
accu-positioner

OPERATION AND MAINTENANCE MANUAL

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WARRANTY

ROS, Inc. (hereinafter called "**ROS**") warrants its products as stated below subject to the conditions specified.

ROS warrants its products, when operated under normal conditions, to be free from defects in material or workmanship for a period of one year from the date of purchase provided that inspection by **ROS** discloses that such defects developed under normal and proper use. **ROS** products repaired or replaced pursuant to this warranty shall be warranted for the unexpired portion of the warranty applying to the original product. The liability of **ROS** under this warranty shall exist subject to the following conditions:

- (a) Purchaser properly notifies ROS of such defects and the defective product is returned to ROS; transportation charges paid by Purchaser.
- (b) ROS shall be released from all obligations under its warranty in the event repairs or modifications are made by persons not authorized by ROS.
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ROS, Inc. uses a worldwide network of stocking distributors and representatives who are familiar with our products and are able to provide assistance during installation and/or operation of these products.

If you have any questions or problems with this product that are not covered by this manual or instruction, please contact our agent in your area, or contact us directly by phone or FAX or e-mail.

TEL: (001) 858-565-8500

FAX: (001) 858-565-8808

Sales: sales@rosys.com

Web Site: www.rosys.com

Technical Support: support@rosys.com

Change Record

<u>REV</u>	<u>DESCRIPTION</u>	<u>DATE</u>
A	SEE EC-03199	08JUN20
B	SEE EC-03239	27AUG20
C	SEE EC-03265	20OCT20

1. Introduction

The AccuPositioner (Figure 1) is a high-accuracy, high torque, light-weight, compact positioner for underwater use. Options include oil-filled or air-filled. The AccuPositioner is powered by 20-28 VDC to provide 10 ft lb of torque, and can turn up to 24 deg/s, 360 deg continuous.



Figure 1. AccuPositioner

2. Product Specifications

Table 1 shows the mechanical specifications for the AccuPositioner. Table 2 shows the electrical specifications.

Table 1. Mechanical Specifications

	Air-Filled	Oil-Filled
Weight in air	6.6 lb (3.0 kg)	7.7 lb (3.5 kg)
Weight in water	3.1 lb (1.4 kg)	4.2 lb (1.9 kg)
Depth rating	230 ft (70 m)	20 k ft (6.0 km)
Operating temp	-10 to 50°C	
Storage temp	-20 to 60°C	
Material	Housing: 6061-T6 Shaft: 17-4 PH Yoke: 5052-H32 Mtg block: 6061-T6 or Delrin	
Range	Continuous	
Maximum speed	24 deg/s	
Torque	See Figure 2	

Table 2. Electrical Specifications

Voltage	20 - 28 VDC
Current	2 A Max
Communication	RS 485 Half-Duplex, 300 - 115200 Baud
Accuracy	+/- 0.1 deg

