Laboratori Nazionali del Sud

Giovanni De Luca

Guida all' IDE di Bascom-AVR

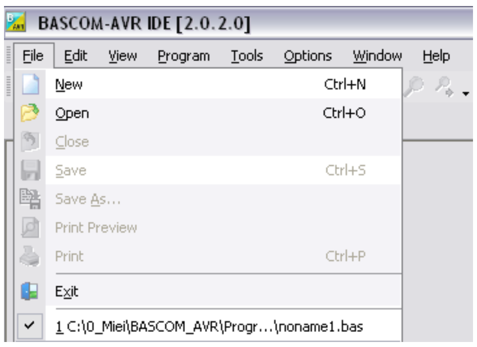
Integrated Development Enviroment per uC ATMEL serie AVR (AT90, ATtiny, Atmega, ATxmega)

www.delucagiovanni.com
deluca@lns.infn.it

Download DEMO e Utility

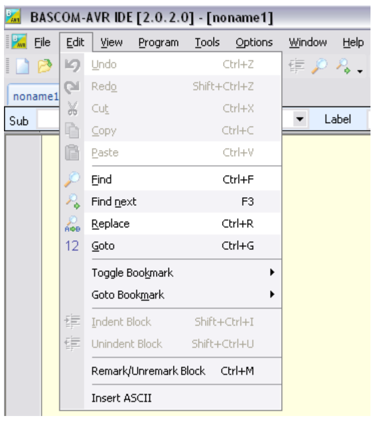
- Download Demo
- Manuale 2.0.5.0 in Inglese
- Help
- AVR Calculator
- PWM Calculator
- AVR Designer

Menù File



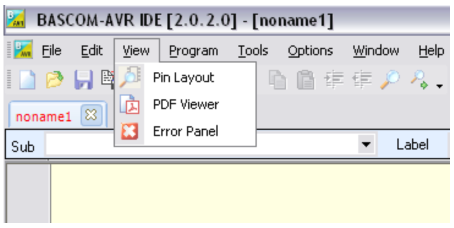
- Classico menù '**File**' di Windows.
- Abbiamo la possibilità di creare un nuovo file, di aprirne uno esistente o di salvarlo.
- Menù di stampa con preview e uscita dal programma.

Menù Edit


BASCOM-AVR IDE [2.0.2.0] - [noname1]
File Edit View Program Tools Options Window Help
noname1
Sub
Label
Undo Ctrl+Z
Redo Shift+Ctrl+Z
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Find Ctrl+F
Find next F3
Replace Ctrl+R
Goto Ctrl+G
Toggle Bookmark
Goto Bookmark
Indent Block Shift+Ctrl+I
Unindent Block Shift+Ctrl+U
Remark/Unremark Block Ctrl+M
Insert ASCII

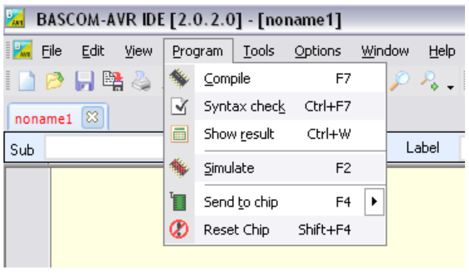
- Classico '**Edit**' di Windows.
- Copy and Paste
- Find and replace
- Bookmark

Menù View



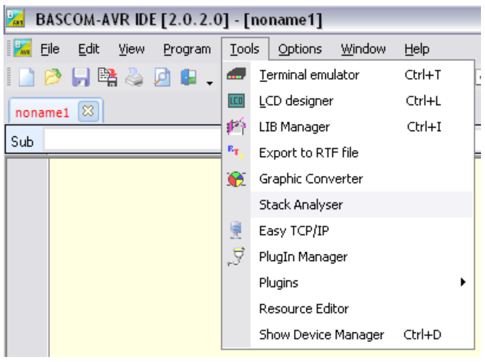
- Con ‘**View**’ è possibile abilitare la visualizzazione dei pin del chip selezionato.
- E’ possibile fare un link al pdf del chip usato nel progetto

Menù Program



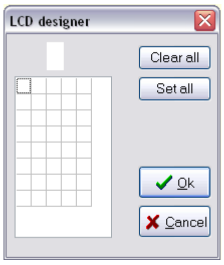
- Da questo menù si accede alla compilazione, al syntax check, alla simulazione e alla programmazione del File.bin sulla flash del uC.

Menù Tools



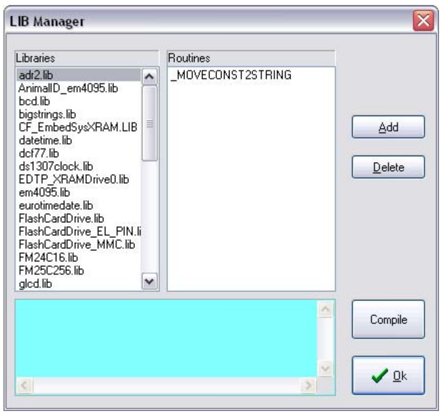
- Da qui è possibile accedere al terminale RS232, al LCD designer, e ad altri importanti tools che il Bascom mette a disposizione.

Tools -> LCD designer



- Questo tools permette di creare caratteri da usare con LCD es. 16x2

Tools -> LIB manager

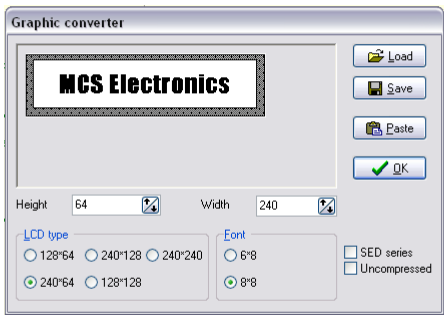


Libraries
adr2.lib
AnimalID_em4095.lib
bcd.lib
bigstrings.lib
CF_EmbedSysXRAM.LIB
datetime.lib
dcf77.lib
ds1307clock.lib
EDTP_XRAMDrive0.lib
em4095.lib
eurotimedate.lib
FlashCardDrive.lib
FlashCardDrive_EL_PIN.li
FlashCardDrive_MMC.lib
FM24C16.lib
FM25C256.lib
glcd.lib

Routines
_MOVECONST2STRING

- Questo tool permette di compilare librerie scritte in assembly e criptarle come obj per distribuirle insieme al progetto sorgente.

Tools -> Graphic converter



Height 64 Width 240

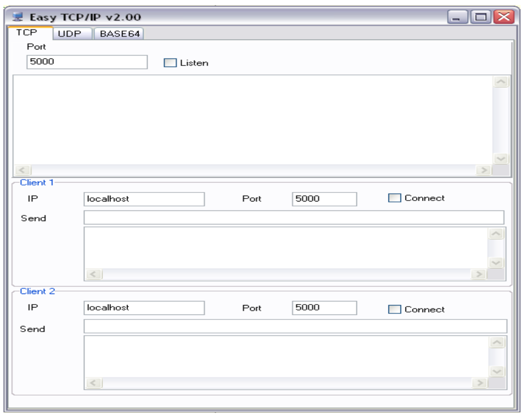
LCD type: ( ) 128*64 ( ) 240*128 ( ) 240*240 [✓ 240*64] ( ) 128*128

Font: ( ) 6*8 [✓ 8*8]

☐ SED series
☐ Uncompressed

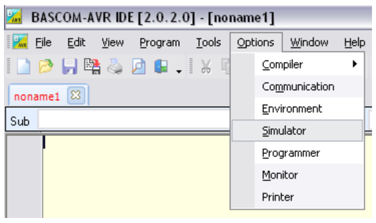
- Se si usa un LCD grafico sarà necessario convertire immagini bitmap nel formato BGF con questo tool.
- E' possibile scegliere tra vari formati, e se creare un file compresso o no.

Tools -> Easy TCP/IP



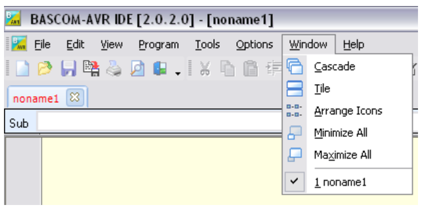
- Con questa utility è possibile comunicare con applicazioni che usano interfacce di comunicazione ethernet.
- E' possibile stabilire connessioni TCP o UDP.

Menù Option



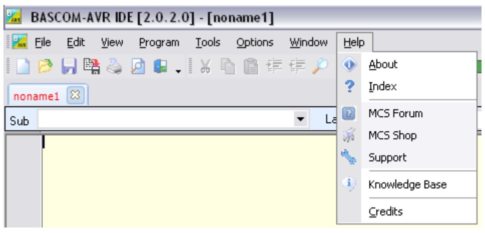
- Menù per la configurazione del chip, delle comunicazioni e del programmatore.

