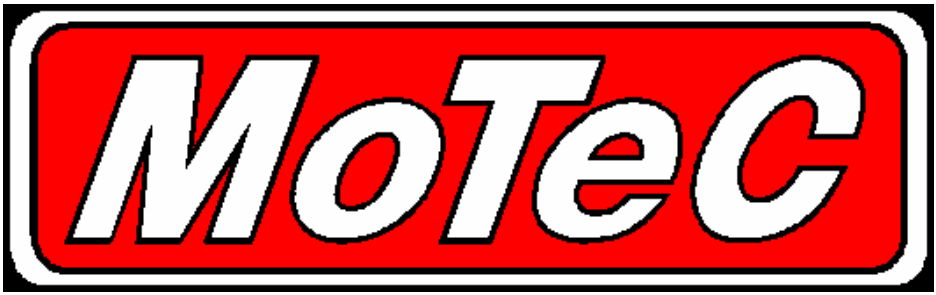


SIM3

Engine Simulator

User's Manual

Contents

11 July, 2005

Introduction

This document describes the MoTeC SIM3 engine simulator. It is intended for use in conjunction with a MoTeC ECU or ADL to simulate signals from an engine and various sensors. This allows in depth testing of ECU/ADL configurations, functions and is also a valuable training aid.

In order to simulate different triggering systems and modes, the SIM3 has the ability to generate a large number of Ref/Sync modes. See Appendix 2 for a full list of currently available Ref/Sync modes

SIM3 Front Panel

Overview

Note: The SIM3 I/O terminology and labelling always refers to the functionality of the attached Device Under Test (DUT), ie: the ECU or ADL.

Signal Outputs

There are 24 output test points and associated LED indicators for outputs from the DUT, grouped as INJECTOR, IGNITION and AUXILIARY OUTPUTS. The LED indicators are active when the associated DUT connector pin is pulled low by the DUT. The test points are connected directly to the associated DUT connector pin and may be used to attach external loads to outputs.

Analog Inputs

There are 8 potentiometers labelled AV1 to AV8 for analog inputs to the DUT. Each potentiometer varies the analogue voltage at the associated DUT connector pin and test point between 0V and 5V. The 5V is supplied by the DUT. The 0V and 5V must be supplied by the DUT on the 0V and 5V DUT connector pins in order to use the analog inputs.

Switch Inputs

The 4 SWITCH INPUT switches (on, off or momentary on) switch the DUT switch inputs to the 0V from the DUT.

Speed Inputs

The SPD1 to SPD4 potentiometers and the SPEED MODE rotary switch control the speed inputs to the DUT. The speed inputs are available on the DUT connector and on test points SPD1 to SPD4. Speed inputs on the DUT may also be known as Digital inputs.

The functionality of the speed inputs is determined by the SPEED MODE switch as described below. The STATUS LED flashes if an invalid speed mode is selected. An invalid speed mode is a switch position that does not have a mode implemented.

Speed Mode 0

SPD1 Pot	Speed 1 input frequency
SPD2 Pot	Speed 2 input frequency
SPD3 Pot	Speed 3 input frequency
SPD4 Pot	Speed 4 input frequency

Notes:

Frequency is variable from approx 10Hz to 1200Hz

Duty cycle is fixed at 50%

At the minimum pot position (fully anticlockwise), the corresponding speed input is held high. This corresponds to a duty cycle of 0%, ie: speed = 0.

Speed Mode 1

SPD1 Pot	Speed 1 input frequency
SPD2 Pot	Speed 1 input duty cycle
SPD3 Pot	Speed 3 input frequency
SPD4 Pot	Speed 3 input duty cycle

Notes:

Frequency is variable from approx 10Hz to 1200Hz

Duty cycle is variable from 0 to 100%

Speed Mode 2

SPD1 Pot	RPM divider ratio for Speed 1 input
SPD2 Pot	RPM divider ratio for Speed 2 input
SPD3 Pot	RPM divider ratio for Speed 3 input
SPD4 Pot	RPM divider ratio for Speed 4 input

Notes:

Speed inputs are variable with the speed pots and with RPM.

The resulting frequency is variable up to approx 930Hz (at 20000RPM)

Duty cycle is fixed at 50%

At the minimum pot position (fully anticlockwise), the corresponding speed input is held high. This corresponds to a duty cycle of 0%, ie: speed = 0.

Speed Mode 3

SPD1 Pot	Speed 1 input on/off
SPD2 Pot	Speed 2 input on/off
SPD3 Pot	Speed 3 input on/off
SPD4 Pot	Speed 4 input on/off

Notes:

The pots now act as on/off switches and not as a variable speed signals.

At the minimum pot position (fully anticlockwise), the corresponding speed input is held high. Otherwise the input is held low.

Speed Mode 4

SPD1 Pot	Speed 1 input frequency
SPD2 Pot	Speed 2 input frequency
SPD3 Pot	Speed 3 input frequency
SPD4 Pot	Speed 4 input frequency

Notes:

Frequency is variable from approx 0Hz to 100Hz

Duty cycle is fixed at 50%

At the minimum pot position (fully anticlockwise), the corresponding speed input is held high. This corresponds to a duty cycle of 0%, ie: speed = 0.

Speed Mode B

SPD1 Pot	Sync advance/retard
SPD2 Pot	
SPD3 Pot	Cam 0 retard on Speed3 input
SPD4 Pot	Cam 1 retard on Speed4 input

Notes:

Sync signal is active depending on the ref/sync mode.

Sync advance/retard range is set separately for each particular ref/sync mode.

The maximum RPM that Sync and Cam control will reliably work at is dependent on the particular ref/sync mode. For example, with narrow sync pulses (positive going) of 3 degrees width, the advance/retard only works reliably to around 7000rpm.

The cam retard range is set separately for each particular ref/sync mode.

