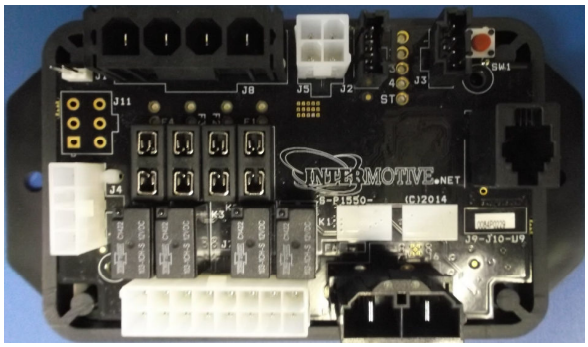
EXP401-A

FlexTech Expansion Module

This product is not vehicle specific

Introduction



The **Expansion Module (EXP)** is an add-on module to the **PRPC** in the **FlexTech System.** The EXP provides four versatile and configurable fused relay outputs (10A Max each) and four configurable low current outputs, LCOs (1A Max each). These outputs are controlled by the PRPC based on its configuration logic. In addition, the relays are hardware configurable to source or sink or even do motor reversing. There are also four general purpose active low inputs. These are read by the PRPC and can be used as inputs to the configuration logic. Refer to the instructions for the specific PRPC version that you are connecting to this module for information on programming (configuration).

EXP401 Enclosures

The EXP401-A comes in a low profile enclosure that gives backing support and insulation to the board while allowing air flow over the board.

Multiple Units

The FlexTech System can have 0, 1, or 2 EXP modules connected in a LIN Bus daisy chain along with 0, 1, or 2 SBB modules (Switch Backer Boards). In most systems there can also be a Gateway or AFIS control and display panel on the daisy chain. In some cases there could also be a PTM (Pre-Trip Module). See page 5 for instructions on installing modules in this daisy chain.

Installation Instructions

Disconnect the battery before proceeding with the installation.

WARNING
Disconnect the battery to prevent setting a check engine light.

IMPORTANT—READ BEFORE INSTALLATION

It is the installer's responsibility to route and secure all wiring harnesses where they cannot be damaged by sharp objects, mechanical moving parts or high heat sources. Failure to do so could result in damage to the system or vehicle, and create possible safety concerns for the operator and passengers. Avoid placing the module where it could encounter strong magnetic fields from high current cabling connected to motors, solenoids, etc. Avoid radio frequency energy from antennas or inverters next to the module. Avoid high voltage spikes in vehicle wiring by always using diode clamped relays when installing upfitter circuits.

EXP401-A Module

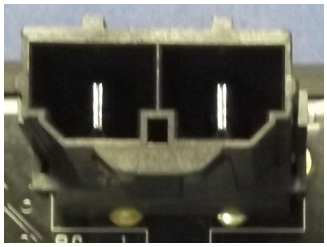
Find a suitable location to mount the EXP401-A module. Do not mount the module where it will be exposed to excessive heat. Do not mount the module until all wire harnesses are routed and secure. The last step of the installation is to mount the module. There is a drawing on the last page of these instructions that shows where each connector is located on the module. Consider this when picking the location and orientation of the module and the wiring harnesses such that connecting and mounting of the module does not stress the wiring harnesses. This module will only operate if it is connected to a PRPC module using a LIN Bus cable.

EXP Power Connection

Connect a 45A Max fused VBAT source to the 2-pin Molex Mini-Fit Senior connector J6. This connector is designed for a maximum wire size of 8 AWG which will allow over 40A. Smaller wire size can be used if the outputs being driven by the EXP total to a smaller current. The smallest wire size the connector pins can use is 16 AWG which will allow a total of 13A. Use a wire size and in-line fuse that will supply the combined output loads plus about 0.5A. See the table below. The installer ***must*** provide strain relief on the cable outside of the EXP's enclosure. It is recommended that the strain relief is within 6" of the enclosure. The absence of strain relief could result in damage to the module.

