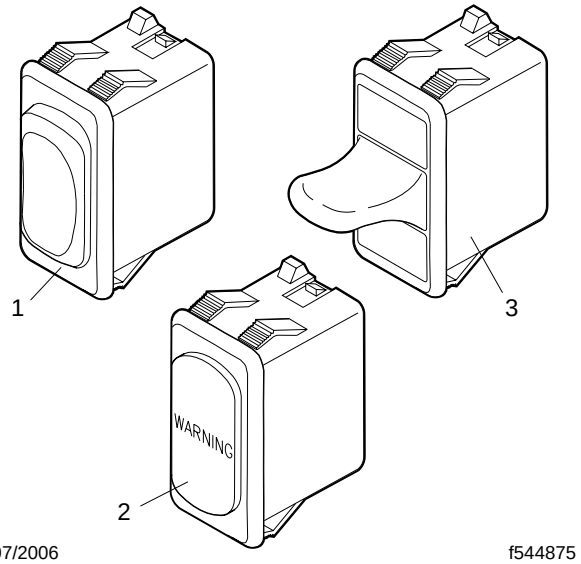
General Information

The smart switch, unlike a conventional switch, requires a device to read the identification code resistors within the smart switch. The device that reads the identification code resistors is the bulkhead module. The identification code resistors indicate the function the switch controls on the vehicle (lights and actuators), as well as the position of the switch (either up, middle, or down). See **Fig. 1** for examples of smart switches. Smart switches also require drive for the status indicator (on/off) of the function and the backlight function symbol.



1. Rocker Switch
2. Pilot Light
3. Paddle Switch

Fig. 1, Smart Switches and Pilot Light

A pilot light is similar to a smart switch in several ways. They plug into the same harnesses and modules. Pilot lights have their own unique internal identification code resistors like smart switches. However, unlike smart switches, pilot lights are only used as indicator pilot lights. There is no switching mechanism. See **Fig. 1**.

The Bulkhead Module (BHM) is capable of connecting with up to five smart switches through five smart switch ports. Each Switch Expansion Module (SEM) is capable of holding up to six additional smart switches with as many as four SEMs possible per vehicle. Finally, the Switch Hub Module (SHM), with up to three Eight Switch Banks (8SB) is capable of holding up to 24 additional smart switches and/or pilot lights.

The following are some general facts about smart switch and pilot lights.

- Each smart switch/pilot light is unique, and is identified by internal resistors.
- A smart switch does not carry the electrical current for the function itself.
- A smart switch acts as an input to the BHM to tell it what position the switch is in.
- Function identification inputs—identifies itself as to what function it serves.
- Switch position input—tells the BHM what position the switch is in.
- The BHM controls the indicator light in the smart switch.
- The indicator turns on and stays on as long as the function is active.
- The indicator blinks if the BHM does not get the anticipated feedback.
- Each smart switch contains a backlighting circuit.
- A smart switch or pilot light can be plugged into any of the smart switch ports either on the BHM, the SEM, or the SHM/8SB.

Smart switches are used to control a variety of optional functions on Saf-T-Liner busses such as heated mirrors, fog lights, strobe light, warning lights, etc. Options that use a pilot light include the wheelchair lift power red and power green LEDs, post-trip inspection light, stop request pilot light, etc.

Troubleshooting

Typical Smart Switch Problems

Smart switch problems can cause several types of symptoms or faults, and must be investigated to determine if the smart switch itself is the cause of the problem. **Table 1** lists symptoms and faults that may indicate a smart switch problem.

See the heading "Definition of Smart Switch Faults" for further explanation of each type of smart switch fault code.

Smart switch symptoms are as follows:

- Smart switch controlled function does not work
- Smart switch indicator light does not work

Definition of Smart Switch Faults

Missing Smart Switch Fault

This fault indicates that the Bulkhead Module (BHM) can not detect a smart switch for a function that is programmed into the BHM by a reference parameter. For example, a fog light switch could not be detected, but a reference parameter for fog lights is programmed into the BHM.

