

INTELLIJECT DATASHEET

A. Overview

Intelliject is an Electronic Fuel Injection system designed by Power4Flight specifically for use in small engine aerospace applications.

Hardware features

- Onboard power conditioning (8-30 Volts in)
- Three injector outputs with fault detection on two
- Three ignition outputs
- Fuel pump control output
- PWM outputs for throttle and dual cowl flap control
- Manifold and dual barometric pressure sensors
- Dual redundant crank sense inputs
- Four configurable temperature inputs
- Fuel pressure input
- Analog and PWM throttle input
- MicroSD card slot for onboard data logging
- CAN and Serial communications
- Weights
 - Board Only: **29.0g** (1.02oz)
 - With Enclosure: 71.3g (2.51oz)
- Size
 - Board Only: **45mm x 75mm** (1.77" x 2.95")
 - With Enclosure: 51.4mm x 80.4 (2.03" x 3.17")



Software features

- Highly configurable for a variety of engine types (two/four-stroke, triples, twins, and singles)
- Designed to be integrated with third party systems, particularly flight controllers
- Free communications specification and software developer's kit
- Sophisticated and robust firmware designed for high reliability aerospace applications
- Choice of alpha-n or speed-density fuel injection with multi-variable compensation
- Direct throttle command, RPM control, or throttle sensing
- Configurable throttle limiting based on temperature, pressure, and/or speed
- Spark and injection interruption for rev limiting
- Injector skipping to improve injector dynamic range
- Fuel pump control using proportional or bang-bang fuel pressure feedback
- Fault detection and correction for MAT, MAP, Baro, CHT, fuel pressure, and crank sense
- Free user interface for engine and configuration development
- Onboard electronic log-booking, maintenance tracking, and data logging

B. Specifications

Table 1 Electrical specifications

Sub-system	Specification	Min	Max	Unit
Input Voltage	12V regulator installed	8.0	30.0	V
Input Voltage	12V regulator not installed	10.0	16.0	V
Input Current		0.2	3.0	A
12V Current	Available current depends on input voltage	2.0	5.0	A
6V Current		N/A	3.0	A
Injector Current	High impedance injectors (12 – 16 Ω)	N/A	4.0	A
Temperature	As measured on the PCB	-40	85	C
Input Enable	Ground to disable, HI-Z to enable	0.0	7.0	V
PWM input		0.0	5.0	V
Analog inputs	Fuel pressure and TPS	0.0	5.0	V
Temp inputs	Suitable for RTDs and Thermistors	50	100K	Ω
PWM outputs	Throttle, cooling 1, cooling 2, pump PWM	0.0	5.0	V

