Introduction to Using Input/Output (I/O) Controls for Advanced SAM Troubleshooting

54-230

FLA COE
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Freightliner Service Bulletin

Description of Revisions: *This bulletin replaces the version dated September 2008. The bulletin is revised to reflect recent SAM software updates.*

General Information

Input/output (I/O) controls, introduced with SAM Cab and SAM Chassis software release 5.2 in early 2009, allow a technician to control and isolate an external circuit connected to a SAM ECU to determine if the circuit itself is operating correctly. Use I/O controls to pinpoint the root cause of a failure. In general, possible failure locations for any circuit include the following:

- Output circuit and components
- Input circuits and components
- System interlocks
- ECUs associated parameter settings
- ECU hardware

This bulletin introduces I/O controls, including a description of what they are, where to find them in ServiceLink, and how to use them to troubleshoot a SAM ECU.

Determining if I/O Controls are Available

First, confirm which SAM version is on the vehicle to see if I/O controls are available. Connect to the vehicle using ServiceLink then read the software version for both SAM ECUs. Find the software version displayed in **Table 1** to determine if I/O controls are available.

SAM Software/Release Versions and I/O Control Availability			
ECU	**Software Version**	**Release Version**	**I/O Controls Available**
SAM Cab	07.17.003	5.0	No
	07.36.005	5.2	Yes
	08.17.015	5.4	Yes
SAM Chassis	07.17.003	5.0	No
	07.36.005	5.2	Yes
	08.17.016	5.4	Yes

Table 1, SAM Software/Release Versions and I/O Control Availability

I/O Controls in ServiceLink Templates

ServiceLink templates contain features to help take advantage of I/O controls, including:

- *Compatibility on all SAM ECU Templates*

  Each SAM template has a section called "ECU Compatibility" that confirms whether both SAM ECUs are compatible with the template. See **Fig. 1**. If all LEDs show green, then the template is compatible and will work properly with the connected SAM ECUs software. If one or more LED(s) show red, that may indicate that one of the SAM ECUs is not at a compatible software version. For example, one SAM ECU may require a software upgrade. To ensure that the vehicle ECUs are at compatible software levels, refer to **Service Bulletin 54-239** *Cascadia Cabin CAN ECU Compatibility*. ServiceLink will attempt to make available only those templates that are compatible with the connected ECUs.

- *Input/Output (I/O) Controls for Improved Troubleshooting*

  I/O controls appear on ServiceLink templates as buttons, typically labeled "ON" and "OFF." See **Fig. 2**. This functionality is not available for every circuit.

- *Safety Interlocks*

  To help ensure technician safety while circuits are controlled, I/O controls are subject to safety interlocks; either the parking brake must be set, or the vehicle speed must be less than 5 mph. If neither condition is met, the I/O control buttons will not work. Each template with I/O control buttons has a section confirming that at least one of the safety interlocks is met. See **Fig. 3**.

- *"Return Control to Vehicle" Button*

  Each template with I/O controls has a "Return Control to Vehicle" button. See **Fig. 4**. When an I/O control button is used, the template is given control of that circuit. The ECU then ignores all inputs, parameters, and interlocks normally considered for that circuit. The ECU will not assume control of the circuits until one of the actions in **Table 2** is taken.

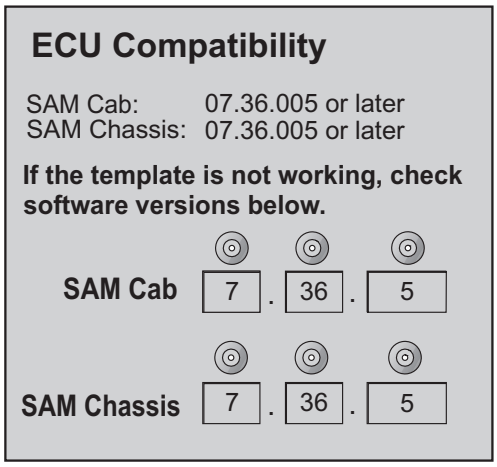

Fig. 1, ECU Compatibility Area on Template

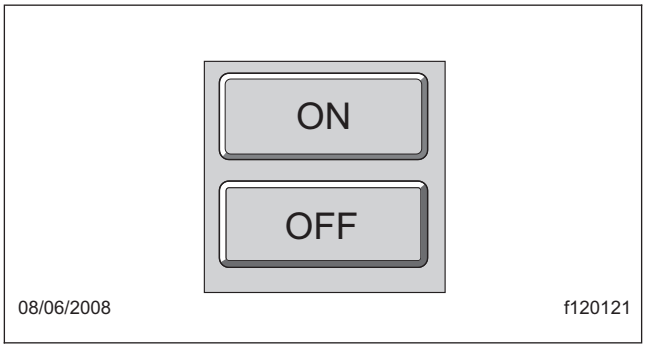

Fig. 2, Example of I/O Control Buttons

Actions for SAM ECU to Resume Control of Circuits	
Action	**Effect in ServiceLink**
Click the "Return Control to Vehicle" button.	The template continues to function, but the ECUs reclaim control of all circuits.
Close the template: Click the "X" in the upper-right corner of the window, or select "Close" from the "File" menu.	The template closes and the ServiceLink "Templates" screen reappears.
Disconnect the template: Click the "Connect/Disconnect" button, or select "Disconnect" from the "Connection" menu.	The template stops communicating, but stays open.

