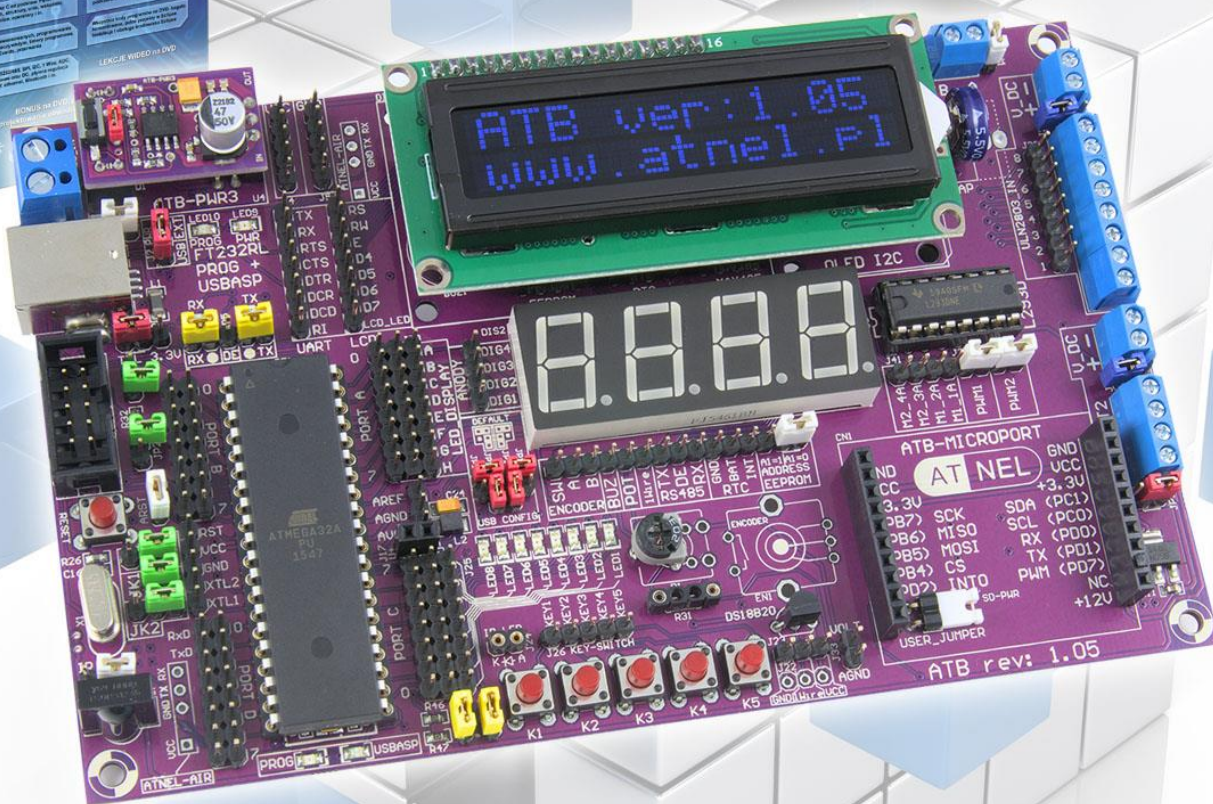


ATNEL

Mirosław Kardaś



[MANUAL - ATB 1.05]

Basic information regarding ATB sets ver. 1.05. Description of modules included in the design. Detailed board and modules schematics. Methods of power supply and connection of the modules. Recommended literature along with links to video guides.

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Components of the ATB set

The set includes:

1. Hardware USBasp programmer
2. ATB-PWR3 converter - choice in range of +5 V / +3,3 V (it is possible to mount ATB-LION)
3. USB/RS232 converter based on FT232RL (full RS232 with RS485)
4. ATmega32A microcontroller
5. Replaceable quartz resonator with a stand - 11,0592 MHz
6. RESET button
7. External programmer connector (KANDA type)
8. V-USB
9. 8 green LED diodes
10. IR receiver - 36 kHz
11. IR diode transmitter
12. LCD display 2x16 (blue)
13. 7-segment LED display (red)
14. Tact-switch buttons (5 pcs.)
15. Potentiometer 20k
16. Digital temperature sensor - DS18B20
17. EEPROM memory - 24C04
18. Clock and calendar chip based on PCF8583
(possible to replace with: PCF8563, DS1307+, DS1337+)
19. MAX485 (SN75176)
20. Gel capacitor 0,22 F
21. Power driver ULN2803
22. ATB-Microport juncture (new!)
23. HUB-USB - 2 ports
24. Software: MkAvrCalculator - full license
25. Software: MkBootloader - full license

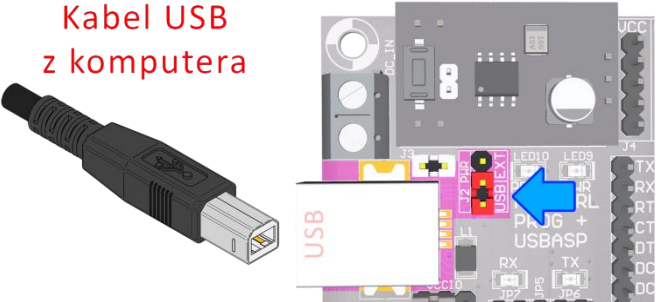
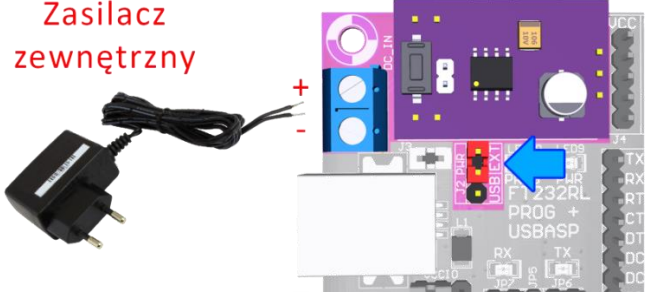
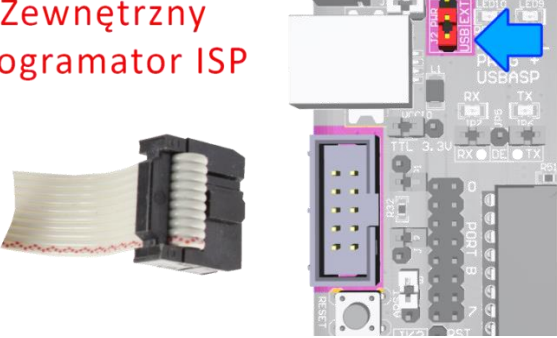
Methods of power supply

Every ATB set in basic version with ATB-PWR3 converter installed can be powered from one of the three following sources:

1. Type A-B USB cable (printer type) connected to PC (default power supply mode)
2. External power source of 12V with use of ATB-PWR3 converter
3. External KANDA tape – power supply from the programmer

The source is selected by using J2 PWR jumper allowing to switch between USB and EXT. By default USB is selected as the source.

In case of use ATB-LION (providing buffered power) and lack of external power - its possible to use Li-Ion batteries and LiPo. It is also possible to use it without any batteries by just connecting external charger to micro USB port (i.e. from mobile device or to USB port in PC).

(1)	<p>Kabel USB z komputera</p>  <p>1. USB cable from the computer</p>
(2)	<p>Zasilacz zewnętrzny</p>  <p>2. External power source</p>
(3)	<p>Zewnętrzny programator ISP</p>  <p>3. External ISP programmer</p>

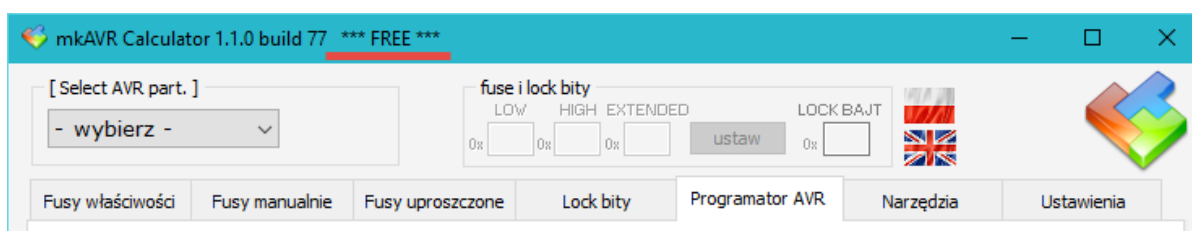
First run - testing the set

All recommended steps allowing to properly test the primary components of the ATB set are described in this chapter.

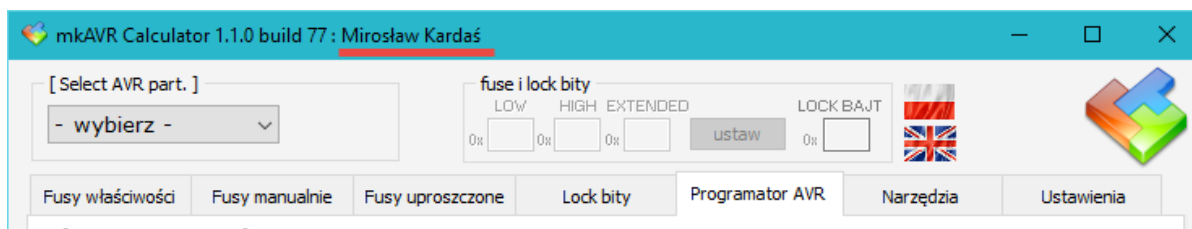
MkAvrCalculator software - license

For performing operations on microcontroller i.e. reading, programming, checking proper behavior, it is necessary to always use up-to-date MkAvrCalculator software which can be downloaded from <http://atnel.pl/mkavrcalculator.html>. Once downloaded, unpack it to destination folder of your choice. After download, the software runs in FREE/DEMO mode by default. Everyone who bought ATB set, receive a license file via email (lic.dat) for MkAvrCalculator software. In order to activate this license – place the file in a folder which contains the software. Once it is done and the software is restarted it will be running in FULL version mode which allows to interact with every AVR microcontroller including Atmega32 mounted in the ATB set.

Screenshot of software running in FREE version (*without license*)



Screenshot of software running in FULL version (*with license*)

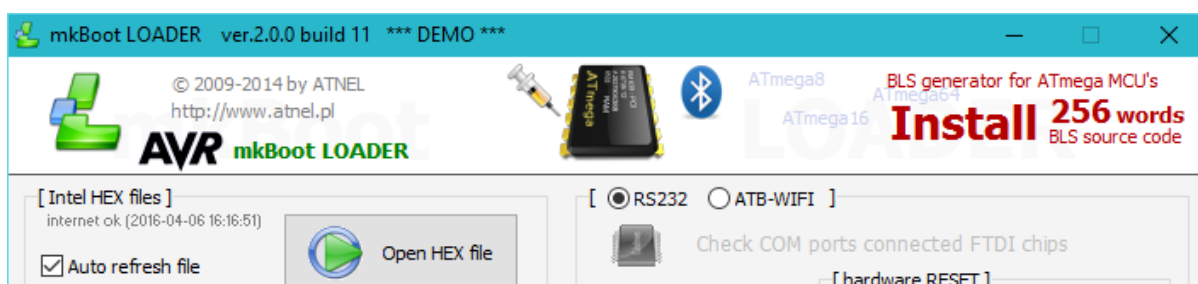


Before further interacting with the set, software should be installed on a computer which will allow for fully automated installation of digitally signed drivers for build-in USBasp programmer. The installation will take place completely automatically.

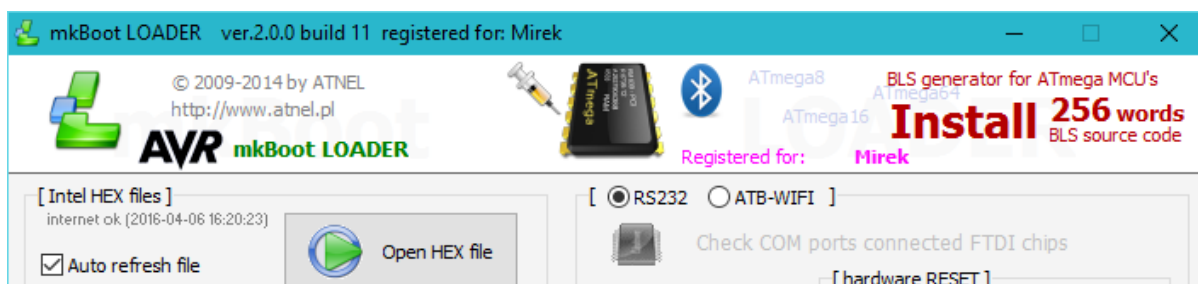
MkBootloader software - license

It is necessary to always use up-to-date MkBootloader software which can be downloaded from <http://atnel.pl/MkBootloader.html>. Once downloaded, unpack it to destination folder of your choice. After download, the software runs in FREE/DEMO mode by default. Everyone who bought ATB set receive a license file via email (lic.dat) for **MkBootloader** software. In order to activate this license - place the file in a folder which contains the software. Once that is done and the software is restarted it will be running in FULL version mode.

Screenshot of software running in FREE version (without license)

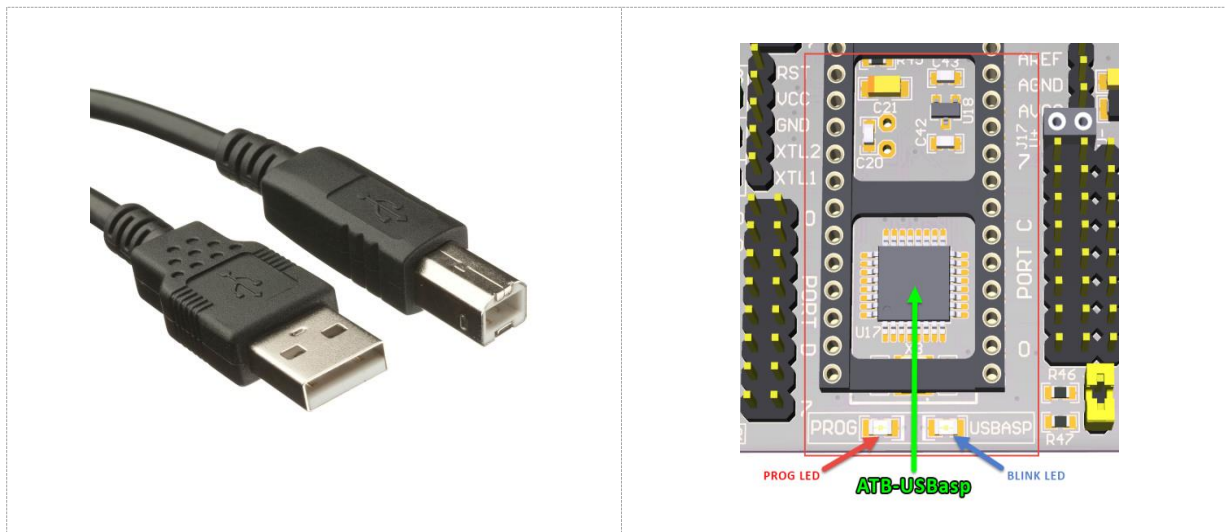


Screenshot of software running in FULL version (with license)



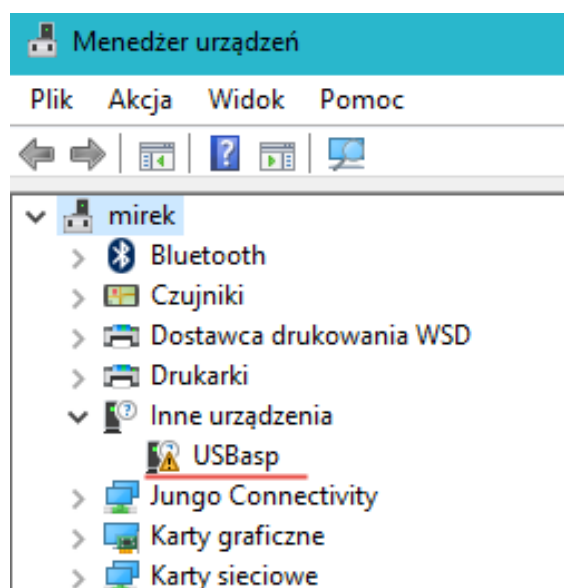
Build-in ATB-USBasp programmer

Every ATB set since version 1.05 contains build-in hardware ATB-USBasp programmer! By default, the programmer is immediately active and does not require any extra cables. Just connect ATB to PC with type A-B USB cable (printer type). Programmer is positioned under Atmega32 holder.

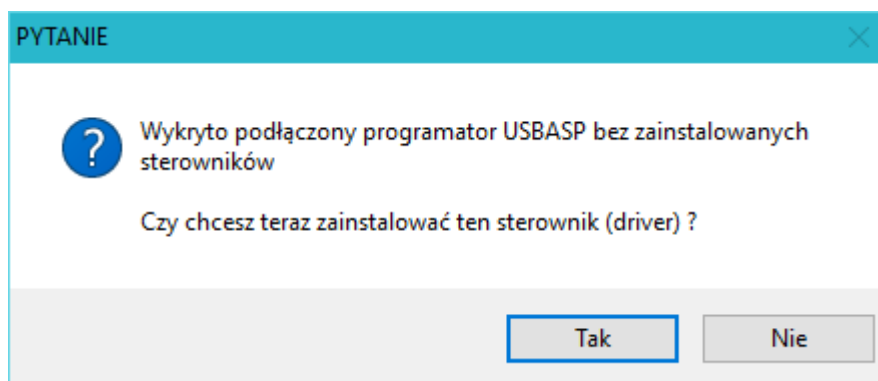


Installing drivers for build-in USBasp programmer

If you have not had previously installed USBasp drivers in your system, then thanks to MkAvrCalculator software, you just need to connect ATB-module to PC and enjoy fully automated installation of digitally signed drivers. If, while connecting the module to PC, MkAvrCalculator software was not running then Windows will notify you about newly discovered USB hardware. Drawback here is that the device will show missing appropriate drivers.



