



Beta mini
PIC Development Kit

General Description

Betamini is a PIC development kit designed particularly for students, beginners and fresh graduated engineers to provide easy developing of PIC microcontroller projects.

Betamini supports a wide range of PIC microcontrollers. It kit provides the most common devices and circuits, such as LCD, keypad, serial interface, and more. All I/O pins are brought out via pin header for direct port accessing.

Betamini kit saves most of the wasted time in hardware design and testing.

Kit Specifications



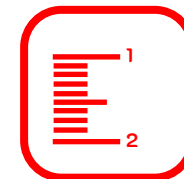
power supply

- USB powered
- 9-20VDC (1A)



weight

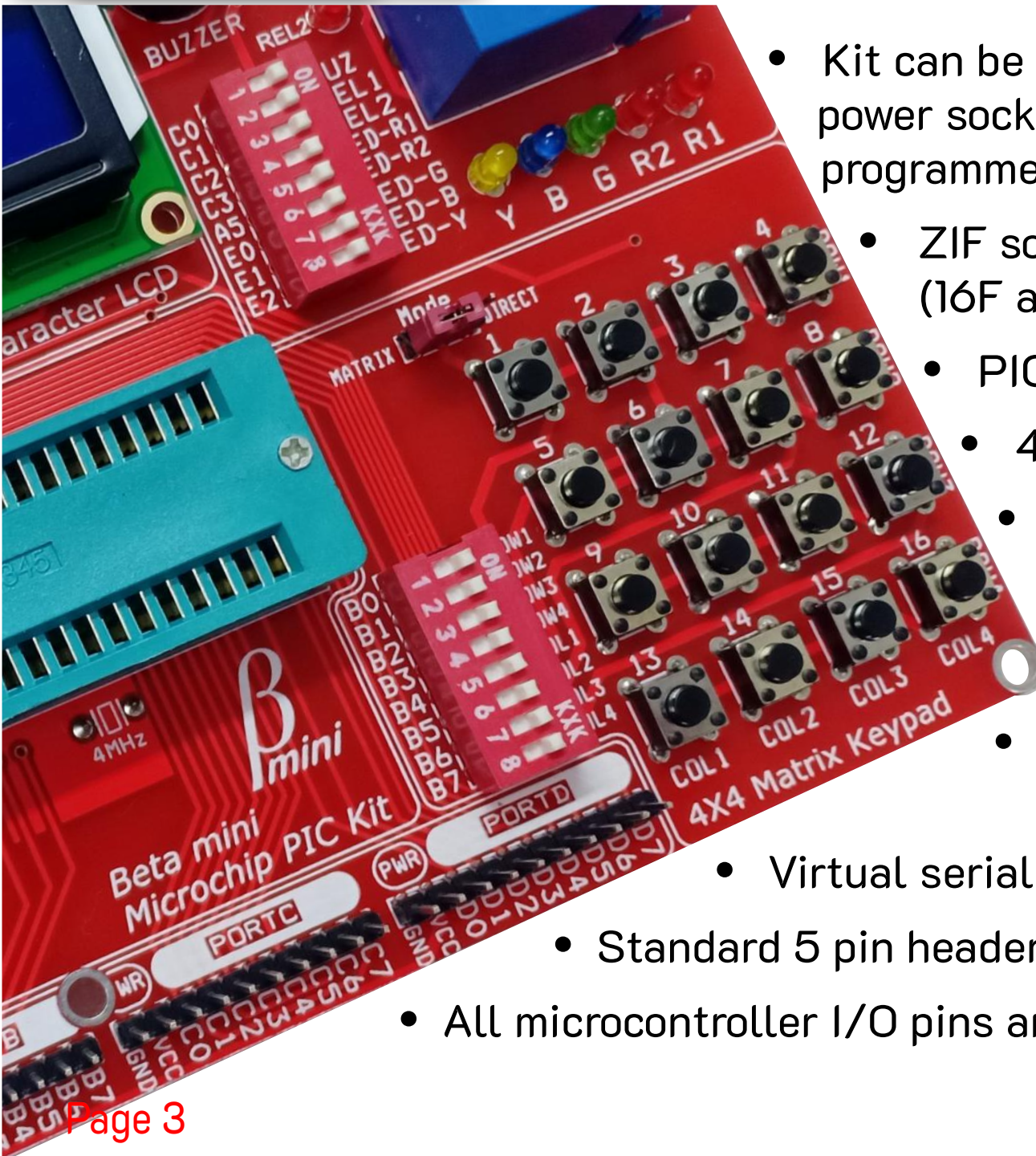
- 250 gm



board dimensions

- 183 X 113 X 30 mm

Key Features

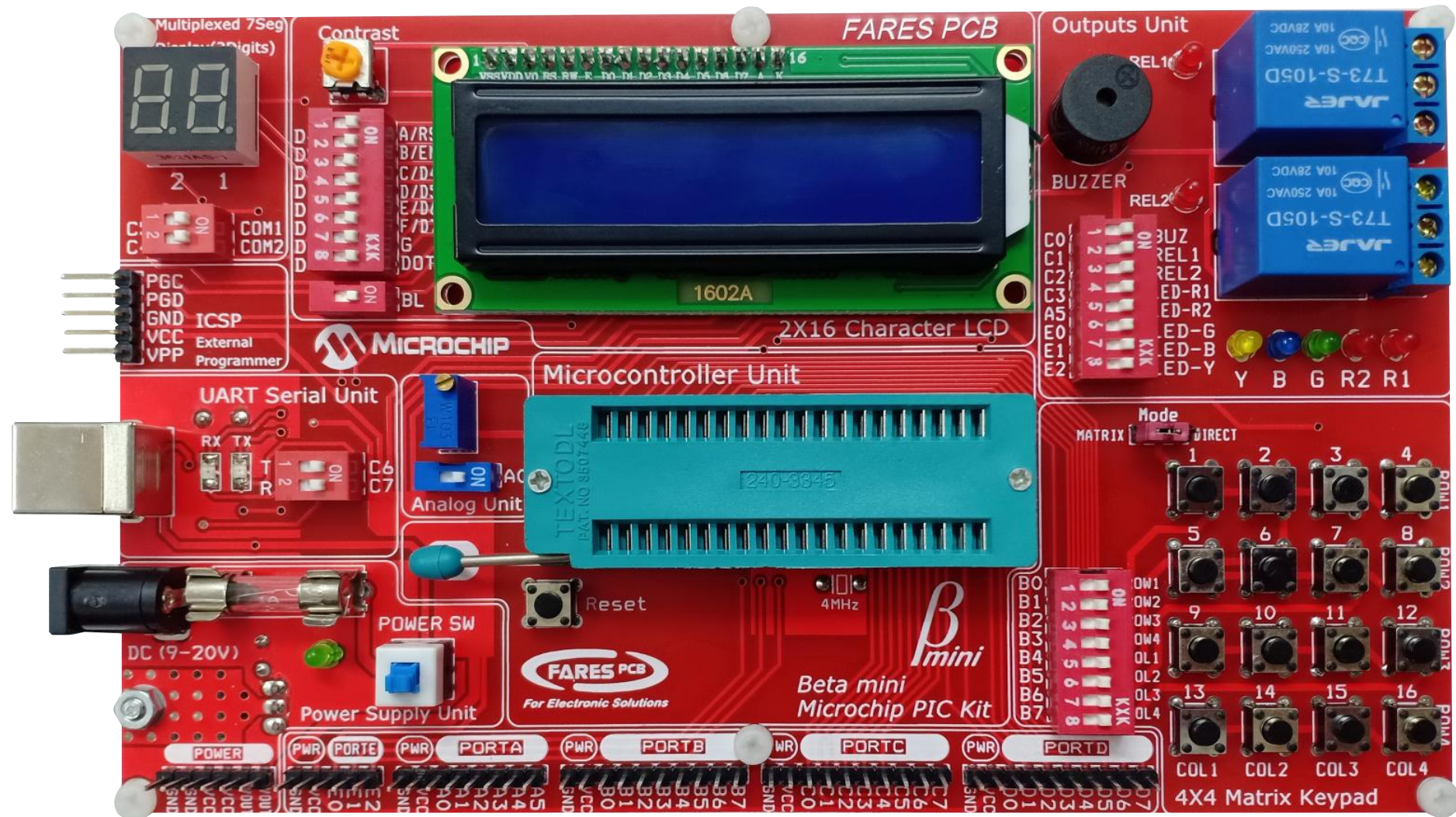


- Kit can be powered from DC adaptor (1A) via DC power socket 9-20V, PC via USB type B socket or external programmer via ICSP socket.
- ZIF socket supports wide range of PIC microcontrollers (16F and 18F families).
- PICkit 2 Programmer is included.
- 4X4 matrix keypad.
- Outputs unit includes LEDs, relays and buzzer.
- Multiplexed two digits 7 Segment display.
- 2X16 LCD display module.
- One variable analog input using high precise multi-turn variable resistor.
- Virtual serial COM port via USB (CH340) .
- Standard 5 pin header socket ICSP for external programmers.
- All microcontroller I/O pins are brought out via pin header.

