MoTeC

M1 GPR ROTARY DRAG PACKAGE

Based on MoTeC's GPR Rotary Package, the GPR Rotary Drag Package is a versatile tuning platform that has been developed for drag racing applications using rotary engines.

This single product can be configured over a huge range of rotary engine configurations, from controlling a simple, naturally aspirated 13B to a multi-throttle, boosted quad rotor with three injectors per rotor.

Included in GPR Rotary Drag are numerous ancillary features common to race cars, such as:

- Anti-lag
- Driver switches (e.g. pit switch, launch enable and boost limit)
- Gearbox control
- Knock control
- Intercooler sprays
- Launch control
- Gearbox coolant pumps
- Traction control

Key features for drag racing include:

- Time based trims and compensations
- Improved large turbo boost building for launch
- Traction control for vehicles with torque converters
- "Two Step" Launch
- Individual cylinder exhaust temperature fuel trim
- Suspension position with 1000Hz logging capability

Also accommodated are many systems found on modified road vehicles, such as air conditioning.

The product fully integrates with other MoTeC products, and provides pre-defined CAN messaging for all current Displays,

Loggers, Video Capture Systems, PDMs, E888, GPS, ADR, BR2, and SLM. A Vector database (.dbc) file is available on request.

▶ ECU VARIANTS

This Package is available for use with MoTeC's M130, M150, M170 and M190 ECUs. A pin-out example for the M130 follows.

▶ VEHICLE COMPATIBILITY

This product also includes CAN messaging for OE vehicle integration with the Mazda RX8. This enables OE vehicle systems such as power steering, ABS, TPMS, transmission and instrument cluster information.

▶ ROTARY DRAG SPECIFIC FEATURES

The GPR Rotary Drag Package is based on MoTeC's GPR Rotary Package with the addition of these rotary engine-specific features:

- Additional Vehicle Speed and Race Time conditions on auxiliary outputs.
- Auxiliary output fuel and ignition trims.
- Boost Servo system - utilise a servo motor to control a wastegate, or use an additional throttle servo to bleed boost air from the compressor. This can assist with compressor surge, act as a blow off valve or control boost with higher response.
- Clutch position threshold for Launch condition - can be updated with a switch, for drag vehicles with a clutch and critical 'bite' position.
- Improved tuning resolution for highly tuned engines.
- Improved sensor and calculation resolution critical to drag racing.
- Individual rotor fuel trim for respective exhaust temperature.

- Warnings with engine speed and throttle limits for Primary, Secondary and Tertiary Injector Duty Cycle.

- Support for automatic transmission gear detection and converter slip monitoring.

- Gear Output Shaft Speed fuel and ignition trims, plus throttle and boost limits.

- Closed Loop Control of engine torque by changing the ignition timing used for Traction Control and Launch Control. By varying ignition timing rather than cutting ignition events, turbo lag on large turbos is reduced.

- Improved Launch Control for more vehicle configurations - faster boost building, multi step staging, nitrous integration and Traction Control integration.

- Improved Nitrous Control - bottle pressure warning and additional conditions for use during Launch Control and time after launch.

- Improved Race Time triggering strategy - more configurable, false start detection and reset, and integration with Traction Control for acceleration limiting.

- Improved Traction Control using ignition timing control. Wheel speed or engine speed based limiting for use with automatic transmissions.

- Shift Light Output

- Additional sensor inputs:
  - Suspension Position x 4, logging at 1000Hz (with optional Level 3 logging).
  - Transmission Temperature x 2
  - Transmission Pressure x 2
  - Tyre Pressure x 4
  - Tyre Temperature x 4
  - Wheelie Bar Pressure x 2

- Transmission brake control with improved 'bump' functionality (pulse or PWM modes) for perfect vehicle staging.

- Vehicle Speed based fuel and ignition trims and throttle limit.

- Vehicle Speed Estimate calculation utilising wheel speeds, GPS speed and time based speed after launch. Different modes of estimation for various vehicle setups.

- Wastegate pressure control by CO2 style dual solenoids and pressure feedback.

- Live adjustment for tyre growth with speed.

▶ GPR ROTARY FEATURES

The following features from MoTeC's GPR Rotary Package are maintained in the GPR Rotary Drag Package:

Rotary Specific

- Operates port injected rotary engines from 1 to 4 rotors.

- Configurable engine synchronisation modes for common rotary engines. Refer to the Engine Speed Modes section for details.

- Configurable leading and trailing ignition outputs for each rotor. The trailing ignition timing can be defined as either an angle relative to the leading ignition (i.e. split angle) or TDC.