Speed Mode C

SPD1 Pot	Cam 0 retard on Speed1 input
SPD2 Pot	Cam 1 retard on Speed2 input
SPD3 Pot	Cam 0 retard on Speed3 input
SPD4 Pot	Cam 1 retard on Speed4 input

Notes:

Mode C allows four cam signals to be generated, with each cam waveform appearing on two speed outputs with individual retard control. Cam0/Cam1 refers to the source waveform.

Cam signals are retarded from their position in the ref/sync data in flash.

The maximum RPM that Cam control will reliably work at is dependent on the width of the cam pulses.

The cam retard range is set separately for each particular ref/sync mode.

Depending on the ref/sync mode, the retarded Cam 0 signal controlled by the SPD1 pot may also be used as the Sync signal.

Speed Mode D

SPD1 Pot	Cam 0 retard on Speed1 input
SPD2 Pot	Cam 1 retard on Speed2 input
SPD3 Pot	RPM divider ratio for Speed 3 input
SPD4 Pot	RPM divider ratio for Speed 4 input

Notes:

Cam signals are retarded from their position in the ref/sync data in flash.

The maximum RPM that Cam control will reliably work at is dependent on the width of the cam pulses.

The cam retard range is set separately for each particular ref/sync mode.

Depending on the ref/sync mode, the retarded Cam 0 signal controlled by the SPD1 pot may also be used as the Sync signal.

Speed inputs 3 & 4 are variable with the speed pots and with RPM.

The resulting frequency on speed inputs 3 & 4 is variable up to approx 930Hz (at 20000RPM)

Speed inputs 3 & 4 duty cycle is fixed at 50%

At the minimum pot position (fully anticlockwise) for pots 3 & 4, the corresponding speed input is held high. This corresponds to a duty cycle of 0%

Speed Mode E

SPD1 Pot	Cam 0 retard on Speed1 input
SPD2 Pot	Cam 1 retard on Speed2 input
SPD3 Pot	Speed 3 input frequency
SPD4 Pot	Speed 3 input duty cycle

Notes:

Cam signals are retarded from their position in the ref/sync data in flash.

The maximum RPM that Cam control will reliably work at is dependent on the width of the cam pulses.

The cam retard range is set separately for each particular ref/sync mode.

Depending on the ref/sync mode, the retarded Cam 0 signal controlled by the SPD1 pot may also be used as the Sync signal.

Speed 3 frequency is variable from approx 10Hz to 1200Hz

Speed 3 duty cycle is variable from 0 to 100%

Speed Mode F

SPD1 Pot	Cam 0 retard on Speed1 input
SPD2 Pot	Cam 1 retard on Speed2 input
SPD3 Pot	Speed 3 input frequency
SPD4 Pot	Speed 4 input frequency

Notes:

Cam signals are retarded from their position in the ref/sync data in flash.

The maximum RPM that Cam control will reliably work at is dependent on the width of the cam pulses.

The cam retard range is set separately for each particular ref/sync mode.

Depending on the ref/sync mode, the retarded Cam 0 signal controlled by the SPD1 pot may also be used as the Sync signal.

Speed 3 and Speed 4 frequency is variable from approx 10Hz to 1200Hz

Speed 3 and Speed 4 duty cycle is fixed at 50%

At the minimum pot position (fully anticlockwise) for pots 3 & 4, the corresponding speed input is held high

Ref/Sync Inputs

The ref/sync generator can generate different ref, sync and cam signals for input into an ECU. Up to 256 ref/sync modes can be stored in the onboard SIM3 FLASH memory. These ref/sync modes can be upgraded from a PC over the CAN bus.

The ref/sync generator has test points for REF, SYNC, TDC and TRIGGER signals. Cam signals are generated using the relevant CAM related speed modes.

The ref/sync mode is selected with the two REF/SYNC MODE rotary switches. If the SIM3 PC application is running, a brief description of the current mode is retrieved from the SIM3 and displayed on the PC.

The COARSE and FINE RPM rotary pots can adjust the RPM up to approximately 20000rpm.

The ref and sync input waveforms can have both positive and negative components.

The REF RISE/FALL and SYNC RISE/FALL switches determine the polarity of the ref and sync input waveforms.

The REF MAG/HALL and SYNC MAG/HALL switches remove the negative component of the ref or sync waveforms when in the HALL position.

The REF LEVEL and SYNC LEVEL pots determine the amplitude of the ref and sync waveforms.

The OFFSET pot determines the DC voltage offset of both the ref and sync waveforms. The offset can be positive or negative.

Communications

RS232

The DUT connector has logic level and RS232 level pins for serial connection to the DUT.

Only one of the serial interfaces should be used at a time, as both interfaces connect to the single 9 pin RS232 connector on the SIM3.

The logic level interface has an RS232 level shifter in the SIM3, allowing an M4/M48/M8 ECU to be connected to a PC without needing a PCI cable or CIM module.

The RX and TX test points are connected directly to the RS232 level pins (RX232 and TX232) on the DUT connector.

CAN

The CAN pins on the DUT connector are connected directly to the CAN-HI and CAN-LO test points, and to the 5 pin CAN connector.

The microcontroller in the SIM3 is also connected to the CAN bus for communication with the SIM3 PC application.

There are no CAN termination resistors in the SIM3.

USB

For USB connection to the ADL2 or SDL, the SIM3 loom should provide a USB type B socket that is wired directly to the DUT. There is no USB connection available via the SIM3.

Note that a UTC can be plugged directly into the SIM3.

PC Communications

The SIMSEND PC application is used to send ref/sync patterns to the SIM3, and to view the description of the currently selected ref/sync mode.

To install Simsend, create the folder c:\motec\sim3 and copy simsend.exe and sim3.bin into the folder. CAN drivers must be installed on the PC (by installing another MoTeC product) to use Simsend.

