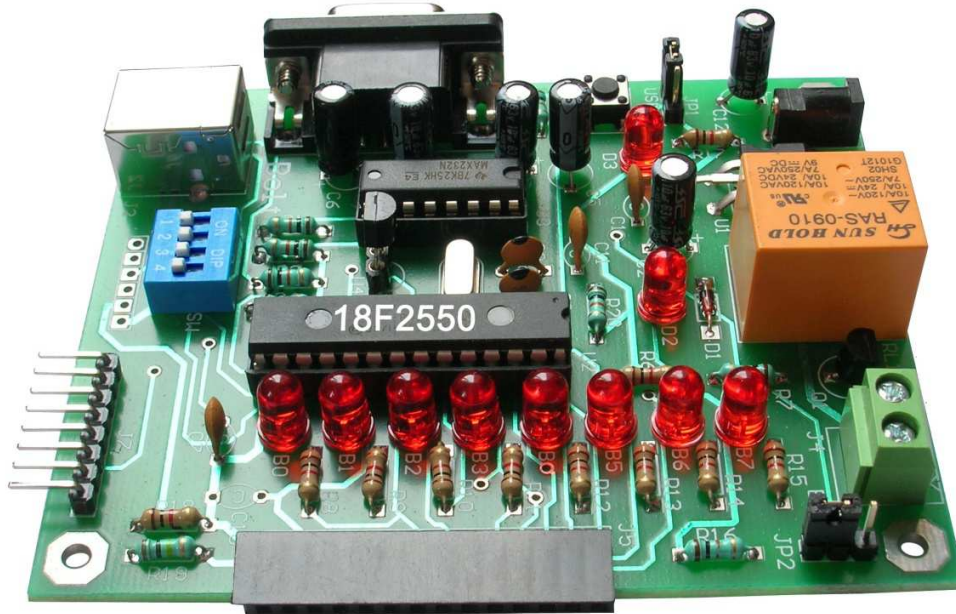


Bolt 18F2550 System Hardware Manual



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1. Overview:

Bolt 18F2550 system was specially designed for use in a wide range of applications: as a trainer kit for learning of microcontroller systems, useful to students and teachers in technical careers or degrees in Electronics, Control, Computers, Mechatronics and Embedded Systems, or as development module in instrumentation, robotics, industrial control, communications, network monitoring and access control applications, among many others.

Bolt module is based on the powerful high performance 18F2550 Microchip's multifunction USB microcontroller and may be programmed in ANSI C language. The 18F2550 has 28 pins DIL, which allows for a small card design, at a minimum cost. By means of a bootloader program, factory preloaded in its upper code memory, the Bolt 18F2550 system may be powered and programmed via its USB port. Power supply may be as well be fed through an external wall transformer. Everything -hardware and software- you need to develop new projects is included in the Bolt 18F2550 kit.

Development Software: through the MPLAB IDE v.8.63 software (XP, Vista and Windows 7 compatible), and C18 v.3.40 compiler developed by Microchip and included in CD, you can edit, compile or simulate programs in ANSI C. The executable .hex file generated by C18 compiler is compatible with the Bolt v.1.0.1 programming software. During the development phase, board is powered through the USB cable.

Programming software: the system includes an special and very easy to use programming software Bolt v.1.0.1 (Windows 7, Vista and XP compatible). You may store your programs in 18F2550 FLASH memory directly through the USB port of your PC or Laptop. With this software you'll be able to program the whole 32 Kb of FLASH memory in less than 5 seconds.

Projects and test programs: we provide more than 20 projects, dozens of ANSI C and assembly language test programs for the Bolt 18F2550 system, all developed using MPLAB IDE and C18 compiler. Some of the documented projects for Bolt 18F2550 are: a RFID detections system, a Bluetooth interface, a remote device control using a GSM modem and a 7x10 led matrix display.

Field applications: once the user has developed its project, and is ready for field applications, module may function without the needs of the USB cable, using only an external wall transformer. Board includes an special plug and an on card 5 volt regulator for this purpose (please see photos).

