

### AUTONAUT WAVE PROPELLED UNMANNED SURFACE VESSEL (USV)

### **RUDDER CALIBRATION PROCEDURE**

### 5M AutoNaut – Spektrum V2 Rudder System



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### 1 INTRODUCTION

This document is provided to enable operators to change rudder parameters and re calibrate the steering system after maintenance.

The AutoNaut uses a high torque servo system that has been modified specifically for the AutoNaut and is controlled by an independent motor controller.

The motor controller is a COTS item from RoboteQ and can be sourced from a number of locations. Additionally, the technical manual for the controller can be downloade4d directly from the manufacturers web site.

The Controller is a RoboteQ SDC2130. This unit can be used for 2 channel operation, however in AutoNaut only the first channel is used.

The motor controller used the position of the potentiometer within the rudder servo to determine the zero position in software, however due to the mechanical coupling on the rudder it is possible to install the rudder at a different angle. To remedy this the rudder motor controller needs to be re calibrated.

#### **1.1 Preparation**

For this activity the boat will need to be fully assembled and powered. You will also need the micro USB cable supplied in the build up box and a laptop / PC with the RoboRun software installed.

AutoNaut supply a default settings profile for the controller should you require a basic setup to be installed.

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### 2 Connecting to the Motor Controller

The motor controller is housed inside the PDE enclosure, you will need physical access to this enclosure with the boat assembled and powered in order to complete the calibration. Follow the steps below in sequence in order to re calibrate either the rudder feedback or the steering input to the controller:-

- 1. With the boat assembled and powered Disconnect cable into PDE05. This removes the motor power from the servo but maintains position feedback allowing you to manually articulate the rudder over its operating range.
- 2. Carefully open the PDE enclosure and identify the motor controller as shown in the Figure below
- 3. Attach the USB cable to the motor controller as shown and plug the other end into a laptop or PC with the RoboRun Software installed and open.



4. When the software detects the controller is will automatically request download of the settings from the controller, accept this request.

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5. Click on the "Configuration" tab.

Roborun+										-		×
Dehe	1-0	Motor Cont	rol Utility		١	/iew Pinout		]	Work O	fline	Eme	rgency
τορο	<b>Te</b>	Rev 1.8. 7/31/17		Script:	Run	Pause	Restart	Controller Model:	SDC2130	~	ST	OP)
Configuration	Run	Console		Scripting				COM FOIL.	Auto	Ŷ	ES	C key
Inputs/Outputs			Power Output									
▷ ♥ Start-up ▷ ♥ Commands			⊳ 🖋 General	Dutput					Load f	rom Control	er	
▷ (a) Spektrum RC ▷ 3 CAN			⊳ Motor Cor ⊳ a)≜ Amps	nfiguration Limits					Save	to Controlle	r	
▷ j <sup>*</sup> Encoders▷ <sup>**</sup> Digital Inputs			⊳ 🥳 Power ⊳ 🍻 Speed	r Adjust 1 & Acceler	ation				Load P	rofile from D	lisk	
▷ ♀ Analog Inputs ▷ ₽ Pulse Inputs			Operating ⊳ 😭 Close	Mode: <u>Clo</u> d Loop Par	osed Loop ameters	Position R	<u>elative</u>		Save	Profile to Di	sk	
Digital Outputs			⊳ ₀i Motor2 C	Output					Rese	t Defaults		
									Add / I	Remove Lo	ck	

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### **3** Recalibrating The Rudder

- 1. Select "Analogue Inputs".
- 2. Select "AIn5", this is the position feedback channel and will expand a drop menu.



3. Select "Range", this should expand the Range drop menu.

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#### **Commercial in Confidence**

# AutoNaut



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4. Select "Calibrate", the calibration page should open.

