BASCOM® 8051

Help Reference

MCS ELECTRONICS

EMBEDDED SYSTEMS
BASIC COMPILERS
DEVELOPMENT

Making things easy

BASCOM-8051 user manual

Introduction

by MCS Electronics

Dear reader.

Thank you for your interest in BASCOM.

BASCOM was "invented" in 1995. It was intended for personal usage only. I decided to make it public as I found no other tool that was so simple to use. Since that time, a lot of options and extensions were added. Without the help and patience of the many users, BASCOM would not be what it is today : "the best and most affordable tool for fast proto typing".

We hope that BASCOM will contribute in making your work with microprocessors Easy and enjoyable.

The MCS Electronics Team

BASCOM-8051

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Special thanks to:

All the people who contributed to this document, all the forum members that contributed in a positive way, all beta testers , and all customers.

Table of Contents

Foreword 0

Part I INDEX 13

1 Table of contents 14
2 Keyword Reference 17

Part II Installing BASCOM-8051 21

Part III Updates 27

Part IV BASCOM IDE 33

1 RUNNING BASCOM-8051 33
2 BASCOM IDE 34
3 File New 35
4 File Open 35
5 File Close 36
6 File Save 36
7 File Save As... 36
8 File Print Preview 36
9 File Print 37
10 File Exit 37
11 Edit Undo 38
12 Edit Redo 38
13 Edit Copy 38
14 Edit Cut 38
15 Edit Paste 39
16 Edit Find 39
17 Edit Find Next 39
18 Edit Replace 40
19 Edit Goto 40
20 Edit Indent Block 41
21 Edit Unindent Block 41
22 Editor Keys 42
23 Program Compile 43
24 Program Syntax check 43
25 Program Show Result 44
26 Program Simulate 45
27 Program Send to chip 48
28 Tools Terminal Emulator 49
29 Tools LCD designer 50

30 Tools Graphic Converter 50
31 Tools LIB Manager 51
32 Tools Triscent Converter 52
33 Tools Export to RTF 53
34 Options Compiler Output 53
35 Options Compiler Communication 54
36 Options Compiler I2C 54
37 Options Compiler LCD 55
38 Options Compiler Misc 56
39 Options Communication 56
40 Options Environment 58
41 Options hardware simulator 60
42 Options Programmer 60
43 Options Monitor 61
44 Options Printer 62
45 Window cascade 62
46 Window Tile 63
47 Window arrange icons 63
48 Window minimize all 63
49 Help About 63
50 Help Index 63
51 Help on help 63
52 Help Shop 64
53 Help Forum 64
54 Help Support 64
55 Help Credits 64

Part V Language fundamentals 66

1 Language fundamentals 66

Part VI BASCOM Language Reference 73

1 BASCOM Statements 73
2 #IF 76
3 #ELSE 77
4 #ENDIF 78
5 1WIRE 79
6 1WIRECOUNT 80
7 1WSEARCHFIRST 81
8 1WSEARCHNEXT 83
9 $ASM - $END ASM 84
10 $BAUD 85
11 $BGF 85
12 $CRYSTAL 87

13 $DEFAULT XRAM ... 88
14 $EXTERNAL ... 88
15 $INCLUDE ... 89
16 $IRAMSTART ... 90
17 $LARGE ... 90
18 $LIB ... 91
19 $LCD ... 91
20 $LCDRS ... 92
21 $MAP ... 93
22 $NOBREAK ... 93
23 $NOINIT ... 94
24 $NONAN ... 94
25 $NONULL ... 95
26 $NORAMCLEAR ... 95
27 $NOSP ... 96
28 $OBJ ... 96
29 $RAMSIZE ... 97
30 $RAMTRON ... 97
31 $RAMSTART ... 99
32 $REGFILE ... 100
33 $ROMSTART ... 100
34 $SERIALINPUT ... 101
35 $SERIALINPUT2LCD ... 101
36 $SERIALOUTPUT ... 102
37 $SIM ... 103
38 $TIMEOUT ... 103
39 $WAIT ... 104
40 ALIAS ... 104
41 ABS ... 105
42 ASC ... 106
43 AVG ... 106
44 BAUD ... 107
45 BCD ... 108
46 BITWAIT ... 108
47 BREAK ... 109
48 CALL ... 109
49 CHR ... 110
50 CLS ... 111
51 CONST ... 112
52 CONFIG ... 112
53 CONFIG 1WIRE ... 113
54 CONFIG ADUC812 ... 113

55 CONFIG BAUD ... 115
56 CONFIG BAUD1 ... 115
57 CONFIG DEBOUNCE ... 116
58 CONFIG I2CDELAY ... 116
59 CONFIG GETRC ... 117
60 CONFIG GRAPHLCD ... 117
61 CONFIG LCDPIN ... 121
62 CONFIG LCD ... 121
63 CONFIG LCDBUS ... 122
64 CONFIG MICROWIRE ... 123
65 CONFIG PRINT ... 123
66 CONFIG SCL ... 124
67 CONFIG SDA ... 125
68 CONFIG SERVOS ... 125
69 CONFIG SPI ... 126
70 CONFIG TIMER0, TIMER1 ... 127
71 CONFIG WATCHDOG ... 128
72 COUNTER ... 129
73 CPEEK ... 130
74 CURSOR ... 131
75 DATA ... 132
76 DEBOUNCE ... 133
77 DECR ... 134
78 DECLARE ... 135
79 DEF ... 136
80 DEFLCDCHAR ... 136
81 DELAY ... 137
82 DIM ... 137
83 DISABLE ... 139
84 DISPLAY ... 139
85 DO ... 140
86 ELSE ... 140
87 ENABLE ... 141
88 END ... 142
89 END IF ... 142
90 ERASE ... 143
91 EXIT ... 144
92 FOR ... 144
93 FOURTHLINE ... 145
94 FUSING ... 146
95 GET ... 147
96 GETAD ... 148

97 GETAD2051 ... 149
98 GETRC ... 154
99 GETRC5 ... 156
100 GOSUB ... 158
101 GOTO ... 159
102 HEX ... 159
103 HEXVAL ... 160
104 HIGH ... 160
105 HIGHW ... 161
106 HOME ... 162
107 I2CRECEIVE ... 162
108 I2CSEND ... 163
109 I2C ... 164
110 IDLE ... 165
111 IF ... 165
112 INCR ... 167
113 INKEY ... 167
114 INP ... 169
115 INPUT ... 169
116 INPUTBIN ... 171
117 INPUTHEX ... 172
118 INSTR ... 173
119 LCASE ... 174
120 LCD ... 174
121 LCDINIT ... 177
122 LCDHEX ... 178
123 LEFT ... 179
124 LEN ... 179
125 LOAD ... 180
126 LOCATE ... 181
127 LOOKUP ... 181
128 LOOKUPSTR ... 182
129 LOW ... 183
130 LOWW ... 184
131 LOWERLINE ... 184
132 MAKEBCD ... 185
133 MAKEDEC ... 185
134 MAKEINT ... 186
135 MAX ... 186
136 MID ... 187
137 MIN ... 188
138 MOD ... 188

139 MWINIT ... 189
140 MWREAD ... 189
141 MWWOPCODE ... 190
142 MWWRITE ... 191
143 NEXT ... 192
144 ON interrupt ... 192
145 ON value ... 193
146 OPEN ... 194
147 OUT ... 196
148 PORT ... 197
149 PEEK ... 198
150 POKE ... 198
151 POWERDOWN ... 199
152 PRINT ... 199
153 PRINTBIN ... 200
154 PRINTHEX ... 201
155 PRIORITY ... 202
156 PSET ... 203
157 PUT ... 203
158 READ ... 204
159 READMAGCARD ... 205
160 REM ... 207
161 REPLACE ... 207
162 RESET ... 208
163 RESTORE ... 208
164 RETURN ... 209
165 RIGHT ... 210
166 RND ... 210
167 ROTATE ... 211
168 SELECT ... 212
169 SET ... 212
170 SHIFTCURSOR ... 213
171 SHIFT ... 213
172 SHIFTIN ... 214
173 SHIFTLCD ... 215
174 SHOWPIC ... 216
175 SOUND ... 216
176 SOUNDEXT ... 217
177 SPACE ... 218
178 SPC ... 219
179 SPIIN ... 220
180 SPIINIT ... 220

181 SPIOUT 221
182 START 221
183 STOP 222
184 STOP Timer 222
185 STR 224
186 STRING 224
187 SUB 225
188 SWAP 226
189 THIRDLINE 226
190 UCASE 227
191 UPPERLINE 228
192 VAL 228
193 VARPTR 229
194 WAIT 229
195 WAITKEY 230
196 WAITMS 230
197 WAITMSE 231
198 WATCHDOG 231
199 WHILE .. WEND 232

Part VII Using assembly 235

1 Using assemly 235
2 Internal registers 242
3 Initialization 244

Part VIII Additional Hardware 247

1 Additional Hardware 247
2 Alternative port-pin functions 252
3 Hardware - LCD display 253
4 Hardware - I2C 254
5 1WIRE INFO 254

Part IX Supported Programmers 260

1 MCS Flash programmer 260
2 MCS SPI programmer 262
3 Blow IT Flashprogrammer 263
4 PG2051 flash programmer 263
5 PG302 programmer 264
6 SE512 or SE514 programmer 265
7 SE-812 266
8 Sample Electronics ISP programmer 266
9 CYGNAL JTAG Programmer 268
10 Futurelec 268

11 JPK Systems X-programmer 268
12 Peter Averill's TAFE programmer 269
13 STK200/300 ISP Programmer 270
14 Rhombus SCE-51 271
15 SE511-SE516 programmer 272
16 MCS USBISP Programmer 273

Part X BASCOM Misc 278

1 Error messages 278
2 Compiler Limits 281
3 Reserved Words 282

Part XI Microprocessor support 287

1 Microprocessor support 287
2 TIMER2 288
3 DATA EEPROM 291
4 AT898252 WATCHDOG 291
5 WATCHDOG 80515 292
6 INTERRUPTS and PRIORITY 80515 292
7 INTERRUPTS and PRIORITY 80537 293
8 ADUC 812 293
9 89C51 296

Part XII International Resellers 299

1 International Resellers 299

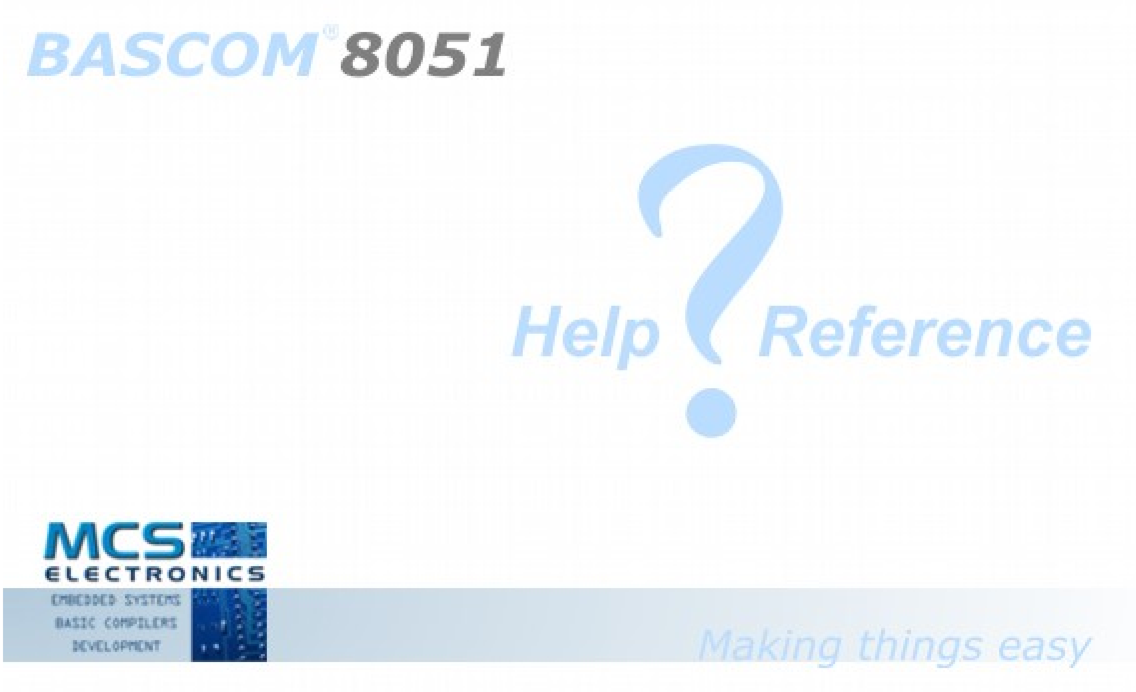
Part XIII Third party hardware 301

1 Third party Hardware 301
Grifo 301
Rhombus 308

Index 310

Part I

1 INDEX



Help Version **2.0.18.0**

See Installing BASCOM-8051 21 for the installation procedure

1.1 Table of contents

Installing BASCOM-8051 21
BASCOM IDE 34
Running BASCOM 8051 33
Updates 27

File

File New 35 , File Open 35 , File Close 36 , File Save 36 , File Save As... 36
File Print 37 , File Print Preview 36 , File Exit 37

Edit

Edit Undo 38 , Edit Redo 38 , Edit Copy 38 , Edit Cut 38 , Edit Paste 39
Edit Find 39 , Edit Find Next 39 , Edit Replace 40 , Editor Keys 42 , Edit Goto 40 , Edit Indent 41 , Edit Unindent 41

Program

Compile 43 , Syntax check 43 , Show Result 44 , Simulate 45 , Send to chip 48

Tools

Terminal Emulator 49 , LCD designer 50 , Graphic Converter 50 , LIB Manager 51 , Export to RTF 53

Options

Compiler Output 53 , Compiler Communication 54 , Compiler I2C 54 , Compiler LCD 55
Compiler Misc. 56 , Communication 56 , Environment 58
Hardware Simulator 60 , Programmer 60 , Monitor 61 , Printer 62

Window

Cascade 62 , Tile 63 , Arrange Icons 63 , Minimize all 63

Help

About 63 , Index 63 , Help on Help 63 , Credits 64 , Forum 64 , Shop 64 , Support 64

BASCOM Statements 73
Language Fundamentals 66
Internal Registers 242
Initialization 244

Microprocessor support 287

Reserved Words 282
Errors 278
Programmers 48
Additional hardware 247
Compiler limits 281
ASM programming 235
International Resellers 299
Available third party hardware 301

Language Reference

-1-

1WRESET, 1WREAD, 1WWRITE 79 , 1WSEARCHFIRST 81 , 1WSEARCHNEXT 83 , 1WIRECOUNT 80

-COMPILER DIRECTIVES-

#IF 76 , #ELSE 77 , #ENDIF 78 , $ASM - $END ASM 84 ,$INCLUDE 89 , $BAUD 85 , $BGF 85 , $CRYSTAL 87 , $DEFAULT XRAM 88 , $IRAMSTART 90 , $LARGE 90 , $LCD 91 , $MAP 93 , $NOBREAK 93 , $NOINIT 94 , $NONAN 94 , $NONULL 95 , $NORAMCLEAR 95 , $NOSP 96 , $OBJ 96 , $RAMSIZE 97 , $RAMSTART 99 , $REGFILE 100 , $ROMSTART 100 , $SERIALINPUT 101 , $SERIALINPUT2LCD 101 , $SERIALOUTPUT 102 , $SIM 103

-A-

ABS 105 , ALIAS 104 , ASC 106 , AVG 106

-B-

BITWAIT 108 , BCD 108 , BREAK 109

-C-

CALL 109 , CLOSE 194 , CLS 111 , CHR 110 , CONFIG 112 , CONST 112 ,COUNTER 129 , CPEEK 130 , CURSOR 131

-D-

DATA 132 , DEBOUNCE 133 , DECR 134 , DECLARE 135 , DEFINT 136 , DEFBIT 136 , DEFBYTE 136 , DEFLCDCHAR 136 , DEFWORD 136 , DELAY 137 , DIM 137 , DISABLE 139 , DISPLAY 139 , DO 140

-E-

ELSE 140 , ENABLE 141 , END 142 , END IF 142 , ERASE 143 , EXIT 144

-F-

FOR 144 , FOURTHLINE 145 , FUSING 146

-G-

GET 147 , GETAD 148 , GETAD2051 149 , GETRC 154 , GETRC5 156 , GOSUB 158 , GOTO 159

-H-

HEX 159 , HEXVAL 160 , HIGH 160 , HIGHW 161 , HOME 162

-I-

I2CRECEIVE 162 , I2CSEND 163 , I2CSTART 164 , I2CSTOP 164 , I2CRBYTE 164 , I2CWBYTE 164 , IDLE 165 , IF 165 , INCR 167 , INKEY 167 , INP 169 , INPUT 169 , INPUTBIN 171 , INPUTHEX 172 , INSTR 173

-L-

LCASE 174 , LCD 174 , LCDINIT 177 , LCDHEX 178 , LEFT 179 , LEN 179 , LOAD 180 , LOCATE 181 , LOOKUP 181 , LOOKUPSTR 182 , LOOP 140 , LOW 183 , LOWW 184 , LOWERLINE 184

-M-

MAKEDEC 185 , MAKEBCD 185 , MAKEINT 186 , MAX 186 , MID 187 , MIN 188 , MOD 188

-N-

NEXT 192

-O-

ON Interrupt 192 , ON Value 193 , OPEN 194 , OUT 196

-P-

P1,P3 197 , PEEK 198 , POKE 198 , PSET 203 , POWERDOWN 199 , PRINT 199 , PRINTBIN 200 , PRINTHEX 201 , PRIORITY 202 , PUT 203

-R-

READ 204 , READMAGCARD 205 , REM 207 , REPLACE 207 , RESET 208 , RESTORE 208 , RETURN 209 , RIGHT 210 , RND 210 , ROTATE 211

-S-

SELECT 212 , SET 212 , SHIFT 213 , SHIFTCURSOR 213 , SHIFTIN 214 , SHIFTOUT 214 , SHIFTLCD 215 , SHOWPIC 216 , SOUND 216 , SOUNDEXT 217 , SPACE 218 , SPC 219 , SPIN 220 , SPIOUT 221 , START 221 , STOP 222 , STOP TIMER 222 , STR 224 , STRING 224 , SUB 225 , SWAP 226

-T-

THEN 165 , THIRDLINE 226 , TO 144

-U-

UCASE 227 , UPPERLINE 228

-V-

VAL 228 , VARPTR 229

-W-
WAIT 229 , WAITKEY 230 , WAITMS 230 , WAITMSE 231 , WHILE .. WEND 232

1.2 Keyword Reference

1WIRE
1Wire routines allow you to communicate with Dallas 1wire chips.
1WRESET, 1WREAD, 1WWRITE 79 , 1WSEARCHFIRST 81, 1WSEARCHNEXT 83 , 1WIRECOUNT 80

Conditions
Conditions execute a part of the program depending on the condition
IF 165 , ELSE 140 , END IF 142 , EXIT 144, DO 140 , LOOP 140 , SELECT 212 , FOR 144 , NEXT 192 , TO 144 , THEN 165 , WHILE .. WEND 232

Configuration
Configuration command initialize the hardware to the desired state.
CONFIG 112

Conversion
A conversion routine is a function that converts a number or string.
ASC 106, BCD 108 , CHR 110 , FUSING 146 , HEX 159 , HEXVAL 160 , HIGH 160 , HIGHW 161 , MAKEDEC 185 , MAKEBCD 185 , MAKEINT 186 , STR 224 , VAL 228

Delay
Delay routines delay the program for the specified time.
DELAY 137 , WAIT 229 , WAITMS 230

Directives
Directives are special instructions for the compiler. They can override a setting from the IDE.
#IF 76 , #ELSE 77 , #ENDIF 78 , $ASM - $END ASM 84 ,$INCLUDE 89 , $BAUD 85 , $BGF 85 , $CRYSTAL 87 , $DEFAULT XRAM 88 , $IRAMSTART 90 , $LARGE 90 , $LCD 91 , $MAP 93 , $NOBREAK 93 , $NOINIT 94 , $NONAN 94 , $NONULL 95 , $NORAMCLEAR 95 , $NOSP 96 , $OBJ 96 , $RAMSIZE 97 , $RAMSTART 99 , $REGFILE 100 , $ROMSTART 100 , $SERIALINPUT 101 , $SERIALINPUT2LCD 101 , $SERIALOUTPUT 102 , $SIM 103

Graphical LCD
Graphical LCD commands extend the normal text LCD commands.
PSET 203 , SHOWPIC 216

I2C

I2C commands allow you to communicate with I2C chips with the TWI hardware or with emulated I2C hardware.
I2CRECEIVE 162 , I2CSEND 163 , I2CSTART 164 , I2CSTOP 164 , I2CRBYTE 164 , I2CWBYTE 164

Interrups

Interrupt related routines.
ON Interrupt 192 , ENABLE 141 , DISABLE 139 , PRIORITY 202

IO

I/O commands are related to the I/O pins of the processor.
ALIAS 104 , BITWAIT 108 , DEBOUNCE 133 , SET 212 , RESET 208

Math

Math functions
ABS 105 , AVG 106 , MAX 186 , MIN 188 , MOD 188

Micro

Micro statements are highly related to the micro processor.
BREAK 109 , P1,P3 197 , IDLE 165 , END 142 , POWERDOWN 199 , START 221 , STOP 222 , STOP TIMER 222

Memory

Memory functions set or read RAM , EEPROM or flash memory.
CPEEK 130 , ERASE 143 , INP 169 , OUT 196 , PEEK 198 , POKE 198 , DIM 137 , READ 204 , RESTORE 208 , DATA 132 , VARPTR 229

Remote control

Remote control statements send or receive IR commands for remote control.

GETRC5 156

RS-232

RS-232 are serial routines that use the UART or emulate a UART.

WAITKEY 230 , PRINT 199 , PRINTBIN 200 , PRINTHEX 201 , PUT 203 , OPEN 194 ,SPC 219 , INKEY 167 , INPUT 169 , INPUTBIN 171 , INPUTHEX 172 , GET 147 , CLOSE 194

SPI

SPI routines communicate according to the SPI protocol with either hardware SPI or software emulated SPI.
SPIIN 220 , SPIOUT 221 , SPIINIT 220

String

String routines are used to manipulate strings.

MID 187 , LCASE 174 , INSTR 173 , LEFT 179 , LEN 179 , RIGHT 210 , STRING 224 , REPLACE 207 , SPACE 218 , UCASE 227

Text LCD

Text LCD routines work with the normal text based LCD displays.

CLS 111 , CURSOR 131 , FOURTHLINE 145 , HOME 162 , LCD 174 , LCDINIT 177 , LCDHEX 178 , LOCATE 181 , SHIFTLCD 215 , SHIFTCURSOR 213 ,DISPLAY 139 , LOWERLINE 184 , UPPERLINE 228 , THIRDLINE 226

Various

This section contains all statements that were hard to put into another group

CALL 109 , CONST 112 , COUNTER 129 , DECR 134 , DECLARE 135 , DEFINT 136 , DEFBIT 136 ,DEFBYTE 136 , DEFLCDCHAR 136 , DEFWORD 136 , GETAD 148 , GETAD2051 149 , GETRC 154 , , GOSUB 158 , GOTO 159 , INCR 167 , LOAD 180 , LOOKUP 181 , LOOKUPSTR 182 , LOW 183 , LOWW 184 , ON Value 193 , READMAGCARD 205 , REM 207 , RETURN 209 , RND 210 , ROTATE 211 , SHIFT 213 , SHIFTIN 214 , SHIFTOUT 214 , SOUND 216 , SUB 225 , SWAP 226

Part II

2 Installing BASCOM-8051

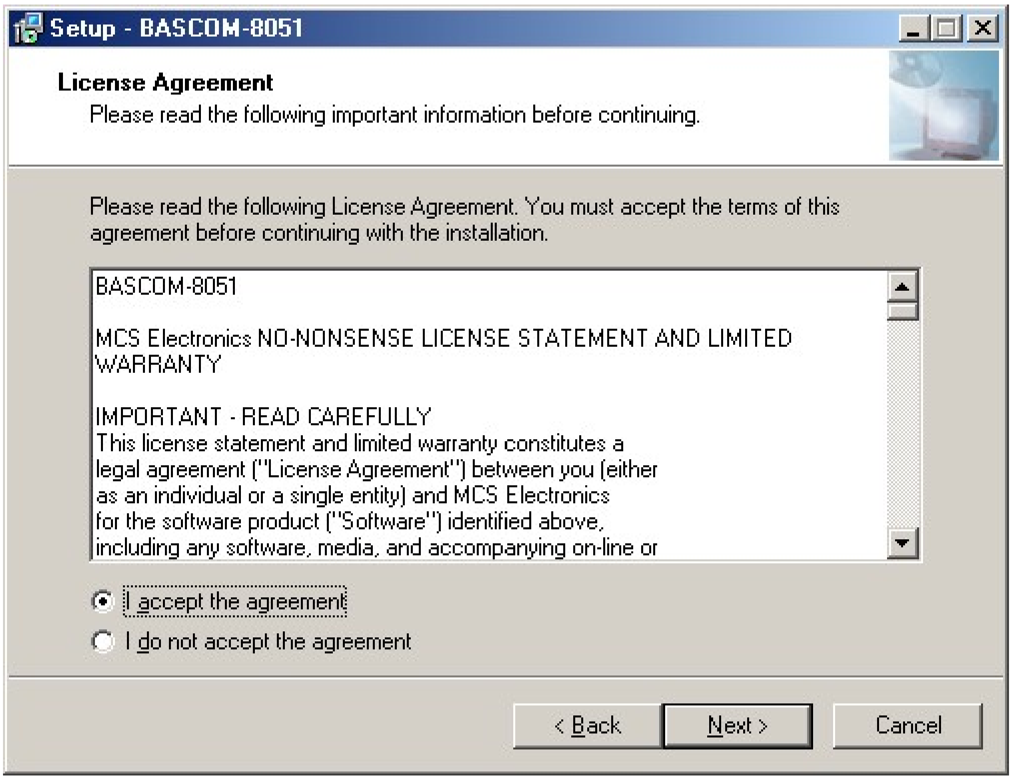
After you have downloaded the software you need to UNZIP the downloaded file.
There is only one file named setup.exe
You may run this setup.exe from within the Windows Shell but it is important to notice that when you use the commercial version, you MUST UNZIP the setup.exe since you need to copy the license file to the same directory as setup.exe.

You must have Administrator rights in order to be able to run setup.

The opening screen looks like :

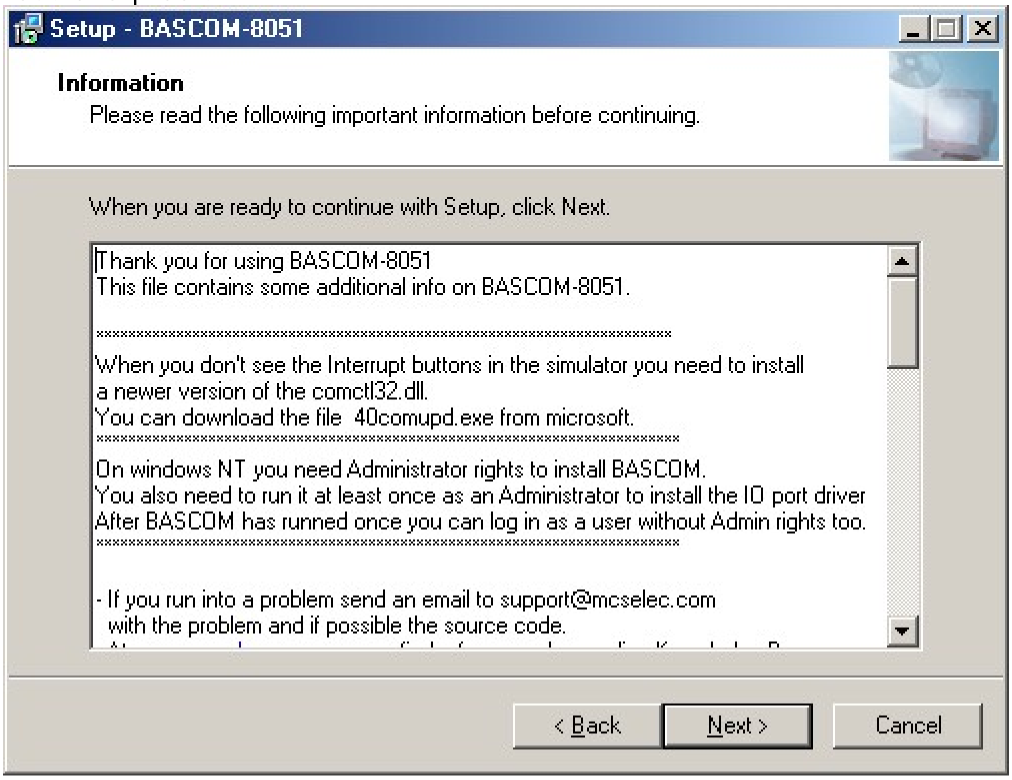
You need to click the Next-button to continue.

A license agreement will be shown. You need to read it and accept the agreement. This is a no-nonsense agreement where you are allowed to install/copy on as many computers as you want, providing that you use only one computer at the same time.



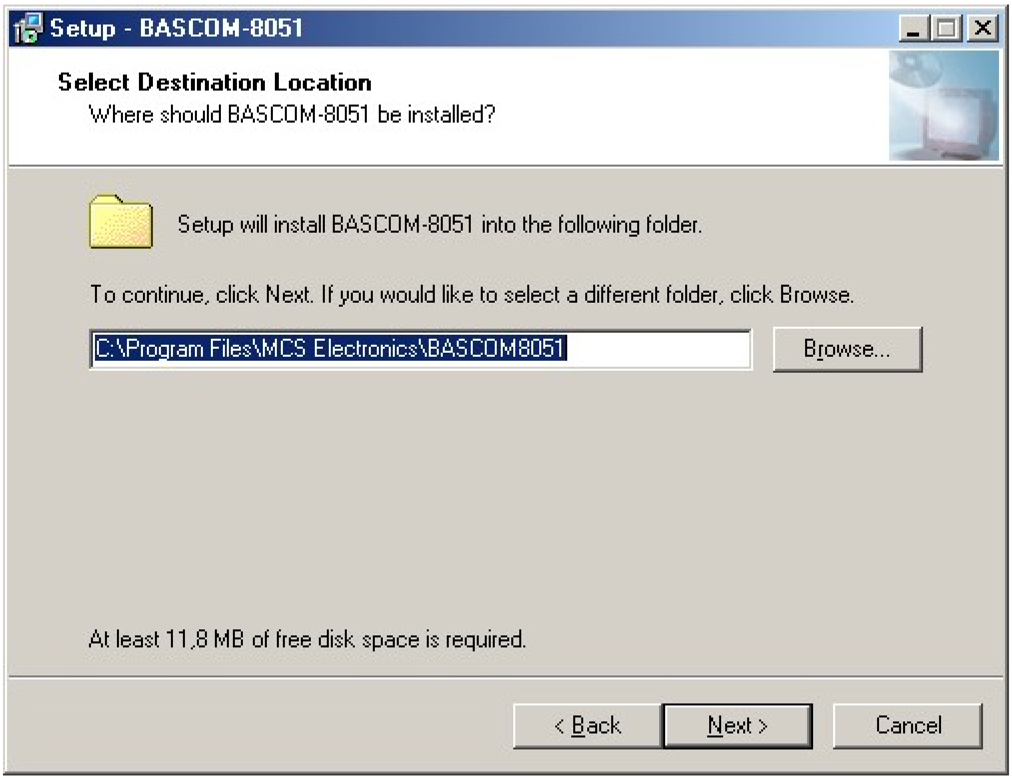
After clicking the 'I accept the agreeement' option, you need to click the Next-button again to continue.

The readme.txt file is shown. Basicly it tells you to contact support@mcselec.com in case of a problem.



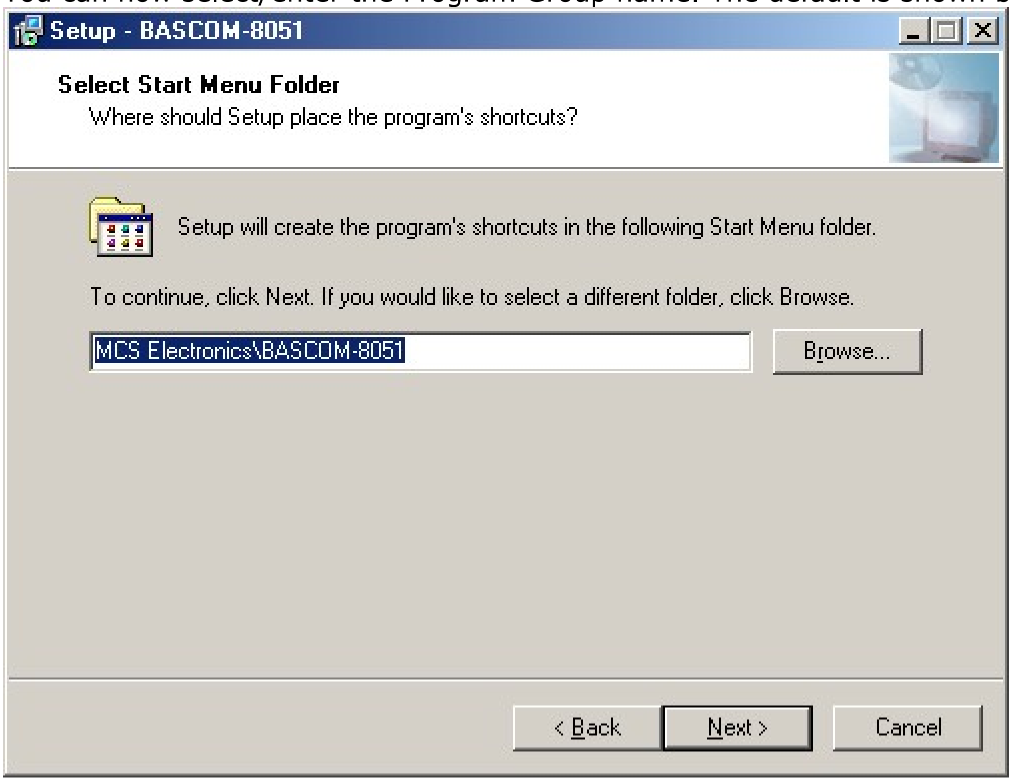
Click the Next-button again to continue with the setup.

You can now select where you want to Install BASCOM-8051.
The default is shown below.



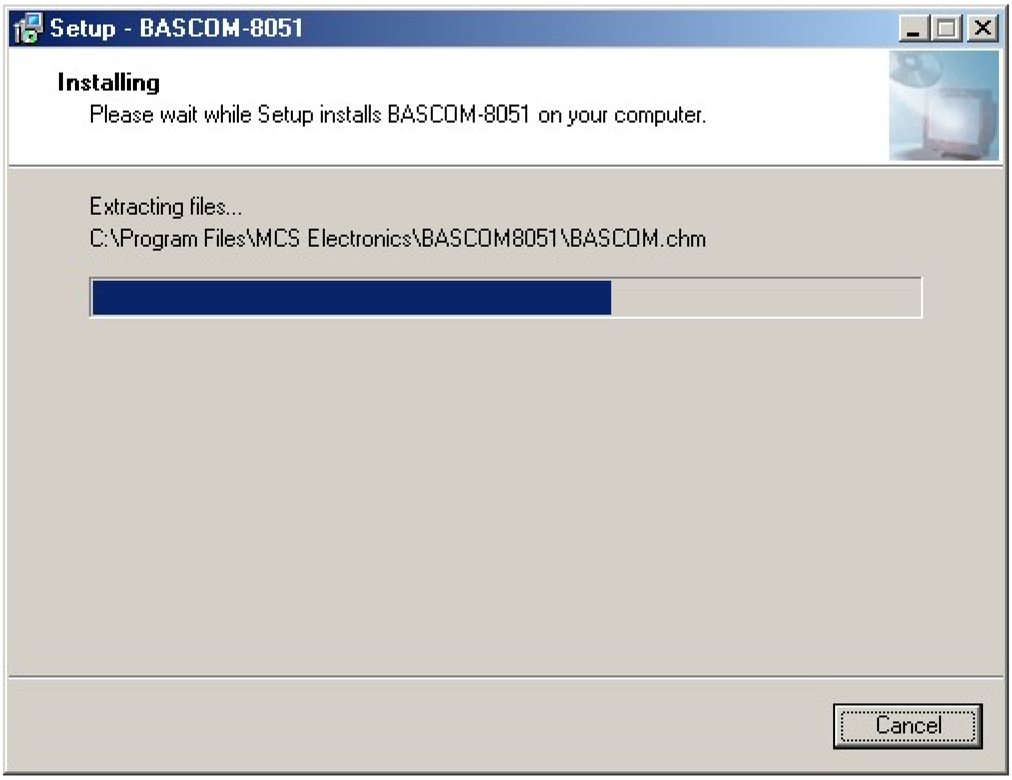
Click the Next-button again to continue.

You can now select/enter the Program Group name. The default is shown below.

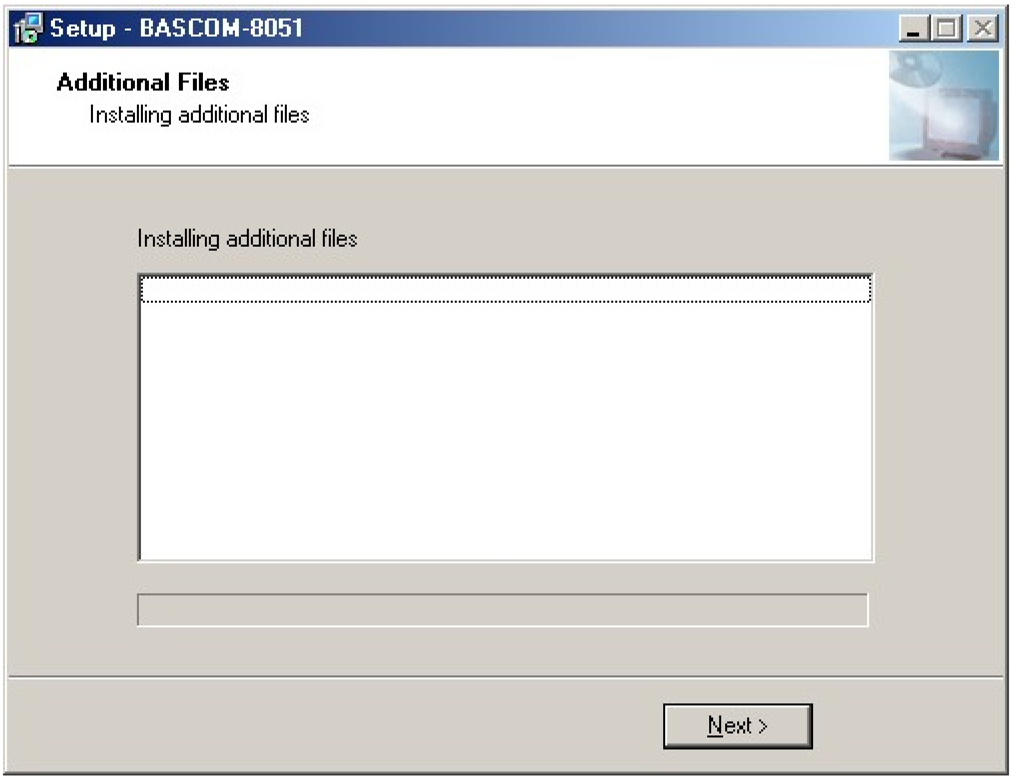


Click the Next-button again to continue.

The files will now be installed.
A screenshot is shown below :

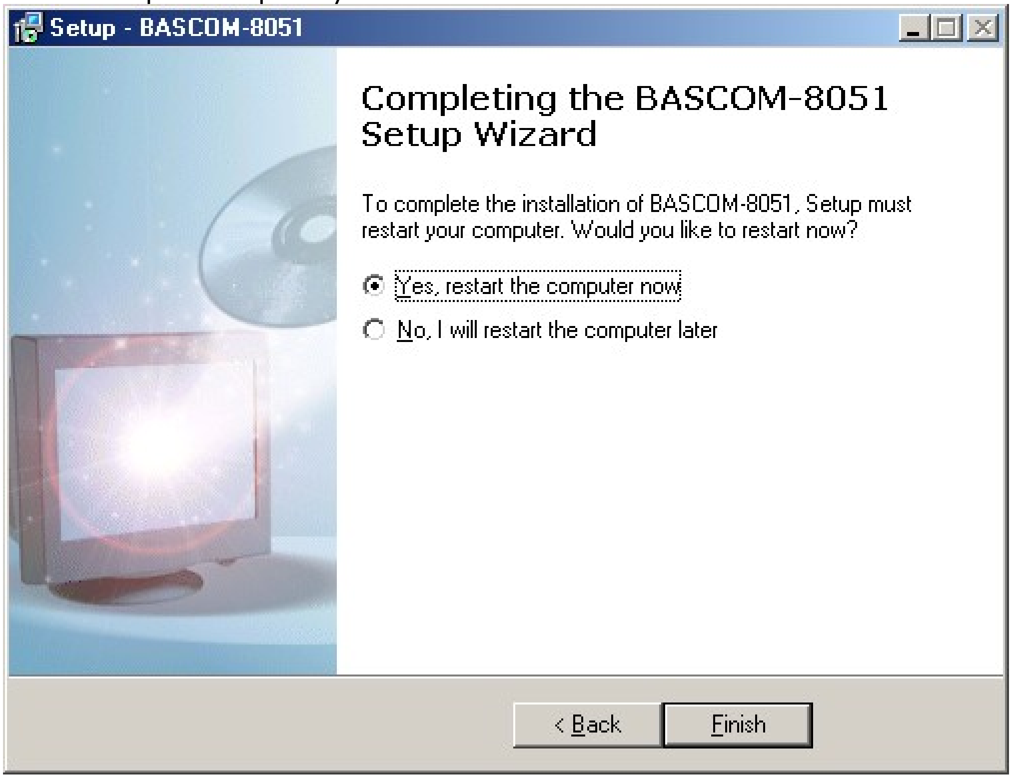


When the files are installed, the installer will install some addiitonal files :



Press the Next-Button to install the additional files. This will go quick in most cases. When you install from CD-ROM the setup will also copy PDF datasheets. The installation will take longer then.

When setup is completely finished it will show the last screen :



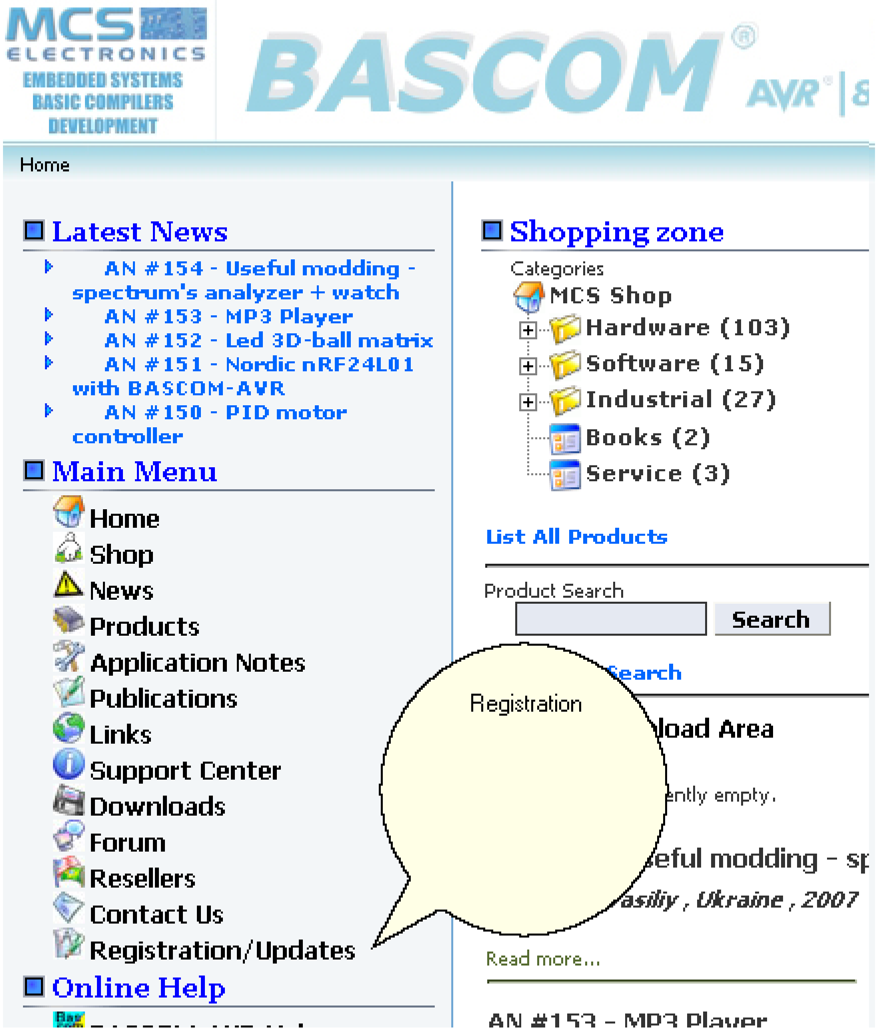
You MUST reboot your PC since it will install a driver needed for the programming.

Part III

3 Updates

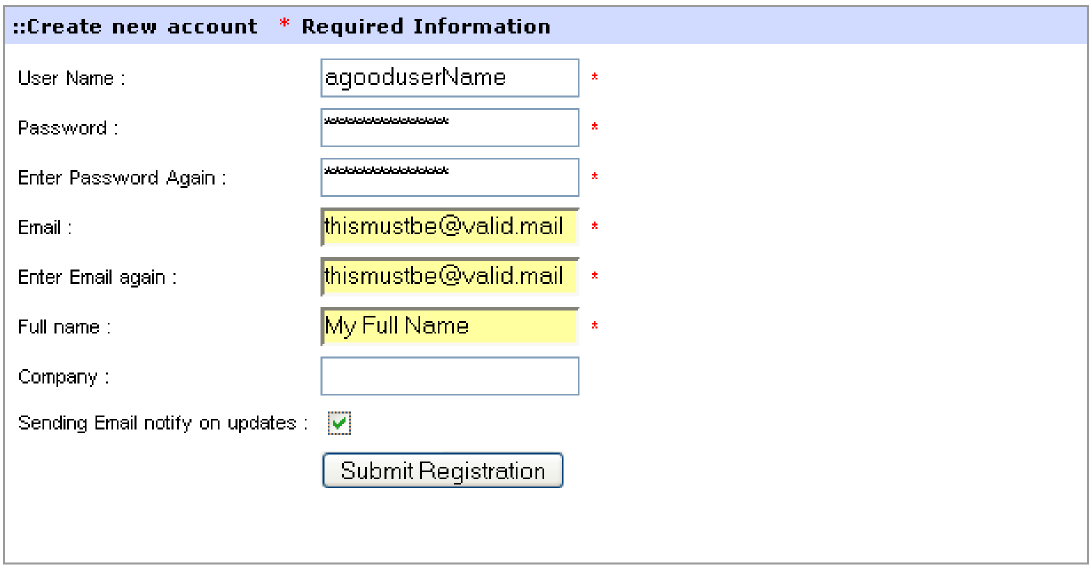
The update process is simple.

- Go to the main MCS website at http://www.mcselec.com
- In the left pane under 'Main Menu' you will find a link named 'Registration/ Updates'



Notice that the website uses two different accounts : one for the forum/shop and one for the registration/updates. You will see the following screen:

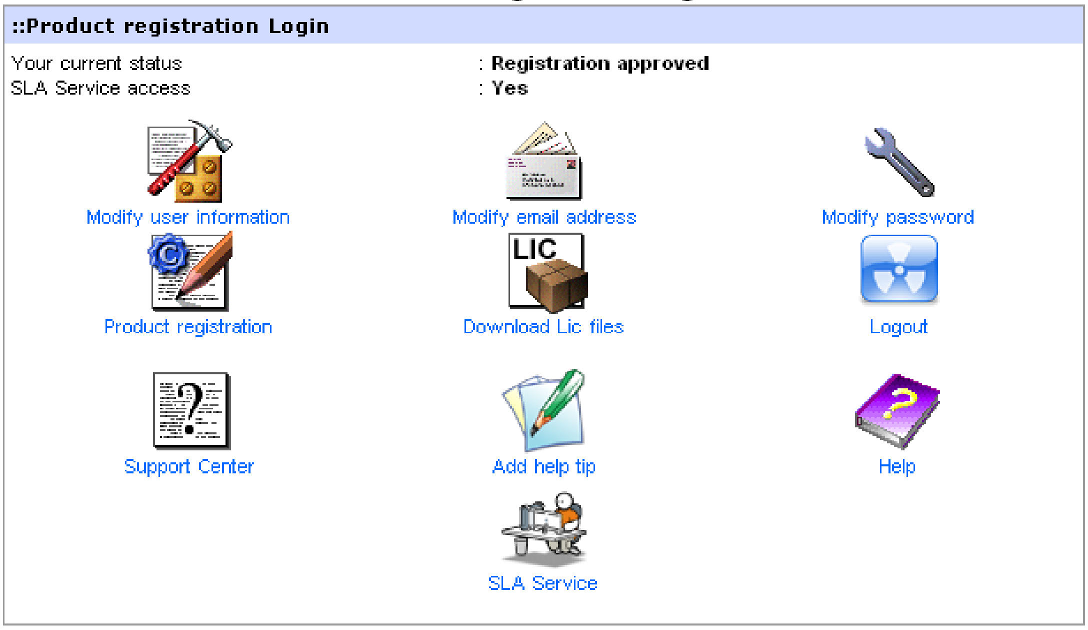
- Click the link and select ['Create new account']()



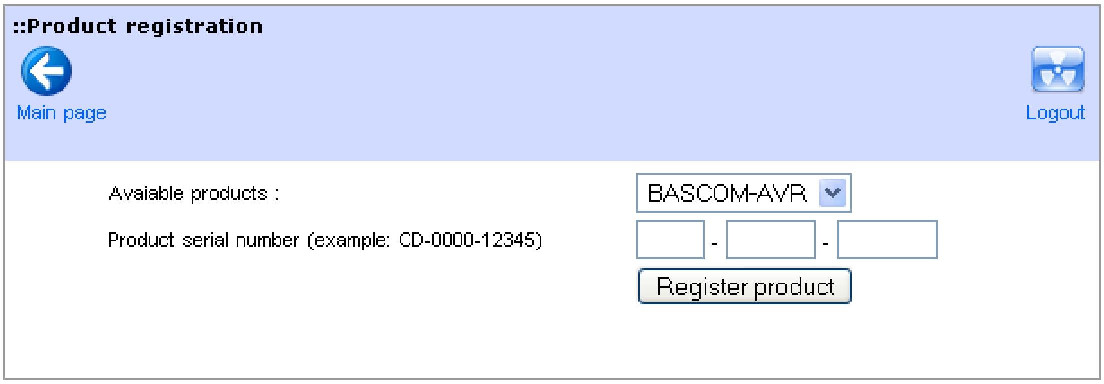
You need to provide a username, password, email and full name. Company name is optional. When you want to receive notifications when updates are available, select this option.
When you filled in the information, click 'Submit Registration'.

- After you click submit, you can get various error messages. For example that a username already exists. Press the Back-button in your browser, and correct the error, then try again
- If the registration is successful you will get a message that the registration succeeded.
- Now you can login. You will see the following screen :

Product registration Login

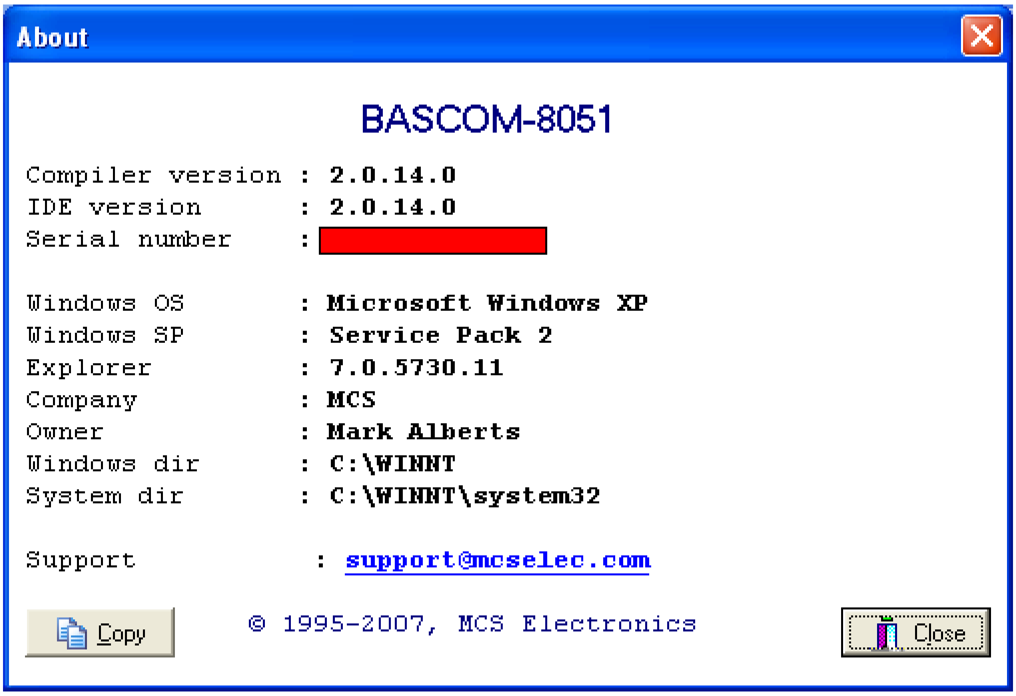


- You need to chose 'Product registration'.
- The following screen will be shown:

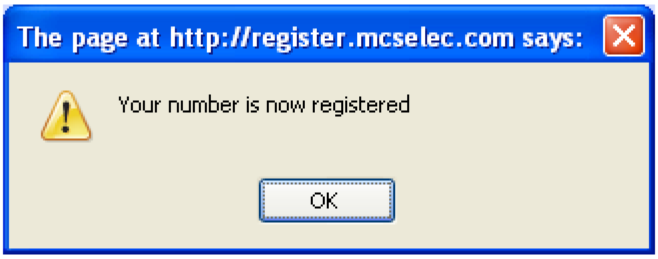


- Select a product from the list. (BASCOM-8051)
- Enter the serial number

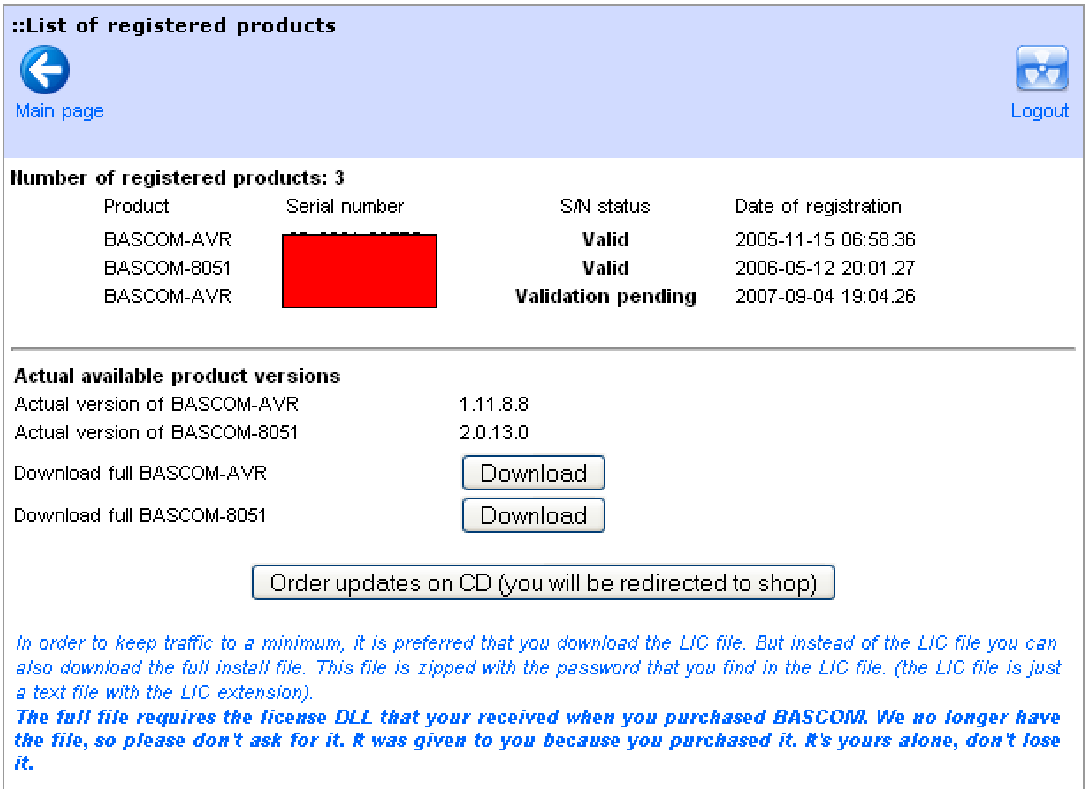
It is important that you enter a **valid** serial number. Do not try to enter serial numbers from cracked versions. When you enter invalid serial numbers, you will loose support and the ability to update.
The valid serial number is shown in the Help, About box.