C18 libraries and functions: you'll be able to use C18 templates, libraries and functions, available for all interfaces in module i.e. LCD, keypad, DS18B20 temperature sensor, serial port, EEPROM, A/D converters. This makes development of new applications fast and simple.

Multifunction system: the system has ports for direct connection, without cables, of a 16 x 1 LCD display and an hexadecimal keypad (both included in the kit). It contains a serial communications port with complete RS232 interface, through which it is possible to perform remote control applications. It also includes a temperature sensor DS18B20 with its C18 functions available.

Additional devices built into the module: a total of 13-bit input / output, 8 leds, 4 microswitches, 1 relay with 127 VAC, 1 amp. contacts; asynchronous and synchronous serial port USART, SPI, I2C; 7-channel of A/D conversion with 10 bits resolution; 1 PWM generator, 3 timers, and a complete interrupt system.

2. Technical specifications

Microcontroller: 18F2550-I/SP Microchip, multifunction, high-performance, 28-pin DIP, operating with 20 MHz external crystal. Effective speed of 48 MHz, thanks to on-chip PLL multipliers. Harvard architecture, with RISC set of 75 instructions. Word length of 16 bits in code memory.

USB Port: v.2.0 compatible, 12 Mb/s. 18F2550 programming from PC or Laptop via this port.

Power supply: selectable with jumper. Either 5 volts, directly from USB port, or from an external wall transformer (includes plug and 5v. on board 7805 regulator).

Firmware bootloader: preloaded, allows self-programming of FLASH memory using Bolt v.1.0.1 software.

Memory: 32K bytes (16K words of 16 bits) FLASH, 2K bytes of RAM, 256 bytes of EEPROM.

Testing devices: 8 leds connected as witnesses and 4 microswitches for emulation of digital inputs.

Input/Output Ports: A total of 21 bits programmable either as inputs or outputs.

Relay: on card. 127 VAC @ 1A contacts, with screw terminals. Power supply for relay may only be fed through an external wall transformer to avoid inductive loads to the 5 volt USB signal.

Digital temperature sensor: DS18B20, with a resolution of 0.1 degrees Celsius (easily converted to Fahrenheit), integrated into module.

Timers: A total of 4 (16 bits), for generation of precision delays, real-time clock or event counters.

USART serial port: for asynchronous communication, with standard RS232 interface and DB9 connector output.

Synchronous Serial Port: SSP (Serial Port Synchronous) with 2 modes, SPI Master/Slave mode and I2C Slave Mode.

PWM (Pulse Wide Modulation): 2 special outputs to generate PWM with 10 bit resolution.

A/D conversion channels: a total of 10 channels of analog-digital conversion with 10 bit resolution.

LCD display port: 14-pin, 8 data bits, for connection to any standard LCD display.

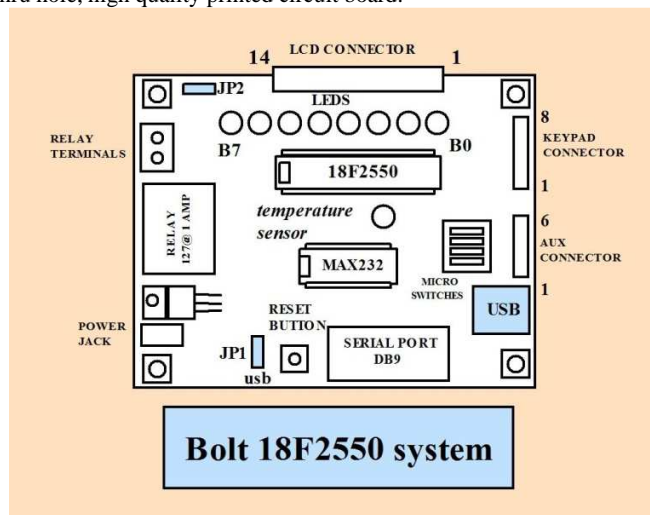
Keypad port: 8-pin connect to 16-key hexadecimal matrix keypad. 6-pin auxiliary header for further expansion.

Special Features: Watch Dog to prevent microcontroller out of operation. Brown Out protection circuit reset. Low Power Sleep mode.

