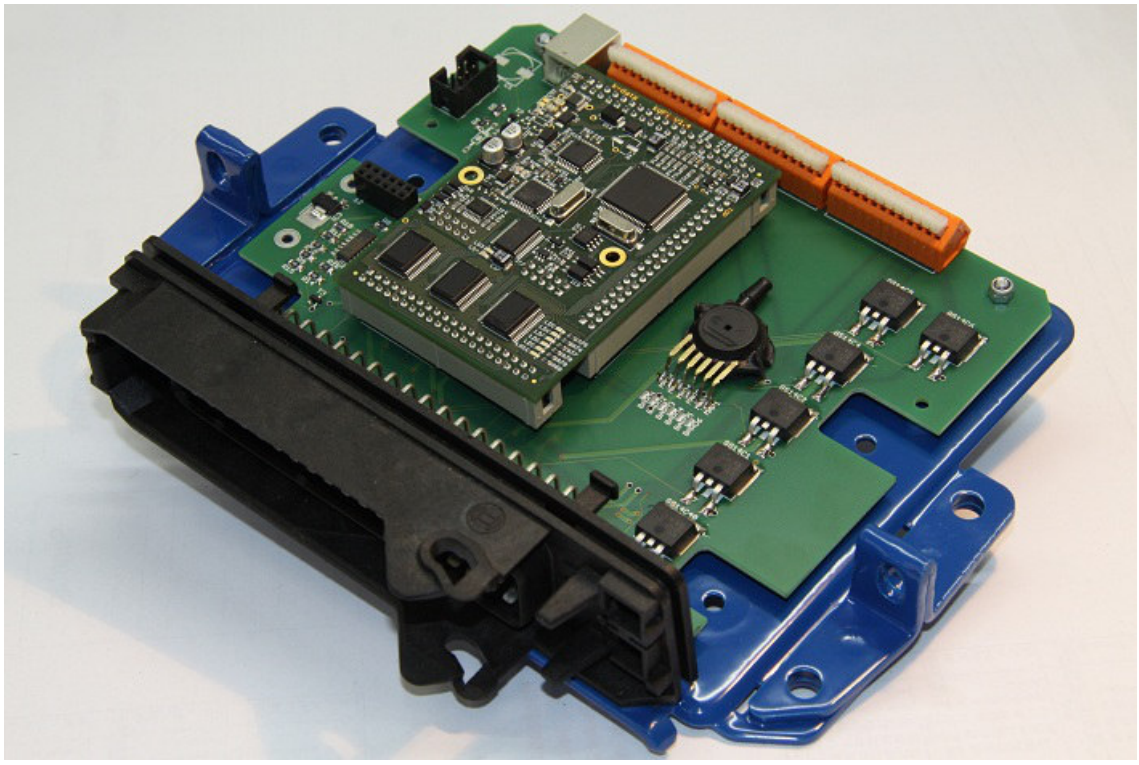
kdFi V1.4 PNP BMW M20/M30/M40/S38B36

R13 (As fr. 28.11.2021)

User Manual (English)



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

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1. Introduction

The circuit of the kdFi bases upon Megasquirt MS2 V3.0. It was refined for the firmware MS2extra and provided with additional circuits in order to enable easy adaptation to a great number of engine types.
A Wideband Lambda Controller (breitband-lambda.de) is also arranged on the PCB. A Bosch LSU 4.2 Lambda Sonde can be connected directly without the need to buy a further controller.
In addition for ease of use the serial inputs were replaced by an USB port galvanically isolated from the PC.

2. Included in Delivery

- kdFi V1.4 device ready for use
- Software CD
- User manual
- USB cable
- Plug set

3. Software

It is recommended installing the software from the starting menu of the CD before connecting the kdFi for the first time.

