stop may have been pressed, the Control Cable may be disconnected, the Main Power Switch may be in the OFF position, or the Control Module is not receiving input AC power.

Installing the rapidCAST System

Environmental Conditions

The RapidCAST is rated to IP65. All exterior components are sealed and water-tight when the cables are mated. Dust caps should be installed on connectors when they are not in use.

Overall, the system has very good UV resistance, but should not be left outdoors for extended periods of time, i.e., months.

When installed in cold/wet environments near freezing (0°C), ice may form on the system. Due to the mechanical nature of the system, it is necessary to prevent and de-ice the system prior to and during operation. Store the system inside or cover it when not in use to prevent icing.

Hot environments (greater than 30°C) require careful consideration of the environmental conditions. The radiative heat from the sun and ship deck can cause ambient shipboard temperatures to exceed 40°C. When operating in a hot environment the following items should be considered:

1. Deep casts at higher ship speeds will generate the most heat because the motor is working hard for an extended period.
2. Shallow casts at lower ship speeds will generate the least amount of heat.
3. Consider reducing the duty cycle of the system and allow it to cool off between casts if heat generation is excessive.
4. Remove the orange side cover on the motor side during operation to assist with cooling.

The RapidCAST system monitors the temperature of the Motor Controller which has a maximum allowed temperature of 70°C. If the Motor Controller temperature reaches 70°C, the brake will engage, and the motor will no longer be powered. The Motor Controller will re-activate when the temperature drops below 70°C. If this condition occurs, the user should re-evaluate the duty cycle.

Lifting the RapidCAST System

DO NOT USE THE TENSION ARM AS A LIFT POINT. The tension arm is not load bearing and could be damaged if it is used as a lifting point.

The system should be lifted by any of the four (4) handles available on the covers. If the covers are removed, the system can be lifted by the frame.

The top handles can accommodate lifting slings if a crane is available for loading. The center of mass is located approximately where shown in the figure below.

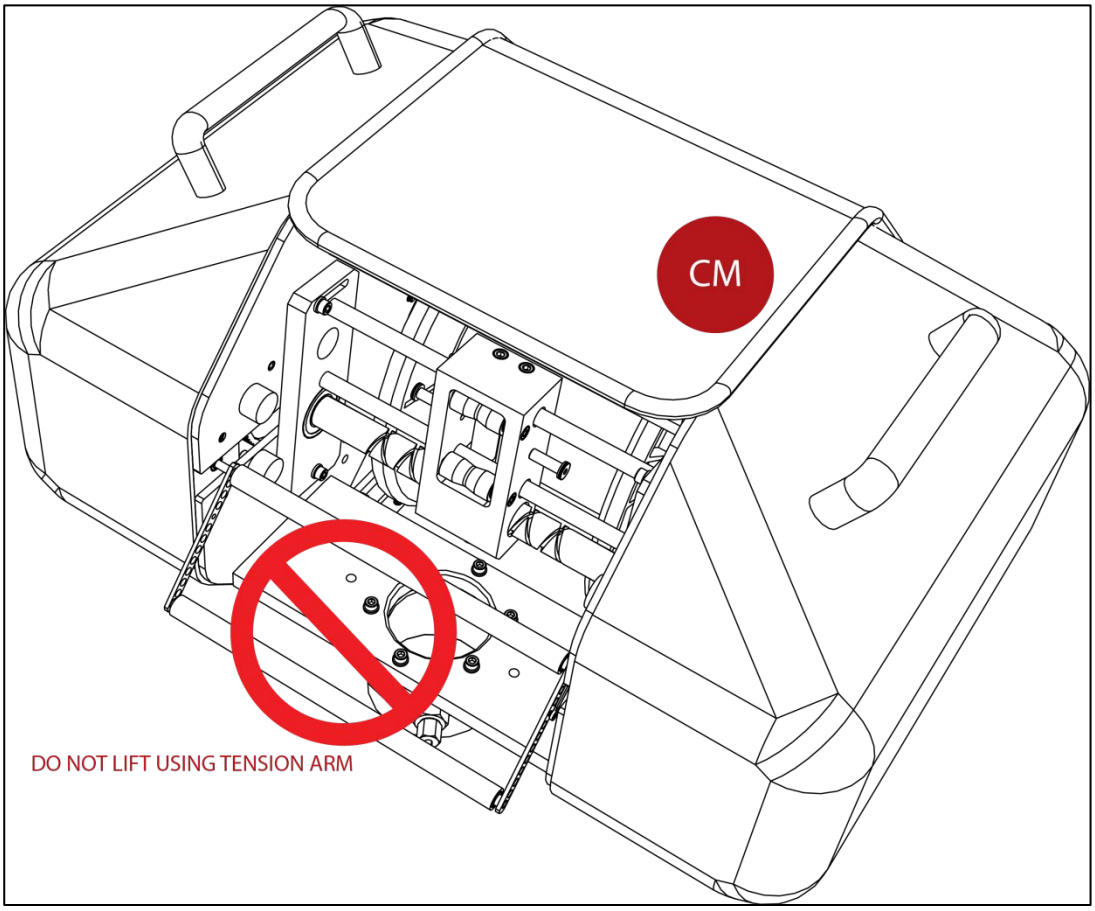


Figure 21. Center of Mass (CM) Location

Installing the Pipe Mount

A custom mounting plate is required to mount the Pipe Mount, PN 8000592.

An adapter is available that will facilitate the installation of a RapidCAST where an Underway CTD was previously installed. One such adapter is shown below.

Attach the pipe mount to the custom mounting plate using 6 X M6 or 6 X ¼-20 screws as shown below:

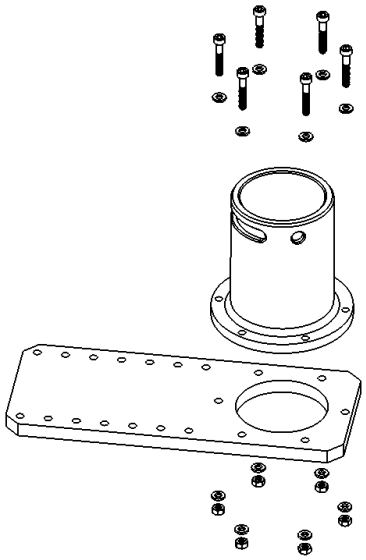


Figure 22. Attaching Pipe Mount

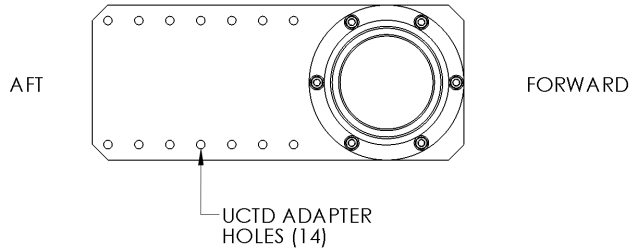


Figure 23. Pipe Mount Installed on UCTD Adapter Plate

Installing the Winch on the Pipe Mount

1. Pipe Mount
2. Disengage the winch spring pin by pulling and then rotating. Slide the winch on to the pipe mount and rotate the winch back and forth until it is fully seated on the pipe mount.
3. Install the davit and retaining pin. Block is oriented downward as shown in Figure 24.
4. Engage the spring pin by rotating until it engages in the slot.

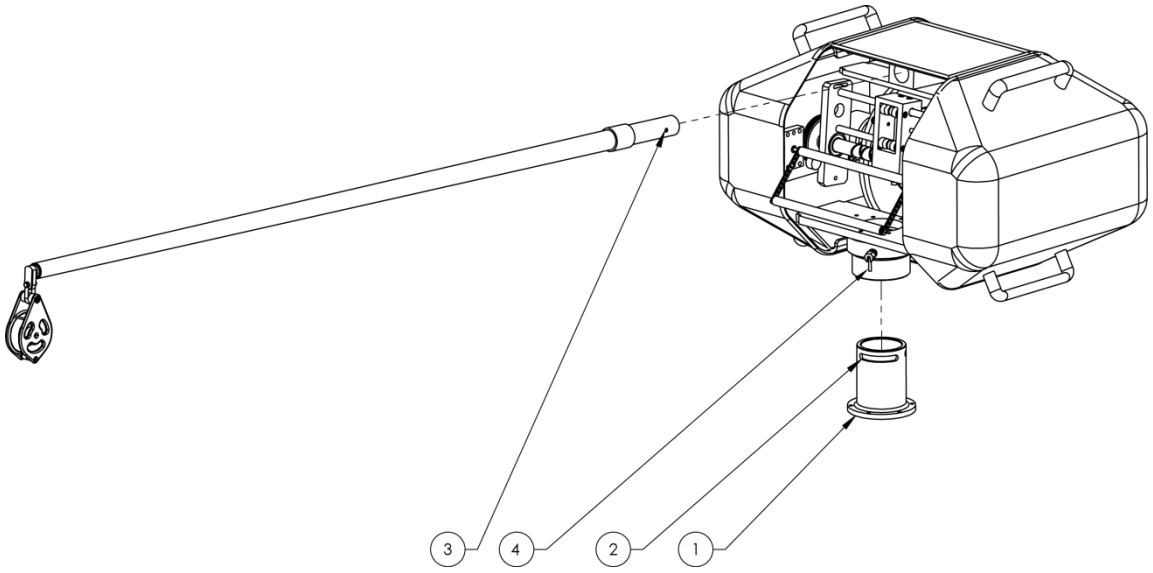


Figure 24. Installing the Winch on the Pipe Mount

Optional mounting shown using a custom pedestal rather than the ship's rail.

Installing the Control Module

The control module has two standard 1-5/8-inch strut channels located on the back. These will accept standard pipe mounts (not included). The control module is mounted within 8 feet of the winch and to the ship's rail or other available mounting location

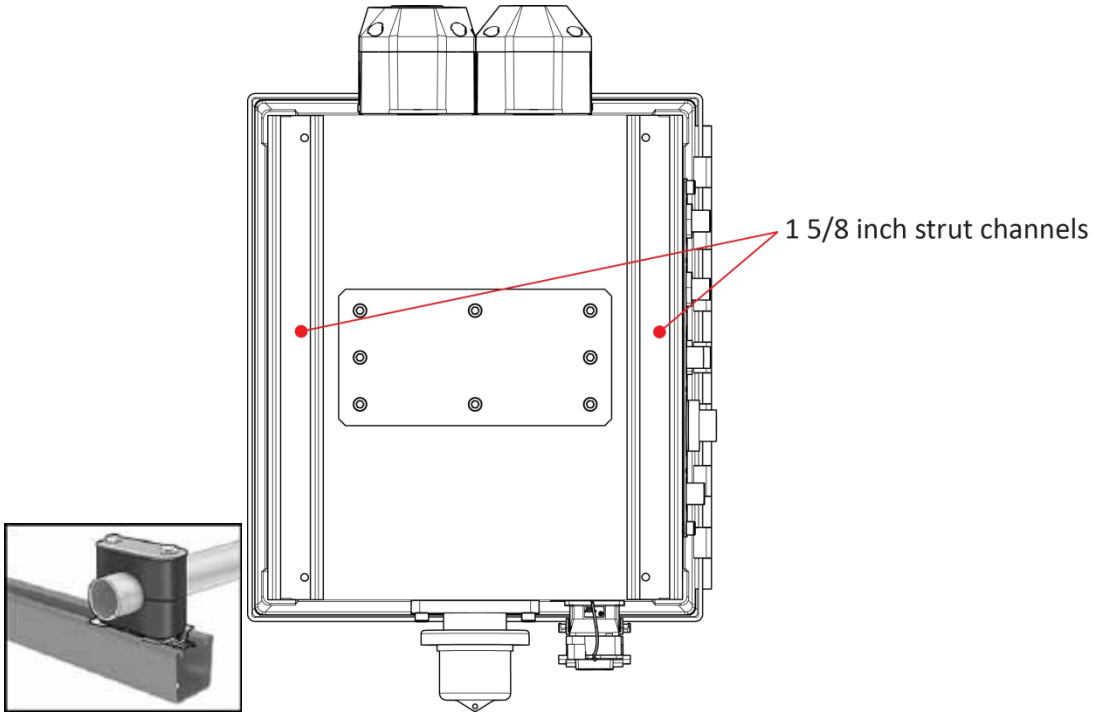


Figure 25. Mounting the Control Module

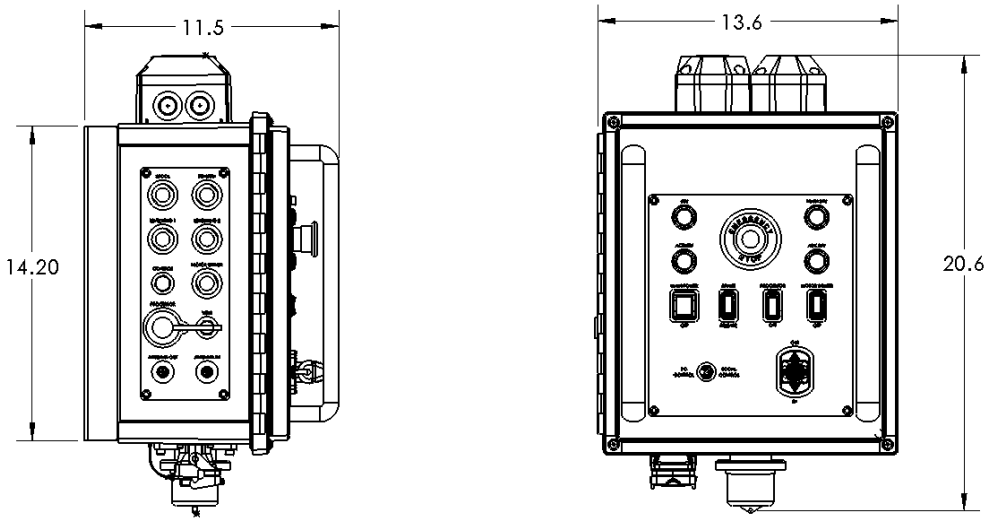


Figure 26. Control Module Dimensions

Line Properties

Spectra Line is composed of braided High-Molecular-Weight-Polyethylene.

- Negligible stretching means line does not snap back violently if severed under load.
- Rated tensile strength of 226 kg.
- Can splice multiple segments together.
- **Spectra Line is very sensitive to heat**, especially heat caused by friction. Portions of line that have been exposed to high heat should not be used, as heat permanently damages the line and makes it prone to breaking.

Never wrap line around fingers or limbs while the winch is powered as the line's high tensile strength can cause serious injury if body parts get caught by line as the winch is moving. Always wear the strap cutter included in tools and spare parts kit 6001751.

Excessive tension on the line or slamming the probe into its dock position can cause the line to bury between the spooled layers and can be difficult to release without damaging the line. Fixing sometimes requires cutting out and re-splicing the line to remove the stuck portion of line.

The very bottom layer of line is attached to the spool via adhesive tape and is not fixed in a permanent way. This is intentional. If the probe is snagged by a submerged obstacle, the idea is to allow the probe to be pulled cleanly off the spool once line runs out, rather than allow the winch to be damaged by a permanently tethered probe.

Mission-critical cruises would typically carry backup line and probes. Backup winches, however, are less likely to be carried, so the probe was considered the more expendable element in this worst-case scenario.

Each spool is loaded with a grand total of ~1954 meters of line, of which ~1700 meters can be used for normal operation. The line is spliced in three main sections:

- 55 m of "Leader" Red Line: When reeling in the probe, this warns users that the probe is near the vessel.
- 1645 m of White Line: Normal line used for deployment.
- 254 m of "Terminal" Red Line: Bottom part of the spool. The RapidCAST winch software prevents this portion from being paid out, and in fact, automatically stops deployment before this portion of line is reached. If, for some reason, the winch ends up using this segment of line (perhaps through misconfiguration, improper homing, or this safeguard is overridden). If line is still being deployed and you start to see **red line, use the EMERGENCY STOP BUTTON.**

Line Routing Procedure

IMPORTANT!!! Follow the lockout procedure before routing the line.

Before routing the line, remove the short section of Duct Tape that is securing the line to the spool. The spools are shipped with the line secured to the spool. Removal of the middle cover may be necessary.

Line routing procedure:

1. Thru the LevelWind rollers.
2. Over the tension arm rotational axis roller.
3. Under the tension arm outer roller.
4. Under the two horizontal pins in block and thru.

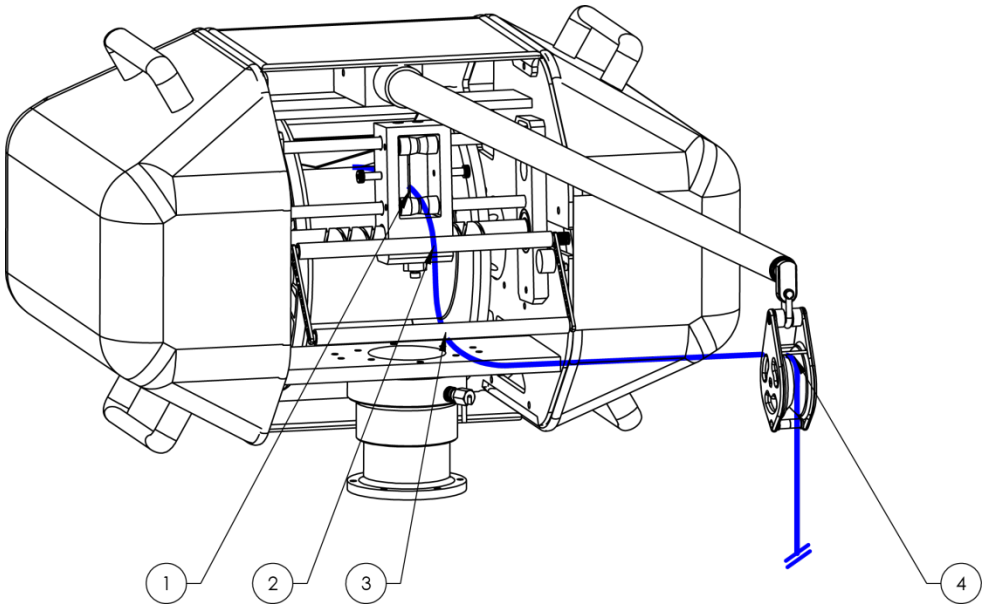


Figure 27. Line Routing Procedure

For shipping and storage, secure the line to the spool using a short 15cm piece of the Duct Tape.

Installing and Connecting the Probe

1. Remove tailspool - depress the white button and rotate tailspool as shown while holding probe.
2. Pass end of winch line thru shackle on tailspool.
3. Slide tailspool thru eye of winch line.
4. Pull winch line tight at shackle as shown. Make sure the eye of the line is not twisted and the eye lines are evenly tensioned when the line is pulled.
5. Re-install tailspool - rotate tailspool onto probe until white button engages and is springy when pushed. **

**there is only one position where the tailspool will mate with the probe.

If there is excessive "play" between the tailspool and probe, use a shim to tighten up the connection. Shims are included in the Tools and Spare Parts kit 6001751.

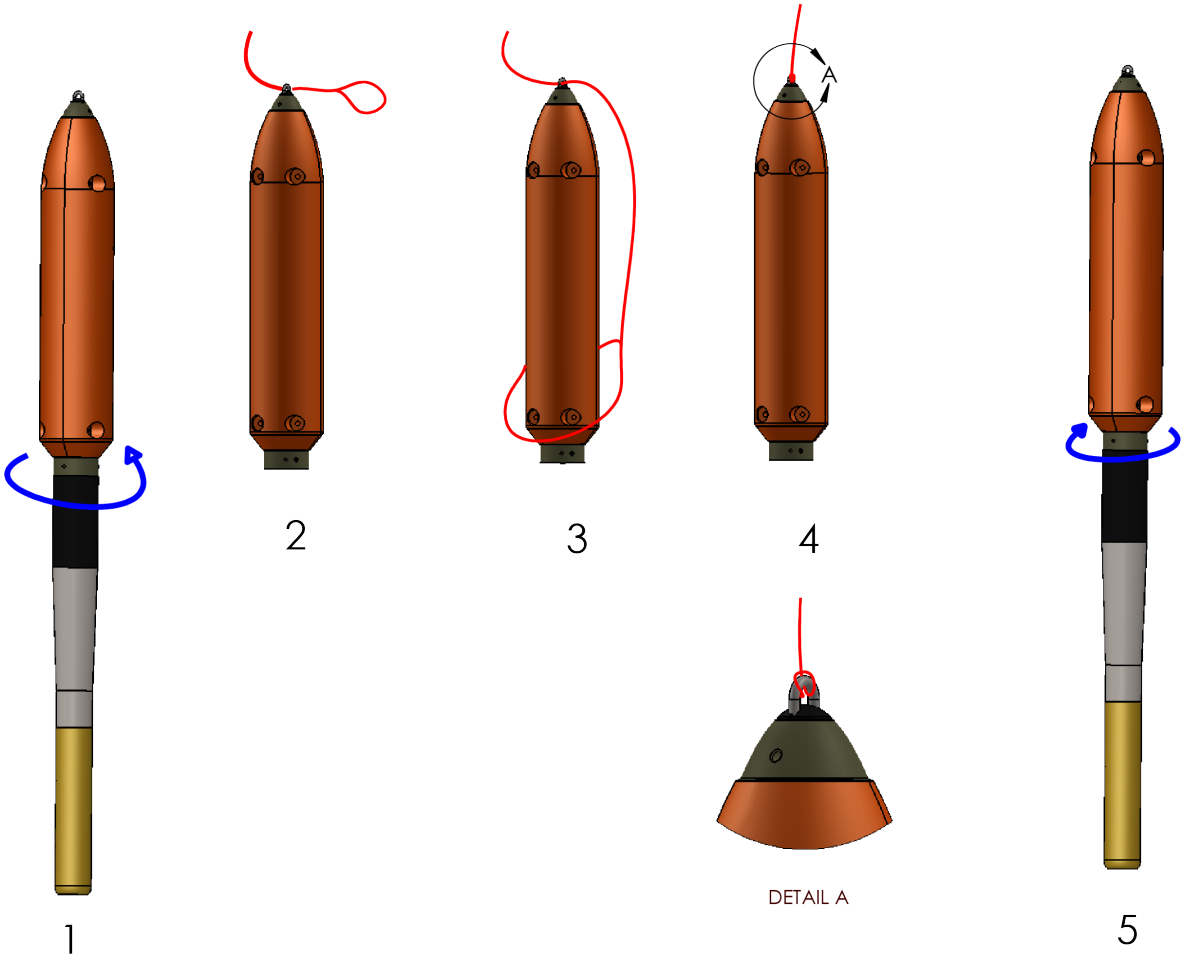
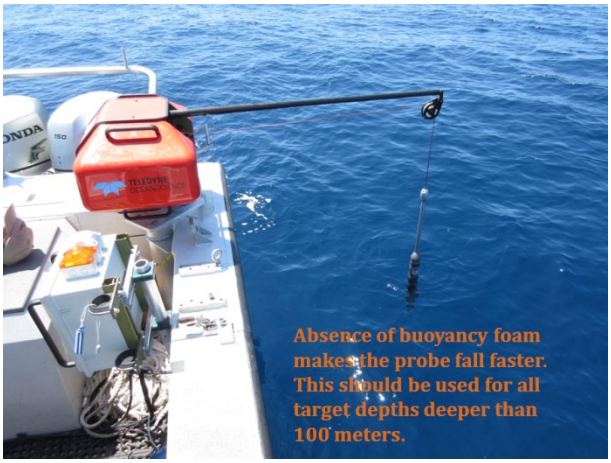
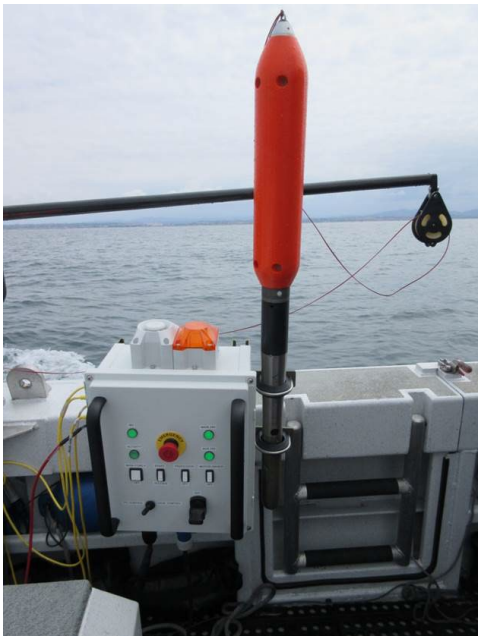


Figure 28. Installing the Probe

See **Loop Splice** for instructions on how to create a loop splice. Instruction videos are available for download on https://www.teledynemarine.com/support/RDI/technical-manuals.





The orange buoyancy tailspool module has a maximum depth rating of 100 meters. If you are deploying deeper than 100 meters, switch to the plain tailspool.

During intensive surveys, the probe loop splice should be replaced daily by cutting 50cm of line from the end and re-splicing the termination. See Loop Splice for instructions. The entire line section should be replaced after 1000 casts as a preventative measure.

Installing the Probe Software

Follow the instructions shipped with the probe to install the probe software onto the same computer running the rapidCAST Interface software.

Verifying Probe Communications

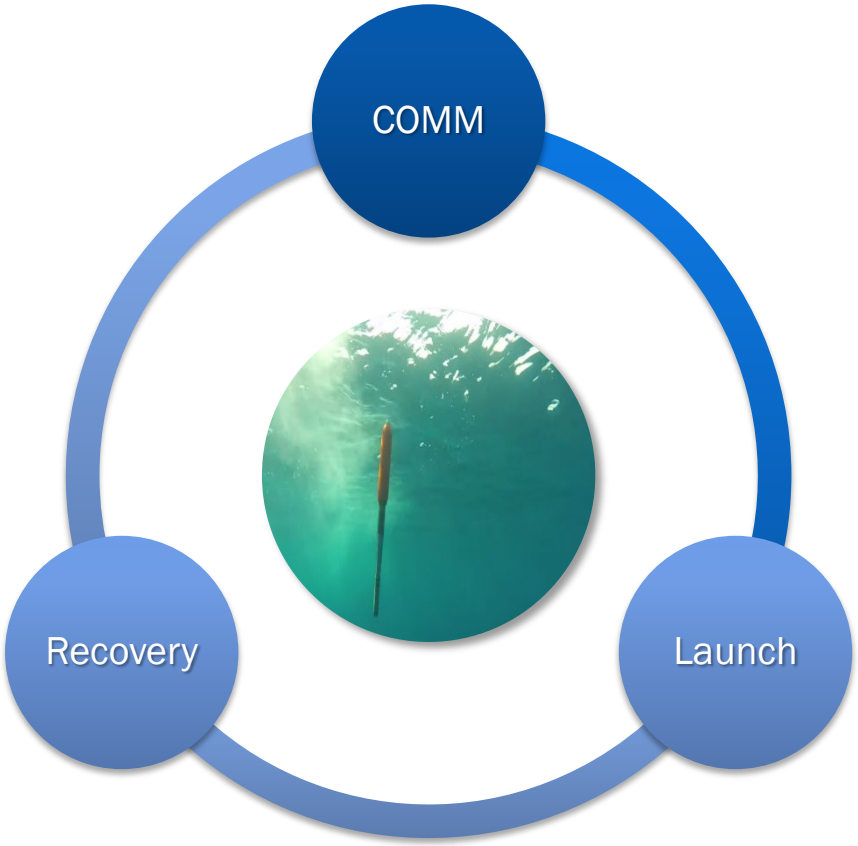
Follow the instructions shipped with the probe to verify that it can communicate using Bluetooth with the probe software.

The current version of Valeport rapidSVLog software is *extremely* conservative and reports a "low battery" warning even when there is still plenty of charge left. Actual low battery is when voltage is 1.0V or less.

Quick Review

	
Check that you have all the rapidCAST parts.	If you are missing parts, contact Teledyne RD Instruments support or call +1 (858) 842-2600.
Check that the system is installed.	Reference figures Figure 13 through Figure 28.
Check that the cables are connected.	Reference figures Figure 15 and Figure 16.
Check that the rapidCAST Interface Software is installed	Reference page 16.
Software, documentation, and training videos are available for download.	Use our online customer portal at https://www.teledynemarine.com/support/RDI/technical-manuals to download manuals or other Teledyne RDI documentation. RapidCAST Interface Software and the USB RS-485 Driver are available on https://tm-portal.force.com/TMsoftwareportal
Verify you can communicate with the probe	Reference page 35

Initial Setup



INITIAL SETUP INCLUDES THE FOLLOWING STEPS:

- Connecting the Winch to a PC
- Verifying Basic Motion Functionality
- Setting the Home Position
- Defining the Dock, Comm, Launch, and Recovery Positions
- Saving and Loading Workspaces

Power up Sequence

1. **Main Power Switch** set to **OFF position (down)**
2. **Control Switch** set to **PC Control**
3. **Brake, Processor, and Motor Driver Switches** are powered ON (up)
4. Connect and check all cable connections are secure
5. Turn power ON by switching the **Main Power Switch** to ON (up)

Connecting the Winch to a PC

To connect the winch to the PC and verify communication:

1. Apply power to the Control Module, follow **Power Up Sequence**.
2. Start the RapidCAST Interface software. The Select Communication Ports dialog will open. To re-open this screen, click the **Comms** menu.
3. Select the Serial COM Ports that were assigned in **Step 1 of Installing Drivers and Software**.

- Lower COM Port number for the **Telemetry COM**
- Higher COM Port number for the **Control COM**

Always assign the lower numbered port for **Telemetry** and the higher numbered port for **Control**. If the ports are switched, the winch will not be able to Define the Positions.

4. Once both the **Telemetry COM** and the **Control COM** have been assigned a COM Port Number, click the **Connect** button.