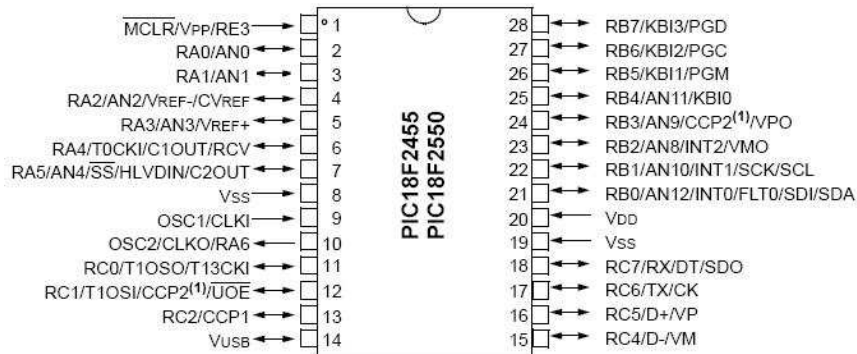
System interrupts: generated from multiple devices, including the state change from inputs in ports, timers, USART, writing in EEPROM and 3 external interrupts.

Consumption: nanoWatt technology with very low consumption, <60 ma. @ 5 volts.

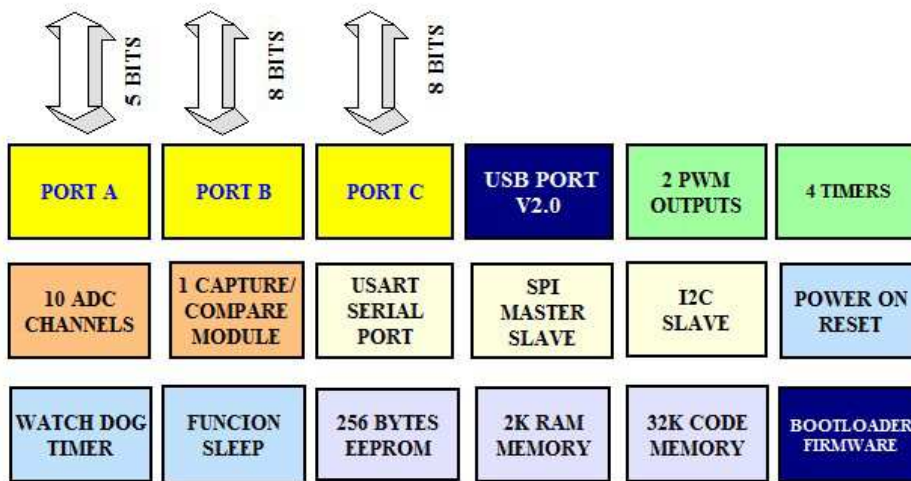
Dimensions: 8 x 9.5 cms., fiber glass, thru hole, high quality printed circuit board.



3. Pins description.



4. Block diagram:



18F2550 BLOCK DIAGRAM

5. Flash memory *Bootloader programmer*:

The card has a programmer for FLASH memory, based on its ability of self-programming. The firmware called "Bootloader" is factory preloaded on code memory (000H-7FFH). Through this firmware, and software Bolt v1.0.1, user may program quickly and easily the FLASH memory. Programming is done from the PC computer through the USB port. The mentioned software is compatible with operating systems Windows XP, and Windows 7, 32 and 64 bits.

6. Digital Ports :

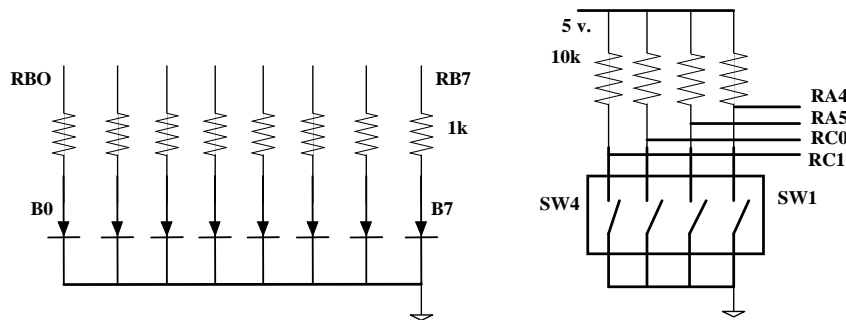
The 18F2550 has 3 digital ports. All ports are bidirectional, that is, can be programmed as inputs or outputs, according to data address registers, called "TRIS". Each port has 7 or 8 bits, but some of them are used for specific functions of the module. For example, RC4 and RC5 bits are used for the USB interface. The function assignment in each of the bits in Bolt system are shown in the following table. Please note that some bits are available in several connectors (LCD, keypad and AUX) so that the user can connect external devices.