C. Electro-mechanical ICD

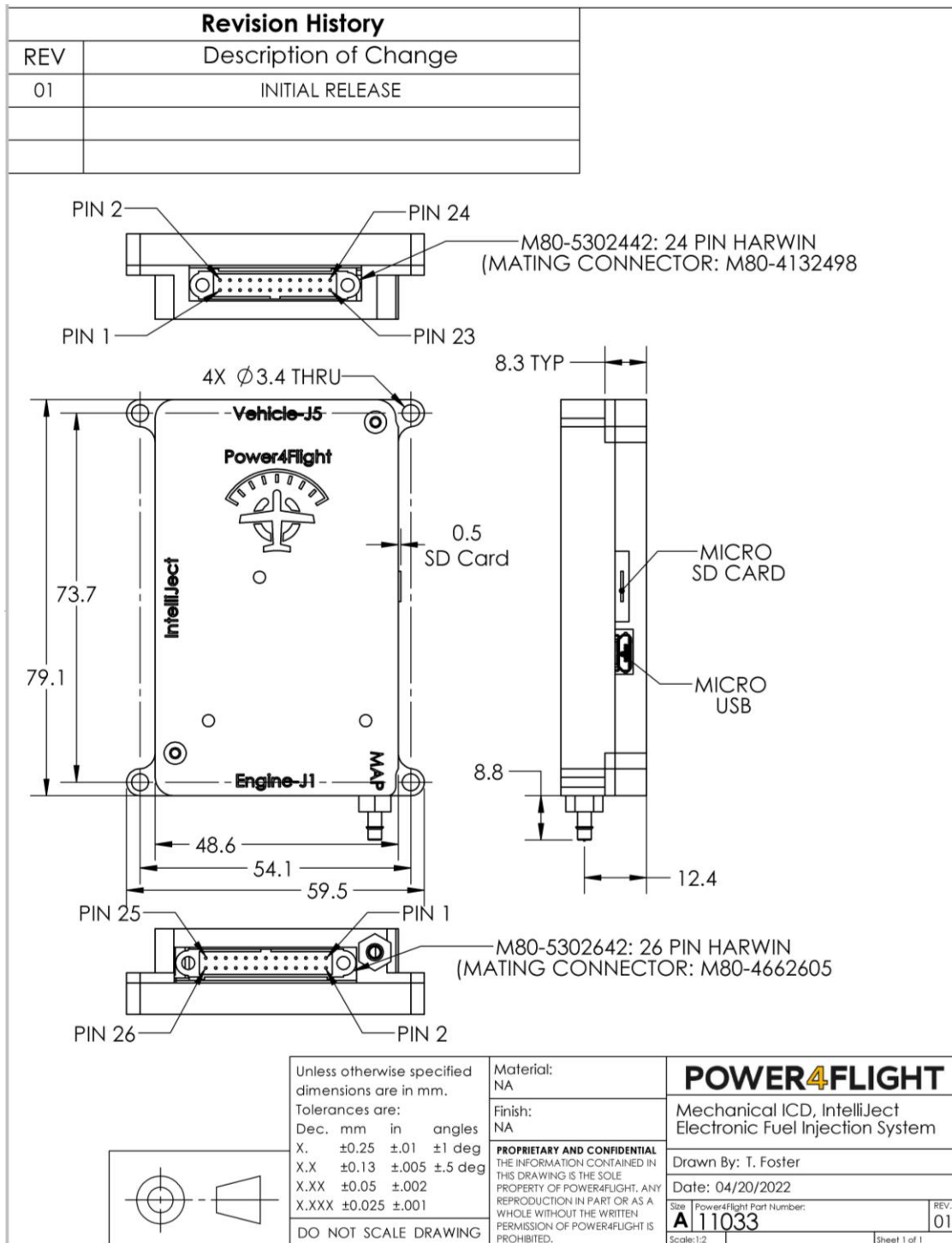


Figure 1: IntelliJect enclosure dimensions

D. Connector Pin Outs

Intelliject has two main connectors. One notionally faces the engine, and the other faces the vehicle, so they are referred to as the *Engine* and *Vehicle* connectors. The pinouts were changed slightly for revision 3 of Intelliject to provide more functionality. Revision 3 changes are in red; for earlier revisions, these signals should not be connected. Revision 4 changes are in green; and revision 5 changes are in blue.

1. Engine connector

The engine connector is Harwin part number M80-5302642, with mating connector M80-4662605. The connector has 26 pins in 2 rows of 13, as given in Table 2.

Table 2 Signals on the engine connector.

PIN	NAME	TYPE	DESCRIPTION
1	12V	OUTPUT	12.0V to injector 1
3	INJECTOR_1	INPUT	Primary low side injector driver
5	CDI_1_OUT	OUTPUT	6V Primary capacitive discharge ignition driver
7	6V	OUTPUT	CDI 1 power
9	GND	INPUT	CDI 1 return
11	CHT_1_SENSOR	OUTPUT	1.16 ma current source output -OR- configurable pull up
13	GND	INPUT	CHT 1 Return
15	MAT_SENSOR	OUTPUT	1.16 ma current source output -OR- configurable pull up
17	GND	INPUT	MAT return
19	THR_PWM_OUT	OUTPUT	Throttle servo signal
21	6V	OUTPUT	Throttle servo power
23	GND	INPUT	Throttle servo return
25	GND	INPUT	TPS return
2	TACH_1	INPUT	Hall sensor 1 input (5K internal pullup)
4	HEARTBEAT	OUTPUT	5V output: 1 ms pulse per crank revolution; alternate: spark3.
6	5VA	OUTPUT	Hall sensor 1/2 power
8	GND	INPUT	Hall sensor 1/2 return
10	CHT_2_SENSOR	OUTPUT	1.16 ma current source output -OR- configurable pull up
12	GND	INPUT	CHT 2 return
14	TACH_2	INPUT	Hall sensor 2 input (5K internal pullup)
16	COWL2_PWM_OUT	OUTPUT	5V PWM output to drive cowl 2 servo.
18	CDI_2_OUT	OUTPUT	Secondary capacitive discharge ignition driver signal
20	6V	OUTPUT	CDI 2 power
22	CDI_2_GND	GND	CDI 2 return
24	5VA	PASSIVE	5VA for TPS sensor (alternate function for rev3: Injector 3)
26	TPS_AIN	PASSIVE	TPS analog input