Duplicate Smart Switch Fault

This fault indicates that the BHM has detected more than one smart switch for a particular function programmed into the BHM by a reference parameter. For example, two fog light smart switches are connected.

Extra Smart Switch Fault

This indicates that the BHM detects a smart switch for a function that is not programmed into the BHM by a reference parameter. For example, a fog light switch is connected, but the vehicle is not programmed for fog lights.

Smart Switch VBATT Short to Ground

This fault indicates a smart switch indicator and backlight drive overloaded. Only smart switches connected to either a Switch Expansion Module (SEM) or a Switch Hub Module/Eight Switch Banks (SHM/8SB) will report this fault.

Determining Which Smart Switches the Vehicle is Programmed to Use

Follow the instructions below to determine which vehicle functions use a smart switch.

1. In ServiceLink, click on the BHM icon.

Smart Switch Faults						
J1587			J1939			Fault Description
MID	SID	FMI	SA	SPN	FMI	
164	022	07	33	6918	07	Missing Smart Switch
164	021	07	33	6919	07	Duplicate Smart Switch
164	020	07	33	6920	07	Extra Smart Switch
—	—	—	49	6914	04	Smart Switch VBATT Short to Ground
—	—	—	128	6914	04	Smart Switch VBATT Short to Ground
—	—	—	129	6914	04	Smart Switch VBATT Short to Ground
—	—	—	130	6914	04	Smart Switch VBATT Short to Ground
—	—	—	131	6914	04	Smart Switch VBATT Short to Ground

Table 1, Smart Switch Faults

2. Click on the "Features" tab. A list of all the reference parameters that are programmed into the BHM can be seen. Functions that use a smart switch will have (smart switch) in the reference parameter description text. See **Fig. 1**.

   In the ServiceLink example, the reference parameters which have smart switches are:

   - 26-02028-007 with ID sign (smart switch)
   - 26-02031-001 with driver dome lamp (smart switch)
   - 26-02032-001 passenger dome lights, IGN-On/Acc, follows entrance door (smart switch)
   - 26-02047-011 step well lights w/2-speed heater (smart switch)
   - 26-02049-003 left side aft heater fan, 2 speed, IGN-enabled On/Acc (smart switch)
   - 26-02050-007 with defroster fan on windshield heater (smart switch) and escape hatch w/buzzer

If the vehicle is equipped with an SEM, there will be a separate icon on the left-hand menu. Click this icon and a separate tab for smart switches will appear (the same applies for the SHM icon). This menu will list all smart switches connected to SEM and the SHM. Smart switches connected to the BHM will not be listed here.

Troubleshooting Smart Switch Problems

Missing Smart Switch Fault

This fault indicates that a smart switch the BHM is programmed to use is not connected to one of the smart switch ports. To troubleshoot this fault, determine which smart switches the vehicle is programmed to use. Use the "Features" screen in ServiceLink to determine what smart switches the vehicle should have. See the heading "Determining Which Smart Switches the Vehicle is Programmed to Use".