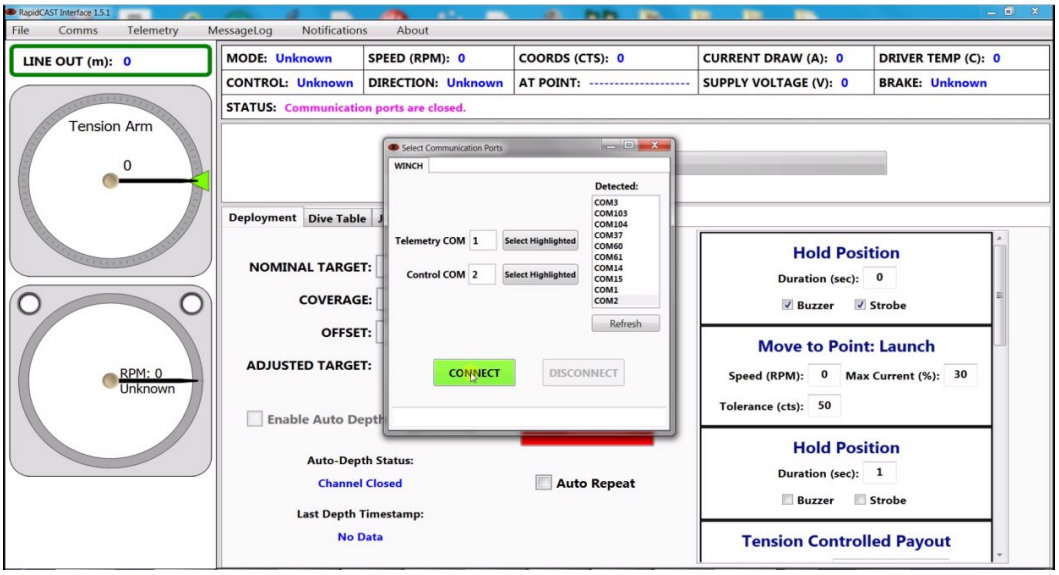


Figure 29. Assigning the COMM Ports

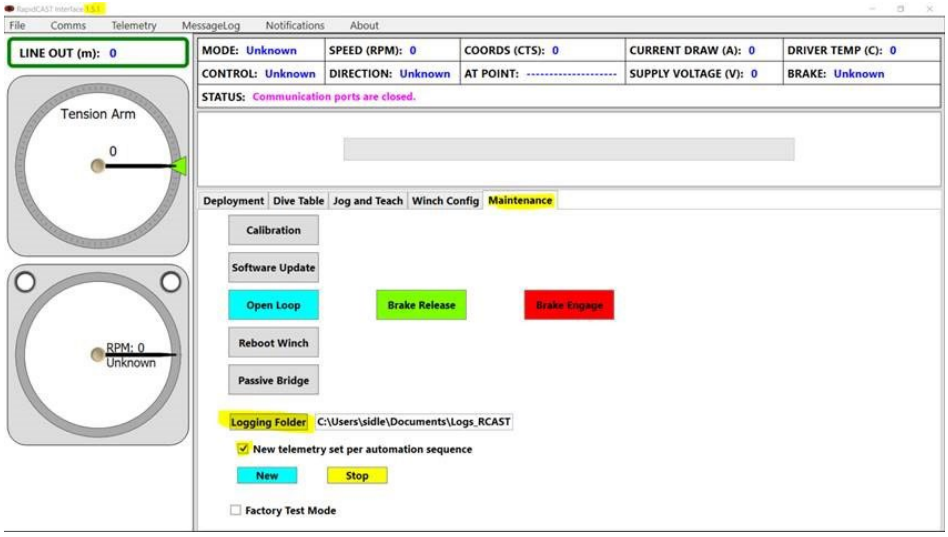
This step must be done each time the RapidCAST Interface software is started. See Installing the rapidCAST Interface Software for detailed instructions on how to identify what comm ports to use.

Using the Telemetry Log File

The Telemetry log file records all winch operations. In case something goes wrong, being able to provide TRDI the telemetry file provides priceless troubleshooting information of the rapidCAST operation. In fact, TRDI recommends logging telemetry during all casts.

To enable the telemetry log file:

1. Open the RapidCAST Interface software.
2. Click the **Maintenance** tab.
3. Check the **New telemetry set per automation sequence** box. This creates a new file for each cast.
4. Click the **Logging Folder** button and specify where to log the telemetry data.



Telemetry files can be large with multiple MB per hour accumulating on the hard drive. Periodically archive or delete the files to avoid running out of disk space.

Checking the Tension Arm Settings

If the below conditions are not met, DO NOT DEPLOY the rapidCAST. Follow the Tension Arm Zero Position Adjustment maintenance procedure and then perform a Tension Arm Calibration.

When the tension arm is at its lowest position, the angular gauge in the interface software should show the tension arm pointing at the far edge of the red zone. The reading should be 1000 to 1200.

Swing the tension arm slowly through its full range of motion and verify that at no point does the reading report less than 0 or greater than 4096 counts.

Verifying Basic Motion Functionality

The purpose of this section is to explain simple tests that should be performed on a newly installed winch to verify that it is operational.

To verify basic motion functions:

1. Turn power ON using the Power Up Sequence.
2. Start the rapidCAST Interface software.
3. On the Control Module, set the **Control Switch** to the **Local Control** position. Note that the rapidCAST may creep (slowly moving cable in/out) in the **Local Control** position.
4. Use the joystick to pay **OUT** and pay **IN** a few meters of cable. See Line Management and Check for Fouling when playing out line.
5. Observe the LevelWind and line as it is comes off the spool. The direction of the LevelWind travel and the direction cable is comes off the spool should match. See Adjusting the LevelWind Position if an adjustment is needed.
6. While paying OUT cable, press the **Emergency Stop** button on the Control Module. Verify that the break is engaged on the winch and power is off to the Control Module. ALL LEDs should be off except for the Aux 24V, see LED Functions.
7. Reset the **Emergency Stop** button and verify that the system powers up.
8. On the Control Module, set the **Control Switch** to the **PC Control** position.

When the joystick is not actively being used, the toggle switch should be set to **PC Control** to properly engage the brake. Note that the rapidCAST may creep (slowly moving cable in/out) in the **Local Control** position.

If the winch is run from the joystick (**Local Control**) for casts, the closed loop control fail safes are overridden and the user could damage the winch. **Always perform casts with the winch in PC Control.**

9. In the software, open the **Jog and Teach** tab.
   a. Click the **Crawl** button to set the speed to 8 RPM.
   b. Set **Jog Mode** to **Continuous**.
   c. Use the **In**, **Out**, and **Stop** buttons to deploy and retract a few meters of cable.
10. While deploying cable, press the **Emergency Stop** button on the **Interface Module**. Verify that the break is engaged on the winch and power is off to the Control Module. ALL LEDs off except for Aux 24V, see LED Functions.
11. Reset the **Emergency Stop** button and verify that the system powers up.

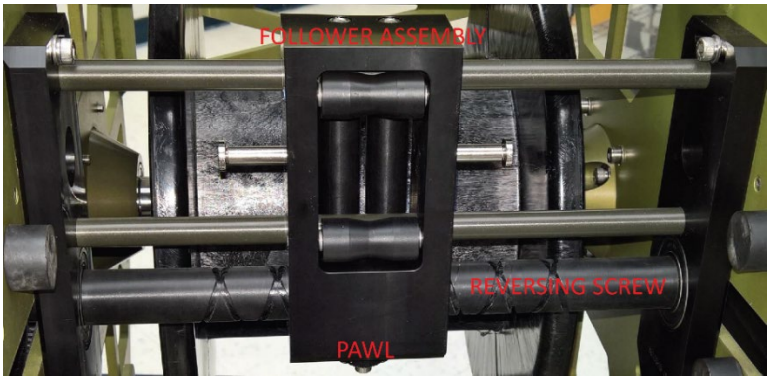
Figure 30. Jog and Teach Tab

Adjusting the LevelWind Position

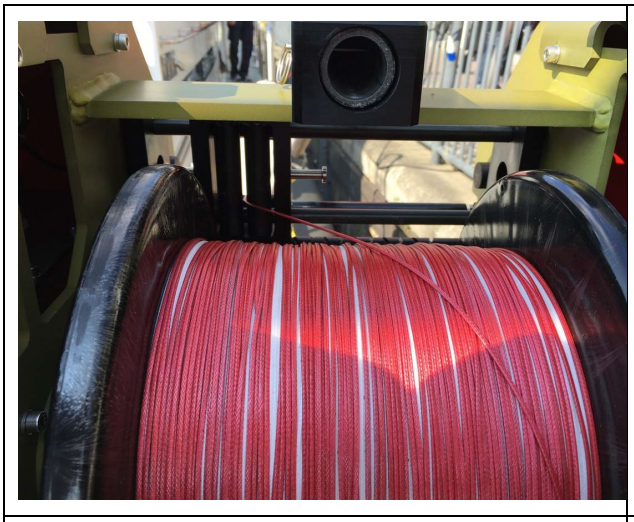
As line is deployed in or out, the direction of the LevelWind travel and the direction the line as it is rolled off the spool should be in-line with each other. The LevelWind's reciprocating motion is generated entirely mechanically via rotation of a reversing screw. The LevelWind Drive Belt links the reversing screw to the spool. Spool rotation, in turn, drives the reversing screw. A pawl (dull blade) sits inside the reversing screw grooves. As the reversing screw rotates, the pawl traces the contour of the groove and drags the follower along with it. When the end of travel is reached, the reversing screw thread loops back on itself, which causes the pawl to reverse direction and travel the opposite way.

To adjust the LevelWind position:

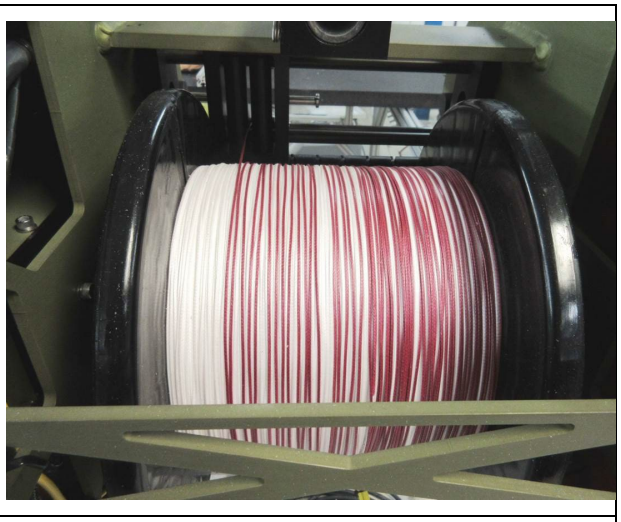
1. Follow Lockout Procedure to prevent winch operation while adjusting the LevelWind.
2. Disengage the LevelWind pawl by pulling down.



3. Move the LevelWind to match the position of the line as it comes of the spool.
4. Engage the LevelWind pawl spring pin by releasing it. Ensure that the pin is fully seated into the reversing screw groove.
5. Manually pull out line and observe that the when the LevelWind travels the line on the spool matches the direction of travel and location so that line is pulled straight off the spool.



LevelWind Out of Sync



LevelWind in Sync

Figure 31. LevelWind Adjustment

Line Management

While the probe is in the water or hanging in the air, it pulls on the line and keeps it under tension. This helps prevent line fouling.

When the probe is on deck, line is not normally under tension. If the spool is rotated outward while there is no tension on the line, loose loops can form. An operator may not notice loose loops due to the winch covers concealing the spool, and these loops may "hop" the spool sidewall or snag internal winch components and cause fouling.

When feeding line to someone holding the probe on deck, it is important to remember that line is flexible. The winch is incapable of "pushing" line out, so line should always be "pulled" under tension by the person requesting additional line.

Keep the line under tension when rotating the spool to guard against fouling.

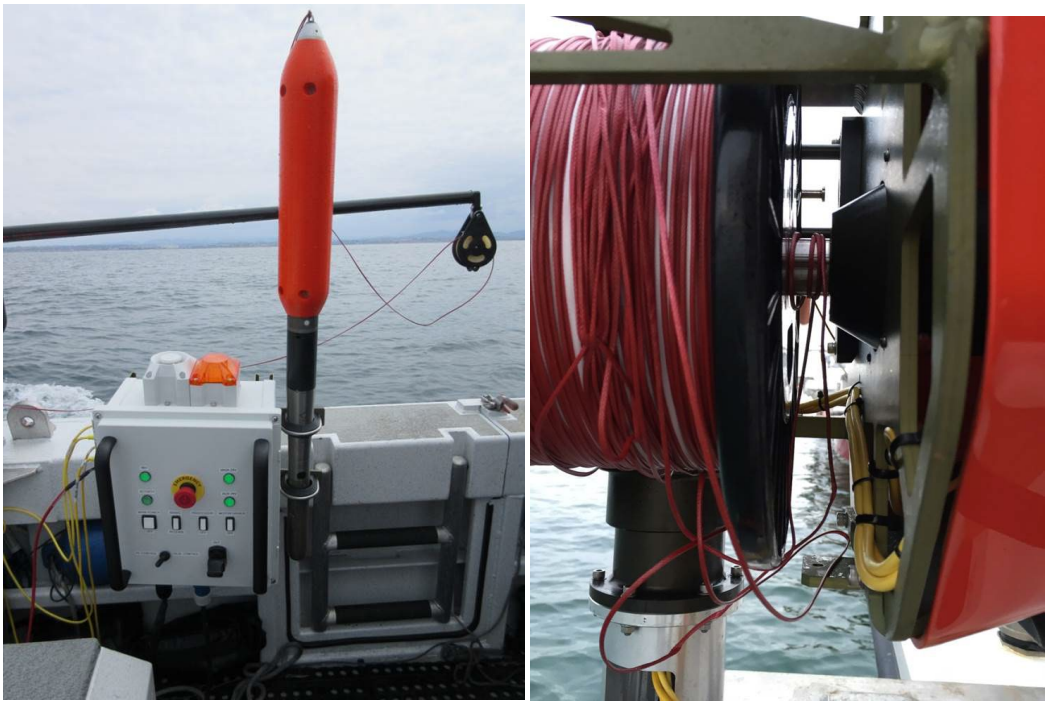


Figure 32. Line Management

Checking for Line Fouling

The easiest way to detect line fouling is to inspect the spool visually. Another indication of fouling is if the probe moves in a direction opposite what you expect:

- If you rotate the spool out, yet the probe moves closer…
- If you rotate the spool in, yet the probe moves farther…

These may indicate that line is wrapped around something undesirable.

Excessive tension on the line or slamming the probe into its dock position can cause the line to bury between the spooled layers and can be difficult to release without damaging the line. Fixing sometimes requires cutting out and re-splicing the line to remove the stuck portion of line.

Defining Positions

The following positions are dependent on vessel speed and environmental conditions. If either of these conditions changes significantly, re-evaluate the positions.

Setting the Home Position

The **Home** position is the absolute topmost position, where the probe can't go up any further. This is the position at which the encoder value is set to zero.

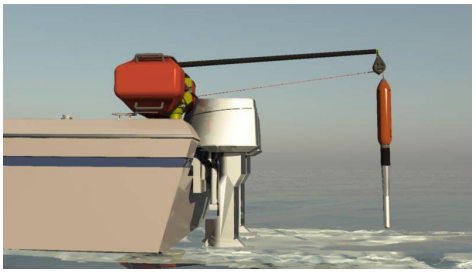
To set the **Home** position:

1. Turn power on to the system and start the rapidCAST Interface software.
2. On the Control Module, set the **Control Switch** to the **Local Control** position (joystick control) or **PC Control** position (use the **In**, **Out**, **Stop** and **Speed** buttons on the **Jog and Teach** tab).

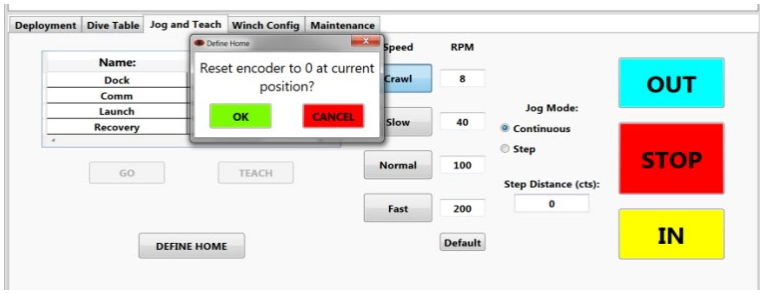
When the joystick is not actively being used, the toggle switch should be set to **PC Control** to properly engage the brake. Note that the rapidCAST may creep (slowly moving cable in/out) in the **Local Control** position.

If the winch is run from the joystick (**Local Control**) for casts, the closed loop control fail safes are overridden and the user could damage the winch. **Always perform casts with the winch in PC Control.**

3. Move the probe to the topmost position next to the swivel block at the end of the davit.



4. Click the **Jog and Teach** tab on the rapidCAST Interface software.
5. Click the **Define Home** button. On the Define Home dialog, click **OK**.



This step must be done each time the rapidCAST system is powered up.

The winch uses incremental encoders to track the spool position. Unfortunately, incremental encoders lose their value when power is lost (winch is turned off). When power is regained (winch is turned on) they always initialize at zero. Therefore, if the winch is currently at the **Launch** position, which originally had an encoder value of 12345 and then somehow power is lost at this position and subsequently regained, the encoders will now think that they are at value 0 (which is not the case). To recover from this, the probe needs to be manually moved to the home position and then the **Home** position is set once more.

Dock Position

The **Dock** position is where the probe is completely out of the water and at the topmost position next to the swivel block at the end of the davit. This is the position the winch will go to if the user wishes to bring the probe back on board and is ready to swing the davit around to the deck.

To define the **Dock** Position:

1. Move the probe to the topmost position next to the swivel block at the end of the davit.
2. Click the **Jog and Teach** tab on the rapidCAST Interface software.
3. Click **Dock** and then click the **Teach** Button. On the Record Position dialog, click **OK**.

Dock position should only be used to bring the probe on and off the boat.

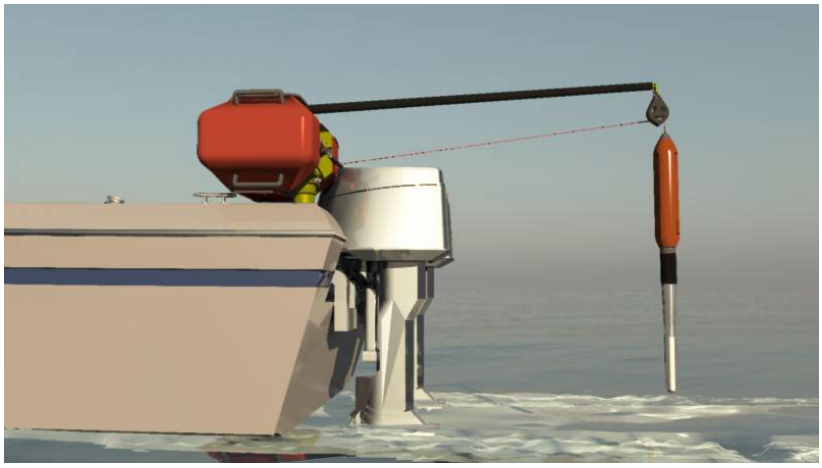


Figure 33. Dock Position

Comm Position

The **Comm** position is where the probe antenna is out of the water and can communicate with the Blue-tooth antenna. The front of the probe is in the water to maintain stability.

To define the **Comm** Position:

1. Move the boat forward at the desired survey speed.
2. Move the probe to where the probe antenna (the black portion of the probe) is out of the water.
3. Click the **Jog and Teach** tab on the rapidCAST Interface software.
4. Click **Comm** and then click the **Teach** Button. On the Record Position dialog, click **OK**.

Figure 34. Comm Position

The Comm Position will be closer to the vessel at slower speeds and farther out at higher speeds due to the hydrodynamic characteristics of the probe.

The Comm Position may require updating during operation due to the line packing effects on positional accuracy. As the line is wetted and tensioned during recovery, the Comm Position could drift and will be further away from the ship than the intended position. In this case, re-define the Positions and continue the survey.

Launch Position

The **Launch** position is located just outside the wake. This is the position you want the probe to be at just before initiating the tension control algorithm.

To define the **Launch** Position:

1. Begin moving the boat forward.
2. Move the probe to just outside the wake.
3. Click the **Jog and Teach** tab on the rapidCAST Interface software.
4. Click **Launch** and then click the **Teach** Button. On the Record Position dialog, click **OK**.

Figure 35. Launch Position

Recovery Position

Typically set the **Recovery** position is farther out from the **Launch** position. After the tension-controlled payout has finished, the rapidCAST will start reeling the probe back in. The reel-in speed can be fairly high (up to 200 RPM). The **Recovery** position is the point at which you are comfortable having the probe return to the boat at potentially high speed. Once the probe reaches the **Recovery** position, the reel-in speed will slow down when near the boat for safety and peace of mind.

To define the **Recovery** Position:

1. Begin moving the boat forward.
2. Move the probe to beyond the wake.
3. Click the **Jog and Teach** tab on the rapidCAST Interface software.
4. Click **Recovery** and then click the **Teach** Button. On the Record Position dialog, click **OK**.

Figure 36. Recovery Position

Saving and Loading Workspaces

The rapidCAST can save all of the settings for communications, Dock, Comm, Launch, and Recovery positions, and Configuration Settings to a Workspace file *(*.rcstprj* file). The settings will be lost in the event of a power cycle and can be recovered if they are saved.

To save a Workspace file:

1. Click **File**, **Save Workspace**.
2. Name the file and click **Save**. The **.rcstprj* file extension will be added automatically.

To open a Workspace file:

1. Click **File**, **Open Workspace**.
2. Locate the file and click **Open**.

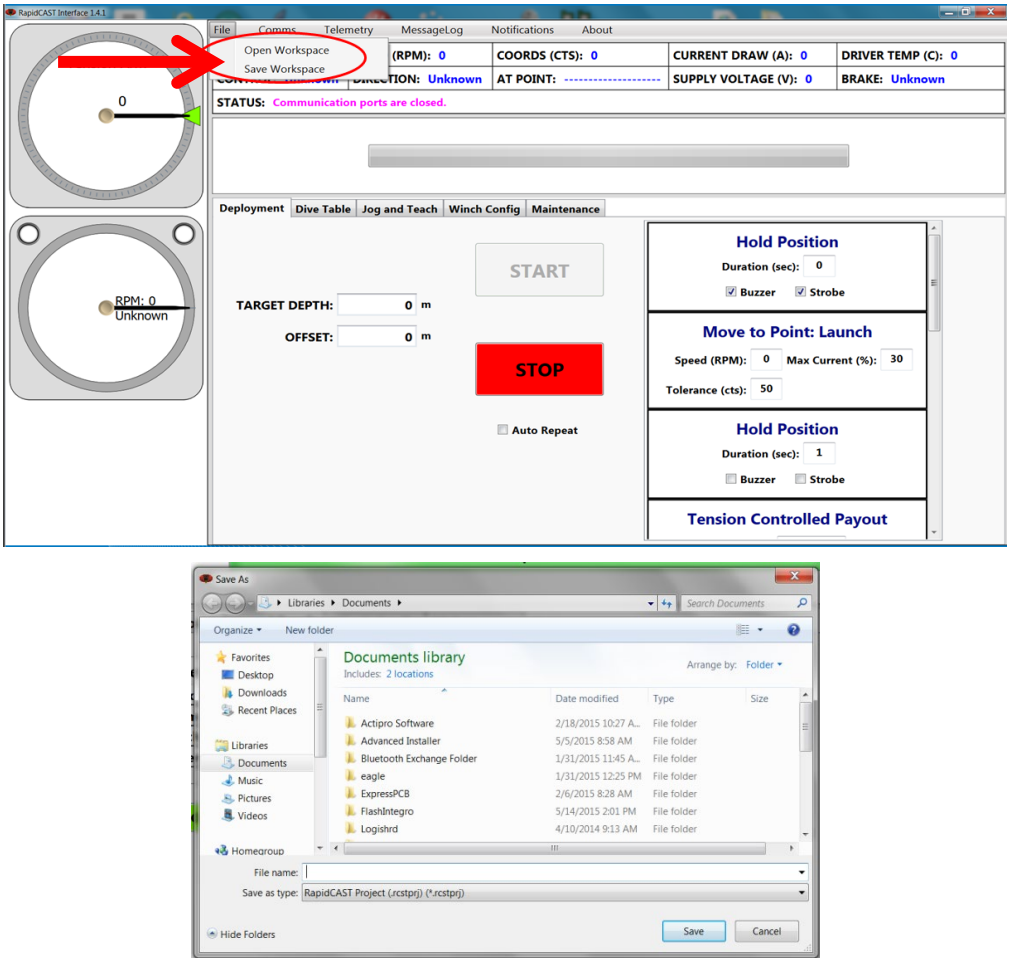


Figure 37. Workspace Files

Quick Review

	
Check that the communication ports are assigned.	Reference page 38
Turn on Telemetry logging	Reference page 39
Check the tension arm settings	Reference page 39
Check the Basic Motion Functionality	Reference page 39
Check that the Home, Dock, Comm, Launch, and Recovery positions are set	Reference page 43

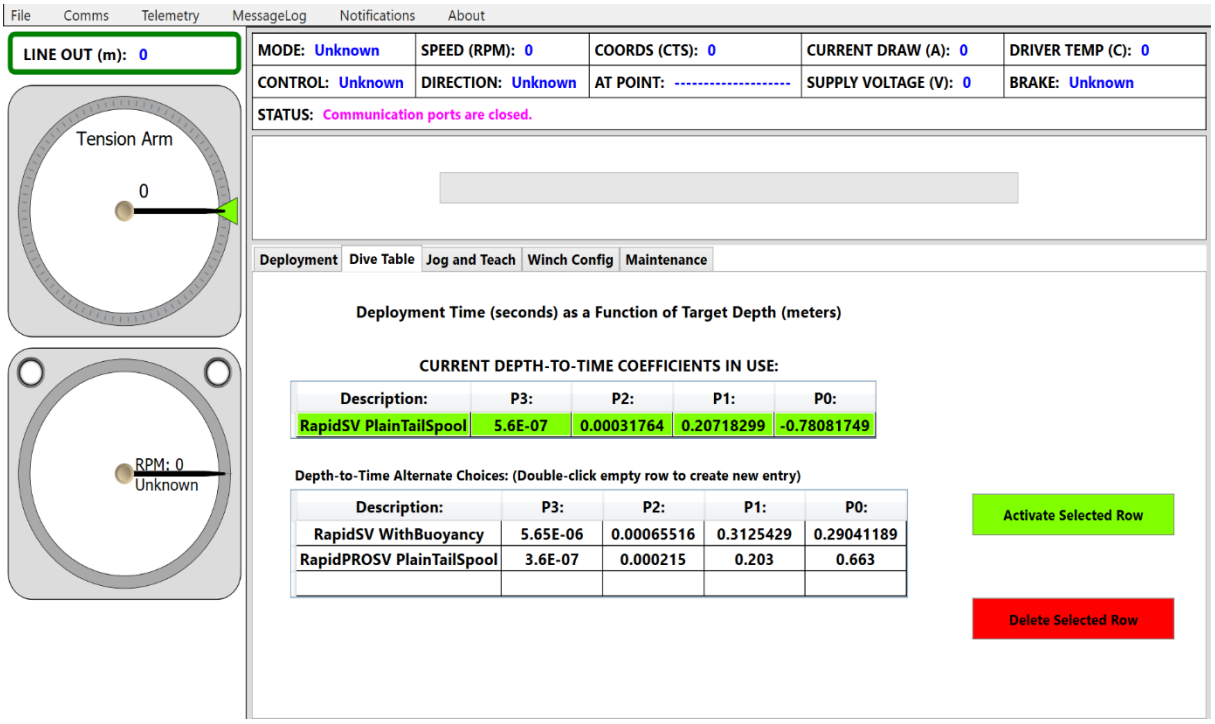
Curve Fitting & Dive Table Creation

When gravity is the primary force acting on the probe, its depth can be predicted via a ballistic dive table. The Dive Table is used to model the probe fall behavior during the deployment. Two tail spool options are possible.

- Tailspool with buoyancy module is used for deployments <100m to gain greater accuracy
- Plain tailspool is used for deployments >100m

To switch between pre-defined dive tables:

1. Start the rapidCAST Interface software.
2. Click the **Dive Table** tab.
3. The CURRENT DEPTH-TO-TIME COEFFICIENTS IN USE table shows the currently used dive table. To swap tables, select the Alternate Choice in the second table and click the **Activate Selected Row** button.



The orange buoyancy tail spool module has a maximum depth rating of 100 meters. If you are deploying deeper than 100 meters, switch to the plain tailspool.

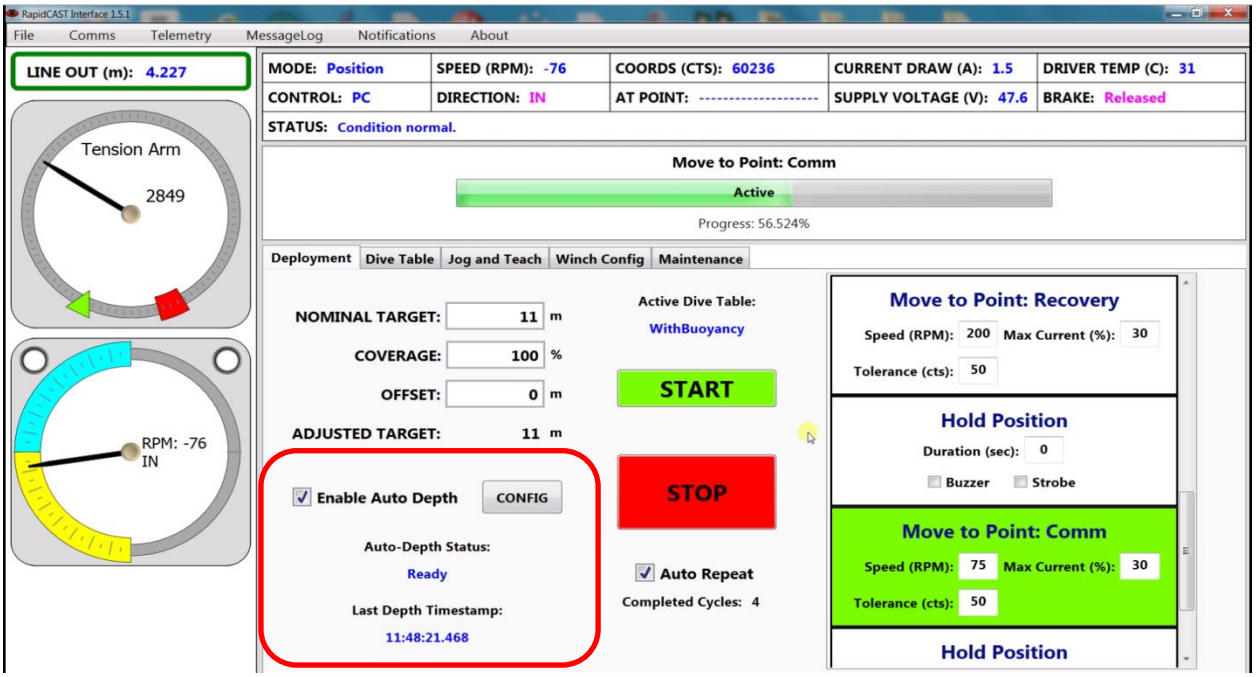
If you have a new probe or are operating in an environment with varying water conditions, a new dive table will need to be created. Please contact technical support for further assistance with this.