When the product is selected, the serial number is entered, and you press 'Register product' you will see the following message :



- This does mean that you registered successfully.
- MCS Electronics will validate all registrations once in a few days. When the product is validated you will receive an email. After you receive the email, you can login to the register again.
- Now you need to select 'Download LIC files'. The following screen will be shown:



At the top you can see which products are registered, and which status they have.
When you want to do a FULL SETUP, you need to download the full version.
You do not need to uninstall a previous version. You can install an update into the same directory or a new directory.

The ZIP file you download contains only one setup.exe. You need to run this executable.
It is also important that you put the license DLL into the same directory as setup.exe
Setup will copy this file to the bascom application directory. You can also manual copy this file.
The license file is on CD-ROM, diskette, or the media (email) you received it on. It is only supplied once.
Without the file, bascom will not run.

The file is named bsc5132L.DLL for BASCOM-8051.
When you got the license by email, it was zipped and probably had a different extension. Consult the original installation instructions.
The file is only provided once, we can not, and do not provide it again.

See Installing BASCOM 21 on how to do a full install.

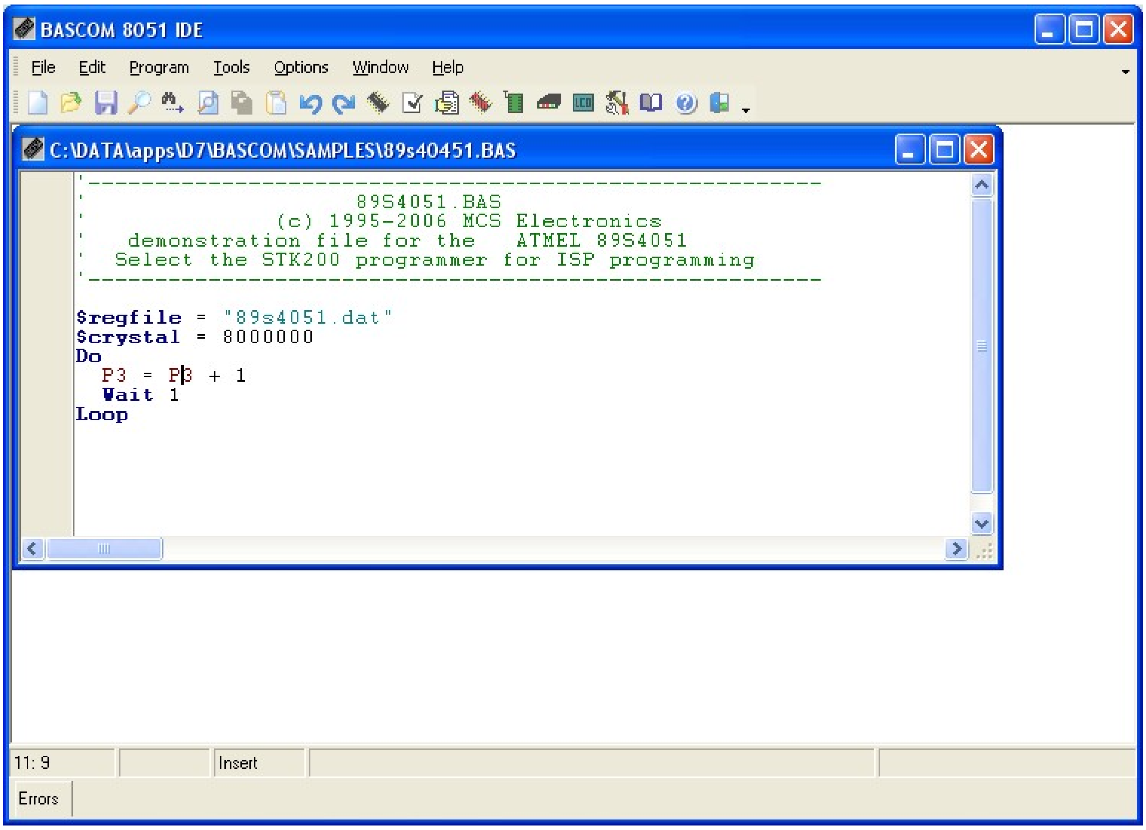
Partial updates are no longer supported. You always need to download and install the full setup!

Part IV

4 BASCOM IDE

4.1 RUNNING BASCOM-8051

When you run BASCOM-8051 the following window will appear.



The last saved/closed program will be loaded automatic.
When reformatting is enabled, the loaded program will be reformatted too.
This is only meaningful for programs written with another editor.

The BASCOM IDE is a so-called multi document application. This means that you can open more than one source file. The operations that you perform are always done on the current document, that is, the window with the focus.

The filename is shown in the caption of the window.

The status bar is separated in four panels.
- line, character position indicator
- modified indicator, to indicate that text has changed
- insert/overwrite indicator
- message panel

Some actions such as programming will make a progress indicator visible.

4.2 BASCOM IDE

Running BASCOM 8051 33

File

File New 35
File Open 35
File Close 36
File Save 36
File Save As... 36
File Print 37
File Print Preview 36
File Exit 37

Edit

Edit Undo 38
Edit Redo 38
Edit Copy 38
Edit Cut 38
Edit Paste 39
Edit Find 39
Edit Find Next 39
Edit Replace 40
Editor Keys 42

Program

Compile 43
Syntax check 43
Show Result 44
Simulate 45
Send to chip 48

Tools

Terminal Emulator 49
LCD designer 50
Graphic Converter 50
LIB Manager 51

Options

Compiler Output 53
Compiler Communication 54
Compiler I2C 54
Compiler LCD 55
Compiler Misc. 56
Communication 56
Environment 58
Hardware Simulator 60
Programmer 60
Monitor 61
Printer 62

Window

Cascade 62
Tile 63
Arrange Icons 63
Minimize all 63

Help

About 63
Index 63
Forum 64
Shop 64
Support 64
Credits 64

4.3 File New

Action

This option creates a new window in which you can write your program.
The focus is set to the new window. Depending on the environment settings, the window is normal sized or maximized.

Note that you must save your program before you can compile it. Newly created files will have the name [nonameX] in the window caption. Where X is a number starting with 1 for the first editor window.
Before you can compile your program, you must give it a valid name.

4.4 File Open

Action

With this option, you can load an existing program from disk.
BASCOM saves files in ASCII format. Therefore, if you want to load a file, which is made with another editor, be sure that it is saved as an ASCII file.

You can specify that BASCOM must reformat the file when it opens the file.
See Options Environment 58 options.

This should only be necessary when loading files made with another editor.
Since saved/closed files are put in a so called 'recent file list' , you can also open a file by selecting it from the File menu.

4.5 File Close

Action

Close current editor window. When changes are made, and they are not saved yet, you will be asked to save your program.

4.6 File Save

Action

With this option, you can quick save your current program to disk.
If the program was created with the File New 35 option, you will be asked for a filename first.
Use the File Save As 36 option to save the file with another name.
Note that the file is saved as an ASCII file.

4.7 File Save As...

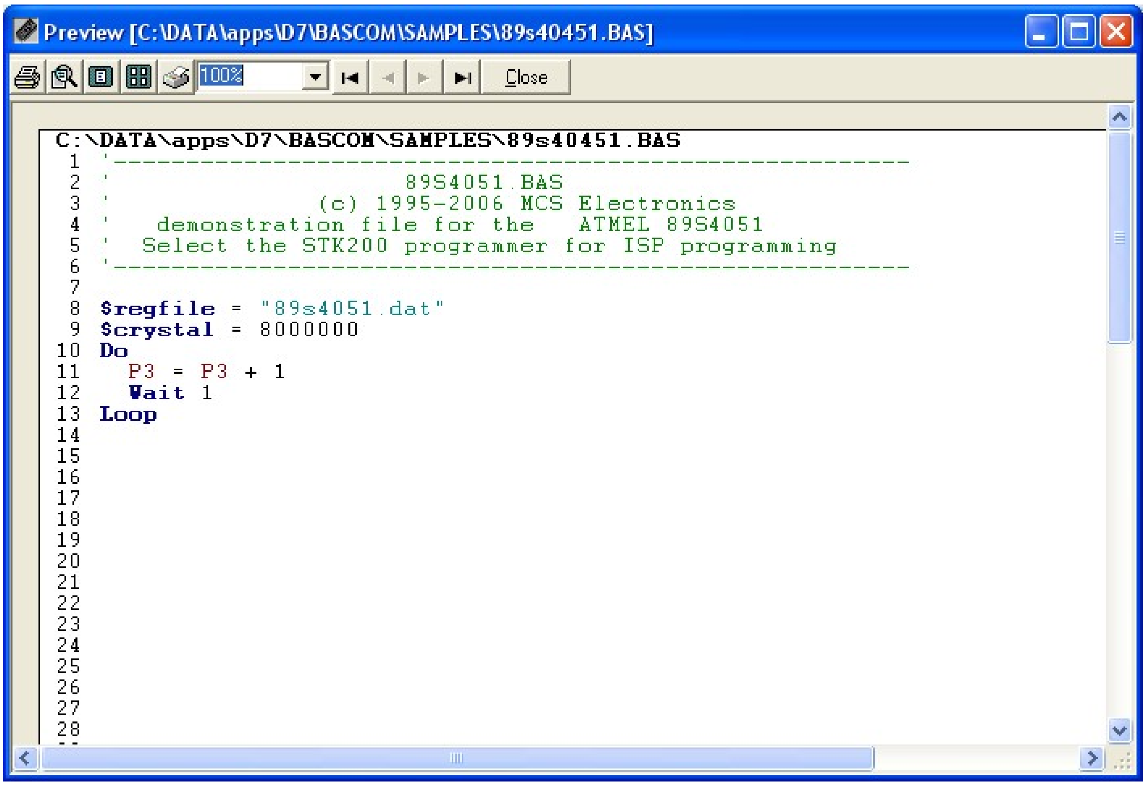
Action

With this option, you can save your current program to disk.
You can enter a filename before your program is saved.
Note that the file is saved as an ASCII file.

4.8 File Print Preview

Action

This will display the print preview window.



By clicking the Setup-button, you can change some printer properties. For margin settings, you must use the Options Printer settings 62. For a hardcopy, click the Print-button.

See also

Print 37

4.9 File Print

Action

With this option, you can print the current program.
Note that the current program is the editor window, which has the focus.

See also

Print preview 36

4.10 File Exit

Action

With this option, you can leave BASCOM.
If you have made changes to your program, you can save them upon leaving BASCOM.

4.11 Edit Undo

Action

With this option you can undo the last change you made to your program.
By selecting this option again, you can undo the previous change to your program.

See also

Edit Redo 38

Shortcut

CTRL+Z

4.12 Edit Redo

Action

With this option you can redo the last undo action.

See also

Edit Undo 38

Shortcut

SHIFT+CTRL+Z

4.13 Edit Copy

Action

With this option, you can copy selected text into the clipboard. You can select text by dragging the mouse cursor over the text or by Double clicking on a word.
Another possibility is to hold the shift key down and pressing the cursor keys.
Selected text is shown inverted.

Shortcut

CTRL+C and **CTRL+INS**

4.14 Edit Cut

Action

With this option, you can cut selected text into the clipboard.
The selected text is copied into the clipboard, and deleted from your program.

Shortcut

CTRL+T

4.15 Edit Paste

Action

With this option, you can paste text from the clipboard into the current cursor position.

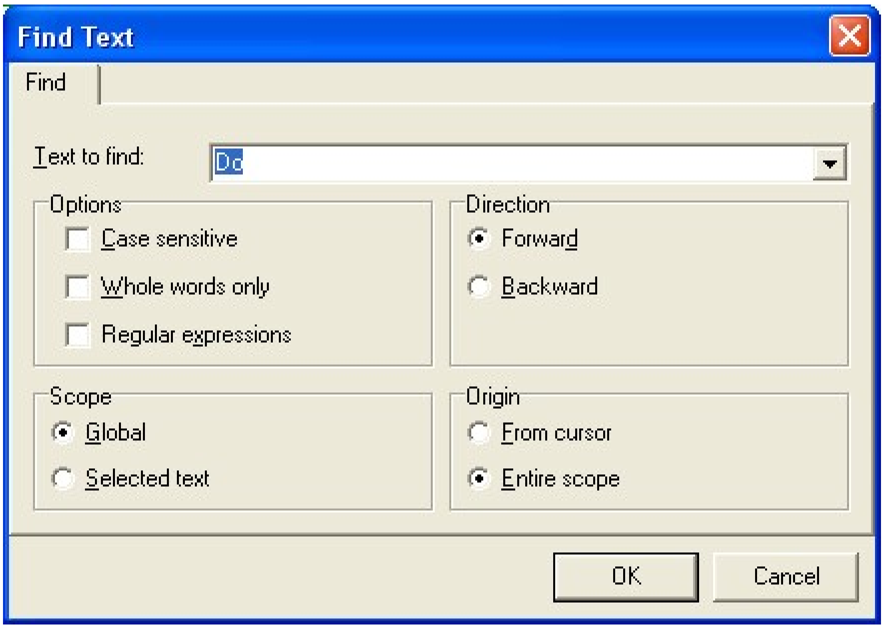
Shortcut

CTRL+ V and SHIFT + INS

4.16 Edit Find

Action

With this option, you can search for text in your program. The following dialog window will appear:



You can choose to search forward or backward. Optional you can search case sensitive and for whole words.
Regular expressions are also supported.

Shortcut

CTRL+F

4.17 Edit Find Next

Action

With this option you can search for the next occurrence of the specified text.
When you didn't specify a search text, you will be asked for the text to find, with the windows find-dialog.

See Also

Edit Find 39

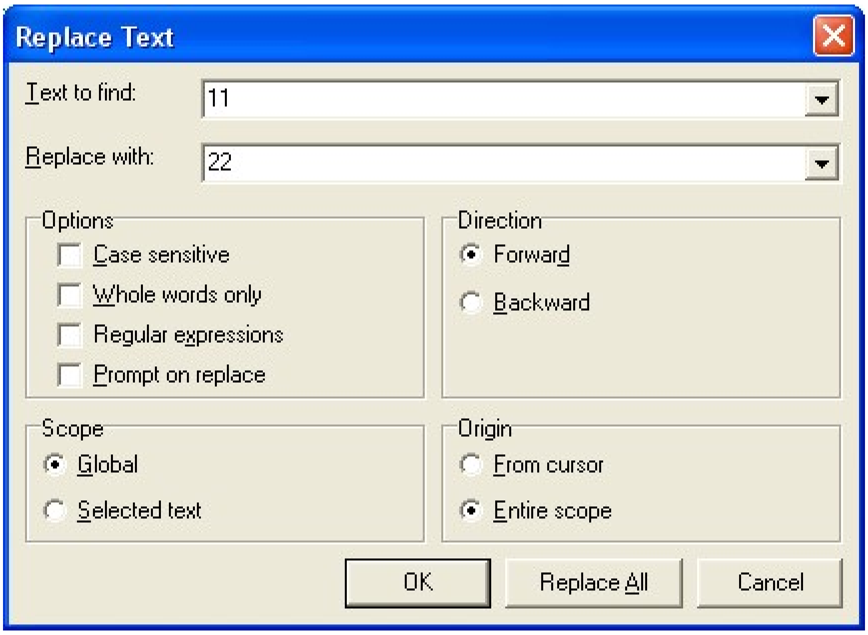
Shortcut

F3

4.18 Edit Replace

Action

With this option, you can replace text in your program.
The following replace dialog will appear:



Enter the text to search for and the text to replace with, and press return.

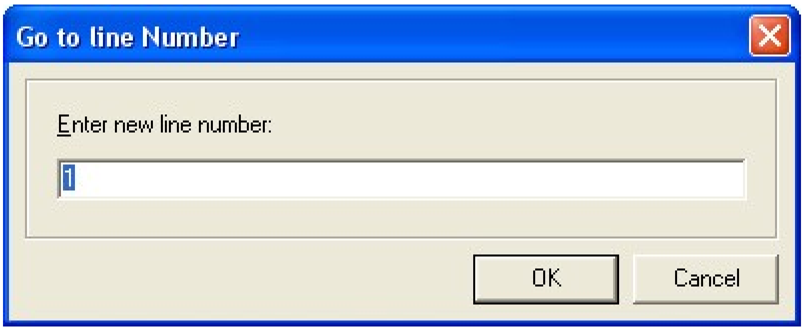
Shortcut

CTRL+R

4.19 Edit Goto

Action

With this option you can type the line number of the line you want to go to.
The following screen will be shown :



The current line number will be shown. You can edit this and press RETURN to jump to the line number of your choice.

4.20 Edit Indent Block

Action

Indents a block of selected text.

You need to select at least one line in order to use this option.
When you have a structure like :

Do
a=a+1
b=b+1
Loop

It is hard to see the structure. You can best indent your code.

```
Do
   a=a+1
   b=b+1
Loop
```

When you have code that is not indented you can indent it by selecting the two line within the structure and choose 'Edit Indent Block'.

4.21 Edit Unindent Block

Action

UnIndents a block of selected text.

You need to select at least one line in order to use this option.
When you have a structure like :

Do
a=a+1
b=b+1
Loop

It is hard to see the structure. You can best indent your code.

```
Do
   a=a+1
   b=b+1
Loop
```

When you have code that is not indented you can indent it by selecting the two line within the structure and choose 'Edit Indent Block'. The Unindent option can be used when the code is too much indented :

```
Do
               a=a+1
                  b=b+1
Loop
```

The sample above show that too much indention does not make the program readable.

4.22 Editor Keys

The following table lists all editor shortcuts.

Key	Action
LEFT ARROW	One character to the left
RIGHT ARROW	One character to the right
UP ARROW	One line up
DOWN ARROW	One line down
HOME	To the beginning of the line
END	To the end of the line
PAGE UP	Up one window
PAGE DOWN	Down one window
CTRL+LEFT	One word to the left
CTRL+RIGHT	One word to the right
CTRL+HOME	To the start of the text
CTRL+END	To the end of the text
CTRL+ Y	Delete current line
INS	Toggles insert/overstrike mode
F1	Help (context sensitive)
F2	File Simulation
F3	Find next text
F4	Send program to chip or run programmer
F5	Run program (simulator)
F7	Compile File
CTRL+F7	Syntax check
F8	Step through program (simulator)
SHIFT + F8	Step over code (simulator)
F9	Toggle breakpoint (simulator)
F10	Run to cursor (simulator)
CTRL+J	Pop up code template
CTRL+G	Goto line
CTRL+O	Load File
CTRL+S	Save File
CTRL+P	Print File
CTRL+T	Terminal emulator

CTRL+F	Find text
CTRL+W	Show result of compilation
CTRL+L	LCD designer
CTRL+X	Cut selected text into clipboard
CTRL+C	Copy selected text into clipboard
CTRL+V	Copy text from clipboard into editor
CTRL+Z	Undo
CTRL+SHIFT+Z	Redo
CTRL+SHIFT+I	Indent block
CTRL+SHIFT+U	Unindent block

To select text: Hold the SHIFT key down and use the cursor keys to select text. or keep the left mouse key pressed and tag the cursor over the text to select.

To select a word, double click on it.

4.23 Program Compile

Action

With this option you can compile your current program. Your program will be saved automatically before it will be compiled.
So if you didn't give it a name, you will be asked for it.
The following files will be created depending on the Option Compiler Settings.

File	Description
xxx.BIN	Binary file which can be burned into EPROM.
xxx.DBG	Debug file which is needed by the simulator.
xxx.HEX	Intel hexadecimal file.
xxx.ERR	Error file. (only when errors are found)
xxx.RPT	Report file.
xxx.SIM xxx.PRJ	Generated by the simulator to store the variable names of the watch window and the breakpoints.

If an error occurs, you will receive an error message and the compilation will end. The cursor will be set to the line in which the error occurred. The line will be marked with a red color too. The red marking color will disappear when you compile the program again.

Shortcut

F7

4.24 Program Syntax check

Action

With this option you can check the syntax of your program.
No files are generated with this option.

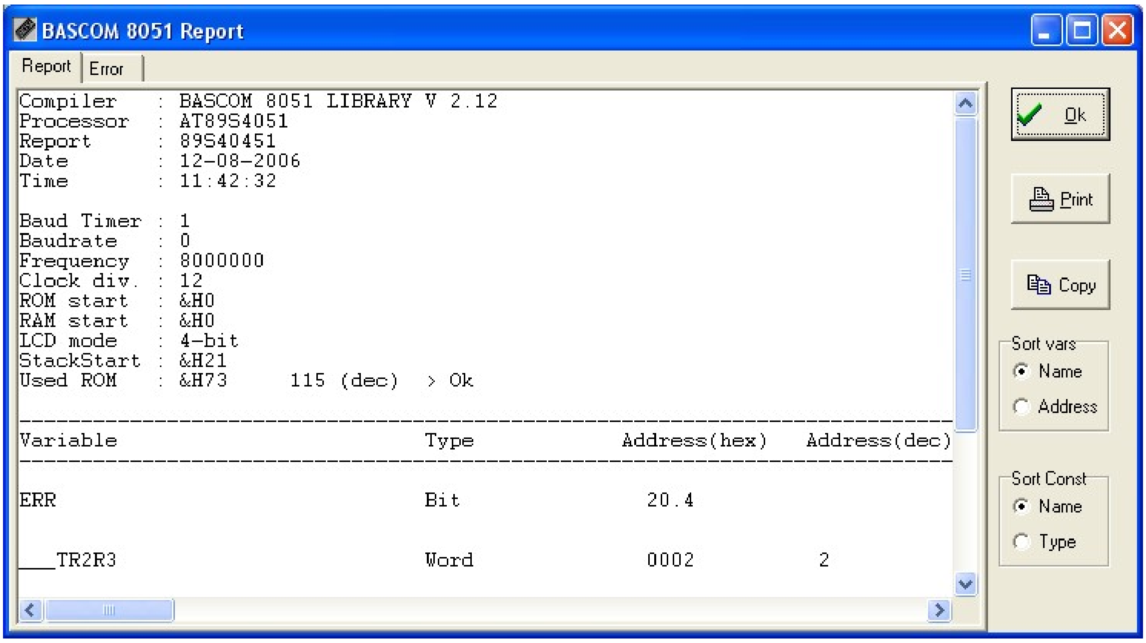
Shortcut

CTRL+F7

4.25 Program Show Result

Action

Use this option to view the result of the compilation.



See the Options Compiler Output 53 for specifying which files must be created.
The files that can be viewed are report and error.
Click the Print button to print the selected file.
Click the Ok button to return to the editor.

Shortcut

 or CTRL+W

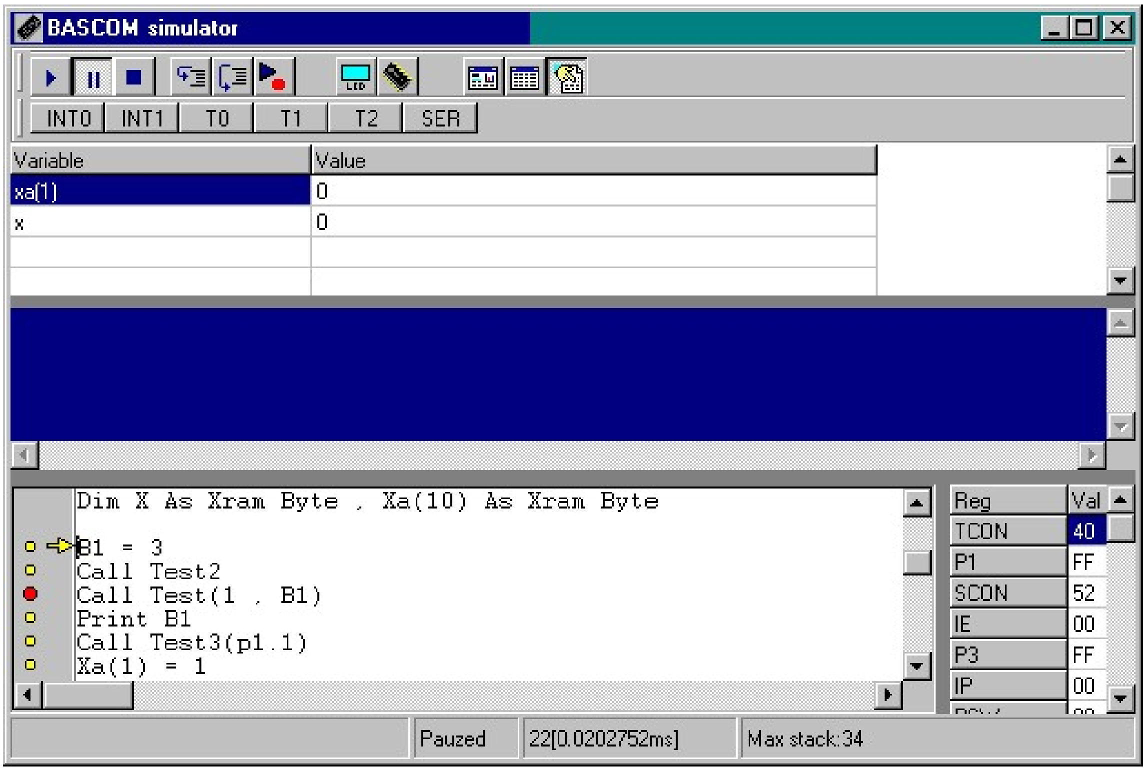
Information provided in the report:

Info	Description
Compiler	Shows the version of the library (the compiler).
Processor	The type of microprocessor the file is compiled for.
Report	The name of the source file.
Date and time	The compilation date and time.
Comp.time	The start and end time needed for compilation.
Baud timer	The timer used for the generation of the baud rate.
Baud rate and frequency	The baud rate selected for the uP and the used crystal. This info is used for RS232 related statements such as PRINT and INPUT. Note that when you use the $crystal and $baud statements the exact baud rate is shown.

ROM start	The starting location of ROM memory.
RAM start	The starting location of RAM memory.
LCD mode	4 bit or 8 bit LCD mode.
Stack start	The starting location of the stack. The space below the stack is used for internal variables. The stack grows when calls are made by the machine language routines.
Used ROM	Displays the length of the binary file.
Variable	The name, type and the location in memory of the used variables

4.26 Program Simulate

This option displays the Simulator window in which you can simulate a compiled program. When the source code is saved without compiling, you will be warned that the debug file differs from the source code. You have the option to compile it before you simulate or continue without recompiling.



The simulator window is divided in a few sections.

- Toolbar with speed buttons
- Variable watch/modify window
- Source code window
- Terminal (input/output) window
- Register window
- Status bar

The margin

On the left side a margin is visible. This margin can display the following icons:

 a yellow dot, indicating that the line holds executable code

a read dot, indicating that a break line is set. You can only set a breakpoint on a line that has a
yellow dot.
a yellow arrow. This arrow shows the line currently executing.

The register window

On the right side the register window is visible. You can change the value of a register by entering a new value.

The variable watch section

The section below the toolbar is the variable watch section.
You can add a variable by entering one in an empty cell. You can also add a new variable by selecting it from the source window, and pressing return.
You can insert a new variable watch line by pressing the INS-key.
You can delete a variable watch line by pressing the CTRL+DEL keys.
You can change the value of a variable by setting the focus to the cell with the variables value and then by entering the new value.
The variable names are saved and loaded after each simulation session.

The terminal section

The blue window emulates the serial port. So serial output (the PRINT statement for example), is displayed in this window.
When serial input is required, you must set the focus to the serial window, before you enter text. The INPUT statement for example, requires serial input.

The source code window

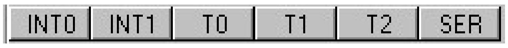
The source code windows shows the source file being simulated.
You can start a simulation by pressing F5 or by clicking the run button .
When your program runs, you can pause it by clicking the pause button .
You can stop the simulation by clicking the stop button.
You can also step through the code line by line, by pressing F8, or by clicking the step button .
By pressing SHIFT+F8 , you can step over code, like GOSUB and CALL.

To pause execution at a certain line, you can set a breakpoint. Just set the cursor on that line and press F9. By pressing F9 again, you can remove the breakpoint.
Note that a breakpoint can only be set on a line that contains executable code.
This is visible by the yellow dot. Statements like $romstart don't contain executable code and won't have a corresponding yellow dot.
You can also run to a specified line by clicking the run to button .

The status bar

The status bar is also divided into a few sections. These sections from left to right display the following information:

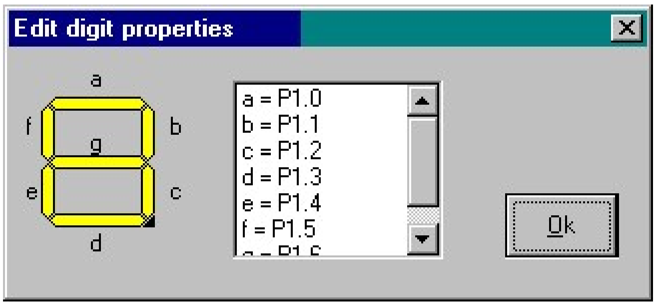
- The value of a variable in the source code window. You can select a variable by moving the mouse cursor over the variable name.
- The status of the simulator (stopped, running or paused)
- The number of clock cycles and the execution time of the executed code.
  You can reset the value by clicking on this section.
- The stack depth of the program. The stack depth is the deepest level the stack has reached during execution. If it exceeds the available internal memory (128 or 256 bytes), the program will not run correctly in the chip.

The interrupt buttons 

The INT0, INT1, T0, T1 and SER buttons can be clicked to generate an interrupt. Because this is a software emulator, no hardware interrupts can be generated. You have to do this yourself by clicking these buttons. TIMER 0 and TIMER 1 are simulated by software. Therefore, they will generate an interrupt automatically if the software enables this. The external gate however isn't simulated so for this occasion you must click the corresponding button.
Depending on the chip used, other interrupt buttons can be visible. They have the same purpose as the default interrupt buttons.

Hardware simulator button

By clicking the hardware simulator button  a special window will become visible.
This window has a LCD simulator, which can simulate custom characters, LED simulation for port 0-3, and a 7-digit LED display simulation.
The LCD type can be selected from the menu. Note that the display isn't as fast as it could be, but to assign/display all the dots costs a lot of processor time. The advantage however is that custom characters can be displayed too.
The LED's can be switched on or off by clicking on it.
The LED type can be set with the CG checkboxes. To select common ground you must set the marker. This will have the effect that all common cathodes are connected to ground and so the LED will be on when the port value will be high.
The 7-digit display can be connected to individual port pins.
To change the setting you must press the right mouse button to bring up the digit properties window.



Each segment is named with a letter. To change a port pin, select the segment from the list and press the spacebar. Now you can enter the desired port pin.
After you are done with assigning/changing, press the Ok button.

Real hardware simulation

Press the real hardware simulation button  to enable the hardware simulation.
You need additional hardware to use this feature. You can use the MCS flash programmer to simulate one port.
An application note can be downloaded that describes the needed hardware.
The hardware simulator can simulate port 1 and 3.
This way you can test your program in circuit without programming the device.
Now only the status reading and setting of the ports is supported.
This means that interrupts are not yet supported in hardware simulation.

Update source

The displaying of the variables and the arrow costs a lot of processor time. To simulate faster, you can disable the update of these items. Click the  button to enable/disable the update.

Display memory window

To display the memory of the internal RAM, you can click the button. By clicking again, you can hide the window.

Refresh variables

Normally, variables are only refreshed in step mode (F8), because depending on the used statements, the value would be hard to watch. You can also choose to display the value during program execution. The default is on.

The sections can be made larger or smaller by using the splitters.
When you press the right mouse button, a popup menu will be visible.
Depending on the place the mouse cursor was at the time you pressed the right-mouse button, different options will be showed.

Extra options that will be come available are:
- Clear breakpoints
- Hide register window
- Hide watch window

To end a session close the windows or just set the focus to an editor window.

4.27 Program Send to chip

After you have tested your program you can run one of the supported programmers.
You can also press **F4** or click on the button.

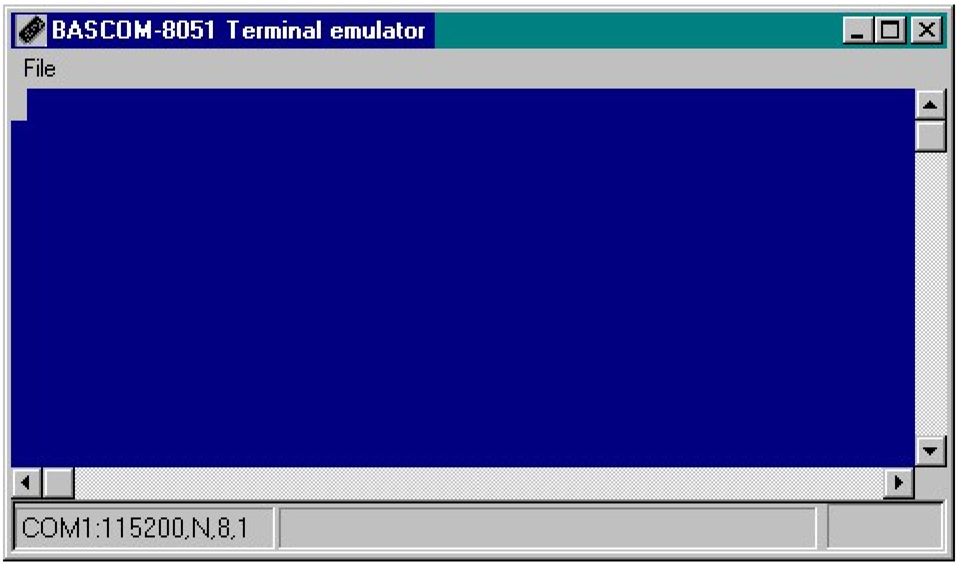
Some programmers support the auto flash option from the programmers options. When you select this option, the programmer window will not be visible, but the chip will be erased, programmed and verified automatically. The progress will be visible in the IDE-menu bar.

Different serial comport and parallel printer port based programmers are supported.
You must select one first with the Options Programmers 60 menu.

MCS Flashprogrammer 260
Blow IT Flashprogrammer 263
PG2051 263
MCS SPI programmer 262
PG302 264
JPK Systems X-programmer 268
Peter Averill's TAFE programmer 269
SE512 or SE514 265
SE-812 266
STK200/STK300 ISP programmer 270
Sample Electronics simple cable ISP programmer 266
RHOMBUS SCE-51 Emulator 271
CYGNAL JTAG programmer 268

4.28 Tools Terminal Emulator

With this option you can start the built in terminal emulator.
The following window will appear:



The terminal emulator supports ANSI, TTY, VT100 and VT220 terminal emulation.
Information you type and information that the computer board sends,
are displayed in the same window.

You must use the same baud rate for the terminal emulator and the program you compile. If you compiled your program with the Compiler Settings at 4800 baud, you must set the Communication Settings also to 4800 baud. The setting for the baud rate is reported in the report file.

The terminal menu has a few options.

File upload

This will upload the current program in HEX format to a monitor program.
With the Options Monitor settings, you can specify an optional header to be sent before the actual hex file is sent to the monitor.
Also a delay in mS can be specified for a optional delays after each line sent.

When an ALTAIR ROM is selected from the Monitor Options, a binary file will be sent to the monitor. The baud rate of the terminal emulator will be used.
For an 552 ALTAIR ROM, the terminal baud rate must be set to 115200 baud.

While sending the hex file to the monitor, an extra menu option will be available:

File Escape

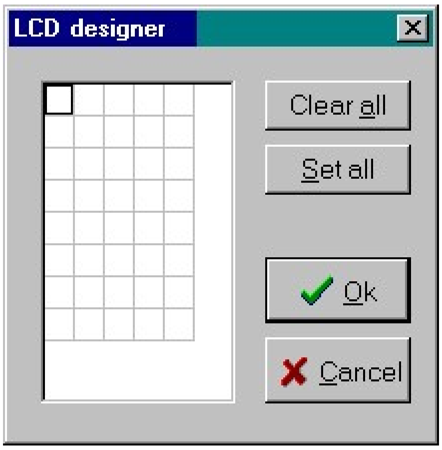
This will abort the upload to the monitor program.

File Exit

This will close the terminal emulator window.

4.29 Tools LCD designer

With this option, you can design special characters for LCD displays.
The following window will appear:



The LCD matrix has 7x5 points.
The bottom row is reserved for the cursor but can be used.
You can select a point by clicking the left mouse button.
If a cell was selected it will be de selected.

By clicking, the Clear All button you can clear all points.
By clicking the Set All button you can set all points.

With the Options Compiler LCD 55 settings you can choose if the 3 most significant bits must be set high. Some LCD displays require this.

When you are finished you can press the Ok button:
a statement will be inserted in your active program editor window at the current cursor position.
The statement looks like this :

Deflcdchar 136 ?,1,2,3,4,5,6,7,8

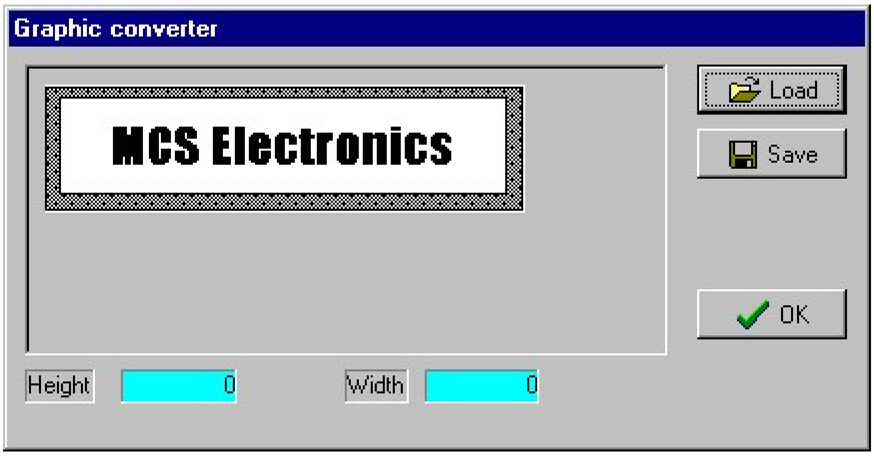
You must replace the ?-sign with a number ranging from 0 to7.
When you want to display the custom character you can use the chr() function.
LCD chr(0) 'will display custom character 0.

The numbers after the custom character are representing the row values.
An empty row is converted to 32 (space) since a zero is used to terminate the bytes.

4.30 Tools Graphic Converter

The Graphic converter is intended to convert BMP files into BASCOM Graphic Files (BGF) that can be used with Graphic LCD displays.

The following dialog box will be shown :



To load a picture click the Load button.
The picture may be 64 pixels high and 240 pixels width.
When the picture is larger it will be adjusted.

You can use your favorite graphic tool to create the bitmaps and use the Graphic converter to convert them into black and white images.

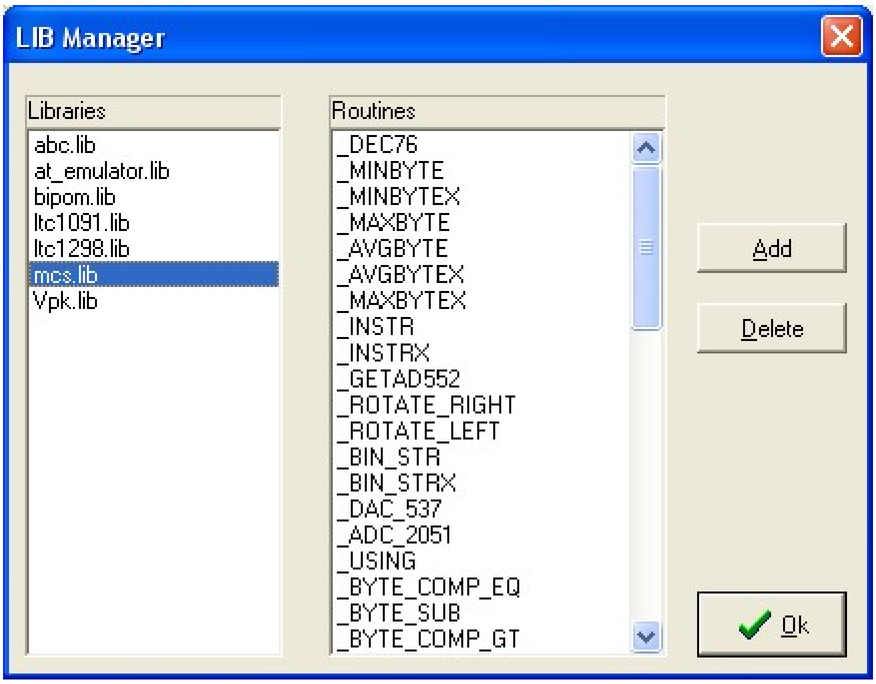
When you click the Save-button the picture will be converted into black and white. Any non-white color will be converted into black.

The resulting file will have the **BGF** extension.
Press the Ok-button to return to the editor.

The picture can be shown with the ShowPic 216 statement.

4.31 Tools LIB Manager

With this option you can add and remove ASM routines to the libraries.
The following windows will be displayed:



Select a library first by clicking on it.
The Routines list will be refreshed with the contents of the selected library.

By clicking the Add button a dialog box will be shown to select the ASM file that contains the ASM routine(s).

By clicking on the Delete button the selected Routine will be removed from the selected library.

A library is an ASCII file that contains ASM routines.

Each routine must be preceded by the name of the routine between brackets.
Each routine must be ended with the [END] line.

A sample routine is shown here :

```
[_DEC76]
;decrease the register pair r6 and r7 with one
; return zero in ACC when r6r7 is zero
_Dec76:
Dec r6                  ; dec LSB
Cjne r6,#255,*+4        ; if it was zero
Dec r7                  ; we need to decrease r7 to
Mov a,r7                ; result into a
Orl a,r6                ; OR with r6 to see if it is zero
Ret
[END]
```

The library can be included with the $LIB 91 directive.
A routine can be imported with the $EXTERNAL 88 directive.

```
$lib "mylib.lib"
$external _dec76
```

4.32 Tools Triscent Converter

The Triscent Converter will convert a .H file generated by the Triscend program into a triscend.DAT file that can be used by BASCOM.

The triscend.DAT file has an additional section named XBYTE.

```
[XBYTE]
CMAP0_TAR = ff00
CMAP0_ALT = ff01
```

The 3 lines above show the section and 2 entries. The triscend chips are configured by writing to locations where normally XRAM is located.

BASCOM handles this automatic for you. So when you assign a value to CMAP0_TAR, the value is written to location &HFF00 where the CMAP0_TAR register is located.

Reading this XRAM SFR will do the reverse.

At www.triscend.com you can find all info you need. Look for the E5 line of chips. These are 8051 compatible chips which can be configured with the Triscend software. You can for example create 3 UARTS, add I2C, SPI, TIMERS etc.

So the E5 chip is hardware configurable by software!

After you created your 'chip' , you create the .H file and this file must be imported with the Tools Triscend Convert option.

There is an evaluation KIT available from triscend. Another pro is that the chips have many pins. So when your design needs a lot of I/O pins, I advise to look at these chips.

4.33 Tools Export to RTF

Action

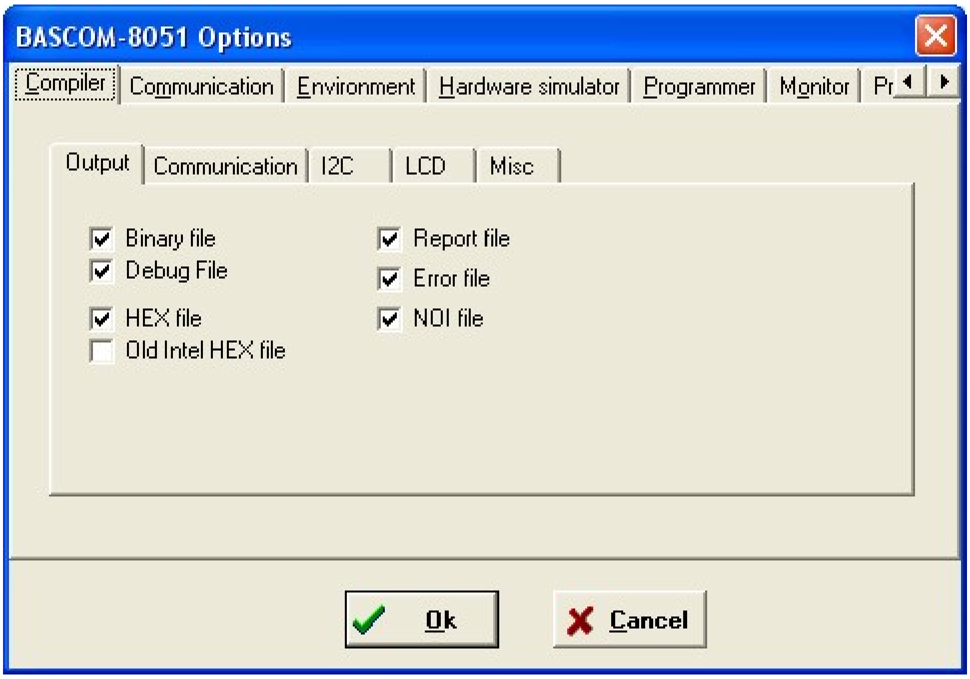
Exports the current file to an RTF file.

Remarks

RTF files can be used in documents such as Word files. RTF files can also be used to show code with colors on a web page. When your file has the name test**.bas** , a file with the name test**.rtf** will be created in the same directory.

4.34 Options Compiler Output

With this option you can specify which files must be created.

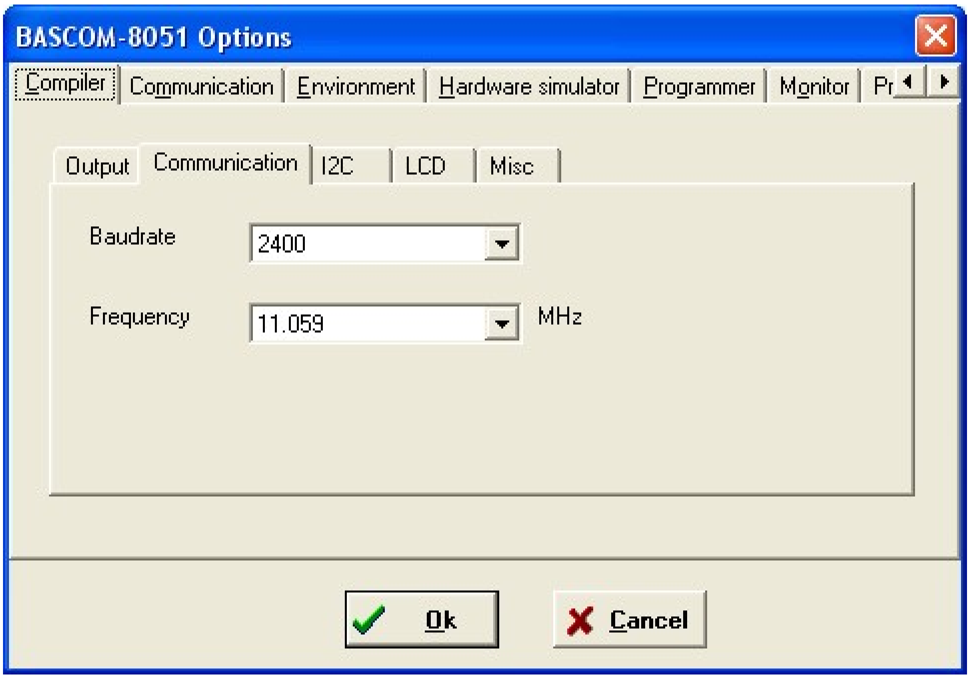


Binary file	This will generate a ROM-image of the program. Of course you can

	also store it in a flashrom.
Debug file	This option will generate a DBG-file. It is used by the simulator. When you don't use the simulator, you don't need to generate it.
Hex file	This is an Intel hex-file that is used by most programmers and monitor programs.
Old Intel hex file	This option will generate an old style Intel hex file and is used by the Elektor monitor. If you choose this option, you must unselect the Hex File option.
Report file	This file contains info about the program, such as the baudrate, used variables etc.
Error file	This file is generated when an error occurs. It holds the error descriptions. When there is no error, the file will not be created.

4.35 Options Compiler Communication

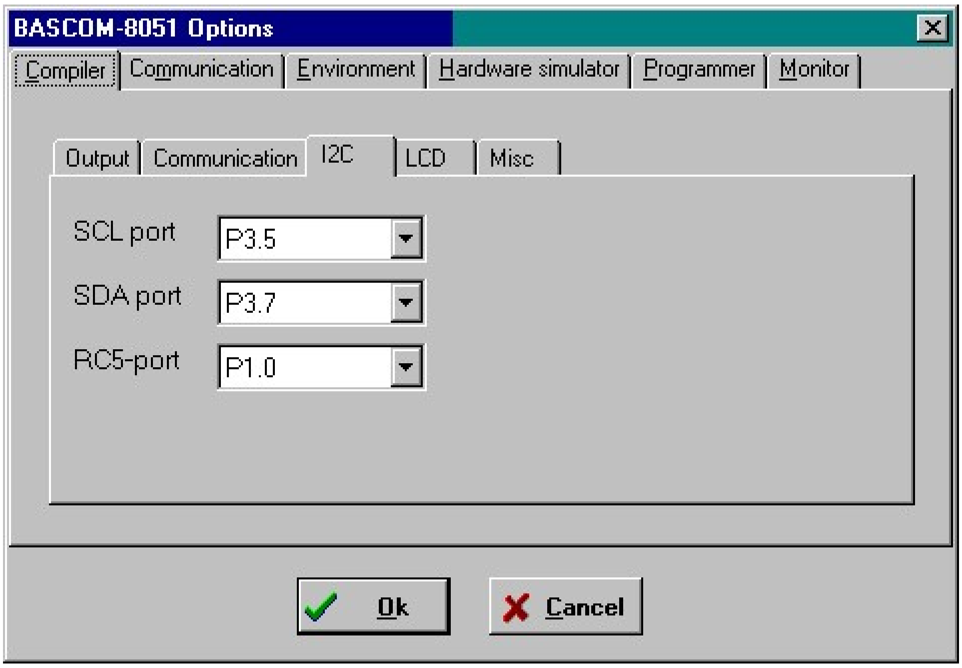
With this options you can select the used crystal and the baud rate that must be used with serial communications.



We advise to use the $BAUD 85 and $CRYSTAL 87 compiler directives in your program.
This way the settings are stored in your source code.

4.36 Options Compiler I2C

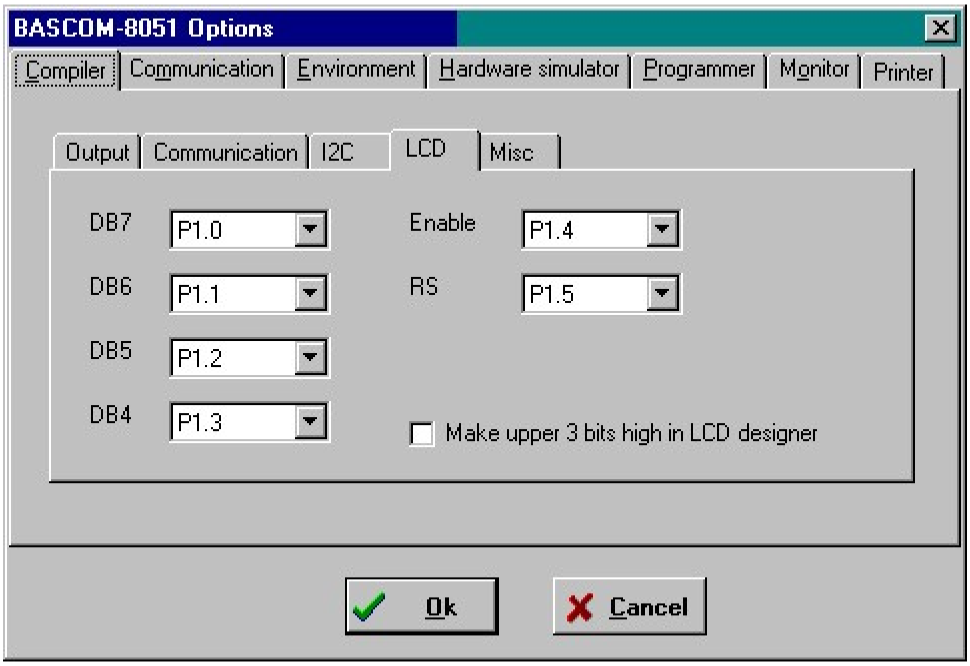
With this option you can select the port pins that serve as the SDA and SCL line for the I2C statements.



You can also use the CONFIG SDA 125 and CONFIG SCL 124 statements.

4.37 Options Compiler LCD

With this option you can select the port pins for the LCD display.
This only applies to the LCD statements when used in 4-bit mode and if the LCD display is connected to the port pins.
You can also choose the port pins with the CONFIG LCDPIN 121 statement.



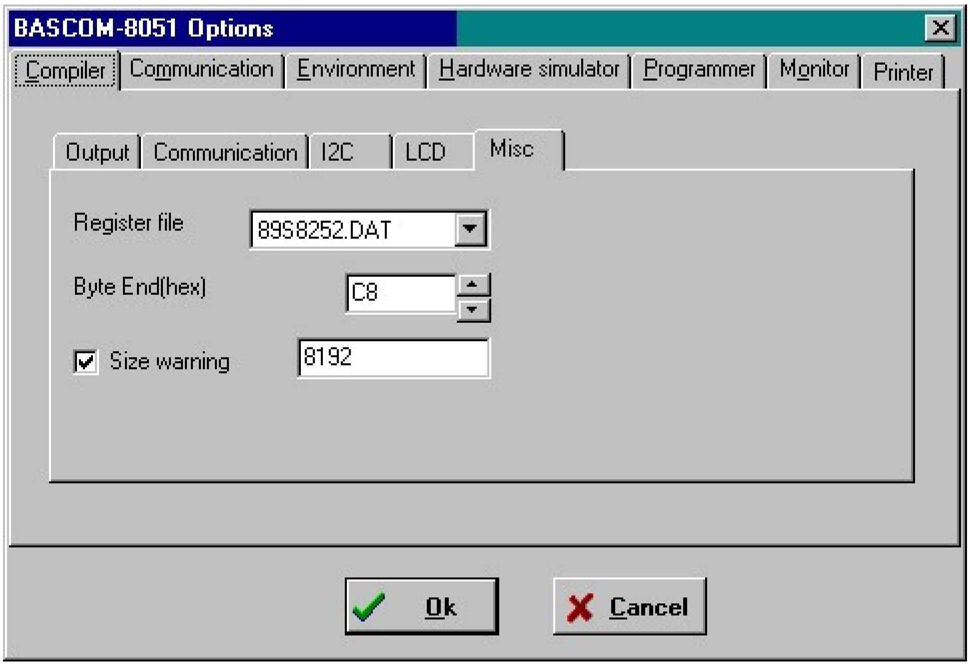
In the 4-bit mode, only the highest nibble of the data lines is used.
To spare a pin for the R/W pin, reading from the LCD is not supported and you must connect the R/W line to ground. See additional hardware 253 for more info.

You can also use the LCD statements in the data bus mode.

Some LCD displays needs the upper 3 bits to be set high. So when you have this kind of display you must select this option. When you select this option the LCD designer will set the upper 3 bits high when the DEFLCDCHAR 136 statement is generated.

