Mitsubishi EVO 9 Plug-in

Evolution 9

EMtron Australia

Contents

1.0 Introduction

The Mitsubishi EVO 9 ECU is designed to be plugged into the OEM harness to allow for a true "Plug and Play" install. The system is based on the KV Series Motorsport ECU, so all the same features are available with the limitation based around the OEM connector system. An Expansion loom is included giving access to unused Input channels. CAN Bus 2 is also available providing additional I/O expandability.

2.0 Plugin Features

General

- KV8 ECU based platform.
  - Dual 100MHz processors
  - 32MB ECU logging memory
  - Over 1000 logging channels available
  - 1Hz to 500Hz logging rate
- Aluminium 6061 Grade CNC billet enclosure
- Compatible with all Emtron proven motorsport features(Launch Control, Rolling Launch, Anti-Lag, Traction Control)
- Upgradeable to run the Emtron fuel model through installation of a flex meter, fuel temperature and fuel pressure sensor
- Idle speed closed loop control using DBW with advanced Throttle Mass Flow (TMF) airflow calculations
- Knock control with high speed digital filtering for each cylinder using the OEM sensor with selectable centre frequency and bandwidth
- Pre-configured Calibration file loaded providing a comprehension tuning platform
- Input Expansion Capabilities through DTM connector
  - 3x User Analog Volt Inputs (Fuel Temperature, Fuel Pressure, Inlet Temperature)
  - 3x User Digital Input (Flex Meter Input and switch inputs)
- Emtune software for tuning and data analysis

Communications

- CAN 2.0B Bus 2: User CAN Bus for I/O expansion (Lambda, EGT)
- High Speed Ethernet 100Mbps for tuning software connection

Operating Temperature

- Recommended operating range: -30 to 85°C (-22 to 185°F)

Physical

- Enclosure Size 160 mm x 162 mm x 38 mm
- 890g

3.0 Installation

3.1 Expansion Port

The ECU's input capabilities can be expanded using the expansion connection which is a male DTM 12 Way. See Table 3.0.

These additional inputs can be connected to any sensor, but the recommended sensors are indicated in brackets.

Pin	Function
1	Analog Sensor 0V Reference
2	5V Vref2 Supply
3	AN 8 (e.g. Fuel Temp or Inlet Temp)
4	AN 9 (e.g. Fuel Temp or Inlet Temp)
5	AN 10 (e.g. Fuel Pressure)
6	DI 6 (e.g. Ethanol Content Sensor)
7	14V Out Protected (e.g. ELC2 Power Supply). Post ECU serial numbers 2700 only.
8	ECU Ground (e.g. ELC2 or E85 Sensor Ground) Post ECU serial numbers 2700 only.
9	DI 13
10	DI 14
11	CAN 2 Hi
12	CAN 2 Lo

Table 3.0 - Expansion Port Pinout (DTM06-12SA)

3.2 CAN Bus 2 Wiring

The ECU CAN Bus 2 is reserved for Emtron CAN Bus devices, expanding the IO capability of the ECU. The following devices can be connected:

- ELC1/2 (Emtron Lambda to CAN 1/2 channel)
- ETC4/ETC8M (Emtron Thermocouple to CAN 4/8 channels)
- EIC10/EIC16M (Emtron Input to CAN 10/16 Channel)

For more information on each device refer to the downloads section on the website: (emtron.world/downloads)

Emtron ELC/ETC4/EIC10 to CAN

All these CAN devices share a common power, ground and CAN pinout using a 4-way DTM. See Table 3.1.

Pin	Function	Wire Colour
1	Ground	BLACK
2	CAN Lo	GREEN
3	CAN Hi	YELLOW
4	12V Supply	RED

Table 3.1. CAN Device Power and CAN Deustch Connector Pinout

To help with installation time, each CAN Device pin can be directly connected into the ECU IO Expansion Port. Pinout information is shown Table 3.2.

