M1 MINI R56 2008 N14B16 PACKAGE

The MINI R56 2008 N14B16 package is a fully programmable replacement for the factory fitted ECU in MINI R56 models.

FEATURES

- Fully integrates with these original systems: direct injection, stability, dash (partially, see Vehicle Compatibility), power steering, ABS, and purge canister. **Lambda control is supported with optional LTC and Bosch LSU4.9 sensor**.
- Pre-configured sensor calibrations for Original Equipment (OE) sensors and engine triggers.
- Pre-configured control of primary (Direct Injector) fuel system.
- 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.

- Pre-configured reference mode for engine synchronisation and control of 2 camshafts with tuneable inlet and exhaust timing tables.
- Pre-configured physical settings for engine displacement, fuel density, stoichiometric ratio, fuel pressure, and primary injector linearisation, which allow for simplified engine start-up prior to tuning.
- Pre-configured CAN messaging for OE systems including ABS / VSC, dashboard and power steering.
- Pre-configured control of 2 OE coolant fans with temperature thresholds.
- Pre-configured transient fuelling compensation using physical modelling of fuel film for direct injectors.
- Pre-configured wheel speed detection via CAN from OE ABS system, allowing gear detection via engine speed / wheel speed estimate.
- Pre-configured on-board knock control for each cylinder using the OE knock sensor (optionally can be configured to use up to 4 sensors) and selectable centre frequency.
- Pre-configured camshaft control for inlet and exhaust cams.
- Configurable boost control with single wastegate actuator. Single and dual solenoids supported.
- Configurable anti-lag for single turbo variants with ignition timing limit, fuel volume trim, ignition cut, fuel cut, engine speed limit, boost aim and throttle aim tables.
- Configurable closed loop alternator system for PWM field winding control.

  ⇨ OE MINI alternators are not controlled by this subsystem, and will default to 14.0V.

- Gearbox position detection via sensor or engine speed / wheel speed.
- Gearbox shift request via up shift switch / down shift switch or gear lever force sensor.
- Gearbox shift control with ignition cut and engine speed matching.
- GPS acquisition and logging via CAN or RS232.
- Intercooler temperature and spray control.

- Lap distance, time and number via BR2 or switched input, with split and sector options.
- Configurable launch control with tables.
- Race time system with tables for ignition timing trim, fuel mixture aim, boost limit, and throttle limit.
- Engine Load Average channel with tables for engine speed limit, ignition timing trim, fuel mixture aim, boost limit, and throttle limit.
- Engine run time total for engine hour logging.
- Configurable security for multiple users with differing access options.
- ECU CAN Receive from a defined ID base address for data reception from MoTeC devices.
- 6 configurable driver switches, 4 rotary switches and 6 CAN switches each with 9 positions that can be simultaneously mapped to launch control, pit switch, anti-lag, traction, race time reset, engine speed limit maximum, throttle pedal translation, fuel volume trim, ignition timing, fuel mixture aim, boost limit, traction aim, and traction control range.
- Pulsed tachometer output with configurable output pin and scaling.
- Transmission pump output with transmission temperature threshold and hysteresis control.
- Traction control with tables for aim main, aim compensation, control range.
- Optional channels for additional sensors via input pin and/or CAN message, including:
  - Airbox Mass Flow, Temperature and Pressure
  - Ambient Pressure and Temperature
  - Air Conditioner Refrigerant Pressure
  - Air Conditioner Request
  - Boost Pressure
  - Brake Pressure Front and Rear
  - Brake 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 4.
  - Exhaust Lambda via LTC, LTCN, or PLM for Collector, Bank 1 and 2 Collector, and Cylinders 1 to 4
  - Fuel Pressure and Temperature
  - Fuel Tank Level
  - Gear Position
  - Gear Lever Force
  - Gear Neutral Switch
  - Gear Shift Request
  - Intercooler Temperature
  - Steering Angle and Pressure
  - Transmission Temperature
  - Turbocharger Speed
  - G-Force (acceleration) - Longitudinal, Lateral, Vertical
  - Wheel Speed Front Left, Front Right, Rear Left, and Rear Right

LICENCING

To load the package onto the ECU, the **M1 Licence - MINI R56 2008 N14B16** (part number 23069) is required.

