Versatile Board for AVR Micro

Platino[1], the greatest star of the support act

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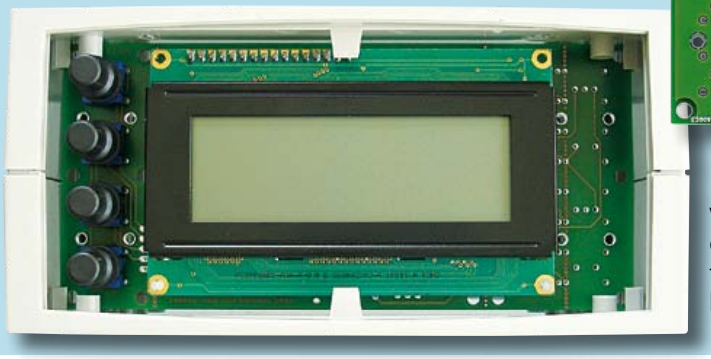
In electronics projects, the printed circuit board often only plays a minor role. Without the PCB, a circuit is definitely much more difficult to realise, but who can remember the PCB on which everything else depends, once everything is said and done? In order to rectify this injustice we have decided to give the leading part of this article to the circuit board. Ladies and gentlemen, please a warm applause for... Platino!

Biography

Platino was born on November 20, 2010 in the Netherlands; he is a versatile circuit board for circuits based on an 8-bit AVR controller. After several months of preparation this little brother of the J²B [2] met his first AVR microcontroller in June 2011. Because he did not yet feel properly prepared to brave the electronics jungle, he decided to optimise himself by taking his idol



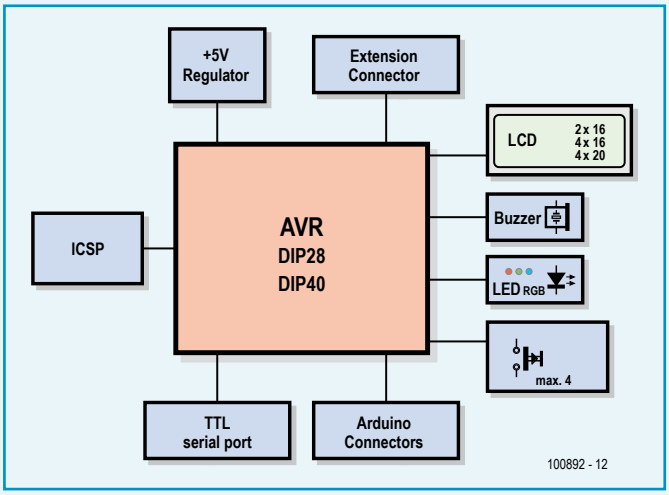
Arduino as an example. However, this carefree and innocent life was completely overturned by the chance meeting with a Bopla enclosure. It was love at first sight and they decided to continue together. The festive joining took place in July 2011 and you can be assured that they want many offspring.

1. The name Platino is a playful reference to the French (and German) word 'Platine' meaning 'circuit board', with a slight wink at 'Arduino'.

controller Circuits

Elegant and fashionable

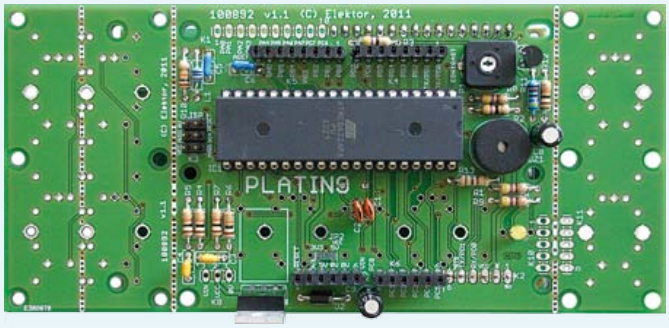
The time when we would dress ourselves exactly the same every day, such as Donald Duck or Tintin, has been long gone — Platino knows better. The modern circuit board is agile, adapting itself depending on necessity or circumstance. In a gloomy, dull environment Platino prefers to be adorned with a large LCD screen measuring 4 lines x 20 characters, but the moment the occasion presents itself Platino will resort to a scanty 2 lines x 16 characters. He does not fret that this will expose his beautiful circuit traces, quite the contrary! Platino is not prudish.



