



Programmable 8 Channel Injector Driver Module

554-142

Overview:

The 8 channel fuel injector driver module allows for an input signal from any ECU to be changed into a user selectable peak and hold current. The selectable peak and hold currents allow for the user to select the most ideal setting based on the battery voltage, fuel pressure and specific injector used.

Injector Driver Basic Function:

This injector driver module uses a common “peak and hold” current methodology. Basic operation is such that the driver will allow for a certain current level to be reached when an injector is opened. Under normal circumstances, when this current is met, the injector should be fully open. At this time the driver will reduce the current to a lower “hold” current level, as to not overheat the injector. It is possible, depending on the resistance of the injector and battery voltage, that the peak current level cannot be reached. If this occurs, the driver will maintain this current for 5 milliseconds and then reduce to the hold current. To determine how much current an injector can draw, use the following calculation. Use a volt/ohm meter to measure the resistance of the injector (put the probes across the injector with the meter set to measure resistance)

$$\text{Current} = \text{System Voltage}/\text{Injector Coil Resistance}$$

For example:

$$\text{Current} = 13.8 \text{ volts}/2 \text{ Ohms}$$

$$= 6.9 \text{ Amps}$$

In this case, this injector, at 13.8 volts would not draw enough current to reach an 8 Amp setting.

If the battery voltage was increased to 16.5 volts it would however:

$$16.5 \text{ volts}/2 \text{ Ohms} = 8.25 \text{ Amps}$$

The module allows for the user to select different operation settings. These settings are:

- “Peak Current” – This is the amount of supply current the driver will limit to when the injector is opening. Depending on the injector resistance and battery voltage, this current may or may not be reached. If this current is not reached, the peak current will time-out after 5 milliseconds. This will also set a fault.
- “Peak Current Hold Time” – This is the amount of time the Peak Current is held, after the Peak Current is reached. The injector pintle should be fully open by the time the Peak Current is reached, however the current can be held after this current is reached for a short time, to ensure injector opening if the pintle hasn’t opened fully at this point.

Injector Driver Setup:

User Configuration

The 8 channel fuel injector driver module has user configurable settings that can be adjusted by a set of DIP switches concealed behind an access door on the bottom of the enclosure. The DIP switches come pre-set to position 7 (8A Peak/2A Hold W/ long peak duration). Other than the 10A settings, this setting is the “most aggressive” setting in terms of applying current to make sure the injector is open. The dip switches are under a cover that can be removed with four screws on the back of the unit.

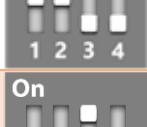
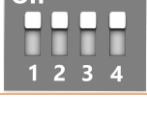
DIP Switch Configuration

To change the configuration set by the DIP switches a specific sequence must be followed.

- 1) Remove rear cover on the back of the unit.
- 2) Power on unit.
- 3) Set the DIP switch to the desired position.
- 4) Hold the pushbutton next to the DIP switch for a minimum of 10 seconds.

Configuration of the unit can only occur provided no injector pulses have been seen since the previous power cycle. This will prevent an accidental reconfiguration during operation. Additionally, the adjacent momentary pushbutton switch must be pressed and held continuously for at least 10 seconds to store a new configuration. At this point, the unit’s LEDs will flash the Configuration Number 3 times in Green on the Indicator LEDs to indicate that a new configuration was stored.

The configuration options that can be set are as follows:

Configuration Number	DIP Switches	Setting
1		4A Peak / 1A Hold Short Peak Duration (0.5ms)
2		6A Peak / 1.5A Hold Short Peak Duration (0.5ms)
3		8A Peak / 2A Hold Short Peak Duration (0.5ms)
4		10A Peak / 2.5A Hold Short Peak Duration (0.5ms)
5		4A Peak / 1A Hold Long Peak Duration (1ms)
6		6A Peak / 1.5A Hold Long Peak Duration (1ms)
7 (DEFAULT)		8A Peak / 2A Hold Long Peak Duration (1ms)
8		10A Peak / 2.5A Hold Long Peak Duration (1ms)
9 .. 15		Reserved
16		Enter Test Sequence (see Test Sequence section of instructions)

Selecting the Right Settings:

Common injectors and their settings:

Injector	Configuration Number
Holley 160 (522-168)	1
Holley 220 (522-228)	1
Billet Atomizer 160-245	3
Billet Atomizer 325-800	7
Precision 500	7

If your injector is not listed, you can still calculate an approximate peak current needed. You will need to use a multimeter to check resistance across one of your injectors and also know the voltage that your injectors will be run at. Once you know or have a good idea of both voltage and resistance (Ohms), you can divide them together to come up with your approximate amperage requirements.