PORT/BIT	FUNCTION
RA0	ACTIVATE/DISACT. RELAY
RA1	CONTROL LCD
RA2	CONTROL LCD
RA3	TEMPERATURE SENSOR DS18B20
RA4	MICROSWITCH A1
RA5	MICROSWITCH A2
RB0	LED B0, KEYPAD Y1
RB1	LED B1, KEYPAD Y2
RB2	LED B2, KEYPAD Y3
RB3	LED B3, KEYPAD Y4

RB4	LED B4, KEYPAD X1
RB5	LED B5, KEYPAD X2
RB6	LED B6, KEYPAD X3
RB7	LED B7, KEYPAD X4
RC0	MICROSWITCH A3
RC1	MICROSWITCH A4
RC4	D- USB PORT
RC5	D+ USB PORT
RC6	TX SERIAL PORT
RC7	RX SERIAL PORT

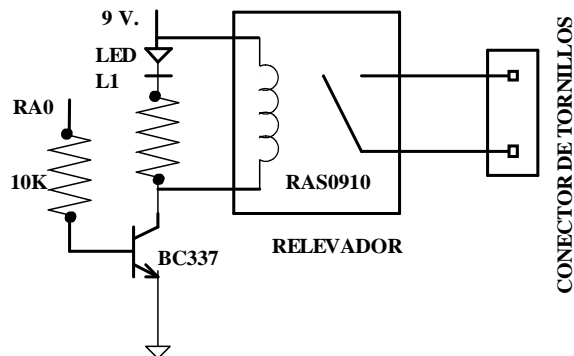
6.1 LEDS AND MICROSWITCHES:

Once ports are initialized, a test program can be written to control the LEDS, the microswitches, and relay, considering the electronic diagrams shown below. The aim of the LEDS and the microswitches is to give the user the possibility of emulations digital sensors and outputs for the activation of actuators.



6.2 RELAY

By managing the port A bit RA0, the processor can activate a relay integrated to Bolt card. Rated data of this relay are: a SPST, with 9 volts DC activation and contact 127 VAC @ 1 Ampere. This relay can be used either as a digital on-off sensor to alert other devices of any alarm condition, or as an actuator to activate external devices such as lights, solenoids, motors, etc. Please note the relay is fed through the external wall transformer, to avoid inductive loads to the USB 5 volt signal.

