



USER MANUAL

Digital ECU Tuner 3

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1. Warnings and notes

Attention:

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- Digital ECU Tuner 3 can be used only for motor sports and cannot be used on public roads!
- The installation of the device can be conducted only by trained specialists. The installation performed by an unskilled person may lead to the damage of both the device and the engine!
- Incorrect tuning of the engine with Digital ECU Tuner 3 (DET3) can result in a serious damage of your vehicle!
- Never modify the device's settings when the car is moving because it may cause an accident!
- Ecumaster is not responsible for the damages caused by an incorrect installation or/ and tuning of the device!

Important:

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- The manual below refers to the 1.0 (HW Version 1.0) version of the Digital ECU Tuner 3 (DET3).
- Modification of the tables should be conducted only by people who understand the working rules of the device and working rules of the modern injection and ignition systems.
- Always use the AFR meter during the modification of fuel settings.
- Never short-circuit the lines of the engine's wiring loom as well as the outputs of the DET3 device.
- All modifications of the engine's wiring loom as well as of the DET3 device must be performed with the unplugged negative terminal of the battery.
- It is important for the quality of the joints of the wiring loom links to be high and to be correctly insulated.
- The connection wires should not be longer than 30 cm.
- All signals from the variable reluctant sensors should be connected by using shielded cables.
- Every unused input should be connected to the Ground.
- The device must be disconnected during welding of any car body elements!

2. Digital ECU Tuner 3

2.1. Description of the device

Digital ECU Tuner 3 is used to modify signals from sensors to ECU (Electronic Control Unit). Thanks to this function, it is possible to modify such engine parameters as the fuel dose, ignition angle, boost controlling or extra injectors. Additionally, some of the device's functions help to tune the car thanks to the advanced datalogger and the road dyno, which can measure the power and the vehicle's torque in the real conditions (a car driving on the road).

2.2. The device's characteristics

- 4 independent tables 16 x 16 (fuel table, two PWM tables, ignition table),
- 8 correction tables 16 x 1,
- 2 independently switching table sets,
- an option to modify a single analog signal,
- 4 analog inputs,
- built in Data Flash, which enables the signals to log in without plugging in the laptop,
- measurement of the power supply voltage,
- an option to modify a signal from the frequency based MAP and MAF sensors (in range of 17Hz-4kHz),
- supporting the ignition signal with using: variable reluctant sensors, Hall's, optical sensors and signals, which control the ignition module. The device supports both the *single ended* and *differential* signals.
- support of many ignition types: 60-2, 36-2, 36-1, 18-1-18-1, EDIS, Multitooth, Ignition Modules, Subaru GT, Honda D Series,
- an option of boost control using 3-way solenoid valves,
- servicing of 4 high-Z injectors (batch fire system),
- an option for a direct modification of the injection time for the batch fire systems,
- ON/ OFF type parametric output,
- automatic conversion from MAP to MAF using auto learning system,
- launch control,
- road dyno,
- an option to calibrate any analog sensors, which enables the analog values to be displayed in their real values (for example, a signal from MAP sensor in bars, a signal from a WBO meter as AFR, etc.),

- an option for a free firmware upgrade (new ignition modes, additional functions),
- USB communication port.

3. Minimal PC configuration

For the correct functioning of the device, the following minimal configuration is required:

- Windows 2000, XP, Vista , Windows 7
- 128/256/512 MB RAM
- Resolution, at least 1024x768 16bit,
- 600MHz CPU or better,
- USB

3.1. Components of the set:

- DET 3 device,
- USB AA cable,
- Connector,
- A set of connector pins,
- CD with the software, drivers and the user's manual in English,
- Additional set of resistors and a rectifying diode, useful for the installation of the device.

3.2. Firmware

Firmware is the device's internal software that controls its operation. It can be updated to enhance functionality in the future. Additionally, to use a new firmware, a proper software (client) should be used for Windows. The software is compatible 'backwards', which means that the new version of the software for Windows works with all previous versions of the device's firmware. The latest software can be found at https://www.ecumaster.com/products/digital-ecu-tuner-3/.

4. Firmware update

Due to the changes in the device's firmware, (for example: improvements, additional functions) it is possible to change the firmware. To do this, the Upgrade firmware... function should be used (in the File menu). To choose a new firmware, press Open. The Firmware History window shows a list of changes made to a specific firmware version. To continue, press the Upgrade button.



n 🖗 Upgrade firmware	×
Firmware history	
Open file contains firmware update. Be aware that firmware upgrade will clear permanently all your tables and configurat data!	ion
	~
Current FW version:: 257.5	
Version to upgrade: : N//A	
Open Upgrade Car	ncel

A window with a warning will be displayed: "All your tables and configuration will be lost."

樈 Upgrade version	×
Are you sure you want to upgrade firmware?	? All your tables and configuration will be lost!
Yes	No

After accepting, a window informing about the progress of the firmware's change will be displayed. At this time, don't switch off the computer nor the device! If communication with the device is interrupted during installation, take the following steps to ensure the completion of the installation:

- 1. Connect the device to a laptop,
- 2. Power up the device,
- 3. Start the client for Windows,
- 4. Choose Upgrade Firmware from the menu and follow the above directions.

Attention:

Updating the firmware causes the loss of the saved tables and setup parameters! The project should be saved on a hard-drive before updating!



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Warning:

Firmware change should not be conducted if there are problems with the communication between the device and PC computer!

5. Connector pinout

Front view of the device



Signals connector

Pin	Name	Description				
1	+12V	Power supply after the "ignition switch". 1A fuse should be used.				
2	Maps Switch	Input for changing table sets.				
3	Pullup	Pullup resistor 2K to +12V				
4	Bipolar ign. out inverted	A complementary output of the ignition of the bipolar signal for differential signals				
5	Bipolar ign. out	Ignition output for the bipolar signal.				
6	Ignition out	Ignition output for the unipolar signal.				
7	Frequency out	Frequency output				
8	Pullup	Pullup resistor 2K to +12V				
9	Ignition in	Ignition input for unipolar and bipolar signals				
10	Frequency in	Frequency input				
11	Ground	The device's Ground				
12	+5V out	Output +5V for feeding of the additional sensors (for exam				
		map sensor)				
13	Analog #1 in	Analog Input #1				
14	Analog #2 in	Analog Input #2				
15	Analog #3 in	Analog Input #3				
16	Analog #4 in	Analog Input #4				
17	Analog out	Analog Output				
18	Power out #2	Power Output, parametric or PWM, 5A				
19	Power ground	Ground used for feeding of the power outputs				

Pin	Name	Description
20	Power out #1	Power Output PWM, 5A

6. Software installation

Client installation

To install a client, executable file (EcumasterDET3_1_xx.exe) should be activated. After choosing a language and accepting the license agreement, choose the targeted folder. It is important to remember that before installing a new version, the old one should be uninstalled! User's folders will be saved.

Driver's installation

Windows XP

During the first connection of the device to a computer, a message will appear, informing that a new equipment is found.

Next, choose the option: "Install from a list or specific location". When installing from a CD from the set, choose CD and DET3\USB_DRIVER folder, (for example, D:\DET_3\USB_DRIVER). If the driver is installed from a hard drive (for example downloaded from https://www.ecumaster.com/products/digital-ecu-tuner-3/) choose a proper folder.



The above directions should be repeated for every new equipment found by the computer. If FTDI drivers of FTDI brand are already installed on a computer, the information about finding a new equipment will not appear and the drivers' installation will not be necessary. After a successful installation, a client can be started.

