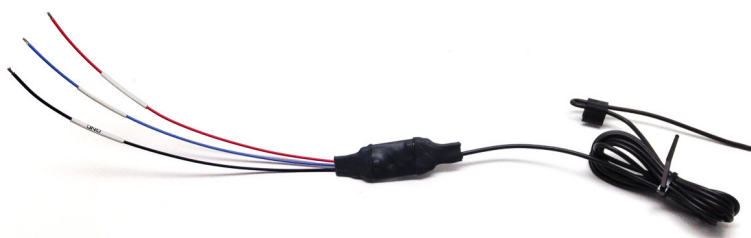User Manual

SUPPORTED ECU COMMUNICATION PROTOCOLS AND AIM LOGGERS CONNECTION

Release 1.03

INDICE

1 – ECU communication protocol": general information

The "available channels list" of Race Studio 2 "Configuration" window comes from the ECU communication protocol.

The communication protocol includes all the available channels of a generic Pectel / DTA etc. ECU. The channels you may sample among the "available channels list" are function of the ECU model, of the ECU configuration and of the wiring.

The number of channels that the data logger is able to sample depends on the ECU type and configuration, on the wiring and on the sensors connected to the ECU itself.

To know which channels are acquired by AIM logger, please check the logger channel page in Race Studio 2 software, where all recorded channels are shown.

Note: for specific information on ECU pinout and wirings always refer to the ECU user manual. Here follow some examples of ECU configuration and connection with AIM loggers; these information come from tests made by AIM research and development board or from dealers or customers that have verified them.

2 – Supported ECUs: general information

AIM loggers support both CAN and RS232 communication protocols.

2.1 – ECU connection: general information

AIM loggers can communicate with the ECU both with a CAN protocol and with an RS232 protocol, using respectively a CAN cable or a Serial cable.
The connection is usually done as below explained:

2.1.1 – Serial Communication Set-Up

The usual connection is as follows: connect cable called RS232 RX with ECU TX and cable called GND with ECU GND as shown below.

LOG GND **LOG RX**	Cable labelled GND — Cable labelled RS232 RX	**ECU GND** **ECU TX**
AIM LOGGER		**ECU**
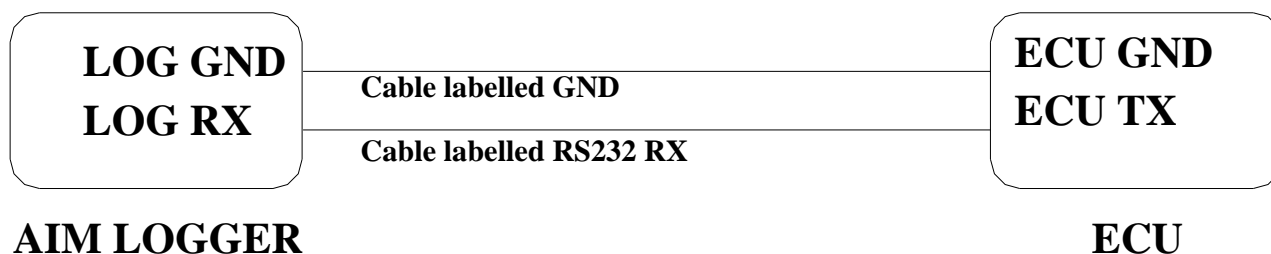
Note: this setup is all right for almost all ECU communicating with RS232 protocol; there can anyway be ECUs that need LOG TX cable to be connected to ECU RX too. For further information, see the following paragraphs, related to the single ECUs or single ECU documents published on AIM website www.aim-sportline.com.

2.1.2 – CAN Communication Set-Up

The connection is as follow: connect cable labelled CAN+ with ECU CAN+, cable labelled CAN- with ECU CAN- and cable called GND with ECU GND as in the figure below.

