



Display DDU 8



ECU MS 5.0

Bosch Motorsport **Motorcycle System**

MS 5.0 and DDU 8 for BMW S1000RR



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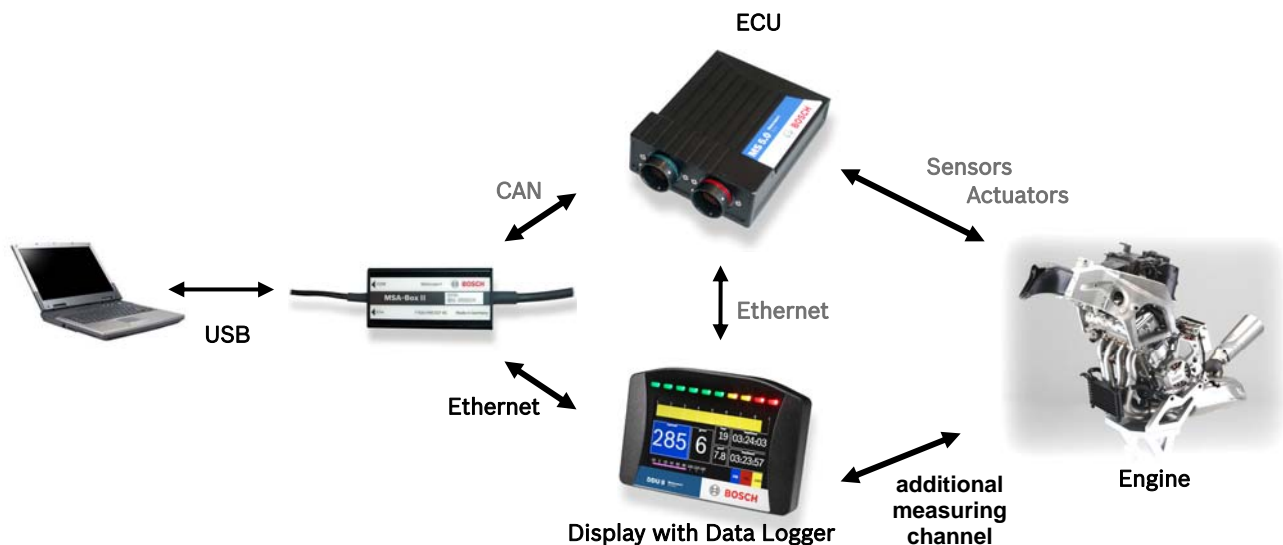
System Overview

The system is designed to run a BMW S1000RR with little modification in the highest level of international motorcycle races.

The BMW S1000RR has proven it to be a powerful basis for racing in various Stock Series.

To make hardware modifications easy and to provide a simple means of adapting to different riders' demands, the stock ECU (Engine Controller Unit) has to be replaced by a motorsport unit.

State of the art functionalities in the Motorsport ECU permit the best driveability of the motorcycle and therefore best lap times. A comprehensive documentation that describes all calibration possibilities is available with the Motorsport ECU.



Logging the signals from the engine and chassis with high sampling rate of up to 1ms and a large data logging memory of 2GB provides the base for a perfect setup of the motorcycle.

Components

Engine Controller MS 5.0

The MS 5.0 engine control unit manages gasoline engines up to 8 injectors. As a member of the MS 5 family, it features a powerful digital processing core with floating point arithmetic and a high-end FPGA for ultimate performance and flexibility. The MS 5 family utilizes a new software development process based on MATLAB/Simulink, which significantly decreases algorithm development time by using automatic code and documentation generation. Custom functions can be quickly and easily generated. The flexible hardware design allows the MS 5.0 to support complex or unusual engine or chassis configurations.

Display and Data Logger DDU 8

The display, DDU 8, integrates a programmable full colour dash board display with a data logging system. This allows for synchronized acquisition and visualization of engine data from the ECU and chassis data from up to 24 analogue and 4 digital input channels. Additional input devices can be connected via the Ethernet and/or CAN buses. Recorded data from the internal 2 GB flash memory can be downloaded via high-speed Ethernet or via wireless connection with the BT 60 burst telemetry system.

Alternatively a C60 Data logger (same capacity and logging capability as DDU 8) can be connected with a third party display.

Wiring Harness

The wiring harnesses are especially designed to fit in the S1000RR Chassis. The number of branches, intersections and connectors has been specifically designed to keep the weight and costs at a minimum without limiting the system functionality. Robust connectors (military specification – Deutsch Autosport) as well as high quality wire and protective tubing are used to guarantee the best reliability.

The main wire harness connects the ECU and the display and offers several connectors for the sensors and actuators.