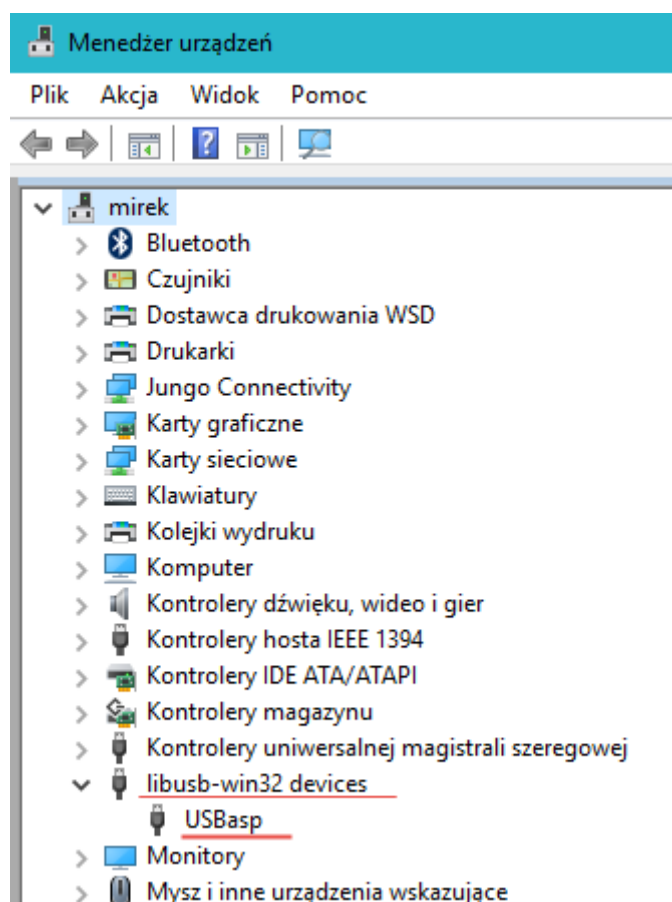
In this case you just need to start MkAvrCalculator software which will automatically detect missing USBasp drivers. User will be prompted with:



4. USBasp programmer has been detected without drivers. Do you want to install this driver now?

In response to acceptance of the operation, MkAvrCalculator will attempt to install the drivers. This will result in installation of digitally signed drivers which can take up to 30 sec.

Once completed, the following will be shown in Windows Device Manager:



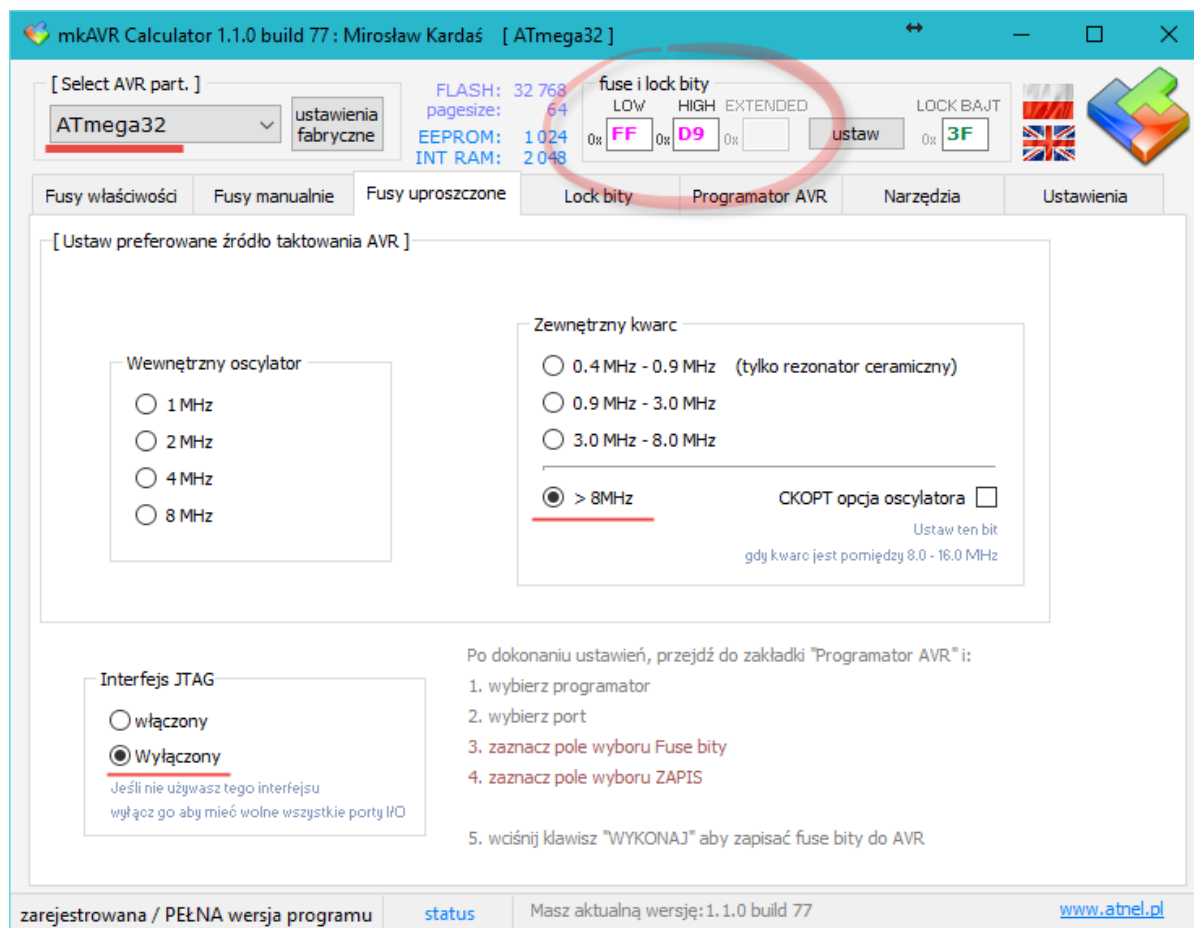
This confirms that the operation has completed successfully and allows to continue work with use of build-in or external USBasp programmer.

These drivers work with any USBasp programmers which are fully compliant with USBasp standard.

ATB set fusebit settings

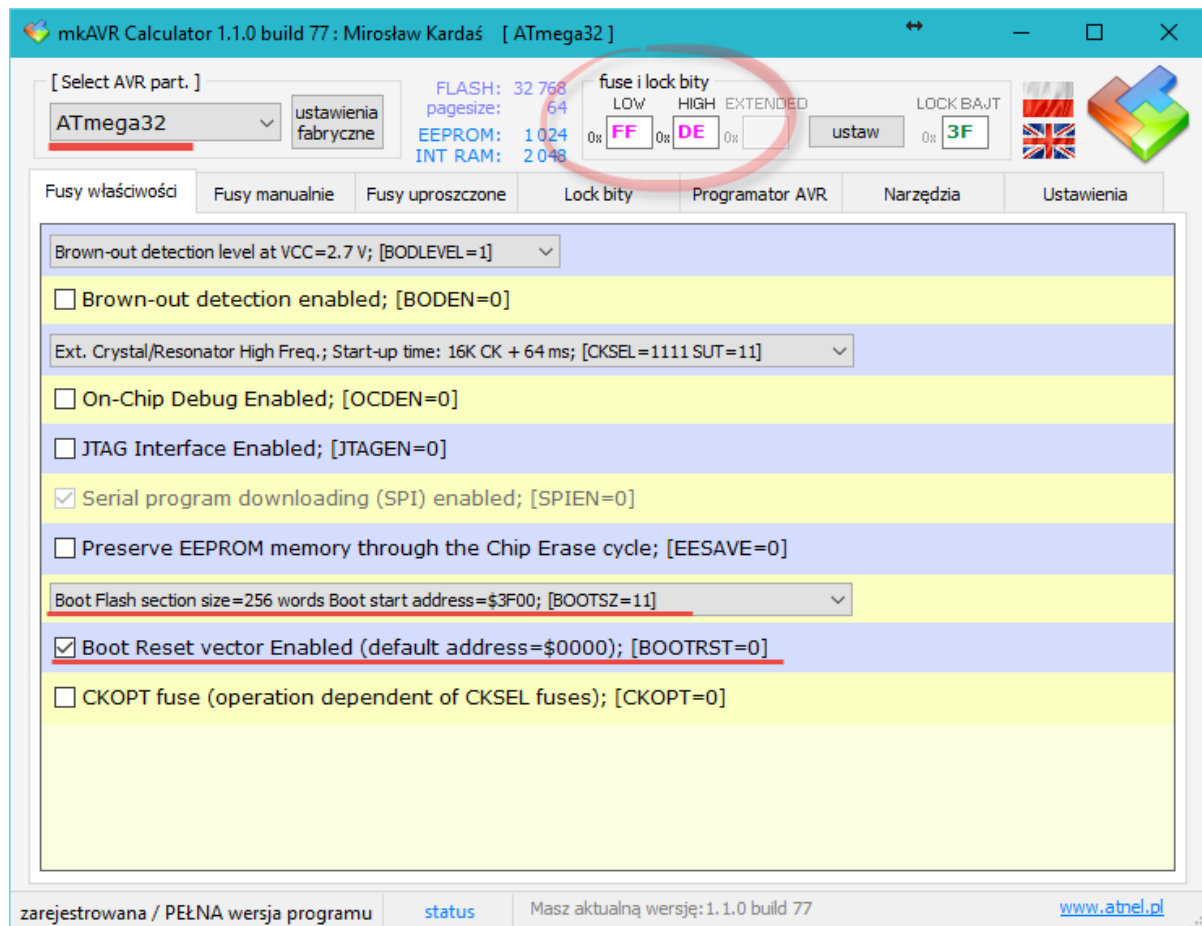
Every Atmega32 microcontroller mounted by Atmel corporation in the ATB set has fuse settings different from factory defaults. Changes include:

1. Enabled external clocking source (quartz 11,0592 MHz included in the set)
2. Disabled JTAG.



BLS reading- first test of proper operation of the microcontroller

Every Atmega32 microcontroller mounted by Atmel corporation in the ATB set has changed fusebits responsible for placing the bootloader in a Flash memory, as well as its automatic start after the reset. A bootloader is also uploaded into the mounted microcontroller.



Testing the set

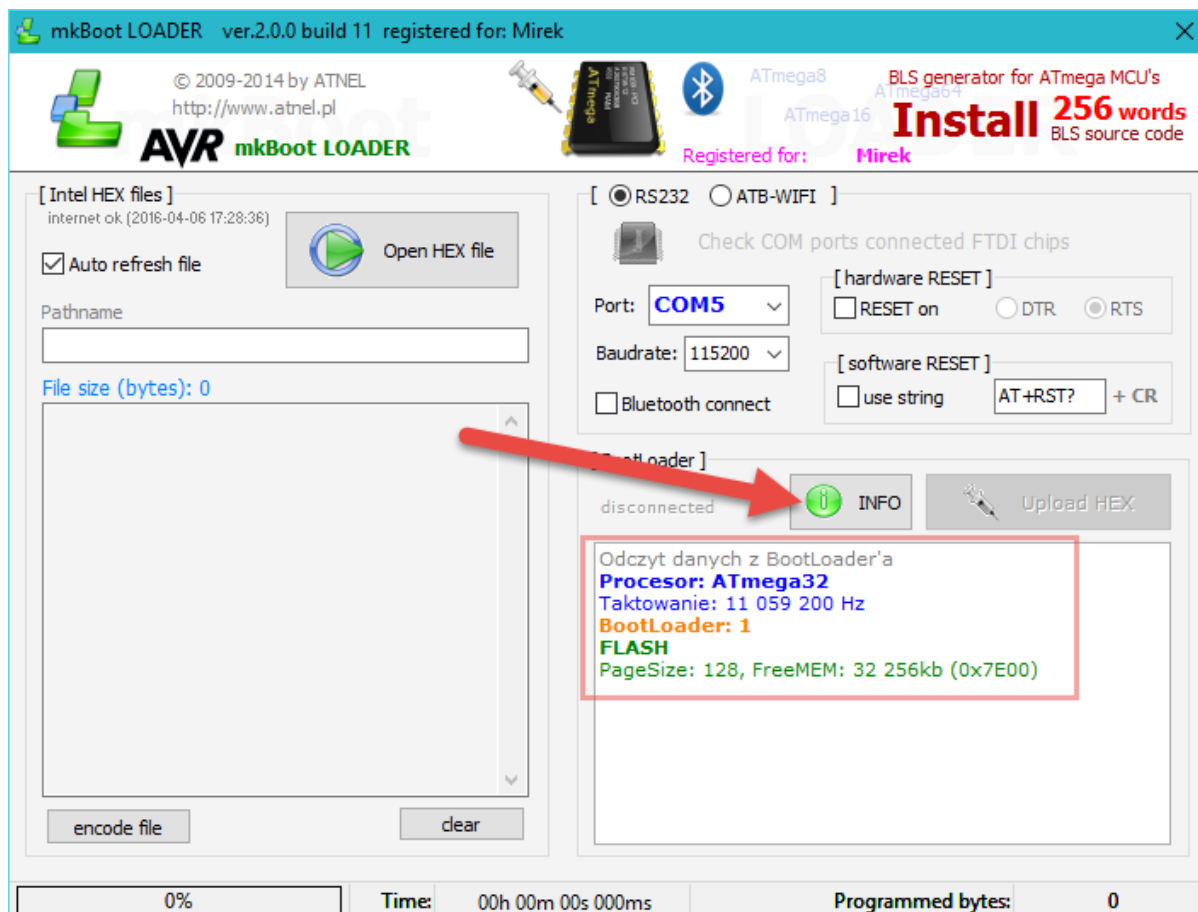
In order to test proper work of not only the microcontroller but also the of the USB/RS232 adapter mounted in the ATB set, it is necessary to perform the following:

1. Connect the ATB set with a USB cable to a computer.
2. Set the power supply voltage of the **J2 PWR** jumper in **USB** position.
3. Check if the yellow jumpers **[JP6]** and **[JP7]** just above the microcontroller are closed.
4. Start MkBootloader.
5. Set the MkBootloader in RS232 work mode.
6. Select the transmission Speed (baudrate) 115200 in settings.
7. Select the correct COM port no. (show in MkAvrCalculator).
8. Press INFO key in the MkBootloader.

Screenshot of MkAvrCalculator, showing COM port no., presenting COM port no. which has been assigned to the connected USB/RS232 adapter from the ATB set.



In this case, select the COM port specified in the MkBootloader and press the INFO button. As a result of this action you will see the response from the microcontroller.

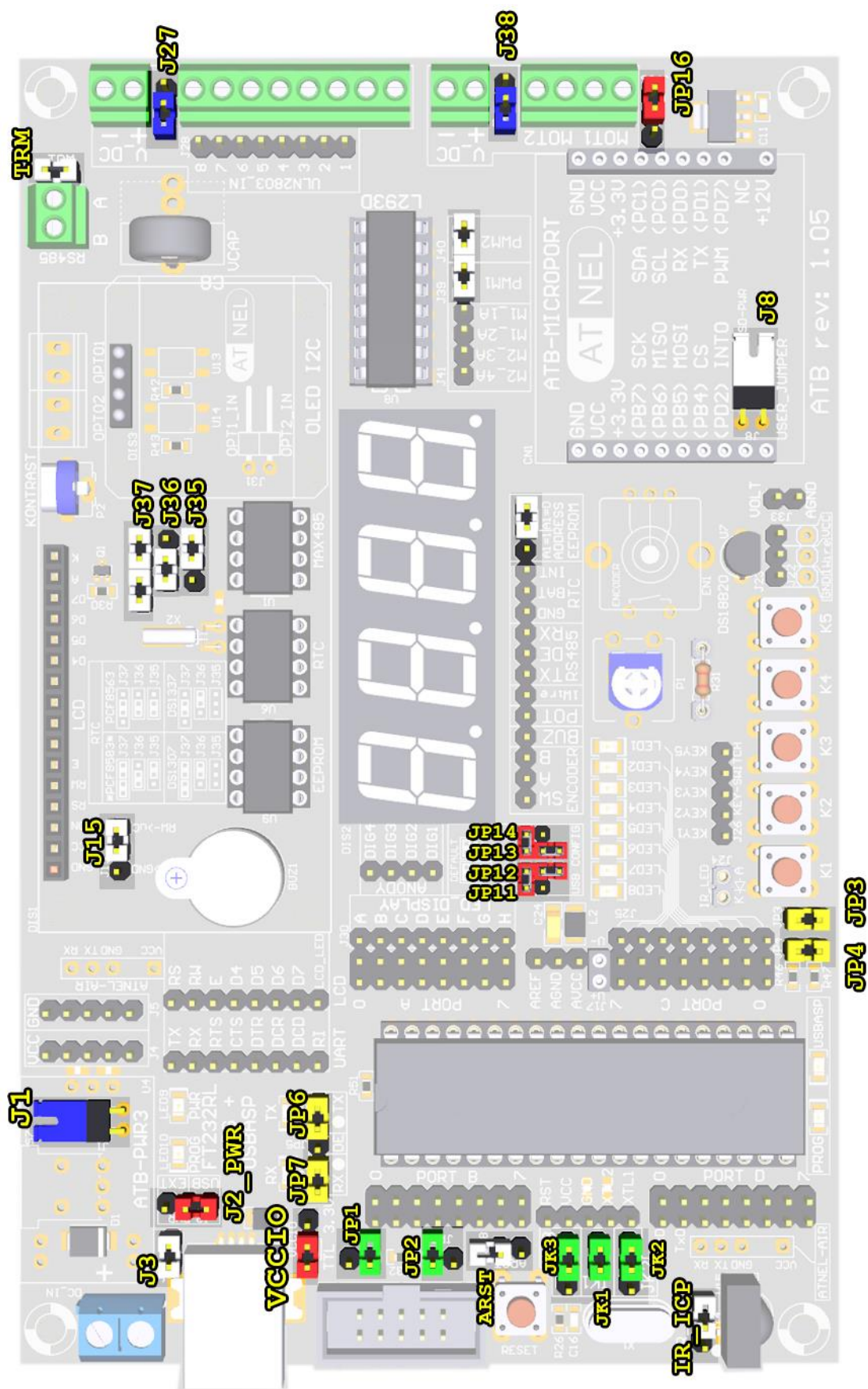


A response from the microcontroller is visible in the red frame. This confirms the correct operation of the microcontroller and the USB / RS232 adapter.

Warning! First upload of your own software to the microcontroller, even the flashing LED, erases BLS (bootloader) in the microcontroller, so you cannot repeat the test described above. But do not worry about this situation, because the BLS (bootloader) can be uploaded at any time. To do this, take a look at the guide on youtube: <https://www.youtube.com/watch?v=1KcyLMuvchQ>.

Jumpers in the ATB set

View from the top of the ATB set ATB and the default settings of all jumpers.



Description and functions of the jumpers:

(asterisk) * - default condition of a jumper, when the ATB set is released from the factory.

GREEN jumpers – microcontroller configuration

- JP1** - **closed**, INT2 (PB2) processor input is connected to KANDA
open *, PB2 input is not connected to KANDA
- JP2** - **closed**, SS (PB4) SPI data bus input is connected to KANDA
open *, PB4 input is not connected to KANDA

JK1 , JK2 , JK3 - **configuration of microcontroller clocking** in accordance with the below table:



5. External quartz - External TTL generator - External RC oscillator

BLUE jumpers – connected with power supply line +12 V

- J1** - **closed** *, when a S1 side switch is not soldered.
open, when a S1 side switch is soldered.
- J27** - **closed**, power supply +12 V is connected to ULN2803
open *, it is possible to connect your own power to ULN2803
- J38** - **closed**, power supply +12 V is connected to L293D
open *, it is possible to connect your own power to L293D

RED jumpers – connected with power supply line +5 V / +3,3 V

- J2_PWR** - position **USB** *, the set is powered by USB cable (from PC)
position **EXT**, the set is powered by external power supply - ATB-PWR3
- VCCIO** - position **TTL** *, RS232 pins of FT232RL in TTL standard
position **3.3V**, RS232 pins of FT232RL in 3,3V standard
- JP16** - **closed**, when the ATB-PWR3 converter operates with +5 V
open *, when the ATB-PWR3 converter works with +3,3V
(stabilizier system 3,3V for ATB-Microport is omitted)

[YELLOW jumpes] – responsible for data bus in sets: **RS232** and **I2C**

<i>RS232 Data Bus</i>		
JP6	-	closed * , TX processor line connected with RX line of FT232R opened , TX processor line disconnected from RX line of FT232R
JP7	-	closed * , RX processor line connected with TX line of FT232R opened , RX processor line disconnected from TX line of FT232R
WARNING ! Jumpers are closed by default which means that you cannot connect additional Bluetooth or WiFi modules at that time to PD0 and PD1 microcontroller pins. Additionally, you cannot use them for different purposes at that time - you have to open both jumpers to be allowed to do this.		

