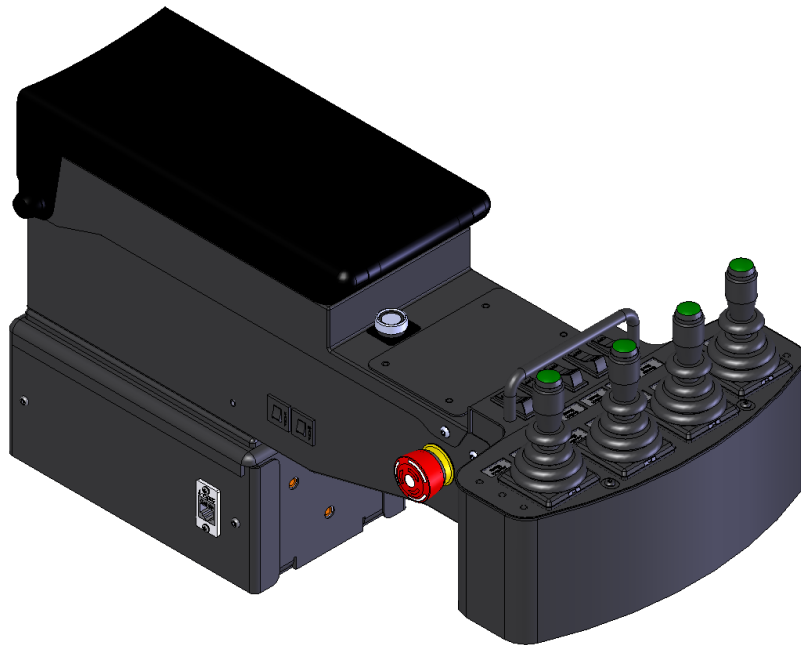


9-Axis Proportional Joystick Control System with CAN Bus

Operation Manual



Firmware Version
2.1

FORCE[®]
America INC.


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Hardware & System Operation

Force America Spreader Compatibility

The FORCE America 9-Axis System may be integrated with any of the FORCE America spreader controls in the following table, with the spreader control's operator interface installed in the arm between the joysticks and the arm rest. For simplicity, all images in this manual will display the MPJC-BLANK-4-ULTRA arm with no spreader control installed.

Spreader Control	Operator Interface
5100ex	 The image shows a black, rectangular operator interface for the 5100ex spreader control. It features three main controls: a green push-button labeled 'SPREADER' with 'PUSH' above it, a blue push-button labeled 'SPINNER' with 'BLAST' above it, and a silver rotary knob labeled 'PRESET' below it. The 'FORCE America' logo is visible in the bottom left corner, and '5100ex' is printed in the top right corner of the panel.

The FORCE America 9-Axis System is operated with the following components:

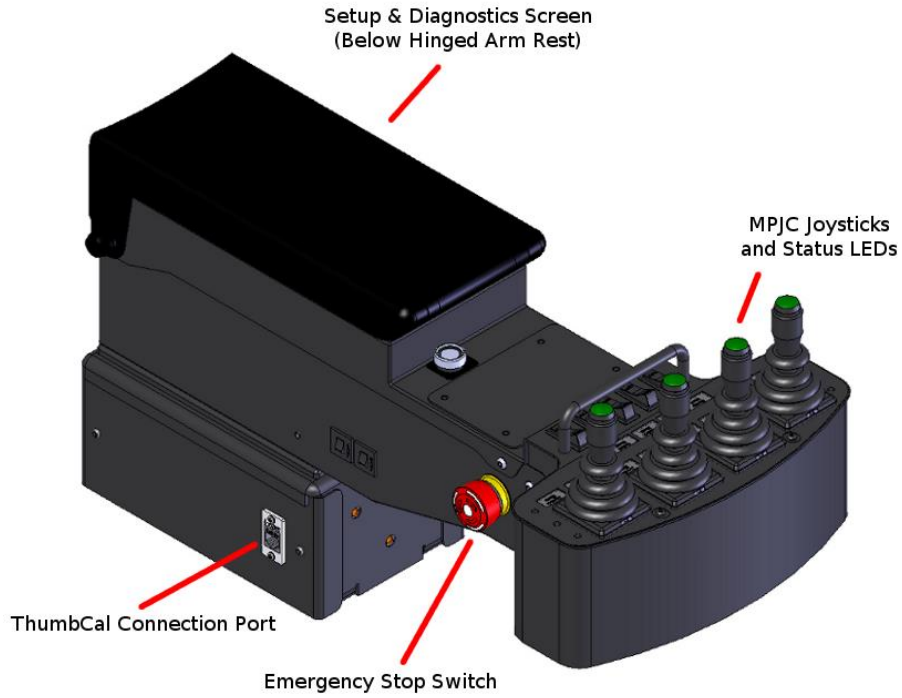


Figure 1: 9-Axis System Operation Hardware

Setup & Diagnostics Screen

The Setup & Diagnostics Screen displays the status of all active outputs as well as detailed error messages.