For a fast and reliable connection of all sensors and actuators that are mounted at the airbox, a single intersection connects the main harness to the airbox harness.

Engine Sensors

Additional to the original airbox and water temperature sensors, there is an airbox pressure sensor mounted. This sensor enables the engine to run seamlessly at varying ambient conditions and at a high ram air effect.

Two wide band lambda sensors (Bosch LSU4.9) allow for precise closed loop lambda control. With the two lambda sensors mapping of the fuel injection can be done in a manner that achieves both maximum power and the best rideability.

Different oil temperature and oil pressure sensors as well as three additional 5 volt auxiliary analogue sensors can be connected to the ECU.

The original gear potentiometer is utilized to provide a signal to the ECU for gear position. The signal is then used by the ECU for various gear dependent functionalities. The drivers demand for a gear shift is detected by the signal of the gear shift sensor (quick shift sensor).

Chassis Sensors

The original wheel speed sensor (Bosch DF11) and its trigger wheel can be used. A special input stage in the ECU reads the signal current of the sensor which then used by the ECU to calculate wheel speed.

The original Lean Angle Sensor can also be used. To increase the accuracy in corners, a different algorithm is used and the sensor has to be installed horizontal with the connector facing backwards.

A different Spring travel sensor, IR-Tire temperature (infra red) and brake pressure sensor, all which must be of analogue type that require a supply voltage of 5 volts can be connected to the ECU.

Handlebar Switches

Two wiring harnesses with open end are prepared to connect the preferred handle bar switches and buttons. Push buttons for the Launch Control, different Ignition /Fuel Mappings, Pitspeed Control, different settings of the Traction Control, the main power switch and the starter can be fitted.



Throttle Body

To provide a high standard of safety with an electronic throttle control system the throttle body is a complex combination of different sensors, actuators and mechanical parts. The Bowden cable from the throttle grip is connected to the throttle body to measure the driver requested throttle demand. A safety clutch provides an additional protection, as it can prevent the throttle from opening over the drivers demand. The individual butterflies are driven by an electric motor and the throttle position is measured by a potentiometer.

All original parts can be used without mechanical changes. To increase the reliability in the rough environment of motorsports, all connectors should be changed to ones with military specification (Deutsch connectors).



To reduce the engine braking at higher engine speed, the throttle is opened past the normal idle throttle angle. The maximum throttle angle before the safety clutch will interfere can be adjusted by a set screw under a cap at the front side of the throttle body.

If the regulations allow a modification of the throttle body, the safety clutch can be mechanically disabled. The integrated functionality in the ECU allows for automatic downshift blipping of the throttle that liberates the rider from manual double clutching.

Fuel Injection

The fuel pressure is measured by the stock sensor. To control the pressure to the desired target value, the fuel pump is driven by PWM signal (pulse width modulation). The two original fuel injectors per cylinder prepare the mixture in the intake manifold. The injectors below the throttle ensure a good engine response in dynamic conditions, the injectors above the trumpets increase the maximum horse power at wide open throttle.

Ignition

The standard spark plugs can be used as well as the ignition coils. The coils are directly driven by the ECU which then compensates the dwell time at each coil for variation in the battery voltage.

Variable trumpet control

A special signal sequence drives the variable trumpet actuator. The trumpet position can be chosen at different engine speeds and throttle positions to generate best driveability and maximum power.

Functionalities

- Engine Brake Control (static & dynamic)
- Lean Angle Measurement
- Traction Control (PI- and Acceleration Control)
- Gear Lash damping (closed loop)
- Power Up & Down Shift (Blipper)
- Parameters depending on position on Race Track
- Launch Assistance
- Pit speed Control
- Fuel Saving Strategy
- Broadband or long range telemetry can be directly connected

Further functionality can be developed on customer demand.

Software Tools

The entire communication to the electronic is done by the MSA-Box2 and a single connector at the bike. This connector can also be used to charge the battery.

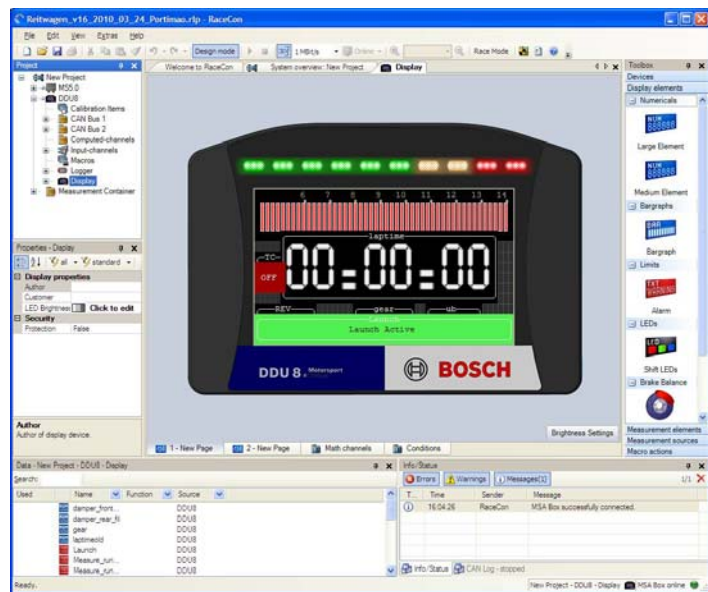
The ECU calibration is done via a CAN interface and recorded data will be downloaded by a high-speed Ethernet communication.