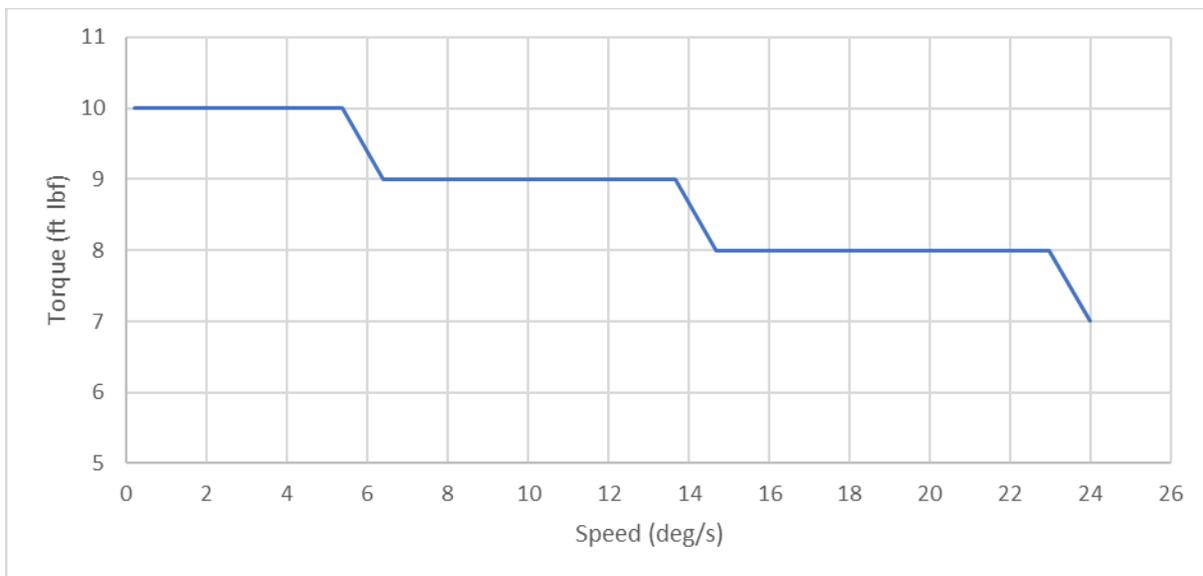


Figure 2. Minimum Measured Torque vs. Speed

3. Installation

3.1. Electrical

The AccuPositioner pinout will depend on customer selections; Figure 3 shows the default wiring.

3.2. Mounting

Figure 4 shows the outline of the AccuPositioner with the yoke and mounting base sold by Remote Ocean Systems. Figure 5 shows the outline of the AccuPositioner without the yoke and mounting base. The AccuPositioner may be mounted by the pan or tilt axis shaft.

⚠ WARNING

The AccuPositioner should be operated only through a circuit with ground fault interrupt protection.