Name	ECU IO Expansion 12-Way DTM	CAN Device 4-Way DTM
Ground	Pin 8	Pin 1
CAN 2 Lo	Pin 12	Pin 2
CAN 2 Hi	Pin 11	Pin 3
Power	Pin 7	Pin 4

Table 3.2. IO Expansion to CAN Device wiring

The following points should be noted when using the CAN Bus:

- CAN Bus High and Low are differential signals, so twisted pair **MUST** be used. Failing to do so will compromise the entire CAN Bus System. It is recommended to twist the CAN wire pairs at a minimum one twist per 40mm of cable.
- In some extreme environments, shielded twisted pair may be required to help with reliability and data integrity.
- The less connectors in any transmission system the better. Unnecessary connectors are almost guaranteed to present an impedance discontinuity and hence may cause reflections and data loss.
- CAN Bus termination must be done correctly by using a 120 ohm 0.25W resistor at each END of the bus system. See the example in Figure 3.1.
- Maximum Stub length to a device from the main Bus is recommended at 0.3m, in accordance with High-Speed ISO 11898 Standard specification. See Figure 3.2.

ALL Emtron CAN devices do **not** include an on-board CAN termination resistor, allowing the device to be wired at any position on the Bus. CAN Bus termination must be done correctly by using a 120 ohm 0.25W resistor at each end of the bus system as mentioned above.
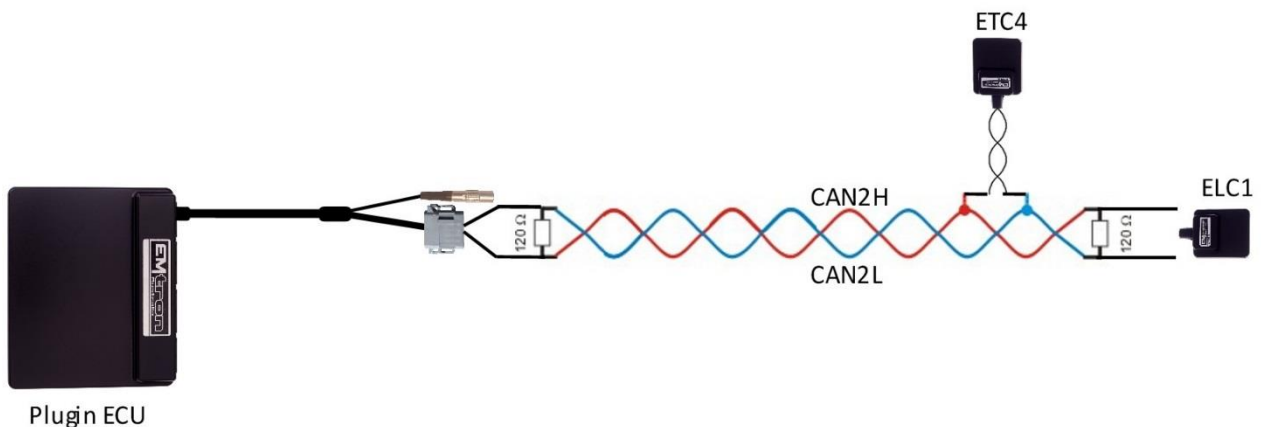
Figures 3.1. CAN Bus wiring example. ECU and ELC1 at each end with 120 Ohm Termination
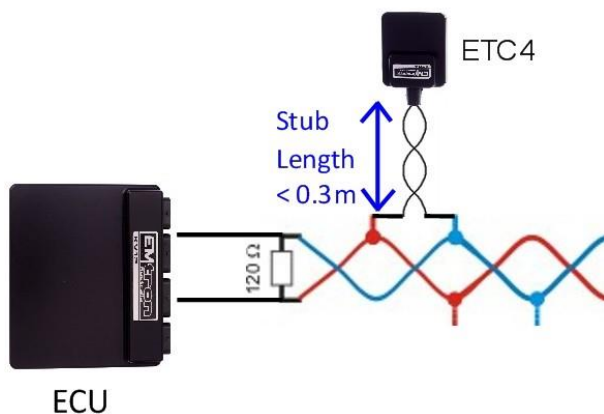

Figure 3.1. CAN Bus wiring example. Stub Length less than 0.3m

3.3 Sensor Wiring

5V VRef2 Sensor Supply Pin (Pin 2 of Expansion port)

This is a 250mA 5V output designed to supply automotive sensors.

