TECHNICAL / INSTALLATION MANUAL

PN 11355-xx
Smart Actuator 4 (Ver 4.1)

PN 11355-12UC-33E

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1.0 Product Overview

The Smart Actuator 4 (SA4) is a single function mechanical actuator, which can receive different types of electrical / electronic commands and control a mechanical device.

For input, the SA4 can receive an analog command, switched input command, or CAN digital communication

For output, the SA4 can move a mechanical cable (typically, Type 33C) over a 3 inch stroke. It can also control an external switch output

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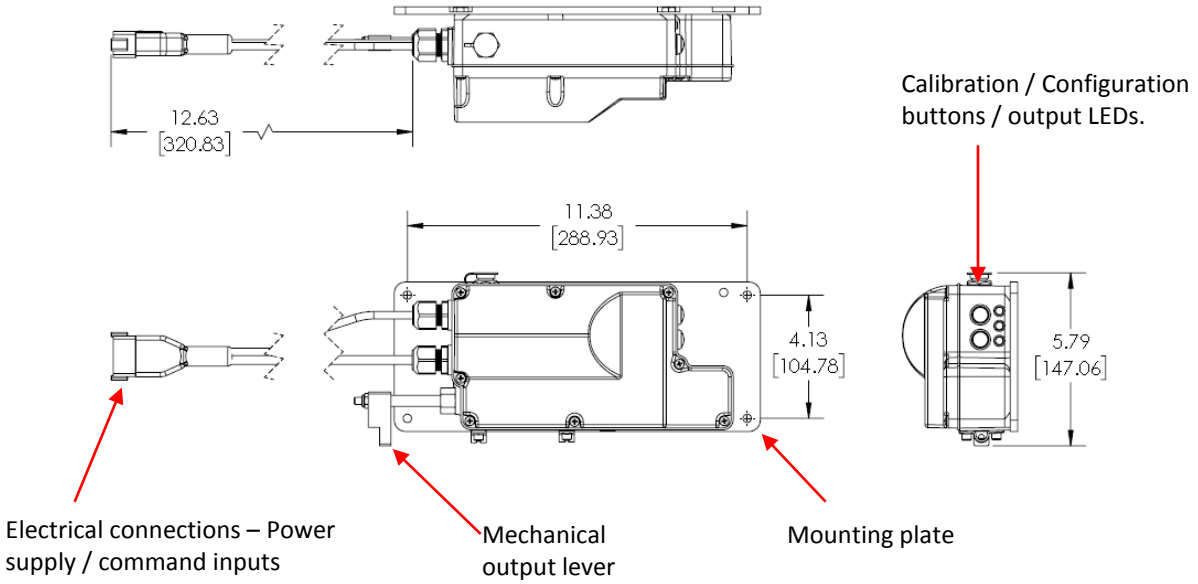
2.0 Product Description

The Smart Actuator 4 (SA4) is a single function mechanical actuator, which can receive different types of electrical / electronic commands and control a mechanical device.



SPECIFICATIONS

Operating voltage:	10 – 36 VDC
Control Input:	CANbus / Analog / Switch control
Mechanical output:	40 kg
Mechanical output speed:	60mm/ sec (can be reduced)
Size:	Length / Width / Height: 233mm (9.2 inch) / 124mm (4.87 inch) / 90mm (3.5 inch)
Ingress Protection	IP67
Other	Complies with CE requirements 2 x switch outputs (for trim pump or electric shift.

PART NUMBER DESCRIPTIONS

11355-12UC-33E	Smart Actuator (V4.1) – with CAN input control / switch output control Types of Applications: Sterndrive (with trim control), Mechanical throttle (with electric shift control), Waterjet bucket (with electric shift)
11355-12UA-33E	Smart Actuator (V4.1) – with analog control Types of Applications: Waterjet bucket

