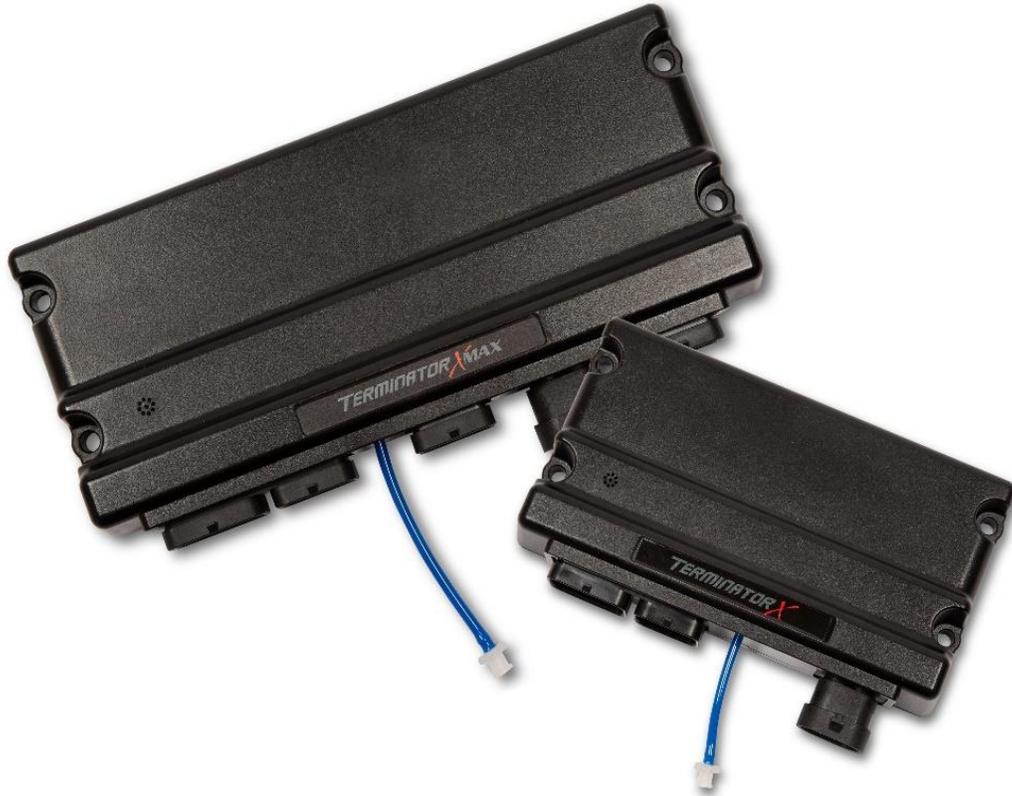


# TERMINATOR<sup>™</sup>X

# TERMINATOR<sup>™</sup>X MAX



## Gasoline Direct Injection Controller: GM Gen V LTx

Min Software Version: Term X V2 build 20

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## Overview:

The GDI Controller is designed to work in tandem with Holley Terminator X ECUs to control GM Gen V engines. It provides various functions such as fuel rail pressure control, variable cam timing, and diagnostic information via the Terminator X V2 Software. On stock engines the Terminator X handheld can be used to setup the calibration meaning that no laptop is required.

## Wiring

The Wiring Harness for the GDI Controller has 5 main connections.

GDI Controller Connectors – These two connectors plug into the GDI Controller

INJ ODD and EVEN Connections – these two connectors plug into their respective bank of the engine injector sub harnesses and control the injectors, high pressure pump, as well as read rail pressure.

Injector Inputs Connection – This plugs directly into the injector connector on the engine main harness and is what tells the GDI controller how much fuel to inject

Bulkhead – This also plugs into the engine main harness GDI connector and carries all of the shared signals between the two harnesses.

## Fuel Pressure Sensor Differences:

There are two different fuel pressure sensors that GM uses with the Gen V LTx engines. Depending on which one your engine has will determine which kit/harness is required. The Sensor is mounted to the back of the driver side fuel rail (as shown below). Compare your sensor to the pictures below to determine if you have an early or late sensor.

**WARNING!** This type of work **MUST** be performed in a well-ventilated area. Do not smoke or have an open flame present near gasoline vapors or an explosion may result.

**NOTE:** The fuel rail pressure sensor and the matching fuel rail have different tapers to seal the fuel. They can NOT be swapped without using the matching fuel rail. A high pressure leak and fire can result if you use the incorrect rail pressure sensor.