Sim3.bin contains the ref/sync modes. The current ref/sync modes are described in Appendix 2. An editor is currently planned to allow the refsync modes to be modified.

To send ref/sync modes to the SIM3, connect the CAN cable to the SIM3 then run simsend.exe and press the Start button. It will then take a few minutes to send the file.

The Simsend application displays information about the currently selected ref/sync mode. Note that if the selected ref/sync mode is empty, the ref/Sync description will display rubbish.

The Simsend application cannot be run in conjunction with other PC applications (such as ECU manager) that use the CAN bus to communicate with the DUT.

Miscellaneous

Voltage Test Points

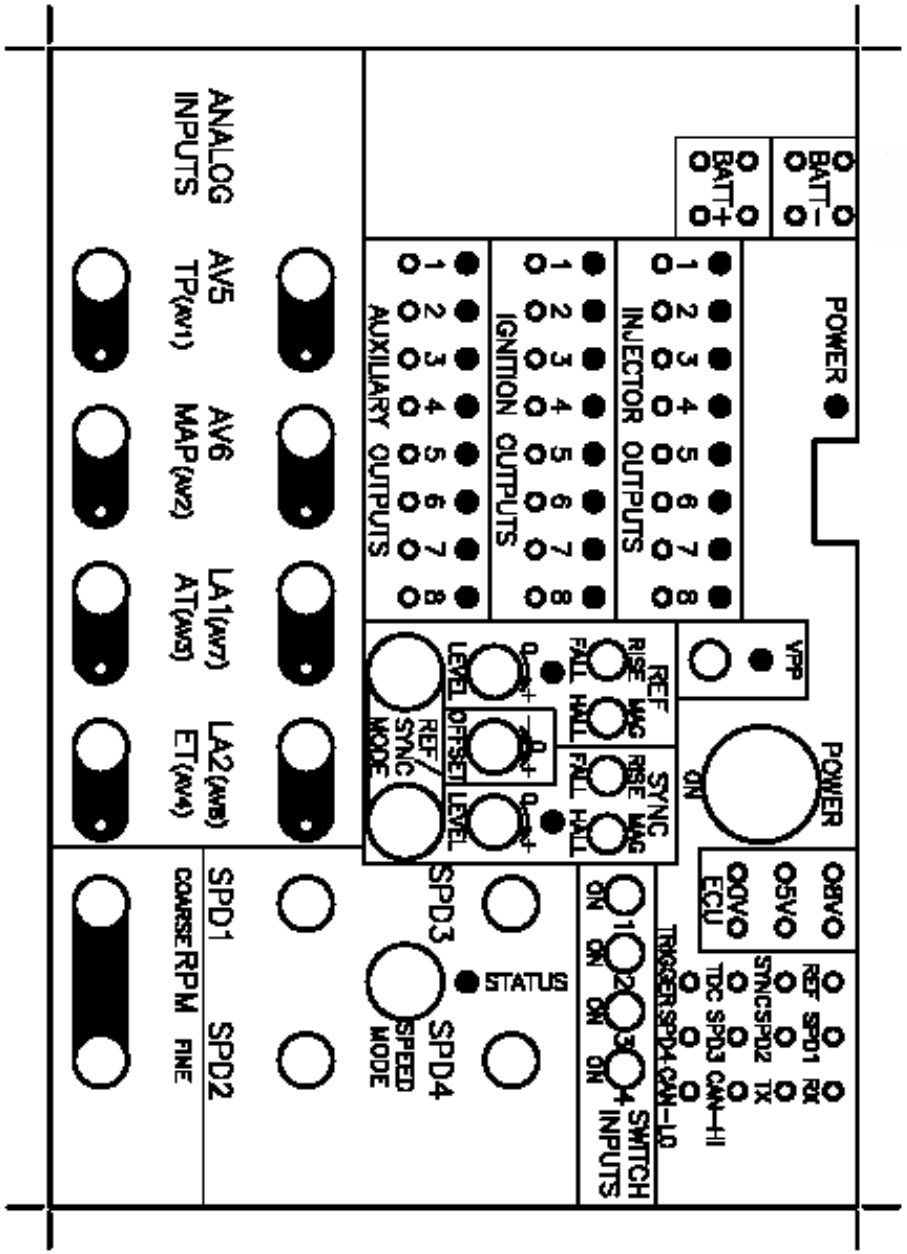
The ECU 8V, 5V and 0V test points are connected directly to the 8V, 5V and 0V connector pins to test the DUT voltages.

The BATT- and BATT+ pins are connected directly to the SIM3 power supply after the main power switch and fuse.

Programming Voltage

The VPP switch controls the VPP connector pin for programming M4/M48/M48 units without an external SUU (Software Update Unit).

Front Panel


POWER
BATT−
BATT+
INJECTOR OUTPUTS
IGNITION OUTPUTS
AUXILIARY OUTPUTS
VPR
REF RISE
REF FALL
MAG
HALL
LEVEL
OFFSET
REF SYNC MODE
SYNC RISE
SYNC FALL
MAG
HALL
LEVEL
POWER
ON
O8V/O
O5V/O
O0V/O ECU
REF SPD1 RX
SYNCSPD2 TX
TDC SPD3 CAN−H
SPD4 CAN−L
TRIGGER
SWITCH INPUTS
ON
STATUS
SPD3
SPD4
SPEED MODE
ANALOG INPUTS
AV5 TP(AV1)
AV6 MAP(AV2)
LA1(AV7) AT(AV3)
LA2(AV8) ET(AV4)
SPD1 COARSE
SPD2 FINE
RPM

Appendix 1: Specifications

Environmental

Dimensions (mm): 190 (w) x 138 (h) x 46 (d)