2.0 Product Description (continued)

Buttons and LEDs – used for Actuator Configuration and Calibration

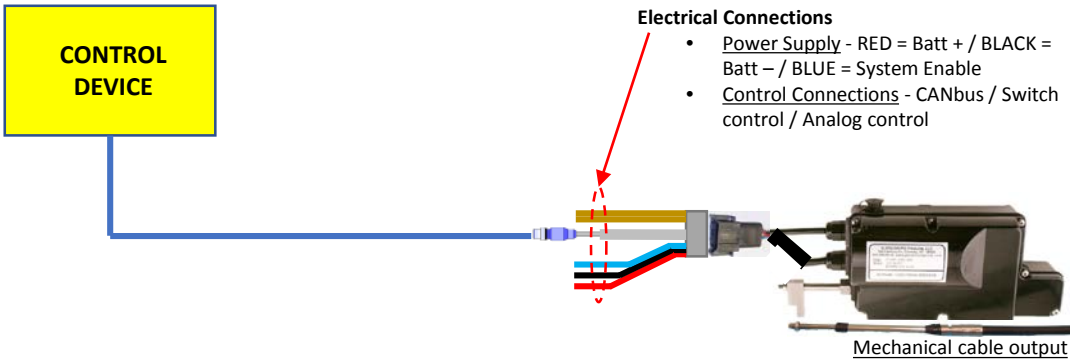
3.0 Product Operation

The operation of the Smart Actuator 4 (SA4) is very simple

- Provide a command via one of the available inputs methods (CANbus, switch input, or analog voltage)
- The actuator will move the mechanical output to the commanded position. NOTE: The actuator can also output electrical signals in response to CANbus commands.

The SA4 configuration is set to the correct input method using the Configuration Procedure – see Appendix A-1. In addition, the harness which connects theSA4

A typical Smart Actuator 4 installation is shown here:

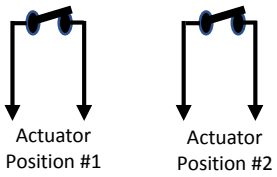


3.0 Product Operation (continued)

The following are examples of control devices which can be used with the Smart Actuator

Control Panel with knob (analog control)

Control lever (CAN control)



Switch control

4.0 Product Installation

Installation of the Smart Actuator 4 consists of the following:

1) Mount the Actuator
   - in a suitable location where the Actuator is not exposed to conditions greater than the following:
     - Temperature –maximum external air temperature is 75 deg C (167 deg F)
     - Water Exposure – not in a location where the Actuator will be submerged or subject to direct water sprays
     - Vibration – the Actuator should NOT be mounted on an engine or to any device which has continuous vibration
   - The Actuator may be able to operate in conditions which are outside the above environmental conditions. Contact the Glendinning Engineering staff for details.

2) Provide Battery Power to the electrical connection harness
   - The actuator is suitable for either 12 or 24 VDC nominal voltage inputs
   - The preferred power supply for the Actuator is a battery.
   - If using a power supply, connect the Actuator to a power source which has sufficient ampacity to supply momentary peak currents of over 40 amps
   - The power supply wiring should be protected at the power source with an appropriate fuse or circuit breaker
     - 12 VDC input = 20 amps / 24 VDC input = 15 amps.

3) Provide an “enable” signal to the electrical connection harness
   - In order to operate, the Actuator must be “enabled”. Connect the “system enable” (blue wire) to a battery voltage input.
   - It is possible to connect the “system enable” wire (blue wire) to the same connection point as the Red wire (Batt +) and then activate / deactivate the actuator function with a power supply circuit breaker. However the preferred installation is to provide the power through an “unswitched” / circuit protected connection and control the actuator function with the Blue “system enable” wire

4.0 Product Installation (continued)

4) Provide a command input to the electrical connection harness
   - Connect the CANBus or digital switch input / output wires as required by the installation

5) Mechanical output cable connection
   - Connect the mechanical push pull cable to the mechanical output.

6) Actuator Calibration – VERY IMPORTANT!!!
   - The calibration endpoints for the actuator function must be adjusted / configured before the actuator is operated. See Appendix B of the Manual for this procedure

5.0 Product Maintenance

There are no regular / periodic maintenance requirements. However, for reliable operation, the following should be periodically checked to ensure that the Smart Actuator 4 is in good working order

1) The actuator should be observed while the mechanical output is moved from one travel end point to the other.
   - The output rod should be observed for any sign of corrosion. If there is corrosion, this should be corrected.
   - The endpoints should be confirmed that they are correct. For example, with a mechanical shift application, it should be confirmed that the actuator is moving to the correct mechanical end point locations for Forward / Neutral / Reverse gears. This is critical to do on a regular basis. Failure to do this may cause transmission failure.