Sensor 0V Reference Pin (Pin 1 of Expansion port)

This pin should be connected directly to the 0V (Ground) pin on any low current analog sensor, for example Pressure or Temperature. Figures 3.3 and 3.4 show the correct and incorrect wiring system.

- **DO NOT** connect the 0V Reference pin directly to the Engine Block or ECU Ground. This is a dedicated and specialised 0V/ground output for analog sensors.
- **DO NOT** connect frequency-based sensor grounds to the 0V Reference pin; for example, an Ethanol content sensor. Use Pin 8 (Ground) in the Expansion port.
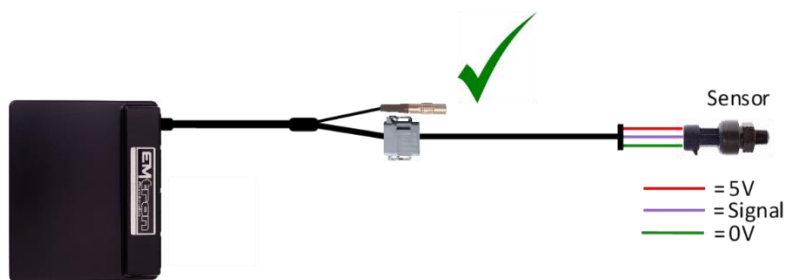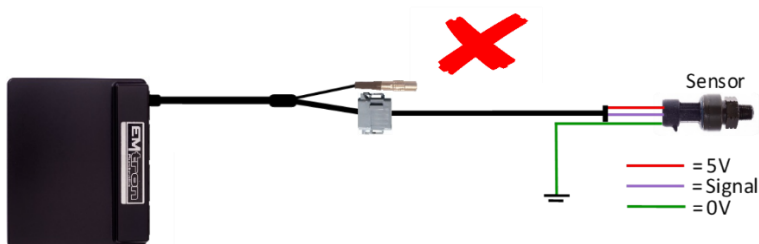
Figure 3.3. Correct Pressure Sensor 0V Wiring

Figure 3.4. Incorrect Pressure Sensor 0V Wiring

3.4 Ethanol Content Sensor wiring

An Ethanol Content sensor can be wired into the ECU using the Expansion port. The following channel assignment is recommended for the GM sensor:

GM Sensor Pinout	Expansion Loom	Description
Pin 1	Pin 9. 14V Protected	Supply, 8V or 14V
Pin 2	Pin 10. ECU Ground	Ground
Pin 3	Pin 6. DI 6	Output. Temperature and Ethanol Content
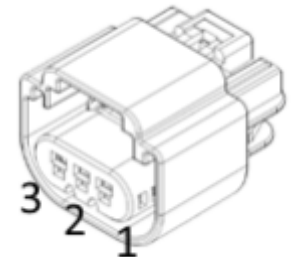
NOTE:

- **DO NOT** connect the Ethanol Content sensor ground to the "Analog Sensor 0V Reference". Use the ECU Ground from Pin 10 in the Expansion port.
- The Ethanol sensor produces a frequency based output. Suitable ECU channels are DI 1-8.

Description	Calibration
Ethanol Content (%)	50Hz = 0% Ethanol 150Hz = 100% Ethanol
Fuel Temperature	1ms = -40 DegC 5ms = 125 DegC

To config the ECU for this sensor, select the Ethanol Sensor Input Source to DI6. The ECU will automatically decode the Ethanol Content and Fuel Temperature.

