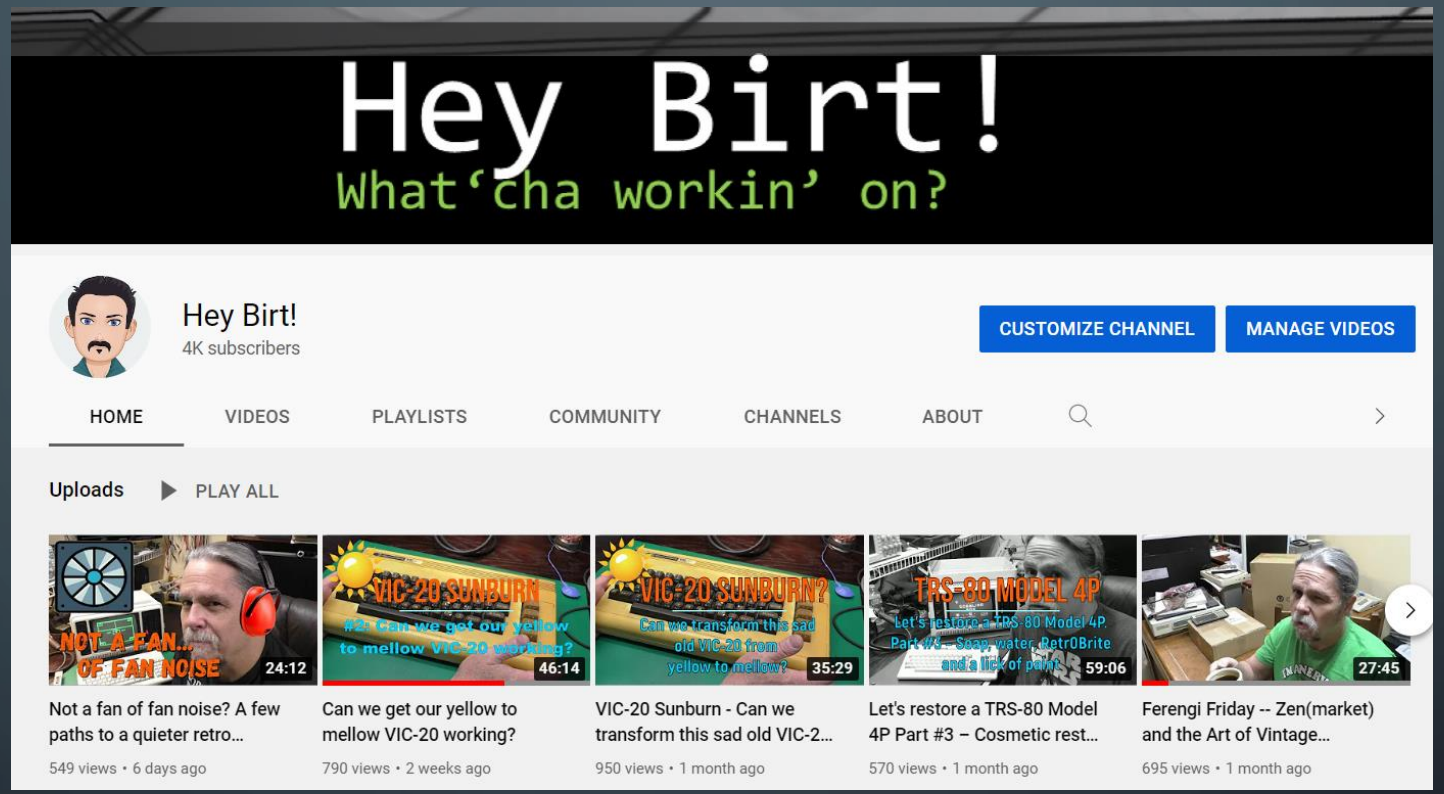
PROGRAMMING POCKET COMPUTERS



Tandy Assembly

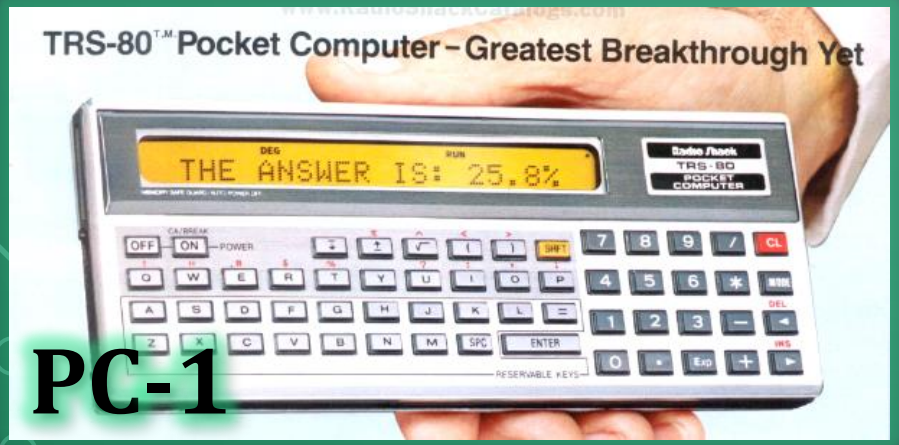
PROGRAMMING POCKET COMPUTERS

TRS-80 / Tandy pocket computers
a.k.a. Sharp / Casio

Most are just rebadged versions except the PC-2 which has a different keyboard layout than the Sharp PC-1500