VEHICLE COMPATIBILITY

This product includes CAN messaging for basic OE vehicle integration. It caters for OE vehicle systems such as power steering, ABS, starting systems and dashboards. Not all OE dashboard functions are reproduced. Tachometer and speed are supported, while dash warning lights and fuel displays are not.

This product offers configurable closed loop alternator control for PWM field winding control.

⇨ OE MINI alternators are not controlled by this subsystem, and will default to 14.0V.

OPERATION

When the M142 ECU is installed according to the included wiring pinout, this package mimics most aspects of OE operation as follows.

Start System

The OE vehicle utilises an immobiliser key fob to control power supply to the ECU and to crank the engine when the Start button is pressed. The M142 package does not change this behaviour.

Air Conditioner

There is no interaction between the M1 package and the air conditioner system.

Power Steering

No user interaction or settings are required.

ABS / Stability

While this product uses some sensor information provided by these systems (for example wheel speeds) no further interaction occurs.

Turbocharger Coolant Pump

This pump may be controlled by configuring the Coolant Pump After Run subsystem in the M1 package. When the M142 ECU is installed according to the included wiring pinout, duty cycle should be set to -100% to effect high-side output drive.

Coolant Thermostat

MINI N14 engines have a heated thermostat which may be used to alter cooling system behaviour. Settings for this device are found in the MINI R56 Coolant Thermostat group of the M1 package.

Power Relays

MINI R56 vehicles control the DME and start relays from the ECU. When the M142 ECU is installed according to the included wiring pinout, these outputs may be configured from the MINI R56 Power group of the M1 package.

Some variants of the vehicle may control these relays independently, so actual behaviour may not always match the settings in the M1.

Purge Canister

A simplified purge strategy is available and may be configured from the MINI R56 Fuel Purge group of the M1 package.

WIRING

A wiring schematic is included at the end of this datasheet. The components required to make up a loom based on this schematic may be purchased from MoTeC:

- 65092 – MINI N14 ECU Header Connector Set
- 41212 – IGN4
- 65044 – Connector, 34 pin key 1
- 65045 – Connector, 26 pin key1
- 65067 – Connector, M142 34 pin key 2
- 65068 – Connector, M142 26 pin key 3
- 61236 - Ethernet cable
- 68054 - Connector, DTM 4 Pin (F)
- 68056 - Connector, DTM 6 Pin (F)

These additional components should be sourced independently:

- Diode, 1N5404 or similar
- Resistor, 100 ohm
- Splices

M142 PINOUT

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		1k Pull up to SEN_5V_C	
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 -	A29		Fuel Cylinder 1 Primary Output
A07	INJ_D1A_POS	Direct Injector 1A +	A04		Fuel Cylinder 1 Primary Output
A08	INJ_D1B_POS	Direct Injector 1B +			
A09	INJ_D1B_NEG	Direct Injector 1B -			
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	G04		GPS 5V Supply
A19	SEN_5V0_B2	Sensor 5.0V B			
A20	LIN	LIN Bus			
A21	RS232_RX	RS232 Receive	G02		GPS Receive
A22	RS232_TX	RS232 Transmit			
A23	DIG1	Digital Input 1			
A24	BAT_NEG3	Battery Negative	C53		Chassis Ground
A25	BAT_NEG4	Battery Negative			
A26	SEN_0V_C1	Sensor 0V C			
A27	SEN_0V_C2	Sensor 0V C	G01		GPS 0V Supply
A28	CAN3_HI	CAN Bus 3 High			
A29	CAN3_LO	CAN Bus 3 Low			
A30	CAN2_HI	CAN Bus 2 High	C40		Vehicle 500k CAN Bus
A31	CAN2_LO	CAN Bus 2 Low	C52		Vehicle 500k CAN Bus
A32	BAT_NEG5	Battery Negative			
A33	SEN_0V_B1	Sensor 0V B	B07, B08		0V Pulse Sensors: Crank, Inlet Cam
A34	SEN_0V_A1	Sensor 0V A	B09, B13, B14, B26, B43		0V Analog Sensors: Throttle Servo, Air Mass Meter, MAP, Coolant, TMAP

