PaRay Senior (*PRS*) Engine Control Module Data Sheet

PaRay Electronique's *PRS* is a programmable industrial engine control module that provides all the common functions necessary to control an engine: injection duration and phase, ignition advance, electronic throttle body control, fixed engine speed control (closed loop PID), turbo waste gate solenoid actuator control (closed loop PID), solenoid idle valve control (closed loop PID), exhaust oxygen control (closed loop PID), radiator fan control with hystheresis, coolant temp shut off, oil pressure shut off, engine over speed cut off, etc.

A PRS is typically used with the DashPro software to perform engine control calibrations and monitor engine operation.

MECHANICAL SPECIFICATIONS SUMMARY

Dimensions

Width: 188 mm (not counting mounting flange)
Length: 188 mm (not counting mounting flange)
Height: 52.3 mm
Mounting flange length: 216.7 mm

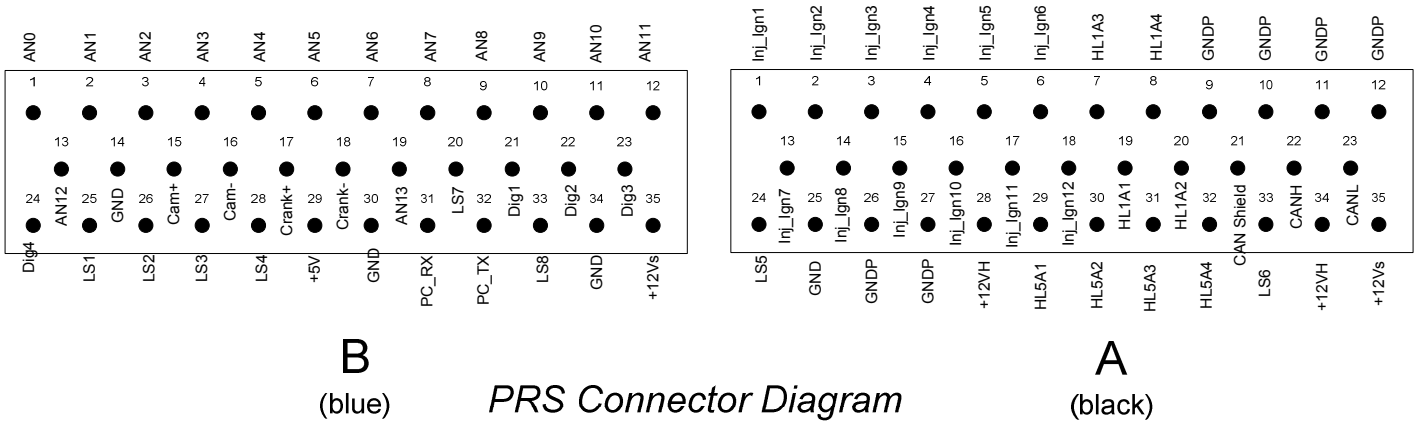
Environmental

Operating temperature range: -40 to +90 C
Vibrations: TBD max g
Protection: Urethane coating on circuit board, or silicone encapsulation, specified by user.

Miscellaneous

Finish: Blue anodized
Weight: 1Kg (without silicone potting), 1.6Kg (with silicone potting)
Engine connectors: Dual AMPSEAL male, 35 way gold plated automotive connectors
A connector is black, B is blue
mates with AMP 776164-1 and 776164-5 wire attachment housings

CONNECTOR PINOUT & SIGNAL DESCRIPTION



B (blue) *PRS Connector Diagram* A (black)

Pin	Name	Description	Typical connection, 4.9L I6 engine	Suggested AWG
A1	Inj_Ign1	10A Low side switch #1	Cylinder 1 injector	16
A2	Inj_Ign 2	10A Low side switch #2	Cylinder 2 injector	16
A3	Inj_Ign 3	10A Low side switch #3	Cylinder 3 injector	16
A4	Inj_Ign 4	10A Low side switch #4	Cylinder 4 injector	16
A5	Inj_Ign 5	10A Low side switch #5	Cylinder 5 injector	16
A6	Inj_Ign 6	10A Low side switch #6	Cylinder 6 injector	16
A7	HL1A3	1A High/Low output #3		
A8	HL1A4	1A High/Low output #4		
A9	GNDP	Power ground	Engine block	16
A10	GNDP	Power ground	Engine block	16
A11	GNDP	Power ground	Engine block	16
A12	GNDP	Power ground	Engine block	16
A13	Inj_Ign 7	10A Low side switch #7	Ignition power module	20
A14	Inj_Ign 8	10A Low side switch #8		
A15	Inj_Ign 9	10A Low side switch #9		
A16	Inj_Ign 10	10A Low side switch #10		
A17	Inj_Ign 11	10A Low side switch #11		
A18	Inj_Ign 12	10A Low side switch #12		
A19	HL1A1	1A High/Low output #1		
A20	HL1A2	1A High/Low output #2		
A21	CANS	CAN shield	CAN network shield	
A22	CANH	CAN High side signal	CAN network H line	
A23	CANL	CAN Low side signal	CAN network L line	
A24	LS5	0.5A Low side switch #5	Up to 500mA load	
A25	GND	Signal common	Engine block	16
A26	GNDP	Power ground	Engine block	16
A27	GNDP	Power ground	Engine block	16
A28	+12VH	High power 12V supply	Main relay n.o. contact (fuse/relay box)	16