Once the Ethanol Senor has been assigned an input, more settings become available in the Tuning View -> Engine Functions menu.
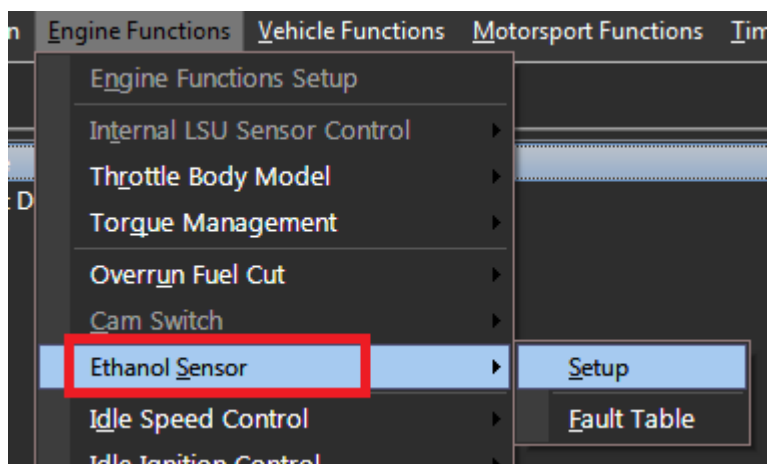
4.0 ECU Channel Assignment

ECU Channel - Injection	Function
Injection Channel 1	Fuel Injector Cylinder 1
Injection Channel 2	Fuel Injector Cylinder 2
Injection Channel 3	Fuel Injector Cylinder 3
Injection Channel 4	Fuel Injector Cylinder 4
Injection Channel 5	Rear Lambda Heater
Injection Channel 6	Front Lambda Heater
Injection Channel 7	Purge Solenoid 1
Injection Channel 8	Secondary Air Solenoid
Injection Channel 9	Not Used
Injection Channel 10	Not Used
Injection Channel 11	Not Used
Injection Channel 12	Not Used

ECU Channel - Ignition	Function
Ignition Channel 1	Ignition Cylinder 1/4
Ignition Channel 2	Ignition Cylinder 2/3
Ignition Channel 3	I/C Spray Lamp
Ignition Channel 4	Alternator Load Control
Ignition Channel 5	Fuel Pump Relay
Ignition Channel 6	Fuel Pump Speed Relay
Ignition Channel 7	A/C Clutch Relay
Ignition Channel 8	CE Light
Ignition Channel 9	A/C Fan High
Ignition Channel 10	A/C Fan Low
Ignition Channel 11	Not Used
Injection Channel 12	Not Used

ECU Channel - Analog Inputs	Function
Analog Voltage 1	MAP
Analog Voltage 2	TPS
Analog Voltage 3	02 Front
Analog Voltage 4	02 Rear
Analog Voltage 5	MAF Baro
Analog Voltage 6	Fuel Level
Analog Voltage 7 (Pull-up Channel)	Engine Temperature
Analog Voltage 8 (Pull-up Channel)	IO Expansion port
Analog Voltage 9 (Pull-up Channel)	IO Expansion port
Analog Voltage 10 (Pull-up Channel)	IO Expansion port
Analog Voltage 11 (Pull-up Channel)	Intake Temperature in MAF
Analog Voltage 12 (Pull-up Channel)	Fuel Tank Pressure (US Models)
Analog Voltage 13	Not Used
Analog Voltage 14	Not Used

NOTE: Analog Voltage Channels 7-12 have switchable pull-ups which are suitable for temperature measurement.

