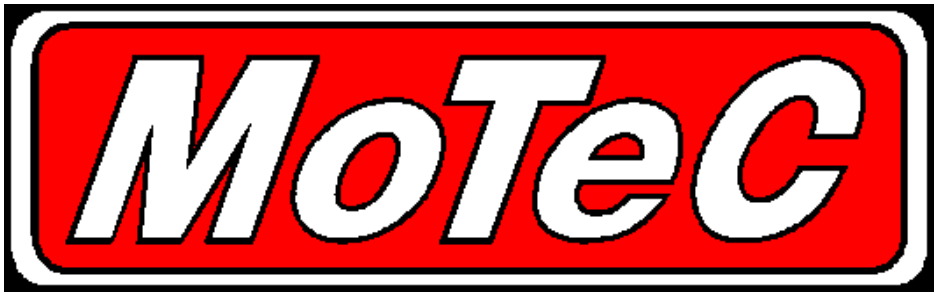

SIM3

Engine Simulator

User Manual

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9 May, 2014

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 5

SPD1 Pot	LTC1 (0x460) Lambda Simulation
SPD2 Pot	LTC2 (0x461) Lambda Simulation
SPD3 Pot	LTC3 (0x462) Lambda Simulation
SPD4 Pot	LTC4 (0x463) Lambda Simulation

Notes:

LTC functionality is described below in the section 'LTC Simulation'

Speed Mode 6

SPD1 Pot	Speed 1 input frequency
SPD2 Pot	Speed 2 input frequency
SPD3 Pot	LTC1 (0x460) Lambda Simulation
SPD4 Pot	LTC2 (0x461) Lambda Simulation

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.

LTC functionality is described below in the section 'LTC Simulation'

Speed Mode 7

SPD1 Pot	Cam 0 retard on Speed1 input Cam 0 retard on Speed3 input
SPD2 Pot	Cam 1 retard on Speed2 input Cam 1 retard on Speed4 input
SPD3 Pot	LTC1 (0x460) Lambda Simulation
SPD4 Pot	LTC2 (0x461) Lambda Simulation

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.

LTC functionality is described below in the section 'LTC Simulation'

Speed Mode 8

SPD1 Pot	Cam 0 retard on Speed1 input Cam 0 retard on Speed3 input
SPD2 Pot	Cam 1 retard on Speed2 input Cam 1 retard on Speed4 input
SPD3 Pot	LTC1 (0x460) Lambda Simulation
SPD4 Pot	LTC2 (0x461) Lambda Simulation

Notes:

Frequency is variable from approx 10Hz to 1200Hz

Duty cycle is variable from 0 to 100%

LTC functionality is described below in the section 'LTC Simulation'

Speed Mode A

SPD1 Pot	Cam 0 retard on Speed1 input Cam 0 retard on Speed3 input
SPD2 Pot	Cam 1 retard on Speed2 input Cam 1 retard on Speed4 input
SPD3 Pot	LTC1 (0x460) Lambda Simulation 500K CAN
SPD4 Pot	LTC2 (0x461) Lambda Simulation 500K CAN

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.

The CAN bus speed is set to 500K.

LTC functionality is described below in the section 'LTC Simulation'

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

LTC Simulation

The SIM3 can simulate the CAN messages from up to four MoTeC LTC units.

Speed mode 5 simulates four LTC units.

Speed modes 6,7,8 & A each simulate two LTC units.

The LTC messages are sent on the default LTC CAN addresses (0x460 to 0x463).

The lambda and Ip values are simulated with the speed pots, from rich (la 0.635) to lean (la 20.084).

With the pot wound fully counter-clockwise the simulated values are all set to zero.

LTC heater duty, fault bits, Ri, battery voltage and temperature are set to fixed values in the LTC messages.

The SIM3 can also receive the LTC enable/disable message on CAN address 0x480. This message will change the simulated LTC state and readings in the same way as a real LTC.

LTC messages are sent at 1Mbit/sec in speed modes 5,6,7 & 8.

LTC messages are sent at 500Kbit/sec in speed mode A.

The SIM3 CAN interface is only enabled when a speed mode that supports LTC simulation is enabled.

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.

Note! *The SIM3 CAN interface is only enabled when a speed mode that supports LTC simulation is enabled (speed modes 5,6,7,8 & A). In all other speed modes the SIM3 will not participate on the CAN bus.*

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.

