UAB PNP BMW M20/M30/S38B36
Circuit Board R10 (from 16 July 2023)

User manual (English)

Only use the instructions that are appropriate for the board revision

You will find the latest information and documentation on www.k-data.org

https://download.k-data.org

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1. Introduction

The UAB is a **u**niversal **a**dapter **b**oard which was developed as an engine control unit with features for tuning.
A wideband lambda controller is also available on the board.
A Bosch LSU 4.2 lambda sensor can be connected directly without the need for another controller.

2. Scope of delivery

- **UAB device ready for use**
- **SD card with documentation**
- **User manual**
- **USB cable**
- **Plug set**

3. Commissioning

It is recommended to install the USB driver before connecting the UAB for the first time.

3.1 USB Driver / Connection

To connect to the control unit, the UAB must be supplied with 12V.
The USB driver from FTDI can be found on the SD card in the "USB" directory.
This is the FTDI232 chip. The chip simulates an RS232 connection which can be used in 2 ways:

Tunerstudio - Communications - Settings: RS232 , COM-Port , 115200 Baud
Tunerstudio - Communications - Settings: FTDI-D2XX , Auto , 115200 Baud

The USB chip is "USB Powered" up to the galvanic isolation in order to be able to re-establish a connection more quickly in the event of a reset of the control unit. Any standard USB A-B cable can be used as a connection cable.

3.2 Status LED´s

LED	Colour	Function
LD1	red	Connection error
LD2	green	Power supply voltage OK
LD3	yellow	Data package from USB
LD4	green	Data package from USB
LD5	blue	Ignition impulse A
LD6	blue	Ignition impulse B
LD7	blue	Ignition impulse C
LD8	blue	Ignition impulse D
LD9	blue	Ignition impulse E
LD10	blue	Ignition impulse F
LD11	red	Wideband-controller error
LD12	green	Wideband-controller LED on: Standby
LD12	green	Wideband-controller LED flashes slowly: Operation
LD12	green	Wideband-controller LED flashes fast: Heat up sensor
LD13	green	Operation
LD14	yellow	reserved
LD15	red	reserved
LD16	blue	Bluetooth

The LEDs LD5 to LD10 can also have other functions depending on the software. These depend on the customer's settings.

3.3 Load Firmware

Tuner Studio must be closed during firmware loading/updating to prevent access conflicts.
The ignition coils must be unplugged during the firmware update until the appropriate configuration has been loaded again via MSQ file.
In case of major version jumps, the MSQ file must be recreated.
Please read the documentation of your new firmware!

3.4 Tunerstudio

For tuning we recommend using the software "Tunerstudio" available on the Internet under „Tunerstudio.com". You will find the corresponding manual on the website of the manufacturer.
All settings can be adjusted with the "free" version. For DIY tuning we recommend the registered version, because of it´s comfort features. We do not offer Tunerstudio registration codes. Please buy direct at www.tunerstudio.com.

3.5 Assignment of the controller ports

The following ports are permanently assigned and cannot be configured for other purposes:
- SD card: PH0, PH1, PH2, PH3
- Knock sensor (SPI): PM2, PM3 (SLED), PM4 (ALED), PM5 (WLED), PJ7 (JS11)
- Clock (RTC): PK1, PK3
- Exhaust gas temperature (EGT): AD13