Using Auto-Depth

If **Auto-Depth** is enabled, the target depth is automatically set via NMEA 0183 messages from a depth sounder. DBT, DPT, DBK, and DBS sentences are supported. Serial communication is the supported transmission protocol in this initial release. NMEA messages may be input to the rapidCAST Interface via a physical serial port or a virtual serial port.

In cases where rapidCAST Interface and the hydrographic survey software both reside on the same PC, a virtual serial port may be the easier option to implement. If the survey software is already receiving NMEA messages to perform its job, and if it has data re-broadcast capability, the survey software may re-gurgitate the NMEA data through a virtual serial port, which rapidCAST Interface can connect to, without requiring physical cabling.

Third-party software can be used to create virtual serial ports. This feature has been successfully tested with EIVA NaviScan survey software working in conjunction with virtual serial ports provided by Eltima Software, for example.

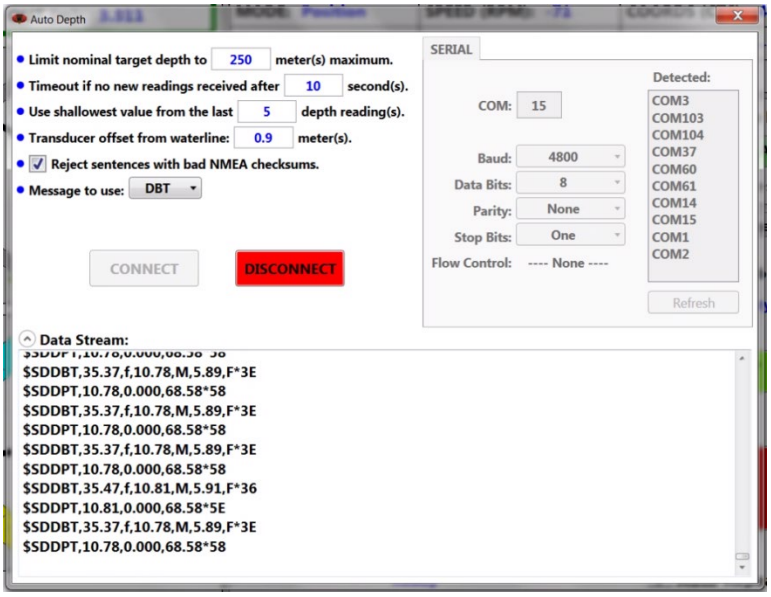


What Auto-Depth Does and Does Not Do

Enabling **Auto-Depth** simply allows the NMEA stream to automatically populate the "Nominal Target Depth" field as depth readings are received on-the-fly. For operational safety, it does NOT automatically deploy the probe without human authorization. An operator must still decide when to *start* the deployment sequence.

Nominal Target Depth is updated as each valid depth reading is received. This happens continuously until the tension-controlled deployment has started to ensure that the newest depth information is used up to the moment it is needed. Once probe freefall has started, a "Paused for Deployment" status message will indicate that the Nominal Target Depth is intentionally left unchanged for the duration of the cast, so that the user knows the depth that is being targeted. When the cast is finished, NMEA messages will resume updating the target depth.

Auto-Depth Customizable Parameters



Limit nominal target depth to [X] meter(s) maximum - The user can specify the maximum target depth that Auto-Depth is allowed to set. If you are operating in deep waters and only want to profile the upper 100 meters, for example, you can set this parameter so that any depth readings that are deeper are capped to this value.

Timeout if no new readings received after [X] second(s) - Auto-Depth and Auto-Repeat will be disabled if the NMEA stream has stopped and no valid readings are received within a user-selectable expiration time. If this happens in the middle of a deployment, the current deployment will be allowed to complete, but with **Auto-Repeat** disabled, additional casts will not be performed without operator authorization. This feature ensures that if contact with the depth sounder is lost, rapidCAST Interface will not be using old/outdated depth data. For operational safety, if depth readings resume, the user must manually re-enable **Auto-Depth** and/or **Auto-Repeat**, as desired.

Use shallowest value from the last [X] depth reading(s) - This feature reduces the probability of the probe hitting the seafloor if surveying in a complex environment with rapidly changing depths, or if depth sounder readings are fluctuating/noisy. From a candidate pool of the most recent depth readings, the shallowest of these readings is chosen as the target. The user can customize the size of the candidate pool. If the user does not wish to select shallower alternatives, this value can be set to 1, causing the candidate pool to consist of only one reading, which defaults to the newest depth.

Transducer offset from waterline: [X] meters - Nominal Target Depth is specified as the desired probe depth measured from the surface. Because the depth sounder may be mounted on different parts of the vessel (along the keel versus off to the side, for example), the depth reported by the transducer may be offset from the waterline. If a transducer is mounted 1.3 meters below the waterline, and it reports a DBT value of 15 meters, the actual depth from the surface is 15 + 1.3 = 16.3 meters. The value of [X] in this example should therefore be set to 1.3. This value will be *added* to each depth reading, correcting each one to be relative to the surface. This offset may also be negative, if the user wants to subtract a fixed value from each reported depth.

Reject sentences with bad NMEA checksums - The NMEA 0183 Standard specifies a checksum value to be appended to the end of every sentence in order to guard against possible message corruption. The sender of the message calculates a checksum based on the contents of the sentence that it is about to send, and embeds that value at the end of the sentence. The receiver of the message should also calculate a checksum based on the contents of the sentence that it has received. The sender's checksum and the receiver's checksum should match. If they do not, this indicates that the contents of the sentence have been altered by noise or communication errors.

If **Reject sentences with bad NMEA checksums** is checked, the rapidCAST Interface will calculate the checksums of each message received, and ignore sentences with invalid checksums, thus ensuring that the reported depth readings have not been altered by communication noise.

However, it has been discovered that some depth sounders (which otherwise operate correctly in every other respect) occasionally miscalculate the checksum value and provide bad checksums regardless. Some transducers have also been encountered that do not provide checksums at all, in contravention to the standard. If a user encounters this situation and wants to make use of the provided messages anyway, this setting should be unchecked.

Message to use - Users should specify the expected message type (DBT, DPT, DBK, or DBS) to use for extracting depth information. If more than one of these message types are present in the NMEA stream, the user must choose one to use (ideally the message that gives the most reliable depth readings).

Auto Depth Status

Auto Depth Status informs the operator of Auto-Depth state.

Possible status messages are:

- **Channel Closed***:* The NMEA communication channel is closed and not receiving messages.
- **Channel Open**: The NMEA communication channel is open and waiting for messages, but no valid messages have yet been received.
- **Timeout**: The allotted time to receive a new NMEA message has expired, causing **Auto-Depth** and **Auto-Repeat** to be deactivated.
- **Ready**: Valid NMEA messages are currently being received and can be used to update the Nominal Target Depth if the user chooses to enable Auto-Depth.
- **Paused for Deployment**: During probe freefall, this indicates that Nominal Target Depth is intentionally kept frozen to inform the user of the intended depth for the current cast.
- **Error**: An unexpected communication error is preventing NMEA messages from being read.
- **Bad NMEA Checksum**: Appears only when **Reject sentences with bad NMEA checksums** is checked. This is reported if a checksum mismatch has been detected for the latest NMEA message, causing it to be rejected.
- **Last Depth Timestamp** reports the PC clock time when the last depth reading was received. This should continually update while depth data is streaming. If this timestamp has stopped, valid depth values are no longer being received, and if stopped for long enough, a Timeout condition will result.

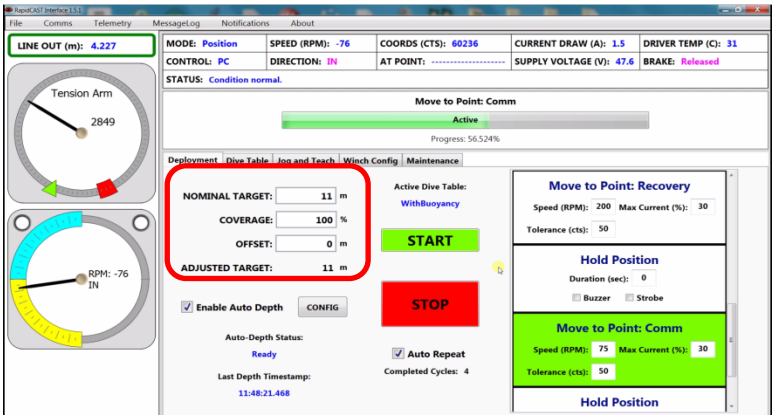
Using Coverage

In the ideal case, a properly fitted dive table ensures that the probe will end up slightly shallower than its target depth (i.e., the possibility of the probe impacting the seafloor is minimal). With an optimal dive table, there is reasonably good agreement between the planned target depth and the actual depth achieved by the probe during each cast. In this ideal situation, no adjustments are necessary.

If operating conditions or probe drop behavior changes drastically, the dive table may no longer be reliable, and the probe may end up significantly deeper or shallower than the intended depth. The ideal remedy is to redefine the dive table to match current conditions but collecting data for a new dive table takes time and effort.

As a crude alternative, adjustments can be applied to the Nominal Target Depth, increasing or decreasing it as necessary, to reduce the gap between intended depth and actual depth.

An Offset parameter allows a user to add a positive or negative distance to the Nominal Target Depth to "tweak" the depth that is ultimately fed to the dive table, so that the actual achieved depth agrees more closely with the intended target. For example, if the Nominal Target Depth is 30 meters, and it is discovered that the current dive table is achieving an actual probe depth of 28 meters, an Offset of 2 meters can be entered to make the probe fall deeper. Conversely, if the Nominal Target Depth is again 30 meters, but the actual depth overshoots the target and is 31.5 meters, a negative offset of -1.5 meters can be entered to adjust the depth shallower. *The Offset parameter is additive: positive offsets will make the probe fall deeper; negative offsets will make it fall shallower.*



RapidCAST Interface 1.5.1 introduces a multiplier factor called **Coverage**. **Coverage** is a positive-valued parameter that can adjust Nominal Target Depth from 0% thru +100% to give the user increased flexibility in specifying a correction factor. In the context of depth correction, these fields take on the following meaning:

Nominal Target Depth: The depth which the user *truly* wants to achieve with the probe; the actual goal.

Adjusted Target Depth: The corrected depth that is passed to the dive table in order to achieve the Nominal Target Depth. This is the "tweaked" depth that is feed the dive table in order to coerce it into achieving the nominal depth, in reality.

*Nominal Target Depth * (Percent Coverage / 100) + Offset = Adjusted Target Depth*

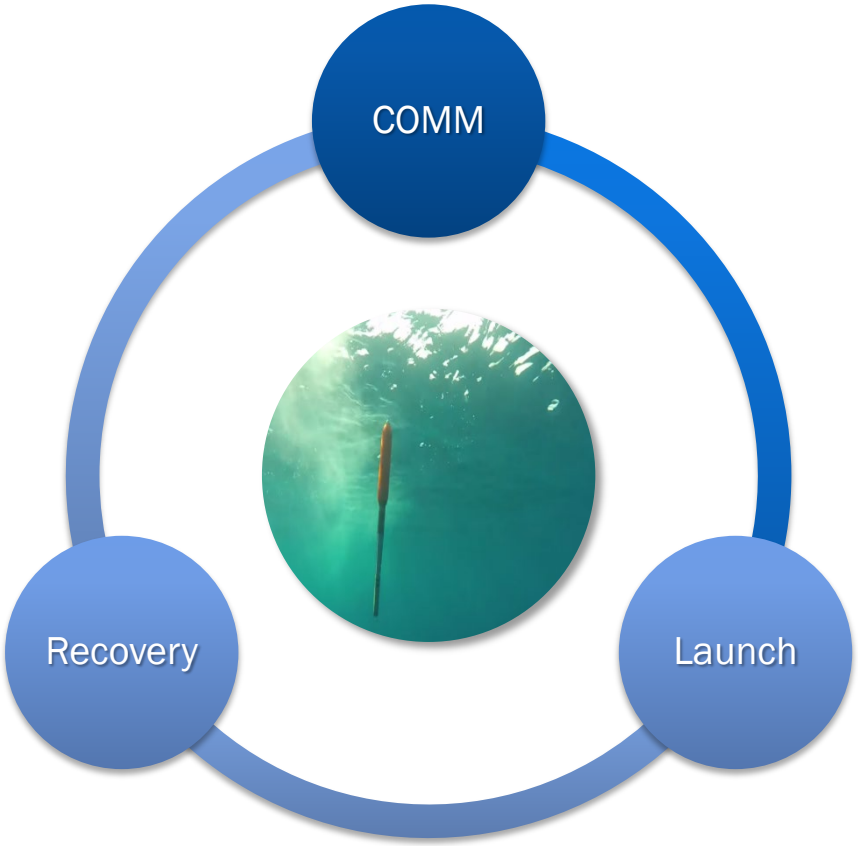
If no adjustments are necessary, **Coverage** should be 100% and **Offset** should be 0 meters, in which case the dive table will receive the Nominal Target Depth as-is.

Beyond acting merely as a corrective multiplier, an alternate interpretation for Coverage can be found in the context of Auto-Depth: Assuming an accurate dive table, now that a depth sounder can measure the depth to the seafloor and can set the **Nominal Target Depth** to this value automatically; the user can specify percent coverage of this depth. For example, if the user wants the probe to cover 90% of the water column, **Percent Coverage** can be set to 90%.

Using Auto-Repeat

After the deployment sequence has been started by the user, hands-free automation comes in the form of the **Auto-Repeat** checkbox being checked. If **Auto-Repeat** is enabled, the deployment sequence will automatically repeat at the conclusion of each cast. A user-selectable wait period can be specified via the final Hold Position task to give the probe time to download its data before being deployed again and/or to control the frequency of automated casts. If **Auto-Repeat** is *not* checked, the winch remains stationary until the user starts the next cast.

Performing Your First Cast



CASTING INCLUDES THE FOLLOWING STEPS:

- Checklists
- Step 1 – Setup
- Step 2 - Set Target Depth
- Step 3 – Set Parameters
- Step 4 - Launch
- Step 5 - Tension Controlled Payout
- Step 6 – Recovery
- Step 7 – Communication and Data Download from Probe

Pre-Deployment Checklist

Perform a detailed inspection before casts:

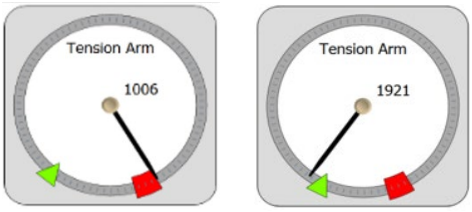
Check	Description

☐ 1. ✔ Connect the Winch to a PC

- Lower numbered Comm port for **Telemetry**
- Higher numbered Comm port for **Control**

☐ 2. ✔ Turn on Telemetry logging

☐ 3. ✔ Check the tension arm settings prior to operation



☐ 4. ✔ Verify Basic Motion Functionality

When the joystick is not actively being used, the toggle switch should be set to **PC Control** to properly engage the brake. Note that the rapidCAST may creep (slowly moving cable in/out) in the **Local Control** position.

If the winch is run from the joystick (**Local Control**) for casts, the closed loop control fail safes are overridden and the user could damage the winch. **Always perform casts with the winch in PC Control.**

☐ 5. ✔ Set the Home Position

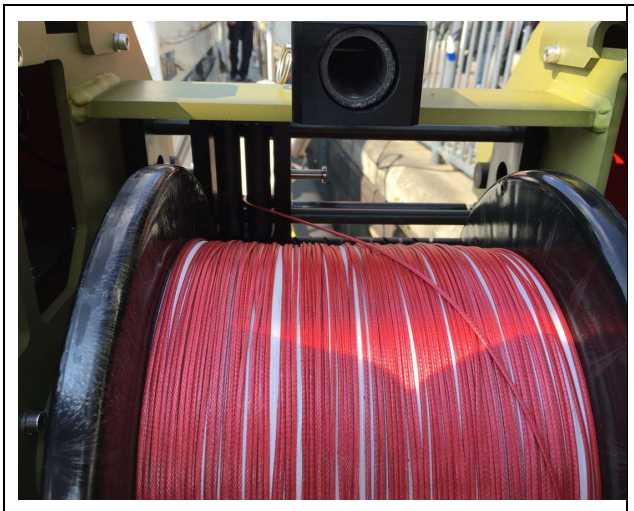
☐ 6. ✔ Define the Dock, Comm, Launch, and Recovery Positions

☐ 7. ✔ Save and Load the Workspace

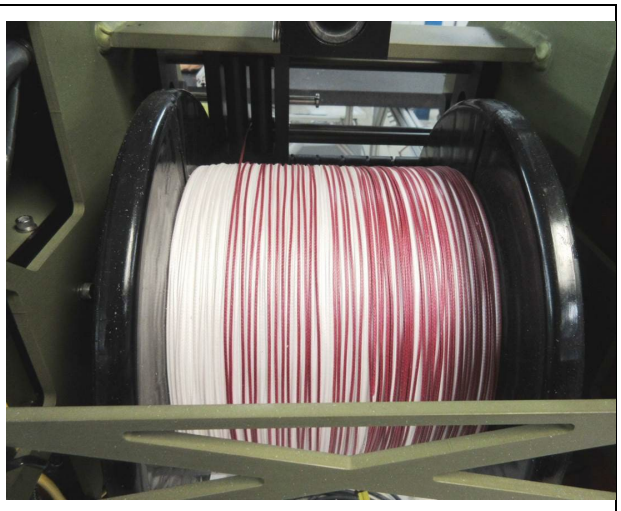
Pre-Cast Checklist

Use this checklist before starting a cast:

Check	Description
☐ 1.	✔ Line is routed correctly through LevelWind, tension arm, and pulley block.
☐ 2.	✔ Line is tight on the spool and not tangled or buried below the surface layer of the spool.
☐ 3.	✔ LevelWind is in sync with line.
☐ 4.	✔ Line is not damaged, and the loop splice is in good condition.
☐ 5.	✔ Tension arm moves smoothly when tension is applied to line.
☐ 6.	✔ Tension arm settings (see Pre-deployment checklist).
☐ 7.	✔ Tailspool shackle is free from defects, scratches, or anything that may damage the line.



LevelWind Out of Sync



LevelWind in Sync

During Operation Checklist

Use this checklist while casts are in process:

Check	Description
☐ 1.	During intensive surveys, the probe loop splice should be replaced daily
☐ 2.	The entire line section should be replaced after 1000 casts as a preventative measure.
☐ 3.	Keep the line under tension when rotating the spool to guard against fouling.
☐ 4.	Monitor Telemetry log file size and available disk space.
☐ 5.	Every 10 to 50 casts, rinse the LevelWind assembly and Davit Block with fresh water to prevent salt build-up.

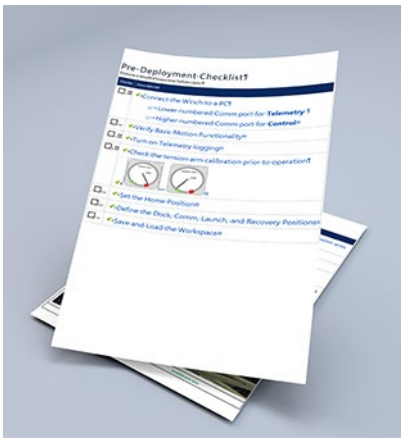
After Operation Checklist

Use this checklist after casts are done:

Check	Description
☐ 1.	Rinse the LevelWind assembly and Davit Block with fresh water to prevent salt build-up.
☐ 2.	Coat the LevelWind bearings with DC111 or AquaShield to prevent cosmetic rust.
☐ 3.	Stow the system in the cases when it is not in use for long periods.
☐ 4.	Cover the system with a tarp when not used for short periods.

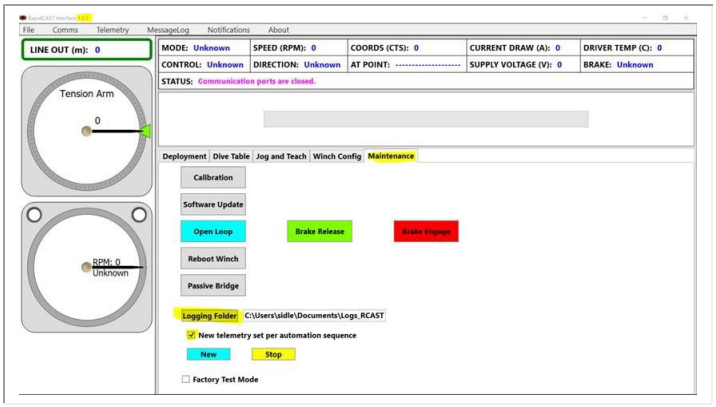
Performing Casts

Step 1 –Setup



1. Use the Pre-Deployment, Pre-Cast, and During Operation checklists.

Checklists can be printed.



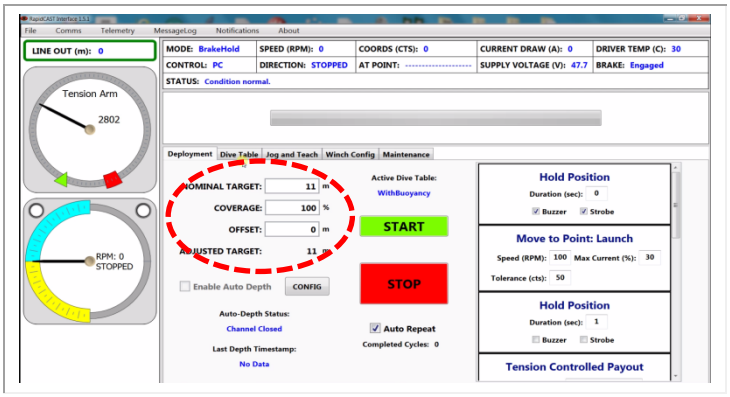
2. Turn on Telemetry logging.

For more information, see Using the Telemetry Log File.

The training probe (P/N 8000112) should be used for the first two to three casts every day to ensure proper setup and functionality.

3. Attach the desired tailspool to the line.
4. Slowly lower the probe into the water by holding the line and slipping it out by hand.
5. Check that the swivel is locked or unlocked in the desired position.

Step 2 – Set Target Depth



Start the rapidCAST system and verify that the Home, Dock, Comm, Launch, and Recovery positions are set (see Initial Setup). Check the selected Dive Table.

Click the **Deployment** tab.

Enter the **Target Depth** for the probe.

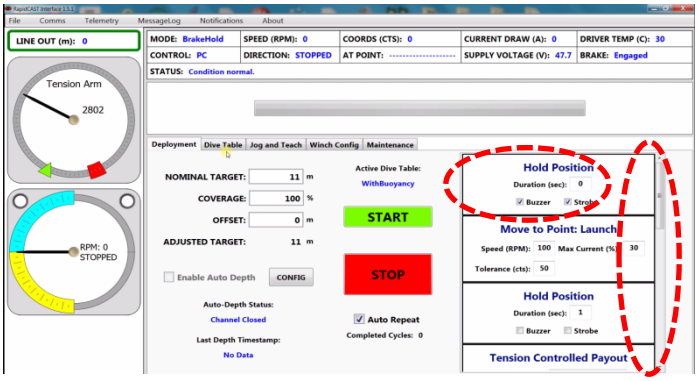
Leave the **Offset** set to zero and **Coverage** set to 100% for the first casts.

When **Auto Repeat** is checked, once the start button is checked, the deployment sequence will automatically repeat at the conclusion of each cast until **Auto Repeat** is unchecked.

For more information, see Using Auto-Depth, Using Coverage, and Using Auto-Repeat.

When the joystick is not actively being used, the toggle switch should be set to **PC Control** to properly engage the brake. Note that the rapidCAST may creep (slowly moving cable in/out) in the **Local Control** position. **Always perform casts with the winch in PC Control.**

Step 3 – Set Parameters



If you want to enter a delay between steps, enter a number of seconds in the **Hold Position** boxes.

Select Buzzer and/or Strobe to add warnings between steps as needed.

Recommended setting:

Enter a delay of 1 to 5 seconds between steps except for the hold position between **Tension Controlled Payout** and **Move to Point Recovery**. This hold duration should be **equal to** the Tension Controlled payout duration. This will help in the initial retrieval of the probe by using the boat's forward speed.

Select the Buzzer for the first step only. Use the Strobe for the rest of the positions.

The software sequence will execute the following actions, in order. The actions have a default setting and are all user settable.

Review the settings by scrolling through:

Hold Position – time before next task begins with an audio/visional notification option.

Move to Point: Launch – move the probe to launch point defined in Jog and Teach tab.

Hold Position – time before next task begins with an audio/visional notification option.

Tension Controlled Payout – Deploy probe for XX seconds as defined in Dive Table tab.

Hold Position – time to hold probe using brake and bring it to surface.

This Hold duration should be **equal to** Tension Controlled payout duration.

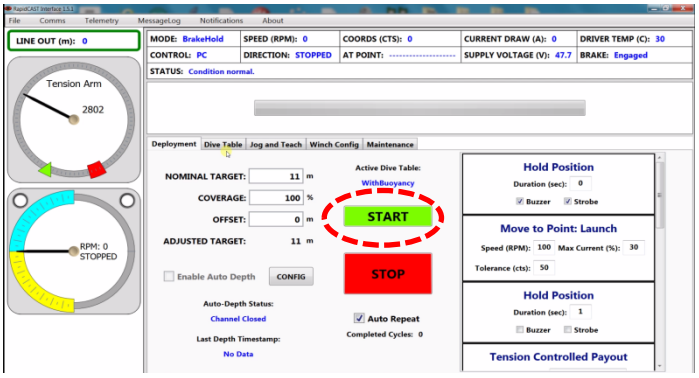
Move to Point: Recovery – Recovery of probe to recovery point defined in Jog and Teach tab.

Hold Position – time before next task begins with an audio/visional notification option.

Move to Point: Comm – Recovery of probe to comm point defined in Jog and Teach tab.

Hold Position – option to signal cast completion with an audio/visional notification.

Step 4 – Move to Point Launch



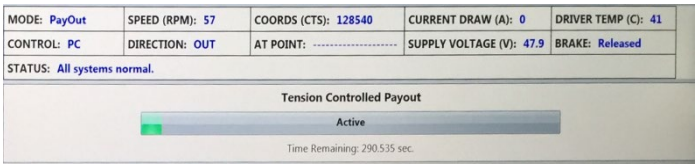
Move the boat forward at the desired survey speed.

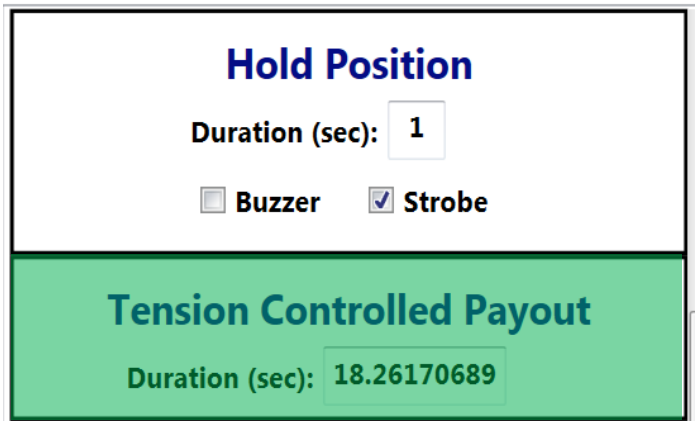
Click the **Start** button.

Watch the video showing a rapidCAST deployment.

When **Auto Repeat** is checked, once the start button is checked, the deployment sequence will automatically repeat at the conclusion of each cast until **Auto Repeat** is unchecked.

Step 5 – Tension Controlled Payout

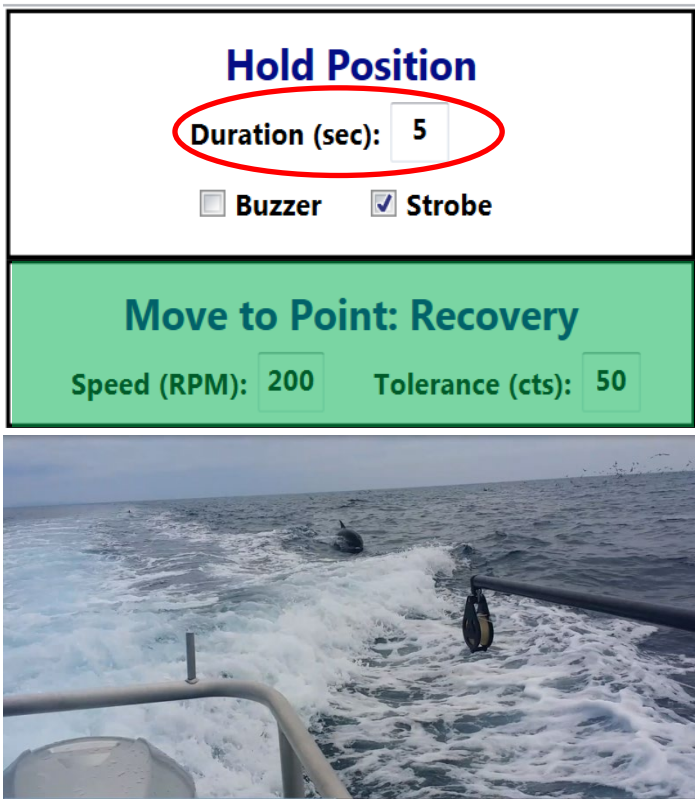




Observe the progress bar as each step is completed.

Observe the winch tension control arm and line operation.

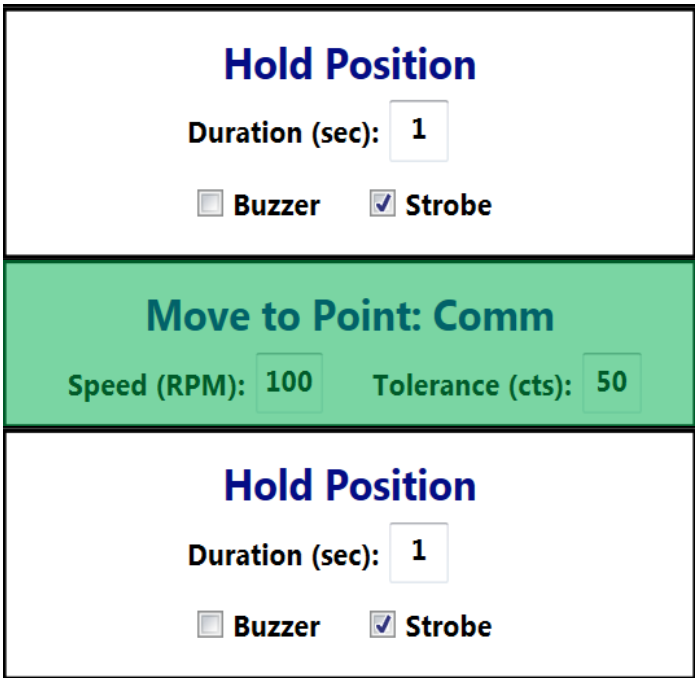
Step 6 – Move to Point Recovery



Observe probe as it is rapidly retrieved to the Recovery position.