LOG GND **LOG CAN+** **LOG CAN-**	Cable labelled GND — Cable labelled CAN + — Cable labelled CAN -	**ECU GND** **ECU CAN+** **ECU CAN-**
AIM LOGGER		**ECU**
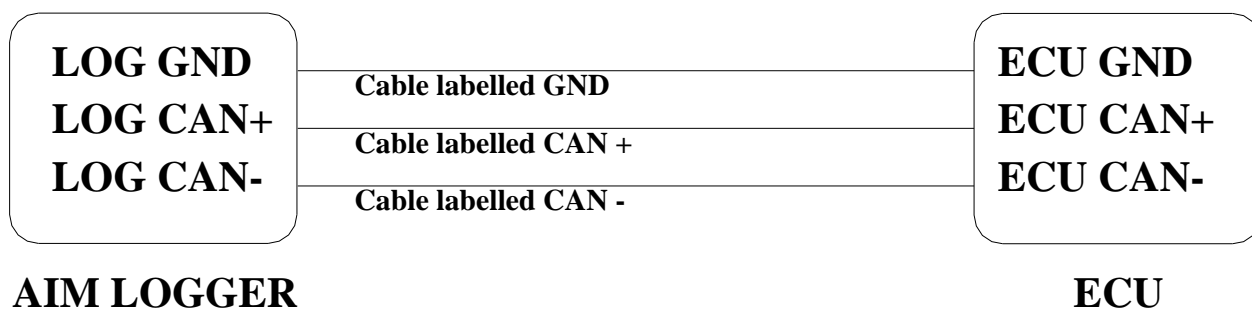
Note: once the ECU is connected to AIM Logger, it needs to be set in the logger configuration in Race Studio 2 software.

3 – AIM – PROPRIETARY CAN & RS232 PROTOCOL

3.1 – CAN Asynchronous Messaging

AIM technique is referred to as Asynchronous messaging, basically the whole stream of parameters (all 35 Bytes) is split up into 8 bytes-length packets, that are sequentially inserted into CAN messages and in a given order. The data packets do not contain a specific identifier, they are just in a predefined order. At the receiving node the device looks for the Header information (this is a constant contained in the data stream), when this is seen the device knows that next message is the start of the data stream and all subsequent CAN messages will contain the given parameters in the predefined order.
This way the CAN system is simply a carrier for seemingly highly variable data under a single base addresses and the software handlers at either end know how to breakdown and reassemble these separate packets of data into a continuous and complete data stream.
The CAN bus has a bit rate of 1Mbit/s and the CAN Buffer Identifier is 11bit.(CAN 2.0a)
CheckSum is the sum of all bytes of the structure up to and including marker byte 3.

Byte	Signal	Units	Scaling
0:1	RPM	RPM	1RPM
2:3	Wheel Speed	Km/h	0.1km/h
4:5	Oil Pressure	Bar	0.1Bar
6:7	Oil Temperature	Deg C	0.1Deg C
8:9	Water Temperature	Deg C	0.1Deg C
10:11	Fuel Pressure	Bar	0.1Bar
12:13	Battery Voltage	Volts	0.01Volts
14:15	Throttle Angle	%	0.1%
16:17	Manifold Pressure	mBar	1mBar
18:19	Air Charge Temperature	Deg C	0.1Deg C
20:21	Exhaust Gas Temperature	Deg C	1Deg C
22:23	Lambda	Lambda	0.001 La
24:25	Fuel Temperature	Deg C	0.1Deg C
26:27	Gear	0=neutral,1=first,2=second,etc	
28:29	Errors	ECU-specific error flags	
30	Number of Data Bytes	30	
31	Marker Byte 1	FC	
32	Marker Byte 2	FB	
33	Marker Byte 3	FA	
34	CheckSum		

3.1.1 – AIM "PROT_CAN"

ECU_1	AIM_RPM	RPM
ECU_2	AIM_WHEELSPEED	vehicle speed
ECU_3	AIM_OILPRESS	oil pressure
ECU_4	AIM_OILTEMP	oil temperature
ECU_5	AIM_WATERTEMP	water temperature
ECU_6	AIM_FUELPRESS	fuel pressure
ECU_7	AIM_BATTVOLT	battery voltage
ECU_8	AIM_TPS	throttle position
ECU_9	AIM_MAP	manifold pressure
ECU_10	AIM_AIRTEMP	intake air temperature
ECU_11	AIM_EXHAUST_TEMP	exhaust temperature
ECU_12	AIM_LAMBDA	lambda value
ECU_13	AIM_FUELTEMP	fuel temperature
ECU_14	AIM_GEAR	engaged gear
ECU_15	AIM_ERRORS	error signal

3.2 – RS232 – Serial protocol

The data stream is standard RS232 at 19200,n,8,1. It consists of a number of short packets. Packets are sent on 10 ms ticks. Note that this does not mean that there is a packet sent every 10 ms tick – there is a pattern which repeats once a second to achieve the channel frequencies listed below, and there are some unused ticks where nothing is transmitted. Each packet consists of 5 bytes. The first byte is the channel number, the second is always A3$_H$, the third and fourth are the channel value, high byte first. The fifth is the sum of the preceding four bytes.