Wire Size AWG	Female Pin Molex Part #	Maximum Current (A)
16	42815-0042	13
14	42815-0042	17
12	42815-0012	23
10	42815-0012	33
8	42815-0032	45

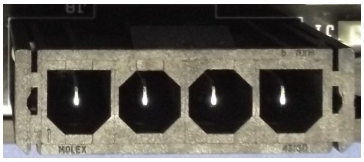
Pin # **1** **2**
Ground **Power**



4-Pin EXP401-A Relay Connector Pin-Out Definition

Connector J8 contains the 4 EXP401-A fused output pins. These 4 fused output pins are connected to 4 configurable relay outputs. These outputs are activated and de-activated by the attached PRPC using the configuration in the PRPC. The output mode of each relay is controlled by the hardware configuration connector J7 described on the next page. Each relay output is capable of 10A maximum. **The EXP401-A module has an absolute maximum current rating of 45A.**

Pin # 1 2 3 4



4 Pin Output

The 4 fused relay output pins on connector J8 are defined as follows:

- Pin #1 - Configurable Relay Output 1, Fuse 1
- Pin #2 - Configurable Relay Output 2, Fuse 2
- Pin #3 - Configurable Relay Output 3, Fuse 3
- Pin #4 - Configurable Relay Output 4, Fuse 4

Connect the desired outputs to vehicle equipment as needed.

4-Pin EXP401-A LCO Connector Pin-Out Definition

Connector J5 contains the EXP401-A's 4 low current output (LCO) pins. These outputs are activated and de-activated by the attached PRPC using the configuration in the PRPC. Each output is rated at 1A, and is intended to drive relay coils or other low current loads. **Note: when driving relays, a diode-protected type must be used. InterMotive recommends Digi-Key #PB682-ND Relay.**

4 Pin Output

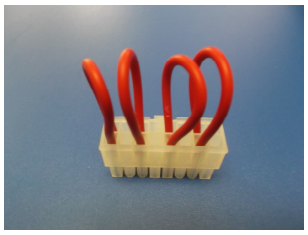
The 4 LCO output pins on connector J5 are defined as follows:

- Pin #1 - Configurable LCO Output 1, Active High
- Pin #2 - Configurable LCO Output 2, Active High
- Pin #3 - Configurable LCO Output 3, Active High
- Pin #4 - Configurable LCO Output 4, Active High

Connect the desired outputs to vehicle equipment as needed. When connecting to relays, use relays with appropriate kick-back suppression, such as Digi-Key #PB682-ND. Unsuppressed relays will induce very high voltage spikes throughout modern vehicles sensitive computer electronics and should not be used, per Ford, GM, SAE, etc.

16-Pin EXP401-A Relay Hardware Configuration Connector

The relays in the EXP401-A are single-pole-double-throw, with both normally open and normally closed inputs (Form C). For any of the relay outputs to operate there must be a configuration mating connector plugged into the relay configuration connector, J7. This connector is a 16-pin Molex Mini-Fit Plus connector and is used to connect the relay inputs with the source that is needed for the application. It is possible to connect the NO (normally open) input to either 12V or ground. It is also possible to connect the NC (normally closed) input to either 12V or ground. For most installations it is expected that the 4 relay outputs will be switching 12V to a load and when not activated will be open. For this case there is a supplied configuration connector (shown in the adjacent photo, InterMotive part number S-H30EX) that connects all 4 NO inputs to 12V and leaves all 4 NC inputs open.

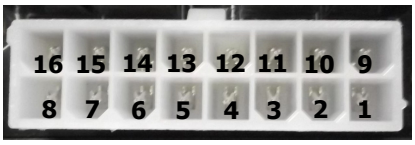


There are many different combinations that a particular installation might need. A couple of examples will be discussed to give the installer an idea of how to modify the supplied connector for simple changes. Assume that relay 1 needs to be set to sink current from an external 12V source with the other 3 relays staying at the default. The easiest and quickest way to do this is to use a Molex pin extractor tool (Molex part number 011030044) to remove the wire and pin from position 2 then insert this pin into position 1. This will connect the NO input of relay 1 to ground, still leaving the NC input open.

Another example would be to convert relays 1 and 2 into a motor reversing pair. For this use 2 added wires to connect the NC inputs of relays 1 and 2 to ground. Use two 16 AWG wires about 3 inches in length (black is recommended). Crimp Molex female pins (Molex part number 45750-3111) onto both ends of these 2 wires. Insert the first wire into position 1 with the other end inserted into position 9. Do the same with the second wire inserting one end into position 3 and the other end into position 11. Leave the original red wires in place.

For more complex configurations it may be best to purchase the Molex mating connector housing (Molex part number 39-01-2160) and create the needed configuration. Use the table below. It is recommended that red wire is used for 12V connections and black wire for ground connections. It is also recommended that pins 1 and 2 are used to configure relay 1, pins 3 and 4 for relay 2, pins 5 and 6 for relay 3, and pins 7 and 8 for relay 4.

