MSnS-extra PCB v1.0

Lite User Manual

Connectors

9-pole round power connector

This connector is used for high current signals. The connector is watertight CPC series connector made by AMP. Maximum current carrying capacity is 13A per pole.

Pole numbers and signals

#	Signal	Description
1	V12	+12V, switched by ignition key
2	GND	Ground
3	V12_INJ	+12V feed to injectors
4	INJ_1	Injector output, bank 1
5	INJ_2	Injector output, bank 2
6	COIL1	Ignition output 1
7	COIL2	Ignition output 2
8	FP_PWR	Fuel pump power
9	GND	Ground

25 pin D-sub connector

This connector is used for the rest of the signals like sensors, serial port etc. Wiring harness end of the connector is sealed version made by ITW. Normal 25 pin D-sub connector can be used as well if sealing isn't required. Maximum current carrying capacity is 5 A per pin.

Pin numbers and signals

#	Signal	Description
1	2ND_TRIG_IN	2nd engine position trigger input
2	KNOCK_IN	Knock sensor
3	GND	Signal ground
4	IGN_GND	Ground for the trigger signal
5	TRIG	1st engine position trigger input
6	O2	O2 sensor signal
7	EGT+	Thermocouple sensor +
8	EGT-	Thermocouple sensor -
9	TXD	Serial port, transmit
10	RXD	Serial port, receive
11	V12_PROT	12V supply (for sensors etc.)
12	LAMBDA_HEAT	12V supply for O2 sensor heater
13	PWR_GND	Power ground, e.g. for O2 sensor heater
14	GND	Signal ground
15	I/O1	General purpose I/O 1
16	I/O2	General purpose I/O 2
17	CLT	Engine coolant temp
18	MAT	Intake air temp
19	VREF	5V supply, analog signals (e.g. TPS)
20	GND	Signal ground
21	TPS	Throttle position sensor
22	VCC	5V supply, digital signals (e.g. ignition triggers)
23	OUT_A_PWR	General purpose power output A
24	OUT_B_PWR	General purpose power output B
25	OUT_C_PWR	General purpose power output C

Injector outputs

Injector outputs have active flyback circuit (like ”official” MS V3.0 board) so it’s possible to use low impedance injectors with PWM current limiting. The output stages are protected against short circuits and overheating.

The controller provides +12V supply for the injectors. This supply is protected by onboard MiniBlade type automotive fuse (F6). To minimize electrical interference it’s recommended to always use this supply to power the injectors.

Ignition outputs

The controller has power output stages to drive two ignition coils. The outputs have current limiting circuits to protect the coils and output stages. The current limit can be set to four different values by setting jumpers on the board. Please not that driving the coils against the current limit generates excessive amounts of heat in the output stages so it’s better to set the dwell times correctly.

Current limit settings by jumper block J18

Jumpers	Current limit (approx.)
1-2, 3-4	6A
3-4	8A
1-2	10A
-	15A

Outputs are controlled by processor pins 7 and 8 (LED17 and LED19 in settings). Output 1 is connected to the processor through jumper J35 so it's possible to change this output to be controlled by some other processor pin if required.

Triggering / engine position sensors

Trigger input 1

The first trigger input supports several sensor types. User can select input circuit between optocoupler circuit and VR sensor signal conditioner circuit (LM1815) by changing jumper positions.

VR sensor conditioner circuit is selected when jumpers J22 and J23 are in position 2-3. This is only required setting with VR sensor. The signal conditioner circuit adapts automatically to most of the sensors.

For optocoupler input the jumpers J22 and J23 should be in position 1-2. Jumper J21 changes input sensitivity and signal filtering.

J21 position 1-2 produces 680 Ohms input resistance for the optocoupler. This setting is suitable for hall sensors and other sensors that give 5-12V logic signal. Position 2-3 produces 2.7 kilo-Ohm resistance and low pass filtering. This setting is for cases when the triggering is taken from primary side of the ignition coil. If the jumper is omitted the input resistance is also 2.7 kilo-Ohms but there is no filtering.

Jumper J3 selects grounding of the optocoupler. When the jumper is set the optocoupler is grounded to the board ground and there is no need for external grounding. If the jumper is open the optocoupler must be grounded through pin 4 of the signal connector. This may help to reduce noise in some cases. External grounding through pin 4 can also be used in some alternative sensor arrangements.

Trigger input 2

Trigger input 2 doesn't have any signal conditioner circuitry. The signal goes directly to the processor through 1 kilo-Ohm series resistor and over voltage protection. The input can be used with sensors that produce 5V logic signals, for example hall sensors. For other sensors some additional signal conditioner circuitry is required.

General purpose power outputs

The controller has three general purpose power outputs. They are open collector type so in other words the output pin is connected to the ground when the output is activated; otherwise the output pin is floating. The outputs are protected by resettable fuses. Trip limit of the fuses is 2.5 – 5 A, in practice usually about 5A. The outputs are also equipped with flyback diodes to 12V supply so they can be used with inductive loads like relays and solenoids.

Control inputs for the power outputs are connected to connections points J14, J15 and J19 that should be connected to appropriate processor outputs (depending on application) by jump wires.

General purpose I/O

Two of the signal connector pins are reserved for general purpose inputs or outputs. These lines are equipped with 1 kilo-Ohm series resistors and over voltage protection diodes.

I/O1 is connected to point J28 and I/O2 to point J29. These can be connected to appropriate processor pins by jump wires.

Power output for fuel pump

The controller provides +12V supply for the fuel pump. The output is switched by short circuit protected solid state switch so in most cases there is no need to use external relay nor fuse for the pump.

If the pump draws high amount of current the maximum current of the power connector pins may exceed. In this case external relay and fuse are required. Typically limit for current draw of the pump is about 10A depending on the rest of the setup.

O2 sensor interface

The controller can use normal narrow band O2 sensor or wideband sensor with external controller. The signal ground of the sensor shall be connected to one of signal ground pins on the signal connector.

The controller provides +12V supply (LAMBDA_HEAT, pin 12) for sensor heating element or power supply of a wideband controller. The supply is switched by short circuit protected solid state switch. Control of the switch can be selected between the main power or fuel pump control. Selection is done by installing a zero Ohm resistor in place R32 or R75. R75 (default position) selects control by the main power, R32 by fuel pump control. Make sure to not install both resistors simultaneously!

Grounding of the heating element or wideband controller power grounding shall be connected to the power ground of the controller (PWR_GND, pin 13).

Knock sensor interface

The controller has interface circuit for piezoelectric knock sensors. The interface circuit has a band pass filtering that passes frequencies between 5-9kHz that corresponds to resonance frequency of cylinder sizes of 64-115mm. The pass band frequency can be altered by changing component values in the filter circuit.

Sensitivity of the knock detection can be adjusted by trimmer R61.

Thermocouple interface

The controller has interface circuit for type K thermocouples that can be used for exhaust gas temperature measurement, for example. The interface works with “floating” sensors and sensors that are grounded at the tip.

Bootloader jumper

The controller can be set to bootloader state by short circuiting pins of J2 (with MS1 processor).