ECU Channel - Digital Inputs	Function
Digital Input 1	Cam Position - Inlet
Digital Input 2	Vehicle Speed
Digital Input 3	Clutch Switch
Digital Input 4	Power Steer Pressure Switch
Digital Input 5	A/C Switch 2
Digital Input 6	IO Expansion Loom (Ethanol Sensor)
Digital Input 7	MAF
Digital Input 8	I/C Spray Switch - Auto
Digital Input 9	I/C Spray Switch - Manual
Digital Input 10	Fuel Level Low Light
Digital Input 11	Ignition Start
Digital Input 12	A/C Pressure Switch
Digital Input 13	IO Expansion port
Digital Input 14	IO Expansion port

ECU Channel - Auxiliary Outputs	Function
Auxiliary 1	VVT Inlet Solenoid
Auxiliary 2	Wastegate Solenoid
Auxiliary 3	Tacho
Auxiliary 4	Engine Fan Relay
Auxiliary 5	Stepper Motor B1
Auxiliary 6	Stepper Motor A1
Auxiliary 7	Stepper Motor A2
Auxiliary 8	Stepper Motor B1
Auxiliary 9	Fuel Pressure Solenoid
Auxiliary 10	I/C Spray Relay
Auxiliary 11	EGR Solenoid
Auxiliary 12	Evap Ventilation Solenoid
Auxiliary 13	Not Used
Auxiliary 14	Not Used
Auxiliary 15	Not Used
Auxiliary 16	Not Used

NOTE: Auxiliary Channel 9/10 can be reconfigured to run DBW

ECU Channel - Crank/Cam	Function
Crank Index	Crank Sensor
Sync Sensor	Cam Position - Inlet LH

5.0 Plug-in Specific Information

5.1 Fuel Model

The base ECU calibration is supplied in Speed Density mode. It is recommended to install an Emtron 4Bar MAP sensor and wire it to an unused ANV Input in the Emtron expansion port. The ECU may also be configured to run on MAF only or using a combination MAF and Speed Density (MAP).

5.2 Inlet Air Temperature

ECU Pin 62 is assigned to the Intake Air Temperature (MAF). The sensor is physically located in the Mass Air Flow Meter. This is not ideal for the fuel model and it is recommended to install an inlet air temperature sensor in the inlet manifold. This can be wired directly to pin 3 in the Emtron expansion port connector as shown in Table 3.0. ANV8 may then be assigned in the inputs setup page in Emtune.

Some models have an inlet air temperature sensor fitted in the plenum. This is connected to Pin 94 in the ECU and is also assigned to ANV8. if the vehicle is fitted with a plenum mounted sensor already the input channel simply needs to be assigned.

*Note if the OEM sensor is fitted pin 3 on the Emtron expansion port will no longer be available unless this sensor is disconnected as the pin is shared.

5.3 Drive by Wire (DBW)

Auxiliary Channels 9 and 10 can be reconfigured to run DBW.

	OEM Configuration	Reconfigured
Auxiliary Output 9	Fuel Pressure Solenoid	DBW Motor +
Auxiliary Output 10	I/C Spray Relay	DBW Motor -