Board Components

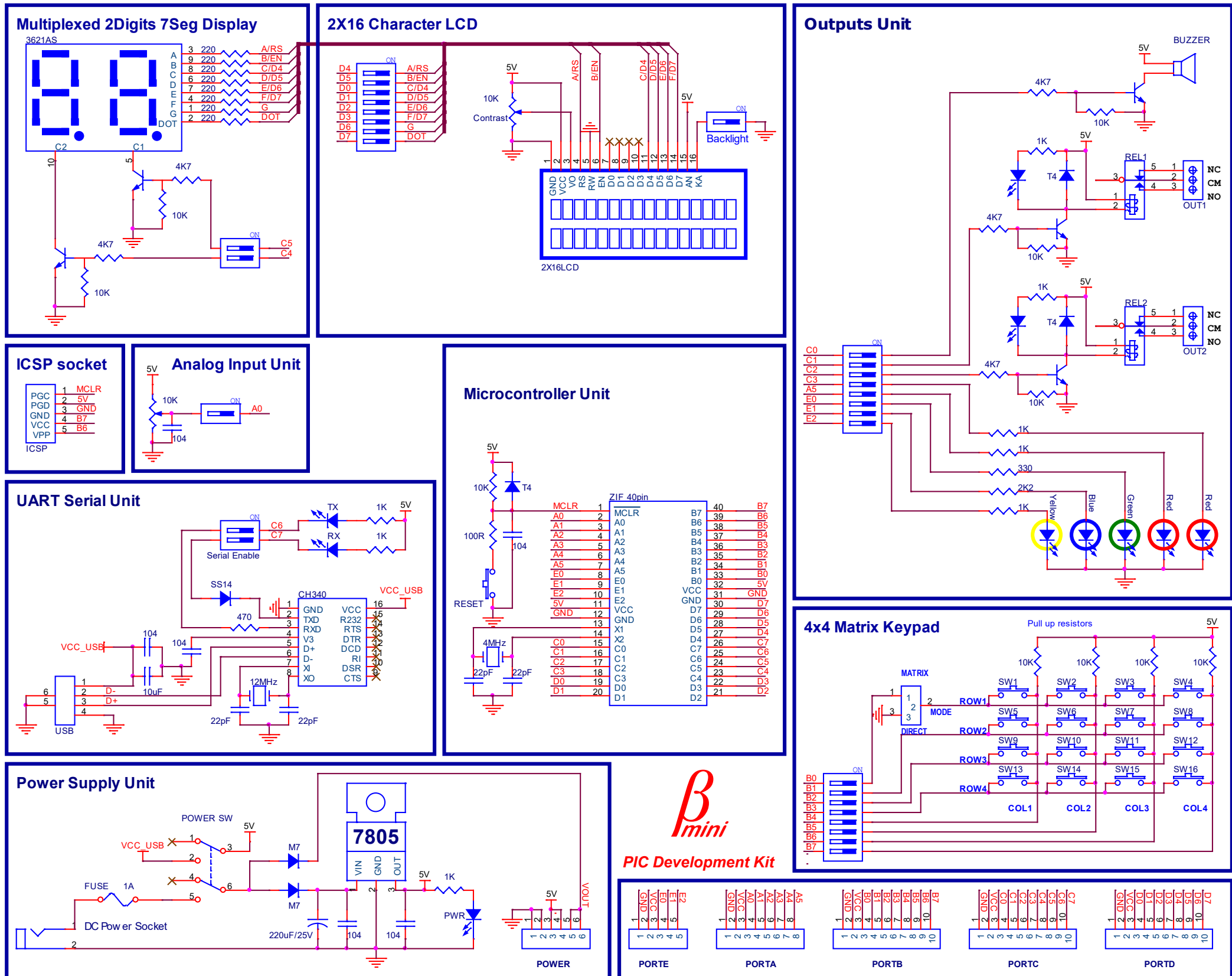


PICKit 2
Programmer



Betamini Kit

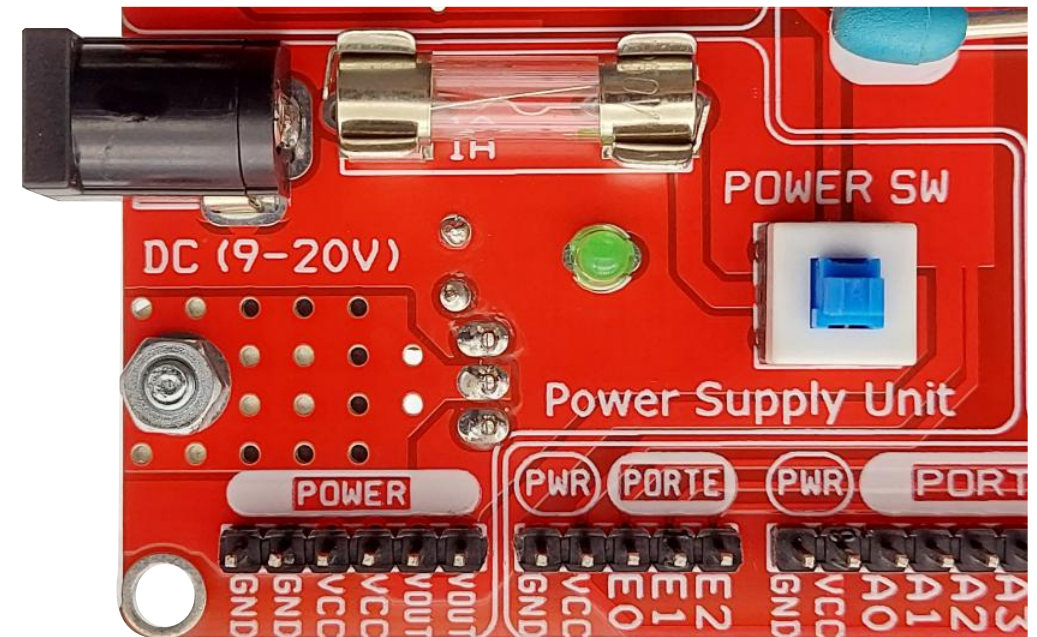
Schematic



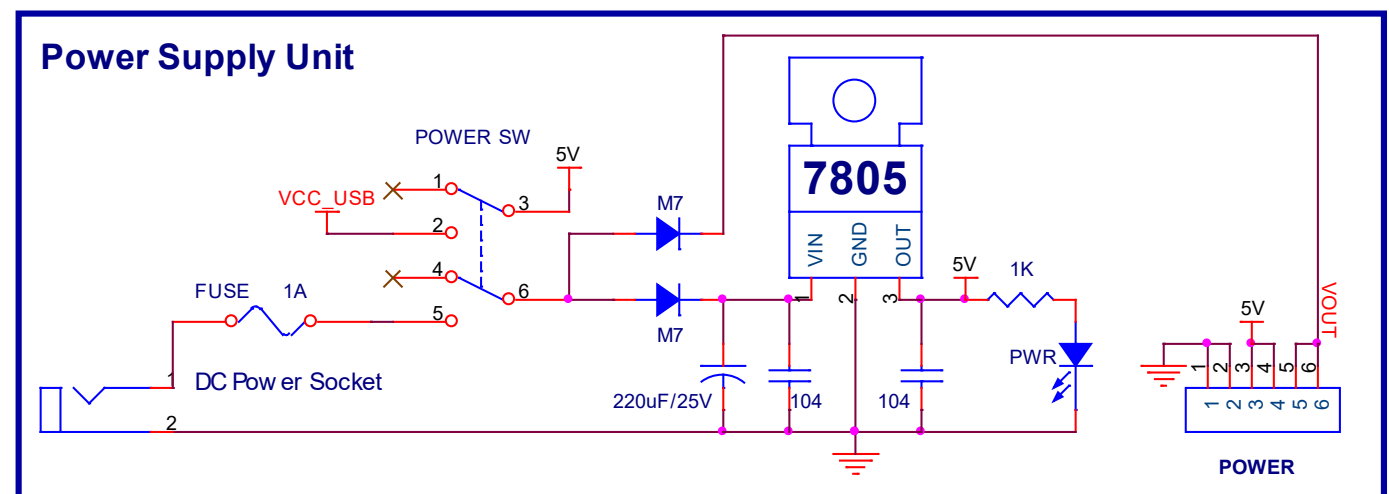
Power Supply Unit

➤ Power supply unit features:

- On/Off Power switch.
- Green LED power indicator.
- 7805 (5V regulator %5 tolerance).
- Over-current and reverse polarity protection.
- GND, VCC(5V) and adaptor voltage(VOUT) are available for external using via header socket.



Betamini kit is protected against over-current and reversed polarity of power.



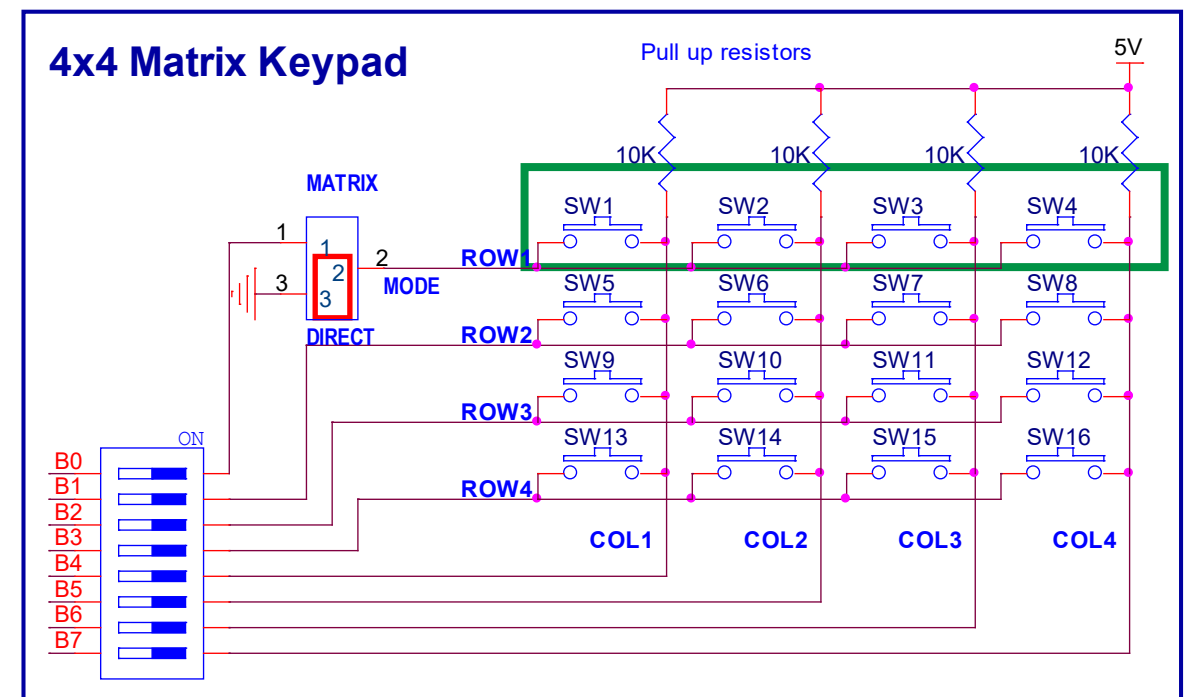
4X4 Matrix Keypad Unit

Betamini includes 16 push button switches configured as 4 rows intersected by 4 columns. Each intersection creates a switch position. Microcontroller can scan switches using one of two modes; matrix mode and direct mode.

➤ Direct Mode

Just 4 switches are activated to save microcontroller pins in case of no need for more switches, and to reduce firmware complexity in scanning operation. Column lines are pulled up by 10K Ω resistors. Switches in the first row are only enabled (i.e. SW1, SW2, SW3 and SW4) and can be read directly as inputs through column lines. Microcontroller checks the column lines. If a column line goes low, it means a switch is pressed otherwise, it is considered released.

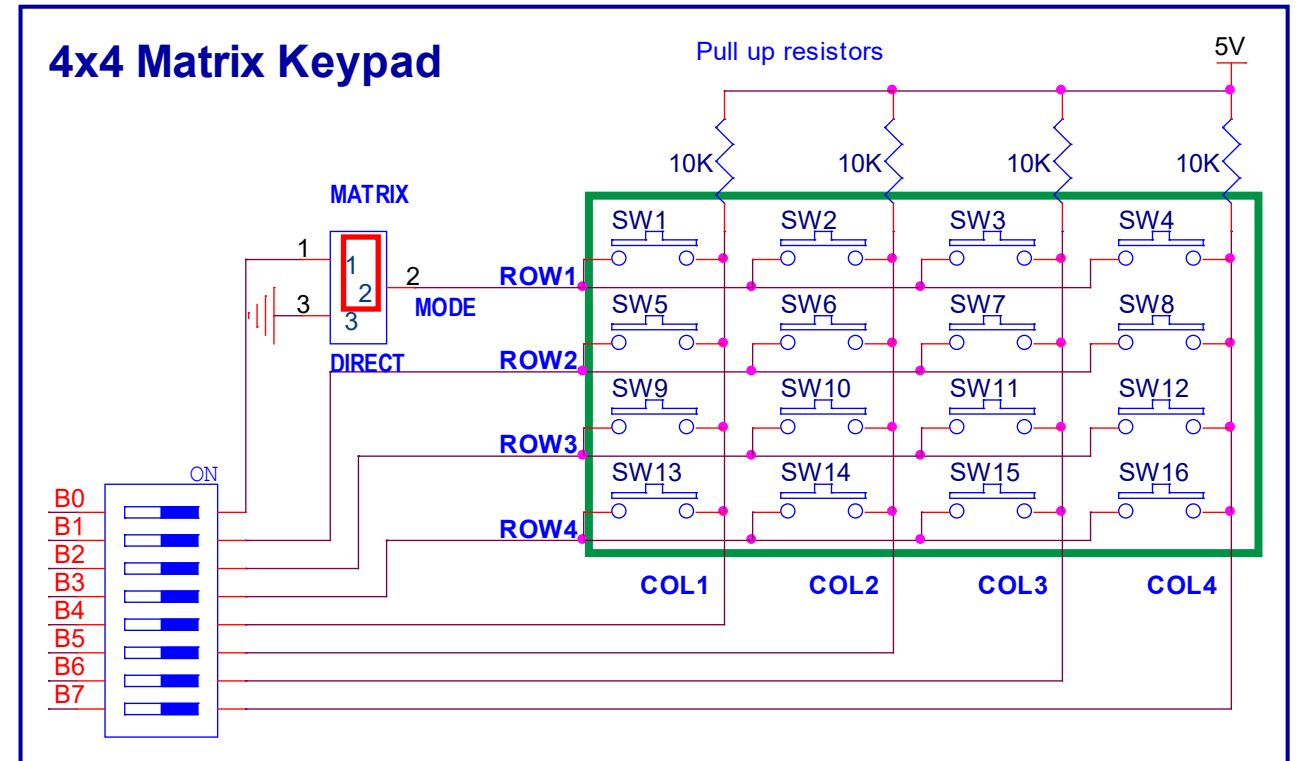
| Switch | MCU pins |
|--------|----------|
| SW1 | B4 |
| SW2 | B5 |
| SW3 | B6 |
| SW4 | B7 |



➤ Matrix Mode

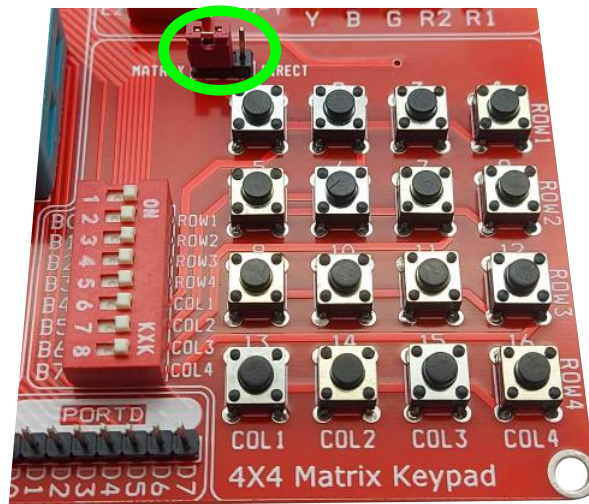
All 16 switches are activated and configured as 4 row lines and 4 column lines. Microcontroller scans these lines to detect a button pressed state. Column lines are pulled up by 10K Ω resistors. (i.e. microcontroller port pin reads high if no switch is pressed). Scan process starts by setting all rows and columns as inputs. To scan switches in a row, microcontroller configures it as output and initiates it to low, then checks columns one at a time. If a column line goes low, microcontroller detects a pressed switch otherwise, no pressed switch is detected in this row hence, it goes to scan next row and so on.

