EB88 Development Board
User's Manual

1. Introduction:

The design philosophy of this module is focused on maximizing the number of functions available to the user at minimal cost. **EVOLUPIC Bootloader 16F88 (EB88)** retains compatibility with 16F628 and 16F84, making only minimal changes in the programs.

With the ability of self-programming of 16F88 microcontroller's flash memory, the **EB88** does not need the ICSP programming hardware which greatly simplifies the electronics and allows, through the Bootloader firmware (preloaded) programming via a serial cable DB9-DB9or any USB-DB9 interface, using software that runs on the PC.

We recommend you go directly to Chapter 10, **"Start Up"** to get the system running quickly. This manual is accompanied by technical specifications as well as diagrams and detailed explanation of each of its interfaces.

Please call tel. (52) (55) 5653- 5801 to clarify any questions about EVOLUPIC Bootloader 16F88 **(EB88)**. You can also send your emails to: atencionaclientes@puntoflotante.net Juan Martinez, Punto Flotante, SA, January 2011

2.Overview.

EB88 module system was designed for use in a wide range of applications: as a kit for training and learning the 16F88 microcontroller, or as central module instrumentation equipment, robotics applications, communications and network access control, or incorporated into industrial control or security systems. The Lay Out is shown in the figure below.
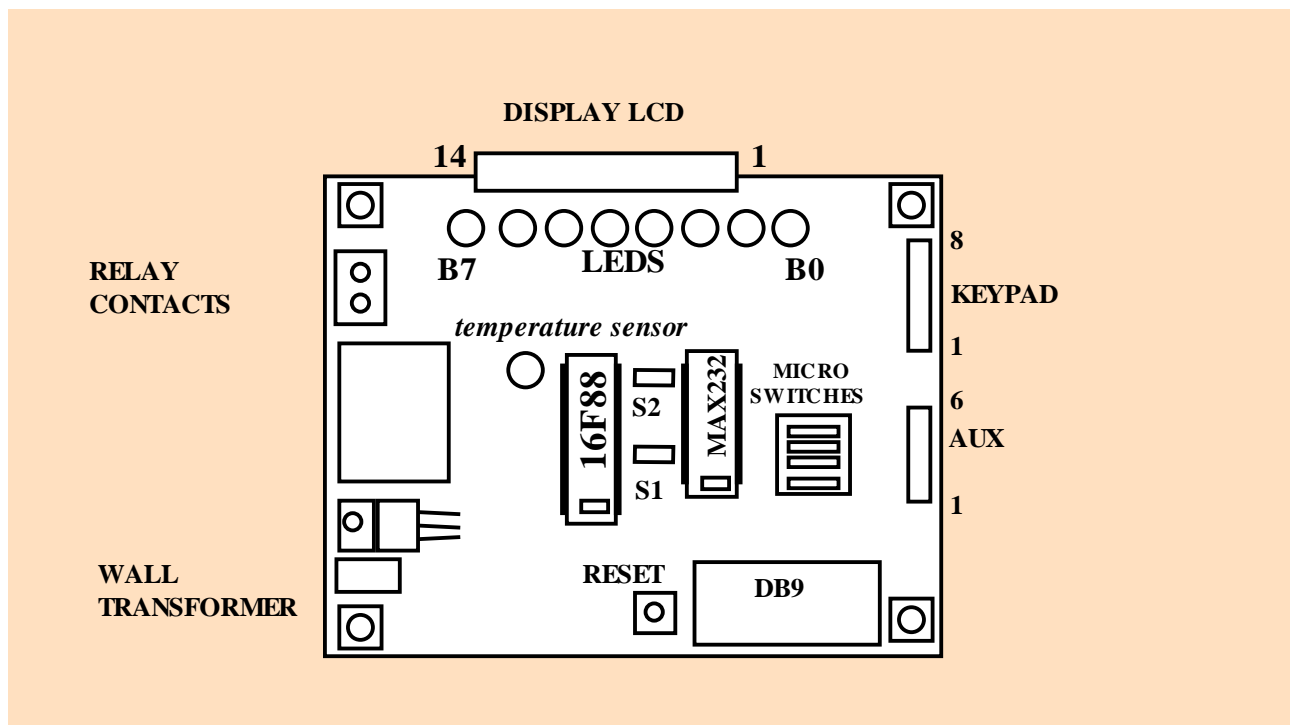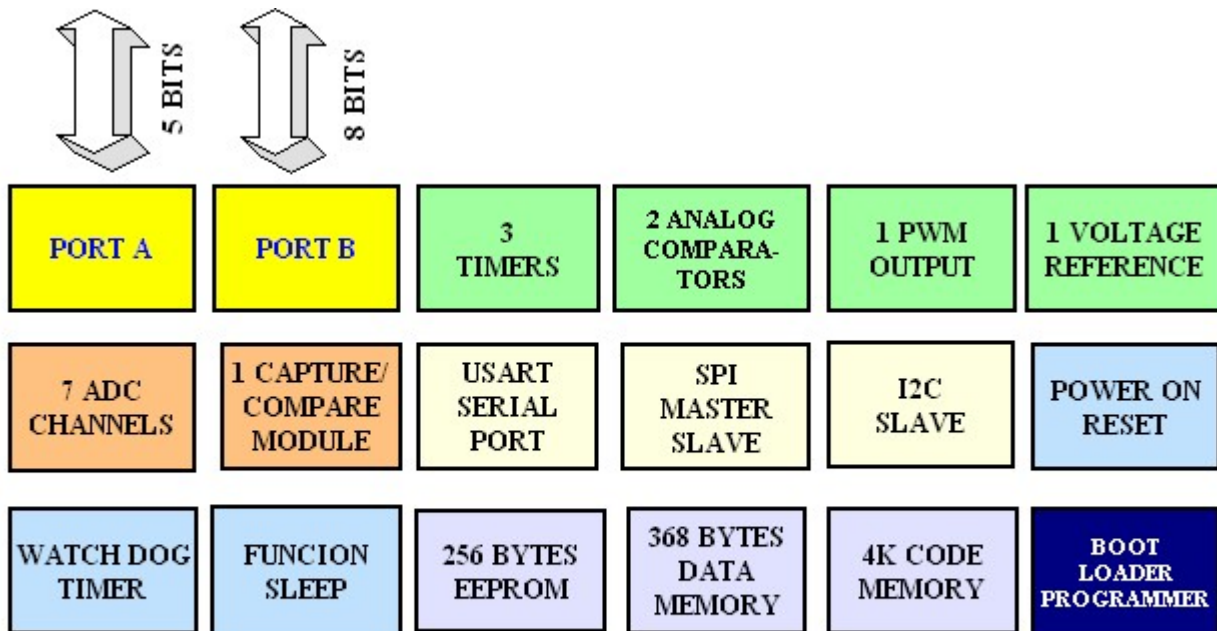