Menù Window


BASCOM-AVR IDE [2.0.2.0] - [noname1]
File Edit View Program Tools Options Window Help
Cascade
Tile
Arrange Icons
Minimize All
Maximize All
1 noname1
noname1
Sub

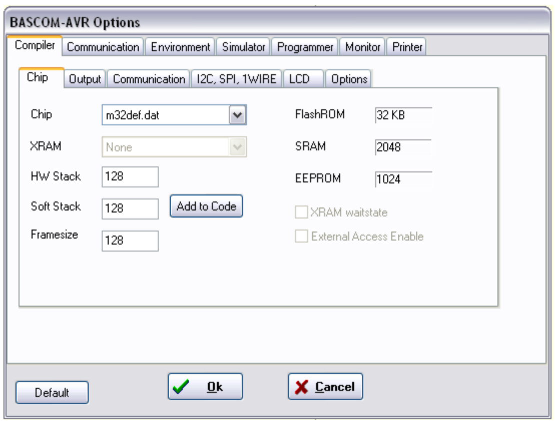
- Menù per la modalità della visualizzazione delle finestre dell'applicazione.

Menù Help


BASCOM-AVR IDE [2.0.2.0] - [noname1]
File Edit View Program Tools Options Window Help
About
Index
MCS Forum
MCS Shop
Support
Knowledge Base
Credits
noname1
Sub

- Menù attraverso il quale si accede ai file di Help, ai forum e al support on-line

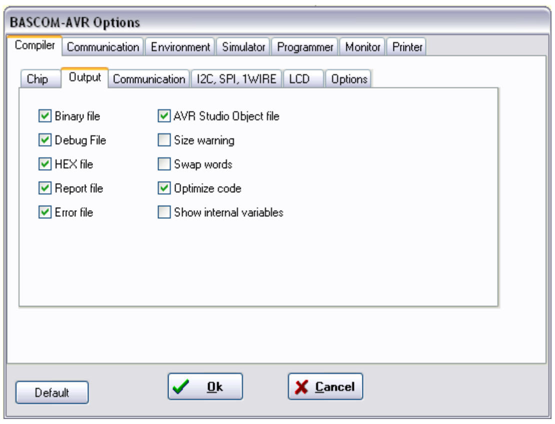
Option -> Compiler -> Chip



Chip: m32def.dat
XRAM: None
HW Stack: 128
Soft Stack: 128
Framesize: 128
FlashROM: 32 KB
SRAM: 2048
EEPROM: 1024
☐ XRAM waitstate
☐ External Access Enable

- Da questa finestra è possibile selezionare il chip, abilitare o disabilitare l'accesso alla memoria esterna, settare l'ammontare di memoria da riservare allo stack.

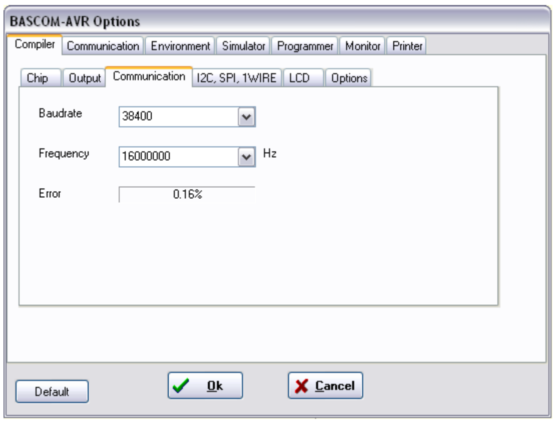
Option -> Compiler -> Output



☑ Binary file
☑ Debug File
☑ HEX file
☑ Report file
☑ Error file
☑ AVR Studio Object file
☐ Size warning
☐ Swap words
☑ Optimize code
☐ Show internal variables

- Qui si decide quale tipo di file deve essere generato durante la compilazione del sorgente, se si vuole abilitare l'opzione di 'optimize code'

Option -> Compiler -> Comm



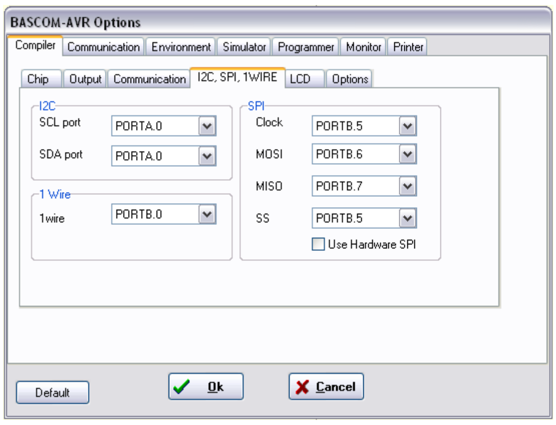
Baudrate 38400

Frequency 16000000 Hz

Error 0.16%

- Da questa finestra è possibile settare la frequenza di clock e il valore di baud rate relativo alla porta Com RS232.
- Un text box ci mostra se nei calcoli del baud rate verrà introdotto un errore espresso in %.

Option -> Compiler -> I2C etc



SCL port PORTA.0

SDA port PORTA.0

1wire PORTB.0

Clock PORTB.5

MOSI PORTB.6

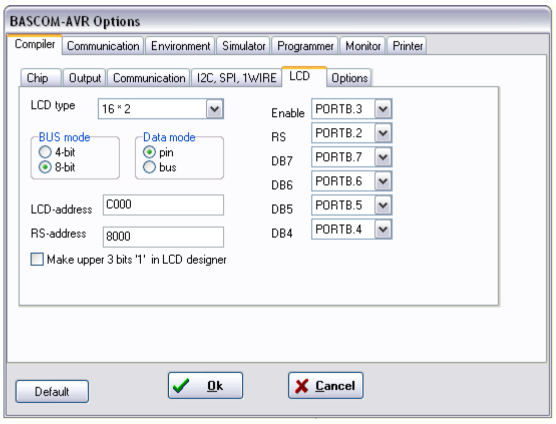
MISO PORTB.7

SS PORTB.5

☐ Use Hardware SPI

- Possiamo scegliere e configurare i pin da assegnare alle interfacce integrate : I2C, 1Wire 2 SPI.

Option -> Compiler -> LCD

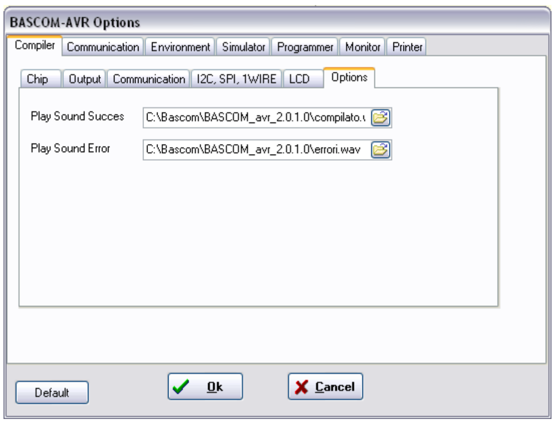


LCD type: 16 * 2
BUS mode: 4-bit [✓ 8-bit]
Data mode: [✓ pin] bus
LCD-address: C000
RS-address: 8000
☐ Make upper 3 bits '1' in LCD designer

Enable	PORTB.3
RS	PORTB.2
DB7	PORTB.7
DB6	PORTB.6
DB5	PORTB.5
DB4	PORTB.4

- Qui possiamo configurare il tipo di LCD da collegare al nostro uC.
- Inoltre possiamo scegliere di mappare l'LCD in memoria oppure utilizzare i singoli pin del display.

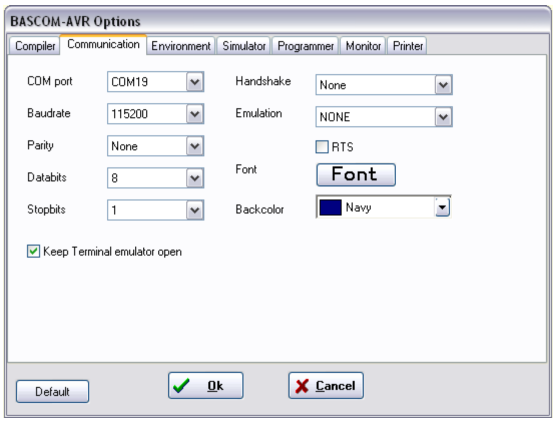
Option -> Compiler -> Option



Play Sound Succes: C:\Bascom\BASCOM_avr_2.0.1.0\compilato.
Play Sound Error: C:\Bascom\BASCOM_avr_2.0.1.0\errori.wav

- Possiamo assegnare dei suoni ad eventi particolari.
- Per esempio alla fine della compilazione il sistema dice a voce “Programma compilato con successo”.
- Se il compilatore rileva errori il sistema dice “Errori trovati”.