| Function | MCU pins |
|----------|----------|
| Row1 | B0 |
| Row2 | B1 |
| Row3 | B2 |
| Row4 | B3 |
| Col1 | B4 |
| Col2 | B5 |
| Col3 | B6 |
| Col4 | B7 |



Keypad Modes

Matrix mode



Direct mode

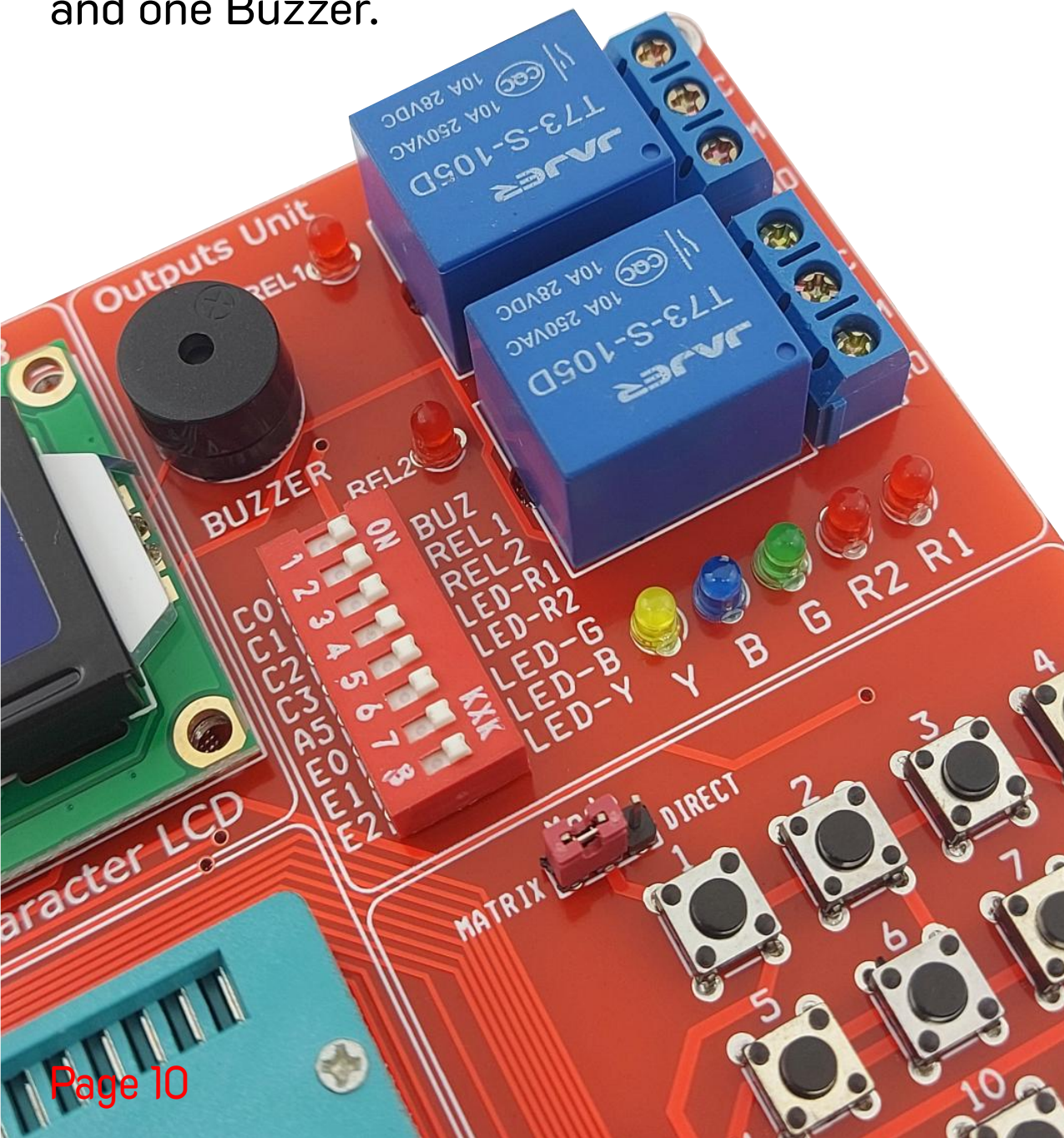


- To configure keypad in matrix mode, just set Mode jumper to MATRIX position.
- All switches are activated.

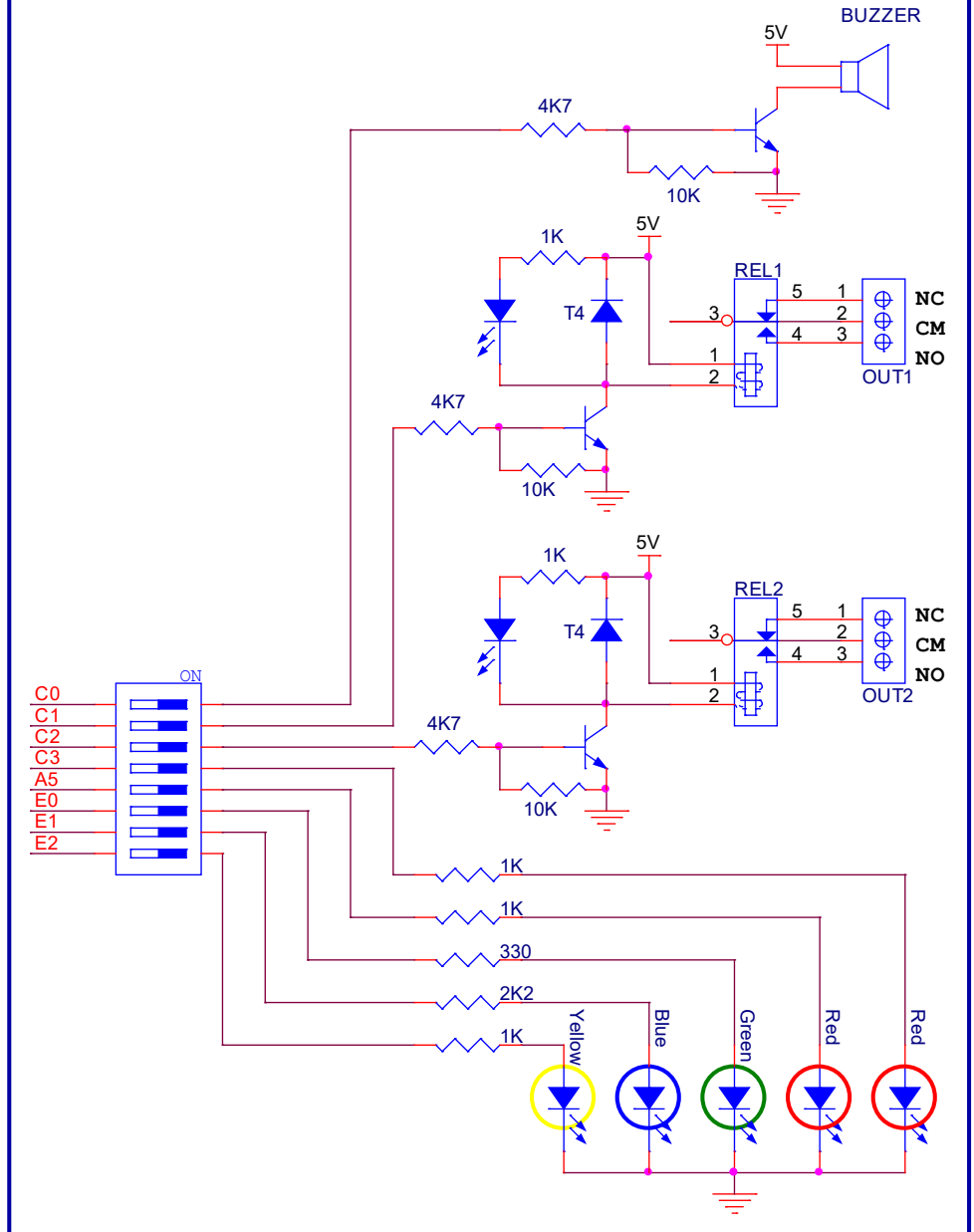
- To set keypad in direct mode, just set Mode jumper to DIRECT position.
- Switches in first row are only enabled (SW1, SW2, SW3 and SW4) and can be read directly as inputs through column lines.

Outputs Unit

This unit contains eight outputs divided to five LEDs **Red1**, **Red2**, **Green**, **Blue** and **yellow** , two relays REL1, REL2 and one Buzzer.



Outputs Unit



➤ Outputs Unit:

Two output relays

Betamini kit provides two output relays which are suitable for AC and DC switching applications. Each relay has its own LED status indicator and can be individually enabled via DIP switch. NPN transistors are used to drive relays. Freewheeling diodes are included to protect transistors from back EMF voltage that arises on relay coil during switching off. Relay1 and relay2 are driven by μ C pins C1 and C2 respectively. Relays are 5V coil and rated up to 5A contacts (resistive load). Both normally open and normally closed contacts are brought out via screw terminals.

Five output LEDs

Five LEDs (**Red1**, **Red2**, **Green**, **Blue** and **yellow**) with current limiting resistors are driven by μ C pins C3, A5, E0, E1 and E2 respectively. LEDs are active high. i.e. output high turns LED on. Each LED can be individually enabled via DIP switch.

One output buzzer

One output buzzer (5VDC) is driven by μ C pin C0. Also, it can be enabled via DIP switch.

| Output | MCU pins |
|------------|----------|
| Buzzer | C0 |
| Relay 1 | C1 |
| Relay 2 | C2 |
| Red1 LED | C3 |
| Red2 LED | A5 |
| Green LED | E0 |
| Blue LED | E1 |
| Yellow LED | E2 |

Microcontroller Unit

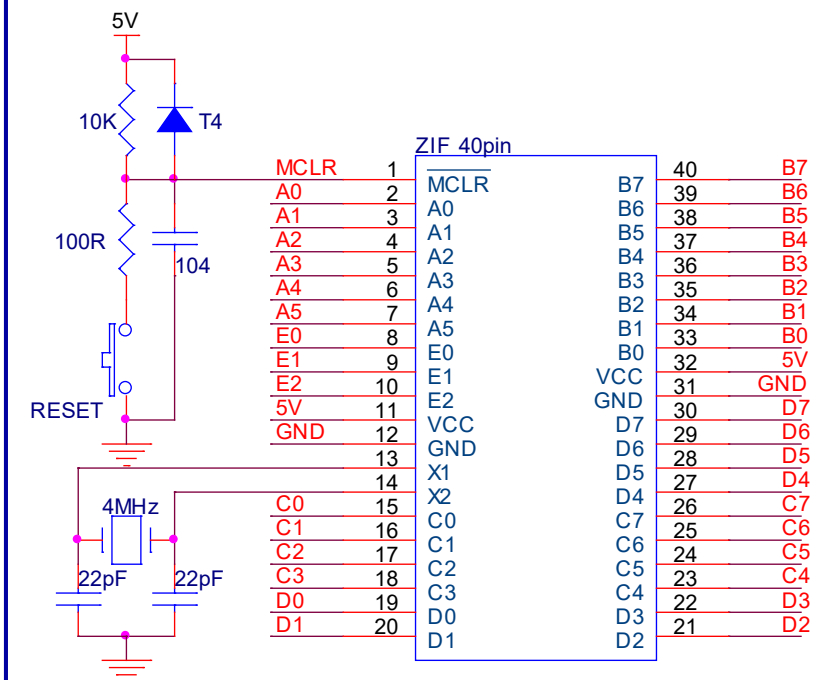
Betamini includes a 40-pin ZIF socket that supports a wide range of 16F and 18F microcontroller families. It enables users to burn code on DIP package microcontroller via only one socket.