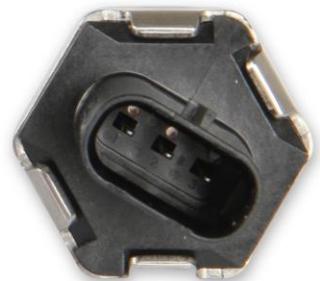
EARLY



LATE



EARLY



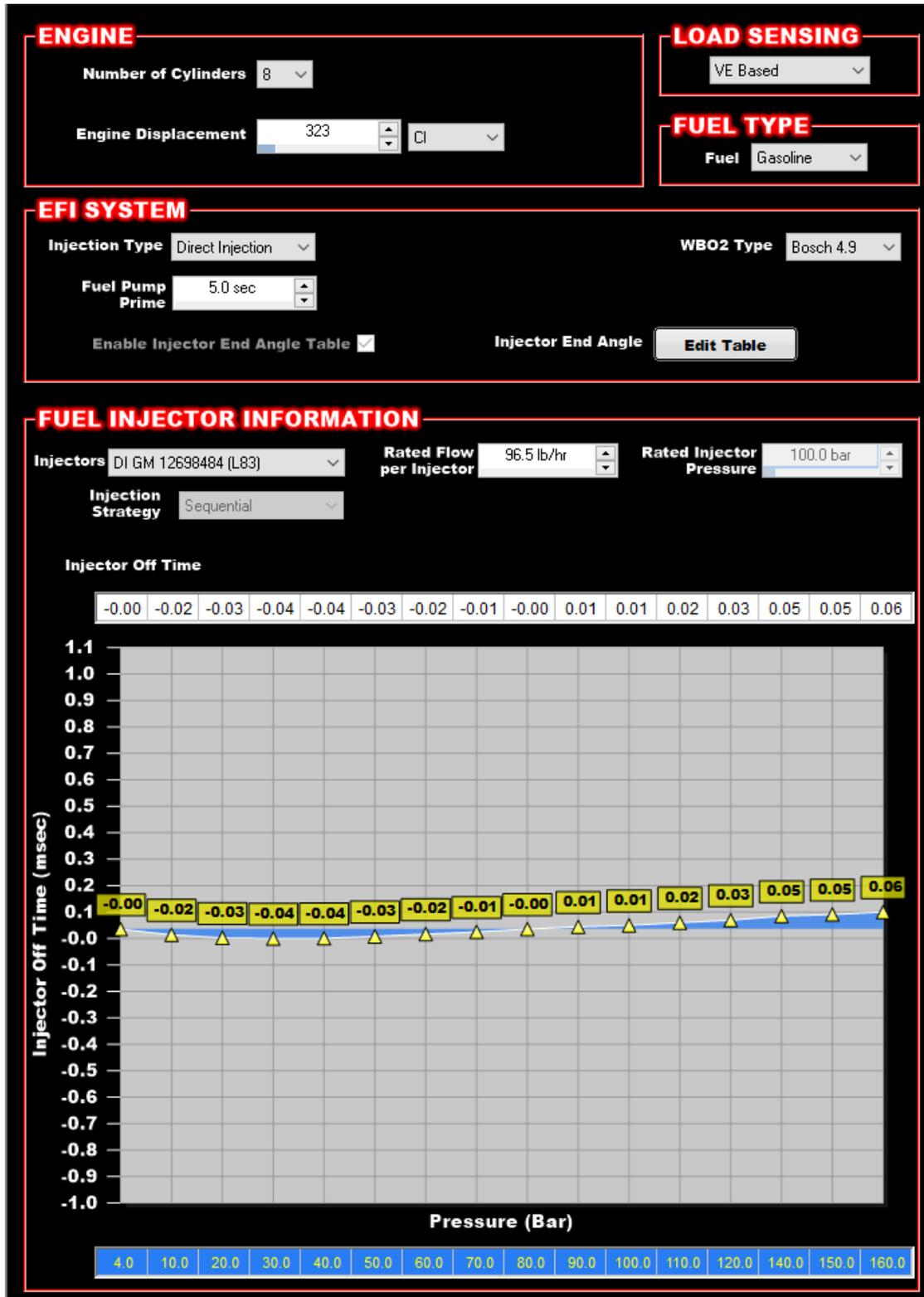
LATE

## Software:

Several new options have been added under the system ICF including a new injection type, new crank and cam options, a Variable Cam Timing option, and revisions to the DI Target Fuel Pressure.

### Engine Setup -

Direct Injection has been added as a new injection type. It enables the DI Target Fuel Pressure Table as well as changes the rest of the engine setup to a direct injection specific layout.





# VCT Tables

The VCT Tables are prepopulated with data for each of the Gen V engines. There is also a custom option, which simply unlocks the currently selected table. For example, if you want to modify the VCT table but think the L83 table is a good starting point then make sure to select the L83 option and then the custom option to unlock it.

**NOTE:** Changing the cam position can have a large effect on airflow. Care should be taken to retune fuel and spark after making changes to the VCT table.