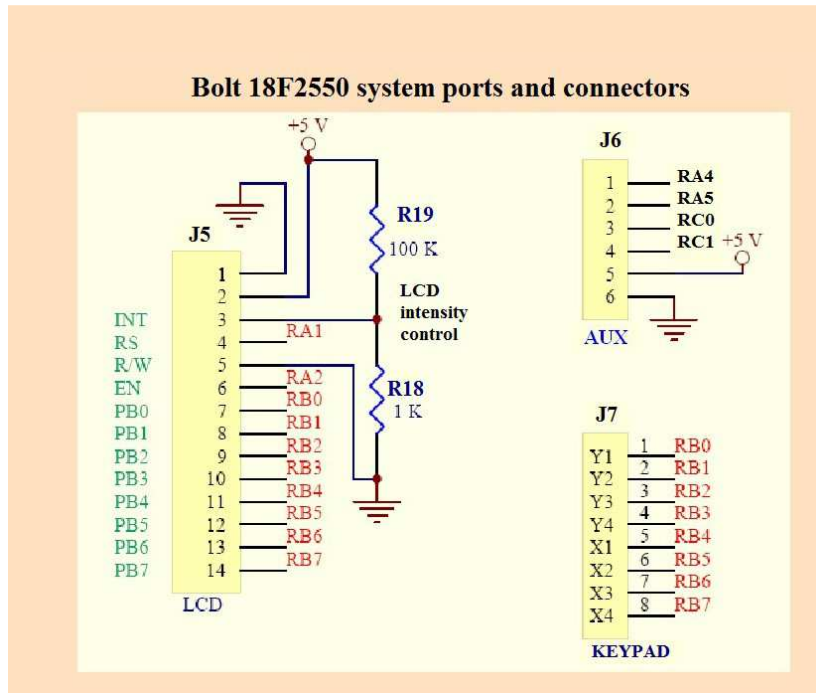


6.3 LCD, KEYPAD, AND AUX CONNECTORS.

Bolt 18F2550 board has 3 connectors for expansion, named LCD, Keypad and Aux. Please see diagram below to locate pins of 18F2550 assigned to each of them.

Table shows 14 standard signals for the LCD connector:

LCD	BOLT	FUNCION	LCD	BOLT	FUNCION
1		Gnd	8 DB1	RB1	DATA
2		5 volt.	9 DB2	RB2	DATA
3 INT		LCD Intensity control	10 DB3	RB3	DATA
4 RS	RA1	0=command 1=data	11 DB4	RB4	DATA
5 R/W	GND	0=write on LCD 1=read	12 DB5	RB5	DATA
6 EN	RA2	Enable pulse	13 DB6	RB6	DATA
7 DB0	RB0	DATA	14 DB7	RB7	DATA



7. Technical information:

7.1 POWER SUPPLY

The module can be powered in 2 ways: via USB cable or an external wall transformer. Whatever the option chosen by the user, it is necessary to move the jumper (JP1) according to the indication: “USB” position, power is chosen via the USB cable. In the opposite, power is fed by the wall transformer.

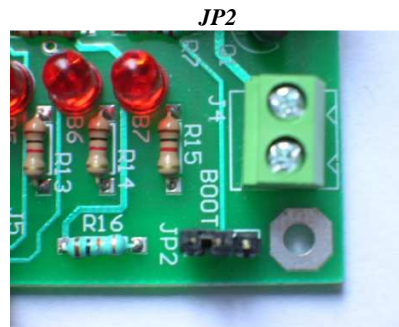
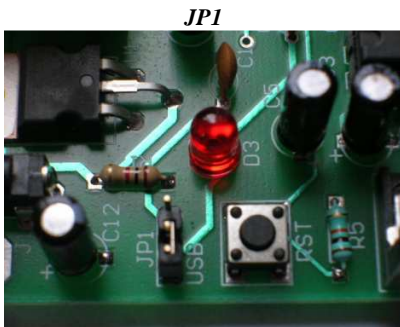
Power through USB cable, allows the user to quickly develop and test programs, already having a supply voltage of 5 volts available in the cable itself. It is important to note that if you choose this option, and for reasons of safety to the PC circuits, this voltage does not feed the relay 12v. @ 1 amp. so as to avoid inductive loads to the USB power supply.

Feeding by an external wall transformer is an option that allows the user to use the system in field applications, in auto-run mode and without the need for connection to a PC. In this case, the card has its own 5 volt regulator integrated, and feeds 100% of Bolt components including the relay mentioned in the above paragraph.