<i>I2C Data Bus</i>		
JP3	-	closed * , SDA (PC1) processor line connected to data bus on ATB open , SDA (PC1) processor line disconnected from data bus on ATB
JP4	-	closed * , SCL (PC0) processor line connected to data bus on ATB open , SCL (PC0) processor line disconnected from data bus on ATB

[WHITE jumpers] – configuration of the peripheral systems in the set

<p>[J35 J36 J37]</p> <p>Jumpers enable selecting and mounting in the ATB set one of the four RTC systems.</p> <p>You can choose from:</p> <ol style="list-style-type: none"> 1. PCF8583 – mounted by default 2. PCF8563 3. DS1307+ 4. DS1337+ 		
---	--	--

[JP8-ARST] - close, auto RESET from DTR system is set, FT232R (*like in Arduino*)
open *, RESET line disconnected from DTR

[J3] - closed *, **it has to be CLOSED for ATB-PWR3 transformer!**
open, **it has to be OPEN for ATB-LION transformer !**

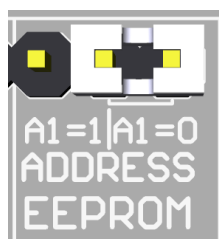


[IR_ICP] - closed, connection of IR receiver output to pin PD6
open *, disconnection of IR receiver output

- [J15] - **position RW->uC**, display RW pin connected to the processor
position RW->GND *, display RW pin connected to GND
- [J8] - **closed ***, for ATB-microSD module close this jumper
open, for different modules for ATB-Microport, connect it in accordance with the manual

Use the remaining white PCB jumpers in accordance with the visible description on PCB. The two jumpers just below L293D system [J39] and [J40] are used to connect permanently inputs of EN system; operation in PWM mode = 100%. The jumpers can be removed and connected to the single pins of the microcontroller in order to control separately each bridge with use of PWM.

Additionally, with one of the white jumpers you can select the address on I2C data bus of external EEPROM 24c04 memory.



USB (raster 2 mm) jumpers – configuration of one of USB-HUB ports.

[J11 J12 J13 J14]

Jumpers enable **USB configuration** in the set.

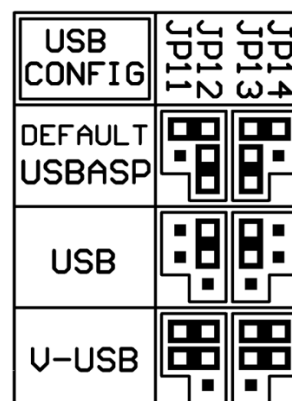
You can choose from:

1. **USBasp – configuration by default ***

The following options result in disconnection of the USBasp

2. USB – clear D+ and D- lines on junction J17
3. V-USB system is ready for connecting J17

(table with a description on the back of a PCB)

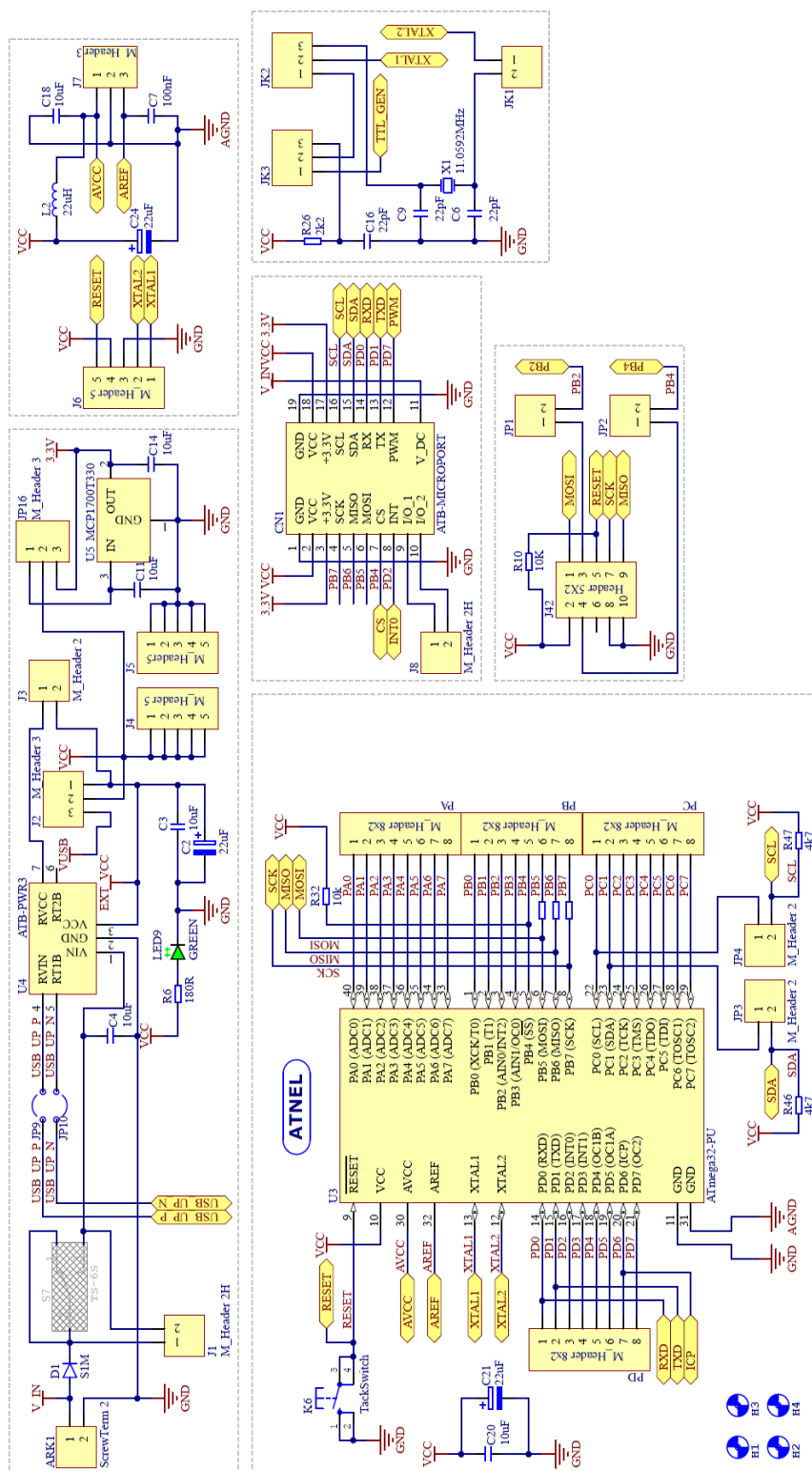


(asterisk) * - default condition of a jumper, when the ATB set is released from the factory.

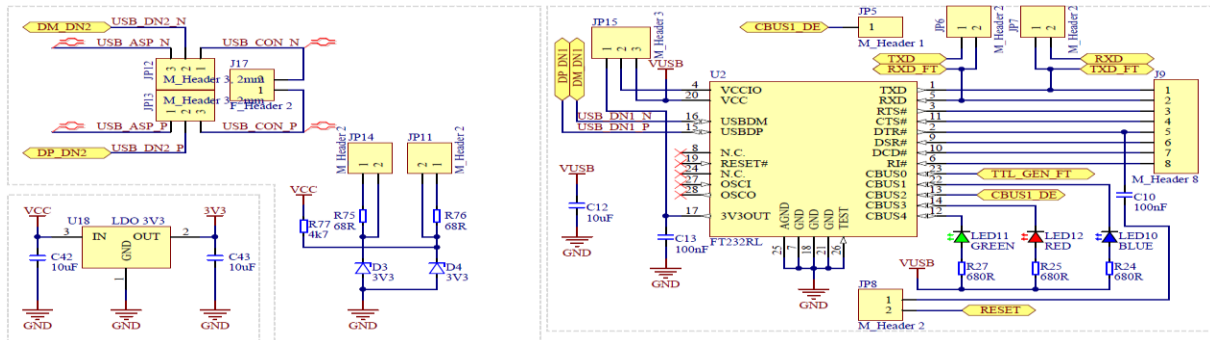
SHIFT+CTRL+MINUS – turn left SHIFT+CTRL+PLUS – turn right

General scheme of the ATB set

The scheme is divided to three sheets and presented in this manual only demonstratively. The schemes are available in separate PDF files.







Warning! Schemes do not contain elements: USBasp and USB HUB

The scheme is divided into functional blocks. Gray circled rectangles represent elements that normally are not mounted in the set. This includes:

1. **Slide switch S1** (under the ATB converter) - switching power supply +12 V in the set .
2. **Rotary encoder.**
3. **Buck converter ICL7660** contrast with external elements.
4. **Sockets ATNEL - AIR** (supports the modules ATB - BTM -222 or ATNEL - WIFI232 - T) .
5. **Two optoisolators** (U13 and U14) LTV335T with ARK connector.

You can purchase the optional items separately at Atmel online store and install them by yourself in the ATB set.

www.sklep.atmel.pl

Microcontrollers in the ATB set

ATB set is equipped with **ATmega32A-PU** microcontroller which is mounted in the precise DIL40 base. The system of terminals allows the use of replacements in the form of popular microcontrollers:

- ATmega16
- ATmega644 / 644P
- ATmega1284P

Each of the four ports of the microcontrollers of this type (A, B, C, D) has its output in the form of double row of goldpins. In addition, other pins such as power supply VCC, GND, XTAL pins, AREF, AVCC and AGND were derived outside.

The applied output and precise base allow you to attach external (optional) modules which enable connecting to a series of other AVR microcontrollers, such as:

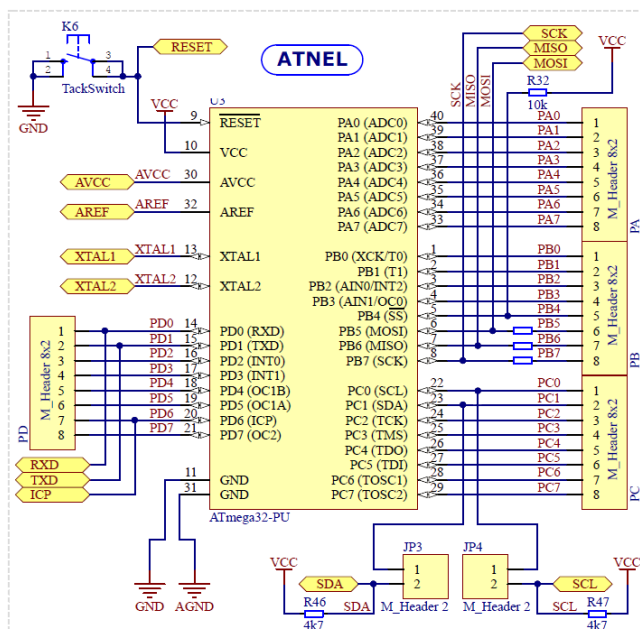
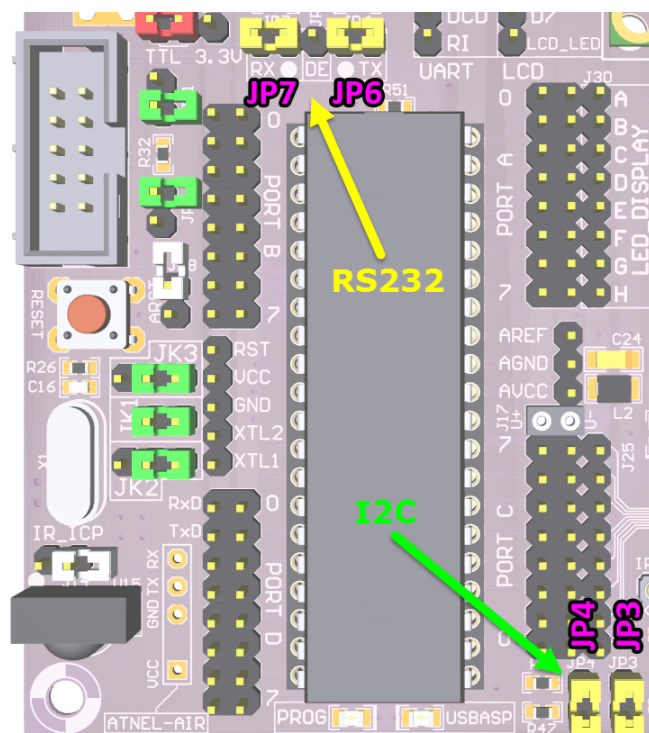
- ATmega8/48/88/168/328
- ATmega128A (*ATB-SHIELD IO*)
- ATtiny2313
- ATtiny13/25/45/85

Jumpers **[JP6]** and **[JP7]**, closed by default, connect **RS232** data bus of the microcontroller with **USB/RS232 (FT232R)** adapter's system.

⚠ When both of the jumpers are closed, **[PD0] and **[PD1]** pins must not be used for any purposes other than RS232 communication, because it may damage the systems.**

Jumpers **[JP3]** and **[JP4]**, closed by default, connect **I2C** data bus of the microcontroller with other systems in the set: 24c04, RTC, OLED. Lines of I2C data bus lead to VCC with use of 4,7 k resistors.

Due to the special construction of data bus connection **ISP** (resistors in series on lines MOSI, MISO, SCK), during programming various modules can be connected to **PORTB** pins, such us: LCD display, SD memory card, or other using the SPI data bus through ATB-Microport.



Methods of microcontroller clocking

The ATB sets are equipped with all of the described sources of the external clocking of the microcontroller. You choose source of the clocking by three combinations jumpers **JK1**, **JK2** and **JK3**.

There are three options:

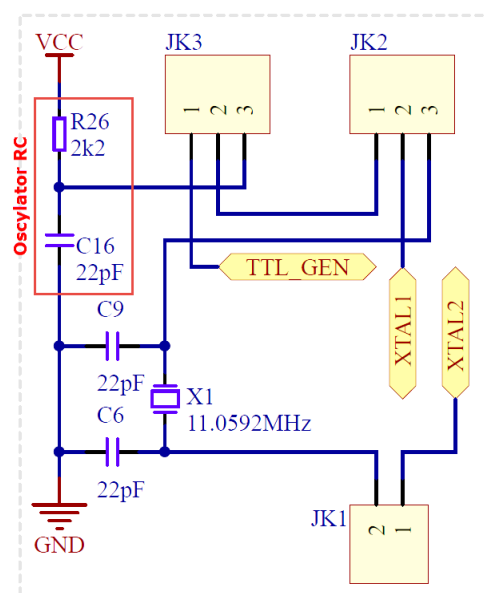
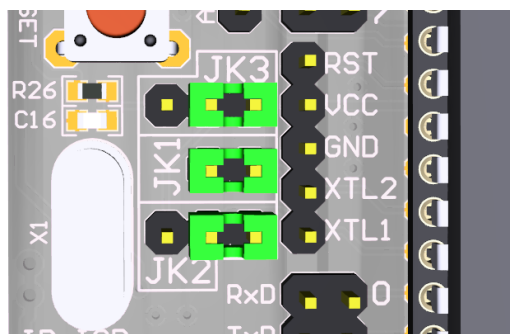
- ❖ **external quartz resonator (by default)**
- ❖ **external RC oscillator (approx. 6 MHz)**
- ❖ **external TTL generator (6 MHz)**

Every set is equipped with **stand under the quartz resonator**. This allows for free exchange of resonators of different frequencies.

By default, a resonator of 11,0592 MHz clocking frequency is mounted in the ATB sets.

Source of the TTL generator clocking comes from FT232RL, that is why it has to be powered. In order to do it you have to connect USB cable to the set.

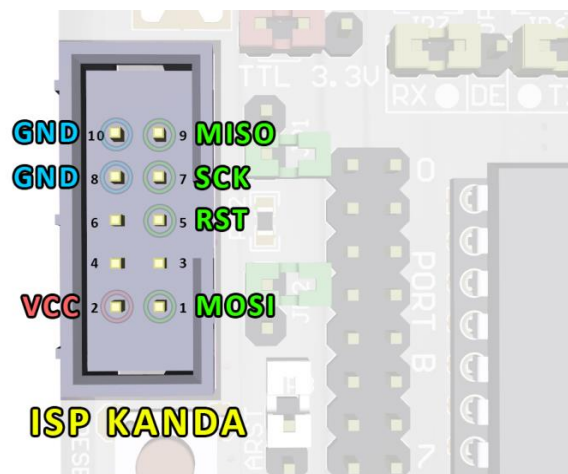
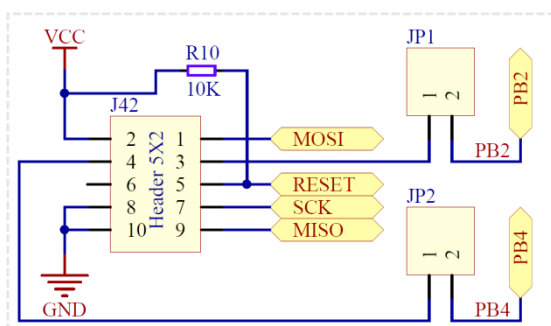
External RC oscillator consists of: R26 resistor and C16 capacitor.



Connector of the ISP - KANDA programmer (internal / external programmer)

In the left part of the PCB, below the USB socket, a ISP programmer socket has been placed in the KANDA standard. It makes it possible to use external ISP programmers, as well as to program external systems with a built-in USBasp programmer.

Masses signals are led only to the pins no. 8, and 10th slot so you need to check in your own programmer, whether the mass signal is brought to at least one of these pins.



Warning! KANDA connector in the ATB set may be used both as the **INPUT** to connect band from external programmers, and also as the **OUTPUT** when you want to use the built-in **USBasp** programmer to program external system, for example on a breadbord, or of your own construction. The only condition which has to be met to use the connector as the **OUTPUT** is to remove the microcontroller from the base. Then you can connect the KANDA band to your own external system and program it with a built-in programmer.

To sum up, the ATB sets v. 1.05 can be used as the external USBasp programmer. Thus, with one band you can connect to external system (apart from the ISP lines) also power supply such as VCC and GND.

Methods of microcontroller RESET

You can RESET the microcontroller by using the tact-switch placed just below the KANDA connector. Pushing the button closes directly the RESET line of the microcontroller to GND.

Soft RESET.