7. Toolbar

The useful functions of the program are placed on the toolbar. A list of icons from the toolbar and their descriptions are placed below.

lcon	Description
D	New project – erases tables' content and sets new default values.
É	Open project – project opening
	Save project – saving a project on a disc
4	Make maps permanent – saving tables and configuration in the Data Flash memory of the device. Saving them is necessary so that they are not lost after power off.
	Colored cells - Turns on/off the colouring of the tables
#	Mark visited cells - Based on a data log, marks cells which have been "visited" during a session.
aix	Display analog in x values - "covers" the table with the values from a given analog input which are placed in a current log. It helps to, for example, cover a table with AFR or EGT values.
	Display cross – displays an extra indicator, which precisely shows the current location of the value from the table.
颧	Properties – displays a window with extra options

8. Tables

Digital Ecu Tuner 3, has 4 3D, 16 x 16 tables which allow to modify / generate signals in the engine's speed and load functions. Additionally, every 3D table has two 2D correction tables assigned (16 x 1).

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8.1. Interface description

Ag D	IGI	TAL	ECU T	UNER	III																		_ 🗆 🗙
File	Ed	it S	ietup	Dyno	Help																		
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1111	Fue	el Tab	ble (F1)	III	PWM	Table	#1 (F2) I III	lgn. T	able #	1 (F3)	III F	WM T	able #	2 (F4)	₹ ا	.og Winda	ow(F5) 🚺 🔿 Ro	ad Dyno (F6)	1			
E		22	5	34	63	67	71	75	70	93	80	96	103	110	114	110	8000						[
.5		21	8	42	72	73	75	76	78	83	88	95	102	113	117	117	7500						
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-62	2.	34	-7	20	46	52	53	55	56	58	64	72	76	82	87	94	5000	{		Att	11	H	
-66		40	-15	10	33	43	45	47	49	51	57	64	69	75	80	87	4500		///X/		H	tt	
-69		45	-22	0	22	33	36	39	42	45	50	58	65	68_	74	80	4000		IH X	XII	H	TH	
-73	3.	-51	-30	-8	10	19	25	30	34	38	43	49	55	61	1	73	3500		IXX	MI	HT	TH	
-78	; .	-56	-37	-18	-5	6	14	21	28	32	34	Er	nter va	lue 📕	Б	61	3000		VXX	XII	HT	H	
-80).	62	-45	-26	-16	-7	1	6	11	15	21	In	creme	nt	3	46	1		VXX	ALL	- 30	Map	
-80).	62	-45	-34	-27	-21	-15	-10	-5	1	9	D(ecreme ero	ent	7	28	2	8000		HH	Ва	ar display stograms	
-81		67	-54	-42	-37	-33	-29	-24	-20	-16	-7	In	terpola	ate	1	10	1500	600 50		H		scograms	4 / H
-8	ł	73	-64	-56	-50	-45	-40	-35	-30	-25	-19	Di	icolay ()e		alue		4	3000				$\setminus \mid \parallel$
-83	Ĭ.	78	-74	-70	-63	-57	-52	-45	-40	-34	-28	-21	-1b	-10	Ťv	oltage			2009				
0		7	13	20	27	33	40	6	53	60	67	73	80	87	F	requer	ncy		0.80	-0.14	0.51	1.17	1.50
Anal	og ir	n #2	17	1				-										Log					
70		70	70	70	70	70	70	70	70	0	70	70	70	70	70	70	%	Analog#1 In	0.000 V	Analog#1 Out	0.000 V	RPM	0
10.	0 1	10.7	11.3	12.0	12.7	13.3	14.0	14.7	15.3	7 .0	16.7	17.3	18.0	18.7	19.3	20.0	AFR	Analog#2 In	0.000 V	lgn. adv./ret.	15deg	Freq In	0.0
Ana	log i	n #3												0				Analog#3 In	0.000 V	PWM 1 DC	1%	Freg Out	0.0
80	8	30	80	80	80	80	80	80	80	I	80	80	80	80	80	80	%	Augle =#410	0.0001/		0%	loi in	0.0 ms
-0.0	30 -	0.65	-0.49	-0.34	-0.19	-0.03	0.12	0.27	0.43	.	0.73	0.89	1.04	1 19	1.35	1.50	BAR	Analog#4 In		1 1111200	0%	ung, un	0.0 ms
Anal	og ir	1#4				19	2				H₩∖	/er. 1.0	n 1	2	FW	ver. 1.(00	User output		Acc. voltage	12.63 V	Inj. out	
Conn	ecte	ed.		Ignit	ion syr	า 🛛 รโ	D NO	SYNC	Currre	nt map	s set =	0											

- 1. Table's area is 16x16. Values in the table's cells have different meanings for each map (and sometimes mode):
 - for the Fuel Table, the values mean a change of a defined input signal (Analog In), or a change of the frequency of the signal from the input Ignition#2 In (more on the topic can be found in the chapter Modification of frequency signals (on page 30)).
 - for the PWM1/PWM2 tables, values in the cells denote the level of impulse duty cycle (0 100%). In the mode of the direct injectors steering, table values range from 0 200%.
 - for the Ignition table, values in the cells denote the angle of the ignition retard (negative values), or ignition advance (positive values).
- 2. 3D table graphics representation. To rotate the 3D graph, keep the left mouse button pressed and move it on the 3D area.
- 3. View select. (from the left: 3D Table View, Bard Display, Histograms)

	RPM	0	Histogram of analog in #2 NUM 554 AVG: 221 MIN: 2 MAX 238 MFR 228
	Analog #1[V]	4.59V	
	Analog #2[%]	89.35%	
	Analog #3[AFR]	17.68AFR	
	Analog #4[BAR]	-0.80BAR	
	Analog Out[V]	2.49V	
	PWM 1 DC[%]	1.00%	_
	PWM 2 DC[%]	0.00%	_
VXX THTHE	User Output	Inactive	
	Freq. In[Hz]	0.00Hz	_
8000	Freq. Out[Hz]	0.00Hz	1
5000 5000	Acc. Volt.[V]	12.63V	
4000 3000 2000	Inj. In[ms]	0.00ms	
1008	Inj. Out[ms]	0.00ms	
-0.80 -0.14 0.51 1.17 1.50			

- 4. Real time log. A set of values from the device's inputs and outputs.
- 5. A column defining the range of the engine's speed value for a given cell.
- 6. A row defining a range of the load for a given cell.
- 7. "Selection" area. Thanks to the selection, it is possible to modify a group of cells simultaneously.
- 8. Marker of a cell currently visited by the device.
- 9. First correction table. In case of Fuel and PWM table, the correction describes a proportional change of the output signal, in case of the ignition table, the correction represents the ignition change angle.
- 10. Second correction table. In case of Fuel and PWM table, the correction describes a proportional change of the output signal, in case of the ignition table, the correction represents the ignition change angle,
- 11. Menu (right mouse button) enables the conduction of operations in the map's cells:

Enter value (Enter key)	Displays a dialog, which enables the filling of the marked cells
	with the chosen value
Increment (+ key)	Enables the change of the increment cell's value by 1, with the
	SHIFT key pressed by 5
Decrement (- key)	Enables the change of the decrement cell's value by 1, with the
	SHIFT key pressed by 5
Zero (0 key)	Resets cell's value to 0
Interpolate	Linearly interpolates cells' values within a marked area

12. **Display As...**, in case of frequency signals it is possible to change the presentation of data from the table into real frequency values (especially important for nonlinear scales). For the analog signals, it is possible to set the table presentation in volts.

- 13. Hardware version (HW ver.) and its firmware (FW ver.). More information on the topic can be found in the chapter Firmware update *(on page 6)*.
- 14. Status bar describes the current state of the device:

Cannot connect	The device is not communicating with the PC computer
Connected	The device is communicating with the PC computer
Ignition sync. status	No signal (or signal incorrect) at the input Ignition #1 In
NO SYNC.	
Ignition sync. status	Synchronization of the ignition signal (for the systems with a
SYNCHRONIZING	missing tooth). It means that the device is trying to detect the
	"missing tooth" gap
Ignition sync. status	The device is already synchronized with the ignition signal
SYNCHRONIZED	
Current map set	Currently chosen set of tables

15. Name of the input used as an argument of the table's X axis.

All values are smoothly interpolated between adjacent cells, resulting in optimal engine performance. This is particularly crucial for the MAP to MAF conversion process.