Signal	Channel	Freq [Hz]	Transform		Units
RPM	1	10	y=x		RPM
Wheel speed	5	10	y=x/10		Km/h
Oil pressure	9	5	y=x/1000		Bar
Oil temp	13	2	y=x/10-100		Deg C
Water temp	17	2	y=x/10-100		Deg C
Fuel pressure	21	5	y=x/1000		Bar
Battery voltage	33	5	y=x/100		Volts
Throttle angle	45	10	y=x/10		Deg
Manifold press	69	10	y=x		MBar
Air charge temp	97	2	y=x/10-100		Deg C
Exhaust temp	101	2	y=x/10-100		Deg C
Lambda Sensor	105	10	y=x/1000		Lambda
Fuel temp	109	2	y=x/10-100		Deg C
Gear	113	5	y=x		0=rev, 1=neutral, 2=first, 3=second…
Errors	125	2	-		ECU-specific error flags

3.2.1 – AIM "PROT_UART"

ECU_1	AIM_RPM	RPM
ECU_2	AIM_WHEELSPEED	Vehicle speed
ECU_3	AIM_OILPRESS	Oil pressure
ECU_4	AIM_OILTEMP	Oil temperature
ECU_5	AIM_WATERTEMP	Water temperature
ECU_6	AIM_FUELPRESS	Fuel pressure
ECU_7	AIM_BATTVOLT	Battery voltage
ECU_8	AIM_THROTANG	Throttle position
ECU_9	AIM_MANIFPRESS	Manifold pressure
ECU_10	AIM_AIRCHARGETEMP	Intake air temperature
ECU_11	AIM_EXHTEMP	Exhaust temperature
ECU_12	AIM_LAMBDA	Lambda value
ECU_13	AIM_FUELTEMP	Fuel temperature
ECU_14	AIM_GEAR	Engaged gear
ECU_15	AIM_ERRORFLAG	Error signal

4 – BMW

4.1 – BMW Z4M COUPÉ

ECU_1	BMW_RPM	RPM
ECU_2	BMW_IGN_ANG	Ignition advance angle
ECU_3	BMW_TPS	Throttle position
ECU_4	BMW_GEAR_LEVER	Gear lever position
ECU_5	BMW_VANOS	Variable valve timing
ECU_6	BMW_TPS_KORR_DSC	
ECU_7	BMW_EGAS_POS	
ECU_8	BMW_ECU_STATE	
ECU_9	BMW_AZ_KORR_DSC	
ECU_10	BMW_AIR_PRESS_DYN	
ECU_11	BMW_OIL_TEMP	Oil temperature
ECU_12	BMW_WATER_TEMP	Water temperature
ECU_13	BMW_FUEL_TEMP	Fuel temperature
ECU_14	BMW_AIR_TEMP	Intake air temperature
ECU_15	BMW_DIFF_TEMP	Differential temperature
ECU_16	BMW_GEAR_TEMP	Gear box oil temperature
ECU_17	BMW_ECU_TEMP	Ecu temperature
ECU_18	BMW_CURRENT	
ECU_19	BMW_PSLIM_STATE	
ECU_20	BMW_GEAR	Engaged gear
ECU_21	BMW_FUEL_LEVEL	Fuel level
ECU_22	BMW_SW_STATE	
ECU_23	BMW_FUEL_PRESS	Fuel pressure
ECU_24	BMW_WATER_PRESS	Water pressure
ECU_25	BMW_OIL_PRESS	Oil pressure
ECU_26	BMW_VBATT	Battery voltage
ECU_27	BMW_BRK_PFL	Brake pressure front left w.
ECU_28	BMW_BRK_PFR	Brake pressure front right w.
ECU_29	BMW_BRK_PRL	Brake pressure rear left w.
ECU_30	BMW_BRK_PRR	Brake pressure rear right w.
ECU_31	BMW_P400_N	*** No info available yet***
ECU_32	BMW_P400_C	*** No info available yet***
ECU_33	BMW_P_400T	*** No info available yet***
ECU_34	BMW_SPEED_FL	Vehicle speed – front left wheel
ECU_35	BMW_SPEED_FR	Vehicle speed – front right wheel
ECU_36	BMW_SPEED_RL	Vehicle speed – rear left wheel
ECU_37	BMW_SPEED_RR	Vehicle speed – rear right wheel
ECU_38	BMW_LMBD1	Lambda value#1
ECU_39	BMW_LMBD2	Lambda value#2