Pin	Name	Description	Typical connection, 4.9L I6 engine	Suggested AWG
A29	HL5A1	5A Half bridge #1	Electric throttle body motor, positive side	16
A30	HL5A2	5A Half bridge #2	Electric throttle body motor, negative side	16
A31	HL5A3	5A Half bridge #3		
A32	HL5A2	5A Half bridge #4		
A33	LS6	0.5A Low side switch #6		
A34	+12VH	High power 12V supply	Main relay n.o. contact (fuse/relay box)	16
A35	+12Vs	Low power 12V supply	Ignition switch	16
B1	AN0	Analog input #0	ECT sensor thermistor	20
B2	AN1	Analog input #1	IAT sensor thermistor	20
B3	AN2	Analog input #2		
B4	AN3	Analog input #3	MAP sensor	20
B5	AN4	Analog input #4	TPS1 signal	20
B6	AN5	Analog input #5		20
B7	AN6	Analog input #6	WBO2 signal	20
B8	AN7	Analog input #7	PPS (Pedal position sensor) signal	20
B9	AN8	Analog input #8		
B10	AN9	Analog input #9		
B11	AN10	Analog input #10		
B12	AN11	Analog input #11	FT sensor thermistor	20
B13	AN12	Analog input #12	FP sensor thermistor	20
B14	GND	Signal common	Engine block	16
B15	Cam+	Camshaft trigger	Camshaft sensor, positive side	20
B16	Cam-	Camshaft trigger	Camshaft sensor, negative side (signal common)	20
B17	Crank+	Crankshaft trigger	Crankshaft sensor, positive side	20
B18	Crank-	Crankshaft trigger	Crankshaft sensor, negative side (signal common)	20
B19	AN13	Analog input #13		
B20	LS7	0.5A Low side switch #7		
B21	Dig1	Digital input #1	Camshaft index sensor, if used	20
B22	Dig2	Digital input #2	Crankshaft index sensor, if used	20
B23	Dig3	Digital input #3		
B24	Dig4	Digital input #4	Ignition switch (switch on signal)	20
B25	LS1	0.5A Low side switch #0	Main relay coil	20
B26	LS2	0.5A Low side switch #1		
B27	LS3	0.5A Low side switch #2		
B28	LS4	0.5A Low side switch #3		
B29	+5V	+5V supply for sensors	5 Volt reference for MAP, TPS, WBO2, PPS	20
B30	GND	Signal common		
B31	PC_RX	RS232 Rx signal	Serial communication to PC connector	20
B32	PC_TX	RS232 Tx signal	Serial communication to PC connector	20
B33	LS8	0.5A Low side switch #8		
B34	GND	Signal common	Serial communication to PC connector	20
B35	+12Vs	Low power 12V supply	Ignition switch	16

ELECTRICAL SPECIFICATIONS

Electrical power

Operating voltage:	6 to 15Vdc (+12Vs and +12VH)
Current consumption:	< 0.35A (note 1)

High power Low Side Switches (INJ_IGN1 to INJ_IGN12)

Typical usage:	Injector and ignition outputs
Output configuration:	Low side switch. Pullup resistors to +12Vh may be installed at the factory on individual outputs
Current sink capability:	> 10A peak, 6A average not to exceed 30A average for all INJ_IGN outputs (note 2)
Switch off clamp voltage:	45V nominal (40V min, 50V max)
Inductive energy rating:	480mJ max @ 3600rpm, 240mJ max @ 7200rpm (note 3)

High power Half Bridge outputs (HL5A1 to HL5A4)

Typical usage:	Throttle body motor drive, idle valve drive, EGR valve, turbo waste gate drive
Output configuration:	0V or +12VH (supply voltage – 1V nominal) active output or PWM @ 2.5 KHz.
Current drive capability	5A sink or source, over current protected