The sim3rscompile application allows 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.

Note! Ensure that the SIM3 speed mode is set to mode 5 to enable the SIM3 CAN interface.

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

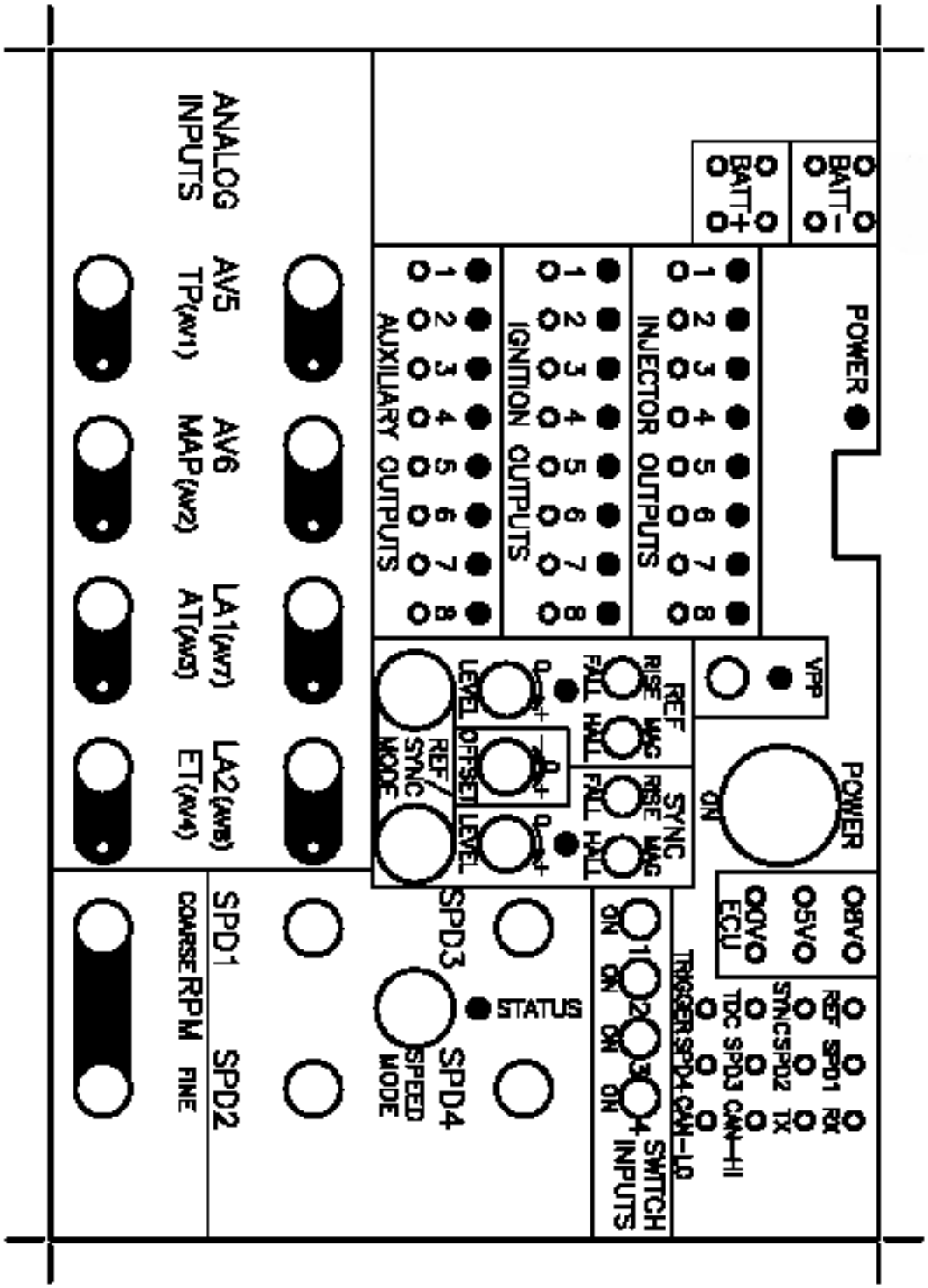
The ECU 8V, 5V and 0V test points are connected directly to the 8V, 5V and 0V connector pins to test the DUT voltages.