**SYSTEM PARAMETERS** ^ x

ECU Configuration

Engine Parameters

Ignition Parameters

Dwell Time

Sensor Scaling/Warnings +

Basic I/O +

Closed Loop/Learn +

Variable Cam Timing

DI Target Fuel Pressure

Injector Phasing

Individual Cylinder

Inputs/Outputs

SETUP

Enable

Engine Type GM Gen V LTx

Engine Subtype L83

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CAM SETTINGS

Graph X Axis RPM Y Axis Grams/Cyl

	0.60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	3.0	4.0	4.0	6.0	8.0
	0.52	0.0	1.0	4.0	5.0	7.0	8.0	9.0	9.0	9.0	6.0	7.0	5.0	5.0	5.0	6.0	6.0
	0.48	0.0	3.0	7.0	9.0	11.0	11.0	12.0	13.0	11.0	8.0	8.0	6.0	6.0	6.0	6.0	6.0
	0.44	0.0	6.0	11.0	15.0	14.0	15.0	15.0	16.0	12.0	10.0	6.0	7.0	7.0	7.0	7.0	7.0
	0.40	0.0	7.0	14.0	16.0	16.0	17.0	18.0	18.0	14.0	12.0	10.0	11.0	7.0	7.0	7.0	7.0
	0.36	0.0	9.0	16.0	18.0	19.0	20.0	20.0	21.0	17.0	13.0	12.0	12.0	10.0	10.0	8.0	8.0
	0.32	0.0	11.0	18.0	21.0	22.0	22.0	23.0	23.0	18.0	15.0	14.0	12.0	12.0	12.0	10.0	8.0
	0.28	0.0	15.0	22.0	24.0	24.0	25.0	24.0	23.0	18.0	17.0	17.0	17.0	18.0	20.0	12.0	13.0
	0.24	0.0	15.0	20.0	24.0	24.0	24.0	25.0	26.0	22.0	19.0	20.0	22.0	22.0	28.0	18.0	15.0
	0.20	0.0	11.0	17.0	20.0	24.0	24.0	24.0	25.0	24.0	23.0	24.0	28.0	28.0	28.0	23.0	20.0
	0.16	0.0	4.0	6.0	10.0	12.0	14.0	16.0	22.0	24.0	24.0	28.0	28.0	27.0	28.0	26.0	18.0
	0.14	0.0	2.0	5.0	6.0	8.0	9.0	11.0	16.0	18.0	18.0	20.0	20.0	21.0	20.0	20.0	16.0
	0.12	0.0	0.0	2.0	2.0	3.0	4.0	6.0	10.0	12.0	12.0	12.0	13.0	14.0	14.0	14.0	14.0
	0.10	0.0	0.0	2.0	2.0	3.0	4.0	6.0	10.0	12.0	12.0	12.0	13.0	14.0	14.0	14.0	14.0
	0.08	0.0	0.0	2.0	2.0	3.0	4.0	6.0	10.0	12.0	12.0	12.0	13.0	14.0	14.0	14.0	14.0
	0.04	0.0	0.0	2.0	2.0	3.0	4.0	6.0	10.0	12.0	12.0	12.0	13.0	14.0	14.0	14.0	14.0
		400	600	800	1200	1400	1600	1800	2200	2800	3200	3600	4000	4400	4800	5200	6400

RPM [RPM]

# Injector Phasing

Injector Phasing is quite important to the function of a direct injection engine. If you move the phasing too far the engine will effectively stop running. All Terminator X wizard cals have an injector phasing table configured to work with stock engines.

**NOTE:** The auto calculation feature of the injector end angle table is disabled with direct injection.

File Save Toolbox Offline Help Help ? Datalog

SYSTEM PARAMETERS

ECU Configuration

Engine Parameters

Ignition Parameters

Dwell Time

Sensor Scaling/Warnings +

Basic I/O +

Closed Loop/Learn +

Variable Cam Timing

DI Target Fuel Pressure

Injector Phasing

Individual Cylinder

Inputs/Outputs

OPEN
CLOSE
DURATION

Cam Intake	0.0° BTDC	0.0° ABDC	180.0°
Cam Exhaust	0.0° BBDC	0.0° ATDC	180.0°
Cam Advance/Retard	0.0°	(-) Retard (+) Advance	Lobe Separation Angle: 90.0°
Injector Placement	0.0 inches		Overlap: 0.0°
Injector Phase Offset	0.0°		Intake Centerline (Abs): 90.0° Intake Centerline (EFI): -90.0°

Graph
Recalculate

Injector End Angle (°)