- Configurable on-board knock detection for each rotor with up to two assignable knock sensors and 4 selectable centre frequencies.

- Control of up to six injectors (3 pairs) per rotor with user definable tables to control the fuel contribution of each injector.

- Coolant and engine oil temperature compensations for engine speed limiting, ignition timing, fuel volume and boost limiting.

- Supports control of a Sequential Shutter Valve with fuel injector integration as found on the Mazda RX8.

- Supports control of VFAD, VDI and APV inlet manifold valves found on Mazda rotaries.

- Diagnostic checking of SSV, VFAD, VDI and APV valves via feedback position sensors.

- User configurable engine efficiency table with adjustments based on the state of the SSV, VFAD, VDI and APV valves.

- Supports control of a stepper motor-based Metering Oil Pump. This includes diagnostics and a warning system to detect failure of the components.

- Supports dual speed cooling fans via three relay outputs as found on Mazda rotaries.

- CAN Integration, for the Mazda RX8, to enable the operation of the power steering, transmission and ABS. Wheel speeds, steering angle, fuel tank level, tyre pressure monitoring and park brake data are also received from the CAN bus for use in the ECU.

General Purpose

- Closed loop lambda control support; requires optional LTC with Bosch LSU4.9 sensor or LTCN with NTK sensor.

- Physical settings for engine displacement, fuel properties, and injector characteristics allow for simplified engine start-up prior to tuning.

- Fast and easy engine tuning using engine efficiency map.

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

- Differential pump output with user definable differential temperature control.

- Transmission pump output with user definable transmission temperature 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.
- Supports both sequential and batch fire fuel injection.
- GPS acquisition and logging via CAN or RS232.
- 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.
- 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 a single Collector, Bank 1 and 2 Collectors, and Rotors 1 to 4.
- Exhaust Lambda via LTC, LTCN, or PLM for a single Collector, Bank 1 and 2 Collectors, and Rotors 1 to 4.
- 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 suitable for one, two, three or four rotor engines with port injectors.

Known OE engines that are suitable:

Engine Family	Engine Designation	Year	Vehicle Platform	Comment
Mazda 12A	10A			See Note 1
Mazda 12A	10B			See Note 1
Mazda 12A	12A			See Note 1
Mazda 12A	12A Turbo	1984-1985 1982-1989 1982-1985	RX7 Cosmo Luce	See Note 1
Mazda 12A	13A			See Note 1
Mazda 13B	13B			See Note 1
Mazda 13B	13B-RESI	1984-1985 1984-1985 1984-1985	RX7 FB Cosmo HB Luce HB	See Note 1
Mazda 13B	13B-DEI	1986-1988 1989-1991	RX7 FC3S S4 RX7 FC3S S5	See Note 1
Mazda 13B	13B-T	1986-1988 1989-1991 1986-1991	RX7 FC3S S4 RX7 FC3S S5 Luce HC	See Note 1
Mazda 13B	13B-MSP Renesis (Standard)	2003-2007	RX8 Gen 1	4-Port Intake System
Mazda 13B	13B-MSP Renesis (High Power)	2003-2007	RX8 Gen 1	6-Port Intake System
Mazda 20B	20B			See Note 1

Note 1: All variants of this engine can be run provided they meet the following criteria (from factory or modified):

- Fitted with an engine speed reference sensor that matches one of the Engine Speed Modes listed.
- Individual coil for each spark plug.
- Is not fitted with a twin sequential turbocharger.

Known OE engines that are not suitable:

Engine Family	Engine Designation	Year	Vehicle Platform	Not Applicable Because
Mazda 13B	13B-RE	1990-1995	Eunos Cosmo	Sequential Turbocharger*
Mazda 13B	13B-REW	1992-2002	RX7 FD	Sequential Turbocharger*
Mazda 13B	13B-MSP Renesis	2008-2012	RX8 Gen 2	Metering Oil Pump**

▶ ENGINE SPEED MODES

This Package currently supports the following engine speed reference modes:

- Crankshaft One Missing Tooth
- Crankshaft Two Missing Teeth
- Multi Tooth
- Mazda RX8 - Mazda Renesis 13B-MSP