FIGURE 1

- It uses 18-pin version of the 16F88 microcontroller with encapsulated "dual in line", which contains 4096 bytes of FLASH memory, 368 bytes of RAM and 256 bytes of EEPROM, y. The design makes extensive use of ports and interfaces offered by the microcontroller to offer the user a system with a maximum of available options.
- 16F88 Microcontroller, running a 4-MHz external crystal.
- Programmer of FLASH memory via RS232 serial port.
- 4K bytes of FLASH memory, 256 bytes of EEPROM, 368 bytes of RAM.
- CMOS technology with very low power consumption during normal operation, <1 milliamperes @ 5 volts.
- Harvard architecture, RISC with a set of only 35 instructions.
- output port 8-bit LEDs connected as witnesses to provide evidence for the user ..
- 4 microswitches digital signals for testing and emulation of alarms.
- A total of 16-bit programmable as inputs or outputs.
- Relay 127VAC @ 1A, integrated into the card to activate external devices.
- DS18B20 digital temperature sensor, integrated into the module.
- 3 Timers 8 / 16 bits for the generation of delay, real time clock or event counters.
- serial port USART for asynchronous communication standard RS232 with DB9 connector output.
- SSP (Serial Port SYNCRONOUS) synchronous serial port, with 2 modes: SPI (Serial Peripheral Interface Master mode / Slave) and I2C (Integrated, Integrated Circuit. Slave Mode)
- 1 analog reference voltage output
- 2 analog comparators.
- 1 capture module / digital comparison.
- 1 special outing to generate PWM (Pulse wide modulation), with 10 bit resolution.
- 7 channel ADC converters with 10 bit resolution.
- 14-pin connector for connection to LCD display 16 x 1
- 8-pin connector for 16-key matrix keyboard.
- Header Connector 6x auxiliary for connecting to external applications.
- Programmable Watch Dog Circuit to prevent the microcontroller is out of operation.

- Brown Out Protection Circuit Reset, which generates an automatic reset if detects peaks in the voltage of 5 v.
- mode of operation of low power SLEEP, with a virtual consumption of 0 (<1 ua).
- CODE PROTECTION to avoid possible copy of the firmware of the circuit.
- system interrupts, generated from various devices, including signals at the ports, the timer and the USART, writing in the EEPROM.
- **EB88** can be activated by an external wall transformer, which feeds a 5 volt regulator integrated into the card, or can work independently using a standard battery of 9 volts .
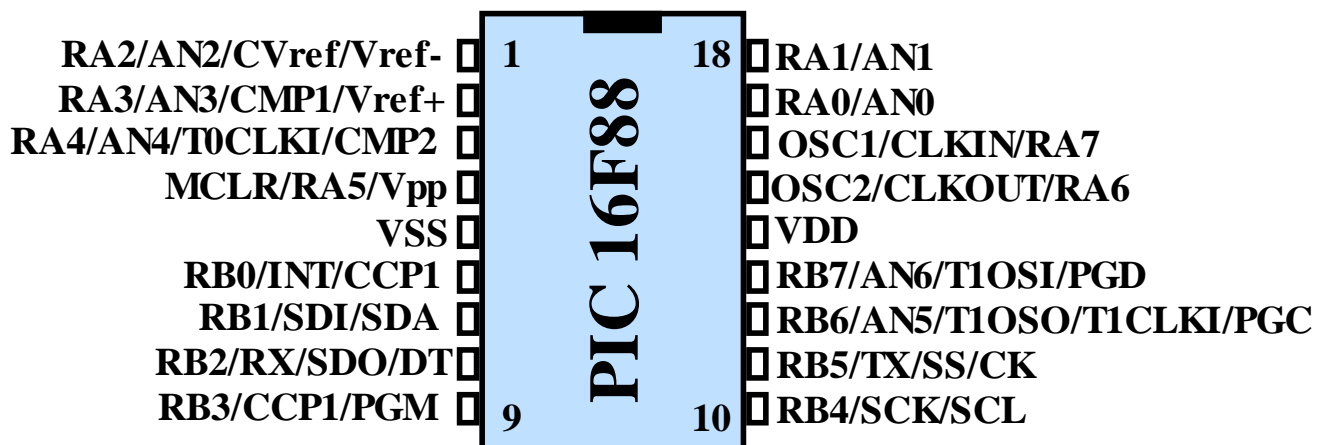
SOFTWARE:

- a CD is provided with the system: the MPLAB IDE program (executable from a PC with any Windows platform), which includes editor, macroassembler, simulator and C compiler.
- Also included is the Free Open Source software called "TINY", for programming the 16F88 FLASH memory via its RS232 serial port and a preloaded firmware Bootloader also called TINY.
- Dozens of sample programs for testing or development of peripherals and each of the functions of the system.

5 BITS	8 BITS				
PORT A	PORT B	3 TIMERS	2 ANALOG COMPARA-TORS	1 PWM OUTPUT	1 VOLTAGE REFERENCE
7 ADC CHANNELS	1 CAPTURE/ COMPARE MODULE	USART SERIAL PORT	SPI MASTER SLAVE	I2C SLAVE	POWER ON RESET
WATCH DOG TIMER	FUNCION SLEEP	256 BYTES EEPROM	368 BYTES DATA MEMORY	4K CODE MEMORY	BOOT LOADER PROGRAMMER

16F88 MICROCONTROLLER BLOCK DIAGRAM

3. Pins assignment in 16F88.

	PIC 16F88	
RA2/AN2/CVref/Vref- ☐ 1		18 ☐ RA1/AN1
RA3/AN3/CMP1/Vref+ ☐		☐ RA0/AN0
RA4/AN4/T0CLKI/CMP2 ☐		☐ OSC1/CLKIN/RA7
MCLR/RA5/Vpp ☐		☐ OSC2/CLKOUT/RA6
VSS ☐		☐ VDD
RB0/INT/CCP1 ☐		☐ RB7/AN6/T1OSI/PGD
RB1/SDI/SDA ☐		☐ RB6/AN5/T1OSO/T1CLKI/PGC
RB2/RX/SDO/DT ☐		☐ RB5/TX/SS/CK
RB3/CCP1/PGM ☐ 9		10 ☐ RB4/SCK/SCL