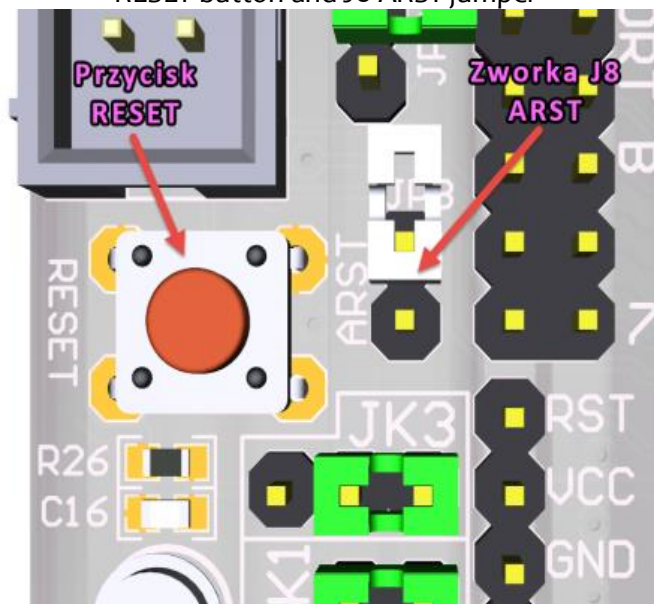
Additionally, it is possible to reset the microcontroller from application on PC by signal from **DTR** COM serial port in the computer.

A ceramic C10 capacitor of a 100 nF capacity (*visible on the module scheme with FT232R system*) has been placed between DTR line and the microcontroller's RESET pin.

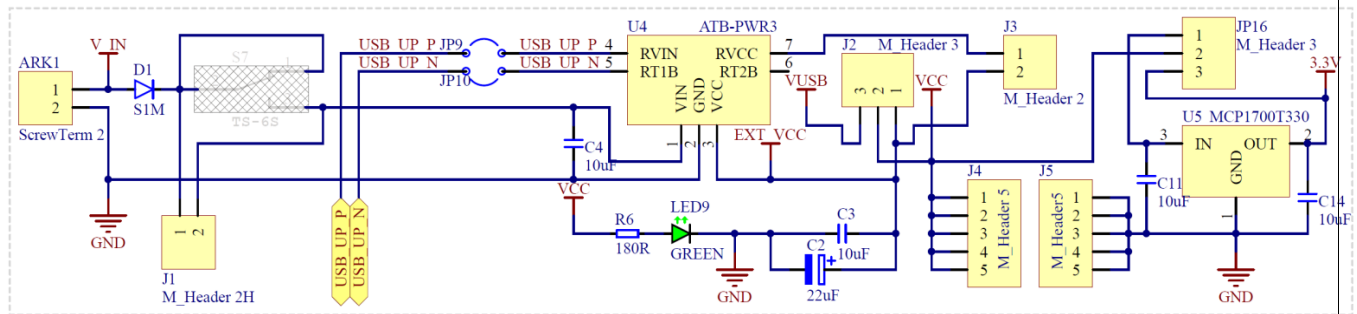
By default, this jumper is open. When you want to perform the soft reset, for example from MkBootloader software or Arduino, then you have to close the ARST jumper.

Bear in mind that after closing the ARST jumper, every connection of power supply to the set (specifically to FT232R set) will result in several resets of the microcontroller and the application in it. This is because during the initialization of the FT232R, the state on the input changes from Hi to Lo and back several Times. As a result, the ceramic capacitor charges and discharges for several times which leads to short-time give of low state on RESET microcontroller line.

RESET button and J8 ARST jumper



External power supply of the set - options



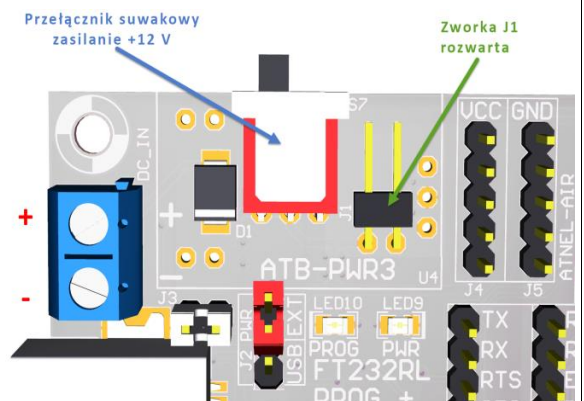
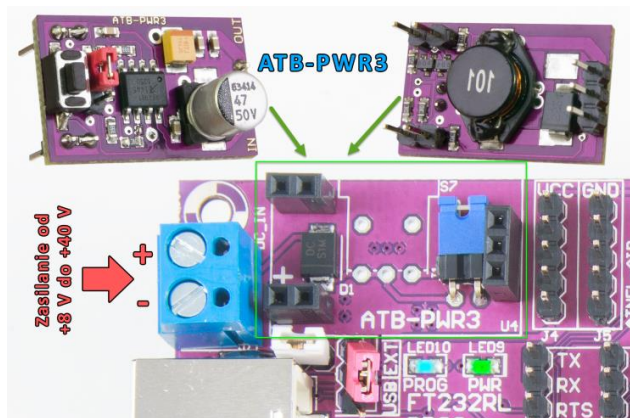
Every ATB set can be powered from external Power supply. Każdy zestaw ATB może być zasilany z zewnętrznego zasilacza thanks to the attached converter.

The **ATB-PWR3** converter is assembled in a special socket which makes it possible to use different Atnel converters in the future, such as **ATB-LION**, which acts also as a charger; and a converter for batteries **Li-Ion** and **LiPo** type. The ATB-LION converter with a single 18F650 battery acts as a perfect-quality buffer power supply. Using ATB-PWR3 converter installed by default you can connect any power supply to the set with DC voltage of **+8 V to +40 V** max. It is important that the performance of this power supply is at a minimum of **500 mA**. Recommended performance is **1 A to 1,5 A**.

Both Atnel converters provide possibility to power the set by one of the two voltages with use of a jumper on the converted. By default every converter is set on **+5 V** voltage.

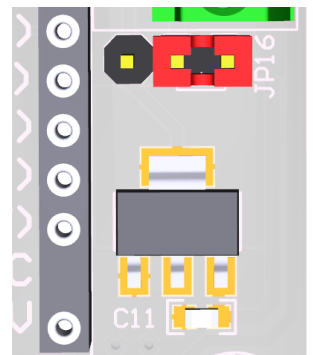
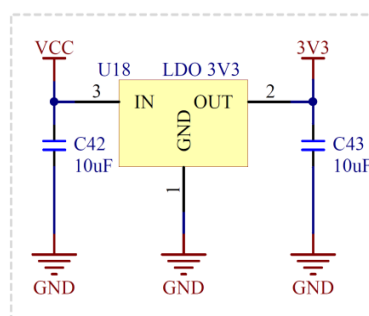
In a standard version of the ATB set no **S1** slide switch is mounted. That is why the **J1** jumper has to be closed.

If you solder the **S1** slide switch you have to open the **J1** jumper.

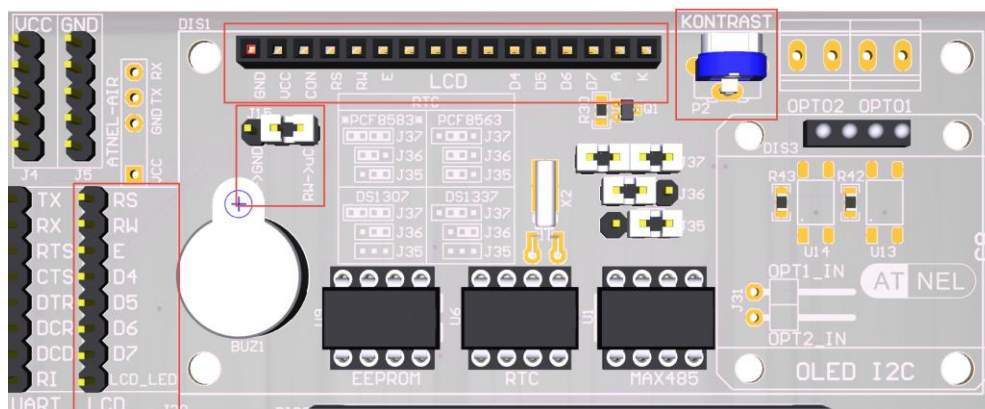


Additionally, there is a **LM1117** line stabilizer mounted in the set in order to obtain **+3,3 V** voltage when the whole set is powered from a **+5 V** converter.

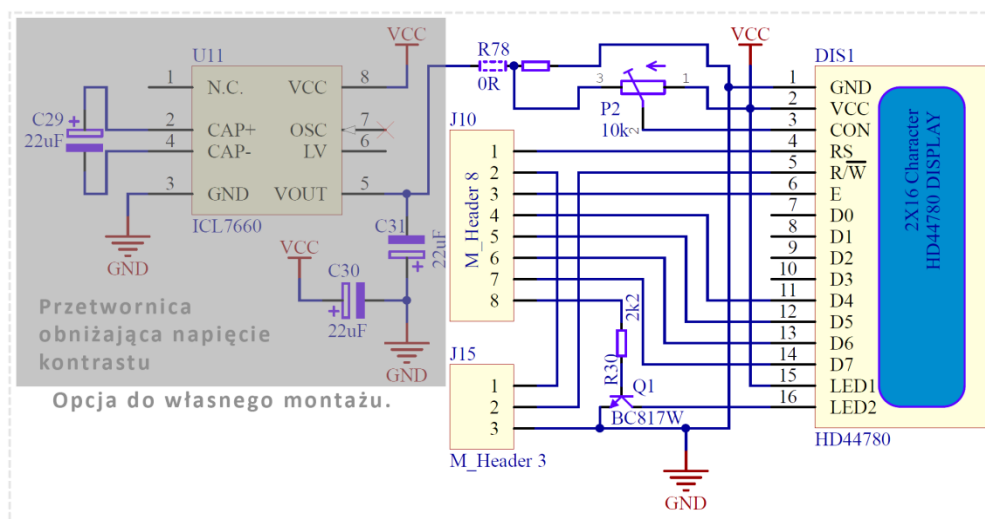
This power supply is needed mainly for the use of **ATB-Microport**, but you can use it also for your own purposes. When a converter operates under **+3,3V** you can omit the stabilizer with a **JP16** jumper.



LCD display 2x16cz



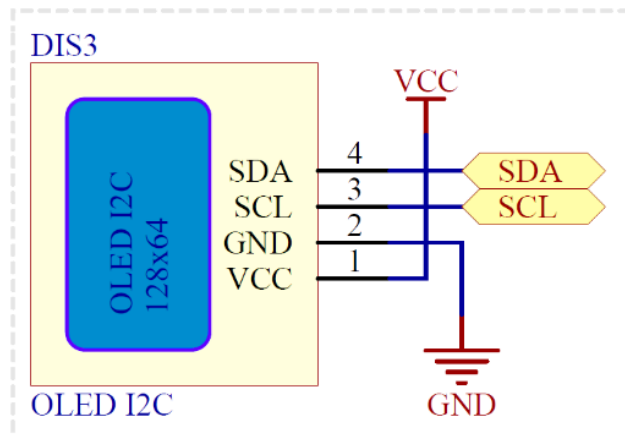
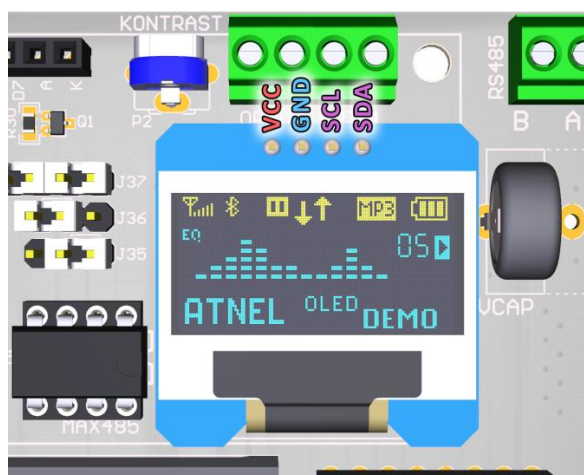
In the ATB sets, standard alphanumeric LCD 2x16 displays based on HD44780 controllers are used. The user has a **J15** jumper located under the display, through which he can decide on his own whether the RW pin of the display will be connected permanently to GND or to the microcontroller (by default the jumper connects the RW pin with the microcontroller). The display itself is equipped with a range of 16 goldpins, through which it can be connected to the female socket located on the top edge of the set. Control signals of the display: **RS RW E** and four data lines **D7...D4** with the backlight control signal are derived from the left side of the display on a 8-pin **J10** connector. For users convenience there is a transistor with a resistor in the base steering the backlight. You can either permanently connect this pin to VCC to ensure continuous illumination or to connect this pin to the microcontroller to obtain programming possibility of steering the backlight. On the right side of the display there is a small assembly potentiometer 10k used to adjust the contrast.



In a standard version of the ATB set an **ICL7660 converter** (along with the capacitors) enabling correct work of the display with the set under +3,3V is not assembled. You can buy the converter at the Atmel online store and assembly it on your own. Then, the converter is activated by changing the position of the SMD **R78** resistor in the opposite direction.

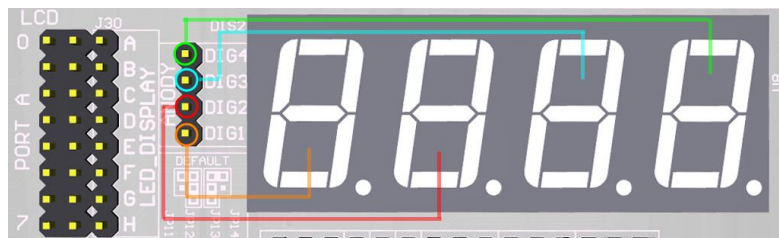
www.sklep.atmel.pl

OLED display - I2C



Each ATB set comes with a **stand for OLED display with I2C data bus**. This is a four-pin female connector. The display itself is not included in the set and you need to buy it on your own. The display is connected to I2C data bus in the ATB set, in which operate also EEPROM memory and RTC system

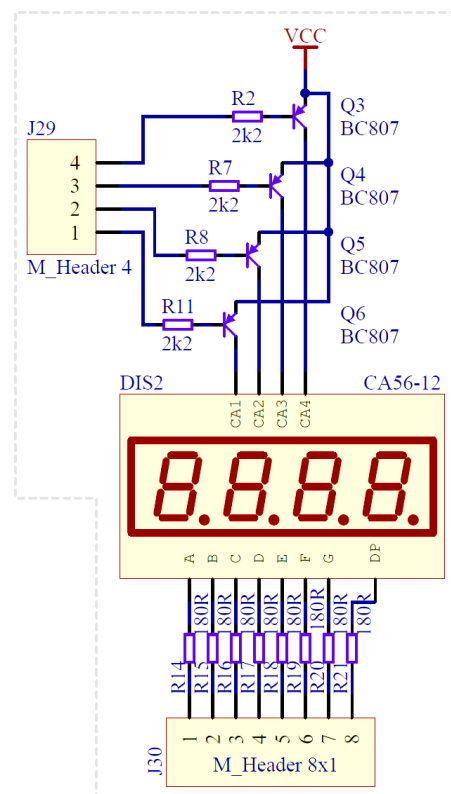
7-segment LED display - 4 positions



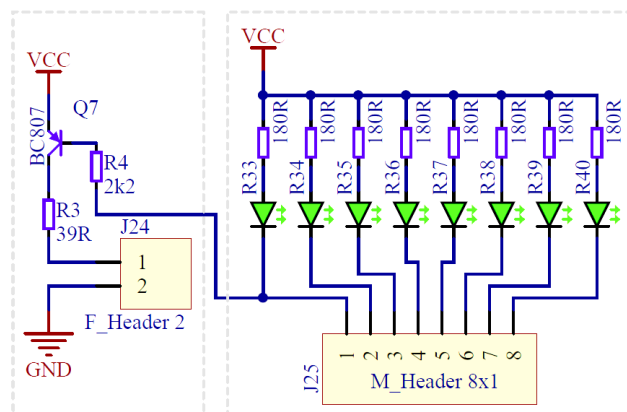
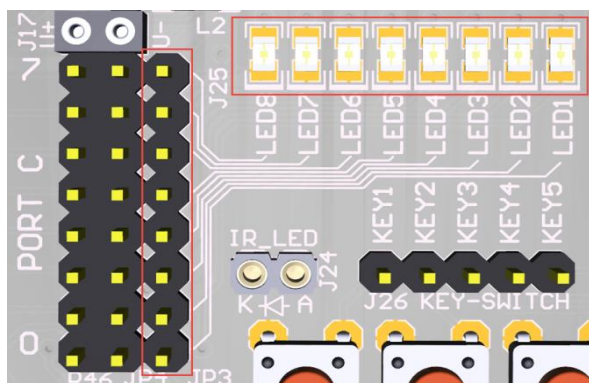
The 7-segment LED display (**red colour**), has four digits and four dots. The display is in configuration with common anode. Eight segments from **A** to **H** (**H-dot**). Pins of segments are located in parallel to PORTA pins, thanks to which you can use standard jumpers in 2,54mm raster to connect the chosen segments quickly and conveniently to the microcontroller, without the necessity of using any wires.

Pins of a display common anode are marked from **DIG1** to **DIG4** and are responsible for the consecutive digits from left to right side of the display.

This display is perfectly suitable for the most important exercise described in my book „**Mikrokontrolery AVR - Język C podstawy programowania**” (<http://atnel.pl/wydawnictwo.html>)

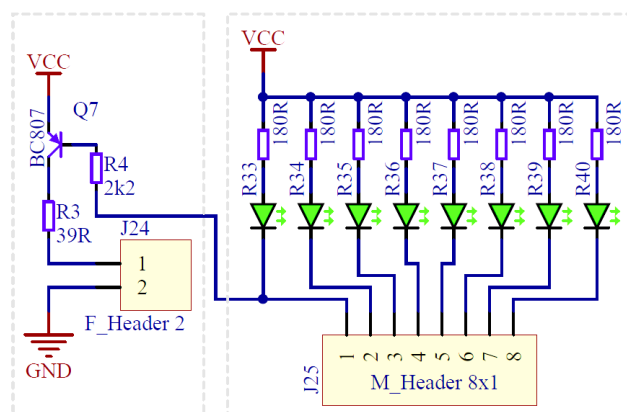
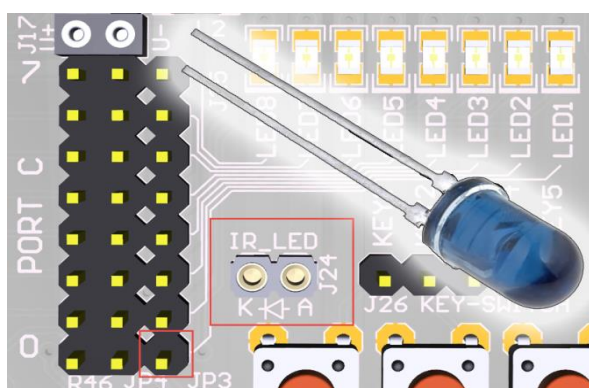


LED diodes – 8 pieces



8 LED diodes **of green colour** have been mounted in the ATB set. **They are permanently connected with anodes to VCC, cathodes are available for the user.** The cathodes are led in a form of a goldpin connector placed in parallel with the microcontroller PORTC so that they could be quickly and conveniently connected with jumpers, instead of using wires. Warning! You can also use the transistor with use of the LED1 diode to steer with a IR diode transmitter, if it is mounted in a base.

