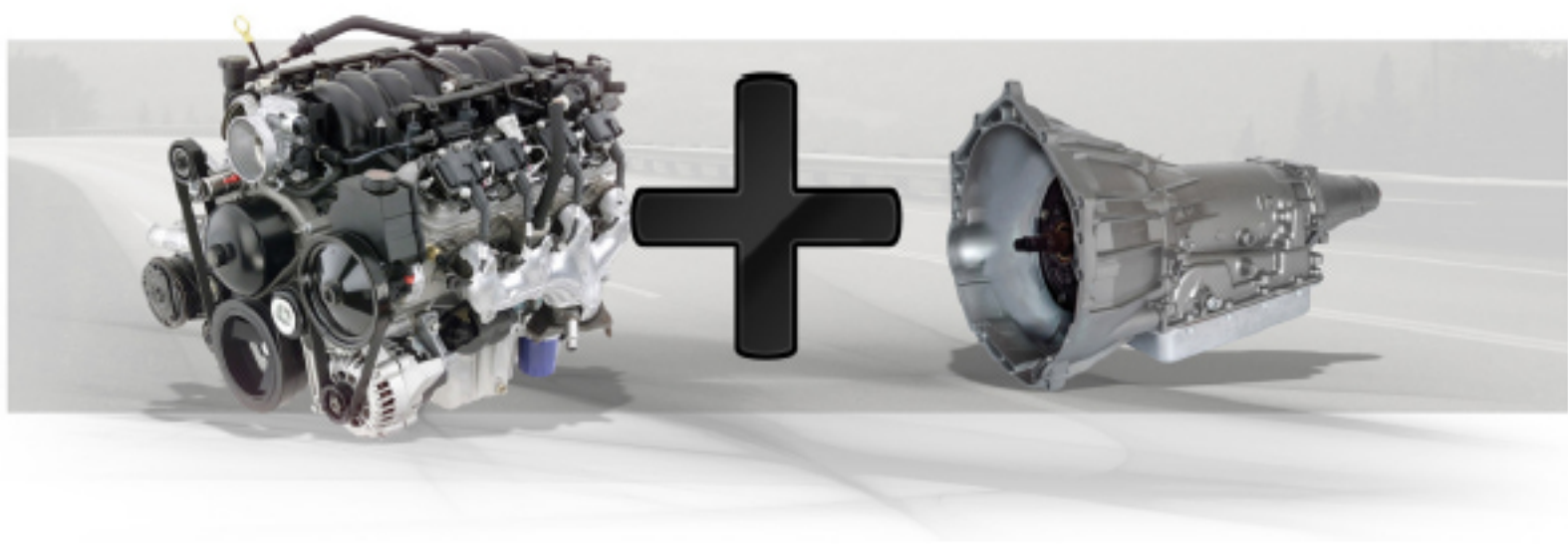
M1 GPR AUTO TRANSMISSION PACKAGE



MoTeC's GPR Automatic Transmission Package is a versatile and adaptable platform for the operation of port-injected engines coupled with automatic transmission control.

This single product provides a flexible solution that can be used to control a large number of engine and automatic transmission combinations (with up to 5 gears).

This Package allows for the operational control of an automatic transmission's line pressure solenoids, gear shift solenoids, torque convertor lockup clutch solenoids and manual range selector. It also gives users full control of the gear shift points, torque convertor lockup clutch and line pressure. Refer to the **Transmission Compatibility** section for a full list of capabilities.

Also included are many ancillary features commonly found on race cars, such as anti-lag, driver switches (e.g. pit switch, launch enable, boost trim), knock control, intercooler sprays, launch control, traction control, gearbox, differential and coolant pumps. Also accommodated are many systems found on modified road vehicles, such as air conditioning.

The product fully integrates with other MoTeC devices, and provides pre-defined CAN messaging for all current Display Loggers, Loggers, E888 Expanders, Video Systems, GPS, ADR, BR2, PDM and SLM modules. A Vector database (.dbc) file is available on request.

LICENSING

To load the Package onto an M1 ECU, MoTeC's **M1 GPR Automatic Transmission Licence** (part number 23394) is required.

ECU VARIANTS

This Package is available for use with MoTeC M150 or M190 ECUs. A pinout example for the M150 follows.

AUTOMATIC TRANSMISSION FEATURES

The GPR Auto Transmission Package is based on MoTeC's GPR Package with the addition of the following automatic transmission specific features:

- Support for Manual or Automatic shift modes, selectable via a driver switch.
- The Automatic shift mode automatically shifts gears based on a user definable vehicle speed and throttle pedal position. A multi-position switch (up to 10 positions) can also be configured to vary the gear shift points.
- The Manual shift mode allows the driver to shift up and down at any time via up and down gear shift switches.
- Configurable gear shift engine speed settings that automatically shift gears when the engine speed is outside the user definable range (e.g. above maximum engine speed).
- Support for a switching and/or proportional torque convertor lockup clutch solenoid.
- Fully configurable torque convertor lockup clutch control that can be based on vehicle speed, gear, throttle pedal, transmission temperature, range selector position and torque convertor slip. The proportional solenoid can also be ramped in and out as the torque convertor lockup clutch is applied and released, delivering smoother transitions.
- Support for a line pressure control solenoid to vary the pressure of the transmission's hydraulic fluid. This line pressure solenoid's output can be set to be dependent on many variables, including: gear, gear shift state, throttle pedal position, torque convertor lockup clutch state and transmission temperature to give the ideal transmission pressure under all conditions.
- Support for up to 3 other pressure control solenoids that can be used to vary the line pressure within the transmission (e.g. 3-2 Control Solenoid on a GM 4L60E transmission). These solenoid outputs can be set to be dependent on numerous variables, including: gear, gear shift state, throttle pedal position, torque convertor lockup clutch state, transmission temperature and vehicle speed. Also included are a wide variety of settings that can be used to ramp in and out these solenoids during gear shifts and range selector position changes.
- Support for up to 4 gear shift solenoids. These shift solenoids can be set to any user defined combination, enabling many transmissions to be run from this single Package.
- Support for a manual range selector whose position (Park, Neutral, Drive etc.) can be configured from any combination of up to 8 individual switch inputs. This range selector can then be used to limit the gears selectable in each position.
- Supports input and output shaft speed sensors with calculations for torque convertor, as well as internal clutch and band slip (Gear Slip).
- Warnings to alert the user of excessive torque convertor and gear slip. Once active, these warnings can reduce engine torque via engine speed limiting or reduced throttle (DBW engines only).
- Support for a transmission temperature sensor with overrides and trims for the torque convertor lockup clutch, pressure control solenoids and gear shift points.
- Support for a transmission pressure sensor.
- Warnings to alert the user of undesired transmission pressures and temperatures.
- Support for a transmission cooler fan along with an additional temperature and pressure sensor.
- Support for a transfer case with selector and position switches, allowing the output ratio to be set based on the transfer case selector position.
- Support for a shift lock solenoid to restrict movement of the range selector under certain conditions.
- CAN transmit of the most common transmission channels using standard MoTeC CAN templates that can easily import into MoTeC displays and other devices.

GPR FEATURES

The following features from MoTeC's GPR Package are maintained in the GPR Automatic Transmission Package:

- Operates port injected engines from 1 to 12 cylinders (M150 or M190) or 1 to 8 cylinders (M130 or M170).
- Configurable engine synchronisation modes 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 selectable centre frequencies.
- Configurable camshaft control from 1 to 4 cams, plus 1 switched camshaft.
- 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.
- Quick and easy 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.
- Sensor calibrations available for many common automotive 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 for MoTeC devices: ADR, E8XX, PDM, SLM, Video Capture Systems
- 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 turbocharger boost control (using a normal and inverted solenoid output).
- Support for a turbocharger bypass valve control.
- Support for two coolant fan outputs (PWM controlled).
- Air conditioner support with switched output control.
- Coolant temperature compensations for engine speed limit, ignition timing, 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.
- GPS acquisition and logging via CAN or RS232 (hardware dependent).
- Intercooler temperature and spray control.
- Differential temperature control with dedicated temperature sensor and switched pump output.
- Engine Charge Temperature calculation, allows for correction of Inlet Air Temperature (compensation for heat soak effect etc.).
- Lap distance, time and number via BR2, GPS or switched input, with split and sector options.
- Race time system with trim tables for ignition timing compensation, 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.
- Inlet Manifold Flap support (actuator with 2 bank position feedback).
- Inlet Manifold Runner support (actuator with position feedback).
- Assisted engine start with dedicated fuel volume and idle compensations during crank and post start.
- Closed loop Alternator control.
- Engine run time total for engine hour logging.
- Configurable security for multiple users.
- Configuration of brake state using a switch or a pressure sensor.
- Brake Vacuum control system with dedicated switched pump.
- 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 one (M130/M170) or 3 (M150/M190) 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 10 positions simultaneously mappable to Pit Switch, Auxiliary Time, Race Time Reset, Engine Speed Limit Maximum, Throttle Pedal Translation, Ignition Timing, Fuel Mixture Aim, Boost Limit.
- Analogue tachometer output with configurable output pin and scaling.
- Dual bank drive by wire throttle servo control.
- Throttle Pedal sensor with translation table.
- Use of a Throttle Pedal sensor or a Throttle Position sensor in case of a cable throttle.
- Transmission pump output with transmission temperature threshold and hysteresis control.
- 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.
- 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 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
  - 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 (M150/M190: 12)
  - Exhaust Lambda via LTC, LTCN, or PLM for Collector, Bank 1 and 2 Collector, and Cylinders 1 to 8 (M150/M190: 12)
  - Fuel Pressure and Temperature
  - Fuel Tank Level
  - 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.

TRANSMISSION COMPATIBILITY

This product is a generic, versatile solution that has been designed for adaptability to a wide range of automatic transmissions. It can control any transmission that has the following electrical requirements and features:

- Up to 5 forward gears. Automatic transmission control Packages with more than 5 gears are in development.
- Up to 5 forward drive gear ranges (e.g. Drive, Drive 3, Drive Low etc.) and 1 Park, Neutral and Reverse range.
- A line pressure control solenoid (Proportional).
- Up to 3 other pressure control solenoids (Proportional or Switched), e.g. 3-2 Solenoid found in GM 4L60E transmission.
- Proportional and/or Switching torque convertor lockup clutch solenoid.
- Up to 4 gear shift solenoids (Proportional or Switched).
- Input and/or output shaft speed sensor. (A driven wheel speed sensor can also be used to determine the output shaft speed).
- Transmission fluid temperature sensor and warning light output.
- Manual range selector position detection using up to 8 position indication switches.
- Gear shift pattern switch.
- Manual up and down gear shift switches.
- Manual/Automatic gear shift mode selection switch.
- Shift lock solenoid.
- Transmission brake solenoid output (Switched).