# M1 GPR-DI PACKAGE



This product is specifically for use with M1 Series hardware.

**The GPR-DI Package is a versatile and adaptable platform for the operation of direct injected engines up to twelve cylinders (hardware dependant) that use inductive direct injectors and synchronous direct injection fuel pumps, such as Bosch HDP5 or Hitachi HFS034.**

**In addition to the primary direct injectors, secondary port injectors may be configured.**

**Only saturated (high-ohm) secondary injectors are supported in this hardware. Peak-hold (low-ohm) secondary injectors are not supported.**

Included are many ancillary features commonly found on race cars, such as anti-lag, driver switches (pit switch, launch enable, boost trim, etc.), gearbox control, knock control, intercooler sprays, launch control, gearbox coolant pumps and traction control. Also accommodated are many systems found on modified road vehicles, which may also be useful in a racing context, such as air conditioning control.

The product fully integrates with other MoTeC products, and provides pre-defined CAN messaging for all current display loggers, loggers, E888, VCS, GPS, ADR, BR2, PDM, and SLM. A Vector database (.dbc) file is available on request.

## ▶ LICENCING

To load the Package onto the ECU, the **GPR-DI Licence** (part number 23008) is required.

## ▶ ECU VARIANTS

The Package is available across MoTeC's M1 direct injection ECU range: M182 (up to 12 cylinders) and M142 (up to 8 cylinders).

⇨ Injector and wiring loadings must be calculated prior to the commencement of the project.

An example pinout is provided for each ECU variant.

## ▶ VEHICLE COMPATIBILITY

This product does not include CAN messaging for OE vehicle integration. Therefore, it does not cater for OE vehicle systems such as power steering, ABS, starting systems and dashboards.

## ▶ FEATURES

• Operates gasoline direct injected engines from 1 to 12 cylinders with inductive injectors and synchronous direct injection fuel pumps (M142 suits up to 8 cylinders). Refer to the Engine Compatibility section for known applicable engines.

• Optionally configurable secondary (port injector) fuel control with a tuneable balance table.

⇨ Only saturated (high-ohm) secondary injectors are supported in this hardware. Peak-hold (low-ohm) secondary injectors are not supported.

- Configurable engine synchronisation mode for many common engine types. Refer to the Engine Synchronisation Modes section for current details.

- Configurable top dead centre for each cylinder allows for odd-fire engines.

- Configurable ignition output pin for each cylinder allows for coil-on-plug or wasted spark and distributor ignition systems.

- Configurable on-board knock for each cylinder with up to 4 assignable knock sensors (hardware dependant) and 4 selectable centre frequencies.

- Configurable camshaft control from 1 to 4 cams, plus 1 switched camshaft.

- Configurable control of 1 or 2 synchronous direct injection fuel pumps, such as Bosch HDP5 or Hitachi HFS034.

- 4 auxiliary outputs for PWM control of added actuators:

  - Duty cycle tables using Engine Speed and Throttle or Manifold Pressure Axes

  - Activation based on inlet manifold pressure or throttle position

  - Auxiliary Output 1 includes tables for Ignition Timing Compensation, Fuel Volume Trim and Mixture Aim

- Dual bank lambda control supported; requires optional LTC with Bosch LSU4.9 sensor or LTCN with NTK sensor.

- Physical settings for engine displacement, fuel density+molar mass, stoichiometric ratio and injector characteristics allow for simplified engine start-up prior to tuning.

- Easy and fast engine tuning using engine efficiency map.

- Engine load modelling based on inlet manifold pressure and inlet manifold temperature. Alternatively, for example, when using individual throttle bodies, throttle position can be used.

- Fuel volume calculation considers delay effects resulting from the secondary (high) injector installation position.

- Sensor calibrations available for many common automotive sensors.

- Support for analogue and digital (frequency or duty cycle) sensors.

- Transient fuelling compensation using physical modelling of fuel film.

- Nitrous system with two activation stages and additional fuel pumps, bottle heater control and pressure sensor.

- Transmission brake control ('bump') functionality for perfect positioning of cars.

- Support of MoTeC devices: ADR, E8XX, PDM, SLM, VCS

- Test settings for most outputs, including injection and ignition outputs, for easier setup.

- Turbocharger wastegate pressure control with pressure sensor and two PWM outputs.

- Configurable boost control with single wastegate actuator. Single and dual solenoids supported.

- Configurable turbocharger bypass control.

- Configurable anti-lag for single turbo with ignition timing limit, fuel volume trim, ignition cut, engine speed limit, boost aim and throttle aim tables.

- Supports 2 coolant fan outputs (PWM controlled).

- Configurable closed loop alternator system for PWM field winding control.

- Supports 2 switchable inlet manifold flaps with position feedback, and 1 switchable inlet manifold runner with position feedback, for variable inlet systems.

- Air conditioner support with switched output control.

- Coolant temperature compensations for engine speed limit, ignition timing, fuel volume, fuel mixture, boost limit.

- Coolant pump output with PWM control.

- Coolant pump after-run functionality, optionally with additional pump output.

- Engine speed limiting with ignition cut and/or fuel cut.

- Fuel pump switched output.

- Fuel Flow Supply Sensor and Fuel Flow Return Sensor.

- Gearbox position detection via optional dual sensor or engine speed / wheel speed estimate.

- Gearbox shift request via Up Shift Switch / Down Shift Switch or Gear Lever Force sensor.

- Gearbox shift support with ignition cut, fuel cut, throttle blip and engine speed matching in forward gears.

- GPS acquisition and logging via CAN or RS232.

- Intercooler temperature and spray control.

- Closed loop Alternator control.

- Lap distance, time and number via BR2, GPS or switched input, with split and sector options.

- Configurable launch control with tables for engine speed, throttle limit, boost aim and fuel volume trim.

- Race time system with tables for ignition timing trim, fuel mixture aim, boost limit and throttle limit.

- Idle closed loop control system using ignition, drive by wire actuation or idle solenoid.

- Idle bypass control with stepper motor supported.

- Engine Load Average channel with tables for engine speed limit, ignition timing trim, fuel mixture aim, boost limit and throttle limit.