Example: 13.8 volts divided by 1.7 ohms = 8.1 amps

LED Behavior

The 8 channel injector driver includes 8 RGB LEDs to display various information. During power up or after changing the driver configuration the LED will flash to indicate the configuration setting. Afterward the LEDs will display the status of their associated injector channel.

At any time, the LEDs may also indicate a fault if one is detected. Fault reporting is further explained later in these instructions. Faults will be shown at the first key-on after they have occurred and can be logged to an ECU as well.



Behavior of the LEDs during operation is as follows:

Condition	LED (1...8)
Normal Operation	Solid Green
No Injector Pulses for > 1s (following first pulse)	Solid Yellow
Channel Fault Detected	Solid Red
Global Fault Detected (e.g., wiring fault)	All LEDs Solid Red
Idle/Unused	Off

On startup, the LED associated with the current stored configuration (1 – 8) will flash Green 3 times.

NOTE: It is common for the LEDs to stay red at idle. This is due to the short pulse widths at idle not allowing enough time for the injectors to hit peak current. However, the LEDs should turn green once pulse width increases.

Test Sequence

A special test sequence is included in the design to allow for a quick test of injector operation in the field. To limit the potential damage from misuse of the test sequence, operation is limited to 5 seconds total.

The test sequence is triggered by applying a specific configuration setting using the DIP switches on the unit, and holding down the configuration button continuously for at least 10 seconds. Once triggered, all 8 injectors will fire sequentially for 5 one-second cycles (4ms ON time each cycle) with the stored configuration settings, after which the test sequence will stop and normal operation will resume. As with other configuration changes, the test sequence can only be initiated provided no injector pulses have been sent to the module since the last power cycle. Multiple test sequences can be initiated without a power cycle, but require pressing and holding the configuration button for 10s each time.

Once the test is preformed, move the dip switch back to desired setting. Performing the test sequence does NOT change what the configuration setting is, so it does not have to be re-programmed, but it does no harm to do so.

Fault Handling

The injector module is capable of detecting a number of fault conditions, either at power up or during operation:

Fault	Description
Under voltage	Input voltage dropped to < 6V during operation (likely indicating a wiring issue)
Over voltage	Input voltage exceeded 34V during operation
Output Shorted to Battery	Injector output is short-circuited to battery (peak current > 15A)
Output Open Load	Peak output current is < 25% of target value
Thermal Shutdown	Driver overheated and was forced to turn off fast demagnetization. Slow demagnetization enabled to retain functionality.
Wiring Fault	A wiring fault has been detected on the I/O connector (e.g., +12V_OUT has been shorted to GND)
No Configuration Found	No stored configuration found in memory. In the case of this fault to reduce risk of engine damage, the unit will default to configuration #7.
Injector Power Not Present	The injector driver includes two power connections, one large gauge 2-pin connector for high current and another on the 34 Pin connector for switched power. The device monitors for the presence of the large gauge power connection and, if it is not present, will shut down operation until the next power cycle to prevent damage.
Injector Not Hitting Peak Current	The injector current is monitored and a fault is raised if the peak current is not reached in a certain amount of time. This fault is not stored over a power cycle. NOTE: it is common for this code to appear at idle due to the short pulse widths associated with fuel demands at idle. This is not cause for concern and should go away once pulselwidth increases.

Fault Viewing

There are two ways to view fault codes within the Injector Driver Module. The first is through the fault output wires. These wires send a voltage that corresponds to a code within the module and are explained further below. The second method is via the supplied CAN connector when used with Holley EFI. If the CAN wiring is connected to a Holley EFI ECU, then you will be able to view faults via the Holley Software.