Option -> Comm -> Port

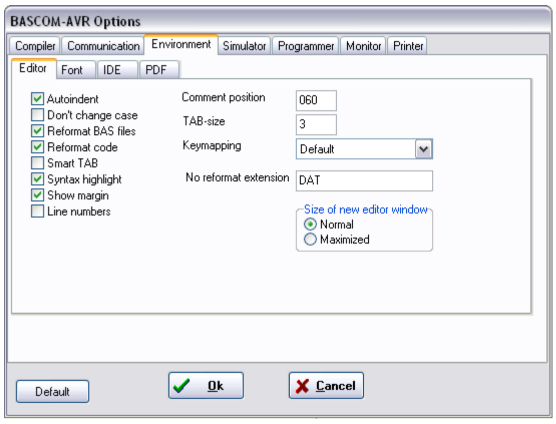


COM port	COM19	Handshake	None
Baudrate	115200	Emulation	NONE
Parity	None	☐ RTS	
Databits	8	Font	Font
Stopbits	1	Backcolor	Navy

✓ Keep Terminal emulator open

- Qui configuriamo i parametri del terminale: numero della Com, Baudrate, Parity, etc.

Option -> Enviroment



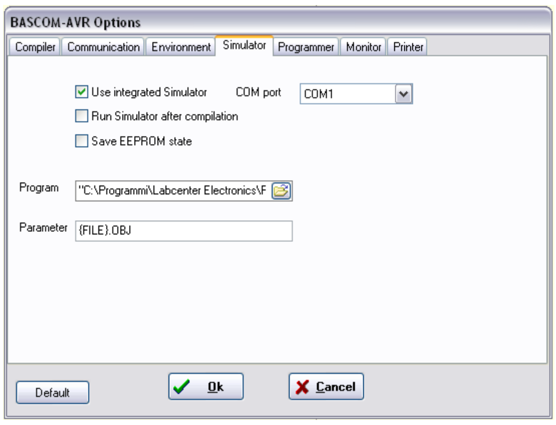
- ✓ Autoindent
- ☐ Don't change case
- ✓ Reformat BAS files
- ✓ Reformat code
- ☐ Smart TAB
- ✓ Syntax highlight
- ✓ Show margin
- ☐ Line numbers

Comment position	060
TAB-size	3
Keymapping	Default
No reformat extension	DAT

Size of new editor window: [✓ Normal] Maximized

- Si possono definire alcuni parametri relativi alla modalità di visualizzazione dell' editor.

Option -> Simulator


BASCOM-AVR Options

Compiler | Communication | Environment | Simulator | Programmer | Monitor | Printer

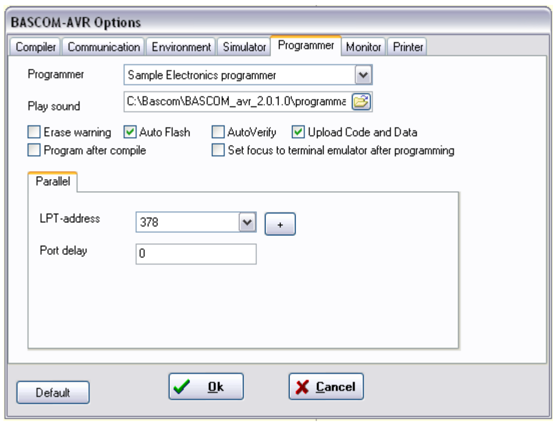
- ✓ Use integrated Simulator — COM port: COM1
- ☐ Run Simulator after compilation
- ☐ Save EEPROM state

Program: "C:\Programmi\Labcenter Electronics\F

Parameter: {FILE}.OBJ

- Uso del simulatore: Interno o esterno.

Option -> Programmer


BASCOM-AVR Options

Compiler | Communication | Environment | Simulator | Programmer | Monitor | Printer

Programmer: Sample Electronics programmer

Play sound: C:\Bascom\BASCOM_avr_2.0.1.0\programma

- ☐ Erase warning
- ✓ Auto Flash
- ☐ AutoVerify
- ✓ Upload Code and Data
- ☐ Program after compile
- ☐ Set focus to terminal emulator after programming

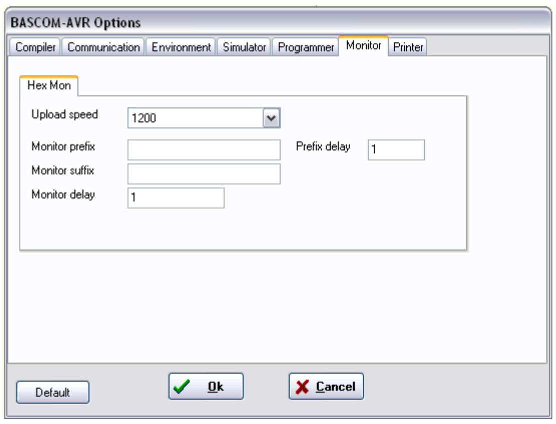
Parallel

LPT-address: 378

Port delay: 0

- Da qui è possibile scegliere il tipo di programmatore; MCS permette di utilizzare moltissimi tipi di programmatori.
- Alcuni possono essere auto-costruiti e collegati facilmente alla porta parallela di qualsiasi PC.
- Altri possono essere collegati alle porte seriali, altri alle porte USB.

Option -> Monitor


BASCOM-AVR Options

Hex Mon

Upload speed: 1200

Monitor prefix:

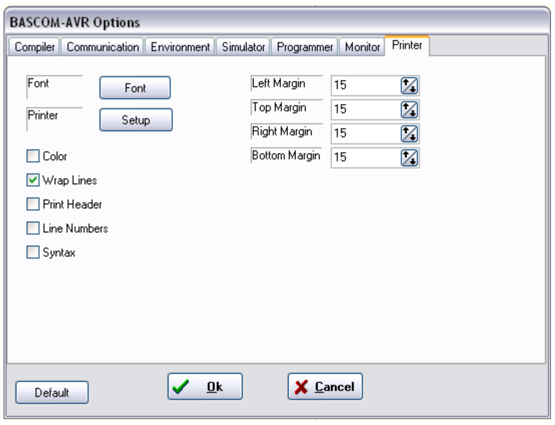
Monitor suffix:

Monitor delay: 1

Prefix delay: 1

- E' possibile configurare il programma per il monitoraggio del download da BootLoader.

Option -> Printer


BASCOM-AVR Options

Font

Printer

Left Margin: 15

Top Margin: 15

Right Margin: 15

Bottom Margin: 15

☐ Color

☑ Wrap Lines

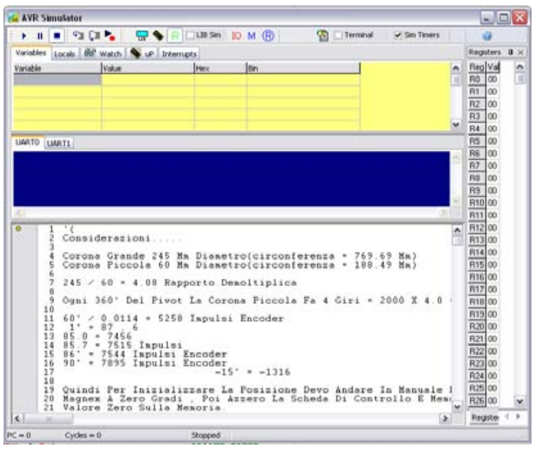
☐ Print Header

☐ Line Numbers

☐ Syntax

- Configurazione della stampante, set dei colori e modalità di impaginazione

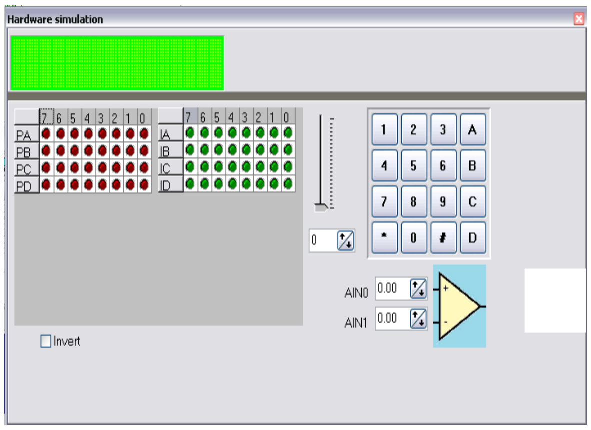
AVR Simulator



```
'(
Considerazioni.....

Corona Grande 245 Mm Diametro(circonferenza = 769.69 Mm)
Corona Piccola 60 Mm Diametro(circonferenza = 188.49 Mm)

245 / 60 = 4.08 Rapporto Demoltiplica

Ogni 360° Del Pivot La Corona Piccola Fa 4 Giri = 2000 X 4.0

60° / 0.0114 = 5258 Impulsi Encoder
 1° = 87 . 6
85.0 = 7456
85.7 = 7515 Impulsi
86° = 7544 Impulsi Encoder
90° = 7895 Impulsi Encoder
                          -15° = -1316

Quindi Per Inizializzare La Posizione Devo Andare In Manuale I
Magnex A Zero Gradi , Poi Azzero La Scheda Di Controllo E Mem
Valore Zero Sulla Memoria.
```