4.38 Options Compiler Misc

With the miscellaneous options you can change the following



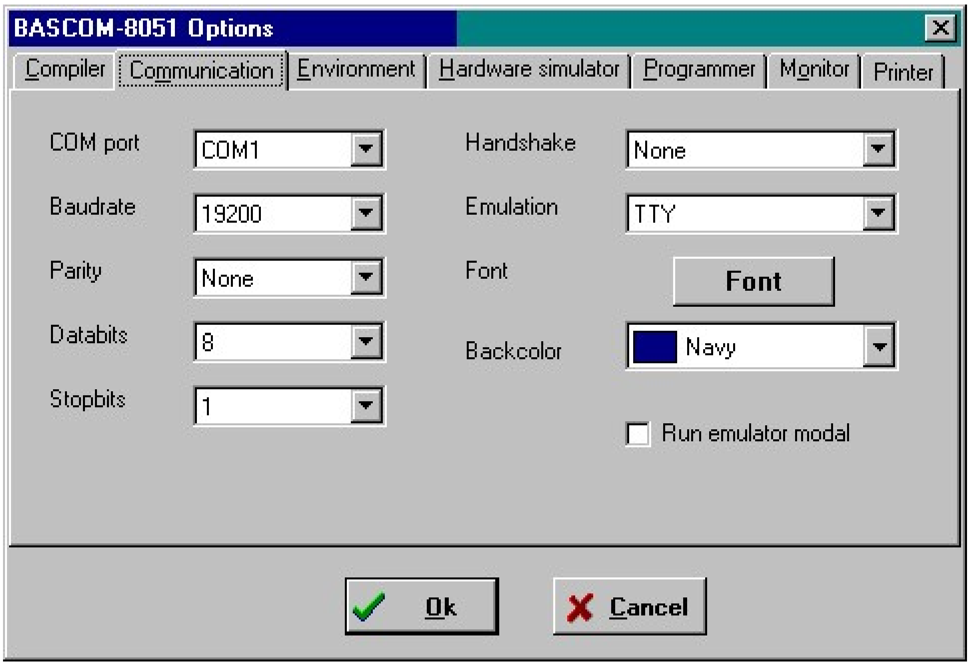
Remarks

register file	Select the register file which is suitable for your target uP. The reg51.DAT file is the common file that works for every uP, but doesn't have hardware specific registers. You can use this file as a base for your own DAT file.
byte end	Specifies the last location of internal memory that can be used by the compiler for storing variables. For uP's with 128 bytes of RAM set it to 70 for example. All space after this value is used for the stack. With the simulator you can test if you run out of stack space. For uP's with 256 bytes of internal RAM, you can use a higher value, F0 for example.
size warning	Select this option to enable the compiler to give a warning message when the code size exceeds the specified size.(decimal)

4.39 Options Communication

With this option you can modify the communication settings for the BASCOM terminal emulator.

The following window will appear:

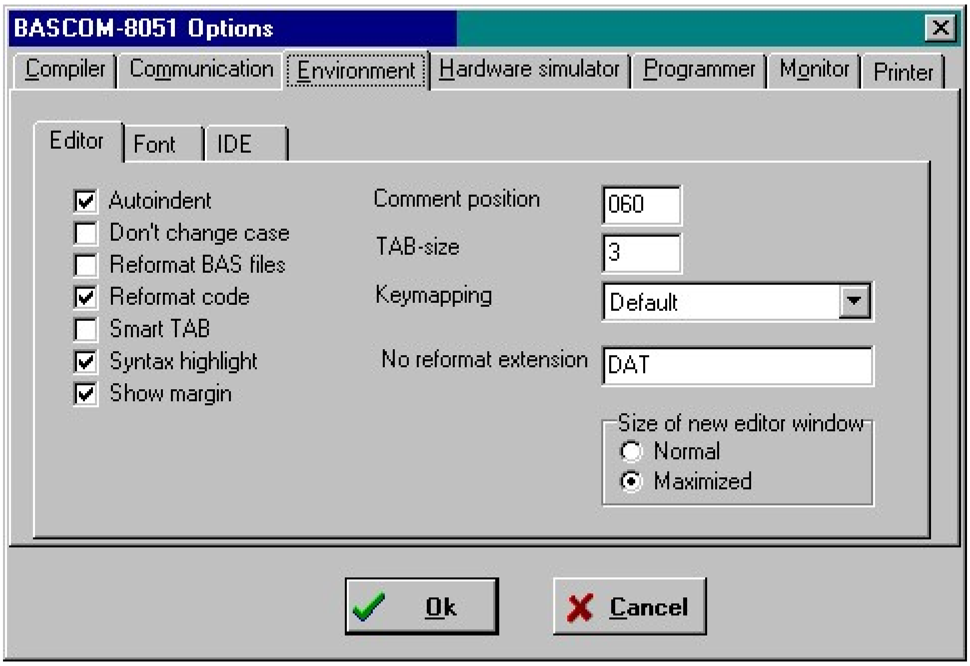


Option	Remark
Comport	The comport of you computer to use.
Baud rate	The baud rate to use.
Parity	The parity to use.
Data bits	The number of data bits to use.
Stop bits	The number of stop bits to use.
Handshake	The handshake to use.
Emulation	The terminal emulation to use.
Font	Click the button to select the font and font color to use.
Backcolor	The background color to use (default blue)
Run emulator modal	Runs the terminal emulator in modal mode so you can use all key combinations that are normally reserved to the IDE.

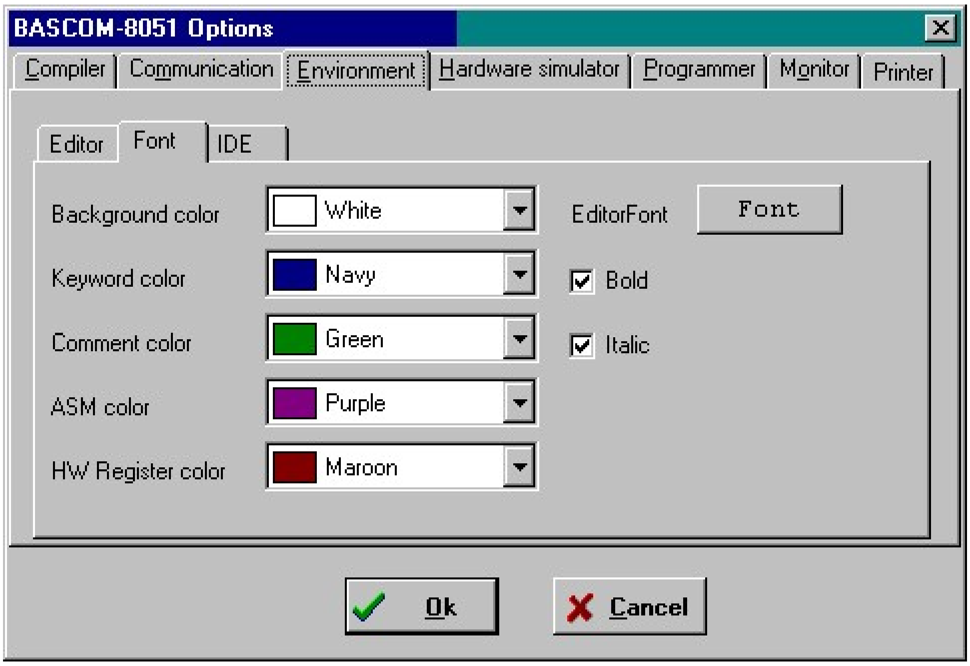
Note that the baud rate of the terminal emulator and the baud rate setting of the compiler options, must be the same in order to work correctly.

4.40 Options Environment

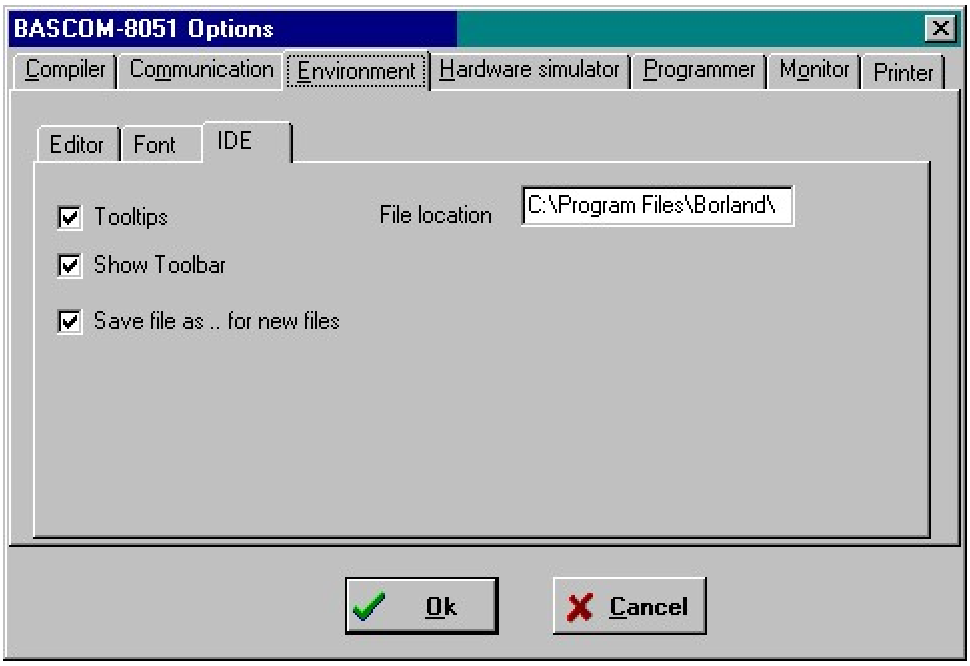
With this option you can modify the environment options.



OPTION	DESCRIPTION
Auto indent	With auto indent, the cursor will be set to the same left margin as the current line when you press return.
Don't change case	This option will not change the case of your line when you enabled 'Reformat code'. By default each first characters case is set to uppercase.
Reformat BAS files	Reformat files when loading them into the editor. This is only necessary when you are loading files that were created with another editor. Normally you don't need to set this option.
Reformat code	Reformat code when entered in the editor. This will reformat the line after you have set focus to a new line.
Smart tabs	Will look at the previous line for non spaces to position the cursor.
Syntax highlight	Enables/disables syntax highlighting
Show margin	Shows a margin at position 80.
Comment position	The right position of the comment.
Tab size	The number of spaces equivalent to one tab.
Key mapping	Selects the behavior of the editor. Default behaves like Delphi.
No reformat extension	Specifies file extensions separated by a space where the reformatting is disabled. (for text files or dat files)
Size of new edit window	Selects the size of the edit window when a file is opened.



OPTION	DESCRIPTION
Background color	Background color of the editor
Keyword color	Color used to highlight keywords(statements)
Comment color	Color used to highlight comment
ASM color	Color used to highlight assembly
HW register color	Color used to highlight special function registers
Editor font	Font name of the editor
Bold	Check to display keywords in bold
Italic	Check to display comment in Italic



OPTION	DESCRIPTION
Tool tips	Will enable/disable tool tips.
Show Toolbar	Will display/hide the toolbar of the IDE.
Save File As... for new files	When you enable this option you will be prompted to give new files a name before they will be saved with their default name.
File location	The path to the location of your BAS files. Normally Windows will use My documents as a default.

4.41 Options hardware simulator

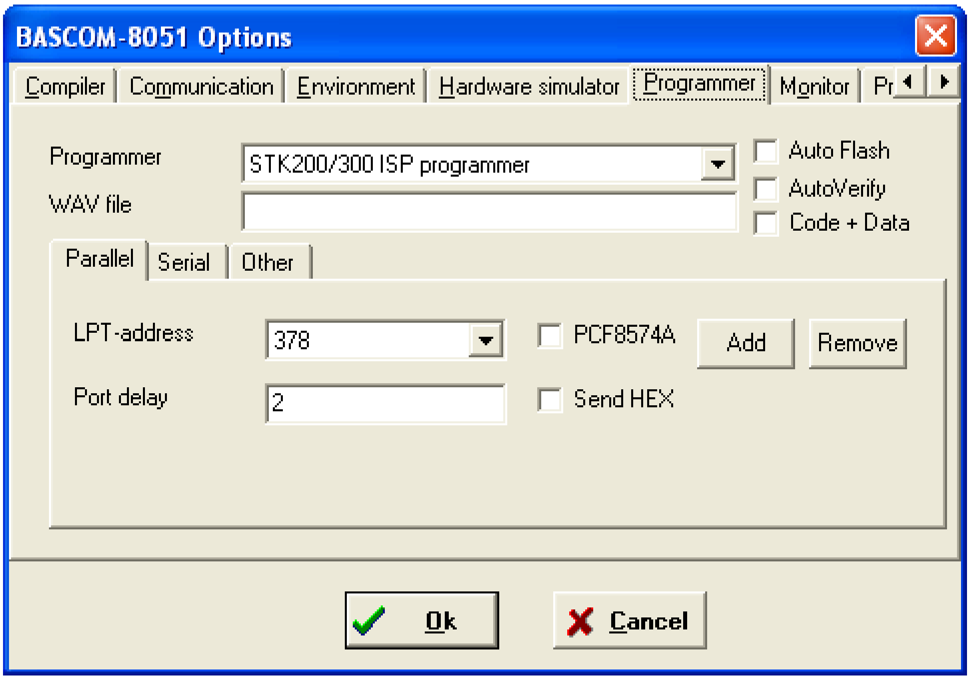
This option let you select the address of the LPT connected to the optional hardware simulator.

4.42 Options Programmer

This option let you select the target programmer.
The supported programmers are :

- MCS Flashprogrammer 260
- Blow IT programmer 263
- PG2051 263
- MCS SPI programmer 262
- PG302 264
- JPK Systems X-programmer 268
- Peter Averill's TAFE programmer 269
- SE512 or SE514 265
- SE-812 266
- CYGNAL 268
- FutureLec 268
- SE511-SE516 272

The auto flash options will automatic program a chip without displaying the programmer window.
The auto verify option will verify automatically after each programming.
Selecting 'Code + Data' will program both the flash and the EEPROM.



You can select various programmers. On the Parallel-TAB you can select the LPT-address.
You can also Add or Remove an LPT-address. It is only possible to remove address that you added yourself.

The port delay can best be set to 0. In some cases you might want to increase the value.
Some programmers have I2C chips on them. For example the MCS Flash programmer. Since different I2C chips exist for the PCF8574, you need to select the checkbox when you use the PCF8574**A**.

4.43 Options Monitor

With the monitor options you can select the monitor you use.

There are only a few monitor programs supported.

- Altair 535/537
- Altair 552
- Monitor hex upload

The Altair monitor needs special instructions and uses binary files.
The hex upload feature is meant for monitor programs that work with hex files.

You can upload a file to the target uP from the terminal emulator with the Upload file option.

For hex file based monitors there are 3 additional options:

- o monitor prefix, is sent before the hex file
- o monitor suffix, is sent after the hex file upload is completed

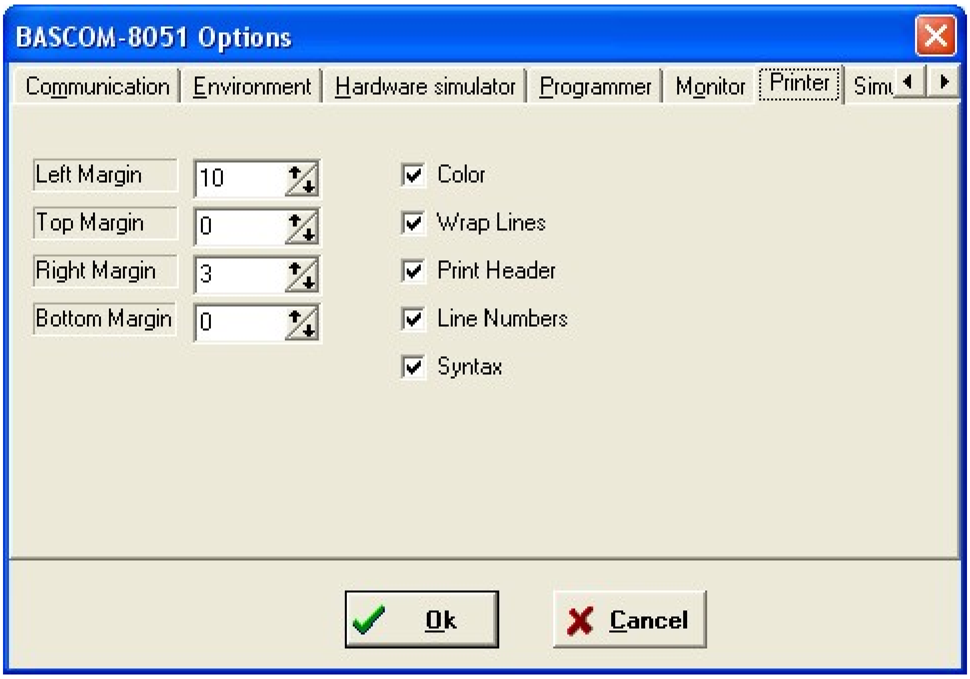
The prefix and suffix can contain returns or any ASCII character.
Use {asc} , to imbed an ASCII character. asc=0-255.

For example @{13} for the prefix, will send @ followed by a return.

- o monitor delay, must be specified in msec's, and is the delay time for each line sent.

4.44 Options Printer

These options let you select the printer margins.



Left Margin	The left printer margin in mm
Top Margin	The top printer margin in mm
Right Margin	The right printer margin in mm
Bottom Margin	The bottom printer margin in mm
Color	Check to print in color.
Wrap Lines	Check when you want long lines to be wrapped. This is convenient when you have long lines of source code that would otherwise would not fit on the paper.
Print Header	Check to print a header with file name and page number
Line Numbers	Check to print line numbers
Syntax	Check to use syntax highlighting options and colors

4.45 Window cascade

Will cascade all editor windows so they will all be visible.

4.46 Window Tile

Window Tile will tile all editor windows.

4.47 Window arrange icons

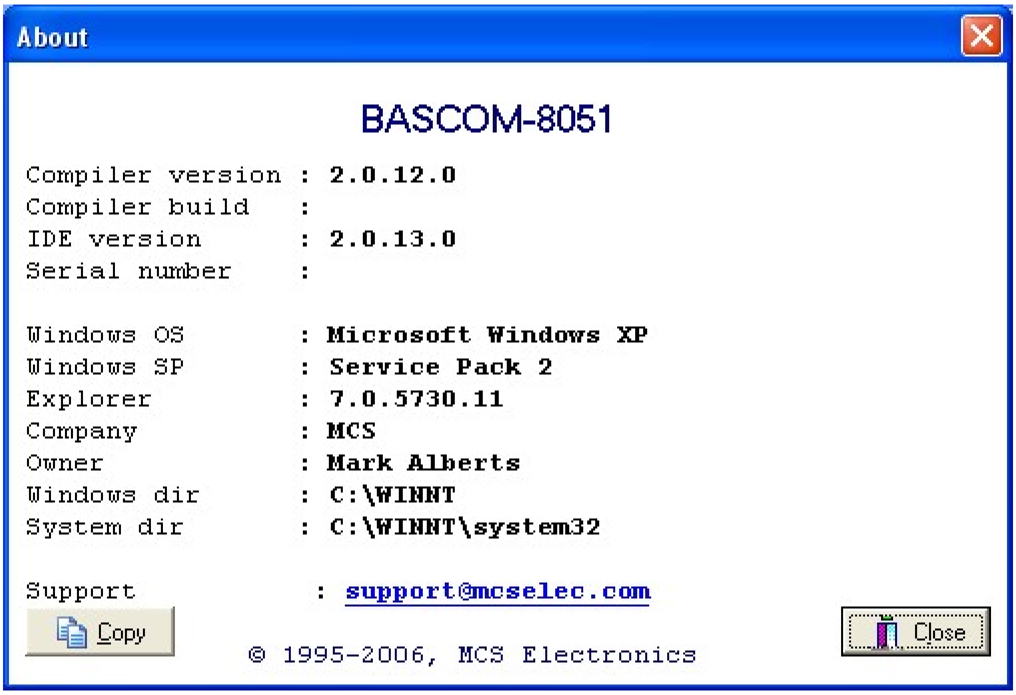
Will arrange all iconized windows.

4.48 Window minimize all

Will minimize all editor windows.

4.49 Help About

This option shows an about box as displayed below.



Your serial number is shown in the about box.
You will need this when you have questions about the product.
The library version is also shown.
You can compare it with the one from our web site in case you need an update.

Click on the Ok-button to return to the editor.

4.50 Help Index

Will show the help index of BASCOM.

4.51 Help on help

Will bring up help about the Windows help system.

4.52 Help Shop

Action

This option will launch your default web browser and will open the MCS Electronics Shop.
We have a number of BASCOM-8051 KIT's and affordable 89Cx051 programmers from Sample Electronics

4.53 Help Forum

Action

This option will launch your default web browser and will open the MCS Forum.
The forum can be used to talk to other BASCOM users. You can get idea's there, discuss your problems and questions, and you can help other members.

4.54 Help Support

Action

This option will launch your default web browser and will open the MCS Support system.
The support system can be used to search the knowledge base.

4.55 Help Credits

Will launch this help file and show this topic.

MCS would like to thank the following people who have contributed to BASCOM development :

- Peter Averill from the Victoria University TAFE. Peter designed both the TAFE AT89C2051 programmer and the software to support it.
- Antti from Silicon Studio Ltd. Antti designed the BlowIT ATA89C2051 programmer and software to support it.
- Jakub Jiricek, he designed the SPI-programmer and software to support it.
- Francois du Plessis, he wrote a Windows version of Jacub's SPI-programmer software.
- Henry Arndt (DL2TM) , he provided me with the source for his popular Atmel Programmer.

Part V

5 Language fundamentals

5.1 Language fundamentals

Characters from the BASCOM character set are put together to form labels, keywords, variables and operators.
These in turn combine to form statements that make up a program.
This chapter describes the character set and the format of BASCOM program lines.
In particular, it discusses:

- The specific characters in the character set and the special meanings of some characters.
- The format of a line in a BASCOM program.
- Line labels.
- Program line length.

Character Set

The BASCOM BASIC character set consists of alphabetic characters, numeric characters, and special characters.
The alphabetic characters in BASCOM are the uppercase letters (A-Z) and lowercase letters (az) of the alphabet.
The BASCOM numeric characters are the digits 0-9.
The letters can be used as parts of hexadecimal numbers.
The following characters have special meanings in BASCOM statements and expressions:

Character	Description
ENTER	Terminates input of a line
	Blank (or space)
'	Single quotation mark (apostrophe)
*	Asterisks (multiplication symbol)
+	Plus sign
,	Comma
-	Minus sign
.	Period (decimal point)
/	Slash (division symbol) will be handled as \
:	Colon
"	Double quotation mark
;	Semicolon
<	Less than
=	Equal sign (assignment symbol or relational operator)
>	Greater than
\	Backslash (integer/word division symbol)

The BASCOM program line

BASCOM program lines have the following syntax:
[[*line-identifier*]] [[*statement*]] [[:*statement*]] ... [[*comment*]]

Using Line Identifiers

BASCOM support one type of line-identifier; alphanumeric line labels:
An alphanumeric line label may be any combination of from 1 to 32 letters and digits, starting with a letter and ending with a colon.
BASCOM keywords are not permitted. The following are valid alphanumeric line labels:
Alpha:
ScreenSUB:
Test3A:
Case is not significant. The following line labels are equivalent:
alpha:
Alpha:
ALPHA:
Line labels may begin in any column, as long as they are the first characters other than blanks on the line.
Blanks are not allowed between an alphabetic label and the colon following it.
A line can have only one label.

BASCOM Statements

A BASCOM statement is either " executable" or " nonexecutable" .
An executable statement advances the flow of a programs logic by telling the program what tot do next.
Non executable statement perform tasks such as allocating storage for variables, declaring and defining variable types.
The following BASCOM statements are examples of non executable statements:

- **REM** or (starts a comment)
- **DIM**

A " comment" is a nonexecutable statement used to clarify a programs operation and purpose.
A comment is introduced by the REM statement or a single quote character(').
The following lines are equivalent:
PRINT " Quantity remaining" : REM Print report label.
PRINT " Quantity remaining" ' Print report label.
More than one BASCOM statement can be placed on a line, but colons(**:**) must separate statements, as illustrated below.
FOR I = 1 TO 5 : PRINT " Gday, mate." : NEXT I

BASCOM LineLength

If you enter your programs using the built-in editor, you are not limited to any line length, although it is advised to shorten your lines to 80 characters for clarity.

Data Types

Every variable in BASCOM has a data type that determines what can be stored in the variable. The next section summarizes the elementary data types.

Elementary Data Types

- **Bit (1/8 byte)**
- **Byte (1 byte)**
  Bytes are stores as unsigned 8-bit binary numbers ranging in value from 0 to 255.
- **Integer (two bytes).**

Integers are stored as signed sixteen-bit binary numbers ranging in value from -32,768 to +32,767.
- **Word (two bytes).**
  Words are stored as unsigned sixteen-bit binary numbers ranging in value from 0 to 65535.
- **Long (four 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.
- **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.

Variables can be stored internal (default) or external.

Variables

A variable is a name that refers to an object--a particular number.
A numeric variable can be assigned only a numeric value (either integer, word, byte long, single or bit).
The following list shows some examples of variable assignments:
- **A constant value:**
  A = 5
  C = 1.1
- **The value of another numeric variable:**
  abc = def
  k = g
- **The value obtained by combining other variables, constants, and operators:**
  Temp = a + 5
  Temp = C + 5

Variable Names

A BASCOM variable name may contain up to 32 characters.
The characters allowed in a variable name are letters and numbers.
The first character in a variable name must be a letter.
A variable name cannot be a reserved word, but embedded reserved words are allowed.
For example, the following statement is illegal because AND is a reserved word.
AND = 8
However, the following statement is legal:
ToAND = 8
Reserved words include all BASCOM commands, statements, function names, internal registers and operator names.
(see BASCOM Reserved Words 282 , for a complete list of reserved words).
You can specify a hexadecimal or binary number with the prefix **&H** or **&B**.
a = **&H**A , a = **&B**1010 and a = 10 are all the same.
Before assigning a variable you must tell the compiler about it with the DIM statement.
Dim b1 As Bit, I as Integer, k as Byte , s As String * 10
You can also use DEFINT 136, DEFBIT 136, DEFBYTE 136 and/or DEFWORD 136.
For example **DEFINT c** tells the compiler that all variables that are not dimensioned and that are beginning with the character **c** are of the Integer type.

Expressions and Operators

This chapter discusses how to combine, modify, compare, or get information about expressions by using the operators available in BASCOM.
Anytime you do a calculation you are using expressions and operators.
This chapter describes how expressions are formed and concludes by describing the following kind of operators:

- Arithmetic operators, used to perform calculations.
- Relational operators, used to compare numeric values.
- Logical operators, used to test conditions or manipulate individual bits.
- Functional operators, used to supplement simple operators.

Expressions and Operators

An expression can be a numeric constant, a variable, or a single value obtained by combining constants, variables, and other expressions with operators.

Operators perform mathematical or logical operations on values. The operators provides by BASCOM can be divided into four categories, as follows:
1. **Arithmetic**
2. **Relational**
3. **Logical**
4. **Functional**

Arithmetic

Arithmetic operators are **+**, **-** , ***** and ****.

- Integer
  Integer division is denoted by the backslash (\).
  Example: Z = X \ Y
- Modulo Arithmetic
  Modulo arithmetic is denoted by the modulus operator MOD.
  Modulo arithmetic provides the remainder, rather than the quotient, of an integer division.
  Example: X = 10 \ 4 : remainder = 10 MOD 4
- Overflow and division by zero
  Division by zero, produces an error.
  At this moment there is no message, so you have to insure yourself that such wont happen.

Relational Operators

Relational operators are used to compare two values as shown in the table below. The result can be used to make a decision regarding program flow.

Operator	Relation Tested	Expression
=	Equality	X = Y
<>	Inequality	X <> Y
<	Less than	X < Y
>	Greater than	X > Y
<=	Less than or equal to	X <= Y
>=	Greater than or equal to	X >= Y

Logical Operators

Logical operators perform tests on relations, bit manipulations, or Boolean operators.
There are four operators in BASCOM, they are :

Operator	Meaning
NOT	Logical complement
AND	Conjunction
OR	Disjunction
XOR	Exclusive or

It is possible to use logical operators to test bytes for a particular bit pattern.
For example the **AND** operator can be used to mask all but one of the bits of a status byte, while **OR** can be used to merge two bytes to create a particular binary value.

Example

```
A = 63 And 19
PRINT A
A = 10 Or 9
PRINT A
```

Output
16
11

Floating point

Single numbers conform to the IEEE binary floating point standard.
An eight-bit exponent and 24 bit mantissa are supported.
Using four bytes, the format is shown below:

```
31 30________23 22______________________________0
s    exponent     mantissa
```

The exponent is biased by 128. Above 128 are positive exponents and below are negative. The sign bit is 0 for positive numbers and 1 for negative. The mantissa is stored in hidden bit normalized format so that 24 bits of precision can be obtained.

All mathematical operations are supported by the single.
You can also convert a single to an integer or word or vise versa:

```
Dim I as Integer, S as Single
S = 100.1                   'assign the single
I = S                       'will convert the single to an integer
```

Take a look at the single.bas example for more information.

Arrays

An array is a set of sequentially indexed elements having the same type. Each element of an array has a unique index number that identifies it. Changes made to an element of an array do not affect the other elements.
The index must be a numeric constant, a byte, an integer or a word. This means that an array can hold 65535 elements as a maximum. The minimum value is 1 and not zero as in QB.

Arrays can be used on each place where a 'normal' variable is expected but there are a few exceptions.
These exceptions are shown in the help topics.
Note that there are no BIT arrays in BASCOM-8051.
Example:

```
Dim a(10) as byte 'make an array named a, with 10 elements (1 to 10)
Dim c as Integer
For C = 1 To 10
  a(c) = c              'assign array element
  Print a(c)              'print it
Next
```

Strings

Strings can be up to 254 characters long in BASCOM.
To save memory you must specify how long each string must be with the DIM statement.

Dim S As String * 10
This will reserve space for the string S with a length of 10 bytes. The actual length is 11 bytes because a nul(0) is used to terminate the string.

You can concatenate string with the + sign.

```
Dim S As String * 10 , Z As String * 10
S = "test"
Z = S + "abc" + var
```

In QB you can assign a string with a value and add the original string (or a part of it) too :

```
S = "test"
S = "a" + s
```

This will result in the string "atest"
In BASCOM-8051 this is NOT possible because this would require a copy of the string.
In BASCOM the string S is assigned with "a" and on that moment the original string S is destroyed. So you must make a copy of the string yourself in the event you need this functionality.

Part VI

6 BASCOM Language Reference

6.1 BASCOM Statements

-1-

1WRESET, 1WREAD, 1WWRITE 79
1WSEARCHFIRST 81, 1WSEARCHNEXT 83 , 1WIRECOUNT 80

-COMPILER DIRECTIVES-

#IF 76
#ELSE 77
#ENDIF 78
$ASM - $END ASM 84
$INCLUDE 89
$BAUD 85
$BGF 85
$CRYSTAL 87
$DEFAULT XRAM 88
$IRAMSTART 90
$LARGE 90
$LCD 91
$MAP 93
$NOBREAK 93
$NOINIT 94
$NONAN 94
$NONULL 95
$NORAMCLEAR 95
$NOSP 96
$OBJ 96
$RAMSIZE 97
$RAMSTART 99
$REGFILE 100
$ROMSTART 100
$SERIALINPUT 101
$SERIALINPUT2LCD 101
$SERIALOUTPUT 102
$SIM 103

-A-

ABS 105
ALIAS 104
ASC 106
AVG 106

-B-

BITWAIT 108
BCD 108
BREAK 109

-C-

CALL 109
CLOSE 194

CLS 111
CHR 110
CONFIG 112
CONST 112
COUNTER 129
CPEEK 130
CURSOR 131

-D-

DATA 132
DEBOUNCE 133
DECR 134
DECLARE 135
DEFINT 136
DEFBIT 136
DEFBYTE 136
DEFLCDCHAR 136
DEFWORD 136
DELAY 137
DIM 137
DISABLE 139
DISPLAY 139
DO 140

-E-

ELSE 140
ENABLE 141
END 142
END IF 142
ERASE 143
EXIT 144

-F-

FOR 144
FOURTHLINE 145
FUSING 146

-G-

GET 147
GETAD 148
GETAD2051 149
GETRC 154
GETRC5 156
GOSUB 158
GOTO 159

-H-

HEX 159
HEXVAL 160
HIGH 160
HIGHW 161
HOME 162

-I-

I2CRECEIVE 162
I2CSEND 163
I2CSTART 164
I2CSTOP 164
I2CRBYTE 164

I2CWBYTE 164
IDLE 165
IF 165
INCR 167
INKEY 167
INP 169
INPUT 169
INPUTBIN 171
INPUTHEX 172
INSTR 173

-L-

LCASE 174
LCD 174
LCDINIT 177
LCDHEX 178
LEFT 179
LEN 179
LOAD 180
LOCATE 181
LOOKUP 181
LOOKUPSTR 182
LOOP 140
LOW 183
LOWW 184
LOWERLINE 184

-M-

MAKEDEC 185
MAKEBCD 185
MAKEINT 186
MAX 186
MID 187
MIN 188
MOD 188

-N-

NEXT 192

-O-

ON Interrupt 192
ON Value 193
OPEN 194
OUT 196

-P-

P1,P3 197
PEEK 198
POKE 198
PSET 203
POWERDOWN 199
PRINT 199
PRINTBIN 200
PRINTHEX 201
PRIORITY 202
PUT 203

-R-

READ 204
READMAGCARD 205
REM 207
REPLACE 207

RESET 208
RESTORE 208
RETURN 209
RIGHT 210
RND 210
ROTATE 211

-S-

SELECT 212
SET 212
SHIFT 213
SHIFTCURSOR 213
SHIFTIN 214
SHIFTOUT 214
SHIFTLCD 215
SHOWPIC 216
SOUND 216
SPACE 218
SPC 219
SPIIN 220
SPIOUT 221
START 221
STOP 222
STOP TIMER 222
STR 224
STRING 224
SUB 225
SWAP 226

-T-

THEN 165
THIRDLINE 226
TIMEOUT 103
TO 144

-U-

UCASE 227
UPPERLINE 228

-V-

VAL 228
VARPTR 229

-W-

WAIT 229
WAITKEY 230
WAITMS 230
WHILE .. WEND 232

6.2 #IF

Action

Conditional compilation directive that tests for a condition.

Syntax

#IF test
[**#ELSE**]

#ENDIF

Remarks

test	An expression to test for. The expression may contain defined constants.

Conditional compilation is used to include parts of your program. This is a convenient way to build different files depending on some constant values.
Note that unlike the IF statement, the #IF directive does not expect a THEN.
You may nest conditions to 25 levels.
The use of #ELSE is optional.

See Also

#ELSE 77 , #ENDIF 78

Example

```
Const DEMO = 1  ' 0 = normal , 1= demo
#If Demo
   Print "Demo program"
#Else
   Print "Full version"
#Endif
```

Since the constant DEMO is assigned with the value 1, the compiler will compile only the line : Print "Demo program".
Code between #else and #endif is not compiled!
When you change the constant DEMO to 0, the other line will be compiled.

6.3 #ELSE

Action

Conditional compilation directive that tests for a NOT condition.

Syntax

#IF test
#ELSE
#ENDIF

Remarks

test	An expression to test for. The expression may contain defined constants.

Conditional compilation is used to include parts of your program. This is a convenient way to build different files depending on some constant values.
Note that unlike the IF statement, the #IF directive does not expect a THEN.
You may nest conditions to 25 levels.
The use of #ELSE is optional. The code between #ELSE and #ENDIF will be compiled when the expression is not true.

See Also

#IF 76 , #ENDIF 78

Example

```
CONST DEMO = 1  ' 0 = normal , 1= demo
#IF Demo
  Print "Demo program"
#ELSE
  Print "Full version"
#ENDIF
```

Since the constant DEMO is assigned with the value 1, the compiler will compile only the line : Print "Demo program" . Code between #else and #endif is not compiled! When you change the constant DEMO to 0, the other line will be compiled.

6.4 #ENDIF

Action

Conditional compilation directive that ends a test.

Syntax

#IF test
[**#ELSE**]
#ENDIF

Remarks

Test	An expression to test for. The expression may contain defined constants.

Conditional compilation is used to include parts of your program. This is a convenient way to build different files depending on some constant values.
Note that unlike the IF statement, the #IF directive does not expect a THEN.
You may nest conditions to 25 levels.
The use of #ELSE is optional.
Note that #ENDIF must be written as #ENDIF, not as #END IF

See Also

#IF 76 , #ELSE 78

Example

```
CONST DEMO = 1  ' 0 = normal , 1= demo
#IF Demo
  Print "Demo program"
#ELSE
  Print "Full version"
#ENDIF
```

Since the constant DEMO is assigned with the value 1, the compiler will compile only the line : Print "Demo program" . Code between #else and #endif is not compiled!

When you change the constant DEMO to 0, the other line will be compiled.

6.5 1WIRE

Action

These routines can be used to communicate with Dallas Semiconductors 1Wire-devices.

Syntax 1 for use with the CONFIG 1WIRE statement

1WRESET
1WWRITE var1 [, bytes]
var2 **= 1WREAD(** [bytes]**)**

Syntax 2 for use with multiple devices/pins

1WRESET pin
1WWRITE var1 [, bytes] pin
var2 **= 1WREAD(** [bytes] [, pin]**)**
var2 **= 1WREAD(** [pin]**)**

Pin is the port pin to use with the device such as P1.1

Remarks

1WRESET	Reset the 1WIRE bus. The error variable ERR will return 1 if an error occurred.
1WWRITE var1	Sends the value of var1 to the bus. Optional is the number of bytes that mist be sent. var1 is a numeric variable or constant.
var2 = 1WREAD ()	Reads a byte from the bus and places it into var2. Optional is the number of bytes that must be read. var2 is a number variable.

Example

```
'-------------------------------------------------------------
'                     1WIRE.BAS
' demonstrates 1wreset, 1wwrite and 1wread()
' pull-up of 4K7 required to VCC from P.1
' DS2401 serial button connected to P1.1
'-------------------------------------------------------------
Config 1wire = P1.1                   'use this pin
Dim Ar(8) As Byte , A As Byte , I As Byte

1wreset                               'reset the device
Print Err                             'print error 1 if error
1wwrite &H33                          'read ROM command
For I = 1 To 8
  Ar(i) = 1wread()                    'place into array
Next
For I = 1 To 8
   Printhex Ar(i);                    'print output
Next
Print
'linefeed

'You can also use multiple pins
```

```
'alias the pin first
Tsensor Alias P1.2

'the optional argument specifies the pin to use
1wreset Tsensor                                                 'reset

1wwrite &H33 Tsensor                                            'write
value to Tsensor
1wwrite Ar(1) , 2 Tsensor                                       'write 2
bytes to Tsensor
A = 1wread(tsensor)                                             'return
byte from Tsensor
Ar(1) = 1wread(2 , P1.2)                                        'read 2
bytes from Tsensor
End
```

6.6 1WIRECOUNT

Action

This statement returns the number of 1wire devices found on the bus.

Syntax

var2 = **1WIRECOUNT(array)**

Remarks

var2	A word variable that is assigned with the number if found 1wire devices on the bus.
Array	A variable or array that should be at least 8 bytes long. It is used to store the 1wire ID's while counting.

The 1wireCount function uses the 1wSearchFirst() and 1wSearchNexy functions internally.

See also

1WIRE 79 , 1WSEARCHFIRST 81, 1WSEARCHNEXT 83

Example

```
'----------------------------------------------------------------------
------
'                        1wirecount.bas
'                    (c)1995-2006 MCS Electronics
' demonstration of using multiple devices
'----------------------------------------------------------------------
-----
'chip we use
$regfile = "89s8252.dat"
'crystal attached
$crystal = 12000000

'baud rate
$baud = 4800

'wait for 500 mili secs
Waitms 500

'the pins we use
```

```
'connect a 4K7 resistor from the data pin to VCC
Config 1wire = P1.0

'we need an array of 8 bytes to hold the result
Dim Ar(8) As Byte
'we also need a counter variable and a word variable
Dim I As Byte , W As Word

'some ids of 1wire chips I tested
' 01 51 B5 8D 01 00 00 56
' 01 84 B3 8D 01 00 00 E5

Print "start"
'get the number of connected 1wire device
W = 1wirecount(ar(1))
'print if there was an error and how many sensors are available
Print "ERR " ; Err ; " count " ; W

'now get the data from the first 1wire device on the bus

Ar(1) = 1wsearchfirst()
'print the ID
For I = 1 To 8
  Printhex Ar(i);
Next
Print

'I assume that there are more than 1 1wire devices
Do
  'get the next device
  Ar(1) = 1wsearchnext()
  For I = 1 To 8
    Printhex Ar(i);
  Next
  Print
Loop Until Err = 1
'when ERR is 1 it means there are no more devices
' IMPORTANT : 1wsearchfirst and next functions do require that you use
the SAME array
'In this example this is ar(1)

'once you know the ID, you can address a specific device
End
```

6.7 1WSEARCHFIRST

Action

This statement reads the first ID from the 1wire bus into a variable array.

Syntax

var2 = **1WSEARCHFIRST( )**

Remarks

var2	A variable or array that should be at least 8 bytes long and that will be assigned with the 8 byte ID from the first 1wire device on the bus.

The 1wireSearchFirst() function must be called once to initiate the ID retrieval process. After the 1wireSearchFirst() function is used you should use successive function calls to the 1wireSearchNext function to retrieve other ID's on the bus.

A string can not be assigned to get the values from the bus. This because a null may be returned as a value and the null is also used as a string terminator.
We advice to use a byte array as shown in the example.

The ERR bit is set when there are no 1wire devices found.

See also

1WIRE 79, 1WIRECOUNT 80, 1WSEARCHNEXT 83

Example

```
'--------------------------------------------------------------------------
'                         1wirecount.bas
'                      (c) 1995-2006 MCS Electronics
'  demonstration of using multiple devices
'--------------------------------------------------------------------------
- - - -
'chip we use
$regfile = "89s8252.dat"
'crystal attached
$crystal = 12000000

'baud rate
$baud = 4800

'wait for 500 mili secs
Waitms 500

'the pins we use
'connect a 4K7 resistor from the data pin to VCC
Config 1wire = P1. 0

'we need an array of 8 bytes to hold the result
Dim Ar(8) As Byte
'we also need counter variable and a word variable
Dim I As Byte , W As Word

'some ids of 1wire chips I tested
' 01 51 B5 8D 01 00 00 56
' 01 84 B3 8D 01 00 00 E5

Print "start"
'get the number of connected 1wire device
W = 1wirecount(ar(1))
'print if there was an error and how many sensors are available
Print "ERR " ; Err ; " count " ; W

'now get the data from the first 1wire device on the bus

Ar(1) = 1wsearchfirst()
'print the ID
For I = 1 To 8
  Printhex Ar(i);
Next
Print

'I assume that there are more than 1 1wire devices
Do
  'get the next device
    Ar(1) = 1wsearchnext()
  For I = 1 To 8
    Printhex Ar(i);
```

```
  Next
  Print
Loop Until Err = 1
'when ERR is 1 it means there are no more devices
' IMPORTANT : 1wsearchfirst and next functions do require that you use
the SAME array
'In this example this is ar(1)

'once you know the ID, you can address a specific device

End
```

6.8 1WSEARCHNEXT

Action

This statement reads the next ID from the 1wire bus into a variable array.

Syntax

var2 = **1WSEARCHNEXT( )**

Remarks

var2	A variable or array that should be at least 8 bytes long that will be assigned with the 8 byte ID from the next 1wire device on the bus.

The 1wireSearchFirst() function must be called once to initiate the ID retrieval process. After the 1wireSearchFirst() function is used you should use successive function calls to the 1wireSearchNext function to retrieve other ID's on the bus.

A string can not be assigned to get the values from the bus. This because a null may be returned as a value and the null is also used as a string terminator.
I would advice to use a byte array as shown in the example.

The ERR variable is set when there are no more devices found.

See also

1WIRE 79 , 1WSEARCHFIRST 81, 1WIRECOUNT 80

Example

```
'------------------------------------------------------------------------
-----
'                        1wirecount.bas
'                    (c) 1995-2006 MCS Electronics
' demonstration of using multiple devices
'------------------------------------------------------------------------
----
'chip we use
$regfile = "89s8252.dat"
'crystal attached
$crystal = 12000000

'baud rate
$baud = 4800
```

```
'wait for 500 mili secs
Waitms 500

'the pins we use
'connect a 4K7 resistor from the data pin to VCC
Config 1wire = P1.0

'we need an array of 8 bytes to hold the result
Dim Ar(8) As Byte
'we also need a counter variable and a word variable
Dim I As Byte , W As Word

'some ids of 1wire chips I tested
' 01 51 B5 8D 01 00 00 56
' 01 84 B3 8D 01 00 00 E5

Print "start"
'get the number of connected 1wire device
W = 1wirecount(ar(1))
'print if there was an error and how many sensors are available
Print "ERR " ; Err ; " count " ; W

'now get the data from the first 1wire device on the bus

Ar(1) = 1wsearchfirst()
'print the ID
For I = 1 To 8
  Printhex Ar(i);
Next
Print

'I assume that there are more than 1 1wire devices
Do
  'get the next device
  Ar(1) = 1wsearchnext()
  For I = 1 To 8
    Printhex Ar(i);
  Next
  Print
Loop Until Err = 1
'when ERR is 1 it means there are no more devices
' IMPORTANT : 1wsearchfirst and next functions do require that you use
the SAME array
'In this example this is ar(1)

'once you know the ID, you can address a specific device
End
```

6.9 $ASM - $END ASM

Action
Start of inline assembly code block.

Syntax
$ASM

Remarks
Use $ASM together with $END ASM to insert a block of assembler code in your BASIC code.
You can also insert ASM code by preceding the line with the **!** sign.

See also

[ASM programming](235)

Example

```
Dim c as Byte
$ASM
  Mov r0,#{C}  ;address of c
  Mov a,#1
  Mov @r0,a         ;store 1 into var c
$END ASM
Print c
End
```

6.10 $BAUD

Action

Instruct the compiler to override the baud rate setting from the options menu.

Syntax

$BAUD = var

Remarks

Var	The baud rate that you want to use. Var must be a numeric constant.

When you want to use a crystal/baud rate that can't be selected from the options, you can use this compiler directive.
You must also use the $CRYSTAL 87 directive.
These statements always work together.

In the generated report you can view which baud rate is actually generated.
But the baud rate is only shown when RS-232 statements are used like PRINT, INPUT etc.

See also

$CRYSTAL 87

Example

```
$baud = 2400
$crystal = 14000000                        ' 14 MHz crystal
Print "Hello"
End
```

6.11 $BGF

Action

Binds a **B**ASCOM **G**raphic **F**ile into the program for use with Graphic LCD displays.

Syntax

$BGF "file"

Remarks

"file" is the name of the BGF file that is included in the program,
BMP files can be converted with the Tools Graphic Converter 50.

See also

SHOWPIC 216

Example

```
'--------------------------------------------------------------------
---------
'                          (c) 1995-2006 MCS Electronics
'                                GLCD.BAS
'             Sample to show support for T6963C based graphic display
'             Only 240*64 display is supported with 30 columns(yet)
'             At the moment the display can only be used in PORT mode
' Connection :
' P1.0 - P1.7  to DB0-DB7 of LCD
' P3.2         to FS, font select of LCD can be hard wired too
' P3.5         to CE, chip enable of LCD
' P3.4         to CD, code/data select of LCD
' P3.6         to WR of LCD
' P3.7         to RD of LCD
'A future version will allow external data access too which also uses
RD and WR
'The display from www.conrad.com needs a negative voltage for the
contrast.
'I used two 9 V batteries
'--------------------------------------------------------------------
---------
'configure the LCD display
Config Graphlcd = 240 * 64 , Port = P1 , Ce = P3.5 , Cd = P3.4 , Cols
= 30

'dimension some variables used by the DEMO
Dim X As Byte , Y As Byte

'
Reset P3.2                                                     '8 bit
wide char is 30 columns


'The following statements are supported:
Cls                                                            'will
clear graphic and text
'cls TEXT will clear only the text
'cls GRAPH will clear only the graphic part

'To init the display manual you can use:
'Lcdinit
'But this should not be needed as it is initilised at start up.

'Locate is supported and you can use 1-8 for the row and 1-30 for the
column
Locate 1 , 1
```

```
'cursor control is the same as for normal LCD
Cursor On Blink

'And to show some text you can use LCD
Lcd "Hello world"
'Note that the cursor position is not adjusted. You can set it with
locate

'Now comes the fun part for using a graphic LCD
'We can display a BMP file. You may use MSPAINT or any other tool that
can create
'a BMP file. With the Graphic converter from the Tools Menu you can
convert the file
'into a BGF file. (BASCOM GRAPHICS FILE). The conversion will convert
all non white
'pixels to BLACK.

'To display the BGF file you use the SHOWPIC statement that needs an X
and Y parameter
'the third param is the label where the data is stored.
'The position must be divideble by 8 because this is the way the
display handles the data

Showpic 0 , 0 , Picture1

'And we use the PSET known from QB to set or reset a single pixel
'A value of 0 means clear the pixel and 1 means set the pixel

'create a block
For X = 0 To 10
  For Y = 0 To 10
    Pset X , Y , 1
  Next
Next

'You could remove it too
For X = 0 To 10
  For Y = 0 To 10 Step 2
    Pset X , Y , 0
  Next
Next

'A simple scope or data logger could be made with PSET !
'We hope to get an AN from an inspired user :-)
End

'label for the picture
Picture1:
'$BGF includes the data from the specified file
$bgf "samples\mcs.bgf"
```

6.12 $CRYSTAL

Action

Instruct the compiler to override the crystal frequency options setting.

Syntax

$CRYSTAL = var

Remarks

var	Frequency of the crystal.

var : Constant.

When you want to use an unsupported crystal/baud rate you can use this compiler directive.
When you do, you must also use the corresponding $BAUD 85 directive.
These statements always work together.

See also

$BAUD 85

Example

```
$baud = 2400
$crystal = 14000000                          ' 14 MHz crystal
Print "Hello"
End
```

6.13 $DEFAULT XRAM

Action

Compiler directive to handle each dimensioned variable as XRAM variable.

Syntax

$DEFAULT XRAM | IRAM

Remarks

When you are using many XRAM variables it make sense to set this option, so you don't have to type XRAM each time.
To dimension a variable to be stored into IRAM, specify IRAM in that case.

See Also

DIM 137

Example

```
$default Xram
Dim X As Integer                             'will go to XRAM
Dim Z As Iram Integer                        'will be stored in IRAM
```

6.14 $EXTERNAL

Action

Compiler directive that instructs the compiler to include the specified assembler routines.

Syntax

$EXTERNAL myrout [, other]

Remarks

The $EXTERNAL directive is used internally by the compiler in order to enable the customizing of the assembler routines by the user.
You can use it to include your own assembler routines. At the moment using $EXTERNAL will always include the routine no matter if it is used or not.

See also

$LIB 91 , LIB Manager 51

Example

```
$LIB "mylib.lib"
$EXTERNAL _dec76
```

6.15 $INCLUDE

Action

Includes an ASCII file in the program at the current position.

Syntax

$INCLUDE "file"

Remarks

file	Name of the ASCII file which must contain valid BASCOM statements. This option can be used if you make use of the same routines in many programs. You can write modules and include them into your program. If there are changes to make you only have to change the module file, not all your BASCOM programs. You can only include ASCII files!

Example

```
'-----------------------------------------------------------------
'                    (c) 1995-2006 MCS Electronics
'-----------------------------------------------------------------
'  file: INCLUDE.BAS
'  demo: $INCLUDE
'-----------------------------------------------------------------
Print "INCLUDE.BAS"
$include "123.bas"                        'include file that prints
Hello
Print "Back in INCLUDE.BAS"
End
```

6.16 $IRAMSTART

Action
Compiler directive to specify starting internal memory location.

Syntax
$IRAMSTART = constant

Remarks

Constant	A constant with the starting value (0-255)

See also
$NOINIT 94 , $RAMSTART 99

Example
```
$NOINIT
$NOSP
$IRAMSTART = &H60              'first usable memory location
SP = 80
DIM I As Integer
```

6.17 $LARGE

Action
Instructs the compiler that LCALL statements must be used.

Syntax
$LARGE

Remarks
Internally when a subroutine is called the ACALL statement is used.
The ACALL instruction needs only 2 bytes (the LCALL needs 3 bytes)
The ACALL statement however can only address routines with a maximal offset of 2048 within the page. AT89C2051 chips will have no problems with that.

When code is generated for another uP, the subroutine being called can be further away and you will receive an error. With the $LARGE statement you instruct the compiler to use the LCALL statement which can address the full 64K address space.

Example
```
$LARGE           'I received an error 148 so I need this option
```

6.18 $LIB

Action
Compiler directive that instructs the compiler to look for assembler routines in the specified LIB file.

Syntax
$LIB "myrout.LIB"

Remarks
The $LIB directive is used internally by the compiler in order to enable the customizing of the assembler routines by the user.
You can use it to specify your own libraries. You can for example copy the mcs.lib file to a new file named mylib.lib and delete the content of the mcs.lib file. This way the compiler will use your routines. The mcs.lib file must exist in the \LIB subdirectory and that is why you may not delete it.
Always make a backup of the mcs.lib file before you change it.
It is not encouraged to change the mcs.lib file itself other than making a dummy because updates will contain more asm routines and you have to change everything for each update.

See also
$EXTERNAL 88

Example
```
$LIB "mylib.lib"
$EXTERNAL _dec76
```

6.19 $LCD

Action
Instruct the compiler to generate code for 8-bit LCD displays attached to the data bus.

Syntax
$LCD = [&H]*address*

Remarks

address	The address where must be written to, to enable the LCD display. The db0-db7 lines of the LCD must be connected to the datelines D0-D7. The RS line of the LCD must be connected to the address line A0. On systems with external RAM/ROM it makes more sense to attach the LCD to the data bus. With an address decoder you can select the LCD display.

See Also
$LCDRS 92

Example
```
$lcd = &HA000          'writing to this address will make the E line of
the LCD high.
Cls
Lcd "Hello world"
End
```

6.20 $LCDRS

Action
Instruct the compiler to generate code for 8-bit LCD displays attached to the data bus.

Syntax
$LCDRS = [&H]*address*

Remarks

Address	The address where must be written to, to enable the LCD display and the RS of the LCD. The db0-db7 lines of the LCD must be connected to the data lines D0-D7. The RS line of the LCD must be connected to the address line A0 by default. When it is connected to another address line you can specify $LCDRS On systems with external RAM/ROM it makes more sense to attach the LCD to the data bus. With an address decoder you can select the LCD display.

See Also
$LCD 91

Example
```
$lcd = &H8000          'writing to this address will make the E line of
the LCD high.
$lcdrs = &H8002        'writing to this address will make the RS line of
the LCD high.

Cls
Lcd "Elektor"
End
```

6.21 $MAP

Action
Generates info in the report file with hexadecimal address of each source line.

Syntax
$MAP

Remarks
For debugging it can be useful to know at which address a source line begins.

See also
NONE

Example
```
$MAP
Print "Hello"
Print "Test"
```

Will generate the following section in the report file :

```
Code map
----------------------------------------------------------
Line                              Address(hex)
----------------------------------------------------------
2                               52
3                               69
5                               80
```

6.22 $NOBREAK

Action
Instruct the compiler that BREAK statements must not be compiled.

Syntax
$NOBREAK

Remarks
With the BREAK statement, you can generate a reserved opcode that is used by the simulator to pause the simulation.
When you want to compile without these opcode's you don't have to remove the BREAK statement: you can use the $NOBREAK statement to achieve the same.

See also
BREAK 109

Example

```
$nobreak
Break           ' this isn't compiled into code so the simulator will
not pause
End
```

6.23 $NOINIT

Action

Instruct the compiler that no initialization must be performed.

Syntax

$NOINIT

Remarks

BASCOM initializes the processor depending on the used statements.
When you want to handle this by yourself you can specify this with the compiler directive **$NOINIT**.
The only initialization that is always done is the setting of the stack pointer and the initialization of the LCD display (if LCD statements are used).

When you have selected the Altair as a monitor in the Monitor options, the following code will be generated:

Mov IE,#255

Mov scon,#82
This because the Altair monitor needs this code despite of the $NOINIT. When you do not want that, you have to select HEX Monitor for example.