2) All the electrical connections should be checked for signs of corrosion.

Appendix A-1 – Actuator Configuration Procedure

Smart Actuator 4 can be configured for control by different inputs – analog, switch or CAN. The specific configuration is set by following the attached procedure:

Step	Action (Do the following)	Result (Confirm that the actuator responds as described in this column)
1	Supply power and an enable signal to the actuator	The Power LED should be on.
2	Press / release the RED button, then the BLACK button, then the RED button. These 3 button presses must be completed with in 5 seconds	LED 1 and LED 2 will blink slowly to indicate that the system is in Configuration Mode
3	Press / release the RED button the number of times to access the desired configuration menu: Menu 1 = Actuator configuration	LED 1 will blink the to indicate the menu which will be selected after the BLACK button is pressed in Step 4. Example = 1 blink will indicate that Menu 1 has been chosen / 2 blinks indicate Menu 2 / etc.
4	Press / release the BLACK button 1 time to select the menu chosen in Step 3	LED 1 will blink to indicate the menu selected / LED 2 will be blink to indicate the option which has been selected for this menu
5	Press / release the RED button the number of times to access the desired option for the selected menu. The options for each configuration menu choices are indicated in Appendix A-2	LED 1 will blink to indicate the menu selected / LED 2 will be blink to indicate the option which has been selected for this menu
6	Press / release the BLACK button to confirm / save the option selecte(Note 1)d in Step 5	LED 1 and LED 2 will blink slowly to indicate that the system is in Configuration Mode

NOTES

1) Modification of the Actuator configuration may not be required during installation. Where the application is known at the time of product manufacture, the Actuator will be pre-configured for the correct application.

Appendix A-2 – Actuator Configuration Options

Smart Actuator 4 can be configured for control by different inputs – analog, switch or CAN. The specific configuration is set by using the Configuration Procedure – Appendix A-1

Config Option	Type / Description	Endpoints (Note 1)	Default Home Position (Note 2)	Command out of range
1	Analog voltage (0 – 5 VDC – ratiometric voltage relative to reference voltage)	0,5 VDC = 0% / 4.5 VDC = 100% Endpoint locations are configured via Calibration Mode	0% calibrated value	Control signal less than 0,25 VDC or greater than 4.75 VDC
2	Switch inputs (“digital”)-	• Switch 1 (S1) = 0% • Switch 2 (S2) = 100% • If no switch is closed then actuator moves to 50% of full stroke. • Endpoint locations are configured via Calibration Mode	50% of full stroke	If both S1 and S2 are closed simultaneously
3	Proprietary Position Protocol CAN input PGN 0xFF00/ 0xFF01 sets mechanical output PGN 0xFF08 (trim) – electric output	Defined in CAN details		Valid CAN message not received within ____sec
4	“Throttle control” CAN input PGN 0xFF03 (EEC2) sets mechanical output	• Throttle command is 0 to 250 (0 – 100%) – Described in CAN details • Endpoint locations are configured via Calibration Mode	0% calibrated value	Valid CAN message not received within ____sec
5	“Sterndrive control” CAN input PGN 0xF005 (ETC2) – mechanical output PGN 0xFF08 (trim) – electric output	• Shift command defines 3 specific locations (F / N / R) - Defined in CAN details – • Endpoint locations are configured via Calibration Mode	50% of full stroke	Valid CAN message not received within ____sec
6	“Waterjet control” CAN input PGN 0xFF00 / 0xFF01– mechanical output PGN 0xF005 (ETC2) – electric shift output	• Bucket command is 0 to 250 (0 – 100%) – Described in CAN details • Endpoint locations are configured via Calibration Mode	35% of calibrated value	Valid CAN message not received within ____sec
7	“Steering control” CAN input PGN 0xFF10 - mechanical output	• Steering command is 0 to 250 (0 – 100%) – Described in CAN details • Endpoint locations are configured via Calibration Mode	50% of full stroke	Valid CAN message not received within ____sec
8	Transmission Shift Control PGN TC1 / SPN 525	Defined in CAN details – Shift positions are configured via CAN		
9	Engine Speed Control PGN 0x0000 (TSC1) / SPN 898			
10	“Shift Control” – with start interlock PGN “ETC2”	• Shift command defines 3 specific locations (F / N / R) - Defined in CAN details – • Endpoint locations are configured via Calibration Mode	50% of full stroke	
11	“Waterjet bucket” / “CPP Pitch” PGN _____	• Pitch / reverse buket command is 0 to 250 (0 – 100%) – Described in CAN details • Endpoint locations can be configured using graphic display tool	“Center position” defined by programmed value using display tool	