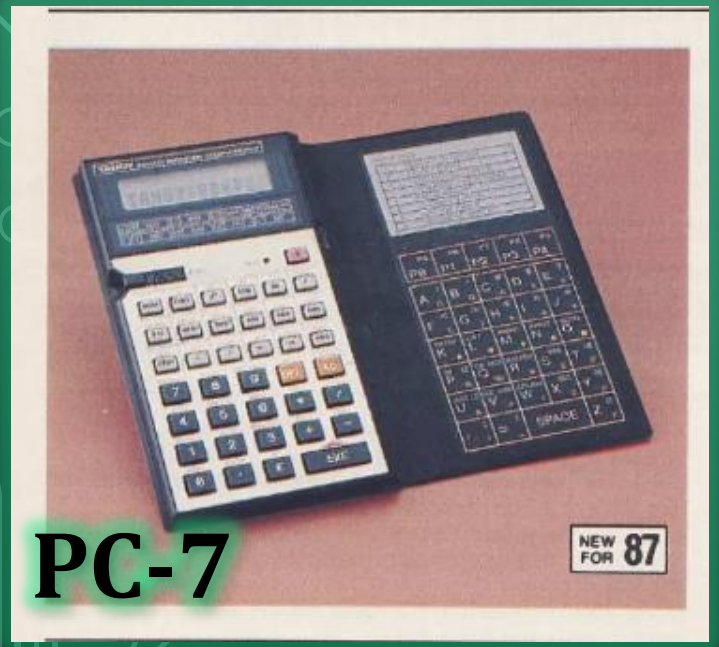
PROGRAMMING POCKET COMPUTERS

Sharp made units -

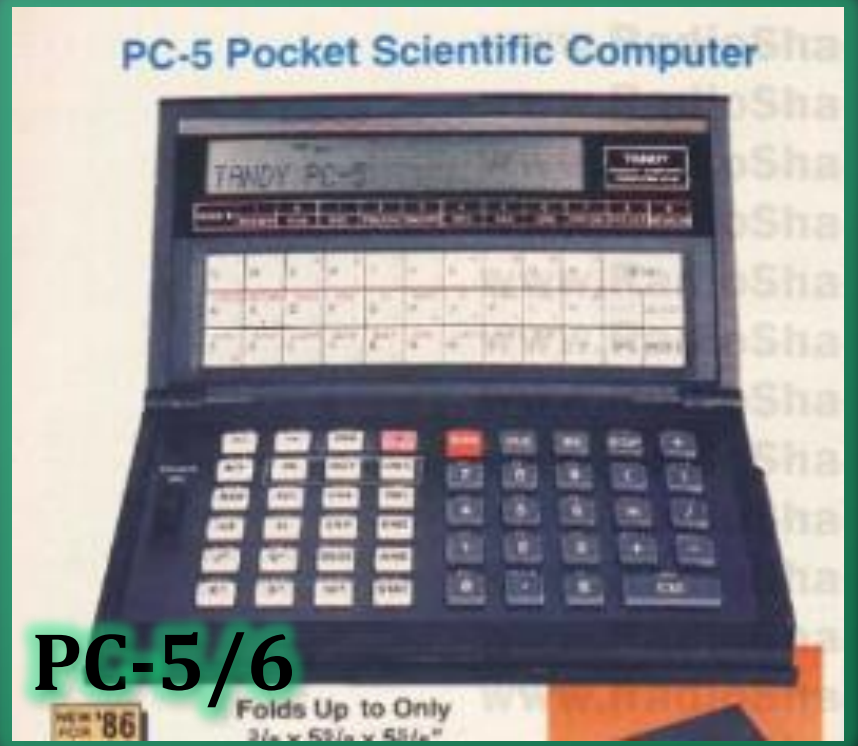


PROGRAMMING POCKET COMPUTERS

PC-4



PC-7



PC-5/6

Casio made units -

PROGRAMMING POCKET COMPUTERS

Programming Languages –

- **All can be programmed in BASIC**
- **PC-2, PC-3, PC-8 can use assembly**
- **PC-5/6 docs mention assembler. This is really an interpreted teaching language.**

PROGRAMMING POCKET COMPUTERS

Programming Demo -


```
10 INPUT”A=”,A
20 INPUT”B=”,B
30 INPUT”C=”,C
40 IF A=0 THEN 80
50 IF B=0 THEN 90
60 IF C=0 THEN 100
70 PRINT”INPUT ERROR”:END
80 A=SQR(C*C-B*B):PRINT “A=”;A:END
90 B=SQR(C*C-A*A):PRINT “B=”;B:END
100 C=SQR(A*A+B*B):PRINT “C=”;C:END
```