Supported Families

| | | |
|---------|---------|---------|
| 16F877A | 18F452 | 18F4550 |
| 16F777 | 18F4321 | 18F4525 |
| 16F884 | 18F4410 | 18F4523 |
| 16F887 | 18F4420 | 18F4553 |
| 16F877 | 18F4423 | 18F4580 |
| 16F874 | 18F4431 | 18F4585 |
| 16F747 | 18F4450 | 18F4610 |
| 16F874A | 18F4455 | 18F4620 |
| 18F442 | 18F4458 | 18F4680 |
| 18F448 | 18F4480 | 18F4682 |
| 18F4221 | 18F4510 | 18F4685 |
| 18F4455 | 18F4515 | |
| 18F458 | 18F4520 | |



Microcontroller Unit

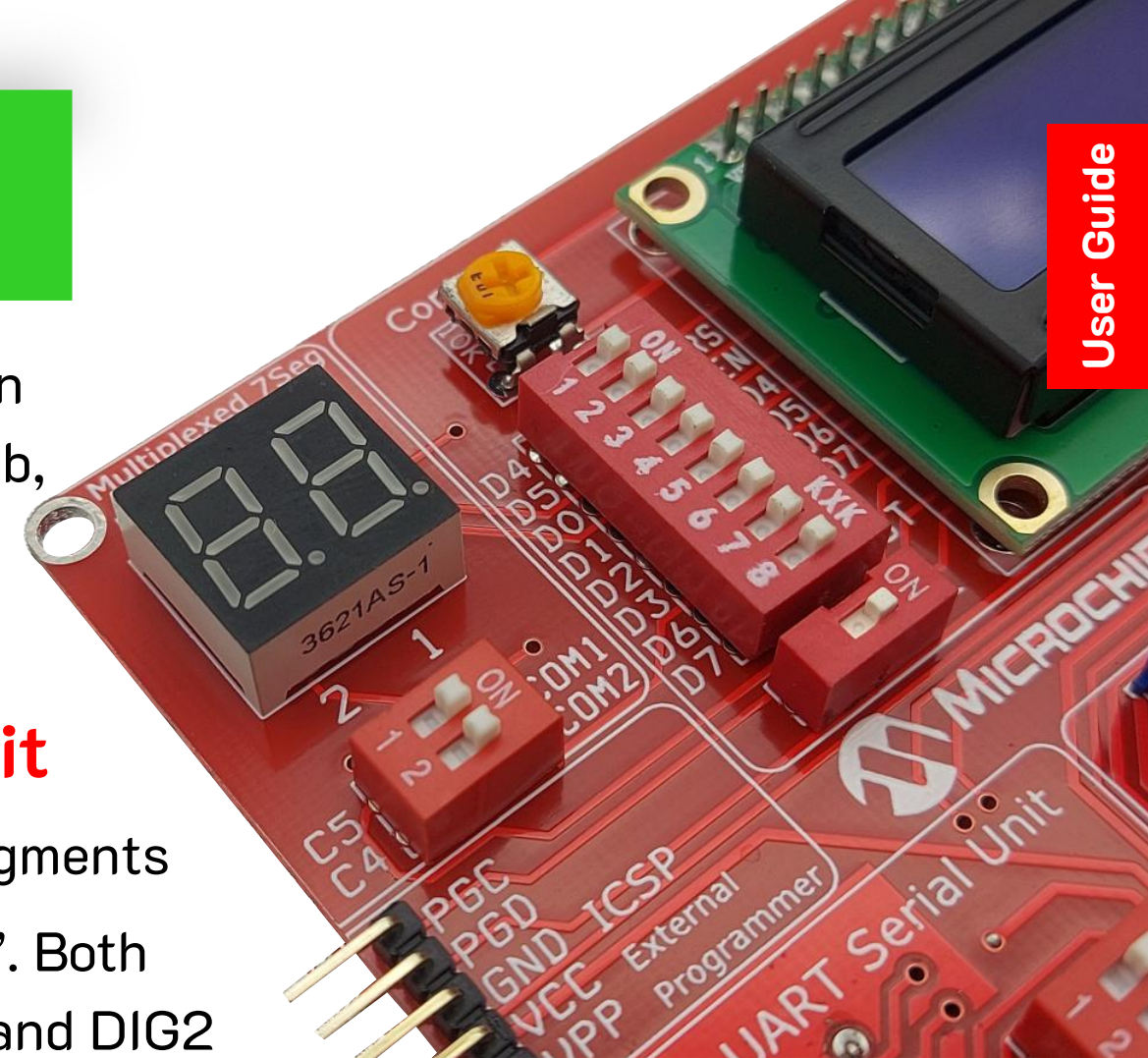


7Segment Display

7segment display is used to indicate numerical data. It can display digits from 0 to 9 and some characters such as A, b, C, H, E, F ,etc. 7segment display is very popular and has many applications.

➤ Multiplexed Two Digits 7seg Display Unit

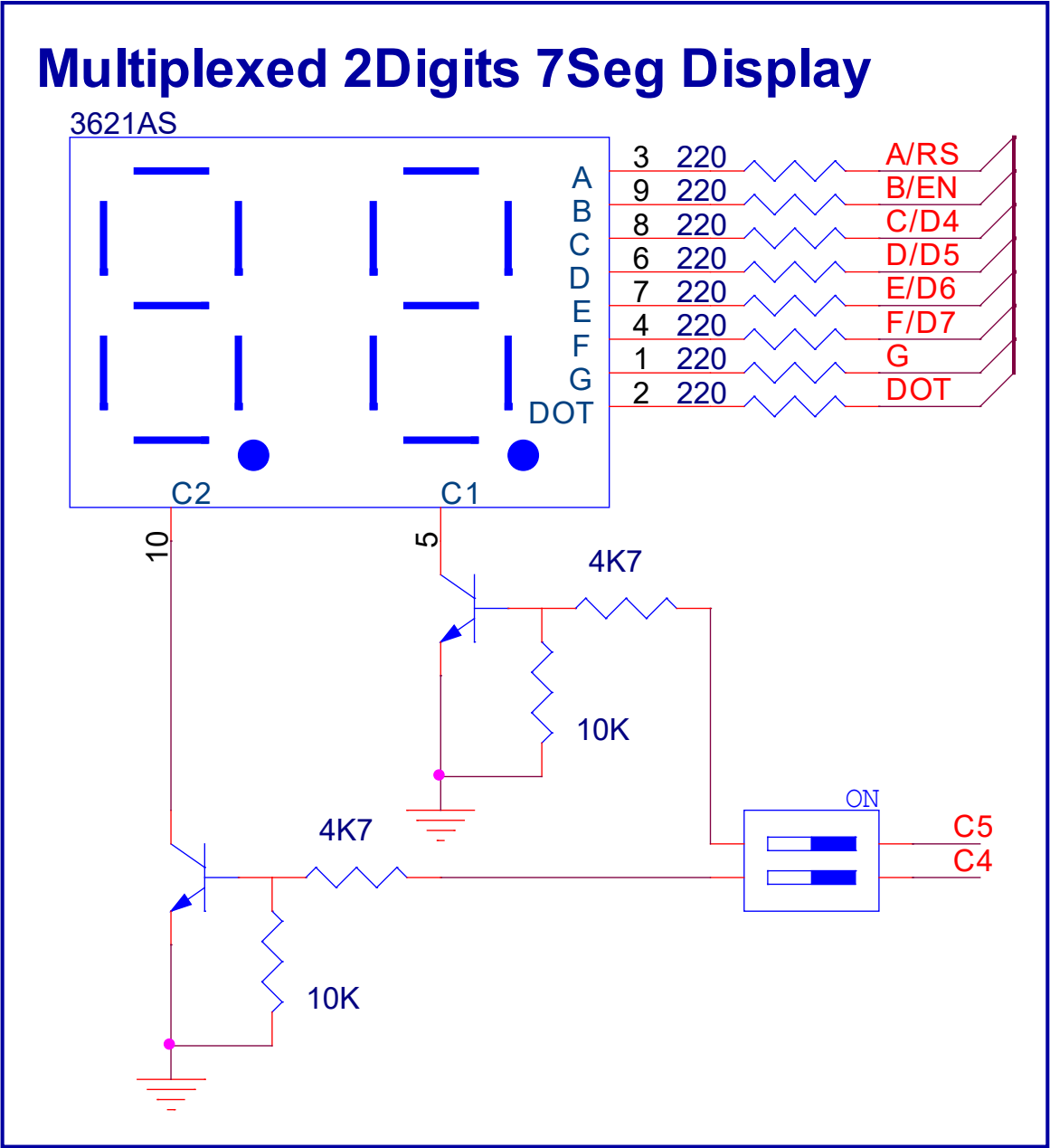
Two multiplexed 7seg digits are added to *Betamini* kit. Segments are referred to by letters “A”, “B”, “C”, “D”, “E”, “F”, “G”, “DOT”. Both digits share the same segments. i.e. segment “A” of DIG1 and DIG2 are driven by the same μ C pin. Each digit has its own common cathode which is driven by NPN transistor. So, a high logic from microcontroller turns transistor on, which enables the digit. Segments are active high, i.e. a high logic turns segment on.



Note : Each 7seg digit can be enabled or disabled individually using DIP switch.

Segments commons are connected to microcontroller as shown in table:

| Segment | MCU pins |
|---------|----------|
| A | D4 |
| B | D5 |
| C | D0 |
| D | D1 |
| E | D2 |
| F | D3 |
| G | D6 |
| DOT | D7 |
| Common | MCU pins |
| Com 1 | C5 |
| Com 2 | C4 |

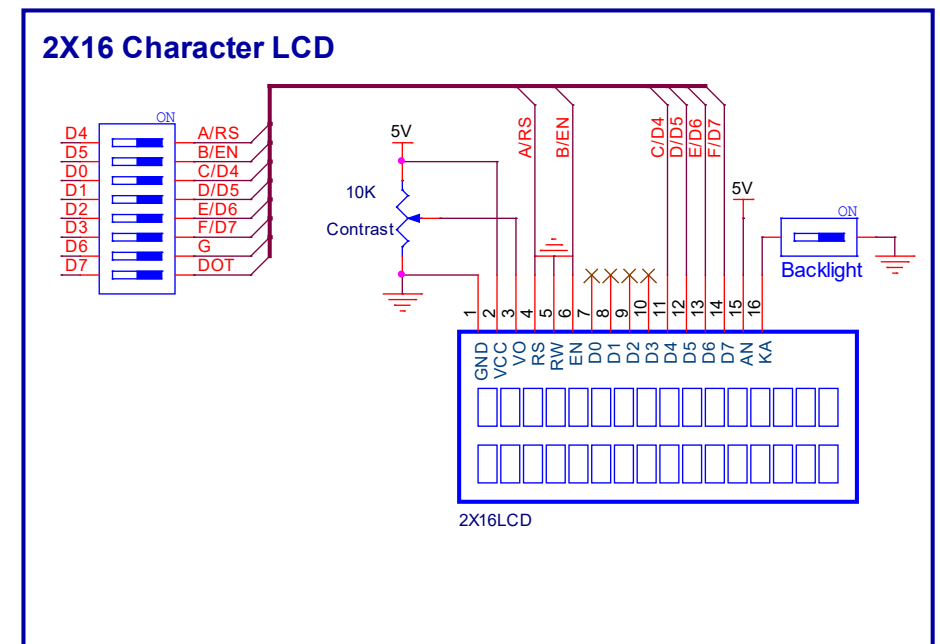


2X16 LCD Display

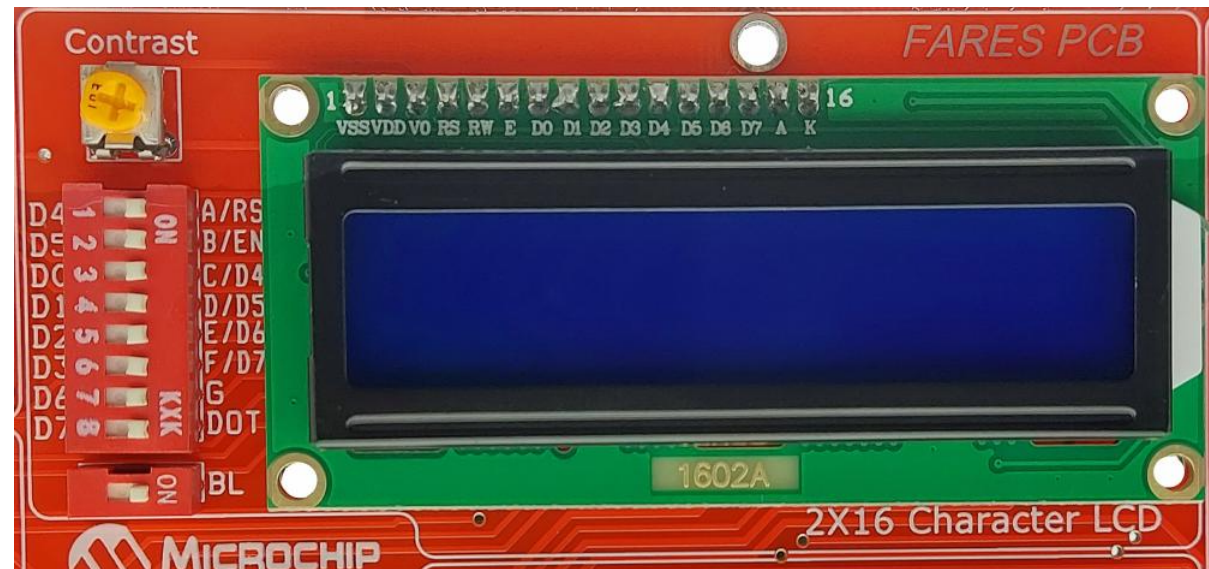
2X16 alphabetic LCD with contrast and backlight control configured in 4 bit mode is connected to the least 6 significant bits of PORTD via DIP switch as following:

| LCD pin NO | LCD pin symbol | LCD pin function |
|------------|----------------|--|
| 1 | Vss | Ground |
| 2 | Vcc | +5V |
| 3 | Vo | Contrast adjustment |
| 4 | RS | Register Select(0 : command, 1 : data) |
| 5 | R/W | R/W (0 : write, 1 : read) |
| 6 | EN | Enable |
| 7 | D0 | Data bit 0 |
| 8 | D1 | Data bit 1 |
| 9 | D2 | Data bit 2 |
| 10 | D3 | Data bit 3 |
| 11 | D4 | Data bit 4 |
| 12 | D5 | Data bit 5 |
| 13 | D6 | Data bit 6 |
| 14 | D7 | Data bit 7 |
| 15 | A | Back light anode (+) |
| 16 | K | Back light cathode (-) |

| LCD pin number | LCD pin symbol | µC pins |
|----------------|----------------|---------|
| 4 | RS | D4 |
| 6 | EN | D5 |
| 11 | D4 | D0 |
| 12 | D5 | D1 |
| 13 | D6 | D2 |
| 14 | D7 | D3 |



➤ 2X16 LCD display:



- LCD R/W control is tied to ground.
- 10K Ω variable resistor denoted by "Contrast" is used to adjust the LCD contrast.