To move around the table, use the arrow keys, a selected area on the table can be marked with the SHIFT key. It is also possible to mark a chosen area by holding the left mouse button pressed. Press + and – keys to change values of the cells (with the SHIFT button 5 unit change). 0 key resets cells value to zero.

There are 4 tables to choose from:

8.2. Fuel Table (F1)

It is the basic table, where modifications of the fuel dose can be made, with using modifications of analog and frequency signals.

8.3. PWM Table #1 (F2)

It is a table, used for the configuration of the power output #1 PWM signal duty cycle (0 - 100%), or, in the case of direct injectors steering, it is a scale of injector opening time (0-200%)

8.4. Ign. Table (F3)

It is a table containing the modification of the ignition advance angle. Positive values denote the ignition advance, and negative values denote the ignition retard.

8.5. PWM Table #2 (F4)

It is a table used for the configuration of the power output #2 PWM signal duty cycle (0 - 100%).

8.6. Tables Configuration

For every map, it is important to define, which input signals will be modified and which signals will be used as *Load* for the main map as well as for the corrections.

Modify	Analog in #1	•		
Load	Analog in #2	•	Load	Analog in #2
Correction #1	Analog in #3	-	Correction #1	Analog in #3
Correction #2	Analog in #4	•	Correction #2	Analog in #4
Ignition Lable			PWM Table #2-	
Load	Analog in #2	•	Load	Analog in #2
Correction #1	Analog in #3	•	Correction #1	Analog in #3
Correction #2	Analog in #4	•	Correction #2	Analog in #4
his configuration	window allow to configure what	signal will ac	t as deflection, corre	ection and what signal will be modified fo
iven table.				

To enter Tables configurations, choose Setup tables from the menu Setup...

The modified signal for the *Fuel Table* can be chosen among *Analog#1-Analog#4*, *Frequency* and *Zero*. Depending on the kind of a sensor (analog, frequency), a proper input can be chosen. Zero means that the value of a modified input signal will be 0. This option is used for the MAF to MAP conversion.

For the Load, it is possible to choose all analog inputs and frequency input. For the correction maps, apart from the choices mentioned above, there is also a Disable option, which switches the correction off.

8.7. Tables sets switching

Digital ECU Tuner 3 has an option to define two independent table sets, which can be changed with a switch while driving the car. The current set of tables is displayed on the toolbar as *Current map set*.

To change tables, pull the input 2 of the device down (Maps switch).



Attention:

When saving a project on a hard drive, only the currently chosen set of tables will be saved!

9. Analog Inputs

Digital ECU Tuner has 4 analog inputs. All operate the voltage from 0 - 5V with 10 bit resolution. Voltages above 5V are interpreted as 5V, however, such high voltages should be avoided because they may damage the device.



Every analog input can be assigned as a modified signal, load or corrections. These assignments can vary depending on the table, and also the analog signals can be used for different functions (for example as a modified signal and load).

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The output value of the modified analog signal for fuel table is calculated on the following basis:

Vout = (TableValue * Vstep + Vin + AnalogOutOffset) * Correction1 * Correction2

```
If Vout < Analog Out Min then Vout = Analog Out Min;

If Vout > Analog Out Max then Vout = Analog Out Max,

where,

Vout - Output voltage (Analog Out 1)

Vin - Input voltage (Analog In 1)

Vstep - Modification step (0.019V, 0.098V, 0.0049V menu Analog Output Configuration)

TableValue - Fuel table value

AnalogOutOffset - Analog output offset (menu Analog Output Configuration)

Correction1 - Proportional value from the first correctional table's cell

Correction2 - Proportional value from the second correctional table's cell
```

9.1. Load

Load determines the table's column for the X-axis, indicating where the value will be applied. For example, sensors such as TPS (for NA engines only!), MAP sensor, MAF sensor, etc., can supply voltage or frequency as load.

To obtain as many signal modifications as possible, the range of the input signal must be correctly configured (*Analog Inputs Configuration* menu). The minimal and maximal value of the chosen analog input should be set for the correct highest and lowest frequency value indicated by the sensor.

For example, if the MAP sensor gives 0.5 V at the 40kpa of absolute and 4.0 V at 200kpa, then parameters should be set: 0.5V and 4.0V, respectively. This way, it will be possible to use all cells from the table.

CAUTION:

In turbocharged cars, a signal from the TPS sensor cannot be used as Load, because the value from TPS sensor does not reflect the real load of such engine! In this case, signal from MAP or MAF sensor must be used.

The ranges of the input analog signals can be defined in the Setup/Analog Inputs Configuration window. In this window, it is also possible to precisely define the range of the input voltages and to switch the filtering of the signal using digital low - pass filter. This option can be very useful if the input signal is noisy.

Analog inputs	configuration	
	Minimum Value[V]	Maximum Value[V]
Analog #1 In	0.00 ₹ 0.00 ∨	5.00 🗧 5.00 V 🗌 Filter
Analog #2 In	0.00	5.00 📩 100 % 🗖 Filter
Analog #3 In	0.00 🔺 10.0 AFR	5.00 20.0 AFR Filter
Analog #4 In	0.00 0.80 BAR	5.00 🔺 1.50 BAR 🗖 Filter
This menu enable of tables space. F input.	e limiting of analog signals. Pro ilter options enable internal di	per limiting is essential for maximum using gital filter of noisy signal of given analog
		Cancel

Each analog input can be configured as a correction input. (eg. ignition angle in function of the temperature intake). Also, all spare analog inputs can be used for logging additional signals, like signals from WBO controller. Using logged data user can cover the table with average values for a given table cell. To use this feature press tool bar icon representing given analog input.

Table covered with AFR values

10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8500
10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	7968
10.1	10.8	11.5	12.1	12.9	13.5	14.3	14.8	15.6	15.9	16.8	17.1	16.3	18.7	10.0	10.0	7437
10.0	10.8	11.8	12.3	12.9	13.5	14.0	14.7	15.2	16.0	16.7	17.2	17.7	18.5	10.0	10.0	6906
10.1	10.9	11.6	12.2	13.0	13.5	13.9	14.8	15.3	16.0	16.5	17.3	17.7	18.4	18.8	10.0	6375
10.0	10.9	11.8	12.3	12.9	13.4	13.9	14.5	14.8	16.1	16.6	17.3	17.9	18.4	10.0	10.0	5843
10.1	10.8	11.4	12.4	12.8	13.5	14.0	14.8	15.3	16.0	16.5	17.2	17.7	18.4	10.0	10.0	5312
10.1	11.2	11.5	12.2	12.9	13.4	14.1	14.8	15.3	15.8	16.9	17.3	18.2	18.4	10.0	10.0	4781
10.1	10.9	11.4	12.4	12.8	13.4	14.0	14.7	15.2	16.0	16.5	17.3	17.7	10.0	10.0	10.0	4250
10.0	10.9	11.3	12.3	12.9	13.4	13.8	14.8	15.3	15.9	16.3	17.1	17.9	18.6	18.9	10.0	3718
10.0	11.3	11.4	12.4	13.0	13.5	14.1	14.8	15.4	16.0	16.5	17.2	18.0	18.5	10.0	10.0	3187
10.0	11.0	11.6	12.3	12.9	13.3	14.1	14.7	15.5	15.9	16.3	17.5	18.0	18.5	10.0	10.0	2656
10.0	10.8	11.8	12.3	12.9	13.5	14.1	14.6	15.4	16.0	16.7	17.1	17.6	18.5	10.0	10.0	2125
10.0	10.9	11.3	12.3	12.9	13.5	14.0	14.8	15.4	14.8	16.8	10.0	10.0	18.5	10.0	10.0	1593
10.0	10.7	11.3	12.4	12.9	13.5	14.1	14.6	15.3	10.0	16.7	10.0	10.0	18.7	10.0	10.0	1062
10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	531
-0.80	-0.65	-0.49	-0.34	-0.19	-0.03	0.12	0.27	0.43	0.58	0.73	0.89	1.04	1.19	1.35	1.50	BAR

10. Analog output (Analog Out)

Analog output (**Analog Out**) is made of a high quality 10 – bit DAC converter. Maximal signal resolution is 0,0049V. In the *Setup/Analog Output Configuration* window, it is possible to choose the voltage step, which would correspond to the value 1 on the map. It is 0.0195V, 0.0098V or 0.0049V, respectively. The choice of the step directly influences the maximal possible change of the output signal. For 0.0195V it is +/- 2.5V, for 0.0098V +/-1.25V and for 0.0049 +/-0.625V.