- Ease of engine start with dedicated fuel volume and idle compensations during crank and post start.

- Engine run time total for engine hour logging.

- Configurable security for multiple users with differing access options.

- Configuration of brake state using a switch or a pressure sensor.

- Configuration of clutch state using a switch, a position sensor or a pressure sensor.

- Calculation of clutch slip.

- ECU-internal G-force (acceleration) – longitudinal, lateral, vertical

- ECU CAN receive from a defined CAN ID for data reception from MoTeC devices. Support of 3 (M142/M182) CAN buses.

- ECU CAN transmit of the most common channels using standard MoTeC CAN templates.

- 8 configurable switches and 8 rotary switches (wired or CAN input) with each of 9 positions simultaneously mappable to Launch Control, Pit Switch, Anti-Lag, Traction, Race Time Reset, Engine Speed Limit Maximum, Throttle Pedal Translation, Ignition Timing, Fuel Mixture Aim, Boost Limit, Traction Aim and Traction Control Range.

- Pulsed tachometer output with configurable output pin and scaling.

- Dual bank drive by wire throttle servo control.

- Configurable throttle sensor input, with 2 channel analogue or single wire digital (SENT) protocol.

- Throttle Pedal sensor with translation table. Hybrid OE pedals (for example Ford) are supported - one analogue and one digital channel.

- Use of a Throttle Pedal sensor or a Throttle Position sensor in case of a cable throttle.

- Differential pump output with differential temperature threshold and hysteresis control.

- Transmission pump output with transmission temperature threshold and hysteresis control.

- Traction control with tables for Aim Main, Aim Compensation and Control Range.

- Vehicle speed measurement using wheel speed sensors, estimation or GPS.

- Vehicle Speed Limit Control system (DBW-throttle based), which can also be used for pit speed limiting.

- Configurable warning system with light and CAN output.

- Auxiliary time system with tables for ignition timing compensation, fuel volume trim and fuel mixture aim.

- Optional channels for additional sensors via input pin and/or CAN message, including:

  – Airbox Mass Flow, Pressure and Temperature

  – Ambient Pressure and Temperature

  – Boost Pressure

  – Brake Pressure Front and Rear

  – Brake Switch

  – Clutch Pressure and Position

  – Clutch Switch

  – Coolant Pressure and Temperature

  – Differential Temperature

  – Engine Oil Pressure and Temperature

  – Engine Crankcase Pressure

  – Exhaust Pressure Bank 1 and Bank 2

  – Exhaust Temperature (EGT) via TCA Thermocouple Amplifier, Generic CAN, or E888 for Collector, Bank 1 and 2 Collector, and Cylinders 1 to 8 (M142) or 1 to 12 (M182)

  – Exhaust Lambda via LTC, LTCN, or PLM for Collector, Bank 1 and 2 Collector, and Cylinders 1 to 8 (M142) or 1 to 12 (M182)

  – Fuel Pressure and Temperature

  – Fuel Tank Level

  – Gear Position

  – Gear Lever Force

  – Gear Neutral Switch

  – Gear Shift Request

  – Inlet Manifold Flap Position x 2, Inlet Manifold Runner Position

  – Intercooler Temperature

  – Steering Angle and Pressure

  – Transmission Pressure and Temperature

  – Turbocharger Speed

  – Turbocharger Inlet/Outlet Temperature

  – Turbocharger Wastegate Position

  – G-Force (acceleration) – Longitudinal, Lateral, Vertical

  – Wheel Speed sensors front/rear left/right, wired or CAN input.

## ► ENGINE COMPATIBILITY

This product is for four, five, six, eight, ten or twelve cylinder engines with inductive direct injectors and synchronous direct injection fuel pumps.

Attention - engines of more than 8 cylinders should have injector and wiring loadings calculated prior to commencement of project. Contact MoTeC for details.

### Engines that are suitable

| Engine Family - Four Cylinder | Engine Designation | Year | Vehicle Platform | DI Fuel Pump | Comment |
|---|---|---|---|---|---|
| Ford 1.6 Ecoboost | 1.6Ti-VCT Sigma, 1.6 GTDI | 2013+ | Ford Fiesta ST | Bosch HDP5 | |
| Ford 2.0 Ecoboost | 2.0 GTDI | 2013+ | Ford Focus | Bosch HDP5 | |
| Hyundai 1.6 Gamma | T-GDi Gamma (G4FJ) | 2012+ | Hyundai Veloster FS-t, Kia Pro-Ceed GT | Bosch HDP5 | |
| Nissan 1.6 DIG-T | MR16DDT | 2013+ | Juke ST-S, Tiida ST-S, RenaultSport Clio | | |
| Subaru | FA20DIT | 2014+ | Forester, WRX | Hitachi | This is the Direct Injected only variant of the engine. |
| Subaru | FA20D | 2012+ | Toyota 86, Subaru BRZ, Scion FR-S | Hitachi | This is the Direct Injected + Port variant of the engine. OE drive box not required. |
| Mazda | L3-VDT | 2007+ | Mazda 3 MPS | Hitachi | |
| GM 2.0 Ecotec Gen II | LDK, A20NFT | 2014+ | Opel Astra J OPC | Bosch HDP5 | Variants with GM single wire digital throttle (SENT protocol) are supported. |
| Audi / VW TFSI / TSI | EA113 | 2005+ | Platforms may include Audi S3, Audi TT, Golf Mk5 GTI | Hitachi | 2.0 litre capacity |
| Audi / VW TFSI / TSI | EA111 | 2008+ | Platforms may include Golf Mk6 | | Variants with 1.2, 1.4 litre capacity |
| Audi / VW TFSI / TSI | EA888 Gen I, Gen II | 2007+ | Platforms may include Audi A4, Audi TT Mk2, VW Golf Mk5 GTI, Mk6 GTI | Hitachi | Variants with 1.8 , 2.0 litre capacity. Gen III with electrical wastegate is not supported. |
| Mini | N18 | | Mini R56N Cooper S | | |
| BMW | N13B16 | 2011+ | F20 116i, 118i, F30 316i, 320i | | Same as Mini N18 |
| BMW | N20B20 | 2011+ | F30 320i, 328i, E89 Z4 sDrive28i, | | |
| Mini | N20 | | | | |