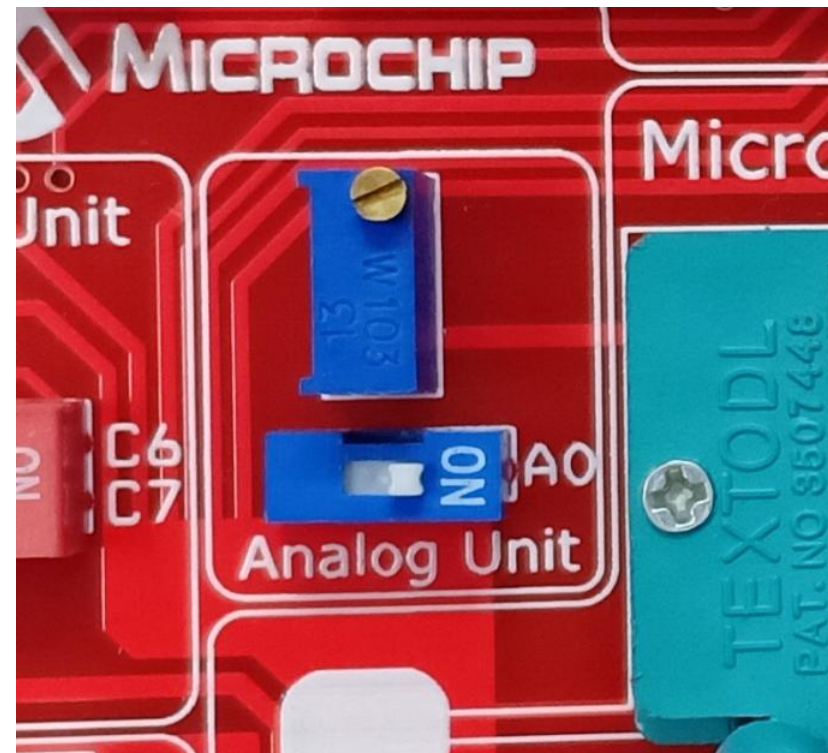
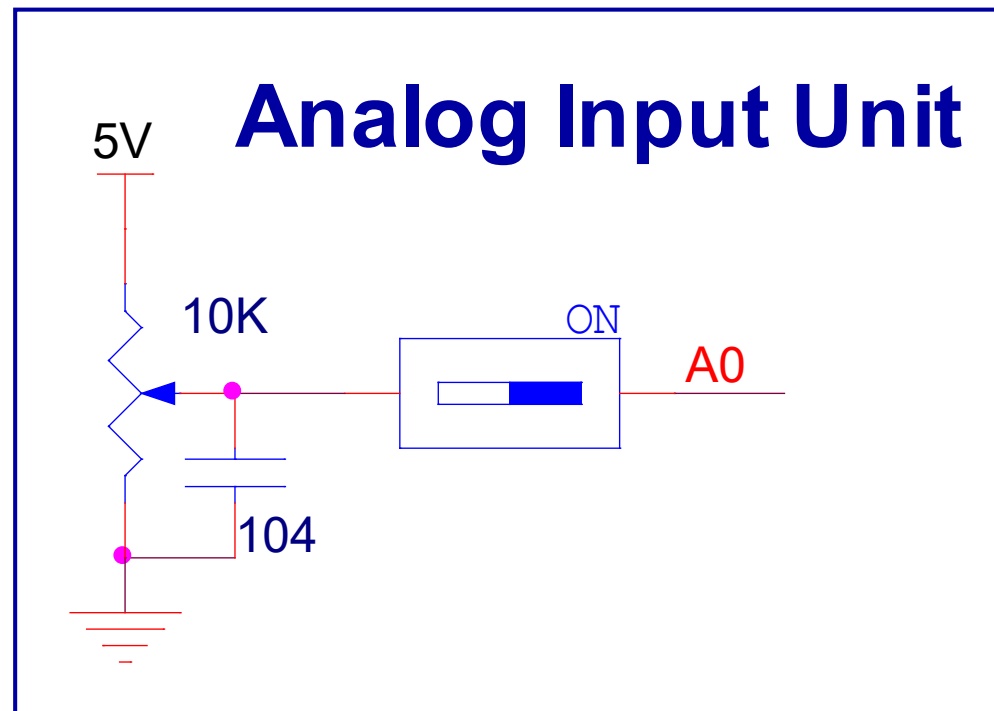
- Disable 7Segment display (turn off COM1 and COM2) before using LCD module.

Analog Input Unit

Betamini includes 10Kohm multi-turn variable resistor. The fixed terminals of variable resistor are connected to GND and +5VDC whereas the variable terminal is connected via DIP switch to μ C pin A0. The resistor can be adjusted precisely to the required voltage (0.00V to 5.00V).

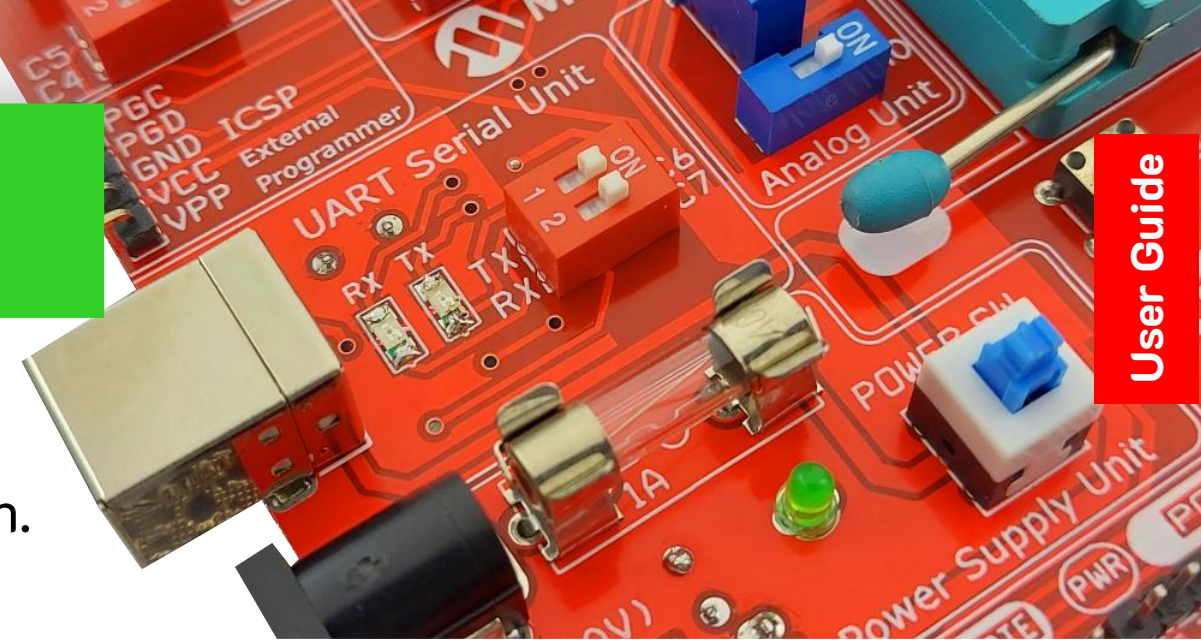
Analog input is connected to microcontroller as shown in table:

| Analog Input | μ C pin |
|--------------|-------------|
| 0-5V | A0 |

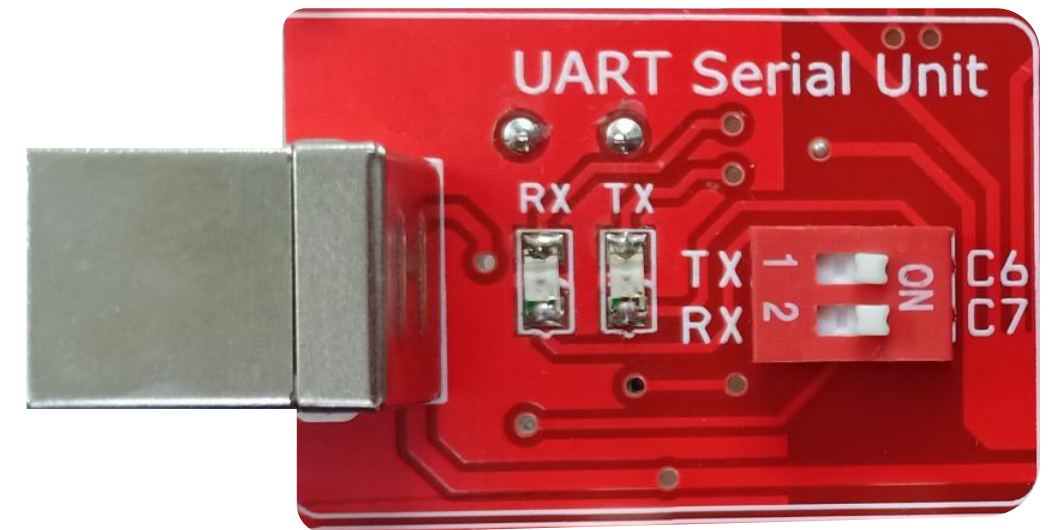
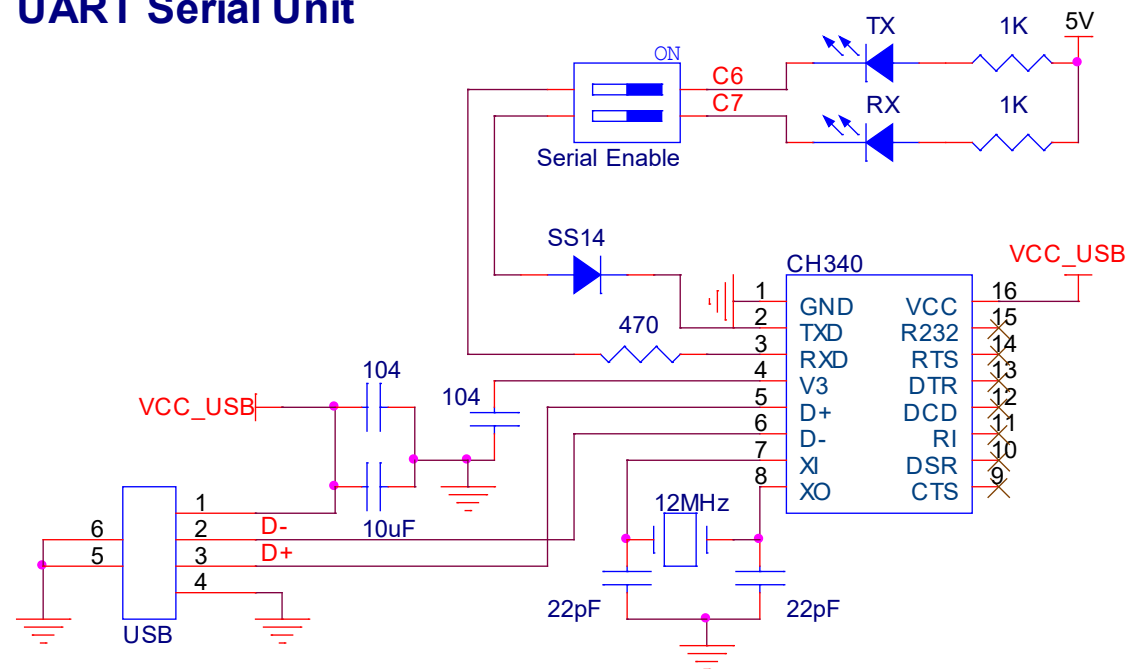


USB Serial Unit

This unit contains USB to serial chip (CH340) and provides USB type B socket for PC serial communication. Serial interface circuit can be enabled via DIP switch. CH340 is connected to the internal UART peripheral of microcontroller pins C7 (RX) and C6 (TX). RX, TX pins can be enabled individually via DIP switch.