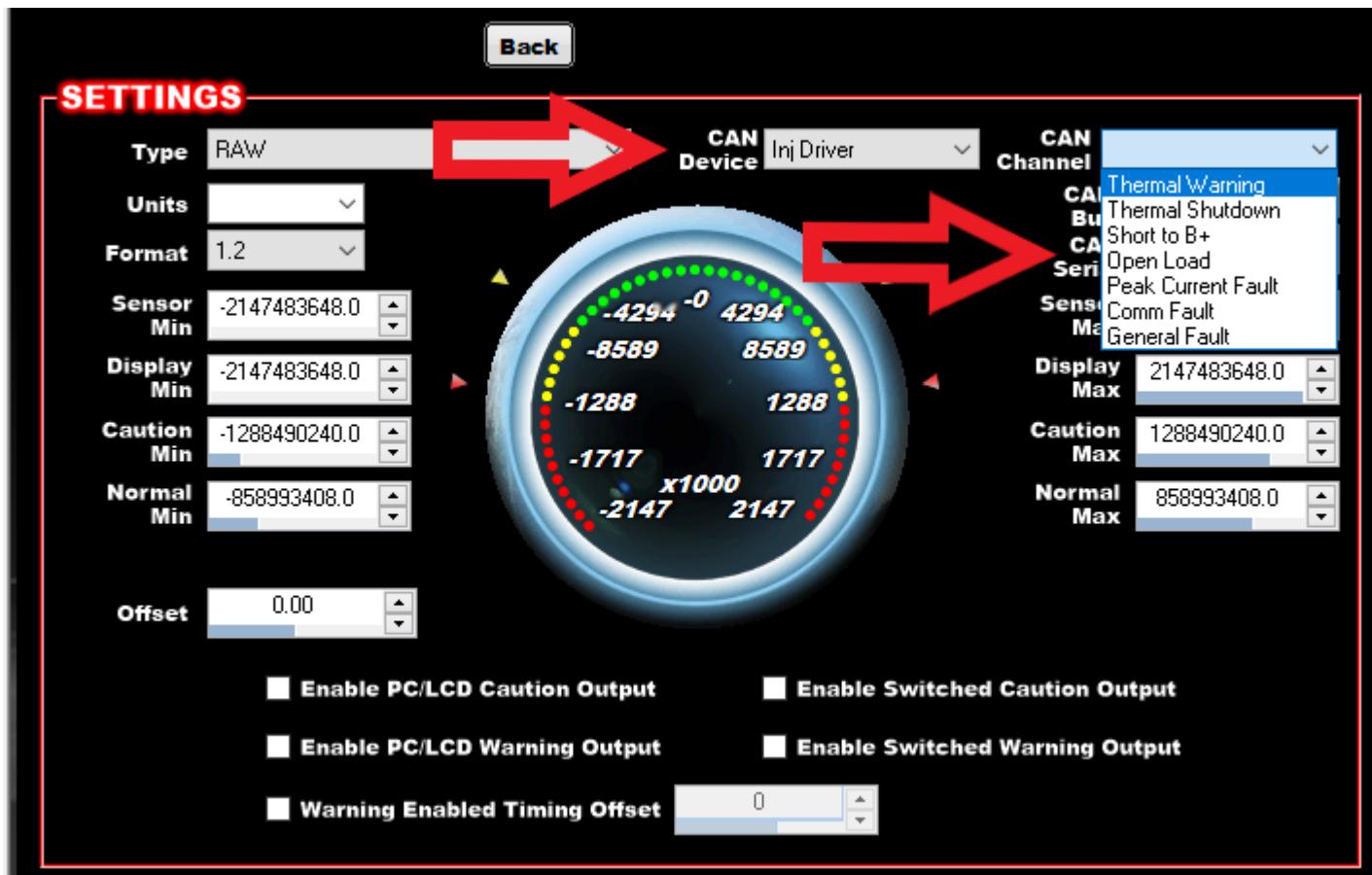
CAN Fault Setup

Software Setup (version V5 build 110 or above is required for CAN diagnostics to work)

1. Start by selecting a CAN channel in the I/O ICF.

Inputs 1-20		Inputs 21-40		Inputs 41-60		Inputs 61-80	
INPUTS							
NAME	TYPE	ECU PIN	ENABLE	Configure	Where Used	Configure	Where Used
#1	CAN	NOT DEFINED	<input checked="" type="checkbox"/> Enable	Configure	Where Used	Configure	Where Used
#2	+12V	NOT DEFINED	<input type="checkbox"/> Enable	Configure	Where Used	Configure	Where Used
#3	GROUND	NOT DEFINED	<input type="checkbox"/> Enable	Configure	Where Used	Configure	Where Used
#4	DIGITAL SPEED/FREQ	NOT DEFINED	<input type="checkbox"/> Enable	Configure	Where Used	Configure	Where Used
#5	IPU SPEED/FREQ	NOT DEFINED	<input type="checkbox"/> Enable	Configure	Where Used	Configure	Where Used
#6	5 VOLT	NOT DEFINED	<input type="checkbox"/> Enable	Configure	Where Used	Configure	Where Used
#7	20 VOLT	NOT DEFINED	<input type="checkbox"/> Enable	Configure	Where Used	Configure	Where Used
#8	THREE WIRE CAN	NOT DEFINED	<input type="checkbox"/> Enable	Configure	Where Used	Configure	Where Used
#9	GROUND	NOT DEFINED	<input type="checkbox"/> Enable	Configure	Where Used	Configure	Where Used
#10	GROUND	NOT DEFINED	<input type="checkbox"/> Enable	Configure	Where Used	Configure	Where Used