Ambient temperature range: -10°C to 70°C

Weight: 500g

Electrical

Input Supply Voltage: 8V – 15V

Reverse Voltage Protection

Battery Transient Protection

Maximum Current: 0.5A (excluding external device)

Internal 10A fuse

Operation

Hardware

- 8 x analogue outputs with potentiometers and test points for measuring the voltage
- 4 x switches (on/off/momentary)
- 4x speed outputs with several modes of operation, including CAM position simulation
- 24 x test points for device outputs (8 x IGN, 8 x FUEL, 8 x AUX) with LED indicators
- Test points for ECU 0V, 5V, 8V
- RPM generation to 20000 RPM
- REF/SYNC generator with REF, SYNC, TDC and TRIGGER outputs and REF/SYNC LEDs
- REF/SYNC modes allow edges to be defined with 0.5 degree resolution
- HALL and MAG ref/sync generation with adjustable levels and polarity

- Provision for up to 256 REF/SYNC modes, each with up to two CAM position waveforms
- CAN communication via 5pin “canon” socket for CAN cable
- Power via 3 pin “canon” socket
- M4/M48/M8 ECUs can be connected via the simulator to a PC without a PCI cable (standard RS232 cable)
- Allows M4/M48/M8 ECU programming without external SUU
- Connector Type: 60 way (same as M800)

Software

- Field update of REF/SYNC generator software via CAN
- SPEED status LED flashes when setup in an invalid mode or a pot that isn’t in use, is moved
- REF LED flashes if an invalid REF/SYNC mode is selected, ie: a mode number that does not have a mode implemented for it.
- Status information available via CAN includes –

REF/SYNC mode, RPM, SPEED mode, SPEED output frequency/duty cycle or CAM retard in degrees

Appendix 2: Ref/Sync Modes

The following list contains the default ref/sync modes supplied with the SIM3. The description is crank (sync) teeth / crank degrees, cam (ref) teeth / crank degrees. Eg: 6/360, 1/720 indicates that there are 6 crank teeth and 1 tooth on the camshaft.

Hall modes transition between two voltage levels, while Magnetic modes have three voltage levels. The amplitude of the signal can be adjusted with the 'Level' control, while a DC offset (not normally required) can be added using the 'Offset' control.

Mode	Description
00	2 / 360, 1 / 720 Hall Dual Edge & 1 Tooth
01	3 / 360, 1 / 720 Hall Dual Edge & 1 Tooth
02	4 / 360, 1 / 720 Hall Dual Edge & 1 Tooth
03	5 / 360, 1 / 720 Hall Dual Edge & 1 Tooth
04	6 / 360, 1 / 720 Hall Dual Edge & 1 Tooth
05	12 / 360, 1 / 720 Hall Dual Edge & 1 Tooth
0A	2 / 360, 2 / 720 MX5,VR4 etc
0B	3 / 360, 4 / 720
0C	12 / 360, 1 / 720 Commodore series III
0F	1 / 360, 2 / 720 Harley Davidson
10	2 / 360, 1 / 720 Magnetic 6 Deg Duration
11	3 / 360, 1 / 720 Magnetic 6 Deg Duration
12	4 / 360, 1 / 720 Magnetic 6 Deg Duration
13	5 / 360, 1 / 720 Magnetic 6 Deg Duration
14	6 / 360, 1 / 720 Magnetic 6 Deg Duration
15	8 / 360, 1 / 720 Magnetic 6 Deg Duration
16	10 / 360, 1 / 720 Magnetic 6 Deg Duration
17	12 / 360, 1 / 720 Magnetic 6 Deg Duration

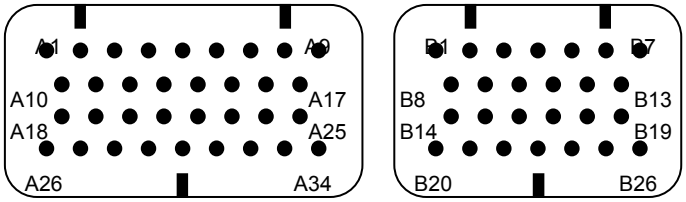
18	18 / 360, 1 / 720 Magnetic 6 Deg Duration
19	20 / 360, 1 / 720 Magnetic 6 Deg Duration
1A	16 / 360, 1 / 720 Magnetic 6 Deg Duration
1F	4 / 360, 2 / 720 Ford Cosworth /Lancia
20	4+1 / 360, 1 / 720 Magnetic 6 Deg Duration
21	6+1 / 360, 1 / 720 Magnetic 6 Deg Duration
22	8+1 / 360, 1 / 720 Magnetic 6 Deg Duration
23	12+1 / 360, 1 / 720 Magnetic 6 Deg Duration
2A	12+1 / 360, 4+1 / 720 Honda Type R
30	30-1 / 360, 1 / 720 Missing tooth mode for Mag & Hall
31	30-2 / 360, 1 / 720 Missing tooth mode for Mag & Hall
32	36-1 / 360, 1 / 720 Missing tooth mode for Mag & Hall
33	36-2 / 360, 1 / 720 Missing tooth mode for Mag & Hall
34	60-2 / 360, 1 / 720 Missing tooth mode for Mag & Hall
35	66-1 / 360, 1 / 720 Missing tooth mode for Mag & Hall
36	60-2 / 360, 4 / 720 BMW
37	48-1 / 360, 1 / 720
38	36-2 / 360, 3 / 720 Toyota 2ZZGE
39	36-2 / 360, 4-1 / 720 Toyota
3A	60-2 / 360, 8-1 / 720 BMW V8 VANOS
3B	60-2 / 360, 6+1 / 720 BMW #1
3C	60-2 / 360, 6+1 / 720 BMW #2 (Position Check)
3D	36-1 / 360, 6-1-1 / 720 Ford BA
3E	36-2 / 360, 3 / 720 Lexus IS300
3F	60-2 / 360 ,4-1 / 720 Peugeot 206RC
40	180 / 360, 1 / 720 Nemicon OEW-036-2MHC
41	180 / 360,4&21 / 720 Nissan VQ (sync has 2 signals 5V6 zen req)
42	180 / 360, 4-8 / 720 Pulsar SSS