3.6 Speed measurement
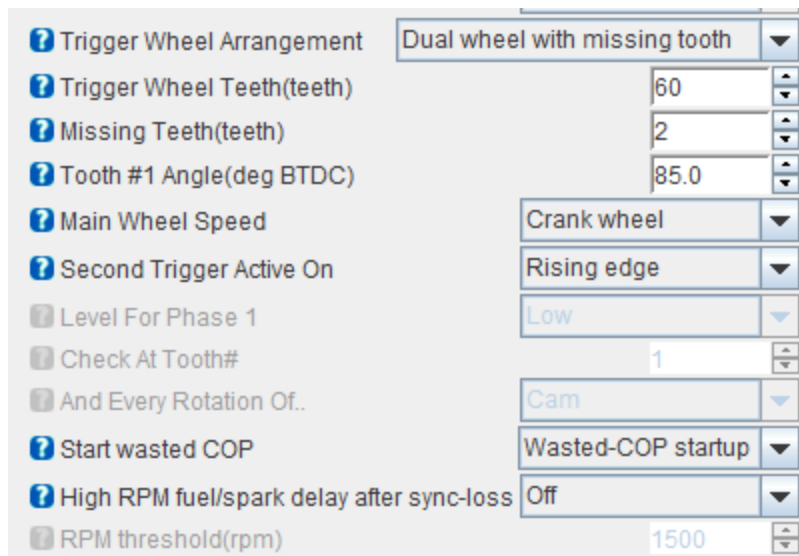
Crankshaft: VR sensor

In the BMW M20 / M30 / S38B36, the speed of the crankshaft is measured by a VR sensor. An alternating voltage is induced in the coil of the VR sensor by a metal disc with 60-2 teeth. A specialised component was used in the UAB, which performs the adaptation to various sensors itself.

Camshaft: Induction sensor on ignition cable number 6

Only used when converting the wiring harness for sequential operation.

See also points 3.15 and 3.16.

Setting in Tuner Studio:

❓ Trigger Wheel Arrangement	Dual wheel with missing tooth ▼
❓ Trigger Wheel Teeth(teeth)	60
❓ Missing Teeth(teeth)	2
❓ Tooth #1 Angle(deg BTDC)	85.0
❓ Main Wheel Speed	Crank wheel ▼
❓ Second Trigger Active On	Rising edge ▼
❓ Level For Phase 1	Low ▼
❓ Check At Tooth#	1
❓ And Every Rotation Of..	Cam ▼
❓ Start wasted COP	Wasted-COP startup ▼
❓ High RPM fuel/spark delay after sync-loss	Off ▼
❓ RPM threshold(rpm)	1500

3.7 Sensors

Standard OEM sensors with 2.49 kOhm bias resistor

3.8 MAP Sensor

The integrated MAP sensor is a 4 bar absolute pressure sensor of the type MPX4400AP which can measure up to 3 bar boost pressure.

3.9 Throttle potentiometer (optional at external terminals for Alpha-N)

The BMW M20 / M30 / S38B36 engines do NOT have a throttle potentiometer as standard. The throttle potentiometer can be omitted when using the intake manifold pressure. For tuned naturally aspirated engines we recommend the Alpha-N setting for which the throttle potentiometer is required.

+5V and GND are connected to the outer, static connections of the potentiometer. The voltage corresponding to the throttle position is tapped via the sliding contact and connected to the TPS (Throttle Position Sensor) input. The possible travel of the potentiometer may be greater than the rotation of the throttle valve axis.

TPS= PIN 52   +5V= PIN 53   Ground via motor wiring harness

The pin assignment on the TPS connector of the OEM wiring harness must be adapted for the use of a potentiometer.

3.10 Tachometer output

The "Tacho" output is provided for standard tachometers.
A standard 12V square wave signal suitable for the BMW instrument cluster is provided.

3.11 Idle speed controller

The OEM idle actuator is still used. The settings can be found under "Startup/Idle". IDLO (open) and FIDLE (close) are used as outputs.
If you do not use the idle controller, set the PWM control to 0 instead of deactivating the idle control.

3.12 Air condition

In the R10 board revision still in the test phase.

3.13 EVAP

In the R10 board revision still in the test phase.

3.14 Vehicle Speed Sensor

In the R10 board revision still in the test phase.

3.15 Ignition

The UAB has power IGBT drivers which allow direct control of the individual ignition coils. Self-resetting thermal fuses protect the UAB from damage caused by excessive ignition coil charging currents due to incorrect software settings.

In case of ignition problems, check and reduce the dwell time.

To use more ignition coils they must be wired to the 14-pin auxiliary connector.
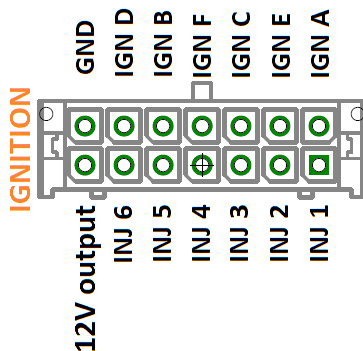
3.16 Injection / conversion to fully sequential

The injectors are controlled in 2 groups according to the standard wiring harness. Basically, we recommend only high-impedance injectors (12 - 16 Ohm). These can be controlled without PWM or Peak&Hold.