5 – CARMO

5.1 – CARMO AFI 2003

AIM loggers can be connected to both Carmo ignition or injection unit (AFI 2003); they can acquire data from Carmo units installed on Honda CBR600, Kawasaki ZX6R, Yamaha YZ6F and Suzuki GSXR600.
The configuration procedure is the same for every bike; when the channels to acquire or to display have been selected, the logger will automatically select the right set of sensors, using the information given by AFI unit.

NOTE: each manufacturer has its own set of sensors; if the set of sensors is not the one used by the manufacturer for that type of bike, acquired data could be wrong.

Injection unit
When the logger is connected to the injection unit all channels listed in the configuration dialog window are available.
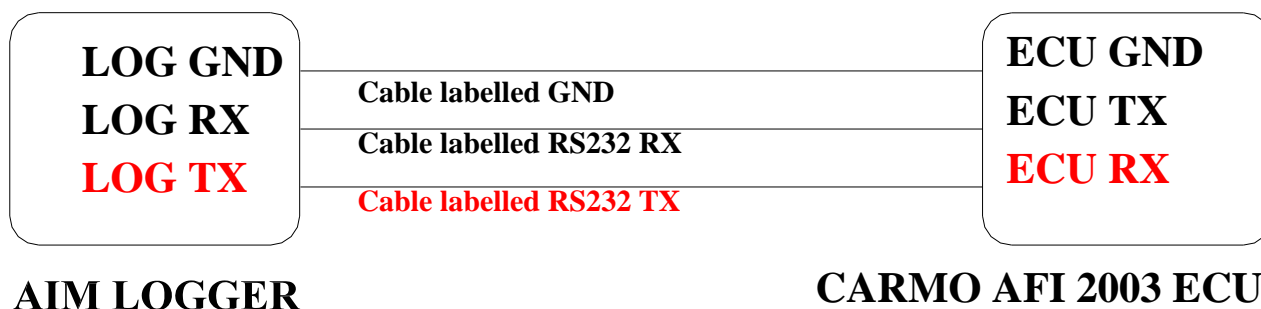
Ignition unit
When the logger is connected to the ignition unit only RPM and Throttle Position channels are available. In this case we recommend to disable the other ECU channels in order to save memory.

5.1.1 – Connection with AIM Data logger

Connect cable labelled **RS 232 RX** with **ECU TX** pin, cable called **RS 232 TX** with **ECU RX** pin and cable called **GND** with **ECU Power GND** pin as shown below.

Refer to the ECU user manual to know the ECU pinout.

LOG GND	Cable labelled GND	ECU GND
LOG RX	Cable labelled RS232 RX	ECU TX
LOG TX	Cable labelled RS232 TX	ECU RX

AIM LOGGER   **CARMO AFI 2003 ECU**

Note: this ECU needs connection of LOG TX cable to ECU RX pin too.

ECU_1	CARMO_RPM	RPM
ECU_2	CARMO_THROTTLE	THROTTLE POSITION
ECU_3	CARMO_AIRTEMP	INTAKE AIR TEMPERATURE
ECU_4	CARMO_WATERTEMP	WATER TEMPERATURE
ECU_5	CARMO_MANIFPRES	MANIFOLD PRESSURE
ECU_6	CARMO_BATTERY	BATTERY VOLTAGE