Even if you are a beautiful circuit board, without a sharp brain and a shrewd mind users will quickly become bored with you. Platino was therefore compelled to choose a microprocessor. Because his parents have always instilled the ethic of never doing a job by halves, Platino excels himself by offering accommodation to *all* AVR microprocessors with 28 or 40 pins, from the famous design studio and renowned manufacturer Atmel. In practice this amounts to all 8-bit AVR microprocessors in a DIP package.

Everybody knows the proverb "The coat makes the man", and therefore the accessories complement in an elegant way the already fashionable appearance of Platino, who *adores* his tailor-made suit! He frequently turns over his collection of pushbuttons, by sometimes placing up to four of these jewels to the left, right or below his display. Platino is crazy about them, because they can be fitted with caps of different lengths, colour or shape. It is true that these are a little bit more expensive, but when it comes to broadening the options Platino does not pinch a penny.

Another accessory favoured by Platino is the rotary encoder, which can be used to replace the functionality of two (or three even) pushbuttons. Up to two of these switches can be fitted at the same time!

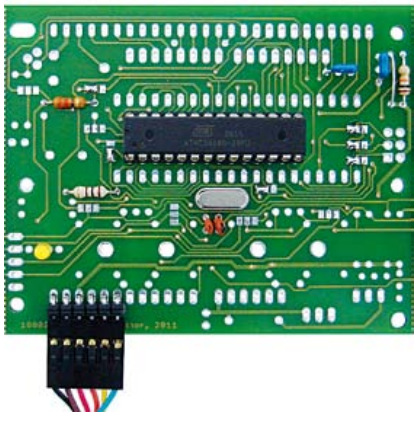


Platino likes to be the centre of attention. He therefore has invested in a buzzer to ensure no one ignores him. To prevent him becoming hoarse he always uses the buzzer with a current-limiting series resistor (R2).

The mid-life crisis has not passed Platino either, so he adorns himself with a three-colour LED. This can dazzle with perfectly white light, by suitably adapting the values of the resistors R1, R8 and R9, depending on the type of RGB LED chosen. He can also be green with fury or red with excitement, Platino has a mind of his own!

Lookalike

From a very young age, Platino has worshipped Arduino, the Italian star of fast embedded prototype development, who has been extensively studied by him. Although Platino is very much impressed, he is certainly not blinded and decided to adopt a few good aspects of his idol and to improve on certain weak points. As a result, he also takes the expansion connectors (K4 to K7) so that, like his example Arduino, he can adorn himself with *shields* (expansion boards), but in addition he also has expansion connectors with a more usual pitch (K1, K2, K9).



In contrast with Arduino, Platino can live without a USB/TTL adapter. He claims you can always resort to an external FTDI cable if you really must. Youthful arrogance? Maybe, but also cheaper. And Platino isn't stupid either!

This cable also serves to program the microprocessor using the Arduino IDE, because Platino behaves himself exactly like Arduino. He assures us of a restart of the microprocessor via the IDE, without a

reset button, thanks to resistor R13, which, remarkably enough, can also be a 0.1 µF capacitor. Platino can manage either solution. You have to realise that this works only if the microprocessor on the Platino has been programmed with an Arduino compatible programmer and a recent version of the IDE [3]. This is done via K3, using a standard AVR programmer.

Arduino has often been the victim of criticism regarding his limited options at times; that is why Platino decided not to tie himself to just one type of microprocessor. With an ATmega168 or ATMega324 Platino can play the lead role in a large number of *sketches*. And for the most demanding builders Platino has a convincing trump in hand: he can be fitted with an ATmega1284!

Platino can turn his hand to a three-colour LED, but is also content with a simple LED, just like his idol. To achieve this you only need to connect R8 to RB5 via JP14. The LED will now flash when the microprocessor is programmed via the serial port. The *Blink* example from the Arduino IDE also works without any modification.

