

UAB PNP BMW M42/M43

PCB R12 (Date: 14.12.2023)

User manual (English)



Use only 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 universal adapter board which was developed as an engine control unit with features for tuning.

A wideband lambda controller (breitband-lambda.de) 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 that the USB driver be installed 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.

You will find the USB driver from FTDI on the SD card in the "USB" directory. This is the FTDI232 chip. The chip simulates an RS232 connection that can be used in 2 ways:

Tunerstudio – Communications – Settings: RS232 , COM-port , 115200 Baud

Tunerstudio – Communications – Settings: Wireless and USB

(only in the registered version), 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 cable can be used as a connection cable.

3.2 Status LED's

Description	Colour	Function
LD1	red	Connection error
LD2	green	Power supply OK
LD3	yellow	Data packet from USB to MS2
LD4	green	Data packet from MS2 to USB
LD5	blue	Ignition pulse A
LD6	blue	Ignition pulse B
LD7	blue	Ignition pulse C
LD8	blue	Ignition pulse D
LD9	blue	Ignition pulse E
LD10	blue	Ignition pulse F
LD11	red	Wideband controller error
LD12	green	Wideband controller LED on: Stand-by
LD12	green	Wideband controller LED flashing slowly: operation
LD12	green	Wideband controller LED flashing fast: Heat sensor
LD13	green	Ready
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

The Motorola 9S12XEP100 is delivered with a serial bootloader that enables firmware to be loaded via USB.

Tuner Studio must be closed during firmware loading/updating to prevent access conflicts. If you want to load the Megasquirt 3 firmware, please make sure that you have a licence to use the software on this board.

3.4 Tunerstudio

For tuning, we recommend the Tunerstudio software, which is available on the Internet at Tunerstudio.com. You will find a description on the manufacturer's homepage.

All settings can be adjusted with the unregistered version.

For DIY tuning, we recommend the registered version, as it has additional functions.

Registration codes for Tunerstudio are not available from us, please purchase them directly from tunerstudio.com.

3.5 Assignment of the Controllerports

The following ports are permanently assigned and cannot be configured for other purposes:

- SD card: PH0, PH1, PH2, PH3
- Knocksensing (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 M42 and M43, 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. With the UAB, a specialised component was used that adapts to the sensors itself.

Camshaft: VR Sensor

3.7 Sensors

Standard Bosch Sensors with 2,49 kOhm Biasresistor

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

The M42 and M43 engine has a throttle potentiometer as standard which should at least be used to optimise acceleration enrichment.

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 a 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.

3.10 Tachometer

The "Tacho" output is provided for standard tachometers.

A standard 12V square wave signal suitable for the BMW instrument cluster is output.

3.11 Idle Speed Actuator

The serial idler is still used. The settings can be found under "Startup/Idle".

IDLO (open) and FIDLE (close) are used as outputs.

3.12 Air Condition

in PCB revision R12 in testing

3.13 EVAP

in PCB revision R12 and later in combination with ESP32 firmware v0.116 and later you can use CANOUT8 to control the EVAP valve.

Necessary CAN settings are already set in our MSQ file.

3.14 Vehicle Speed Sensor

in PCB revision R12 in testing

3.15 Ignition / Conversion to active ignition coils

The UAB has power 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.

To use active ignition coils such as those used in the VAG TFSI engines, please refer to our "Ignition Coils Conversion sheet" which can be downloaded from our product website.

3.16 Injection (grouped / full sequential)

The injectors are controlled in groups according to the standard wiring harness.

If you wish to rewire to full sequential injection you can use the additional INJ outputs as described in pint 7 of this manual.

Basically, we recommend only high-impedance injectors (12 - 16 Ohm).

These can be controlled without PWM or Peak&Hold.