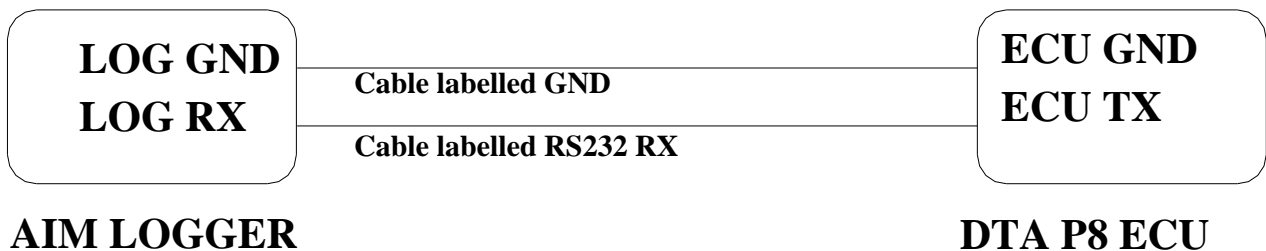# 6 – DTA

6.1 – DTA P8

6.1.1 – Serial Communication Set-Up

The ECU is equipped with a serial communication interface (RS232) used to communicate parameters to an external data logger, or to configure the ECU itself.

6.1.2 – Connection with AIM Data logger

To connect AIM logger to the ECU connect AIM cable labelled "**RS232RX**" with **ECU TX**, AIM cable labelled as "**GND**" with **ECU GND** as shown below.

**Refer to the ECU user manual to know ECU pinout.**

LOG GND		ECU GND
LOG RX	Cable labelled GND	ECU TX
	Cable labelled RS232 RX	

AIM LOGGER   **DTA P8 ECU**

ECU_1	DTA_RPM	RPM
ECU_2	DTA_WHEELSPD	Vehicle speed
ECU_3	DTA_WATERTEMP	Water temperature
ECU_4	DTA_AIRTEMP	Intake air temperature
ECU_5	DTA_MANIFPRESS	Manifold pressure
ECU_6	DTA_THROTANG	Throttle position
ECU_7	DTA_LAMBDA	Lambda value
ECU_8	DTA_BATTV	Battery voltage

7 – NIRA

7.1 – NIRA – I3+"

The communication is done over an RS232 link to NIRA i3+. Her below is ECU pinout.
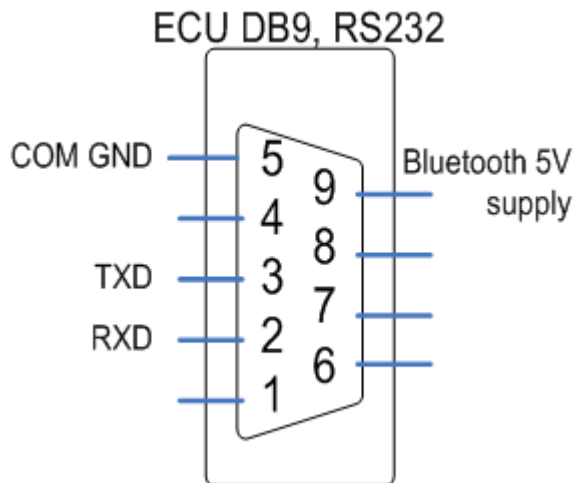
| ECU_1	NIRA_RPM	RPM
ECU_2	NIRA_WATER_TEMP	Water temperature
ECU_3	NIRA_BATTERY_VOLT	Battery voltage
ECU_4	NIRA_TPS	Throttle position
ECU_5	NIRA_MAP	Manifold pressure
ECU_6	NIRA_AIRTEMP	Intake air temperature
ECU_7	NIRA_EXAUST_GAS_TEMP	Exhaust temperature
ECU_8	NIRA_LAMBDA	Lambda value
ECU_9	NIRA_AUX1	Auxiliary channel#1
ECU_10	NIRA_AUX2	Auxiliary channel#2
ECU_11	NIRA_AUX3	Auxiliary channel#3
ECU_12	NIRA_AUX4	Auxiliary channel#4

8 – PERFORMANCE ELECTRONICS

8.1 – PERFORMANCE ELECTRONIC ECU1

The ECU is equipped with a serial communication interface (RS232) used to communicate parameters to an external data logger, or to configure the ECU itself.