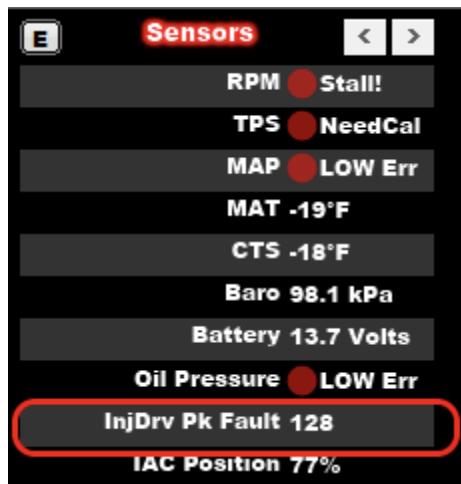
2. Select configure on the new channel and select the Inj Drive for the CAN device. Then, select the CAN Channel you would like to add.



3. Next select the CAN bus. "CAN BUS 1" is the connector on the main harness. "CAN BUS 2" is on the J3 connector available only on Dominator ECUs.
4. Enter the "CAN Serial" that matches your controller. This is a unique number and will be different on each controller. It can be found on the bottom sticker of the controller.

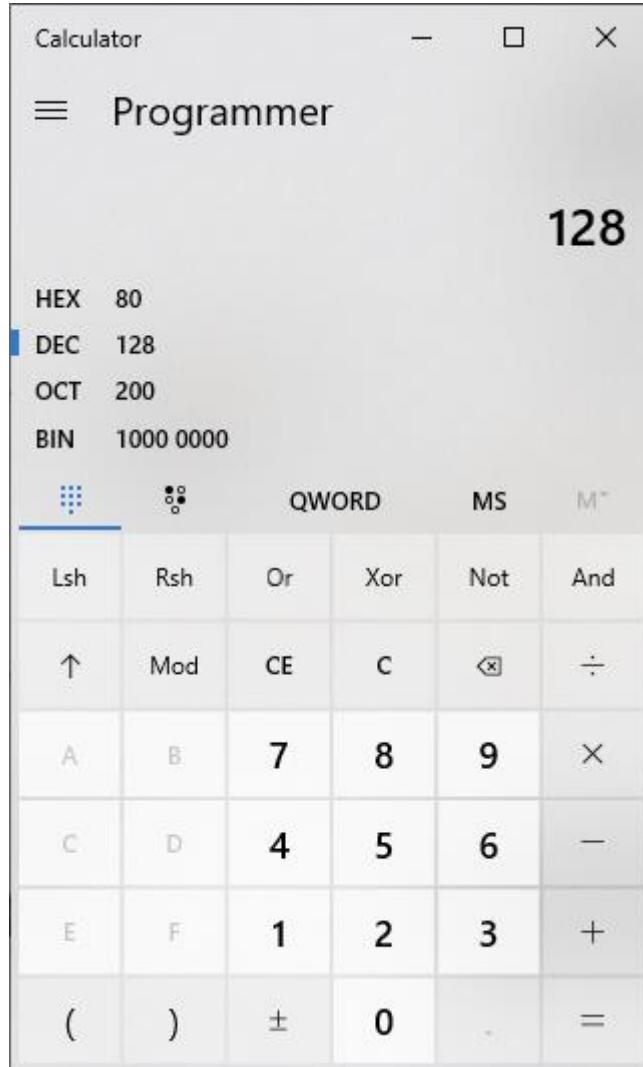
CAN Fault review

Since each fault can be active for up to 8 channels, you will need to "decode" the fault to tell which channel is giving a fault. Below is an example of an injector driver peak current fault giving code 128.



The easiest way to decode the code is to take 128 and input it to a binary converter. Windows Calculator can be used for this.

Open up windows calculator (Windows 10 version shown). Click the menu (3 horizontal lines) and change to programmer mode, then type in the value read from the module (e.g., 128). The calculator will show the binary value (e.g., 1000 0000) next to the letters BIN. Each digit in the BIN number will correspond to a cylinder of the injector driver with cylinder 1 being the right most digit and counting up to the left. In this example, there is a fault only on Channel 8 as shown by the 8th digit from the right displaying a 1 instead of 0.