NOTES

1) “Endpoints” refer to the mechanical output shaft position. The exact mechanical output shaft position when fully extended or retracted set using the Endpoint Calibration procedure (Appendix B)
   - 0% position = shaft is fully retracted
   - 100% position = shaft is fully extended.
2) “Home position” is the position that the actuator mechanical output shaft will move to when the command output is removed.

Appendix B – Actuator Endpoint Calibration Procedure

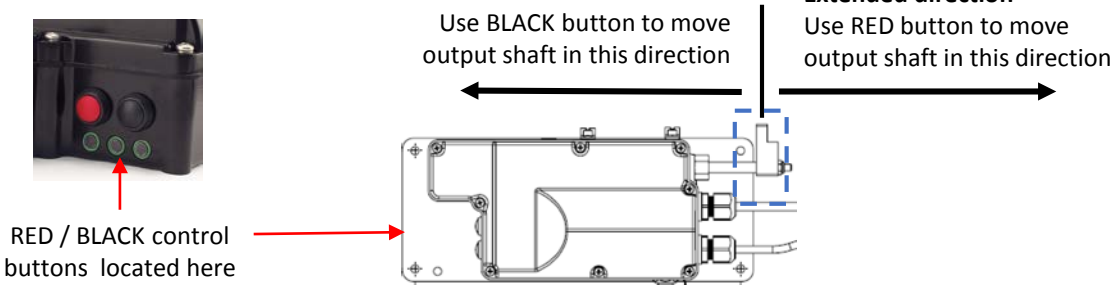
Before the Smart Actuator 4 is put into service, the Actuator must be calibrated so that correct travel "endpoints" of the mechanical output are adjusted. The following page describes the procedure to set the actuator endpoints

Please note the following regarding these endpoints:

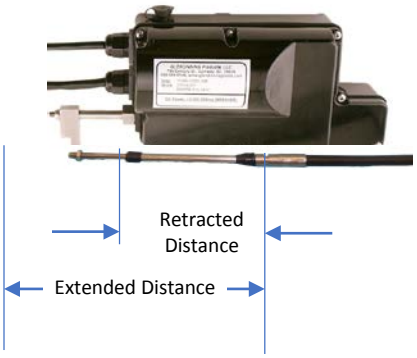
- **<u>The endpoints must be set in a specific order – Endpoint 1 / Endpoint 2.</u>** These endpoints will depend on the function / configuration of the actuator.

Actuator Function (Actuator Configuration)	Endpoint 1 (0% command)	Endpoint 2 (100% command)
Throttle control (Menu 1 / option 4)	Minimum speed position (Idle)	Maximum speed position (WOT)
Shift control (Menu 1 / Option 5)	Forward shift	Reverse Shift
Waterjet reverse bucket (Menu 1/ Option 11)	Bucket up (Ahead thrust)	Bucket down (Reverse thrust)

- "Retracted" vs. "Extended" direction



- For waterjet applications, use the following procedure to set the endpoints



1) Route the mechanical cables from the Actuator to the Reverse Bucket control lever – mount the cables in the cable clamps at each end. Attach the cables to the waterjet control lever. DO NOT connect the mechanical cable to the Actuator until endpoints have been set AND verified