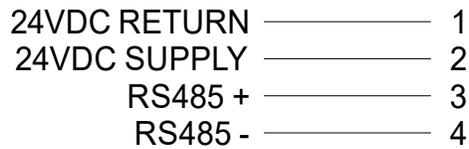


Figure 3. Sample Wiring

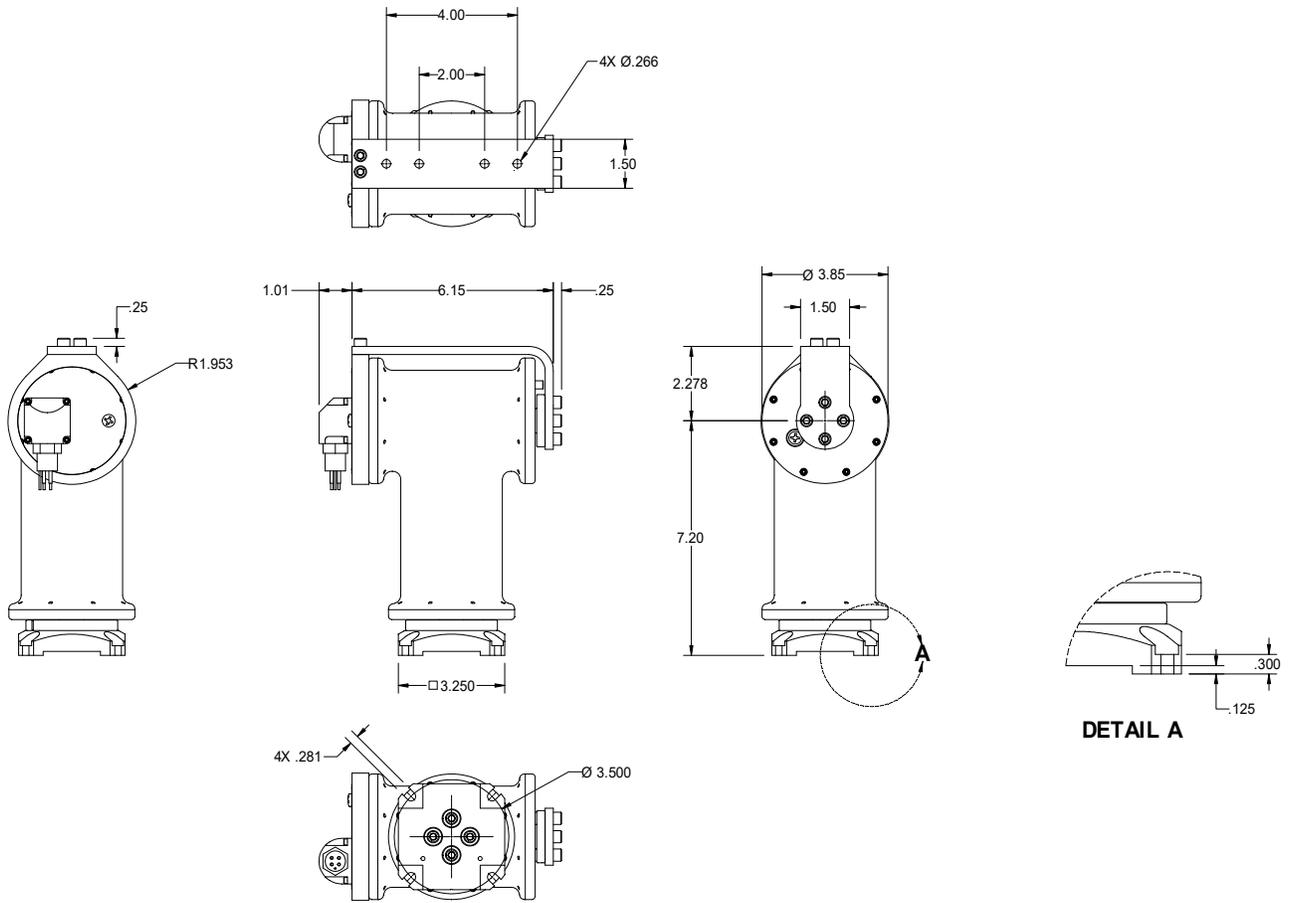


Figure 4. Installation Outline with Yoke and Mounting Block

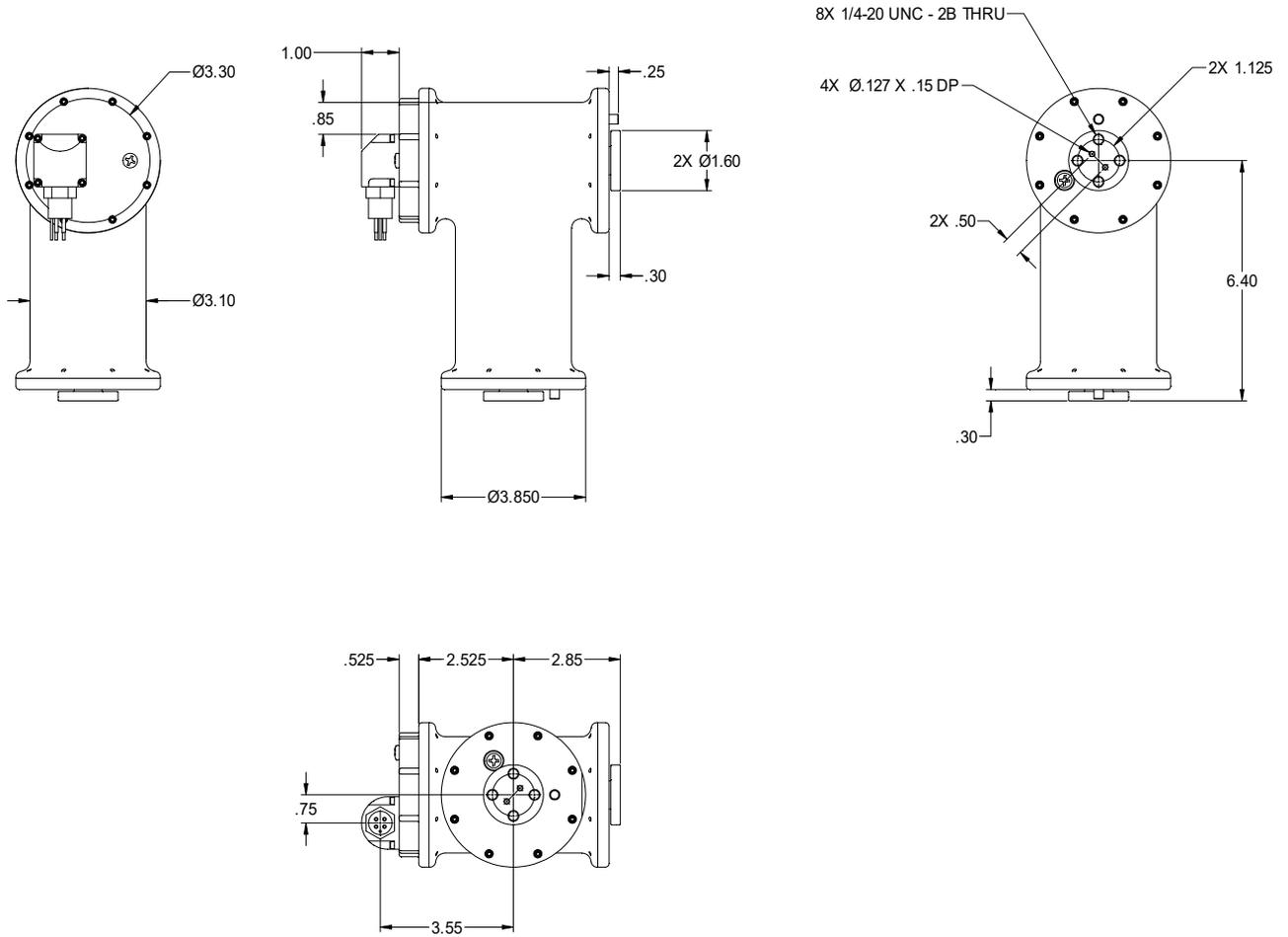


Figure 5. Installation Outline without Yoke and Mounting Block

4. Operation

4.1. GUI Operation

The AccuPositioner can be operate using the ROS provided GUI, Eos. Please contact ROS for access to the GUI and documentation.

4.2. Serial Operation

The AccuPositioner can be operated by by sending RS-485 serial commands directly from user-written software or firmware. Table 3 shows the AccuPositioner serial communications parameters. Table 4 lists commands and inquiries that may be sent to the AccuPositioner, along with their expected responses and behavior.

Table 5 lists standard response messages.

NOTE

All serial commands, inquiries and responses are terminated with hex byte ff (255).

Table 3. Serial Parameters

Baud Rate	9600 (default)
Data bits	8
Start bits	1
Stop bits	1
Parity	None
Flow control	None