| Engine Family - Five Cylinder | Engine Designation | Year | Vehicle Platform | DI Fuel Pump | Comment |
|---|---|---|---|---|---|
| Audi 2.5 R5 20v TFSI | CEPA, CEPB | 2009+ | Audi TT RS, Audi RS3 | Hitachi | |

| Engine Family - Six Cylinder | Engine Designation | Year | Vehicle Platform | DI Fuel Pump | Comment |
|---|---|---|---|---|---|
| GM SIDI 3.0, 3.6L Alloytec V6 | LLT, LFX | 2008+ | Holden Commodore, Chevrolet Camaro, Impala, Caprice, Traverse | Bosch HDP5 | |
| BMW 335 | N55B30 (late) | 2011+ | BMW 335i (F30) | Bosch HDP5 | |
| Audi 3.2 V6 24v TFSI | 06E, CAKA, CCBA | 2009+ | Audi S4 (B8), A8, A6, A4 | Hitachi | |

| Engine Family - Eight Cylinder | Engine Designation | Year | Vehicle Platform | DI Fuel Pump | Comment |
|---|---|---|---|---|---|
| GM 6.2l | LT1, LT4 | 2014+ | Chevrolet Corvette C7, Chevrolet Silverado | Stanadyne | GM single wire digital throttle (SENT protocol) is supported. |
| Audi 4.2 V8 32v FSI | 079D, BAR, CAU, BVJ | 2006+ | Audi A6 Quattro, R8, S5 | 2 x Hitachi | |

| Engine Family - Ten Cylinder | Engine Designation | Year | Vehicle Platform | DI Fuel Pump | Comment |
|---|---|---|---|---|---|
| Audi / Lamborghini 5.2 V10 FSI | 07L.Y / BUJ / LP560 | 2009+ | Audi R8, Lamborghini Gallardo, Lamborghini Hurracan | 2 x Hitachi | Injector and wiring loadings must be calculated prior to commencement of project. |

## Engines that are not suitable

| Engine Family | Engine Designation | Year | Vehicle Platform | DI Fuel Pump | Not applicable because: |
|---|---|---|---|---|---|
| Audi / VW TFSI / TSI | EA211 | 2012+ | Platforms may include Golf Mk7 | | Electrical wastegate. |
| Audi / VW TFSI / TSI | EA888 | 2012+ | Platforms may include Golf Mk7 | | Electrical wastegate. |
| Mini | N14 | | Mini R56 | Siemens | PWM controlled continuous pump. |
| BMW | B48 | 2014+ | | | These engines use piezo injectors. |
| BMW | N55B30 (early) | 2008-2010 | BMW 335i (E90) | Siemens | PWM controlled continuous pump. |

▶ **ENGINE SPEED MODES**

**As of M1 System 1.4.00.0019**

- BMW M54
- BMW N55 - BMW N55 and N52 engines
- BMW S1000RR MY2015
- BMW S50 - BMW S50B32 (E36M3)
- BMW S62 - BMW E36 M3 S52B32, BMW E46 M3 S64B32, BMW E39 M5 S62B50 NOTE: not tested - please contact MoTeC before running this engine
- BMW S85 - BMW E60 M3 S85B50, BMW E90 M3 S65B40
- Bosch 140 40 - General Motors LLT, Audi BXA / Lamborghini LP560, Mazda L3-VDT
- Chrysler SRT8 2005 - Chrysler 6.1l Hemi 2005-2010 (eg Chrysler 300C SRT–8, Dodge Challenger SRT–8)
- Chrysler SRT8 2011 - Chrysler "Apache" 6.4l Hemi with variable camshaft timing 2011- (eg Chrysler 300C SRT–8, Dodge Challenger SRT–8)
- Camshaft One Missing Four Stroke
- Camshaft Two Missing Four Stroke
- Corvette C4 ZR1 - GM LT5 (1990 - 1995)
- Crankshaft One Missing Four Stroke
- Crankshaft One Missing Two Stroke
- Crankshaft Two Missing Four Stroke
- Crankshaft Two Missing Two Stroke
- Custom EJ20G - Subaru GC8 WRX and STi (EJ20G, EJ20K, EJ207 etc.) from MY95 - MY00 with the MY01 crankshaft sprocket (part number 13021AA141)
- Denso 270 90
- Dodge Viper - Experimental mode for Dodge Viper pre 2008
- Dodge Viper MY2008 - Experimental mode for 2008-
- Fiat TwinAir
- Ford Coyote
- Ford Duratec Synchronisation - Duratec, EcoBoost, BA cams
- Ford Sigma TiVCT
- Ford Windsor - with 'PIP' sensor in the distributor
- General Motors DMAX LMM - General Motors 6.6L Duramax LMM diesel engines (late 2007 - early 2011) when the eighth digit of the VIN number is 6.
- General Motors LS1 - (Gen 3 V8)
- General Motors LS7
- Honda 20FC (Honda S2000)
- Honda Bike Synchronisation