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
VPP
REF
RISE
MAG
FALL
HALL
SYNC
LEVEL
OFFSET
REF/SYNC MODE
POWER
ON
5V0
0V0
ECU
REF SPD1 RX
SYNC SPD2 TX
TDC SPD3 CAN+HI
TRIGGER SPD4 CAN-LO
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
SPD2
COARSE
RPM
FINE

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
0B	3 / 360, 4 / 720
0C	12 / 360, 1 / 720, Comodore 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
27	36-1 / 360, 6 / 720, Ford CD338 2.3L iVCT Mag & Hall
28	32-2 / 360, 1 / 720, Harley V twin. 1996-
2A	12+1 / 360, 4+1 / 720, Honda Type R, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = 0 or B

Mode	Description
2B	6+1/360,6/720, GM 4.2L Inline 6
2C	24-1 / 360, 1 / 720, Suzuki Hayabusa K3 Missing tooth mode for Mag & Mag
2D	24-2 / 360, 1 / 720, Suzuki GSXR1000 Missing tooth mode for Mag & Hall
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, TDC fall at M800 index, 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 1ZZ, 2ZZ VVT, 3SG VVT, etc
3A	60-2/360,8-1/720 EX,6/720 IN, BMW S54B32 (E46 M3) and early V8 vanos, Switches REF=FALL,MAG SYNC=FALL,HALL, Speed Mode = C 1:In 1, 2: Ex 1
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, Toyota 2JZ-GE (Lexus IS300), Switches REF=FALL,MAG SYNC=FALL,MAG, Speed Mode B-F: Sync=In
3F	60-2 / 360 ,4-1 / 720, Peugeot 206RC
40	180 / 360, 1 / 720, Nemicon OEW-036-2MHC
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
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 WRX and STi V7 MY01-, Switches REF=FALL,MAG SYNC=FALL,MAG, Speed Mode = 0, or D for STi AVCS
63	Rover K Series
64	6 / 360, 7 / 720 Odd, Subaru EJ20 1994 - 2000, Switches REF=FALL,MAG

Mode	Description
	SYNC=FALL,MAG, Speed Mode = 0 or B
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
6A	36-1 / 360, 6-1-1-2 / 720, Jag S Type R V8
6B	36-1 / 360, 4+1 / 720, Mazda 6,Ford Focus ST170
6C	36-2-2/360,10/720, Nissan CR10DE,CR12DE,CD14DE
6D	36-2-2-2/360,6/720, Mazda MX5 2006, SYNC=REF, CAM0 to DIG1 for SYNC, Must use SPD mode C-F, CAM0 has 0-50deg retard
6E	36-2-1/360,6/720, Mitsubishi Colt CZ3
6F	2011 Ford Coyote (Mustang) 36-1/360 7/720,TDC rise at cyl1, Switches REF=FALL,HALL SYNC=FALL,MAG, Speed Mode = C 1:In 1, 2:Ex 1, 3:In 2, 4:Ex 2
70	60-2 / 360, 3 / 720, BMW R6, Must use speed mode B
71	36-1-1-1-1/360,4/720, Lamborghini Gallardo
72	36-2 / 360, 1 / 720, Sync tooth in missing tooth gap
73	36-2-2-2 / 360, 4-1 / 720, Subaru FA20D for BRZ and Toyota FT86, Switches REF=FALL,MAG SYNC=FALL,HALL, Speed Mode = C
74	36-2-2-2 / 360, 7 / 720 odd, Subaru EJ20 new crank sprocket with old CAM pattern, Switches REF=FALL,MAG SYNC=FALL,MAG, Speed Mode = 0
75	36-3-2 / 360, 4-1 / 720, Subaru FA20DIT, Switches REF=RISE,HALL SYNC=RISE,HALL, Speed Mode = C
79	IEX test Cycle time = 26.17mSec
7F	60-2/360,4/720,TDC rise at cyl1, Mazda 3 MPS Direct Injection, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = C 1:In 1, 2: Ex 1
80	60-2/360,2/720,2/720, Volvo(Yamaha) V8, Switches REF=FALL,MAG SYNC=FALL,HALL, Speed Mode = C
81	9-1-1-1/360,1/720, Porsche TAG F1, Switches REF=RISE,MAG SYNC=FALL,HALL, Speed Mode = 0
82	36-2-2-2/360,4/720, Suzuki Swift, Switches REF=FALL,MAG SYNC=FALL,HALL, Speed Mode = D
83	36-2-2-2/360,3/720, Subaru 3R Six Variable CAM, Switches REF=RISE,MAG SYNC=FALL,HALL, Speed Mode = D. Connect ECU REF&SYNC to SIM3 REF
84	36-2-1/360,4/720, Mitsubishi 4B11, Switches REF=FALL,HALL SYNC=FALL,HALL, Sync=Ex. Mode C-F: 1=In, 2=Ex
85	10-ODD/360,1/720, DODGE VIPER V10, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = 0
86	36-1-1/360,10/720, Chrysler SRT8, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = 0
87	48-2, Ducati, Switches REF=FALL,MAG SYNC=FALL,MAG, Speed Mode = 0
88	24-2, Triumph, Switches REF=FALL,MAG SYNC=FALL,MAG, Speed Mode = 0
89	4+1/360,1/720, Yamaha PWC SHO, Switches REF=RISE,MAG SYNC=FALL,HALL,