Table 4. Serial Commands and Inquiries

Command	Packet	Note
Cancel Command	8x 2y ff	Stops the positioner from driving open loop or closed loop without deceleration. Returns Command Cancelled x = address y = socket (default 1)
Drive Open Loop	8x 01 06 01 vv ww yy zz ff	x = address vv: Pan speed 0x01 (low speed) to 0x18 (high speed) or 0x00 ww: Tilt speed 0x01 (low speed) to 0x00 (high speed) or 0x00 yy = direction: 01 = left, 02 = right, 03 = none zz = direction: 01 = up, 02 = down, 03 = none Speed range is 0.2 (0x01) to 24 (0x18) deg/s. The positioner responds Command Acknowledged after receiving and executing a valid command. It will ramp up to the set speed and run until receiving Cancel, Drive Open Loop, or Drive Absolute Position. To stop the unit with ramping, send drive open loop command with 0 speed.
Drive Absolute Position	8x 01 06 02 vv ww 0y 0y 0y 0y 0z 0z 0z 0z ff	x = address vv: Pan speed 0x01 (low speed) to 0x18 (high speed) ww: Tilt speed 0x01 (low speed) to 0x18 (high speed) yyyy: Pan Position zzzz: Tilt Position Speed range is 0.2 (0x01) to 24 (0x18) deg/s. Position range is 0 (0 deg) to $2^{16} - 1$ (360 deg - epsilon) bits. The unit responds Command Acknowledged after receiving and beginning a valid command. The unit will servo to the set position to the best of its ability without going faster than the set speed or accelerating faster than the maximum acceleration. If a set point is commanded outside of the user limits, the unit will servo to the user limit. The positioner will continue to servo until it receives Cancel, Drive Open Loop, or Drive Absolute Position. To stop the unit with ramping, send drive open loop command with 0 speed. If position limits are cleared, the unit will take the shortest route to the set point. If position limits are set, the unit will take the route that does not pass through zero.
Drive Home	8x 01 06 04 ff	Drive Absolute Position to the User Zero at 5 deg /s.

Table 4. Serial Commands and Inquiries

Command	Packet	Note
Set Position Limits	8x 01 06 07 00 0w 0y 0y 0y 0y 0z 0z 0z 0z ff	<p>w: 1 = up right, 0 = down left yyyy: Hex pan limit position zzzz: Hex tilt limit position</p> <p>Set the user limits on position. Position range is 0 (0 deg) to $2^{16} - 1$ (360–360/2^{16} deg) bits. Returns Command Completed once the limits have been successfully written to non-volatile memory. Returns Not Executable if the unit is already outside the requested limits, the unit is moving, or there is an error writing the limits to non-volatile memory.</p>
Clear Position Limits	8x 01 06 07 01 0w 07 0f 0f 0f 07 0f 0f 0f ff	<p>x = address w: ignored</p> <p>Clear the user limits on position and allow the unit to rotate continuously. Returns Command Completed once non-volatile memory has been successfully written. Return not executable if there is an error writing to non-volatile memory.</p>
Get Max Speed	8x 09 06 11 ff	<p>x = address</p> <p>Returns y0 50 ww zz ff ww = Pan max speed (deg/s) zz = Tilt max speed (deg/s) y = address + 8</p>
Get Position	8x 09 06 12 ff	<p>x = address</p> <p>Returns z0 50 0v 0v 0v 0v 0w 0w 0w 0w ff vvvv = Pan position wwww = Tilt position z = address + 8</p> <p>Gets the current position relative to the user-set zero. Position range is 0 (0 deg) to $2^{16}-1$ (360 deg - epsilon) bits. Convert to degrees by the formula $x = vvvv * 360 / 2^{16}$</p>

Table 4. Serial Commands and Inquiries

Command	Packet	Note
Get Position Limits	8x 09 06 13 0w ff	<p>x = address w: 1 = up right, 0 = down left</p> <p>Returns z0 50 0u 0u 0u 0u 0v 0v 0v 0v FF uuuu = Hex pan limit vvvv = Hex tilt limit z = address + 8</p> <p>Get the user limits on position. Position range is 0 (0 deg) to $2^{16} - 1$ (360 - $360/2^{16}$ deg) bits. Convert to degrees by the formula $x = uuuu * 360 / 2^{16}$</p>
Get Max Acceleration	8x 09 06 14 ff	<p>x = address</p> <p>Returns z0 50 yy zz yy = Pan max acceleration (1 - 125 deg/s²) zz = Tilt max acceleration (1 - 125 deg/s²)</p> <p>Gets the user-set acceleration limit in degrees/second².</p>
Get Serial Delay	8x 09 06 52 ff	<p>x = Address</p> <p>Returns z0 50 0y 0y yy = Serial delay</p> <p>Get the current delay between sent bytes in increments of 250 micro seconds.</p>
Set Max Acceleration	8x 01 06 51 0y 0y 0z 0z ff	<p>x = address yy = 8-bit integer Pan max acceleration (0 - 125 deg/s²) zz = 8-bit integer Tilt max acceleration (0 - 125 deg/s²)</p> <p>Sets the user-set acceleration limit in degrees/second². Returns Command Completed once the limits have been successfully written to non-volatile memory. Returns Not Executable if there is an error writing to nonvolatile memory. Returns Syntax Error if greater than 125 is requested max acceleration is requested. Set max acceleration to 0 to allow unlimited acceleration.</p>