Fault Output Wires

FAULT OUTPUT (Pin 2)

The fault output signal is a low-side drive output that will activate whenever a fault is detected. It is suggested that users hook this up to a ground input on their EFI and/or to a “fault light” for diagnostic purposes. The fault output will activate for a minimum of 10ms after which it will remain active if the fault persists. Once the fault has cleared, the output deactivate until another fault occurs.

FAULT CODE OUTPUT (Pin 23)

The fault code output signal is 0 – 5V analog voltage output that provides more details about a fault after the fault output (pin 2) has activated. The fault code output will send two pulses, each 100ms long. The 1st pulse will indicate the type of fault that was detected, and the 2nd will indicate the channel that it occurred on (if applicable). Connect this to a 0-5V/analog input on the ECU. Encoding of the signals is as follows:

Fault Type (1 st pulse)		
Fault Code Voltage	Fault Number	Fault Type
0.5V	1	Thermal Shutdown
1.0V	2	Undervoltage Fault
1.5V	3	Oversupply Fault
2.0V	4	Output Shorted to Battery
2.5V	5	Output Open Load
3.0V	6	No Configuration Found
3.5V	7	Injector Power Not Present
4.0V	8	Wiring Fault
4.5V	9	Injector Not Hitting Peak Current

Fault Channel	
Vault Code Voltage	Channel
0.5V	1
1.0V	2
1.5V	3
2.0V	4
2.5V	5
3.0V	6
3.5V	7
4.0V	8

Fault pulse pairs will be separated by a 5V pulse marker in between to help differentiate different faults.

Stored Faults

The Injector Module will store the latest fault for diagnostic use, and will retain the fault over a single power cycle. On startup, once the unit has flashed the stored configuration, it will flash the stored fault code if it exists. The Fault Number will be flashed first in Red, followed by the Fault Channel (if applicable) in Blue. At any time during this sequence, if an injector pulse is received the LEDs will revert to their normal operating behavior.

NOTE: the Injector Not Hitting Peak fault is not stored, and will not be displayed on startup, but will be output on the fault outputs as it occurs.

Pinout

2-Pin Power

The 2-pin power uses the same power connector as Holley EFI ECU's. (Positive on left when looking at connector on device with latch on top).

- Ground is on Pin A
- Batt+ is on Pin B

34-Pin Connector

Pin Number	Signal	Pin Number	Signal
1	Injector #1 Output	18	Injector #3 Output
2	Fault Switched Output	19	
3		20	
4	Injector #6 Input	21	
5	Injector #7 Input	22	
6	Injector #8 Input	23	Fault Analog/Code Output
7		24	CANH
8	Low-Drive Configuration	25	Injector #7 Output
9	Injector #5 Output	26	Injector #4 Output
10	Injector #2 Output	27	Injector #1 Input
11	+12V_SWITCHED	28	Injector #2 Input
12		29	Injector #3 Input
13		30	Input Drive Configuration
14		31	Injector #4 Input
15		32	CANL
16	High-Side Drive Configuration	33	Injector #5 Input
17	Injector #6 Output	34	Injector #8 Output

Wiring

Wiring is supplied with the 554-142 that allows wiring from a Holley EFI HP/Dominator ECU to the injector driver module and from the injector driver box to an injector harness. A metripak 150 crimper will be needed to install the supplied injector connector. The injector driver module uses the same connector and pin type that the HP and Dominator ECU uses. Wires are supplied that have the proper pins pre-crimped on them and installed in the connector. If these are shortened, loose pins are included to re-terminate these wires. A Holley PN 567-100 crimping tool can be used for this.

There are two likely wiring scenarios that will be performed using a Holley EFI ECU on an 8 cylinder engine. The first will cover using the driver module with eight injector driver outputs. The second will cover using injector driver boxes with 2 sets of injectors with the V5 "custom" injection type strategy. For more information on 16 injector setup please review our multiple injector setup document here:

https://documents.holley.com/techlibrary_199r11696.pdf

Wiring Size

Individual Injector Trigger Wire - The wiring supplied for individual injector triggers is 18 gauge. 20 gauge is usually adequate, but with some of the more aggressive current settings, it is better to use larger wire.

Injector Power Feed - The user must supply wire for injector power. There is no harm in using larger gauge wire. It is recommended to use a 10-14 gauge wire, split into two 18 gauge wires (as short as possible) at the 10 pin metripak connector. Use a minimum of a 40A relay to power a set of 8 injectors. The injector power is NOT supplied or run through the injector driver box.