On a standard fit vehicle, the Setup & Diagnostics screen is located underneath the hinged arm rest.

Setup & Diagnostics Screen
on standard fit systems

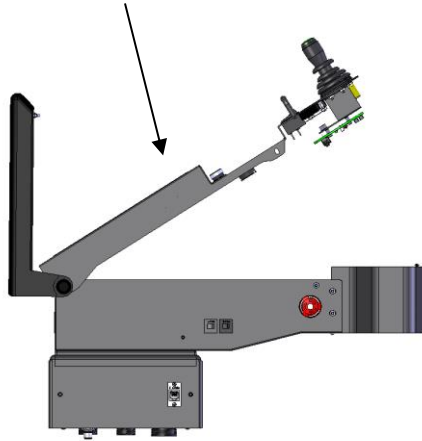


Figure 2: Standard Fit 9-Axis System

On a retrofitted vehicle, the Setup & Diagnostics screen is located on the circuit board either inside the arm assembly or at the front of the switch base.

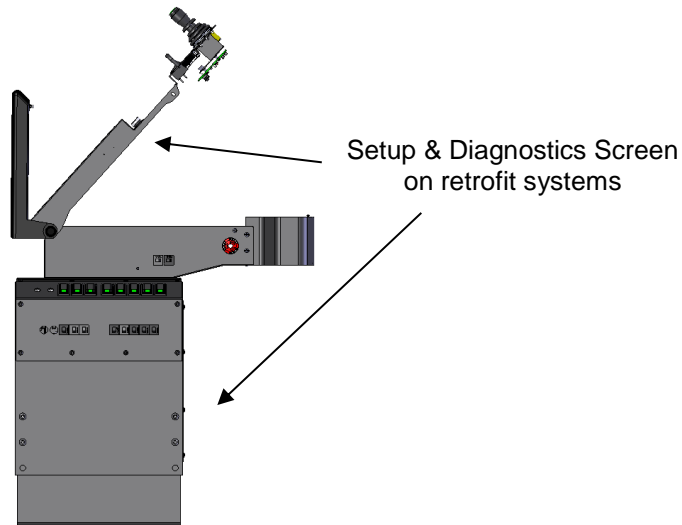


Figure 3: Retrofit 9-Axis System

If no outputs are active and no errors are occurring, the Setup & Diagnostics screen will display “System Ready” on the screen.

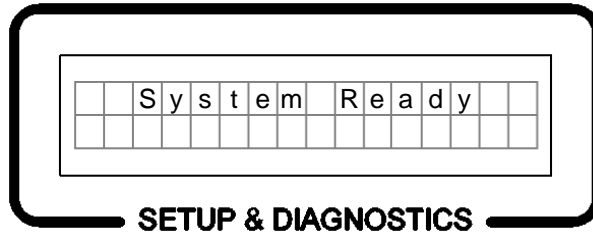


Figure 4: System Ready

If a joystick output is active, the Setup & Diagnostics screen will display its output percentage on the top line of the screen. For example, if the JS1F output is active at 45%, the screen will display Figure 5.

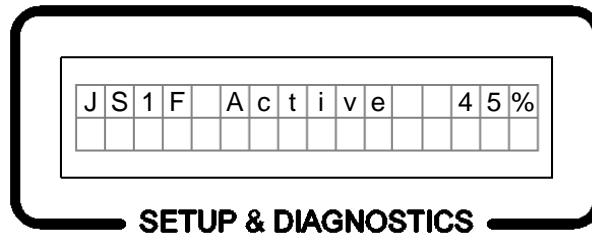


Figure 5: Joystick 1 Forward Active at 45%

Joysticks and Status LEDs

The FORCE America 9-Axis System supports up to 4 dual-axis and 1 single-axis proportional joysticks and up to 5 joystick pushbuttons. The joysticks and their pushbuttons must be configured in Calibration with a 94069A001 ThumbCal device in order to be functional.

Each joystick will run its output proportionally between the Min and Max settings configured in the Calibration Menu. For example, if Joystick 1 has its Min set at 35% and its Max set at 75%, and the joystick is moved halfway forward, the JS1F output will run at 55%.

Status LEDs

Each joystick has a set of LEDs under the corresponding joystick decal which display the status of the joystick and its corresponding valve outputs.

LED Color and Activity	Description
Amber, Solid	The joystick is inactive. If it is moved off-center, the output will not function.
Amber, off for $\frac{1}{10}$ of a second	The joystick is interlocked but the output (single-acting float) or its float output (dual-acting float) is floating.
Green, Solid	The joystick is active but the output is not functioning. If the joystick is moved off-center, the output will function.
Green, Blinking Steadily	The joystick is active and the output is functioning. The lights will blink faster as the output is run at a higher rate.
Green, off for $\frac{1}{10}$ of a second	The joystick output (single-acting float) or its float output (dual-acting float) is floating.
Red, Solid Red, Blinking Steadily	An error has occurred. See Error Conditions & Troubleshooting on page 7 for beep codes.