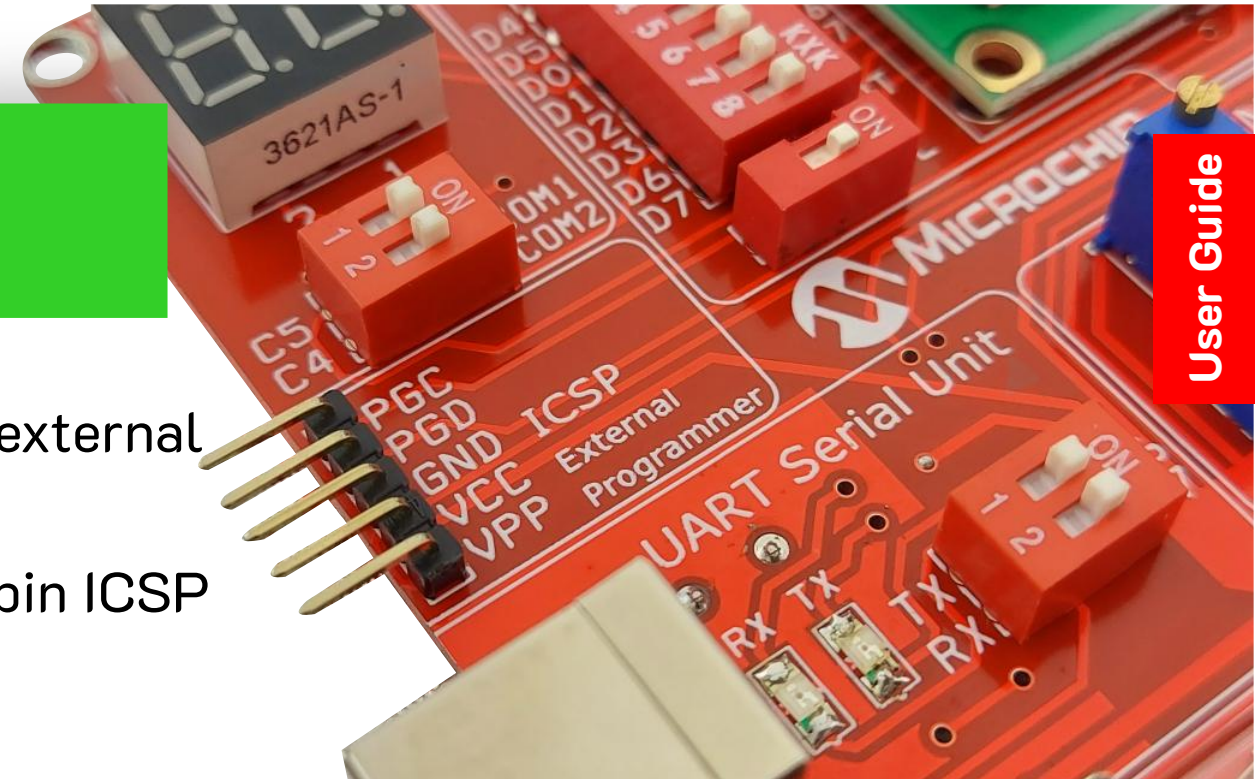


UART Serial Unit



External Programmer

Betamini is designed mainly to be programmed using external programmer such as PICKIT2, PICKIT3 and PICKIT4. It connected to external programmer via standard 5- pin ICSP socket.



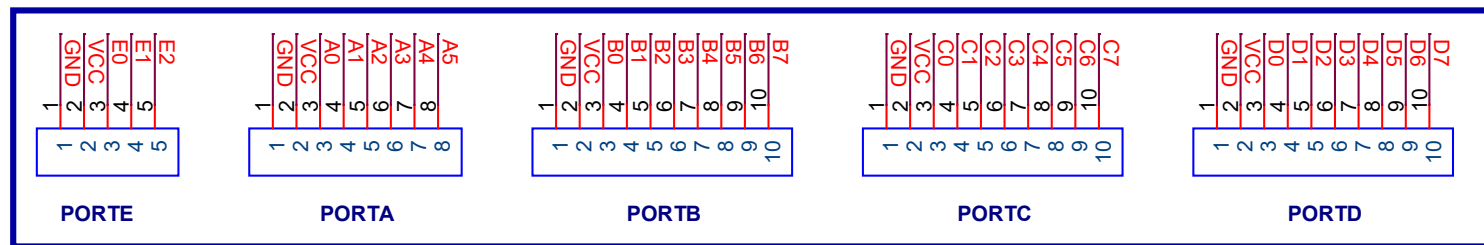
ICSP socket

| | | |
|-----|---|------|
| PGC | 1 | MCLR |
| PGD | 2 | 5V |
| GND | 3 | GND |
| VCC | 4 | B7 |
| VPP | 5 | B6 |

ICSP

I/O PORTS

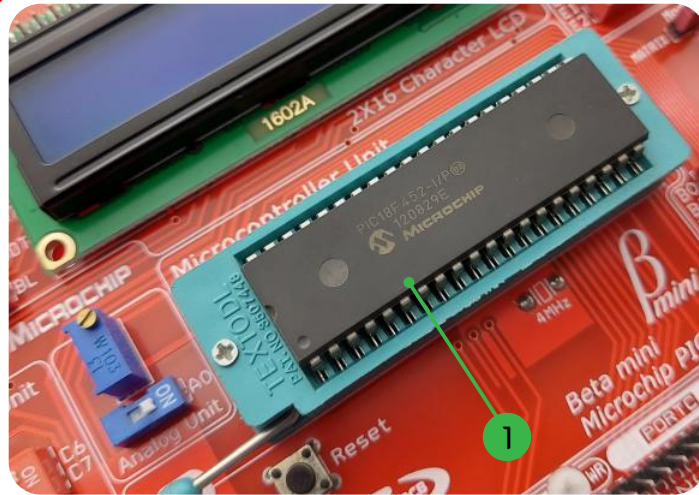
All microcontroller port pins are brought out for external using via header sockets. External headers are grouped into 5 units. Each one represents microcontroller port (I/O), in addition to GND and 5V.



- Please ensure to disconnect the built-in circuits attached to the port pins intended to use.



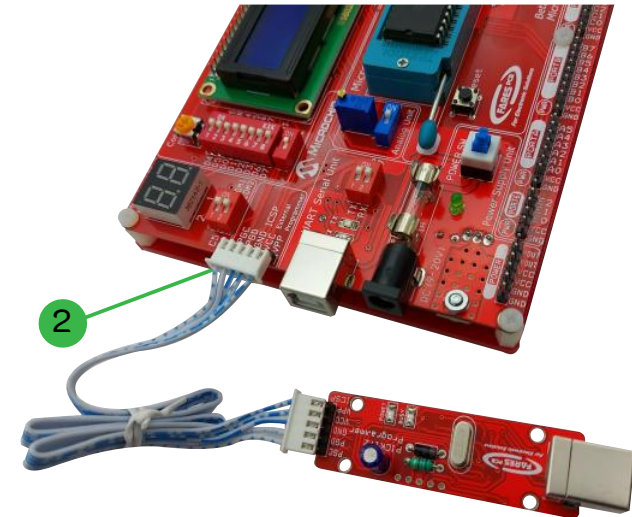
How to connect hardware



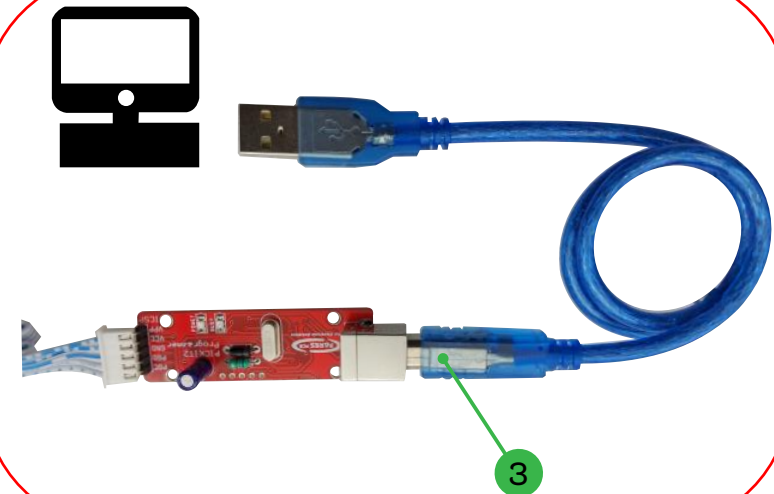
1. Insert your microcontroller into the ZIF socket and lock it.



Note that the notch of any target microcontroller is aligned to the first pin of the ZIF socket beside the lever.



2. *Betamini* is connected to PICKit2 programmer via standard 5-pin ICSP socket.



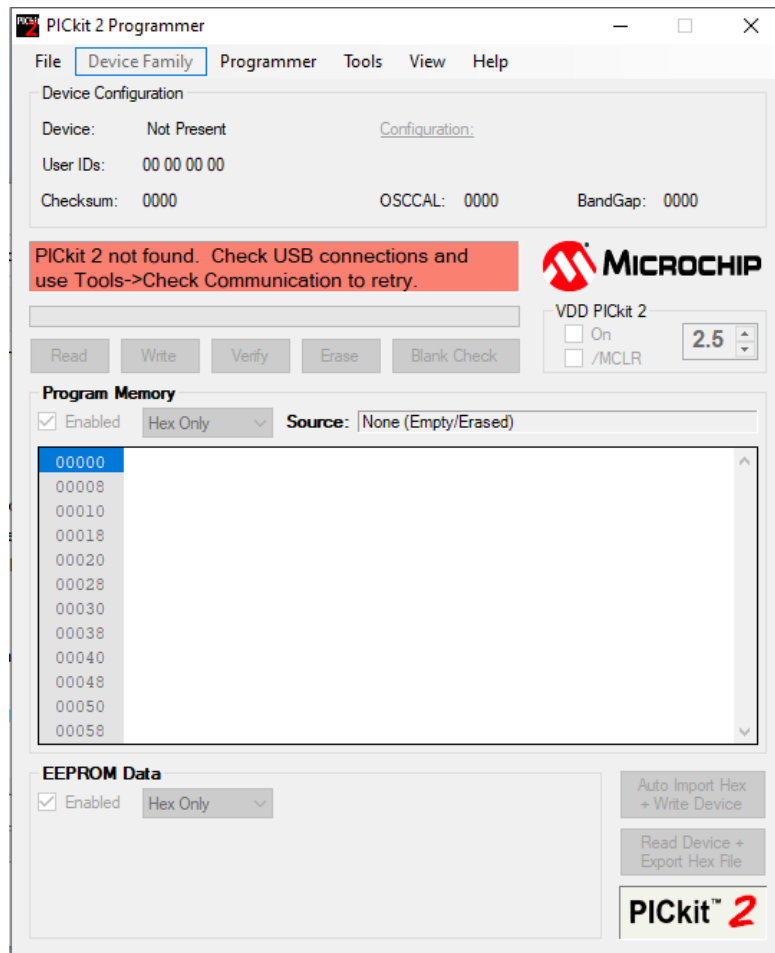
3. Connect your PICKit2 programmer to PC using USB cable.