▶ EXAMPLE M130 PINOUT

PINOUT - M130 CONNECTOR A - 34 WAY

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

Pin	Designation	Full Name	Description
A01	OUT_HB2	Half Bridge Output 2	Fuel Pump
A02	SEN_5V0_A1	Sensor 5.0V A	Sensor 5V Analogue Signals
A03	IGN_LS1	Low Side Ignition 1	Ignition Rotor 1 Leading Output
A04	IGN_LS2	Low Side Ignition 2	Ignition Rotor 2 Leading Output
A05	IGN_LS3	Low Side Ignition 3	Ignition Rotor 1 Trailing Output
A06	IGN_LS4	Low Side Ignition 4	Ignition Rotor 2 Trailing Output
A07	IGN_LS5	Low Side Ignition 5	
A08	IGN_LS6	Low Side Ignition 6	
A09	SEN_5V0_B1	Sensor 5.0V B	Sensor 5V Analogue Signals
A10	BAT_NEG1	Battery Negative	Ground
A11	BAT_NEG2	Battery Negative	Ground
A12	IGN_LS7	Low Side Ignition 7	
A13	IGN_LS8	Low Side Ignition 8	
A14	AV1	Analogue Voltage Input 1	Throttle Servo Bank 1 Position Main
A15	AV2	Analogue Voltage Input 2	Throttle Servo Bank 1 Position Tracking
A16	AV3	Analogue Voltage Input 3	Fuel Pressure Sensor
A17	AV4	Analogue Voltage Input 4	Engine Oil Pressure
A18	OUT_HB1	Half Bridge Output 1	
A19	INJ_PH1	Peak Hold Injector 1	Fuel Rotor 1 Primary
A20	INJ_PH2	Peak Hold Injector 2	Fuel Rotor 2 Primary
A21	INJ_PH3	Peak Hold Injector 3	Fuel Rotor 1 Secondary
A22	INJ_PH4	Peak Hold Injector 4	Fuel Rotor 2 Secondary
A23	INJ_LS1	Low Side Injector 1	
A24	INJ_LS2	Low Side Injector 2	
A25	AV5	Analogue Voltage Input 5	Inlet Manifold Pressure Sensor
A26	BAT_POS1	Battery Positive	ECU Battery Voltage
A27	INJ_PH5	Peak Hold Injector 5	
A28	INJ_PH6	Peak Hold Injector 6	
A29	INJ_PH7	Peak Hold Injector 7	
A30	INJ_PH8	Peak Hold Injector 8	
A31	OUT_HB3	Half Bridge Output 3	Throttle Servo Bank 1 Motor Output
A32	OUT_HB4	Half Bridge Output 4	Throttle Servo Bank 1 Motor Output
A33	OUT_HB5	Half Bridge Output 5	
A34	OUT_HB6	Half Bridge Output 6	

PINOUT - M130 CONNECTOR B - 26 WAY

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

Pin	Designation	Full Name	Function
B01	UDIG1	Universal Digital Input 1	Engine Speed Sensor
B02	UDIG2	Universal Digital Input 2	Engine Synchronisation Sensor
B03	AT1	Analogue Temperature Input 1	Inlet Air Temperature Sensor
B04	AT2	Analogue Temperature Input 2	Coolant Temperature Sensor
B05	AT3	Analogue Temperature Input 3	Engine Oil Temperature Sensor
B06	AT4	Analogue Temperature Input 4	
B07	KNOCK1	Knock Input 1	
B08	UDIG3	Universal Digital Input 3	Engine Run Switch
B09	UDIG4	Universal Digital Input 4	
B10	UDIG5	Universal Digital Input 5	
B11	UDIG6	Universal Digital Input 6	
B12	BAT_BAK	Battery Backup	
B13	KNOCK2	Knock Input 2	
B14	UDIG7	Universal Digital Input 7	
B15	SEN_0V_A2	Sensor 0V A	Sensor 0V for Digital Signals
B16	SEN_0V_B2	Sensor 0V B	Sensor 0V for Digital Signals
B17	CAN1_HI	CAN Bus 1 High	MoTeC 1 Mbit/sec CAN
B18	CAN1_LO	CAN Bus 1 Low	MoTeC 1 Mbit/sec CAN
B19	SEN_6V3	Sensor 6.3V	
B20	AV6	Analogue Voltage Input 6	
B21	AV7	Analogue Voltage Input 7	Throttle Pedal Sensor Main
B22	AV8	Analogue Voltage Input 8	Throttle Pedal Sensor Tracking
B23	ETH_TX+	Ethernet Transmit+	Ethernet Green/White
B24	ETH_TX-	Ethernet Transmit-	Ethernet Green
B25	ETH_RX+	Ethernet Receive+	Ethernet Orange/White
B26	ETH_RX-	Ethernet Receive-	Ethernet Orange