3.1 USB Driver

You will find the USB driver of the FTDI Company on the CD in the directory “USB”. It is the FTDI232 Chip.
The Chip simulates a serial RS232 connection which you can use in 2 ways:
1. Tunerstudio – Communications – Settings: RS232 , COM-port , 115200 Baud
2. Tunerstudio – Communications – Settings: Wireless and USB (only in registered Version), Auto , 115200 Baud

3.2 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 tunerstudio.com

4. Connection

To establish a communication the kdFi must be supplied with 12V.

4.1 Cable Types

Recommended cable types:

Ignition:	min 1.5 mm²
Injection:	min 1.5 mm²
VR sensor:	min 0.5 mm², shielded
Sensors:	min 0.5 mm²
Others:	min 0.75 mm²

4.2 Fuses

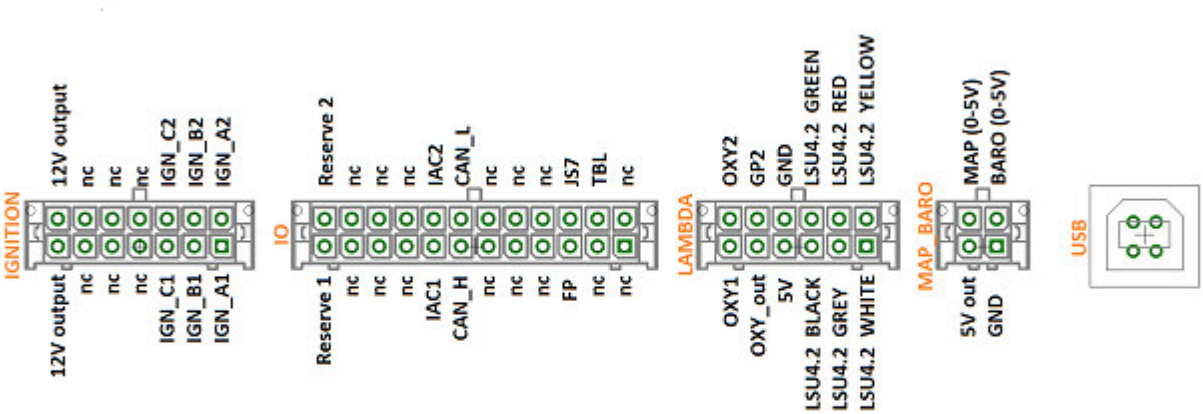
The kdFi must be fused externally.
The amperage rating of the fuse must not exceed the maximum allowable amperage of the cable. We recommend 5A.

4.3 USB Port (Galvanically Isolated)

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 ECU.
Each standard USB cable can be used as connection cable.

4.4 Assignment of the Additional Terminals

The programmable inputs/ outputs of the kdFi are already connected with the corresponding extension circuitry on the PCB.



5. Commissioning

5.1 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

The LEDs LD5 to LD10 may also have other functions according to the software. They depend on the customer's settings.

5.2 Speed Measurement

VR Sensor

In BMW engines from M20 to M50TU the speed is sensed via a VR sensor. An AC voltage is induced in the coil of the VR sensor by a metal wheel with 60-2 teeth.
A specialised component performing an auto-adaptation to the different sensors is integrated in the kdFi V1.4.

5.3 Sensors

The factory settings of kdFi are adapted to Bosch sensors. A separate software calibration of the sensors is possible via software.

5.4 Throttle Potentiometer **(optional at external terminals for Alpha-N)**

The throttle can be omitted when using the MAP. For natural aspirated engines, we recommend the Alpha-N setting, which needs a throttle potentiometer,
this is connected in place of the original throttle switch. +5V and GND are connected to the outer pins of the potentiometer. The voltage relating to the throttle position is tapped via the sliding contact and connected to the input TPS (Throttle Position Sensor).The covered distance of the potentiometer may be longer than the rotation of the throttle axle. The corresponding calibration is done via "Tools" – "Calibrate TPS".
TPS= PIN 52 **+5V= PIN 53** **Ground via motor wiring harness**

5.5 Digital Input

There is a digital input that can be used for example as “Launch Control”. The corresponding function has to be defined in Megatune. Specify JS7 as input.