Low Power Low side Switches (LS1 to LS8)

Typical usage:	Main relay driver, fuel pump relay, tach output, warning lights, …
Output configuration:	Low side Switch, 55V clamp
Current drive capability:	0.5A

Digital inputs (Dig1 to Dig4)

Typical usage:	Digital crankshaft/camshaft position sensor, switch on signal, governor gate
Impedance:	10KΩ to signal common

Threshold:	1.5V nominal with 0.3V hysteresis

Analog inputs (AN0 to AN13)

Typical usage:	Analog temperature sensor, MAP sensor, …
Input configuration:	Pull-up (note 9) to +5Vdc, 100Kohm protection series resistor. Pull up value configured at factory for each channel according to customer specifications
Input range:	0 – 5V
Resolution	10 bits, approx. 5mV

Trigger inputs (Crank+, Cam+)

Typical usage:	Crankshaft and/or camshaft position sensors
Electrical configuration:	Adaptive analog input or fixed threshold digital input 20 KΩ to ground input impedance
Sensitivity:	300 mVpp to greater than 30 Vpp in analog adaptative mode 2.5 V threshold with 0.5 V hysteresis in digital mode

Communication port

Physical protocol:	RS232

Notes:

(1) Current consumption figure shown with no load on HL5A and HL1A outputs.

(2) Injector output current sink capability: maximum average current sink corresponds to four Quantum injectors at 100% duty cycle, six injectors at 90% duty cycle, and eight injectors at 67% duty cycle. This is typically more than required to drive the Ford 4.9L engine at maximum output power.

(3) Injector inductive energy rating: the maximum rpm for a given number of injectors N, each having inductive energy storage E in mJ, is given by $RPM_{\max} = \frac{1.73 \cdot 10^6}{N \cdot E}$. Quantum injectors have an E value of 40mJ, thus a *PRS* can drive 6 of them at up to 7200rpm. These values suppose one injection pulse per cycle for each cylinder. For one injection pulse per turn, divide rpm values by two.

FUNCTIONAL SPECIFICATIONS SUMMARY

Trigger system

Operating modes:	separate channel index, extra pulse index, missing pulse(s) index
Trigger sensor type:	hall effect, pickup coil or digital output
Number of pulses per turn:	1 to 128, referred to crankshaft or camshaft
Maximum trigger rate:	> 15 KHz
Maximum rpm: (beyond which operation ceases)	> 28000 rpm
Minimum rpm: (below which engine is considered stalled)	programmable from 40 to 2000 rpm
Initial starting blind time:	programmable from 0 to 1sec. in 0.01 sec. steps
Validation:	separate accumulation and reporting of extra trigger pulses and missing trigger pulses, with a 16 bit range (0 to 65535)

Synchronous signals

Number of synchronous output channels:	up to 32 logical channels
Logical to physical mapping:	any logical channel can be mapped to any of Inj_Ign output, LS output or HL1A output.
Time accuracy:	Programmable from 1 to 50 µs
Phase jitter:	±0.05 degree @ 1000rpm, proportional to rpm
Source data:	any map or scalar function (for both phase and length)
Cutoff:	any channel can be programmed with a cutoff ranging from 0 to greater than 24000rpm, with a resolution of approximately 60rpm

Maps and scalar computation functions

Operands and results data type:	16 bit fixed point
Number of 2D maps available:	16
Map computation method:	bilinear interpolation
Map dimensions:	X: 1 to 128 rpm values Y: 1 to 256 y input values, powers of two only
Maximum map size:	total for all 16 maps must contain no more than 16384 values
Map Y source data:	any map or scalar function or analog input
Number of scalar functions:	up to 64
Type of computation:	addition, subtraction, multiplication, shifting, scaling
Source operands:	any map or scalar function or analog input
Cycle time: (computation refresh rate)	10ms (with 8 maps and 30 scalar functions) less than 50ms (16 maps and 64 scalar functions)

Host interface

Physical layer:	RS-232 @ 56Kbaud, 8 bits, 1 stop bit, 1 start bit no parity, DCE configuration
Application layer protocol:	master slave command driven transactional protocol, host is master and controller is slave.
Transport layer protocol:	handshake following every command or at every 8byte blocks going from host to controller
Function sets	monitoring functions; logical configuration definition functions, logical configuration storage and retrieval functions; register level access functions, debugging functions

Miscellaneous

Electric throttle servo drive:	can drive Bosch electric throttles from a PPS* input. Motor driven in PWM* mode at 1.5KHz to 10Khz, PID type servo.

Battery monitoring, internal board temperature monitoring.