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	B48		Coolant Pump After Run Output
B02	OUT_HB10	Half Bridge Output 10			
B03	UDIG8	Universal Digital Input 8	C19		Driver Switch 1
B04	UDIG9	Universal Digital Input 9	A14		Airbox Mass Flow Sensor Digital Input
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			
B09	INJ_LS3	Low Side Injector 3	C11		Fuel Pump Output
B10	AV9	Analogue Voltage Input 9			
B11	AV10	Analogue Voltage Input 10			
B12	AV11	Analogue Voltage Input 11			
B13	BAT_POS	Battery Positive	C05		ECU Battery Voltage
B14	INJ_LS6	Low Side Injector 6	B06		Fuel Purge Solenoid Output
B15	INJ_LS4	Low Side Injector 4	C28		Power DME Relay Output
B16	AV12	Analogue Voltage Input 12			
B17	AV13	Analogue Voltage Input 13			
B18	AV14	Analogue Voltage Input 14			
B19	BAT_POS	Battery Positive	C06		ECU Battery Voltage
B20	OUT_HB7	Half Bridge Output 7	A07		Boost Actuator Output
B21	OUT_HB8	Half Bridge Output 8	B49		Coolant Thermostat Output
B22	INJ_D2A_NEG	Direct Injector 2A -	A27		Fuel Cylinder 2 Primary Output
B23	INJ_D2A_POS	Direct Injector 2A +	A06		Fuel Cylinder 2 Primary Output
B24	INJ_D2B_POS	Direct Injector 2B +			
B25	INJ_D2B_NEG	Direct Injector 2B -			
B26	SEN_5V0_A	Sensor 5.0V A	C20, C46, A22		5V Analog Sensors: APP, FRP