5.6 Table Switch

Via the input "TBL", a second set of parameters can be activated in the controller. With a switch setting the input to ground, you can switch between two stored ignition and injection maps. This is useful for various tunings such as road/ racing, petrol/ gas, petrol/ E85 etc.
Connecting to a higher voltage than 5V will damage the processor of the kdFi.
Digital inputs must only be connected to ground for activation.

5.7 Barometric Correction

For using the constant barometric correction there must be a second absolute pressure transmitter (MPX4250) at the back side that is not installed ex works.
The option “Barometric Correction” has to be activated in Megatune “Basic Settings” – “General Lags” and adjusted in “Extended” – “Barometric Correction”.
Choose JS4 as input.

5.8 Tacho Output

The output “Tacho Output” is provided for standard tachometers. It has been activated in the software “Extended” – “Tacho Output”. “JS10“ has already been selected as “Output on”. Don’t change these settings!

5.9 Idle Speed Controller

The standard idle actuator is still used. The settings can be found under "Startup / idle" all idle settings.

5.10 Ignition (option single sparks, wired on terminals)

The ignition coil can be activated directly by the power drivers integrated in the kdFi V1.4. The kdFi is equipped with six power drivers enabling direct activation of up to six ignition coils in the Wasted Spark principle. We recommend using a shielded multi-conductor cable for connection.
To use active coils like from TFSI please check our „Ignition Coils Conversion sheet“ which you can download from our product website.

5.11 Injection

The injectors are activated in groups according to the standard wiring harness. Please change the values below only if it is really necessary.
We generally recommend only high impedance injectors (around 12 – 16 Ohm)

Attention: **The kdFi V1.4 hardware controls the current of the injectors, so PWM Current Limit always needs to be set to 100%, also on low impedance injectors.**
If low impedance injectors are used 1 output can handle only 1 injector In this ECU there are 3 injectors connected to 1 output by the stock wiring loom. Please change the wiring before switching to low impedance injectors.

5.12 Relay Output/ Boost Pressure Control (IAC1 on terminals)

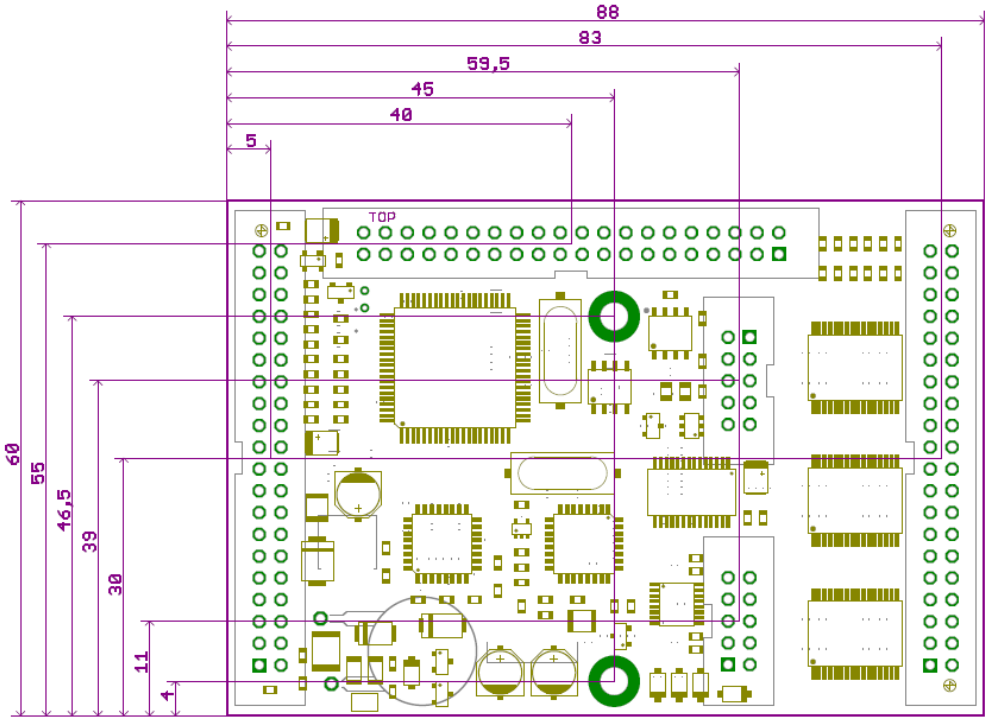
"IAC1" and "IAC2" can be used both as relay outputs and as PWM outputs,
e.g. for the boost pressure control valve.
Switching current max. 2 amps.