(100892)

Platino's outfit

An impeccable outfit is an absolute necessity for Platino. This is what he knows about his preferences for the parts:

Resistors

"Resistors are important, they can limit the current or apply a voltage. I prefer to use a 47 Ω for R2 and R3, 100 Ω for R13, 4.7 kΩ for R11 and, also a bit for convenience, 10 kΩ for R4 through R7, R10 and R12. R1, R8 and R9 are more difficult, that is because these have to be connected to the three-colour LED. But 470 Ω is always a good middle-of-the-road choice".

"I use P1, my horizontal trimpot, to adjust the contrast of my LCD. I have one with a value of 10 kΩ".

Capacitors

"Capacitors are often denigrated to some backwater, but I nevertheless give them my attention. For C1 and C2 of the 16-MHz crystal I ask for a couple of niggling 22 pFs. High frequency noise works on my nerves. That is why I always carry C3, C4, C5. 100 nF is generally a good choice, but for C4 I prefer to take a 10 nF. This increases the bandwidth of the frequencies to be suppressed. The pitch is not important, 2.5 mm or 5 mm. When I fit IC3 then I also fit C8 and C9. C8 ensures the stability of IC3 and 1 µF gets the job done. Much the same for C9, but the often-made recommendation is to use one that is 10 x bigger. I therefore fit one with a value of 10 µF. Both have to be able to tolerate at least 16 V, C9 sometimes a bit more. Preferably use a pitch of 2.5 mm".

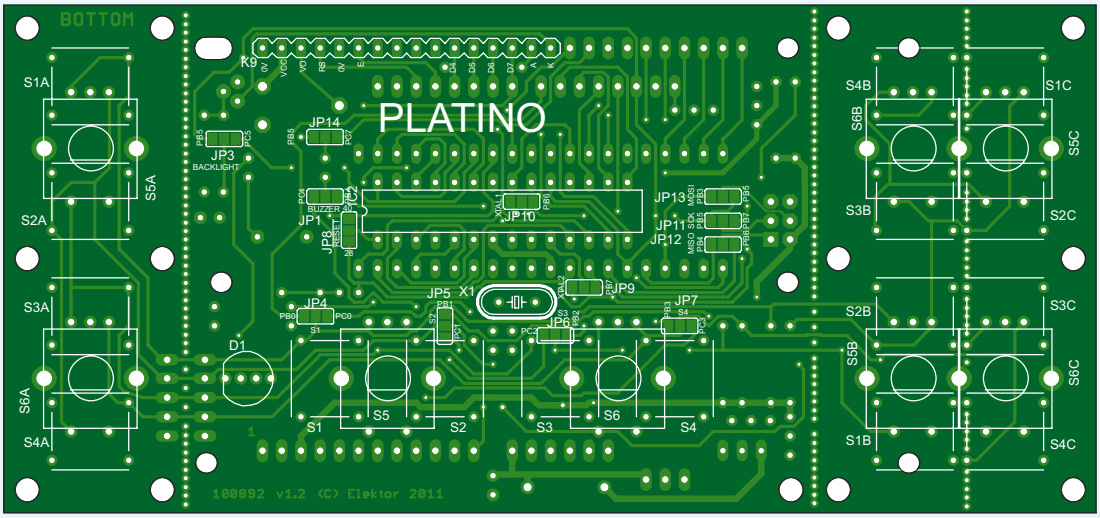
Inductors

"I have only one: L1. He takes care of the power supply for the analogue to digital converter inside the microprocessor. C5 is there to assist him. 10 µH is a good value, but a wire bridge works well enough in most applications too."

Semiconductors

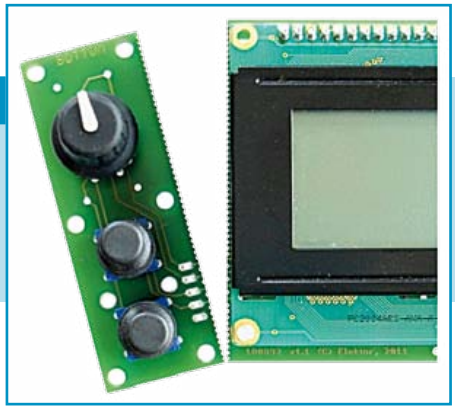
"I never use IC1 and IC2 at the same time, maybe that's possible.... to be investigated further... For standard occasions I prefer to take IC2, this one is easier to carry and cheaper. I therefore can make my selection from an ATmega48, an ATmega88, an ATmega168 or an ATmega328, which I mount on the solder side. IC1 has to be mounted on the component side, perhaps an ATmega164, an ATmega324, an ATmega644 and even an ATmega1284, which is more suitable for those special occasions. I only use those types that can use a 20 MHz crystal".