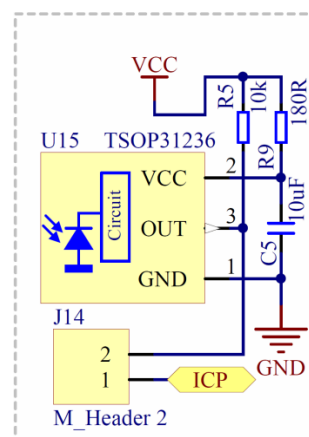
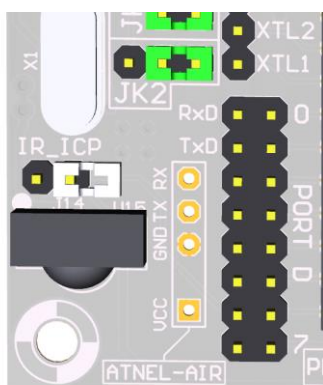
IR diode transmitter (infrared)



Every ATB set includes IR diode transmitter (5mm diameter). It is loosely attached in a string bag. Whenever needed, it can be mounted in a precise IR_LED, stand and use ordinary LED1 diode for steering. During the process, when the infrared will be transmitting, the **LED1** will be also lit.

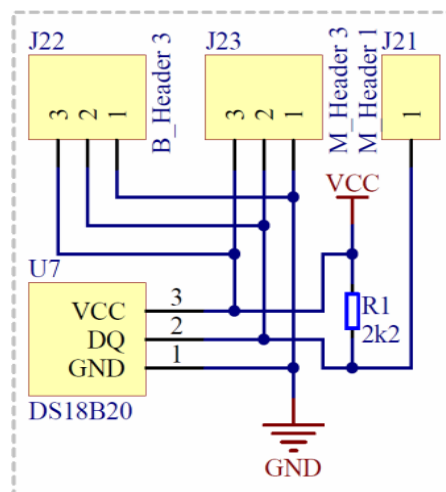
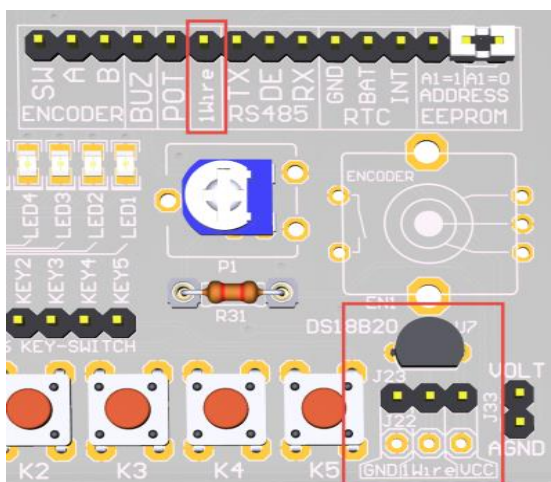
Steering with the IR diode takes place with use of **PNP** transistor and **R3** resistor (39R) in order to obtain as wide range of transmitting as possible.

Infrared received (TSOP31236)



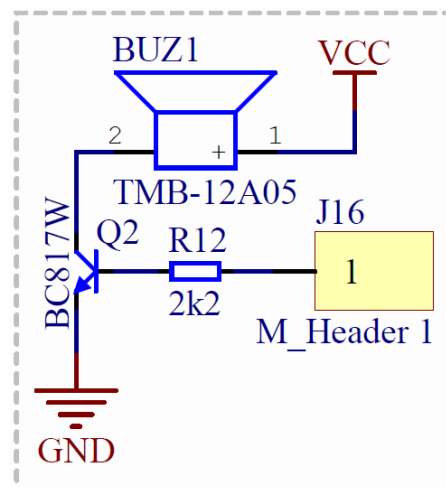
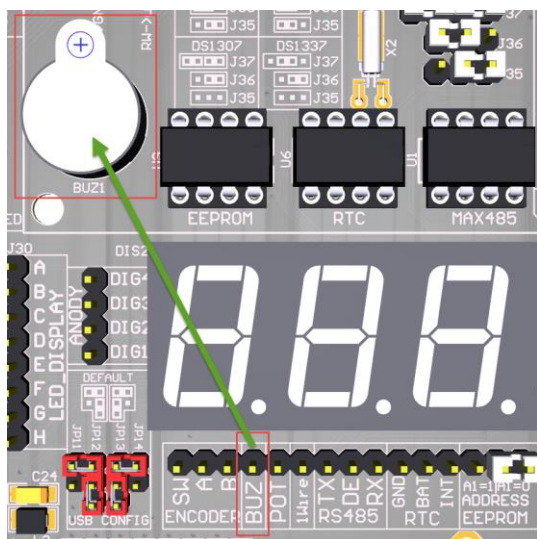
In the set there is an integrated IR receiver mounted designed for 36 kHz carrier frequency. It can be successfully used, however, to receive the codes from pilots transmitting frames with a carrier frequency in the range of 32 kHz up to 44 kHz. Power supply of the receiver is filtered very well, output pulled up to VCC. The **J14** jumper described as **IR_ICP** makes it possible to connect directly the receiver's output to PD6 pin of ATmega32 microcontroller.

Digital temperature sensor DS18B20



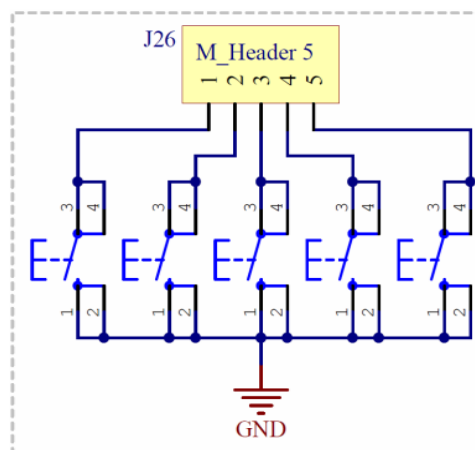
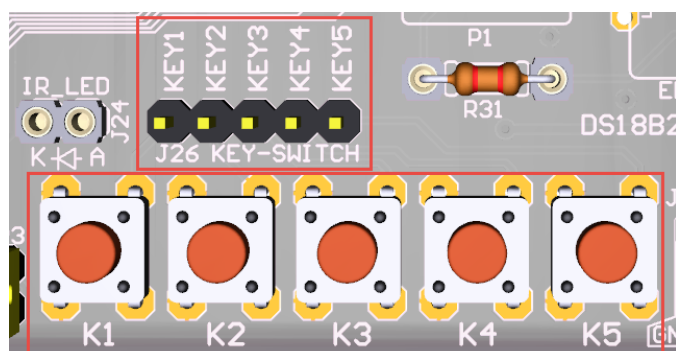
There is an integrated temperature sensor soldered into the ATB set PCB, marked as DS18B20. The sensor is powered with a VCC voltage, which may be +3,3 V or +5 V (by default). Output pin of the sensor is pulled up to VCC with a 2,2K resistor and led to a goldpin juncture described as **1wire**. Beneath the sensor there are 3 soldered goldpins enabling connecting next sensors to the data bus. Additionally, there is a free space left for the purposes of soldering three goldpins.

Buzzer (loudspeaker)



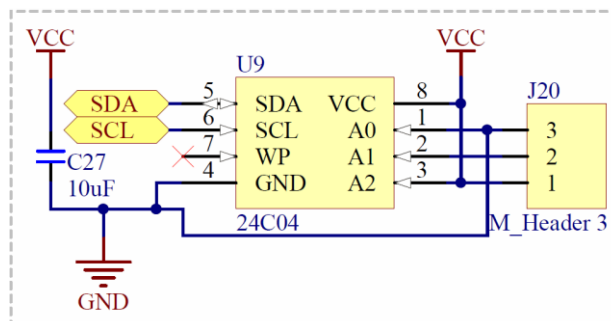
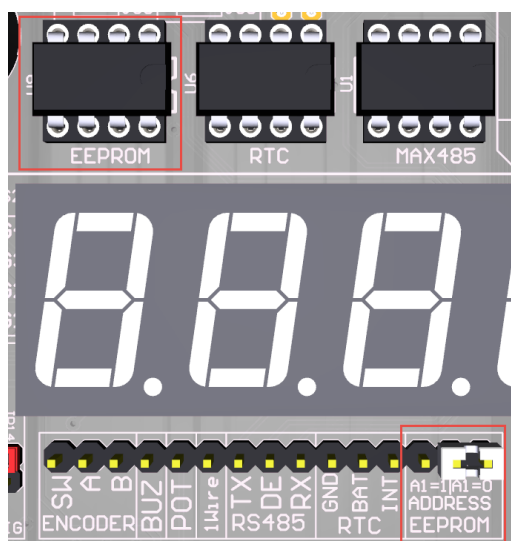
You will find in the ATB set a piezoceramic buzzer (loudspeaker) with a built-in generator, so you have to connect only +5V voltage to use it. The voltage is steered with use of NPN transistor, which base is connected to goldpin juncture through a resistor. One of the pins is described as BUZ and it can be connected to whichever microcontroller's pin to steer the buzzer.

Buttons (key buttons) tact-switch type



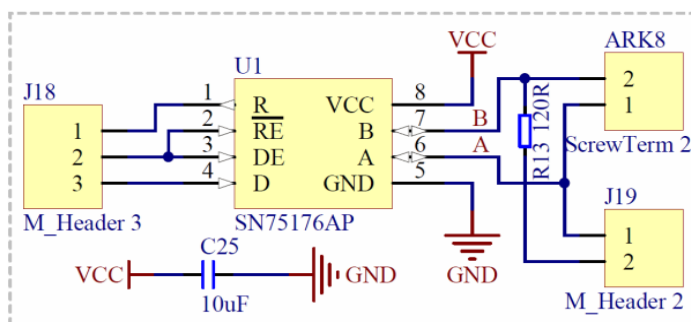
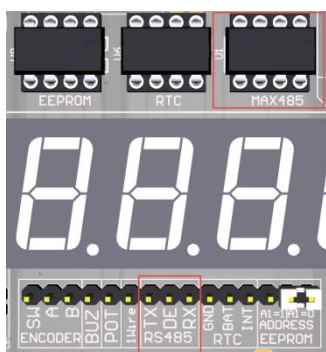
Every set is equipped with five tact-switch buttons. You can find their pins on J26 juncture.

External EEPROM memory - 24c04e



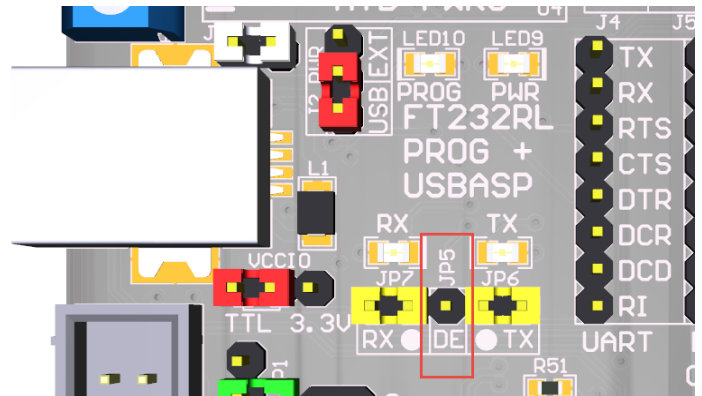
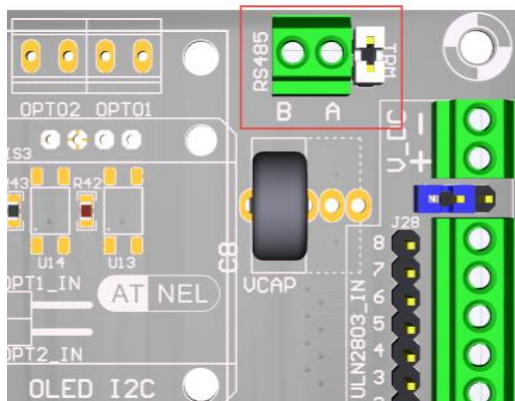
External **EEPROM 24C04** memory is connected to I2C data bus in the ATB set. You can change its address with use of a white jumper on a configuration goldpin juncture (on the right side). In order to do it, you have to connect A1 pin of the system to GND or VCC (it is described also on PCB). The system is placed in a precise stand below the LCD display.

RS485 - SN75176 integrated circuit (MAX485) equivalent



There is a system designed for communication through RS485 data bus mounted in the set. Symbol of the system is **SN75176**, equivalent of MAX485. It is placed in a precise stand below the LCD display. You can find its pins on a goldpin juncture below the LCD display, and they can be easily connected to the microcontroller. Three signals are available: **RX**, **TX** and **DE** (the DE signal consist of joint RE and DE pins of the system) which makes it more convenient to switch from transmitting to receiving (and vice versa) through changing the state from Hi to Lo and vice versa.

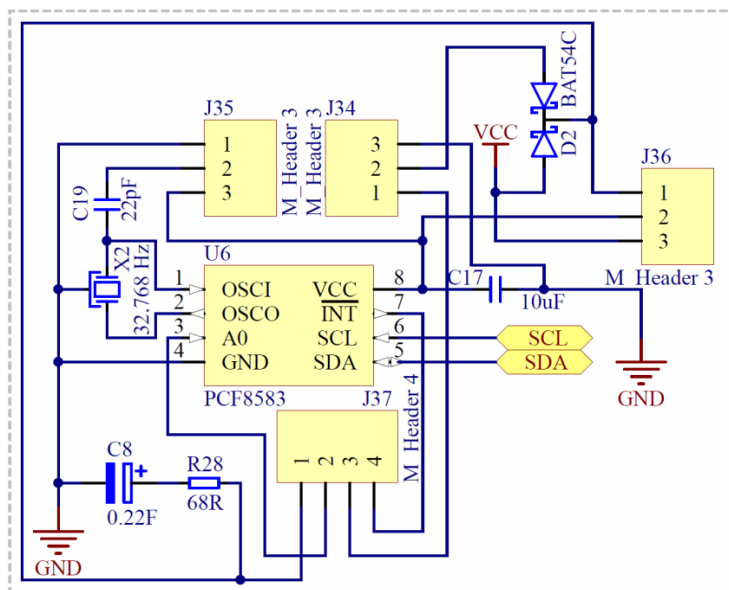
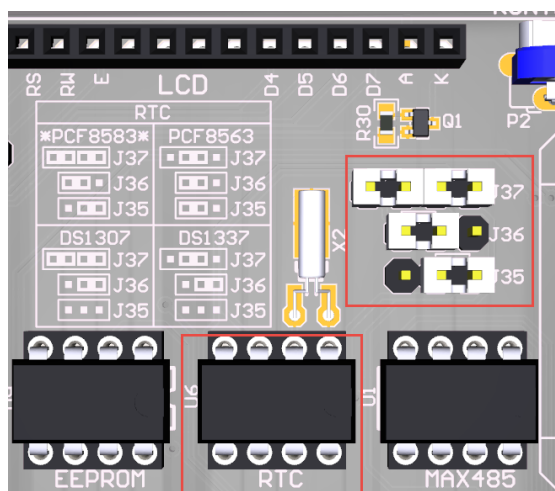
RS485 – transmission and PC control



Differential lines **MAX485** are LED on a juncture in the upper right corner of the PCB, on a screw connector marked as RS485. On the right side of the juncture there is a white jumper marked as TRM, which is used for switching the RS485 data bus terminator, that is 120R resistor between the differential lines. By default the jumper is closed which means that the terminator is on. Lines **A** and **B** are visibly marked on PCB below the screw connector type ARK – left picture.

In the picture on the right side you can see USB/RS232 adapter, which is mounted in every start-up kit, and marked **DE (JP5)** pin. This is connected with the fact that the MAX485 system mounted in the set can be used either for operation with a microcontroller or with a USB/RS232 adapter, which enables convenient communication of RS485 directly from computer for test purposes. To do it, you have to connect across: TX line of the USB/RS232 adapter to RX of MAX485, as well as RX line of the USB/RS232 adapter do TX line of MAX485. Additionally, connect DE line of MAX485 to **DE (JP5)** line of the USB/RS232 adapter. By doing so, communication from PC can be steered as in the RS232 mode, because system of FT232RL adapter takes care itself of switching the state of DE line in order to listen or send data through MAX485.

RTC systems in the ATB sets – by default PCF8583



A great advantage of the ATB start-up kit is the possibility of mounting and testing **several different RTC (Real Time Clock) systems**. **PCF8583** system is assembled by default. It is mounted on a precise stand below the LCD display, so you can remove it from the stand and use other, at the moment more popular systems, such as: : PCF8563 (*newer version of PCF8583*), or other system made by Dallas **DS1307+** or **DS1337+**.

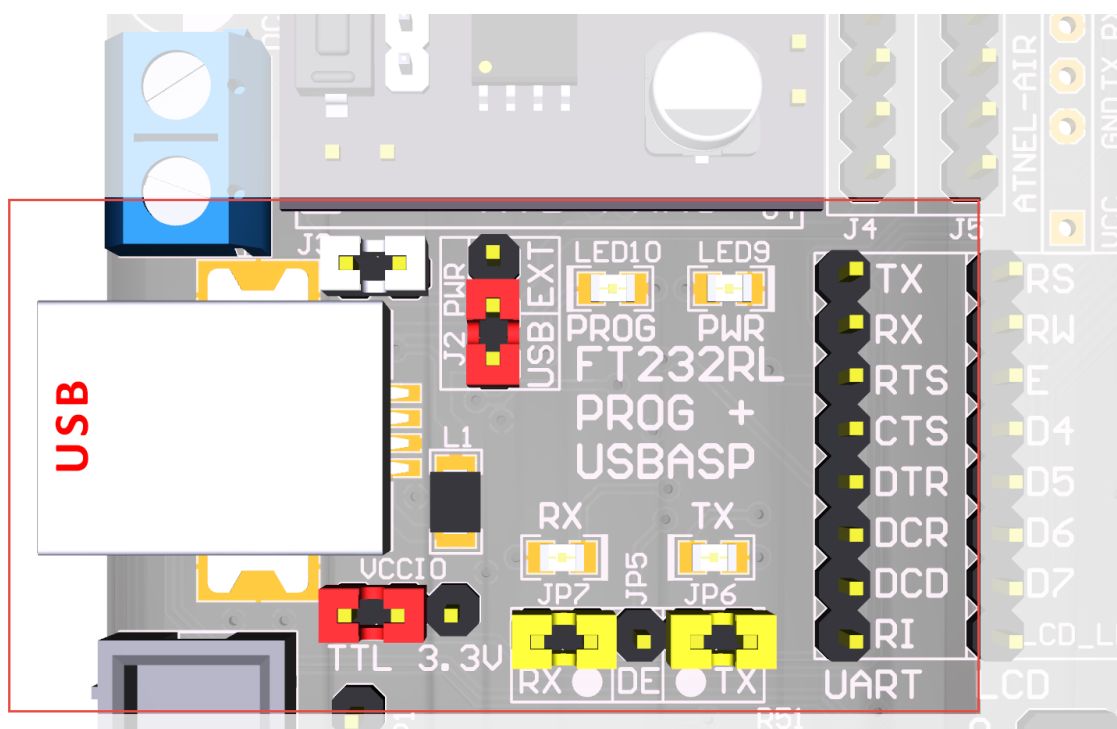
RTC	
PCF8583	PCF8563
J37	J37
J36	J36
J35	J35
DS1307	DS1337
J37	J37
J36	J36
J35	J35

These systems are provided with a battery power supply backup by a gel capacitor with huge capacity 0,22F. They are clocked by a clock quartz resonator of 32,768 kHz frequency. Power supply of RTC systems is separated from the power supply in the set with use of double Schottky D2 diode. It prevents from current leakage from the gel capacitor when the set is off, and additionally the set can operate relatively long without the main power supply.