Table 4. Serial Commands and Inquiries

Command	Packet	Note
Set Serial Delay	8x 01 06 52 0y 0y ff	<p>x = address yy = serial delay / 250 microseconds (0 - 125)</p> <p>Set a delay before the AccuPositioner responds in increments of 250 micro seconds. Returns Command Completed once the limits have been successfully written to non-volatile memory. Returns not executable if there is an error wring to nonvolatile memory.</p>
Set Zero	8x 01 06 55 0v 0w 0y 0y 0y 0y 0z 0z 0z 0z ff	<p>x = address v = 0 (subtract value from current pan zero), 1 add value to current pan zero) w = 0 (subtract value from current tilt zero), 1 add value to current tilt zero) yyyy = value to add to pan zero zzzz = value to add to tilt zero</p> <p>Set the user-zero to a position offset from the current zero. Offset range is 0 (0 deg) to $2^{16}-1$ (360 - $360/2^{16}$ deg). Returns Command Completed once the zero has been successfully written to non-volatile memory. Returns Not Executable if the requested zero is outside of user limits, the requested zero is greater than 65386 or less than 182, the unit is moving, or there is an error writing to nonvolatile memory.</p>

Table 5. Serial Response Messages

Response	Packet	Note
Command Acknowledged	Z0 4y ff	<p>z = address + 8 y = socket (default 1)</p> <p>Returned when a command that takes time to execute is accepted and begun.</p>
Command Completed	z0 5y ff	<p>z = address + 8 y = socket (default 1)</p> <p>Returned when a command that can be executed instantaneously is completed</p>

Syntax Error	z0 60 02 ff	z = address + 8 Returned when the command format is incorrect or when a command with illegal command parameters is accepted.
Command Not Executable	z0 6y 41 ff	z = address + 8 y = socket (default 1) Returned when a command cannot be executed because it would put the unit out of limits, because the unit's current state makes the command illegal, or because an error occurred.

4.3. Networking Multiple Positioners

The AccuPositioner can be set to answer to one of 7 addresses, 0x81 to 0x87. 0x88 is reserved in the Visca protocol for broadcast commands. The factory default address is 0x81. Positioners on the same network must be set to different addresses, or they will step on each other when trying to respond to commands. Units not connected to the same network may share an address. Consequently, each network may contain up to 7 units. There is no limit to the number of networks. A sample network diagram is shown in Figure 6.

Note

The unit is designed to operate as a device in an RS485 network. Ensure the proper terminating resistor value is used for multiple device networks.

The unit address may be changed using the serial command in Table 4, or via the user settings window in the Eos GUI.

Note

When assigning an address, only one unit may be connected to the network. Otherwise all connected units will be assigned the new address.