	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
105	-114.1	-124.7	-97.0	-107.0	-102.0	-111.4	-109.0	-89.9	-111.3	-126.1	-136.8	-126.3	-139.0	-152.1	-165.5	-179.2
100	-111.4	-118.9	-89.6	-107.0	-126.5	-103.6	-102.6	-101.0	-103.3	-115.4	-125.9	-117.5	-131.8	-146.8	-162.4	-178.7
95	-108.9	-114.1	-90.7	-107.8	-117.8	-111.5	-118.9	-108.4	-103.8	-108.5	-116.0	-108.6	-122.3	-137.2	-152.8	-169.2
90	-106.3	-109.9	-97.0	-98.5	-106.7	-128.9	-132.0	-110.3	-104.9	-105.6	-110.1	-103.8	-117.1	-133.0	-149.5	-167.0
84	-105.0	-105.0	-101.7	-103.6	-115.5	-123.0	-129.2	-110.8	-106.0	-106.4	-109.1	-105.6	-118.0	-132.8	-148.1	-164.4
79	-107.2	-107.2	-100.7	-125.5	-131.1	-129.0	-108.1	-104.9	-107.2	-106.8	-109.9	-107.5	-118.7	-132.8	-148.3	-164.3
74	-112.7	-112.7	-116.6	-134.8	-136.9	-133.6	-96.8	-92.9	-98.7	-105.3	-110.0	-106.3	-116.6	-128.9	-142.5	-157.1
69	-115.5	-115.5	-125.6	-136.0	-139.1	-139.8	-94.4	-78.3	-85.1	-93.3	-101.5	-100.0	-106.9	-116.6	-127.4	-139.0
64	-119.2	-119.2	-129.8	-137.4	-135.4	-143.6	-101.2	-75.1	-73.8	-79.0	-89.1	-97.4	-103.5	-111.7	-121.0	-130.8
59	-122.9	-122.9	-133.9	-138.5	-136.4	-143.2	-112.3	-82.3	-80.0	-85.3	-86.0	-86.9	-93.4	-100.8	-108.7	-117.0
54	-126.6	-126.6	-138.1	-142.7	-130.0	-139.9	-123.3	-119.2	-107.3	-104.2	-100.7	-99.8	-98.0	-104.4	-110.2	-117.1
49	-130.0	-130.0	-142.0	-147.0	-130.0	-139.8	-136.9	-137.8	-131.7	-127.0	-117.8	-105.2	-106.9	-112.8	-117.0	-121.3
44	-130.0	-130.0	-142.0	-147.0	-130.0	-140.0	-132.5	-132.0	-126.8	-122.3	-116.5	-101.9	-107.1	-111.8	-115.7	-119.4
39	-130.0	-130.0	-142.0	-147.0	-130.0	-140.0	-130.0	-127.9	-122.2	-116.5	-109.8	-94.1	-97.7	-101.1	-104.8	-108.6
34	-130.0	-130.0	-142.0	-147.0	-130.0	-140.0	-130.0	-125.0	-118.2	-111.6	-103.8	-86.7	-88.5	-90.4	-92.4	-94.8
3	-130.0	-130.0	-142.0	-147.0	-130.0	-140.0	-130.0	-125.0	-115.0	-108.0	-98.8	-80.0	-80.0	-80.0	-80.0	-80.0

(+) A Positive degree value indicates the fuel injection event will end after BDC of the intake stroke.  
 (0) A Zero degree value indicates the fuel injection event will end at BDC of the intake stroke.  
 (-) A Negative degree value indicates the fuel injection event will end before BDC of the intake stroke.

## Inputs/Outputs

### *Outputs:*

Output #4 is preconfigured in the wiring harness to control the 2-stage oil pump on Gen V engines. If left off the oil pump will default to the high oil pressure state. Turning the output on will lower the oil pressure.

### *Inputs:*

There is a large amount of I/O available from the GDI Controller. There are 4 main categories: Injectors, VVT, Pump, and Diagnostics. The categories and their respective parameters are described in detail below.

Note: If you use the Terminator X Handheld wizard to create a calibration the parameters with a \* before their name will automatically be added to the calibration on inputs 21-30.

#### Injectors:

- \* Injector PW 1-8: These 8 parameters are the delivered pulse width to each injector after all modifiers have been applied such as pressure compensation and dead times.
- \* Injector Faults 1234 and 5678 – Used for engineering purposes, this should always read 0. If it does not read 0 please Contact Holley Technical Service Dept.

#### VVT:

- Calculated Oil Temp: The calculated engine oil temperature from the GDI controller
- Desired Cam Position: This is the target cam position the GDI controller is trying to maintain after all modifiers have been applied. **Note:** the GDI desired cam position may not always match the Terminator X desired cam position, this is normal.
- \* Actual Cam Position: The actual position of the cam as reported by the GDI Controller
- Solenoid Duty cycle: The calculated duty cycle of the VVT solenoid
- Solenoid Current: The amperage reading of the VVT Solenoid circuit

#### Pump:

- \* Actual Fuel Rail Pressure: This is the rail pressure as measured by the GDI controller
- \* Faults: Used for engineering purposes, this should always read 0. If it does not read 0 please Contact Holley Technical Service Dept.
- 
- \* Start Angle: This is how many degrees before the peak of the fuel pump lobe that the high pressure pump solenoid is activated.
- Duration: This is how long, in degrees, the high pressure fuel pump solenoid is activated
- \* PID Output: This is the offset to the start angle to correct for error in the actual vs desired fuel pressure.
- CC/Stroke: This is the amount of fuel in CC per lobe stroke of the high pressure fuel pump.