		Motor Contro			١	/iew Pinout			Work Offline	
KODO.	<b>IeU</b>	Rev 1.8. 7/31/17	" Ouncy	Script:	Run	Pause	Restart	Controller Model:	SDC2130 V	ST
Configuration	Run	Console		Scripting				COM FOIL	Auto	ESC
Inputs/Outputs		F	Power Output							
▷ ① Start-up			⊳ 🖋 General						Load from Controller	
▷ J Commands ▷ P Spektrum RC	Range Editor - Aln	5	J Motor1 O	utout				×	Save to Controller	
<ul> <li>▷ S CAN</li> <li>▷ CAN</li> <li>▷ CAN</li> <li>▷ Original Inputs</li> <li>△ Analog Inputs</li> </ul>	AIn5 Input: 3 62 Minimum:								Load Profile from Disk Save Profile to Disk	
<ul> <li>▷ → Ain1.</li> <li>▷ ☆ Ain2:</li> <li>▷ ☆ Ain3:</li> <li>▷ ☆ Ain4:</li> <li>☆ Ain5:</li> </ul>	44 Center: 62 Maximum: 1253 5							1	Reset Defaults	
Conversion Type: Input Use: <u>Feedbar</u> Range: <u>Calibrat</u> Input Min (mV):	Start	Reset Auto Cente	er			Dor	ie	Cancel	Add / Remove Lock	
Input Center (m) Input Max (mV); Conversion Polariti Input Deadband (% Action on Min: No. Action on Max: No.	/): <u>2220</u> <u>3296</u> y: <u>Direct</u> ): <u>1</u> <u>Action (1)</u> <u>Action (1)</u>									
Pulse Inputs										

5. Select "Start", Then manually exercise the rudder through its range of 45 degrees to starboard and 45 degrees to port. The min and max limiters should move to the minimum and maximum points achieved.

nge Editor - Aln5		
Aln5		
Input: 3		
Minimum:		
44		
62		
Maximum:		
1253		
Start Reset Auto Center	Done Ca	ancel

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6. Center the rudder to amidships and select "Done". This has updated the calibration setting s in the software but not downloaded them to the controller yet. You should see a small red star next to each setting that has changed.

(w) a straight and a			
Spektrum RC		Motor Configuration	Save to Controller
D 🐨 CAN		⊳ @Amps Limits	
⊳ 🔆 Encoders		⊳ 🦓 Power Adjust	
Digital Inputs		▷ jjú Speed & Acceleration	Load Profile from Disk
🖌 🍄 Analog Inputs		Operating Mode: Closed Loop Position Relative	Course Desfile to Disk
⊳ 🍄 Aln1:		Closed Loop Parameters	Save Profile to Disk
⊳ 🍄 Aln2:		⊳ ⊲i Motor2 Output	
⊳ 🗳 Aln3:			Reset Defaults
⊳ 🗳 Aln4:			
Aln5:			
Conversion Type: Relative V	=		
Input Use: Feedback (1)			
🖌 🛬 Range: Calibrate			
* Input Min (nV): 1400			Add / Remove Lock
Input Center (mV): 2200			
<ul> <li>Input Max (mV): 3300</li> </ul>			

7. Select "Save to Controller". This will save the settings to the controller and the red stars should disappear from the configuration page.

You can now plug PDE05 back in and exercise the rudder. It is wise to save a copy of the configuration file for reference later.

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### 4 Calibrating the Rudder Demand

1. Select "Pulse Inputs".



- 2. Select "Pin1", this is the PWM input channel and will expand a drop menu.
- 3. Select "Range", this should expand the Range drop menu.



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4. Select "Calibrate", the calibration page should open.

Range Editor - Aln5		×
P III.		
62		
Minimum:		
44		
Center:		
62		
Maximum:		
1253		
Grad Bread D Ada Cardan	Darra	Canad
Start Reset Auto Center	Done	Cancel

5. Select "Start", Then using the controller demand maximum left and right rudder. The min and max limiters should move to the minimum and maximum points achieved.

Range Editor - Aln5		×
Pin1  Input: 3  62  Minimum:  44  Center:  62  Maximum:  1365		
Start Reset Auto Center	Done Canc	el

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- 6. Return the demand to zero(rudder amidships) and select "Done". Again, this will have updated the calibration settings in the software but not downloaded them to the controller yet. You should see a small red star next to each setting that has changed.
- 7. Select "Save to Controller". This will save the settings to the controller and the red stars should disappear from the configuration page.

You can now plug PDE05 back in and exercise the rudder. It is wise to save a copy of the configuration file for reference later.

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### **5** General Controller Settings

The RoboRun software allows the user to change a number of other settings for the rudder motor and it is possible to tune the closed loop characteristics.

Extreme caution should be taken if attempting to change other settings as it is possible to permanently damage the steering system. The current limits and closed loop parameters have been carefully selected in order to promote smooth running and provide the maximum life for the system.

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