Pin #	16	15	14	13	12	11	10	9
Relay Input	NO-4	NC-4	NO-3	NC-3	NO-2	NC-2	NO-1	NC-1
Pin #	8	7	6	5	4	3	2	1
Source Type	12V	GND	12V	GND	12V	GND	12V	GND



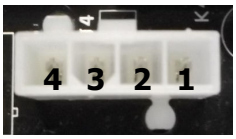
16 Pin Configuration

4-Pin EXP401-A Input Connector Definition

Connector J4 contains the EXP401-A's 4 discrete general purpose wire inputs. These are all active low. These inputs have their own internal pull up resistors so they can be left floating when not used or not active. These inputs are used as part of the programmable logic in the attached PRPC to configure the output pins either on the PRPC or on the EXP.

- Pin #1 - General Purpose Input 1, Active low
- Pin #2 - General Purpose Input 2, Active low
- Pin #3 - General Purpose Input 3, Active low
- Pin #4 - General Purpose Input 4, Active low

Connect inputs as needed.

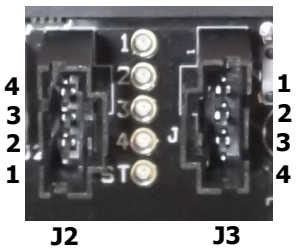


4 Pin Input

Connecting the EXP401-A to the PRPC and Other Modules:

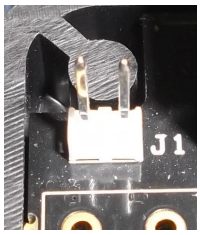
The EXP401-A must be connected to a PRPC to work (even to power up). This connection is done with the supplied LIN Bus cable. In the simplest system, with a PRPC and 1 EXP module just connect one end of the LIN Bus cable to J5 on the PRPC and the other end to J2 or J3 on the EXP module.

For more complex FlexTech configurations the modules are connected in a "daisy chain." The PRPC is always at the "Head End" of the chain and any Gateway or AFIS panel will be at the "Tail End" of the chain. The modules can be connected in any order. This will be decided by their physical location. There can be 0, 1, or 2 EXP modules and 0, 1, or 2 SBB modules in the chain. In some systems there could also be a PTM module. A PTM is frequently added with a LIN Bus "Y" cable as shown in the example below. In connecting the EXP in the daisy chain, it does not matter what order the modules are in nor does it matter which LIN connector is used.

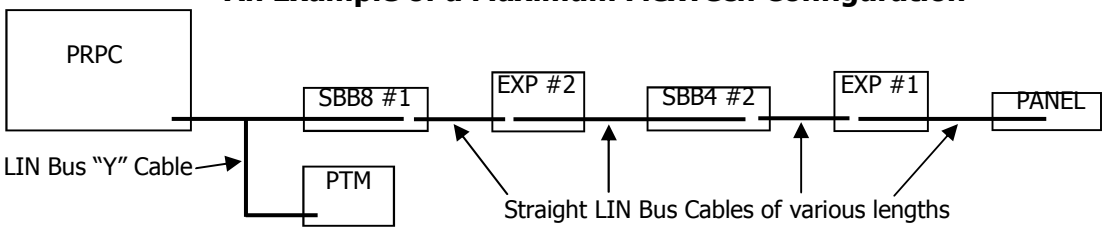


LIN Bus Connectors

In order to use 2 EXP modules in one system a shunt (3M part number 929950-00) must be slid onto the 2 pin header J1 on one of the EXP modules. See the adjacent photo for the location of this connector. Keep track of which module has the shunt and which does not. For programming the configuration into the PRPC the EXP module without the shunt will be designated Expansion Board 1 and the EXP module with the shunt will be designated Expansion Board 2. Again, it does not matter in what physical order the modules are placed in the daisy chain.



An Example of a Maximum FlexTech Configuration



Finishing the Installation and Testing Operation

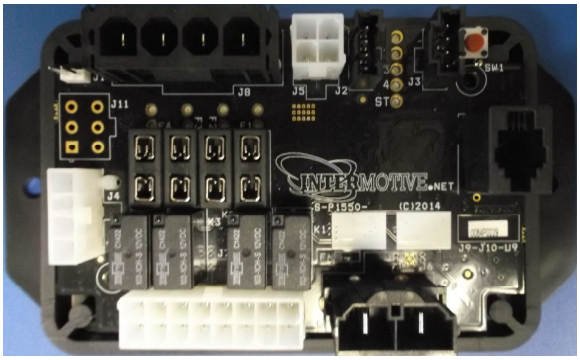
Module Mounting

1. Ensure all the harnesses are properly routed with strain relief where needed.
2. Mount the EXP401-A module as described on page two.
3. Verify that the module is in an area away from any external heat sources (engine heat, heater ducts, etc.).
4. Secure using screws or double sided tape.