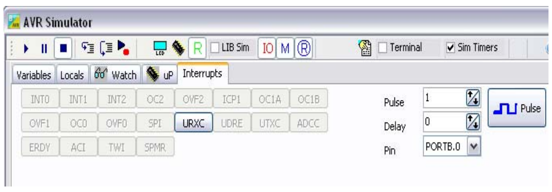
- Una delle finestre più importanti dell'IDE di Bascom è il Simulatore).
- Si possono gestire i segnali di stimulus, gli interrupts, e le periferiche analogiche presenti sul chip.

I/O Hardware simulation



- Da questa finestra è possibile simulare ed applicare segnali digitali ai singoli pin, agli ingressi analogici, usare una keyboard matrix 4x4 e visualizzare i dati su un LCD.

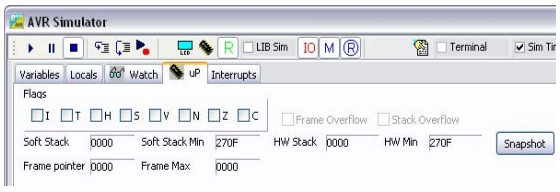
Interrupts stimulus



Pulse 1
Delay 0
Pin PORTB.0

- Cliccando sui pulsanti si possono generare impulsi di stimolo e interrupts vari:
- Int. non mascherabili, provenienti dalla fine conversione dell'ADC o dalla seriale e altro.

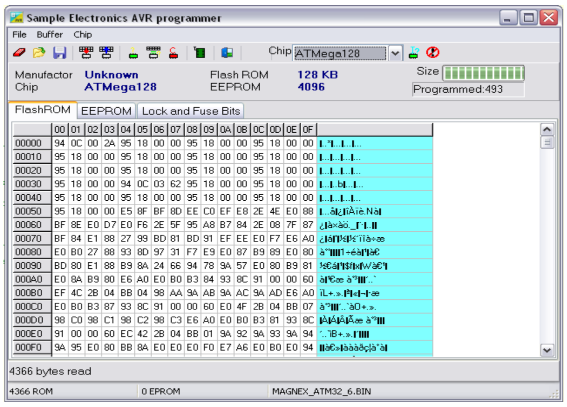
uC state



Soft Stack 0000 Soft Stack Min 270F HW Stack 0000 HW Min 270F
Frame pointer 0000 Frame Max 0000

- Vengono mostrati in questa finestra: lo stato dei flags, degli stacks.

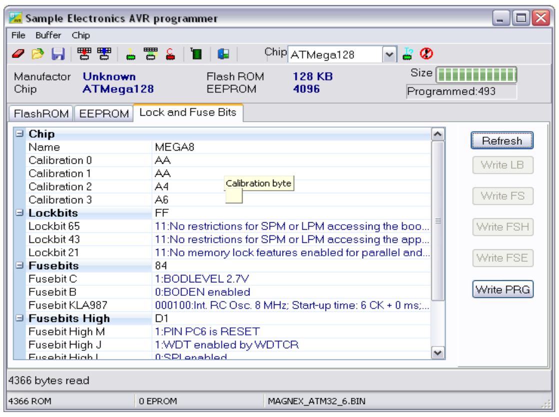
Sample programmer



```
Chip ATMega128

Manufactor  Unknown        Flash ROM  128 KB
Chip        ATMega128      EEPROM     4096        Programmed:493

       00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
00000  94 0C 00 2A 95 18 00 00 95 18 00 00 95 18 00 00  I..*I...I...I...
00010  95 18 00 00 95 18 00 00 95 18 00 00 95 18 00 00  I...I...I...I...
00020  95 18 00 00 95 18 00 00 95 18 00 00 95 18 00 00  I...I...I...I...
00030  95 18 00 00 94 0C 03 62 95 18 00 00 95 18 00 00  I...I..bI...I...
00040  95 18 00 00 95 18 00 00 95 18 00 00 95 18 00 00  I...I...I...I...
00050  95 18 00 00 E5 8F BF 8D EE C0 EF E8 2E 4E E0 88  I...åI¿IîÀïè.NàI
00060  BF 8E E0 D7 E0 F6 2E 5F 95 A8 B7 84 2E 08 7F 87  ¿Ià×àö._I¨·I..I
00070  BF 84 E1 88 27 99 BD 81 BD 91 EF EE E0 F7 E6 A0  ¿IáI'I½I½'ïîà÷æ
00080  E0 B0 27 88 93 8D 97 31 F7 E9 E0 87 B9 89 E0 80  à°'IIII1÷éàI¹IàI
00090  BD 80 E1 88 B9 8A 24 66 94 78 9A 57 E0 80 B9 81  ½IáI¹I$fIxIWàI¹I
000A0  E0 8A B9 80 E6 A0 E0 B0 B3 84 93 8C 91 00 00 60  àI¹Iæ à°³IIII..`
000B0  EF 4C 2B 04 BB 04 98 AA 9A AB 9A AC 9A AD E6 A0  ïL+.».IªI«I¬Iæ
000C0  E0 B0 B3 87 93 8C 91 00 00 60 E0 4F 2B 04 BB 07  à°³III'..`àO+.».
000D0  98 C0 98 C1 98 C2 98 C3 E6 A0 E0 B0 B3 81 93 8C  IÀIÁIÂIÃæ à°³III
000E0  91 00 00 60 EC 42 2B 04 BB 01 9A 92 9A 93 9A 94  '..`ìB+.».IIII
000F0  9A 95 E0 80 BB 8A E0 E0 E0 F0 E7 A6 E0 B0 E0 94  IIàI»IàààðçIà°àI

4366 bytes read
4366 ROM        0 EPROM        MAGNEX_ATM32_6.BIN
```

- Questa è l'interfaccia di uno dei programmatori disponibili; Sample Programmer)
- Lo schema elettrico è disponibile sull'Help.
- Abbiamo la possibilità di programmare la flash, la eeprom o i fuse bits del micro.

Lock and fuse bits



Chip ATMega128

Manufactor Unknown | Flash ROM 128 KB | Programmed:493
Chip ATMega128 | EEPROM 4096

Chip	
Name	MEGA8
Calibration 0	AA
Calibration 1	AA
Calibration 2	A4
Calibration 3	A6
Lockbits	FF
Lockbit 65	11:No restrictions for SPM or LPM accessing the boo...
Lockbit 43	11:No restrictions for SPM or LPM accessing the app...
Lockbit 21	11:No memory lock features enabled for parallel and...
Fusebits	84
Fusebit C	1:BODLEVEL 2.7V
Fusebit B	0:BODEN enabled
Fusebit KLA987	000100:Int. RC Osc. 8 MHz; Start-up time: 6 CK + 0 ms;...
Fusebits High	D1
Fusebit High M	1:PIN PC6 is RESET
Fusebit High J	1:WDT enabled by WDTCR
Fusebit High I	0:SPI enabled

4366 bytes read

4366 ROM | 0 EPROM | MAGNEX_ATM32_6.BIN

- E' possibile configurare i fuse bits a seconda delle esigenze.
- E' possibile scegliere il generatore di clock, abilitare o disabilitare la protezione alla lettura, abilitare il watchdog hardware e altro.