Pin	Name	Tipo	Function
1	RA2/ AN2/ CVref / Vref-		RA2 INPUT/OUTPUT PORT A AN2 INPUT ANALOG 2 Vref OUTPUT VOLTAGE REFERENCE Vref- LOW VOLTAJE REFERENCE FOR A/D.
2	RA3/ AN3/ Vref+/ C1out		RA3 INPUT/OUTPUT PORT A AN3 INPUT ANALOG 3 Vref+ HIGH VOLTAJE REFERENCE FOR A/D C1out OUTPUT OF COMPARADOR ANALOG 1
3	RA4/ AN4/ T0CKI/ C2out		RA4 INPUT/OUTPUT PORT A. OUTPUT ES OPEN DRAIN. AN4 INPUT ANALOG 4 T0CKI INPUT CLOCK TIMER 0 C2out OUTPUT ANALOG COMPARATOR 2
4	MCLR/ RA5/ Vpp		MCLR MASTER RESET RA5 INPUT PORT A Vpp PROGRAMMING VOLTAJE ICSP
5	VSS		GND 16F88
6	RB0/ INT / CCP1		RB0 INPUT/OUTPUT PORT B INT EXTERNAL INTERRUPT CCP1 INPUT CAPTURE MODULE OUTPUT PWM
7	RB1/ SDI / SDA		RB1 INPUT/OUTPUT PORT B SDI INPUT DATA SPI SDA TRANSMITTER DATA I2C
8	RB2/ SDO/ RX /DT		RB2 INPUT/OUTPUT PORT B SD0 OUTPUT DATA SPI RX USART ASYNCRONOUS RCV DATA DT SYNC DETECTION USART
9	RB3/ PGM/ CCP1		RB3 INPUT/OUTPUT PORT B PGM LOW VOLTAJE PROGRAMMING ICSP CCP1 CAPTURE MODULE OUTPUT DE PWM
10	RB4/ SCK/ SCL		RB4 INPUT/OUTPUT PORT B SCK INPUT/ OUTPUT SYNC FOR SPI SCL INPUT SYNC FOR I2C
11	RB5/ SS/ TX/ CK		RB5 INPUT/OUTPUT PORT B SS SLAVE MODE SELECTOR SPI TX TRASMITTER DATA ASYNCRONOUS USART CK CLOCK SYNC SPI
12	RB6/ AN5/ PGC/ T1OSO/ T1CKI		RB6 INPUT/OUTPUT PORT B AN5 INPUT ANALOG 5 PGC INPUT CLOCK PROGRAMMING ICSP T1OSO OSCILLATOR TIMER 1 T1CKI INPUT EXTERNAL CLOCK TIMER 1
13	RB7/ T1OSI/ PGD/ AN6		RB7 INPUT/OUTPUT PORT B T1OSCI INPUT OSCILLATOR TIMER 1 PGD INPUT DE DATA PROGRAMMING ISCP AN6 INPUT ANALOG 6
14	VDD		5 VOLTS VOLTAGE 16F88
15	OSC2/ CLKO/ RA6		OSC2 INPUT OSCILLATOR CRYSTAL 4 MHZ CLKO IF OSCILLATOR RC EXTERNAL, OUTPUT ¼ OF FREQUENCY RA6 INPUT/OUTPUT BIDIRECTIONAL
16	OSC1/ CLKI/ RA7		OSC2 INPUT OSCILLATOR EXTERNAL CRYSTAL 4 MHZ CLKIN INPUT OSCILADOR EXTERNAL RA7 INPUT/OUTPUT PORT A
17	RA0/ AN0		RA0 INPUT/OUTPUT PORT A AN0 INPUT ANALOG 0
18	RA1/ AN1		RA1 INPUT/OUTPUT PORT A AN1 INPUT ANALOG 1

4. Bootloader FLASH memory programming:

EVOLUPIC Bootloader 16F88 **(EB88)** board is based on the ability of self-programming the 16F88. The so-called Tiny Bootloader is a firmware preloaded at the top of the code memory 16F88. Through the Bootloader, and a software called "tinybldWin.exe" it is quick and easy to program the FLASH memory, without using an ICSP programmer, or additional electronic circuitry.

Programming is done from the computer PC via a DB9-DB9 serial cable or via a USB-Serial interface cable, whose driver installer creates a virtual COM port.

5. The 16F88 machine cycle

The 16F88 can work with an internal oscillator or an external crystal for applications that require accurate time base. For **EB88** board, an external 4 MHz crystal is installed. The master oscillator is divided by 4 to form the pulses Q1, Q2, Q3 and Q4, the 4 pulses cause a machine cycle. The following diagram shows the basic diagram of the clock operation, where the main oscillator is divided into 4 cycles for each machine cycle.
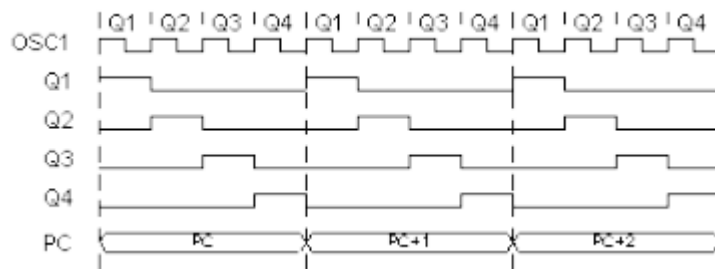

FIGURE 4

6. 16F88 PIC microcontroller architecture

The PIC16F88 belongs to the type of processors with Harvard architecture, ie the data memory and code are separated, the microcontroller has the following elements: 4K program memory FLASH type, electrically erasable programmable, 256 bytes of memory EEPROM for parameter storage, addresses or passwords, depending on the application, 368 bytes of RAM., port A and B with 8 signals each, a total of 16 input and output signals. Additionally, the microcontroller has 3 timers.

Thanks to a RISC instruction set (Reduced Instruction Set Computer), the CPU processes only 35 instructions. All instructions have a word length of 14 bits and execute in instruction cycle, with the exception of statements that modify the contents of the program counter: JUMP, BRANCH, CALL, RETURN, RETFIE, RETLW. This scheme is due to the pipeline used in the Harvard architecture allows the processor to perform the FETCH and EXECUTE simultaneously with the exception of jump instructions mentioned. The following diagram shows the execution of the example program with a system type pipeline. Note that in all clock cycles, fetch and execute execute at the same time, except TCY4 cycle.
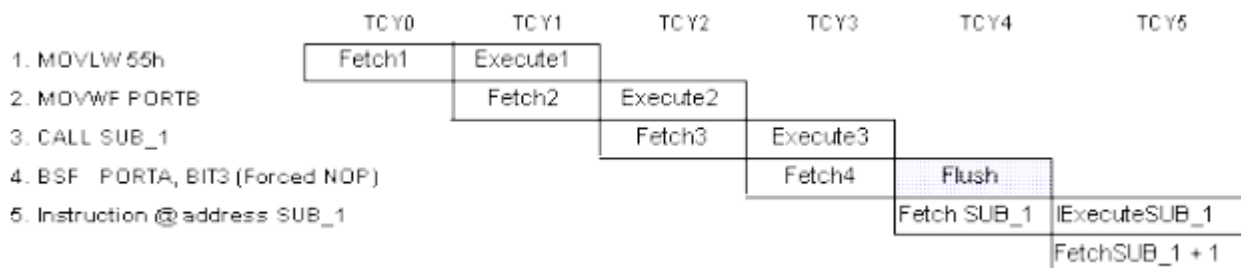