System Configuration, RaceCon

Every signal in the ECU can be measured with the data logger. Different sampling rates down to 1ms and crank angle synchronous raster can be chosen.

The information displayed on the dashboard as well as other components from Bosch can also be configured by RaceCon.

The tool is free of charge!



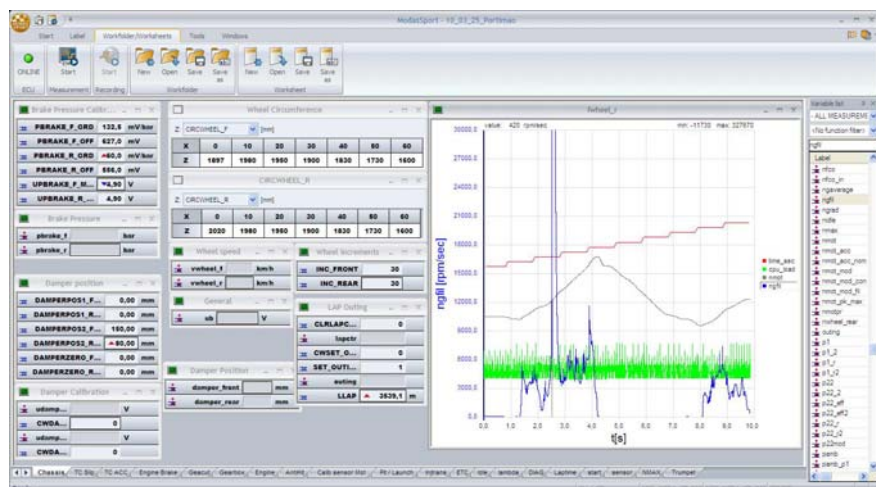
Calibration Tool, Modas Sport

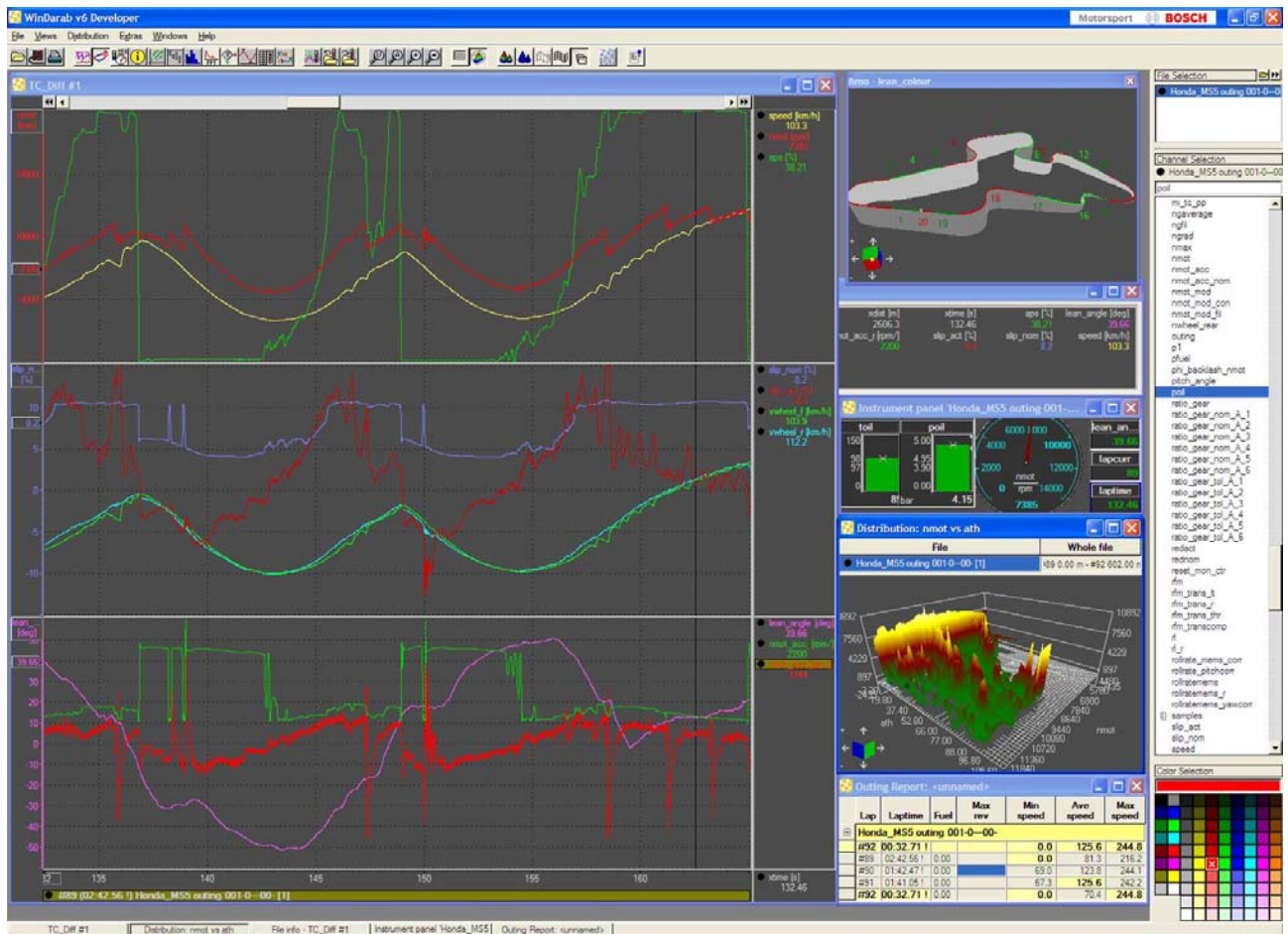
For fast and efficient work at the engine dyno and race track, the appearance of the calibration tool can be customized. Different folders for different work tasks can be generated. Macros and parameter files simplify periodic jobs.