5.13 CAN Bus

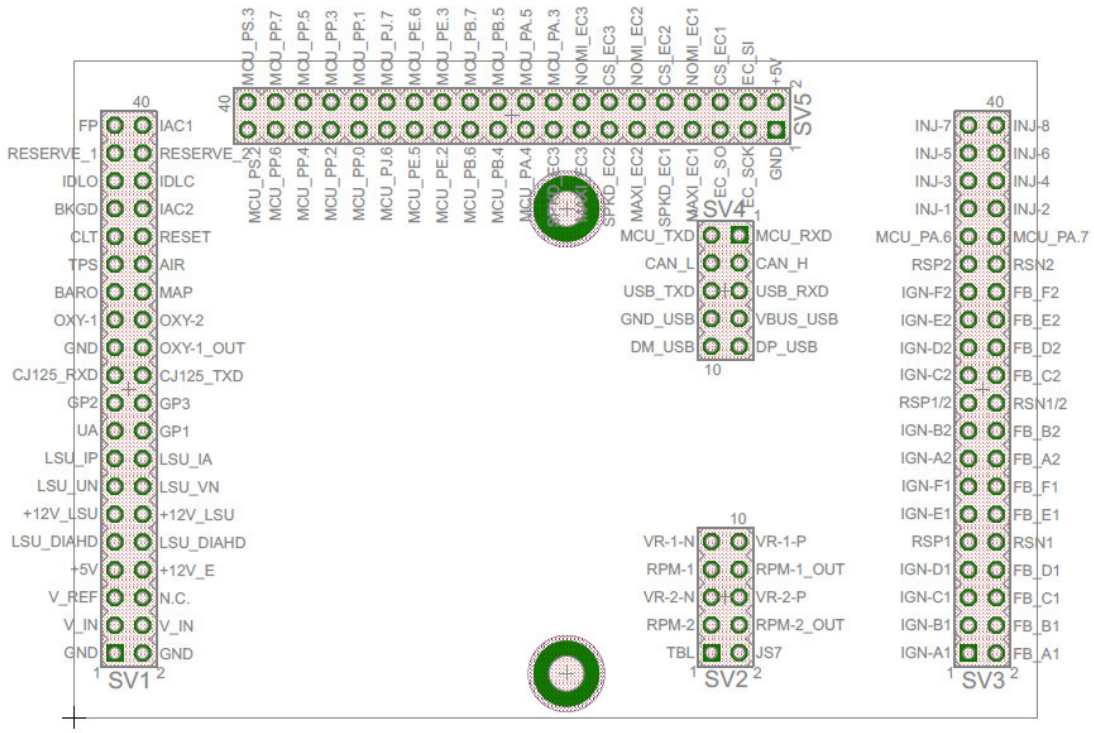
Like for the Megasquirt 2 the CAN Bus is equipped concerning the hardware, but has to be programmed accordingly by the user if desired. For further information on this item please read the respective Megasquirt /MSextra websites on the internet.