Supplied Wiring Components:

Loose Wires

Qty	Length	Component	Terminations	Use
1	6'	18 Ga Black Wire	Terminal/Terminal	ECU to Driver Module
1	6'	18 Ga Black Wire	Terminal/Cut	Driver Module to Injector Harness
1	6'	18 Ga Blue Wire	Terminal/Terminal	ECU to Driver Module
1	6'	18 Ga Blue Wire	Terminal/Cut	Driver Module to Injector Harness
1	6'	18 Ga Grey Wire	Terminal/Terminal	ECU to Driver Module
1	6'	18 Ga Grey Wire	Terminal/Cut	Driver Module to Injector Harness
1	6'	18 Ga Green Wire	Terminal/Terminal	ECU to Driver Module
1	6'	18 Ga Green Wire	Terminal/Cut	Driver Module to Injector Harness
1	6'	18 Ga Yellow Wire	Terminal/Terminal	ECU to Driver Module
1	6'	18 Ga Yellow Wire	Terminal/Cut	Driver Module to Injector Harness
1	6'	18 Ga Brown Wire	Terminal/Terminal	ECU to Driver Module
1	6'	18 Ga Brown Wire	Terminal/Cut	Driver Module to Injector Harness
1	6'	18 Ga Purple Wire	Terminal/Terminal	ECU to Driver Module
1	6'	18 Ga Purple Wire	Terminal/Cut	Driver Module to Injector Harness
1	6'	18 Ga Orange Wire	Terminal/Terminal	ECU to Driver Module
1	6'	18 Ga Orange Wire	Terminal/Cut	Driver Module to Injector Harness
1	6'	20 Ga Red/White	Terminal/Cut	Must be installed in Pin 11
1	4"	20 Ga White	Terminal/Terminal	Must be installed per instructions

Components

Qty		Component		Use
15		Cavity Plug		Install in open connector cavities
12		Loose Terminals (bagged)		Use for re-terminations if needed
1		Module Connector		Populate with proper wires
1		Bagged Injector Connector/Pins/Seals/TPA		Used to assemble new Injector Connection

Main Power Harness

Qty		Component		Use
1		Main Power/Ground		Main Power/Ground for Module

Required Wires!! – The following are REQUIRED connections. These are in addition to the injector input and output wires. These are NOT indicated on the injector wiring diagrams below.

Injector Driver Module Power Harness – An injector driver module power harness is supplied. This should be connected to battery power and ground. A fuse can be added if desired. Use a 30A fuse if installed. The red wire goes to battery power and the black to ground. Make sure you do NOT short the power to ground, or damage may result. Terminals and heat shrink are supplied. **REQUIRED CONNECTION**

Switched Power Wire – The included 20 ga red/white wire needs to be installed in pin #11. This should be run to a switched ignition power source. This draws less than 1 Amp. **REQUIRED CONNECTION**

Injector Drive Configuration Jumper – The included 4" white jumper wire must be installed in one of the two configuration methods (**ONE REQUIRED**):

“Low Side Driven Injector Drivers” – EFI systems, which include any Holley EFI system, where the ECU triggers the injectors with a ground (meaning the injectors have a constant battery power feed), need to connect the white wire jumper from pin #8 to pin #30.

“High Side Driven Injector Drivers” – If the EFI system triggers the injectors with a 12v/battery voltage signal (meaning the injectors have a constant ground applied), need to connect the white jumper wire from pin #16 to pin #30.

Optional Wires:

Switched Fault Output – Pin 2 – This is a ground output (connect to a ground input on an ECU) that will activate whenever a fault is detected. See the fault output signal area for more information. This can be datalogged.

Analog Fault Output – Pin 23 – This is a 0-5V analog output voltage (connect to a 0-5V analog input on an ECU) that provides more detail when a fault occurs. See the fault output signal area for more information. This can be datalogged.

Wiring Scenario 1 – Eight injector inputs in and eight out to injectors

This scenario would be when using eight injector outputs on the Holley EFI J1B connector (either HP or Dominator ECUs) or any ECU with eight injector triggers on a V8 engine. The eight ECU outputs simply go into the eight driver box inputs, and eight outputs are run to the injectors. See Diagram 1 below.

NOTE: See the REQUIRED WIRES section for other required wires!