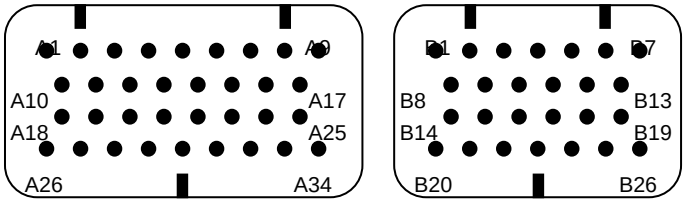
Mode	Description
	Speed Mode = 0
8A	60-2/360,6/720,6/720, BMW S85B50 V10 (E60/61 M5, E63/64 M6), Switches REF=FALL,MAG SYNC=FALL,HALL, Speed Mode = C 1:In 1, 2:Ex 1, 3:In 2, 4:Ex 2
8B	60-2/360,5/720, Dodge Viper 2008, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = C
8C	12/360,4-1/720, Honda S2000, Switches REF=RISE,MAG SYNC=RISE,MAG, Speed Mode = 0
8D	36-2-2-2/360,3/720, Subaru 2004 STI, Switches REF=FALL,MAG SYNC=FALL,HALL, Speed Mode = D
8E	60-2/360,6/720,6/720, BMW V10 M5-M6, Switches REF=FALL,MAG SYNC=FALL,HALL, Speed Mode = C
8F	36-1-1/360,10/720, Nissan Titan V8, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = 0
90	36-1-1/360,10/720, Nissan Amada V8, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = 0
91	36-2-2-2/360,6/720,6/720, NISSAN VQ35HR, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = C
92	12/360,3/720, Honda Bike, Switches REF=FALL,MAG SYNC=FALL,MAG, Speed Mode = 0
93	12+1/360,6/720, GM Inline 6, Switches REF=RISE,MAG SYNC=FALL,HALL, Speed Mode = 0
94	4odd/360,2+1/720, Mazda MX5, , Speed Mode B
95	6/360,4/720, Mitsubishi 6G74, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode B
96	60-2/360,4/720,4/720,TDC rise at cyl1, GM LLT Direct Injection, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = C
97	60-2/360,four cams 180,270,180,90, TDC rise at cyl1, Jaguar AJ-V8 Gen III (AJ133) Direct Injection, Switches REF=RISE,HALL SYNC=RISE,HALL, Speed Mode = C 1:In 1, 2:Ex 1, 3:In 2, 4:Ex 2
98	20/360,1/720, KTM 250 4 stroke, one narrow tooth, Switches REF=RISE,MAG SYNC=FALL,HALL, Speed Mode = 0
99	18-2/360,1/720, KTM 250 4 stroke, one wide tooth, Switches REF=RISE,MAG SYNC=FALL,HALL
9A	60-2/360,3/720, Fiat TwinAir, Switches REF=FALL,HALL SYNC=RISE,HALL
9B	60-2/360,6+1/720,TDC fall at cyl1 TDC, Scania SGL12A, Switches REF=FALL,MAG SYNC=FALL,MAG, Fixed sync (moves in Speed Mode = B)
9C	60-2/360,4/720,TDC rise at cyl1, Audi BXA and Lamborghini LP560 Direct Injection, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = C 1:In 1, 2: Ex 1
9D	60-2/360, inlet cam edges 180,120,60, TDC fall at cyl1, PSA EP6DTS, BMW THP175 for Cooper S Turbo, etc, Switches REF=FALL,HALL SYNC=FALL,HALL, Speed Mode = C 1:Inlet
9E	60-2/360,766+1/720,TDC fall at cyl1 TDC, Scania DC16. Not all edges on sync due to 32 edge sim3 limit, Switches REF=FALL,MAG SYNC=FALL,MAG, Fixed sync (moves in Speed Mode = B)
9F	2 / 360, 2 / 720, EVO1 - EVO IX including MIVEC, Switches REF=RISE,HALL SYNC=RISE,HALL, Speed Mode = 0 or D (for MIVEC)