Set the Hold position before Recovery **equal to** the Tension Controlled payout duration. This will help in the initial retrieval of the probe by using the boat's forward speed.

Step 7 – Move to Point Comm



Once the probe returns to Recovery position the speed will drop until the probe returns to the Comm position. The probe software will open and data download over the Bluetooth connection will begin.

Observe the progress bar as each step is completed.

Observe the winch tension control arm and line

Observe the data download and depth the probe obtained. If this depth is slightly different then the set depth in step 2, use an offset for the next cast.

When **Auto Repeat** is checked, set the final Hold Position long enough for the probe to download data. The rapidCAST will start another cast until **Auto Repeat** is unchecked.

Telemetry files can be large with multiple MB per hour accumulating on the hard drive. Periodically archive or delete the files to avoid running out of disk space.

Complete

That's it! You completed a cast.

To start another cast, repeat steps 4 through 7.

Quick Review

	
Setup and check system	Step 1 - Setup
Check that target depth is set	Step 2 – Set Target Depth
Review/Set Parameters and verify hold positions have been entered as needed	Step 3 – Set Parameters
Check that rapidCAST moves through deployment steps	Step 4 – Move to Point Launch Step 5 – Tension Controlled Payout Step 6 – Move to Point Recovery
Check that Data Downloaded Target Depth met	Step 7 – Move to Point Comm
After casts are done	Follow the After Operation Checklist

Resolving Fault Conditions

PROBLEM: Can connect in RS485 and move the spool using RapidCAST Interface to jog, but not teach the rapidCAST the Dock, Comm, Launch, and Recovery positions.

INDICATIONS: Symptoms of having the ports incorrectly set:

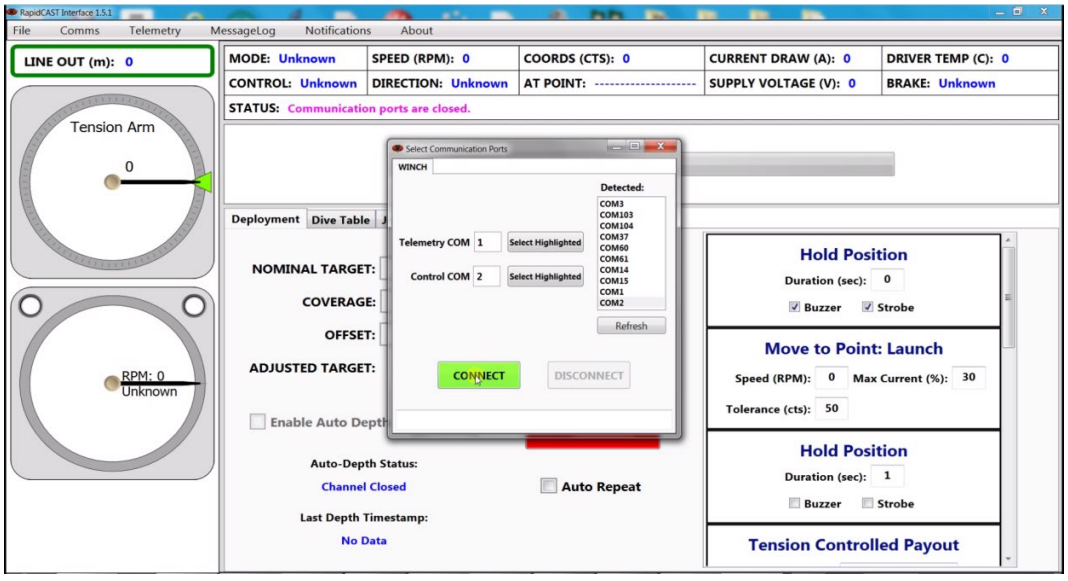
- Jog functions normally
- Able to click connect once the Comm port numbers are entered
- Can not define the Dock, Comm, Launch, and Recovery positions
- Can not calibrate the tension arm
- The spool and the tension arm counts and most of the Runtime Telemetry remain at zero
- There is no software incompatibility issues: i.e. there is no red text in the **About** screen
- The Control Module's front panel lights, including the activity light behave as expected
- All external cables are connected, and show no signs of corrosion or other issues

DESCRIPTION: If the communication ports for **Telemetry** and **Control** are swapped, the rapidCAST Interface will connect, but you will not be able to teach the Dock, Comm, Launch, and Recovery positions.

BASIC REMEDIES:

Follow the instructions on Installing the rapidCAST Interface Software and ensure:

- **Lower** numbered Comm port for **Telemetry**
- **Higher** numbered Comm port for **Control**

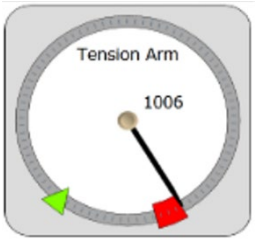


PROBLEM: The rapidCAST performs opposite of what the operator expected.

INDICATIONS: The tension arm reads above 1200 when no tension is applied.

DESCRIPTION: The tension arm zero-position range of 1000 to 1200 sets a reference point and the tension arm calibration sets the scaling. If the tension arm range ever goes over 4096 at the top end of the scale (because of bad zeroing or improper calibration) then the motor will reverse direction, which could snap the line or deploy it out depending on the operation being requested.

BASIC REMEDIES: Follow the instructions in Tension Arm Zero Position Adjustment and then do a Tension Arm Calibration.

	When the tension arm is at its lowest position, the angular gauge in the interface software should show the tension arm pointing at the far edge of the red zone. The reading should be 1000 to 1200.
	Swing the tension arm slowly through its full range of motion and verify that at no point does the reading report less than 0 or greater than 4096 counts.

PROBLEM: The Control Module does not appear to be powered.

INDICATIONS: One or more LEDs on the Control Module are off. In the example picture shown below, the 48V LED is off. The 48VDC power supplies the fans and motor controller. You should not be able to hear the fan running when the box is open.

DESCRIPTION: For normal operation:

- ✓ The green 48V, Main 24V, and Aux 24V LEDs must all be lit
- ✓ The green Activity LED must be blinking
- ✓ The red Emergency Stop LED must be lit

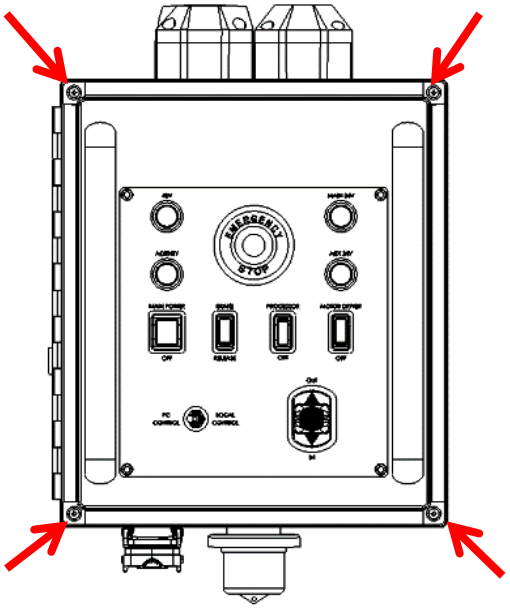
An unlit LED indicates a lack of power to the corresponding subsystem, or a failure of the LED itself (unlikely).

BASIC REMEDIES: (ensure that ALL the following are satisfied):

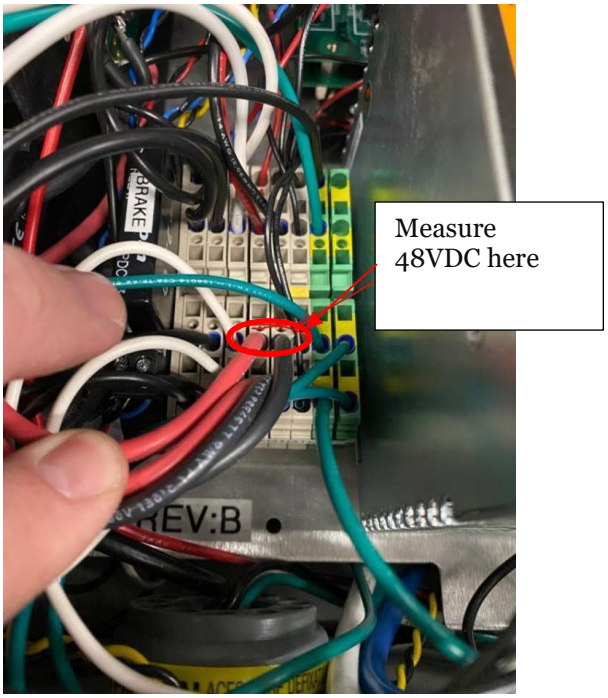
- ✓ Verify that the control module is receiving sufficient AC power. See Electrical Requirements section.
- ✓ Verify that Main Power and Motor Driver Switches are in the On position (upper halves are depressed).
- ✓ Ensure that Emergency Stop switches on the Control Module and Interface Module are released in the up position.
- ✓ Ensure that the Control Cable is connected between the Control Module and the Interface Module. Disconnecting this cable is equivalent to pressing an Emergency Stop; this cable must be connected for normal operation.

ADVANCED REMEDIES: (to be attempted if Basic Remedies do not resolve the issue):

1. Remove the four (4) Philips head screws on the lid and swing the cover open.
2. Check the circuit breaker position is in the ON position, DOWN. The figure shows the circuit breaker in the OFF position, UP.



3. The next step is to check the terminal block for any loose connections.



4. If all wires are secured, apply power to the control module, and measure the DC voltage of ~48VDC across the circled Red and Black pair of 14AWG power wires. If you don't measure ~48VDC, either the supply voltage is disconnected somewhere, or the power supply has failed.

PROBLEM: The Motor Brake does not appear to be engaging/stopping the spool.

INDICATIONS: If the Control Module detects that the spool has rotated 10 or more revolutions even after the brake has been commanded to engage, the following fault will be reported by the Interface Software: "EXCESSIVE BRAKE SLIPPAGE DETECTED." The Control Module will activate the Buzzer and Strobe for 30 seconds if this fault is encountered.

DESCRIPTION: The spool is stopped by an electromagnetically-actuated brake, which functions like a solenoid. When the brake is unpowered, a spring clamps the brake shut, preventing rotation of the motor shaft. This ensures that in the event of a power loss, the spool will be stopped and the probe will be retained. Applying 24V DC power to the brake will energize an electromagnet that separates the brake pads, which will release the motor shaft and allow it to rotate freely. A solid-state relay inside the Control Module determines whether 24V DC is applied to the brake.

Corrective action depends on whether the brake slippage is due to a mechanical or electrical fault, with a mechanical cause being more probable. Mechanical causes are varied and may include anything from a loose brake/motor setscrew or loose fasteners/couplers anywhere along the drivetrain. An electrical cause might be the solid-state relay's failure to cut power to the brake (because the relay may have failed short, and thus continues to conduct power even when it shouldn't).

When brake slippage is detected, the motor will actively stop the spool and prevent further rotation. The motor will substitute for the brake, though this should only be treated as an emergency feature and should not be relied on for normal operation.

REMEDIES:

- ✓ If the error is encountered while the probe is in the water, *stop the vessel immediately* to alleviate the strain on the motor caused by drag. Excessive drag may cause the motor to fail due to over-heating from high current, potentially leading to loss of the probe and damage to the winch.
- ✓ Recover the probe and bring it on board.
- ✓ Once the probe is safely stowed, turn the Main Power Switch OFF. Cutting power should cause the brake to engage. Attempt to move the spool by hand. If the spool can be rotated, this indicates that the root cause is most likely mechanical. If the spool cannot be rotated, an electrical cause (faulty relay) is more probable. When attempting to move the spool by hand, apply a fair amount of force, since the brake is designed to resist large loads. Partial slippage is an indication of a potential mechanical fault.
- ✓ If a mechanical cause is suspected, remove the winch covers, remove the motor cover, and perform a careful inspection of the drivetrain starting from the brake and continuing to the spool. Tighten any loose couplers/fasteners along the drivetrain, paying particular attention to collars and set screws.
- ✓ If the brake relay is suspected, you may activate the backup brake relay. A secondary relay was included in the design. The original (suspect) relay must first be disconnected, since a shorted relay will interfere with the operation of the backup relay. Open the Control Module and locate the Processor Circuit Board. On this circuit board, disconnect the Brake Relay Out connector, which is located just underneath the ribbon cable. Close the Control Module.
- ✓ In the Interface Software's *Winch Config* tab, set the *UseBackupBrakeRelay* variable to *True*. This will bypass the original suspect relay. Please note that this setting is not retained if the Interface Software is closed. If you *Save Workspace* while this variable has the desired value, and later *Load Workspace*, the variable will be set when loading the stored workspace.
- ✓ If the brake cannot be repaired yet completing the survey is paramount, the motor can take the place of the brake *as long as survey depths are restricted to 100 meters or less and survey vessels speeds are restricted to 6 knots or less*. In all cases, deploying the probe without a functioning brake increases the risk of probe loss, especially if the motor becomes damaged during deployment and is unable to hold the probe. The importance of completing the survey versus the value of the probe should be weighed carefully.

PROBLEM: The Motor Brake is not releasing the spool when commanded to.

INDICATIONS: One or more of the following conditions may indicate a brake failure to release:

- Unpleasant grinding noise when the spool is rotating.
- The spool appears to be struggling or shaking when rotating.
- The Interface Software reports unusually high current levels when attempting to move the spool.
- The Interface Software reports wide speed fluctuations when attempting to move the spool.

DESCRIPTION: The spool is stopped by an electromagnetically-actuated brake, which functions like a solenoid. When the brake is unpowered, a spring clamps the brake shut, preventing rotation of the motor shaft. This ensures that in the event of a power loss, the spool will be stopped, and the probe will be retained. Applying 24V DC power to the brake will energize an electromagnet that separates the brake pads, which will release the motor shaft and allow it to rotate freely. A solid-state relay inside the Control Module determines whether 24V DC is applied to the brake.

Failure of the brake to release is indicative of an electrical fault, since it requires electrical energy in order to generate an electromagnetic force which releases the brake pads. Prime candidates include a malfunction of the brake relay and its inability to conduct current when needed, or a failure of the brake power supply.

You may toggle the brake state to test its functionality:

- ✓ On the Control Module, set the **Toggle Switch** to **Local Control**
- ✓ Set the **Brake Switch** to **Release** and back to **Brake**, repeating this as many times as desired.
- ✓ You should hear clicks coming from the motor housing, indicating that the brake is engaging and releasing based on the switch position.
- ✓ Remember to return the **Brake Switch** to **Brake** and the **Toggle Switch** to **PC Control** if you want to use the Interface Software.

REMEDIES:

- ✓ On the Control Module, verify that the MAIN 24V LED is lit. If this LED is not lit, this indicates that the power supply for the brake has failed or is not supplying power. Using a Multimeter, verify the output of the power supply is 24VDC. If there is 24VDC output, then inspect all of the wiring in and out of the power supply. If the power supply has failed, this is a terminal condition. The brake cannot operate until this power supply is replaced.
- ✓ Disconnect the Motor Power Cable and inspect the connector for possible damage to the pins and conductors. Ensure that this cable is properly seated when connected.
- ✓ If the brake relay is suspected, you may activate the backup brake relay. In the *Winch Config* tab, set the *UseBackupBrakeRelay* variable to *True*. This will bypass the original suspect relay. Please note that this setting is not retained if the Interface Software is closed. If you *Save Workspace* while this variable has the desired value, and later *Load Workspace*, the variable will be set when loading the stored workspace.
- ✓ If the brake cannot be released despite the above remedies, and the probe is still in the water, following the steps in the next section to remove the brake. Once the brake is removed, recovery using the motor should be possible.

PROBLEM: Manual recovery of the probe is required and not possible by hand.

INDICATIONS: One or more of the following conditions may require a manual probe recovery:

- Power is no longer available from the vessel.
- The system is non-functional.

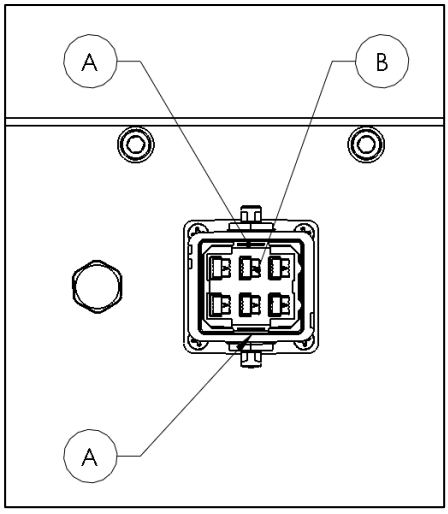
DESCRIPTION: The probe is in the water and the system is not functioning. Recovery by hand is not possible because the line out is greater than 100 meters or the load on the line is too great to pull in safely by hand.

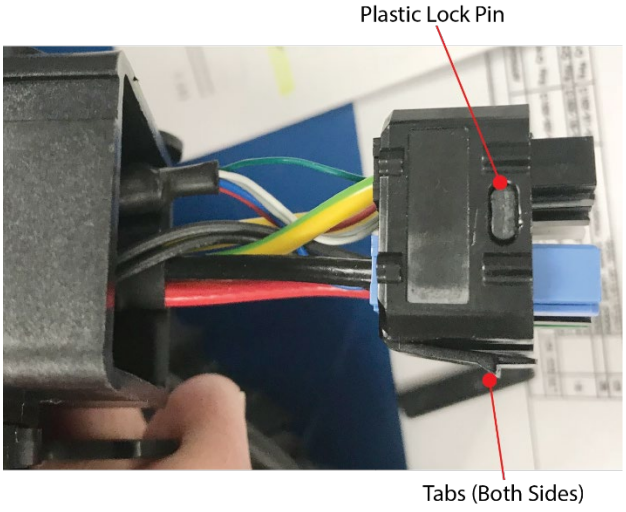
REMEDIES: The spool is stopped by an electromagnetically-actuated brake. To physically uninstall the brake and recover the probe:

Tools Required:

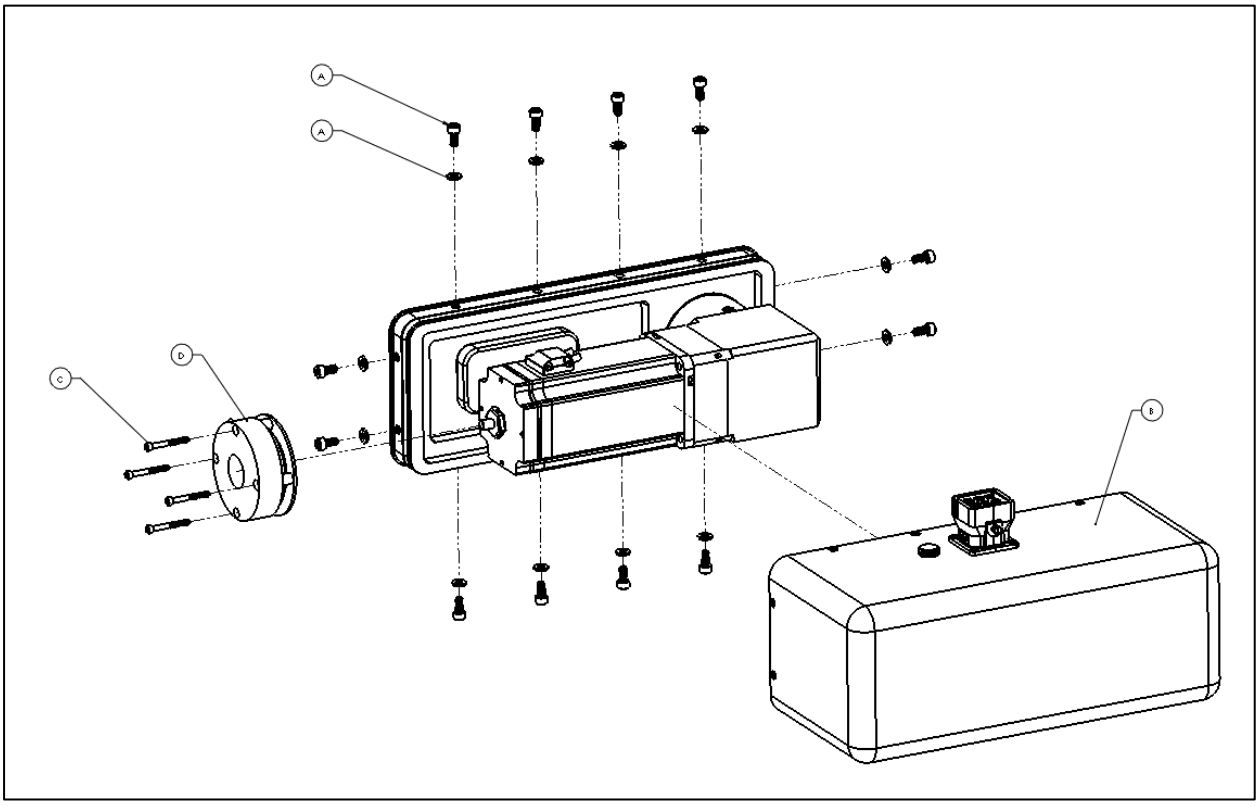
- (2) Flathead screwdrivers
- (1) Needle nose pliers
- (1) 5mm hex key
- (1) 9/64in hex key

1. **Stop the vessel** to reduce the drag exerted by the probe.
2. Remove the winch covers, specifically the center cover that hides the spool, as well as the motor-side cover.
3. Lockout the system and disconnect the motor power cable from the top of the motor.
4. Secure the spool to prevent rotation by tying rope from the slots in the spool to the rear of the frame or have a crewmember hold the spool stationary to prevent rotation. Thick and sturdy gloves are strongly recommended to protect the person's hands in case of spool rotation.
5. Disassemble the motor power bulkhead connector.
    a. Use a large tweezer to depress the two tabs in the connector (be careful – they break off easily).
    b. While the tabs are depressed, use pliers to pull on one of the connectors. This will remove the power bulkhead.
    c. Use a flathead screwdriver to remove the plastic lock pin in the bulkhead. This disengages the power connectors and frees them from the bulkhead.



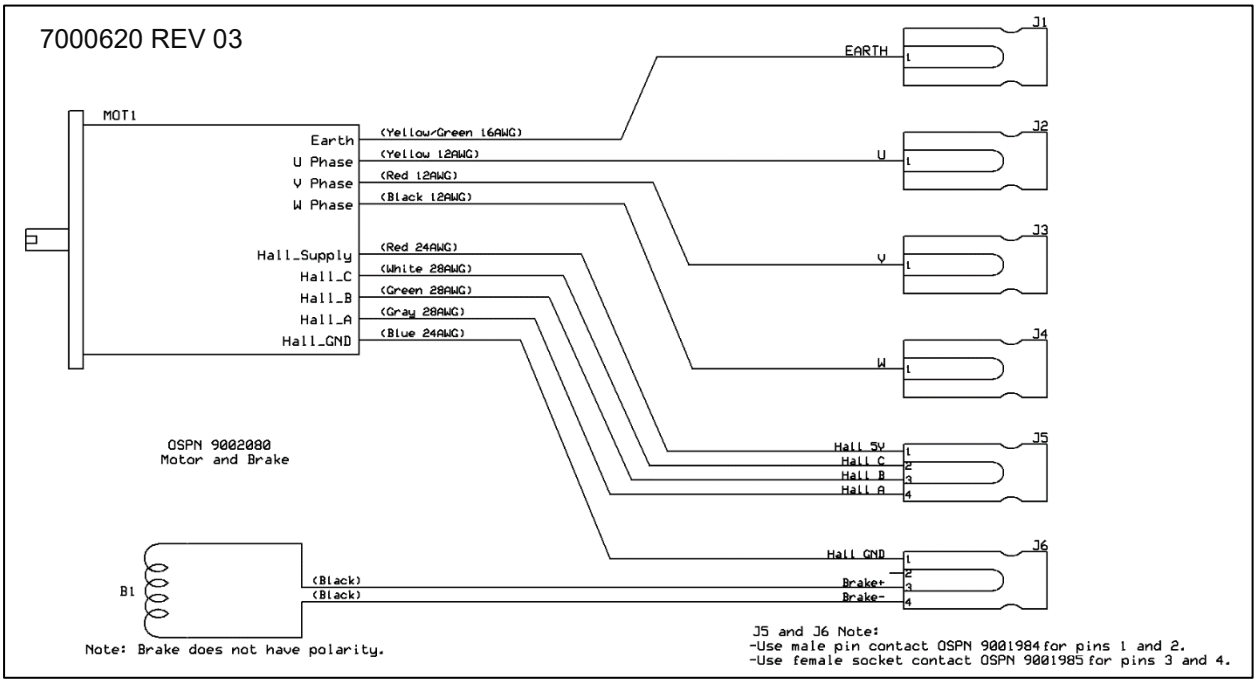


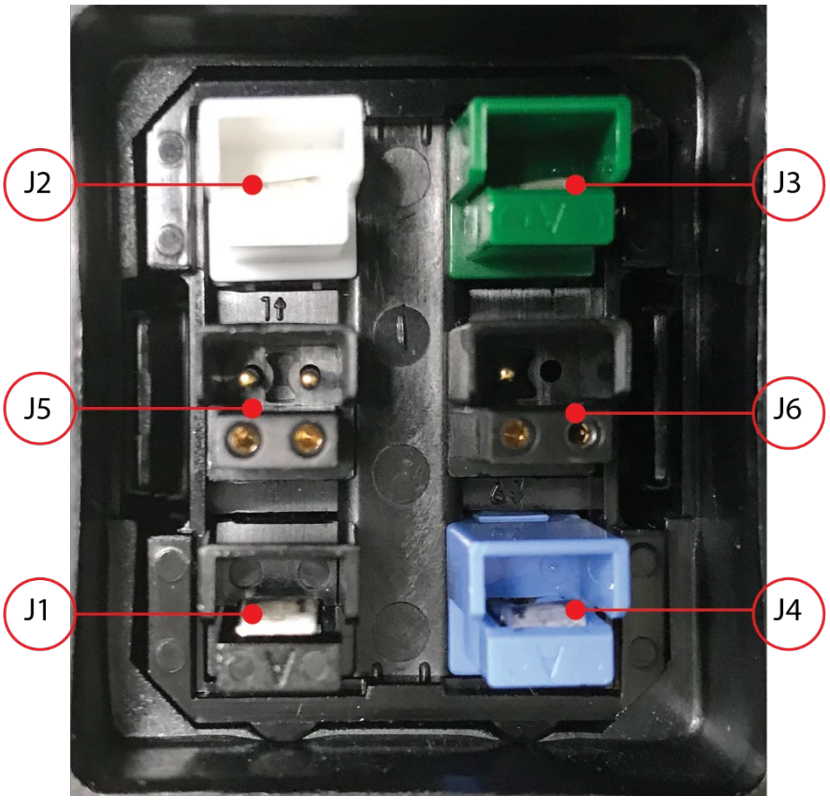
6. Remove the Brake:
    a. Remove the twelve (12) X M6 screws and washers using a 5mm hex key.
    b. Slide off the motor cover making sure the motor wires are no longer attached.
    c. Remove the four (4) X #8-32 screws using a 9/64 hex key.
    d. Slide off the brake.



7. Now that the brake has been removed, the spool is free to rotate, but it is still secured.
8. Recovery by hand is possible by rotating the spool IN manually.
9. Recovery using a power drill connected to the motor rear shaft is recommended if one is available. The motor is connected to the spool through a reduction gearbox, which provides increased output torque and reduced output speed. The rotational speed of the spool will be less than the input rotational speed of the drill.
    a. In general, the drill chuck can be coupled directly to the shaft in the rear of the motor. Be sure the chuck and motor shaft are clean and free from grease.
    b. For maximum torque, a 7/8inch deep socket can be connected to the brake nut on the motor shaft. This will eliminate slippage of the drill chuck on the shaft but **may damage the brake nut and hinder further operations with the system**.
    c. As you rotate the motor shaft using the drill, slowly release the spool to make sure the drill has adequate torque to pull in the line.
    d. STOP if the drill is unable to rotate the spool or if anything is abnormal. Inspect the setup and try again if possible.
    e. In case recovery with a drill is not possible, disconnect the drill and recover the probe by hand, rotating the spool IN manually.

10. Once the probe has been safely recovered, the malfunctioning brake must be replaced before future deployments can proceed. Recommended to replace the motor assembly.
11. To install the NEW brake, reverse the above procedure starting with Step 6. Take care to re-install the power bulkhead contacts as shown below:





PROBLEM: The Spool Encoder is malfunctioning.

INDICATIONS: Any of the following may indicate a problem with the spool encoder:

- Erratic spool motion during tension-controlled payout or when moving between points. Erratic motion may include instantaneous unexpected speed changes or brief stoppages.
- Inconsistent or non-existent position count feedback. Feedback on the winch's current position may freeze or skip counts during motion.
- Inability of the winch to maintain a reasonably constant speed for extended periods, despite being commanded to do so.

DESCRIPTION: Feedback on the spool's position and speed is provided by an incremental optical encoder with a resolution of 10,000 counts per spool revolution. By virtue of its extremely high resolution, the spool encoder is a precision sensor whose performance can be degraded by moisture ingress, foreign contaminants, mechanical misalignment, or extreme shocks or vibration. In addition to mechanical disturbances, sensor feedback from the encoder can also be corrupted by electrical noise when high levels of electromagnetic interference are present. The spool encoder is a critical component of the motion control system, and degradation in its performance will interfere with the ability to control the spool's motion reliably and predictably.

REMEDIES:

1. If the probe is in the water, retrieve the probe and stow it on the vessel. Once the probe has been stowed, on the Control Module turn the Motor Driver Switch OFF. Verify that the Activity LED becomes dim, which confirms that the motor driver has been successfully deactivated. Turn the Brake Switch to Release. Move the Control Source Toggle Switch to Local Control.

   Detach the line from the probe. Secure all line onto the spool and use adhesive tape or other fastener to fix the end of the line to the spool so that the line cannot snag any objects. The goal is to allow the spool to rotate freely.