See also

$NOSP 96 , $NORAMCLEAR 95

Example

$NONIT
$NORAMCLEAR 95
'your program goes here
End

6.24 $NONAN

Action

Compiler directive for changing NAN (not a number) into 0.0

Syntax

$NONAN

Remarks
A single can return a NAN when it is not considered to be a number.
With the $NONAN directive 0.0 will be returned.

See also
NONE

Example
NONE

6.25 $NONULL

Action
Compiler directive for changing the behavior of the DATA statements.

Syntax
$NONULL = value

Remarks

value	0 for default behavior. And -1 for special behavior

When a string is stored with a DATA statement, a null is added to indicate the string end. In some situations you might not want this. When you write a custom routine to work with a long string for example. With $NONULL = -1 , the additional null byte is not added. To switch back to normal mode use a value of 0.

See also
NONE

Example
```
$nonull = -1
Lbl:
Data "test" , "this"
Lbl2:
$nonull = 0                                          'normal mode
Data "test" , "this"
```

6.26 $NORAMCLEAR

Action
Instruct the compiler that the internal RAM should not be cleared at start up.

Syntax
$NORAMCLEAR

Remarks

BASCOM clears the internal memory after a reset. When you don’t want this behavior you can use the $NORAMCLEAR compiler directive.

See also

NONE

Example

$NORAMCLEAR
‘your code goes here
End

6.27 $NOSP

Action

Instruct the compiler that the stack pointer must not be set.

Syntax

$NOSP

Remarks

BASCOM initializes the processor depending on the used statements.
When you want to handle this by yourself you can specify this with the compiler directive **$NOINIT**.
The only initialization that is always done is the setting of the stack pointer and the initialization of the LCD display (if LCD statements are used).
With the **$NOSP** directive the stack will not be initialized either.

See also

$NOINIT 94

Example

$NOSP
$NOINIT
End

6.28 $OBJ

Action

Includes Intel object code.

Syntax

$OBJ obj

Remarks

obj is the object code to include.
In some cases it can be useful to include object code. This object code can be generated with other tools.

Example

$OBJ D291 'this is equivalent to SET **P1.1**

6.29 $RAMSIZE

Action

Specifies the size of the external RAM memory.

Syntax

$RAMSIZE = [&H] size

Remarks

Size	Size of external RAM memory chip.

size : Constant.

See also

$RAMSTART 99

Example

```
$ROMSTART = &H4000
$RAMSTART = 0
$RAMSIZE = &H1000
DIM x AS XRAM Byte        'specify XRAM to store variable in XRAM
```

6.30 $RAMTRON

Action

Tell the compiler to use SPI memory as XRAM.

Syntax

$RAMTRON

Remarks

address	The (hex)-address where the data is stored. Or the lowest address which enables the RAM chip.

	You can use this option when you want to run your code in systems with external RAM memory.

Ramtron (www.ramtron.com) sell EEPROM's that are as fast as normal RAM chips. They can be written billions of times. The $ramtron directive will use such as ramtron device as xram device. This only works for the AT89S8252. You only add a ramtron EEPROM to the hardware SPI lines and when you dim a variable as XRAM, the EEPROM will be used to store and retrieve the data.

This is a convenient way to add more memory without adding an address decoder and a RAM chip. Since the EEPROM is housed in a 8 pins chip it will make your design simple.
Note however that it is best practice that writing to such a XRAM variable must not be excessive. The data sheet of the Ramtron chips show that you can write it many times and in effect it will take years until you reach the limit.

Note that $RAMTRON does not need a parameter.

ASM

When XRAM is written with Movx @dptr,a , a call will be made to _WriteRamtron. Nothing is destroyed or returned.
When XRAM is read with Movx a,@dptr , a call will be made to _ReadRamtron. Value is returned in ACC as movx a,@dptr would do too.
Both routines are in the mcs.lib file. Both routines call _Wait_Spif to wait for the SPI, SPIF bit.

Example

```
'--------------------------------------------------------
'                 (c) 1995-2006 MCS Electronics
'                       RAMTRON.BAS
' This example shos how to use the www.ramtron.com eeprom
' to be used a XRAM
'--------------------------------------------------------
'it works only for the 8252
$regfile = "89s8252.dat"



'tell the compiler about ramtron
'THIS SAMPLE WILL NOT SIMULATE beause of the $RAMTON directive
'Suggestion is to add the directive when you simulated your program
$ramtron

'dim some variables
Dim X As Byte , X1 As Byte

'Now dim XRAM. This will be stored in the Ramtron devic
Dim Z(10) As Xram Byte
```

```
Wait 1


'I used P1.3 for the CS so the mcs.lib also uses this pin
'P1.4 could be used too but it needs a change in the mcs.lib
'This sample works actually!
'But since I also have code like *+4 it will not work always
'I need to rewrite that code. Let me know when some routines dont work
'with the $ramtron directive

'fill the data
For X = 1 To 10
  Z(x) = X
Next

'print the data
For X = 1 To 10
  Print Z(x)
Next
End
```

6.31 $RAMSTART

Action

Specifies the location of the external RAM memory.

Syntax

$RAMSTART = [&H]address

Remarks

address	The (hex)-address where the data is stored. Or the lowest address which enables the RAM chip. You can use this option when you want to run your code in systems with external RAM memory. Address must be a numeric constant.

See also

$RAMSIZE 97

Example

```
$ROMSTART = &H4000
$RAMSTART = 0
$RAMSIZE = &H1000
```

6.32 $REGFILE

Action
Instructs the compiler to use the specified register file.

Syntax
$REGFILE = "file"

Remarks

File	The name of the register file to use.

The $REGFILE statement must be placed before any other executable statements or compiler directives.

See also
NONE

Example
'comment is no problem before the $REGFILE statement
$REGFILE = "8052.DAT"   'use the 8052.DAT file

6.33 $ROMSTART

Action
Specifies the location of the ROM memory.

Syntax
$ROMSTART = [&H] *address*

Remarks

address	The (hex)-address where the code must start. Default is 0. This value will be used when $ROMSTART is not specified. You can use this option when you want to test the code in RAM. The code must be uploaded and placed into the specified address and can be called from a monitor program. The monitor program must relocate the interrupts to the correct address! When $ROMSTART = &H4000 is specified the monitor program must perform a LJMP instruction. For address 3 this must be &H4003. Otherwise interrupts can not be handled correctly. But that is up to the monitor program.

See also

$RAMSTART 99

Example

```
$ROMSTART = &H4000        'ROM enabled at 4000 hex
```

6.34 $SERIALINPUT

Action

Specifies that serial input must be redirected.

Syntax

$SERIALINPUT = label

Remarks

Label	The name of the assembler routine that must be called when an character is needed from the INPUT routine. The character must be returned in ACC.

With the redirection of the INPUT command, you can use your own routines.
This way you can use other devices as input devices.
Note that the INPUT statement is terminated when a RETURN code (13) is received.

See also

$SERIALOUTPUT 102

Example

```
$SERIALINPUT = Myinput
'here goes your program
END
!myinput:
;perform the needed actions here
  mov a, sbuf  ;serial input buffer to acc
ret
```

6.35 $SERIALINPUT2LCD

Action

This compiler directive will redirect all serial input to the LCD display instead of echoing to the serial port.

Syntax

$SERIALINPUT2LCD

Remarks

You can also write your own custom input or output driver with the $SERIALINPUT and $SERIALOUTPUT statements, but the $SERIALINPUT2LCD is handy when you use a LCD display.

See also

$SERIALINPUT 101 , $SERIALOUTPUT 102

Example

```
$serialinput2lcd
Dim V As Byte
Cls
Input "Number " , V                         'this will go to the LCD
display
```

6.36 $SERIALOUTPUT

Action

Specifies that serial output must be redirected.

Syntax

$SERIALOUTPUT = label

Remarks

label	The name of the assembler routine that must be called when a character is sent to the serial buffer (SBUF). The character is placed into ACC.

With the redirection of the PRINT and other serial output related commands, you can use your own routines.
This way you can use other devices as output devices.

See Also

$SERIALINPUT 101

Example

```
$SERIALOUTPUT = MyOutput
'here goes your program
END
!myoutput:
;perform the needed actions here
  mov sbuf, a  ;serial output buffer  (default)
ret
```

6.37 $SIM

Action
Generates code without the actual waiting loops in order to speed up the simulator.

Syntax
$SIM

Remarks
When simulating the WAIT statement, you will experience that it takes a long time to execute. You can also switch off the updating of variables/source which costs time, but an alternative is the $SIM directive.

You must remove the $SIM statement when you want to place your program into a chip/EPROM.

See also
BREAK 109

Example
```
$SIM            'don't make code for WAIT and WAITMS
WAIT 2            'the simulator is faster now
```

6.38 $TIMEOUT

Action
Compiler directive to specify that the TIMEOUT option is used with serial input.

Syntax
$TIMEOUT

Remarks
$TIMEOUT will modify the serial input routine so that it enables you to use the TIMEOUT with the INPUT, INPUTBIN, INPUTHEX etc. statements.

See also
INPUT 169 , GET 203

Example
```
$TIMEOUT
DIM Name as string * 10
REM Now we can use theTIMEOUT option
INPUT "Name " , name TIMEOUT = 100000 'enable time out
INPUT "Name ", name  'wait until <13> pressed.
```

6.39 $WAIT

Action
Will insert a one second delay in the startup code.

Syntax
$WAIT

Remarks
When using the AT89C8252 ISP facility it is needed that the chip waits 1 second after reset. Otherwise it can occur that the chip can not be programmed serial anymore.
Do not confuse $WAIT with the WAIT statement.
$WAIT is only needed for the AT89C8252 !

See also
NONE

Example
```
$WAIT               'for at89c8252 only
```

6.40 ALIAS

Action
Indicates that the variable can be referenced with another name.

Syntax
newvar **ALIAS** oldvar

Remarks

Oldvar	Name of the variable such as P1.1
Newvar	New name of the variable such as direction

Aliasing port pins can give the pin names a more meaningful name.
You can also ALIAS a variable: M ALIAS var.0 for example.

See also
CONST 112

Example

```
Direction Alias P1.1                        'now you can refer to P1.1
with the variable direction
Set Direction                               'has the same effect as SET
P1.1

Dim A As Byte
M Alias A.0
N Alias A.1
Set M
Set N
If M = N Then
  Print "Both bits are set"
End If
End
```

6.41 ABS

Action

Returns the absolute value of a numeric variable.

Syntax

var **=** **ABS(**var2**)**

Remarks

var	Variable that is assigned the absolute value of var2. Var must be a numeric variable.
Var2	The source variable to retrieve the absolute value from. Var2 must be an integer or long.

The absolute value of a number is always positive.

See also

NONE

Example

```
Dim a as Integer, c as Integer
a = -1000
c = Abs(a)
Print c
End
```

Output

1000

6.42 ASC

Action
Convert a string into its ASCII value.

Syntax
var = ASC(string**)**

Remarks

var	Target variable that is assigned.
String	String variable or constant to retrieve the ASCII value from.

var : Byte, Integer, Word, Long.
string : String, Constant.

Note that only the first character of the string will be used.
When the string is empty, a zero will be returned.

See also
CHR 110

Example
```
Dim A As Byte , S As String * 10
S = "Abc"
A = Asc(s)
Print A
End
```

Output
65

6.43 AVG

Action
Returns the average value of a byte array.

Syntax
var = **AVG(** ar(1) **)**

Remarks

Var	Numeric variable that will be assigned with the lowest value of the array.
ar()	The first array element of the array to return the lowest value of.

At the moment AVG() works only with BYTE arrays.
Support for other data types will be added too.

See also

MAX 186 , MIN 188

Example

```
Dim ar(10) As Byte
Dim bP as Byte
For bP = 1 to 10
  ar(bP) = bP
Next
bP = Avg(ar(1))
Print bP
End
```

6.44 BAUD

Action

Instruct the compiler to set a new baud rate at run time.

Syntax

BAUD = var

Remarks

Var	The baud rate that you want to use.

var : Constant.

When you want to use a crystal/baud rate that can't be selected from the options, you can assign this special variable.
Do not confuse it with the $BAUD 85 directive!

See also

$CRYSTAL 87 , $BAUD 85

Example

```
$BAUD = 2400
$CRYSTAL = 14000000        ' 14 MHz crystal
PRINT "Hello"
BAUD = 9600
Print "Hello"
END
```

6.45 BCD

Action
Converts a variable into its BCD value.

Syntax
PRINT BCD(var **)**
LCD BCD(var **)**

Remarks

Var	Variable to convert. This must be a numeric variable or constant.

When you want to use a I2C clock device which stores its values as BCD values you can use this function to print the value correctly.
BCD() will displays values with a trailing zero.

The BCD() function is intended for the PRINT/LCD statements.
Use the MAKEBCD function to convert variables.

See also
MAKEBCD 185 , MAKEDEC 185

Example
```
Dim A As Byte
A = 65
Lcd A
Lowerline
Lcd Bcd(a)
End
```

6.46 BITWAIT

Action
Wait until a bit is set or reset.

Syntax
BITWAIT x **SET | RESET**

Remarks

x	Bit variable or internal register like P1.x , where x ranges form 0-7.

When using bit variables be sure that they are set/reset by software.
When you use internal registers that can be set/reset by hardware such as P1.0 this doesn't apply.

See also

NONE

Example

```
Dim A As Bit
Bitwait A , Set                              'wait until bit a is set
Bitwait P1.7 , Reset                         'wait until bit 7 of Port 1
is 0.
End
```

ASM

BITWAIT P1.0 , SET will generate :
Jnb h'91,*+0

BITWAIT P1.0 , RESET will generate :
Jb h'91,*+0

6.47 BREAK

Action

Generates a reserved opcode to pause the simulator.

Syntax

BREAK

Remarks

You can set a breakpoint in the simulator but you can also set a breakpoint from code using the BREAK statement.
Be sure to remove the BREAK statements when you debugged your program or use the $NOBREAK directive.

The reserved opcode used is **A5**.

See also

$NOBREAK 93

Example

```
PRINT "Hello"
BREAK           'the simulator will pause now
End
```

6.48 CALL

Action

Call and execute a subroutine.

Syntax

CALL Test [(var1, var-n)**]**

Remarks

var1	Any BASCOM variable or constant.
var-n	Any BASCOM variable or constant.
Test	Name of the subroutine. In this case Test

With the CALL statement you can call a procedure or subroutine.
As much as 10 parameters can be passed but you can also call a subroutine without parameters.
For example : **Call Test2**

The call statement enables you to implement your own statements.

You don't have to use the CALL statement:
Test2 will also call subroutine test2

When you don't supply the CALL statement, you must leave out the parenthesis.
So Call Routine(x,y,z) must be written as Routine x,y,z

See also

DECLARE 135, SUB 225

Example

```
Dim A As Byte , Bb As Byte
Declare Sub Test(bb As Byte)
A = 65
Call Test(a)                              'call test with parameter A
Test A                                    'alternative call
End

Sub Test(bb As Byte)                      'use the same variable as the
declared one
  Lcd Bb                                  'put it on the LCD
  Lowerline
  Lcd Bcd(bb)
End Sub
```

6.49 CHR

Action

Convert a byte, Integer/Word variable or a constant to a character.

Syntax

PRINT CHR(var**)**
s = CHR(var**)**

Remarks

Var	Byte, Integer/Word variable or numeric constant.
S	A string variable.

When you want to print a character to the screen or the LCD display,
you must convert it with the CHR() function.

See also

ASC 106

Example

```
Dim A As Byte
A = 65
Lcd A
Lowerline
Lcdhex A
Lcd Chr(a)
End
```

6.50 CLS

Action

Clear the LCD display and set the cursor home.

Syntax

CLS

Syntax for graphic LCD

CLS TEXT
CLS GRAPH
CLS BOTH

Remarks

Clearing the LCD display does not clear the CG-RAM in which the custom characters are stored.

See also

$LCD 91 , LCD 174

Example

```
Cls
Lcd "Hello"
Wait 5
Cls
End
```

6.51 CONST

Action

Declares a symbolic constant.

Syntax

CONST symbol = value

Remarks

symbol	The name of the symbol.
Value	The value to assign to the symbol.

Assigned constants consume no program memory.
The compiler will replace all occurrences of the symbol with the assigned value.
Value may also be an expression that uses other defined constants.
The functions that may be used for the expressions are : ASC , ABS, ATN, COS , EXP , FIX, INT , LOG, RND , SGN , SIN ,SQR , TAN.
Operators are : AND, OR ,XOR +, - , / , \ , ^ , * , NOT , > , < , = , >= , <=,<> , (,)

See also

DIM 137

Example

```
'-----------------------------------------------------
'               (c) 1995-2006 MCS Electronics
'               CONST.BAS
'-----------------------------------------------------
Dim A As Const 5                        'declare a as a constant
Dim B1 As Const &B1001
Dim S As Single
'Or use the new preferred syntax
Const Cbyte = &HF
Const Cint = -1000
Const Csingle = 1.1
Const Cstring = "test"

S = Csingle
Print S ; "  " ; Cstring
Waitms A                                'wait for 5 milliseconds
Print A
Print B1
End
```

6.52 CONFIG

The config statement configures all kind of hardware related statements.
Select one of the following topics to learn more about a specific config statement.

CONFIG TIMER0, TIMER1 127

CONFIG TIMER2 288 (for 8052 compatible chips)
CONFIG LCD 121
CONFIG LCDBUS 122
CONFIG LCDPIN 121
CONFIG BAUD 115
CONFIG 1WIRE 113
CONFIG SDA 125
CONFIG SCL 124
CONFIG DEBOUNCE 116
CONFIG WATCHDOG 128
CONFIG SPI 126
CONFIG I2CDELAY 116
CONFIG MICROWIRE 123
CONFIG SERVOS 125
CONFIG ADUC812 113
CONFIG GETRC 117
CONFIG PRINT 123
CONFIG GRAPHLCD 117

6.53 CONFIG 1WIRE

Action

Configure the pin to use for 1WIRE statements.

Syntax

CONFIG 1WIRE = pin

Remarks

pin	The port pin to use such as P1.0

See also

1WRESET 79 , 1WREAD 79 , 1WWRITE 79

Example

```
Config 1WIRE = P1.0         'P1.0 is used for the 1-wire bus
1WRESET                      'reset the bus
```

6.54 CONFIG ADUC812

Action

Configures the ADUC812 microprocessor.

Syntax for ADC

Config ADUC812 = ADCON , **MODE** = mode, **CLOCK** = clock , **AQUISITION** = aq , **TIMER2** = tm , **EXTRIG** = value

Syntax for DAC

Config ADUC812 = DAC , **MODE** = mode, **RANGE0** = r0 , **RANGE1** = r1 , **CLEAR0** = clr0 , **CLEAR1** = clr1 , **SYNC** = sync, **POWER0** = pwr0, **POWER1** = pwr1

Remarks ADC

mode	POWERDOWN, NORMAL, PDNE, STANDBY. PDNE means POWERDOWN if not executing a conversion cycle.
clock	This is a constant that specifies the clock division of the master clock. It may be 1,2,4 or 8. An ADC conversion will require 16 ADC clocks in addition to the selected number of acquisition clocks.
aq	This is a constant that specifies the time available for the input/track hold amplifier to acquire the input signal. It may be in range from 1-4. 1 Acquisition clock is enough for an impedance up to 8K
tm2	The TIMER2 can be ENABLED or DISABLED. When enabled the timer2 overflow serves as a trigger for the AD conversion.
value	The external trigger may be ENABLED or DISABLED. When enabled the external pin 23 (CONVST) can start the conversion while it is low.

Remarks DAC

Mode	The DAC can be in 8 bit mode or 12 bit mode. So the parameter may be 8 or 12. Both DACS are set with this parameter.
r0	The DAC0 range can be set to VDD or VREF. With VDD the range is from 0-VDD. For VREF it is 0-VREF.
r1	The DAC1 range can be set to VDD or VREF. With VDD the range is from 0-VDD. For VREF it is 0-VREF
clr0	This parameter when TRUE will clear the DAC0. This will set the output voltage to 0 V.
clr1	This parameter when TRUE will clear the DAC1. This will set the output voltage to 0 V
Sync	May be ENABLED or DISABLED. While enabled the DAC outputs as soon as the DACxL SFR's are written. The user can simutaneously update both DAC's by first updating the DACxL/H SFR's while SYNC is disabled. Both DACs will then update when the SYNC is enabled.
pwr0	This parameter when ON will power ON the DAC0. When OFF the DAC0 is powered OFF.
pwr1	This parameter when ON will power ON the DAC1. When OFF the DAC1 is powered OFF

6.55 CONFIG BAUD

Action

Configure the uP to select the intern baud rate generator.
This baud rate generator is only available in the 80515, 80517, 80535, 80537 and compatible chips.

Syntax

CONFIG BAUD = baud rate

Remarks

Baud rate	Baud rate to use : 4800 or 9600

Example

```
CONFIG BAUD = 9600       'use internal baud generator
Print "Hello"
End
```

6.56 CONFIG BAUD1

Action

Configure the uP to select the internal baud rate generator for serial channel 1.
This baud rate generator is only available in the 80517 and 80537.

Syntax

CONFIG BAUD1 = baudrate

Remarks

Baudrate	Baud rate to use : 2048 - 37500

The 80517 and 80537 have 2 serial ports on board.

See also

CONFIG BAUD 115

Example

```
CONFIG BAUD1 = 9600       'use internal baud generator

OPEN "Com2:" for Binary as #1
Print #1, "Hello"
Close #1
End
```

6.57 CONFIG DEBOUNCE

Action
Configures the delay time for the DEBOUNCE statement.

Syntax
CONFIG DEBOUNCE = time

Remarks

time	A numeric constant which specifies the delay time in mS.

When the debounce time is not configured, 25 mS will be used as a default.
Note that the delay time is based on a 12 MHz clock frequency.

See also
DEBOUNCE 133

Example
```
Config Debounce = 25 mS             '25 mS is the default
```

6.58 CONFIG I2CDELAY

Action
Configures the delay for the I2C clock.

Syntax
CONFIG I2CDELAY = value

Remarks

Value	A numeric constant. 1 will generate the default clock. 0 will generate a higher clock and >=2 will generate a lower clock frequency.

By default the following delay routine is called with an ACALL :

```
Delay5:
  Nop
Ret
```

For 12 MHz, there is a 1 MHz system clock. So not counting the other statement, the minimal delay is 4 * 2 = 8 cycles.
The I2Cdelay value will insert the number of specified NOP instructions.
By default the settings are right for all I2C devices and when working with a 12 MHz crystal.

See also

CONFIG SCL 124 , CONFIG SDA 125

Example

CONFIG I2CDELAY = 0 'we need a higher clock

6.59 CONFIG GETRC

Action

Configures the GETRC() charge time.

Syntax

Config GETRC = time

Remarks

Time	The time in milli seconds to charge the capacitor

See also

GETRC 154

6.60 CONFIG GRAPHLCD

Action

Configures the Graphical LCD display.

Syntax

Config GRAPHLCD = type , **PORT** = mode, **CE** = pin , **CD** = cd , **COLS** = 30

Remarks

Type	This must be one of the following : • 240 * 64 • 240 * 128
mode	This is the name of the port that is used to put the data on the LCD data pins db0-db7. P1 for example.
Ce	The name of the pin that is used to enable the chip on the LCD.
Cd	The name of the pin that is used to control the CD pin of the display.
Cols	The number of columns for use as text display. The current code is written for 30 columns only.

In the sample the following connections were used:

P1.0 to P1.7 to DB0-DB7 of the LCD
P3.2 to FS, font select of LCD can be hard wired too
P3.5 to CE, chip enable of LCD
P3.4 to CD, code/data select of LCD
P3.6 to WR of LCD, write
P3.7 to RD of LCD, read

The LCD used from www.conrad.de needs a negative voltage for the contrast.
Two 9V batteries were used with a pot meter.

The FS (font select) must be set low to use 30 columns and 8x8 fonts.
It may be connected to ground. This pin is not used by the software routines.
The current asm code only support 30 columns. You can change it however to use 40 columns.

The T6963C displays have both a graphical area and a text area. They can be used together. The routines use the XOR mode to display both text and graphics layered over each other.

The statements that can be used with the graphical LCD are :
CLS 111, will clear the graphic display and the text display
CLS GRAPH will clear only the graphic part of the display
CLS TEXT will only clear the text part of the display
CLS BOTH is the same as CLS and will clear both text and graphics.

LOCATE 181 **row,column** Will place the cursor at the specified row and column
The row may vary from 1 to 8 and the column from 1 to 30.

CURSOR 131 **ON/OFF BLINK/NOBLINK** can be used the same way as for text displays.

LCD 174 can also be the same way as for text displays.
LCDHEX 178 can also be used the same way as for text display

New are:
SHOWPIC 216 X, Y , Label where X and Y are the column and row and Label is the label where the picture info is placed.

PSET 203 X, Y , color Will set or reset a pixel. X can range from 0-239 and Y from 9-63. When color is 0 the pixel will turned off. When it is 1 the pixel will be set on.

$BGF 85 "file.bgf" 'inserts a BGF file at the current location
$TIFF is removed from the Help but it still supported this version. $BGF should be used however.

Example

```
'--------------------------------------------------------------------------------
'                    (c) 1995-2006 MCS Electronics
'                         GLCD.BAS
'          Sample to show support for T6963C based graphic display
'          Only 240*64 display is supported with 30 columns(yet)
'          At the moment the display can only be used in PORT mode
' Connection :
' P1.0 - P1.7  to DB0-DB7 of LCD
' P3.2         to FS, font select of LCD can be hard wired too
' P3.5         to CE, chip enable of LCD
' P3.4         to CD, code/data select of LCD
' P3.6         to WR of LCD
' P3.7         to RD of LCD
'A future version will allow external data access too which also uses RD and WR
'The display from www.conrad.com needs a negative voltage for the contrast.
'I used two 9 V batteries
'--------------------------------------------------------------------------------
'configure the LCD display
Config Graphlcd = 240 * 64 , Port = P1 , Ce = P3.5 , Cd = P3.4 , Cols = 30

'dimension some variables used by the DEMO
Dim X As Byte , Y As Byte

'
Reset P3.2                                          '8 bit wide char is 30 columns



'The following statements are supported:
Cls                                              'will clear graphic and text
'cls TEXT will clear only the text
'cls GRAPH will clear only the graphic part

'To init the display manual you can use:
'Lcdinit
'But this should not be needed as it is initilised at start up.

'Locate is supported and you can use 1-8 for the row and 1-30 for the column
Locate 1 , 1

'cursor control is the same as for normal LCD
Cursor On Blink
```

```
'And to show some text you can use LCD
Lcd "Hello world"
'Note that the cursor position is not adjusted. You can set it with locate

'Now comes the fun part for using a graphic LCD
'We can display a BMP file. You may use MSPAINT or any other tool that can create
'a BMP file. With the Graphic converter from the Tools Menu you can convert the file
'into a BGF file. (BASCOM GRAPHICS FILE). The conversion will convert all non white
'pixels to BLACK.

'To display the BGF file you use the SHOWPIC statement that needs an X and Y
parameter
'the third param is the label where the data is stored.
'The position must be dividable by 8 because this is the way the display handles the
data

Showpic 0 , 0 , Picture1

'And we use the PSET known from QB to set or reset a single pixel
'A value of 0 means clear the pixel and 1 means set the pixel

'create a block
For X = 0 To 10
  For Y = 0 To 10
    Pset X , Y , 1
  Next
Next

'You could remove it too
For X = 0 To 10
  For Y = 0 To 10 Step 2
    Pset X , Y , 0
  Next
Next

'A simple scope or data logger could be made with PSET !
'We hope to get an AN from an inspired user :-)
End

'label for the picture
Picture1:
'$BGF includes the data from the specified file
$bgf "samples\mcs.bgf"
```

6.61 CONFIG LCDPIN

Action

Override the LCD-options to store the settings in your program.

Syntax

CONFIG LCDPIN = PIN, DB4= P1.1,DB5=P1.2,DB6=P1.3,DB7=P1.4,E=P1.5, RS=P1.6

Remarks

P1.1 etc. are just an example in the syntax. The pins of the LCD display that must be connected in PIN mode are :

Name	LCD Display
DB4	DB4
DB5	DB5
DB6	DB6
DB7	DB7
E	E
RS	RS

The WR line of the display must be connected to GND.

See also

CONFIG LCD 121

Example

CONFIG LCDPIN = PIN ,DB4= P1.1,DB5=P1.2,DB6=P1.3,DB7=P1.4,E=P1.5, RS=P1.6

6.62 CONFIG LCD

Action

Configure the LCD display.

Syntax

CONFIG LCD = LCDtype

Remarks

LCDtype	The type of LCD display used. This can be : 40 * 4, 40 * 2, 16 * 1, 16 * 1a, 16 * 2, 16 * 4, 16 * 4, 20 * 2 or 20 * 4 , 40 * 4**a** or NHD0420 Default 16 * 2 is assumed.

The 16 * 1a LCD display is a special one. It is intended for the display that has the memory organized as 2 lines of 8 characters.

The 40 * 4a LCD display is also a special one. It has two ENABLE lines.
The CONFIG LCDPIN directive must be used to configure the second E line:

CONFIG LCDPIN = PIN , E1 = Pin, E2 = pin, etc.

To select between E1 and E2 you need to set the B register.

Mov b,#0 'selects E1

Mov b,#1 'selects E2

LCD with a constant will work and also with strings.

To call the low level routines :

Mov a,#2 ; code into acc

Mov B,#0 ; or use Mov b,#1

Acall LCD_CONTROL ; call routine

To send data use the low level routine WRITE_LCD instead of LCD_CONTROL

Most LCD routines will work with the 40*4a display but some will fail. In that case you need to use the low level ASM routines as shown above.

The NHD0420 is added in version 218. It is an I2C based LCD. See also the provided sample 89c51rd2-lcd-i2c.BAS.

Example

```
REM Sample for normal displays
CONFIG LCD = 40 * 4
LCD "Hello"               'display on LCD
FOURTHLINE          'select line 4
LCD "4"                'display 4
END
```

6.63 CONFIG LCDBUS

Action

Configures the LCD databus.

Syntax

CONFIG LCDBUS = constant

Remarks

constant	4 for 4-bit operation, 8 for 8-bit mode (default)

Use this statement together with the $LCD = address statement.
When you use the LCD display in the bus mode the default is to connect all the data lines. With the 4-bit mode you only have to connect data lines d7-d4.

See also
CONFIG LCD 121

Example
```
$LCD = &H8000            'address of enable signal
Config LCDBUS = 4          '4 bit mode
LCD "hello"
```

6.64 CONFIG MICROWIRE

Action
Configures the micro wire pins.

Syntax
Config Microwire = Pin , **Cs** = P1.1 , **Din** = P1.2 , **Dout** = P1.4 , **Clock** = P1.5 , **Al** = 7

Remarks
CS	Chip select
DIN	Data input
DOUT	Data output
CLOCK	Pin that generates the Clock
AL	Address lines. See table below. It depends if you work with bytes or words. In our example we will use the 93C46 and work with bytes. AL will be 7 in this case.

Chip	93C46		93C56		93C57		93C66	
Data bits	8	16	8	16	8	16	8	16
AL	7	6	9	8	8	7	9	8

See also
MWINIT 189 , MWWOPCODE 190 , MWWRITE 191 , MWREAD 189

Example
NONE

6.65 CONFIG PRINT

Action
Configures the PRINT statement.

Syntax

Config PRINT = pin
Config PRINTMODE = mode

Remarks

Pin	The pin to use for the output control such as P3.0
Mode	The mode of the control pin. SET or RESET.

When you want to control a RS-485 device you need an additional pin to control the buffer direction. When the pin must be high during printing use SET. When it must be low during print use RESET.

Example

Config Print = P3.0 'this pin controls the buffer
Config mode = SET 'during PRINT this pin goes high.
Print "Hello"

6.66 CONFIG SCL

Action

Overrides the SCL pin assignment from the Option Settings 54.

Syntax

CONFIG SCL = pin

Remarks

Pin	The port pin to which the I2C-SCL line is connected.

When you use different pins in different projects, you can use this statement to override the Options Compiler setting for the SCL pin. This way you will remember which pin you used because it is in your code and you do not have to change the settings from the options.
This statement can not be used to change the pin dynamically during runtime.

See also

CONFIG SDA 125 , CONFIG I2CDELAY 116

Example

CONFIG SCL = P3.5 'P3.5 is the SCL line

6.67 CONFIG SDA

Action

Overrides the SDA pin assignment from the Option Settings 54.

Syntax

CONFIG SDA = pin

Remarks

pin	The port pin to which the I2C-SDA line is connected.

When you use different pins in different projects, you can use this statement to override the Options Compiler setting for the SDA pin. This way you will remember which pin you used because it is in your code and you do not have to change the settings from the options.

See also

CONFIG SCL 124 , CONFIG I2CDELAY 116

Example

```
CONFIG SDA = P3.7                'P3.7 is the SDA line
```

6.68 CONFIG SERVOS

Action

Configures the number of servos and their pins.

Syntax

Config SERVOS = number , **SERVO1** = P1.1 , **SERVO2** = P1.2 , **SERVO3** = P1.4 , **SERVO4** = P1.5 , **RELOAD** = value

Remarks

number	The number of servos you want to use. When you specify 2, you must also add the SERVO1 and SERVO2 parameters.
servo1	The pin that is attached to servo 1.
servo2	The pin that is attached to servo 2.
servo3	The pin that is attached to servo 3.
servo4	The pin that is attached to servo 4.
RELOAD	The reload value in uS. Default 100 uS

The CONFIG SERVOS compiler directive will include an interrupt that will execute every 100 uS. The TIMER0 interrupt is enabled and the TIMER0 is started.

The number of bytes used by the use of SERVO's is 1 + number of servos.

When you use 2 servo's , it will take 3 bytes of internal memory.
TIMER0 can not be used by your program anymore.
To change the pulse duration you assign the special reserved variables the number of 100 uS steps:
SERVO1 = 8 '800 uS pulse
SERVO2 = 12 '1200 uS duration
After 20 mS the pulses will be sent again to the port pins.

The maximum number of servo's is 14. The example shows how to set it up for 4 servo's only.
When you specify RELOAD = 50 , 50 uS steps will be used!
When you have a lot of servo's the RELOAD must be higher than when you have less servos. When you have a reload of 10 uS for example it will be impossible for the 8051 to handle more than 1 servo without losing time.
For 2 servo's 20 or 25 should be used for best results.

6.69 CONFIG SPI

Action

Configures the SPI related statements.

Syntax

CONFIG SPI = SOFT, DIN = PIN, DOUT = PIN , CS = PIN, CLK = PIN ,DATA ORDER = DO, NOCS =
CONFIG SPI = ON
CONFIG SPI = OFF
CONFIG SPI = HARD, INTERRUPT = ON|OFF, DATA ORDER = LSB|MSB, MASTER=YES|NO,POLARITY=HIGH|LOW,PHASE=0|1,CLOCKRATE=4|16|64|128

Remarks

When you use the software SPI mode you must specify the following information:

DIN	Data input. Pin is the pin number to use such as p1.0
DOUT	Data output. Pin is the pin number to use such as p1.1
CS	Chip select. Pin is the pin number to use such as p1.2
CLK	Clock. Pin is the pin number to use such as p1.3
NOCS	Option without parameter. Use it to disable the resetting and setting of the CS pin.
DATA ORDER	Use MSB or LSB. With MSB, MS bit will be sent first. LSB option will send the LS bit first.
SPIOUTEDGE	Falling or Rising. Falling is the default. The edge specifies if the the data will be clocked with a low to high or a high to low edge.

When the NOCS option is used you must reset and set the CS pin yourself.
The option is intended when you want to do large transfers between the micro and the SPI device. With the little internal memory you can do that in steps but of course you don't want the CS pin to change after each use of the SPIIN or SPIOUT

routine.

When you want to use the hardware SPI that is available in the 89S8252, you must specify the following information:

INTERRUPT	ON or OFF to enable or disable that the SPI interrupt is set.
DATA ORDER	LSB or MSB. Determines which bit is sent first.
MASTER	Yes or No. Set it to Yes for usage with the BASCOM SPI routines.
POLARITY	High or Low. See the Atmel datasheet
PHASE	0 or 1.
CLOCKRATE	4, 16, 64 or 128. This is a division that determines the clock rate. The oscillator clock is divided by the number you specify.
ON	You can turn on/enable SPI by using this option. It sets the enable bit.
OFF	You an turn off the SPI by using this option. It resets the enable bit.

See also

SPIIN 220 SPIOUT 221

Example

Config SPI = SOFT, DIN = P1.0 , DOUT = P1.1, CS = P1.2, CLK = P1.3
SPIINIT ' init pins
SPIOUT var , 1 'send 1 byte

6.70 CONFIG TIMER0, TIMER1

Action

Configure TIMER0 or TIMER1.

Syntax

CONFIG TIMERx = COUNTER/TIMER , GATE=INTERNAL/EXTERNAL , MODE=0/3

Remarks

TIMERx	TIMER0 or TIMER1. COUNTER will configure TIMERx as a COUNTER and TIMER will configure TIMERx as a TIMER. A TIMER has built in clock input and a COUNTER has external clock input.
GATE	INTERNAL or EXTERNAL. Specify EXTERNAL to enable gate control with the INT input.
MODE	Time/counter mode 0-3. See Hardware for more details.

So CONFIG TIMER0 = COUNTER, GATE = INTERNAL, MODE=2 will configure TIMER0 as a COUNTER with no external gate control , in mode 2 (auto reload)

When the timer/counter is configured the timer/counter is stopped so you must start it afterwards with the START TIMERx statement.

See the additional statements for other microprocessors that use the CONFIG statement.

Example

```
CONFIG TIMER0=COUNTER, MODE=1, GATE=INTERNAL
COUNTER0 = 0                  'reset counter 0
START COUNTER0                'enable the counter to run
DELAY                         'wait a while
PRINT COUNTER0                'print it
END
```

6.71 CONFIG WATCHDOG

Action

Configures the watchdog timer from the AT89C8252

Syntax

CONFIG WATCHDOG = time

Remarks

Time	The interval constant in mS the watchdog timer will count to. Possible settings: 16 , 32, 64 , 128 , 256 , 512 , 1024 and 2048.

When the WD is started, a reset will occur after the specified number of mS.
With 2048, a reset will occur after 2 seconds, so you need to reset the WD in your programs periodically.

See also

START WATCHDOG 291 , STOP WATCHDOG 291 , RESET WATCHDOG 291

Example

```
'--------------------------------------------------------------
'                 (c) 1995-2006 MCS Electronics
' WATCHD.BAS demonstrates the AT89S8252 watchdog timer
' select 89s8252.dat !!!
'--------------------------------------------------------------
Config Watchdog = 2048                    'reset after 2048 mSec
Start Watchdog                            'start the watchdog timer
Dim I As Word
For I = 1 To 10000
  Print I                                 'print value
  '  Reset Watchdog
  'you will notice that the for next doesnt finish because of the reset
  'when you unmark the RESET WATCHDOG statement it will finish because
the
  'wd-timer is reset before it reaches 2048 msec
Next
```

```
End
```

6.72 COUNTER

Action

Set or retrieve the COUNTER0 or COUNTER1 variable.
For 8052 TIMER2 compatible chips, COUNTER2 can be used too.

Syntax

COUNTERX = var
var = **COUNTERX**

Remarks

Var	A byte, Integer/Word variable or constant that is assigned to the counter.
counterX	COUNTER0 , COUNTER1 or COUNTER2.

Use counterX = 0 to reset the counter.
The counter can count from 0 to 255 in mode 2 (8-bit auto reload).
And to 65535 in mode 1(16-bit).
In mode 0 the counter can count to 8192. The MSB and 5 bits of the LSB are used in that case. When you assign a constant to a TIMER/COUNTER in mode 0, the bits will be placed in the right place :
COUNTER0 = &B1_1111_1111_1111_1111 '13 bits
Will be translated for mode 0 into 1111_1111_0001_1111

The counterx variables are intended to set/retrieve the TIMER/COUNTER registers from BASCOM. COUNTER0 = TL0 and TH0.
So the COUNTERx reserved variable is a 16 bit variable.

To set TLx or THx, you can use : TL0 = 5 for example.

Note that the COUNTERx variable operates on both the TIMERS and COUNTER because the TIMERS and COUNTERS are the same thing except for the mode they are working in. To load a reload value, use the LOAD 180 statement.

After access to the counter, the timer/counter is stopped. So when it was running, start it with the statement START COUNTERx

Example

```
'--------------------------------------------------------------
'                      (c) 1995-2006 MCS Electronics
'--------------------------------------------------------------
'  file: COUNTER.BAS
'  demo: COUNTER
'--------------------------------------------------------------
'     Connect the timer input P3.4 to a frequency generator
'     *TIMER/COUNTER 1 is used for RS-232 baud rate generator
'--------------------------------------------------------------
Dim A As Byte , C As Integer
Config Timer0 = Counter , Gate = Internal , Mode = 1
'Timer0 = counter : timer0 operates as a counter
```

```
'Gate = Internal  : no external gate control
'Mode = 1         : 16-bit counter


Counter0 = 0                            'clear counter
Start Counter0                          'enable the counter to count
Do                                      'set up a loop
  A = Inkey                             'check for input
  C = Counter0                          'get counter value
  Print C                               'print it
  Start Counter0   're-start it because it was stopped by accessing the
COUNTER
Loop Until A = 27                       'until escape is pressed

End
```

For the next example the ASM code is shown:
COUNTER0 = 1000

Generated code :
Clr TCON.4
Mov tl0,#232
Mov th0,#3

6.73 CPEEK

Action

Returns a byte stored in code memory.

Syntax

var **= CPEEK(** address **)**

Remarks

var	Numeric variable that is assigned with the content of the program memory at address
address	Numeric variable or constant with the address location

There is no CPOKE statement because you cannot write into program memory.

See also

PEEK 198 , POKE 198 , INP 169 , OUT 196

Example

```
'-----------------------------------------------------
'              (c) 1995-2006 MCS Electronics
'                     PEEK.BAS
' demonstrates PEEk, POKE, CPEEK, INP and OUT
'
```

```
'---------------------------------------------------------------
Dim I As Integer , B1 As Byte
'dump internal memory
For I = 0 To 127                        'for a 8052 225 could be used
'  Break
  B1 = Peek(i)                          'get byte from internal
memory
  Printhex B1 ; "  ";
  'Poke I , 1                             'write a value into memory
Next
Print                                   'new line
'be careful when writing into internal memory !!

'now dump a part ofthe code-memory(program)
For I = 0 To 255
  B1 = Cpeek(i)                         'get byte from internal
memory
  Printhex B1 ; "  ";
Next
'note that you can not write into codememory!!

Out &H8000 , 1                          'write 1 into XRAM at address
8000
B1 = INP(&H8000)                        'return value from XRAM
Print B1
End
```

6.74 CURSOR

Action
Set the LCD cursor state.

Syntax
CURSOR ON / OFF   BLINK / NOBLINK

Remarks
You can use both the ON or OFF and BLINK or NOBLINK parameters.
At power up the cursor state is ON and NOBLINK.
For Graphic LCD 117 displays the state is ON BLINK

See also
DISPLAY 139

Example
```
Dim a as byte
A = 255
LCD a
```

```
Cursor Off                                'hide cursor
Wait 1                                    'wait 1 second
Cursor Blink                              'blink cursor
End
```

6.75 DATA

Action

Specifies values to be read by subsequent READ statements.

Syntax

DATA var [, varn]

Remarks

Var	Numeric or string constant.

To specify a character that cannot be written in the editor such as " you can use $34. The number is the ASCII value of the string. A null will be added so it will be a string of one character!

When you want to store the string data without the ending null you can use the $NONULL directive as shown below:
DATA "abcd" 'stored with and ending 0
$NONULL = -1 'from now on store the data without the extra 0
DATA "abcd" , "edgh"
$NONULL = 0 'and go back to the normal default operation

Version 2.09 supports expressions. You must use either expressions or normal constant data on the DATA lines. You may not mix them.

DATA INTEGER(15 * constval + x)
Where constval is a declare constant (CONST) and x is a CONST too.
The INTEGER() funtion must be used to indicate that the resulting constant is of the integer type.
Use WORD(), INTEGER(), LONG() or SINGLE() to specify the resulting constant.

Difference with QB

Integer and Word constants must end with the **%** -sign.
Long constants must end with the **&**-sign.
Single constants must end with the **!**-sign.

See also

READ 204 , RESTORE 208

Example

```
Dim A As Byte , I As Byte , L As Long , S As Xram String * 15
Restore Dta1                              'point to data
For A = 1 To 3
```

```
  Read I : Print I                          'read data and print it
Next

Restore Dta2                                'point to data
Read I : Print I                            ' integer data
Read I : Print I

Restore Dta3
Read L : Print L                            ' long data

Restore Dta4
Read S : Print S                            ' string data
END

DTA1:
Data 5 , 10 , 100

DTA2:
Data -1% , 1000%
'Integer and Word constants must end with the %-sign.
' (Integer : <0 or >255)

DTA3:
Data 1235678&
'long constants must end with the &-sign

DTA4:
Data "Hello world" , $34

REM You can also mix different constant types on one line
Data "TEST" , 5 , 1000% , -1& , 1.1!
```

6.76 DEBOUNCE

Action

Debounces a port pin connected to a switch.

Syntax

DEBOUNCE Px.y , state , label [, SUB]

Remarks

Px.y	A port pin like P1.0 , to examine.
State	0 for jumping when Px.y is low , 1 for jumping when Px.y is high
Label	The label to GOTO when the specified state is detected
SUB	The label to GOSUB when the specified state is detected

When you specify the optional parameter SUB, a GOSUB to label is performed instead of a GOTO.
The DEBOUNCE statements wait for a port pin to get high(1) or low(0).
When it does it will wait 25 mS and checks again (eliminating bounce of a switch)
When the condition is still true and there was no branch before, it branches to the label.
When DEBOUNCE is executed again, the state of the switch must have gone back in

the original position before it can perform another branch.
Each DEBOUNCE statement which uses a different port uses 1 BIT of the internal memory to hold it's state.

What also should be mentioned is that P2.2-P2.7 and P3 have internal pull up resistors. This can affect the debounce statement. With these port pins, debounce is best to be used as: **Debounce P1.1, 0, Pr [, sub]** , as it will not require an external pull up resistor.

See also

CONFIG DEBOUNCE 116

Example

```
'-----------------------------------------------------
'                   DEBOUN.BAS
'             Demonstrates DEBOUNCE
'-----------------------------------------------------
Config Debounce = 30                        'when the config statement
is not used a default of 25mS will be used

  'Debounce P1.1 , 1 , Pr 'try this for branching when high(1)
  Debounce P1.0 , 0 , Pr , Sub
  Debounce P1.0 , 0 , Pr , Sub
  '                   ^----- label to branch to
  '              ^---------- Branch when P1.0 goes low(0)
  '        ^---------------- Examine P1.0

  'When P1.0 goes low jump to subroutine Pr
  'P1.0 must go high again before it jumps again
  'to the label Pr when P1.0 is low

  Debounce P1.0 , 1                         'no branch
  Debounce P1.0 , 1 , Pr                    'will result in a return
without gosub
End

Pr:
  Print "P1.0 was/is low"
Return
```

6.77 DECR

Action

Decrements a variable by one.

Syntax

DECR var

Remarks

Var	Variable to be decremented.

var : Byte, Integer, Word, Long, Single.

There are often situations where you want a number to be decreased by 1.
The **DECR** statement is faster then var = var - 1.

See also

INCR 167

Example

```
'--------------------------------------------------------------
'                     (c) 1995-2006 MCS Electronics
'--------------------------------------------------------------
'  file: DECR.BAS
'  Demo: DECR
'--------------------------------------------------------------
Dim A As Byte

A = 5                                   'assign value to a
Decr A                                  'decrease (by one)
Print A                                 'print it
End
```

6.78 DECLARE

Action

Declares a subroutine.

Syntax

DECLARE SUB TEST[(var as type)]

Remarks

test	Name of the procedure.
Var	Name of the variable(s). Maximum 10 allowed.
Type	Type of the variable(s). Bit, Byte,Word, Integer, Long or String.

You must declare each sub before writing or using the sub procedure.

See also

CALL 109, SUB 225

Example

```
Dim A As Byte , B1 As Byte , C As Byte
Declare Sub Test(a As Byte)
A = 1 : B1 = 2 : C = 3

Print A ; B1 ; C

Call Test(b1)
Print A ; B1 ; C
End


Sub Test(a As Byte)
  Print A ; B1 ; C
End Sub
```

6.79 DEF

Action

Declares all variables that are not dimensioned of the DefXXX type.

Syntax

DEFBIT b
DEFBYTE c
DEFINT I
DEFWORD x

Difference with QB

QB allows you to specify a range like DEFINT A - D. BASCOM doesn't support this.

Example

```
Defbit b : DefInt c        'default type for bit and integers
Set b1        'set bit to 1
c = 10        'let c = 10
```

6.80 DEFLCDCHAR

Action

Define a custom LCD character.

Syntax

DEFLCDCHAR char,r1,r2,r3,r4,r5,r6,r7,r8

Remarks

char	Variable representing the character (0-7).

r1-r8	The row values for the character.

char : Byte, Integer, Word, Long, Constant.
r1-r8 : Constant.

You can use the LCD designer to build the characters.

It is important that after the DEFLCDCHAR statement(s), a CLS follows.

The special characters can be printed with the Chr() function.

See also

Edit LCD designer 50 , LCD 174

Example

```
DefLCDchar 0,1,2,3,4,5,6,7,8        'define special character
Cls                                 'select LCD DATA RAM
LCD Chr(0)                          'show the character
End
```

6.81 DELAY

Action

Delay program execution for a short time.

Syntax

DELAY

Remarks

Use DELAY to wait for a short time.
The delay time is 100 microseconds based on a system frequency of 12 MHz.

See also

WAIT 229 , WAITMS 230

Example

```
P1 = 5          'write 5 to port 1
DELAY           'wait for hardware to be ready
```

6.82 DIM

Action

Dimension a variable.

Syntax

DIM var **AS** **[XRAM/IRAM]** type

Remarks

Var	Any valid variable name such as b1, i or longname. var can also be an array : ar(10) for example.
Type	Bit/Boolean, Byte, Word, Integer, Long, Single or String
XRAM	Specify XRAM to store variable in external memory
IRAM	Specify IRAM to store variable in internal memory (default)

A string variable needs an additional parameter that specifies the length of the string:
Dim s As XRAM **String * 10**
In this case, the string can have a length of 10 characters.

Note that BITS can only be stored in internal memory.

Difference with QB

In QB you don't need to dimension each variable before you use it. In BASCOM you must dimension each variable before you use it.
Also the XRAM/IRAM options are not available in QB.

See Also

CONST 112 , ERASE 143

Example

```
'--------------------------------------------------------------
'                     (c) 1995-2006 MCS Electronics
'--------------------------------------------------------------
'  file: DIM.BAS
'  demo: DIM
'--------------------------------------------------------------
Dim B1 As Bit                           'bit can be 0 or 1
Dim A As Byte                           'byte range from 0-255
Dim C As Integer                        'integer range from -32767 -
+32768
Dim L As Long
Dim S As Single
'Assign bits
B1 = 1                                  'or
Set B1                                  'use set
'Assign bytes
A = 12
A = A + 1
'Assign integer
C = -12
C = C + 100
```

```
Print C
'Assign long
L = 12345678
Print L
'Assign single
S = 1234.567
Print S
End
```

6.83 DISABLE

Action

Disable specified interrupt.

Syntax

DISABLE interrupt

Remarks

Interrupt	**INT0**, **INT1**, **SERIAL**, **TIMER0**, **TIMER1 or TIMER2**.

For other chips : INT2, INT3, INT4, INT5, INT6, INT7 , INT8, CAN

By default all interrupts are disabled.
To disable all interrupts specify INTERRUPTS.
To enable the enabling and disabling of individual interrupts use ENABLE INTERRUPTS.

Depending on the chip used, there can be more interrupts.
Look at microprocessor support 287 for more details.

See also

ENABLE 141

Example

```
Enable Interrupts                          'enable the setting of interrupts
Enable Timer0                              'enable TIMER0
Disable Serial                             'disables the serial interrupt.
Disable Interrupts                         'disable all interrupts
```

6.84 DISPLAY

Action

Turn LCD display on or off.

Syntax

DISPLAY ON / OFF

Remarks
The display is turned on at power up.

See also
CURSOR 131 , LCD 174

Example
```
Dim a as byte
a = 255
LCD a
DISPLAY OFF
Wait 1
DISPLAY ON
End
```

6.85 DO

Action
Repeat a block of statements until condition is true.

Syntax
DO
  statements
LOOP [UNTIL expression **]**

Remarks
You can exit a DO..LOOP with the EXIT DO 144 statement.

See also
EXIT 144 , WHILE 232 WEND 232 , FOR 144 , NEXT 192

Example
```
Dim A As Byte
Do                                          'start the loop
   A = A + 1                                'increment A
   Print A                                  'print it
Loop Until A = 10                           'Repeat loop until  A = 10
Print A                                     'A is still 10 here
```

6.86 ELSE

Action
Executed if the IF-THEN expression is false.

Syntax

ELSE

Remarks

You don't have to use the ELSE statement in an IF THEN .. END IF structure.
You can use the ELSEIF statement to test for another condition.

IF a = 1 THEN
...
ELSEIF a = 2 THEN
..
ELSEIF b1 > a THEN
...
ELSE
...
END IF

See also

IF 165 , END IF 142 SELECT CASE 212

Example

```
Dim A As Byte
A = 10                                  'let a = 10
If A > 10 Then                          'make a decision
   Print "A >10"                        'this will not be printed
Else                                    'alternative
   Print "A not greater than 10"        'this will be printed
END IF
```

6.87 ENABLE

Action

Enable specified interrupt.

Syntax

ENABLE interrupt

Remarks

Interrupt	**INT0**, **INT1**, **SERIAL**, **TIMER0**, **TIMER1** or **TIMER2**

For other chips also : INT2, INT3, INT4, INT5, INT6, INT7, INT8 , CAN

By default all interrupts are disabled.
To enable the enabling and disabling of interrupts use ENABLE INTERRUPTS.

Other microprocessors can have more interrupts than the 8051/8052.
Look at specific microprocessor support 287 for more details.

See also
DISABLE 139

Example
```
ENABLE INTERRUPTS        'allow interrupts to be set
ENABLE TIMER1            'enables the TIMER1 interrupt
```

6.88 END

Action
Terminate program execution.

Syntax
END

Remarks
STOP can also be used to terminate a program.

When an END or STOP statement is encountered, a never ending loop is generated.

See also
STOP 222

Example
```
PRINT " Hello"       'print this
END                  'end program execution
```

6.89 END IF

Action
End an IF .. THEN structure.

Syntax
END IF

Remarks
You must always end an IF .. THEN structure with an END IF statement.

You can nest IF ..THEN statements.
The use of ELSE is optional.

The editor converts ENDIF to End If when the reformat option is switched on.

See also

IF THEN 165 , ELSE 140

Example

```
Dim Nmb As Byte
Again:                                     'label
Input " Number " , Nmb                     'ask for number
If Nmb = 10 Then                           'compare
   Print " Number is 10"                   'yes
Else                                       'no
    If Nmb > 10 Then                       'is it greater
Print " Number > 10"                      'yes
    Else                                   'no
Print " Number < 10"                      'print this
    End If                                 'end structure
End If                                     'end structure
End                                        'end program
```

6.90 ERASE

Action

Erases a variable so memory will be released.

Syntax

ERASE var

Remarks

var	The name of the variable to erase.

The variable must be dimensioned before you can erase it.

When you need temporary variables you can erase them after you used them. This way your program uses less memory.

You can only ERASE the last dimensioned variables. So when you DIM 2 variables for local purposes, you must ERASE these variables. The order in which you ERASE them doesn't matter.

For example :
Dim a1 as byte , a2 as byte , a3 as byte , a4 as byte
'use the vars
ERASE a3 : ERASE a4   'erase the last 2 vars because they were temp vars
Dim a5 as Byte 'Dim new var
Now you can't erase the vars a1 and a2 anymore !

Note that ERASED variables don't show up in the report file nor in the simulator.

Example

```
Dim A As Byte                               'DIM variable
A = 255                                     'assign value
Print A                                     'PRINT variable
Erase A                                     'ERASE
Dim A As Integer                            'DIM again but now as INT
Print A                                     'PRINT again
REM Note that A uses the same space a the previous ERASED var A so
REM it still holds the value of the previous assigned variable
```

6.91 EXIT

Action

Exit a FOR..NEXT, DO..LOOP , WHILE ..WEND or SUB..END SUB.