The system's scheme seems to be complicated, but it is caused by the amount of jumpers used, which enable fast and convenient configuration of the system which you wish to use and test in the set.

There is a table on the PCB just above the system with description of jumpers for each particular RTC system configuration. Because the jumpers along with the goldpins are presented in a form of a picture, you do not need to check number of a particular jumper. The first system in the top left corner of the table is marked with an asterisk, what makes the default configuration of PCF8583 significantly easier.

USB adapter / RS232 / RS485



The USB/RS232 adapter based on FT232RL is one of the strongest feature of the ATB sets from Atmel. The great advantage of the built-in adapter in our sets is use of all the possibilities of the FT232RL in 100 %, therefore it can be used to perform several functions in the set:

1. **Full USB/RS232 adapter** with possibility to choose range of voltage on the pins (*All lines of the RS232 port are available for the user*).
2. **USB/RS485 adapter**, which can be connected with a PC to RS485 industrial data bus through the MAX485 mounted in the set to perform any tests with use of your own or external software.
3. **Spare programmer** type **ATB-FT232RL**.
4. **Generator TTL** for clocking of the microcontroller.

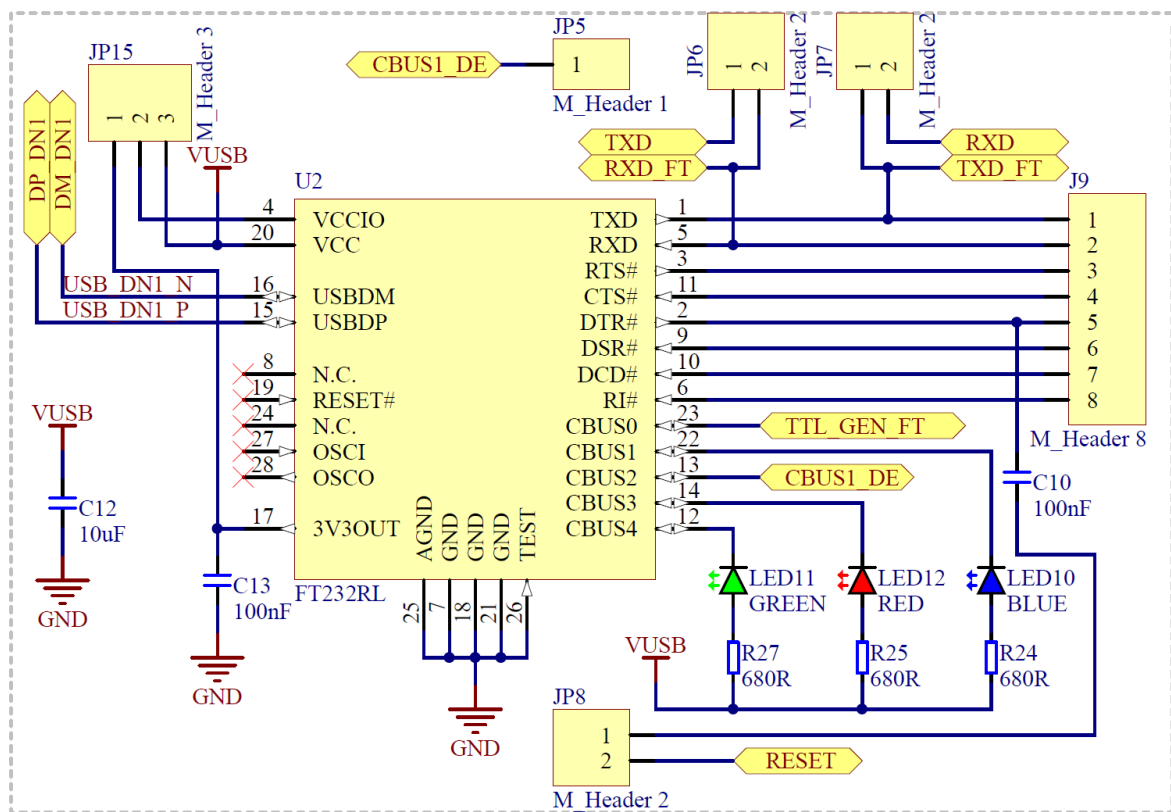
A jumper marked as **VCCIO (JP15)** is used for choosing range of voltage on the pins, which is placed just below the USB slot. TTL standard is set by default. Bear in mind to change it with a jumper to 3.3V if you change power supply of the set, for example from the ATB-PWR3 converter on voltage +3,3 V.



Warning! The adapter is **BY DEFAULT** connected with lines **RX** and **TX** to microcontroller with use of jumpers **JP6** and **JP7**. If you wish to use the adapter separately for connecting, for MAX485 system, or for your own external system like telephone etc.; it is essential to remember about opening JP6 and JP7 jumpers. It is also applicable if you want to connect for example LED diodes for tests, or other periphery components, to pins PD0 and PD1 of the microcontroller; as well as when you want to connect systems such a **Bluetooth** or **ATNEL-WIFI232-T** through **ATNEL-AIR stand** mounted in the lower left corner of the set, between the IR receiver and the microcontroller.

Failure to follow these instructions may cause damage to either FT232 or a microcontroller, or both at the same time in the worst case.

Scheme of the adapter and connections



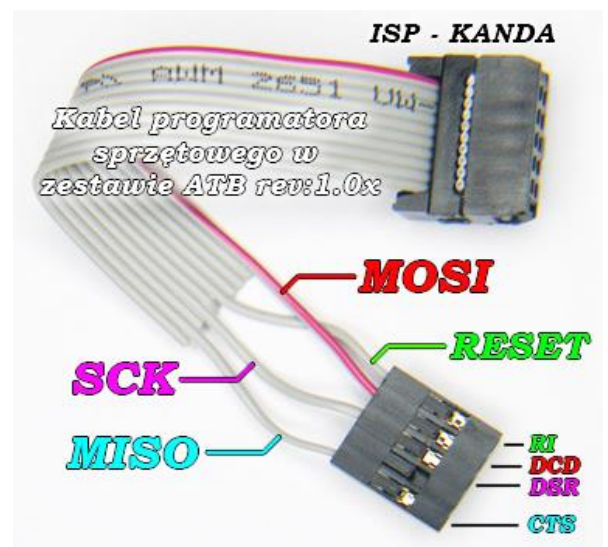
The USB/RS232 adapter is equipped with three LED diodes. Green and red indicate transmission of data via TX and RX lines. Blue LED diode indicates the process of programming the microcontroller.

In order to take advantage of the programmer's functionality it is worth using the so-called „programmer's cable”, which should connect the KANDA juncture to signals on UART header, in accordance with description of the signals in the picture on the right side. Signals used: DCD, DSR, CTS and RI. The cable is available in our online store:

<https://www.sklep.atnel.pl/pl/p/Kabel-programatora/29>

You will find instruction, description and a video guide explaining how to use the built-in ATB-FT232R programmer, in the ELECTRONICS section on Atnel website by choosing from menu on the left side „FT232 programmer in ATB” or using the below link:

<http://atnel.pl/ft232r-programator-w-atb.html>



6. Programmer's cable in the ATB set

Installing drivers for FT232RL

ATNEL tech-forum • Forum x D2XX Direct Drivers x

← → ↻ 1 www.ftdichip.com/Drivers/D2XX.htm

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Introducing...
FTDI Chip
CleO

D2XX Direct Drivers
This page contains the D2XX drivers currently available for FTDI devices.
For Virtual COM Port (VCP) drivers, please click [here](#).
Installation guides are available from the [Installation Guides](#) page of the [Documents](#) section of this site for s

D2XX Drivers
D2XX drivers allow direct access to the USB device through a DLL. Application software can access the [Guide](#) document which is available from the [Documents](#) section of this site.
Programming examples using the D2XX drivers and DLL can be found in the [Projects](#) section of this site.

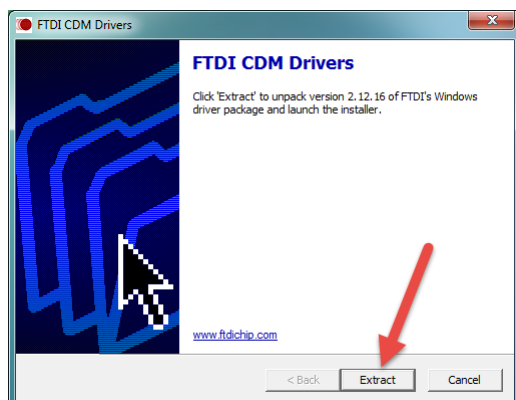
To install the drivers follow these steps:

1. Open in your browser the producer's website www.ftdichip.com.
2. Choose **DRIVERS** from the Menu on the left side.
3. Choose **D2XX Drivers** from the next Menu (*strictly only this version*).
4. Scroll down until you find a table (*position*) „Currently Supported D2XX Drivers:”

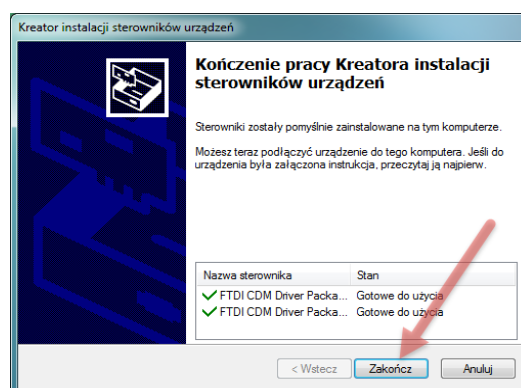
Currently Supported D2XX Drivers:

Operating System	Release Date	Processor Architecture					Comments
		x86 (32-bit)	x64 (64-bit)	ARM	MIPS	SH4	
Windows*	2016-03-16	2.12.16	2.12.16	-	-	-	WHQL Certified. Includes VCP and D2XX. Available as a setup executable . Please read the Release Notes and Installation Guides .

MS Windows are always interested in the first position of the table, as well as the last column on the right side where they can click the link „[setup executable](#)” in order to download the drivers in a form of an EXE file. Once the download is complete it is necessary to start the file and to follow the installation programme. During the process, the user has to accept several license provisions, and in the end of the installation just press “finish” key.



Start of the installation programme of the drivers



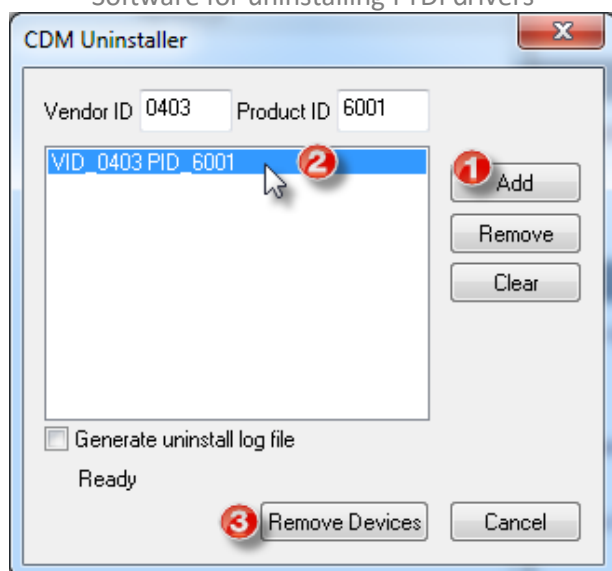
Finish of the installation programme

Once the installation of the drivers is complete just connect the ATB set to a computer, what will result in automatic installation of proper drivers in the system for FT232RL. If the ATB set is connected during the installation process, then the installation of the drivers will also start automatically at once after completion of the installation.

Warning! In case of any problems with the installation of the drivers it is recommended to use the **CLEANER** software, which is also available on the producer's website. For this purpose you have to follow these steps:

1. Choose **SUPPORT** from the main Menu on the left side.
2. Choose **UTILITIES** from the new menu.
3. Scroll down and find the ZIP file „**CDM Uninstaller**”.
4. Download the software and **disconnect the ATB set from the computer**.
5. Unpack the ZIP file and click „**CDMuninstallerGUI.exe**”.

Software for uninstalling FTDI drivers



After starting the program, perform the following three steps:

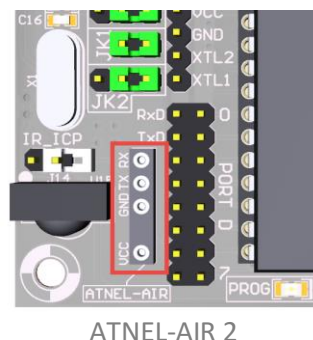
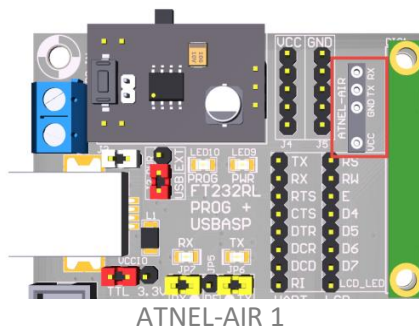
1. Press **Add** key.
2. Point a new position with the cursor.
3. Press **Remove Devices** key.

After completion, the following appears

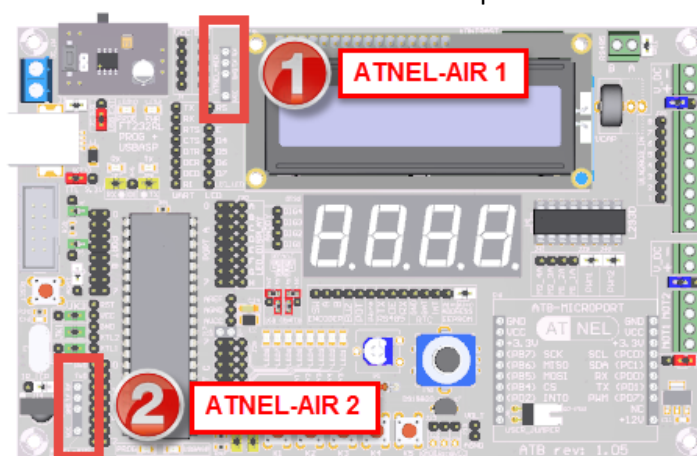


Once the uninstall is complete you can start installation of the drivers once again, in accordance with the instruction above. **Warning!** The uninstaller removes the drivers from every previously installed device with the built-in FT232RL system.

Optional ATNEL-AIR slots

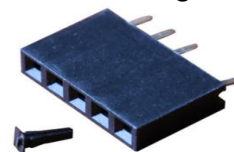


Location of the ATNEL-AIR stands in the ATB set is in line with the picture below.



In the ATB set you can install on your own slots (stands) ATNEL-AIR type for the following modules:

1. **Bluetooth** ATB-BTM-222
2. **WiFi** - ATNEL-WIFI232-T
3. **Radiomodem** HM-TRP



ATNEL-AIR header connector with key (no pin)

Slot marked with no. 1 is connected with pins **TX** and **RX** of the USB/RS232 converter, so connecting one of these module to this slot enables convenient work and configuration of the module through a PC software. **Slot marked with no. 2** is connected with the microcontroller's pins **PD0** and **PD1 (RX/TX)**, so by connecting module into this slot you can test the module with use of a software in the microcontroller. Both slots, after connecting the modules, enable testing communication between two independent modules via radio or with Bluetooth, WiFi, or HM-TRP modem.

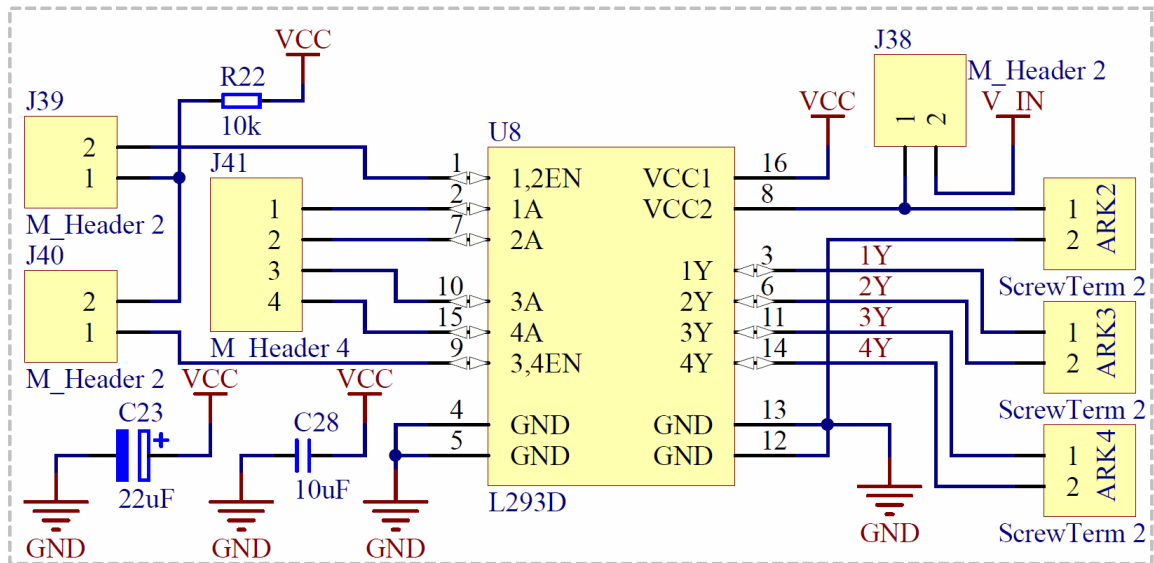


WARNING! Connecting the module to any slot strictly requires opening jumpers **JP6** and **JP7**.

The stands are available at Atnel online store:

<https://www.sklep.atnel.pl/pl/p/Podstawka-do-ATB-BTM-ATNEL-AIR/74>

Motor driver L293D



Atnel is the first company in Poland to introduce to AVR start-up kits the DC motor driver and bipolar stepper motor driver. MOT1 and MOT2 pins are used to connect motors.