43	180 / 360, 4-16 / 720 SR20,CA18 etc
44	180 / 360, 6-8 / 720 RB30
45	180 / 360, 6-16 / 720 RB20
46	180 / 360, 6-24 / 720 VG30, RB26 etc
47	180 / 360, 8-16 / 720 Nissan V8
48	180 / 360, 8-22 / 720 GM V8
49	(null)
50	4 with 1 Narrow / 720
51	6 with 1 Narrow / 720
52	8 with 1 Narrow / 720
5A	4 / 360 , 2+1 / 720 Mazda Miata
60	20-2 / 180, 1 / 720
61	22-2 / 180, 1 / 720
62	36-2-2-2 / 360, 2 / 720 Subaru VII
63	Rover K Series
64	6 / 360, 6 / 720 Odd Subaru to VI(6)
65	18-1 / 180, 1 / 720 Rover
66	36-2-2-2 / 360, 6 / 720 Nissan VQ35, can RETARDED
67	36-2-2-2 / 360, 6 / 720 Nissan VQ35, cam ADVANCED
68	36-2-2-2 / 360, 3 / 720 Subaru 6cyl 3.2L
69	36-2-2-2 / 360, 4-1 / 720 Subaru Legacy 4cyl quad cam 2004
79	IEX test Cycle time = 26.17mSec

Appendix 3: PIN Descriptions

Please note that as the SIM3 can be connected to all ECUs, the pin numbers do not correspond to a particular ECU. MoTeC are able to supply looms for all MoTeC ECUs the ADL/ADL2 and SDL.

Device Under Test (DUT) Connector



Pin Number	Name	SIM3 Panel Reference	Connection
A-01	AUX6	AUXILIARY OUTPUT 6	LED to VBAT
A-02	AUX5	AUXILIARY OUTPUT 5	LED to VBAT
A-03	AUX1	AUXILIARY OUTPUT 1	LED to VBAT
A-04	AUX2	AUXILIARY OUTPUT 2	LED to VBAT
A-05	AUX3	AUXILIARY OUTPUT 3	LED to VBAT
A-06	AUX4	AUXILIARY OUTPUT 4	LED to VBAT
A-07	IGN8	IGNITION OUTPUT 8	LED to VBAT
A-08	IGN7	IGNITION OUTPUT 7	LED to VBAT
A-09	IGN6	IGNITION OUTPUT 6	LED to VBAT
A-10	AUX7	AUXILIARY OUTPUT 7	LED to VBAT
A-11	AV8	ANALOG INPUT LA2(AV8)	1k pot 0VECU to 5VECU
A-12	AV7	ANALOG INPUT LA1(AV7)	1k pot 0VECU to 5VECU
A-13	SW4	SWITCH INPUT 4	Switch to 0VECU

A-14	SW3	SWITCH INPUT 3	Switch to 0VECU
A-15	SYNC	SYNC	sync waveform from ref/sync generator
A-16	REF	REF	ref waveform from ref/sync generator
A-17	IGN5	IGNITION OUTPUT 5	LED to VBAT
A-18	AUX8	AUXILIARY OUTPUT 8	LED to VBAT
A-19	AV6	ANALOG INPUT AV6	1k pot 0VECU to 5VECU
A-20	AV5	ANALOG INPUT AV6	1k pot 0VECU to 5VECU
A-21	SW2	SWITCH INPUT 2	Switch to 0VECU
A-22	SW1	SWITCH INPUT 1	Switch to 0VECU
A-23			
A-24	8VECU	ECU 8V	8V from device
A-25	IGN1	IGNITION OUTPUT 1	LED to VBAT
A-26	AV4	ANALOG INPUT ET(AV4)	1k pot 0VECU to 5VECU
A-27	AV3	ANALOG INPUT AT(AV3)	1k pot 0VECU to 5VECU
A-28	AV2	ANALOG INPUT MAP(AV2)	1k pot 0VECU to 5VECU
A-29	AV1	ANALOG INPUT TP(AV1)	1k pot 0VECU to 5VECU
A-30	5VECU	ECU 5V	5V from device
A-31	0VECU	ECU 0V	0V from device
A-32	RX232	RX	RS232 comms to PC
A-33	TX232	TX	RS232 comms from PC
A-34	VPP	VPP	programming voltage to device
B-01	IGN4	IGNITION OUTPUT 4	LED to VBAT
B-02	INJ8	INJECTOR OUTPUT 8	LED to VBAT

B-03	INJ7	INJECTOR OUTPUT 7	LED to VBAT
B-04	INJ6	INJECTOR OUTPUT 6	LED to VBAT
B-05	INJ5	INJECTOR OUTPUT 5	LED to VBAT
B-06	INJ1	INJECTOR OUTPUT 1	LED to VBAT
B-07	INJ2	INJECTOR OUTPUT 2	LED to VBAT
B-08	IGN3	IGNITION OUTPUT 3	LED to VBAT
B-09	SPD1	SPD1	speed signal switched to ground (generated by SIM3)
B-10	SPD2	SPD2	speed signal switched to ground (generated by SIM3)
B-11	SPD3	SPD3	speed signal switched to ground (generated by SIM3)
B-12	SPD4	SPD4	speed signal switched to ground (generated by SIM3)
B-13	INJ3	INJECTOR OUTPUT 3	LED to VBAT
B-14	IGN2	IGNITION OUTPUT 2	LED to VBAT
B-15			
B-16	VBAT1	BATT+	Power from SIM3
B-17	RXTTL		Logic level comms to PC via RS232 level shifter in SIM3
B-18	TXTTL		Logic level comms from PC via RS232 level shifter in SIM3
B-19	INJ4	INJECTOR OUTPUT 4	LED to VBAT
B-20	CAN-HI	CAN-HI	CAN bus
B-21	CAN-LO	CAN-LO	CAN bus
B-22	VBAT2	BATT+	Power from SIM3