"If I feel the need to control the backlight of my display then I will fit T1. I don't have any particular preference as long as the transistor is able to switch a few hundred milliamps. A BC547C is okay. Fitting a link in place of T1 (collector/emit-



Unfaithful

Platino is very fond of his spacious Bopla housing but nevertheless has an eye for other enclosures. Platino is a jack of all trades and for convenience has a large number of mounting holes, but Platino remains changeable. He easily adapts by disposing of a few projecting parts, see the dotted lines... Thanks to connectors K10 and K11 he even has the option of taking advantage of his push buttons from a distance!



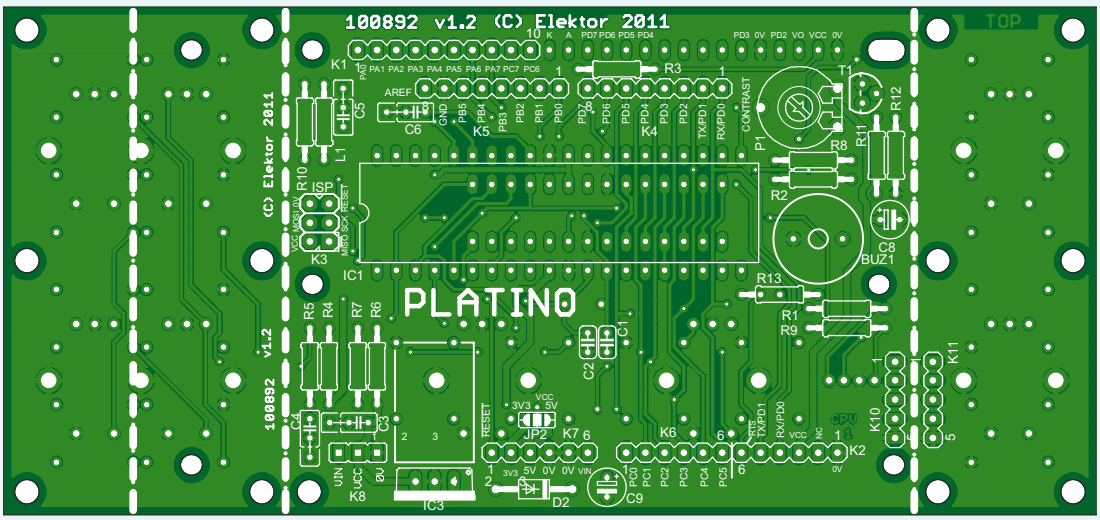
ter) is also an option".
"I sometimes do not have a lot of trust in an external +5-V power supply. In that case I will appeal to IC3, a +5-V voltage regulator. I'm already contented with the old, familiar 7805, although there are much nicer solutions these days. I also fit D2, a 1N5817 if the input voltage is not too high or an 1N4001 if this is above, say, ... 9 V. With D2 and IC3 I can handle voltages up to 18 V and I am protected against reverse polarity. I can also derive my power supply from the cable of the USB/TTL adapter. In that case do not feed me via V_{in}, otherwise IC3 can cause some trouble. Some of us might prefer not to fit the regulator at all in this particular arrangement".

"D1 is my three-colour LED with 4 connections. Kingbright makes models, such as the L-154A4S-URKQBxxxx series, which are very agreeable to me. The COM-09264 from Sparkfun is also good".