Connect the Harnessing:

The following sequence should be performed **prior to** reconnecting the vehicle battery:

1. Connect each of the harness connectors to the corresponding connector on the EXP401-A. Each connector has a different number of pins and will only fit into the connector on the board with the same number of pins. Do not use force to insert a connector.
2. Ensure that the PRPC has been completely installed.
3. Ensure that the EXP401-A module is connected to the PRPC with the LIN Bus cable.
4. The vehicle battery may now be reconnected.



Install Fuses for the Relays

Install a fuse into each fuse position that has a relay being used. Make sure to use fuses that are rated for the load being driven by the relay. **Do not exceed 10A per fuse.**

EXP401-A Post Installation Testing

1. Turn the ignition ON to wake up and initialize the PRPC module.
2. When the PRPC is up and operating it will tell the EXP to turn on (the green LEDs and amber status LED will blink once).
3. With these conditions met, ensure that all desired outputs are responding correctly per their programmed set of conditions in the PRPC configuration (e.g., EXP relay 4 activates when the engine is running).

The EXP401-A is properly installed only if it passes the above tests. If any irregular operational issues persist, recheck the set of conditions in the configuration.

Contact InterMotive at 530-823-1048 for technical assistance.

FlexTech System Operation:

Turning the vehicle ignition ON will wake up and initialize the attached PRPC. Once the PRPC is on it will turn on the EXP401-A through the LIN Bus. Outputs are controlled based on the module's configuration.

When the key is turned OFF, the attached PRPC will turn off the EXP401-A and then the PRPC will go into a low power sleep mode . This may take up to TEN minutes, and the LED's on the module will go out once in sleep mode. Other vehicle activity such as opening doors, inserting key in the ignition, etc. may delay sleep mode.

PCB Temperature Load Shedding:

The EXP401-A module has a thermistor mounted on the board near the relays and fuses to monitor the temperature. The raw 8-bit A/D reading from the thermistor is reported to the PRPC. If the reading reaches a value that corresponds to 115°C the highest numbered relay that is currently active will be de-activated. This will be reported to the PRPC as an over temperature condition and the status of the relay is readable by the PRPC. If, after 2 minutes, the temperature is still above 115°C, the next highest numbered active relay will be de-activated and the 2 minute timer restarted. If, at any time, the temperature is indicated to be above 120°C, **all** relays will be immediately de-activated.

During the over temperature condition, all requests from the PRPC to activate any relay will be ignored. The LCOs will continue to operate normally.

When the temperature is indicated to be below 100°C **and** the 2 minute timer has expired, all relays that are still showing a request for activation will be re-activated. The over temperature condition will be removed and this change will be reported to the PRPC.

Status Displays and Diagnostics

Relay Outputs:

Each relay has an associated on-board green LED that indicates when the relay coil is active. These green LEDs can be thought of as conditions met indicators. They are controlled by the on-board processor and are turned on when the corresponding relay is activated. In addition, each fused relay output has two on-board red LEDs which are used to indicate when the fuse is blown. These red LEDs are not processor controlled. If a fuse is blown one of the red LEDs will light when the relay is active and connected to its load. The red LED farthest from the fuse lights for a blown fuse when the output is in the sourcing mode (activated output is 12V and de-activated is open.) If the relay is in sinking mode (activated presents a ground and de-activated is open) the blown fuse will be indicated by the red LED nearest to the fuse when the relay is activated.