Syntax

EXIT [**FOR**] [**DO**] [**WHILE**] [**SUB**]

Remarks

With the EXIT ... statement you can exit a structure at any time.

See also

FOR 144 , DO 140 , WHILE 232

Example

```
Dim A As Byte , B1 As Byte                  'DIM variable
A = 2 : B1 = 1
If A >= B1 Then                             'some silly code
   Do                                       'begin a DO..LOOP
     A = A + 1                              'inc a
      If A = 100 Then                       'test for a = 100
         Exit Do                            'exit the DO..LOOP
      End If                                'end the IF..THEN
  Loop                                      'end the DO
End If                                      'end the IF..THEN
```

6.92 FOR

Action

Execute a block of statements a number of times.

Syntax

FOR var = start **TO/DOWNTO** end [**STEP** value]

Remarks

Var	The variable counter to use
Start	The starting value of the variable var
End	The ending value of the variable var
Value	The value var is increased/decreased with each time NEXT is encountered.

var : Byte, Integer, Word, Long, Single.
start: Byte, Integer, Word, Long, Single, Constant.
end : Byte, Integer, Word, Long, Single, Constant.
step : Byte, Integer, Word, Long, Single, Constant.

For incremental loops you must use TO.
For decremental loops you must use DOWNTO.
You may use TO for a decremental loop but in that case you must use a negative STEP :
For a = 10 To 1 STEP **-1**
You must end a FOR structure with the NEXT statement.
The use of STEP is optional. By default a value of 1 is used.

See also

NEXT 192 , EXIT FOR 144

Example

```
Dim Y As Byte , A As Byte,x as byte

y = 10     'make y 10
For A = 1 To 10                                 'do this 10 times
For X = Y To 1                                 'this one also
  Print X ; A                                   'print the values
Next                                           'next x (count down)
Next                                            'next a (count up)


Dim S As Single
For S = 1 To 2 Step 0.1
  Print S
Next
End
```

6.93 FOURTHLINE

Action

Reset LCD cursor to the fourth line.

Syntax

FOURTHLINE

Remarks
Only valid for LCD displays with 4 lines.

See also
HOME 162 , UPPERLINE 228 , LOWERLINE 184 , THIRDLINE 226 , LOCATE 181

Example
Dim a as byte
a = 255
LCD a
Fourthline
LCD a
Upperline
END

6.94 FUSING

Action
Formats a floating point value.

Syntax
var = **Fusing**(source, mask)

Remarks

Var	The string that is assigned with the result.
Source	A variable of the type single that must be formatted.
Mask	The formatting mask . ###.## The # sign is used to indicate the number of digits before and after the decimal point. Normal rounding is used. When you don't need rouding the result, use the & sign instead of the # sign after the point. When you want leading zero's use the 0 character before the point.

See also
STR 224

Example
```
Dim S As Single , Targ As String * 16
'The FUSING() function formats a single into a string in order to
'represent it better without all the digits after the point
```

```
'assign single
S = 99.4999
Targ = Fusing(s , ##.#)
Print Targ
'with the # mask, you can provide the number of digits before and
after 'the point
'the result should be 99.5


'with a 0 before the point, you can indicate how many digits you want
to 'have filled with zeros
Targ = Fusing(s , 000.#)
'the result should be 099.5

'When you dont want that the result is rounded, you can use the &
indicator

Targ = Fusing(s , 000.&&)
'result should be 099.49

'note that if the number of digits you provide is not enough to store
the 'result result is extended automaticly

'Also note that the - sign will use one digit of the mask too

S = -99.12
Targ = Fusing(s , 00.&&)
'result is -99.12
End
```

6.95 GET

Action

Retrieves a byte from the software UART.

Syntax

GET #channel , var

Remarks

Channel	Positive numeric constant that refers to the opened channel.
Var	A variable that receives the value from the software UART.

Note that the channel must be opened with the OPEN statement.
Also, note that the CLOSE statement, must be the last in your program. Please see comment on OPEN 194 statement
An optional TIMEOUT can be specified so that the routine will return when no character is received.

See also

PUT 203 , $TIMEOUT 103

Example

```
Dim S As String * 12 , I As Byte , A As Byte , Dum As Byte

Open "com3.1:9600" For Output As #1 'p3.1 is normally used for tx so
testing is easy
Open "com3.0:9600" For Input As #2 'p3.0 is normally used for RX so
testing is easy


S = "test this"   'assign string
Dum = Len(s)   'get length of string
For I = 1 To Dum  'for all characters from left to right
  A = Mid(s , I , 1)  'get character
  Put #1 , A   'write it to comport
Next

Do
  Get #2 , A   'get character from comport
  Put #1 , A   'write it back
  Print A    'use normal channel
Loop

Printbin #1, a   'Printbin is also supported
Inputbin #2, a   'Inputbin is also supported

Close #1                                ' finally close device
Close #2
End

'To use the TIMEOUT option include (without the remarks):
'$TIMEOUT
'  Get #2 , A TIMEOUT = 10000  'get character from comport
```

6.96 GETAD

Action

Retrieves the analog value from channel 0-7.
Channel ranges from 0-11 on a 80517 or 80537.

Syntax

var = **GETAD**(channel, range)

Remarks

Var	The variable that is assigned with the A/D value
Channel	The channel to measure
Range	The internal range selection. 0 = 0-5 Volt 192 = 0 - 3.75 Volt 128 = 0 - 2.5 Volt 64 = 0 - 1.25 Volt 12 = 3.75 - 5 Volt 200 = 2.5 - 3.75 Volt 132 = 1.25 - 2.5 Volt

The GETAD() function is only intended for the 80515, 80535,80517, 80535 and 80552.
For the 89Cc051 use GETAD2051().
It is a microprocessor depended support 287 feature.

See also

GETAD2051 149

Example

```
Dim b1 as Byte, Channel as byte,ref as byte
channel=0                    'input at P6.0
ref=0                        'range from 0 to 5 Volt
b1=getad(channel,ref)         'place A/D into b1
```

6.97 GETAD2051

Action

Retrieves the analog value from a 89C2051 or 89C4051.

Syntax

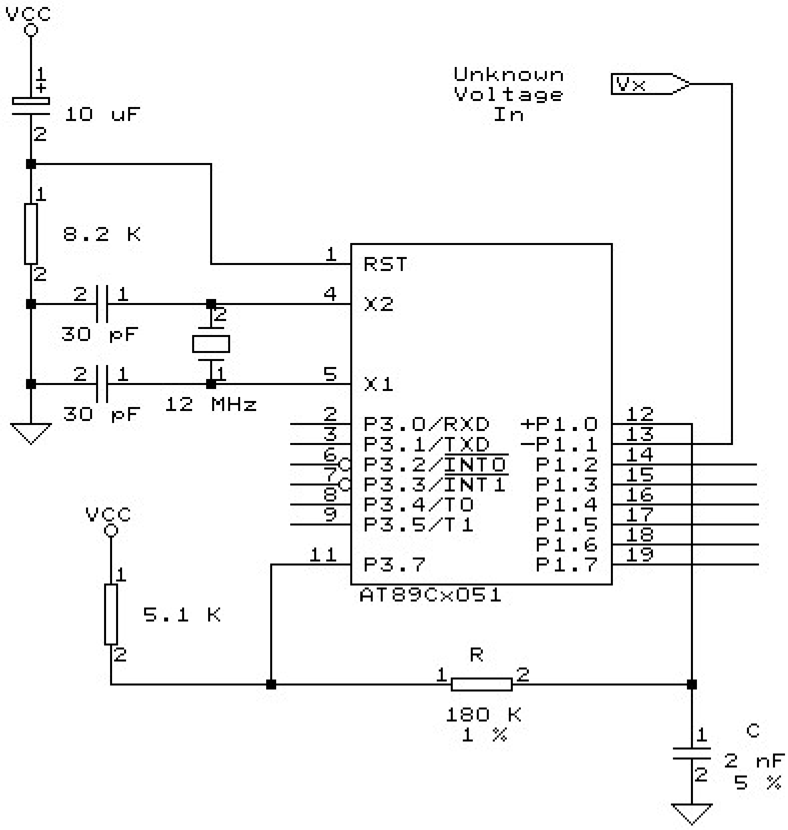
var = **GETAD2051**()

Remarks

var	The variable that is assigned with the A/D value

The GETAD2051() function is only intended for the 89C2051 and 89C4051. It uses the analog comparator of the chip.

Connect the hardware as following :



See also

[GETAD](148)

Example

```
$regfile = "89c2051.dat"
Dim A As Byte
Do
  A = Getad2051()
  A = Lookup(a , Dta)
  Print A
Loop
End

'this table converts the value into a packed BCD value
'this value can be used to diaplay the value on 2 7-segment displays

Dta:
  Data 0                                ' 0  0.000
  Data 1                                ' 1  0.047
  Data 1                                ' 2  0.093
```

```
Data 2                                      ' 3  0.138
Data 2                                      ' 4  0.184
Data 3                                      ' 5  0.229
Data 3                                      ' 6  0.273
Data 3                                      ' 7  0.317
Data 4                                      ' 8  0.361
Data 4                                      ' 9  0.404
Data 5                                      ' 10 0.447
Data 5                                      ' 11 0.489
Data 6                                      ' 12 0.531
Data 6                                      ' 13 0.573
Data 6                                      ' 14 0.614
Data 7                                      ' 15 0.655
Data 7                                      ' 16 0.696
Data 8                                      ' 17 0.736
Data 8                                      ' 18 0.776
Data 8                                      ' 19 0.815
Data 9                                      ' 20 0.854
Data 9                                      ' 21 0.893
Data &H10                                     ' 22 0.931
Data &H10                                     ' 23 0.969
Data &H10                                     ' 24 1.006
Data &H11                                     ' 25 1.044
Data &H11                                     ' 26 1.080
Data &H11                                     ' 27 1.117
Data &H12                                     ' 28 1.153
Data &H12                                     ' 29 1.189
Data &H12                                     ' 30 1.224
Data &H13                                     ' 31 1.260
Data &H13                                     ' 32 1.295
Data &H13                                     ' 33 1.329
Data &H14                                     ' 34 1.363
Data &H14                                     ' 35 1.397
Data &H14                                     ' 36 1.431
Data &H15                                     ' 37 1.464
Data &H15                                     ' 38 1.497
Data &H15                                     ' 39 1.530
Data &H16                                     ' 40 1.562
Data &H16                                     ' 41 1.594
Data &H16                                     ' 42 1.626
Data &H17                                     ' 43 1.657
Data &H17                                     ' 44 1.688
Data &H17                                     ' 45 1.719
Data &H18                                     ' 46 1.750
```

```
Data &H18                                   ' 47 1.780
Data &H18                                   ' 48 1.810
Data &H19                                   ' 49 1.840
Data &H19                                   ' 50 1.869
Data &H19                                   ' 51 1.898
Data &H19                                   ' 52 1.927
Data &H20                                   ' 53 1.956
Data &H20                                   ' 54 1.984
Data &H20                                   ' 55 2.012
Data &H21                                   ' 56 2.040
Data &H21                                   ' 57 2.068
Data &H21                                   ' 58 2.095
Data &H21                                   ' 59 2.122
Data &H22                                   ' 60 2.149
Data &H22                                   ' 61 2.176
Data &H22                                   ' 62 2.202
Data &H22                                   ' 63 2.228
Data &H23                                   ' 64 2.254
Data &H23                                   ' 65 2.279
Data &H23                                   ' 66 2.305
Data &H23                                   ' 67 2.330
Data &H24                                   ' 68 2.355
Data &H24                                   ' 69 2.379
Data &H24                                   ' 70 2.404
Data &H24                                   ' 71 2.428
Data &H25                                   ' 72 2.452
Data &H25                                   ' 73 2.476
Data &H25                                   ' 74 2.499
Data &H25                                   ' 75 2.523
Data &H26                                   ' 76 2.546
Data &H26                                   ' 77 2.569
Data &H26                                   ' 78 2.591

Data &H50                                   ' 79 5.000
Data &H49                                   ' 80 4.953
Data &H49                                   ' 81 4.907
Data &H48                                   ' 82 4.862
Data &H48                                   ' 83 4.816
Data &H47                                   ' 84 4.771
Data &H47                                   ' 85 4.727
Data &H47                                   ' 86 4.683
Data &H46                                   ' 87 4.639
Data &H46                                   ' 88 4.596
Data &H45                                   ' 89 4.553
```

```
Data &H45                                           ' 90 4.511
Data &H44                                           ' 91 4.469
Data &H44                                           ' 92 4.427
Data &H44                                           ' 93 4.386
Data &H43                                           ' 94 4.345
Data &H43                                           ' 95 4.304
Data &H42                                           ' 96 4.264
Data &H42                                           ' 97 4.224
Data &H42                                           ' 98 4.185
Data &H41                                           ' 99 4.146
Data &H41                                           ' 100 4.107
Data &H40                                           ' 101 4.069
Data &H40                                           ' 102 4.031
Data &H40                                           ' 103 3.994
Data &H39                                           ' 104 3.956
Data &H39                                           ' 105 3.920
Data &H39                                           ' 106 3.883
Data &H38                                           ' 107 3.847
Data &H38                                           ' 108 3.811
Data &H38                                           ' 109 3.776
Data &H37                                           ' 110 3.740
Data &H37                                           ' 111 3.705
Data &H37                                           ' 112 3.671
Data &H36                                           ' 113 3.637
Data &H36                                           ' 114 3.603
Data &H36                                           ' 115 3.569
Data &H35                                           ' 116 3.536
Data &H35                                           ' 117 3.503
Data &H35                                           ' 118 3.470
Data &H34                                           ' 119 3.438
Data &H34                                           ' 120 3.406
Data &H34                                           ' 121 3.374
Data &H33                                           ' 122 3.343
Data &H33                                           ' 123 3.312
Data &H33                                           ' 124 3.281
Data &H32                                           ' 125 3.250
Data &H32                                           ' 126 3.220
Data &H32                                           ' 127 3.190
Data &H31                                           ' 128 3.160
Data &H31                                           ' 129 3.131
Data &H31                                           ' 130 3.102
Data &H31                                           ' 131 3.073
Data &H30                                           ' 132 3.044
Data &H30                                           ' 133 3.016
```

```
Data &H30                                    ' 134 2.988
Data &H29                                    ' 135 2.960
Data &H29                                    ' 136 2.932
Data &H29                                    ' 137 2.905
Data &H29                                    ' 138 2.878
Data &H28                                    ' 139 2.851
Data &H28                                    ' 140 2.824
Data &H28                                    ' 141 2.798
Data &H28                                    ' 142 2.772
Data &H27                                    ' 143 2.746
Data &H27                                    ' 144 2.721
Data &H27                                    ' 145 2.695
Data &H27                                    ' 146 2.670
Data &H26                                    ' 147 2.645
Data &H26                                    ' 148 2.621
Data &H26                                    ' 149 2.596
Data &H26                                    ' 150 2.572
Data &H25                                    ' 151 2.548
Data &H25                                    ' 152 2.524
Data &H25                                    ' 153 2.501
Data &H25                                    ' 154 2.477
Data &H24                                    ' 155 2.454
Data &H24                                    ' 156 2.431
Data &H24                                    ' 157 2.409
```

6.98 GETRC

Action

Retrieves the value of a resistor or a capacitor.

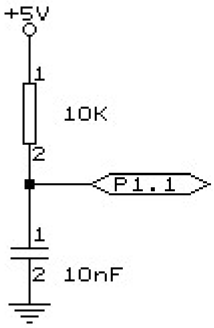
Syntax

var = **GETRC**(pin)

Remarks

var	The variable that receives the value.
pin	The port pin the R/C is connect to.

GETRC needs a resistor and capacitor in order to work. The capacitor is discharged and the charging time will vary depending on the user resistor/capacitor value.



Uses

This function uses TIMER0.

See also

NONE

Example

```
'--------------------------------------------------------------------
---
'                             GETRC.BAS
'  Retrieve resistor value
'  Connect 10KOhm variable resistor from +5V to P1.7 for this example
'  Connect 10nF capacitor from P1.7 to ground
'  The GETRC(pin) function measures the time needed to discharge the
capacitor
'--------------------------------------------------------------------
---
Config Timer0 = Timer , Gate = Internal , Mode = 1       'the GETRC()
functions needs timer 0
Config Getrc = 10                                             '10mS
wait for charging the capacitor. This is the default so for 10 the
CONFIG is not needed
$baud = 9600                                  'just my settings
$crystal = 11059200
Dim W As Word                                 'allocate space for
variable

Do                                            'forever
  W = Getrc(p1.7)                             'get RC value
  Print W                                     'print it
  Wait 1                                      'wait a moment
Loop


'return values for cap=10nF .The resistor values where measured with
a DVM
'             250 for 10K9
```

```
'            198 for  9K02
'            182 for  8K04
'            166 for  7K
'            154 for  6K02
'            138 for  5K04
'            122 for  4K04
'            106 for  3K06
'             86 for  2K16
'             54 for  1K00
'             22 for   198 ohm
'             18 for   150 ohm
'             10 for   104 ohm
'              6 for     1 ohm (minimum)

'As you can see there is a reasonable linearity
'So you can do some math to get the resistor value
'But the function is intended to serve as a rough indication for
resistor values
'You can also change the capacitor to get larger values.
'With 10nF, the return value fits into a byte
```

6.99 GETRC5

Action

Retrieves a RC5 infrared code and sub address.

Syntax

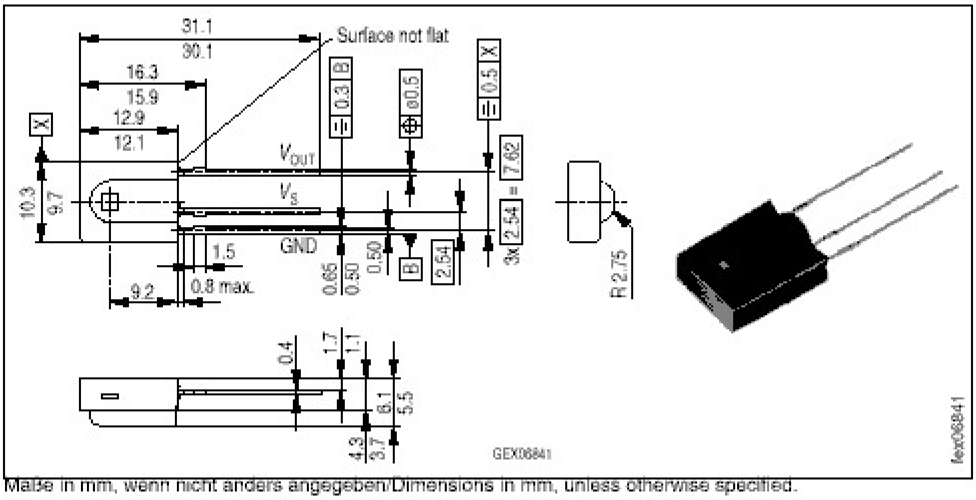
GETRC5(address , command)

Remarks

Address	The RC5 sub address received.
Command	The RC5 command received.

Use a Siemens infrared receiver SFH506-36 and connect it to port pin 3.2 to use this command.
This statement works together with the INT0 interrupt. See the example below on how to use it.
In version 2.09 the command returns the toggle bit in bit position 5 of the address.
You can clear it like : address = address AND &B0001_1111
The toggle bit will toggle after each key press of the remote control.

IR-Empfänger/Demodulator-Baustein **SFH 506**
IR-Receiver/Demodulator Device



Maße in mm, wenn nicht anders angegeben/Dimensions in mm, unless otherwise specified.

See Also

NONE

Example

```
'-----------------------------------------------------------------------
--------
'                      RC5.BAS  (c) 1995-2006 MCS Electronics
'  connect SFH506-36 IR-receiver to PORT 3.2 (INT0)
'  choose the correct port from the Compiler I2C TAB. Int0 should
have P3.2 pin
'  On other chips it may be another pin!
'-----------------------------------------------------------------------
--------
Dim New As Bit
Dim Command As Byte , Subaddress As Byte

Reset Tcon.0
'triggered by rising edge
On Int0 Receiverc5
Enable Int0
Enable Interrupts
Do
  If New = 1 Then
'received new code
     Disable Int0
     Print Command ; "  " ; Subaddress
     New = 0                                                      'reset
new bit
     Enable Int0
  End If
```

```
Loop



Receiverc5:
'interrupt routine
  'the getrc5 routine uses 30 bytes ! of the stack for measuring
  'the interval between the bits
  Getrc5(Subaddress,command)
  New = 1                                                          'set
flag
Return
```

6.100 GOSUB

Action

Branch to and execute subroutine.

Syntax

GOSUB label

Remarks

label	The name of the label where to branch to.

With GOSUB, your program jumps to the specified label, and continues execution at that label.
When it encounters a RETURN statement, program execution will continue after the GOSUB statement.

See also

GOTO 159 , CALL 109 , RETURN 209

Example

```
GOSUB Routine       'branch to routine
Print "Hello"         'after being at 'routine' print this
END                 'terminate program

Routine:            'this is a subroutine
      x = x + 2      'perform some math
      PRINT X       'print result
RETURN              'return
```

6.101 GOTO

Action
Jump to the specified label.

Syntax
GOTO label

Remarks
Labels can be up to 32 characters long.
When you use duplicate labels, the compiler will give you a warning.

See also
GOSUB 158

Example
```
Dim A As Byte

Start:                                    'a label must end with a
colon
A = A + 1                                 'increment a
If A < 10 Then                            'is it less than 10?
Goto Start                               'do it again
End If                                    'close IF
Print " Ready"                            'that is it
```

6.102 HEX

Action
Returns a string representation of a hexadecimal number.

Syntax
var = **HEX**(x)

Remarks
Var	A string variable.
X	A numeric variable such as Byte, Integer or Word.

See also
HEXVAL 160 , VAL 228 , STR 224

Example

```
Dim A As Byte , S As String * 10
A = 123
S = Hex(a)
Print S
End
```

6.103 HEXVAL

Action

Convert string representing a hexadecimal number into a numeric variable.

Syntax

var **= HEXVAL(** x **)**

Remarks

var	The numeric variable that must be assigned.
X	The hexadecimal string that must be converted.

var : Byte, Integer, Word, Long.
x : String.

The string that must be converted must have a length of 2 bytes ,4 bytes or 8 bytes, for bytes, integers/words and longs respectively.

Difference with QB

In QB you can use the VAL() function to convert hexadecimal strings.
But since that would require an extra test for the leading &H signs, that are required in QB, a separate function was designed.

See also

HEX 159 , VAL 228 , STR 224

Example

```
Dim A As Integer , S As String * 15
S = "000A"
A = Hexval(s) : Print A                    '10
End
```

6.104 HIGH

Action

Retrieves the most significant byte of a variable.

Syntax

var = **HIGH**(s) ‘ high function gets the upper byte of a word
HIGH(word) = byte ‘high statement set the upper byte of a word

Remarks

Var	The variable that is assigned with the MSB of var S.
S	The source variable to get the MSB from.
Word	A word or integer variable that is assigned
Byte	The value to set to the MSB of the Word/Integer variable

The HIGH() function returns the MSB of a variable while the HIGH() statement sets the MSB of a word variable.

See also

LOW 183 , LOWW 184 , HIGHW 161

Example

```
Dim I As Integer , Z As Byte
I = &H1001
Z = High(I)  ' is 16
```

6.105 HIGHW

Action

Retrieves the two most significant bytes of a long.

Syntax

var = **HIGHW**(s)

Remarks

Var	The variable that is assigned with the two MSB of var S. It must be an Integer or Word
S	The source variable to get the MSB from. Must be a long

See also

LOW 183 , HIGH 160 , LOWW 184

Example

```
Dim I As Long , Z As Word
I = &H10011001
```

Z = HighW(I)

6.106 HOME

Action
Place the cursor at the specified line at location 1.

Syntax
HOME UPPER | LOWER | THIRD | FOURTH

Remarks
If only HOME is used than, the cursor will be set to the upper line.
You can also specify the first letter of the line like: HOME U

See also
CLS 111 , LOCATE 181 , LCD 174

Example
```
Lowerline
LCD " Hello"
Home Upper
LCD " Upper"
```

6.107 I2CRECEIVE

Action
Receives data from an I2C serial device.

Syntax
I2CRECEIVE slave, var
I2CRECEIVE slave, var ,b2W, b2R

Remarks

slave	A byte, Word/Integer variable or constant with the slave address from the I2C-device.
Var	A byte or integer/word variable that will receive the information from the I2C-device.
b2W	The number of bytes to write. Be cautious not to specify too many bytes!
b2R	The number of bytes to receive. Be cautious not to specify too many bytes!

In BASCOM LT you could specify DATA for var, but since arrays are supported now you can specify and array instead of DATA.

This command works only with some additional hardware. See appendix D 247.

See also

I2CSEND 163

Example

```
x = 0                          'reset variable
slave = &H40                      'slave address of a PCF 8574 I/O IC
I2CRECEIVE  slave, x               'get the value
PRINT x                       'print it


Dim buf(10) as String
buf(1) = 1 : buf(2) = 2
I2CRECEIVE slave, buf(), 2, 1'send two bytes and receive one byte
Print buf(1)                       'print the received byte
```

6.108 I2CSEND

Action

Send data to an I2C-device.

Syntax

I2CSEND slave, var
I2CSEND slave, var , bytes

Remarks

slave	The slave address off the I2C-device.
var	A byte, integer/word or number that holds the value which will be sent to the I2C-device.
bytes	The number of bytes to send.

This command works only with additional hardware. See appendix D 247.

See also

I2CRECEIVE 162

Example

```
x = 5                              'assign variable to 5
Dim ax(10) As Byte
slave = &H40                          'slave address of a PCF 8574 I/O IC
```

```
bytes = 1                      'send 1 byte
I2CSEND slave, x                 'send the value  or


For a = 1 to 10
   ax(a) = a                     'Fill dataspace
Next
bytes = 10
I2CSEND slave,ax(),bytes
END
```

6.109 I2C

Action

I2CSTART generates an I2C start condition.
I2CSTOP generates an I2C stop condition.
I2CRBYTE receives one byte from an I2C-device.
I2CWBYTE sends one byte to an I2C-device.

Syntax

I2CSTART
I2CSTOP
I2CRBYTE var, 8|9
I2CWBYTE val

Remarks

var	A variable that receives the value from the I2C-device.
8/9	Specify 8 or ACK if there are more bytes to read. (**ACK**) Specify 9 or NACK if it is the last byte to read. (**NACK**)
val	A variable or constant to write to the I2C-device.

This command works only with additional hardware. See appendix D 247.

These functions are provided as an addition to the I2CSEND 163 and I2CRECEIVE 162 functions.

See also

I2CRECEIVE 162 , I2CSEND 163

Example

```
'----- Writing and reading a byte to an EEPROM 2404 -----------------
Dim A As Byte
Const Adresw = 174                         'write of 2404
Const Adresr = 175                         'read adres of 2404
I2cstart                                   'generate start
I2cwbyte Adresw                            'send slaveadres
I2cwbyte 1                                 'send adres of EEPROM
```

```
I2cwbyte 3                                  'send a value
I2cstop                                     'generate stop
Waitms 10                                   'wait 10 mS because that is
the time that the chip needs to write the data


'----------now read the value back into the var a -------------------
I2cstart                                    'generate start
I2cwbyte Adresw                             'write slaveadres
I2cwbyte 1                                  'write adres of EEPROM to
read
I2cstart                                    'generate repeated start
I2cwbyte Adresr                             'write slaveadres of EEPROM
I2crbyte A , 9                              'receive value into a. 9
means last byte to receive
I2cstop                                     'generate stop
Print A                                     'print received value
End
```

6.110 IDLE

Action
Put the processor into the idle mode.

Syntax
IDLE

Remarks
In the idle mode, the system clock is removed from the CPU but not from the interrupt logic, the serial port or the timers/counters.
The idle mode is terminated either when an interrupt is received or upon system reset through the RESET pin.

See also
POWERDOWN 199

Example
IDLE

6.111 IF

Action
Allows conditional execution or branching, based on the evaluation of a Boolean expression.

Syntax

IF expression **THEN**

[**ELSEIF** expression **THEN**]

[**ELSE**]

END IF

Remarks

expression	Any expression that evaluates to true or false.

New is the ability to use the one line version of IF :
IF expression THEN statement [ELSE statement]
The use of [ELSE] is optional.

Also new is the ability to test on bits :
IF var.bit = 1 THEN

In V 2.00 support for variable bit index is added:
```
Dim Idx as Byte
For IDX = 0 To 7
  If P3.IDX = 1 Then
    Print "1" ;
  Else
   Print "0" ;
  End if
Next
```

A new feature in V2 is the ability to use multiple tests:
If a > 10 **AND** A < 10 **OR** A = 15 Then
NOP
End if
It does not work with strings but only numeric conditions.
When you want to test on bytes you can also use the string representation:
Dim X As Byte
If X = "A" then ' normally you need to write :
If X = 65 Then 'so these two lines do the same thing

See also

ELSE 140 , END IF 142

Example

```
Dim A As Integer
A = 10
If A = 10 Then                             'test expression
Print " This part is executed."           'this will be printed
Else
Print " This will never  be executed."    'this not
```

```
End If
If A = 10 Then Print "New in BASCOM"
If A = 10 Then Goto Label1 Else Print "A<>10"

Label1:
Rem The following example shows enhanced use of IF THEN
If A.15 = 1 Then                                'test for bit
   Print "BIT 15 IS SET"
End If
REM the following example shows the 1 line use of IF THEN [ELSE]
If A.15 = 0 Then Print "BIT 15 is cleared" Else Print "BIT 15 is set"
```

6.112 INCR

Action
Increments a variable by one.

Syntax
INCR var

Remarks

Var	Any numeric variable.

There are often situations where you want a number to be increased by 1.
The **INCR** statement is faster then var = var + 1.

See also
DECR 134

Example

```
Dim A As Integer
Do                                          'start loop
Incr A                                     'increment a by 1
Print A                                    'print a
Loop Until A > 10                           'repeat until a is greater
than 10
```

6.113 INKEY

Action
Returns the ASCII value of the first character in the serial input buffer.

Syntax

var = **INKEY()**
var = **INKEY(#channel)**

Remarks

Var	Byte, Integer, Word, Long or String variable.
Channel	The channel number of device

If there is no character waiting, a zero will be returned.

The INKEY routine can be used when you have a RS-232 interface on your uP.
See the manual for a design of an RS-232 interface.
The RS-232 interface can be connected to a comport of your computer.

The INKEY() function only works with the hardware UART, not the software UART.

See also

WAITKEY 230

Example

```
Dim A As Byte
Do                                    'start loop
A = Inkey()                          'look for character
If A > 0 Then                        'is variable > 0?
    Print A                           'yes , there was a character in
the buffer
                                             'so print it
End If
Loop                                  'loop forever
```

Example

```
$regfile = "80517.dat"
Open "COM2:" For Binary As #1               'open serial channel 1 on
80537
Dim St As Byte
St = Inkey(#1)                              'get key from com2
If St > 0 Then
   Printbin #1 , St                         'send to com 2
End If
Close #1
```

6.114 INP

Action

Returns a byte read from a hardware port or external memory location.

Syntax

var = **INP**(address)

Remarks

var	Numeric variable that receives the value.
address	The address where to read the value from.

The INP statement only works on systems with an uP that can address external memory.

See also

OUT 196 , PEEK 198 , POKE 198

Example

```
Dim a As Byte
a = INP(&H8000)        'read value that is placed on databus(d0-d7) at
                       'hex address 8000
PRINT a
END
```

6.115 INPUT

Action

Allows input from the keyboard during program execution.

Syntax

INPUT [" prompt"] , var [, varn]   [NOECHO] [TIMEOUT = xx]

Remarks

Prompt	An optional string constant printed before the prompt character.
Var,varn	A variable to accept the input value or a string.
NOECHO	Disables input echoed back to the Comport.
TIMEOUT	Optional delay time. When you specify the delay time, the routine will return when no input data is available after the specified time. No timer is used but a long is used to count down.

The INPUT routine can be used when you have a RS-232 interface on your uP.
See the manual for a design of a RS-232 interface.
The RS-232 interface can be connected to a serial communication port of your computer.

This way you can use a terminal emulator and the keyboard as an input device. You can also use the built in terminal emulator. A backspace will remove the last entered character.

Difference with QB

In QB you can specify &H with INPUT so QB will recognize that a hexadecimal string is used.
BASCOM implements a new statement: INPUTHEX.

See also

INPUTHEX 172 , PRINT 199 , $TIMEOUT 103

Example

```
'--------------------------------------------------------------
'                  (c) 1995-2006 MCS Electronics
'--------------------------------------------------------------
'  file: INPUT.BAS
'  demo: INPUT, INPUTHEX
'--------------------------------------------------------------
'To use another baudrate and crystalfrequency use the
'metastatements $BAUD =  and $CRYSTAL =
$baud = 1200                                                 'try
1200 baud for example
$crystal = 12000000                                          '12 MHz

'---------------------------------------------------------------
'   When you need that the program times out on waiting for a
character
'   you need to use the TIMEOUT option.
'   When the charcter is not received within the specified time ERR
will be set to 1
'   otherwise ERR will be 0.
'   IMPORTANT : the TIMEOUT variable will use 4 bytes of internal
memory
'---------------------------------------------------------------


Dim V As Byte , B1 As Byte
Dim C As Integer , D As Byte
Dim S As String * 15                                         'only
for uP with XRAM support

Input "Use this to ask a question " , V
Input B1                                                     'leave
out for no question

Input "Enter integer " , C
Print C
```

```
Inputhex "Enter hex number (4 bytes) " , C
Print C
Inputhex "Enter hex byte (2 bytes) " , D
Print D

Input "More variables " , C , D
Print C ; " " ; D

Input C Noecho                                              'supress
echo

Input "Enter your name " , S
Print "Hello " ; S

Input S Noecho                                              'without
echo
Print S

'unremark next line and remark all lines above for the TIMEOUT option
'this because when you use TIMEOUT once, you need to use it for all
INPUT statements
'Input "Name " , S Timeout = 0
'Print Err ; " " ; s
End
```

6.116 INPUTBIN

Action

Read binary values from the serial port.

Syntax

INPUTBIN var1 [,var2]
INPUTBIN #dev, var1 [,var2]

Remarks

var1	The variable that is assigned with the characters from the serial port.
var2	An optional second (or more) variable that is assigned with the characters from the serial.
#dev	Device number. For use with OPEN and CLOSE. Dev is the device number.

The number of bytes to read is depending from the variable you use.
When you use a byte variable, 1 character is read from the serial port.
An integer will wait for 2 characters and an array will wait wait until the whole array is filled.

Note that the INPUTBIN statement doesn't wait for a <RETURN> but just for the number of bytes.

See also

PRINTBIN 200 , INPUT 169, INPUTHEX 172

Example

```
Dim a as Byte, C as Integer
INPUTBIN a, c                'wait for 3 characters
End

'This code only for 80517 and 80537 with dual serial port
Open "COM2:" For Binary As #1          'open serial channel 1
INPUTBIN #1, a
Close #1
```

6.117 INPUTHEX

Action

Allows input from the keyboard during program execution.

Syntax

INPUTHEX [" prompt"] , var [, varn] [NOECHO] [TIMEOUT=xx]

Remarks

prompt	An optional string constant printed before the prompt character.
Var,varn	A numeric variable to accept the input value.
NOECHO	Disables input echoed back to the Comport.
TIMEOUT	Optional delay time. When you specify the delay time, the routine will return when no input data is available after the specified time. No timer is used but 4 bytes are taken from the internal memory to provide a count down timer.

When you use the TIMEOUT option once, you must use it for all INPUT/INPUTHEX statements. Providing zero as the timeout parameter will wait for the longest possible time.
The INPUTHEX routine can be used when you have a RS-232 interface on your uP.
See the manual for a design of a RS-232 interface.
The RS-232 interface can be connected to a serial communication port of your computer.
This way you can use a terminal emulator and the keyboard as input device.
You can also use the build in terminal emulator.

If var is a byte then the input must be 2 characters long.
If var is an integer/word then the input must be 4 characters long.
If var is a long then the input must be 8 characters long.

Difference with QB

In QB you can specify &H with INPUT so QB will recognize that a hexadecimal string is used.
BASCOM implement a new statement : INPUTHEX.

See also

INPUT 169 , INPUTBIN 171 , PRINTBIN 200

Example

```
Dim  x As Byte
INPUTHEX " Enter a number " , x        'ask for input
```

6.118 INSTR

Action

Returns the position of a sub string in a string.

Syntax

var = **INSTR(** start , string , substr **)**
var = **INSTR(** string , substr **)**

Remarks

Var	Numeric variable that will be assigned with the position of the sub string in the string. Returns 0 when the sub string is not found.
Start	An optional numeric parameter that can be assigned with the first position where must be searched in the string. By default (when not used) the whole string is searched starting from position 1.
String	The string to search.
Substr	The search string.

At the moment INSTR() works only with internal strings.
Support for external strings will be added too.

Difference with QB

No constants can be used for the string and sub string.

See also

None

Example

```
Dim S As String * 10 , Z As String * 5
Dim Bp As Byte
S = "This is a test"
```

```
Z = "is"
Bp = Instr(s , Z) : Print Bp               'should print  3
Bp = Instr(4 , S , Z) : Print Bp           'should print 6
End
```

6.119 LCASE

Action

Converts a string into lower or upper case.

Syntax

dest = **LCASE**(source)

Remarks

dest	The string variable that will be assigned with the lower case of string SOURCE.
source	The source string. The original string will be unchanged.

See also

UCASE 227

Example

```
Dim S As String * 12 , Z As String * 12
Input "Hello " , S                         'assign string
S = Lcase(s)                               'convert to lowercase
Print S                                    'print string

S = Ucase(s)                               'convert to upper case
Print S                                    'print string
```

6.120 LCD

Action

Send constant or variable to LCD display.

Syntax

LCD x

Remarks

X	Variable or constant to display.

More variables can be displayed separated by the **;** -sign
LCD a ; b1 ; " constant"
The LCD statement behaves just like the PRINT statement.

See also

LCDHEX 178 , $LCD 91 CONFIG LCD 121

Example

```
'--------------------------------------------------------------
'                 (c) 1995-2006 MCS Electronics
'--------------------------------------------------------------
'  file: LCD.BAS
'  demo: LCD, CLS, LOWERLINE, SHIFTLCD, SHIFTCURSOR, HOME
'        CURSOR, DISPLAY
'--------------------------------------------------------------
$sim
Rem The $sim statement will remove long delays for the simulator
Rem It is important to remove this statement when compiling the final
file

'Config Lcdpin = Pin , Db4 = P3.1 , Db5 = P3.2 , Db6 = P3.3 , Db7 =
P3.4 , E = P3.5 , Rs = P3.6
Rem with the config lcdpin statement you can override the compiler
settings


Dim A As Byte
Config Lcd = 16 * 2                     'configure lcd screen
'other options are 16 * 4 and 20 * 4, 20 * 2 , 16 * 1a
'When you dont include this option 16 * 2 is assumed
'16 * 1a is intended for 16 character displays with split addresses
over 2 lines

'$LCD = address will turn LCD into 8-bit databus mode
'       use this with uP with external RAM and/or ROM
'       because it doesnt need the port pins !

Cls                                     'clear the LCD display
Lcd "Hello world."                      'display this at the top line
Wait 1
Lowerline                               'select the lower line
Wait 1
Lcd "Shift this."                       'display this at the lower
line
Wait 1
For A = 1 To 10
```

```
    Shiftlcd Right                         'shift the text to the right
    Wait 1                                 'wait a moment
Next

For A = 1 To 10
    Shiftlcd Left                          'shift the text to the left
    Wait 1                                 'wait a moment
Next

Locate 2 , 1                               'set cursor position
Lcd "*"                                    'display this
Wait 1                                     'wait a moment

Shiftcursor Right                          'shift the cursor
Lcd "@"                                    'display this
Wait 1                                     'wait a moment

Home Upper                                 'select line 1 and return home
Lcd "Replaced."                            'replace the text
Wait 1                                     'wait a moment

Cursor Off Noblink                         'hide cursor
Wait 1                                     'wait a moment
Cursor On Blink                            'show cursor
Wait 1                                     'wait a moment
Display Off                                'turn display off
Wait 1                                     'wait a moment
Display On                                 'turn display on
'-----------------NEW support for 4-line LCD------
Thirdline
Lcd "Line 3"
Fourthline
Lcd "Line 4"
Home Third                                 'goto home on line three
Home Fourth
Home F                                     'first letteer also works
Locate 4 , 1 : Lcd "Line 4"
Wait 1

'Now lets build a special character
'the first number is the characternumber (0-7)
'The other numbers are the rowvalues
'Use the LCD tool to insert this line
Deflcdchar 0 , 31 , 17 , 17 , 17 , 17 , 17 , 31 , 0' replace ? with
number (0-7)
Deflcdchar 1 , 16 , 16 , 16 , 16 , 16 , 16 , 16 , 31' replace ? with
number (0-7)
```

```
Cls                                     'select data RAM
Rem it is important that a CLS is following the deflcdchar statements
because it will set the controller back in datamode
Lcd Chr(0) ; Chr(1)                     'print the special character

'----------------- Now use an internal routine ------------
Acc = 1                                 'value into ACC
Call Write_lcd                          'put it on LCD
End
```

6.121 LCDINIT

Action

Reinitialize the LCD display.

Syntax

LCDINIT

Remarks

When you use any of the LCD display routines the LCD display will be initialized automatic at startup of your program. The LCD routines demand that the WR of the LCD display is connected to GND. When in your design the WR pin of the LCD is connected to a PIN of the micro processor, it will be high during the initialization and so the display will not be initialized properly. The LCDINIT routine allows you to perform initialization after you have set the pin that controls WR of the LCD to 0V.

See also

LCDHEX 178 , $LCD 91 CONFIG LCD 121

Example

```
'--------------------------------------------------------------
'                  (c) 1995-2006 MCS Electronics
'--------------------------------------------------------------
'  file: LCD.BAS
'  demo: LCD, CLS, LOWERLINE, SHIFTLCD, SHIFTCURSOR, HOME
'        CURSOR, DISPLAY
'--------------------------------------------------------------
$sim
Rem The $sim statement will remove long delays for the simulator
Rem It is important to remove this statement when compiling the final
file
```

```
'Config Lcdpin = Pin , Db4 = P3.1 , Db5 = P3.2 , Db6 = P3.3 , Db7 =
P3.4 , E = P3.5 , Rs = P3.6
Rem with the config lcdpin statement you can override the compiler
settings


Dim A As Byte
Config Lcd = 16 * 2                     'configure lcd screen
'other options are 16 * 4 and 20 * 4, 20 * 2 , 16 * 1a
'When you dont include this option 16 * 2 is assumed
'16 * 1a is intended for 16 character displays with split addresses
over 2 lines

'$LCD = address will turn LCD into 8-bit databus mode
'       use this with uP with external RAM and/or ROM
'       because it doesnt need the port pins !

'----------------- these 2 lines can be used when WR is connected to
P1.0 for example ---
P1.0 = 0
INITLCD
'-----------------------------------------------------------------------
-------------------
Cls                                     'clear the LCD display
Lcd "Hello world."                      'display this at the top line
Wait 1
Lowerline                               'select the lower line
Wait 1
Lcd "Shift this."                       'display this at the lower line
```

6.122 LCDHEX

Action

Send variable in hexadecimal format to the LCD display.

Syntax

LCDHEX var

Remarks

var	Variable to display.

var1 : Byte, Integer, Word, Long, Single, Constant.

The same rules apply as for PRINTHEX 201.

See also

LCD 174

Example

Dim a as byte
a = 255
LCD a
Lowerline
LCDHEX a
End

6.123 LEFT

Action

Return the specified number of leftmost characters in a string.

Syntax

var = **LEFT(**var1 , n **)**

Remarks

var	The string that is assigned.
Var1	The sourcestring.
n	The number of characters to get from the sourcestring.

n : Byte, Integer, Word, Long, Constant.

For string operations, all the strings must be of the same type : internal or external.

See Also

RIGHT 210 , MID 187

Example

```
Dim S As Xram String * 15 , Z As Xram String * 15
S = "ABCDEFG"
Z = Left(s , 5)
Print Z                                     'ABCDE
End
```

6.124 LEN

Action

Returns the length of a string.

Syntax

var = **LEN**(string)

Remarks

var	A numeric variable that is assigned with the length of string.
string	The string to calculate the length of.

Example

```
Dim S As String * 12
Dim A As Byte
S = "test"
A = Len(s)
Print A  ' prints 4
```

6.125 LOAD

Action

Load specified TIMER with a value for auto reload mode.

Syntax

LOAD TIMER , value

Remarks

TIMER	TIMER0, TIMER1 or TIMER2.
Value	The variable or value to load.

When you use the ON TIMERx statement with the TIMER/COUNTER in mode 2, you can specify on which interval the interrupt must occur.
The value can range from 1 to 255 for TIMER0 and TIMER1.
For TIMER2 the range is 1-65535.

The LOAD statement calculates the correct reload value out of the parameter.
The formula : TLx = THx = (256-value)
For TIMER2 : RCAP2L = RCAP2H = (65536 - value)

The load statement is not intended to assign/read a value to/from the timers/ counters. Use COUNTER129x instead.

See Additional hardware247 for more details

Example

```
LOAD TIMER0, 100                'load TIMER0 with 100

Will generate :
Mov tl0,#h'9C
Mov th0,#h'9C

LOAD TIMER2, 1000
```

Will generate:
Mov RCAP2L,#24
Mov RCAP2H,#252

6.126 LOCATE

Action

Moves the LCD cursor to the specified position.

Syntax

LOCATE y **,** x

Remarks

X	Constant or variable with the position. (1-64*)
Y	Constant or variable with the line (1 - 4*)

* depending on the used display
For Graphical displays X can be in the range from 1-30 and y in the range from 1-8.

See also

CONFIG LCD 121 , LCD 174 , HOME 162 , CLS 111

Example

```
LCD "Hello"
Locate 1,10
LCD "*"
```

6.127 LOOKUP

Action

Returns a value from a table.

Syntax

var **=LOOKUP(** value**,** label **)**

Remarks

var	The returned value
value	A value with the index of the table
label	The label where the data starts

var : Byte, Integer, Word, Long, Single.
value : Byte, Integer, Word, Long, Constant.

See also

[LOOKUPSTR](182) 182

Example

```
Dim B1 As Byte , I As Integer
B1 = Lookup(1 , Dta)
Print B1                                    ' Prints 2 (zero based)

I = Lookup(0 , Dta2)
End


Dta:
Data 1 , 2 , 3 , 4 , 5

Dta2:                                       'integer data
Data 1000% , 2000%
```

6.128 LOOKUPSTR

Action

Returns a string from a table.

Syntax

var =**LOOKUPSTR**(value, label [, language , length])

Remarks

var	The string returned
value	A value with the index of the table. The index is zero-based. That is, 0 will return the first element of the table.
label	The label where the data starts
language	An optional variable that holds a number to identify the language. The first language starts with the number 0.
length	The length of the data for each language.

value : Byte, Integer, Word, Long, Constant. Range(0-255)

See also

LOOKUP 181

Example

```
Dim S As String * 8 , Idx As Byte
```

```
Idx = 0 : S = Lookupstr(idx , Sdata)
Print S                                    'will print 'This'
End

Sdata:
Data "This" , "is" , "a test"
```

Example 2

```
Dim S As String * 8 , Idx As Byte , Language As Byte
Idx = 0 : Language = 1
S = Lookupstr(idx , Sdata , Language , 17)
Print S                                    ' will print 'Dit '
End

Sdata:
Data "This" , "is" , "a test  "  'each language data must have the
same length
Data "Dit " , "is" , "een test"  'the length is 17 because strings
include a 0  byte
```

6.129 LOW

Action

Retrieves the least significant byte of a variable.

Syntax

var = **LOW**(s)

Remarks

Var	The variable that is assigned with the LSB of var S.
S	The source variable to get the LSB from.

See also

HIGH 160 , LOWW 184 , HIGHW 161

Example

Dim I As Integer , Z As Byte
I = &H1001
Z = Low(I) ' is 1

6.130 LOWW

Action
Retrieves the two least significant bytes of a long.

Syntax
var = **LOWW**(s)

Remarks

var	The variable that is assigned with the two LSB of var S.
s	The source variable to get the LSB's from.

See also
HIGHW 161 , HIGH 160 , LOW 183

Example
```
Dim L As Integer , Z As Long
L = &H1001
Z = LowW(L)
```

6.131 LOWERLINE

Action
Reset the LCD cursor to the lower line.

Syntax
LOWERLINE

Remarks
None

See also
UPPERLINE 228 , THIRDLINE 226 , FOURTHLINE 145 , HOME 162

Example
```
LCD "Test"
LOWERLINE
LCD "Hello"
End
```

6.132 MAKEBCD

Action
Convert a variable into its BCD value.

Syntax
var1 = **MAKEBCD**(var2)

Remarks

var1	Variable that will be assigned with the converted value.
Var2	Variable that holds the decimal value.

When you want to use an I2C clock device, which stores its values as BCD values you can use this function to convert variables from decimal to BCD.
For printing the bcd value of a variable, you can use the BCD() function.

See also
MAKEDEC 185 , BCD() 108

Example
```
Dim a As Byte
a = 65
LCD a
Lowerline
LCD BCD(a)
a = MakeBCD(a)
LCD "   " ; a
End
```

6.133 MAKEDEC

Action
Convert a BCD byte or Integer/Word variable to its DECIMAL value.

Syntax
var1 = **MAKEDEC**(var2)

Remarks

var1	Variable that will be assigned with the converted value.
var2	Variable that holds the BCD value.

When you want to use an I2C clock device which stores its values as BCD values you can use this function to convert variables from BCD to decimal.

See also
MAKEBCD 185 , BCD 108

Example
```
Dim a As Byte
a = 65
LCD a
Lowerline
LCD BCD(a)
a = MakeDEC(a)
LCD "   " ; a
End
```

6.134 MAKEINT

Action
Compacts 2 bytes into a word or integer.

Syntax
varn = **MAKEINT**(LSB , MSB)

Remarks

Varn	Variable that will be assigned with the converted value.
LSB	Variable or constant with the Least Significant Byte.
MSB	Variable or constant with the Most Significant Byte.

The equivalent code is :
varn = (256 * MSB) + LSB

See also
MAKEDEC 185 BCD() 108

Example
```
Dim a As Integer , I As Integer
a = 2
I = MakeINT(a , 1) 'I = (1 * 256) + 2  = 258
End
```

6.135 MAX

Action
Returns the highest value of an array.

Syntax
var = **MAX(** ar(1) **)**

Remarks

Var	Numeric variable that will be assigned with the highest value of the array.
ar()	The first array element of the array to return the highest value of.

At the moment MAX() works only with BYTE arrays.
Support for other data types will be added too.

See also

MIN 188 , AVG 106

Example

```
Dim ar(10) As Byte
Dim bP as Byte
For bP = 1 to 10
  ar(bP) = bP
Next
bP = Max(ar(1))
Print bP 'should print 10
End
```

6.136 MID

Action

The MID function returns part of a string (a sub string).
The MID statement replaces part of a string variable with another string.

Syntax

var = **MID(**var1 ,st [, l] **)**
MID(var ,st [, l] **)** = var1

Remarks

Var	The string that is assigned.
Var1	The source string.
St	The starting position.
L	The number of characters to get/set.

Operations on strings require that all strings are of the same type(internal or external)

See also

LEFT 179 , RIGHT 210

Example

```
Dim S As Xram String * 15 , Z As Xram String * 15
S = "ABCDEFG"
Z = Mid(s , 2 , 3)
Print Z                                   'BCD
Z = "12345"
Mid(s , 2 , 2) = Z
Print S                                   'A12DEFG
End
```

6.137 MIN

Action
Returns the lowest value of an array.

Syntax
var = **MIN(** ar(1) **)**

Remarks

Var	Numeric variable that will be assigned with the lowest value of the array.
ar()	The first array element of the array to return the lowest value of.

At the moment MIN() works only with BYTE arrays.
Support for other data types will be added too.

See also
MAX 186 , AVG 106

Example
```
Dim ar(10) As Byte
Dim bP as Byte
For bP = 1 to 10
  ar(bP) = bP
Next
bP = Min(ar(1))
Print bP 'should print 1
End
```

6.138 MOD

Action
Returns the remainder of a division.

Syntax
ret = var1 **MOD** var2

Remarks

Ret	The variable that receives the remainder.
var1	The variable to divide.
var2	The divisor.

Example

```
a = 10 MOD 3          'divide 10 through 3
PRINT a              'print remainder (1)
```

6.139 MWINIT

Action

Initializes the pins in order to use them with the micro wire statements.

Syntax

MWINIT

See also

CONFIG MICROWIRE 123 , MWREAD 189 , MWWRITE 191 , MWWOPCODE 190

6.140 MWREAD

Action

Read a value from the micro wire bus.

Syntax

MWREAD variable , opcode , address, bytes

Remarks

Variable	The variable that is assigned with the value retrieved from the micro wire bus.
Opcode	The opcode to use.
Address	The address of the device.
Bytes	Number of bytes to send.

See also

MWWRITE 191 , MWWOPCODE 190 , MWINIT 189

Example

```
'-----------------------------------------------------------------
'                    MicroWire test file
```

```
' please read microwire specs for understanding microwire
'-----------------------------------------------------------------
'CS   - chip select
'DIN  - data in
'DOUT - data Out
'CLOCK- Clock
'AL   - address lines

'            93C46    93C56    93C57    93C66
'----------------------------------------------------------------------------
' Data bits:    8  16   8   16    8    16    8   16
' AL       :    7   6   9    8    8     7    9    8

'you could use the same pin for DIN and DOUT
'we use a 93C46 and send bytes not words so AL is 7
Config Microwire = Pin , Cs = P1.1 , Din = P1.2 , Dout = P1.4 , Clock = P1.5 , Al = 7

'init pins
Mwinit

'dimension variable used
Dim X As Byte

'enable write to eeprom
'send startbit, opcode (00) and 11 + address

'Mwwopcode opcode, numberOfBits
Mwwopcode &B1001100000 , 10
'the mwwopcode can send a command(opcode) to a device

X = 10
'write value of X to address 0
'opcode is 01
'we write 1 byte
'Mwwrite var,opcode,address,numberOfBytes
Mwwrite X , &B101 , 0 , 1

Waitms 10
X = 0
'read back
' mwread var,opcode,address,numberofbytes
Mwread X , &B110 , 0 , 1

'disable write
'send startbit, opcode (00) and 00 + address
Mwwopcode &B1000000000 , 10
End
```

6.141 MWWOPCODE

Action

Write an opcode to a micro wire device.

Syntax

MWWOPCODE opcode , bits

Remarks

Opcode	The opcode that needs to be send to the micro wire device. See the micro wire docs for the right values.
Bits	The number of bits to send.

Before you can work with micro wire you must send an opcode to enable writing an EEPROM for example.

See also

MWINIT 189 , MWWRITE 191 , MWREAD 189
[****] 189

Example

```
'enable write to EEPROM
'Needed bits : startbit (1), opcode (00) and (11) + address
'Mwwopcode opcode, numberOfBits
Mwwopcode &B1001100000 , 10  'send the code
```

6.142 MWWRITE

Action

Writes a value to the micro wire bus.

Syntax

MWWRITE variable , opcode , address, bytes

Remarks

Variable	The variable which's content must be send to the micro wires device.
Opcode	The opcode to use.
Address	The address of the device.
Bytes	Number of bytes to send.

See also

MWINIT 189 , MWREAD 189 , MWWOPCODE 190

Example

```
'write value of X to address 0
'opcode is 01 and we write one byte
Mwwrite X , &B101 , 0 , 1
```

6.143 NEXT

Action
Ends a FOR..NEXT structure.

Syntax
NEXT [var]

Remarks

Var	The index variable that is used as a counter when you form the structure with FOR var. Var is optional and not needed.

You must end each FOR statement with a NEXT statement.

See also
FOR 144

Example
```
Dim X As Byte , Y As Byte , A As Byte
Y = 10                                      'make y 10
For A = 1 To 10                             'do this 10 times
For X = Y To 1                             'this one also
  Print X ; A                               'print the values
Next                                       'next x (count down)
Next A                                      'next a (count up) END
```

6.144 ON interrupt

Action
Execute subroutine when specified interrupt occurs.