6.0 Diagnostic Trouble Codes (DTCs)

On initial installation it is advised to clear all the DTC's if error(s) are reported. To check: connect to Emtune and look at the DTC status in the bottom toolbar. If there are Errors the status box will be Red as shown in Figure 6.0.
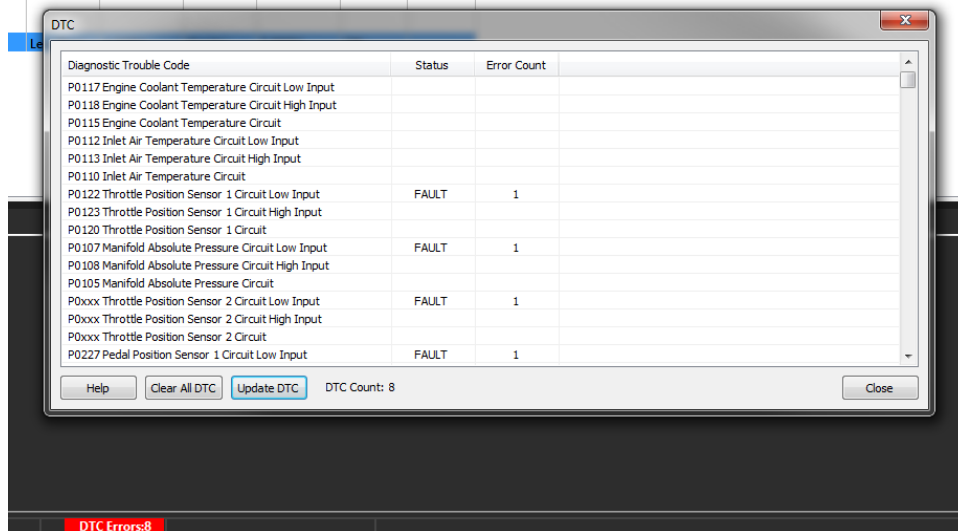
Figure 6.0. DTC example showing 8 errors.

To open the DTC window, click on the DTC Status box in the bottom toolbar OR use the File menu -> Open DTC. Next select "Clear ALL DTCs" and confirm all the Error Codes have been removed; the DTC Status box should go Green indicating this as shown in Figure 6.1. Close the DTC window.

Figure 6.1. DTC example showing no errors.

If the Error Codes have not all been removed, select "Update DTC" then use the DTC window to locate the sensor that is on fault.

7.0 Ordering Information

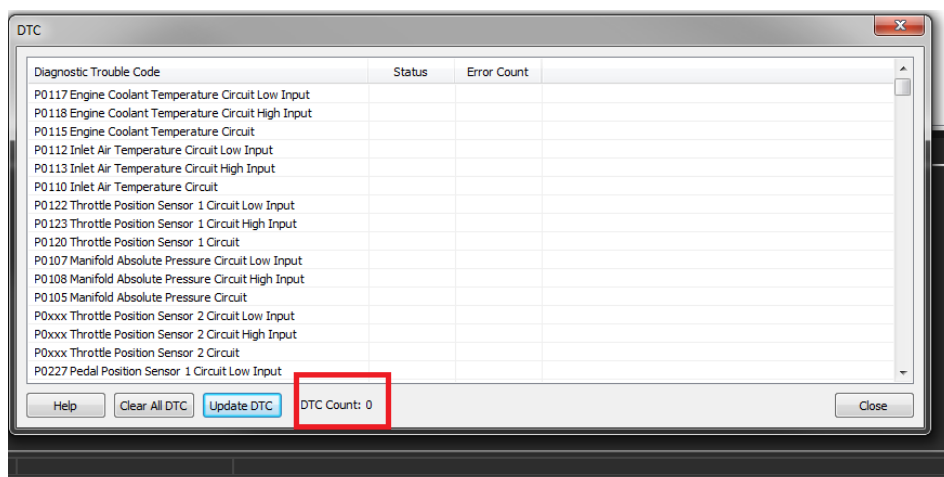| Product	Part Number
Emtron Mitsubishi EVO 9 Plugin	1609-5229
Emtron Ethernet Tuning Cable (1.5m)	553-15