Introduzione al Bascom-AVR

- Scelta del microcontrollore
- Utilizzo dei file di definizione (Def.dat)
- Configurazione della porta Com1
- Configurazione del display LCD
- Configurazione delle porte di I/O
- Configurazione dell'ADC interno
- Dimensionamento delle variabili
- Tipi di variabili
- Struttura del MAIN
- Esempio: Blink Led
- Uso di Locate, LCD, Cls, Cursor
- Uso della UART, Print e Input
- Interrupt seriale URXC

Scelta del microcontrollore

- Prima di procedere con la stesura di qualsiasi programma è necessario stabilire il tipo di uC da utilizzare, o almeno fissarne il package (DIP, TQFP)
- Bisogna fare i conti con il numero dei pin disponibili e con le periferiche hardware che ci necessitano (come stabilito sullo schema elettrico).
- N.B. Non tutti i uC della stessa famiglia sono pin to pin compatibili.
- Una volta scritto un programma sarà comunque possibile, facendo piccole modifiche, ricompilarlo per altri chip della stessa famiglia.

Primo passo : file Def.dat

```
$regfile = "m128def.dat"
$crystal = 14745600
$baud = 115200
$hwstack = 128
$swstack = 128
$framesize = 128
```

$HWSTACK, $FRAMESIZE

- The Hardware stack is room in RAM that is needed by your program. When you use GOSUB label, the microprocessor pushes the return address on the hardware stack and will use 2 bytes for that. When you use RETURN, the HW stack is popped back and the program can continue at the proper address. When you nest GOSUB, CALL or functions, you will use more stack space. Most statements use HW stack because a machine language routine is called.
- You need a minimum frame size of 24 bytes. This space is used by a number of routines. For example string<>numeric conversion routines. If you use Print numVar, then the numeric variable "numvar" is converted into a string representation of the binary number. The framespace buffer is used for that. While the framespace server as dynamic memory, a fixed address is used. For this reason the buffer has a fixed size of 24 bytes.

Configurazione della Com1

CONFIG COM1 = baud , synchrone=0|1,parity=none|disabled|even|odd,stopbits=1|2,databits=4|6|7|8|9,clockpol=0|1

baud	Baud rate to use. Use 'dummy' to leave the baud rate at the $baud value.
synchrone	0 for asynchrone operation (default) and 1 for synchrone operation.
Parity	None, disabled, even or odd
Stopbits	The number of stop bits : 1 or 2
Databits	The number of data bits : 4,5,7,8 or 9.
Clockpol	Clock polarity. 0 or 1.

Config Com1 = 115200 , Synchrone = 0 , Parity = None , Stopbits = 1 , Databits = 8 , Clockpol = 0

Configurazione dell’ LCD

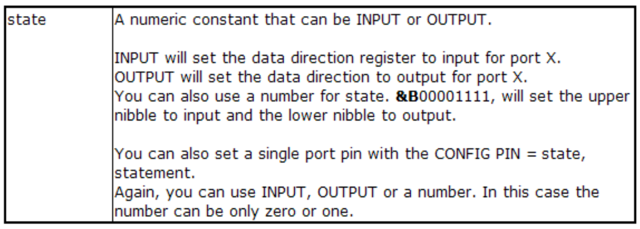
CONFIG LCD = LCDtype , CHIPSET=KS077 | Dogm163v5 | DOG163V3 | DOG162V5 | DOG162V3 [,CONTRAST=value]

LCDtype	The type of LCD display used. This can be : 40 * 4,16 * 1, 16 * 2, 16 * 4, 16 * 4, 20 * 2 or 20 * 4 or 16 * 1a or 20*4A. Default 16 * 2 is assumed.
Chipset KS077	Most text based LCD displays use the same chip from Hitachi. But some use the KS077 which is highly compatible but needs an additional function register to be set. This parameter will cause that this register is set when you initialize the display.
CHIPSET DOGM	The DOGM chip set uses a special function register that need to be set. The 16 x 2 LCD displays need DOG162V3 for 3V operation or DOG162V5 for 5V operation. The 16 x 3 LCD displays need DOG163V3 for 3V operation or Dogm163v5 for 5V operation
CONTRAST	The optional contrast parameter is only supported for the EADOG displays. By default a value from the manufacture is used. But you might want to override this value with a custom setting.

Config Lcd = 16 * 2

Configurazioni delle porte I/O

CONFIG PORTx = state
CONFIG PINx.y = state



state	A numeric constant that can be INPUT or OUTPUT. INPUT will set the data direction register to input for port X. OUTPUT will set the data direction to output for port X. You can also use a number for state. **&B**00001111, will set the upper nibble to input and the lower nibble to output. You can also set a single port pin with the CONFIG PIN = state, statement. Again, you can use INPUT, OUTPUT or a number. In this case the number can be only zero or one.

Config Portd = **Input**
Config Porta = **Output**

Configurazioni delle porte I/O

Altra modalità usando i registri di configurazione:
```
DDRA=&B_1111_1111  ‘configura tutti i pin della porta A come output
DDRA=&HFF          ‘configura tutti i pin della porta A come output
DDRB=&B_0000_1111  ‘configura i bit 3..0 come output, 7..4 come input
DDRB.3=1           ‘configura il bit 3 come output
```

Uso delle resistenza di pull-up:
```
DDRA.0=0           ‘configura il bit 0 della PORT(A) come input
PORTA.1=1          ‘abilitiamo la resistenza di pull-up forzando a 1 il pin
```

Uso di ‘ALIAS’:
```
Pulsante ALIAS PINA.0 ‘al pin d’ingresso PINA.0 diamo il nome ‘Pulsante’
```

Configurazione ADC

```
Config Adc = Single , Prescaler = Auto , Reference = Avcc
Start Adc
Dim W As Word , Channel As Byte

Channel = 0
Do

  W = Getadc(channel)
  Print "Channel " ; Channel ; " value " ; W
  Incr Channel
  If Channel > 7 Then Channel = 0

Loop
End
```

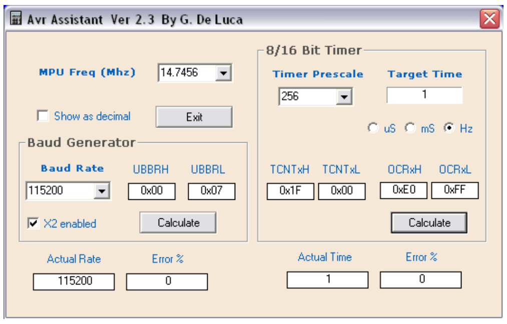
Lettura ADC in free mode

```
Config Adc = Free , Prescaler = Auto , Reference = Internal
On Adc Adc_isr Nosave
Enable Adc
Enable Interrupts
Dim W As Word , Channel As Byte

Channel = 0
Do
  Channel = 0
  Start Adc
  Idle
  Stop Adc
  Print "Channel " ; Channel ; " value " ; W
Loop
End
```

```
Adc_isr:
      push r26
      push r27
      push r24
      in r24,sreg
      push r24
      push r25
      W = Getadc(channel)

      pop r25
      pop r24
      !out sreg,r24
      pop r24
      pop r27
      pop r26
Return
```

Configurazione del Timer 0

Uso di AVR Assistant


Avr Assistant Ver 2.3 By G. De Luca

MPU Freq (Mhz): 14.7456
[ ] Show as decimal

Baud Generator

Baud Rate	UBBRH	UBBRL
115200	0x00	0x07

[✓] X2 enabled

Actual Rate	Error %
115200	0

8/16 Bit Timer

Timer Prescale: 256
Target Time: 1
uS mS [✓ Hz]

TCNTxH	TCNTxL	OCRxH	OCRxL
0x1F	0x00	0xE0	0xFF

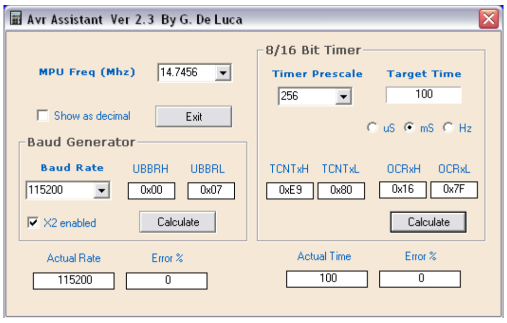
Actual Time	Error %
1	0

In questo esempio con un cristallo di 14.7456 Mhz, impostando opportunamente i registri è possibile ottenere un Baudrate di 115200 e una frequenza di intervento del Timer pari a 1Hz

Per calcolare i valori da assegnare ai registri dei timer per impostare il BaudRate
o il tempo di intervento del Timer 0,1,2, è possibile utilizzare questa utility scaricabile dal sito : www.delucagiovanni.com

Configurazione del Timer 0

Uso di AVR Assistant


Avr Assistant Ver 2.3 By G. De Luca

MPU Freq (Mhz): 14.7456
[ ] Show as decimal

Baud Generator

Baud Rate	UBBRH	UBBRL
115200	0x00	0x07

[✓] X2 enabled

Actual Rate	Error %
115200	0

8/16 Bit Timer

Timer Prescale: 256
Target Time: 100
uS [✓ mS] Hz

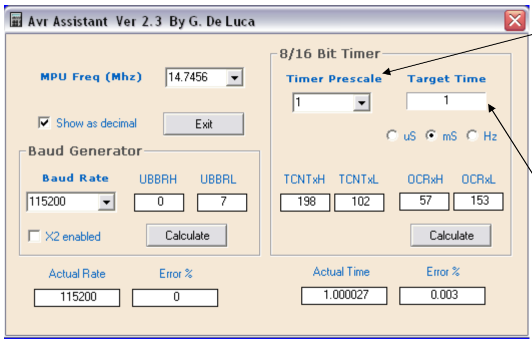
TCNTxH	TCNTxL	OCRxH	OCRxL
0xE9	0x80	0x16	0x7F

Actual Time	Error %
100	0

Con questa configurazione otteniamo un periodo di intervento di 100 mSec. Abilitando l'interrupt corrispondente e indicando l'indirizzo di gestione, il programma ogni 100 mSec salterà all' Interrupt Handler ed eseguirà le istruzioni contenute nella subroutine.