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No matter which step of the signal change is chosen, the interpolation of the map's values is conducted with the full 10 bit resolution. There is also an option to define the initial range of the output signal. It means that independently of the calculated analog output value, the output will never be lower than *Analog Out Min* or higher than *Analog Out Max*. In the *Setup* bookmark, it is possible to set the offset (*Analog Out Offset*) for the analog output (the way of calculating the value of the output voltage can be found at the description of the analog inputs). The possibility to set the value of the device's initial voltage is an additional option. DET3 needs about 7ms for the initialization and to start working. During this process, voltage of the analog output equals 0V. It is possible to enforce a given initial voltage during the initialization process. It may be required for some ECU, which at this time is reading the voltage from a sensor (MAP sensor, MAF sensor), and in case of 0V, to report an error. In such situations, the initial voltage value should be set to the sensor's reading when the engine is turned off.

Analog output configuration	×
Analog Out Min [V] 0.00 + Analog Out Analog Out Max [V] 5.00 + Analog Out	Offset [V] 0.00 💉
Force startup output voltage Analog sign Startup Voltage [V] 0.00 0.0049V 0.0098V This configuration window allows to co 0.0098V	al modification step [V]
Analog Out Offset - constant offset addet to analo Analog Out Min - minimum voltage at analog outp Analog Out Max - maximum voltage at analog outp Startup Value - voltage at analog output at device Analog signal modification step - analog output res	g output voltage. ut. startup. solution.
Apply OK	Cancel

! Attention:

Connecting the analog output directly into the ground or + 12V may cause a damage of the DAC converter!

11. Controlling ignition angle

The device includes options to control ignition in the ignition systems listed below:

- 1. retard / advance of the signal from the toothed wheel 60-2,
- 2. retard / advance of the signal from the toothed wheel 36-2,
- 3. retard / advance of the signal from the toothed wheel 36-1,
- 4. retard / advance of the multitooth signal,
- 5. retard / advance of the SAW signal which controls EDIS module,
- 6. retard / advance signal from toothed wheel Subaru GT (6 teeth),

- 7. retard / advance signal from toothed wheel 12+1 (Honda D series),
- 8. retard / advance signal from toothed wheel 18-2-18-2 (Nissan QG18DE),
- 9. retard of a single signal controlling the ignition module,
- 10. retard of two signals controlling dual ignition modules,
- 11. retard of a single regular signal

The device has an advanced ignition input (Ignition #1 In), with configurable functionality. Thanks to that option, one input can serve both signals: the VR and Hall's/ optical sensors.

Input mode of Ignition #1 In	Description
VR Sensor adaptive threshold	Input mode, which serves VR sensors. Thanks to the signal
	true zero cross detection and the adaptive hysteresis, this
	input mode is very noise immune.
VR Sensor fixed threshold	This mode is used to serve VR sensors using true zero cross
	detection and hysteresis at the 200mV level.
Hall effect or optical sensor	This mode serves optical and Hall's sensors. The signal's
	amplitude is required to be higher than 2.5V.
Other sensors	This mode serves other inductive and Hall's sensors without
	hysteresis.

The device has 3 ignition outputs:

- 1. Ignition Out (Pin 6) used for the unipolar signals,
- 2. Bipolar Ignition Out (Pin 5) used for the bipolar, unbalanced signals (single ended),
- 3. **Bipolar Ignition Out Inverted** (Pin 4) complementary signal for the signal from the output Bipolar Ignition Out used for bipolar, balanced signals (*differential*),

Attention:

ļ

Connecting ignition outputs directly to the ground , +12V or directly to the ignition coil will damage the device!

Value of the advance angle change is calculated as follows:

IgnAngle = MapValue + CorrMap1Value + CorrMap2Value

If *IgnAngle* < Maximum Retard then *IgnAngle* = Maximum Retard

If IgnAngle > Maximum Advance then IgnAngle = Maximum Advace

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Positive values on the table correspond to the advancement of the mixture ignition, negative values retarding the mixture ignition. Depending on a type of a modified signal, which controls the ignition, the range of the advance angle changes. Therefore, the permitted change for a signal from the toothed wheel is 60-2, +/- 90 degrees. In case of retarding of the symmetrical signal from the camshaft or crankshaft sensor, a permitted angle equals to the angle between two consecutive teeth. Therefore, if there is a toothed wheel with four symmetrical teeth on the crankshaft, the angle between the teeth is 90 degrees and it is the maximal angle of the ignition retard. Ignition configuration can be done in the *Setup/Ignition Configuration* menu.

3 Ignition configuratio	n		×
Ignition mode			
Retard / Advance 60-2	signal		•
This ignition mode is suit with 58 teeth and gap wil European cars based on trigger type is VR sensor,	ble for all cars with in h 2 missing teeth (cc Bosh Motronic syste however there are s	gnition trigger system based or mmonly known as 60-2). It is v ms. The most common senso ystems based on Hall sensor o) toothed wheel very popular in r used for this on the market.
Ignition #1 input configu	ration		
Ignition #1 input type	Hall effect or optic	al sensor	•
- General			
Maximum RPM	7000	Maximum retard(deg)	15 🔹
Num signals per 720	2 🗾	Maximum advance(deg)	15 📩
Max RPM ever	7000	Reset RPM	
Max RPM - maximum rpm Num sig. per 720 - numb Max RPM ever - maximal Reset RPM - reset maxim Maximum retard - maximu Maximum advance - max	represented on map of cran/cam signal RPM that was recor um RPM ever value m allowable spark re mum allowable spark	Y axis: s per 2 engine revolutions. ded by device. tard s advance.	
		Apply OK	Cancel

Parameter	Description
Ignition Mode	Choosing the ignition mode, suitable for the ignition system of the modified vehicle
Ignition input type	Choosing the ignition input mode of working, enables the choice between sensors (induction or Hall's)
Maximum RPM	Maximal revs on the table's vertical axis
Num signals per 720	For some of the ignition systems (for example multitooth), it is required to give the amount of signals per engine work cycle (720 degrees). An incorrect value will give a wrong read of the engine's speed and an incorrect change of the advance angle acceleration

Parameter	Description
Max RPM ever	Maximal engine speed registered by the device
Reset RPM	Resets the counter of maximal engine speed
Maximum retard(deg)	Value of the maximal retard of the ignition angle
Maximum advance(deg)	Value of the maximal advance of the ignition angle

11.1. Signal types

Depending on the kind of crankshaft / camshaft sensor, there are different kinds of signals sent from the sensors. The simplest sensor is the variable reluctant sensor (VR sensor), which, based on the induction laws, generates bipolar signal, which amplitude depends on the rotational speed of the crankshaft / camshaft. The signal has approximately the shape of a sinusoid. With low engine rotation speed, the voltage amplitude is measured in dozens mV and may reach a few dozen Volt with its high revolutions. Some of the car ECU interprets a signal for the sensor as *single ended*, which means that one of the sensor's poles is connected to the ground and the signal is taken from the other one. The second approach is treating the signal form the sensor as a balanced one (*differential*) and using both halves of the signal.

Another kind of sensors are optical/ Hall's sensors. They require power supply and generate a rectangular, unipolar signal.