FIGURE 5

The 16F88 microcontroller contains the following registers: the W register of 8 bits, and the PC register (program counter) which is a 12-bit pointer which points to the next memory location to be read and executed. The STACK, used for handling instructions CALL, RETURN, RETFIE, RETLW, of 8 levels. Addresses are stored and retrieved after

subroutine calls. It is important to note that since this is a stack of only 8 locations, can only be nested up to 8 calls to subroutines or interrupts within the program.

7. Memory organization

HARVARD architecture allows the use of two separate data buses for program memory and data. Program memory is FLASH type, capable of up to 10,000 program and erase cycles and has 4096 locations of 14 bits, with addresses 000H to FFFH.

Addresses 0 and 4 are used for RESET and interrupt vectors respectively, ie after RESET, the program counter points to address 0 and after the occurrence of an interrupt (which is allowed) The program counter will point to the address 4.

The data memory is 8-bit locations, including 368 locations in RAM, and 256 locations in EEPROM (with ability to program and erase up to 10 million times.) RAM data memory is organized into 4 banks. Available RAM addresses are: BANK 0: 20H to 7FH (96 bytes), Bank 1: A0H to EFH (80 bytes), Bank 2: 110H to 16FH (96 bytes) and BANK 3: 190 to 1EF (96 bytes) . The locations can be accessed with direct or indirect addressing.

The following diagram shows the two types of architecture used in computers: the Harvard architecture and Von Neumann.
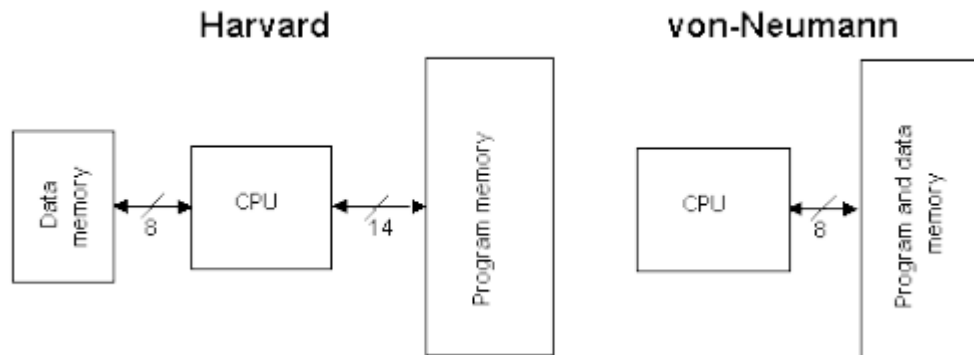

FIGURE 6

8. Special Function Registers, SFR:
The so-called SFR (Special Function Registers), allow the programmer to select the various options of the functions of the microcontroller. The bank is selected by bits RP0 and RP1 of STATUS register. Some of the registers are repeated in the banks.

FIGURE 2-3:   **PIC16F88 REGISTER FILE MAP**

File Address		File Address		File Address		File Address	
Indirect addr.(*)	00h	Indirect addr.(*)	80h	Indirect addr.(*)	100h	Indirect addr.(*)	180h
TMR0	01h	OPTION	81h	TMR0	101h	OPTION	181h
PCL	02h	PCL	82h	PCL	102h	PCL	182h
STATUS	03h	STATUS	83h	STATUS	103h	STATUS	183h
FSR	04h	FSR	84h	FSR	104h	FSR	184h
PORTA	05h	TRISA	85h	WDTCON	105h		185h
PORTB	06h	TRISB	86h	PORTB	106h	TRISB	186h
	07h		87h		107h		187h
	08h		88h		108h		188h
	09h		89h		109h		189h
PCLATH	0Ah	PCLATH	8Ah	PCLATH	10Ah	PCLATH	18Ah
INTCON	0Bh	INTCON	8Bh	INTCON	10Bh	INTCON	18Bh
PIR1	0Ch	PIE1	8Ch	EEDATA	10Ch	EECON1	18Ch
PIR2	0Dh	PIE2	8Dh	EEADR	10Dh	EECON2	18Dh
TMR1L	0Eh	PCON	8Eh	EEDATH	10Eh	Reserved[1]	18Eh
TMR1H	0Fh	OSCCON	8Fh	EEADRH	10Fh	Reserved[1]	18Fh
T1CON	10h	OSCTUNE	90h		110h		190h
TMR2	11h		91h				
T2CON	12h	PR2	92h				
SSPBUF	13h	SSPADD	93h				
SSPCON1	14h	SSPSTAT	94h				
CCPR1L	15h		95h				
CCPR1H	16h		96h	General Purpose Register 16 Bytes		General Purpose Register 16 Bytes	
CCP1CON	17h		97h				
RCSTA	18h	TXSTA	98h				
TXREG	19h	SPBRG	99h				
RCREG	1Ah		9Ah				
	1Bh	ANSEL	9Bh				
	1Ch	CMCON	9Ch				
	1Dh	CVRCON	9Dh				
ADRESH	1Eh	ADRESL	9Eh				
ADCON0	1Fh	ADCON1	9Fh		11Fh		19Fh
	20h		A0h		120h		1A0h
General Purpose Register 96 Bytes		General Purpose Register 80 Bytes		General Purpose Register 80 Bytes		General Purpose Register 80 Bytes	
			EFh		16Fh		1EFh
			F0h		170h		1F0h
		accesses 70h-7Fh		accesses 70h-7Fh		accesses 70h - 7Fh	
	7Fh		FFh		17Fh		1FFh
Bank 0		Bank 1		Bank 2		Bank 3	

    ☐   Unimplemented data memory locations, read as '0'.

    *   Not a physical register.

Note 1:   This register is reserved, maintain this register clear.

8.1 PCL, PCLATH registers:

PCLATH (PC Latch) register, may be modified with MOVWF, instructions but its execution does not modifies the upper part of the program counter.