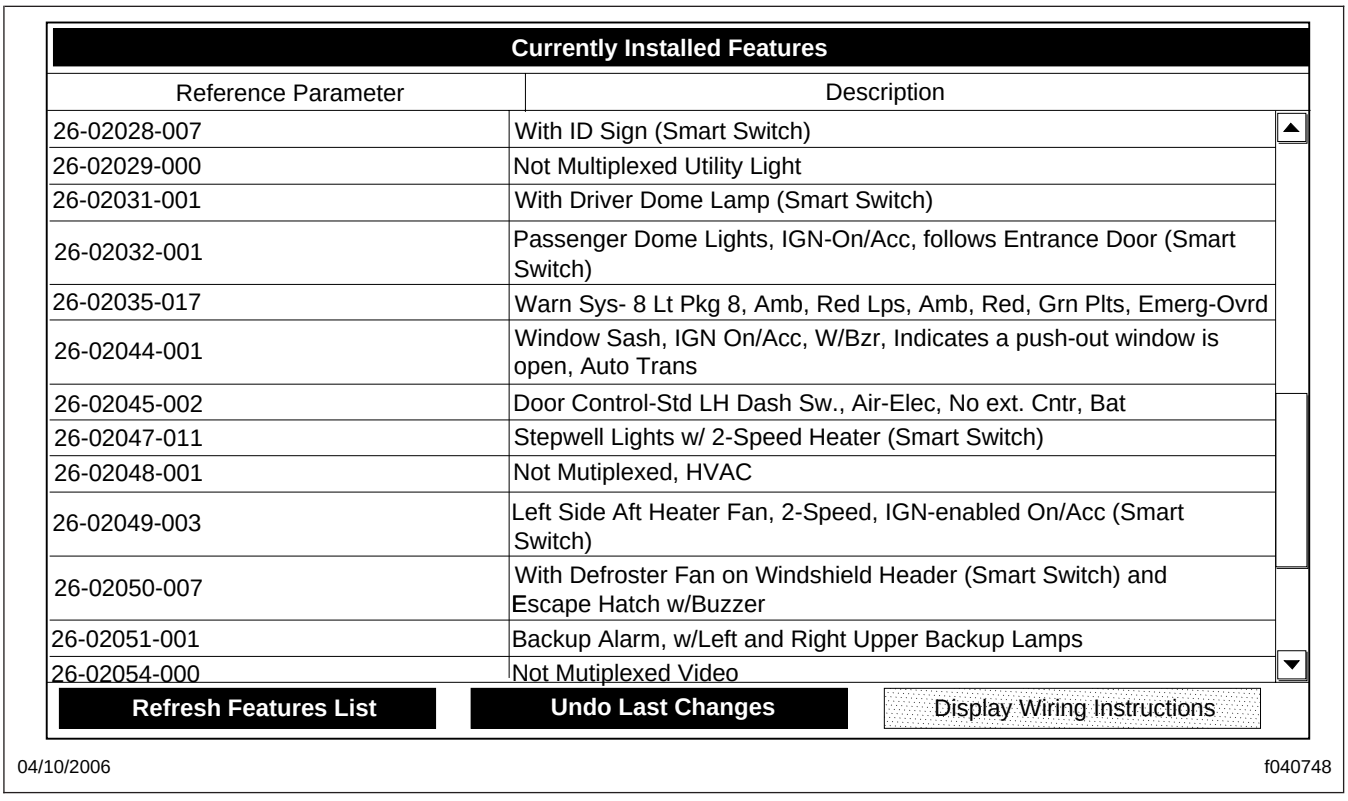


Fig. 1, Installed Features Example

Next, use one of the appropriate J1939 smart switch templates in ServiceLink (either from the BHM, SHM, or SEM) to identify which smart switches the vehicle recognizes.

NOTE: See the ServiceLink Users Guide under "Templates" for instructions on using Datalink Monitor Templates.

These templates have the unique smart switch ID number that indicates what smart switches the bulkhead module actually recognizes as being on the vehicle.

Extra Smart Switch Fault

This fault indicates that a smart switch the vehicle is not programmed to use, is not found connected to one of the smart switch ports. This can be for any switch connected to the BHM, SHM, or SEM.

To troubleshoot this fault, first determine which smart switches the vehicle is programmed to use. Use the features screen in ServiceLink to determine which smart switches the vehicle should have. See the heading "Determining Which Smart Switches the Vehicle is Programmed to Use".

Next, identify which smart switches the vehicle recognizes using one of the appropriate J1939 smart switch templates in ServiceLink (BHM, SEM, or SHM Datalink Monitor Templates).

NOTE: See the ServiceLink Users Guide under "templates" for instructions on using Datalink Monitor Templates.

These templates will give you the unique smart switch ID number that indicates what smart switches the bulkhead module actually recognizes as being on the vehicle.

See **Specifications 400** to cross reference the smart switch ID number with the smart switch description. Compare this with the smart switches you were expecting based on what features the bulkhead module was programmed to use. See the heading "Determining Which Smart Switches the Vehicle is Programmed to Use". From this, determine which smart switch is extra or not being correctly identified.

Duplicate Smart Switch Fault

This fault indicates that there are two or more identical smart switches connected to either BHM, SEM, or SHM/8SB smart switch ports.