M142 Connector C - 34 Way

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

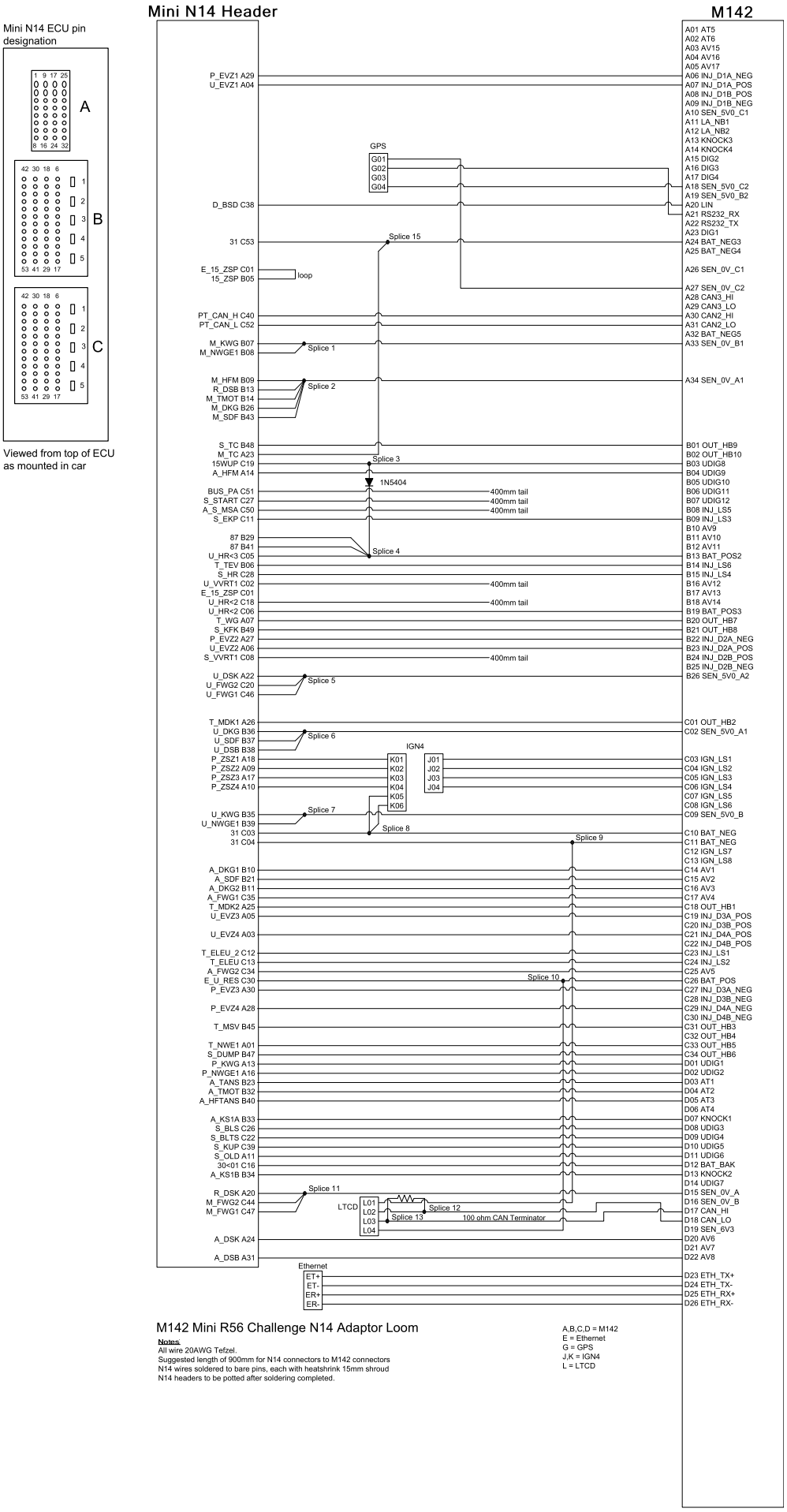
Pin	Designation	Full Name	OE Pin	Function	Description
C01	OUT_HB2	Half Bridge Output 2	A26		Throttle Servo Bank 1 Motor Output
C02	SEN_5V0_A	Sensor 5.0V A	B36, B37, B38		5V Analog Sensors: Throttle Servo, MAP, TMAP
C03	IGN_LS1	Low Side Ignition 1	to IGN4 J01	IGN4 K01 to A18	Ignition Cylinder 1 Output
C04	IGN_LS2	Low Side Ignition 2	to IGN4 J02	IGN4 K02 to A09	Ignition Cylinder 2 Output
C05	IGN_LS3	Low Side Ignition 3	to IGN4 J03	IGN4 K03 to A17	Ignition Cylinder 3 Output
C06	IGN_LS4	Low Side Ignition 4	to IGN4 J04	IGN4 K04 to A10	Ignition Cylinder 4 Output
C07	IGN_LS5	Low Side Ignition 5			
C08	IGN_LS6	Low Side Ignition 6			
C09	SEN_5V0_B	Sensor 5.0V B	B35, B39		5V Pulse Sensors: Crank, Inlet Cam
C10	BAT_NEG1	Battery Negative	C03, K05, K06	To IGN4 Power Ground	Chassis Ground
C11	BAT_NEG2	Battery Negative	C04, L01	To LTC Power Ground	Chassis Ground
C12	IGN_LS7	Low Side Ignition 7			
C13	IGN_LS8	Low Side Ignition 8			
C14	AV1	Analogue Voltage Input 1	B10		Throttle Servo Bank 1 Position Sensor Main
C15	AV2	Analogue Voltage Input 2	B21		Inlet Manifold Pressure Sensor
C16	AV3	Analogue Voltage Input 3	B11		Throttle Servo Bank 1 Position Sensor Tracking
C17	AV4	Analogue Voltage Input 4	C35		Throttle Pedal Sensor Main
C18	OUT_HB1	Half Bridge Output 1	A25		Throttle Servo Bank 1 Motor Output
C19	INJ_D3A_POS	Direct Injector 3A +	A05		Fuel Cylinder 3 Primary Output
C20	INJ_D3B_POS	Direct Injector 3B +			
C21	INJ_D4A_POS	Direct Injector 4A +	A03		Fuel Cylinder 4 Primary Output
C22	INJ_D4B_POS	Direct Injector 4B +			
C23	INJ_LS1	Low Side Injector 1	C12		Coolant Fan 2 Output
C24	INJ_LS2	Low Side Injector 2	C13		Coolant Fan 1 Output
C25	AV5	Analogue Voltage Input 5	C34		Throttle Pedal Sensor Tracking
C26	BAT_POS	Battery Positive	C30		ECU Battery Voltage
C27	INJ_D3A_NEG	Direct Injector 3A -	A30		Fuel Cylinder 3 Primary Output
C28	INJ_D3B_NEG	Direct Injector 3B -			
C29	INJ_D4A_NEG	Direct Injector 4A -	A28		Fuel Cylinder 4 Primary Output
C30	INJ_D4B_NEG	Direct Injector 4B -			
C31	OUT_HB3	Half Bridge Output 3	B45		Fuel Pressure Direct Pump Output
C32	OUT_HB4	Half Bridge Output 4	leave empty		leave empty
C33	OUT_HB5	Half Bridge Output 5	A01		Inlet Camshaft Bank 1 Actuator Output
C34	OUT_HB6	Half Bridge Output 6	B47		Turbocharger Bypass Actuator Output