2) Manually operate the bucket from the full down to full up position and measure and record the cable positions on the actuator at each endpoint (Retracted distance / extended distance)

3) Use the distances recorded in Step 2) and the Endpoint Calibration procedure to set the actuator endpoints

4) After the actuator endpoints have been set, operate the Actuator electronically and operate the bucket manually. **DO NOT connect the mechanical cable to the Actuator** Compare the actuator position with the cable positions at each endpoint and verify that they match

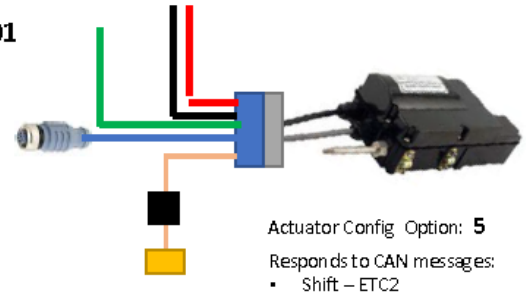
5) If the endpoints have been validated after completing Step 5, then connect the mechanical cable to the Actuator.

Appendix B – Actuator Endpoint Calibration Procedure (cont'd)

Step	Action (Do the following)	Result (Confirm that the actuator responds as described in this column)
1	Attach the mechanical push-pull cable to the actuator. Connect the cable at the device which will be controlled (engine throttle, transmission shift control lever, etc). DO NOT connect the cable to the output rod of the actuator	The mechanical cable will be mounted and connected to the actuator and engine / transmission
2	Supply power and an enable signal to the actuator	The Power LED should be on.
3	Press / release the RED and BLACK buttons together / simultaneously 3 times. These 3 button presses must be completed with in 5 seconds	The mechanical output shaft will move to the fully retracted position. LED 1 / LED2 will be OFF
4	Press / hold the RED or BLACK button so that the mechanical output shaft moves to the "Endpoint 1" position. Press / release the BLACK or RED buttons to move the mechanical output shaft in small increments.	Actuator output shaft will be in a position which matches push-pull cable position associated with Endpoint 1.
5	Press / release the RED and BLACK buttons together / simultaneously 1 time in order to store the Endpoint 1 position	LED 1 will be on to indicate that the Endpoint 1 position has been saved in actuator memory
6	Press / hold the RED button so that the actuator output shaft moves to the Endpoint 2 position. Press / release the BLACK or RED buttons to move the mechanical output shaft in small increments	Actuator output shaft will be in a position which matches push-pull cable position associated with Endpoint 2.
7	Press / release the RED and BLACK buttons together / simultaneously 1 time in order to store the Endpoint 2 position	LED 2 will be on to indicate that the Endpoint 1 position has been saved in actuator memory
8	OPTIONAL (this step can be skipped) – Endpoint position validation. • Press / release both buttons to enter the endpoint validation procedure • Press / hold the Black button – the output shaft will move to the Endpoint 1 position • Press / hold the Red button – the output shaft will move to the Endpoint 2 position	• LEDs will flash quickly while in this step • When the Red or Black button is pressed and held, the mechanical output shaft will move to the associated position – confirm that the mechanical output shaft endpoints match the push-pull cable endpoints
9	Cycle power to the actuator (power off / power on) in order to exit Calibration Mode	Power LED will turn off and then back on.

SA4 wiring interface harness summary

PN 11610-SA4-001



Actuator Config Option: **5**

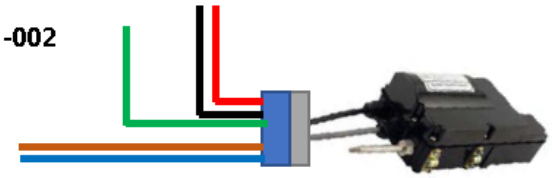
Responds to CAN messages:
- Shift – ETC2
- Trim OxFFC8

"Sterndrive control" – provides control of sterndrive shift and trim control via CAN signal

Connection details:
- DC Power – supplied via ___ amp circuit protection
- System enable wire
- CAN connection – including DC power supplied **TO** CAN network
- Trim output – **Digital OUTPUT** 1 / 2 with relay – responds to CAN message for trim control