Programming



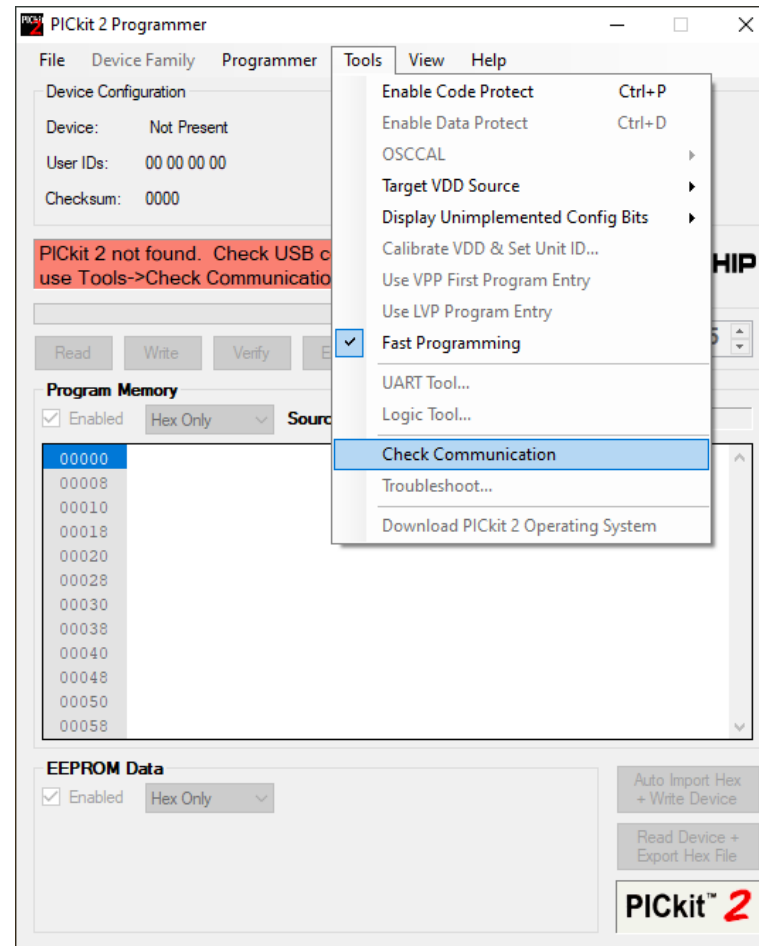
Download PICKit 2

A



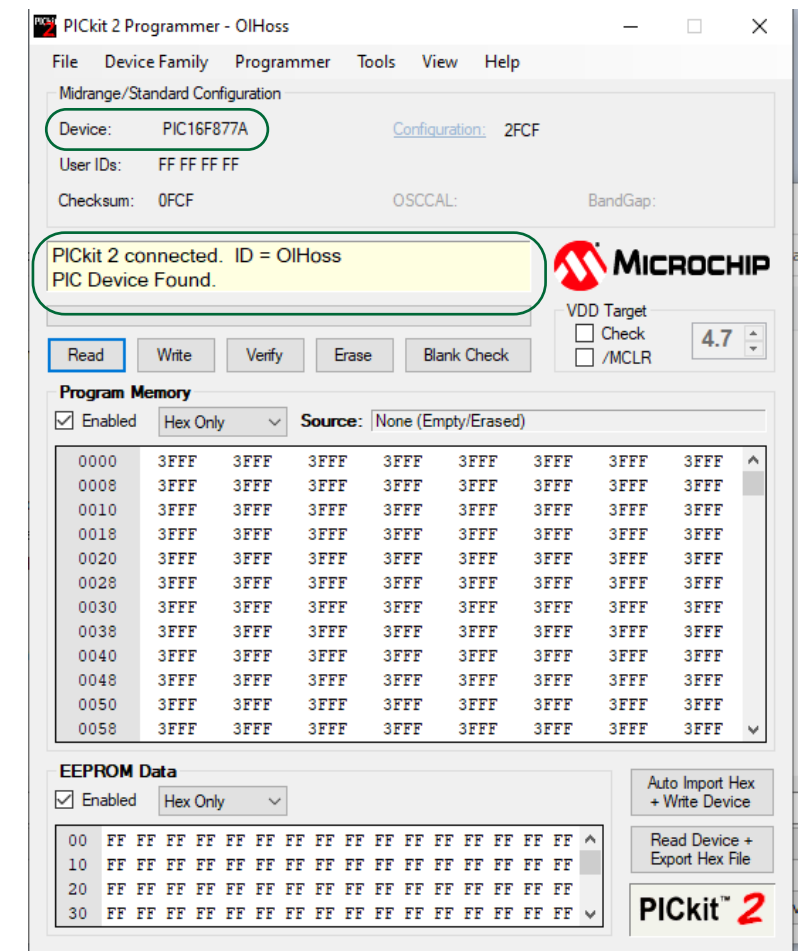
Step 1: Open PICKit 2 program.

B



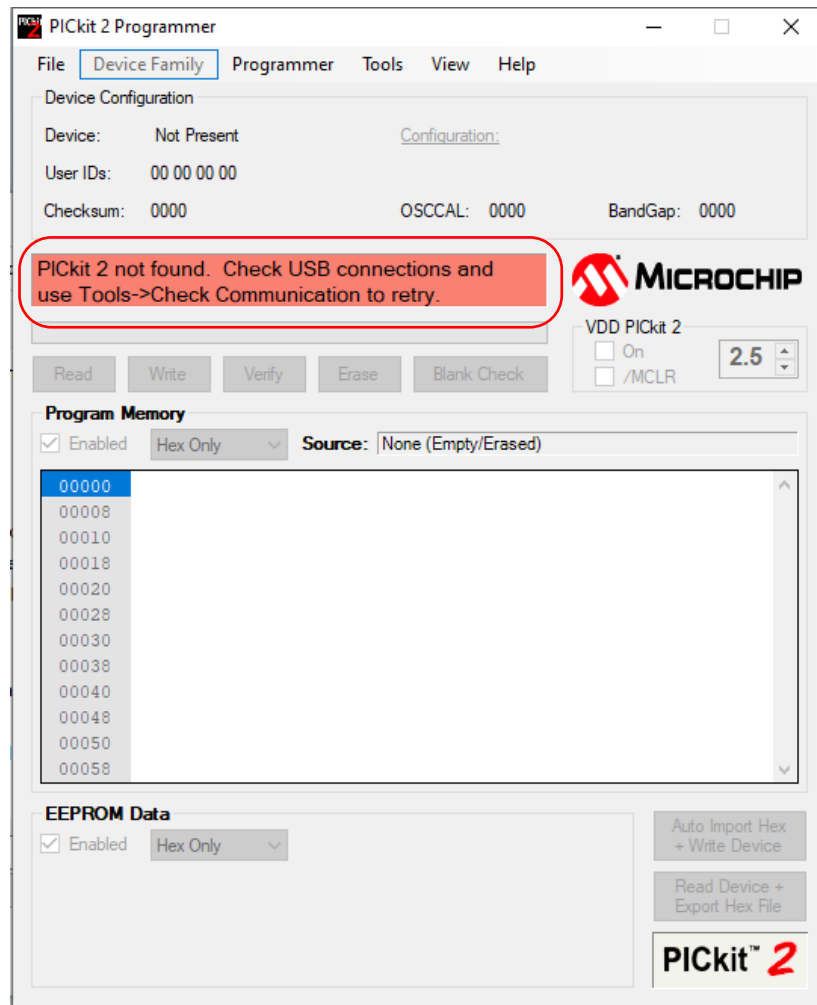
Step 2: Go to Tools menu and click on Check Communication.

C

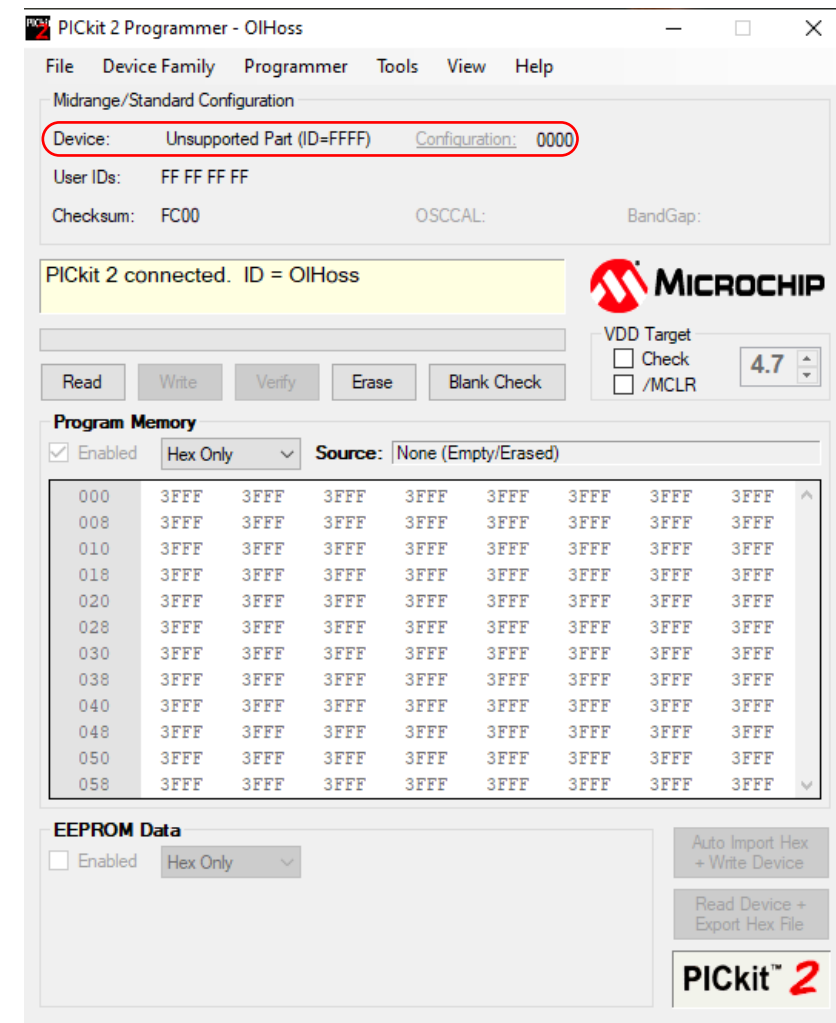


Step 3: Target μ C is auto detected

➤ Issues may be faced



If this message appears, it means the program can't detect PICkit 2 programmer, so check the USB cable connection.



If this message appears, it means the program can't detect target μ C, so make taht μ C insertion is correct and isn't damaged.

Testing

We recommend few tests before begin to work on **Betamini** kit.

If it is the first time to use **Betamini** kit, we recommend performing some test operations to make sure everything is ok. We provide a comprehensive test code that can be loaded using PICKit2 programmer. This code is compiled to 16F877A. All kit modules can be tested using the hex code.

To download test code click on below link

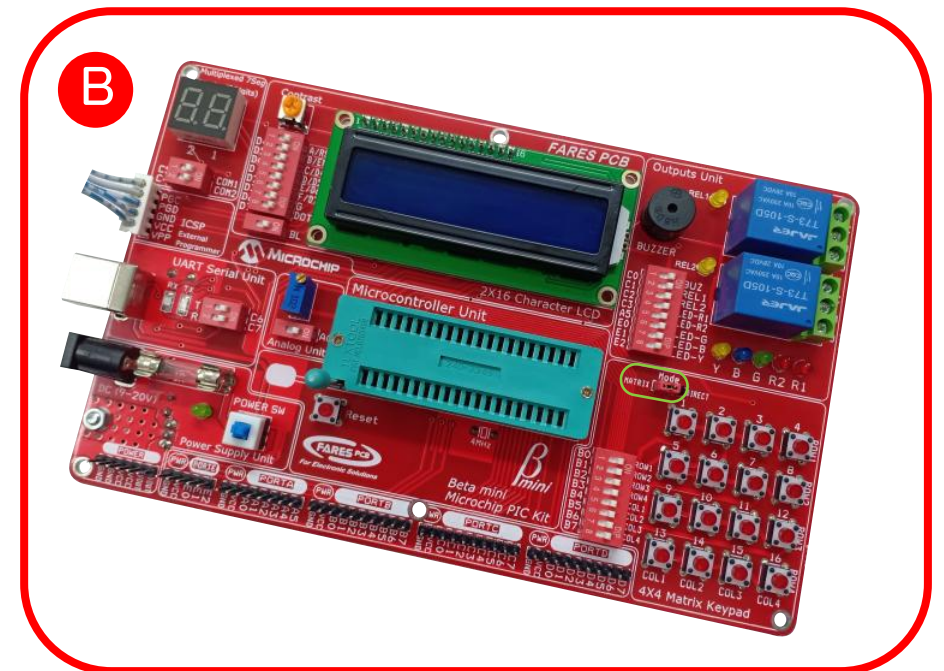
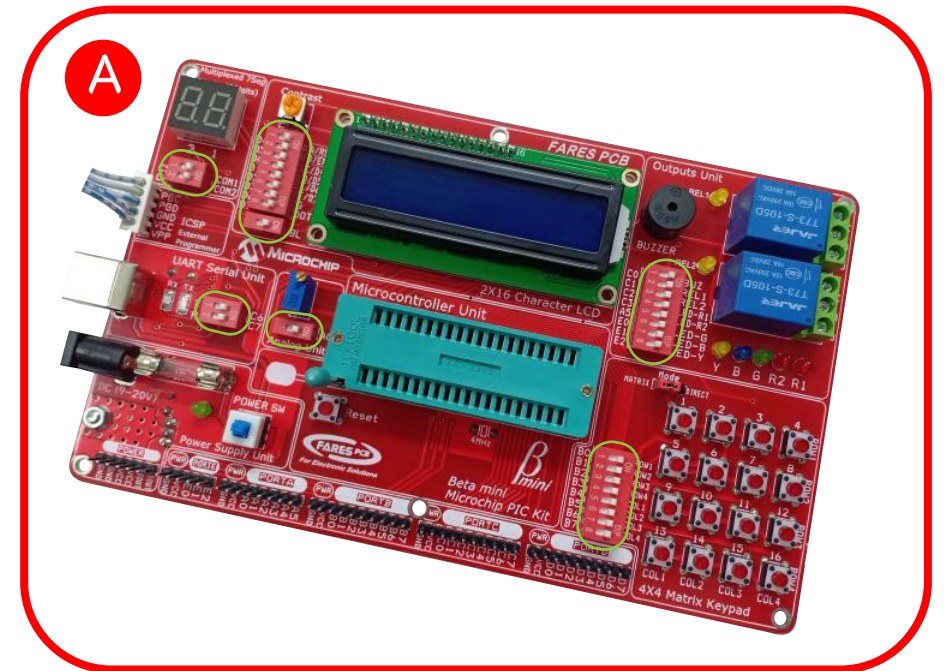


https://fares-pcb.com/?post_type=product&p=23235&attachment_id=23251&download_file=yvz9