To troubleshoot this fault, first determine which smart switches the vehicle is programmed to use. Use the features screen in ServiceLink to determine which smart switches the vehicle should have. See the heading "Determining Which Smart Switches the Vehicle is Programmed to Use".

The switch function that is duplicated will be two or more smart switch ports that have the same smart switch ID number shown in the applicable template. The duplicate switch must be disconnected.

NOTE: See the ServiceLink Users Guide under "templates" for instructions on using Datalink Monitor Templates.

Smart Switches VBATT Short to Ground Fault

This fault indicates a smart switch indicator and/or backlight drive overloaded. Only smart switches connected to an SEM or SHM will report this fault.

Use ServiceLink to determine which smart switches are connected specifically to an SEM or SHM. Using ServiceLink, click on either the switch expansion module or the switch hub module icon on the left-hand list of ECUs. Then click on the smart switch tab. This will give you a list of all smart switches that are connected to the SEM and SHM. Smart switches connected to the bulkhead module will not show on this list. Troubleshoot these smart switches for short circuit conditions.

Troubleshooting a Smart Switch Controlled Option that Does Not Work

Generally, when a function does not work when the smart switch is activated, the problem may be due to one of the following.

Input problems:

- Faulty smart switch.
- Faulty smart switch wiring.
- Other input conditions for the function to activate are not met. For example, the BHM does not sense that the ignition switch is in the ON position for the reading lights to activate.

Output problems:

- The output device is faulty.

Troubleshooting

- The output device wiring is faulty.
- Output is not wired to the correct output pin.
- If the output is connected to the CHM (Chassis Module), there may be J1939 communication problems between the BHM and the CHM.
- If the output is connected to the EXM (Expansion Module), there may be J1939 communication problems between the BHM and the EXM.
- If the output is connected to the SHM, there may be communication problems between the BHM and SHM.

Hardware problems:

- Faulty BHM, CHM, EXM, or SHM output drivers (internal BHM, CHM, EXM, or SHM problem).
- BHM, CHM, EXM, or SHM output driver circuit is overloaded (too much current will cause the output to shut off).
- Main VBATT fuse that supplies the output pin is blown.

Software problems:

- Reference parameter is not compatible with vehicle options.
- Reference parameter has errors.

If a function does not work, and there are no active smart switch fault codes, then the following procedure will help to determine if the smart switch itself or its wiring is the cause of the problem. If smart switch fault codes are active, troubleshoot them first.

To determine if the smart switch or its wiring is the cause of the multiplexed function not working, follow the steps in **Table 2**.

Smart Switch Problems

Step	Procedure	Result	Action
1	Are any smart switch faults active?	Yes	Troubleshoot faults as outlined under previous headings.
		No	Go to step 2.
2	Observe the smart switch indicator (if equipped) while attempting to operate the function with the switch. NOTE: If the switch does not have an indicator light, go to step 3.	Blinks steady	This means that function interlocks were met, but the BHM does not sense that the function actually engaged. This does not indicate a problem with the smart switch.
		On, then quickly off	This means that some other condition(s) is not met in order for the function to work. For example, if the function requires that the parking brake be set in order for the function to operate, and the parking brake is not set, then the function will not work because the condition is not met (parking brake not set).
		Off	Go to step 3.
3	Using ServiceLink, look at the BHM features screen. Is there a reference parameter listed for the function, and does it indicate the use of a smart switch?	Yes	Go to step 4.
		No	The reference parameter for the function is not loaded into the BHM. Load the correct reference parameter using ServiceLink.

Smart Switch Problems			
Step	**Procedure**	**Result**	**Action**
4	In ServiceLink, open the applicable smart switch template (either for the BHM, SHM, or SEM). Locate the column that has the smart switch ID that matches software decimal value for that switch. While observing the input or position status on the template, operate the switch through each position. You should note a change in either the voltage input or position, depending on which template you are using. Do you see the change in switch position reflected in the template?	Yes	The problem is not with the smart switch or its wiring. The problem is either with the output function, or possibly a reference parameter problem.
		No	Go to step 5.
5	Remove the smart switch. Check resistance between pins 2 and 9 for each switch position. Compare readings with the values in **Specifications 400**. Are the resistance values within specifications?	Yes	Check the wiring between pin 2 of the smart switch and either the BHM, SEM, or SHM/8SB. Repair as necessary.
		No	Replace the smart switch.