## Diagnostics

- \* Cam Sync Status : Displays the current cam sensor syncing status based on the table below

<b>0</b>	SEEK_STALL
<b>1</b>	TOOTH_DETECTED
<b>2</b>	HALF_SYNC
<b>3</b>	FULL_SYNC

- \* Crank Sync Status: Displays the current crank sensor syncing status based on the table below

<b>0</b>	SEEK_STALL
<b>1</b>	TOOTH_DETECTED
<b>2</b>	HALF_SYNC
<b>3</b>	FULL_SYNC

- Crank Sync Count: Displays the current crank sensor status based on the table below

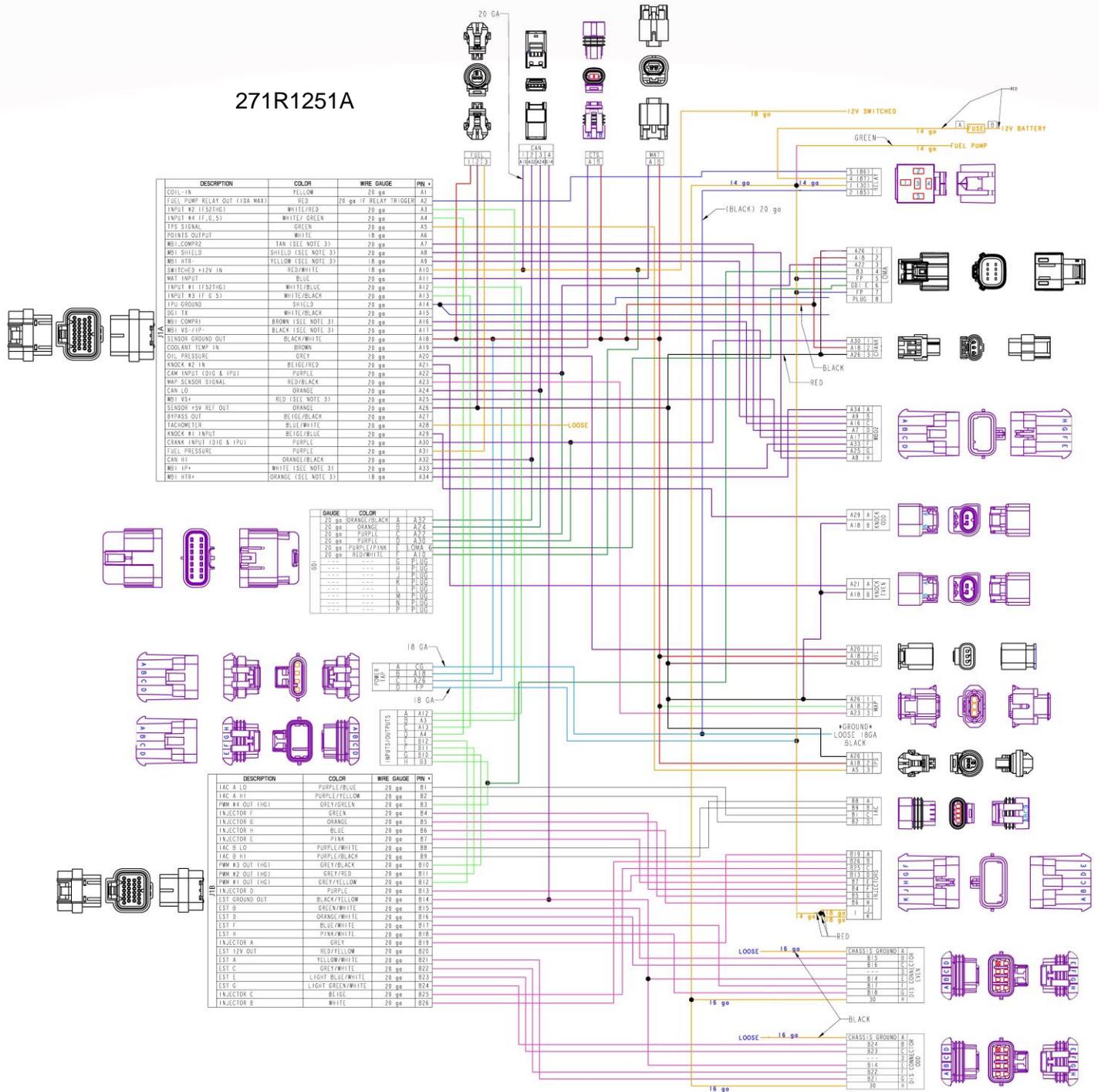
<b>1</b>	FIRST HALF CRANK SYNC
<b>2</b>	SECOND HALF CRANK SYNC