2. Confirm that the spool encoder is indeed malfunctioning. Other sources of erratic motion may be mechanical in nature such as loose couplers or mechanical obstructions. To rule out mechanical sources of error, rotate the spool by hand and feel for any mechanical grittiness, looseness, or obstructions. If manual rotation of the spool feels smooth, this clears the mechanical system and makes the spool encoder suspect. Set the Control Source Toggle Switch to PC Control and set all power switches to their normal (up) positions at the end of this test in order to use the Interface Software.

3. As additional confirmation that the spool encoder may be damaged, use the Interface Software to command the spool to rotate without relying on feedback from the encoder. To deactivate the encoder, in the Interface Software *Maintenance* tab, click the *Open Loop* button and confirm that the *Mode* setting on the dashboard indicates *OpenLoop*. This step deactivates feedback from the encoder.

   Afterward, in the *Winch Config* tab, locate the *OpenLoopVelocityScaled* setting. Entering a value here will command the spool to rotate without encoder feedback. A positive value will cause the spool to rotate out. A negative value will cause the spool to rotate in. A value of 0 will stop the spool. The values do not correspond to RPM but correspond to percentages. For example: a value of 1000 (interpreted as 100.0%) will make the spool rotate out at its maximum speed; a value of -1000 (interpreted as -100.0%) will make it rotate in at maximum speed; a value of -637 will make the spool rotate in at 63.7% of its maximum speed; and a value of 50 will make it rotate out at 5.0% of its maximum speed.

   Test and observe spool motion for different values of *OpenLoopVelocityScaled*. If spool motion is smooth and predictable when the encoder has been deactivated, this confirms that the spool encoder is at fault.

4. Damage to the Spool Encoder is terminal. It must be replaced before the winch can be safely operated (see Replacing the Spool Encoder Assembly).

rapidCAST Interface Software

Using the Configuration Settings

The Winch Configuration Settings should not be changed except under verify specific circumstances as outlined in the Resolving Fault Conditions section.

To change a Winch Configuration Settings:

1. Start the rapidCAST Interface software.
2. Click the **Winch Config** tab.
3. Locate the Parameter Name on the list and enter the **DesiredValue**.
4. Click the **Commit All** button.

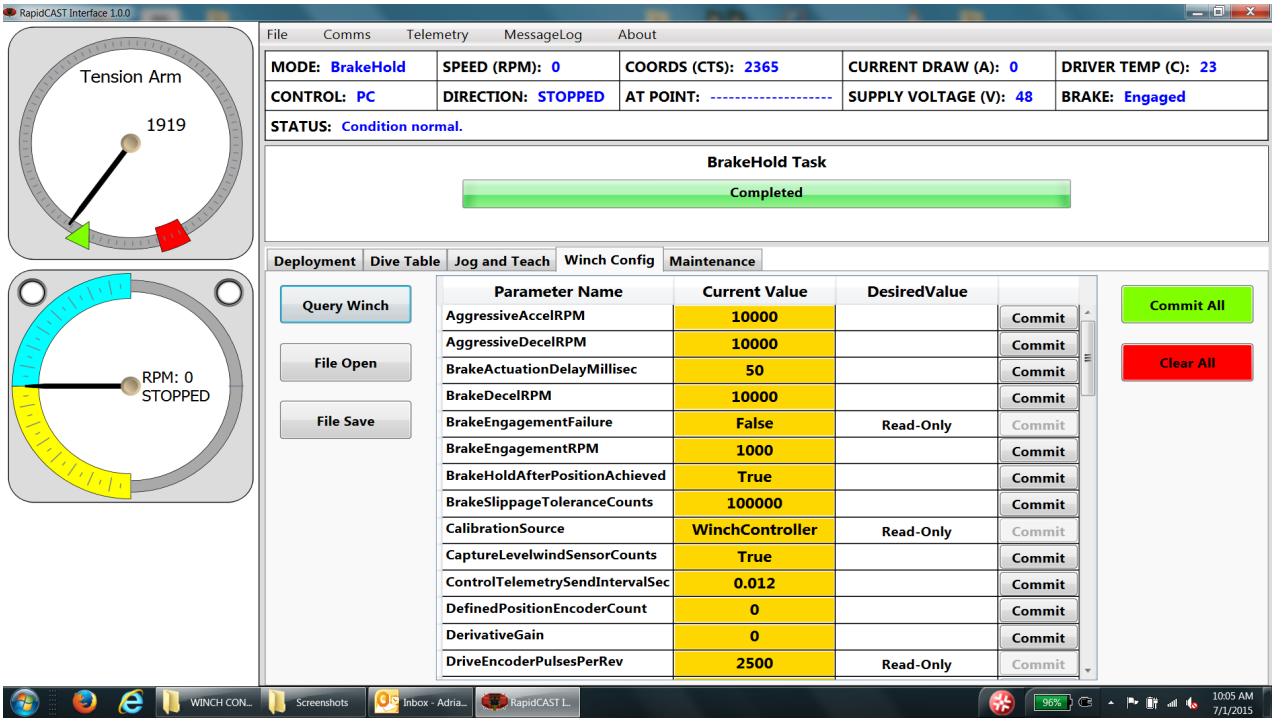
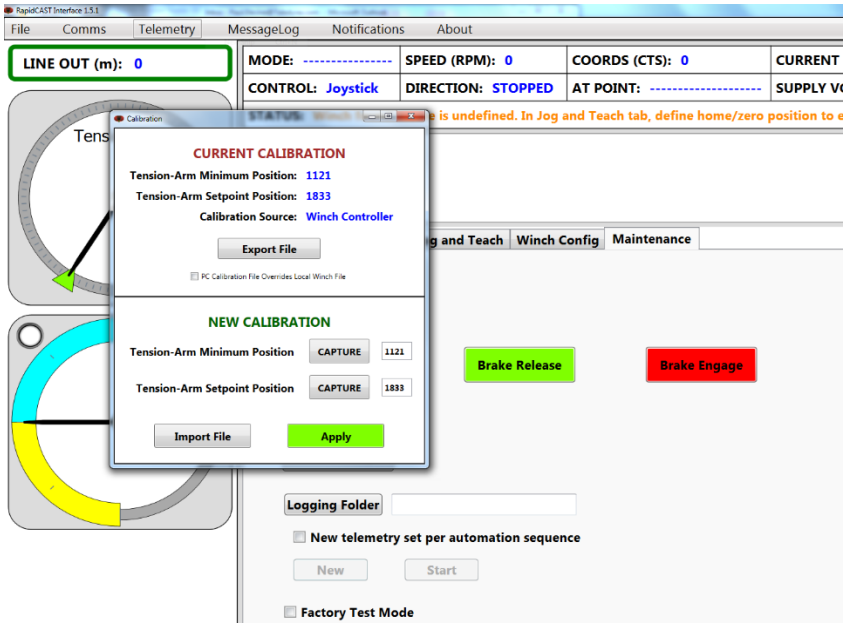


Figure 38. Winch Configuration Settings

Using the Maintenance Tab

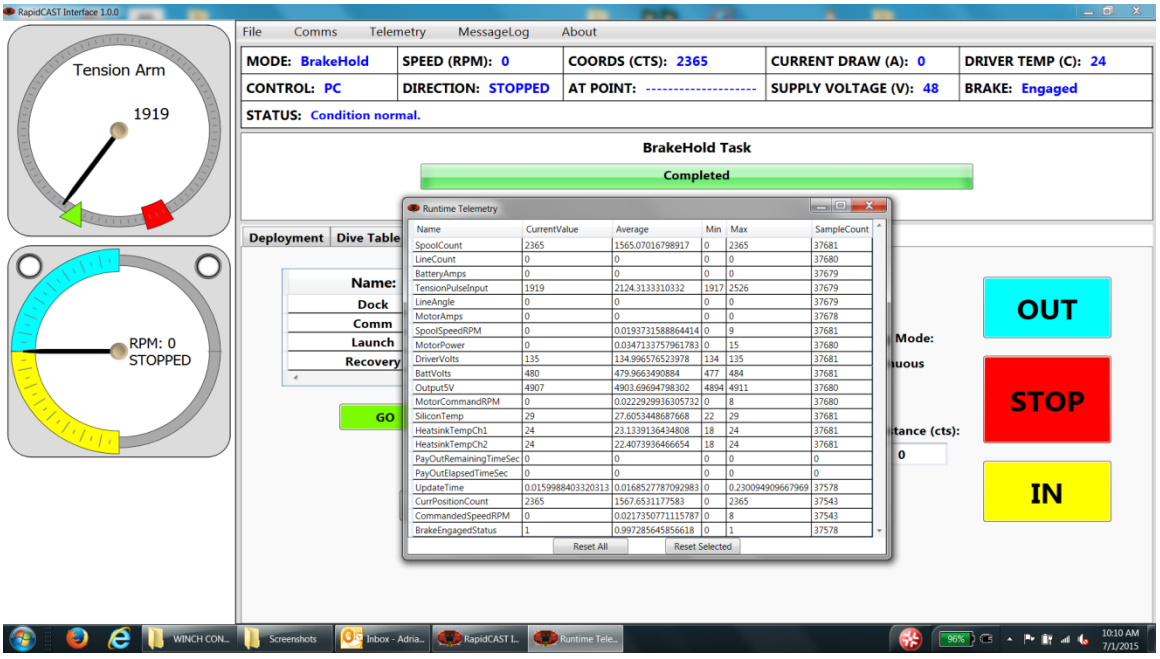
Use the Maintenance tab to turn on Telemetry logging (see Using the Telemetry Log File) and the Tension Arm Calibration.



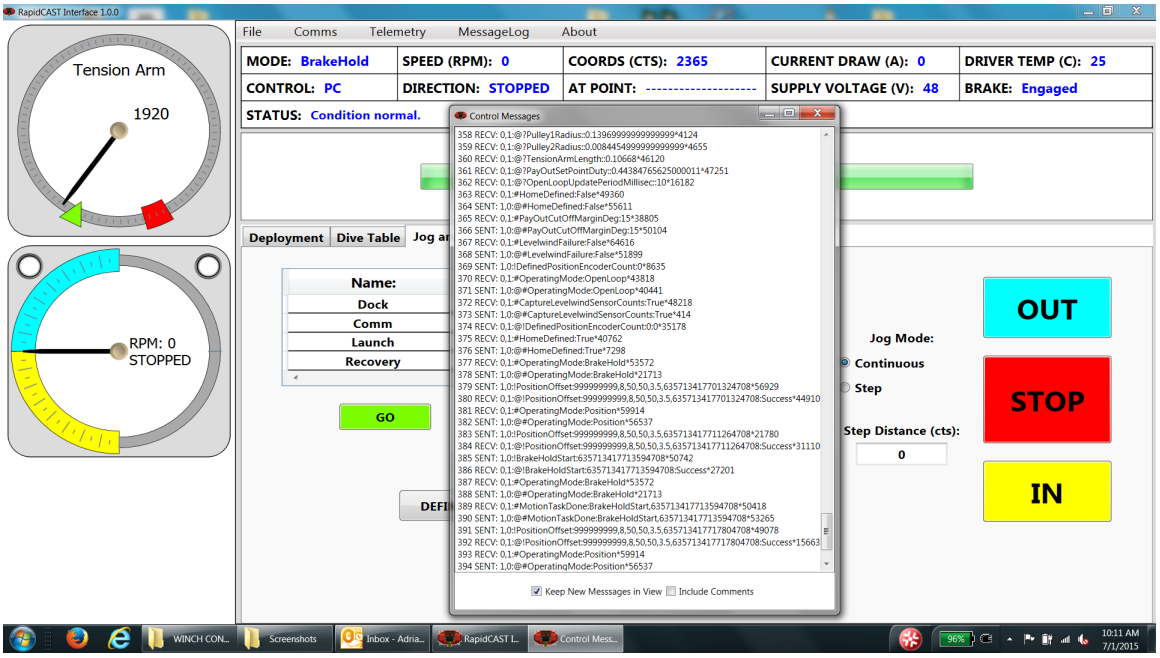
Using the GUI Windows and Controls

The rapidCAST system keeps track of system performance in the Telemetry and Message Log windows. To view the screens, click the desired menu item.

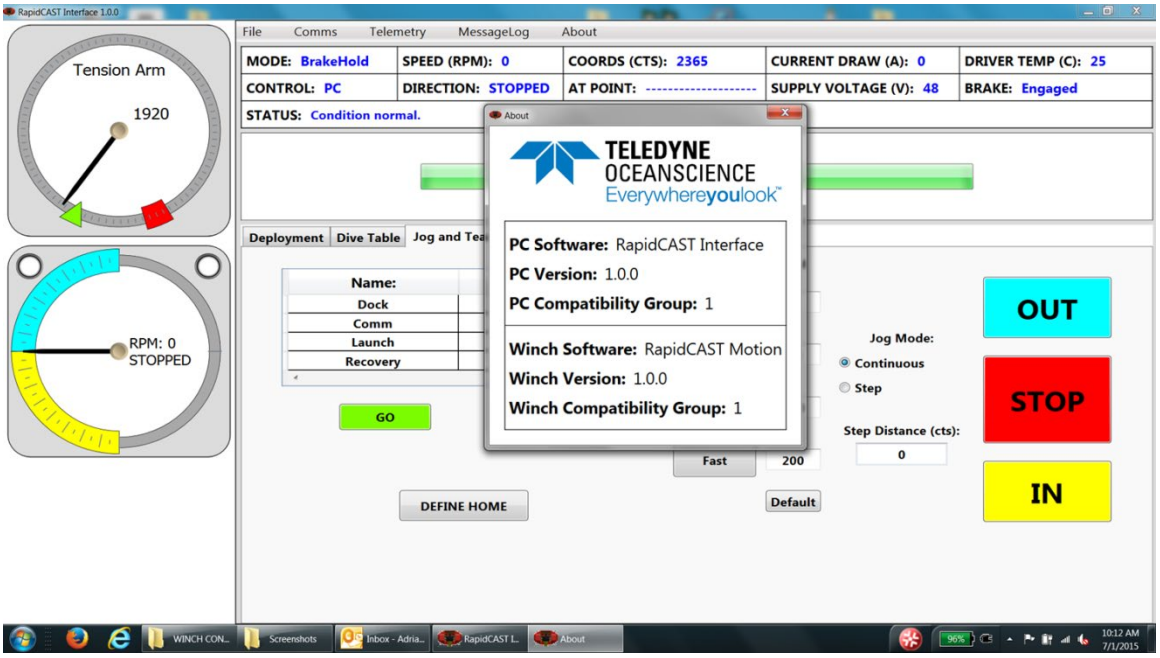
Telemetry menu:



MessageLog menu:



About menu:



Updating the Winch Software

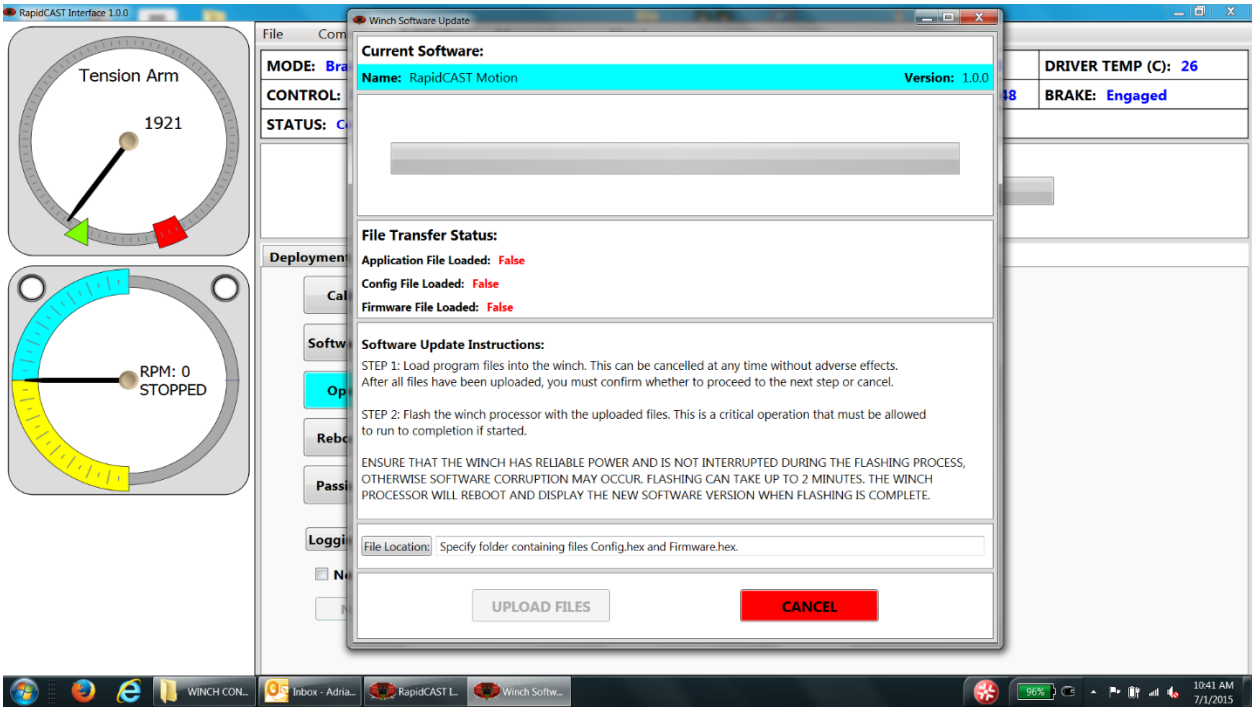
To update the winch software:

1. Start the rapidCAST Interface software.
2. Click the **Maintenance** tab.
3. Click the **Software Update** button.
4. Click the File Location button and navigate to the folder that contains the *Config.hex* and *Firmware.hex* files.

Updates may be sent via e-mail or downloaded from Teledyne RD Instruments.

5. Click the **Upload Files** button.

Ensure that the winch has reliable power and is not interrupted during the flashing process, otherwise software corruption may occur.



Maintenance Procedures

The spare parts kit 71JK6004-00 and Spare Hardware kit 70JK6007-00 includes parts, which are expected to wear out and need to be replaced on a regular schedule.

Table 3. Spare Parts Kit 71JK6004-00

Part Number	Description	Quantity
8000585	SPRING, TENSION ARM, ALTERED ITEM	1
8000589	LevelWind Roller, Vertical, rapidCAST	2
8000595	LevelWind Roller, Horizontal, rapidCAST	2
81J-6000-00	SHACKLE, TAILSPOOL, UCTD	1
9000994	LINE, WINCH, RCAST/UCTD, 500LB, WHITE	1500.00 yards
9000996	LINE, WINCH, RCAST/UCTD, 800LB, RED	700.00 yards
9002064	Stainless Steel External Retaining Ring for 6mm Shaft Diameter	2
9002086	Quick-Release Pin, Type 316 Stainless Steel, 1/4" Diameter, 2.5" Usable Length	1
9002202	BELT, TIMING, RCAST	1
9092K72	CAP, VINYL, 1.75" SQUAREX 1" INSIDE HEIGHT, BLACK	1
9234052	CAP, 0.75"X0.81", VINYL	1

Table 4. Spare Hardware Kit 70JK6007-00

Part Number	Part Description	Quantity
#8WASHSPL	WASHER, SPLIT LOCK #8SST	1
6000601	KIT, SPARE SHIMS, RCAST/UCTD, SET OF 8	1
81J-6000-00	SHACKLE, TAILSPOOL, RCAST/UCTD	1
9000519	PLUNGER, 3/16 X0.441, SST	1
9000577	SCREW, 8-32X1.25, BHSCS, 18-8 SST	1
9000640	HEX KEY SET, 1/16 -1/4, 10 PCS	1
9001401	SCREW, 10-24X0.75, FHSCS, 316 SST	10
9200118	SCREW - 6-32 x 5/8 BHSCS - 18-8SS	1
9210084	SCREW, 10-32X5/8, FHSCS, 316 SST	5
9224037	NEEDLE, SPLICING, RCAST/UCTD, 10 GAUGE, CONSIST OF 5-PACKAGE	4
9230002	SCREW, 4-40X3/16, SHCS, NYLON	3
9234046	PLUNGER, 6MM, PLASTIC BODY	1

Table 5. Tools and Spares Kit 6001751

Part Number	Part Description	Quantity
#8WASHSPL	WASHER, SPLIT LOCK #8SST	1
22-01944	STRAP CUTTER, SINGLE BEVEL, 4.375IN, BLACK	1
6000601	KIT, SPARE SHIMS, RCAST/UCTD, SET OF 8	1
6000608	ASSY, PULLEY, RCAST/UCTD	1
81J-6000-00	SHACKLE, TAILSPOOL, RCAST/UCTD	1
9000519	PLUNGER, 3/16 X 0.441, SST	1
9000577	SCREW, 8-32X1.25, BHSCS, 18-8 SST	1
9000640	HEX KEY SET, 1/16 -1/4, 10 PCS	1
9000714	WASHER, FLAT, M6, 316SST	10
9000783	CABLE, USB-A TO USB-B	2
9001401	SCREW, 10-24X0.75, FHSCS, 316 SST	10
9002086	PIN, QUICK RELEASE, 1/4 X2.5, 316 SST	1
9002198	HEX KEY SET, 1.5MM-5MM, 6 PCS	1
9002199	NUT, M6, FOR 1.675 STRUT CHANNEL, 304 SST	6
9002200	WEIGHT, CALIBRATION, 200G, CLASS 7	1
9002202	BELT, TIMING, RCAST	1
9002205	TOOLBOX, 12 X6 X4	1
9002257	FUSE, 250V, 3A, SLOW BLOW	4
9210084	SCREW, 10-32X5/8, FHSCS, 316 SST	5
9224037	NEEDLE, SPLICING, RCAST/UCTD, 10 GAUGE, CONSIST OF 5-PACKAGE	4
9230002	SCREW, 4-40X3/16, SHCS, NYLON	3
9234046	PLUNGER, 6MM, PLASTIC BODY	1
M6X1.0NUT	NUT, HEX, SST 316	10
M6X1.0X30SH	SCREW, SKT HD, SST 316	10

Tools and Spares Kit 6001751 is included with the rapidCAST system.

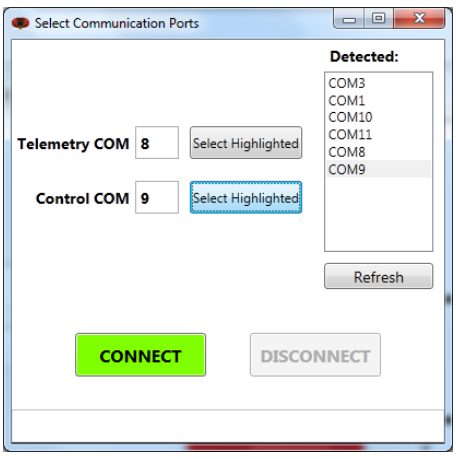
Preventive Maintenance

Check the following items every day while using the rapidCAST system.

1. Every 10 to 50 casts, rinse the LevelWind and Follower assembly with fresh water to prevent salt build-up.
2. Every 10 to 50 casts, rinse the Davit Block assembly with fresh water to prevent salt build-up.
3. Inspect the shackle and loop splice every time the probe is onboard and before it goes overboard. During intensive surveys, the probe loop splice should be replaced daily by cutting 50cm of line from the end and re-splicing the termination. See Loop Splice for instructions. The entire line section should be replaced after 1000 casts as a preventative measure.
4. Remove any cosmetic corrosion on the LevelWind Reversing Screw-with steel wool.
5. Put DC111 or AquaShield over the LevelWind bearings to help with rust prevention. The bearings are sealed and made of a corrosion resistant material but may show cosmetic corrosion.
6. Use the Pre-Cast Checklist and During Operation Checklists to verify the rapidCAST operation.
7. Use the After Operation Checklist once casts are done for the day.

Tension Arm Zero Position Adjustment

The tension arm zero-position range of 1000 to 1200 sets a reference point and the tension arm calibration sets the scaling. If the tension arm range ever goes over 4096 at the top end of the scale (because of bad zeroing or improper calibration) then the motor will reverse direction, which could snap the line or deploy it out depending on the operation being requested. The rapidCAST could perform opposite of what the operator wants.



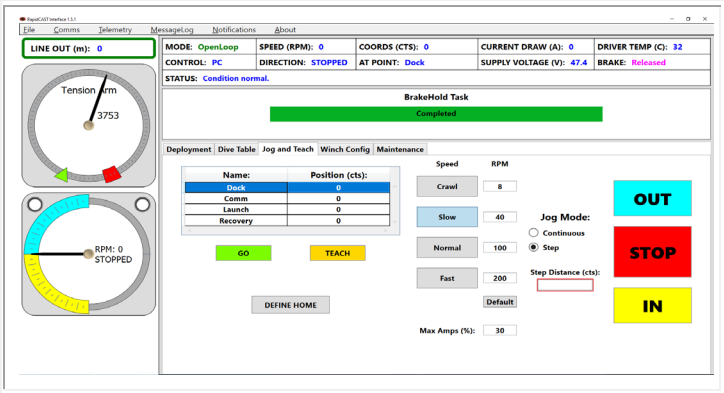
Fully connect the system:

Apply power.

Start the RapidCAST Interface software.

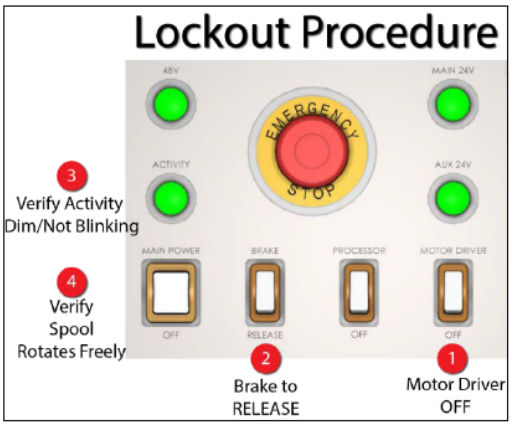
Provide comport numbers for Telemetry and Control, and click **CONNECT**:

This step must be repeated each time the rapidCAST system is started.



Screen will appear similar to below:

Verify the software is communicating with the tension arm encoder by manually raising and lowering the tension arm. The arrow in the 'RapidCAST InterfaceTension Arm' display will rotate with tension arm motion.



Switch motor driver OFF on Control Module.

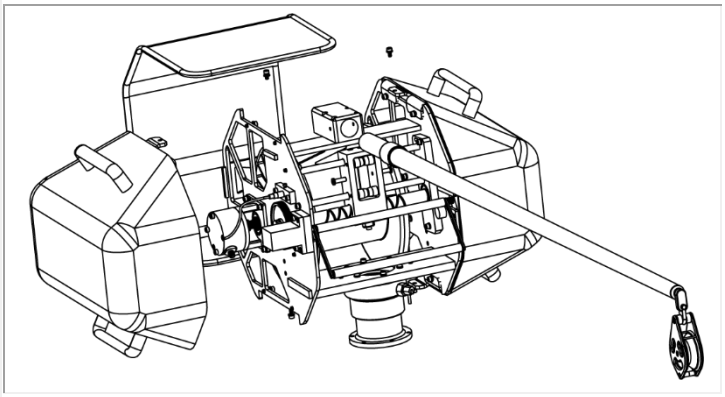
Switch Brake to RELEASE on Control Module.

Check to ensure Activity Light is Dim/Not Blinking

Check to see if the spool rotates freely.

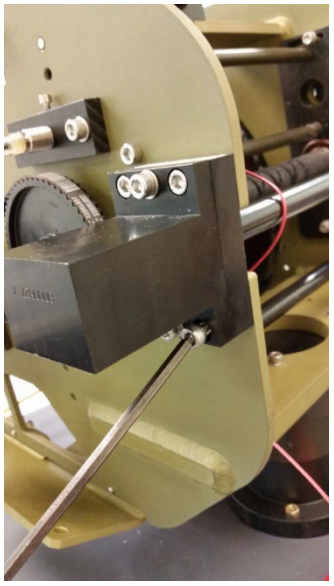
The system is now SAFE/LOCKED OUT

Manually Set 'Zero' Position of Tension Arm



Remove the center and belt side winch covers.

Temporarily disconnect the cable end attached to the tension arm encoder to prevent damage in next steps.



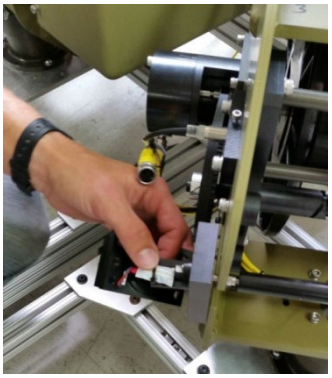
Remove the four recessed Hex head screws holding the encoder cover to the base.

Note the cover will not come off yet.

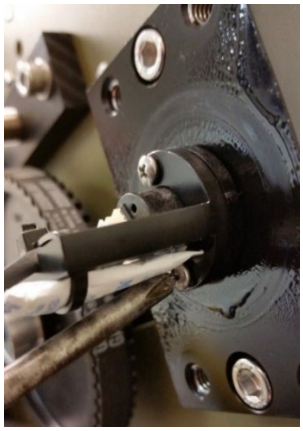
Remove the remaining two longer M6X18mm Hex head screws holding the base and cover to the chassis. Pull back the cover to expose the encoder unit base.

With the encoder cover pushed back, use two M6X12mm screws in the encoder base's center holes to loosely hold the encoder base to the chassis during calibration.

The encoder cover will be pushed back and out of the way for this manual calibration. The internal encoder connector may become disconnected.



Verify that the internal encoder cable is connected to the encoder. Connect the external encoder cable to the other end of the internal encoder cable.



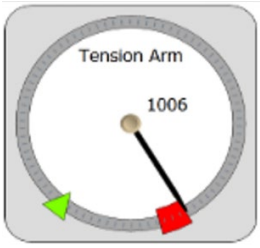
Remove one of the two Phillips head encoder alignment screws. Apply one drop of Loctite 425 to the threaded end. Reinstall the screw snugly, but loose enough to allow rotating the encoder. Repeat these steps for the second encoder alignment screw.

The screws must not be tight yet. They must be slightly loose, just enough to allow rotating the encoder to the proper position; too loose will make the encoder readings change drastically upon final tightening.

Power up Sequence

1. **Main Power Switch** set to **OFF position (down)**
2. **Control Switch** set to **PC Control**
3. **Brake, Processor, and Motor Driver Switches** are powered ON (up)
4. Connect and check all cable connections are secure
5. Turn power ON by switching the **Main Power Switch** to ON (up)

When covers are removed, the system has moving parts that are exposed and dangerous. Proceed with great CAUTION.