Table 2, Smart Switch Problems

Specifications

Smart Switch Pin-Out—Two Position Switch	
Pin	**Circuit Description**
2	Switch Position Input
7	Switch Function ID #1 Input
8	Switch Function ID #2 Input
9	Ground
10	Indicator (+)
11	Backlighting (+)
12	Indicator (–)

Table 1, Smart Switch Pin-Out—Two Position Switch

Smart Switch Pin-Out—Three Position Switch	
Pin	**Circuit Description**
2	Switch position input
7	Switch Function ID #1 Input
8	Switch Function ID #2 Input
9	Ground
11	Backlighting (+)

Table 2, Smart Switch Pin-Out—Three Position Switch

Pilot Light Pin-Out	
Pin	**Circuit Description**
2	Null Switch Position Input
7	Pilot Light ID #1 Input
8	Pilot Light ID #2 Input
9	Ground
10	Indicator (+)
12	Indicator (–)

Table 3, Pilot Light Pin-Out

Function ID Circuit Resistance	
Pins	**Resistance**
Pins 7 to 9 (ID #1)	R1 ± 1%
Pins 8 to 9 (ID #2)	R2 ± 1%

Table 4, Function ID Circuit Resistance

Smart Switch Position Input Resistance (Pin 2 to Pin 9)		
Lower Switch Position	**Mid Switch Position**	**Upper Switch Position**
1138–1162 Ohms	9900–10 100 Ohms	3400–3468 Ohms

Table 5, Smart Switch Position Input Resistance (Pin 2 to Pin 9)

Smart Switch/Pilot Light ID			
Smart Switch/Pilot Light	**Software ID Number**	**Type**	**Switch Position**
			Upper
			Middle
			Lower
Rear Dome Lights	273	Rocker Switch	On
			None
			Off
Rear Dome Lights	273	Rocker Switch	Momentary On
			On
			Off

Specifications

Smart Switch/Pilot Light ID			
Smart Switch/Pilot Light	**Software ID Number**	**Type**	**Switch Position**
			Upper
			Middle
			Lower
Front Dome Lights	274	Rocker Switch	On
			None
			Off
Dome Lights	274	Rocker Switch	On
			None
			Off
Front Dome Lights Dimmer	274	Rocker Switch	Momentary On
			On
			Off
Dome Lights Dimmer	274	Rocker Switch	Momentary On
			On
			Off
Driver's Dome Light	275	Rocker Switch	On
			None
			Off
Driver's Dome Light Dimmer	275	Rocker Switch	Momentary On
			On
			Off
Warning Lights	276	Rocker Switch	Momentary On
			On
			Off
ID Lights	277	Rocker Switch	On
			None
			Off
ID/Marker Lights	277	Rocker Switch	On
			None
			Off
Strobe Light	278	Rocker Switch	On
			None
			Off

Specifications

Smart Switch/Pilot Light ID			
Smart Switch/Pilot Light	**Software ID Number**	**Type**	**Switch Position**
			Upper
			Middle
			Lower
Windshield Defroster Fan	279	Rocker Switch	On
			On
			Off
Luggage Compartment Light	280	Rocker Switch	On
			None
			Off
Air Horn	281	Rocker Switch	Momentary On
			None
			Off
Destination Sign	282	Rocker Switch	On
			None
			Off
Air Service Door	283	Paddle Switch	On
			None
			Off
Electric Service Door	283	Paddle Switch	Momentary On
			Off
			Momentary On
Air Service Door (Three Position Switch)	283	Paddle Switch	On
			On
			Off
Heater Pump	284	Rocker Switch	On
			None
			Off
Mirror Heater	289	Rocker Switch	On
			None
			Off
Left Front Heater	290	Rocker Switch	On
			On
			Off