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	A13		Engine Speed Reference
D02	UDIG2	Universal Digital Input 2	A16		Inlet Camshaft Bank 1 Position
D03	AT1	Analogue Temperature Input 1	B23	1k Pull up to SEN_5V_A	Inlet Manifold Temperature Sensor
D04	AT2	Analogue Temperature Input 2	B32	1k Pull up to SEN_5V_A	Coolant Temperature Sensor
D05	AT3	Analogue Temperature Input 3	B40	1k Pull up to SEN_5V_B	
D06	AT4	Analogue Temperature Input 4		1k Pull up to SEN_5V_B	
D07	KNOCK1	Knock Input 1	B33		Knock Cylinder 1
D08	UDIG3	Universal Digital Input 3	C26		Brake Switch
D09	UDIG4	Universal Digital Input 4	C22		Brake Switch 2
D10	UDIG5	Universal Digital Input 5	C39		Clutch Switch
D11	UDIG6	Universal Digital Input 6	A11		Engine Oil Pressure Low Switch
D12	BAT_BAK	Battery Backup	C16		
D13	KNOCK2	Knock Input 2	B34		Knock Cylinder 1
D14	UDIG7	Universal Digital Input 7			
D15	SEN_0V_A	Sensor 0V A	A20, C44, C47		0V Analog Sensors: APP, FRP
D16	SEN_0V_B	Sensor 0V B			
D17	CAN1_HI	CAN Bus 1 High	L03		MoTeC 1Mbit/sec CAN Bus
D18	CAN1_LO	CAN Bus 1 Low	L02		MoTeC 1Mbit/sec CAN Bus
D19	SEN_6V3	Sensor 6.3V			
D20	AV6	Analogue Voltage Input 6	A24		Fuel Pressure Direct Sensor
D21	AV7	Analogue Voltage Input 7			
D22	AV8	Analogue Voltage Input 8	A31		Boost Pressure Sensor
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		

ADAPTOR LOOM WIRING SCHEMATIC



M142 Mini R56 Challenge N14 Adaptor Loom

Notes:
All wire 20AWG Tefzel.
Suggested length of 900mm for N14 connectors to M142 connectors
N14 wires soldered to bare pins, each with heatshrink 15mm shroud
N14 headers to be potted after soldering completed.

A,B,C,D = M142
E = Ethernet
G = GPS
J,K = IGN4
L = LTCD