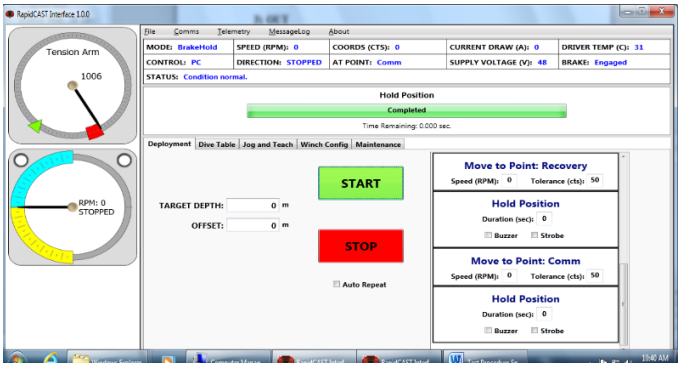


With the tension arm fully retracted, view the tension arm position on the RapidCAST software.

Rotate the encoder such that the tension arm reading on the RapidCast software is between 1000 to 1200.

Perfection is not required since the software will calibrate the actual zero point. Excessive adjustment will not improve accuracy.

Finger tighten the screws snug to perform next step but do not exceed the designated maximum torque setting of 5.5 in-lbs.!

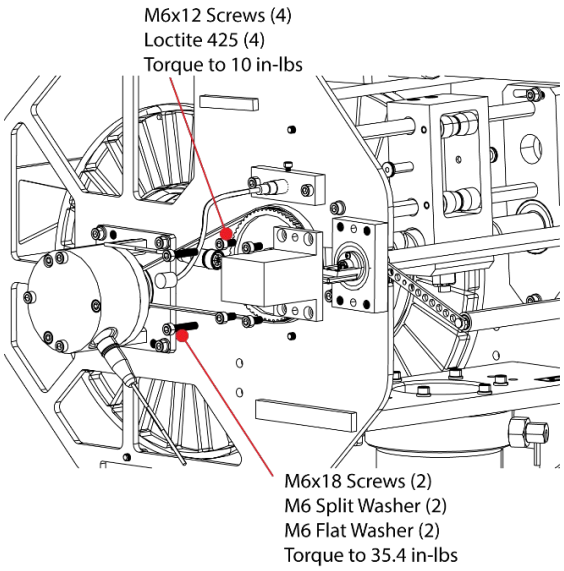


With your hand swing the tension arm through its full range of motion and verify that at no point does the tension/swing arm encoder report less than 0 or greater than 4096 counts.

Tighten the two Philips head encoder alignment screws to the designated torque, 5.5 in-lbs. Be careful not to over tighten as the screws are threaded into a plastic carrier.

If necessary, repeat until these conditions are met before continuing to the next steps.

System Reassembly



Follow the LOCK OUT procedure.

Remove the two temporary M6X12mm screws holding the encoder base to the chassis.

Install the encoder cover to the chassis with two M6X18mm screws with flat and split lock washers in the center holes. Do not tighten fully.

Put a drop of Loctite 425 on the thread end of each of the four M6X12mm screws. Use these M6X12mm screws to secure the encoder cover to the encoder base. Torque the four M6X12mm screws to the designated torque, 10 in-lbs.

Tighten the two M6X18mm screws holding the encoder to the chassis to the designated torque, 35.4 in-lbs.

Reinstall the Winch covers.

Power up Sequence

1. **Main Power Switch** set to **OFF position (down)**
2. **Control Switch** set to **PC Control**
3. **Brake, Processor, and Motor Driver Switches** are powered ON (up)
4. Connect and check all cable connections are secure
5. Turn power ON by switching the **Main Power Switch** to ON (up)

Perform a tension arm calibration. Calibration must be performed if the tension arm or its encoder is removed, replaced, or mechanically adjusted.

Tension Arm Calibration

Tension Arm calibration is a process that captures the Tension Arm's operating characteristics and saves these parameters in the Control Module. The Tension Arm is calibrated at the factory, and in most cases, re-calibration is rarely needed.

However, calibration should be performed if any of the following conditions apply:

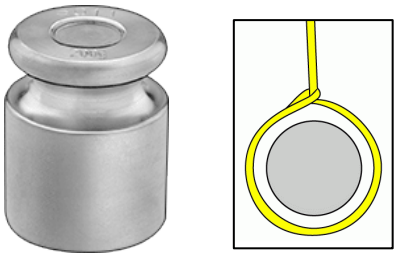
- The Tension Arm or its Encoder is removed, replaced, or mechanically adjusted.
- The desired line tension for the Tension-Controlled Payout needs to be defined.
- The Control Module is paired with a different Winch.
- There is a discrepancy between the Tension Arm's reported position in the software and its true position.

The fastest way to verify the Tension Arm's calibration is to remove all line tension from the arm, such that the arm is resting freely against its lower hard stop.

When the Tension Arm is at its lowest position, the angular gauge in the Interface Software should show the Tension Arm pointing at the far edge of the red zone. If the Tension Arm is *not* depicted at this position when the arm is fully relaxed, calibration is needed.

To create a new calibration:

1. In the rapidCAST Interface software, click the **Maintenance** tab and then click the **Calibration** button (see Figure 39, page 89).
2. In the Calibration window, click the **Save Backup File** button to save the current (incumbent) calibration to a file on the PC. Use the **Browse File** button to load the settings from a previously-saved calibration file, if desired.
3. Safely stow the probe. Untie the line from the probe and ensure that the line is not attached to any objects.
4. Remove all line tension from the Tension Arm so that the arm is resting against its lower hard stop. Under **Tension-Arm Minimum Position** click the **Capture** button to record the arm's position.
5. Ensure that the line is routed through the LevelWind, Tension Arm, and Davit Pulley exactly as it would be during normal operation. Choke the line around the provided 200-gram calibration weight as shown below *and allow it to hang freely*.



6. Tug on the line to create excess tension, and then gently release the line so that the calibration weight gradually settles into its free-hanging position. Under **Tension-Arm Setpoint Position**, click the **Capture** button to record the arm's position. This will set the line tension for Tension-Controlled Payout.
7. If you are satisfied with the captured positions, click the **Apply** button to commit these settings to the Control Module. If you are unsatisfied, you may repeat the capture process as many times as desired, or you may cancel the calibration simply by closing the Calibration Window. Once a new calibration has been applied, the settings are stored in the Control Module's flash memory. A copy of the calibration file is also stored locally on the PC, as a backup in case the Control Module is unable to access flash.
8. Cycle power to the winch controller; Make sure that the **Calibration Source** reads **Winch Controller** (see Figure 39, page 89). Upon power cycling, the controller first checks the internal source of the calibration, which is the FLASH card and this is signified by the **Winch Controller** source.

   If the winch controller fails to find the FLASH stored values, then it reads the temporary file from the local computer and displays **PC** as the source, indicating that there is a problem with the FLASH card, the FLASH is not properly seated, the FLASH is missing, or there is a problem with the CPU assembly.

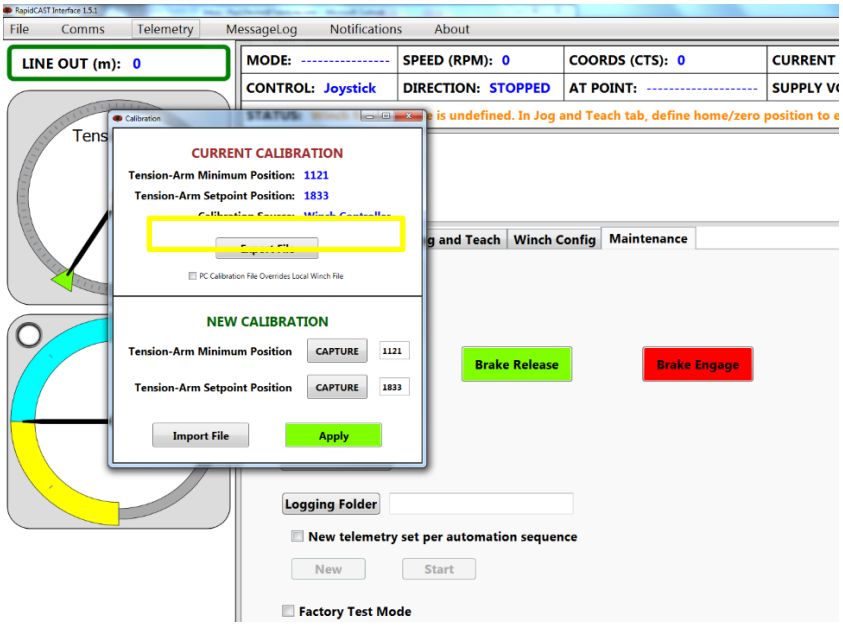


Figure 39. Tension Arm Calibration

How is the calibration data stored, and how is it retrieved?

When you apply a new calibration, the calibration settings are stored in two places simultaneously:

- A microSD card inside the Control Module retains the calibration settings in flash memory.
- The calibration settings are also stored in a local file on the PC. The file resides in a (normally hidden) folder: *C:\ProgramData\Teledyne RD Instruments\RapidCast Interface\[Version]\WinchCalibration.txt*.

When the Control Module boots up, it checks the microSD card for the calibration settings. If the calibration settings cannot be found or if the card is inaccessible, the Interface software will automatically transmit the backup calibration data that is stored on the PC, so that the winch can operate normally.

Under **Current Calibration**, the **Calibration Source** field will identify whether the calibration data is from the Control Module's microSD card, or whether it is from the PC (see Figure 38, page 76).

The **PC Calibration File Overrides Local Winch File** checkbox allows you to force the Control Module to use the calibration data stored in the PC. This is useful if the on-board microSD card has malfunctioned and may be providing incorrect data and thus needs to be overridden.

Tailspool Inspection

- Inspect the shackle and loop splice every time the probe is onboard and before it goes overboard.
- The shackle should be shiny and have no burrs. If the shackle has any burrs or damage, replace it IMMEDIATELY.

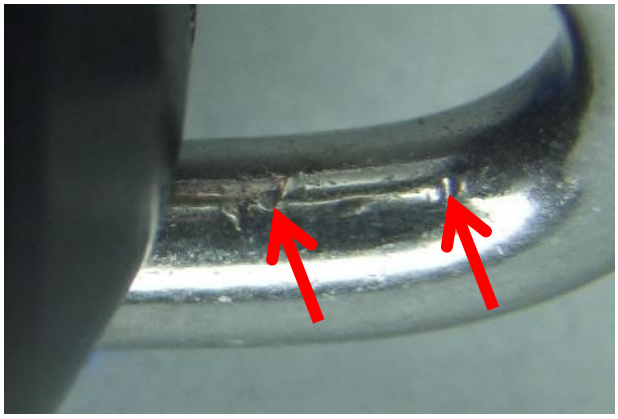


Figure 40. Bad shackle

Arrows show damage from removal with hard tool.

Figure 41. Good Shackle

- The loop splice should be intact and uncut. There is a risk of losing the probe if the splice starts to walk out.

Figure 42. Bad Loop splice, worn and torn

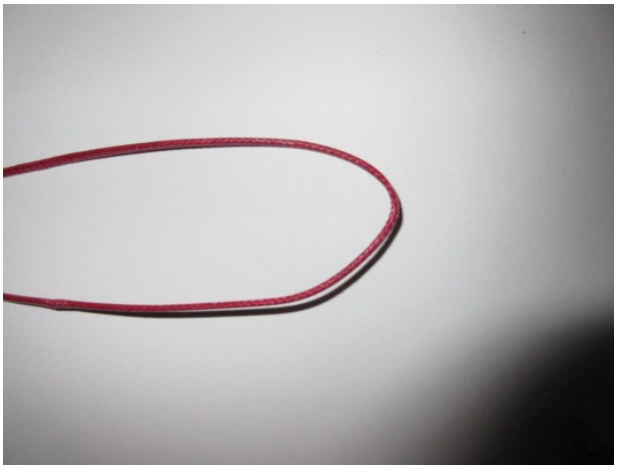


Figure 43. Good Loop Splice

- The inline splice should be intact and not walking out. There is a high risk of losing the probe if the splice starts to walk out. The inline splice is only held by friction and is strongest when loaded.

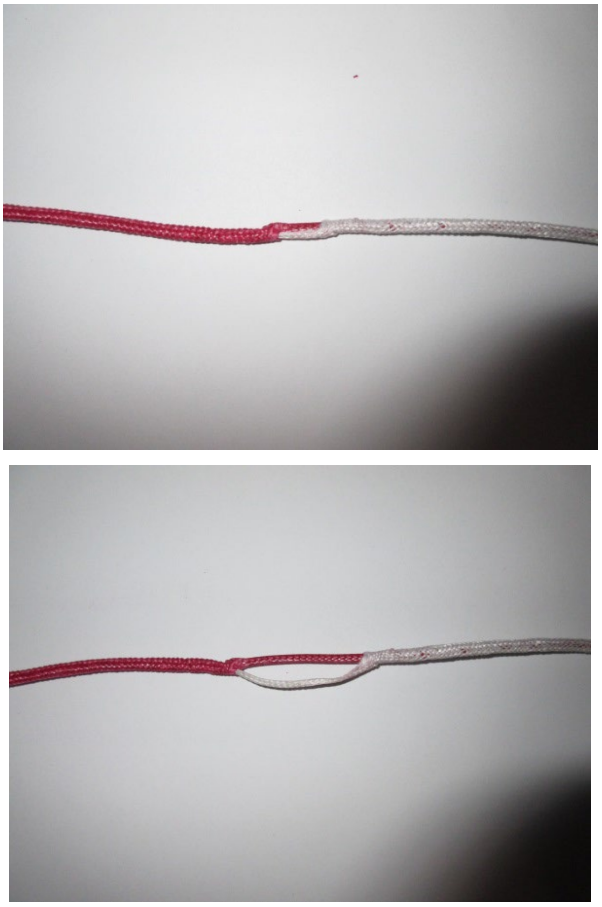


Figure 44. BAD Inline Splice

Note how it is starting to walk out. Re-tighten or replace.

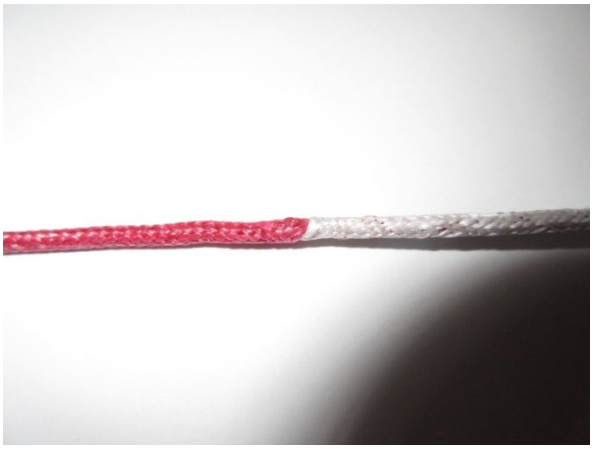


Figure 45. Good Inline Splice

Additional training support is available via videos:

- Line Operation Videos download
- Probe Operation Videos download

Shackle Replacement

ONLY USE ROPE TO THE REMOVE SHACKLE. Use of hard tools will create burrs and render the shackle useless.

To replace the shackle:

1. Loosen and then remove the bolt and flat washer.
2. Using a small length of rope, pull the shackle free.
3. Look for signs of corrosion such as white deposits. If corrosion caused part of the probe to be visibly damaged, do not redeploy your system. Send it back for inspection.
4. Push in the new shackle.
5. Brush the screw with marine environment grease such as AquaShield®. This is used to prevent corrosion in the threads of the aluminum body. Use gloves as the grease tends to stick to your skin. Note that the grease is incompressible and therefore apply a thin layer to the screw to avoid binding or difficulty in the installation of the screw in the mounting hole. Insert the flat washer and bolt and tighten.

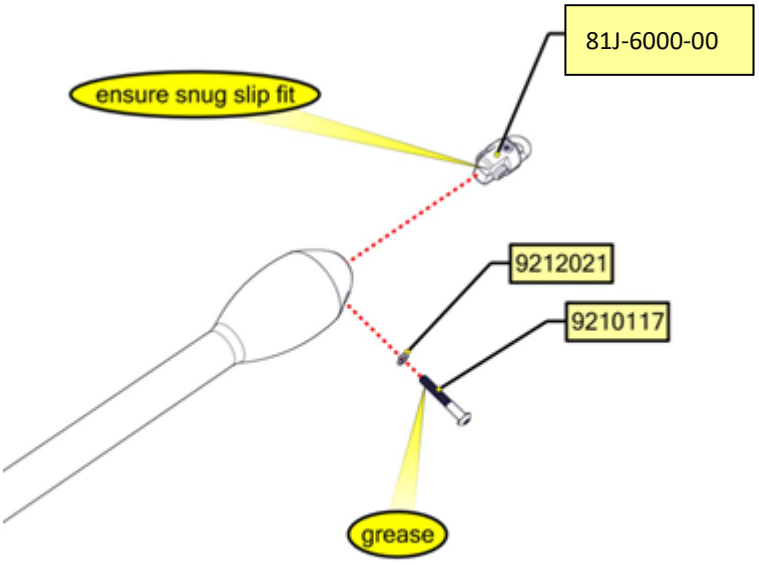


Figure 46. Shackle Replacement

Loop Splice

During intensive surveys, the probe loop splice should be replaced daily by cutting 50cm of line from the end and re-splicing the termination. This will take just a few minutes. The entire line section should be replaced after 1000 casts as a preventative measure.

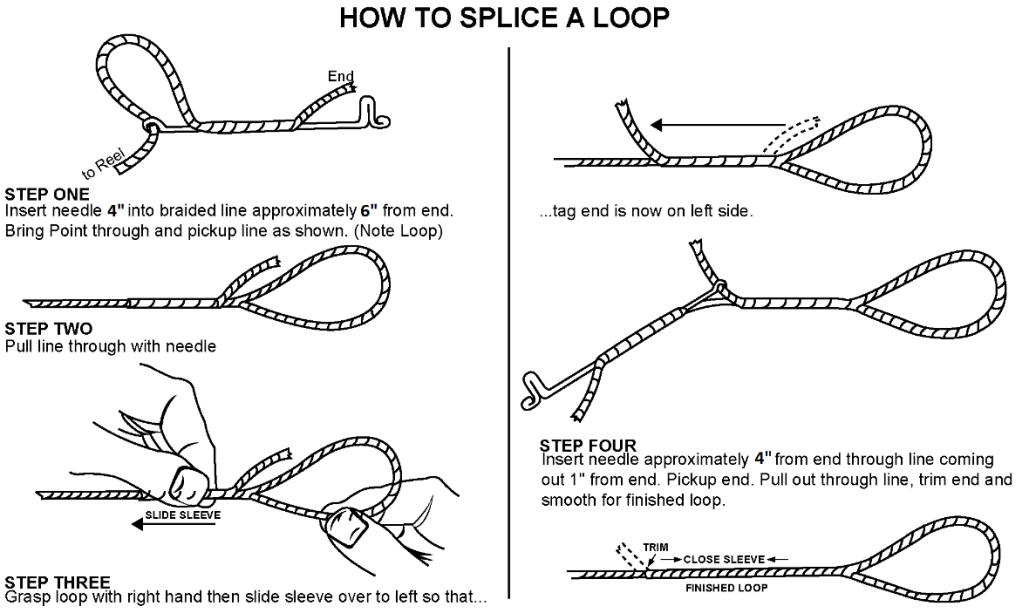


Figure 47. Loop Splice

Graphic courtesy of Innovative Textiles, Inc.

Gearhart 10 Gauge cylinder needles are available from:

https://angoravalley.com/sockmachines/accessories.html

Additional training support is available via videos:

- Line Operation Videos download
- Probe Operation Videos download

Inline Splice

There are two inline splices between the red and white lines. On most systems, the first 200 meters of line is red. The next 1500 meters of line is white. The remaining 100 meters of line is red. Inspect and if needed, follow the hollow core braid splice instructions as shown below.

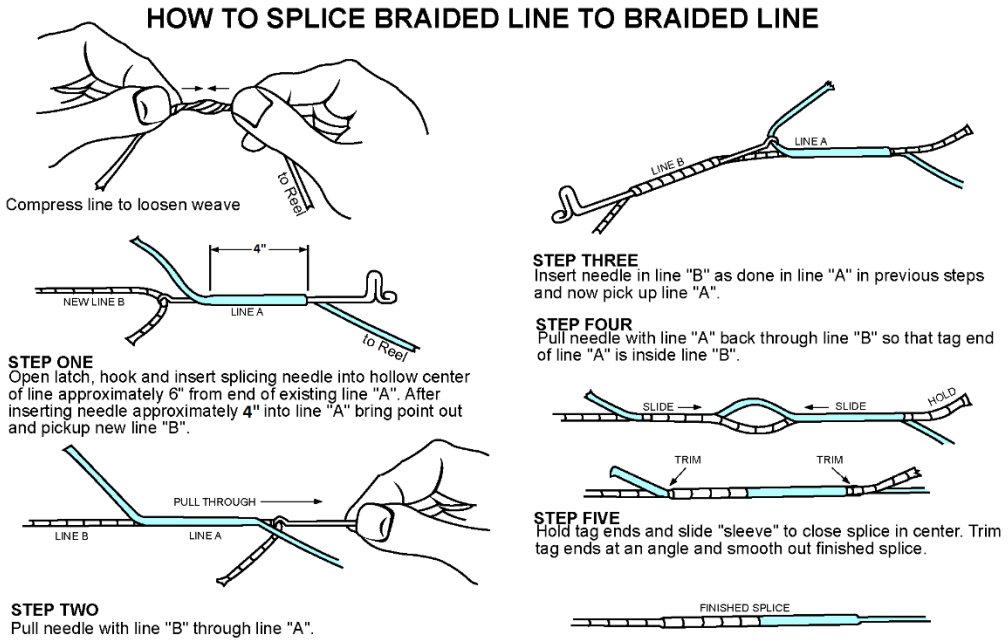


Figure 48. Inline Splice

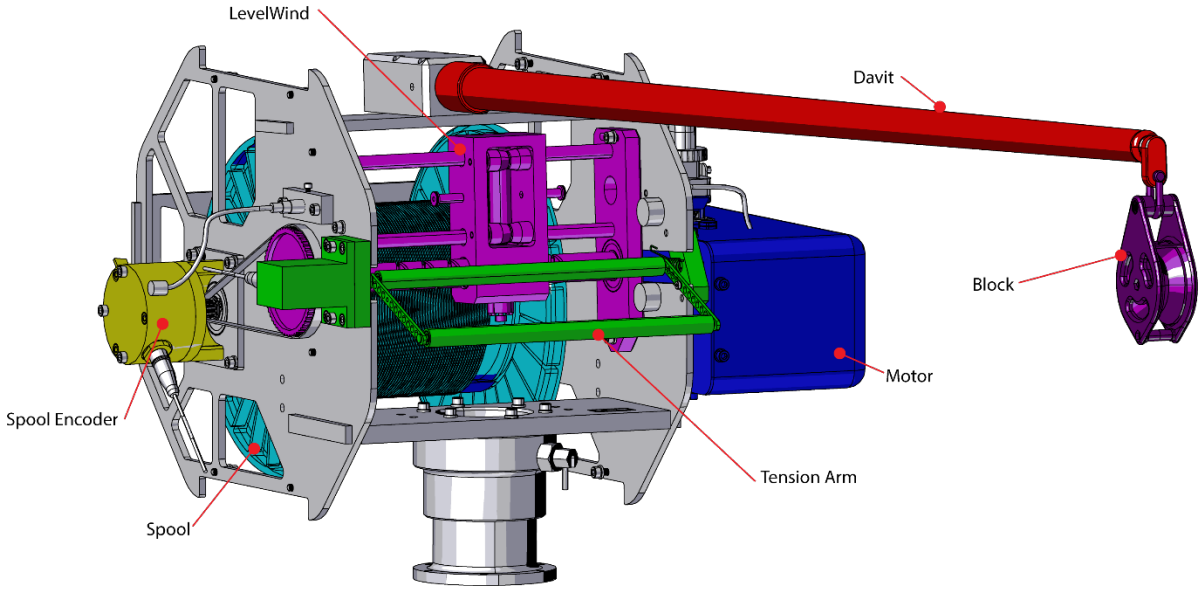
Graphic courtesy of Innovative Textiles, Inc.

Additional training support is available via videos:

- Line Operation Videos download
- Probe Operation Videos download

Replacing Assemblies in the rapidCAST

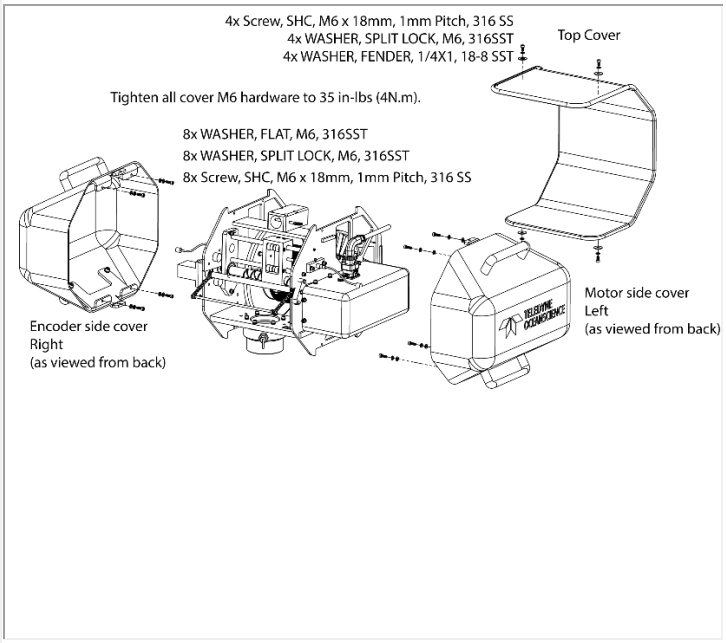
The rapidCAST has easily replaceable assemblies.



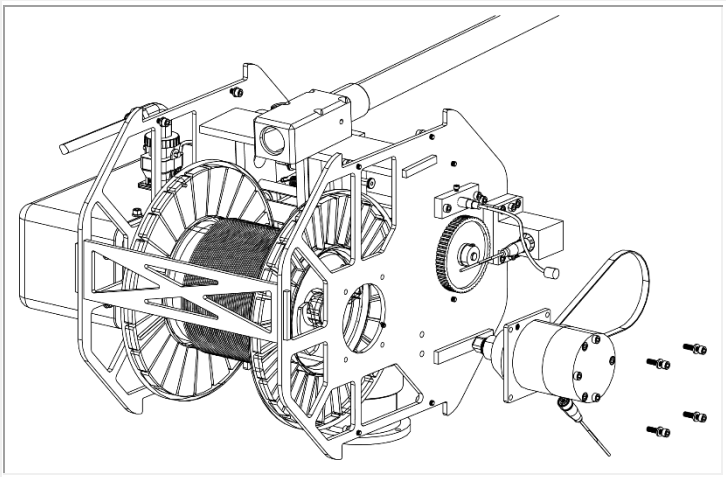
Replacing the Spool

This procedure shows how to replace a spool in the rapidCAST.

Removing the Spool

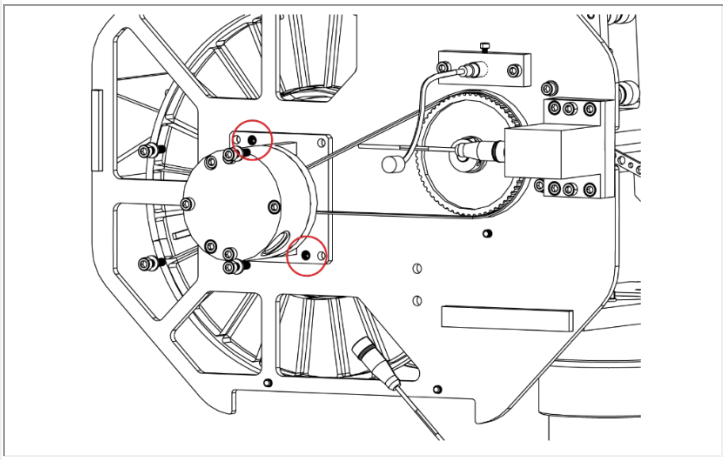


1. Lockout the system and remove power.
2. Remove the probe from the line and stow it in its case.
3. Secure the line to the spool using a piece of tape.
4. Position the rapidCAST such that the rear of the unit can be accessed (Davit arm is extending away).
5. Using appropriate tools remove the four screws and washers holding the top cover of the rapidCAST.
6. Set the cover aside being careful not to lose the hardware (screws and washers).
7. Remove the right-side cover as viewed from the rear. Set aside.



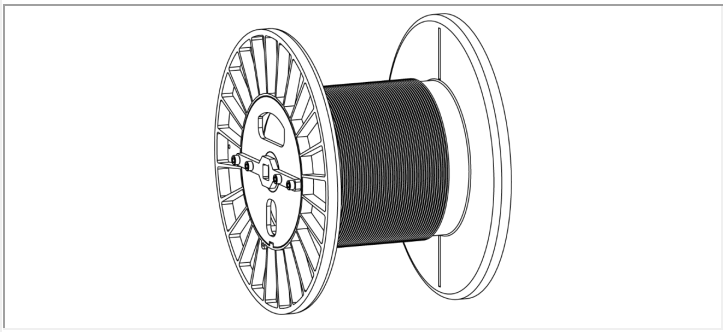
8. Pulling gently on the grip ring, carefully remove the Encoder cable from bottom of the encoder assembly. Allow the cable to dangle in place.
9. Loosen the four bolts holding the Encoder and Idler Shaft assembly to the chassis.
10. Remove the encoder belt from the timing pulley.
11. Remove the loosened screws and washers on the Idler Shaft Assembly and set aside.

Make sure that the spool is supported but does not extract with the following step. It is heavy and can cause damage if dropped.



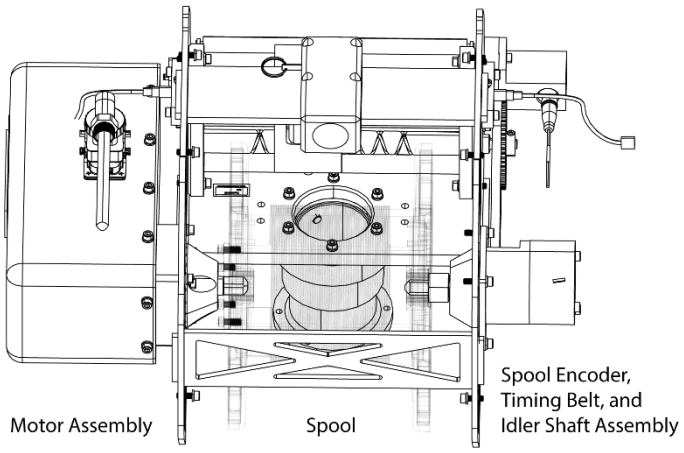
12. Remove the spool encoder, timing belt, and idler shaft by pulling straight back. If the assembly is difficult to remove, use two M6 screws in the jack screw locations (circled in red) for added leverage. Do not remove the spool yet. Set the encoder aside.
13. While supporting the weight of the spool, carefully slide it to the right off the motor axle.
14. Lower the spool through the bottom of the chassis.