Syntax
ON interrupt label   [NOSAVE]

Remarks

interrupt	INT0, INT1, SERIAL, TIMER0 ,TIMER1 or TIMER2. Chip specific interrupts can be found under microprocessor support.
Label	The label to jump to if the interrupt occurs.
NOSAVE	When you specify NOSAVE, no registers are saved and restored in the interrupt routine. So when you use this option be sure to save and restore used registers.

You must return from the interrupt routine with the RETURN statement.
You may have only one RETURN statement in your interrupt routine because the compiler restores the registers and generates a RETI instruction when it encounters

a RETURN statement in the ISR.

You can't use TIMER1 when you are using SERIAL routines such as PRINT because TIMER1 is used as a BAUDRATE generator.

When you use the INT0 or INT1 interrupt you can specify on which condition the interrupt must be triggered.
You can use the Set/Reset statement in combination with the TCON-register for this purpose.

SET TCON.0 : trigger INT0 by falling edge.
RESET TCON.0 : trigger INT0 by low level.
SET TCON.2 : trigger INT1 by falling edge.
RESET TCON.2 : trigger INT1 by low level.

See Hardware 247 for more details

See Also

ON VALUE 193

Example

```
ENABLE INTERRUPTS
ENABLE INT0                'enable the interrupt
ON INT0 Label2 nosave           'jump to label2 on INT0
DO                          'endless loop
LOOP
END

Label2:
   PRINT " A hardware interrupt occurred!"             'print message
RETURN
```

6.145 ON value

Action

Branch to one of several specified labels, depending on the value of a variable.

Syntax

ON var [**GOTO**] [**GOSUB**] label1 **[**, label2 **]**

Remarks

Var	The numeric variable to test. This can also be a SFR such as P1.
label1, label2	The labels to jump to depending on the value of *var*.

Note that the value is zero based. So when var = 0, the first specified label is jumped/branched.

See Also

ON interrupt 192

Example

```
Dim X As Byte

X = 2                                      'assign a variable interrupt
On X Gosub Lbl1 , Lbl2 , Lbl3              'jump to label lbl3
X = 0
On X Goto Lbl1 , Lbl2 , Lbl3
End


Lbl3:
  Print "lbl3"
Return


Lbl1:
nop

Lbl2:
nop

'nop is an ASM statement that does nothing
```

6.146 OPEN

Action

Opens and closes a device.

Syntax

OPEN "device" for MODE As #channel
CLOSE #channel

Remarks

Device	There are 2 hardware devices supported: COM1 and COM2. With the software UART, you must specify the port pin and the baud rate. COM3.0:9600 will use PORT 3.0 at 9600 baud. Optional is **,INVERTED** this will use inverted logic so you don't need MAX232 inverters.
MODE	You can use BINARY, INPUT or OUTPUT for COM1 and COM2, but for the software UART pins, you must specify INPUT or OUTPUT.
Channel	The number of the channel to open. Must be a positive constant.

Since there are uP's such as the 80537 with 2 serial channels on board, the compiler must know which serial port you want to use. That is why the OPEN statement is implemented. With only 1 serial port on board, you don't need this statement.
The statements that support the device are PRINT 199 , PRINTHEX 201, INPUT 169 and INPUTHEX 172.

Every opened device must be closed using the CLOSE #channel statement. Of course you must use the same channel number.

The software UART, only supports the GET 147 and PUT 203 statements to retrieve and send data and the PRINTBIN 200 and INPUTBIN 171 statement.
The SW UART uses timed loops and interrupts can slow down these loops. So turn interrupts off before you use the SW UART.
COM1: and COM2: are hardware ports, and can be used with PRINT etc.
For the software UART it is important that the pin you use is bit addressable. In most cases a PORT is bit addressable but some chips have ports that are not bit addressable. When you use such a port you will get errors like : Error 208, bit variable not found.
Since the OPEN statement doesn't use real file handles like DOS but only serves as a compiler directive, it is important that you must use the CLOSE statement as the last statement in your program.
The following example shows when it will NOT WORK :

```
OPEN "COM2:" FOR BINARY AS #1        'open the port
PRINT #1, "Hello"                    'print to serial 1
Gosub Test
PRINT "Hello"                        'print to serial 0
CLOSE #1

Test:
  Print #1, "test"
Return
```

Since the compiler frees the handle when it encounters the CLOSE statement, the PRINT #1, "test" code is never executed. To solve this you should put the CLOSE #1 statement under the Return statement.

```
OPEN "COM2:" FOR BINARY AS #1        'open the port
PRINT #1, "Hello"                    'print to serial 1
Gosub Test
PRINT "Hello"                        'print to serial 0


Test:
  Print #1, "test"
Return
Close #1
```

See also

GET 147 , PUT 203

Example 1

```
'only works with a 80517 or 80537
CONFIG BAUD1 = 9600                    'serial 1 baudrate
OPEN "COM2:" FOR BINARY AS #1          'open the port
PRINT #1, "Hello"                      'print to serial 1
PRINT "Hello"                          'print to serial 0
CLOSE #1                               'close the channel
```

Example 2

```
'works with every port pin
Dim A As Byte , S As String * 16 , I As Byte , Dum As Byte

'a software comport is named after the pin you use
'for example P3.0  will be "COM3.0:"  (so there is no P)
'for software comports, you must provide the baudrate
'So for 9600 baud, the devicename is "COM3.0:9600"
'When you want to use the pin for sending, you must open the device for OUTPUT
'When you want to use the pin for receiving, you must open the device for INPUT

'At this time only variables can be sent and received with the PUT and GET
statements.
'In the feature PRINT etc. will support these software comports.

Open "com3.1:9600" For Output As #1      'p3.1 is normally used for tx so testing is
easy
Open "com3.0:9600,INVERTED" For Input As #2      'p3.0 is normally used for RX
so testing is easy


S = "test this"                 'assign string
Dum = Len(s)                    'get length of string
For I = 1 To Dum                'for all characters from left to right
  A = Mid(s , I , 1)            'get character
  Put #1 , A                    'write it to comport
Next

Do
  Get #2 , A                    'get character from comport
  Put #1 , A                    'write it back
  Print A                       'use normal channel
Loop

Close #1                        ' finally close device
Close #2
End
```

6.147 OUT

Action

Sends a byte to a hardware port or external memory address.

Syntax

OUT address, value

Remarks

address	The address where to send the byte to.
value	The variable or value to send.

The OUT statement only works on systems with a uP that can address external memory.

See also

INP 169 , PEEK 198, POKE 198

Example

```
Dim a as byte
OUT &H8000,1                'send  1 to the databus(d0-d7) at hex address 8000
END
```

Will generate :

```
Mov A,#1
Mov dptr,#h'8000
Movx @dptr,a
```

6.148 PORT

Action

P1 and P3 are special function registers that are treated as variables.

Syntax

Px = var
var = **Px**

Remarks

X	The number of the port. (1 or 3). **P3.6 can't be used with an AT89C2051!**
Var	The variable to retrieve or to set.

Note that other processors can have more ports such as P0, P2, P4 etc.
When you select the proper **.DAT** file you can also use these ports as variables.
In fact you can use any SFR as a byte variable in BASCOM.

ACC = 0 'will reset the accumulator for example

See hardware 247 for a more detailed description of the ports.

Example

```
Dim A As Byte , B1 As Bit
```

```
A = P1                                   'get value from port 1
A = A Or 2                               'manipulate it
P1 = A                                   'set port 1 with new value
P1 = &B10010101                          'use binary notation
P1 = &HAF                                'use hex notation
B1 = P1.1                                'read pin 1.1
P1.1 = 0                                 'set it to 0
```

6.149 PEEK

Action
Returns a byte stored in internal memory.

Syntax
var **= PEEK(** address **)**

Remarks

var	Numeric variable that is assigned with the content of the memory location address
address	Numeric variable or constant with the address location.(0-255)

See also
POKE 198 , CPEEK 130 , INP 169 , OUT 196

Example
```
DIM a As Byte
a = Peek( 0 )           'return the first byte of the internal memory (r0)
End
```

6.150 POKE

Action
Write a byte to an internal memory location.

Syntax
POKE address , value

Remarks

address	Numeric variable with the address of the memory location to set. (0-255)
value	Value to assign. (0-255)

Be careful with the POKE statement because you can change variables with it, which can cause your program to function incorrect.

See also

PEEK 198 , CPEEK 130 , INP 169 , OUT 196

Example

```
POKE 127, 1              'write 1 to address 127
End
```

6.151 POWERDOWN

Action

Put processor into power down mode.

Syntax

POWERDOWN

Remarks

The power down mode stops the system clock completely.
The only way to reactivate the micro controller is by system reset.

See also

IDLE 165

Example

```
POWERDOWN
```

6.152 PRINT

Action

Send output to the RS-232 port.

Syntax

PRINT var ; " constant"

Remarks

var	The variable or constant to print.

You can use a semicolon (**;**) to print more than one variable at one line.
When you end a line with a semicolon, no linefeed will be added.

The PRINT routine can be used when you have a RS-232 interface on your uP.
See the manual for a design of an RS-232 interface.

The RS-232 interface can be connected to a serial communication port of your computer.
This way you can use a terminal emulator as an output device.
You can also use the build in terminal emulator.

See also

PRINTHEX 201 , INPUT 169 , OPEN 194 , CLOSE 194 , SPC 219

Example

```
'--------------------------------------------------------------
'                 (c) 1995-2006 MCS Electronics
'--------------------------------------------------------------
'  file: PRINT.BAS
'  demo: PRINT, PRINTHEX
'--------------------------------------------------------------
Dim A As Byte , B1 As Byte , C As Integer
A = 1
Print "print variable a " ; A
Print                                   'new line
Print "Text to print."                  'constant to print


B1 = 10
Printhex B1                             'print in hexa notation
C = &HA000                              'assign value to c%
Printhex C                              'print in hex notation
Print C                                 'print in decimal notation

C = -32000
Print C
Printhex C
Rem Note That Integers Range From -32767 To 32768
End
```

6.153 PRINTBIN

Action

Print binary content of a variable to the serial port.

Syntax

PRINTBIN var [**;** varn]
PRINTBIN #dev**,** var **;** [,varn]

Remarks

var	The variable which value is sent to the serial port.

varn	Optional variables to send separated by a **;**.
#dev	Device number for use with OPEN and CLOSE

PRINTBIN is equivalent to PRINT CHR(var); but whole arrays can be printed this way.

When you use a Long for example, 4 bytes are printed.

See also

INPUTBIN 171 , PRINT 199, PRINTHEX 201 , INPUTHEX 172

Example

```
Dim a(10) as Byte, c as Byte
For c = 1 To 10
  a(c) = a                'fill array
Next
PRINTBIN a(1)                'print content

'This code only for 80517/80537 with dual serial port
Open "COM2:" For Binary As #1      'open serial channel 1
PRINTBIN #1 , a(1) ; a(2) ; a(3)      'note that the channel is separated by a , and
the vars by ;
Close #1
```

6.154 PRINTHEX

Action

Sends a variable in hexadecimal format to the serial port.

Syntax

PRINTHEX var

Remarks

var	The variable to print.

The same rules apply to PRINTHEX as PRINT.

The PRINTHEX routine can be used when you have a RS-232 interface on your uP.
See the manual for a design of an RS-232 interface.
The RS-232 interface can be connected to a serial communication port of your computer.
This way you can use a terminal emulator as an output device.
You can also use the build in terminal emulator.

See also

PRINT 199 , INPUTHEX 172 , SPC 219

Example

```
Dim x  As Byte
INPUT x                  'ask for var
PRINT x                  'print it in decimal format
PRINTHEX "Hex " ; x      'print it in hex format
```

6.155 PRIORITY

Action

Sets the priority level of the interrupts.

Syntax

PRIORITY SET / RESET interrupt

Remarks

SET	Bring the priority level of the interrupt to a higher level.
RESET	Bring the priority level of the interrupt to a lower level.
Interrupt	The interrupt to set or reset.

The interrupts are: **INT0, INT1, SERIAL, TIMER0, TIMER1 and TIMER2.**

Interrupt INT0 always has the highest priority.
When more interrupts occur at the same time the following order is used to handle the interrupts.

Note that other microprocessors can have additional/other interrupt setting.
Read microprocessor support 287 to check the additions.

Interrupt	Priority
INT0	1 (highest)
TIMER0	2
INT1	3
TIMER1	4
SERIAL	5 (lowest)

Example

```
PRIORITY SET SERIAL          'serial int highest level
ENABLE SERIAL                'enable serial int
ENABLE TIMER0                'enable timer0 int
ENABLE INTERRUPTS            'activate interrupt handler
ON SERIAL label              'branch to label if serial int occur
DO                           'loop for ever

LOOP
```

```
Label:                          'start label
   PRINT " Serial int occurred."       'print message
RETURN                          'return from interrupt
```

6.156 PSET

Action

Sets or resets a single pixel.

Syntax

PSET X , Y, value

Remarks

X	The X location of the pixel. In range from 0-239.
Y	The Y location of the pixel. In range from 0-63.
value	The value for the pixel. 0 will clear the pixel. 1 Will set the pixel.

The PSET is handy to create a simple data logger or oscilloscope.

See also

CONFIG GRAPHLCD 117

Example

```
Dim X as Byte, Y as Byte
For X = 0 To 10
  For Y = 0 To 10
    Pset X , Y , 1                  'make a nice block
  Next
Next
End
```

6.157 PUT

Action

Sends a byte to the software UART.

Syntax

PUT #channel , var

Remarks

channel	Positive numeric constant that refers to the opened channel.
var	A variable or constant who's value is sent to the the software UART.

See also

GET 147 , PRINT 199 , INPUT 169, OPEN 194

Example

```
Open "com3.1:9600" For Output As #1                    'p3.1 is normally used for
tx so testing is easy
Open "com3.0:9600" For Input As #2                     'p3.0 is normally used for
RX so testing is easy


S = "test this"                   'assign string
Dum = Len(s)                        'get length of string
For I = 1 To Dum                     'for all characters from left to right
  A = Mid(s , I , 1)               'get character
  Put #1 , A                      'write it to comport
Next

Do
  Get #2 , A                      'get character from comport
  Put #1 , A                      'write it back
  Print A                       'use normal channel
Loop


Close #1                          ' finally close device
Close #2
End
```

6.158 READ

Action

Reads those values and assigns them to variables.

Syntax

READ var

Remarks

var	Variable that is assigned data value.

Difference with QB

It is important that the variable is of the same type as the stored data.

See also

DATA 132 , RESTORE 208

Example

```
Dim A As Byte, I As Byte, C As Integer, S As XRAM String * 10
RESTORE dta
FOR a = 1 TO 3
  READ i : PRINT i
NEXT
RESTORE DTA2
READ C : PRINT C
READ C : PRINT C
Restore dta3 : Read s : Print s
END

dta:
Data 5,10,15
dta2:
Data 1000%, -2000%
dta3:
Data " hello"
```

6.159 READMAGCARD

Action

Reads data from a magnetic card reader.

Syntax

READMAGCARD var , bytes , code, timeout

Remarks

Var	A byte array large enough to store the data from the magnetic card reader.
bytes	The number of bytes read from the card.
Shifts	The coding used. Must be 5 or 7. In version 2.03 only 5 is supported.
Timeout	A LONG variable or constant that the routine will wait for a card. **Err** will be set when no card is detected within Timeout.

There can be 3 tracks on a magnetic card.

Track 1 strores the data in 7 bit including the parity bit. This is handy to store alpha numeric data.

On track 2 and 3 the data is stored with 5 bit coding.

The ReadMagCard routine works with ISO7811-2 5 and 7 bit decoding.

The returned numbers for 5 bit coding are:

Returned number	ISO characterT
0	0
1	1
2	2

3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	hardware control
11	start byte
12	hardware control
13	separator
14	hardware control
15	stop byte

See also
None

Calls
_Read_Magcard_Code5

Example
```
'[DIM used variables]
Dim X(40) As Byte , I As Byte , Bts As Byte

'[ALIAS the pins used]
_mcs Alias P1.1
_mclock Alias P1.2
_mdata Alias P1.0

Do
  Print "Slide magcard through reader"
  Readmagcard X(1) , Bts , 5, 10000              'call routine
  '                        ^ may be 5 or 7. 7 bit coding not implemented yet
  Print "Error " ; Err                           '1 if error occured
  Print ; " " ; Bts ; " bytes read"                   'show number of bytes read
  Print Err
  For I = 1 To Bts
    Print X(i) ; " ";                            'show number
  Next
  Print
```

```
Loop
End
```

6.160 REM

Action
Instruct the compiler that comment will follow.

Syntax
REM or **'**

Remarks
You can comment your program for clarity.
You can use REM or **'** followed by your comment.
All statements after REM or **'** are treated as comment so you cannot use statements after a REM statement.

It is also possible to use block comments:

```
'(  start block comment
print "This will not be compiled
')  end block comment
```

Note that the starting **'** sign will ensure compatibility with QB
Each block must be closed with a ')

Example

```
REM  TEST.BAS version 1.00
PRINT a        '    " this is comment   :  PRINT " hello"
                       ^--- this will not be executed!
```

6.161 REPLACE

Action
Replace all occurrences of a single character in a string.

Syntax
REPLACE string , old , new

Remarks

string	The source string to change.
old	A string constant or byte that specifies the character to replace.
new	The new character. Also a string constant or a byte.

Example

```
Dim S as String * 12
```

```
s = "Hello"
REPLACE s , "e" , "a"      '  now we got some dutch :-)
Print s                    '  should print Hallo
```

6.162 RESET

Action

Reset a bit of a PORT (P1.x, P3.x) or an internal bit/byte/integer/word/long variable.

Syntax

RESET bit
RESET var.x

Remarks

bit	Can be a P1.x, P3.x or any bitvariable where x=0-7.
var	Can be a byte, integer or word variable.
x	Constant of variable to reset.(0-7) for bytes and (0-15) for Integer/ Word. 0-31 for a LONG.

See also

SET 212

Example

```
Dim b1 as bit, b2 as byte, I as Integer
RESET P1.3                       'reset bit 3 of port 1
RESET b1                        'bitvariable
RESET b2.0                       'reset bit 0 of bytevariable b2
RESET I.15                      'reset MS bit from I
```

6.163 RESTORE

Action

Allows READ to reread values in specified DATA statements.

Syntax

RESTORE label

Remarks

Label	The label of a DATA statement.

See also

DATA 132 , READ 204

Example

```
DIM a AS BYTE, I AS BYTE
RESTORE dta
FOR a = 1 TO 3
  READ a : PRINT a
NEXT
RESTORE DTA2
READ I : PRINT I
READ I : PRINT I
END

DTA1:
Data 5, 10, 100

DTA2:
Data -1%, 1000%
```

Integers must end with the %-sign. (Integer : <0 or >255)

6.164 RETURN

Action

Return from a subroutine.

Syntax

RETURN

Remarks

Subroutines must be ended with a related RETURN statement.
Interrupt subroutines must also be terminated with the Return statement.

See also

GOSUB 158

Example

```
Dim Result As Byte , Y As Byte

Gosub Pr                                  'jump to subroutine
Print Result                              'print result
End                                       'program ends

Pr:                                       'start subroutine with label
Result = 5 * Y                           'do something stupid
Result = Result + 100                    'add something to it
Return                                    'return
```

6.165 RIGHT

Action
Return a specified number of rightmost characters in a string.

Syntax
var = **RIGHT(**var1 ,st **)**

Remarks

var	The string that is assigned.
Var1	The sourcestring.
st	The starting position.

All strings must be of the same data type, internal or external.

See also
LEFT 179 , MID 187

Example
```
Dim s As XRAM String * 15, z As XRAM String * 15
s = "ABCDEFG"
z = Right(s,2)
Print z                              'FG
End
```

6.166 RND

Action
Returns a random number.

Syntax
var = **RND(**limit**)**

Remarks

Limit	The maximum number that will be assigned to the random number.

The RND() function uses 2 internal bytes to store the value of the random seed.

 It is important to understand that the RND() function is a math function. Every time you reset the micro, it will produce the same sequence. Only when you vary the variables with for example a timer, temperature reading, or a clock, you can make a more random value.

See also

NONE

Example

```
'--------------------------------------------------------
'                    (c) 1995-2006 MCS Electronics
'                         RND.BAS
'--------------------------------------------------------
Dim W As Word

Do
  'get a random number and limit it to be maximum 100
  W = Rnd(100)
  Print W
Loop
End
```

6.167 ROTATE

Action

Shifts all bits one place to the left or right.

Syntax

ROTATE var **, LEFT/RIGHT** [**,** shifts]

Remarks

Var	Byte, Integer/Word or Long variable.
Shifts	The number of shifts to perform.

Note that the behavior of ROTATE is just like the ASM RL or RR mnemonic. It works for integer, words, single and longs also. All bits in the variable are preserved so for a byte after 8 rotations, the value will be the same.

See also

SHIFTIN 214 , SHIFTOUT 214 , SHIFT 213

Calls

_ROTATE_LEFT or _ROTATE_RIGHT

Example

```
Dim a as Byte
a = 128
ROTATE a, LEFT , 2
Print a              '1
```

6.168 SELECT

Action

Executes one of several statement blocks depending on the value of a variable.

Syntax

SELECT CASE var
  CASE test1 **:** *statements*
  [**CASE** test2 **:** *statements*]
  CASE ELSE : *statements*
END SELECT

Remarks

var	Variable. to test
Test1	Value to test for.
Test2	Value to test for.

See also

IF THEN 165

Example

```
Dim b2 as byte
SELECT CASE b2                'set bit 1 of  port 1
  CASE 2 : PRINT "2"
  CASE 4 : PRINT "4"
  CASE IS >5 : PRINT ">5"        'a test requires the IS keyword
  CASE 10 TO 20                 'test the range from 10 to 20
  CASE ELSE
END SELECT
END
```

6.169 SET

Action

Set a bit of a PORT(P1.x,P3.x) or a bit/byte/integer/word/long variable.

Syntax

SET bit
SET var.x

Remarks

Bit	P1.x, P3.x or a Bit variable.
Var	A byte, integer, word or long variable.

X	Bit of variable (0-7) to set. (0-15 for Integer/Word) and 0-31 for a LONG.

See also

RESET 208

Example

```
Dim b1 as Bit, b2 as byte, c as Word
SET P1.1       'set bit 1 of  port 1
SET b1         'bitvariable
SET b2.1       'set bit 1 of var b2
SET C.15       'set highest bit of Word
```

6.170 SHIFTCURSOR

Action

Shift the cursor of the LCD display left or right by one position.

Syntax

SHIFTCURSOR LEFT | RIGHT

See also

SHIFTLCD 215 , LCD 174 , CLS 111 , LOCATE 181, HOME 162

Example

```
LCD "Hello"
SHIFTCURSOR LEFT
End
```

6.171 SHIFT

Action

Shifts all bits one place to the left or right.

Syntax

SHIFT var , LEFT/RIGHT [, shifts]

Remarks

Var	Byte, Integer/Word or Long variable.
Shifts	The number of shifts to perform.

The SHIFT statements shifts all bits to the left or right and so for a byte after 8 shifts, the byte will be zero.

See also

SHIFTIN 214 , SHIFTOUT 214 ROTATE 211

Example

```
Dim a as Word
a = 128
SHIFT a, LEFT , 1
Print a                '256
```

6.172 SHIFTIN

Action

Shifts a bit stream in or out a variable.

Syntax

SHIFTIN pin , pclock , var , option [PRE]
SHIFTOUT pin , pclock , var , option

Remarks

pin	The portpin which serves as as input/output.
pclock	The portpin which generates the clock.
var	The variable that is assigned.
option	Option can be : 0 - MSB shifted in/out first when clock goes low 1 - MSB shifted in/out first when clock goes high 2 - LSB shifted in/out first when clock goes low 3 - LSB shifted in/out first when clock goes high For the SHIFTIN statement you can add 4 to the parameter to use the external clock signal for shifting.
PRE	Add this additional parameter (no comma) to sample the input pin before the clock signal is generated.

It depends on the type of the variable, how many shifts will occur.
When you use a byte, 8 shifts will occur and for an integer, 16 shifts will occur.

See also

NONE

Example

```
Dim a as byte
SHIFTIN P1.0 , P1.1 , a , 0
SHIFTOUT P1.2 , P1.1 , a , 0
```

For the SHIFTIN example the following code is generated:

```
Setb P1.1
Mov R0,#h'21
Mov r2,#h'01
__UNQLBL1:
Mov r3,#8
__UNQLBL2:
Clr P1.1
Nop
Nop
Mov c,P1.0
Rlc a
Setb P1.1
Nop
Nop
Djnz r3,__UNQLBL2
Mov @r0,a
Dec r0
Djnz r2,__UNQLBL1
```

Of course, it depends on the parameter, which code will be generated.
To shift with an external clock signal:
SHIFTIN P1.0, P1.1 , a , 4 'add 4 for external clock

Generated code:

```
Mov R0,#h'21
Mov r2,#h'01
__UNQLBL1:
Mov r3,#8
__UNQLBL2:
Jnb P1.1,*+0
Mov c,P1.0
Rlc a
Jb P1.1,*+0
Djnz r3,__UNQLBL2
Mov @r0,a
Dec r0
Djnz r2,__UNQLBL1
```

6.173 SHIFTLCD

Action
Shift the LCD display left or right by one position.

Syntax
SHIFTLCD LEFT / RIGHT

Remarks
NONE

See also
SHIFTCURSOR 213 , CLS 111 , LCD 174 , HOME 162 , LOCATE 181

Example
```
LCD "Very long text"
SHIFTLCD LEFT
Wait 1
SHIFTLCD RIGHT
End
```

6.174 SHOWPIC

Action
Shows a BGF file on the graphic display

Syntax
SHOWPIC x, y , label

Remarks
Showpic can display a converted BMP file. The BMP must be converted into a BGF file with the Tools Grahic Converter 50.
The X and Y parameters specify where the picture must be displayed. X and Y must be 0 or a multiple of 8. The picture height and width must also be an multiple of 8.
The label tells the compiler where the graphic data is located. It points to a label where you put the graphic data with the $BGF directive.

See also
$BGF 85 , CONFIG GRAPHLCD 117 , PSET 203

Example
```
CLS GRAPH              'clear graphic part of display
ShowPic 0,0, label            'show picture
End

Label:
$BGF "mypic.bgf"             'data will be inserted here
```

6.175 SOUND

Action
Sends pulses to a port pin.

Syntax
SOUND pin, duration, frequency [,*NOINT*]

Remarks

Pin	Any I/O pin such as P1.0 etc.
duration	The number of pulses to send. Byte, integer/word or constant. (1- 32768).
Frequency	The time the pin is pulled low and high.
NOINT	An option to disable interrupts during the sound statement.

When you connect a speaker or a buzzer to a port pin (see hardware) , you can use the SOUND statement to generate some tones.
The **NOINT** will clear the global interrupts so no interrupts can occur during the sound statement. When the sound statement has completed the interrupt register is restored.

The port pin is switched high and low for *frequency* uS. The pin will be in the low state when the sound statement ends.
This loop is executed *duration* times.

See also

SOUNDEXT 217

Example

```
SOUND P1.1 , 10000, 10          'BEEP
End
```

6.176 SOUNDEXT

Action

Sends pulses to a port pin.

Syntax

SOUND pin, duration, frequency [,*NOINT*]

Remarks

Pin	Any I/O pin such as P1.0 etc.
duration	This is an integer, word or constant that specifies how long the sound is generated. A bigger value will result in a longer duration of the sound.
Frequency	This is an integer, word, or constant that that will be used to generate the frequency. A higher value will result in a higher frequency. A very low value might result in a sound that can not be heard.
NOINT	An option to disable interrupts during the sound statement.

The SOUNDEXT should be used instead of the SOUND statement. It has a wider range.

When you connect a speaker or a buzzer to a port pin (see hardware) , you can use the SOUNDEXT statement to generate some tones.
The **NOINT** will clear the global interrupts so no interrupts can occur during the sound statement. When the sound statement has completed the interrupt register is restored.

The SoundExt routine will create the sound as following:
- The port pin is set LOW
- The specified frequency is inverted
- The inverted value is decreased
- The port pin is set HIGH
- The inverted value is restored and decreased again

The actions are executed for DURATION times.

When the statement is ready, it will leave the pin in the HIGH state.
The time the pin is low is exact the same time as the pin is high. So the created pulse width is 50%.

Since loops are used, the frequency is relatively to the processor speed.
The width range of the frequency will ensure that you can create hearable tones width a variety of oscillator values. When you want to create tones that are independent of the processor speed, you need to use a timer.

See also

SOUND 216

Example

```
$regfile = "89s4051.dat"
$crystal = 8000000
Dim X As Word
X = 0
Do
   X = X - 10
  Soundext P3.4 , 500 , X
  Waitms 1
Loop
```

6.177 SPACE

Action

Returns a string of spaces.

Syntax

var = **SPACE(**x **)**

Remarks

X	The number of spaces.
Var	The string that is assigned.

Using 0 for x, will result in a string of 255 bytes because there is no check for a zero length assign.

See also
STRING 224, SPC 219

Example
```
Dim s as XRAM String * 15, z as XRAM String * 15
s = Space(5)
Print " {"  ;s ; " }"                          '{     }

Dim A as Byte
A = 3
S = Space(a)
```

Genereated code for last 2 lines :

```
; ---------- library routine -----------
_sStr_String:
Mov @r1,a
Inc r1
Djnz r2,_sStr_String
Clr a
Mov @r1,a
Ret
;---------------------------------------
Mov R1,#h'22 ; location of string
Mov R2,h'21  ; number of spaces
Mov a,#32
Acall _sStr_String
```

6.178 SPC

Action
Prints spaces to the serial port or LCD display.

Syntax
PRINT **SPC(**x **)**

Remarks

x	The number of spaces to print. Range from 1 - 255.

Use SPACE() function to assign spaces to a string.
SPC() can only be used in combination with PRINT and LCD.

See Also
SPACE 218

Example
```
Dim s as XRAM String * 15, z as XRAM String * 15
```

```
s = "Hello"
Print " {"  ;s ; SPC(3) ; "}"
```

6.179 SPIIN

Action
Reads a value from the SPI-bus.

Syntax
SPIIN var, bytes

Remarks

Var	The variable that is assigned with the value read from the SPI-bus.
Bytes	The number of bytes to read.

See also
SPIOUT 221 , CONFIG SPI 126 , SPIINIT 220

Example
```
Dim a(10) as byte
CONFIG SPI = SOFT, DIN = P1.0, DOUT = P1.1, CS=P1.2, CLK = P1.3
SPIINIT
SPIIN a(1) , 4                'read 4 bytes
```

6.180 SPIINIT

Action
Initializes the pins of the SPI-bus.

Syntax
SPIINIT

Remarks
The pins used for the SPI bus must be set to the proper logical level before you can use the SPI commands.

See also
SPIOUT 221 , CONFIG SPI 126 , SPIIN 220

Example
```
Dim a(10) as byte
CONFIG SPI = SOFT, DIN = P1.0, DOUT = P1.1, CS=P1.2, CLK = P1.3
SPIINIT
```

```
SPIIN a(1) , 4            'read 4 bytes
```

6.181 SPIOUT

Action
Sends a value of a variable to the SPI-bus.

Syntax
SPIOUT var , bytes

Remarks

var	The variable woes content must be send to the SPI-bus.
bytes	The number of bytes to send.

See also
SPIIN 220 , CONFIG SPI 126 , SPIINIT 220

Example
```
CONFIG SPI = SOFT, DIN = P1.0, DOUT = P1.1, CS=P1.2, CLK = P1.3
SPIINIT                        ‘ init SPI pins
Dim a(10) as Byte , X As Byte
SPIOUT a(1) , 5          'send 5 bytes
SPIOUT X , 1             'send 1 byte
```

6.182 START

Action
Start the specified timer/counter.

Syntax
START timer

Remarks

timer	TIMER0, TIMER1, TIMER2, COUNTER0 or COUNTER1.

You must start a timer/counter in order for an interrupt to occur (when the external gate is disabled).

TIMER0 and COUNTER0 are the same device.

See also
STOP TIMERx 222

Example

```
ON TIMER0 label2
LOAD TIMER0, 100
START TIMER0
DO                  'start loop
LOOP                  'loop forever

label2:              'perform an action here

RETURN
```

6.183 STOP

Action

Stop program execution.

Syntax

STOP

Remarks

END can also be used to terminate a program.

When an END or STOP statement is encountered a never ending loop is generated.

See Also

STOP TIMER 222 , START 221

Example

```
PRINT var            'print something
STOP                  'thats it
```

6.184 STOP Timer

Action

Stop the specified timer/counter.

Syntax

STOP timer

Remarks

timer	TIMER0, TIMER1, TIMER2, COUNTER0 or COUNTER1.

You can stop a timer when you don't want an interrupt to occur.

TIMER0 and COUNTER0 are the same.

See also

START TIMERx 221 , STOP 222

Example

```
'--------------------------------------------------------------
'                  (c) 1995-2006 MCS Electronics
'--------------------------------------------------------------
'  file: TIMER0.BAS
'  demo: ON TIMER0
'  *TIMER1 is used for RS-232 baudrate generator
'--------------------------------------------------------------
Dim Count As Byte , Gt As Byte

Config Timer0 = Timer , Gate = Internal , Mode = 2
'Timer0 = counter : timer0 operates as a counter
'Gate = Internal  : no external gate control
'Mode = 2         : 8-bit auto reload (default)

On Timer0 Timer_0_int
Load Timer0 , 100                       'when the timer reaches 100 an
interrupt will occur
Enable Interrupts                       'enable the use of interrupts
Enable Timer0                           'enable the timer


Rem Setting Of Priority
Priority Set Timer0                     'highest priority
Start Timer0                            'start the timer

Count = 0                               'reset counter
Do
  Input "Number " , Gt
  Print "You entered : " ; Gt
Loop Until Gt = 1                                             'loop
until users enters 1
Stop Timer0
End


Rem The Interrupt Handler For The Timer0 Interrupt
Timer_0_int:
   Inc Count
   If Count = 250 Then
      Print "Timer0 Interrupt occured"
      Count = 0
```

```
   End If
Return
```

6.185 STR

Action
Returns a string representation of a number.

Syntax
var **= STR(** x **)**

Remarks

Var	A string variable.
X	A numeric variable.

The string must be big enough to store the string.

See also
VAL 228, HEX 159, HEXVAL 160

Difference with QB
In QB STR() returns a string with a leading space. This behaviour is not in BASCOM.

Example
```
Dim a as Byte, S as XRAM String * 10
a = 123
s  = Str(a)
Print s
End
```

6.186 STRING

Action
Returns a string consisting of m repetitions of the character with ASCII code n.

Syntax
var = **STRING(**m ,n **)**

Remarks

Var	The string that is assigned.
N	The ASCII-code that is assigned to the string.
M	The number of characters to assign.

Since a string is terminated by a 0 byte, you can't use 0 for n.
Using 0 for m will result in a string of 255 bytes, because there is no check on a length assign of 0. When you need this let me know.

See also

SPACE 218

Example

```
Dim s as XRAM String * 15
s = String(5,65)
Print s                              'AAAAA
End
```

6.187 SUB

Action

Defines a Sub procedure.

Syntax

SUB Name[(var1)**]**

Remarks

name	Name of the sub procedure, can be any non reserved word.
var1	The name of the parameter.

You must end each subroutine with the END SUB statement.

You must Declare Sub procedures before the SUB statement.
The parameter names and types must be the same in both the declaration and the Sub procedure.

Parameters are global to the application.
That is the used parameters must be dimensioned with the DIM statement.
Therefore, the variables can be used by the program and sub procedures.
The following examples will illustrate this :

```
Dim a as byte, b1 as byte, c as byte      'dim used variables
Declare Sub Test(a as byte)                  'declare subroutine
a = 1 : b1 = 2: c = 3                     'assign variables

Print a ; b1 ; c                          'print them
```

```
Call Test(b1)                    'call subroutine
Print a ;b1 ; c                  'print variables again
End

Sub Test(a as byte)              'begin procedure/subroutine
  print a ; b1 ; c               'print variables
End Sub
```

See also

CALL 109, DECLARE 135

Example

NONE

6.188 SWAP

Action

Exchange two variables of the same type.

Syntax

SWAP var1, var2

Remarks

var1	A variable of type bit, byte, integer or word.
var2	A variable of the same type as var1.

After the swap, var1 will hold the value of var2 and var2 will hold the value of var1.

Example

```
Dim a as integer,b1 as integer
a = 1 : b1 = 2            'assign two integers
SWAP a, b1                'swap them
PRINT a ; b1
```

6.189 THIRDLINE

Action

Reset LCD cursor to the third line.

Syntax

THIRDLINE

Remarks

NONE

See also

UPPERLINE 228 , LOWERLINE 184 , FOURTHLINE 145

Example

Dim a as byte
a = 255
LCD a
Thirdline
LCD a
Upperline
End

6.190 UCASE

Action

Converts a string into upper case.

Syntax

dest = **UCASE**(source)

Remarks

dest	The string variable that will be assigned with the upper case of string SOURCE.
source	The source string. The original string will be unchanged.

See also

LCASE 174

Example

```
Dim S As String * 12 , Z As String * 12
Input "Hello " , S                          'assign string
S = Lcase(s)                                'convert to lowercase
Print S                                     'print string

S = Ucase(s)                                'convert to upper case
Print S                                     'print string
```

6.191 UPPERLINE

Action
Reset LCD cursor to the upper line.

Syntax
UPPERLINE

Remarks
NONE

See also
LOWERLINE 184 , THIRDLINE 226 , FOURTHLINE 145

Example
```
Dim a as byte
a = 255
LCD a
Lowerline
LCD a
Upperline
End
```

6.192 VAL

Action
Converts a string representation of a number into a number.

Syntax
var **= Val(** s **)**

Remarks

Var	A numeric variable that is assigned with the value of s.
S	Variable of the string type.

var : Byte, Integer, Word, Long, Single.

See also
STR 224 , HEXVAL 160

Example
```
Dim a as byte, s As XRAM string * 10
s = "123"
a = Val(s)              'convert string
```

```
Print a
End
```

6.193 VARPTR

Action
Retrieves the memory-address of a variable.

Syntax
var = **VARPTR**(var2)

Remarks

Var	The variable that is assigned with the address of var2.
var2	A variable to retrieve the address from.

See also
PEEK 198 POKE 198

Example
```
Dim I As Integer , B1 As Byte
B1 = Varptr(I)
```

Generated code:
```
Mov h'23,#h'21
```

6.194 WAIT

Action
Suspends program execution for a given time.

Syntax
WAIT seconds

Remarks

seconds	The number of seconds to wait.

The delay time is based on the used X-tal (frequency).
When you use interrupts the delay can be extended.

See also
DELAY 137 , WAITMS 230 , WAITMSE 231

Example

```
WAIT 3              'wait for three seconds
Print "*"
```

6.195 WAITKEY

Action

Wait until a character is received in the serial buffer.

Syntax

var = **WAITKEY()**
var = **WAITKEY(#channel)**

Remarks

Var	Variable that is assigned with the ASCII value of the serial buffer.
channel	The channel number of the device

var : Byte, Integer, Word, Long, String.

See also

INKEY 167

Example

```
Dim A As Byte
A = Waitkey                  'wait for character
Print A
```

Example

```
Dim A As Byte
Open "COM2:" For Binary As #1 'open serial chan.1 COM2 of 80517/80537
Dim St As Byte
St = Inkey(#1)               'get key
St = Inkey()                     'get key from COM1 (the default)
```

6.196 WAITMS

Action

Suspends program execution for a given time in mS.

Syntax

WAITMS mS

Remarks

mS	The number of milliseconds to wait. (1-255)

The delay time is based on the used X-tal (frequency).
The use of interrupts can slow down this routine.
This statement is provided for the I2C statements.
When you write to an EEPROM you must wait for 10 mS after the write instruction.

See also

DELAY 137 , WAIT 229 , WAITMSE 231

Example

```
WAITMS 10               'wait for 10 mS
Print "*"
```

6.197 WAITMSE

Action

Suspends program execution for a given time in mS.

Syntax

WAITMS mS

Remarks

mS	The number of milliseconds to wait. (1-65535)

The delay time is based on the used X-tal (frequency).
So it is important that you provide the right $CRYSTAL 87 value.

The use of interrupts can slow down this routine.
For a real precise delay you should use a timer.
The WAITMS statement can only delay for 255 mS. That is why the WAITMSE statement was added, it can give a longer delay.

See also

DELAY 137 , WAIT 229 , WAITMS 230

Example

```
WAITMSE 1000            'wait for 1000 mS
Print "*"
```

6.198 WATCHDOG

Action

Start and stop the watchdog timer.

Syntax

START WATCHDOG 'will start the watchdog timer.
STOP WATCHDOG 'will stop the watchdog timer.
RESET WATCHDOG 'will reset the watchdog timer.

Remarks

The AT89S8252 has a built in watchdog timer.
A watchdog timer is a timer that will reset the uP when it reaches a certain value.
So during program execution this WD-timer must be reset before it exceeds its maximum value. This is used to be sure a program is running correct.
When a program crashes or sits in an endless loop it will not reset the WD-timer so an automatic reset will occur resulting in a restart.
You need to configure the reset time with CONFIG WATCHDOG.

CONFIG WATCHDOG = value

value	The time in mS it takes the WD will overflow, causing a reset. Possible values are : 16,32,64,128,256,512,1024 or 2048

See Also

CONFIG WATCHDOG 128

Example

```
DIM A AS INTEGER
CONFIG WATCHDOG = 2048              'after 2 seconds a reset will occur
START WATCHDOG                   'start the WD
DO
  PRINT a
  a = a + 1                     'notice the reset
  REM RESET WATCHDOG                    'delete the REM to run properly
LOOP
END
```

6.199 WHILE .. WEND

Action

Executes a series of statements in a loop, as long as a given condition is true.

Syntax

WHILE condition
    statements
WEND

Remarks

If the condition is true then any intervening statements are executed until the WEND statement is encountered.
BASCOM then returns to the WHILE statement and checks condition.
If it is still true, the process is repeated.
If it is not true, execution resumes with the statement following the WEND

statement.

See also

DO .. LOOP 140 , FOR .. NEXT 144

Example

```
Dim A As Byte
While A <= 10
Print A
Incr A
Wend
```

Part VII

7 Using assembly

7.1 Using assemly

In line assembly

Assembler statements are recognized by the compiler.
The only exception is SWAP because this is a valid BASIC statement.
You must precede this ASM-statement with the **!**-sign so the compiler knows that you mean the ASM SWAP statement.

Note that for the ACC register, A is used in mnemonics.(Except for bit operations)
Example:

```
Mov a, #10        'ok
Mov acc,#10       'also ok but generates 1 more byte
Setb acc.0        'ok
Setb a.0          'NOT OK
```

You can also include an assembler file with the **$INCLUDE FILE.ASM** statement.

The assembler is based on the standard Intel mnemonics.
The following codes are used to describe the mnemonics:

Rn	working register R0-R7
Direct	128 internal RAM locations, any IO port, control or status register. For example : P1, P3, ACC
@Ri	indirect internal RAM location addressed by register R0 or R1
#data	8-bit constant included in instruction
#data16	16-bit constant included in instruction
Bit	128 software flags, any IO pin, control or status bit For example : ACC.0, P1.0, P1.1

Boolean variable manipulation

CLR C	clear carry flag
CLR bit	clear direct bit
SETB C	set carry flag
SETB bit	set direct bit
CPL C	complement carry flag
CPL bit	complement direct bit
ANL C, bit	AND direct bit to carry flag
ORL C,bit	OR direct bit to carry flag
MOV C,bit	Move direct bit to carry flag

Program and machine control

LCALL addr16	long subroutine call
RET	return from subroutine
RETI	return from interrupt
LJMP addr16	long jump
SJMP rel	short jump (relative address)
JMP @A+DPTR	jump indirect relative to the DPTR
JZ rel	jump if accu is zero
JNZ rel	jump if accu is not zero
JC rel	jump if carry flag is set
JNC rel	jump if carry flag is not set
JB bit,rel	jump if direct bit is set
JNB bit,rel	jump if direct bit is not set
JBC bit,rel	jump if direct bit is set & clear bit
CJNE A,direct,rel	compare direct to A & jump of not equal
CJNE A,#data,rel	comp. I'mmed. to A & jump if not equal
CJNE Rn,#data,rel	comp. I'mmed. to reg. & jump if not equal
CJNE @Ri,#data,rel	comp. I'mmed. to ind. & jump if not equal
DJNZ Rn,rel	decrement register & jump if not zero
DJNZ direct,rel	decrement direct & jump if not zero
NOP	No operation

Arithmetic operations

ADD A,Rn	add register to accu
ADD A,direct	add register byte to accu
ADD A,@Ri	add indirect RAM to accu
ADD A,#data	add immediate data to accu
ADDC A,Rn	add register to accu with carry
ADDC A,direct	add direct byte to accu with carry flag
ADDC A,@Ri	add indirect RAM to accu with carry flag
ADDC A,#data	add immediate data to accu with carry flag
SUBB A,Rn	subtract register from A with borrow
SUBB A,direct	subtract direct byte from A with borrow
SUBB A,@Ri	subtract indirect RAM from A with borrow
SUBB A,#data	subtract immediate data from A with borrow
INC A	increment accumulator

INC Rn	increment register
INC direct	increment direct byte
INC@Ri	increment indirect RAM
DEC A	decrement accumulator
DEC Rn	decrement register
DEC direct	decrement direct byte
DEC@Ri	decrement indirect RAM
INC DPTR	increment datapointer
MUL AB	multiply A & B
DIV AB	divide A by B
DA A	decimal adjust accu

Logical operations

ANL A,Rn	AND register to accu
ANL A,direct	AND direct byte to accu
ANL A,@Ri	AND indirect RAM to accu
ANL A,#data	AND immediate data to accu
ANL direct,A	AND accu to direct byte
ANL direct,#data	AND immediate data to direct byte
ORL A,Rn	OR register to accu
ORL A,direct	OR direct byte to accu
ORL A,@Ri	OR indirect RAM to accu
ORL A,#data	OR immediate data to accu
ORL direct,A	ORL accu to direct byte
ORL direct,#data	ORL immediate data to direct byte
XRL A,Rn	exclusive OR register to accu
XRL A,direct	exclusive OR direct byte to accu
XRL A,@Ri	exclusive OR indirect RAM to accu
XRL A,#data	exclusive OR immediate data to accu
XRL direct,A	exclusive OR accu to direct byte
XRL direct,#data	exclusive OR immediate data to direct byte
CLR A	clear accu
CPL A	complement accu
RL A	rotate accu left
RLC A	rotate A left through the carry flag
RR A	rotate accu right
RRC A	rotate accu right through the carry flag

SWAP A	swap nibbles within the accu

Data transfer

MOV A,Rn	move register to accu
MOV A,direct	move direct byte to accu
MOV A,@Ri	move indirect RAM to accu
MOV A,#data	move immediate data to accu
MOV Rn,A	move accu to register
MOV Rn,direct	move direct byte to register
MOV Rn,#data	move immediate data to register
MOV direct,A	move accu to direct byte
MOV direct,Rn	move register to direct byte
MOV direct,direct	move direct byte to direct
MOV direct,@Ri	move indirect RAM to direct byte
MOV direct,#data	move immediate data to direct byte
MOV@Ri,A	move accu to indirect RAM
MOV@Ri,direct	move direct byte to indirect RAM
MOV@Ri,#data	move immediate to indirect RAM
MOV DPTR,#data16	load datapointer with a 16-bit constant
MOVC A,@A+DPTR	move code byte relative to DPTR to A
MOVC A,@A+PC	move code byte relative to PC to A
MOVX A,@Ri	move external RAM (8-bit) to A
MOVX A,@DPTR	move external RAM (16 bit) to A
MOVX@Ri,A	move A to external RAM (8-bit)
MOVX@DPTR,A	move A to external RAM (16-bit)
PUSH direct	push direct byte onto stack
POP direct	pop direct byte from stack
XCH A,Rn	exchange register with accu
XCH A,direct	exchange direct byte with accu
XCH A,@Ri	exchange indirect RAM with A
XCHD A,@Ri	exchange low-order digit ind. RAM w. A

How to access labels from ASM.

Each label in BASCOM is changed into a period followed by the label name.

Example :
GOTO Test
Test:

generated ASM code:
```
LJMP .Test
.Test:
```

When you are using ASM-labels you can also precede them with the !-Sign so the label won't be converted.

```
Jb P1.0, Test                ; no period
!test      :                 ; indicate ASM label
```

Or you can include the period in the labelname.
Another good alternative is to use the $ASM $END ASM directives.

Example:
```
$Asm
  mov a,#1
  test:
  sjmp test
$End Asm
```

How variables are stored.

BIT variables are stored in bytes.
These bytes are stored from 20hex -2Fhex thus allowing 16 * 8 = 128 bit variables.
You can access a bit variable as follows:

```
Dim var As Bit        'dim variable
SETB  {var}           ; set bit
CLR {var}             ; clear bit
Print var             ; print value
End
```

Or you can use the BASIC statement SET and RESET which do the same thing.

BYTE variables are stored after the BIT variables.
Starting at address 20 hex + (used bytes for bit vars).

INTEGER/WORD variables are stored with the LSB at the lowest memory position.
LONG variables are stored with the LSB at the lowest memory position too.

You can access variables by surrounding the variable with **{}.**
To refer to the MSB of an Integer/Word use **var+1**.
To refer to the MSB of a Long use **var+3.**
The following example shows how to access the variables from ASM

```
Dim t as Byte, c as Integer
CLR a                     ; clear register a
MOV {t} , a               ; clear variable t
INC {t}                   ; t=t + 1
MOV {c} , {t}             ; c = t
MOV {c+0}, {t}            ; LSB of C = t  (you don't have to enter the +0)
MOV {lain+1}, {t}         ; MSB of C = t
MOV {c},#10               ; assign value
```

You can also change SFRs from BASIC.

```
P1 = 12            'this is obvious
ACC = 5            'this is ok too
B = 3              'B is a SFR too
```

```
MUL AB              'acc = acc * b
Print acc
```

EXTERNAL variables are stored similar.
Strings are stored with a terminating zero.

Example :

```
$RAMSTART = 0
Dim s As String * 10          'reserve 10 bytes + 1 for string terminator
s = "abcde"                   'assign string constant to string

ram location 0 = a            'first memory location
ram location 1 = b
ram location 2 = c
ram location 3 = d
ram location 4 = e
ram location 5 = #0
```

External variables must be accessed somewhat different.

```
Dim T as XRAM Byte
mov dptr,#{T}           ; address of T to datapointer
mov a,#65               ; place A into acc
movx @dptr,a            ; move to external memory
Print T                 ; print it from basic

Dim T1 as XRAM Integer
mov dptr,#{T1}          ; set datapointer
mov a,#65               ; place A into acc (LSB)
movx @dptr,a            ; move to external memory
inc dptr                ; move datapointer
mov a,#1                ; 1 to MSB
movx @dptr,a            ; move to external memory

Print T1                ; print it from basic
```

Helper routines

There are two ASM helper routines that can make it a bit easier:
PLACEVALUE var , SFR
PLACEADRES var, SFR

PLACEVALUE assigns the variable, **var**, to the specified register, **SFR**.
Placevalue 1, A will generate :

```
Mov a,#1
```

Dim x as Byte
Placevalue x ,R0 will generate:

```
Mov a, h'3A  ; in this example only of course
```

Where it is becoming handy is with arrays :
Placevalue a(x), RO will generate :

```
Mov r0,#h'3A
Mov a,@r0
```

```
Rl a
Add a,#h'1F
Mov R0,a
Mov a,@r0
```

These are all examples, the generated code will differ with the type of variables used.
You can only assign 1 SFR with the PLACEVALUE statement.
This is where PLACEADRES comes around the corner.
Placeadres , places a variables address into a register.

Placeadres ar(x),A
Placeadres z , R0

When external variables are used, you don't need to specify a register because DPTR is always assigned.

Dim X as xram Integer
PLACEADRES x , dptr or PLACEADRES x
Will generate :

```
Mov dptr,#2
```

Or with arrays :
PLACEADRES ar(x)

```
Mov dptr,#2
Mov r0,#h'37
Mov a,@r0
Mov r2,a
Inc r0
Mov a,@r0
Mov r3,a
Mov r1,#1
Acall _AddIndex
```

Of course these are also examples, the generated code depends on the types and if they are internal or external variables.

Hexdecimal notation

You can also use hexadecimal notation.
Example : Mov a,#**h'**AA
Or use the BASIC notation :
Mov a,#**&H**AA

Binary notation

You can also use binary notation.
Example : Mov a,#**&B**10001000

Jumping with offset

You can specify an offset instead of a labelname when jumping.

```
Jb P1.0 , *+12              ;jump forward
Jb P1.0 , *-12              ;jump back
Jnb P1.0 , *+0              ;loop until P1.0 becomes high
```

This also applies to the other instructions where can be jumped to a label like SJMP, LJMP DJNZ etc.

Internal buffer for string conversion

The string conversion routines used for PRINT num , STR() and VAL(), use an internal buffer of 16 bytes. This has the advantage that no stack handling is needed but the disadvantage that a fixed space is used.
Of course you can use this buffer. It can be referenced with **___TMP_S1**
So when you need a temp string, you can use this buffer.
Note that this buffer is only available with the mentioned statements!

Example :

```
Dim s as single
s = 1.1
Print s                'now the buffer is needed
___TMP_S1 = "Use this space"
Print ___TMP_S1
```

Comment

The **;** sign can be used or the BASIC comment sign **'**

```
Mov a,#1  ; comment
Mov a,#2  'comment
```

7.2 Internal registers

You can manipulate the register values directly from BASIC.
They are also reserved words. The internal registers are :

BIT addressable registers

TCON	Timer/counter control
P1	Port 0 latch
SCON	Serial port control
IE	Interrupt enable
P3	Port 3 latch
IP	Interrupt priority control
PSW	Program status word
ACC	Accumulator
B	B register

BYTE addressable register

SP	Stack pointer
DPL	Data pointer low word
DPH	Data pointer high word
PCON	Power control
TMOD	Timer/counter mode control

TL0	Timer/counter 0 low byte
TL1	Timer/counter 1 low byte
TH0	Timer/counter 0 high byte
TH1	Timer/counter 1 high byte
SBUF	Serial data port
P1	Port 1 latch
P3	Port 3 latch

The registers and their addresses are defined in the REG51.DAT file which is placed in the BASCOM application directory.
You can use an other file for other uPs.
You can select the appropriate register file with the Options Compiler settings 56.

Take care when you are directly manipulating registers!
The ACC and B register are frequently used by BASCOM.
Also the SP register is better to be left alone.
Altering SP will certainly crash your application!

Bit addressable registers can be used with the SET 212/RESET 208 statements and as bit-variables.
Byte addressable registers can be used as byte variables.
P1 = 40 will place a value of 40 into port 40.

Please note that internal registers are reserved words.
This means that they can't be dimensioned as BASCOM variables!

So you can't use the statement **DIM B as Byte** because **B** is an internal register.
You can however manipulate the register with the B = value statement.

Making your own register file is very simple:
- copy the 8052.DAT file to a new DAT file for example myproc.DAT
  DOS c:\bascom copy 8052.dat myproc.dat
- edit the registerfile with BASCOM

A register file has a few sections. The following example shows only a few items under each section.
The **[BIT]** section contains all SFR's which are bit addressable. A bit addressable SFR ends with 0 or 8.
After the SFR name you can write the hexadecimal address.
An optional initial value for the simulator can also be specified. Separate the values by a comma.
Acc = E0 , 00

The **[BYTE]** section contains all the other SFR's.

The **[MISC]** section has a few items:
- **up** : here you can enter a short name for the uP.
- **IRAM** : the amount of available internal memory (128 or 256 bytes)
- **org** : the hexadecimal address where the code can start. This is 3 bytes after the last interrupt entry address, because the last interrupt will have a LJMP to an ISR and a LJMP needs 3 bytes.
- **I_**xxx : where xxx is the name of the additional interrupt. The name must be no

longer than 6 characters. As you can see in the example below the last interrupt **T2** has an entry address of 73 (hex). So the org is set to 73+3 = 76 (hex).
You only need to specify the additional interrupts. The interrupts for INT0,INT1, TIMER0, TIMER1 and SERIAL are already handled by the compiler.