6. Basic PCB

Dimensions:



Assignment:



Pinout:

Con	Pin	Signalname	Description	Typ Application	I/O	Type
SV1	1	GND	Power In (Ground)	Main GND	I	
SV1	2	GND	Power In (Ground)	Main GND	I	
SV1	3	V_IN	Power In (12V)	12V Ignition on	I	
SV1	4	V_IN	Power In (12V)	12V Ignition on	I	
SV1	5	V_REF	REF Out			
SV1	6	-	Not Connected		nc	
SV1	7	+5V	+5V Out for sensors and circuits		O	
SV1	8	+12V_E	+12V Out sensors and circuits		O	
SV1	9	LSU_DIAHD	Lambda-Sensor Heat PWM	LSU 4.2 grau		
SV1	10	LSU_DIAHD	Lambda-Sensor Heat PWM	LSU 4.2 grau		
SV1	11	+12V_LSU	Lambda-Sensor Heat +12V	LSU 4.2 weiß		
SV1	12	+12V_LSU	Lambda-Sensor Heat +12V	LSU 4.2 weiß		
SV1	13	LSU_UN	Lambda-Sensor Signal UN	LSU 4.2 schwarz		
SV1	14	LSU_VM	Lambda-Sensor Signal VM	LSU 4.2 gelb		
SV1	15	LSU_IP	Lambda-Sensor Signal IP	LSU 4.2 rot		
SV1	16	LSU_IA	Lambda-Sensor Signal IA		nc	
SV1	17	UA	Lambda Amplifier Out		nc	
SV1	18	GP1	I/O-Port ATmega8		I	TTL
SV1	19	GP2	Start Lambdacontroler		I	TTL
SV1	20	GP3	I/O-Port ATmega8		I	TTL
SV1	21	CJ125_RXD	RS232-Interface to CJ125			TTL
SV1	22	CJ125_TXD	RS232-Interface to CJ125			TTL
SV1	23	GND	Ground for Pin 24	GND		
SV1	24	OXY-1_OUT	Wideband Sensor Output	SV1-25	O	0-5V
SV1	25	OXY-1	Analogsignal OXY 1	Lambdasensor 1	I	0-5V
SV1	26	OXY-2	Analogsignal OXY 2	Lambdasensor 2	I	0-5V
SV1	27	BARO	Analogsignal BARO	Barometric Sensor	I	0-5V
SV1	28	MAP	Analogsignal MAP	Map Sensor	I	0-5V
SV1	29	TPS	Analogsignal TPS	Throttle Position	I	0-5V
SV1	30	AIR	Analogsignal AIR	Airtemp Sensor	I	Resistor
SV1	31	CLT	Analogsignal CLT	Coolant Sensor	I	Resistor
SV1	32	RESET	Signal Reset Low-Active		nc	
SV1	33	BKGD	Signal Background Interface Pin		nc	
SV1	34	IAC1	Signal IAC1 (e.g. RPM in Instr. cluster)		O	
SV1	35	IDLO	Idle Valve Open		O	switched GND
SV1	36	IDLC	Idle Valve Close		O	switched GND
SV1	37	RESERVE_1	Reserve 1		nc	
SV1	38	RESERVE_2	Reserve 2		nc	
SV1	39	FP	Fuel Pump		O	switched GND
SV1	40	IAC2	Signal IAC2		O	

Con	Pin	Signalname	Description	Typ Application	I/O	Type
SV2	1	TBL	Signal TBL		I	TTL
SV2	2	JS7	Signal JS7		I	TTL
SV2	3	RPM-2	Signal RPM-Sensor 2	SV2-4	I	
SV2	4	RPM-2_OUT	RPM-Sensor_2 Output	SV2-3	O	
SV2	5	VR-2-N	Cam Signal Negative	GND	I	
SV2	6	VR-2-P	Cam Signal Positive	Hall Sensor	I	
SV2	7	RPM-1	Signal RPM-Sensor 1	SV2-8	I	
SV2	8	RPM-1_OUT	RPM-Sensor_1 Output	SV2-7	O	
SV2	9	VR-1-N	Crank Signal Negative	VR / Hall Sensor	I	
SV2	10	VR-1-P	Crank Signal Positive	VR / Hall Sensor	I	