Information about the type of a signal is crucial for the correct configuration of the device. For VR sensors, in Setup/Ignition Configuration menu, choose the Input Type: **VR Sensor adaptive** *Threshold Ignition*. For optical/ Hall's sensors choose *Hall Effect or optical sensor*. Choosing an incorrect type of signal may cause an incorrect functioning of the device (lack of engine speed data, ignition errors, etc.)

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3 Ignition configuration	n		×
Ignition mode			
Retard / Advance 60-2	signal		-
This ignition mode is suit. with 58 teeth and gap wi European cars based on trigger type is VR sensor,	able for all cars with th 2 missing teeth Bosh Motronic sy however there are	h ignition trigger system based or (commonly known as 60-2). It is v stems. The most common senso a systems based on Hall sensor o	n toothed wheel very popular in r used for this on the market.
- Ignition #1 input config	uration		
Ignition #1 input type	Hall effect or op	tical sensor	-
	VR Sensor adap	otive threshold	
Input mode suitable for w	id VR Sensor fixed	threshold	
This mode is also suitable tupe, so input pullup is re	e Hall effect or op a Other sensors	tical sensor	
type, so input pailup is re	q <u>t o thoir o o hooiro</u>		
Concord			
	7000		15 1
Maximum HPM	7000 =	Maximum retard(deg)	
Num signals per 720	2 -	Maximum advance(deg)	15 🗧
Max RPM ever	7000	Reset RPM	
Max RPM - maximum rpn Num sig, per 720 - numb Max RPM ever - maxima Reset RPM - reset maxin Maximum retard - maximu Maximum advance - max	n represented on m er of cran/cam sig IRPM that was rec hum RPM ever valum m allowable spark imum allowable sp	hap Y axis. nals per 2 engine revolutions. porded by device. ue. retard ark advance.	
		Apply OK	Cancel

11.2. VR Sensors

In case of a VR sensor connected to the ECU as *single ended*, signals should be connected to the ignition input *Ignition In* (9), and the signal's output to *Bipolar Ignition Out* (4).



In the case of the balanced signal (differential), VR sensor should be connected to the DET3 device as *single ended*, and connected to the car's ECU as balanced, using both bipolar outputs.



Ignition In (9) DET 3	ECU
Bipoloar Ign. Out (5)	
Bipoloar Ign. Out Inv. (4)	

Polarity of the sensor is crucial in case of the balanced signal. Reversed connecting will cause an inability to start the engine or errors in controlling the ignition.

For the VR sensors, in the menu Setup/Ignition Configuration choose the Ignition Input Type: VR Sensor Adaptive Threshold. (applies to the single ended sensors as well as balanced ones).

CAUTION:

Signals from the VR sensors should be lead by shielded wires, especially when they are longer than 15 cm.

11.3. Optical/ Hall's sensors

Optical/ Hall's sensor should be connected to the Ignition In. input. In most cases, this type of sensors have the "*open collector*" output, which requires connecting the pullup resistor to +12V (or using device's pullup pin).



For the Hall's/optical sensors, in the menu Setup/Ignition Configuration chose the Ignition Input Type: Hall Effect or optical sensor.

11.4. Ignition module

In case of modifications of the signal controlling the ignition module, the wiring diagram below should be used.



For this signal type, in the menu Setup/Ignition Configuration choose the *Ignition Input Type:* **Hall Effect or optical sensor**. As the *ignition mode* choose the *Retard single signal*. This mode considers the coil dwell time and copies it in the output signal.

11.5. The SAW signal of the EDIS module

In case of the ignition controlling the EDIS module, it is possible to modify the ignition angle through the length modification of the controlling SAW signal.



For this type of signal, in the menu *Setup/Ignition Configuration choose Ignition Input Type:* Hall Effect or optical sensor.

12. Power outputs: Power Out #1 and Power Out #2

Digital ECU Tuner 3 has two power outputs, to which the following functions can be assigned:

- Output Power Out #1 controlled by 3D PWM #1 table,
- Output Power Out #2 controlled by 3D PWM #2 table,
- Parametric output controlling Power Out #2.

Reference to the second	×
Channel #1	Channel #2
PWM frequency [Hz]	PWM frequency [Hz] 35
Enable fast PWM (10x)	Enable fast PWM (10x)
Description	
You can define base frequency for PW/M or also used for injectors control and user out	output. Be aware that PWM outputs can be put!
Apply	OK Cancel

Power outputs can be controlled by PWM within the frequency range of 10Hz-2000Hz. The PWM frequency for every output is defined in the *Setup/PWM Outputs Configuration* window. The *Enable fast PWM (10x)* option increases the output frequency 10 times. PWM controlling is used in all kinds of solenoids (for example, boost solenoid valve control) or when using an additional injector/ injectors. Values on the PWM table range from 0 - 100%.

To use power outputs, additional power ground should be connected to the **Power Ground** (19) input.

12.1. Boost control

To control the boost pressure of the turbocharger, connect the proper 3-way electro valves. It should be able to work with a relatively high frequency (>30Hz) and allow the control with duty cycle at least from 20% to 80%.



The electro valve should be connected in the following way:

The diagram below describes a way of connecting the 3-way electro valve used to control boost for the turbocharger with the integrated wastegate.



The described value is opened between the endings 2 - 3, if it's not powered. With the power on, the opened connection is between 1 - 2 endings.

In the above connection, 0% of the PWM duty cycle gives minimal boost defined by the wastegate actuator's spring, 100% of DC causes maximal boost that the turbocharger can achieve.

To control the boost, MAP sensor must be used for the Load. It allows to control the boost in the feedback loop in the pressure and RPM function.

When problems with the controlling boost occur, it may be necessary to use a restrictor at the electro valve input.

12.2. Controlling additional injectors

The device can control up to 4 high-Z injectors per 1 power output. Using PWM map, it is possible to control the opening time of the extra injectors, and as a result, enriching the fuel mixture. A typical connection of the additional injectors is as follows:



The PWM frequency should be set in range of 30 - 40 Hz. Using the PWM#1 map, it is possible to control output DC (extra fuel dose) from 0% - 100%. A typical example of this usage is a N/A car with a turbocharger. When the boost increases, the DC of additional injectors also increase rising the fuel doses. Due to the additional fuel, the proper AFR can be archived.

12.3. Direct controlling of the injectors opening time

When the injector system works in the "*Full group*" mode (all injectors work simultaneously), it is possible to directly control the injectors' opening time.

The connections should be as follows:



To activate the option of the direct controlling of the injection time, choose Setup/Injection Control Configuration from the options, then choose Injection control type: Full group input, Power Output #1.

It is also possible to set the injectors opening time (default value is 1ms.) that is not scaled by tables values.

The injectors' scale factors can be found on the PWM Table #1.

The value of 100 means 100%, which means the lack of modifications of the injectors opening time.

13. Parametric Output

User Output is used for the parametric control of the external actuator. Depending on the electric current required by the actuator, direct controlling or controlling through an electric relay is possible.

The current drawn from the Power Out #2 cannot exceed 5A (eg. it can be used directly to control LED diode, electrovalves, buzzer, etc.), .If the required current exceeds 5A (for example, fuel pump, water injection pump, etc.), electric relay must be used. It is important to remember to connect an extra Ground to the 19 pin (Power Ground) when using the Power Out #2 output.

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Warning:

Current draw that exceeds 5A will damage the device!

13.1. Sample wiring diagrams

1) Connection of the LED diode (eg. Shift Light)



2) Connection of the fuel pump



13.2. Parametric output configuration

To configure the parametric output, choose the parameter window (*Setup/Parametric output configuration*). In the configuration window, choose inputs, which will be used as function parameters, referential values and conditions, which fulfillment will activate the user output.