- CLOCKDIV : The division factor of the oscillator. By default this is 12 and when you don't specify it, 12 will be used. Some micro processors have a division factor of 6 or 4.

EXAMPLE

[BIT]
ACC = E0
B = F0

[BYTE]
ADCH = C6
ADCON = C5
CTCON = EB

[MISC]
up = 80552
I_TIMER2 = 2B
I_CT0 = 33
I_CT1 = 3B
I_CT2 = 43
I_CT3 = 4B
I_ADC = 53
I_CM0 = 5B
I_CM1 = 63
I_CM2 = 6B
I_T2 = 73
org = 76
IRAM = 256
CLOCKDIV = 12

7.3 Initialization

BASCOM initializes the processor depending on the used statements.
When you want to handle this by yourself you can specify this by the meta command $NOINIT 94.

The only initialization that is always done is the setting of the stack pointer and the initialization of the LCD display (if LCD related statements are used).

You can use the $NOSP 96 statement when you don't want the stack pointer to be set.

All data used for variables like the internal RAM or external RAM, is in an unknown condition at startup. This means that you can not assume that a variables is 0.
For example:

```
Dim a as byte
Print a
End
```

When you run the code, '**a**' can contain any value. When you want to be sure the variable is 0, assign it with 0. During a reset, the memory content might be the same as before the reset, but again, there is no guarantee.

Part VIII

8 Additional Hardware

8.1 Additional Hardware

You can attach additional hardware to the ports of the microprocessor.
The following statements will become available :
I2CSEND and **I2CRECEIVE and other I2C related statements.**
LCD, LCDHEX, DISPLAY and other related LCD statements.
1 WIRE bus explanation. 254
More about connecting a LCD display 253.
More about the I2C bus 254

Hardware related commands

The uP must be connected to a crystal. The frequency of the crystal can range from 0 to 24 Mhz for most chips. The frequency is divided by 12 internally.
So with a 12 Mhz crystal the processor is clocked with 1 Mhz.
Because almost each instruction takes, 1 clock cycle to execute the processor can handle 1 MIPS.

When RS-232 statements such as INKEY, PRINT and INPUT are used, TIMER1 is connected to the system clock.
So TIMER1 cant be used for other purposes such as ON TIMER1 anymore.
When no RS-232 related statements are used you can use TIMER1.

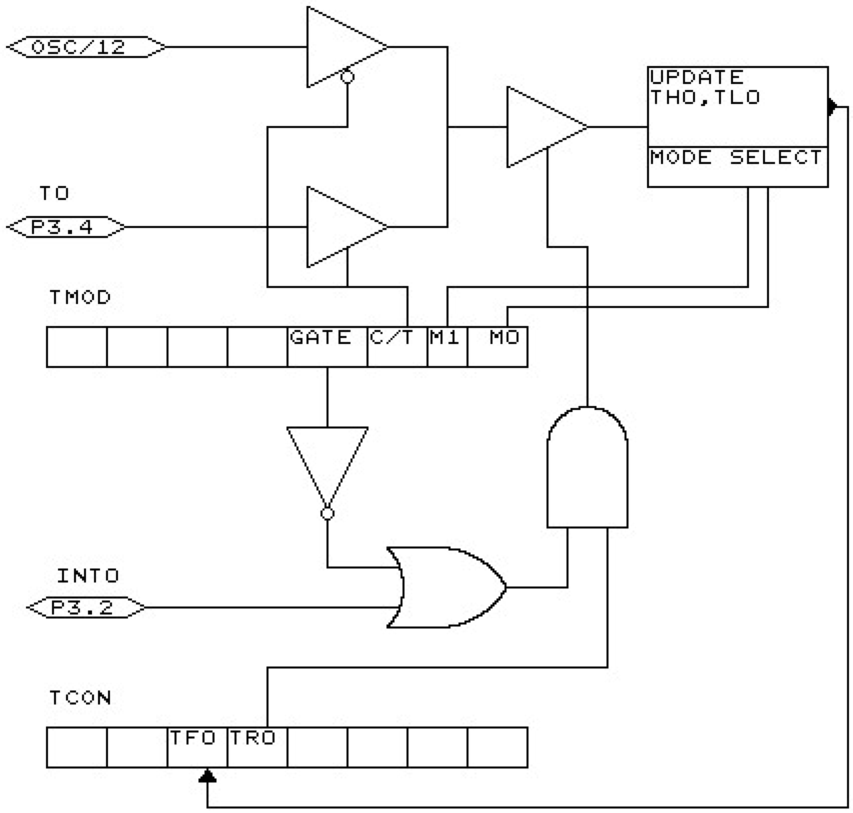
The Baud rate is generated by dividing the system clock.
When a crystal of 11.0592 Mhz is used, the Baud rate can be generated very accurately.
Other crystals can be used too but the generated baud rate will never be exactly 2400 or 4800 baud and higher baud rates are almost impossible.
The exact baud rate is shown in the report file.

Clock

The clock frequency is the system frequency divided by 12.
With a 12 Mhz crystal this means that every microsecond the register is incremented.

Timers and Counters

The 8051 has two 16-bit timers named TIMER0 and TIMER1.
Below the internal representation of timer0 is shown.
TIMER0 and TIMER1 are almost identical so you can read TIMER1 for TIMER0.



Each counter register has two SFRs associated with it.
For TIMER0 the SFRs are TL0 and TH0.
TL0 is the lowest byte of TIMER0 and TH0 is the highest byte of TIMER0.
These two registers make the timers 16-bit wide.

The timer can operate as a timer or as a counter.
A timer uses the system clock divided by 12 as the source of its input pulses.
So it increments periodical.

A counter uses external pulses to increment its count.
The external pulses are received at alternative pin P3.4 for TIMER0 and P3.5 for TIMER1.
The timer/counter can be controlled by the run-bit TR0.

You can stop a timer/counter with the statement STOP TIMER0 222/COUNTER0.
You can start a timer/counter with the statement START TIMER0 221/TIMER1.

The timer/counter can also be controlled with the alternative pin P3.2.
This pin is labeled for its alternative INT0-input but it can be used to control the timer.
When GATE is reset the timer/counter is enabled.
When GATE is set the timer/counter is enabled if INT0 is active(low). (provided that the timer is started)

The timer/counter can operate in four modes:
- mode 0 : 13-bit counter.
  An interrupt is generated when the counter overflows. So it takes 8192 pulses to generate the next interrupt.
- mode 1 : 16-bit counter.

Mode 1 is similar to mode 0. It implements a 16-bit counter.
It takes 65536 input pulses to generate the next interrupt.

- mode 2 : 8-bit auto reload.
  TL0 serves as an 8-bit timer/counter.
  When the timer/counter overflows the number stored in TH0 is copied into TL0 and the count continues.
  An interrupt is generated each time the counter overflows and a reload is performed.
- mode 3 : TIMER1 is inactive and holds its count. (TIMER1).
  For TIMER0 in timer mode two 8-bit timers are available and in counter mode one 8-bit timer is available.
  See a datasheet for more details.

The timer/counter can be configured with the CONFIG statement.
CONFIG TIMER0= COUNTER/TIMER, GATE=INTERNAL/EXTERNAL, MODE=0-3
The first argument is the timer/counter you want to configure, TIMER0 in this case.
GATE specifies if external timer control with the INT0 pin is enabled.
MODE specifies the timer/counter mode (0-3).

So CONFIG TIMER0 = COUNTER, GATE = INTERNAL, MODE=2 will configure TIMER0 as a COUNTER with no external gate control , in mode 2 (auto reload)
When the timer/counter is configured the timer/counter is stopped so you must start it afterwards with the START TIMER0 statement.

The ON TIMERx statement can be used to respond to a timer/counter interrupt when the timer overflows.

When the timer/counter is used in mode 2 (auto reload) the reload value can be specified with the **LOAD TIMERx, *value*** statement.
Because it is an 8-bit register a maximum time of 255 uS can be achieved.

So for a period of 10 uS you must supply a value of (256-10) is 246. To make things easier you can assign the value directly : LOAD TIMERx , 250 will internally be transformed into 256-250=6.
This saves you the trouble of calculating the correct value.

The COUNTER0 and COUNTER1 variables hold the values of timer/counter 0 and 1.
You can also set the timer/counter contents with the COUNTER0 = value statement.

Please note that with the LOAD statement, you can only load a byte value into the timer/counter.
Because the statement is meant for timer/counter mode 2.

Also note that you can assign a value to the timer/counter with the COUNTER0/ COUNTER1 variables. You can not use the TIMER0/TIMER1 in it's place but it does the same thing : assigning/retrieving the timer/counter.

Port 3 is a unique port because it has alternative functions.
That is you can use it as a port like P3.1 = 1 or SET P3.1 or you can make use of the double function of this port.

Port	Alternative function
P3.0	RxD receive data for RS-232
P3.1	TxD transmit data for RS-232

P3.2	INT0 interrupt 0 input/timer 0 gate control
P3.3	INT1 interrupt 1 input/timer 1 gate control
P3.4	T0 timer 0 input or counter input
P3.5	T1 timer 1 input or counter input
P3.5	-
P3.7	-

When you make use of the PRINT, INPUT and other RS-232 related statements P3.0 and P3.1 are used for the RS-232 interface.

When you make use of the INT0/INT1 interrupts, you must connect an interrupt source to the corresponding pins. A switch for example.
The INTx interrupt can occur on the falling edge of a signal or when the signal is low.
Use the following statements to specify the trigger:

SET TCON.0	Falling edge generates interrupt for INT0.
RESET TCON.0	Low signal generates interrupt for INT0.
SET TCON.2	Falling edge generates interrupt for INT1.
RESET TCON.2	Low signal generates interrupt for INT1.

When TCON.x is RESET the interrupts keep on occurring while the input is low.r
When TCON.x is SET the interrupt only occurs on the falling edge.

To test if a hardware interrupt is generated you can test the TCON.1 and TCON.3 flags.
These flags are set by hardware when an external interrupt edge is detected.
They are reset by the RETURN statement of the interrupt service routine or subroutine.
TCON.1 must be tested for INT0 and TCON.3 must be tested for INT1.

Some uPs have an additional timer named TIMER2 288. It depends on the used chip which features TIMER2 has.

Ports and Power Up

Port 1 is an 8-bit bi-directional I/O port. Port pins P1.2 to P1.7 provide internal pull-ups.
P1.0 and P1.1 requires external pull-ups. P1.0 and P1.1 also serve as the positive input(AIN0) and the negative input(AIN1), respectively, of the on-chip precision analog comparator.

The port 1 output buffers can sink 20 mA and can drive LED displays directly.
When 1s are written to Port 1 pins, they can be used as inputs.
When pins P1.2 to P1.7 are used as inputs and are externally pulled low,
they will source current because of the internal pullups.

Port 3 pins P3.0 to P3.5, P3.7 are seven bi-directional I/O pins with internal pull-ups.
P3.6 is hard wired as an input to the output of the on-chip comparator and is not accessible as a general purpose I/O pin.

The port3 output buffers can sink 20 mA.
When 1's are written to Port 3 pins they are pulled high by the internal pullups and can be used as inputs.
Port 3 pins that are externally being pulled low will source current because of the pullups.
Port 3 also serves the functions of various special features of the AT89C2051 as listed below.

Port	Alternative function
P3.0	RxD receive data for RS-232
P3.1	TxD transmit data for RS-232
P3.2	INT0 interrupt 0 input/timer 0 gate control
P3.3	INT1 interrupt 1 input/timer 1 gate control
P3.4	T0 timer 0 input or counter input
P3.5	T1 timer 1 input or counter input
P3.5	-
P3.7	-

Writing to a Port
P1 = 255 will write the value 255 to the port 1, setting all the pins to 1
so all pins can be used as inputs.

P1 = 0 will write the value 0 to port 1, setting al pins to zero.

Reading from a Port
byte = P1 will read the value from port 1 and will assign the value to variable *byte*.

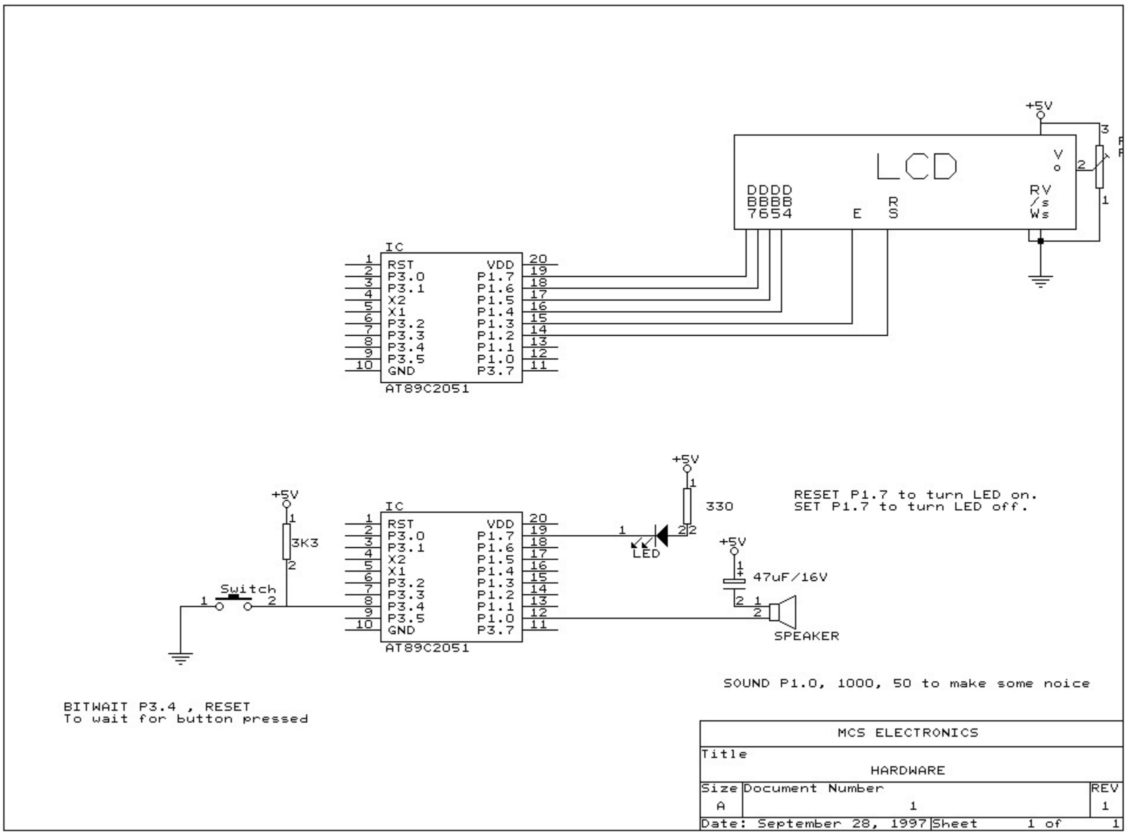
Setting individual pins of a Port
You can also set individual pins of the ports in BASCOM.

SET P1.0 will set pin P1.0 high.
P1.0 = 1 will also set pin P1.0 high.

RESET P1.0 will set pin P1.0 low.
P1.0 = 0 will also set pin P1.0 low.

At power up both ports are high and can be used an inputs.
Individual bits can be set to use a port both as input/output.
For example : **P1** = **&B**00001111 , will set a value of 15 to port 1.
P1.0 to P1.3 can be used as inputs because they are set high.

How to interface the port pins



The schematic above shows how to connect a LED as an output, a speaker as an output and a switch as an input device.

8.2 Alternative port-pin functions

The AT89S8252 ports have alternative functions.
The following table shows the alternative functions.

Port pin	Alternate function
P1.0	T2 external count input to timer.counter 2, clock out
P1.1	T2EX timer/counter 2 capture/reload trigger and direction flag
P1.4	/SS Slave port select input
P1.5	MOSI Master data output, slave data input pin for SPI channel
P1.6	MISO Master data input, slave data output pin for SPI channel
P1.7	SCK Master clock output, slave clock input pin for SPI channel
P3.0	RxD serial input port
P3.1	TxD serial output port
P3.2	/INT0 external interrupt 0
P3.3	/INT1 external interrupt 1
P3.4	T0 timer 0 external input

P3.5	T1 timer 1 external input
P3.6	/WR external data memory write strobe
P3.7	/RD external data memory read strobe

/ means active low

8.3 Hardware - LCD display

The LCD display can be connected as follows:

LCD-DISPLAY	PORT	PIN
DB7	P1.7	14
DB6	P1.6	13
DB5	P1.5	12
DB4	P1.4	11
E	P1.3	6
RS	P1.2	4
RW	Ground	5
Vss	Ground	1
Vdd	+5 Volt	2
Vo	0-5 Volt	3

This leaves P1.1 and P1.0 and P3 for other purposes.

You can change the LCD pin layout from the Options LCD menu.
You can select the display used with the CONFIG LCD 121 statement.

The LCD display operates in 4-bit mode.
See the $LCD 91 statement for operation in 8-bit mode.

BASCOM supports a lot of statements to control the LCD display.
For those who want to have more control the example below shows how to do so.

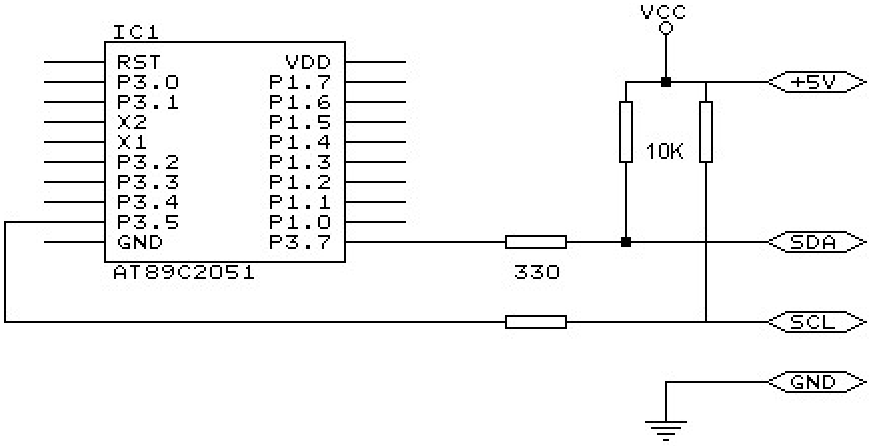
```
Acc = 5              'load register A with value
Call Lcd_control      'it is a control value to control the display
Acc = 65             'load with new value (letter A)
Call Write_lcd        'write it to the LCD display
```

Note that lcd_control and write_lcd are assembler subroutines which can be called from BASCOM.

See manufacture details from your LCD display for the correct assignment.

8.4 Hardware - I2C

The design below shows how to implement an I2C-bus.
Note that you can select which port pins you want to use for the I2C interface with the compiler settings 54.



You can also select the SDA and SCL pin with the CONFIG SDA 125 and CONFIG SCL 124 statement.

8.5 1WIRE INFO

The following information is written by Göte Haluza, thanks!

Dallas Semiconductor (DS) 1wire. This is a brief description of DS 1wirebus when used in combination with BASCOM. For more detailed explanations about the 1w-bus, please go to http://www.dalsemi.com/techbriefs/tb1.html. Using BASCOM, makes the world a lot easier. This paper will approach the subject from a "BASCOM-user-point-of-view".

1wire-net is a serial communication protocol, used by DS devices. The bus could be implemented in two basic ways :

With 2 wires, then DQ and ground is used on the device. Power is supplied on the DQ line, which is +5V, and used to charge a capacitor in the DS device. This power is used by the device for its internal needs during communication, which makes DQ go low for periods of time. This bus is called the **1wirebus.**

With 3 wires, when +5V is supplied to the VDD line of the device, and DQ + ground as above. This bus is called the **2wirebus.**

So, the ground line is "not counted" by DS. But hereafter we use DS naming conventions.

How it works. (1wire)

The normal state of the bus is DQ=high. Through DQ the device gets its power, and performs the tasks it is designed for.

When the host (your micro controller (uC)) wants something to happen with the 1w-bus, it issues a reset-command. That is a very simple electric function that happens then; the DQ goes active low for a time (480uS on original DS 1w-bus). This put the DS-devices in reset mode; then (they) send a presence pulse, and then (they) listen to the host.

The presence pulse is simply an active low, this time issued by the device(s).

Now, the host cannot know what is on the bus, it is only aware of that at least 1 DS device is attached on the bus.

All communication on the 1w-bus is initialized by the host, and issued by time-slots of active-low on a normally high line (DQ), issued by the device, which is sending at the moment. The devices(s) internal capacitor supplies its power needs during the low-time.

How you work with 1w-bus

Thereafter, you can read a device, and write to it. If you know you only have 1 sensor attached, or if you want to address all sensors, you can start with a "Skip Rom" - command. This means; take no notice about the Ids of the sensors - skip that part of the communication.

When you made a 1w-reset, all devices of the bus are listening. If you chose to address only one of them, the rest of them will not listen again before you have made a new 1w-reset on the bus.

I do not describe BASCOM commands in this text - they are pretty much self-explaining. But the uC has to write the commands to the bus - and thereafter read the answer. What you have to write as a command depends on devices you are using - and what you want to do with it. Every DS chip has a datasheet, which you can find at http://www.dalsemi.com/datasheets/pdfindex.html. There you can find out all about the actual devices command structure.

There are some things to have in mind when deciding which of the bus-types to use.

The commands, from BASCOM, are the same in both cases. So this is not a problem.

The +5V power-supply on the VDD when using a 2wire-bus has to be from separate power supply, according to DS. But it still works with taking the power from the same source as for the processor, directly on the stabilising transistor. I have not got it to work taking power directly from the processor pin.

Some devices consume some more power during special operations. The DS1820 consumes a lot of power during the operation "Convert Temperature". Because the sensors knows how they are powered (it is also possible to get this information from the devices) some operations, as "Convert T" takes different amount of time for the sensor to execute. The command "Convert T" as example, takes ~200mS on 2wire, but ~700mS on 1wire. This has to be considered during programming.

And that power also has to be supplied somehow.

If you use 2wire, you don't have to read further in this part. You can simultaneously "Convert T" on all the devices you attach on the bus. And save time. This command is the most power-consuming command, possible to execute on several devices, I am aware of.

If you use 1wire, there are things to think about. It is about not consuming more power than you feed. And how to feed power? That depends on the devices (their consumption) and what you are doing with them (their consumption in a specific operation).

Short, not-so-accurate description of power needs, not reflecting on cable lengths

Only the processor pin as power supplier, will work < 5 sensors. (AVR, 1w-functions use an internal pull-up. 8051 not yet tested). Don't even think of simultaneous commands on multiple sensors.

With +5V through a 4K7 resistor, to the DQ-line, 70 sensors are tested. But, take care, cause issuing "Convert T" simultaneously, would cause that to give false readings. About ~15 sensors is the maximum amount of usable devices, which simultaneously performs some action. This approach DS refers to as "pull-up resistor".

With this in mind, bus up to 70 devices has been successfully powered this way.

The resistor mentioned, 4K7, could be of smaller value. DS says minimum 1K5, I have tested down to 500 ohm - below that the bus is not usable any more. (AVR). Lowering the resistor feeds more power - and makes the bus more noise -resistant. But, the resistor minimum value is naturally also depending on the uC-pin electric capabilities. Stay at 4K7 - which is standard recommendation.

DS recommends yet another approach, called "strong pull-up" which (short) works via a MOS-FET transistor, feeding the DQ lines with enough power, still on 1wire, during power-consuming tasks. This is not tested, but should naturally work. Cause this functionality is really a limited one; BASCOM has no special support for that. But anyway, we tell you about it, just in case you wonder. Strong pull-up has to use one uC pin extra - to drive the MOS-FET.

Cable lengths (this section is only for some limited understanding)

For short runs up to 30 meters, cable selection for use on the 1W bus is less critical. Even flat modular phone cable works with limited numbers of 1-Wire devices. However, the longer the 1W bus, the more pronounced cable effects become, and therefore the greater importance placed on cable selection.

For longer distances, DS recommends twisted-pair-cable (CAT5).

DS standard examples show 100 meters cable lengths, so they say, that's no problem. They also show examples with 300m cabling, and I think I have seen something with 600-meter bus (but I cant find it again).

Noise and CRC

The longer cable and the noisier environment, the more false readings will be made. The devices are equipped with a CRC-generator - the LSByte of the sending is always a checksum. Look in program examples to learn how to re-calculate this checksum in your uC. AND, if you notice that there are false readings - do something about your cables. (Shield, lower resistor)

Transfer speed

On the original 1w-bus, DS says the transfer speed is about 14Kbits /second. And, if that was not enough, some devices has an overdrive option. That multiplies the speed by 10. This is issued by making the communication-time-slots smaller (from 60 uS to 6uS) which naturally will make the devices more sensitive, and CRC-error will probably occur more often. But, if that is not an issue, ~140Kbit is a reachable speed to the devices. So, whatever you thought before, it is FAST.

The BASCOM scanning of the bus is finds about 50 devices / second , and reading a specific sensors value to a uC should be about 13 devices / second.

Topology

Of the 1w-net - that is an issue we will not cover so much. Star-net, bus-net? It seems like you can mix that. It is a bus-net, but not so sensitive about that.

The benefit of the 1w-bus

Each device is individual - and you can communicate with it over the media of 2 wires. Still, you can address one individual device, if you like. Get its value. There are 64 ^ 2 unique identifications-numbers.

Naturally, if lot of cables are unwanted, this is a big benefit. And you only occupy 1 processor pin.

DS supplies with different types of devices, which all are made for interfacing an uC - directly. No extra hardware. There are sensors, so you can get knowledge about the real world, and there are also potentiometers and relays, so you can do something about it. On the very same bus.

And the Ibutton approach from DS (ever heard of it?) is based on 1wire technology. Maybe something to pick up.

BASCOM let you use an uC with 1wire-devices so easy, that (since now) also has to count as a benefit - maybe one of the largest. ;-)

The disadvantages of the 1w-bus

So far as I know, DS is the only manufacturer of sensors for the bus. Some people think their devices are expensive. And, until now, it was really difficult to communicate with the devices. Particularly when using the benefit of several devices on one bus. Still some people say that the 1w-bus is slow - but I don't think so.

Göte Haluza
System engineer

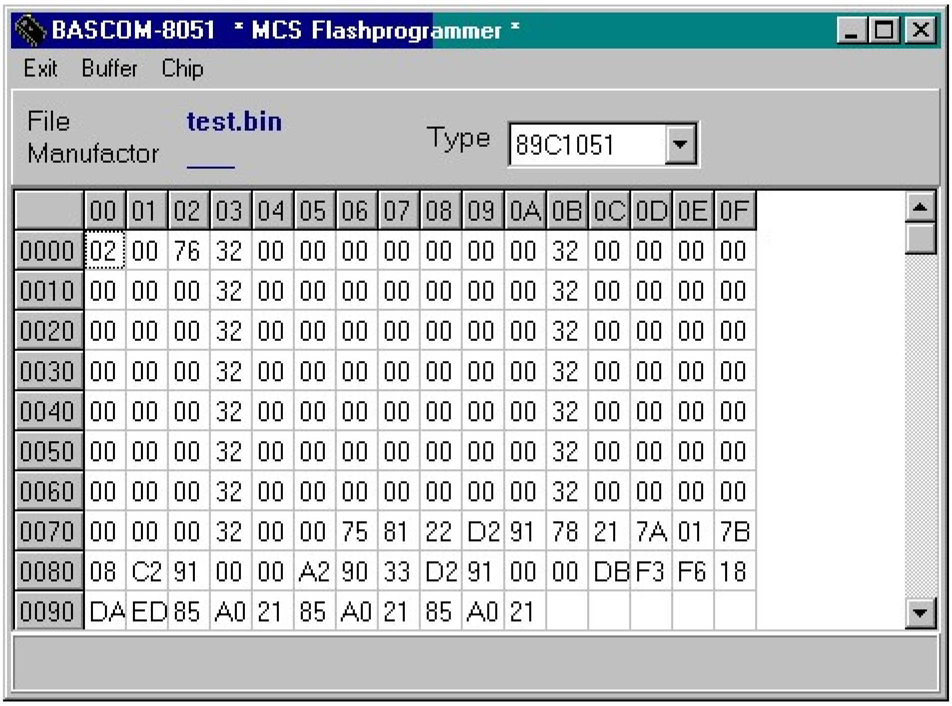
Part IX

9 Supported Programmers

9.1 MCS Flash programmer

There are different models of the MCS Flash programmer, but all of them are compatible with the driver software.

The MCS Flash programmer is a parallel printer port based programmer.
It can only program the ATMEL 89C1051 , AT89C2051 and AT89C4051.
Select the correct printer port address before you run the programmer.
Be sure to switch on the power supply before running BASCOM.



When you run the programmer, the buffer will be filled automatically with your program data. The programmer works with binary files. The following menu options are available.

Exit

Exit the programmer.

Buffer clear

Clear the buffer. That is, fill it with zero bytes.

Buffer Read from disk

Load a file into the buffer. By default the current program.BIN file is selected.
Select a file with the file selection dialog box and press the Ok-button.

Buffer Write to disk

Write the content of the buffer to a file.
Note that the file size is 1024 ,2048 or 4096 bytes depending on the chip type.

Buffer read from chip
Read the content of the FLASGROM into the buffer.
If the lock bits are set all bytes will return FF.

Buffer Write to chip
Program the chip with the content of the buffer.
The chip is erased before the buffer is written to the chip.

Buffer Verify
Compares the content of the buffer with the content of the chip.

Buffer program chip
Erases the chip, writes the buffer to the chip and finally verifies the buffer with the chip.

Chip get type
Retrieves the chip type. AT89C1051 , AT89C2051 or AT89C4051.

Chip Erase
Erases the chip. Lock bits are also erased.

Chip Set lockbit 1
When LB1 is set the chip can not be programmed anymore.

Chip Set lockbit 2
When LB2 is set the chip can not be programmed nor can it be verified (read)
Use LB1 and LB2 together for securing your program.

Options LPT1 .. LPT3
Select the printer port the programmer is connected to.

Option Port delay
Because computers become faster every day and the hardware is run by software a delay can be specified for very fast computers.
A value of 5 is used on a 486DX266. You must increase the value on faster computers if problems occur.
The default is 0, and for best results, 0 should be used.

9.2 MCS SPI programmer

The MCS SPI programmer is a parallel printer port based SPI-programmer.
It is a modified design of Jakub Jiricek's SPI-programmer. (two LED's were added)

The programmer can program the AT89S52 which has an extra 2048 bytes built in EEPROM for storing data and the AT89S53.
The nice thing about SPI-programmable chips is that the chip can be programmed in circuit. You only must design your application so that the SPI-port pins will not be pulled low.

The following menu options are available:

File exit
Will exit the programmer.

Write code
Will program the chip with the current programs binary image.

Write data
Will ask for a file and will write the data to the EEPROM.

Verify code
Will verify the programs binary image with the chip content.

Verify data
Will verify a file with the chips EEPROM content.

Read code
Will ask for a filename and will write the chip content to the file.

Read data
Will ask for a filename and will write the EEPROM content to the file.

Chip reset
Will reset the chip.

Chip erase
Will erase the chip.

Chip set lockbits
Will set the selected lock bits.

The following use feedback was received:

I have at last found my problem with the SPI flash programmer designed by Jakub Jiricek.

My PC's LPT port was set to NORMAL mode in the BIOS. Symptoms include normal reset pulse but very slow progress bar with eventual failure to verify.

Correct programmer operation was achieved by changing to EPP (enhanced parallel port) mode in BIOS. I can only assume that the s/w must be using one line in bi-directional mode. Of course, this "fix" may only apply to my PC.

Not recommended for new programmers.

9.3 Blow IT Flashprogrammer

The Blow IT flashprogrammer is a parallel printer port based programmer and can only erase, and program a chip. The programmer works only with the AT89C1051 to AT89C4051 chips.

The programmer uses the same interface as the MCS Flashprogrammer, but doesn't support all the features due it's design. So for a description read the MCS Flashprogrammer 260 help.

Not recommended for new programmers.

9.4 PG2051 flash programmer

The PG2051 is a serial comport based programmer and can program AT89C1051 and ATC2051 chips only. A nice feature is that the programmer can serve as an simulator too. The programmer works with Intel HEX files only.

The following menu options are available:

File Exit
This will exit the programmer.

Buffer read from disk
This allows you to load a binary file from disk.
The current projects binary file is always loaded automatic.

Buffer write to disk
This option can be used to save the buffer to disk.

Buffer download
With this option you send the programs' hex file to the programmer/simulator.
After it is sent, you can program the chip or simulate the program.

Buffer retrieve
Use this option to load the chip content into the buffer.

Buffer verify
This option will verify the buffer with the chip content.

Buffer autoprogram
This option will erase the chip, download the buffer, program the chip and finally verifies the chip.

Chip get type
To identify the chip you can select this option.

The radio-button 89C1051 or 89C2051 will be set.

Chip set lockbit 1
Set lockbit 1 so the chip can not be programmed anymore.

Chip set lockbit 2
Set lockbit 2 so the chip can not be programmed or verified/read anymore .

Chip erase
Erases the chip.

Chip program
Will program the chip with the downloaded buffer.

Chip simulate
Will simulate the programmed program. This saves swapping the chip in and out of the target application.

9.5 PG302 programmer

The PG302 is a serial comport based programmer.
The programmer can program a wide variety of chips with additional adapters.
The BASCOM interface is designed to look similar with the original PG302 driver software.

You must select the target chip from the device list.
Some chips will enable the memory radio buttons. For example the AT89S8252.
You can select the memory-area with the radio buttons in these cases.

Blank check
Will perform a blank check on the chip. That is, every memory location will be checked if it is equal to 255 (hex FF), indicating an un-programmed byte.

Erase
Will erase the chip. All memory locations will be set to 255.

Program
Will program the chip with the current program.
If EEPROM-memory is selected, you will be asked for a filename.

Verify
Will verify the current program with the target chip.

Read
Will read the target chip and saves the result to a file.

Set lockbit
Will set the selected lock bits.
You must select the lock bits first. The lock bits to set depend on the selected target chip.

Auto erase

When this checkbox is selected, the target chip will be erased before it will be programmed.

Auto verify

When this checkbox is selected, the result will be verified after each programming.

9.6 SE512 or SE514 programmer

The SE512 and SE514 are parallel printer port based programmers.
The nice thing about these programmers is that they can simulate the application too. This has the advantage that no device swapping is needed until your application works like you want. The SE512 can program the AT89C1051 to AT89C4051. The SE514 can program larger chips too.

Buffer clear

Will clear the buffer.

Buffer load from file

With this option you can load a file into the buffer. By default the current program is loaded into the buffer.

Buffer save to file

With this option you can save the buffer to a binary file.

Chip Write buffer into chip

With this option you program the chip.

Chip Read chipcode into buffer

This option will read the target device its memory into the buffer.

Chip Blank check

Performs a blank check on the target device. A chip is considered blank if every memory location contains 255 (FF hex)

Chip Erase

Will erase the target chip.

Chip verify

Will verify the buffer with the chipcontent.

Chip autoprogram

Will erase, program and verify the chip.

Note that the targetchip will be detected automatic. When the targetchip can't be detected, the menu options will not work.

9.7 SE-812

The SE-812 from Sample Electronics is a programmer for the aduc812.

The programmer is well suited for in circuit programming.

Since it is a serial programmer that operates via the COM port, the programming is done with the terminal emulator. When you select the SE812 from the programmer options there will be an additional menu in the terminal emulator.

- Erase chip. This option will erase both the code flash and the EEPROM.
- Erase code flash. This option will erase only the code flash memory.
- Program chip. This will program the chip with the current program.
- Auto program. This will erase the chip and program the chip.

The programmer works only with version 2.00 of the boot loader.

9.8 Sample Electronics ISP programmer

The simple cable programmer was submitted by Sample Electronics.

They produce professional programmers too. This simple programmer you can make yourself within a 10 minutes. And only a few resistors are needed.

The operation is the same a for the STK200/300 programmer 270.

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(AT89S8252)	DT104
2, D0	MOSI, pin 6	J5, pin 4
4, D2	RESET, pin 9	J5, pin 8
5, D3	CLOCK, pin 8	J5, pin 6
11, BUSY	MISO, pin 7	J5, pin 5
18-25,GND	GROUND	J5, pin 1

The MCU pin numbers are shown for an 8252!

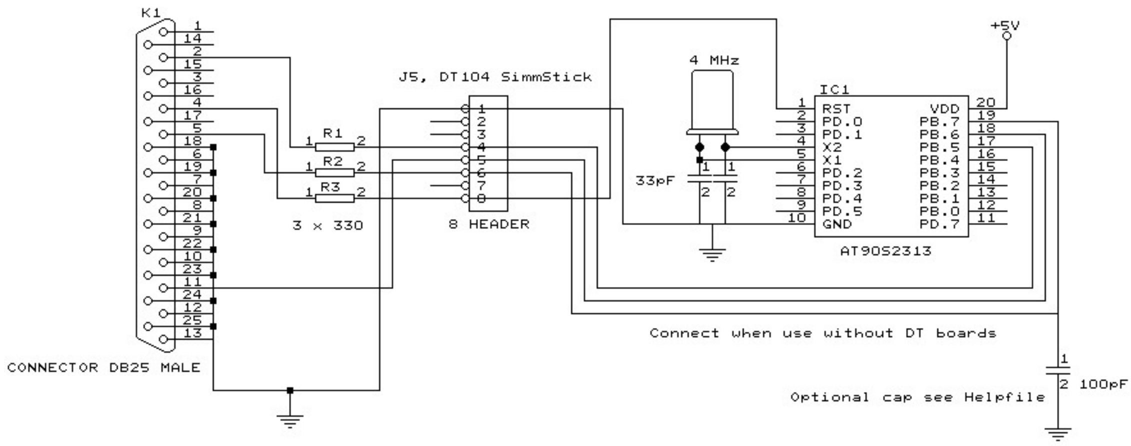
Note that 18-25 means pins 18,19,20,21,22,23,24 and 25

You can use a small resistor of 100 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.

But it was tested without these resistors and my PC still works :-)

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 dont destroy your LPT port that is on the motherboard in the event you make a mistake!

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



I received the following useful information :

Hi Mark,

I have been having spurious success with the simple cable programmer from Sample Electronics for the AVR series.

After resorting to hooking up the CRO I have figured it out (I think). When trying to identify the chip, no response on the MISO pin indicates that the Programming Enable command has not been correctly received by the target. The SCK line Mark/Space times were okay but it looked a bit sad with a slow rise time but a rapid fall time. So I initially tried to improve the rise time with a pullup. No change ie still could not identify chip. I was about to add some buffers when I came across an Atmel app note for their serial programmer

"During this first phase of the programming cycle, keeping the SCK line free from pulses is critical, as pulses will cause the target AVR to loose syncronisation with the programmer. When syncronisation is lost, the only means of regaining syncronisation is to release the RESET line for more than 100ms."

I have added a 100pF cap from SCK to GND and works first time every time now. The SCK rise time is still sad but there must have been enough noise to corrupt the initial command despite using a 600mm shielded cable.

This may be useful to your users.

Regards,

Mark Hayne

9.9 CYGNAL JTAG Programmer

The CYGNAL JTAG programmer comes with the CYGNAL development kit and is also available from www.sample.co.kr

All tests were performed with the programmer/evaluation board from Sample Electronics.

The Cygnal JTAG programmer is controlled by a COM port.

You need to select a free COM port of your PC that is connected to the programmer.

When you program the cygnal chip BASCOM will erase and program the chip.

9.10 Futurelec

The Futurelec programmer from www.futurlec.com is an ISP programmer for the 89S8252.

All tests are performed with the AT89S8252 board from Futurelec Electronics.

9.11 JPK Systems X-programmer

The JPK Systems X-programmer is a serial comport based SPI-programmer.
It is fully optical isolated and so an ideal device for industrial equipment.
It supports AVR chips too, but these aren't supported in BASCOM of course so there is only support for the 89S8252 and the 89S53.

Since it is serial based, the support is placed in the terminal emulator.
After selecting the JPK programmer, there will be additional menu options available in the terminal emulator. All these options can be found under the JPK menu.
The transfer between the PC and the programmer is implemented with the X-modem CRC protocol.

Select device

Use this option to select the targetdevice. You can choose between the 89S8252 and the 89S53.

Erase

Erase the target chip.

Read code

Will read the codememory from the chip. You will be asked for a filename first.

Program chip

Will program the targetchip with the current program.

Set lockbits
Will set the lockbits of the targetchip. All lockbits will be set.

Read EEPROM
Will save the EEPROM data into a file. This only applies to the AT89S8252.

Write EEPROM
Will program the EEPROM with a file. This only applies to the AT89S8252.

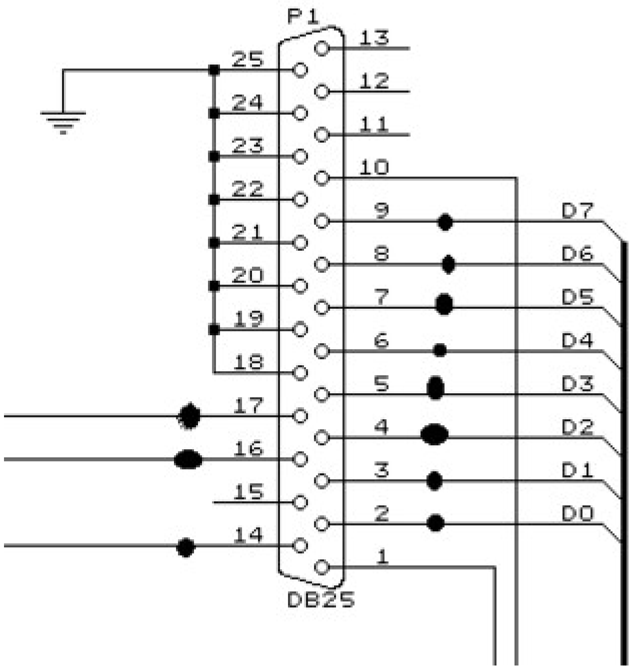
Of course all commands can be typed manually too, but you must set the terminal emulator communication settings to 2400N82 in that case.

9.12 Peter Averill's TAFE programmer

The TAFE flashprogrammer is a parallel printer port based programmer and can be build with the DT004 and DT206 SimmSticks from Dontronics. The programmer can program only AT89C1051 to AT89C4051 chips.

Peter also has schematics available on the web so you can build your own PCB. The programmer supports all the usual features except the 'read signature' feature. Thats is why you have to select the used chip yourself from the mnu.

The programmer uses the same interface as the MCS Flashprogrammer, so for a description read the MCS Flashprogrammer 260 help.
I got some feedback from a user that had problems with his programmer.
he added 5K1 pullup resistors to +5V. This is shown in the picture below. The dots (11) must each have a resistor of 5K1 to +5V.



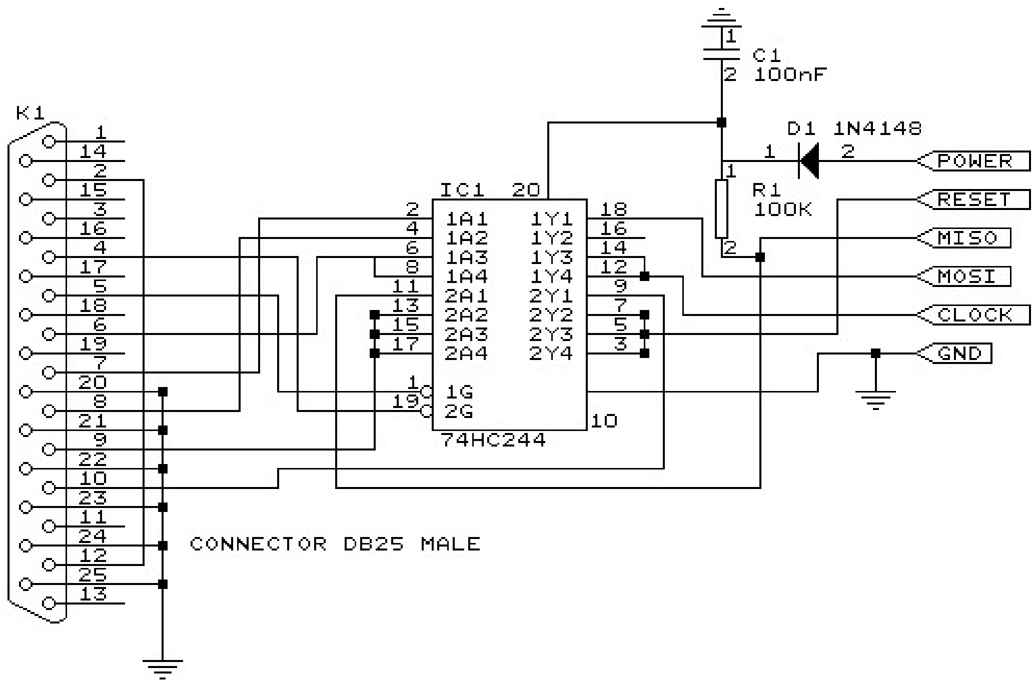
9.13 STK200/300 ISP Programmer

The STK200 and STK300 are AR starter kits from Atmel.

They come with a parallel printer port programmer dongle for in system programming of the chips.

This dongle can be used to program the 89S8252 or 89S53.

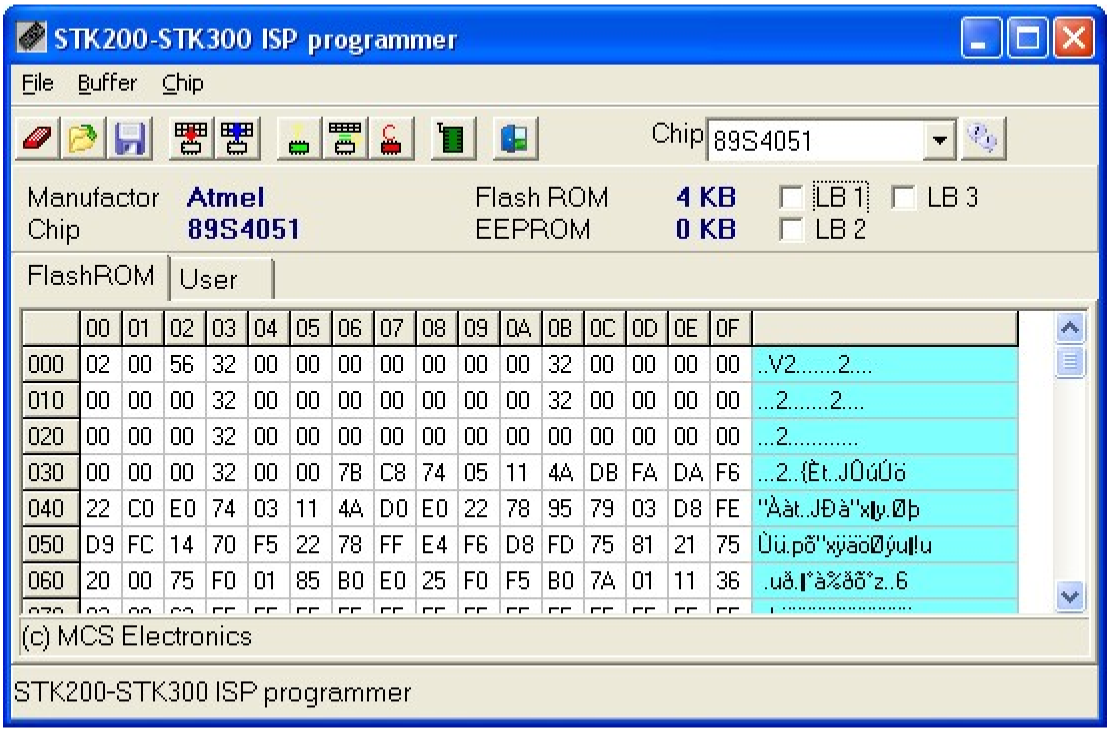
For those who don't have this kit and the programmer the following schematic shows how to make your own programmer:



The dongle has a chip with no identification but since the schematic is all over the web, I have included it. Kanda also sells a very cheap separate programmer dongle. So I suggest you buy this one!

MCS also sells a compatible dongle.

The following screen will pop up when you have selected this programmer:



You must select the chip you use. By selecting the FlashROM TAB or the EEPROM TAB you can write that info to the chip. When the chip does not have EEPROM memory, the EEPROM TAB will not be visible.

When the chip such as the 89S8253, 89S2051 or 89S4051 has USER data, an additional TAB will be shown.

This is intended to read/write the user data.

When you select auto Flash, pressing F4 from the IDE will program the chip automatic and the window will not be displayed.

When Code + Data is selected from the programmer options 60 both the Code and the EEPROM data are programmed.

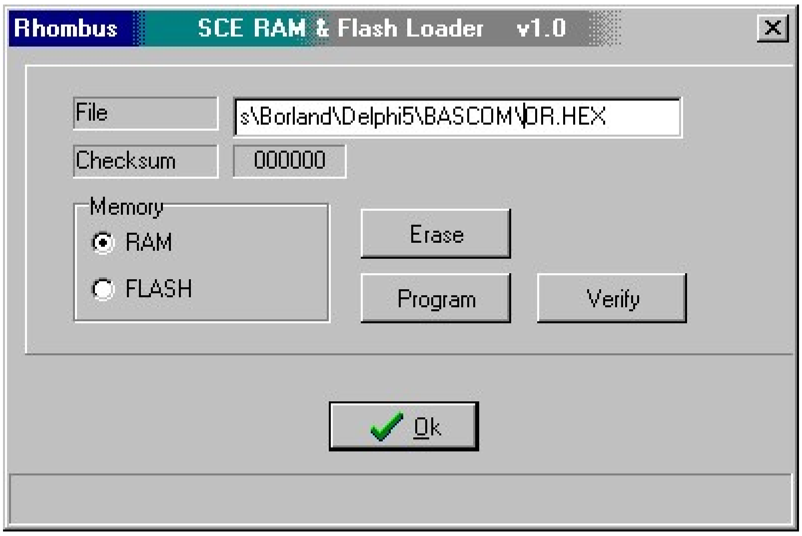
9.14 Rhombus SCE-51

Rhombus developed the SCE-51. A powerful small 8051 micro processor board with on board RAM and FLASHROM and bootloader.

In addition the board serves as an in circuit emulator.

Transferring your program to RAM goes very fast. Faster than loading it into the traditional FLASHROM. So during debugging it is well suited for debugging large applications.

When you select the SCE-51, the following window will appear when you press F4.



The filename is automatic filled.

The original SCE-51 software from Rhombus has much more options and BASCOM only supports programming to RAM and FLASH.

You must select the target memory before you click the Program button.

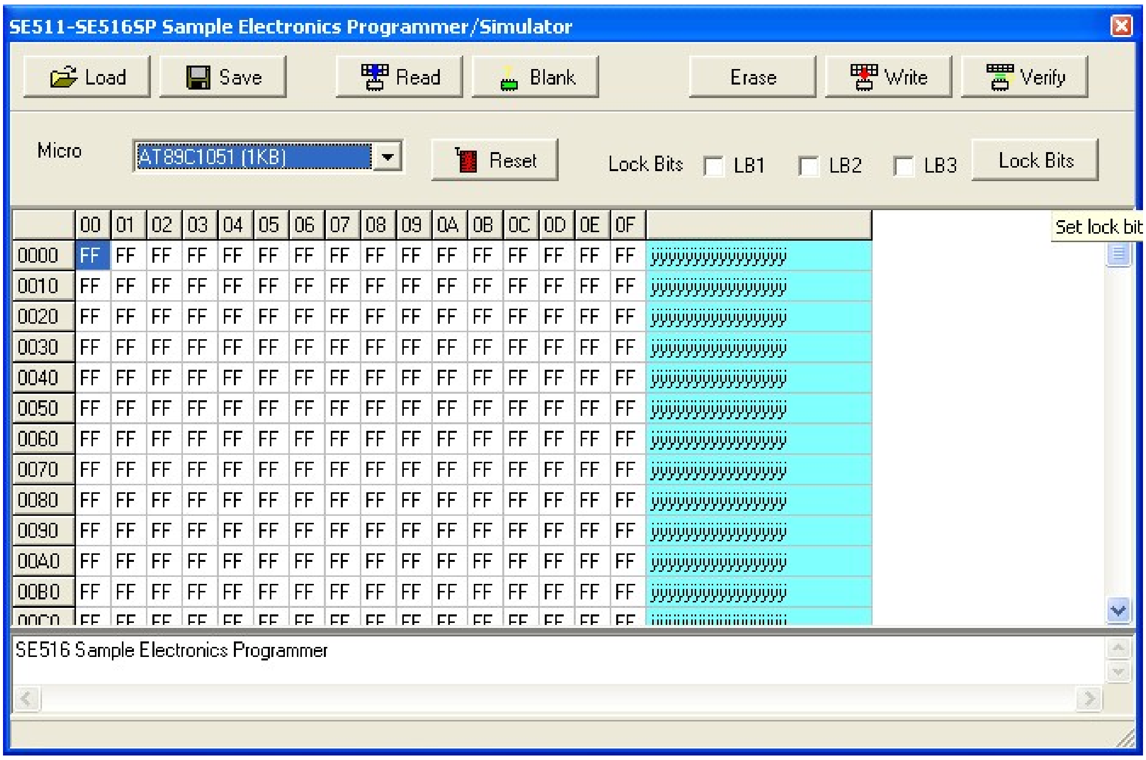
By clicking the Erase button you can erase the memory.

During programming a status bar will be shown.

The baud rate is fixed to 19200 baud. Support for 115200 baud will be added later.

9.15 SE511-SE516 programmer

The SE511-SE516 can be used for the SE511 and SE516 programmers from Sample Electronics.
These programmers are serial programmers. They require a COM port.



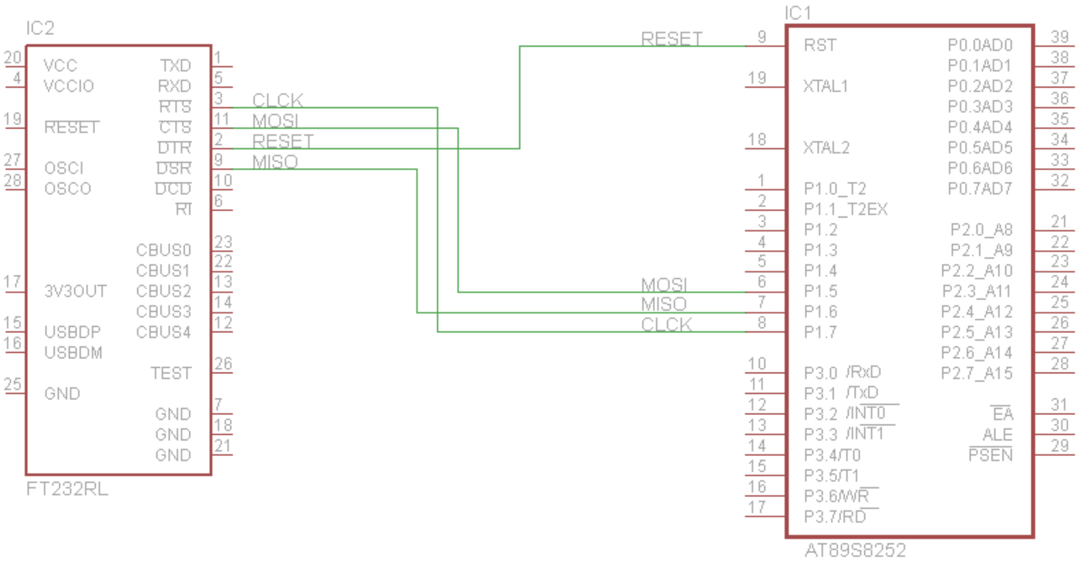
When you launch the programmer, the current program will be loaded into the memory.
You can also use the LOAD button to load a program into the buffer.

Reset	This button will reset the programmer and will determine the used chip.
Load	Load a binary or Intel HEX file into the buffer
Save	Save the current buffer to file
Read	Read the chip flash content
Blank	Test if a chip is blank
Erase	Erase (blank) a chip
Write	Write(program) the buffer into the chip
Verify	Verify if the buffer is the same as the chip content
Lock Bits	Write the selected lock bits

9.16 MCS USBISP Programmer

The MCS USBISP programmer is a new USB programmer based on the FT232RL chip.
The FT232RL is a well known virtual COM port chip. It can also be used in so called 'bitbang' mode. Exactly this mode is used.

The programmer is based on the Sample ELectronics SE-UTS cable. It is modified (the flatcable is removed and a connector is soldered)
But you can also create your own programmer.