Mode	Description
A0	36-2 / 360, 2 / 720, Toyota 1FZ-FE (Landcruiser), Switches REF=FALL,MAG SYNC=FALL,MAG
A1	GM LS1
A2	36-2 / 360, 3 / 720, Toyota 2GR-FE, Switches REF=FALL,MAG SYNC=FALL,HALL
A3	60-2-2-2/360,6+1/720, Volvo D11C, Switches REF=FALL,MAG SYNC=FALL,MAG, Fixed sync (moves in Speed Mode = B),

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

Pin Number	Name	SIM3 Panel Reference	Connection
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

Pin Number	Name	SIM3 Panel Reference	Connection
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)

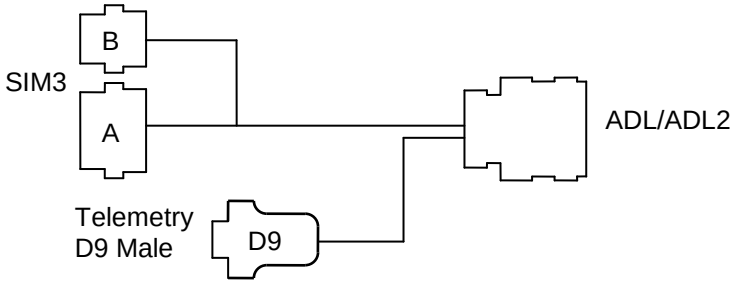
CAN Connector (5pin XLR Female)

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

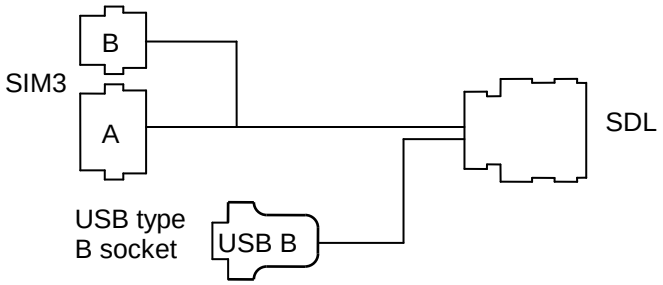


ADL Pin	ADL Name	SIM3 pin	SIM3 Name	Colour
45	AV1	A-29	AV1	blue
46	AV2	A-28	AV2	green
47	AV3	A-27	AV3	violet
48	AV4	A-26	AV4	grey
49	AV5	A-20	AV5	brown
50	AV6	A-19	AV6	blue
19	AV7	A-12	AV7	orange
20	AV8	A-11	AV8	yellow
9	AUX1	A-03	AUX1	orange
10	AUX2	A-04	AUX2	yellow
11	AUX3	A-05	AUX3	green
12	AUX4	A-06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

ADL Pin	ADL Name	SIM3 pin	SIM3 Name	Colour
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

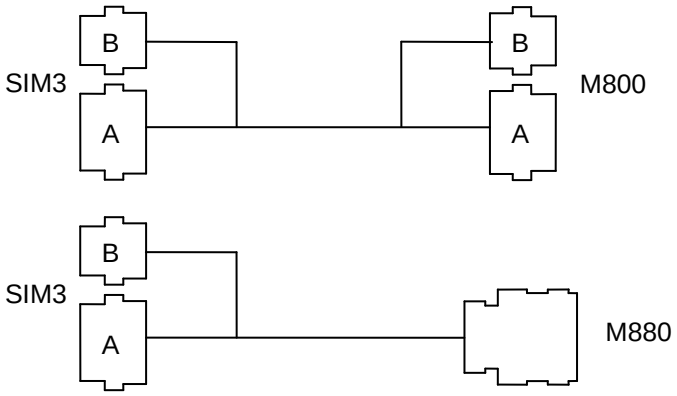


SDL Pin	SDL Name	SIM3 pin	SIM3 Name	Colour
1	AV5	A-20	AV5	brown
2	AV6	A-19	AV6	blue
3	BAT+	B-16	VBAT1	red
4	BAT-	B-24	GND1	black
5	AUX1	A-03	AUX1	orange
6	AUX2	A-04	AUX2	yellow
7	AUX3	A-05	AUX3	green
8	AUX4	A-06	AUX4	blue
11	SW1	A-22	SW1	green