- Hyundai Gamma T GDI
- Honda K20
- Honda K20C1 - Civic Type R 2015+
- Hyundai Lambda II RS GDi Engine (Hyundai Genesis V6)
- Lamborghini V10 - Experimental mode for 5.0L port injected Gallardo 2003 - 2007
- Mazda L3 - Mazda L3 VVTi (example Mazda 3 SPorts SP23, Mazda 6), Ford Duratec 23EW iVCT (e.g. Ford Fusion CD338)
- Mazda MX-5 2006: Mazda LF (MZR family) in MX5 NC (2006-), Suzuki M16A VVT in Swift Sport (2012-)
- Mazda RX8 - Mazda Renesis 13B-MSP
- Mazda SkyActiv G - Mazda6 GJ 2012+, MX5 ND 2015+, Mazda3 BM 2014+, Mazda2 DJ 2014+
- Mercedes M120 - 6.0l V12 (S600 1992 - 2001)
- Mitsubishi 4B11 - Lancer Evolution X
- Mitsubishi 4G63T
- Mitsubishi 6A12 - 6A12, 6A13, 6G74, 6G75
- Mitsubishi Fuso 4P10 (also Agco Sisu Power 49G)
- Mitsubishi Fuso 6M60 - 2015 Fuso TKG-FK61F
- Multi Tooth Four Stroke
- Multi Tooth Two Stroke
- Nissan RB26 - Nissan RB26 and other six cylinder engines with 360 degree optical trigger on camshaft
- Nissan SR20 - Nissan SR20, CA18DET and other four cylinder engines with 360 degree optical trigger on camshaft
- Nissan One wide slot - Nissan RB30 and other engines with 360 degree optical trigger on camshaft
- Nissan VK50VE
- Nissan VK56DE - Nissan VK56DE engine and others
- Nissan VQ35 - Nissan VQ35HR engine, Nissan VR38DETT engine as used in the R35 GTR 2007
- Porsche 997: Porsche Direct Injected engine, 2009 Porsche GT2 with 3.6 Lt engine (Variocam PLUS)
- PSA EP6DTS - Mini Cooper S Turbo (2007-2010) and Peugeot 207 RC/GTI (2006-2010)
- Scania DC16
- Scania SGL12A
- Subaru EJ207AVCS - Subaru EJ205, EJ207, EJ255, EJ257 from MY01 to MY05
- Subaru EJ20G - Subaru GC8 WRX and STi (EJ20G, EJ20K, EJ207 etc.) from MY95 - MY00
- Subaru EZ30 - EZ30D with Dual AVCS

- Subaru FA20D - Subaru EJ205, EJ207 etc. with dual AVCS (MY06-), Subaru FA20D for BRZ and FT86 (2012-)

- Subaru FA20DIT - Subaru Forester 2014, WRX 2015

- Toyota 1FZ FE - Toyota Landcruiser

- Toyota 1UZ-FE

- Toyota 2GR-FE - Lotus Evora, 3GR-FE etc, V6 with dual VVT-i.

- Toyota 2JZ GE - Toyota 6 cylinder 2JZ-GE with VVT (example Lexus IS300)

- Toyota 2UR-GSE in Lexus RC-F 2015 MY (2014/09 - )

- Toyota 2ZZ - Toyota 2ZZ, 3GS and others with VVT.

- Volvo D11C - D11C truck engine (FM450 Platform)

- Yamaha FX SHO

## ▶ EXAMPLE M142 PINOUT - GM LLT 3.6 V6

### M142 Connector A — 34 Way

Mating Connector: Tyco Superseal 34 Position Keying 2 – MoTeC #65067

| Pin | Designation | Full Name | OE Pin | Function | Description |
|-----|-------------|-----------|--------|----------|-------------|
| A01 | AT5 | Analogue Temperature Input 5 | X1-82 | 1k Pull up to SEN_5V_C | Coolant Temperature Sensor |
| A02 | AT6 | Analogue Temperature Input 6 | | 1k Pull up to SEN_5V_C | |
| A03 | AV15 | Analogue Voltage Input 15 | | | |
| A04 | AV16 | Analogue Voltage Input 16 | | | |
| A05 | AV17 | Analogue Voltage Input 17 | | | |
| A06 | INJ_D1A_NEG | Direct Injector 1A - | X1-51 | | Fuel Cylinder 1 Primary Output - |
| A07 | INJ_D1A_POS | Direct Injector 1A + | X1-75 | | Fuel Cylinder 1 Primary Output + |
| A08 | INJ_D1B_POS | Direct Injector 1B + | X1-74 | | Fuel Cylinder 4 Primary Output + |
| A09 | INJ_D1B_NEG | Direct Injector 1B - | X1-50 | | Fuel Cylinder 4 Primary Output - |
| A10 | SEN_5V0_C1 | Sensor 5.0V C | | | |
| A11 | LA_NB1 | Lambda Narrow Input 1 | | | |
| A12 | LA_NB2 | Lambda Narrow Input 2 | | | |
| A13 | KNOCK3 | Knock Input 3 | | | |
| A14 | KNOCK4 | Knock Input 4 | | | |
| A15 | DIG2 | Digital Input 2 | | | |
| A16 | DIG3 | Digital Input 3 | | | |
| A17 | DIG4 | Digital Input 4 | | | |
| A18 | SEN_5V0_C2 | Sensor 5.0V C | | | |
| A19 | SEN_5V0_B2 | Sensor 5.0V B | X2-35,X2-48,X2-49 | | Sensor 5V Analogue signals |
| A20 | LIN | LIN Bus | | | |
| A21 | RS232_RX | RS232 Receive | | | |
| A22 | RS232_TX | RS232 Transmit | | | |
| A23 | DIG1 | Digital Input 1 | | | |
| A24 | BAT_NEG3 | Battery Negative | X2-01,X2-02,X2-04 | | Power ground |
| A25 | BAT_NEG4 | Battery Negative | X2-01,X2-02,X2-04 | | Power ground |
| A26 | SEN_0V_C1 | Sensor 0V C | | | |
| A27 | SEN_0V_C2 | Sensor 0V C | | | |
| A28 | CAN3_HI | CAN Bus 3 High | | | |
| A29 | CAN3_LO | CAN Bus 3 Low | | | |
| A30 | CAN2_HI | CAN Bus 2 High | | | |
| A31 | CAN2_LO | CAN Bus 2 Low | | | |
| A32 | BAT_NEG5 | Battery Negative | X2-01,X2-02,X2-04 | | Power ground |
| A33 | SEN_0V_B1 | Sensor 0V B | | | |
| A34 | SEN_0V_A1 | Sensor 0V A | | | |