Source 1	Condition	Value[V]	V	Hist.[V]
Analog in #1	P ⊥ (• AND	0 OR	J3.00	1.00
Source 2 RPM	Condition	Value[RPM]	RPM 3000	Hist.[RPM]
Description Parametric output allows to acti conditions. Parametric output is ground to pin 19.]	vate selenoids or mapped onto Po	other devices, a wer Out #2. Do	iccording to not forget to	user defined connect addition

Parameters *Source1* and *Source2* allow to choose the inputs. If using only one input, choose *None* as *Source2*. For each input it is possible to choose a condition that needs to be fulfilled to activate an output. The Hysteresis (Hist.) is used to define hysteresis value. This value defines the condition for the output deactivation. For example, if the LED diode is used as a shift light when the engine revolutions are higher than 5000, and hysteresis will be defined at the level of 500 revolutions, the LED diode will turn off when the engine revolutions drops under 4500. Additionally, between the conditions for the *Source1* and *Source2* outputs, it is possible to define a condition (AND, OR) which must be fulfilled to activate a parametric output.

Sample configurations

Shift light

RPM	Condition	Value(RPM) 7300 📑	RPM 7300	Hist.[RPM]
	C AND	C OR		
Source 2	Condition	Value[V] 4.02 =		Hist.[V]
lescription arametric output allows to activa onditions. Parametric output is m round to pin 19 <mark>1</mark>	te selenoids or apped onto Po	other devices, a wer Out #2. Do r	ccording to not forget to	user defined connect additior

When the engine exceeds 7300 revolutions, the LED diode will turn on. When the RPM drops under 7100, the LED will turn off.



Activation of the Nitrous Oxide Systems (NOS)

Source 1	Condition	Value[V]	AFR	Hist.[V]
Analog in #3	• > •	4.02	18.0	4.02
	AND	O OR		
Source 2	Condition	Value[RPM]	RPM	Hist.[RPM]
RPM		3000 🗄	J3000	200 🛨
Description 'arametric output allows to ar onditions. Parametric output round to pin 19.	ctivate selenoids o is mapped onto P	rr other devices, a ower Out #2. Do	according to not forget to	user defined connect additio

In Analog In #3, the TPS sensor is connected. The NOS system activates when the throttle body is fully open (TPS voltage over 4.0V) and RPM exceeds 3000.

14. Modification of frequency signals

Digital Ecu Tuner 3 has a wide range of configurations, which allow to modify and generate the frequency signals:

- 1. Modification of the frequency signal using Fuel Table,
- 2. Generating the frequency signal using Fuel Table, used for the MAF to MAP conversion.
- 3. Clamping of the upper and lower value of the input frequency, used for removing electronic road speed governor (modification of the VSS signal).
- 4. Generating the output signal for the electronic tachometer, based on the current engine speed.

14.1. Modification of the frequency signals using the Fuel Table.

To modify frequency from the flow meter or frequency map sensors, connect signal to the *Frequency In* input. In most cases it will be necessary to connect the pull-up resistor, as most of the sensors are *open collector* type.



Depending on the frequency range of the sensor, it is possible to use one of two modes of the signal's value change: **linear** or **nonlinear**. For a linear mode, frequency change is linear, proportional to the product of the map's value and the value of the **Base Unit**. Also, value of the output signal is limited in the range defined by the **Freq. Min and Freq.Max** units. This mode is used for sensors with frequency range not higher than 500Hz.

Frequency con	iguration				
Modify frequency	input (fuel map), linear)			-
This mode is used Freq. Max and Fr table. Base unit is	d for frequency eq. Min value, a the minimal ste	signal modi and modifie pin Hertz (fication. The f d (in additive t ∦ modification	irequency is way) using F).	clamped to fuel Map
Parameters Freq. Min[Hz] Base unit[Hz]	17 × 4 ×		Freq. Max[H RPM Multipl	Hz] 4000 lier 1.000	
		Apply			Cancel

FreqOut = FreqIn + MapValue * Base Unit

- If (*FreqOut < FreqMin*) *FreqOut = FreqMin*
- If (FreqOut > FreqMax) FreqOut = FreqMax

3 Frequency configuration	×			
Frequency modification type				
Modify frequency input nonlinear (fuel map, non linear)				
This mode is used for frequency signal modification. The frequency is clamped to Freq. Max and Freq. Min value, and modified (in additive way) using Fuel Map table. The minimal step is non linear and is 1Hz for table value 1, 100Hz for table value 50,				
Parameters				
Freq. Min[Hz] 17 Freq. Max[Hz] 4000				
Base unit[Hz] 4 RPM Multiplier 1.000				
Apply OK Cancel				

In the nonlinear mode, table values are rising in the exponential way. There is a comparison of the frequency change value for the linear and nonlinear mode on the chart below:

FreqOut = FreqIn + F(MapValue)

If (**FreqOut** < FreqMin) **FreqOut** = FreqMin If (**FreqOut** > FreqMax) **FreqOut** = FreqMax



It is possible to preview the nonlinear values on the map. To do this, click the right mouse button on the map area and choose Display As/ Frequency on the context menu.

14.2. Generating the frequency signal using the Fuel Table.

In the frequency MAF sensor to analog MAP sensor conversion, choose the frequency generating mode. The output frequency is generated based on the fuel table values. Frequency of the generated signal is calculated in the non linear way. For this mode, input signal from the *Frequency In* input is ignored.

S Frequency configuration	×
Frequency modification type	
Generate frequency output (fuel map, non linear)	•
This mode is used for frequency MAF to MAP conversion. The output signal is generated based on Fuel Map.	:
Parameters	
Freq. Min[Hz] 1 Freq. Max[Hz] 2000	
Base unit[Hz] 2 RPM Multiplier 0.250	
Apply OK Canc	el

FreqOut = F(MapValue)

If (FreqOut < FreqMin) FreqOut = FreqMin

If (FreqOut > FreqMax) FreqOut = FreqMax

The chart below presents the dependency between values on the table and the output frequency.



14.3. Clamping the upper and lower value of the input frequency.

When "clamping" the frequency signal value is necessary (for example, removing road speed governor by limiting frequency of the VSS sensor) it is advised to use "*Clamp VSS frequency signal*" mode. This mode doesn't require the Fuel Table, so this table can be used for other purposes.

A Frequency configuration	×
Frequency modification type	
Clamp VSS frequency signal	•
This mode is used for removing speed limit (clamping VSS signal frequer	ncy).
Parameters	
Freq. Min[Hz] 1 - Freq. Max[Hz] 2000	
Base unit[Hz] 2 PDM Multiplier 0.250	3
	-
Apply OK	Cancel

FreqOut = FreqIn

- If (FreqOut < FreqMin) FreqOut = FreqMin
- If (FreqOut > FreqMax) FreqOut = FreqMax

An exemplary wiring diagram of the VSS sensor connecting.



14.4. Generating the output signal for digital tachometers.

It is possible to generate frequency signal for digital tachometers (where signal is received from ECU and not from the ignition coil.) Frequency of the output signal depends on the current engine speed multiplied by the *RPM Multiplier* factor, which is used for adjusting the signal to a specific tachometer.

S Frequency configuration	X
Frequency modification type	
Generate RPM output	-
This mode is used for generating frequency output used for digital tachometers based on RPM signal. Output frequency equals to RPM multiplied by RPM Multiplier.	
Parameters	
Freq. Min[Hz] 1 Freq. Max[Hz] 2000 a Base unit[Hz] 2 a RPM Multiplier 0.250 a	
Apply OK Cancel	

FreqOut = RPM / 60 * RPM_Multiplier

15. Scales configuration

There is an option to connect different kinds of sensors, which represent voltage, pressure, temperature, AFR, etc. to the analog inputs. Basic unit of the input signal measurement is voltage in Volts. However, it is easier to use signals with the value expressed in units, which are measured by the signal (for example pressure in Bars). And for this purpose, scales of the analog inputs can be used. To find the window with scale choices, choose *Setup* from the menu, and then *Scales Configuration*. In this window, it is possible to choose a proper scale for every analog input. The choice is: voltage scale, proportional percent scale (for example for TPS), pressure sensors (for example, MPX4250AP, GM 115kPa, Greedy 3Bar), temperature sensors, AFR (narrow band, Zytronix WBO, linear wide band sensor 10-20). The chosen set of scales can be saved in a folder using the option *Save*. It is also possible to load a set of scales, which will be automatically loaded at client start-up.