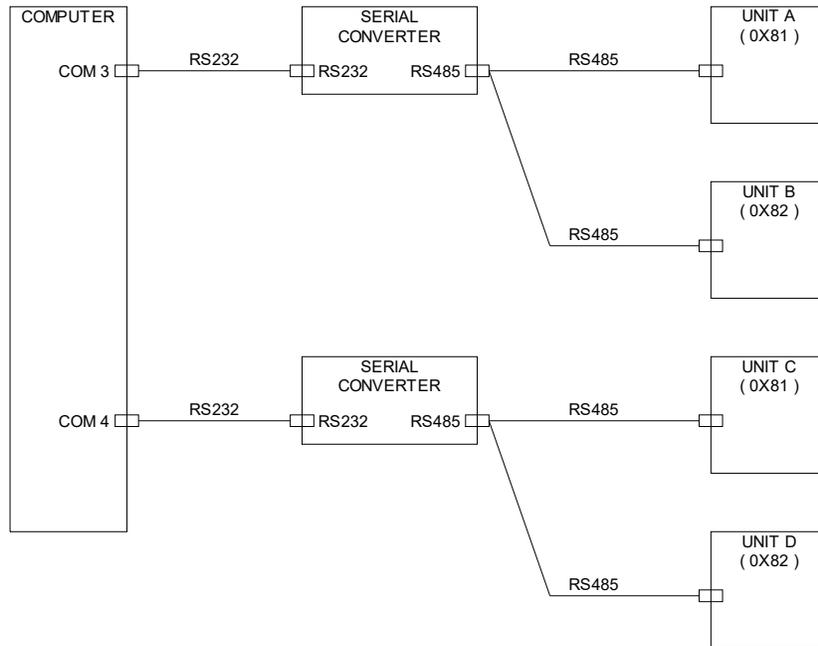


Figure 6. Multiple Units Connected to Multiple Ports

5. Maintenance

The AccuPositioner has no user-serviceable parts. It should not be opened or disassembled outside of the factory. The mounting block and yoke bracket may be removed for cleaning or replacement. See Section 7.

6. Troubleshooting

This section provides guidance for those problems with the AccuPositioner most likely to be encountered.

CAUTION

Troubleshooting should be performed only by trained technicians.

6.1. Slipping

If the unit slips at a lower torque than expected, consider the following guidance.

1. Check the maximum acceleration. Very high maximum acceleration has a small effect on the torque felt by the unit, and some effect on the torque capacity of the motor.
2. Check the maximum velocity. The unit should be able to provide 10 ft lbf at 24 deg/s. It may provide slightly more than this at lower speeds.
3. Check the load calculations. Aside from the weight, ensure that acceleration, and drag from water current, vehicle motion, and load rotation have been taken into account. These must be directly added to the torque from the mass of the load.

6.2. Unit Does Not Respond to Commands

If the unit does not respond to serial commands, consider the following guidance.

1. If the unit does not draw current, contact Remote Ocean Systems for guidance.
2. If the unit does not operate but draws approximately 0.5 A, use the Eos GUI to aid in the following steps
 - a. Verify the unit is installed and connected properly (Section 3.1), with the RS485 connection connected to the USB port of a computer with Eos available.
 - b. Turn the power to the unit off and on again.
 - c. Open the Eos GUI and check whether the unit is detected.
 - d. If the unit is detected, attempt to move the unit with the GUI. If the unit moves as-expected, the problem lies in the user software or firmware.
 - e. If the unit does not operate as expected through the GUI, open the log window. The log window will list attempts to communicate on all available com ports. Inspect the list for the com port / address that the unit should be on. The log should show whether the unit sent a partial response, no response at all, or an incorrect response. The log window may also indicate that the unit responded from a different address than expected.
 - f. The GUI also provides a diagnostic window which gives the ability to send formatted commands on a selected com port and address. Compare any responses received to the expected responses listed in Table 4.
 - g. If the unit still does not communicate, contact Remote Ocean Systems.

7. Parts List

Table 6 contains a list of parts available for use with the AccuPositioner. Figure 7 is an exploded view.

Table 6. Parts List

Item	Qty	Part No.	Description
20	1	21-30307-01	BRKT YOKE P15 AL
30	1	21-30330-01	BRKT RING YOKE W/INSERT P15 DL
40	1	21-30360-01	RING STOP MNTG P15 ACETAL
50	1	21-30361-01	BASE MNTG P15 DL
70	10	62-20133-4	SCREW SHHX 0.25-20X0.5 IN 316SS
80	1	62-20214-4	PIN DOWEL 0.25 IN DIA X 0.5 IN LG 316SS
90		60-02043-4	VIBRA-TITE THREAD LOCKING COMPOUND