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 programmed 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. Extension

4.1 Wiring / Fuse

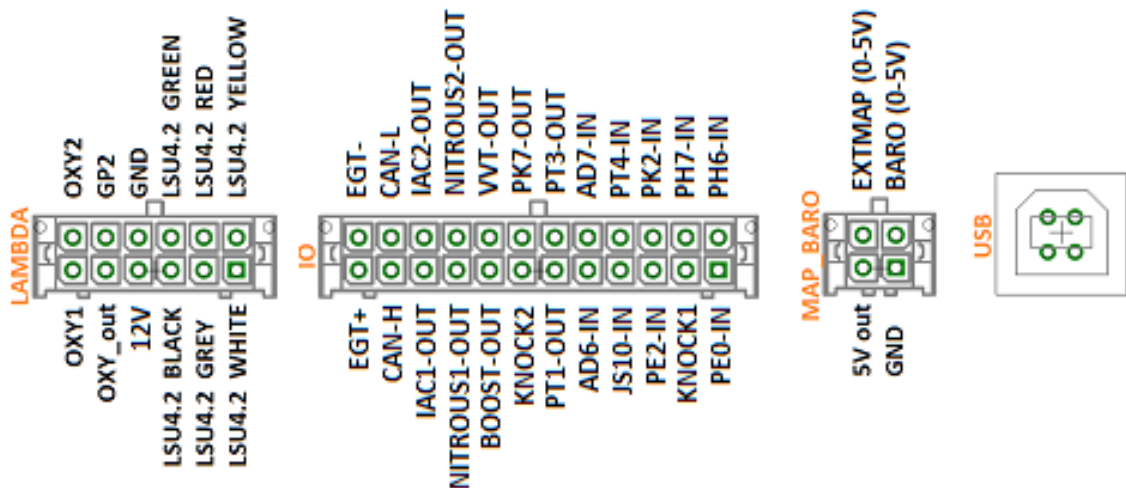
A fuse must be connected upstream of the UAB as well as all other parts supplied with voltage. The amperage of the fuse must not exceed the maximum permissible amperage of the cable.

Recommended cable types:

Ignition:	min 1.5 mm ²
Injection:	min 1.5 mm ²
VR Sensor:	min 0.5 mm ² , shielded
Sensors:	min 0.5 mm ²
Other cables:	min 0.75 mm ²

4.2 Assignment of the additional terminals

The programmable inputs/outputs of the UAB are already connected to the corresponding expansion circuit on the board.



4.3 Digital input

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 output

All pins available on the IO connector that end with "-OUT" can be used for additional functions. Depending on the software setting, both as relay outputs and as PWM outputs. e.g. for a boost pressure control valve.

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

Switching current max. 5 amperes

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

4.5 Analogue 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 required 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 analogue inputs. In R12, the "BARO" input is not connected to AD6-IN.

4.7 Additional sensors

further inputs for analogue sensors are not available in the R12.

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 computing 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.json**" 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 / Datalogging

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 does not give an "SD-in" signal to the Motorola

5.2 JSON parameter

The configuration is stored in the file DM88_cfg.json 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 carried out in a user-friendly way via the SD card.

