

UAB PNP BMW M50TU

Circuit Board R09 (Date: 25.07.2023)

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>

Index

- 1 Introduction**
- 2 Scope of Delivery**
- 3 Commissioning**
 - 3.1 USB Driver / Connection**
 - 3.2 Status LED´s**
 - 3.3 Load Firmware**
 - 3.4 Tunerstudio**
 - 3.5 Assignment of the Controllerports**
 - 3.6 Speed Measurement**
 - 3.7 Sensors**
 - 3.8 MAP Sensor**
 - 3.9 Throttle Potentiometer**
 - 3.10 Tachometer**
 - 3.11 Idle Speed controller**
 - 3.12 Air Condition**
 - 3.13 EVAP**
 - 3.14 Vehicle Speed Sensor**
 - 3.15 Ignition / conversion to active ignition coils**
 - 3.16 Injection / conversion to full sequential**
 - 3.17 Real-time clock / buffer battery**
 - 3.18 CAN Bus**
 - 3.19 Vanos**
- 4 Extension**
 - 4.1 Wiring / Fuse**
 - 4.2 Assignment of the additional terminals**
 - 4.3 Digital inputs**
 - 4.4 Digital outputs**
 - 4.5 Analogue inputs 0-5V**
 - 4.6 Barometric correction**
 - 4.7 Additional sensors**
 - 4.8 Knock sensor**
 - 4.9 Exhaust gas temperature**
- 5 ESP32 Coprozessor**
 - 5.1 SD card / Data logging**
 - 5.2 JSON parameters**
 - 5.3 Bluetooth**
 - 5.4 Mini Terminal**
 - 5.5 ESP32 Firmware Update**
- 6 Circuit Board**
- 7 Pin assignment to the engine wiring harness**
- 8 Wideband Lambda-Controller**
- 9 Notes**

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 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

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

Tunerstudio must be closed during firmware loading/updating to prevent access conflicts. The ignition coils must be disconnected during the firmware update, until the appropriate configuration has been reloaded via MSQ file.

In the case of major version jumps, the MSQ file must be created again.

Please read the documentation of your new firmware!

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 www.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 M50TU (Vanos), 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: Hall Sensor

3.7 Sensors

Standard OEM 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 M50TU 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 controller

The serial idler 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 control, set the PWM control to 0 instead of deactivating the idle control.

3.12 Air Condition

in PCB revision R09 in testing
Output for air conditioner compressor: PK7

3.13 EVAP

in PCB revision R09 in testing

3.14 Vehicle Speed Sensor

in PCB revision R09 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. In case of ignition problems, check and reduce the dwell time.

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 / conversion to fully sequential

The injectors are controlled individually 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. Settings: PWM Current Limiting: Off

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.

3.19 Vanos

The Vanos is controlled in binary form via the VVT-OUT output, which is connected to the appropriate PIN of the wiring harness.

4. Extension

4.1 Wiring / Fuse

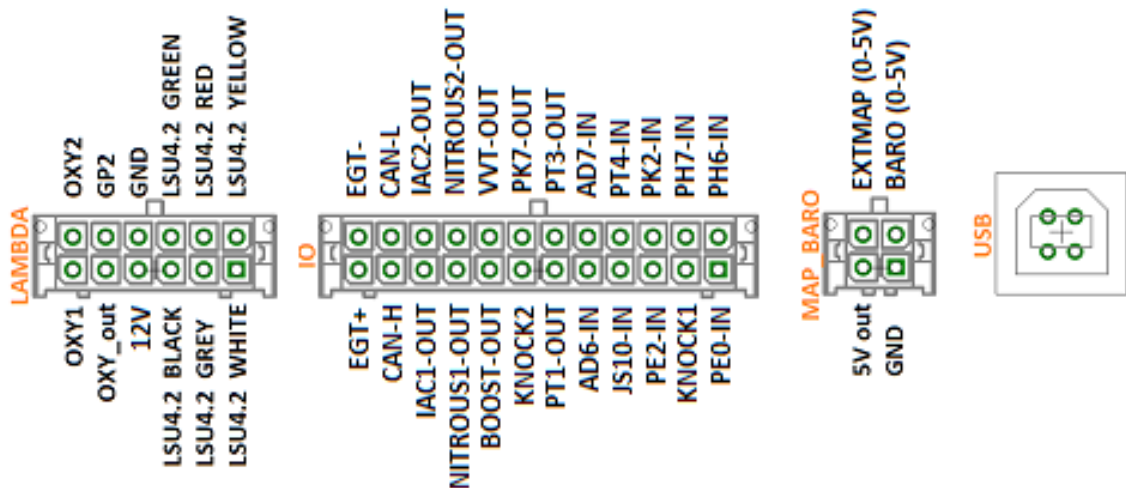
A fuse must be connected upstream of the UAB as well as all other parts supplied with voltage. The amperage of the fuse must not exceed the maximum permissible amperage of the cable.

Recommended cable types:

Supply:	min 1.5 mm ²
Ignition:	min 1.5 mm ²
Injection:	min 1.0 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 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 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 R09, the "BARO" input is not connected to AD6-IN.

4.7 Additional sensors

further inputs for analogue sensors are not available in the R09

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.

The OEM sensors can be used without any modification and are connected on the PCB

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

5.2 JSON parameters

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.