Scales configratio	n		×
Deflection	MOTOROLA MPX4250 MAP SENSOR		Load
Analog IN #1	LINEAR VOLTAGE SCALE 0-5V		Load
Analog IN #2	LINEAR VOLTAGE SCALE		Load
Analog IN #3	WIDE BAND SENSOR AFR 10-20		Load
Default scales	ini\defaultscales.ini		Load
Save	Load	ОК	Cancel

16. Signals logging

Datalogger is a basic tool used during tuning of a car. It helps to trace the changes of signals, which are being logged and modified, and make decisions about the modifications of the tables.

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Using extra analog inputs, with the help of the external WBO controller, it is possible to log a current composition of the mixture (AFR). It is also possible to configure proper scales for every input, which will cause a display of the signal values in the real units (for example pressure in Bars). More information about scales can be found in the chapter **Scales Configuration**. Also, it is possible to save and read the saved logs on the disc. This can be done in the *File / Load Log, File / Save log* menu.



- 1. Log's area with the signals' graph logged in,
- 2. Scales ascribed to signals. The color of a scale matches the color of a logged in signal,
- 3. Values currently indicated by the point of the cursor's log,
- 4. Menu (right mouse button) allowing to perform manipulations on a log:

Hide all	Hides all logged in values		
Show all	Shows all logged in values		
Convert MAF to MAP	Converts data from of the analog flow meter to MAP		
	sensor using the Fuel table		
Convert FREQ MAF to MAP	Converts data from the frequency flow meter to M		
	sensor using the Fuel table		
Dyno start marker	Marking the beginning of the area of the log used fo		
	generating the dyno graph		

Dyno end marker	Marking the end of the log used for generating the dyno	
	graph	
Make dyno graph	Generating the dyno graph	

- 5. Area marked by using the Dyno start/end marker option,
- 6. Options of displaying the device's outputs and inputs on the log. Every signal is logged, even when it's not marked as a displayed signal. *Smooth Graph* option switches on filtering of the displayed data, which causes the straightening of the curves. *Enable log* option turns the logging on/ off. It is important that rewinding and analyzing of the log is possible only when the option *Enable Log* is turned off.
- 7. Zoom In / Zoom Out zooming in or zooming out of the graph area.

17. Road dynamometer

It is possible to generate the torque and power graph on the **vehicle's wheels**, based on the data from the data log. Additionally, it is possible to put any signal from the analog inputs on a graph. To do this, it is required to drive on a flat fragment of the road, which will allow the car to accelerate on a given gear in the full rotational speed of the engine. Next, choose a proper configuration of the car's parameters (*Dyno/Parameters menu*):

Dyno paramters		X
Car parameters Car name: Undefined	Gearbox and tires Gear ratio	Trans. and tires losses RPM Losses (hp) 2000
Coefficient of drag0.29Frontal area (m2)2.20Car Mass (kg)1250RPM ratio0.0217	Tire section width (mm) 185 # Tire profile (%) 60 # Wheel diameter (inch) 15 # Calc. RPM ratio	3000 0
Filters Analog In#1 Filter Analog In#2 Filter Load Save	Analog In#3 Filter 1 -	3000 0 9000 0 10000 0 0K Cancel

First, RPM ratio factor should be calculated. It is the value which, multiplied by the rotational speed of the engine, will give a current speed of the car:

RPMratio = V / RPM,

where V is the vehicle's speed in km/h, and RPM is the rotational speed of the engine. Another method is giving the precise parameters of the gear box and tires of a car. (*Gearbox and tires section*).

Gear ratio	The difference in rotational speed from the input to the output shaft		
Driving axle gear ratio	Main gear ratio		
Tire section width	Tire's width in millimeters		
Tire profile	Profile of a tire		
Wheel diameter	Wheel diameter in inches		

After filling the table with parameters, press *Calc. RPM ratio* button. Another important parameter is the car's mass (*car mass*), which should be given in kilograms. It is possible to do a correction according to the car aerodynamics. To use this function, activate the *"Enable aerodynamic correction"* option and then configure the parameter of the resistance factor (*Coefficient of drag*) and the frontal area of the car (*Frontal area*). This data can be found in the catalogue information of the car.

For example, for Opel Astra (Astra Vauxhall) these values are 0.28 and 2.06 m2. For Audi A3 0.31 and 2.13 m2, respectively. There is also an option to correct the graph concerning the car's rolling resistance. It is important though to have data about the loses on a given gear in the revolutions function (for example, a graph from the roller dynamometer with the loss put on it). Next, these data should be written in the *Trans and tires looses* table.

To activate the correction concerning the resistance on the graph, select the *Enable trans. losses corr.* checkbox.

It is also possible to set filtering of the analog inputs signals, which will also be placed on the power graph. In the *Filters* section, values are describing filtering power. The higher the value is, the more smooth the analog inputs graphs are. The defined parameters can be saved by using the Save option and read in again by using the *Load* option. To generate the dyno graph, data should be collected in the first place. To do this, press the *Start Dyno* button in the log bookmark. After finishing measuring the drive, press the *End Dyno*. Button. It is also possible to generate the power graphs from a normally collected data log. However, in the "Dyno" mode, the software is able to collect more precise data. Next, an area, from which the graph will be generated, should be marked. It is important to make sure that the marked graph is the monotonic function. To mark the log area, click the right mouse button in the chosen area and choose an option: either *Dyno*

Start Marker or *Dyno End Marker*. The marked area will be highlighted in blue. Next, choose the *Make Dyno Graph*. Now we can choose tab Dyno (F6 button) to see the graph.

A correctly marked area from which a power graph will be generated is presented below.



If the input data will be "disturbed" (noisy graph of the rotation speed), the parameter *Filter Power* should be increased.

The generated graph can be exported to a folder in a BMP format. To do this, choose *Export Dyno Graph as BMP* option from the *Dyno* menu.





It is also possible to export text data in CSV format for further analyzes in other programs (eg. Microsoft Excel). To do this, choose *Export Dyno Graph to CSV file* option from the *Dyno* menu.

18. Launch control

Launch control function (starting procedure) is used to set the optimal starting engine speed (for a given RPM the ignition is cut off). In turbocharged engines, it also enables the increase of the boost pressure at the start thanks to retarded ignition and an increased fuel dose.

CAUTION:

Using the *launch control* function in the turbocharged engines may damage the turbocharger.

To configure the *launch control*, enter the "*Setup*" menu and choose "*Launch control configuration*" option. To activate the function, select the activation input. There is also a possibility to turn the launch control off, when the car speed is greater than the defined value (VSS sensor must be connected to the Frequency In input of DET 3).

3 Launch control	configuration		×
Launch control			
Activation input	Analog in #1		•
Activation RPM Cut off RPM	1000 ÷ 5000 ÷	Ignition retard Fuel enrichment	
Enable VSS co	ontrol		
VSS Limit (Hz)	5 •		
Description			
To activate launch active when the vo	i control select a bitage on selecte	ctivation input. Laund d input is greater tha	ch control is n 4.8V.
	Apply	ОК	Cancel

Parameter	Description				
Activation input	Analog input used for activating the launch control function				
Activation. RPM	Engine speed which the ignition retardation and the fuel mixture				
	enrichment takes place				
Cut off RPM	Engine speed when the ignition will be cut off				
Ignition Retard	Ignition retard angle during the staring procedure				
Fuel Enrichment	Value added to the current Analog Out value				
Enable VSS control	Enable vehicle speed sensor (VSS) control over launch control				
VSS Limit	Frequency (in Hz) of Frequency In input, above launch control function				
	will be automatically turned off				

Wiring diagram



To activate the launch control, apply 5V voltage to a chosen analog input.