Setting: PWM Current Limiting: Off

In order to operate the engine fully sequentially, the injectors must be wired as shown in 3.15.

3.17 Real-time clock / buffer battery

For a better allocation of the data logs by means of time stamps, the UAB has a battery-buffered real-time clock which is connected to the Motorola via the I2C bus.

Software Setting: RTC internal

The battery can be replaced by a 3V button cell. Due to vibrations, soldered versions should be used.

3.18 CAN Bus

The CAN bus is prepared on the hardware side, but must - if desired - still be set accordingly by the user. For more information, please refer to the documentation of the firmware you have loaded.

There is a 120 Ohm CAN terminating resistor on the board of the UAB.

4. Connection

4.1 Wiring / Fuses
The UAB must be fused externally as well as all other parts supplied with voltage. The amperage of the fuse must not exceed the maximum permissible amperage of the cable.

Recommended cable types:

Supply:	min 1.5 mm²
Ignition:	min 1.5 mm²
Injection:	min 1.0 mm²
VR Sensor:	min 0.5 mm², shielded
Sensors:	min 0.5 mm²
Other cable:	min 0.75 mm²

4.2 Assignment of the additional terminals
The programmable inputs/outputs of the UAB are connected to the corresponding expansion circuit on the board.
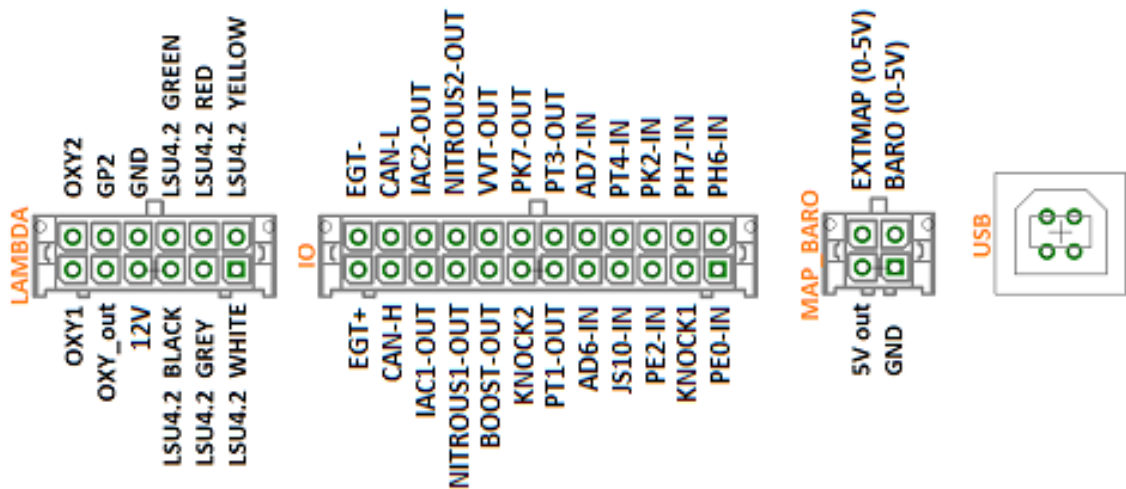
4.3 Digital inputs
Digital inputs are available, which can be used e.g. for the "Launch Control".
The corresponding function must be set in Tunerstudio.
To protect the circuit board, the inputs have galvanic isolation and are tolerant of both 5V and 12V.
To activate the input, it must be connected to ground.

4.4 Digital outputs

All pins available on the IO connector that end with "-OUT" can be used for additional functions. Depending on the software settings, they can be used as relay outputs or PWM outputs.

e.g. for a boost pressure control valve.

These are lowside outputs that switch ground. The power supply of the consumer must be connected to 12V (terminal 15).

Switching capacity max. 5 amps

It is not possible to supply the external devices with continuous voltage as other parts of the UAB could be supplied via freewheeling diodes, which could lead to permanent battery discharge.