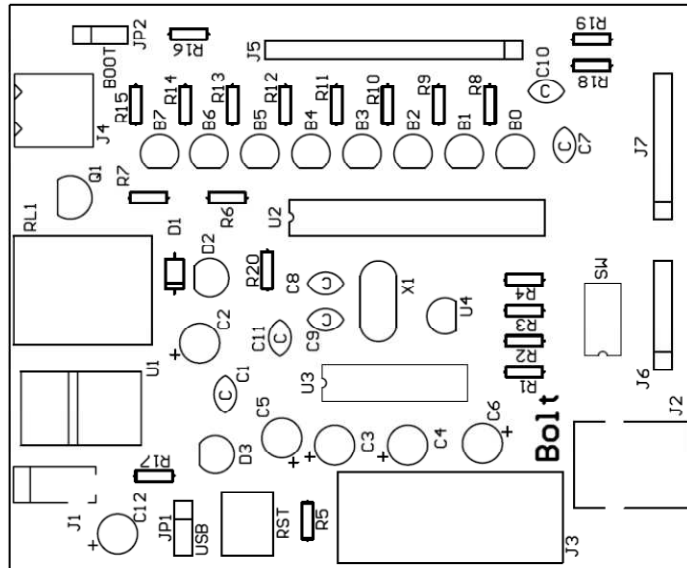
7.2 JUMPERS

<i>Jumper</i>	<i>Position</i>	<i>FUNCTION</i>	<i>Position</i>	<i>FUNCTION</i>
JP1	“USB”	USB cable powers board	<i>Opposite</i>	External wall transformer feeds system
JP2	“JP2”	Executes user program (autorun)	<i>Opposite</i>	Programs FLASH memory of Bolt 18F2550

Position of jumper is written in printed circuit:

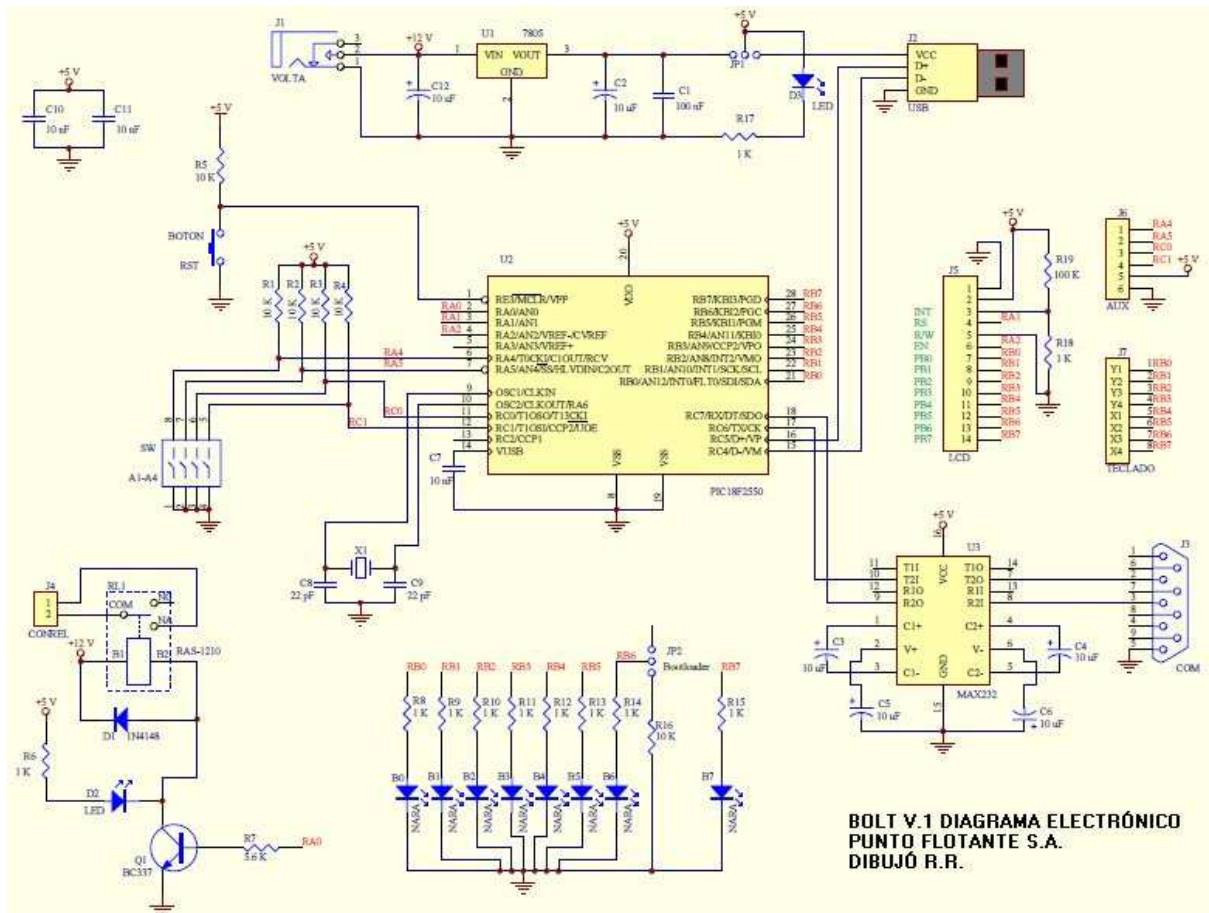


7.3 LAY OUT



7.4 ELECTRONIC DIAGRAM

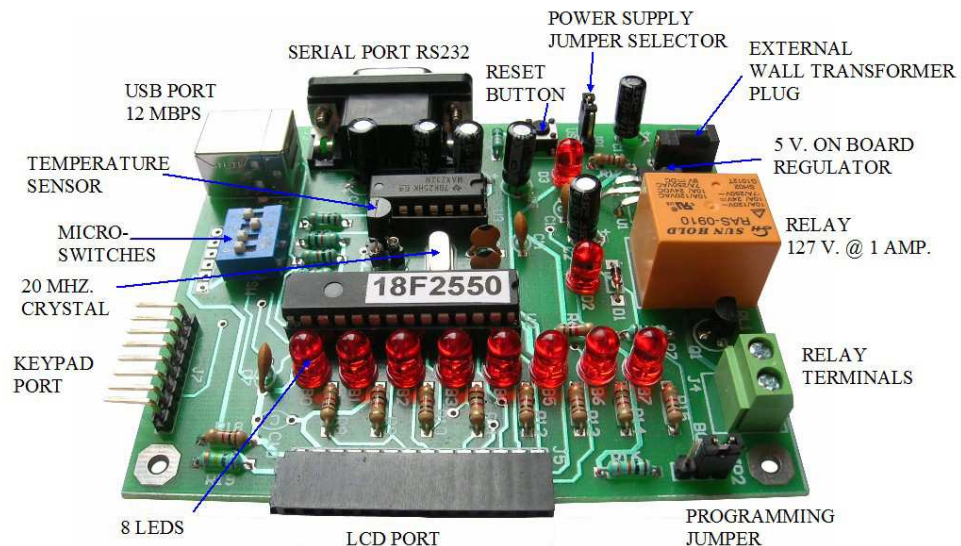
(Please see a higher resolution diagram in CD support disc or in site www.puntoflotante.net)



**BOLT V.1 DIAGRAMA ELECTRÓNICO
PUNTO FLOTANTE S.A.
DIBUJO R.R.**

7.5 COMPONENTS LIST

Ref.	Description	Type	Qty.
1	B0...B7, D2,D3	leds 5 mm.	10
2	C2...C6, C12	Cap. Elec.	6
3	C1,C7,C10,C11	Cap. Cer.	4
5	C8,C9	Cap. Cer.	2
6	D1	Diode	1
7	J3	DB9 for PCB	1
8	J1	Wall transformer plug	1
9	J4	Relay terminals	1
10	J7	Connector 8X angle	1
11	J6	Connector 6X angle	1
12	J5	Connector 14 pin	1
13	R19	resistor 1/4 w	1
14	R1...R5, R7, R16	resistor 1/4 w	7
15	R8...R15, R6, R17, R18	resistor 1/4 w	11
17	RL1	Relay	1
18	RST	Push button	1
19	JP1, JP2	connector jumper 3 pin	2
20		jumpers	2
21	SW	microswitches 4P	1
22	Q1	Transistor NPN	1
23	U4	Temperature sensor	1
24	U3	Serial interface	1
25	U2	Microcontroller	1
26	Socket	For IC	1
27	Socket	For DS18B20	1
28	socket	For IC	1
29	U1	Voltage regulator + 5 V	1
30	X1	Crystal	1
31	J2	Connector USB	1
32	Board	PCB	1

BOLT 18F2550 MICROCONTROLLER SYSTEM

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