- Reserved 1-5: Used for engineering purposes, this should always read 0. If it does not read 0 please Contact Holley Technical Service Dept.
- Boost Converter Voltage: This is the voltage being delivered to the injectors.
- Boost Converter Faults: Used for engineering purposes, this should always read 0. If it does not read 0 please Contact Holley Technical Service Dept.
- Boost Converter MCU Faults: Used for engineering purposes, this should always read 0. If it does not read 0 please Contact Holley Technical Service Dept.
- Comms Faults: Used for engineering purposes, this should always read 0. If it does not read 0 please Contact Holley Technical Service Dept.
- PCB Temp: Internal temperature in Celsius of the GDI Controller
- 8V VCC: Actual voltage from the 8volt regulator
- 3.3V VCC: Actual voltage from the 3.3 volt regulator
- 5V VCC: Actual voltage from the 5 volt regulator

## LED Diagnostic Functions

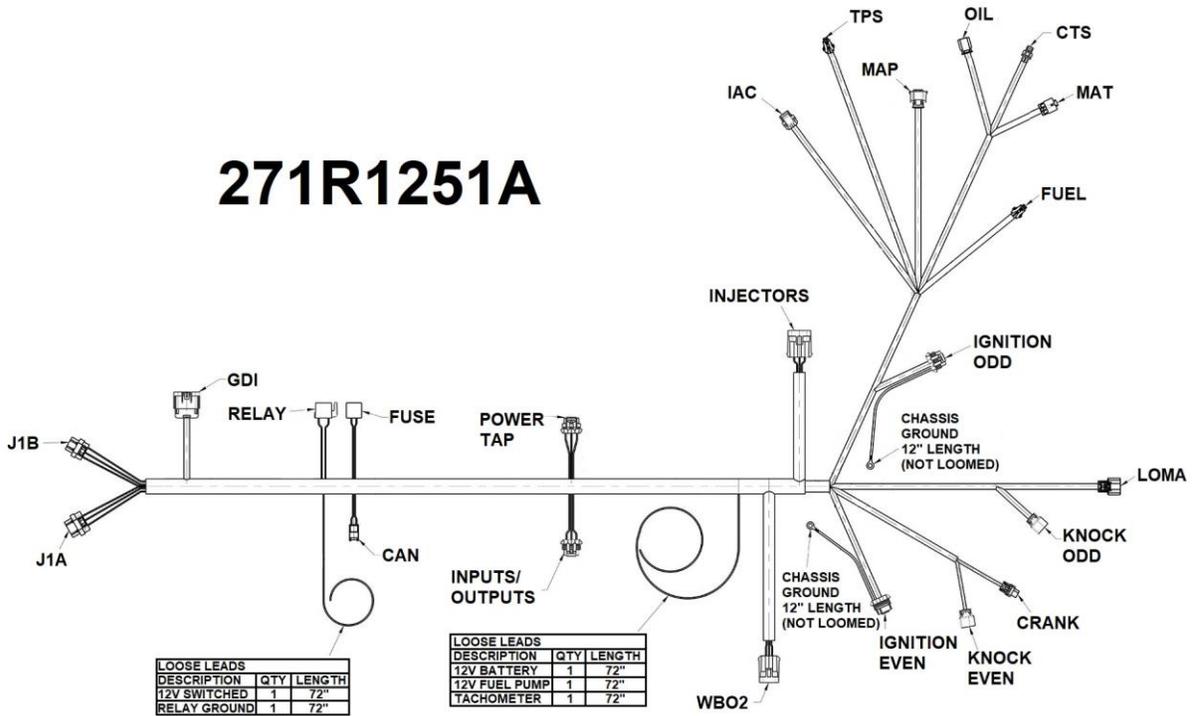
<u>LED #</u>	<u>FUNCTIONS</u>	<u>Color</u>	<u>Definition</u>
1	Heartbeat	Green - flashing 1 sec on / off	ECU is Powered
2	Sync Status	Green	Engine is running and crank and cam sensor are working properly
		Blue	No RPM detected
		Red - flashing 1 sec on / off	Error with crank or cam sensor
3	VVT	Green	VVT working normally
		Red	VVT Error detected resets with key cycle
			Cam was not able to meet target position
4	Pump Control	Green	High Pressure pump is functioning normally
		Red	Error with high pressure pump Resets with key cycle
5	DI injectors	Green	DI Injectors functioning normally
		Red	DI Injector error resets with key cycle
			Short/open circuit detected
			Overlapping injection event
6	Off/Undefined		Future
7	Off/Undefined		Future
8	Off/Undefined		Future