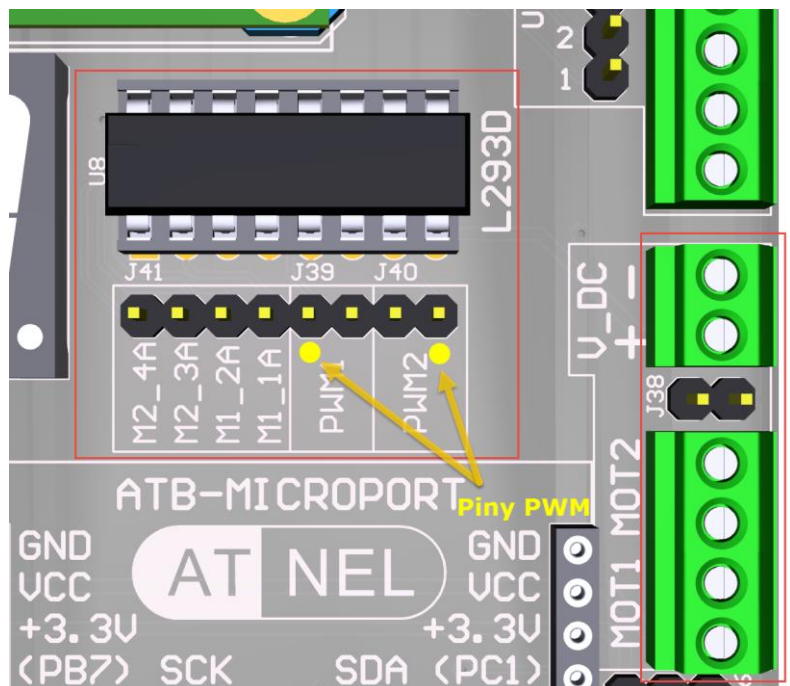
Smart design allows the control of each channel of the L293D by PWM signal from the microcontroller. Just remove the white jumpers J39 and J40 and connect PWM lines to external pins marked with yellow dots in the picture on the right side

If you do not want to use a PWM (motors are to be switched on at maximum power) you need to set up the white jumpers J38 and J40. This is the default setting.

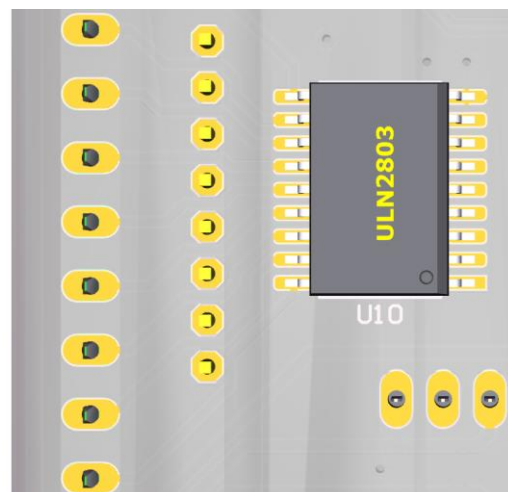
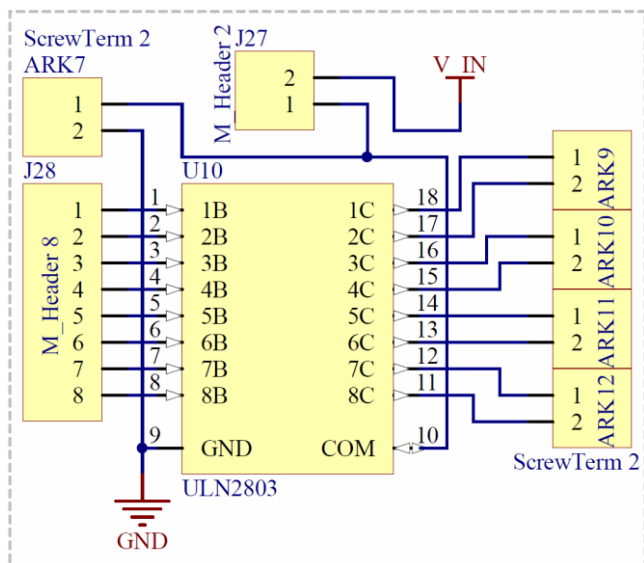
Input described as V_DC allows you to connect your own power supply to the motors (max 24 V), **however, then the jumper J38 must be opened!**



When you want to use the +12V supplied to the ATB set (to ATB-PWR3 converter), then just close the jumper **J38**.



Power driver ULN2803



The system in SMD version
is assembled from the bottom of PCB

The **ULN2803** can be used for various purposes. It can be used for load steering up to 500mA for example with a transmitter, and even with unipolar stepper motors. The system has eight independent channels, each of which can be controlled directly from the microcontroller.

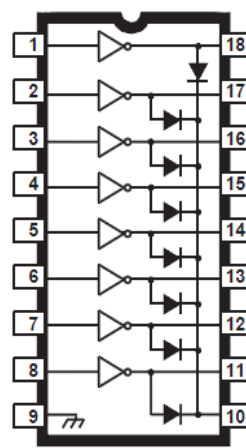
The juncture described on the PCB as **V_DC** in **ULN2803** section enables connection of you own power supply necessary to control the transmitters or motors.



Bear in mind that in such case you have to open the jumper J27!

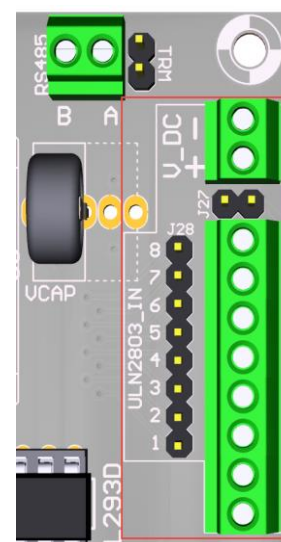
In case you use +12V (applied to the ATB-PWE3 converter of the set) to power the transmitters, motor or other devices, then you have to close the jumper **J27**.

Inputs of the system are available on J28 goldpin.

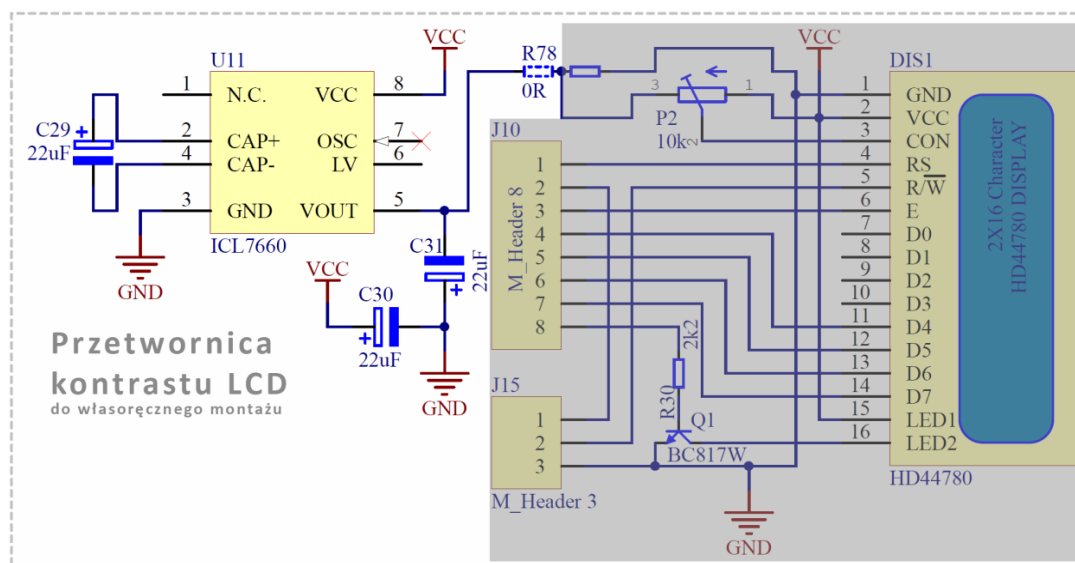


ULN2803

Internal structure
of the system



LCD - ICL7660 contrast converter (option)



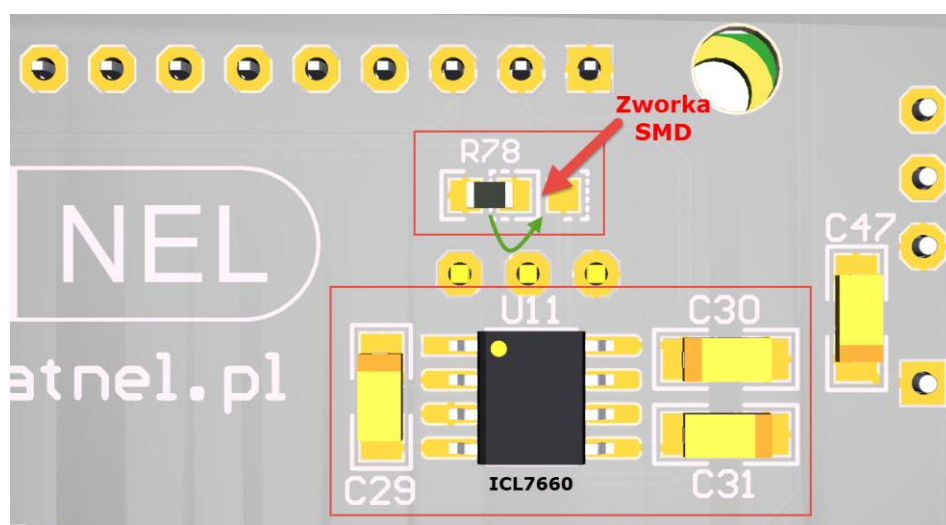
LCD contrast converter for your own assembly

Atmel company introduced to ATB sets the **ICL7660** converter which is used to lower the contrast voltage of the LCD display. The advantage of this solution is the possibility to use the LCD display correctly while powering of the set with **+3,3V**. Without the converter, after lowering the voltage from +5V to +3,3V the display stops to work properly, and no signs appear. In order to enable the work, it is necessary to provide a negative voltage to the LCD display contrast pin, and that is what this converter does. Apart from the integrated circuit, it consists of the three capacitors: **C29**, **C30** and **C31**, each of 22uF capacity. After soldering these components on your own, bear in mind that you have to move the SMD jumper (in a form of R78 resistor) in the opposite direction (to the right), as in the picture below. It is all placed from the bottom of PCB, below the LCD display.

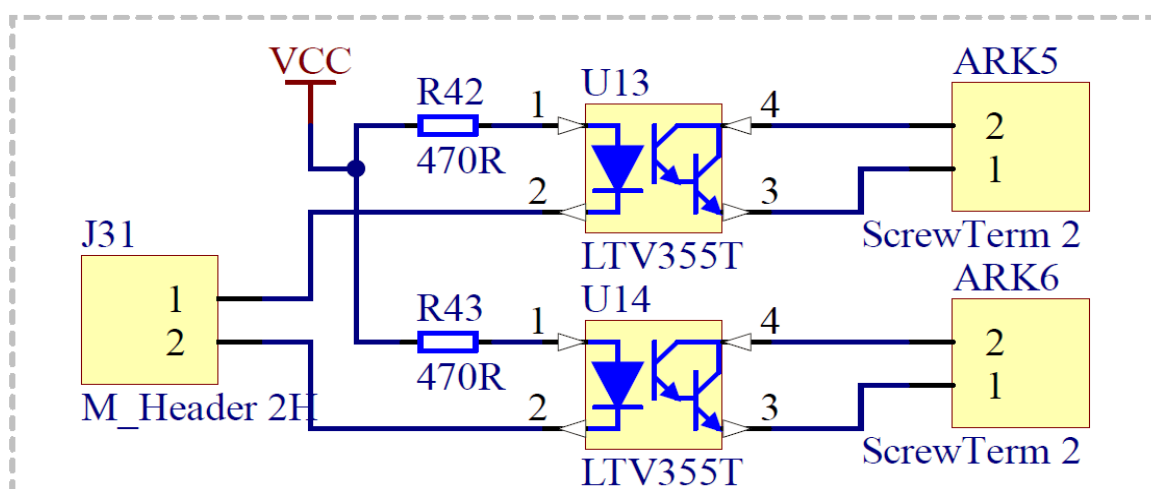


Warning! By default the converter is not assembled in the set. You can buy the necessary components at Atmel online store and solder them on your own.

www.sklep.atmel.pl



LVT optoisolators (option)



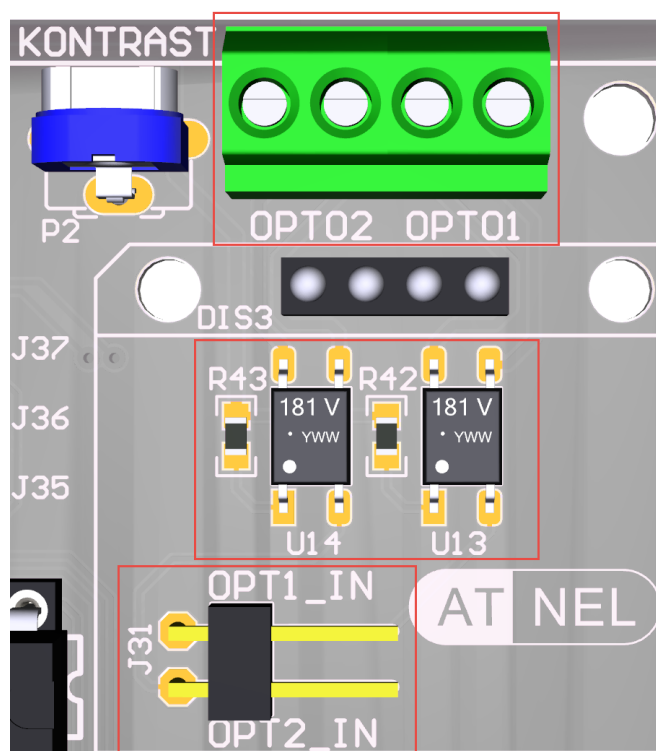
Two-channel optoisolation track in the ATB set consists of two SMD **optoisolators** type **LTV355T**. The systems are located under LCD and OLED.

Inputs of the optoisolators are applied to joint angle **J31**. This way you can connect the inputs to the microcontroller to control an external device. The pins are available on ARK terminal blocks marked with: **OPT01** and **OPT02**.

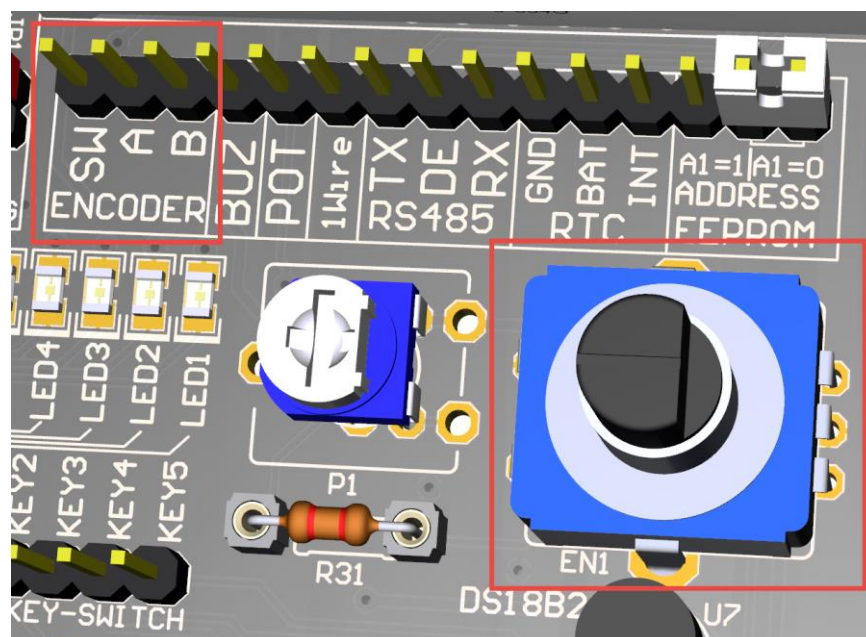
The assembly is very easy because on the PCB SMD resistors R42 and R43 are already soldered, as well as the joint angle **J31**.

WARNING! By default the optoisolators and ARL terminal blocks are not assembled in the set. You can buy them on your own in Atnel online store:

www.sklep.atnel.pl



Rotary encoder (option)



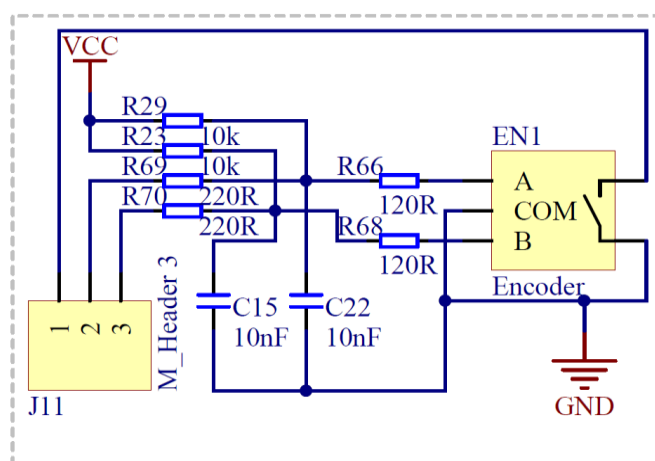
The ATB set also provides for the use of rotary **ENCODER**. You can use different types of encoders (24-steps, 30-steps and similar).

The encoder's systems on the PCB is equipped with a system adjusting signals to microcontrollers. Pins of encoders **A** and **B** as well as the button are LED on a goldpin under LED display.

There is also a place for these encoders which do not have a built-in button.