Con	Pin	Signalname	Description	Typ Application	I/O	Type
SV3	1	IGN-A1	Ignition_A1	Gate IGBT	O	
SV3	2	FB_A1	Feedback_A1	Collector IGBT	I	
SV3	3	IGN-B1	Ignition_B1	Gate IGBT	O	
SV3	4	FB_B1	Feedback_B1	Collector IGBT	I	
SV3	5	IGN-C1	Ignition_C1	Gate IGBT	O	
SV3	6	FB_C1	Feedback_C1	Collector IGBT	I	
SV3	7	IGN-D1	Ignition_D1	Gate IGBT	O	
SV3	8	FB_D1	Feedback_D1	Collector IGBT	I	
SV3	9	RSP1	Current Resistor Sense Positive	GND		
SV3	10	RSN1	Current Resistor Sense Negative	GND		
SV3	11	IGN-E1	Ignition_E1	Gate IGBT	O	
SV3	12	FB_E1	Feedback_E1	Collector IGBT	I	
SV3	13	IGN-F1	Ignition_F1	Gate IGBT	O	
SV3	14	FB_F1	Feedback_F1	Collector IGBT	I	
SV3	15	IGN-A2	Ignition_A2	Gate IGBT	O	
SV3	16	FB_A2	Feedback_A2	Collector IGBT	I	
SV3	17	IGN-B2	Ignition_B2	Gate IGBT	O	
SV3	18	FB_B2	Feedback_B2	Collector IGBT	I	
SV3	19	RSP1/2	Current Resistor Sense Positive	GND		
SV3	20	RSN1/2	Current Resistor Sense Negative	GND		
SV3	21	IGN-C2	Ignition_C2	Gate IGBT	O	
SV3	22	FB_C2	Feedback_C2	Collector IGBT	I	
SV3	23	IGN-D2	Ignition_D2	Gate IGBT	O	
SV3	24	FB_D2	Feedback_D2	Collector IGBT	I	
SV3	25	IGN-E2	Ignition_E2	Gate IGBT	O	
SV3	26	FB_E2	Feedback_E2	Collector IGBT	I	
SV3	27	IGN-F2	Ignition_F2	Gate IGBT	O	
SV3	28	FB_F2	Feedback_F2	Collector IGBT	I	
SV3	29	RSP2	Current Resistor Sense Positive	GND		
SV3	30	RSN2	Current Resistor Sense Negative	GND		
SV3	31	MCU_PA.6	Signal MCU_PA.6		nc	
SV3	32	MCU_PA.7	Signal MCU_PA.7		nc	
SV3	33	INJ-1	Injector_1	Ground Injector	O	
SV3	34	INJ-2	Injector_2	Ground Injector	O	
SV3	35	INJ-3	Injector_3	Ground Injector	O	
SV3	36	INJ-4	Injector_4	Ground Injector	O	
SV3	37	INJ-5	Injector_5	Ground Injector	O	
SV3	38	INJ-6	Injector_6	Ground Injector	O	
SV3	39	INJ-7	Injector_7	Ground Injector	O	
SV3	40	INJ-8	Injector_8	Ground Injector	O	

Con	Pin	Signalname	Description	Typ Application	I/O	Type
SV4	1	MCU_RXD	RS232-Interface to MC9S12C64	SV4-6		
SV4	2	MCU_TXD	RS232-Interface to MC9S12C64	SV4-5		
SV4	3	CAN_H	CAN-BUS-Interface to MC9S12C64	nc		
SV4	4	CAN_L	CAN-BUS-Interface to MC9S12C64	nc		
SV4	5	USB_RXD	RS232-Interface to FT232R (Optocoubler)	SV4-2		
SV4	6	USB_TXD	RS232-Interface to FT232R (Optocoubler)	SV4-1		
SV4	7	VBUS_USB	USB-Interface	USB red		
SV4	8	GND_USB	USB-Interface	USB black		
SV4	9	DP_USB	USB-Interface	USB green		
SV4	10	DM_USB	USB-Interface	USB white		