8.1.1 – Connection with AIM Data logger

AIM loggers can be connected to Performance Electronics ECU via DB9 serial port according to the following wiring scheme:

- Connect the AIM cable labeled "RS 232 RX" with DB9 male Pin 2
- Connect the AIM cable labeled "RS 232 TX" with DB9 male Pin 3
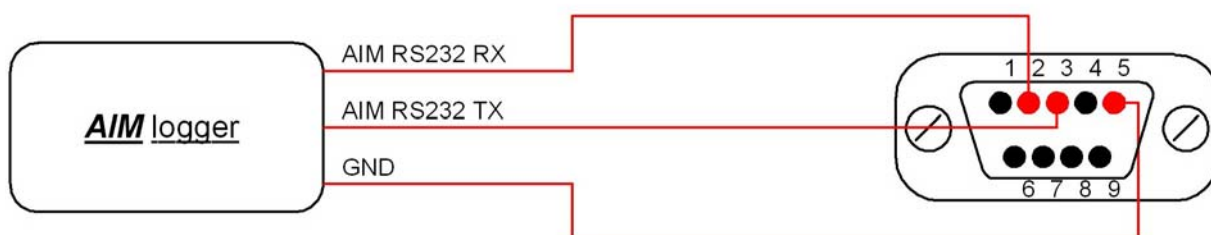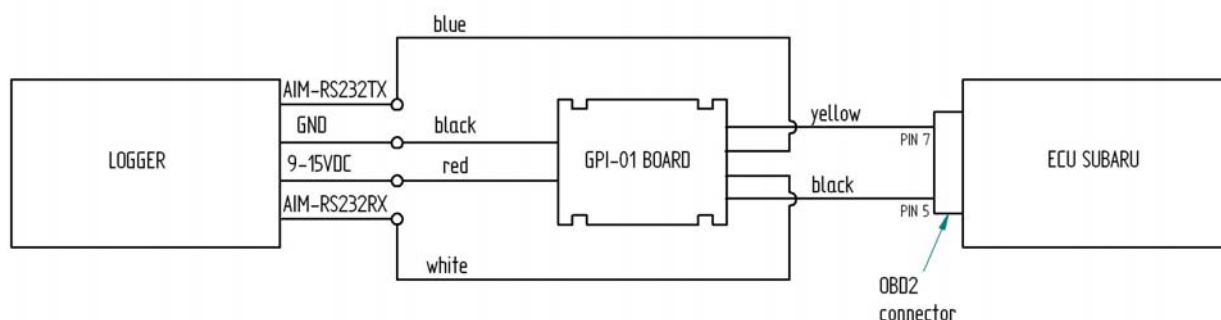

Ecu Channel Table

ECU_1	PERF_RPM	RPM
ECU_2	PERF_TPS	Throttle position
ECU_3	PERF_MAP	Manifold pressure
ECU_4	PERF_IAT	Intake air temperature
ECU_5	PERF_ECT	Water temperature

9 – SUBARU – SSM"

This chapter applies to all Subaru vehicles supporting the SSM (Subaru Select Monitor) with OBD2 connector (from 1999 to 2007). The number of supported channels may vary and depends on car model and year of production.

9.1 – Connection with AIM Data logger

In order to connect the data logger to the SUBARU SSM ECU, AIM GPI01 interface is to be connected to both AIM logger and the ECU as shown below.

ECU Channel Table

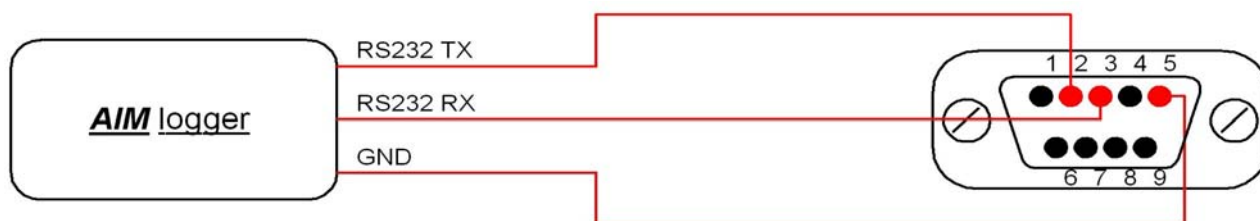| ECU_1	RPM	RPM
ECU_2	SPEED	Vehicle speed
ECU_3	TPS	Throttle position
ECU_4	ECT	Engine coolant temperature
ECU_5	TURBO_PRESS	Turbo pressure
ECU_6	IN_VVT_R	Variable valve timing – right bank
ECU_7	IN_VVT_L	Variable valve timing – left bank
ECU_8	IGN_ADV	Ignition advance
ECU_9	KNOCK_CORR	Knock angle correction
ECU_10	FUEL_LEV	Fuel level
ECU_11	NEUTRAL	Neutral signal
ECU_12	CLUTCH	Clutch switch on/off
ECU_13	BRAKE	Brake switch on/off
ECU_14	ENGINE_LOAD	Engine load
ECU_15	AIR_FLOW	Intake air flow

10 – WALBRO

10.1 – WALBEO BENELLI / BENELLI '04 / BIMOTA / HPUH1"

Each ECU is equipped with a serial communication interface (RS 232) used to communicate parameters to an external data logger, or to configure the ECU itself.