WARNING! By default the **ENCODER** itself is not assembled in the set. You can buy it on your own in Atnel online store:

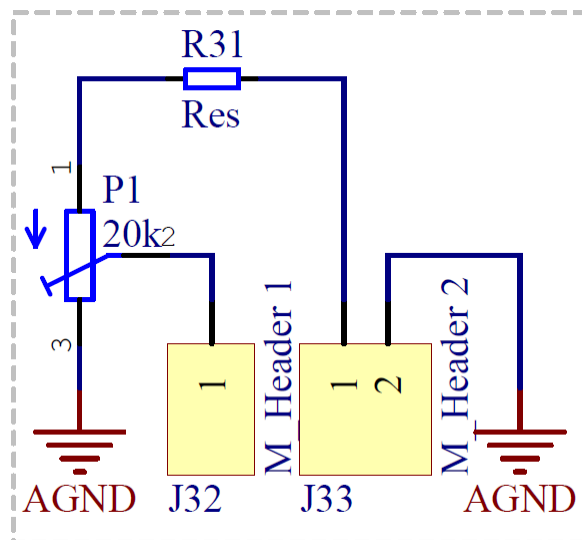
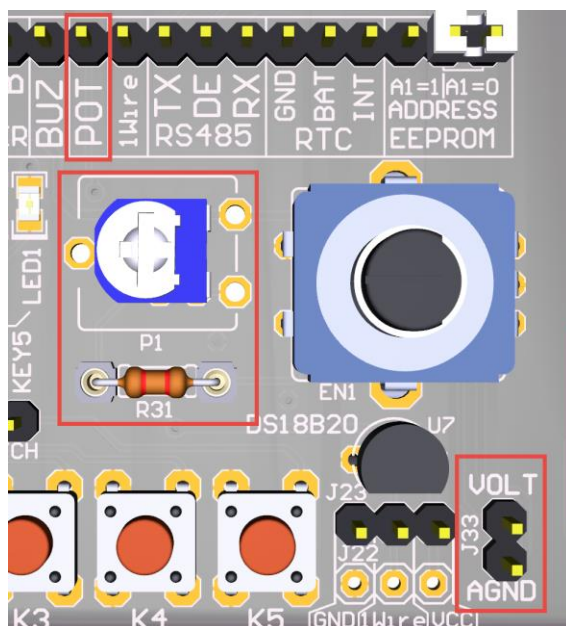
www.sklep.atmel.pl



We highly recommend a series of video guides on encoders and their connections:

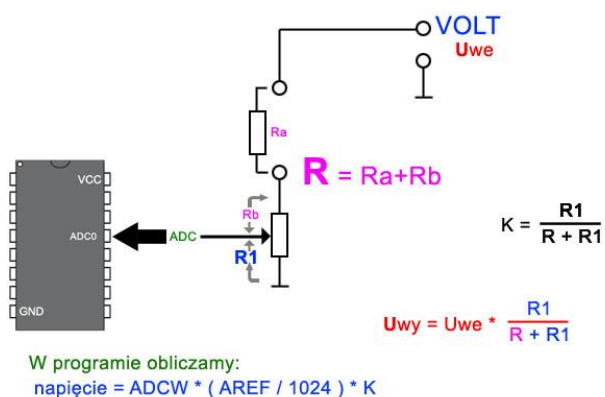
https://www.youtube.com/playlist?list=PLtXXWLsA5QNjgCQ3Op_drDTFthk3YAmhE

ADC input system – voltage measurement



The ATB start-up kits are equipped with, unusual for other companies, voltage divider as well as with input for measuring DC voltage in a very wide positive voltage range. Due to the voltage measurement system, there is a special analog ground line in the set which is well-separated from the digital ground. That is why it you can measure the voltage with the voltage divider only with use of juncture pin **J33** marked on the PCB as **VOLT**. The voltage divider consists of with a pre-soldered assembly potentiometer of 20k resistance, as well as R31 THT resistor placed in a precise stand of value 10k. Use the potentiometer's slider to either change the ratio of distribution of the entire divider by changing range of measured voltage, or to precisely select split of the divider to the current voltage available on AREF microcontroller's pin.

Dzielnik napięcia w zestawie ATB

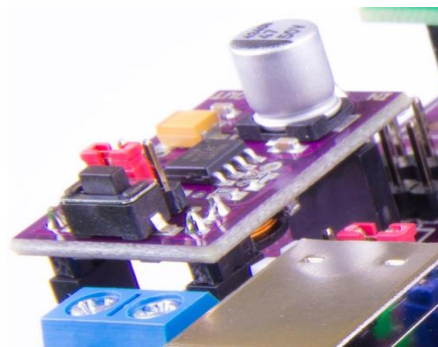
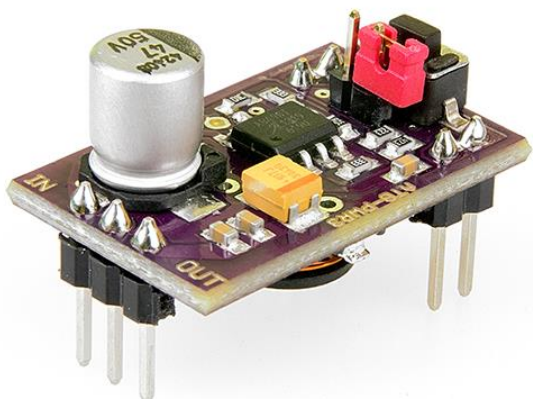


In the picture on the left side you can see a clear scheme of the voltage divider in the ATB set. Ra resistor is an equivalent of a replaceable R31 resistor. It also presents sample calculations for the selection of the input voltage divider with respect to Uwe.

You will find more information and video guides on the Atmel website:

<http://atmel.pl/atb-pomiar-napięcia-adc.html>

ATB-PWR3 converter



The converter mounted in the set

Innovative and reliable DC-DC converters type **ATB-PWR3** are mounted in the ATB sets by default. Assembly of the converter enables exchange or use outside the ATB set.

The converter allows you to power the set with +5V (*by default*) or +3,3V with use of external stabilised power supply. You select the voltage by a jumper on the converter.

When the jumper is open, the voltage is +5V

When the jumper is closed, the voltage is +3,3V

The input voltage may vary in range of +8V up to +40V (max.)

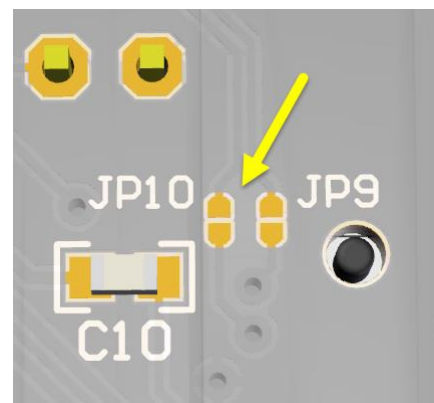
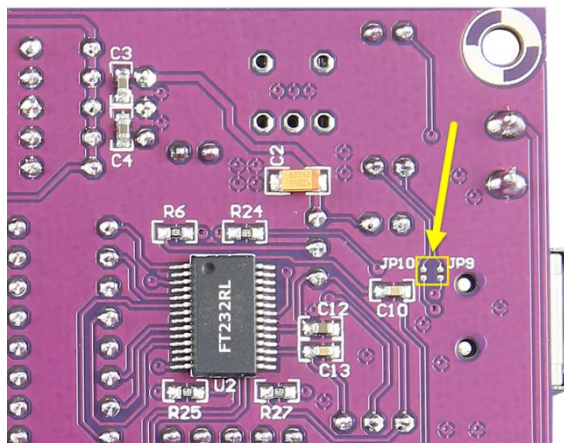
The current efficiency of the inverter is up to 1.2 A!



You will find details about the converter, its configuration and possible use on:

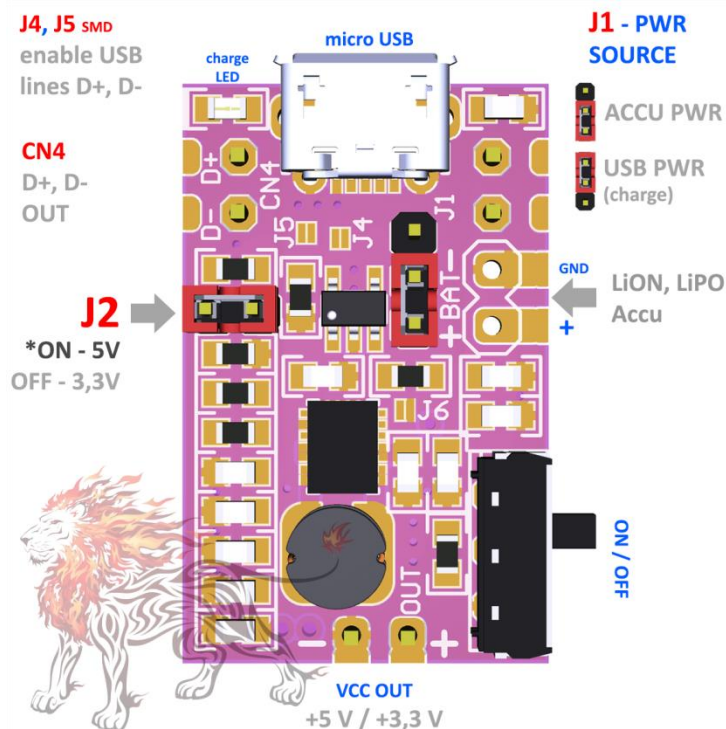
<http://atnel.pl/przetwornice-atb-pwr-3.html>

ATB-LION converter



Zworki SMD JP10 oraz JP9

You can buy the newest converters (buffer power supply) **ATB-LION** at Atnel online store and assembly them optionally in place of ATB-PWR3. Both types of converter fit to the same slot in the set. The **ATB-LION** converter allows for powering the set both with **Li-Ion** batteries and **Li-Po**, as well as from the micro USB slot – to which you can connect either a charger or a USB cable to PC. In the second case, when you connect the module to a computer, you can also provide a communication system of the ATB set with a computer via USB. For this purpose you need to remember to close from the **BOTTOM** side of the PCB (with a drop of tin) jumpers **JP10** and **JP9** presented in the pictures above. Additionally, close SMD jumpers **J5** and **J4** on the converter's module. The connected USB cable provides powering for the battery with a current max. 500 mA. In case of lack of the battery, the converter may operate without the charger but you have to move **J1** jumper on the converter in accordance with the below instruction:

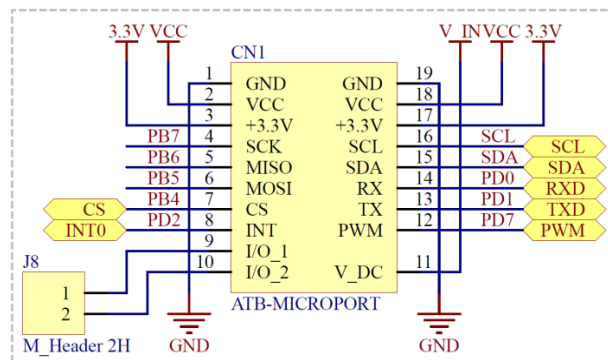
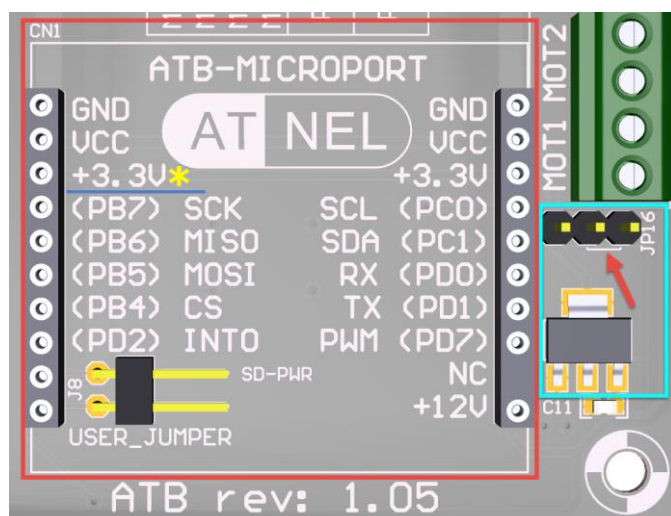


The converter allows you to power the set with +5V (by default) or +3,3V. You select the voltage by the **J2** on the converter (closed = +5V, open = +3,3V).

If you use USB type charger, the input voltage cannot exceed +5V. The charger should provide current efficiency of a minimum 800mA. While charging, you will see the green light of a LED diode placed nearby the USB on the PCB of ATB-LION converter.

The converter is equipped with a convenient slide switch allowing you to power on/off the entire ATB set.

ATB-MICROPORT juncture



The ATB sets starting from version 1.05 are equipped with an interesting expansion juncture in **ATB-MICROPORT** standard. These are two rows of female 10-pin junctures, wherein it is provided with a key (*cap in a place of the NC pin*), so as not to insert the module inversely. Signals applied to the juncture are clearly described on the PCB. Besides the power supply, the following data buses were applied: **SPI** together with SS (**CS**) signal, **I2C** and **UART** (RS232 RX/TX). For better readability, pins of ATmega32 microcontroller are also presented. The juncture is available at Atmel online store as a complete library component for software Cadsoft **Eagle** (*.LBR) and **Altium Designer**.

Power supply in ATB-MICROPORT

Looking from above, on both rows of junctures, GND (ground) and VCC – actual power supply in the ATB set are derived. Depending on the settings of the ATB-PWR3 or ATB-LION converters, it may be +5V or +3,3V. By default, the set is powered with a +5V, so the further derived voltage is +3,3V, which can be obtained by the LDO stabiliser type LM1117 of current efficiency 800 mA. If you want to power the set with a +3,3V from the converter, you have to bypass the LDO stabiliser. Use JP16 jumper for this purpose, its functions are explained below. The red arrow in the picture in a blue frame is a default setting of the jumper **JP16**.



Warning! It is highly recommended to use +3,3V marked with a yellow asterisk in the picture above (blue underline) on the ATB-Microport juncture on the left side.

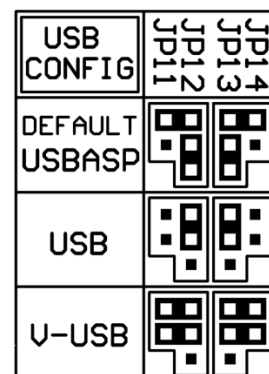
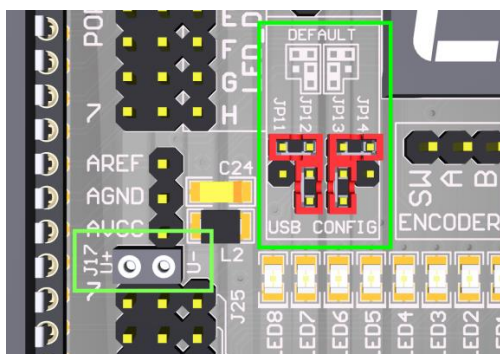


With the default voltage +5V of the ATB set, the jumper is set as in the picture on the left side. Accordingly, +3,3V in the ATB-Microport is supplied through LDO stabiliser.



When voltage of the set is +3,3V you have to move the jumper as in the picture on the left side. This way you will bypass the system of LDO stabiliser. In such case, in the ATB-Microport juncture only +3,3 V is available, even on VCC pins.

V-USB system or clear USB lines for microcontroller



Starting from version 1.05 the ATB sets are equipped with a built-in **two-port HUB USB**. This way, two devices may operate on different USB lines (ports) in each set. One of the devices is ATB-USB-RS232 converter with FT232RL system, which is connected permanently to one of the ports. It also functions as a spare ATB-FT232R programmer. The second USB port was created by default for the built-in **USBasp** programmer. However, it is possible to change configuration of the second USB port by several jumpers – from **P11** to **JP14**. It allows three different variants of work of the second USB port:

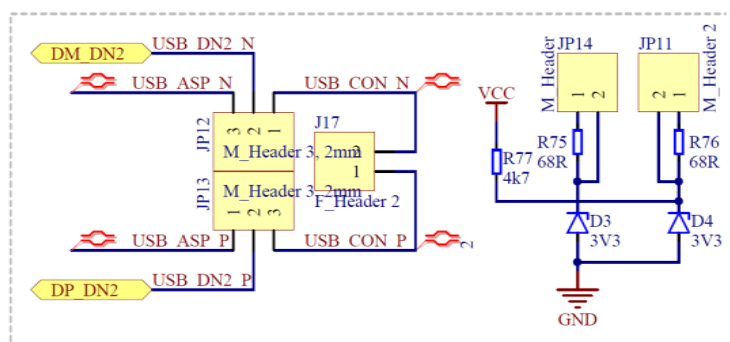
1. Connected built-in **USBasp** programmer (*by default*).
2. Possibility of deriving clear USB lines (**D+** and **D-**) for the user.
3. **Activation of the V-USB system**, which can be connected to the microcontroller with two cables.



Warning! Choosing variant 2 or 3 will result in disconnection of the built-in **USBasp** programmer, but in such situation it is still possible to use the spare **ATB-FT232R** programmer.

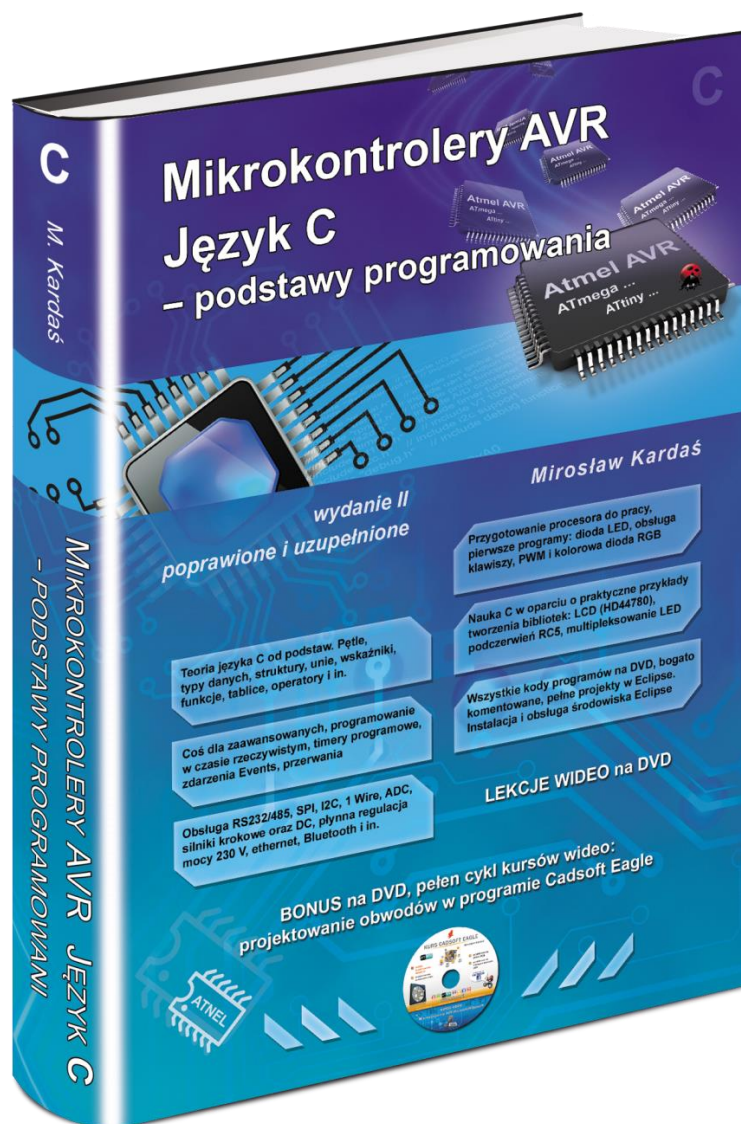
V-USB system consists of already soldered SMD components which together create base (input) of this system on the PCB of the set. You can see the scheme below. The USB lines are protected with Zener diodes 3V3 and with resistors R75 and R76. You can also see prepared pull up of one the lines to VCC.

Outputs of lines **D+** and **D-** both for configuration of a USB and for V-USB systems are located on juncture **J17** and marked as **U+** and **U-**. It is a female juncture because it minimises the risk of the USB line short circuit, or connecting in this place wire jumpers for other modules by mistake. Taken this into consideration, connecting of the lines **U+** and **U-** to the microcontroller requires two female/male wire jumpers.



Recommended literature

Recommended textbook for learning the basics of programming microcontrollers in C programming language with start-up kits ATB series from Atmel:



<http://atmel.pl/mikrokontrolery-avr-jezyk-c.html>

Welcome to our blog:

www.mirekk36.blogspot.com

Welcome to our technical support forum:

www.forum.atmel.pl

Welcome to our video guides on youtube:

www.youtube.com/mirekk36

Welcome to our Facebook fanpage:

www.facebook.com/atmel.mikrokontrolery

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