B-23	VBAT3	BATT+	Power from SIM3
B-24	GND1	BATT-	GND from SIM3
B-25	GND2	BATT-	GND from SIM3
B-26	GND3	BATT-	GND from SIM3

RS232 Connector (D9)

Pin 2	Tx (to PC)
Pin 3	Rx (from PC)
Pin 5	Gnd

Power Connector (3pin XLR Male)

Pin 1	0V
Pin 2	VBatt In (8V-15V)

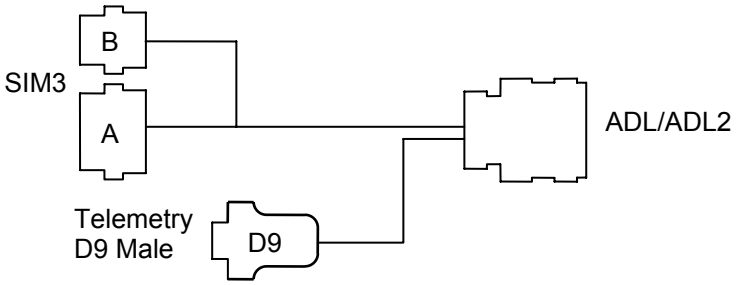
CAN Connector (5pin XLR Female)

This is the standard MoTeC CAN cable pinout

Pin 1	0V
Pin 3	8V out
Pin 4	CAN LO
Pin 5	CAN HI

Appendix 4: Recommended Looms

ADL/ADL2 Loom

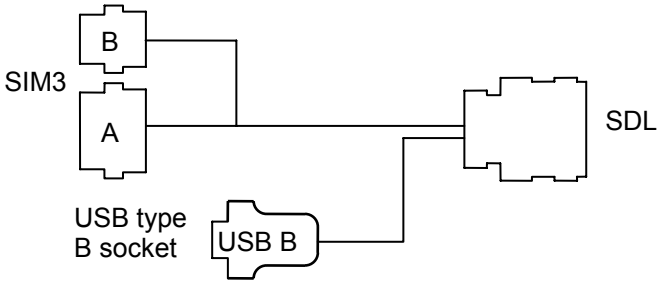


ADL Pin	ADL Name	SIM3 pin	SIM3 Name	Colour
45	AV1	A-29	AV1	blue
46	AV2	A-28	AV2	green
47	AV3	A-27	AV3	violet
48	AV4	A-26	AV4	grey
49	AV5	A-20	AV5	brown
50	AV6	A-19	AV6	blue
19	AV7	A-12	AV7	orange
20	AV8	A-11	AV8	yellow
9	AUX1	A-03	AUX1	orange
10	AUX2	A-04	AUX2	yellow
11	AUX3	A-05	AUX3	green
12	AUX4	A-06	AUX4	blue
13	AUX5	A-02	AUX5	violet
14	AUX6	A-01	AUX6	grey

15	AUX7	A-10	AUX7	blue
16	AUX8	A-18	AUX8	brown
7	BAT-	B-24	GND1	black
8	BAT+	B-16	VBAT1	red
74	CANHA	B-20	CAN-HI	white
73	CANLA	B-21	CAN-LO	green
52	DIG1	A-16	REF	orange
53	DIG2	A-15	SYNC	yellow
79	RX	A-33	TX232	violet
78	TX	A-32	RX232	grey
43	0V	A-31	0VECU	black
44	5V	A-30	5VECU	Red
62	8V	A-24	8VECU	White
63	SPD1	B-09	SPD1	yellow
64	SPD2	B-10	SPD2	orange
65	SPD3	B-11	SPD3	grey
66	SPD4	B-12	SPD4	brown
57	SW1	A-22	SW1	green
58	SW2	A-21	SW2	violet
59	SW3	A-14	SW3	brown
60	SW4	A-13	SW4	orange

ADL Pin	**ADL Name**	**Telemetry pin**	**Telemetry Name**	**Colour**
55	DIG4	D9-1	CD	white
67	TELEM	D9-3	DATA	red
61	0V	D9-5	GND	black

SDL Loom

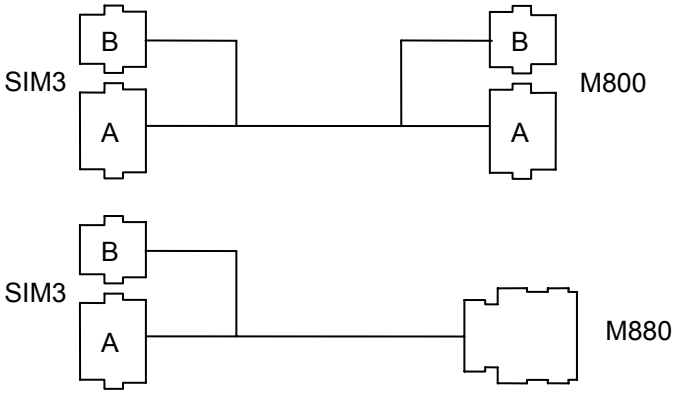


SDL Pin	SDL Name	SIM3 pin	SIM3 Name	Colour
1	AV5	A-20	AV5	brown
2	AV6	A-19	AV6	blue
3	BAT+	B-16	VBAT1	red
4	BAT-	B-24	GND1	black
5	AUX1	A-03	AUX1	orange
6	AUX2	A-04	AUX2	yellow
7	AUX3	A-05	AUX3	green
8	AUX4	A-06	AUX4	blue
11	SW1	A-22	SW1	green
12	SW2	A-21	SW2	violet
13	8V	A-24	8VECU	white
14	5V	A-30	5VECU	red
15	AV1	A-29	AV!	blue
16	AV2	A-28	AV2	green
17	AV3	A-27	AV3	violet
18	AV4	A-26	AV4	grey
19	AV7	A-12	AV7	orange
20	AV8	A-11	AV8	yellow