Per calcolare i valori da assegnare ai registri dei timer per impostare il BaudRate
o il tempo di intervento del Timer 0,1,2, è possibile utilizzare questa utility scaricabile dal sito : www.delucagiovanni.com

Configurazione del Timer 1


Avr Assistant Ver 2.3 By G. De Luca

MPU Freq (Mhz): 14.7456

☑ Show as decimal

Exit

Baud Generator

Baud Rate	UBBRH	UBBRL
115200	0	7

☐ X2 enabled

Calculate

Actual Rate	Error %
115200	0

8/16 Bit Timer

Timer Prescale: 1

Target Time: 1

uS [✓ mS] Hz

TCNTxH	TCNTxL	OCRxH	OCRxL
198	102	57	153

Calculate

Actual Time	Error %
1.000027	0.003

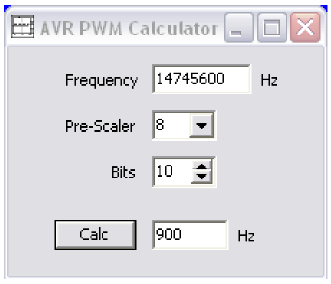
```
$regfile = "m32def.dat"
$crystal = 14745600
Config Timer1 = Timer , Prescale = 1
Ddra.0 = 1
Enable Interrupts
Enable Timer1
On Ovf1 Timer_1
Start Timer1

Do
    nop
Loop
End
'-- entra ogni 1 msec --
Timer_1:
   Tcnt1h = 198
   Tcnt1l = 102
   Ocr1ah = 57
   Ocr1al = 153
   Toggle Porta.0
Return
```

Configurazione del PWM

PWM risoluzione = 8bit
14745600 / 256 = 57600
57600 / 8 (prescale) = 7200 se 8bit
abbiamo 2 uscite OC1A e OC1B
il valore della freq va diviso x 2
abbiamo così 3600 Hz per canale.

PWM risoluzione = 9bit
14745600 / 256 = 57600
57600 / 16 (prescale) = 3600 se 9bit
abbiamo 2 uscite OC1A e OC1B
il valore della freq va diviso x 2
abbiamo così 1800 Hz per canale.

PWM risoluzione = 10bit
14745600 / 256 = 57600
57600 / 32 (prescale) = 1800 se 10bit
abbiamo 2 uscite OC1A e OC1B
il valore della freq va diviso x 2
abbiamo così 900 Hz per canale.


AVR PWM Calculator

Frequency 14745600 Hz

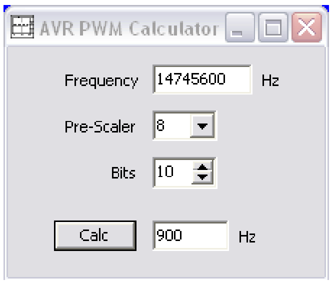
Pre-Scaler 8

Bits 10

Calc 900 Hz

Configurazione del PWM

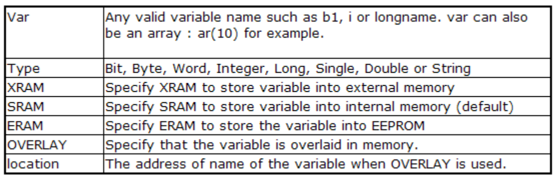
```
$crystal = 14745600
Config Timer1 = Pwm , Pwm = 10 , Compare A Pwm = Clear Down , Prescale = 8
        '14745600 / 256 = 57600 / 32 (10bit) = 1800 Hz
        'abbiamo 2 uscite la freq viene divisa x 2 : abbiamo 900Hz per canale

Pwm1a = 100
Do
  nop
Loop
End
```



Frequency 14745600 Hz
Pre-Scaler 8
Bits 10
900 Hz

Dimensionamento Variabili

DIM var AS [XRAM/SRAM/ERAM]type [AT location/variable] [OVERLAY]



Var	Any valid variable name such as b1, i or longname. var can also be an array : ar(10) for example.
Type	Bit, Byte, Word, Integer, Long, Single, Double or String
XRAM	Specify XRAM to store variable into external memory
SRAM	Specify SRAM to store variable into internal memory (default)
ERAM	Specify ERAM to store the variable into EEPROM
OVERLAY	Specify that the variable is overlaid in memory.
location	The address of name of the variable when OVERLAY is used.

Tipi di variabili

Bit (1/8 byte). A bit can hold only the value 0 or 1. A group of 8 bits is called a byte.

Byte (1 byte). Bytes are stores as unsigned 8-bit binary numbers ranging in value from 0 to 255.

Integer (2 bytes). Integers are stored as signed sixteen-bit binary numbers ranging in value from -32,768 to +32,767.

Word (2 bytes). Words are stored as unsigned sixteen-bit binary numbers ranging in value from 0 to 65535.

Long (4 bytes). Longs are stored as signed 32-bit binary numbers ranging in value from -2147483648 to 2147483647.

Single. Singles are stored as signed 32 bit binary numbers. Ranging in value from 1.5 x 10^–45 to 3.4 x 10^38

Double. Doubles are stored as signed 64 bit binary numbers. Ranging in value from 5.0 x 10^–324 to 1.7 x 10^308

String (up to 254 bytes). Strings are stored as bytes and are terminated with a 0-byte. A string dimensioned with a length of 10 bytes will occupy 11 bytes.

Struttura del Main

```
$sim
$regfile = "m128def.dat"
$crystal = 14745600
$baud = 115200
$hwstack = 128
$swstack = 128
$framesize = 128

Main:
Do
  nop
Loop
End
```

Esempio 1:Blink Led

```
$sim                          ‘uso del simulatore
$regfile = "m128def.dat"
$crystal = 14745600
$baud = 115200
$hwstack = 128
$swstack = 128
$framesize = 128

Ddra.0 = 1                    ‘configurazione output
Led Alias Porta.0             ‘uso di alias
Main:                         ‘main programm
Do                            ‘ciclo do-loop
  Toggle Led                  ‘uso di toggle
  Waitms 1000                 ‘aspetta 1000 mSec=1Sec
Loop                          ‘end loop
End                           ‘end programm
```

Uso di Locate & LCD

```
(configurazione uC)

Config Lcd = 16 * 2

Dim J As Byte

Cls
Cursor Off

Do
  Locate 1 , 1 : Lcd J
  Incr J
  Waitms 100
Loop
End
```

Possiamo fare alcune prove cambiando il dimensionamento della variabile J; word, integer, single, long, double,
e il tempo relativo a WAITMS.
E’ possibile sostituire il valore 100 o altro valore con una costante o con una variabile:

```
CONST Tempo=100
Waitms Tempo
```

```
Dim Tempo1 as byte
Tempo1=100
Waitms Tempo1
```

Uso della UART -> Print

```
Dim J As Byte
Do
  Print J
  Incr J
  Waitms 100
Loop
End
```

Uso della UART -> Input

```
Dim J As Byte
Do
  Input "Number:" , J
  Print J
Loop
End
```