2. Vehicle connector

The vehicle connector is Harwin part number M80-5302442, with mating connector M80-4132498. The connector has 24 pins in 2 rows of 12, as given in Table 3. This connector has main power, RS-232 serial, CAN, PWM throttle input, fuel pressure sensor input, fuel pump control output, the second injector, and the enable signal. Note that for revision 3 and earlier the enable signal is pulled down and 5 Volts must be applied to enable IntelliJect. Starting at revision 4 the enable signal is pulled up, and the signal should be grounded to disable IntelliJect.

Table 3 Signals on the vehicle connector.

PIN	NAME	TYPE	DESCRIPTION
1	THR_PWM_IN	INPUT	5V PWM input
3	GND	PASSIVE	PWM return
5	Fuel_Pressure_AIN	INPUT	0-5 volt analog input
7	5V	OUTPUT	+5VA power for fuel pressure sensor
9	GND	PASSIVE	Return for fuel pressure sensor
11	12V	OUTPUT	12.0V to injector 2
13	INJECTOR_2	INPUT	Secondary low side injector driver
15	RXD_RS232	INPUT	Main serial port receive data
17	TXD_RS232	OUTPUT	Main serial port transmit data
19	GND	PASSIVE	Main serial return
21	PUMP_SW_12V	OUTPUT	High side ON/OFF and PWM modulation for 12.0V fuel pump
23	PUMP_GND	PASSIVE	Return for pump
2	12V/24 Volt	INPUT	8-28 Volts system input
4	GND	PASSIVE	System ground
6	SPARE_SENSOR	OUTPUT	1.16 mA current source output -OR- configurable pull up
8	GND	PASSIVE	Return for ECU_EN, alternate return for spare sensor
10	ECU_EN	INPUT	ECU_EN active high enable 5V input (internal 5K pull down for revision 3 and earlier, 5K pull up for revision 4 and later)
12	COWL1_PWM_OUT	OUTPUT	5V PWM output for cowl flap 1 Servo
14	6V	OUTPUT	Servo power
16	GND	PASSIVE	Servo return
18	PUMP_PWM_OUT	OUTPUT	5V PWM output for modulating brushless fuel pumps
20	GND	PASSIVE	PWM return
22	CANH	I/O	CAN high
24	CANL	I/O	CAN low

E. Configuration Options

1. Power options

Ordinarily IntelliJect accepts 8 to 30 V input power; using onboard regulators to make 12V for the injectors and fuel pump; and 6V for the servos and CDIs. Alternatively, the hardware can be configured to connect the input power directly to the injector rail, in which case the input power must not exceed 16V. Hardware can also be configured to connect input power directly to the servo and CDI power rail, rather than the 6V regulator. Contact Power4Flight for details of the configuration options.

Table 4: Matrix of voltages for different configurations.

Rail Name	Configuration:	12V & 6V Regulated	12V Bypassed, 6V Regulated	12V & 6V Bypassed
12V	Input:	Vin	Vin	Vin
	Output:	12V	Vin	Vin
6V	Input:	12V	Vin	Vin
	Output:	6V	6V	Vin
5V	Input:	12V	Vin	Vin
	Output:	5V	5V	5V
CDI_#_OUT	Output:	6V	6V	5V
PUMP_SW_12V	Output:	12V	Vin	Vin

2. Third injector option

Pin 24 of the engine connector is normally 5V power for an analog TPS sensor. However, hardware can be configured for a third injector low side switch on this pin.