Default / home position = 50% of max travel position

PN 11610-SA4-002



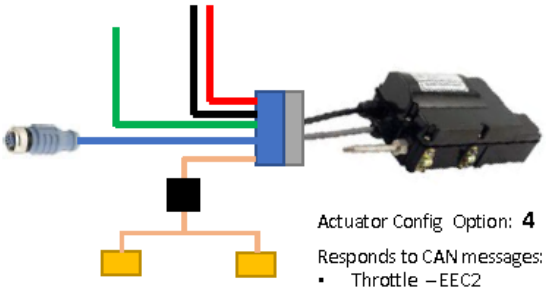
Actuator Config Option: **2**

"Mechanical shift control " – takes output from EEC3 / EEC4 to control mechanical shift.

Connection details:
- DC Power – supplied via ___ amp circuit protection
- System enable wire
- Switch input for shift control - **Digital INPUT 1 / 2 -** provides input to actuator (battery high signal) to control actuator to shift position.

Default / home position = 50% of max travel position

PN 11610-SA4-003



Actuator Config Option: **4**

Responds to CAN messages:
- Throttle – EEC2
- Shift –ETC2

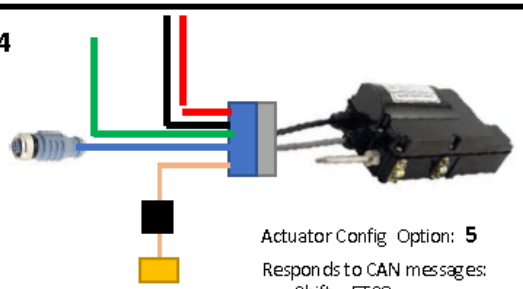
"Mechanical throttle / electric shift" provides control of mechanical throttle and electric shift via CAN commands

Connection details:
- DC Power – supplied via ___ amp circuit protection
- System enable wire
- CAN connection – including DC power supplied **TO** CAN network
- Shift output – **Digital OUTPUT** 1 / 2 with relay box –
- Start interlock – controlled by shift output relay position

Default / home position = "Idle" position

SA4 wiring interface harness summary

PN 11610-SA4-004



Actuator Config Option: **5**

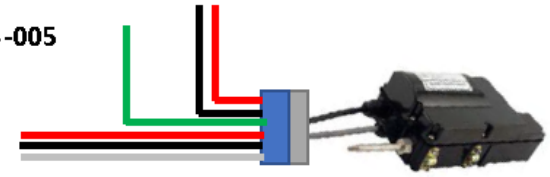
Responds to CAN messages:
- Shift – ETC2

"Mechanical shift" – provides control of mechanical shift via CAN signal

Connection details:
- DC Power – supplied via ___ amp circuit protection
- System enable wire
- CAN connection – including DC power supplied **TO** CAN network
- Start Interlock output – **Digital OUTPUT** 1 / 2 with relay – controlled by relay based on shift position

Default / home position = 50% of max travel position

PN 11610-SA4-005



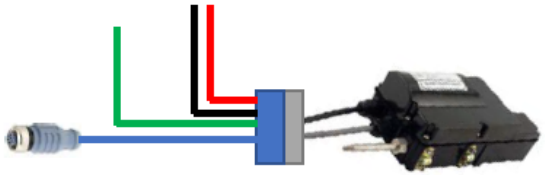
Actuator Config Option: **1**

"Analog Potentiometer" – responds to rationmetric command from potentiometer

Connection details:
- DC Power – supplied via ___ amp circuit protection
- System enable wire
- Analog control input (Vref / Ground / Signal)

Default / home position = Minimum analog position

PN 11610-SA4-006



Actuator Config Option: 10??? (depends on function)

Responds to CAN messages:
- Throttle – EEC2
- Pitch =
- Bucket =

"Mechanical throttle / mechanical pitch / mechanical bucket" control electric shift" – takes input from CANbus command and outputs a mechanical position.

Connection details:
- DC Power – supplied via ___ amp circuit protection
- System enable wire
- CAN connection – including DC power supplied **TO** CAN network

Default / home position = Depends on configuration