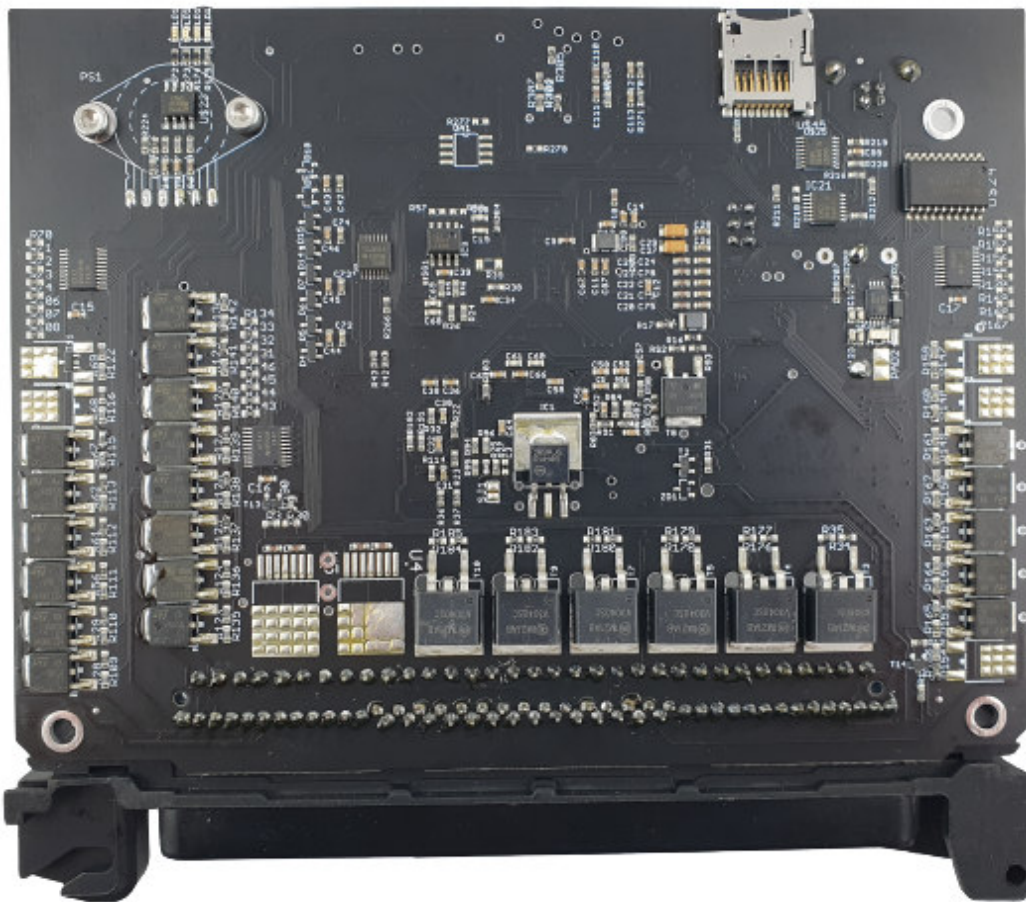
- Copy the firmware as "DM88_FW.bin" into the root directory of the SD card.
- Reset the UAB (switch off the ignition, wait 3 seconds, switch on again).
- As soon as the update starts, the 4 LEDs at the rear edge of the board light up.
- Update is finished as soon as the LEDs are off again.
- File "DM88_FW.bin"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

Do not interrupt the power supply during the update process!

6. Circuit Board

Dimensions: 160 x 120mm, 4 layers

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



7. Pin assignment to the engine wiring harness

PIN Signal

1 : FP-OUT
2 : FIDLE-OUT
3 : INJ2
4 : INJ4
5 : INJ6
6 : GND
7 : VVT-OUT
8 :
9 :
10 :
11 :
12 :
13 :
14 :
15 : GND
16 : VR-1-P
17 : CAM-HALL-IN
18 :
19 :
20 :
21 :
22 :
23 : IGNF
24 : IGND
25 : IGNB
26 :
27 : IGNITION_PULL
28 : GND
29 : IDLO-OUT
30 :
31 : INJ3
32 : INJ5
33 : INJ1
34 : GND
35 :
36 : EVAP
37 :
38 :
39 :
40 : GND
41 :
42 : VR-3-P
43 : VR-1-N
44 : GND

PIN Signal

45 : GND
46 :
47 : TACHO-OUT
48 : PK7-OUT
49 :
50 : IGNA
51 : IGNE
52 : IGNC
53 :
54 : +12V_IN
55 : GND
56 : IGNITION_SET
57 :
58 :
59 : +5V
60 :
61 :
62 :
63 :
64 : KOMPRESSOR_SIGNAL
65 : AC_PRESSURE
66 :
67 :
68 :
69 : KNOCK2
70 : KNOCK1
71 : GND
72 :
73 : TPS
74 :
75 :
76 :
77 : AIR
78 : CLT
79 :
80 :
81 :
82 :
83 :
84 :
85 :
86 :
87 :
88 :

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, as the UAB is only live as long as the ignition is switched on.

In the connection plug, the signal from OXY_out must be connected to the input OXY1. Our connection cable already has the necessary connections.

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

9. Notes