F. Development harness schematics

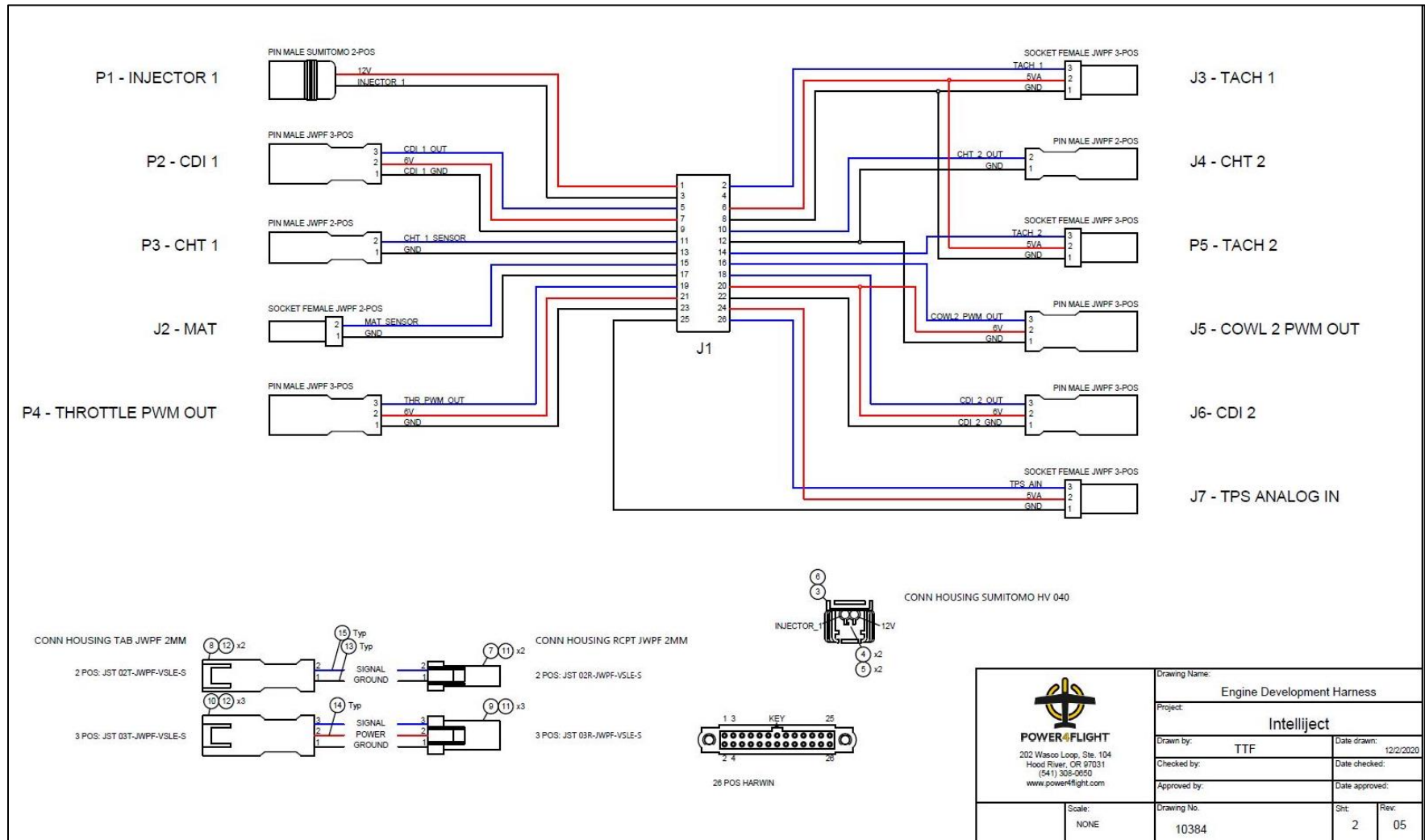


Figure 2: Engine connector development harness: not recommended for flight.