10.1.1 – Connection with AIM Data logger

AIM loggers can be connected to WALBRO ECUs via DB9 serial port according to the following wiring scheme:

- Connect the AIM cable labeled "RS 232 TX" with DB9 male Pin 2
- Connect the AIM cable labeled "RS 232 RX" with DB9 male Pin 3

10.2 – WALBRO – A1BEN_00

| ECU_1	RPM	RPM
ECU_2	MAP	Manifold pressure
ECU_3	TPS	Throttle position
ECU_4	TAIR	Intake air temperature
ECU_5	TENGINE	Engine temperature
ECU_6	VBATT	Battery voltage
ECU_7	LAMBDA	Lambda value
ECU_8	IDLEPOSITION	Idle position
ECU_9	DERIVTPS	Throttle position derivative
ECU_10	SIDE_STAND	Side stand on/off
ECU_11	NEUTRAL	Neutral gear signal
ECU_12	MAPPA_ATTIVA	Selected engine map
ECU_13	TIPO_OVER	Tip over sensor on/off

11 – WOLF

11.1 – WOLF 3D

The ECU is equipped with a serial communication interface (RS 232) used to communicate parameters to an external data logger, or to configure the ECU itself.

11.1.1 – Connection with AIM Data logger

AIM loggers can be connected to WOLF ECU via DB9 serial port according to the following wiring scheme:
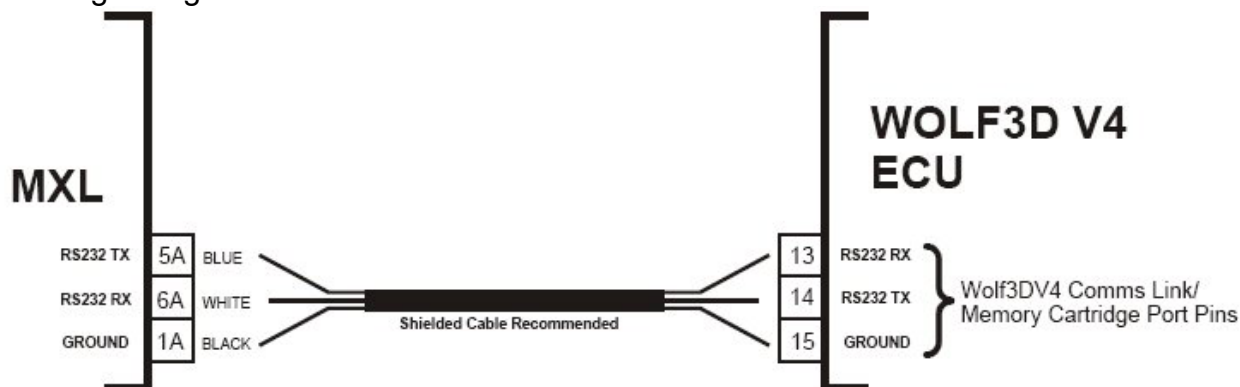
ECU_1	WOLF_RPM	RPM
ECU_2	WOLF_LOAD	Engine load
ECU_3	WOLF_TURBOP	Boost pressure
ECU_4	WOLF_MAP	Manifold pressure
ECU_5	WOLF_INJT	Injection time
ECU_6	WOLF_INJ_DC	Injector duty cycle (0-100%)
ECU_7	WOLF_IGNANG	Ignition advance angle
ECU_8	WOLF_TPS	Throttle position
ECU_9	WOLF_AIRT	Intake air temperature
ECU_10	WOLF_ENGT	Engine temperature
ECU_11	WOLF_OXYGEN	Lambda raw voltage
ECU_12	WOLF_BATT	Battery voltage
ECU_13	WOLF_IDLE_VALVE	Idle valve position
ECU_14	WOLF_NOISE	False signals counter
ECU_15	WOLF_AFR	Air/fuel ratio
ECU_16	WOLF_ERR	Error signal