The PCL register can be accessed by ADDWF and MOVWF instructions. His execution directly modify the lower part of the program counter and also load PCLATH register at the upper part of PC, and thus induces an immediate jump to another location. In short, by modifying PCL, care should be taken well in advance to initialize PCLATH correctly, otherwise the program may make a jump to a location in a page not desired.

8.2 Status register:

STATUS (ADDRESS 03H)

IRP	RP1	RP0	TO	PD	Z	DC	C

Bit 7   Bit 0

- Bits 0, 1 and 2 are the CARRY, CARRY HALF AND ZERO, are flags that are activated with a value equal to 1 when the result of an operation or instruction generates a carry, a half carry or if it is equal to zero respectively.
- Bit 3 is called POWER DOWN and its value is 1 after an instruction CLRWDT (CLEAR WATCH DOG TIMER) or after turning on the system (POWER UP). The value is 0 after executing the SLEEP instruction.
- Bit 4, is called "TIMER OUT"will have a value of 1 after POWER UP, SLEEP, CLRWDT or have a value of 0 if the WDT (Watch Dog Timer) activates.
- Bits 5 and 6 RP0, RP1 select the memory bank to be accessed. If RP0 = 0, RP1 = 0 Bank 0 is selected. If RP0 = 1 Bank 1 RP1 = 0, RP0 = 0, RP1 = 1 bank 2, RP0 = 1, RP1 = 1 bank 3.
- The IRP bit is used for indirect addressing, along with the FSR register to select the bank registers. IRP = 0, select banks 0 and 1, IRP = 1, select banks 2 and 3

9. Digital ports:

16F88 system has two digital ports, port A, and B with 8-bit available each. Both ports are bidirectional, that is, can be programmed as input or output, according to data address registers, called "TRISA" and "TRISB. In **EB88** card, signals have been connected with 4 microswitches for port A and 8 outputs LEDS for port, and a relay connected to pin RA0. The allocation of functions in each of the bits is shown in the table below. Please note that each input and output are available in various connectors (LCD, keypad and AUX) on the card, so that users can connect external devices.

PORT	PIN IN HEADER 16x	FUNCTION
PORT A		
RA0	PIN 1	ACTIVA/DESACTIVA RELEVADOR
RA1	PIN 3	MICROSWITCH A1, CONTROL LCD
RA2	PIN 5	MICROSWITCH A2, CONTROL LCD
RA3	PIN 7	MICROSWITCH A3, TEMPERATURE SENSOR
RA4	PIN 9	MICROSWITCH A4
PORT B		
RB0	PIN 2	LED B0, KEYPAD Y1
RB1	PIN 4	LED B1, KEYPAD Y2,
RB2	PIN 6	LED B2, KEYPAD Y3, RECEIVER SERIAL RX
RB3	PIN 8	LED B3, KEYPAD Y4
RB4	PIN 10	LED B4, KEYPAD X1
RB5	PIN 12	LED B5, KEYPAD X2, TRASMITTER SERIAL TX
RB6	PIN 14	LED B6, KEYPAD X3
RB7	PIN 16	LED B7, KEYPAD X4

Before you can write and read ports, you must first set which bits are inputs and outputs, using the following macros, and working with TRISA and TRISB registers.

```
BANK0       MACRO
            BCF         STATUS,RP0
            BCF         STATUS,RP1
            ENDM
BANK1       MACRO
            BSF         STATUS,RP0
            BCF         STATUS,RP1
            ENDM
```

9.1 LEDS AND MICROSWITCHES:

Once initialized the ports as shown, information can be written to the LEDs or read from the microswitches, considering the electronic charts shown below. The aim of the LEDs and microswitches is to give the user the ability to make emulations of digital sensors and outputs for activating actuators. All signal ports are available in 14x LCD header connector, for connection to external interfaces.
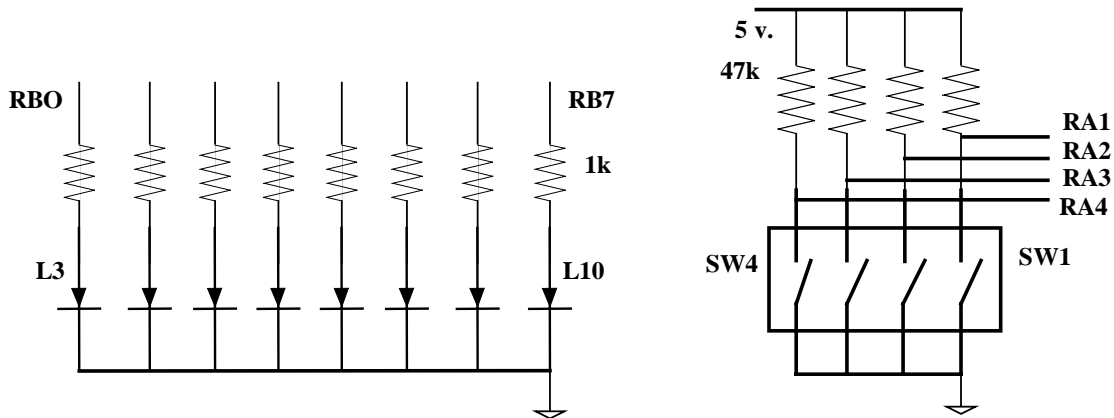
FIGURE 8: DIAGRAM OF LEDS AND MICROSWITCHES

9.2 RELAY

By using the RA0 bit of port A, the processor can activate the relay. The nominal data of this relay are: 9 volts DC activation coil and contacts 127 VAC @ 10 Amps. This relay can be used as an actuator to activate external devices such as lights, valves, solenoids, motors.
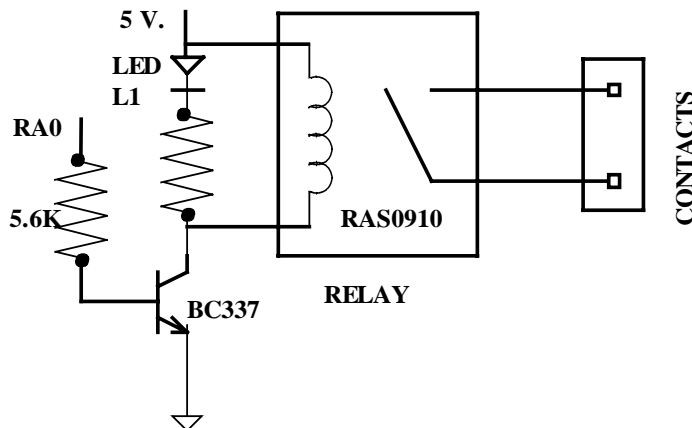

FIGURE 9: RELAY CONNECTION

EVOLUPIC *Bootloader* 16F88 Punto Flotante, S.A. 2011

9.3 KEYPAD AND AUX. CONNECTORS.

The keypad connector has 8 signals marked with numbers from 1 to 8, for ... RB0 RB7 respectively, to insert the keypad. There is also an auxiliary header with 6 signals, marked with numbers from 1 to 6. The signals are respectively RA1 ... RA4, 5 volts and GND. Please see the diagram below.