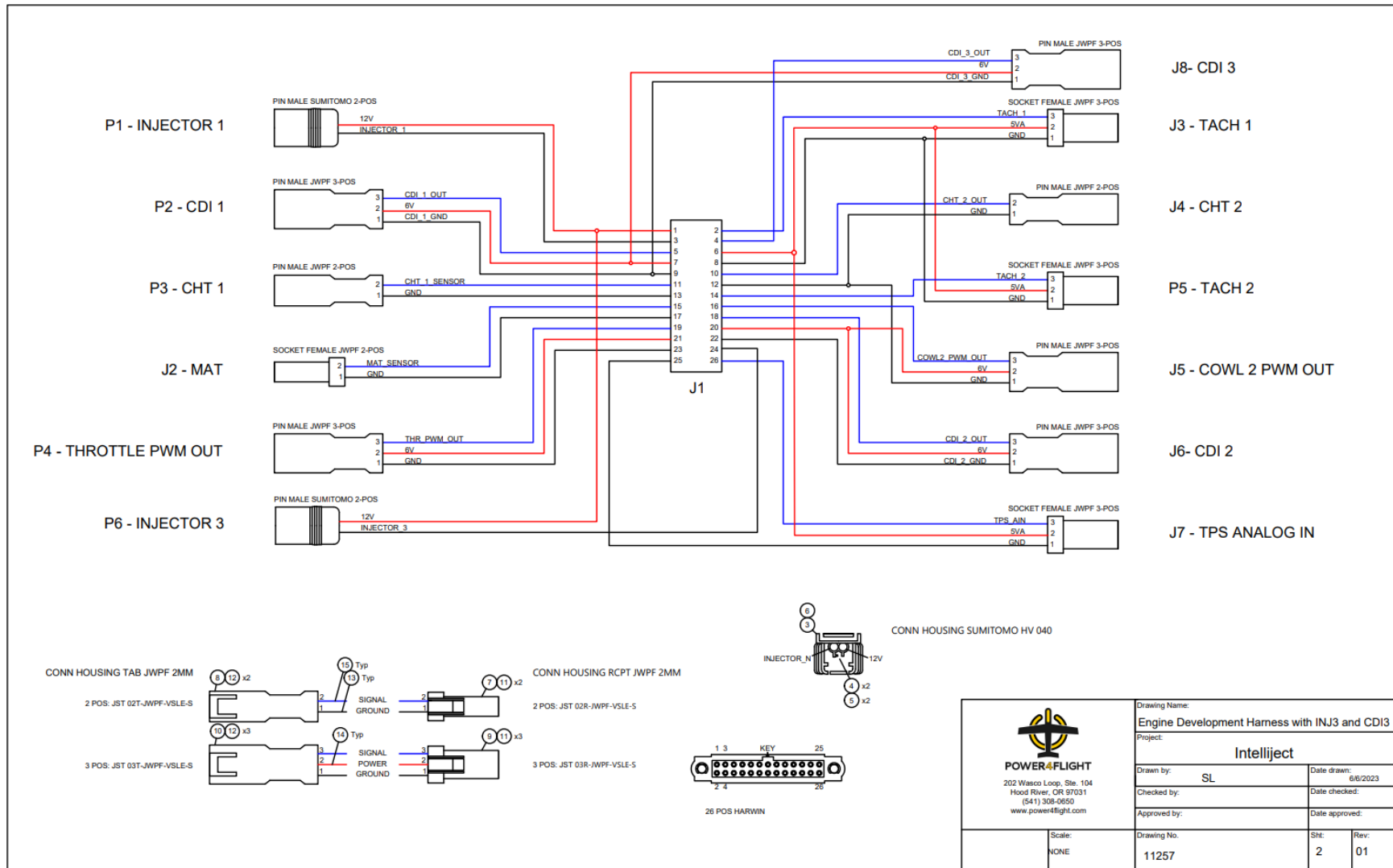


Figure 3: Engine connector development harness showing 3rd injector and 3rd ignition option: not recommended for flight.