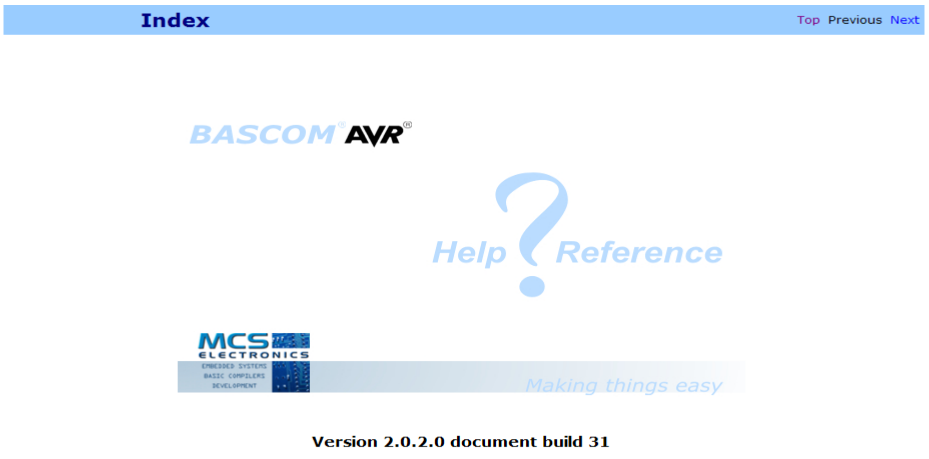
Interrupts -> URXC

Il più semplice & il più usato

```
Enable Interrupts
Enable Urxc
On Urxc Rs232

Dim J As Byte
Dim Rxok As Bit
Rxok=0
Do
  If Rxok = 1 Then
     Rxok = 0
     Print J
  End If
Loop
End

Rs232:
  Input J
  Rxok = 1
Return
```

KEYWORD REFERNCE

in ordine alfabetico



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BASCOM AVR®

Help ? Reference

MCS ELECTRONICS
EMBEDDED SYSTEMS BASIC COMPILERS DEVELOPMENT

Making things easy

Version 2.0.2.0 document build 31

KEYWORD REFERENCE

1Wire routines allow you to communicate with Dallas 1wire chips.
1WRESET , 1WREAD , 1WWRITE , 1WSEARCHFIRST , 1WSEARCHNEXT ,1WVERIFY , 1WIRECOUNT

Conditions execute a part of the program depending on a condition being True or False
IF-THEN-ELSE-END IF , WHILE-WEND , ELSE , DO-LOOP , SELECT CASE - END SELECT , FOR-NEXT

Configuration commands initialize the hardware to the desired state.
CONFIG , CONFIG ACI , CONFIG ADC , CONFIG ADCx , CONFIG BCCARD , CONFIG CLOCK , CONFIG COM1 , CONFIG COM2 , CONFIG DAC , CONFIG DATE , CONFIG DMXSLAVE, CONFIG EEPROM ,CONFIG EXTENDED_PORT , CONFIG PS2EMU , CONFIG ATEMU , CONFIG I2CSLAVE , CONFIG INPUT, CONFIG GRAPHLCD , CONFIG KEYBOARD , CONFIG TIMER0 , CONFIG TIMER1 , CONFIG LCDBUS , CONFIG LCDMODE , CONFIG 1WIRE , CONFIG LCD , CONFIG OSC, CONFIG SERIALOUT , CONFIG SERIALIN , CONFIG SPI , CONFIG SPIx, CONFIG SYSCLOCK , CONFIG LCDPIN , CONFIG PRIORITY , CONFIG SDA , CONFIG SCL , CONFIG DEBOUNCE , CONFIG WATCHDOG , CONFIG PORT , COUNTER0 AND COUNTER1 , CONFIG TCPIP , CONFIG TWISLAVE , CONFIG SINGLE , CONFIG X10 , CONFIG XRAM , CONFIG USB , CONFIG DP , CONFIG TCXX

KEYWORD REFERENCE

A conversion routine is a function that converts a number or string from one form to another.
BCD , GRAY2BIN , BIN2GRAY , BIN , MAKEBCD , MAKEDEC , MAKEINT , FORMAT , FUSING , BINVAL , CRC8 , CRC16 , CRC16UNI , CRC32 , HIGH , HIGHW , LOW , AESENCRYPT , AESDECRYPT

Date Time routines can be used to calculate with date and/or times.
DATE , TIME , DATE$, TIME$, DAYOFWEEK , DAYOFYEAR , SECOFDAY , SECELAPSED , SYSDAY , SYSSEC , SYSSECELAPSED

Delay routines delay the program for the specified time.
WAIT , WAITMS , WAITUS , DELAY

KEYWORD REFERENCE

Directives are special instructions for the compiler. They can override a setting from the IDE.
$ASM , $BAUD , $BAUD1 , $BIGSTRINGS , $BGF , $BOOT , $CRYSTAL , $DATA , $DBG , $DEFAULT , $EEPLEAVE , $EEPROM , $EEPROMHEX , $EEPROMSIZE, $EXTERNAL , $HWSTACK , $INC , $INCLUDE , $INITMICRO , $LCD , $LCDRS , $LCDPUTCTRL , $LCDPUTDATA , $LCDVFO , $LIB , $LOADER , $LOADERSIZE , $MAP , $NOCOMPILE , $NOINIT , $NORAMCLEAR , $NORAMPZ , $PROJECTTIME, $PROG , $PROGRAMMER , $REGFILE , $RESOURCE , $ROMSTART $SERIALINPUT, $SERIALINPUT1 , $SERIALINPUT2LCD , $SERIALOUTPUT , $SERIALOUTPUT1 , $SIM , $SWSTACK , $TIMEOUT , $TINY , $WAITSTATE , $XRAMSIZE , $XRAMSTART , $XA

KEYWORD REFERENCE

File commands can be used with AVR-DOS, the Disk Operating System for AVR.
BSAVE , BLOAD , GET , VER , DISKFREE , DIR , DriveReset , DriveInit , LINE INPUT , INITFILESYSTEM , EOF , WRITE , FLUSH , FREEFILE , FILEATTR , FILEDATE , FILETIME , FILEDATETIME , FILELEN , SEEK , KILL , DriveGetIdentity , DriveWriteSector , DriveReadSector , LOC , LOF , PUT , OPEN , CLOSE

Graphical LCD commands extend the normal text LCD commands.
GLCDCMD , GLCDDATA , SETFONT , LINE , PSET , SHOWPIC , SHOWPICE , CIRCLE , BOX

KEYWORD REFERENCE

I2C commands allow you to communicate with I2C chips with the TWI hardware or with emulated I2C hardware.
I2CINIT , I2CRECEIVE , I2CSEND , I2CSTART,I2CSTOP,I2CRBYTE,I2CWBYTE

I/O commands are related to the I/O pins and ports of the processor chip.
ALIAS , BITWAIT , TOGGLE , RESET , SET , SHIFTIN , SHIFTOUT , DEBOUNCE , PULSEIN , PULSEOUT

Micro statements are specific to the micro processor chip.
IDLE , POWER mode , POWERDOWN , POWERSAVE , ON INTERRUPT , ENABLE , DISABLE , START , END , VERSION , CLOCKDIVISION , CRYSTAL , STOP

KEYWORD REFERENCE

Memory functions set or read RAM , EEPROM or flash memory.
ADR , ADR2 , WRITEEEPROM , CPEEK , CPEEKH , PEEK , POKE , OUT , READEEPROM , DATA , INP , READ , RESTORE , LOOKDOWN , LOOKUP , LOOKUPSTR , CPEEKH , LOAD , LOADADR , LOADLABEL , LOADWORDADR , MEMCOPY

Remote control statements send or receive IR commands for remote control.
RC5SEND , RC6SEND , GETRC5 , SONYSEND

RS-232 are serial routines that use the UART or emulate a UART.
BAUD , BAUD1, BUFSPACE , CLEAR, ECHO , WAITKEY , ISCHARWAITING , INKEY , INPUTBIN , INPUTHEX , INPUT , PRINT , PRINTBIN , SERIN , SEROUT , SPC , MAKEMODBUS

KEYWORD REFERENCE

SPI routines communicate according to the SPI protocol with either hardware SPI or software emulated SPI.
SPIIN , SPIINIT , SPIMOVE , SPIOUT

String routines are used to manipulate strings.
ASC , CHARPOS, UCASE , LCASE , TRIM , SPLIT , LTRIM , INSTR , SPACE , STRING , RTRIM , LEFT , LEN , MID , RIGHT , VAL , STR , CHR , CHECKSUM , HEX , HEXVAL , QUOTE , REPLACECHARS

TCP/IP routines can be used with the W3100/IIM7000/IIM7010 modules.
BASE64DEC , BASE64ENC , IP2STR , UDPREAD , UDPWRITE , UDPWRITESTR , TCPWRITE , TCPWRITESTR , TCPREAD , GETDSTIP , GETDSTPORT , SOCKETSTAT , SOCKETCONNECT , SOCKETLISTEN , GETSOCKET , CLOSESOCKET , SETTCP , GETTCPREGS , SETTCPREGS , SETIPPROTOCOL , TCPCHECKSUM