Joystick Pushbuttons

Joystick pushbuttons can run outputs or activate a joystick interlock. A pushbutton assigned to an output will run its output as long as the button is held down.

A pushbutton assigned to an interlock will activate a joystick until the joystick has been in the center position for a variable number of seconds. By default, releasing an interlock pushbutton deactivates the proportional outputs immediately, but adding a delay to the interlock time is an option in the Calibration Menu.

Floats

A float maintains a function so that the hydraulic implement can adjust to the contours of the road. The float option is most often used on plows and scrapers but can be used on other functions if so desired.

If the float is switch-enabled, the function will not float until the corresponding switch is set to the "On" position. Turning the switch to the "Off" position will disable the float if it is active.

To activate a float:

Move the joystick to at least 90% of its movement in the direction associated with the float. If it is a delayed float, it must be held above 90% for at least 3 seconds.

To deactivate a float:

Move the joystick to at least 10% of its movement in the direction opposite of the one used to activate the float.

Emergency Stop Switch

The Emergency Stop (ESTOP) Switch immediately shuts off all outputs, whether pushbutton, joystick, or float. Press the switch to activate ESTOP, and twist the switch clockwise to deactivate ESTOP.

When the Emergency Stop Switch is activated, the Setup & Diagnostics screen will display "ESTOP".

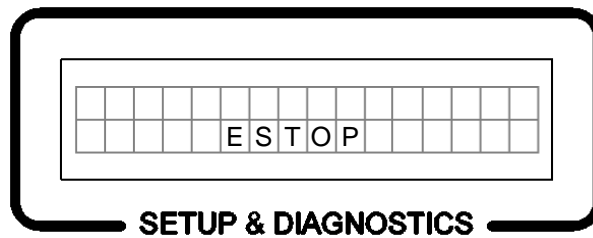


Figure 6: ESTOP Warning

Error Conditions & Troubleshooting

If an error occurs, the Setup & Diagnostics screen will display it on the bottom line of the LCD screen. For example, if a Joystick 2 Stuck Pushbutton Error occurs, the screen will display Figure 7.

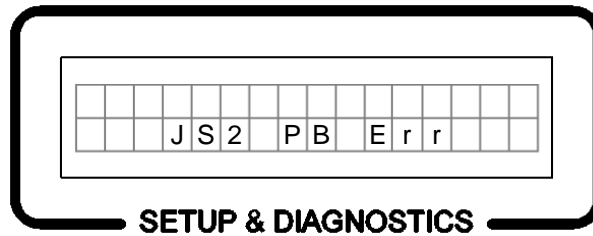


Figure 7: Joystick 2 Pushbutton Error

Each error condition will blink the joystick status lights and sound the buzzer with a beep code. A “long” beep is a tone that lasts for 2 seconds, followed by 2 seconds of silence. A short beep is a tone that lasts for ½ second, followed by ½ second of silence.

If an error occurs during system operation, use the table on the following page to determine the cause and solution.

Number of Beeps	Possible Cause	Solution
Solid	CAN Communication between the driver board and transmitter board has been lost. CAN Communication between the driver board master processor and the slave processor has been lost.	Verify the integrity of the CAN cable connecting the 94065A001 driver board to the 94066A001 transmitter board. Verify the integrity of the 94065A001 driver board.
1 Long	The Emergency STOP (ESTOP) switch has been activated.	Twist the ESTOP switch to deactivate the Emergency Stop.
1 Short	The 9-Axis system is receiving too much voltage. The 9-Axis system is receiving too little voltage.	Verify the vehicle's charging system. Verify the vehicle's battery voltage and wiring to the 9-Axis System.
3 Short	The 9-Axis system has corrupted calibration settings. The 9-Axis system cannot communicate with the calibration settings iButton.	Verify the integrity of the iButton and iButton interface on the 94065A001 driver board.
5 Short	A short or an open circuit has been detected on the joystick output that is blinking. A short or an open circuit has been detected on the pushbutton output that is blinking.	Verify the integrity of the outputs and wiring. Verify the integrity of the outputs and wiring.
7 Short	The joystick that is blinking is operating outside of its acceptable range.	Contact a FORCE America Representative for a replacement joystick.
9 Short	The joystick was detected off-center at startup. The joystick's pushbutton was detected pressed on startup.	Verify that the joystick is not off-center. Verify that the joystick's pushbutton is not pressed.
11 Short	The 9-Axis system cannot communicate with the Setup & Diagnostics screen.	Verify the integrity of the 94065A001 driver board.
13 Short	The Emergency Stop Switch is miswired and will not function properly.	Verify the wiring of the Emergency Stop Switch.
15 Short	Communication with the joystick backlighting board has been lost.	Verify the connection between the joystick backlighting board and the joystick input board.

FORCE America Contact Information

Should you encounter problems with your 9-Axis System that are not documented in this Operation Manual or the *9-Axis Proportional Joystick Control System with CAN Bus Calibration Manual (M0106)*, please contact your local FORCE America Sales Representative for assistance.

For company and product information, please contact FORCE America at:

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