## M142 Connector B — 26 Way

Mating Connector: Tyco Superseal 26 Position Keying 3 – MoTeC #65068

| Pin | Designation | Full Name | OE Pin | Function | Description |
|-----|-------------|-----------|--------|----------|-------------|
| B01 | OUT_HB9 | Half Bridge Output 9 | X1-25 | | Exhaust Camshaft Bank 2 Actuator Output |
| B02 | OUT_HB10 | Half Bridge Output 10 | X1-01 | | Exhaust Camshaft Bank 1 Actuator Output |
| B03 | UDIG8 | Universal Digital Input 8 | | | |
| B04 | UDIG9 | Universal Digital Input 9 | | | |
| B05 | UDIG10 | Universal Digital Input 10 | | | |
| B06 | UDIG11 | Universal Digital Input 11 | | | |
| B07 | UDIG12 | Universal Digital Input 12 | | | |
| B08 | INJ_LS5 | Low Side Injector 5 | | | Fuel Cylinder 5 Secondary Output |
| B09 | INJ_LS3 | Low Side Injector 3 | | | Fuel Cylinder 3 Secondary Output |
| B10 | AV9 | Analogue Voltage Input 9 | | | |
| B11 | AV10 | Analogue Voltage Input 10 | | | |
| B12 | AV11 | Analogue Voltage Input 11 | | | |
| B13 | BAT_POS | Battery Positive | X2-03,X2-05,X2-06 | | ECU Battery Voltage |
| B14 | INJ_LS6 | Low Side Injector 6 | | | Fuel Cylinder 6 Secondary Output |
| B15 | INJ_LS4 | Low Side Injector 4 | | | Fuel Cylinder 4 Secondary Output |
| B16 | AV12 | Analogue Voltage Input 12 | | | |
| B17 | AV13 | Analogue Voltage Input 13 | | | |
| B18 | AV14 | Analogue Voltage Input 14 | | | |
| B19 | BAT_POS | Battery Positive | X2-03,X2-05,X2-06 | | ECU Battery Voltage |
| B20 | OUT_HB7 | Half Bridge Output 7 | X1-49 | | Inlet Camshaft Bank 2 Actuator Output |
| B21 | OUT_HB8 | Half Bridge Output 8 | X1-02 | | Inlet Camshaft Bank 1 Actuator Output |
| B22 | INJ_D2A_NEG | Direct Injector 2A - | X1-52 | | Fuel Cylinder 2 Primary Output - |
| B23 | INJ_D2A_POS | Direct Injector 2A + | X1-53 | | Fuel Cylinder 2 Primary Output + |
| B24 | INJ_D2B_POS | Direct Injector 2B + | X1-29 | | Fuel Cylinder 5 Primary Output + |
| B25 | INJ_D2B_NEG | Direct Injector 2B - | X1-28 | | Fuel Cylinder 5 Primary Output - |
| B26 | SEN_5V0_A | Sensor 5.0V A | | | |

## M142 Connector C — 34 Way

Mating Connector C: Tyco Superseal 34 Position Keying 1 – MoTeC #65044

| Pin | Designation | Full Name | OE Pin | Function | Description |
|-----|-------------|-----------|--------|----------|-------------|
| C01 | OUT_HB2 | Half Bridge Output 2 | X2-10 | | Fuel Pump Output |
| C02 | SEN_5V0_A | Sensor 5.0V A | X1-15,X1-45 | | Sensor 5V for digital signals |
| C03 | IGN_LS1 | Low Side Ignition 1 | X1-55 | | Ignition Cylinder 1 Output |
| C04 | IGN_LS2 | Low Side Ignition 2 | X1-79 | | Ignition Cylinder 2 Output |
| C05 | IGN_LS3 | Low Side Ignition 3 | X1-56 | | Ignition Cylinder 3 Output |
| C06 | IGN_LS4 | Low Side Ignition 4 | X1-80 | | Ignition Cylinder 4 Output |
| C07 | IGN_LS5 | Low Side Ignition 5 | X1-57 | | Ignition Cylinder 5 Output |
| C08 | IGN_LS6 | Low Side Ignition 6 | X1-81 | | Ignition Cylinder 6 Output |
| C09 | SEN_5V0_B | Sensor 5.0V B | X1-38,X1-39,X1-40 | | Sensor 5V Analogue signals |
| C10 | BAT_NEG1 | Battery Negative | X2-01,X2-02,X2-04 | | Power ground |
| C11 | BAT_NEG2 | Battery Negative | X2-01,X2-02,X2-04 | | Power ground |
| C12 | IGN_LS7 | Low Side Ignition 7 | X2-46 | | Coolant Fan 1 Output |
| C13 | IGN_LS8 | Low Side Ignition 8 | X2-45 | | Coolant Fan 2 Output |
| C14 | AV1 | Analogue Voltage Input 1 | X2-15 | | Throttle Pedal Sensor Main |
| C15 | AV2 | Analogue Voltage Input 2 | | | Inlet Manifold Pressure Sensor |
| C16 | AV3 | Analogue Voltage Input 3 | X1-90 | | Throttle Servo Bank 1 Position Sensor Main |
| C17 | AV4 | Analogue Voltage Input 4 | X1-89 | | Throttle Servo Bank 1 Position Sensor Tracking |
| C18 | OUT_HB1 | Half Bridge Output 1 | | | |
| C19 | INJ_D3A_POS | Direct Injector 3A + | X1-27 | | Fuel Cylinder 3 Primary Output + |
| C20 | INJ_D3B_POS | Direct Injector 3B + | X1-03 | | Fuel Cylinder 6 Primary Output + |
| C21 | INJ_D4A_POS | Direct Injector 4A + | | | |
| C22 | INJ_D4B_POS | Direct Injector 4B + | | | |
| C23 | INJ_LS1 | Low Side Injector 1 | | | Fuel Cylinder 1 Secondary Output |
| C24 | INJ_LS2 | Low Side Injector 2 | | | Fuel Cylinder 2 Secondary Output |
| C25 | AV5 | Analogue Voltage Input 5 | X1-61 | | Engine Oil Pressure Sensor |
| C26 | BAT_POS | Battery Positive | X2-03,X2-05,X2-06 | | ECU Battery Voltage |
| C27 | INJ_D3A_NEG | Direct Injector 3A - | X1-26 | | Fuel Cylinder 3 Primary Output - |
| C28 | INJ_D3B_NEG | Direct Injector 3B - | X1-04 | | Fuel Cylinder 6 Primary Output - |
| C29 | INJ_D4A_NEG | Direct Injector 4A - | | | |
| C30 | INJ_D4B_NEG | Direct Injector 4B - | | | |
| C31 | OUT_HB3 | Half Bridge Output 3 | X1-73 | | Fuel Pressure Direct Pump Output |
| C32 | OUT_HB4 | Half Bridge Output 4 | X1-05 | | Fuel Pressure Direct Pump Output |
| C33 | OUT_HB5 | Half Bridge Output 5 | X1-24 | | Throttle Servo Bank 1 Motor |
| C34 | OUT_HB6 | Half Bridge Output 6 | X1-48 | | Throttle Servo Bank 1 Motor |