Low Current Outputs, LCOs

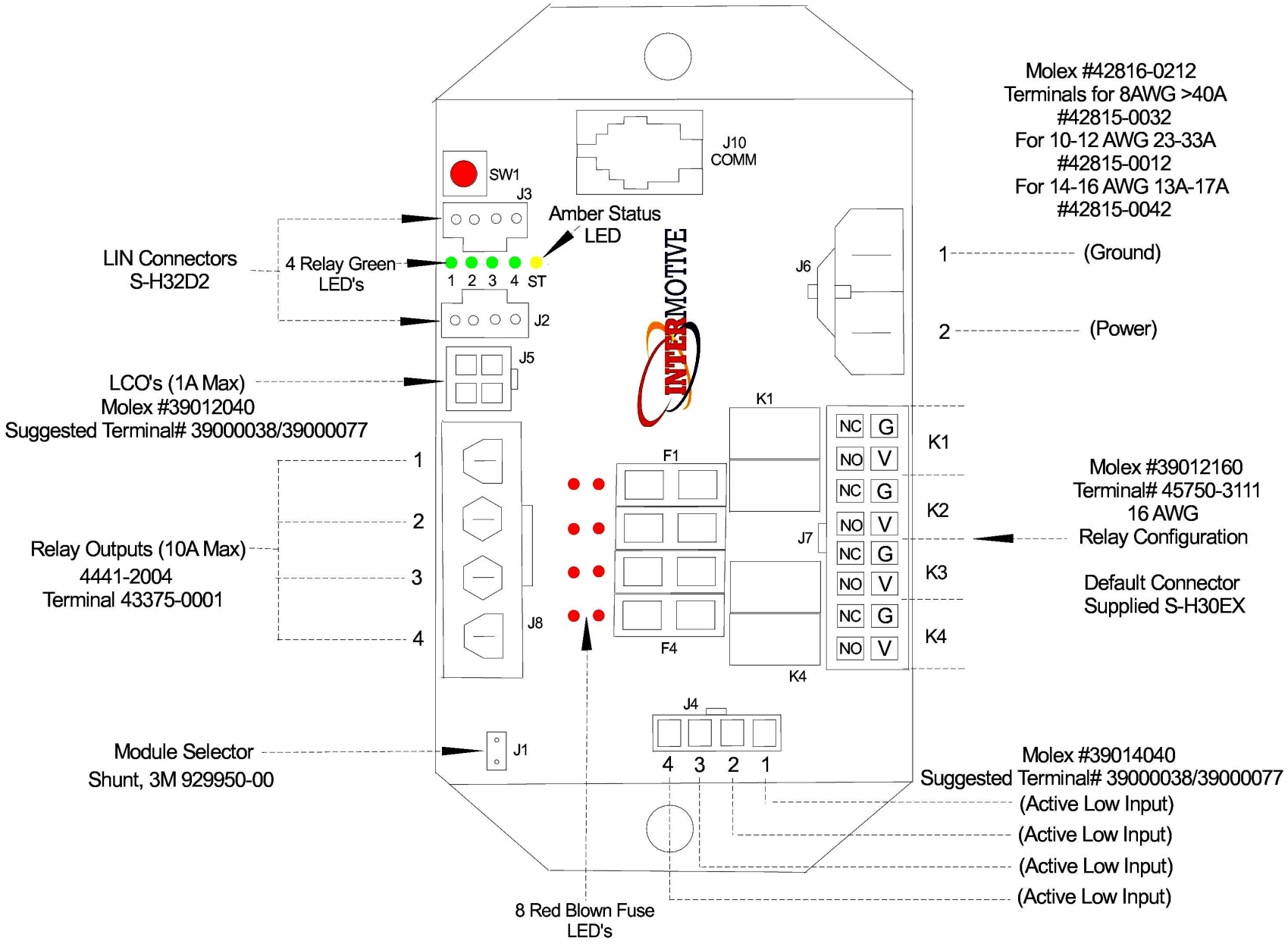
The EXP401-A monitors the LCOs for overvoltage or overcurrent faults. An overcurrent fault could be caused by a short in the load being driven by that LCO. When a fault is detected, the LCO is shut off until the fault is cleared.

There is a fault code display available while the EXP401-A is powered up. To enter the Fault Code display mode, momentarily press and release the red test button. The on-board amber status LED will blink in a way that indicates whether there is a fault or not and, if so, which LCO is faulted. If more than 1 of the LCOs is in a fault condition the higher numbered LCO will be the one displayed.

When everything is working properly, the status LED will blink twice with about a half second between blinks and will repeat this after a 1 full second delay. This is a code of 1-1 which means NO fault has been detected.

When there is a fault, the status LED first blinks twice quickly to indicate a fault, waits about half a second then blinks the LCO number quickly, 1 blink for LCO1, 2 blinks for LCO2, etc. After a full second delay the status LED will repeat the fault code. This blinking will continue until the fault is cleared or the red test button is again pressed and released to turn status mode off. The fault codes are summarized below:

- 1-1 No faults detected
- 2-1 Fault detected for LCO #1
- 2-2 Fault detected for LCO #2
- 2-3 Fault detected for LCO #3
- 2-4 Fault detected for LCO #4



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If the EXP401 fails any step in the Post Installation Test, review the installation instructions and the loaded PRPC configuration by running the FlexTech Programming Utility application. If necessary, call **InterMotive technical support @ (530) 823-1048.**

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