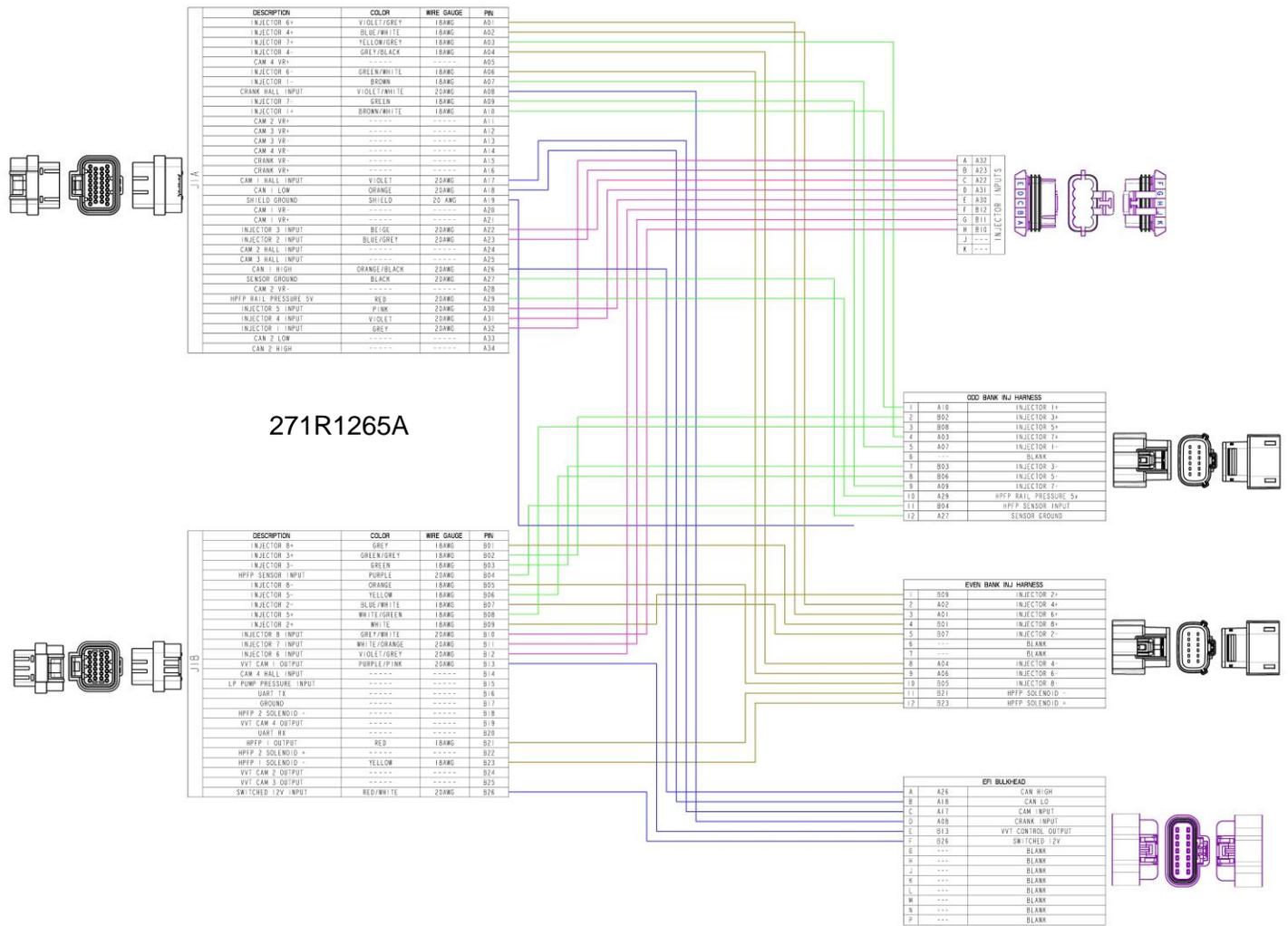
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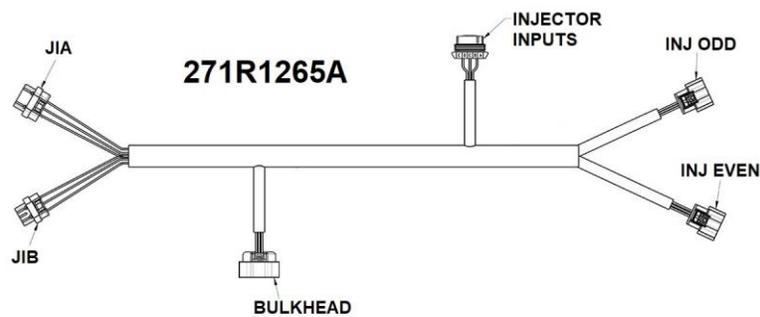
Please refer to the product page on [www.holley.com](http://www.holley.com) to view this pdf and be able to zoom in on the drawings.