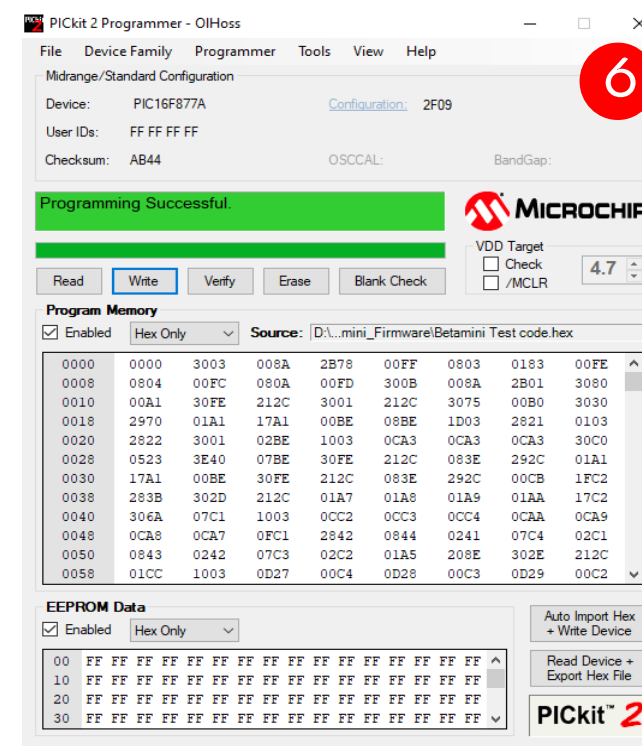
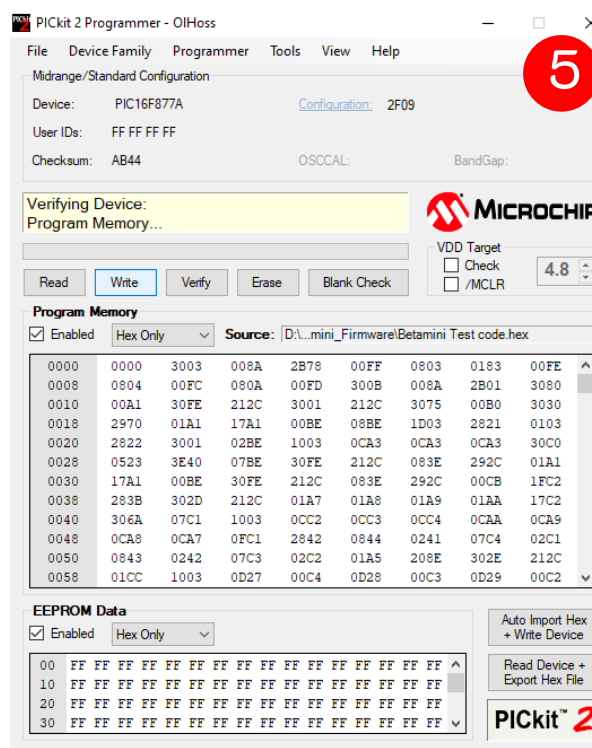
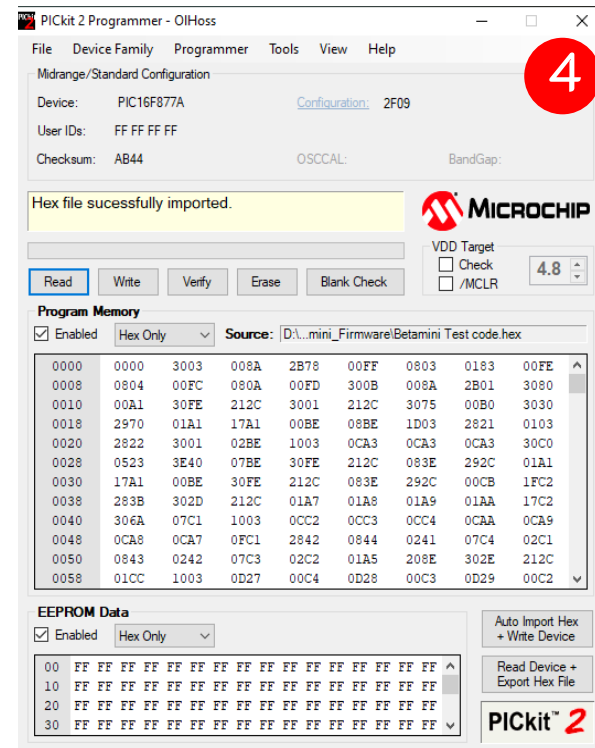
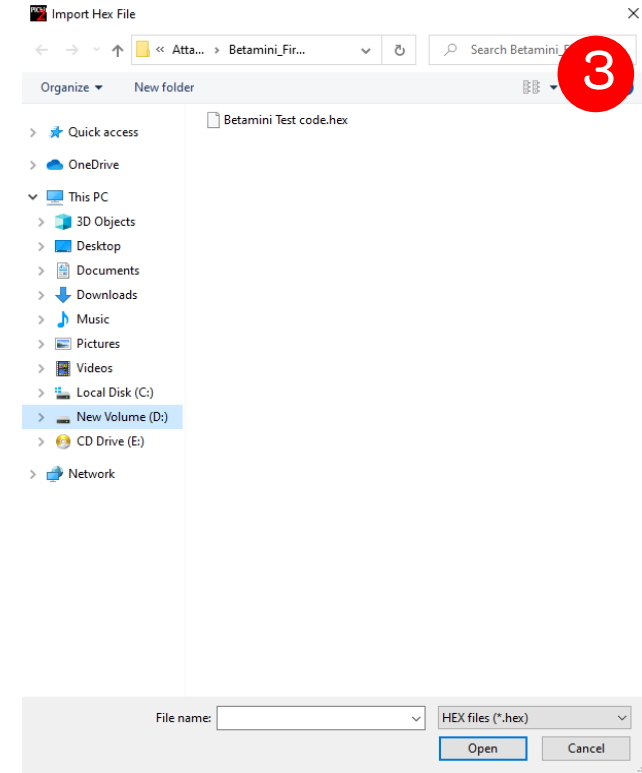
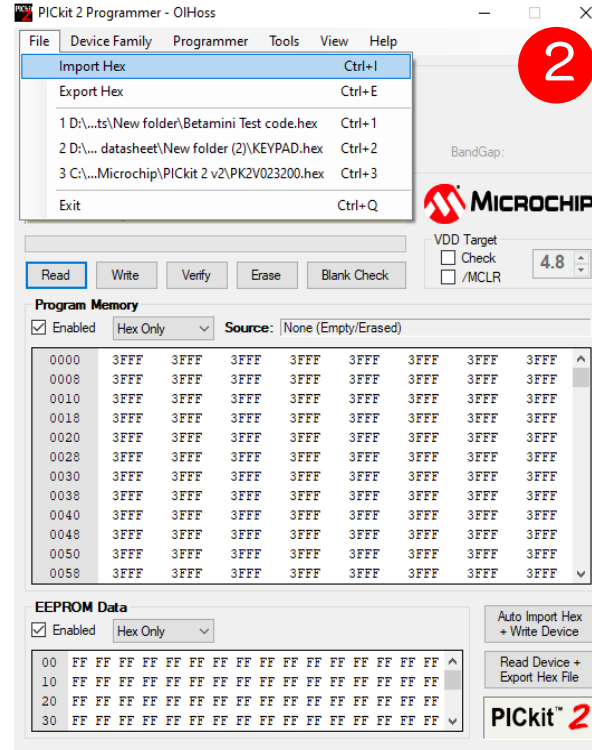
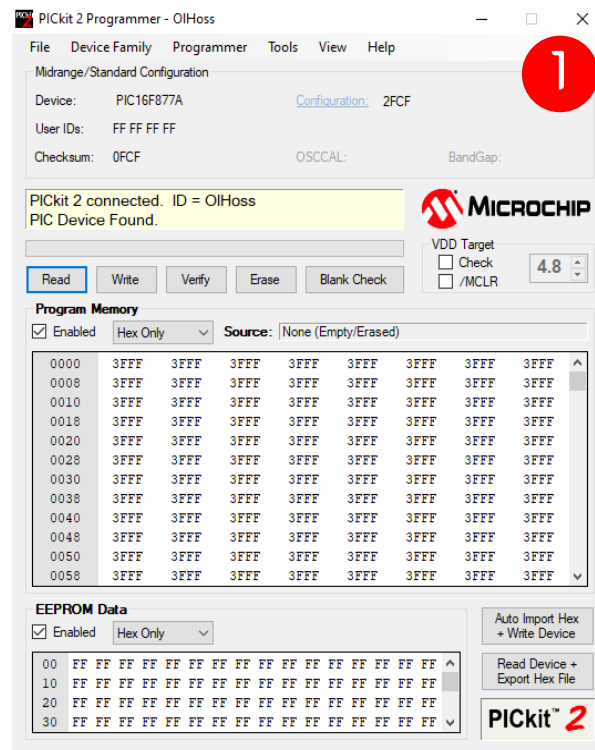
Or go to our website and download it from product Attachment.

How to test

- 1- Enable all DIP switches on kit as shown in **A**
- 2- Set keypad to matrix mode as shown in **B**
- 3- Prepare your environment by connecting hardware and installing PICKit 2 program as shown in **page 21** and **page 22**.
- 4- Turn power switch on.
- 5- Open the software program (PICKit2) as shown in **page 22**.
- 6- PICKit 2 program will detect the programmer and chip automatically.
- 7- Load the included the test code :
 - Go to file menu and click on import Hex (**the result is shown in image 3**)
 - Go to location of saved code, select it and open it (**the result is shown in image 4**)
 - Click on write (**the result is shown in image 6**)



➤ Loading Test Code



In addition to the message displays the number of pressed switch some switches performs a test for specified modules on kit. These tests are listed in table below

| Pressed SW | LCD / Serial message | Test |
|------------|----------------------|--|
| SW 1 | SW 1 is pressed | Toggel LED R1 |
| SW 2 | SW 2 is pressed | Toggel LED R2 |
| SW 3 | SW 3 is pressed | Toggel LED G |
| SW 4 | SW 4 is pressed | Toggel LED B |
| SW 5 | SW 5 is pressed | Toggel LED Y |
| SW 6 | SW 6 is pressed | Toggel Relay1 |
| SW 7 | SW 7 is pressed | Toggel Relay2 |
| SW 8 | SW 8 is pressed | 7Segment Test : Digit 1 counts from 0 to 9, Digit 2 counts from 0 to 9 |
| SW 9 | SW 9 is pressed | - |
| SW 10 | SW 10 is pressed | - |
| SW 11 | SW 11 is pressed | - |
| SW 12 | SW 12 is pressed | - |
| SW 13 | SW 13 is pressed | - |
| SW 14 | SW 14 is pressed | - |
| SW 15 | Analog Test | Analog Test : the Voltage on A0 is displayed in the second line |
| SW 16 | Serial Test | Serial Test : any received characters will be displayed in the second line |

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