Reassembling the Spool Module

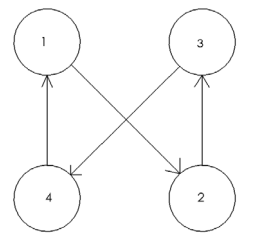


1. Position the spool such that the spool drive bar is to the left of the rapidCAST as viewed from the rear of the rapidCAST (Davit pointing away).
2. The line should now be positioned to unspool from the top.

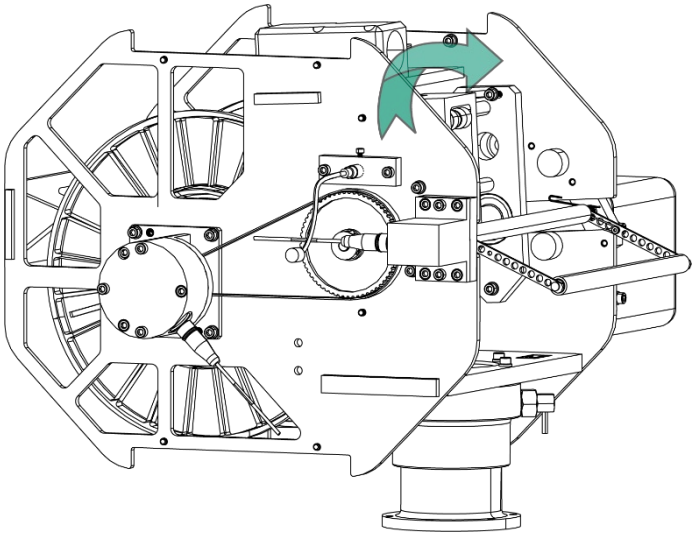
If the line is not in this orientation, then do not use this spool until it is corrected!



3. Lift the spool from the bottom of the chassis and position the square hole in the spool drive bar onto the motor axle.
4. Position the encoder and idler shaft assembly so that the square axle aligns with the hole in the plastic side of the spool.
5. When the encoder is in place, then support the spool while installing the four mounting bolts and washers that you removed earlier to finger tight, but not torqued.
6. Torque the M6 bolts to 35 IN-LBS (4N.m) in a star pattern as shown:



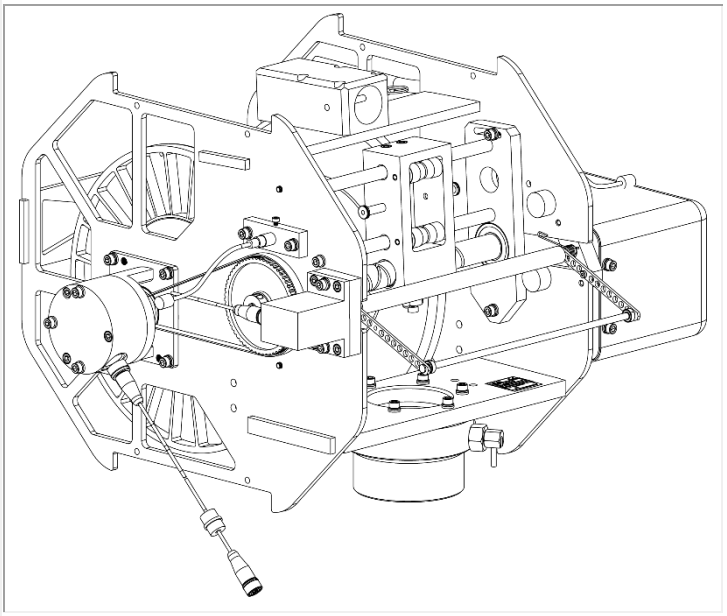
Timing Belt Adjustment



1. Loosen the tension on the timing belt by loosening the top M6 bolts on both sides of the LevelWind. Do not completely remove the bolts, leave them partially engaged.
2. Slide the belt onto the timing pulley. Ensure that it rides on the back gear centered.
3. Gently and slowly pull on the LevelWind assembly to tension the timing belt. Only a small amount of timing belt tension is required, and it should not cause the timing pulley to deflect.
4. Tighten the M6 bolts on the LevelWind to 35 IN-LBS (4N.m).

The timing pulley may be offset up to 50% width of the belt and still maintain proper operation. There is very little force on it, and it will vary from spool to spool due to machine tolerances.

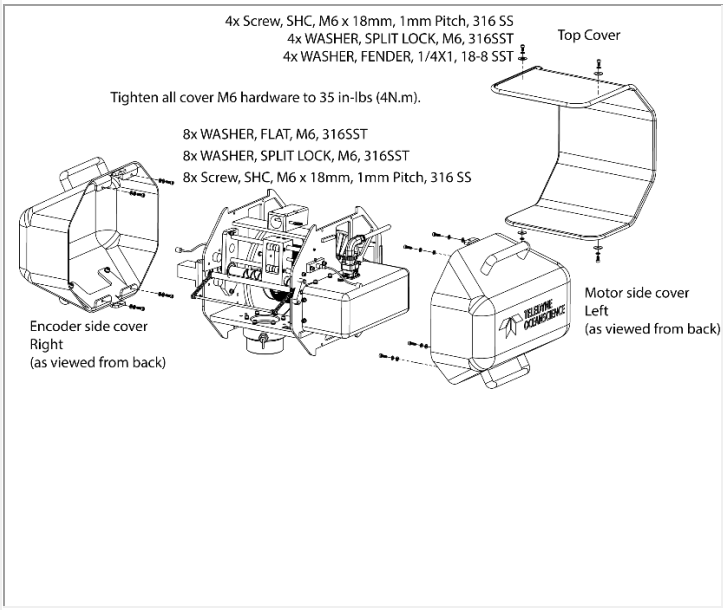
Final Spool Assembly



1. At the bottom of the encoder assembly reposition and install the Spool cable ensuring the grip ring clips into place.
2. Verify proper operation of the spool and belt before installing the right and top covers using the hardware that was removed earlier.
3. Replace the covers.
4. Tighten all cover M6 hardware to 35 IN-LBS (4N.m).

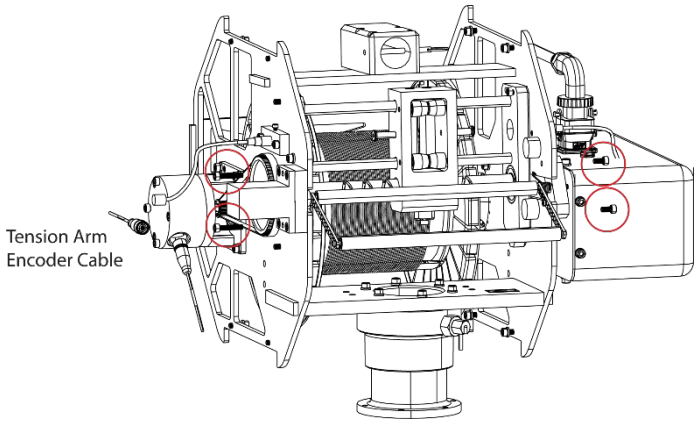
Replacing the Tension Arm Assembly

Replace the Tension Arm assembly if it becomes worn or damaged.



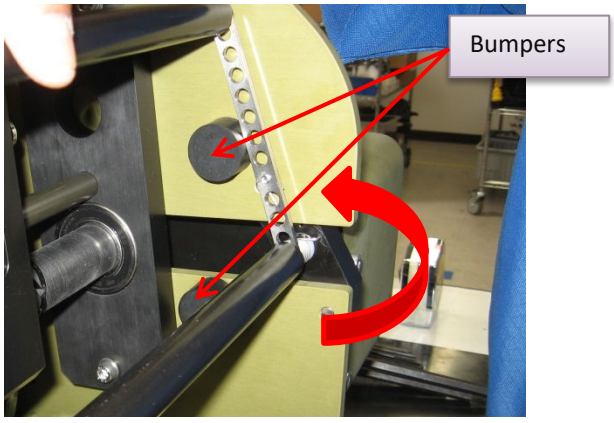
5. Lockout the system and remove power.
6. Remove the probe from the line and stow it in its case.
7. Secure the line to the spool using a piece of tape.
8. Position the rapidCAST such that the front of the unit can be accessed.
9. Using appropriate tools remove the four screws and washers holding the top cover of rapidCAST.
10. Set the cover aside being careful not to lose the hardware (screws and washers).
11. Remove the left and right-side covers as viewed from the rear. Set aside.

Removing the Tension Arm Assembly

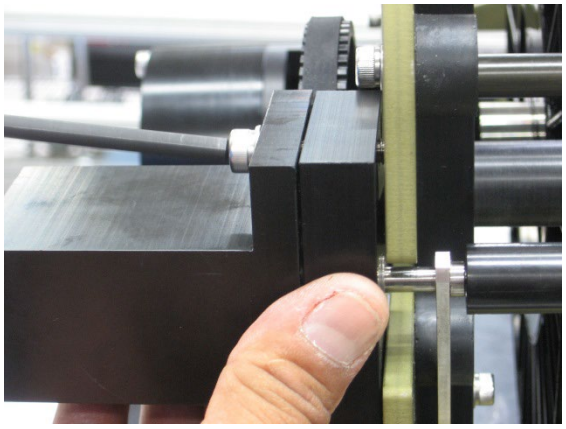


1. disconnect the cable attached to the tension arm encoder.
2. Remove the two M6 bolts on each side.
3. Pull the tension arm assembly straight out from the chassis.

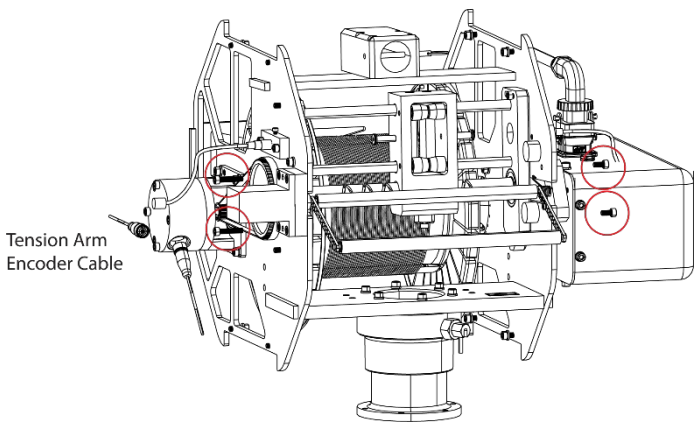
Installing the Tension Arm Assembly



1. Slide the Tension Arm assembly in the slots of the winch frame.
2. Rotate the mount block to align the bolt holes. This will apply tension on the spring. The tension arm should be normally against the lower bumpers.



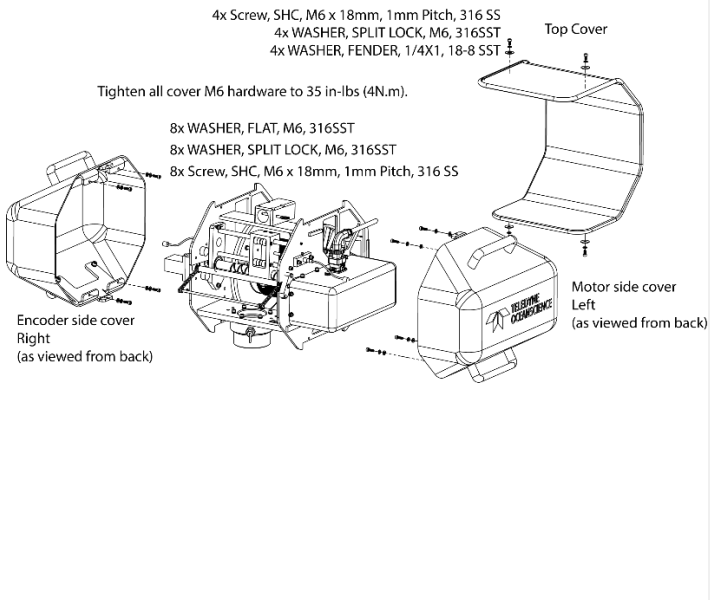
3. Install only the top screw M6 X 12mm and washer on both sides, but not fully tightened.
4. Press and release the Tension Arm assembly to make sure it does not touch anything but the bumpers.



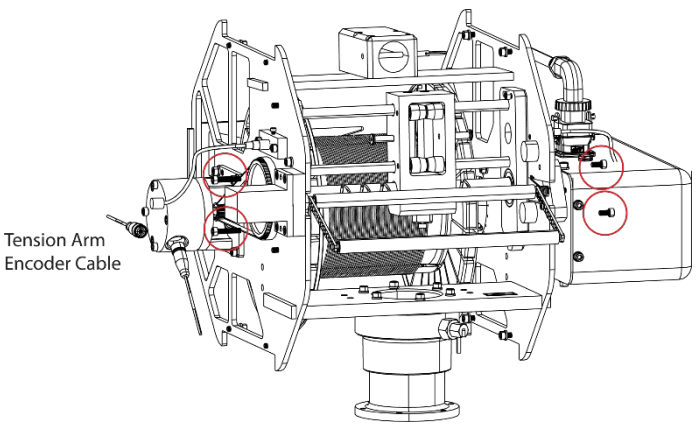
5. Install the lower M6 bolt. Repeat on the Encoder side. Torque all four bolts to 35.4 IN-LBS (4N.m).
6. Connect the cable to the Tension Encoder enclosure.
7. Perform the Tension Arm zero position adjustment for the magnetic encoder module followed by a Tension Arm Calibration.
8. Replace the covers.
9. Tighten all cover M6 hardware to 35 IN-LBS (4N.m).

Replacing the Tension Arm Spring

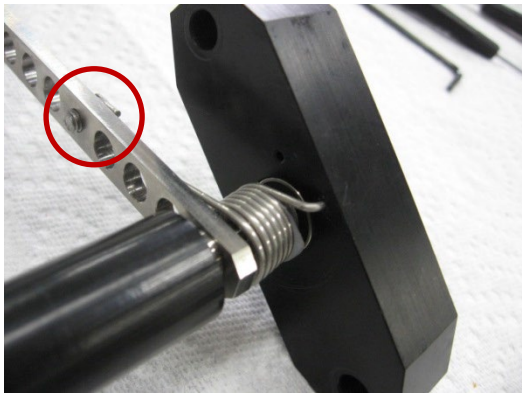
Replace the Tension Arm spring if it becomes worn or broken.



1. Lockout the system and remove power.
2. Remove the probe from the line and stow it in its case.
3. Secure the line to the spool using a piece of tape.
4. Position the rapidCAST such that the front of the unit can be accessed.
5. Using appropriate tools remove the four screws and washers holding the top cover of rapidCAST.
6. Set the cover aside being careful not to lose the hardware (screws and washers).
7. Remove the left and right-side covers as viewed from the rear. Set aside.



8. Remove the tension arm assembly.
9. Remove the broken spring.

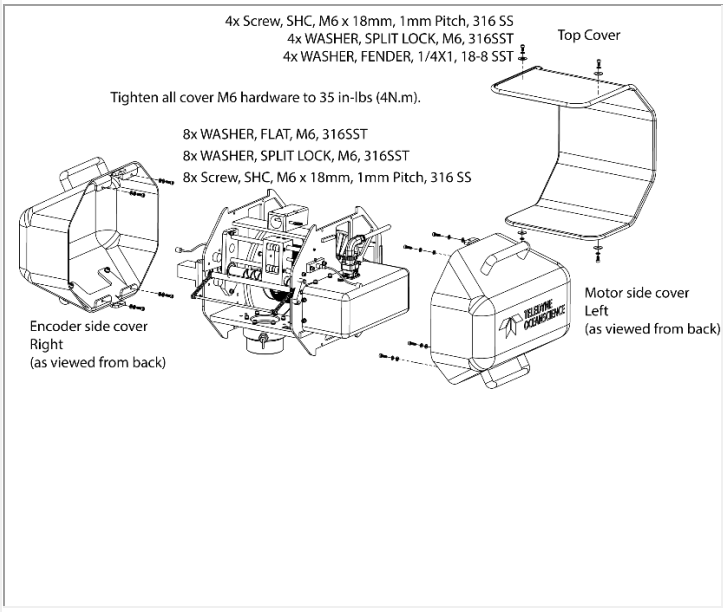


10. Install the new Spring on the shaft. Apply loctite 242 to the M4 screw (circled in red). Torque to 10.6 in-lbs.
11. Install the Tension Arm Mount Block on the shaft. Make sure the end of the Spring is in the hole on the Mounting Block.

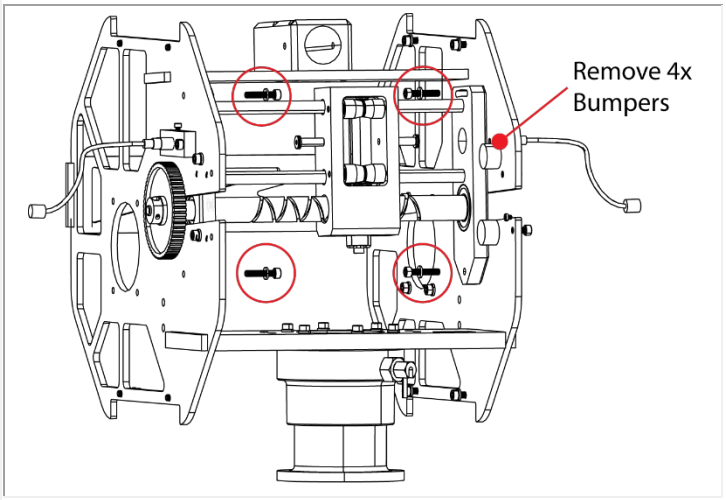
12. Install the E-Ring on the end of the shaft. Use Shim 9002061 as necessary to ensure a snug fit.
13. Install the tension arm assembly into the rapidCAST.
14. Perform the Tension Arm zero position adjustment for the magnetic encoder module followed by a Tension Arm Calibration.
15. Replace the covers.
16. Tighten all cover M6 hardware to 35 IN-LBS (4N.m).

Replacing the LevelWind Assembly

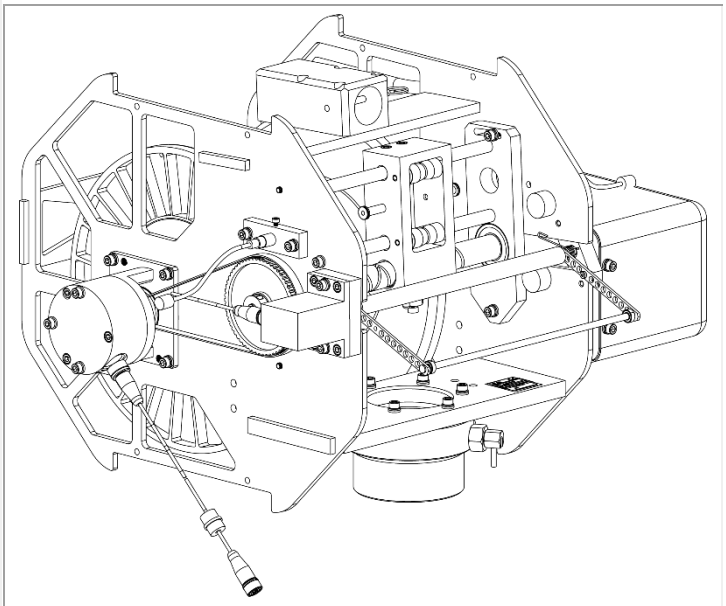
Replace the Levelwind assembly if it becomes worn or damaged.



1. Lockout the system and remove power.
2. Remove the probe from the line and stow it in its case.
3. Secure the line to the spool using a piece of tape.
4. Position the rapidCAST such that the front of the unit can be accessed.
5. Using appropriate tools remove the four screws and washers holding the top cover of the rapidCAST.
6. Set the cover aside being careful not to lose the hardware (screws and washers).
7. Remove the right-and left side covers. Set aside.



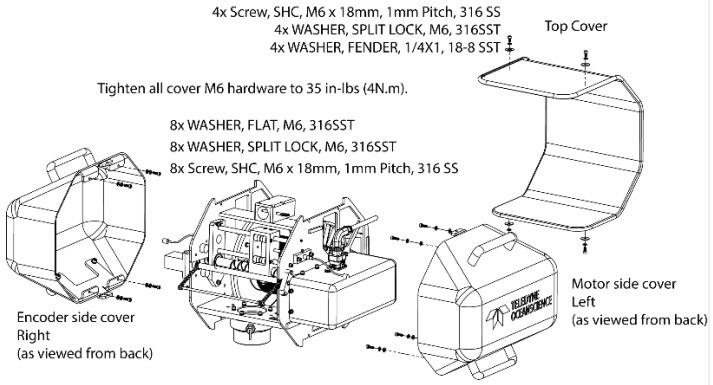
8. Remove the Tension Arm assembly.
9. Remove the motor.
10. Remove the four bumpers.
11. Remove the four bolts holding the LevelWind assembly onto the rapidCAST. Slide the assembly straight out.



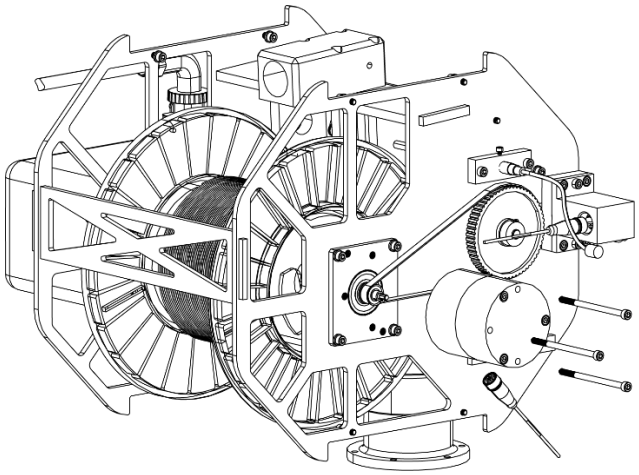
12. Put DC111 or AquaShield over the new LevelWind bearings to help with rust prevention.
13. Install the new LevelWind assembly into the rapidCAST.
14. Install the four bumpers.
15. Install the motor and spool. Slide the belt onto the timing pulley. Ensure that it rides on the back gear centered.
16. Adjust the tension on the timing belt.
17. Torque the LevelWind assembly bolts to 35.4 IN-LB [4 N.m].
18. Install the tension arm assembly into the rapidCAST.
19. Perform the Tension Arm zero position adjustment for the magnetic encoder module followed by a Tension Arm Calibration.
20. Replace the covers.
21. Tighten all cover M6 hardware to 35 IN-LBS (4N.m).

Replacing the Spool Encoder Assembly

This procedure shows how to replace the spool Encoder in the rapidCAST.



1. Lockout the system and remove power.
2. Remove the probe from the line and stow it in its case.
3. Secure the line to the spool using a piece of tape.
4. Position the rapidCAST such that the front of the unit can be accessed.
5. Using appropriate tools remove the four screws and washers holding the top cover of the rapidCAST.
6. Set the cover aside being careful not to lose the hardware (screws and washers).
7. Remove the right-side cover. Set aside.

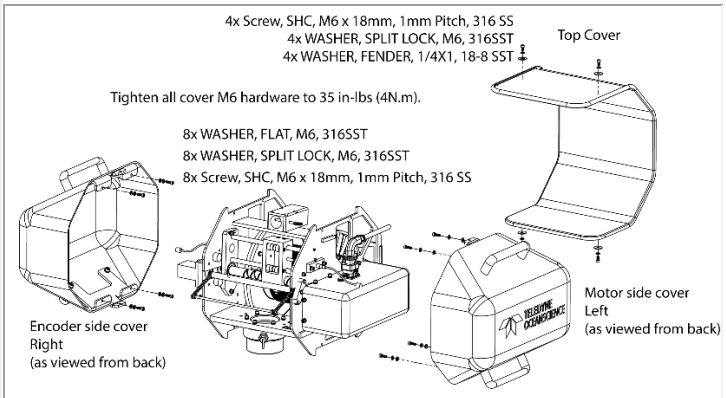


8. Pulling gently on the grip ring, carefully remove the Encoder cable from bottom of the encoder assembly. Allow the cable to dangle in place.
9. Remove the three bolts holding the Encoder on the Idler Shaft assembly.
10. Carefully slide the encoder assembly to the right, away from the chassis. Set the encoder aside.

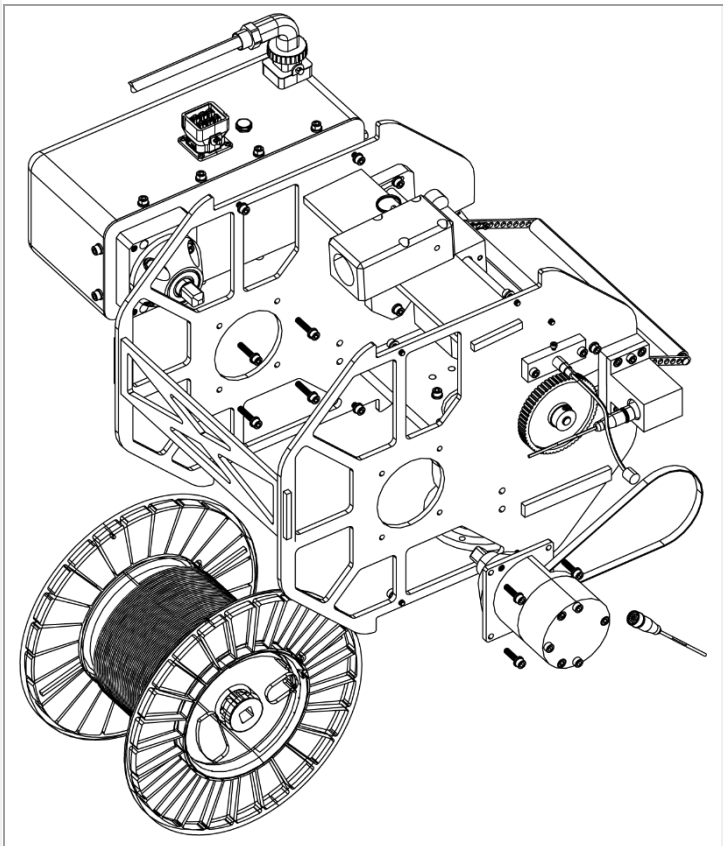
11. Slide on the new Encoder.
12. Apply Loctite 425 to the M6 bolt threads. Tighten the three M6 bolts and flat washers to 35 IN-LBS (4 N.m).
13. At the bottom of the encoder assembly reposition and install the Spool cable ensuring the grip ring clips into place.
14. Replace the covers.
15. Tighten all cover M6 hardware to 35 IN-LBS (4 N.m).

Replacing the Motor

This procedure shows how to replace the motor in the rapidCAST.

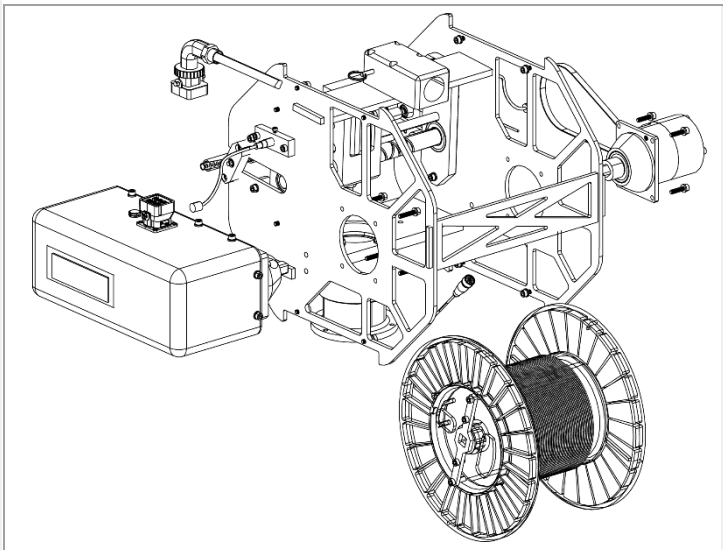


1. Lockout the system and remove power.
2. Remove the probe from the line and stow it in its case.
3. Secure the line to the spool using a piece of tape.
4. Position the rapidCAST such that the front of the unit can be accessed.
5. Using appropriate tools remove the four screws and washers holding the top cover of the rapidCAST.
6. Set the cover aside being careful not to lose the hardware (screws and washers).
7. Remove the left and right-side covers. Set aside.

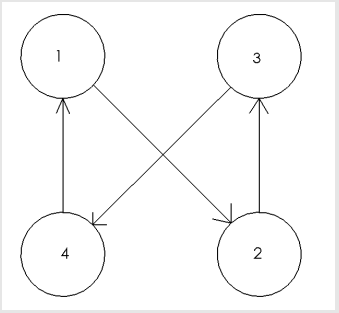


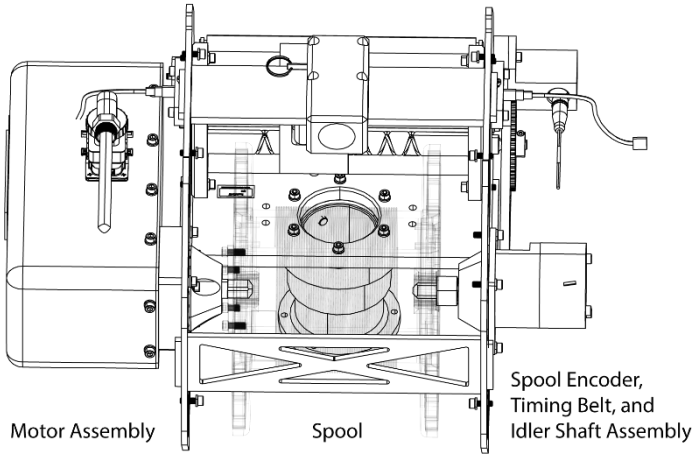
8. Remove the spool assembly.
9. Disconnect the motor power connector.
10. Support the motor so that it does not fall for the remaining steps.
11. Remove the four M6x30mm bolts and M6 flat washers holding the motor in place.
12. Remove the motor and set aside.