The functionalities of the ECU can be optimized by several calibration values and maps.

Datasets (entire calibration file or portion of a calibration file) can be easily viewed, compared and merged.

The tool is free of charge!



Data Analysis, WinDarab


To enable a cost efficient step into the system, a free version of WinDarab is available.

The 'light' and 'expert' version offer additional functionalities.

Race track views, various display and calculation methods are possible. Comparison of laps and statistics makes it easy to find the best setup of mechanical parts and refine calibration.

Components, Order Numbers and Prices

	Part	Order number		UVP
1	Engine Controller MS5.0	F 02U V00 740-01		7.500,00 €
1	Display DDU8	F 02U V00.320-02		4.610,00 €
1	Upgrade 1 DDU8; Datalogger	F 02U V00 701-01		1.190,00 €
	C60 Datalogger	F 02U V00 553-01	alternative to DDU8	3.560,00 €
1	MSA-Box2 Interface	F 02U V00 327-01		720,00 €
1	Chassis harness	F 02U V00 725-01		3.750,00 €
1	Airbox harness	F 02U V00 726-01		1.875,00 €
1	Coil harness	F 02U V00 727-01		362,50 €
1	Handle left cable	F 02U V00 729-01		187,50 €
1	Handle right cable	F 02U V00 730-01		125,00 €
1	Pump cable	F 02U V00 731-01		125,00 €
1	Absolute pressure sensor 0,1 - 1,15 bar	0 261 230 052		44,00 €
2	Lambda Sensor LSU 4.9	B 261 209 356-03		340,00 €
1	Gearshift sensor GSS-M	F 02U V00 354-01		690,00 €
1	Linear poti damper front	B 261 209 534	150 mm	630,00 €
1	Linear poti damper rear	B 261 209 540	100 mm	560,00 €
1	Main Relay	Y 261 A20 597		171,00 €
1	Starter Relay	0 986 332 002		16,00 €

Price reductions for Teams and OEM, as well as volume discounts are available on request.

The following parts of the BMW S1000RR can be used without modification:

Alternator	Trumpet actuator
Voltage Regulator	Throttle position motor*
Fuel pump*	Throttle position sensor*
Fuel pressure sensor	Throttle gripp sensor*
Fuel Injectors	Engine temperature sensor
Crank sensor (engine speed pickup)	Intake air temperature sensor
Crank trigger wheel	Spark plugs
Cam sensor (Cyl.1 detection)	Ignition coils
Cam shaft and tooth position	lean angle sensor
Gear position sensor*	Wheelspeed sensor*

* The connector of these components has to be changed

The connection for second party components is prepared:

2D GPS sensor
 Trans-X Laptrigger
 Various displays with configurable CAN input

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