Table 2, Actions for SAM ECU to Resume Control of Circuits

Using I/O Controls

1. Find the appropriate template.

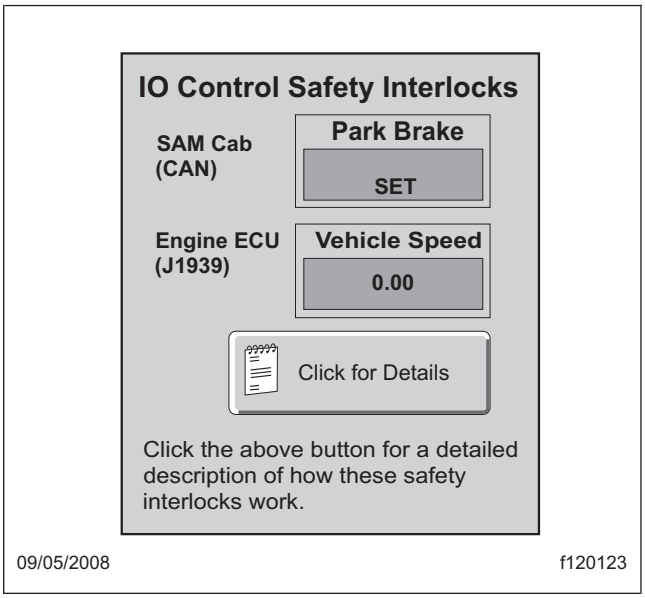

Fig. 3, Interlocks in Place

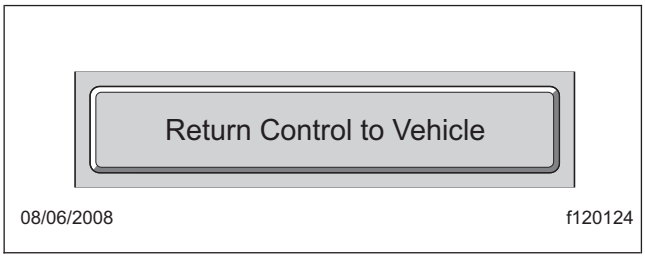

Fig. 4, "Return Control" Button

Cascadia templates are available based on vehicle features. Two options are available for finding the appropriate template:

- Review the list of available templates in ServiceLink to determine whether a template is available for the problem function. Select the "List" icon, then select the "Templates" tab. This shows templates for all ECUs on the vehicle. Or, select the icon of the ECU involved in the symptom or fault, then select its "Templates" screen; for example, for a SAM Chassis fault select the "SAM Chassis" icon, then select the "Templates" screen.
- Refer to the *Cascadia Troubleshooting Manual* to see if there is a specific template available for the affected function. For example, refer to **C04.04 — Stop, Turn and Hazard Lights** for a turn signal problem. In **700 — Diagnostic Tools Required** "DataLink Monitor Template – Stop Turn Hazard Lamps" is listed.

2. Identify whether I/O controls are available.

   Once the template is open, see whether the involved circuits have I/O control buttons available. They are typically labeled as "On" or "Off", but may also indicate a function, such as "Wiper High".

3. Test the circuit and troubleshoot to find the root cause.

   Once a circuit is controlled with an I/O control button, the ECU will ignore all software interlocks, inputs, and parameter settings. This tests if everything is working correctly from the ECUs internal processor through the connected external circuit.

Troubleshooting Using I/O Controls

NOTE: Always confirm that any involved fuses or relays are working before proceeding.

In general, use the following logic to troubleshoot using I/O control buttons.

If the external circuit works when using I/O control buttons:

- The external circuit, including connected fuses or relays, is not the root cause of the failure.

- The hardware inside the ECU is not the root cause of the failure.
- The root cause of the failure may reside in the following locations:
  - Input circuits and components; are all switches plugged in correctly?
  - System interlocks; does the function require certain conditions to be met before activating the output? What other interlocks exist for this function or system?
  - ECUs associated parameter settings; are SAM Cab or SAM Chassis parameters set to the desired values?

If the external circuit does not work when using I/O control buttons:

- The root cause of the failure may reside in the following locations:
  - *Output circuit and components* – This includes any related fuses or relays.
  - *ECU Hardware* – Circuitry within the ECU may fail in rare cases.

To help isolate the root cause of a failure, troubleshooting procedures are available in the *Cascadia Troubleshooting Manual*. Sections **02.04 — SAM Cab** and **02.05 — SAM Chassis** include generic troubleshooting procedures for the following SAM circuit types:

- Logic Controlled Unfused Outputs
- Logic Controlled Relayed Fused Outputs
- Unfused Constant Outputs
- Fused Battery Pass-Through Outputs

For example, if the failure involves the panel lamps circuit, which is powered by pin X10/13 of the SAM Cab, refer to **G02.04 — SAM Cab**. The chart shown in **705 — Fused and FET Controlled Outputs** identifies SAM Cab pin X10/13 as a "logic controlled unfused output". In the same troubleshooting section, **707 — Logic Controlled Unfused Outputs** has a generic troubleshooting procedure for that SAM circuit type.

Warranty

This is an informational bulletin only; warranty does not apply.