Specifications

Smart Switch/Pilot Light ID			
Smart Switch/Pilot Light	**Software ID Number**	**Type**	**Switch Position**
			Upper
			Middle
			Lower
Left Rear Heater	291	Rocker Switch	On
			On
			Off
Right Rear Heater	292	Rocker Switch	On
			On
			Off
Crossing Arm Deactivation	293	Rocker Switch	Momentary On
			None
			Off
Noise Suppression	294	Rocker Switch	Momentary On
			None
			Off
Noise Suppression	294	Rocker Switch	On
			None
			Off
Speaker (Interior/Exterior)	295	Rocker Switch	On
			None
			Off
Amber Warning Lights	296	Pilot Light	—
Red Warning Light	297	Pilot Light	—
Brake Lights	298	Pilot Light	—
Rear Emergency Door	299	Pilot Light	—
Warning Lights	300	Rocker Switch	On
			Off
			On
Warning Lights	305	Rocker Switch	On
			None
			Off
Warning Lights	305	Rocker Switch	Momentary On
			None
			Off

Specifications

Smart Switch/Pilot Light ID			
Smart Switch/Pilot Light	**Software ID Number**	**Type**	**Switch Position**
			Upper
			Middle
			Lower
Emergency Warning (Momentary On)	306	Rocker Switch	Momentary On
			None
			Off
Emergency Warning (Off-On)	306	Rocker Switch	On
			None
			Off
Warning Lights	307	Rocker Switch	Momentary On
			None
			Off
Switch Backlight Dimmer	308	Rocker Switch	Momentary On
			On
			Momentary On
Vandalock Status	309	Pilot Light	—
Warning System (Master Pilot-Green)	310	Pilot Light	—
Warning System (Master Pilot-Red)	310	Pilot Light	—
Red Warning Light	310	Pilot Light	—
Warning Lights	311	Rocker Switch	Momentary On
			Off
			Momentary On
Wheelchair Lift	312	Rocker Switch	On
			None
			Off
Video Camera	313	Rocker Switch	On
			None
			Off
Hatch Vent Fan	314	Rocker Switch	On
			None
			Off
Fog Lights	315	Rocker Switch	On
			None
			Off

Specifications

Smart Switch/Pilot Light ID			
Smart Switch/Pilot Light	**Software ID Number**	**Type**	**Switch Position**
			Upper
			Middle
			Lower
Emergency Door Light	316	Rocker Switch	On
			None
			Off
Warning Override	321	Rocker Switch	On
			None
			Off
Warning Override Momentary	321	Rocker Switch	Momentary On
			None
			Off
Warning Override Momentary	321	Rocker Switch	Momentary On
			None
			Momentary On
A/C Fan	322	Rocker Switch	On
			On
			On
Step/Door Light	323	Rocker Switch	On
			None
			Off
Sander	324	Rocker Switch	On
			None
			Off
Step Well Heater	325	Rocker Switch	On
			On
			Off
A/C	326	Rocker Switch	On
			On
			Off
Engine Light	327	Rocker Switch	On
			None
			Off

Specifications

Smart Switch/Pilot Light ID			
Smart Switch/Pilot Light	**Software ID Number**	**Type**	**Switch Position**
			Upper
			Middle
			Lower
Left Side Defroster	328	Rocker Switch	On
			On
			Off
Reading Lights	329	Rocker Switch	On
			None
			Off
Wheelchair Lift Power Red LED	330	Pilot Light	—
Wheelchair Lift Power Green LED	330	Pilot Light	—
Post Trip Inspection	331	Pilot Light	—
Heated Step Tread	332	Rocker Switch	On
			None
			Off
ADA Stop Request Pilot Light	337	Pilot Light	—
Stop Request Pilot Light	338	Pilot Light	—
Stop Request Switch	339	Rocker Switch	On
			None
			Off
Side Emergency Door	340	Pilot Light	—
Master Warning Switch	341	Rocker Switch	On
			None
			Off
Life Door	342	Pilot Light	—

Table 6, Smart Switch/Pilot Light ID