## M142 Connector D — 26 way

Mating Connector D: Tyco Superseal 26 Position Keying 1 – MoTeC #65045

| Pin | Designation | Full Name | OE Pin | Function | Description |
|-----|-------------|-----------|--------|----------|-------------|
| D01 | UDIG1 | Universal Digital Input 1 | X1-35 | | Engine Speed Reference |
| D02 | UDIG2 | Universal Digital Input 2 | X1-09 | | Exhaust Camshaft Bank 2 Position |
| D03 | AT1 | Analogue Temperature Input 1 | | 1k Pull up to SEN_5V_A | |
| D04 | AT2 | Analogue Temperature Input 2 | X2-50 | 1k Pull up to SEN_5V_A | Inlet Manifold Temperature Sensor |
| D05 | AT3 | Analogue Temperature Input 3 | X1-85 | 1k Pull up to SEN_5V_B | Engine Oil Temperature Sensor |
| D06 | AT4 | Analogue Temperature Input 4 | | 1k Pull up to SEN_5V_B | |
| D07 | KNOCK1 | Knock Input 1 | X1-59 | | Knock Cylinder 1 |
| D08 | UDIG3 | Universal Digital Input 3 | X1-07 | | Inlet Camshaft Bank 1 Position |
| D09 | UDIG4 | Universal Digital Input 4 | X1-34 | | Exhaust Camshaft Bank 1 Position |
| D10 | UDIG5 | Universal Digital Input 5 | X1-33 | | Inlet Camshaft Bank 2 Position |
| D11 | UDIG6 | Universal Digital Input 6 | | | |
| D12 | BAT_BAK | Battery Backup | | | |
| D13 | KNOCK2 | Knock Input 2 | X1-84 | | Knock Cylinder 2 |
| D14 | UDIG7 | Universal Digital Input 7 | | | |
| D15 | SEN_0V_A | Sensor 0V A | X1-13,X1-41,X1-46,X1-78 | | Sensor 0V for digital signals |
| D16 | SEN_0V_B | Sensor 0V B | X2-11,X2-22,X2-34,X2-47 | | Sensor 0V Analogue signals |
| D17 | CAN1_HI | CAN Bus 1 High | | | |
| D18 | CAN1_LO | CAN Bus 1 Low | | | |
| D19 | SEN_6V3 | Sensor 6.3V | | | |
| D20 | AV6 | Analogue Voltage Input 6 | X1-36 | | Fuel Pressure Direct Sensor |
| D21 | AV7 | Analogue Voltage Input 7 | X2-25 | | Throttle Pedal Sensor Tracking |
| D22 | AV8 | Analogue Voltage Input 8 | | | Airbox Mass Flow Sensor Voltage |
| D23 | ETH_TX+ | Ethernet Transmit+ | Ethernet Green/White | | |
| D24 | ETH_TX- | Ethernet Transmit- | Ethernet Green | | |
| D25 | ETH_RX+ | Ethernet Receive+ | Ethernet Orange/White | | |
| D26 | ETH_RX- | Ethernet Receive- | Ethernet Orange | | |

## ▶ EXAMPLE M182 PINOUT - GM LLT 3.6 V6

### M182 Connector A — 55 way

Mating Connector: Autosport 55 way Green - (Deutsch) AS6-16-35SD – MoTeC #65032

| Pin | Designation | Full Name | OE Pin | Function | Description |
|-----|-------------|-----------|--------|----------|-------------|
| A01 | INJ_D1A_POS | Direct Injector 1A + | X1-75 | | Fuel Cylinder 1 Primary Output + |
| A02 | INJ_D2A_POS | Direct Injector 2A + | X1-53 | | Fuel Cylinder 2 Primary Output + |
| A03 | INJ_D2B_POS | Direct Injector 2B + | | | |
| A04 | INJ_D4A_POS | Direct Injector 4A + | X1-74 | | Fuel Cylinder 4 Primary Output + |
| A05 | INJ_D1B_POS | Direct Injector 1B + | | | |
| A06 | LA_NB2 | Lambda Narrow Input 2 | | | |
| A07 | LA_NB1 | Lambda Narrow Input 1 | | | |
| A08 | SEN_5V0_C1 | Sensor 5.0V C | | | |
| A09 | SEN_5V0_C2 | Sensor 5.0V C | | | |
| A10 | INJ_D4B_POS | Direct Injector 4B + | | | |
| A11 | INJ_D1A_NEG | Direct Injector 1A - | X1-51 | | Fuel Cylinder 1 Primary Output - |
| A12 | INJ_D1B_NEG | Direct Injector 1B - | | | |
| A13 | AV11 | Analogue Voltage Input 11 | | | |
| A14 | DIG2 | Digital Input 2 | | | |
| A15 | RS232_RX | RS232 Receive | | | |
| A16 | SEN_5V0_C3 | Sensor 5.0V C | | | |
| A17 | INJ_D6A_POS | Direct Injector 6A + | X1-03 | | Fuel Cylinder 6 Primary Output + |
| A18 | SEN_0V_C1 | Sensor 0V C | | | |
| A19 | SEN_0V_C2 | Sensor 0V C | | | |
| A20 | SEN_0V_C3 | Sensor 0V C | | | |
| A21 | DIG1 | Digital Input 1 | | | |
| A22 | LIN | LIN Bus | | | |
| A23 | RS232_TX | RS232 Transmit | | | |
| A24 | CAN2_HI | CAN Bus 2 High | | | |
| A25 | INJ_D6B_POS | Direct Injector 6B + | | | |
| A26 | INJ_D2A_NEG | Direct Injector 2A - | X1-52 | | Fuel Cylinder 2 Primary Output - |
| A27 | AV15 | Analogue Voltage Input 15 | | | |
| A28 | AV16 | Analogue Voltage Input 16 | | | |
| A29 | AV17 | Analogue Voltage Input 17 | | | |
| A30 | DIG3 | Digital Input 3 | | | |
| A31 | CAN2_LO | CAN Bus 2 Low | | | |
| A32 | INJ_D3A_POS | Direct Injector 3A + | X1-27 | | Fuel Cylinder 3 Primary Output + |
| A33 | INJ_D2B_NEG | Direct Injector 2B - | | | |
| A34 | AV13 | Analogue Voltage Input 13 | | | |
| A35 | AV12 | Analogue Voltage Input 12 | | | |