4.5 Analog inputs 0-5V

AD6 and AD7 are available as universal 0-5V inputs. OXY2 (ADC12) can also be used as a further 0-5V input, if it is not used for a second lambda sensor.

4.6 Barometric correction

The 0-5V signal of a pressure sensor must be connected to one of the free analog inputs.
In the R10, the "BARO" input is not connected to AD6-IN.

4.7 Additional sensors

Further inputs for analog sensors are not available in the R10.

4.8 Knock sensor

2 inputs for standard piezo knock sensors.
Each sensor must be connected to one input and GND.
Observe the torque when mounting the knock sensor. An incorrect torque can falsify the signal of the sensor.

4.9 Exhaust gas temperature

A K-type exhaust gas sensor can be connected directly to EGT+ and EGT-.
It is essential to observe the polarity.
Connected to controller port: Port ADC13 (spare input)

5. ESP32 Coprocessor

The additional controller extends the UAB by some functions and provides additional processing power for more modern features that are not provided for in the Motorola. During the start-up of the ESP32, the configuration file **"DM88_cfg.jso"** in the root directory of the SD card is read out and used to configure the corresponding parameters. If this file is missing, standard parameters are used.

5.1 SD card / Data logging

After the ESP32 has completed the start-up process, the SD card is transferred to the Motorola and the recognition of the SD card for the Motorola is triggered.

If no SD card is present, the ESP32 starts with default parameters and of course does not give an "SD-in" signal to the Motorola.

5.2 JSON parameters

The configuration is stored in the file DM88_cfg.jso in the root directory of the SD card. Example:

```
{
  "BLUETOOTH-PIN": 1234,
}
```

5.3 Bluetooth

As an alternative to USB, the connection to the UAB can also be established via Bluetooth. Pairing code and activation are set via the JSON file on the SD card.
In addition, apps for mobile devices such as Android and iOS can be used.

5.4 Mini Terminal

During start-up, the ESP32 outputs various messages via the serial interface.
For diagnostic purposes, the Mini Terminal in Tunerstudio can be used to read out the status messages of the ESP32 (115200 baud).

5.5 ESP32 Firmware Update

Firmware updates of the ESP32 can be done in a user-friendly way via the SD card.
- Copy the firmware as "DM88_FW.bin" into the root directory of the SD card.
- Reset the UAB (switch off the ignition, wait 3 seconds, switch on again).
- As soon as the update starts, the 4 LEDs at the rear edge of the board light up.
- Update is finished as soon as the LEDs are off again.
- File "DM88_FW.bin" is automatically deleted after successful update.

Do not interrupt the power supply during the update process!

6. Circuit board

Dimensions: 160 x 120mm, 4 layers
Some places for components are left unassembled and free for alternative assemblies.

Picture follows

7. Pin assignment to the engine wiring harness

PIN	Signal		PIN	Signal
1 :	IGNA		29 :	
2 :	GND		30 :	
3 :	FP-OUT		31 :	VR-2-N
4 :	IDLO-OUT		32 :	FIDLE-OUT
5 :	EVAP		33 :	
6 :	TACHO-OUT		34 :	
7 :			35 :	
8 :	VR-2-P		36 :	DNE_ACTIVATE
9 :			37 :	+12V_IN
10 :	GND		38 :	
11 :			39 :	
12 :			40 :	
13 :			41 :	
14 :	GND		42 :	
15 :			43 :	
16 :	INJ1		44 :	AIR
17 :	INJ2		45 :	CLT
18 :			46 :	
19 :	GND		47 :	VR-1-P
20 :			48 :	VR-1-N
21 :			49 :	
22 :			50 :	GND
23 :			51 :	
24 :	GND		52 :	TPS
25 :			53 :	+5V
26 :	GND		54 :	
27 :	IGNITION_SET		55 :	
28 :				

8. Wideband Lambda-Controller

The integrated lambda-controller is activated by connecting the input "GP2" to ground. This can be done permanently with a jumper wire, as the UAB is only live as long as the ignition is switched on.

In the connector plug, the signal from OXY_out must be connected to input OXY1. With our connection cable, the necessary connections are already present.

The measuring signal is output as 0-5V at OXY_out and corresponds to the setting
PLX signal 0-5V = AFR10-AFR20.