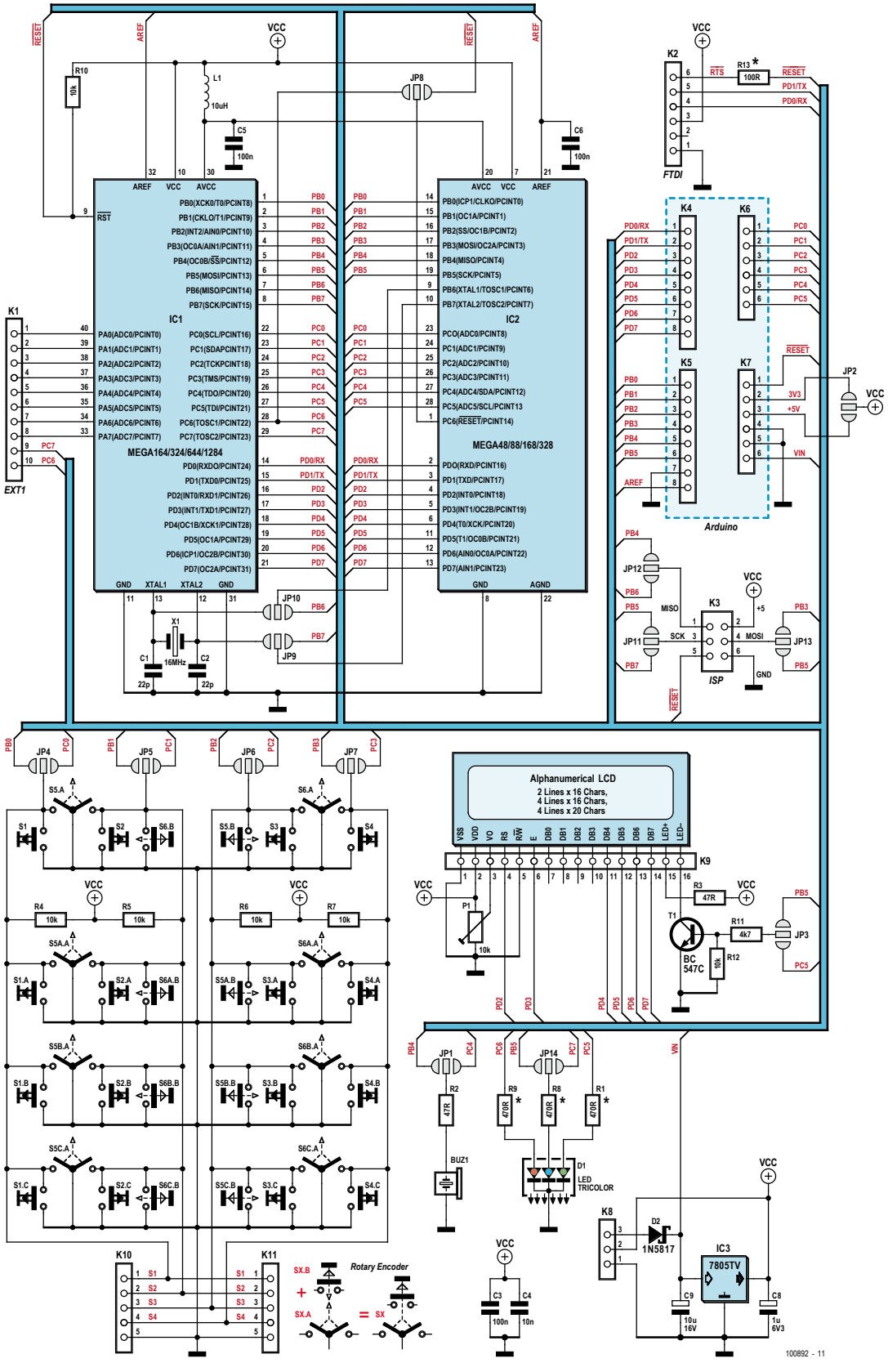
Miscellaneous

"My crystal is a standard 16 MHz, I carry it on my solder side to avoid contact with certain circuit board traces. My BUZ1 of 12 mm diameter has a pitch of 6.5 mm. Now the connectors. They are single row crimp connectors with a pitch of 0.1 inch (2.54 mm) except K3, this is a type with 2 x 3 contacts. K4 to K7 are female and offer a place for a shield. K1 and K9 may be either female or male. K1 has 10 contacts, K4 and K5 have 8, K6 and K7 have 6 and K9 has 16. K2 is a male model with 6 contacts (the right-angle version, very practical) and K8, also male, has only 3 pins. Finally I sometimes wear IC sockets for IC1 or IC2. IC2 requires a DIP socket with 28 pins and with a width of only 7.62 mm, and for IC1 a standard DIP socket with 40 pins".
"Yes, but what about my pushbuttons! Well, these are type 3FTL6 from Multimec, available from Farnell. My rotary switches are Alps type EC12E2424407 (with pushbutton switch) or EC12E2420404 (without pushbutton switch), also to be found at Farnell".