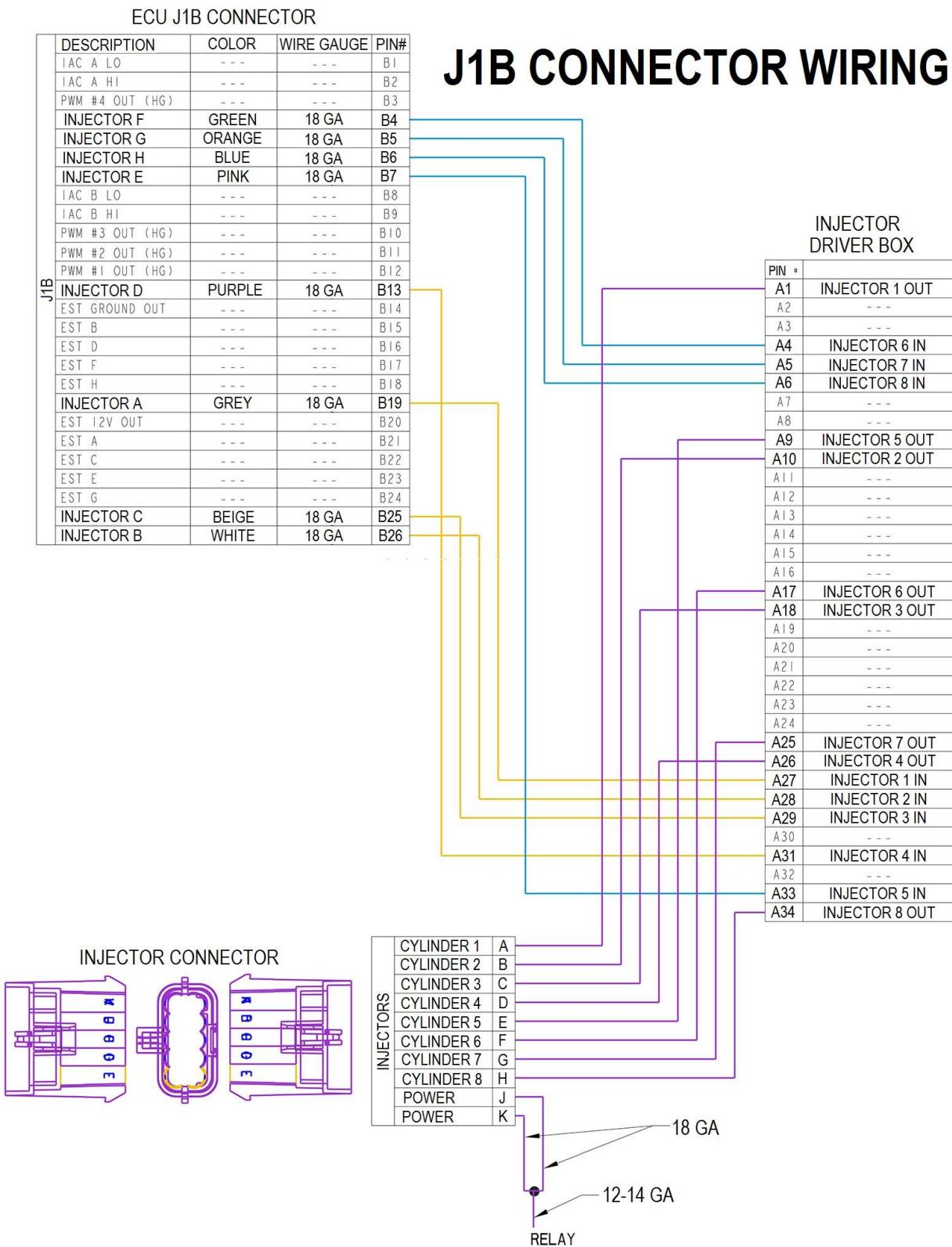


Diagram 1

Wiring Scenario 2 – V5 “Custom Injection” outputs for 2nd and 3rd set of 8 injectors

The following tables show how to wire a second and third injector set using the custom injector strategy in V5 and Holley PN 554-142/143 external injector driver box on an eight cylinder engine. A diagram is also included beneath the tables for wiring the 2nd injector set inputs and outputs.

NOTE: See the REQUIRED WIRES section for other required wires!

The tables below are for ECU to driver box wiring.