21	AT1	A-14	SW3	brown
22	AT2	A-13	SW4	orange
23	SPD1	B-09	SPD1	yellow
26	SPD2	B-10	SPD2	orange
27	DIG1	A-16	REF	orange
28	DIG2	A-15	SYNC	yellow
33	TX	A-32	RX232	grey
34	RX	A-33	TX232	violet
35	CAN LO	B-21	CAN-LO	green
36	CAN HI	B-20	CAN-HI	white
37	0V	A-31	0VECU	black

SDL Pin	**SDL Name**	**USB Name**	**Colour**
9	USB-GND	USB-GND + shield	black
10	USB-VCC	USB-VCC	red
24	USB-DM	USB-DM	white
25	USB-DP	USB-DP	green

M800/M880 Looms

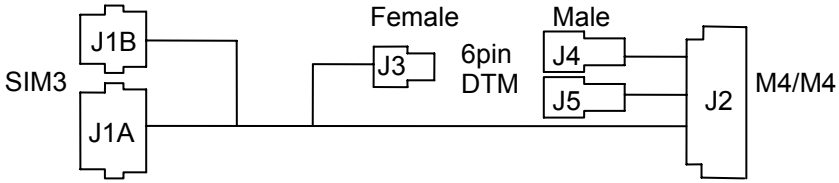


M800 Pin	M880 Pin	M800/M880 Name	SIM3 pin	SIM3 Name	Colour
A-26	23	VBAT	B-16	VBAT1	red
	32	VBAT	B-22	VBAT2	red
	41	VBAT	B-23	VBAT3	red
A-10	14	GND	B-24	GND1	black
A-11	19	GND	B-25	GND2	black
	21	GND	B-26	GND3	black
A-12	3	8V-ENG	A-24	8VECU	white
A-02	16	5V-ENG	A-30	5VECU	red
B-16	27	0V-ENG	A-31	0VECU	black
A-18	9	AUX1	A-03	AUX1	orange
A-01	8	AUX2	A-04	AUX2	yellow
A-23	43	AUX3	A-05	AUX3	green
A-24	51	AUX4	A-06	AUX4	blue

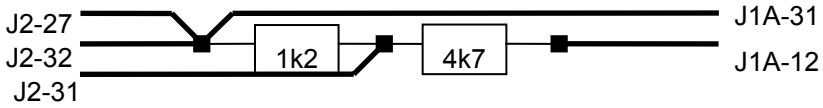
A-31	59	AUX5	A-02	AUX5	violet
A-32	65	AUX6	A-01	AUX6	grey
A-33	58	AUX7	A-10	AUX7	blue
A-34	64	AUX8	A-18	AUX8	brown
A-03	1	IGN1	A-25	IGN1	brown
A-04	5	IGN2	B-14	IGN2	grey
A-05	4	IGN3	B-08	IGN3	orange
A-06	10	IGN4	B-01	IGN4	yellow
A-07	17	IGN5	A-17	IGN5	green
A-08	25	IGN6	A-09	IGN6	blue
A-19	33	INJ1	B-06	INJ1	violet
A-20	50	INJ2	B-07	INJ2	grey
A-21	63	INJ3	B-13	INJ3	green
A-22	66	INJ4	B-19	INJ4	blue
A-27	24	INJ5	B-05	INJ5	brown
A-28	42	INJ6	B-04	INJ6	green
A-29	57	INJ7	B-03	INJ7	orange
A-30	62	INJ8	B-02	INJ8	yellow
B-08	46	DIG1	B-09	SPD1	yellow
B-09	45	DIG2	B-10	SPD2	orange
B-10	52	DIG3	B-11	SPD3	grey
B-11	53	DIG4	B-12	SPD4	brown
A-14	26	AV1	A-29	AV1	blue
A-15	18	AV2	A-28	AV2	green
A-16	6	AV3	A-20	AV5	brown
A-17	7	AV4	A-19	AV6	blue
B-03	28	AT1	A-27	AV3	violet

B-04	38	AT2	A-26	AV4	grey
B-05	30	AT3	A-22	SW1	green
B-06	39	AT4	A-21	SW2	violet
B-07	29	AT5	A-14	SW3	brown
B-19	37	AT6	A-13	SW4	orange
B-01	49	REF	A-16	REF	orange
B-02	56	SYNC	A-15	SYNC	yellow
B-25	54	LA1-S	A-12	AV7	orange
B-12	55	LA2-S	A-11	AV8	yellow
B-17	40	TX-232	A-32	RX232	grey
B-18	31	RX-232	A-33	TX232	violet
B-24	47	CAN-LO	B-21	CAN-LO	green
B-23	48	CAN-HI	B-20	CAN-HI	white