9.4 LCD 14X CONNECTOR:

LCD	EB88	FUNCTION	LCD	EB88	FUNCTION
1	GND	GND	8 DB1	RB1	DATA
2	5 VOLT	5 volts.	9 DB2	RB2	DATA
3 INT		Intensity control	10 DB3	RB3	DATA
4 RS	RA1	0=command 1=data	11 DB4	RB4	DATA
5 R/W	GND	0=write en LCD 1=read	12 DB5	RB5	DATA
6 EN	RA2	Enable	13 DB6	RB6	DATA
7 DB0	RB0	DATA	14 DB7	RB7	DATA

SIGNALS USED IN LCD, KEYPAD AND AUXILIARY HEADERS
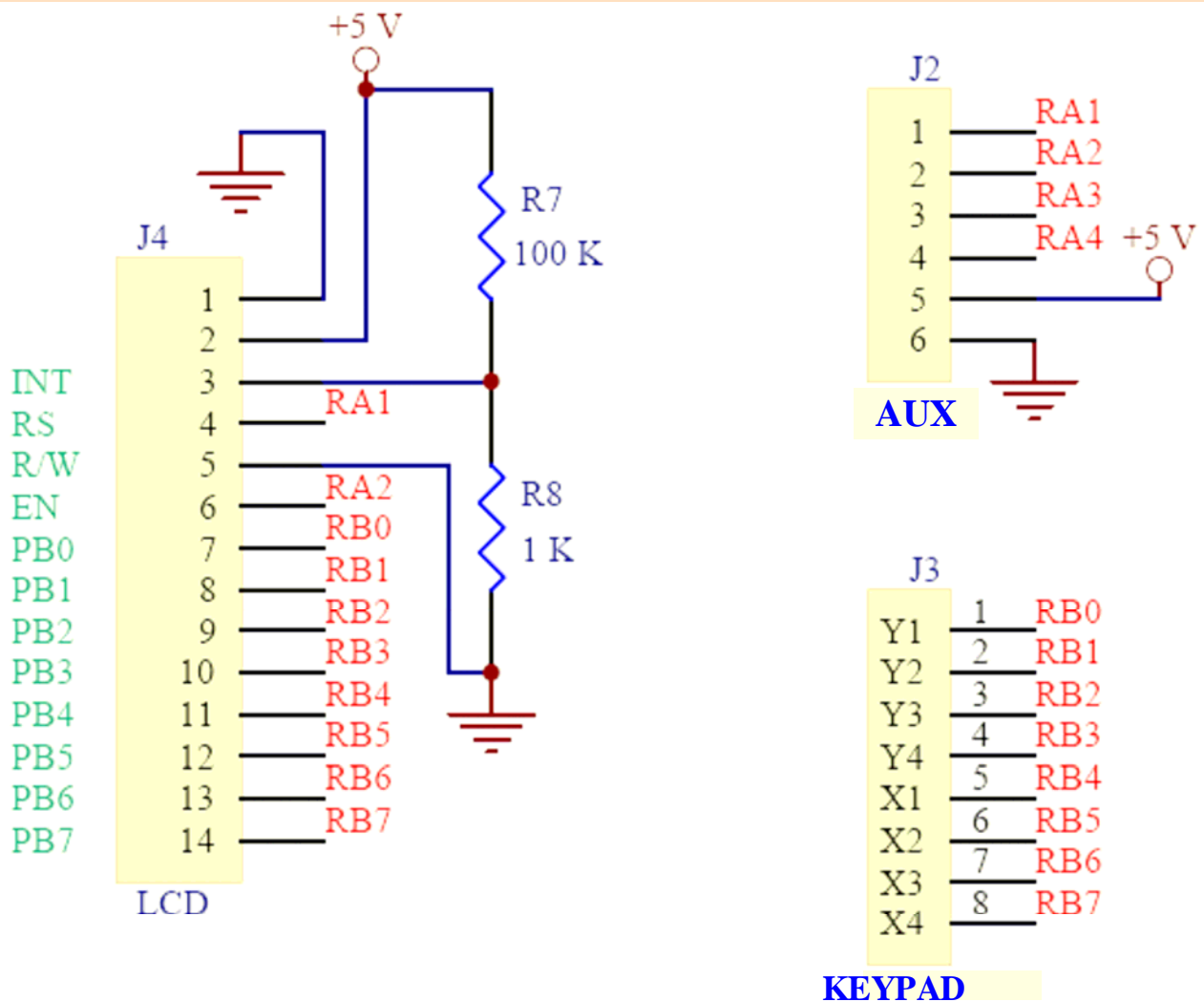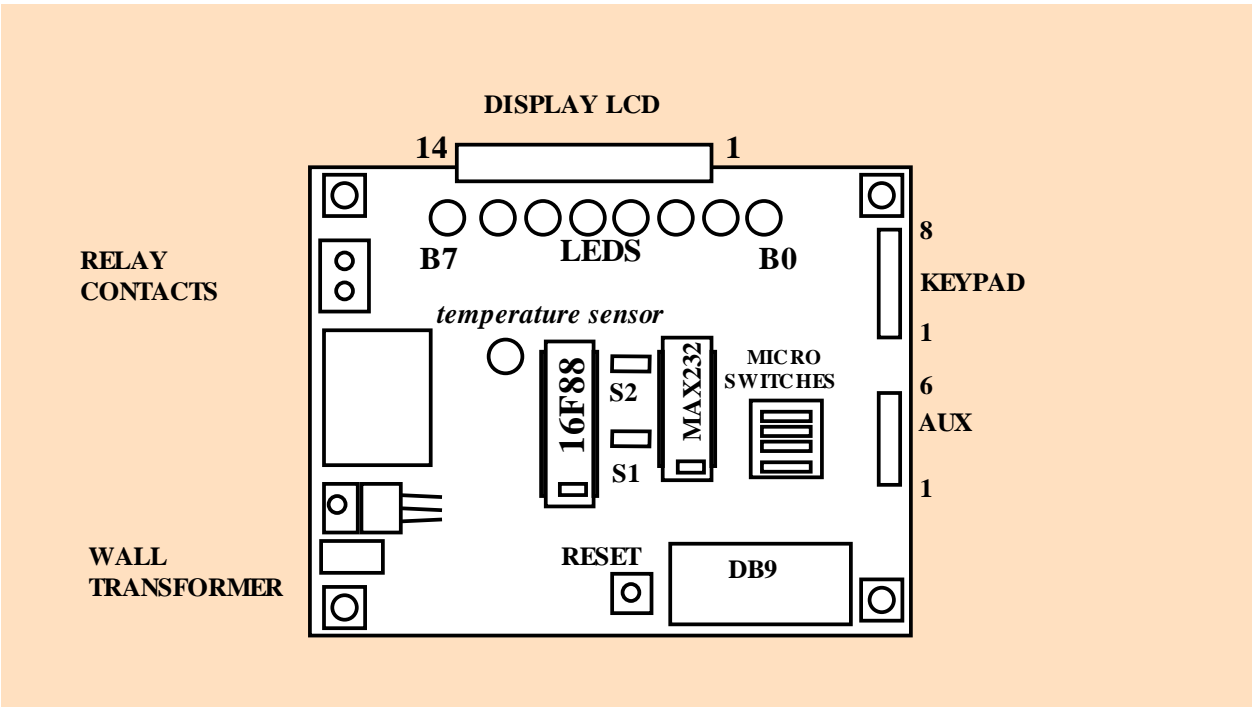
10. Start up:

STEP 1: REVIEW OF PARTS AND INITIAL TEST:

Please review the kit includes the following: **EB88** board, wall transformer, serial cable (or USB-Serial interface), hex keypad, LCD display, temperature sensor DS18B20 and support CD. To use the support disc, you need a computer with Windows XP, Vista, Windows7 with a CD drive, and a DB9 serial port connector or a USB port.

S1 and S2 must be set to "RS232". The 4 microswitches must be set to "OFF. " Insert the LCD display 14-pin connector. Position wall transformer switch to 6.0 or 7.5 volts and connect to **EB88**. The program loaded in 16F88 FLASH memory works immediately, displaying a message in LCD if microswitch SW4="OFF", or reading the DS18B20 sensor and showing in the LCD the room temperature if SW4="ON"

STEP 2: COPY THE CD, AND PROGRAM FLASH MEMORY OF 16F88

Insert the support disk in the CD drive of your computer. Open the disk and copy the entire folder "EB88 DEVELOPMENT BOARD" to your computer. To program the 16F88 FLASH memory, please see the following document, included in the CD :

"EB88 programming the system with TINY software.pdf"

11. Technical Information:

Processor: PIC16F88 microcontroller, crystal of 4 MHz, with low-power CMOS technology.
Architecture: Harvard, with code memory (14 bits) and data (8 bits) separated. Processing pipeline.
Technology: RISC (reduced instruction set computer), with 35 instructions in 14-bit word length.
Memory: 4K locations (14 bit) FLASH, 368 locations (8 bits) of RAM, 128 locations (8 bit) EEPROM.
Bootloader: preloaded firmware capable of self-programming Flash memory.
Cycles to read / write: up to 10,000 cycles on flash memory and up to 10,000,000 in the EEPROM.
Digital Ports: 5-bit port A, port B of 8 bits, a total of 13-bit programmable as inputs or outputs.
Pull up resistors, available on port B, when programmed as inputs.

LED digital outputs: the 8-bit port B connected to LEDS.

Output Capacity: Each output bit can take ("sink"), or generate ("source"), up to 25 milliamps.

Microswitches digital inputs: a total of 4 in Port A.

Output to relay: relay RAS-0910 model, contacts 127 V @ 1 A. Departure connector screws.

Auxiliary Header: 6 contacts, signals RA4… RA1 available, GND and 5 v. Can be extended with the keypad connector to make a single header 14 signals expansion.

Keypad connector: RB0 .. RB7 signals included in the header 8x Keypad 4 x 4 matrix.

LCD Connector: 14 contacts, standard and ready for connecting an LCD or other interfaces.

Serial Ports: USART RS232 compatible with its own port DB9. SSP Synchronous Serial Port.

AD converters: 7 channels, 10 bit resolution.

Additional functions: power-on reset, power up timer, watch dog, code protection, sleep (low power).

Timer / event counter: 3 timers. PWM generator

Interrupts: interrupt sources: external pin RBO / INT, timer overflow, change in the levels of inputs RB4 ... RB7. For the EEPROM write complete. The USART.

Size: 9.5 cms x 7.9 cms, fiberglass board, thru hole.

Consumption: normal <2 mA @ 5V. and 4 MHz., in SLEEP mode only 15 uA.

Power: Wall transformer 300 ma. @ 6 v. or 7.5 v.

Programmer 16F88: integrated into the card, the programming is done from a PC via serial port, using the Bootloader firmware.

Software Development: MPLAB, which includes editor, assembler, simulator and compiler. Software "TINY" Programmer of 16F88 flash memory.