| Pin | Designation | Full Name | OE Pin | Function | Description |
|-----|-------------|-----------|--------|----------|-------------|
| A36 | INJ_D6A_NEG | Direct Injector 6A - | X1-04 | | Fuel Cylinder 6 Primary Output - |
| A37 | DIG4 | Digital Input 4 | | | |
| A38 | BAT_BAK | Battery Backup | | | |
| A39 | CAN3_HI | CAN Bus 3 High | | | |
| A40 | INJ_D3B_POS | Direct Injector 3B + | | | |
| A41 | AV14 | Analogue Voltage Input 14 | | | |
| A42 | INJ_D3A_NEG | Direct Injector 3A - | X1-26 | | Fuel Cylinder 3 Primary Output - |
| A43 | INJ_D4A_NEG | Direct Injector 4A - | X1-50 | | Fuel Cylinder 4 Primary Output - |
| A44 | INJ_D5B_NEG | Direct Injector 5B - | | | |
| A45 | INJ_D6B_NEG | Direct Injector 6B - | | | |
| A46 | CAN3_LO | CAN Bus 3 Low | | | |
| A47 | INJ_D5A_POS | Direct Injector 5A + | X1-29 | | Fuel Cylinder 5 Primary Output + |
| A48 | INJ_D5B_POS | Direct Injector 5B + | | | |
| A49 | INJ_D3B_NEG | Direct Injector 3B - | | | |
| A50 | INJ_D4B_NEG | Direct Injector 4B - | | | |
| A51 | INJ_D5A_NEG | Direct Injector 5A - | X1-28 | | Fuel Cylinder 5 Primary Output - |
| A52 | IGN_LS12 | Low Side Ignition 12 | | | Fuel Cylinder 6 Secondary Output |
| A53 | IGN_LS9 | Low Side Ignition 9 | | | Fuel Cylinder 3 Secondary Output |
| A54 | IGN_LS10 | Low Side Ignition 10 | | | Fuel Cylinder 4 Secondary Output |
| A55 | IGN_LS11 | Low Side Ignition 11 | | | Fuel Cylinder 5 Secondary Output |

## M182 Connector B — 26 way

Mating Connector: Autosport 26 way Red - (Deutsch) AS6-16-26SN – MoTeC #65034

| Pin | Designation | Full Name | OE Pin | Function | Description |
|-----|-------------|-----------|--------|----------|-------------|
| B_A | OUT_HB1 | Half Bridge Output 1 | | | |
| B_B | OUT_HB2 | Half Bridge Output 2 | X2-10 | | Fuel Pump Output |
| B_C | OUT_HB3 | Half Bridge Output 3 | X1-73 | | Fuel Pressure Direct Bank 2 Pump Output |
| B_D | OUT_HB4 | Half Bridge Output 4 | X1-05 | | Fuel Pressure Direct Bank 2 Pump Output |
| B_E | OUT_HB5 | Half Bridge Output 5 | X1-24 | | Throttle Servo Bank 1 Motor Output |
| B_F | OUT_HB6 | Half Bridge Output 6 | X1-48 | | Throttle Servo Bank 1 Motor Output |
| B_G | BAT_NEG1 | Battery Negative | X2-01 | | Power ground |
| B_H | BAT_POS1 | Battery Positive | X2-03 | | ECU Battery Voltage |
| B_J | BAT_POS2 | Battery Positive | X2-05 | | ECU Battery Voltage |
| B_K | BAT_POS3 | Battery Positive | X2-06 | | ECU Battery Voltage |
| B_L | BAT_POS4 | Battery Positive | X2-06 | | ECU Battery Voltage |
| B_M | OUT_HB10 | Half Bridge Output 10 | X1-01 | | Exhaust Camshaft Bank 1 Actuator Output |
| B_N | OUT_HB9 | Half Bridge Output 9 | X1-25 | | Exhaust Camshaft Bank 2 Actuator Output |
| B_P | OUT_HB8 | Half Bridge Output 8 | X1-02 | | Inlet Camshaft Bank 1 Actuator Output |
| B_R | OUT_HB7 | Half Bridge Output 7 | X1-49 | | Inlet Camshaft Bank 2 Actuator Output |
| B_S | INJ_LS4 | Low Side Injector 4 | X2-46 | Low speed fan | Coolant Fan 1 Output |
| B_T | INJ_LS6 | Low Side Injector 6 | | | |
| B_U | INJ_LS1 | Low Side Injector 1 | | | |
| B_V | INJ_LS2 | Low Side Injector 2 | | | |
| B_W | BAT_NEG2 | Battery Negative | X2-02 | | Power ground |
| B_X | BAT_NEG3 | Battery Negative | X2-02 | | Power ground |
| B_Y | BAT_NEG4 | Battery Negative | X2-04 | | Power ground |
| B_Z | BAT_NEG5 | Battery Negative | X2-04 | | Power ground |
| B_a | INJ_LS5 | Low Side Injector 5 | X2-45 | High speed fan | Coolant Fan 2 Output |
| B_b | INJ_LS3 | Low Side Injector 3 | | | |
| B_c | BAT_NEG6 | Battery Negative | X2-01 | | Power ground |