Injector Set 2			
ECU J2B - (PWM-)		Driver box	
Cylinder	J2B Pin	Cylinder	Pin
Cylinder 1	B12	Cylinder 1	A27
Cylinder 2	B6	Cylinder 2	A28
Cylinder 3	B8	Cylinder 3	A29
Cylinder 4	B21	Cylinder 4	A31
Cylinder 5	B5	Cylinder 5	A33
Cylinder 6	B11	Cylinder 6	A4
Cylinder 7	B3	Cylinder 7	A5
Cylinder 8	B9	Cylinder 8	A6

Injector Set 3			
ECU J2B - (PWM-)		Driver box	
Cylinder	J2B Pin	Cylinder	Pin
Cylinder 1	B24	Cylinder 1	A27
Cylinder 2	B25	Cylinder 2	A28
Cylinder 3	B2	Cylinder 3	A29
Cylinder 4	B1	Cylinder 4	A31
Cylinder 5	B4	Cylinder 5	A33
Cylinder 6	B10	Cylinder 6	A4
Cylinder 7	B22	Cylinder 7	A5
Cylinder 8	B23	Cylinder 8	A6

**J2B CONNECTOR WIRING
V5 CUSTOM INJECTION TYPE
2ND INJECTOR SET**

INJECTOR DRIVER

PIN#	DESCRIPTION	COLOR	WIRE GA.
A1	INJECTOR 1 OUTPUT	GREY	18 GA
A2		---	---
A3		---	---
A4	INJECTOR 6 INPUT	GREEN/BLACK	20 GA
A5	INJECTOR 7 INPUT	ORANGE/BLK	20 GA
A6	INJECTOR 8 INPUT	BLUE/BLACK	20 GA
A7		---	---
A8		WHITE	20 GA
A9	INJECTOR 5 OUTPUT	PINK	18 GA
A10	INJECTOR 2 OUTPUT	WHITE	18 GA
A11		RED/WHITE	---
A12		---	---
A13		---	---
A14		---	---
A15		---	---
A16		---	---
A17	INJECTOR 6 OUTPUT	GREEN	18 GA
A18	INJECTOR 3 OUTPUT	BEIGE	18 GA
A20		---	---
A21		---	---
A22		---	---
A23		---	---
A24		---	---
A25	INJECTOR 7 OUTPUT	ORANGE	18 GA
A26	INJECTOR 4 OUTPUT	VIOLET	18 GA
A27	INJECTOR 1 INPUT	GREY/BLACK	20 GA
A28	INJECTOR 2 INPUT	WHITE/BLACK	20 GA
A29	INJECTOR 3 INPUT	BEIGE/BLACK	20 GA
A30		---	---
A31	INJECTOR 4 INPUT	VIOLET/BLACK	20 GA
A32		---	---
A33	INJECTOR 5 INPUT	PINK/BLACK	20 GA
A34	INJECTOR 8 OUTPUT	BLUE	18 GA

J2B ECU

DESCRIPTION	COLOR	WIRE GA.	PIN#
---	---	---	B1
---	---	---	B2
INJECTOR 7 OUTPUT	ORANGE/BLK	20 GA	B3
---	---	---	B4
INJECTOR 5 OUTPUT	PINK/BLACK	20 GA	B5
INJECTOR 2 OUTPUT	WHITE/BLACK	20 GA	B6
---	---	---	B7
INJECTOR 3 OUTPUT	BEIGE/BLACK	20 GA	B8
INJECTOR 8 OUTPUT	BLUE/BLACK	20 GA	B9
---	---	---	B10
INJECTOR 6 OUTPUT	GREEN/BLACK	20 GA	B11
INJECTOR 1 OUTPUT	GREY/BLACK	20 GA	B12
---	---	---	B13
---	---	---	B14
---	---	---	B15
---	---	---	B16
---	---	---	B17
---	---	---	B18
---	---	---	B19
---	---	---	B20
INJECTOR 4 OUTPUT	VIOLET/BLK	20 GA	B21
---	---	---	B22
---	---	---	B23
---	---	---	B24
---	---	---	B25
---	---	---	B26

INJECTOR OUTPUTS

DESCRIPTION	COLOR	WIRE GA.	CAVITY ECU PIN
INJECTOR 1 OUTPUT	GREY	18 GA	A A1
INJECTOR 2 OUTPUT	WHITE	18 GA	B A10
INJECTOR 3 OUTPUT	BEIGE	18 GA	C A18
INJECTOR 4 OUTPUT	VIOLET	18 GA	D A26
INJECTOR 5 OUTPUT	PINK	18 GA	E A9
INJECTOR 6 OUTPUT	GREEN	18 GA	F A17
INJECTOR 7 OUTPUT	ORANGE	18 GA	G A25
INJECTOR 8 OUTPUT	BLUE	18 GA	H A2
B+	RED	18 GA	J LOOSE
B+	RED	18 GA	K LOOSE