KEYWORD REFERENCE

Text LCD routines work with normal text based LCD displays.
HOME , CURSOR , UPPERLINE , THIRDLINE , INITLCD , LOWERLINE , LCD , LCDAT , FOURTHLINE , DISPLAY , LCDCONTRAST , LOCATE , SHIFTCURSOR , DEFLCDCHAR , SHIFTLCD , CLS , LCDAUTODIM

Trig and Math routines work with numeric variables.
ACOS , ASIN , ATN , ATN2 , EXP , RAD2DEG , FRAC , TAN , TANH , COS , COSH , LOG , LOG10 , ROUND , ABS , INT , MAX , MIN , SQR , SGN , POWER , SIN , SINH , FIX , INCR , DECR , DEG2RAD , CHECKFLOAT

KEYWORD REFERENCE

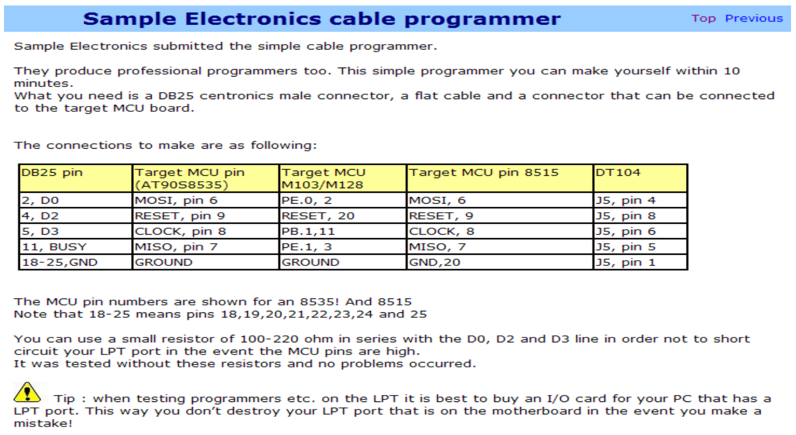
Various
This section contains all statements that were hard to put into another group
CONST , DBG , DECLARE FUNCTION , DEBUG, DECLARE SUB , DEFXXX , DIM , DTMFOUT , EXIT , ENCODER , GETADC , GETKBD , GETATKBD , GETRC , GOSUB , GOTO , LOCAL ,ON VALUE , POPALL , PS2MOUSEXY , PUSHALL , RETURN , RND , ROTATE , SENDSCAN , SENDSCANKBD , SHIFT , SOUND , STCHECK , SUB , SWAP , VARPTR , X10DETECT , X10SEND , READMAGCARD , REM , BITS , BYVAL , CALL , #IF , #ELSE , #ENDIF , READHITAG

XMEGA
READSIG

CONFIG

DIRECTIVE	RE-USABLE	XMEGA ONLY
CONFIG 1WIRE	NO	
CONFIG ACXX	YES	X
CONFIG ACI	YES	
CONFIG ADC	NO	
CONFIG ADCx	YES	X
CONFIG ATEMU	NO	
CONFIG BASE	NO	
CONFIG BCCARD	NO	
CONFIG CLOCK	NO	
CONFIG CLOCKDIV	YES	
CONFIG COM1	YES	
CONFIG COM2 also COM3 - COM8	YES	
CONFIG DAC	YES	X
CONFIG DATE	NO	
CONFIG DCF77	NO	
CONFIG DEBOUNCE	NO	
CONFIG DMXSLAVE	NO	
CONFIG DP	NO	
CONFIG EEPROM	NO	X
CONFIG EXTENDED_PORT	NO	
CONFIG GRAPHLCD	NO	
CONFIG HITAG	NO	
CONFIG I2CDELAY	NO	
CONFIG I2CSLAVE	NO	
CONFIG INPUT	NO	
CONFIG INTx	YES	
CONFIG KBD	NO	
CONFIG KEYBOARD	NO	
CONFIG LCD	NO	
CONFIG LCDBUS	NO	
CONFIG LCDMODE	NO	
CONFIG LCDPIN	NO	
CONFIG OSC	YES	X
CONFIG RC5	NO	
CONFIG PORT	YES	
CONFIG PRIORITY	YES	X
CONFIG PRINT	NO	
CONFIG PRINTBIN	NO	
CONFIG PS2EMU	NO	
CONFIG SERIALIN	NO	
CONFIG SERIALIN1	NO	
CONFIG SERIALIN2	NO	
CONFIG SERIALIN3	NO	
CONFIG SERIALOUT	NO	
CONFIG SERIALOUT1	NO	
CONFIG SERIALOUT2	NO	
CONFIG SERIALOUT3	NO	
CONFIG SERVOS	NO	
CONFIG SHIFTIN	NO	
CONFIG SINGLE	NO	
CONFIG SDA	NO	
CONFIG SCL	NO	
CONFIG SPI	NO	
CONFIG SPIx	YES	X
CONFIG SYSCLOCK	YES	X
CONFIG TCXX	YES	X
CONFIG TCPIP	NO	
CONFIG TWI	YES	
CONFIG TWISLAVE	NO	
CONFIG TIMER0	YES	
CONFIG TIMER1	YES	
CONFIG TIMER2 and 3	YES	
CONFIG USB	NO	
CONFIG WATCHDOG	YES	
CONFIG WAITSUART	NO	
CONFIG X10	NO	
CONFIG XRAM	YES	

SAMPLE CABLE PROGRAMMER



Sample Electronics cable programmer Top Previous

Sample Electronics submitted the simple cable programmer.

They produce professional programmers too. This simple programmer you can make yourself within 10 minutes.
What you need is a DB25 centronics male connector, a flat cable and a connector that can be connected to the target MCU board.

The connections to make are as following:

DB25 pin	Target MCU pin (AT90S8535)	Target MCU M103/M128	Target MCU pin 8515	DT104
2, D0	MOSI, pin 6	PE.0, 2	MOSI, 6	J5, pin 4
4, D2	RESET, pin 9	RESET, 20	RESET, 9	J5, pin 8
5, D3	CLOCK, pin 8	PB.1,11	CLOCK, 8	J5, pin 6
11, BUSY	MISO, pin 7	PE.1, 3	MISO, 7	J5, pin 5
18-25,GND	GROUND	GROUND	GND,20	J5, pin 1

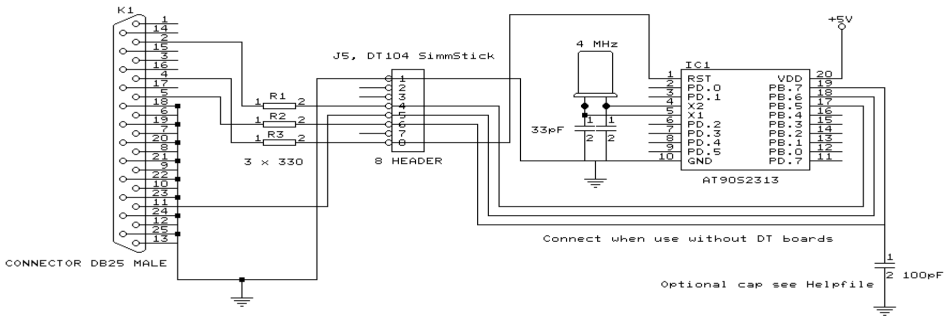
The MCU pin numbers are shown for an 8535! And 8515
Note that 18-25 means pins 18,19,20,21,22,23,24 and 25

You can use a small resistor of 100-220 ohm in series with the D0, D2 and D3 line in order not to short circuit your LPT port in the event the MCU pins are high.
It was tested without these resistors and no problems occurred.

Tip : when testing programmers etc. on the LPT it is best to buy an I/O card for your PC that has a LPT port. This way you don't destroy your LPT port that is on the motherboard in the event you make a mistake!

SAMPLE PROGRAMMER

The following picture shows the connections to make. Both a setup for the DT104 and stand-alone PCB are shown.


K1
CONNECTOR DB25 MALE
R1
R2
R3
3 x 330
J5, DT104 SimmStick
8 HEADER
4 MHz
33pF
IC1
RST
PD.0
PD.1
X2
X1
PD.2
PD.3
PD.4
PD.5
GND
VDD
PB.7
PB.6
PB.5
PB.4
PB.3
PB.2
PB.1
PB.0
PD.7
AT90S2313
+5V
Connect when use without DT boards
100pF
Optional cap see Helpfile