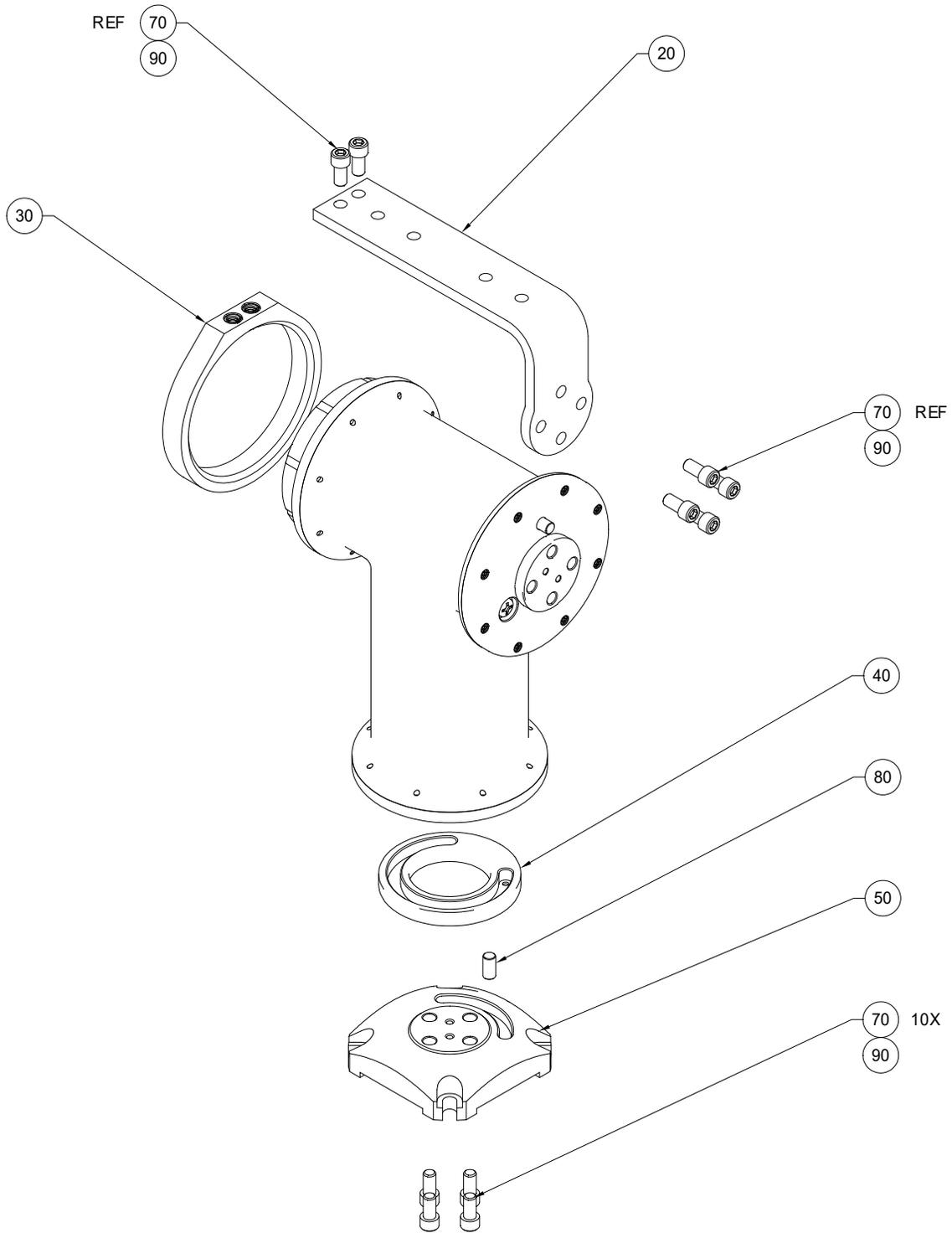


Figure 7. Exploded View