Appendix A - ECU Pinout

Pin	Function	Channel Assignment	
1	Injector 1	**INJ 1**	
2	Injector 4	**INJ 2**	
3	Front O2 Heater	**INJ 6**	
4	Secondary Air Solenoid	**INJ 8**	
5	N/C		
6	EGR Solenoid Relay	**AUX 11**	
7	N/C		
8	Alternator G Terminal	**IGN 4**	
9	Injector 2	**INJ 2**	
10	N/C		
11	Ignition Coil 1 & 4	**IGN 1**	
12	Ignition Coil 2 & 3	**IGN 2**	
13	N/C		
14	Stepper Motor Coil A1	**AUX 6**	
15	Stepper Motor Coil B1	**AUX 5**	
16	Evaporative Purge Solenoid	**INJ 7**	
17	N/C		
18	Engine Fan(4kHz)	**AUX 4**	
19	Volume Airflow Sensor Reset Signal		
20	A/C compressor clutch relay	**IGN 7**	
21	Fuel Pump Relay	**IGN 5**	
22	Check Engine indicator lamp	**IGN 8**	
23	N/C		
24	Injector 3	**INJ 3**	
25	Not used		
26	Rear O2 Sensor Heater (USDM)	**INJ 5**	
27	N/C		
28	Stepper Motor Coil A2	**AUX 7**	
29	Stepper Motor Coil B2	**AUX 8**	
30	A/C Condenser Fan Relay (Low)	**IGN 9**	
31	A/C Condenser Fan Relay (High)	**IGN 10**	
32	MIVEC Oil Control Solenoid	**AUX 1**	
33	N/C		
34	Sensor Ground (CAS, AFM)	**ECU GROUND**	
35	Evaporative ventilation Solenoid (USDM)	**AUX 12**	

Pin	Function	Channel Assignment	
41	Wastegate Solenoid #1	**AUX 2**	
42	+ 5V Supply	**+5V Vref1**	
43	Crank Signal	**Crank Index +**	
44	Engine Coolant temperature	**ANV 7**	
45	Tacho	**AUX 3**	
46	**Engine Block/Power Ground**	**ECU Ground**	
47	**ECU 14V from Main Relay**	**ECU Supply**	
48	Fuel Pressure Solenoid	**AUX 9**	
49	Sensor Ground (MAP, TPS)	**Sensor 0V Reference**	
50	CAM Angle sensor (Exhaust Cam)	**Sync Sensor**	
51	Barometric Pressure Sensor (MAF)	**ANV 5**	
52	Alt FR terminal (Field response) - Freq Based		
53	Inlet Cam Position Sensor	**DI 1**	
54	Power Steer Pressure Switch	**DI 4**	
55	Fuel Pump Speed Relay	**IGN 6**	
56	I/C Spray Relay	**AUX 10**	
57	Main Relay (Gnd to operate)	**EFI RELAY**	
58	**Engine Block/Power Ground**	**ECU Ground**	
59	**ECU 14V from Main Relay**	**ECU Supply**	
60	Battery Backup (+12 Constant)	**Internal Flywheel supply**	
61	Volume Air Flow Sensor	**DI 7**	
62	Intake Air Temp Sensor (MAF)	**ANV 11**	
63	Wastegate Solenoid #2	**AUX 2**	
64	N/C		
65	A/C Switch	**DI 5**	
66	I/C Auto Switch	**DI 8**	
67	I/C Manual Switch	**DI 9**	
68	Ignition Start Signal	**DI 11**	

Pin	Function	Channel Assignment
71	O2 Sensor Signal Front	ANV 3
72	N/C	
73	O2 Sensor Signal Rear	ANV 4
74	N/C	
75	N/C	ECU Ground
76	N/C	
77	N/C	
78	Throttle Position Sensor	ANV 2
79	N/C	
80	Vehicle Speed	DI 2
81	N/C	
82	N/C	
83	A/C Request(Pressure Switch)	DI 12
84	Not Used	
85	Diagnostics K-line(OBD Pin 7)	
86	N/C	
87	N/C	
88	Clutch Switch	DI 3
89	N/C	
90	I/C Spray Lamp	IGN 3
91	Knock Sensor	Knock 1 +
92	Manifold Absolute Pressure Sensor	ANV 1
93	Fuel Tank Differential Pressure Sensor	AN V12
94	N/C	
95	Fuel Level	ANV 6
96	Inlet Plenum Temperature	ANV 8
97	Fuel Level Low (USDM)	DI 10
98	Immobiliser	
99	Ignition Switch	Ignition Switch
100	Diagnostics	

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