19. Scope

DET 3 device has a possibility to analyze the trigger signal from the *Ignition #1* input. To activate this feature, choose the *Scope* ignition mode from menu (*Setup/Ignition configuration*), and the

Ignition input type suitable to sensor type. In this mode, the signal from the ignition input is copied to the ignition output, what allows to run the engine, but there is no possibility to modify ignition advance nor to store tables using the *Make maps permanent* function.

JCOPC			-
In this made sensor sign is stored in device memo	al is copied to the igr ry. This information o	ntion outputs, and information a can be obtained using Scope to	bout trigger patterr col.
Ignition input configura	ion		
Ignition input type	VR Sensor adapt	ive threshold	-
General Maximum RPM	7000 -	Maximum retard(dec)	15 -
Num signals per 720	35	Maximum advance(deg)	15
Max RPM ever	0	Reset RPM	
	n represented on ma	pYaxis.	

After selecting the Scope ignition mode, the button Get Data from Scope window (menu Tools/ Scope) is enabled. To gather signal information, press Get Data button. The gathered signal waveform appears. The amplitude of the signal doesn't represent the amplitude of the real signal.

න් Scope	X
Tconst = 1ms DT = 33.33ms RPM = 1800 CT = 41.15ms	
<pre></pre>	
Selection start (uS) Selection end (uS) 6930 40260 Save,	Zoom In Zoom Out Get data OK

The user is able to get additional signal information by selecting the area of interest by using the mouse. In the parameter window, there appears the waveform parameters:

DT – selection duration,

RPM – engine speed if the selected signal represents the whole revolution,

CT - current time of waveform.

Waveforms can be saved using the Save... button for further analysis.

20. MAF (0-5V) to MAP conversion

To make the conversion, connect MAF sensor to one of the analog inputs of DET 3.As a load connect map sensor.

In the example bellow, the MAF sensor is connected to the Analog input #1 and the MAP sensor to the Analog input #4



Configuration of the fuel table and analog output at this stage should look as follows:

🐴 Setup tables				×					
Fuel Table Modify	Analog in #1	- PWM Table #1-			4	3 Analog output cor	nfiguration		×
Load Correction #1 Correction #2	Analog in #4 Analog in #3 Disable	Load Correction #1 Correction #2	Analog in #2 Analog in #3 Analog in #4	•		Analog Out Min [V] Analog Out Max [V]	0.00 + 5.00 +	Analog Out Offset [V] 0.00	
Ignition Table	Analog in #2	- PWM Table #2-	Analog in #2	-		Force startup outp Startup Value [V]	put value	Analog signal modification step [\ 0.0195V	1 •
Correction #1 Correction #2	Analog in #3	Correction #1 Correction #2	Analog in #3 Analog in #4	•					
This configuration given table.	window allow to configure what signal will ac	t as deflection, corre	ection and what signal will be modified	l for					
1		A	pply OK Can	cel			Apply	OK Cancel	

Next, choose the *Log tab*, press the *Clear* button (to reset the previous log) and then take a ride. The data gathered during the ride will be used to generate the conversion table, so it is very important to drive with diverse load and RPM). After the stage of data gathering, on the log window press the right mouse button and choose *Convert MAF to MAP option*. Fuel table will be created, which has to be saved in the devices memory (*MAKE MAPS PERMANENT*). It is also important to change settings in the tables and analog output configurations (set the *Analog out offset* value to 2.490V and the value of *Modified* to ZERO).

!	W

Warning:

During data gathering engine should have the working temperature.

🐴 Setup tables				×		
Fuel Table Modify	Zero	- PWM Table #1 -			Analog output configuration	×
Load Correction #1 Correction #2	Analog in #4 Analog in #3 Disable	Load Correction #1 Correction #2	Analog in #2 Analog in #3 Analog in #4		Analog Out Min [V] 0.00 *	Analog Out Offset [V]
Ignition Table-	Analog in #2	- PWM Table #2-	Analog in #2		Force startup output value Startup Value [V] 0.00	Analog signal modification step [V] 0.0195∨ ▼
Correction #1 Correction #2	Analog in #3	Correction #1 Correction #2	Analog in #3			
This configuration given table.	window allow to configure what signal will ac	as deflection, corre	ction and what signal will be modified for			
		Ap	pply OK Cancel		Apply	OK Cancel

Corrections on the map should be made if needed (special attention should be paid to the idle revolution). Additionally, using the air temperature sensor in the intake manifold, it is possible to make correction of the fuel dose, depending on the intake air temperature (lower the fuel dose when the temperature of the intake air rises).

CAUTION:

In some cars, ECU checks the value of the signal from the flow meter just after the car's start. DET 3 needs about 6ms for initialization. During this time, on the analog output, there is the value from the analog input. In our case, it will be 0V. To avoid the ECU limp mode, in the device's configuration Force Startup Output Value option should be set, and later, in the Startup Value set the MAF sensor voltage of non running engine.

21. Conversion of the frequency MAF into analog MAP sensor

To make the conversion, connect the frequency MAF sensor to the *Frequency In* input and analog MAP sensor to the one of the analog inputs (load). In most cases, signal from frequency MAF will

require a pull-up resistor at the Frequency input. In the example below, MAP sensor is connected to the analog input #4.



Fuel table and analog output configuration at this stage should look as follows:

🛃 Setup tables				×	1
Fuel Table Modify	Frequency	PWM Table #1-			Frequency configuration
Load	Analog in #4	Load	Analog in #2	-	Frequency modification type
Correction #1	Analog in #3	Correction #1	Analog in #3	•	Modify frequency input (fuel map, linear)
Correction #2	Disable	Correction #2	Analog in #4	•	This mode is used for frequency signal modification. The frequency is clamped to
Ignition Table		PWM Table #2-			ried, max and ried, min value, and modified (in additive way) using rule map table. Base unit is the minimal step in Hertz of modification.
Load	Analog in #2	Load	Analog in #2	•	
Correction #1	Analog in #3	Correction #1	Analog in #3	-	Parameters
Correction #2	Analog in #4	Correction #2	Analog in #4	•	Freq. Min[Hz] 1 Freq. Max[Hz] 2200 F
This configuration given table.	window allow to configure what signal will a	ict as deflection, corre	ection and what signal will be modi	ified for	Base unit[Hz] 2 👷 RPM Multiplier 0.250 🗶
,		A	pply OK C	ancel	Apply OK Cancel

Next, choose Log tab, press the Clear button (to reset the previous log) and then take a ride. The data gathered during the ride will be used to generate conversion table, so it is very important to drive with diverse load and RPM). After the stage of data gathering, on the log window press right mouse button and choose Convert Freq MAF to MAP option. Fuel table will be created, which has to be saved in the device memory (*Make Maps Permanent*). It is also important to change settings in the table configurations and Frequency options.

Warning:

During data gathering, the engine should be at operating temperature.



Setup tables	
Fuel Table Modify	Frequency configuration
Load Analog in #4 Image: Correction #1 Image: Correction #2 Image: Correction #2 <th>Frequency modification type Generate frequency output (fuel map, non linear) This mode is used for frequency MAF to MAP conversion. The output signal is generated based on Fuel Map.</th>	Frequency modification type Generate frequency output (fuel map, non linear) This mode is used for frequency MAF to MAP conversion. The output signal is generated based on Fuel Map.
Load Analog in #2 Image: Connection #1 Analog in #3 Image: Connection #2 Analog in #4 Image	Parameters Freq. Min(Hz) 1 Freq. Max(Hz) 2000
This configuration window allow to configure what signal will act as deflection, correction and what signal will be modified for given table. Apply OK Cancel	Base unit[Hz] 2 RPM Multiplier 0.250 Apply 0K Cancel

Corrections on the map should be made if needed (special attention should be paid to idle revolution). Additionally, using the air temperature sensor in the intake manifold, it is possible to make correction of the fuel dose, depending on the intake air temperature (lower the fuel dose when the temperature of the intake air rises).

22. Document history

Version	Date	Changes
1.0	2016.11.08	Initial release
2.0	2024.08.28	New Ecumaster standard layout applied