## M182 Connector C — 55 way

Mating Connector: Autosport 55 way Red - (Deutsch) AS6-16-35SN – MoTeC #68090

| Pin | Designation | Full Name | OE Pin | Function | Description |
|---|---|---|---|---|---|
| C01 | IGN_LS4 | Low Side Ignition 4 | X1-80 | | Ignition Cylinder 4 Output |
| C02 | IGN_LS3 | Low Side Ignition 3 | X1-56 | | Ignition Cylinder 3 Output |
| C03 | IGN_LS8 | Low Side Ignition 8 | | | Ignition Cylinder 2 Output |
| C04 | IGN_LS6 | Low Side Ignition 6 | X1-81 | | Ignition Cylinder 6 Output |
| C05 | IGN_LS5 | Low Side Ignition 5 | X1-57 | | Ignition Cylinder 5 Output |
| C06 | AV8 | Analogue Voltage Input 8 | | | Airbox Mass Flow Sensor |
| C07 | AV10 | Analogue Voltage Input 10 | | | |
| C08 | IGN_LS2 | Low Side Ignition 2 | X1-79 | | Ignition Cylinder 2 Output |
| C09 | IGN_LS7 | Low Side Ignition 7 | | | Fuel Cylinder 1 Secondary Output |
| C10 | UDIG8 | Universal Digital Input 8 | | | |
| C11 | AV6 | Analogue Voltage Input 6 | X1-36 | | Fuel Pressure Direct Bank 2 Sensor |
| C12 | AV7 | Analogue Voltage Input 7 | X2-25 | | Throttle Pedal Sensor Tracking |
| C13 | AV9 | Analogue Voltage Input 9 | | | |
| C14 | SEN_0V_A1 | Sensor 0V A | X1-13,X1-41, X1-46, X1-78 | | Sensor 0V for digital signals |
| C15 | SEN_0V_A2 | Sensor 0V A | | | |
| C16 | IGN_LS1 | Low Side Ignition 1 | X1-55 | | Ignition Cylinder 1 Output |
| C17 | UDIG7 | Universal Digital Input 7 | | | |
| C18 | UDIG1 | Universal Digital Input 1 | X1-35 | | Engine Speed Reference |
| C19 | UDIG12 | Universal Digital Input 12 | | | |
| C20 | UDIG11 | Universal Digital Input 11 | | | |
| C21 | UDIG10 | Universal Digital Input 10 | | | |
| C22 | UDIG9 | Universal Digital Input 9 | | | |
| C23 | SEN_0V_B1 | Sensor 0V B | | | |
| C24 | CAN1_HI | CAN Bus 1 High | | | |
| C25 | UDIG3 | Universal Digital Input 3 | X1-07 | | Inlet Camshaft Bank 1 Position |
| C26 | ETH_RX- | Ethernet Receive- | Ethernet Orange | | |
| C27 | UDIG4 | Universal Digital Input 4 | X1-34 | | Exhaust Camshaft Bank 1 Position |
| C28 | AV4 | Analogue Voltage Input 4 | X1-89 | | Throttle Servo Bank 1 Position Sensor Tracking |
| C29 | AV5 | Analogue Voltage Input 5 | X1-61 | | Engine Oil Pressure Sensor |
| C30 | SEN_0V_B2 | Sensor 0V B | X2-11,X2-22,X2-34,X2-47 | | Sensor 0V Analogue signals |
| C31 | CAN1_LO | CAN Bus 1 Low | | | |
| C32 | UDIG2 | Universal Digital Input 2 | X1-09 | | Exhaust Camshaft Bank 2 Position |
| C33 | ETH_RX+ | Ethernet Receive+ | Ethernet Orange/White | | |
| C34 | ETH_TX- | Ethernet Transmit- | Ethernet Green | | |

| Pin | Designation | Full Name | OE Pin | Function | Description |
|-----|-------------|-----------|--------|----------|-------------|
| C35 | AV3 | Analogue Voltage Input 3 | X1-90 | | Throttle Servo Bank 1 Position Sensor Main |
| C36 | AV2 | Analogue Voltage Input 2 | | | Inlet Manifold Pressure Sensor |
| C37 | AT1 | Analogue Temperature Input 1 | | 1k Pull up to SEN_5V_A | |
| C38 | AT3 | Analogue Temperature Input 3 | X1-85 | 1k Pull up to SEN_5V_B | Engine Oil Temperature Sensor |
| C39 | AT2 | Analogue Temperature Input 2 | X2-50 | 1k Pull up to SEN_5V_A | Inlet Manifold Temperature Sensor |
| C40 | UDIG5 | Universal Digital Input 5 | X1-33 | | Inlet Camshaft Bank 2 Position |
| C41 | ETH_TX+ | Ethernet Transmit+ | Ethernet Green/White | | |
| C42 | AV1 | Analogue Voltage Input 1 | X2-15 | | Throttle Pedal Sensor Main |
| C43 | KNOCK3 | Knock Input 3 | | | |
| C44 | KNOCK2 | Knock Input 2 | X1-84 | | Knock Cylinder 2 |
| C45 | AT5 | Analogue Temperature Input 5 | X1-82 | 1k Pull up to SEN_5V_C | Coolant Temperature Sensor |
| C46 | AT4 | Analogue Temperature Input 4 | | 1k Pull up to SEN_5V_B | |
| C47 | UDIG6 | Universal Digital Input 6 | | | |
| C48 | SEN_5V0_A1 | Sensor 5.0V A | X1-15,X1-45 | | Sensor 5V Digital signals |
| C49 | KNOCK4 | Knock Input 4 | | | |
| C50 | SEN_5V0_B1 | Sensor 5.0V B | X1-38,X1-39,X1-40 | | Sensor 5V Analogue signals |
| C51 | KNOCK1 | Knock Input 1 | X1-59 | | Knock Cylinder 1 |
| C52 | AT6 | Analogue Temperature Input 6 | | 1k Pull up to SEN_5V_C | |
| C53 | SEN_5V0_A2 | Sensor 5.0V A | | | |
| C54 | SEN_6V3 | Sensor 6.3V | | | |
| C55 | SEN_5V0_B2 | Sensor 5.0V B | X2-35,X2-48,X2-49 | | Sensor 5V Analogue signals |