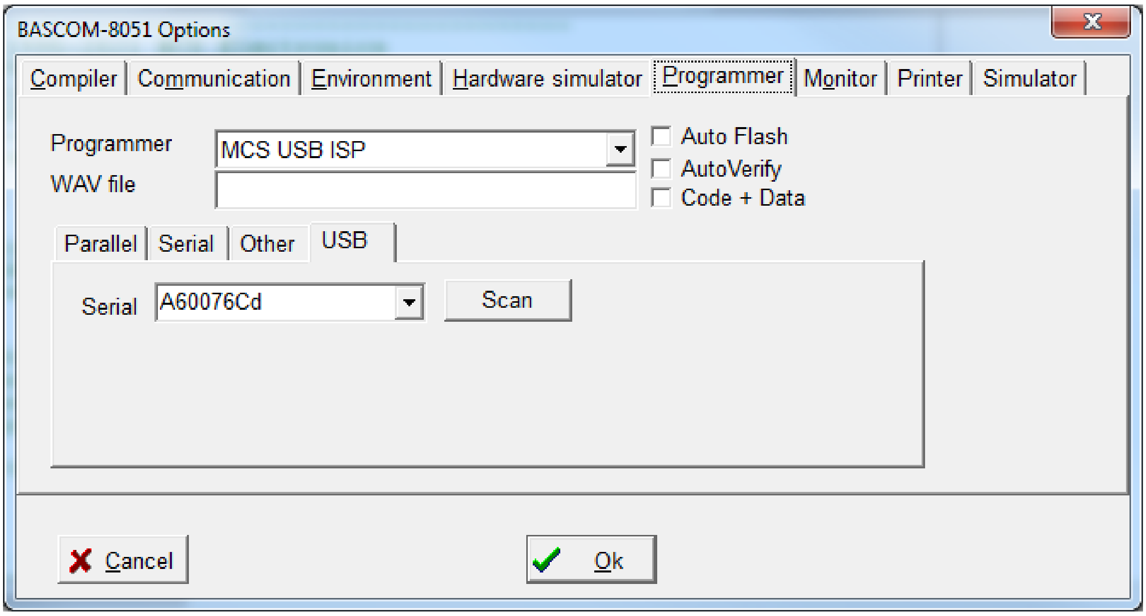
The circuit shows the used FT232RL chip. There are only a few connections to the target 8051 processor : RTS(CLOCK), CTS(MOSI), DTR(RESET), DSR(MISO).
GND is also connected but not shown here. VCC from the USB which is 5V is also connected. But take in mind this is a stand alone programmer.
Normally you would not conenct 5V from the USB to the target circuit since the USB can only supply little power. it is best if you enable your circuit with its own power.
Also note that for ISP programming the used ISP pins may not have a load. When there is hardware connected to the circuit with a low impedance, either use some switch or a MUX.

TX and RX of the FTDI are not used. This way you can use the FTDI in virtual COM port mode as well to communicate with the processor.

The circuit above does not show the complete FT232RL setup. Only the connections for the programming are shown.
Also the 898252 requires an XTAL and capacitors. It is not shown either but your target hardware surely would have this already.

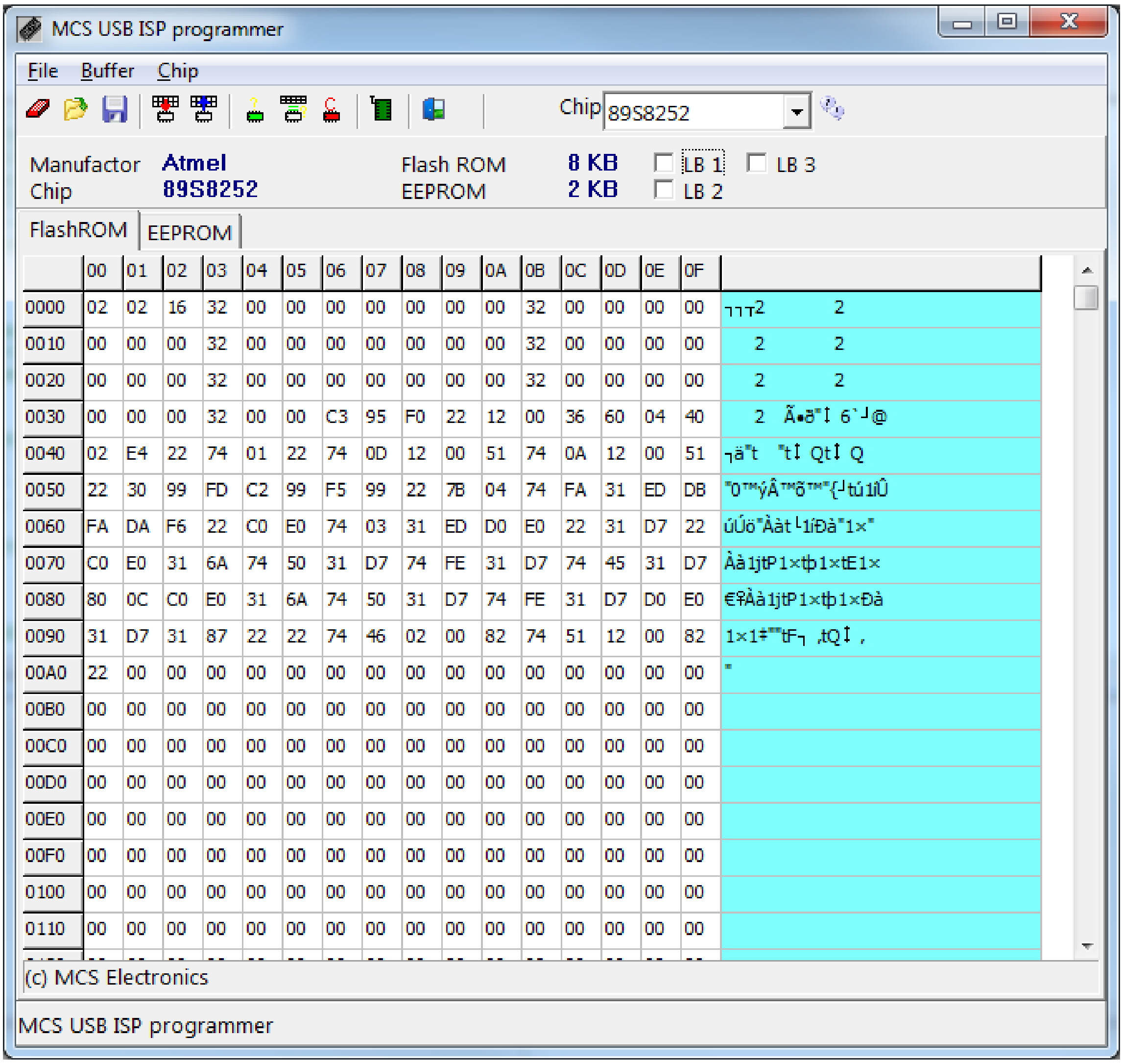
In order to work the FTDI drivers must be installed. On windows 10 they are installed automatically. On older platforms you might need to download from the FTDI site : https://ftdichip.com/drivers/d2xx-drivers/

In options select the programmer :



The SCAN button can be clicked to check the USB devices for FTDI chips. When found, their serial number is shown.
When multiple FTDI devices are connected it is important you select the proper one. If you have one device you can also leave the serial number blank.

The programmer has the usual options :



You can erase the chip, read and write it.
Identify will not work for the 898252.

Programming is relatively slow in ISP mode.
Parallel mode is much faster but does not work in circuit.

Part X

10 BASCOM Misc

10.1 Error messages

The following table list all errors that can occur.

Nr	Error message
1	BASIC source file not found
2	Code does not fit into FLASHROM
3	Unknown statement
4	Extension expected
5	Wrong variable or variable not dimensioned
6	Two parameters expected
7	No more space for BIT
8	No more space for BYTE
9	No more space for INTEGER/WORD
10	Wrong type (BIT,BYTE or INTEGER/WORD) expected
11	AS expected by DIM
12	, expected
13	Unknown interrupt
14	IF THEN expected
15	FOR, DO or WHILE expected
16	Wrong number of parameters
17	Illegal compare (=,>,<,<>,<=,>=) expected
18	THEN expected
19	TIMER0 or TIMER1 expected
20	DO expected
21	UNTIL expected
22	Illegal mathematical operation
23	FOR expected
24	WHILE expected
25	Variable not dimensioned
26	Source file not found
27	Label not found
100-134	These are internal assembler warnings. Contact MCS Electronics .
135	Too many RAM used
136	Variable already dimensioned
137	Constant must be in range of 1-8
138	Baudrate not supported with selected frequency

139	9 parameters expected
140	COUNTER0 or COUNTER1 expected.
141	= expected.
142	Maximum of 128 aliases statements allowed
143	Duplicate label
144	Value does not fit into byte
145	No more space for external BYTE
146	No more space for external INTEGER/WORD
147	No more space for STRING
148	Call outside 2048 page range. Use $LARGE to compile this program.
150	Unsupported LCD display
151	Unsupported mode
152	Variable not found or dimensioned
153	Wrong type (BYTE,INTEGER/WORD, LONG or STRING) expected
154	: expected
155	SELECT CASE expected
156	Numeric variable expected
157	(external) LONG expected
158	Value does not fit into Integer
159	Value does not fit into Word
160	Value does not fit into Long
161	* xxx (xxx=length) expected
162	Variable expected
163	Small string expected.
164	Variable not DIMensioned
166	Three parameters expected
167	1 or 0 expected
168	4 or 8 expected
170	Wrong value for WATCHDOG
171	Wrong parameter for I2C
172	Byte,Integer or Long expected
173	Variable expected
174	Integer or Long expected
175	Value does not fit into bit
176	Variables must be of the same type

177	Illegal operation
178	Value doesn't fit
179	Not supported
180	Illegal operation in PlaceValue
181	Constant or Internal byte or integer expected for index
182	Invalid device
183	Channel not opened
184	Device already open
185	Device was not open
186	Value does not fit into byte
187	IF ... THEN not allowed on same line as CASE
188	END IF expected
189	CONST expected
190	Channel expected (#x)
191	ALIAS already used
192	Word or Integer expected
193	CONST already defined
194	= expected
195	TO expected
196	Jump out of address range
197	RNDDATA variable not dimensioned
198	') expected
199	'(expected
206	Library file not found
207	Library file already registered
208	) expected
209	(expected
210	LEFT or RIGHT expected
211	External routine not found
212	Valid number must be in range from 1-16
213	Numeric constant expected
214	No SUB found.
215	Already in SUB
216	Wrong mode
217	NOINT expected
218	+ must be between {}
219	Address >127, use indirect addressing

999	DEMO allows 2048 bytes of code only

10.2 Compiler Limits

There are some limitations to the compiler :
You can perform only **one** calculation in a formula.

Good	False
a = a * b1	a = a * b1 + c

Maximum allowed labels	5000
Maximum allowed variable names	1000
Maximum number of INTEGER/WORD variables	10*
Maximum number of BYTE variables	20*
Maximum number of BIT variables	120*
Maximum number of STRING variables	Up to available external memory
Maximum number of ALIAS statements	128

*Depending on the used statements and the used variables of the other types.

A maximum of 32 bytes is used internally. This depends on the used statements. The stack uses some space too. So it depends on the used statements how much variables you can use. In the worst case (32+16+8) = 56 bytes are used.
You can find out by viewing the report file 44 how much bytes are used by your program.
When you have a micro such as the 89S8252 with 256 bytes of internal memory, you can have more variables.

8 used bit vars will use 1 byte;
1 used byte will use 1 byte;
1 used integer/word will use 2 bytes;
1 used long will use 4 bytes;
1 used single will use 4 bytes;
1 string with a length of 10 bytes will use 11 bytes.

Maximum nesting :

FOR .. NEXT	50
IF .. THEN	50
DO .. LOOP	50
WHILE .. WEND	50
SELECT .. CASE	25

10.3 Reserved Words

The following table shows the reserved BASCOM statements.
Red keywords can only be used on systems, which can address external RAM memory.

!
;
$INCLUDE
$NOINIT
$NOSP
$NOBREAK
$BAUD
$BGF
$DEFAULT
$CRYSTAL
$LARGE
$LCD
$ROMSTART
$RAMSIZE
$RAMSTART
$SERIALINPUT
$SERIALOUTPUT
$SIM
1WRESET
1WREAD
1WWRITE
ACK
ALIAS
ABS()
AND
AS
ASC()
BAUD
BCD()
BIT
BITWAIT
BLINK
BOOLEAN
BREAK
BYTE
CALL
CASE
CLS
CHR()
CONFIG
CONST
COUNTER
COUNTER0
COUNTER1
CPEEK()
CURSOR
DATA
DEC
DECLARE
DEFBIT
DEFBYTE

DEFLCDCHAR
DEFINT
DEFWORD
DELAY
DIM
DISABLE
DISPLAY
DO
DOWNTO
ELSE
ELSEIF
ENABLE
END
ERR
EXIT
EXTERNAL
FOR
FOURTH
FOURTHLINE
GATE
GETAD
GOSUB
GOTO
HEXVAL()
HIGH()
HIGHW()
HOME
I2CRECEIVE
I2CSEND
I2CSTART
I2CSTOP
I2CRBYTE
I2CWBYTE
IDLE
IF
INC
INKEY
INP()
INPUT
INPUTHEX
INT0
INT1
INTEGER
INTERNAL
IS
LCD
LCDHEX
LEFT
LEFT()
LOAD
LOCATE
LONG
LOOKUP
LOOP
LOW()
LOWW()
LOWER

LOWERLINE
MAKEBCD()
MAKEDEC()
MAKEINT()
MID()
MOD
MODE
NACK
NEXT
NOBLINK
NOSAVE
NOT
OFF
ON
OR
OUT
P0-P6
PEEK()
POKE
POWERDOWN
PSET
PRINT
PRINTHEX
PRIORITY
READ
READEEPROM
REM
RESET
RESTORE
RETURN
RIGHT
RIGHT()
RND()
ROTATE
SELECT
SERIAL
SET
SHIFT
SHIFTLCD
SHIFTCURSOR
SHIFTIN
SHIFTOUT
SHOWPIC
SOUND
SPACE()
START
STEP
STR()
STRING()
STOP
STOP TIMER
SUB
SWAP
THEN
THIRD
THIRDLINE
TIMEOUT

TIMER0
TIMER1
TO
UNTIL
UPPER
UPPERLINE
VAL()
WAIT
WAITKEY
WAITMS
WATCHDOG
WRITEEEPROM
WEND
WHILE
WORD
XOR
XRAM

The internal registers are also reserved words (variables)

TCON
P1
SCON
IE
P3
IP
PSW
ACC
B
SP
DPL
DPH
PCON
TMOD
TL0
TL1
TH0
TH1
SBUF

Note that you can change the internal registers with the Register File 56 settings from the Options menu.

Part XI

11 Microprocessor support

11.1 Microprocessor support

Some microprocessors have additional features compared to the AT89C2051/8051.

8032/8052/AT89S8252
TIMER2 288

AT89S8252
WATCHDOG 231
DATA EEPROM 291
Alternative port-pin functions 252

80515,80535,80517,80535
GETAD 148
WATCHDOG 292
BAUDRATE GENERATOR 115
INTERRUPTS and PRIORITY 292

80517,80537
GETAD 148
WATCHDOG 292
BAUDRATE GENERATOR 115
BAUDRATE GENERATOR1 115
INTERRUPTS and PRIORITY 293

89C51+
WATCHDOG 296
PRIORITY 202

ADUC812
CONFIG ADUC812 113
Using the DAC 293 that also contains an example
The additional interrupts are :

ADCI , I2CSPI and PSMI

To enable them :

ENABLE 141 ADCI, ENABLE I2CSPI, ENABLE PSMI

To disable them:

DISABLE 139 ADCI, DISABLE I2CSPI, DISABLE PSMI

To set the priority to the highest level in addition to the normal priority interrupt sources:

PRIORITY 202 SET|RESET ADCI

PRIORITY 202 SET|RESET I2CSPI

80552

GETAD(channel, prm) where channel is the channel and the prm is a paramter that may be 0 for software trigger only or 32(dec) for trigger by rising edge on STADC too.

To use the **PWM** of the 80552 :

```
Dim Pwp As Byte, Pwa as Byte, Pwb as Byte
Pwp = 200     'set output frequency (0 - 255)
Pwa = 50      'set channel 0 (a) pulse width (0 - 255)
Pwb = 0       'set channel 1 (b) pulse width (0 - 255)
Do
  Gosub Pwm
Loop
Pwm:
$asm
  MOV  PWMP , {Pwp}
  MOV  PWM0 , {Pwa}
  MOV  PWM1 , {Pwb}
$end asm
Return
```

11.2 TIMER2

Some microprocessors have an additional timer on board : TIMER2.
This section describes the 8032 compatible TIMER2 and is not compatible with the TIMER2 found in the 80C535 and others.
TIMER2 is a 16-bit timer/counter which can operate as either an event timer or an event counter. TIMER2 has three main operating modes : capture, auto-reload(up or down counting) , and baud rate generator.
When using the TIMER2 interrupt, you must reset the interrupt bit that caused the interrupt yourself in the ISR handler.

Capture mode
In the capture mode there are two options :
- 16-bit timer/counter which upon overflowing sets bit TF2, the TIMER2 overflow bit. This bit can be used to generate an interrupt.

Counter mode :
CONFIG TIMER2 = COUNTER, GATE = INTERNAL, MODE = 1

Timer mode:
CONFIG TIMER2=TIMER, GATE= INTERNAL,MODE =1

- As above but with the added future that a 1 to 0 transition on at external input T2EX causes the current values in the TIMER2 registers TL2 and TH2 to be captured into the capture registers RCAP2L and RCAP2H.

Counter mode:
CONFIG TIMER2 = COUNTER, GATE = EXTERNAL, MODE = 1

Timer mode:
CONFIG TIMER2=TIMER,GATE=EXTERNAL,MODE=1
In addition the transition at T2EX causes bit EXF2 in T2CON to be set and EXF2 like TF2 can generate an interrupt.

The TIMER2 interrupt routine can interrogate TF2 and EXF2 to determine which event caused the interrupt.
(there is no reload value in this mode. Even when a capture event occurs from T2EX the counter keeps on counting T2EX pin transitions or osc/12 pulses)

Auto reload mode
In the 16-bit auto reload mode, TIMER2 can be configured as a timer or counter which can be programmed to count up or down. The counting direction is determined by bit DCEN.
TIMER2 will default to counting up to **&H**FFFF and sets the TF2 overflow flag bit upon overflow. This causes the TIMER2 registers to be reloaded with the 16-bit value in RCAP2L and RCAP2H.
The values in RCAP2L and RCAP2H are preset by software means.

Counter mode:
CONFIG TIMER2=COUNTER,GATE=INTERNAL,MODE=0

Timer mode:
CONFIG TIMER2=COUNTER,GATE=INTERNAL,MODE=0

If EXEN2=1 then a 16-bit reload can be triggered either by an overflow or by a 1 to 0 transition at input T2EX. This transition also sets the EXF2 bit. The TIMER2 interrupt, if enabled, can be generated when either TF2 or EXF2 are 1.

Counter mode:
CONFIG TIMER2=COUNTER,GATE=EXTERNAL,MODE=0

Timer mode:
CONFIG TIMER2=TIMER,GATE=EXTERNAL,MODE=0
TIMER2 can also count up or down. This mode allows pin T2EX to control the direction of count. When a logic 1 is applied at pin T2EX TIMER2 will count up.
TIMER2 will overflow at **&H**FFFF and sets the TF2 flag, which can then generate an interrupt, if the interrupt is enabled. This timer overflow also causes the 16-bit value in RCAP2L en RCAP2H to be reloaded in to the timer registers TL2 and TH2.

Counter mode:
CONFIG TIMER2=COUNTER,GATE=INTERNAL/EXTERNAL,MODE=0,DIRECTION=UP

Timer mode:
CONFIG TIMER2=COUNTER,GATE=INTERNAL/EXTERNAL,MODE=0,DIRECTION=UP

A logic 0 applied at pin T2EX causes TIMER2 to count down. The timer will under flow when TL2 and TH2 become equal to the value stored in RCAP2L and RCAP2H.
TIMER2 under flows sets the TF2 flag and causes **&H**FFFF to be reloaded into the timer registers TL2 and TH2.

Counter mode:
CONFIG TIMER2=COUNTER,GATE=INTERNAL/EXTERNAL,MODE=0,
DIRECTION=DOWN

Timer mode:

CONFIG TIMER2=COUNTER,GATE=INTERNAL/EXTERNAL,MODE=0,
DIRECTION=DOWN

The external flag TF2 toggles when TIMER2 under flows or overflows.
The EXF2 flag does not generate an interrupt in counter UP/DOWN mode.

Baud rate generator
This mode can be used to generate a baud rate for the serial port. TIMER1 can be used for an other task this way.
CONFIG TIMER2=TIMER,GATE=INTERNAL,MODE=2

Receive only
This mode can be used to generate the baudrate for the receiver only.
TIMER1 can be used for the transmission with an other baudrate.
CONFIG TIMER2=TIMER,GATE=INTERNAL,MODE=3

Note that TIMER1 must be setup from assembler this way.

Transmit only
This mode can be used to generate the baud rate for transmitter only.
TIMER1 can be used for the reception with an other baudrate.
CONFIG TIMER2=TIMER,GATE=INTERNAL,MODE=4

Note that TIMER1 must be setup from assembler this way.

Clock output
Some 8052 deviants have the ability to generate a 50% duty cycle clock on P1.0.
CONFIG TIMER2=TIMER,MODE=5

The output frequency = (fOSC **/** 4) **/** (65536-CAPTURE)

Use CAPTURE = value to set the capture register.

How to determine what caused the interrupt
You can test the bit T2CON.7 to see if an overflow caused the interrupt.
You can test bit T2CON.6 whether either a reload or capture is caused by a negative transition on T2EX.

```
Timer2_ISR:
If T2CON.7 = 1 Then
  Print "Timer overflowed"
  Reset T2con.7
Else
  If T2CON.6 = 1 Then
     Print "External transition"
     Reset t2con.6
  End if
End If
Return
```

11.3 DATA EEPROM

The AT89S8252 has a built in 2Kbytes flash EEPROM.
You can use this to store data.
Two statements are provided : WRITEEEPROM and READEEPROM.

WRITEEEPROM var [, address]

var	Any BASCOM variable name.
Address	The address of the EEPROM where to write the data to. Ranges from 0 to 2047. When you omit the address the address will be assigned automatically. You can view the assigned address in the report file.

READEEPROM var [, address]

var	Any BASCOM variable name.
Address	The address of the EEPROM where to read the data from. Ranges from 0 to 2047. You can omit the address when you have written a value before with the **WRITEEEPROM** var statement. Because in that case the compiler knows about the address because it is assigned by the compiler.

Example

```
Dim S As String * 15 , S2 As String * 10
S = "Hello" : S2 = "test"

Dim L As Long
L = 12345678
Writeeeprom S
Writeeeprom S2                    'write strings
Writeeeprom L                     'write long

S = "" : S2 = "" : L = 0          'clear variables
Readeeprom L : Print L
Readeeprom S : Print S
Readeeprom S2 : Print S2
End
```

11.4 AT898252 WATCHDOG

The AT89S8252 has a built in watchdog timer.
A watchdog timer is a timer that will reset the uP when it reaches a certain value.
So during program execution this WD-timer must be reset before it exceeds its maximum value.
This is used to be sure a program is running correct.
When a program crashes or sits in an endless loop it will not reset the WD-timer so an automatic reset will occur resulting in a restart.

START WATCHDOG will start the watchdog timer.
STOP WATCHDOG will stop the watchdog timer.
RESET WATCHDOG will reset the watchdog timer.

See also

CONFIG WATCHDOG 128

Example

```
'--------------------------------------------------
'               (c) 1998 MCS Electronics
' WATCHD.BAS demonstrates the AT89S8252 watchdog timer
' select 89s8252.dat !!!
'--------------------------------------------------
Config Watchdog = 2048               'reset after 2048 mSec
Start Watchdog                       'start the watchdog timer
Dim I As Word
For I = 1 To 10000
  Print I                            'print value
  '  Reset Watchdog
  'you will notice that the for next doesnt finish because of the reset
  'when you unmark the RESET WATCHDOG statement it will finish because the
  'wd-timer is reset before it reaches 2048 msec
Next
End
```

11.5 WATCHDOG 80515

The 80515 and 80535 both have a WD-timer.
This is a 16 bit timer that can't be stopped!
It will reset the system after 65535 uS at 12MHz.

START WATCHDOG 'start the WD-timer.
RESET WATCHDOG 'will reset the WD-timer.

11.6 INTERRUPTS and PRIORITY 80515

The 80515, 80535, 80517 and 80537 have more interrupt sources and priority is handled different compared to the 8051.

Enable interrupts:
ENABLE AD 'AD converter
ENABLE INT2|INT3|INT4|INT5|INT6 'external interrupt 2-6
ENABLE TIMER2EX 'timer2 external reload

Disable interrupts:
DISABLE AD 'AD converter
DISABLE INT2|INT3|INT4|INT5|INT6 'external interrupt 2-6
DISABLE TIMER2EX 'timer2 external reload

Selecting of priority:
PRIORITY SET|RESET source , level
level can be 0,1,2 or 3.(0=lowest,3=highest)

The source can be :
INT0/ADC
TIMER0/INT2
INT0/INT3

TIMER1/INT4
SERIAL/INT5
TIMER2/INT6

Note that only one of the pairs must be selected.
PRIORITY SET INT4,3 'will set INT4 to the highest priority.
When two ints occur with the same priority the first source in the list will be handled first. So when both TIMER1 and INT4 have the same priority, TIMER1 will be serviced first. Look at a datasheet for more details.

11.7 INTERRUPTS and PRIORITY 80537

The 80517 and 80537 have more interrupts and priority is handled different compared to the 8051.

Enable interrupts:
ENABLE AD 'AD converter
ENABLE INT2|INT3|INT4|INT5|INT6 'external interrupt 2-6
ENABLE TIMER2EX 'timer2 external reload
ENABLE CTF 'compare timer interrupt
ENABLE SERIAL1 'serial1 interrupt

Disable interrupts:
DISABLE AD 'AD converter
DISABLE INT2|INT3|INT4|INT5|INT6 'external interrupt 2-6
DISABLE TIMER2EX 'timer2 external reload
DISABLE CTF 'compare timer interrupt
DISABLE SERIAL1 'serial1 interrupt

Selecting of priority:
PRIORITY SET|RESET source , level
level can be 0,1,2 or 3.(0=lowest,3=highest)

source can be :
INT0/ADC/SERIAL1
TIMER0/INT2
INT0/INT3
TIMER1/CTF/INT4
SERIAL/INT5
TIMER2/INT6
Note that only one of the TRIPLE-pairs must be selected.
PRIORITY SET INT4,3 'will set INT4 to the highest priority.
When two ints occur with the same priority the first source in the list will be handled first. So when both TIMER1 and INT4 have the same priority, TIMER1 will be serviced first.
Look at a datasheet for more details.

11.8 ADUC 812

The 812 has 2 DACS named DAC0 and DAC1.

You can use the CONFIG ADUC812 113 statement to set the DAC behaviour.

The DAC can be powered on or off.
DAC0.POWEROFF will power off the DAC0
DAC1.POWERON will power on the DAC1

To force the output of the DAC to 0 volt use :
DAC0.CLEAR

To let it output the voltage use :
DAC0.NORMAL

The DAC values can be written with the following statements:
DAC0.value = 1024 'or a variable
DAC1.value = word

The sync bit is reset and to sync the DAC with the supplied values use :

DAC.SYNC
Note that the SYNC method operates on both DACS and so there is no 0 or 1 specified!

All the previous methods shown can work with 0 for DAC0 or 1 for DAC1.

See the aduc812.bas example:

```
'--------------------------------------------------------------------
'                ADCU812.bas (c) 2000 MCS Electronics
'       Note that the support for this chip is untested
'       Any feedback appreciated!
'--------------------------------------------------------------------
'Use this dat file
$regfile = "812.dat"

'configure ADC
Config Aduc812 = Adcon , Mode = Normal , Clock = 1 , Aquisition = 1 , Timer2 = Disabled , Extrig = Disabled

'configure DACS
Config Aduc812 = Dac , Mode = 12 , Range1 = Vref , Range0 = Vref , Clear0 = False , Sync = Enabled , Power0 = On , Power1 = Off

Declare Sub Write_ebyte
Declare Sub Read_ebyte

'dim variables
```

```
Dim Wdac As Word
Dim Adc As Word

Dim Eeadr As Word , Eebyte As Byte , Page As Word
'get value from adc channel 0
'note that simulator will halt until you make the adccon2 bit 4 zero.
Adc = Getad(0)

'enable dac0 by powering it on
Dac0.poweron

'0V to output of dac0
Dac0.clear

'put voltage into dacs
Dac0.value = 12
Dac1.value = 500

'dac0 was 0V but must work normal now
Dac0.normal

'and after setting the value(s) the dacs must be updated with the sync method
Dac.sync

'the EEPROM is accessed via pages
'each page is 4 bytes
'to write 1 byte you need to write the whole 4 byte page
'assign eeadr with the address
'and eebyte with the value to write
Eeadr = 100 : Eebyte = 5 : Call Write_ebyte

Eeadr = 100 : Call Read_ebyte
Print Eebyte
End

Sub Write_ebyte
   Page = Eeadr \ 4                                'page
   mov edarl,{page}                                 ; page address
   mov econ,#1                                     ; read 4 current bytes
   mov econ,#5                                     ; erase page
   Waitms 20                                      'wait 20 msecs
   Page = Page * 4
   Page = Eeadr - Page
   If Page = 0 Then
```

```
      mov edata1,{eebyte}                    ; data register to write
    Elseif Page = 1 Then
      mov edata2,{eebyte}                    ; data register to write
    Elseif Page = 2 Then
      mov edata3,{ebyte}                     ; data register to write
    Else                                  'must be 3
      mov edata4,{eebyte}                    ; data register to write
    End If
    mov econ,#2                            ; write registers
  End Sub

  Sub Read_ebyte
    Page = Eeadr \ 4                       'page
    mov edarl,{page}                        ; page address
    mov econ,#1                            ; read 4 current bytes
    Page = Page * 4
    Page = Eeadr - Page
    If Page = 0 Then
      mov {EEbyte},edata1                          ; data register to read
    Elseif Page = 1 Then
      mov {eebyte},edata2                          ; data register to read
    Elseif Page = 2 Then
      mov {eebyte},edata3                    ; data register to read
    Else                                  'must be 3
      mov {eebyte},edata4                    ; data register to read
    End If
    mov econ,#2                            ; write registers
  End Sub

  End
```

11.9 89C51

The 89C51 has an additional PCA interrupt.
The priority mechanism is also different compared to a normal 8051.
You can set a level in the range from 0-3.
PRIORITY SET|RESET source , level
level can be 0,1,2 or 3.(0=lowest,3=highest)

The source can be :
INT0
TIMER0
INT1
TIMER1
SERIAL
TIMER2
PCA

PRIORITY SET INT0,3 'will set INT0 to the highest priority.
Look at a datasheet for more details.

The WATCHDOG can be started with the statement :
START WATCHDOG.
RESET WATCHDOG must be used in your program to reset the WD-timer.
When it reaches 16384 the chip will be reset.
The input to the WD-timer is the XTAL frequency!

Part XII

12 International Resellers

12.1 International Resellers

The list with resellers is updated once in a while. Please look at the resellers list at the MCS website :

http://www.mcselec.com/index.php?option=com_contact&catid=82&Itemid=59

Part XIII

13 Third party hardware

13.1 Third party Hardware

There is a lot of third party hardware available.
Below you find links to some of the available hardware

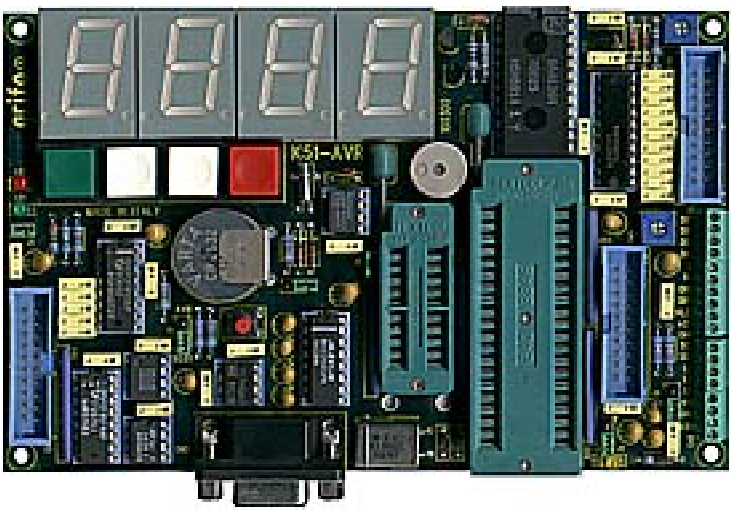
Grifo , boards for BASCOM-AVR, BASCOM-8051 and BASCOM-LT 301

Rhombus SCE-51 , small 8051 board and in circuit emulator 308

13.1.1 Grifo

EXAMPLES

BASCOM - BASIC



The content of this page is provided by Grifo.

As following you can find a wide range of demo programs.The programs have been realized to be used on a well-known hardware, as the **K51-AVR** or the **DEB-01**, etc. in order to avoid any doubts about the interpretation of the results.

The demo programs are well documented in order to allow a fast approach for anybody.In addition to that, being the same demoes written in different languages, it is possible to get an efficient comparison both for Quality and Speed terms.

I N D E X

B A S I C

- Examples - **BASCOM-LT**

- Examples - \BASCOM-8051
- Examples - \BASCOM-AVR

SHORT PROGRAM DESCRIPTION

x_AD11

This program monitors one anagogic channel out of eleven, managed by IC12 (TLC2543), visualization of the channel is in hexadecimal format, through T1 and T2 the channel to convert is selected, T1 increments while T2 decrements.

The display shows first the channel being converted, then the 12 bits wide hexadecimal value of the channel converted: Before compiling set in menu Option/ Compiler/Misc: Byte End 5F; Register File 89c1051.DAT or 8052.DAT.

For use with 8xC51/52 modify the source where the pins used are described replacing pins for 89c1051 with pins for 8xc51.

x_AD4

This program monitors one analogue channel out of four, managed by IC12 (PCF8591), visualization of the channel is in hexadecimal format, through T1 the channel to convert is selected: Whenever a key is pressed, an acoustic signal is emitted.

Display DY1 shows the channel to convert, while displays DY3 and DY4 show the converted value in HEX.

Before compiling set in menu Option/Compiler/Misc: Byte End 5F; Register File 89c1051.DAT or 8052.DAT.

For use with 8xC51/52 modify the source where the pins used are described replacing pins for 89c1051 with pins for 8xc51.

x_DA

This program monitors one D/A converter channel on IC2 (PCF8591), key T1 increments the value, while key T2 decrements the value which is shown in hexadecimal format the 7 segments displays.

Whenever a key is pressed, an acoustic signal is emitted.

Before compiling set in menu Option/Compiler/Misc: Byte End 5F; Register File 89c1051.DAT or 8052.DAT.

For use with 8xC51/52 modify the source where the pins used are described replacing pins for 89c1051 with pins for 8xc51.

x_REE

This program allows to read a serial EEPROM on IC4 (max 24c08), with addresses ranging from &H400 to &H7ff, addresses from &H0 to &H0FF are taken by IC7 (RTC PCF8583) while addresses from &H100 to &H3FF are free space.

At start the program shows the address where to write, through keys T1 and T2 the value in incremented or decremented.

Through key T3 the address is accepted and the value read at such address is shown.

Whenever a key is pressed, an acoustic signal is emitted.

Before compiling set in menu Option/Compiler/Misc: Byte End 5F; Register File 89c1051.DAT or 8052.DAT.

For use with 8xC51/52 modify the source where the pins used are described replacing pins for 89c1051 with pins for 8xc51.

x_WEE

This program allows to write to a serial EEPROM on IC4 (max 24c08), with addresses ranging from &H400 to &H7ff, addresses from &H0 to &H0FF are taken by IC7 (RTC PCF8583) while addresses from &H100 to &H3FF are free space.

At start the program shows the address where to write, through keys T1 and T2 the value in incremented or decremented.

Through key T3 the address is accepted, then the value to write is selected through T1 and T2, as last press key T3 to write.

Whenever a key is pressed, an acoustic signal is emitted.

After the operation is terminated the selected address and the written data are shown one after the other.

Before compiling set in menu Option/Compiler/Misc: Byte End 5F; Register File 89c1051.DAT or 8052.DAT.

For use with 8xC51/52 modify the source where the pins used are described replacing pins for 89c1051 with pins for 8xc51.

x_LCD

This program allows to manage an alphanumeric **LCD** featuring a number rows and columns definable by **User**.

The display must be connected to **CN5** following the connections shown in the diagram of **K51-AVR** page **4** of **4**.

Before compiling select in menu **Option/Compiler/Misc/** :

Byte End **5F**, Register File **REG51.DAT**

In menu **Option/ LCD** select:

Db4 = P1.5 , Db5 = P1.6 , Db6 = P1.7 , Db7 = P1.2 , E = P1.4 , Rs = P1.3

x_PPI

This program shows, in hexadecimal format, the status of the eight lines connected to IC1 (PCF8547A9).

Before compiling set in menu Option/Compiler/Misc: Byte End 5F; Register File 89c1051.DAT or 8052.DAT.

For use with 8xC51/52 modify the source where the pins used are described replacing pins for 89c1051 with pins for 8xc51.

x_PPO

This program activates sequentially one at a time all the 8 lines connected to IC1 (PCF8574A).

Before compiling set in menu Option/Compiler/Misc: Byte End 5F; Register File 89c1051.DAT or 8052.DAT.

For use with 8xC51/52 modify the source where the pins used are described replacing pins for 89c1051 with pins for 8xc51.

x_PPO2

This program turns on in sequence the **16 TTL** lines available on connector **CN3**.

Before compiling select in menu **Option/Compiler/Misc/** :

Byte End **5F**; Register File **8052.DAT**

x_RTC

This program allows you to show the RTC or Real Time Clock on IC7 (PCF8583) to the four 7 segments displays: To set the RTC values keys T2 and T3 are used, in detail key T2 increments the hours and T3 increments the minutes.

Whenever one of the two keys is pressed the seconds are reset.

Key T1 switches between visualization of seconds and hours.

Whenever a key is pressed, an acoustic signal is emitted.

Date and eventual alarm are not managed: Before compiling set in menu Option/Compiler/Misc: Byte End 5F; Register File 89c1051.DAT or 8052.DAT.

For use with 8xC51/52 modify the source where the pins used are described replacing pins for 89c1051 with pins for 8xc51.

x_TER

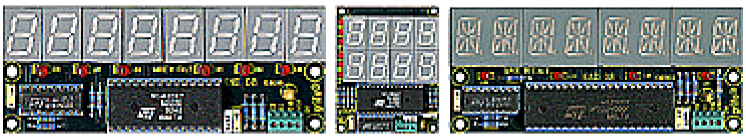
This program reads the temperature measured by IC3 (DS1621) and shows it in centigrade degreases with values ranging from -55 to +125.

Before compiling set in menu Option/Compiler/Misc: Byte End 5F; Register File 89c1051.DAT or 8052.DAT.

For use with 8xC51/52 modify the source where the pins used are described replacing pins for 89c1051 with pins for 8xc51.

BASCOM Examples for boards

KND_08 - KND_44 - KAD_08



KND_08

This program allows to manage the board resources of KND 08 card through a menu, using 2 TTL lines driven by a family 51 micro controller.

This program is managed through a RS 232 serial line, so it is essential to connect a free COM port of the PC to connector CN2 of K51-AVR.

To configure the BASCOM 8051 terminal in menu Options/Communication select the COM port and set Baud Rate to 19200, parity to none, data bits to 8, stop bits to 1.

The board used to drive KND 08 is K51-AVR, connections are:

K51-AVR .... KND 08

L1 (pin4 CN6) ----> SC (pin2 CN1 KND08)

L2 (pin5 CN6) ----> SD (pin1 CN1 KND08)

Supply both the boards.

Before compiling in menu Option/Compiler/Misc set Byte End(Hex) = 60.

KND_44

This program allows to manage the board resources of KND 44 card through a menu, using 2 TTL lines driven by a family 51 micro controller.

This program is managed through a RS 232 serial line, so it is essential to connect a free COM port of the PC to connector CN2 of K51-AVR.

To configure the BASCOM 8051 terminal in menu Options/Communication select the COM port and set Baud Rate to 19200, parity to none, databits to 8, stopbits to 1.

The board used to drive KND 44 is K51-AVR, connections are.

K51-AVR .... KND 44

L1 (pin4 CN6) ----> SC (pin2 CN1 KND44)

L2 (pin5 CN6) ----> SD (pin1 CN1 KND44)

Supply both the boards.

Before compiling in menu Option/Compiler/Misc set Byte End(Hex) = 60.

KAD_08

This program manages a sliding alphanumeric message on eight 14-segments displays, installed on KAD 08 board, through 2 TTL signals driveb by a micro controller of family 51.

The master board is K51-AVR which must be connected to KAD 08 as follows:

K51-AVR .... KAD 08

L1 (pin4 CN6) ----> SC (pin2 CN1 KAD08)

L2 (pin5 CN6) ----> SD (pin1 CN1 KAD08)

Supply both the boards.

Before compiling in menu Option/Compiler/Misc set Byte End(Hex) = 70.

KAD_08_2

This program allows to manage the resources on the KAD 08 board through a menu and 2 TTL lines driven by a micro controller of the 51 family.

This program is controlled through the RS 232 serial line so it is essential to connect a free COM port on the PC to the connector CN2 of K51-AVR.

Configure the BASCOM 8051 terminal using menu Option/Communication, select the COM port and set baud rate to 19200, parity to none, data bits to 8 and stop bits to 1.

The master board is K51-AVR which must be connected to KAD 08 as follows:

K51-AVR .... KAD 08

L1 (pin4 CN6) ----> SC (pin2 CN1 KAD08)

L2 (pin5 CN6) ----> SD (pin1 CN1 KAD08)

Supply both the boards.

Before compiling in menu Option/Compiler/Misc set Byte End(Hex) = 50.

EXAMPLEs

BASCOM-LT

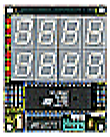
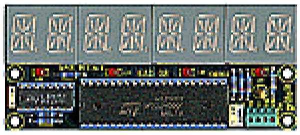
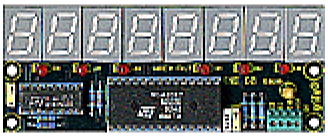
for **K51-AVR**.

K51-AVR

DEMO_AD11, **DEMO_AD4**, **DEMO_DA**, **DEMO_REE**, **DEMO_WEE**, **DEMO_LCD**, **DEMO_PPI**, **DEMO_PPI1**, **DEMO_PPO**, **DEMO_PPO1**, **DEMO_PPO2**, **DEMO_RTC**, **DEMO_TER**,

BASCOM-LT Examples for boards

KND_08 - KND_44 - KAD_08

KND_08, **KND_44**, **KAD_08**

EXAMPLEs

BASCOM-8051

for **K51-AVR**..

K51-AVR

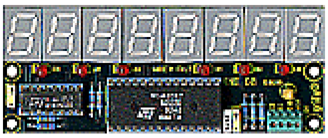
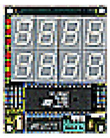
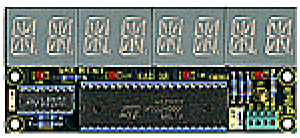
51_AD11, **51_AD4**, **51_DA**, **51_REE**, **51_WEE**, **51_PPI**, **51_PPO**, **51_RTC**, **51_TER**

GPC® F2

F2_AD11, **F2_AD4**, **F2_DA**, **F2_REE**, **F2_WEE**, **F2_PPI**, **F2_PPO**, **F2_RTC**, **F2_TER**

BASCOM-8051 Examples for boards

KND_08 - KND_44 - KAD_08

KND_08, **KND_44**, **KAD_08**, **KAD_08_2**

GPC® F2

F2_KND_08, **F2_KND_44**, **F2_KAD_08**, **F2_KND_08_2**

EXAMPLEs

BASCOM-AVR

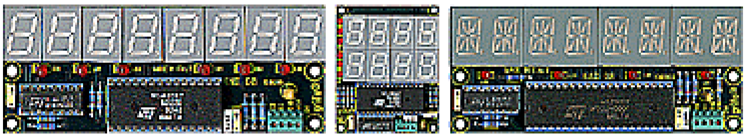
for **K51-AVR**.

K51-AVR

DEMO_AD11, **DEMO_AD4**, **DEMO_DA**, **DEMO_REE**, **DEMO_WEE**, **DEMO_PPI**, **DEMO_PPO**, **DEMO_RTC**, **DEMO_TER**

BASCOM-AVR Examples for boards

KND_08 - KND_44 - KAD_08



KND_08, **KND_44**, **KAD_08**

Page up-dated at June 7st, 2000

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13.1.2 Rhombus

Rhombus developed the SCE-51. A powerful small 8051 micro processor board with on board RAM and FLASHROM and bootloader.

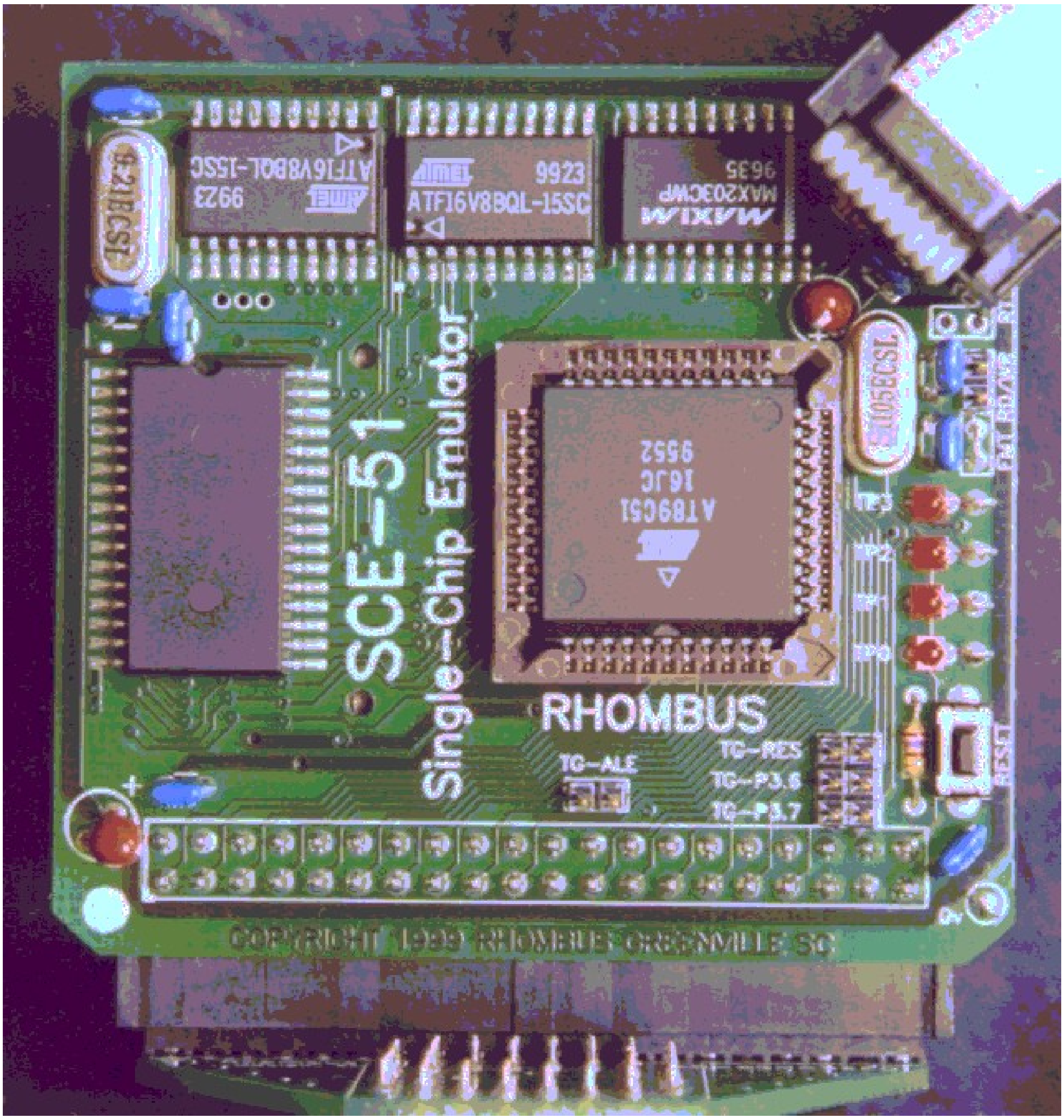
In addition the board serves as an in circuit emulator.

Transferring your program to RAM goes very fast. Faster than loading it into the traditional FLASHROM. So during debugging it is well suited for debugging large applications.

There are many possibilities with this board and you have to look at **www. rhombusinc.com** for all the details.

A picture of the board is included here:

Since the help file must be kept small, the quality of the picture is poor.



A bootloader is integrated into BASCOM. Select the Rhombus SCE-51 programmer to enable it.

Index

- # -

#ELSE 77
#ENDIF 78
#IF 76

- $ -

$BAUD 85
$BGF 85
$CRYSTAL 87
$DEFAULT XRAM 88
$END ASM 84
$EXTERNAL 88
$INCLUDE 89
$IRAMSTART 90
$LARGE 90
$LCD 91, 93
$LCDRS 92
$LIB 91
$NOBREAK 93
$NOINIT 94
$NONAN 94
$NONULL 95, 132
$NORAMCLEAR 95
$NOSP 96
$OBJ 96
$RAMSIZE 97
$RAMSTART 99
$RAMTRON 97
$REGFILE 100
$ROMSTART 100
$SERIALINPUT 101
$SERIALINPUT2LCD 101
$SERIALOUTPUT 102
$SIM 103
$TIMEOUT 103
$WAIT 104

- 1 -

1WIRE 254
1WIRECOUNT 80
1WREAD 79
1WRESET 79
1WSEARCHFIRST 81
1WSEARCHNEXT 83
1WWRITE 79

- 8 -

8032_Alternative port-pin functions 252
8032_TIMER2 288
80515_WATCHDOG 292
89C51 296

- A -

ABS 105
Additional Hardware 247
ALIAS 104
ASC 106
AT898252 WATCHDOG 291
AVG 106

- B -

BASCOM 34
BASCOM statements 73
BAUD 107
BCD 108
BITWAIT 108
Blow IT Flashprogrammer 263
BREAK 109
BROWSE001e 140

- C -

CALL 109
CASE 212
CHR 110
CLOSE 194
CLS 111
Compiler Limits 281
CONFIG 112
CONFIG 1WIRE 113
CONFIG ADUC812 113
CONFIG BAUD 115
CONFIG BAUD1 115
CONFIG DEBOUNCE 116
CONFIG GETRC 117
CONFIG GRAPHLCD 117
CONFIG I2CDELAY 116

CONFIG LCD 121
CONFIG LCDBUS 122
CONFIG LCDPIN 121
CONFIG MICROWIRE 123
CONFIG PRINT 123
CONFIG SCL 124
CONFIG SDA 125
CONFIG SERVOS 125
CONFIG SPI 126
CONFIG TIMER0
TIMER1 127
CONFIG WATCHDOG 128
CONST 112
COUNTER 129
CPEEK 130
Credits 64
CURSOR 131
CYGNAL JTAG Programmer 268

- D -

DATA 132
DATA EEPROM 291
DEBOUNCE 133
DECLARE 135
DECR 134
DEF 136
DEFBIT 136
DEFBYTE 136
DEFINT 136
DEFLCDCHAR 136
DELAY 137
DIM 137
DISABLE 139
DISPLAY 139

- E -

Edit Copy 38
Edit Cut 38
Edit Find 39
Edit Find Next 39
Edit Goto 40
Edit Indent Block 41
Edit Paste 39
Edit Redo 38
Edit Replace 40
Edit Undo 38
Edit Unindent Block 41
Editor Keys 42
ELSE 140
ENABLE 141
END 142
END IF 142
ERASE 143
Error messages 278
EXIT 144

- F -

File Close 36
File Compile 43
File End 37
File Exit 37
File New 35
File Open 35
File Print 37
File Print Preview 36
File Save 36
File Save As... 36
File Simulate 45
File Transmit 49
FOR 144
FOURTHLINE 145
FUSING 146
Futurelec 268

- G -

GET 147, 194
GETAD 148
GETAD2051 149
GETRC 154
GETRC5 156
GOSUB 158
GOTO 159
Grifo 301

- H -

Hardware - I2C 254
Hardware - LCD display 253
Help About 63
Help Credits 64
Help Forum 64
Help index 63
Help on help 63
Help Shop 64

Help Support 64
HEX 159
HEXVAL 160
HIGH 160
HIGHW 161
HOME 162

- I -

I2C 164
I2CRBYTE 164
I2CRECEIVE 162
I2CSEND 163
I2CSTART 164
I2CSTOP 164
I2CWBYTE 164
IDLE 165
IF 165
INCR 167
INDEX 13
Initialization 244
INKEY 167
INP 169
INPUT 169
INPUTBIN 171
INPUTHEX 172
Installing BASCOM-8051 21
INSTR 173
Internal registers 242
International Resellers 299
INTERRUPTS and PRIORITY 80515 292
INTERRUPTS and PRIORITY 80537 293

- J -

JPK Systems X-programmer 268

- K -

Keyword Reference 17

- L -

Language fundamentals 66
LCASE 174
LCD 174
LCD designer 50
LCDHEX 178
LCDINIT 177
LEFT 179
LEN 179
LIB 51
LOAD 180
LOCATE 181
LOOKUP 181
LOOKUPSTR 182
LOOP 140
LOW 183
LOWERLINE 184
LOWW 184

- M -

MAKEBCD 185
MAKEDEC 185
MAKEINT 186
MAX 186
MCS Flash programmer 260
MCS SPI programmer 262
MCS USBISP Programmer 273
Microprocessor support 287
MID 187
MIN 188
MOD 188
MWINIT 189
MWREAD 189
MWWOPCODE 190
MWWRITE 191

- N -

NEXT 192

- O -

ON interrupt 192
ON value 193
OPEN 194
Options Communication 56
Options Compiler Communication 54
Options Compiler I2C 54
Options Compiler LCD 55
Options Compiler Misc 56
Options Compiler Output 53
Options Environment 58
Options hardware simulator 60
Options Monitor 61
Options Printer 62

Options Programmer 60
Options View Report 44
OUT 196

- P -

PEEK 198
Peter Averill's TAFE programmer 269
PG2051 flash programmer 263
PG302 programmer 264
POKE 198
PORT 197
POWERDOWN 199
PRINT 199
PRINTBIN 200
PRINTHEX 201
PRIORITY 202
PSET 203
PUT 194, 203

- R -

READ 204
READMAGCARD 205
REM 207
REPLACE 207
Reserved Words 282
RESET 208
RESTORE 208
RETURN 209
Rhombus 308
Rhombus SCE-51 271
RIGHT 210
RND 210
ROTATE 211
RUNNING BASCOM-8051 33

- S -

Sample Electronics ISP programmer 266
SE 512 or SE514 programmer 265
SE511-SE516 programmer 272
SE-812 266
SELECT 212
Send to chip 48
SET 212
SHIFT 213
SHIFTCURSOR 213
SHIFTIN 214
SHIFTLCD 215
SHOWPIC 216
SOUND 216
SPACE 218
SPC 219
SPIIN 220
SPIINIT 220
SPIOUT 221
START 221
STK200/300 ISP Programmer 270
STOP 222
STOP TIMER 222
STR 224
STRING 224
SUB 225
SWAP 226
Syntax check 43

- T -

Table of contents 14
THIRDLINE 226
Tool LIB Manager 51
Tool Triscent Converter 52
Tools Export to RTF 53
Tools Graphic Converter 50

- U -

UCASE 227
UPPERLINE 228
Using assemly 235
Using the DAC 293

- V -

VAL 228
VARPTR 229

- W -

WAIT 229
WAITKEY 230
WAITMS 230
WATCHDOG 231
WEND 232
WHILE 232
WHILE.. WEND 232
Window arrange icons 63

Window cascade 62
Window tile 63
Windows minimize all 63

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