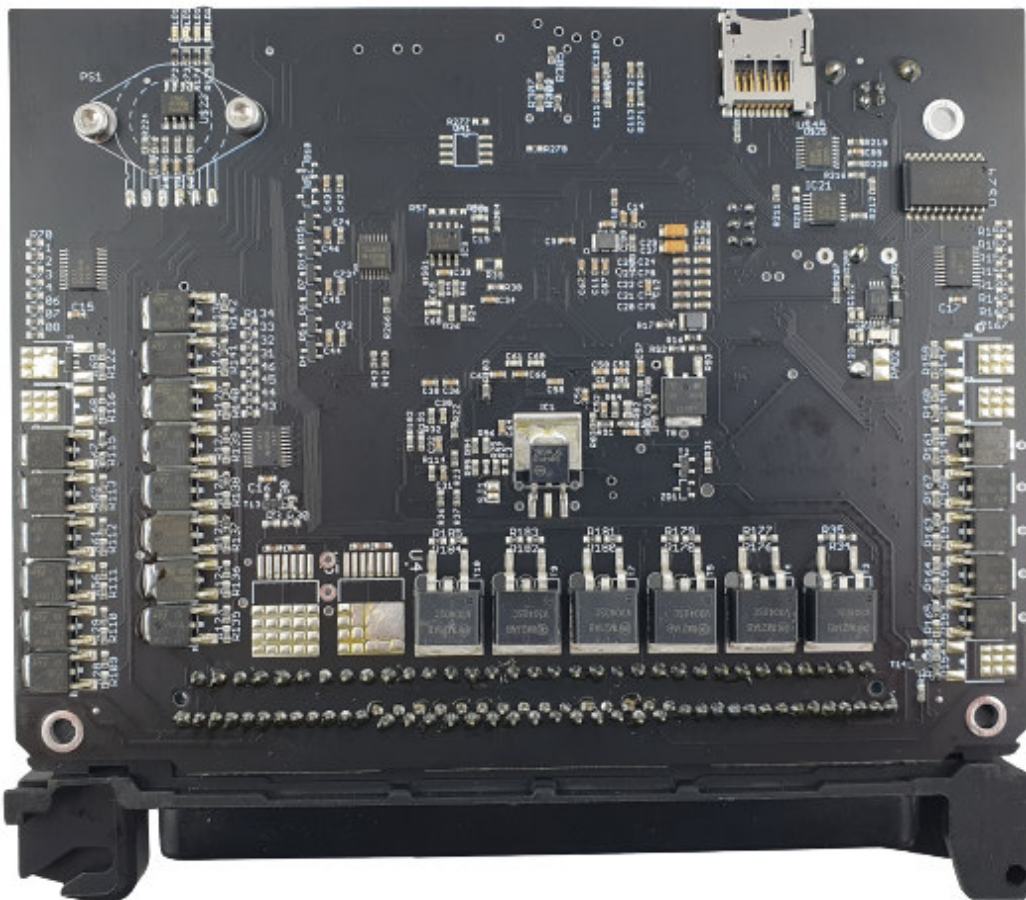
- Copy the firmware as "DM88_FW.bin" into the root directory of the SD card.
- Reset the UAB (switch off the ignition, wait 3 seconds, switch on again).
- As soon as the update starts, the 4 LEDs at the rear edge of the board light up.
- Update is finished as soon as the LEDs are off again.
- File "DM88_FW.bin"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

Do not interrupt the power supply during the update process!

6. PCB

Dimensions: 160 x 120mm, 4 layers

Some places for components are left unassembled and free for alternative assemblies.



7. Pinout to engine wiring loom

PIN Signal

1 : FP-OUT
2 : FIDLE-OUT
3 : INJ2
4 : INJ4
5 :
6 : GND
7 :
8 :
9 :
10 :
11 :
12 : TPS
13 :
14 : GND
15 : KNOCK1
16 : VR-2-N
17 :
18 : INJ8 (DISA)
19 :
20 :
21 :
22 :
23 :
24 : IGNB
25 : IGNA
26 :
27 : DME_ACTIVATE
28 : GND
29 : IDLO-OUT
30 :
31 :
32 : INJ1
33 : INJ3
34 : GND
35 :
36 : EVAP
37 :
38 :
39 : GND
40 : GND
41 :
42 : KNOCK2
43 : GND
44 : VR-2-P

PIN Signal

45 :
46 :
47 :
48 : PK7-OUT
49 :
50 :
51 : IGNC
52 : IGND
53 :
54 : +12V_IN
55 : GND
56 : IGNITION_SET
57 :
58 :
59 : +5V
60 :
61 :
62 :
63 :
64 :
65 :
66 :
67 : VR-1-P
68 : VR-1-N
69 :
70 :
71 : GND
72 :
73 :
74 : TACHO-OUT
75 :
76 :
77 : AIR
78 : CLT
79 :
80 :
81 :
82 :
83 :
84 :
85 : AC_PRESSURE
86 : AC_KOMPRESSOR_ANF
87 :
88 :

8. Widebandlambdacontroller

The integrated lambda controller is activated by connecting the input „GP2“ to ground. This can be done continuously with a bridge as the UAB is only powered as long as the ignition is turned on. In the connector plug, the signal from OXY_out must be connected to the input OXY1. Our connection cable already has the necessary connections.

The measurement signal is output to OXY_out in form of a 0-5V signal and corresponds to the **PLX signal 0-5V = AFR10-AFR20**. This characteristic is stored in Tunerstudio and has already been loaded during the test of the control device. After a firmware update this characteristic but must be selected again.

We highly recommend to use only following setting:

Tunerstudio Settings: EGO Control - Algorithm: Simple

unless you exactly know what you are doing. PID Setting is the main cause for lambda problems.

In case of problems with your Lambda reading do not contact us before you tried Algorithm „Simple“.

9. Notes