SDL Pin	SDL Name	SIM3 pin	SIM3 Name	Colour
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

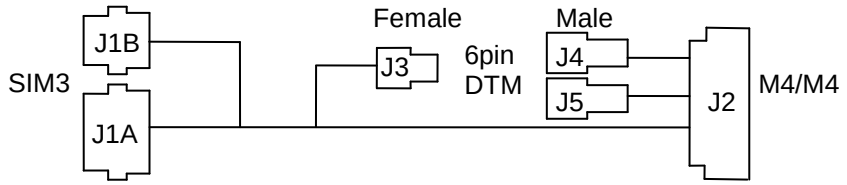
M800/M880 Looms

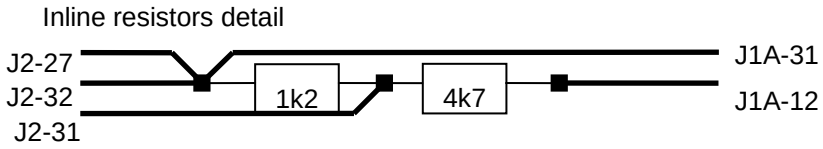


M800 Pin	M880 Pin	M800/M880 Name	SIM3 pin	SIM3 Name	Colour
A-26	23	VBAT	B-16	VBAT1	red
	32	VBAT	B-22	VBAT2	red
	41	VBAT	B-23	VBAT3	red
A-10	14	GND	B-24	GND1	black
A-11	19	GND	B-25	GND2	black
	21	GND	B-26	GND3	black
A-12	3	8V-ENG	A-24	8VECU	white
A-02	16	5V-ENG	A-30	5VECU	red
B-16	27	0V-ENG	A-31	0VECU	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

M800 Pin	M880 Pin	M800/M880 Name	SIM3 pin	SIM3 Name	Colour
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

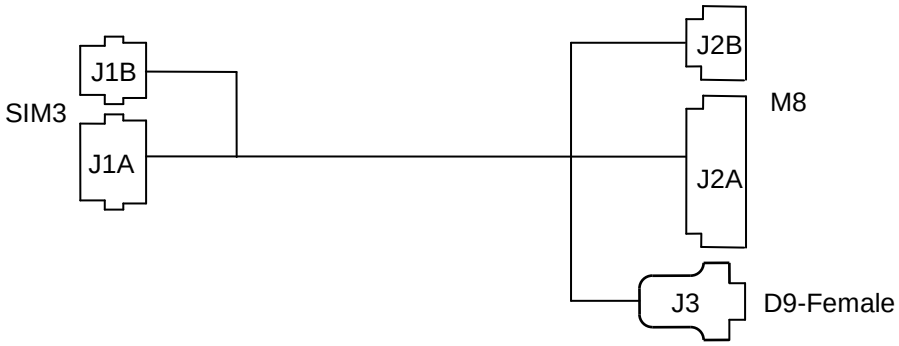




M4/48 Pin	M4/48 Name	SIM3 Pin	SIM3 Name	Colour
J2-1	Bat +	J1B-16	VBAT1	red
J2-2	INJ1	J1B-06	INJ1	violet
J2-3	INJ2	J1B-07	INJ2	grey
J2-4	5V	J1A-30	5VECU	red
J2-6	REF Mag	J1A-16	REF	orange
J2-8	SYNC Mag	J1A-15	SYNC	yellow
J2-9	RX, M48	J4-5	M48M-5	violet
J2-10	RX, M4	J5-5	M4M-5	violet
J2-10#	INJ5	J4-1	M48M-1	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

M4/48 Pin	M4/48 Name	SIM3 Pin	SIM3 Name	Colour
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

M8 Pin	M8 Name	SIM3 Pin	SIM3 Name	Colour
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