11.2. LAY OUT

EVOLUPIC *Bootloader* **16F88 Punto Flotante, S.A. 2011**
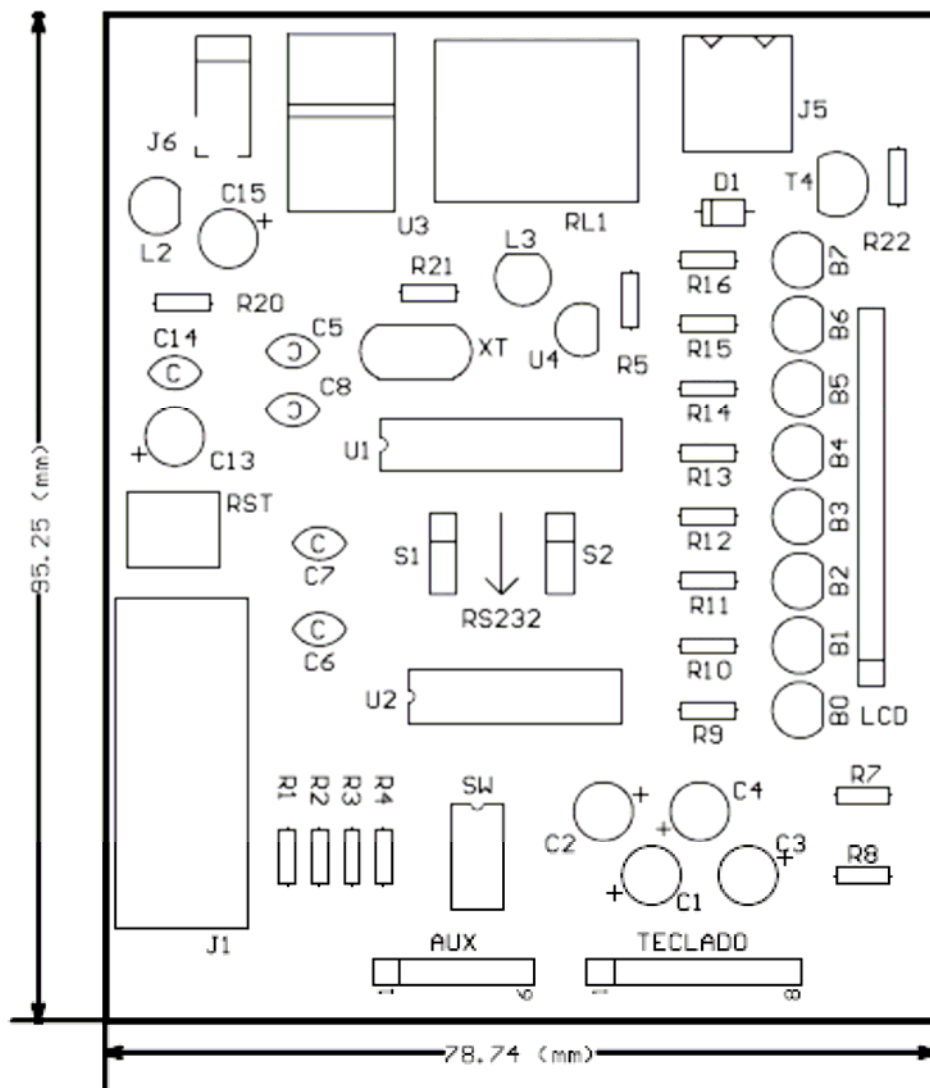
11.3 ELECTRONIC DIAGRAM:
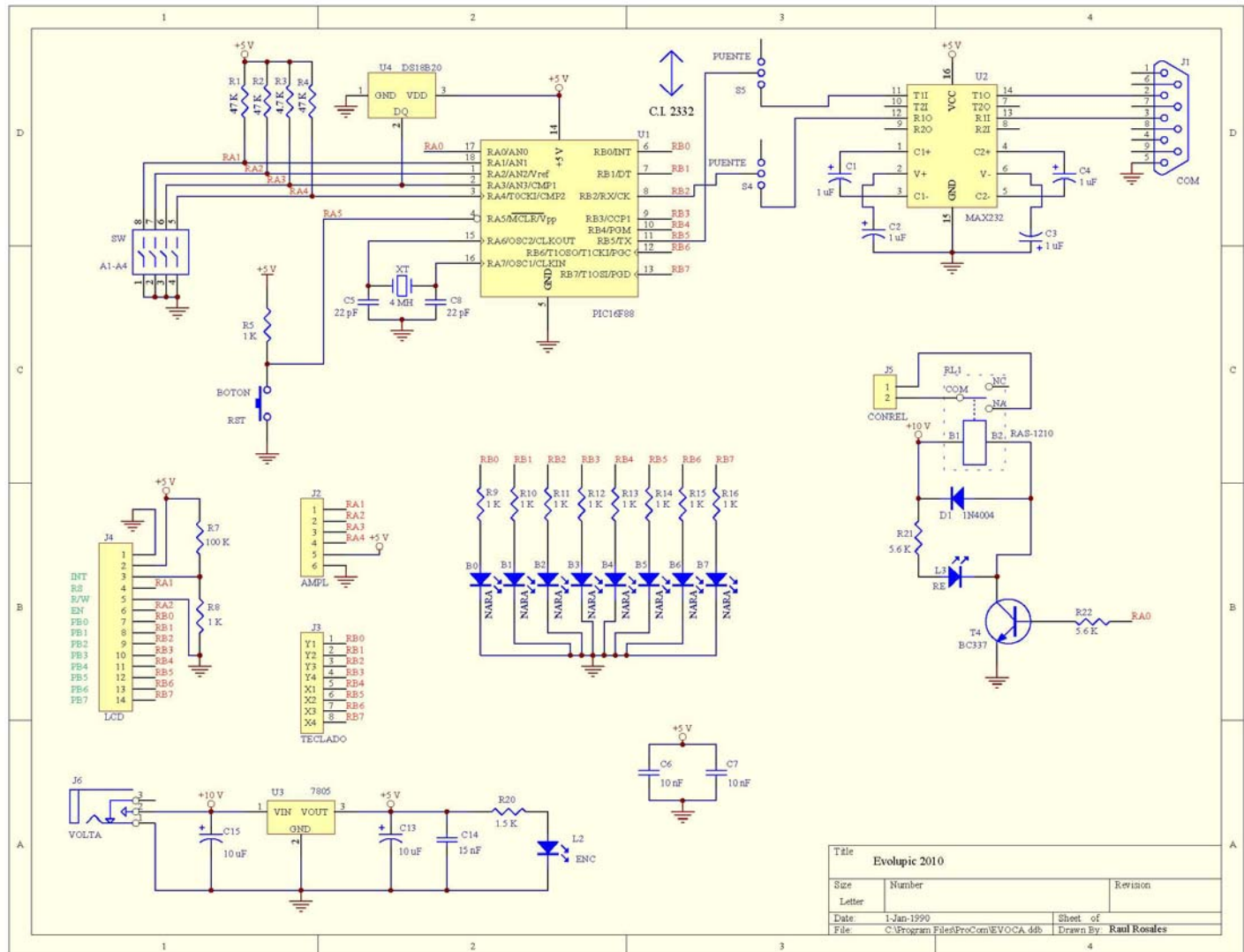
IMPORTANT NOTICE

THE **EB88** SYSTEM HAS A PRELOADED BOOTLOADER FIRMWARE IN FLASH MEMORY.

16F88 MICROCONTROLLER HAS A SAFETY MECHANISM TO PREVENT ACCIDENTAL WRITE IN THE AREA OF FLASH MEMORY WHERE THE ABOVE FIRMWARE IS LOADED. THIS MECHANISM IS SIMILAR TO THAT USED TO PROTECT EEPROM MEMORY CONTENTS.

HOWEVER, EVEN THOUGH IT IS A VERY LOW PROBABILITY EVENT, THE SYSTEM MAY BE PERFORMING AN ACCIDENTAL WRITE IN THIS AREA, WHICH WOULD MAKE IT NECCESARY TO PROGRAM IN THE 16F88 THE BOOTLOADER ORIGINAL FIRMWARE.

IN THIS CASE YOU SHOULD USE A ICSP PROGRAMMER, NOT INCLUDED WITH THE KIT **EB88**. INSTRUCTIONS TO DO SO ARE IN THE FILE

"EB88 programming the system with TINY software.pdf"

EVOLUPIC *Bootloader* 16F88 Punto Flotante, S.A. 2011