Installing the New Motor



1. Install the new motor.
2. Install the four M6x30mm bolts and M6 flat washers.
3. Torque the M6 bolts to 35 IN-LBS (4 N.m) in a star pattern as shown:

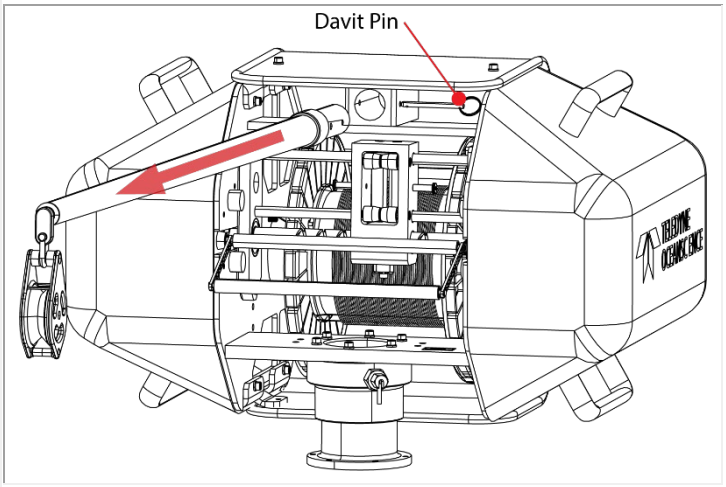




4. Install the spool through the bottom of the frame and slide onto the motor shaft.
5. Check to ensure the spool is fully engaged on the motor shaft up to the hard stop.
6. Install the spool encoder, timing belt, and idler shaft.
7. Torque to 35 IN-LBS (4N.m) in a star pattern to as shown previously.
8. Slide the timing belt on to timing pulley.
9. Adjust the tension on the timing belt.
10. Reconnect the Motor and Encoder electrical cables.
11. Replace the covers.
12. Tighten all cover M6 hardware to 35 IN-LBS (4N.m).

Replacing the Davit

If the Davit is damaged, replace as needed.

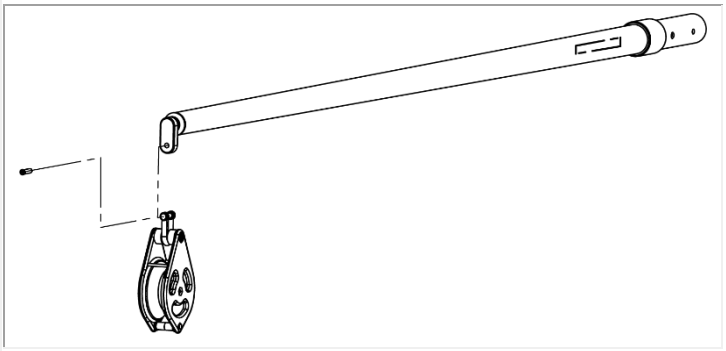


1. Lockout the system and remove power.
2. Remove the probe from the line and stow it in its case.
3. Secure the line to the spool using a piece of tape.
4. Remove the Davit retaining pin and pull the davit out of the mounting block.
5. Insert the Davit. Ensure the Block is oriented downward as shown.
6. Install the Davit retaining pin.

Wear gloves when handling the Davit. The Davit is made from carbon fiber and may cause splinters.

Replacing the Block

The block should be replaced whenever the pulley wheel is worn or damaged.



1. Remove the shackle screw and install the new block.
2. Install the shackle screw and torque to 15.0 IN-LBS (1.70 N.m).

Disassembly and Packing

The system should be stowed in the cases when not in use.

1. Rinse the LevelWind and Follower assembly with fresh water to prevent salt build-up.
2. Power down the controller. Disconnect all cables on the controller and stow them in the Ancillaries Case.
3. Remove the probe from the line and stow it in its case.
4. Secure the line to the spool using a piece of tape.
5. Rinse the Block with fresh water to prevent salt build-up. Remove the davit and stow it in its case.
6. Carefully lift the winch from the pipe mount. The cables should be removed from the winch pipe and stowed inside of the winch prior to packing. It may be easier to remove the cover and wrap the cables around the metal frame and the spool. Place the winch in its case.

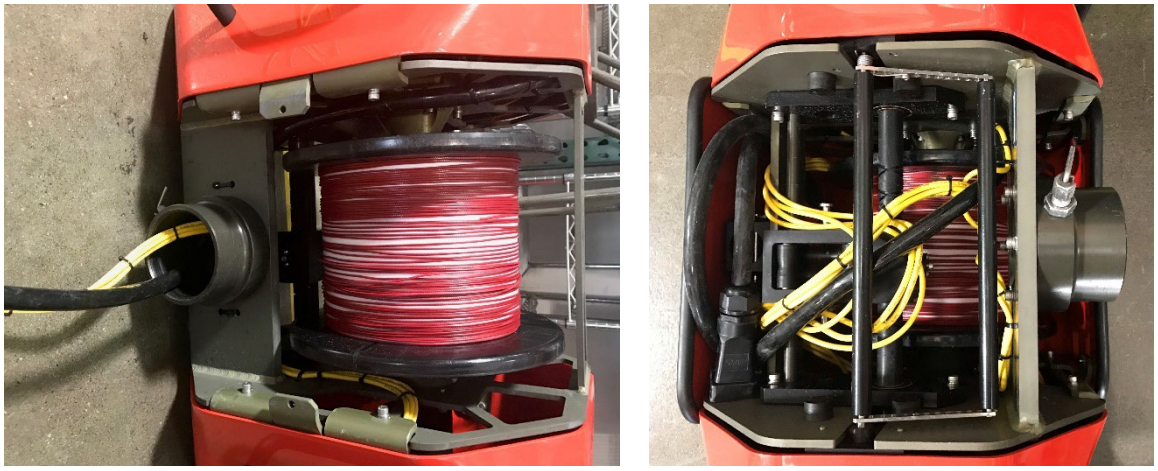
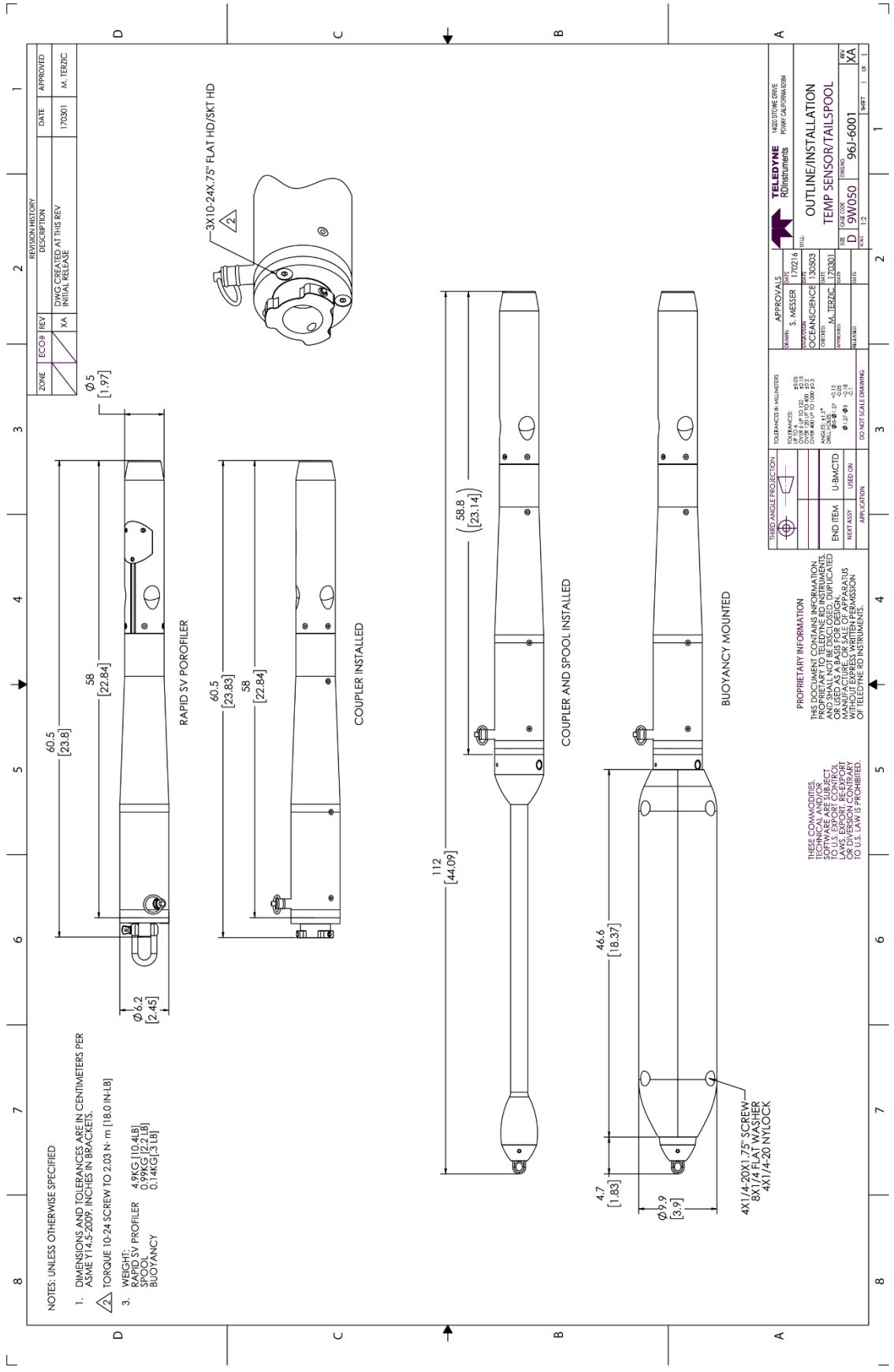


Figure 49. Packing the Winch

DO NOT damage the tension arm when removing or wrapping the cables around the winch.

Appendix A - Installation Drawings


NOTES: UNLESS OTHERWISE SPECIFIED
1. DIMENSIONS AND TOLERANCES ARE IN CENTIMETERS PER ASME Y14.5-2009, INCHES IN BRACKETS.
2. TORQUE 10-24 SCREW TO 2.03 N· m [18.0 IN-LB]
3. WEIGHT:
RAPID SV PROFILER 4.9KG [10.4LB]
SPOOL 0.9KG [2.2 LB]
BUOYANCY 0.14KG[.3 LB]
3X10-24X.75" FLAT HD/SKT HD
RAPID SV POROFILER
COUPLER INSTALLED
COUPLER AND SPOOL INSTALLED
BUOYANCY MOUNTED
4X1/4-20X1.75" SCREW
8X1/4 FLAT WASHER
4X1/4-20 NYLOCK
REVISION HISTORY
DWG CREATED AT THIS REV
INITIAL RELEASE
APPROVALS
OCEANSCIENCE
TELEDYNE RDInstruments
OUTLINE/INSTALLATION
TEMP SENSOR/TAILSPOOL
96J-6001
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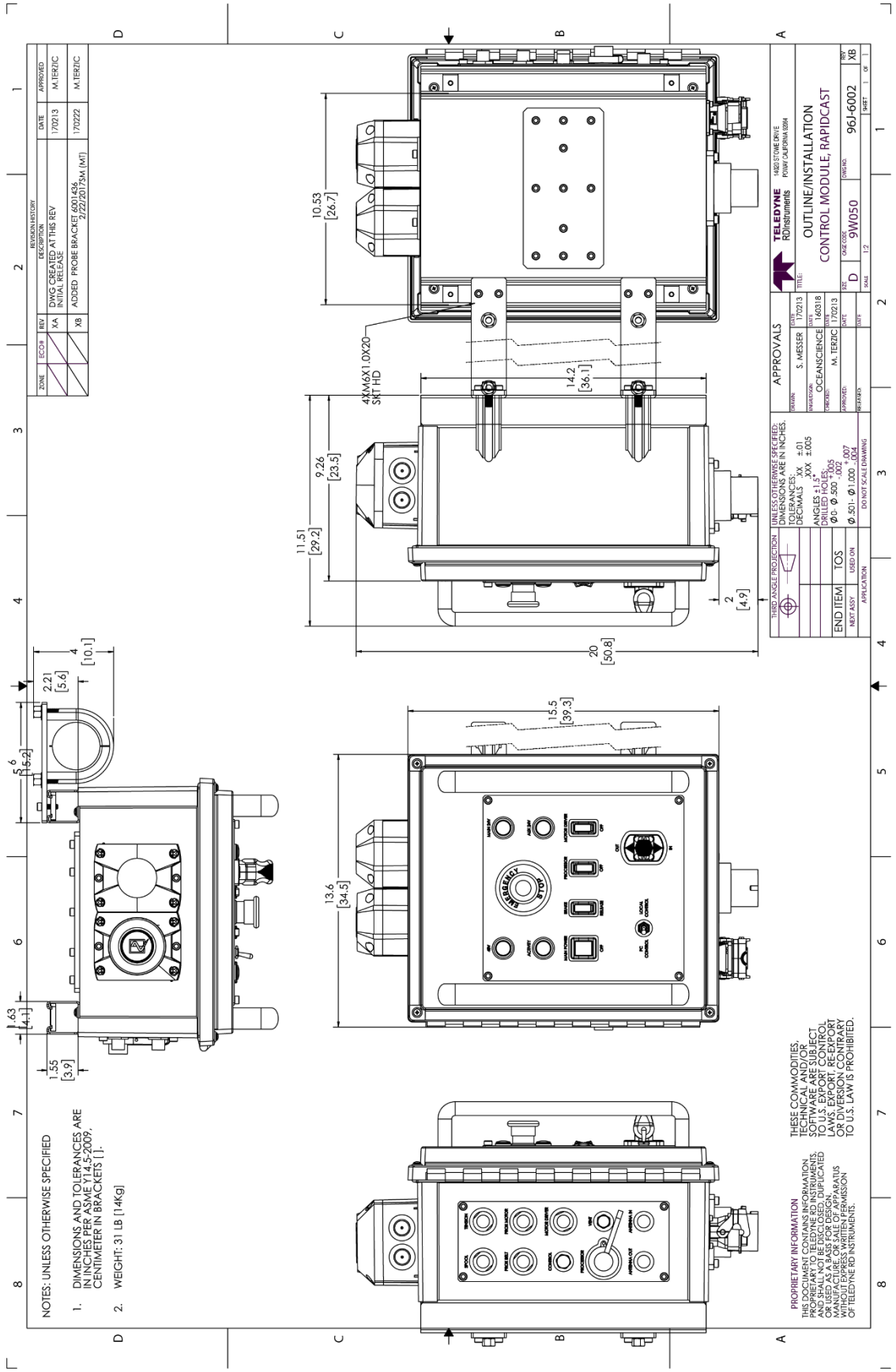
NOTES: UNLESS OTHERWISE SPECIFIED
1. DIMENSIONS AND TOLERANCES ARE IN INCHES PER ASME Y14.5-2009, CENTIMETER IN BRACKETS [ ].
2. WEIGHT: 31 LB [14Kg]
OUTLINE/INSTALLATION
CONTROL MODULE, RAPIDCAST
TELEDYNE RDInstruments
1420 STONE DRIVE POWAY CALIFORNIA 92064
APPROVALS
PROPRIETARY INFORMATION
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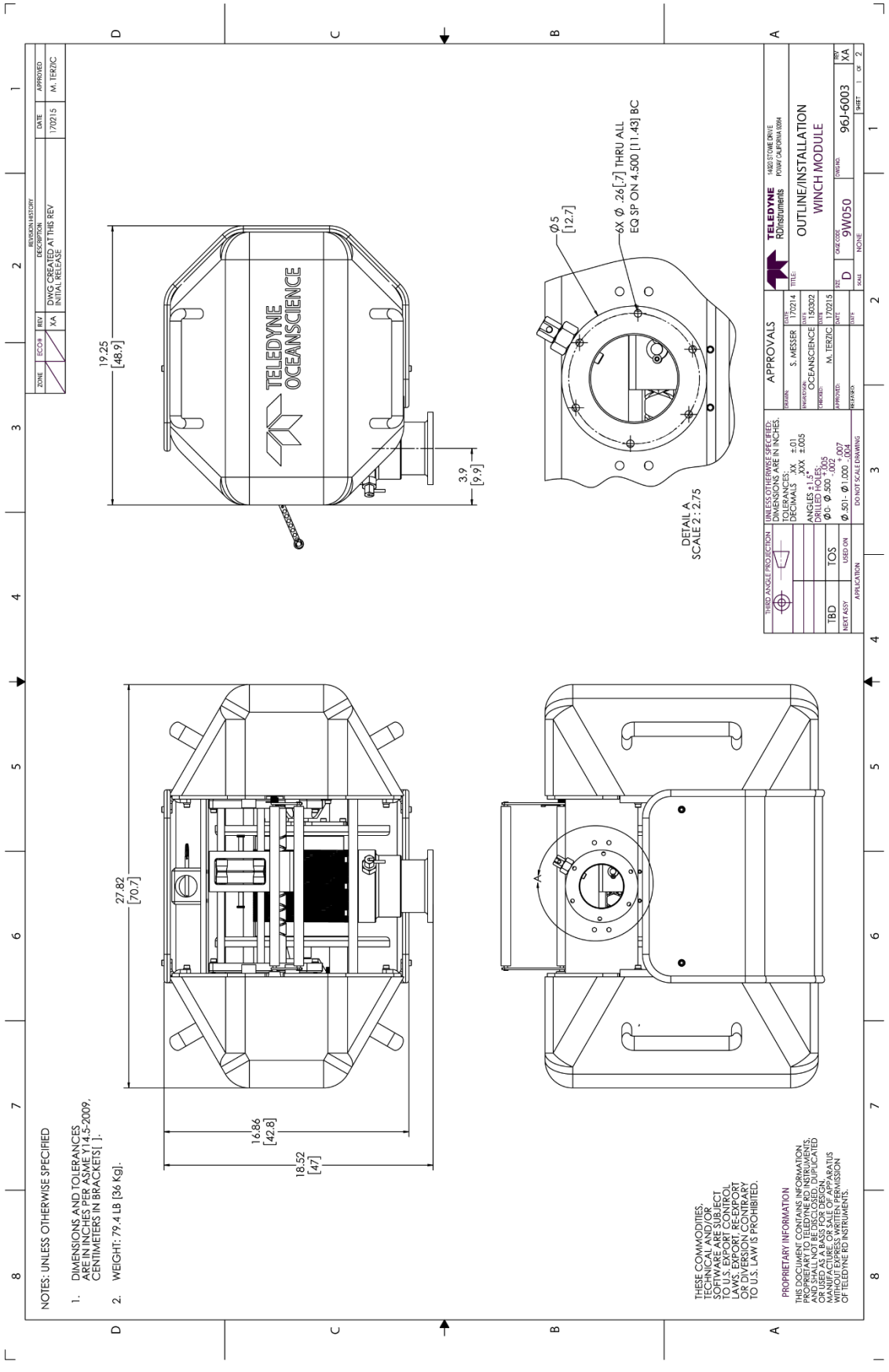
TELEDYNE OCEANSCIENCE
19.25 [48.9]
3.9 [9.9]
Ø.5 [12.7]
6X Ø .26 [.7] THRU ALL EQ SP ON 4.500 [11.43] BC
DETAIL A SCALE 2 : 2.75
27.82 [70.7]
16.86 [42.8]
18.52 [47]
NOTES: UNLESS OTHERWISE SPECIFIED
1. DIMENSIONS AND TOLERANCES ARE IN INCHES PER ASME Y14.5-2009, CENTIMETERS IN BRACKETS[ ].
2. WEIGHT: 79.4 LB [36 Kg].
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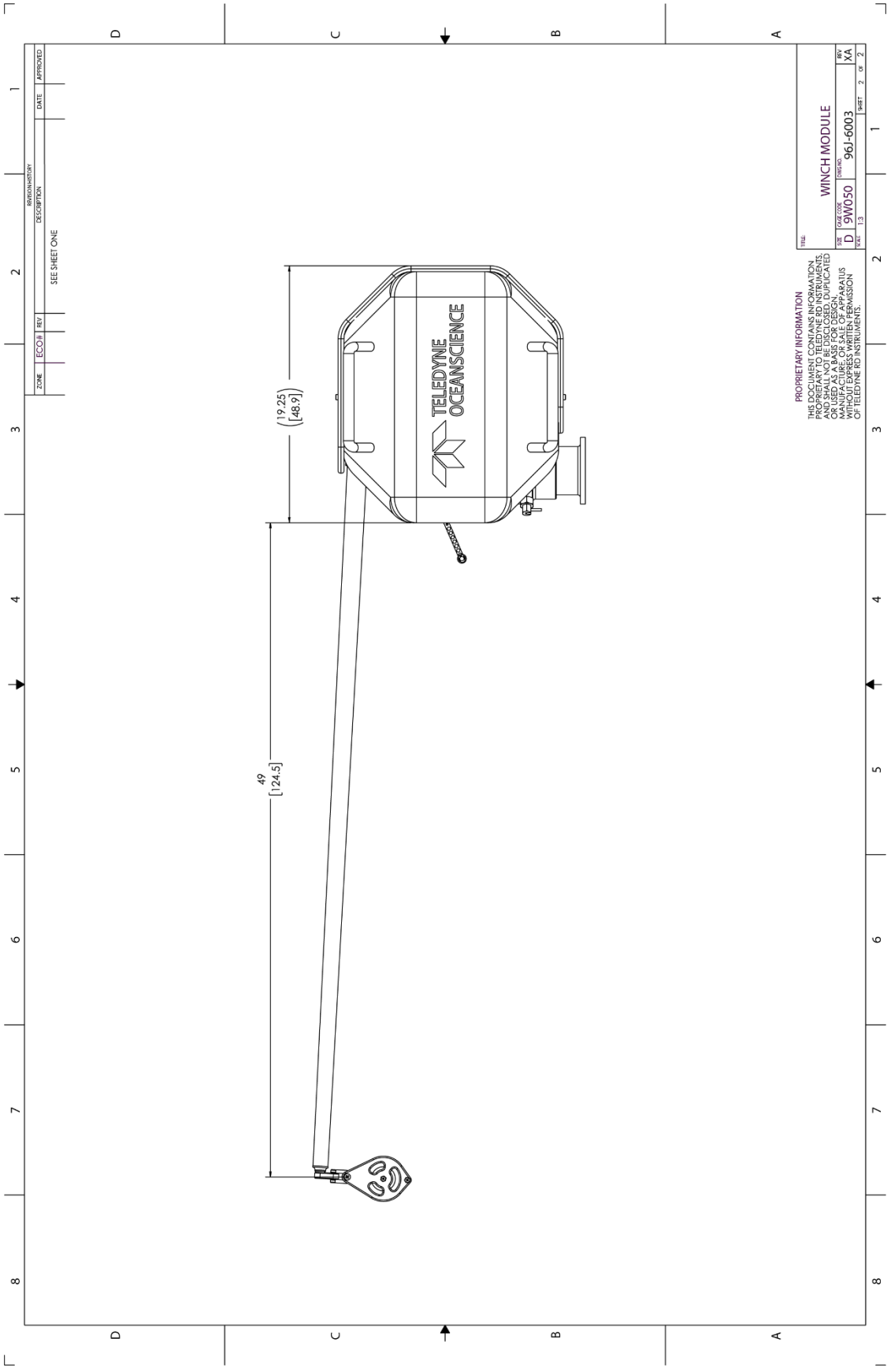
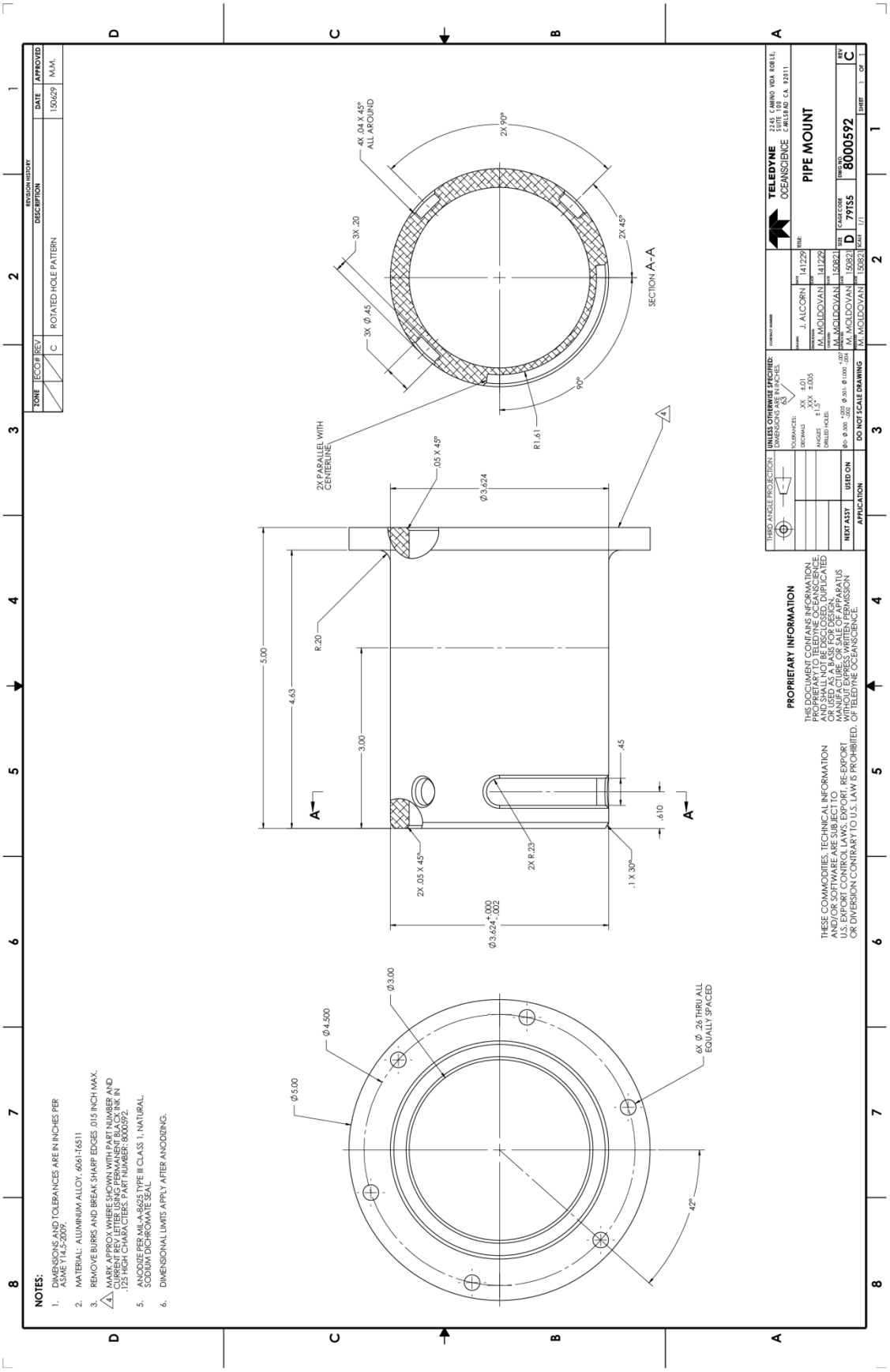
REVISION HISTORY
ZONE | ECO# | REV | DESCRIPTION | DATE | APPROVED
XA | DWG CREATED AT THIS REV INITIAL RELEASE | 170215 | M. TERZIC
APPROVALS
DRAWN: S. MESSER DATE: 170214
ENGINEERING: OCEANSCIENCE DATE: 150302
CHECKED: M. TERZIC DATE: 170215
APPROVED: DATE:
RELEASED: DATE:
TELEDYNE RDInstruments
1420 STONE DRIVE POWAY, CALIFORNIA 92064
TITLE: OUTLINE/INSTALLATION WINCH MODULE
SIZE: D CAGE CODE: 9W050 DWG NO: 96J-6003 REV: XA
SCALE: NONE SHEET 1 OF 2
THIRD ANGLE PROJECTION
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES: DECIMALS .XX ±.01 .XXX ±.005 ANGLES ±1.5° DRILLED HOLES: Ø.0 Ø.500 +.005 -.002 Ø.501 - Ø1.000 +.007 -.004
NEXT ASSY: TBD USED ON: TOS APPLICATION
DO NOT SCALE DRAWING


TELEDYNE
OCEANSCIENCE
(19.25)
[48.9]
49
[124.5]
SEE SHEET ONE
WINCH MODULE
96J-6003
9W050
PROPRIETARY INFORMATION


NOTES:
1. DIMENSIONS AND TOLERANCES ARE IN INCHES PER ASME Y14.5-2009.
2. MATERIAL: ALUMINUM ALLOY, 6061-T6511
3. REMOVE BURRS AND BREAK SHARP EDGES .015 INCH MAX.
4. MARK APPROX WHERE SHOWN WITH PART NUMBER AND SERIAL NUMBER USING LASER ENGRAVER. USE .125 HIGH CHARACTERS. PART NUMBER: 8000592
5. ANODIZE PER MIL-A-8625 TYPE III CLASS 1, NATURAL. SODIUM DICHROMATE SEAL
6. DIMENSIONAL LIMITS APPLY AFTER ANODIZING.
REVISION HISTORY
ZONE | ECO # | REV | DESCRIPTION | DATE | APPROVED
C | ROTATED HOLE PATTERN | 150629 | M.M.
4X .04 X 45° ALL AROUND
2X 90°
3X .20
3X Ø .45
2X 45°
SECTION A-A
2X PARALLEL WITH CENTERLINE
R1.61
90°
.05 X 45°
Ø3.624
5.00
4.63
3.00
R.20
.45
.610
2X .05 X 45°
2X R.23
.1 X 30°
Ø3.624 +.000 -.002
Ø5.00
Ø4.500
Ø3.00
6X Ø .26 THRU ALL EQUALLY SPACED
42°
THIRD ANGLE PROJECTION
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
TOLERANCES: DECIMALS XX ±.01 XXX ±.005 ANGLES ±1.5° DRILLED HOLES: Ø to Ø.500 +.005 -.002 Ø.501 to Ø1.000 +.007 -.004
NEXT ASSY | USED ON
APPLICATION | DO NOT SCALE DRAWING
PROPRIETARY INFORMATION
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TELEDYNE OCEANSCIENCE 2345 CAMINO VIDA ROBLE, SUITE 100 CARLSBAD CA. 92011
TITLE: PIPE MOUNT
DRAWN: J. ALCORN 141229
CHECKED: M. MOLDOVAN 141229
ENG APPR: M. MOLDOVAN 150821
MFG APPR: M. MOLDOVAN 150821
SIZE: D
CAGE CODE: 79TS5
DWG NO: 8000592
REV: C
SCALE: 1/1
SHEET 1 OF 1

NOTES