Con	Pin	Signalname	Description	Typ Application	I/O	Type
SV5	1	GND	Power		nc	
SV5	2	+5V	Power		nc	
SV5	3	EC_SCK	SPI Bus		nc	
SV5	4	EC_SI	SPI Bus		nc	
SV5	5	EC_SO	SPI Bus		nc	
SV5	6	CS_EC1	SPI Bus Engine Controller 1		nc	
SV5	7	MAXI_EC1	SPI Bus Engine Controller 1		nc	
SV5	8	NOMI_EC1	SPI Bus Engine Controller 1		nc	
SV5	9	SPKD_EC1	SPI Bus Engine Controller 1		nc	
SV5	10	CS_EC2	SPI Bus Engine Controller 2		nc	
SV5	11	MAXI_EC2	SPI Bus Engine Controller 2		nc	
SV5	12	NOMI_EC2	SPI Bus Engine Controller 2		nc	
SV5	13	SPKD_EC2	SPI Bus Engine Controller 2		nc	
SV5	14	CS_EC3	SPI Bus Engine Controller 3		nc	
SV5	15	MAXI_EC3	SPI Bus Engine Controller 3		nc	
SV5	16	NOMI_EC3	SPI Bus Engine Controller 3		nc	
SV5	17	SPKD_EC3	SPI Bus Engine Controller 3		nc	
SV5	18	MCU_PA.3	Signal MCU_PA.3		nc	
SV5	19	MCU_PA.4	Signal MCU_PA.4		nc	
SV5	20	MCU_PA.5	Signal MCU_PA.5		nc	
SV5	21	MCU_PB.4	Signal MCU_PB.4		nc	
SV5	22	MCU_PB.5	Signal MCU_PB.5		nc	
SV5	23	MCU_PB.6	Signal MCU_PB.6		nc	
SV5	24	MCU_PB.7	Signal MCU_PB.7		nc	
SV5	25	MCU_PE.2	Signal MCU_PE.2		nc	
SV5	26	MCU_PE.3	Signal MCU_PE.3		nc	
SV5	27	MCU_PE.5	Signal MCU_PE.5		nc	
SV5	28	MCU_PE.6	Signal MCU_PE.6		nc	
SV5	29	MCU_PJ.6	Signal MCU_PJ.6		nc	
SV5	30	MCU_PJ.7	Signal MCU_PJ.7		nc	
SV5	31	MCU_PP.0	Signal MCU_PP.0		nc	
SV5	32	MCU_PP.1	Signal MCU_PP.1		nc	
SV5	33	MCU_PP.2	Signal MCU_PP.2		nc	
SV5	34	MCU_PP.3	Signal MCU_PP.3		nc	
SV5	35	MCU_PP.4	Signal MCU_PP.4		nc	
SV5	36	MCU_PP.5	Signal MCU_PP.5		nc	
SV5	37	MCU_PP.6	Signal MCU_PP.6		nc	
SV5	38	MCU_PP.7	Signal MCU_PP.7		nc	
SV5	39	MCU_PS.2	Signal MCU_PS.2		nc	
SV5	40	MCU_PS.3	Signal MCU_PS.3		nc	

7. Wideband Lambda Controller (www.breitband-lambda.de)

The integrated lambda controller is activated by switching the input "GP2" to ground. This can be done continuously with a bridge as the kdFi is only energized 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.

8. Firmware Updates

Firmware updates are always performed at your own risk. It may happen that the existing firmware is deleted by disconnections or incompatible computers/ software and it can only be reloaded via a BDM interface. We offer this service, but it is not covered by warranty!
Tunerstudio must be closed during the firmware update to prevent access conflicts. The ignition coils must be disconnected during the firmware update, until the appropriate configuration has been reloaded via MSQ file.

9. Notes