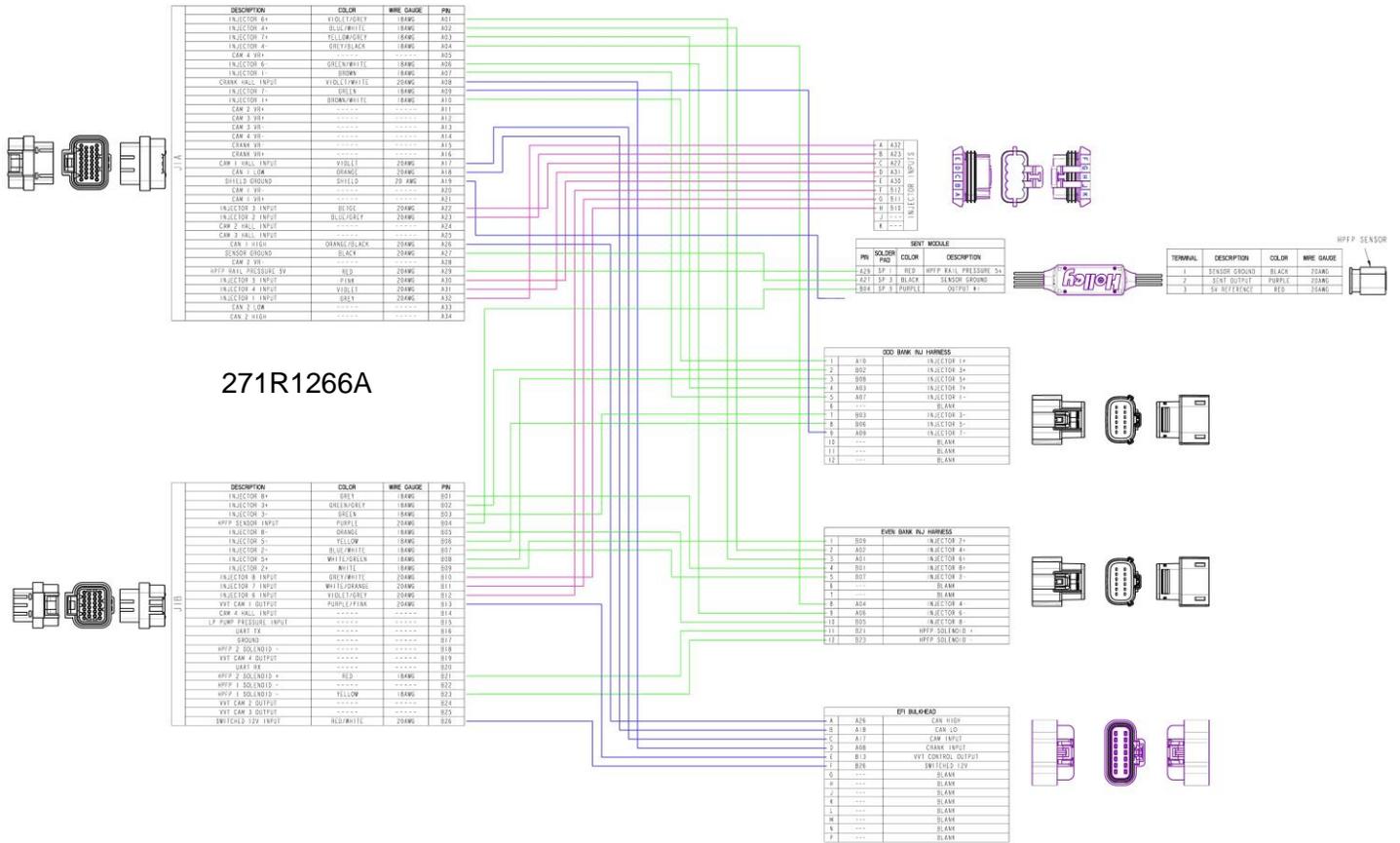
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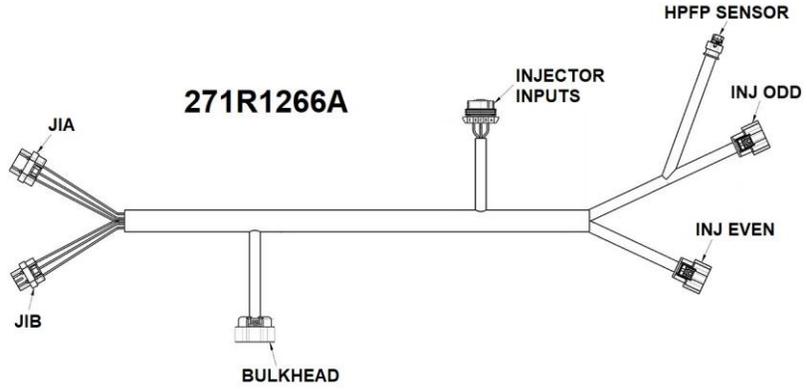


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