M4/M48 Loom



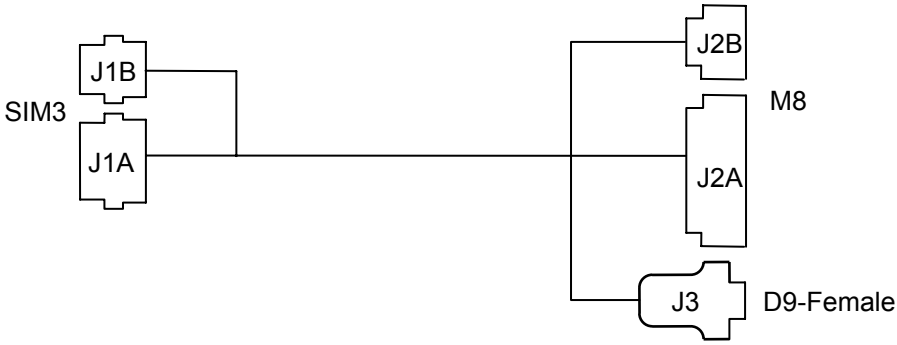
Inline resistors detail



M4/48 Pin	M4/48 Name	SIM3 Pin	SIM3 Name	Colour
J2-1	Bat +	J1B-16	VBAT1	red
J2-2	INJ1	J1B-06	INJ1	violet
J2-3	INJ2	J1B-07	INJ2	grey
J2-4	5V	J1A-30	5VECU	red
J2-6	REF Mag	J1A-16	REF	orange
J2-8	SYNC Mag	J1A-15	SYNC	yellow
J2-9	RX, M48	J4-5	M48M-5	violet
J2-10	RX, M4	J5-5	M4M-5	violet
J2-10#	INJ5	J4-1	M48M-1	brown
J2-11	TX	J1B-17	RXTTL	grey
J2-12	VPP	J1A-34	VPP	white
J2-13	AUX1	J1A-03	AUX1	orange
J2-14	INJ3	J1B-13	INJ3	green
J2-15	INJ4	J1B-19	INJ4	blue
J2-16	TP	J1A-29	AV1	blue

J2-17	MAP	J1A-28	AV2	green
J2-18	Aux V	J1A-20	AV5	brown
J2-19	Digital 1	J1B-09	SPD1	yellow
J2-19	Digital 1	J1A-22	SW1	green
J2-20	Digital 2	J1B-10	SPD2	orange
J2-20	Digital 2	J1A-21	SW2	violet
J2-21	INJ6	J4-2	M48M-2	green
J2-22	INJ7	J4-3	M48M-3	orange
J2-23	INJ8	J4-4	M48M-4	yellow
J2-25	GND	J1B-24	GND1	black
J2-26	8V	J1A-24	8VECU	white
J2-27	0V	J1A-31	0VECU	black
J2-28	ET	J1A-26	AV4	grey
J2-29	AT	J1A-27	AV3	violet
J2-30	Aux T	J1A-19	AV6	blue
J2-31	LA1+	J1A-12	AV7	orange
J2-32	LA1-	J1A-31	0VECU	black
J2-33	IGN1	J1A-25	IGN1	brown
J2-34	IGN2 / AUX2	J1B-14	IGN2	grey
J2-35	IGN3 / AUX3	J1B-08	IGN3	orange
J2-36	IGN4 / AUX4	J1B-01	IGN4	yellow
J3-1		J1B-05	INJ5	brown
J3-2		J1B-04	INJ6	green
J3-3		J1B-03	INJ7	orange
J3-4		J1B-02	INJ8	yellow
J3-5		J1B-18	TXTTL	violet

M8 Loom



M8 Pin	M8 Name	SIM3 Pin	SIM3 Name	Colour
J2A-1	GND	J1B-24	GND1	black
J2A-2	Bat +	J1B-16	VBAT1	red
J2A-3	IGN1	J1A-25	IGN1	brown
J2A-3	Dig In 4	J1B-12	SPD4	brown
J2A-4	IGN2	J1B-14	IGN2	grey
J2A-4	Dig In 3	J1B-11	SPD3	grey
J2A-5	INJ1	J1B-06	INJ1	violet
J2A-6	INJ2	J1B-07	INJ2	grey
J2A-7	INJ3	J1B-13	INJ3	green
J2A-8	INJ4	J1B-19	INJ4	blue
J2A-9	PWM1	J1A-03	AUX1	orange
J2A-10	0V	J1A-31	0VECU	black
J2A-11	8V	J1A-24	8VECU	white
J2A-12	5V	J1A-30	5VECU	red

J2A-13	GND	J1B-25	GND2	black
J2A-14	Bat +	J1B-22	VBAT2	red
J2A-15	IGN3	J1B-08	IGN3	orange
J2A-15	Dig In 2	J1B-10	SPD2	orange
J2A-16	IGN4	J1B-01	IGN4	yellow
J2A-16	Dig In 1	J1B-09	SPD1	yellow
J2A-17	Injector 5	J1B-05	INJ5	brown
J2A-18	Injector 6	J1B-04	INJ6	green
J2A-19	Injector 7	J1B-03	INJ7	orange
J2A-20	Injector 8	J1B-02	INJ8	yellow
J2A-21	PWM2	J1A-04	AUX2	yellow
J2A-23	SW	J1A-22	SW1	green
J2A-24	LA1+	J1A-12	AV7	orange
J2A-25	ET	J1A-26	AV4	grey
J2A-26	AT	J1A-27	AV3	violet
J2A-27	EMAP	J1A-19	AV6	blue
J2A-28	MAP	J1A-28	AV2	green
J2A-29	TP	J1A-29	AV1	blue
J2A-31	SYNC+	J1A-15	SYNC	yellow
J2A-34	REF +	J1A-16	REF	orange
J2B-4	LA2+	J1A-11	AV8	yellow
J2B-5	SW Out 1	J1A-05	AUX3	green
J2B-6	SW Out 2	J1A-06	AUX4	blue
J2B-11	STEP4	J1A-18	AUX8	brown
J2B-12	STEP3	J1A-10	AUX7	blue
J2B-13	FP	J1A-20	AV5	brown
J2B-17	STEP2	J1A-01	AUX6	grey

J2B-18	STEP1	J1A-02	AUX5	violet
J3-5	TX	J1B-17	RXTTL	grey
J3-8	VPP	J1A-34	VPP	white
J3-9	RX	J1B-18	TXTTL	violet