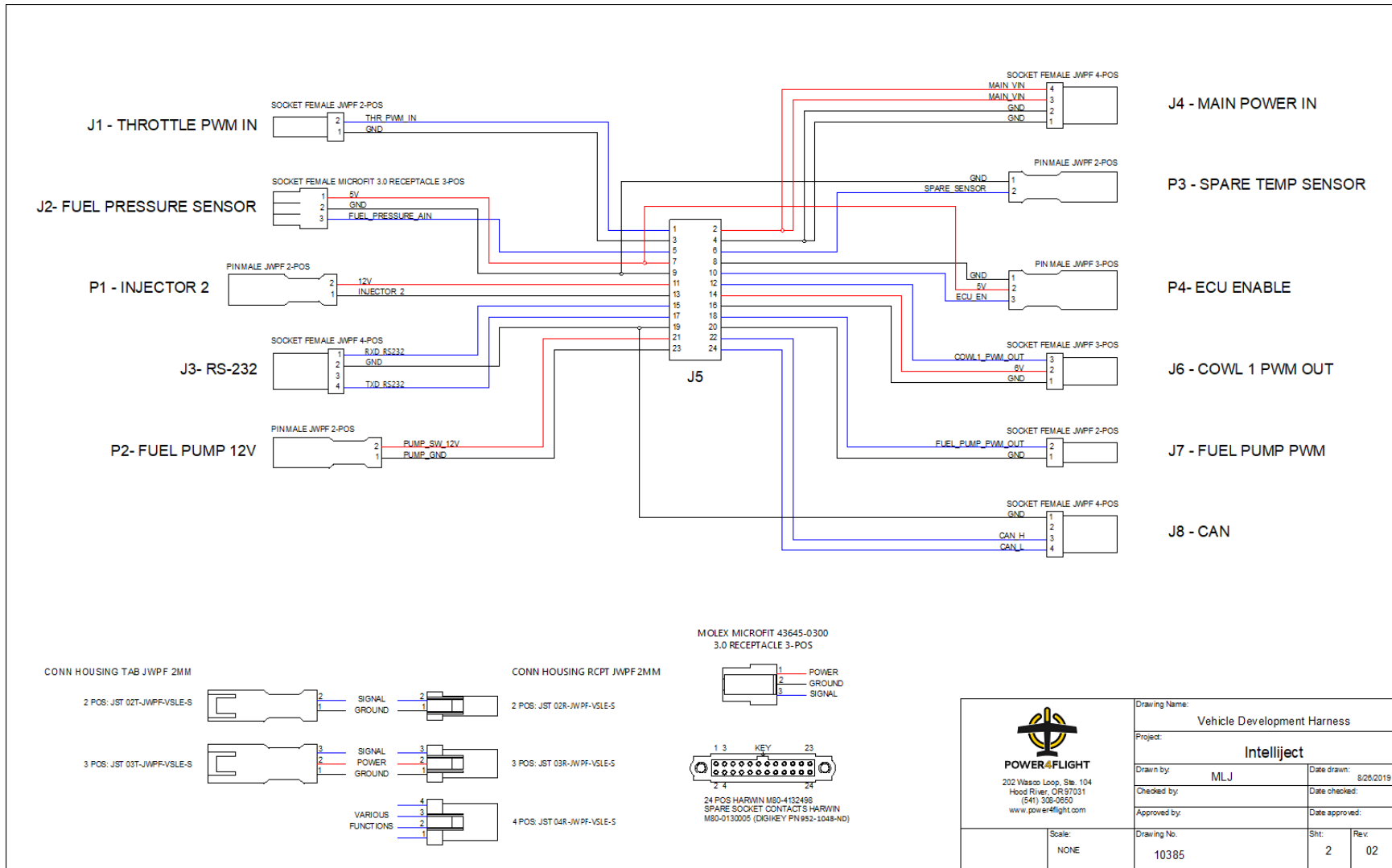


Figure 4: Vehicle connector development harness: not recommended for flight.