"I have a number of displays with different dimensions, 2 x 16, 4 x 16 or 4 x20. They are all suitable, provided they have a single row interface connector with 14 or 16 pins, to the left and above the display, with the condition that the connections correspond. The controller integrated into the display module needs to be compatible with the software libraries for the display driver, HD44780 is a standard when it comes to this".



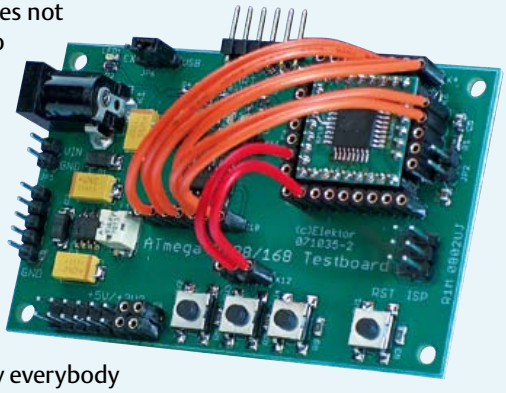
The schematic diagram plays a secondary role to Platino in this article.



Platino to star in Elektor/element14 webinar

The family

Platino does not deny his heritage and proudly shows his descent from the ATM18 BASCOM-AVR/AVR-GCC lineage. When Platino provides accommodation to a 28-pin microprocessor, he does not have the use of the AD6 and AD7 signals that his little nephew the ATM18 [4] has, so they are not completely compatible. But if these signals are indispensable for a particular application then it is sufficient to replace the microprocessor with a type that has 40 pins. It is probably necessary to reconfigure a few ports or move a few wires because the vast majority of microprocessors has a port A, which the little microprocessor does not have.
In honour of a distant family member of the extended AVR microprocessor family of development boards, Platino has ensured that the control of the LCD is compatible with the Mikroelektronika libraries, which uses port D by default in 4-bit mode.



In spite of a few exceptions, Platino is a practical, modest and approachable circuit board who would love nothing more than to serve a broad audience. That is why everybody adores him.

Internet Links

[1] Platino: www.elektor.com/100892
[2] J²B: www.elektor.com/110274
[3] Arduino : www.elektor.com/080931
[4] ATM18: www.elektor.com/atm18

Function	Jumper	My choice
Buzzer BUZ1 on **PB4** or **PC4**	JP1	☐PC4 ☐PB4
Selection of power supply voltage from an Arduino *shield*: 5V or 3.3V.	JP2	☐3.3V ☐5V
Controlling the backlight via **PB5** or **PC5** Note: choosing PB5 here prevents the choice via *JP14*.	JP3	☐PB5 ☐PC5
S1 connected to **PB0** or **PC0**	JP4	☐PB0 ☐PC0
S2 connected to **PB1** or **PC1**	JP5	☐PC1 ☐PB1
S3 connected to **PB2** or **PC2**	JP6	☐PC2 ☐PB2
S4 connected to **PB3** or **PC3**	JP7	☐PB3 ☐PC3
Approval to connect **PC6** of IC2 (DIL28) to /Reset.	JP8	☐PC6
Approval to connect **PB7** of IC2 (DIL28) to the crystal. Always use in combination with JP10.	JP9	☐PB7
Approval to connect **PB6** of IC2 (DIL28) to the crystal. Always use in combination with JP9.	JP10	☐PB6
SCK-ISP : Connected with **PB5** when using IC2 Connected with **PB7** when using IC1	JP11	☐PB5 ☐PB7
MISO-ISP : Connected with **PB4** when using IC2 Connected with **PB6** when using IC1	JP12	☐PB4 ☐PB6
MOSI-ISP : Connected with **PB3** when using IC2 Connected with **PB5** when using IC1	JP13	☐PB3 ☐PB5
Connect with **PB5** for ''Arduino'' compatibility (see also *JP3*), otherwise with **PC7**.	JP14	☐PB5 ☐PC7