FEED
POWER
OFF
ON
Radio Shack
TRS-80
POCKET COMPUTER
CASSETTE INTERFACE
7 PRT ON
8 PRT OFF
4 DEG
5 RAD
6 GRA
1 WRT
2 TRACE ON
3 TRACE OFF
0 RUN
EXT
MODE
AUTO-OFF / PERMANENT MEMORY
Radio Shack
TRS-80
POCKET COMPUTER
POWER
ON
MODE
SHIFT
ON
INS
AC
DEL
STOP
P7
P8
P9
7
8
9
P4
P5
P6
4
5
6
P1
P2
P3
1
2
3
P0
0
EXE
GOSUB
FOR
TO
STEP
NEXT
GOTO
IF
THEN
PRINT
ANS
RETURN
STOP
END
DEFM
RUN
LIST
INPUT
SPC

END

END

C:END

PROGRAMMING POCKET COMPUTERS

Connectivity – back in the day

Small Enough to Fit Pocket or Purse, Big Enough to Solve Tough Problems

NEW FOR '84

PC-3 Pocket Computer
99.95

PC-3 Printer/ Cassette Interface
119.95

- Programmable in BASIC or Use Ready-to-Run Software
- 16 Built-In Arithmetic and 8 String Functions

TRS-80 Pocket Computer Model PC-3. The PC-3 is small enough to go anywhere, yet it gives you real computer power—well beyond that of most programmable calculators! Features 24-character LCD, 1438-character memory, 10-digit accuracy, 2-digit exponents, multiple statements, arrays, edit and trace modes. 3/8 x 5 9/16 x 2 3/4". Weighs 4 oz. With batteries and manual. **26-3590** 99.95

Printer/Cassette Interface. Thermal dot printer prints 24 characters per line at one line per second, with "wrap-around". Add a recorder to store and load programs on cassette tape. Includes rechargeable batteries, U.L. listed AC adapter/charger, paper, cassette cable, manual. **26-3591** 119.95

Printer Paper. 2 1/4" wide. **26-3592** ..... Pkg. of 5/2.49

Ready-to-Run Software for Your PC-3

Personal Finance. 26-3518	19.95	Engineering Math II. 26-3526	14.95
Business Finance. 26-3517	19.95	Engineering Math III. 26-3527	10.95
Business Statistics. 26-3516	19.95	Engineering Math IV. 26-3528	7.95
Statistical Analysis. 26-3522	24.95	Math Drill. 26-3514	14.95
Real Estate. 26-3510	24.95	Games I. 26-3515	14.95
Surveying. 26-3512	29.95	Games II. 26-3523	14.95
Electrical Engineering I. 26-3520	24.95	Calendars. 26-3529	19.95
Engineering Math I. 26-3525	14.95	Golf Scoring. 26-3532	14.95

Take It Anywhere You Need On-the-Spot Data Printing

Fit Your PC-2 With Our Superior Four-Color Printer/Plotter/Dual Cassette Interface

ONE OF OVER 350 NEW LOW PRICES

Was $239.95 In 1983 Catalog **219.95**

- Create Full XY-Axis Graphics With Special BASIC Statements for Drawing and Plotting
- Prints Graphics and Alphanumerics in Four Colors—Red, Blue, Green and Black
- Store and Load Programs and Data Using One or Two Cassette Recorders
- Adds 25 Commands and Statements to PC-2 BASIC

PC-2 Printer/Plotter/Dual Cassette Interface. This superior accessory turns your PC-2 into a powerful, completely portable computer system. You can take it with you wherever you go—on business trips, to meetings, out in the field—anywhere! You can plot superbly detailed 256 x 4096 XY four-color graphics, and print upper and lower case characters in nine different sizes using easily replaceable ballpoint mini-pens. The printer adds 25 commands and statements to Extended Pocket BASIC to make plotting quick and easy. Dual cassette operation allows data to be read in from one cassette, updated and stored on a second cassette automatically. Features built-in self-test and rechargeable batteries that also power the PC-2. Includes U.L. listed AC adapter/charger, paper, pens, cassette cables and manual. **26-3605** 219.95

RS-232C Interface for the PC-2

NEW FOR '84

199.95

Plugs Into PC-2 or Printer

Allows the PC-2 to use most RS-232 devices. Built-in communications program lets you access information networks. Includes built-in rechargeable batteries and U.L. listed adapter/charger. **26-3612** 199.95

Ready-to-Run PC-2 Software

Personal Finance. 26-3700	19.95
Business Finance. 26-3703	19.95
NEW! Investment Analysis. 26-3712	49.95
Math Pak I. 26-3709	14.95
Math Pak II. 26-3710	14.95
Math Plotter. 26-3711	10.95
NEW! Statistics. 26-3704	29.95
NEW! Chemistry Math. 26-3708	14.95
NEW! Pocket Organizer. 26-3706	19.95
NEW! Flight Planner. 26-3707	24.95
Games Pak. 26-3702	14.95
Invasion Force. 26-3705	9.95

Accessories for Your PC-2

NEW! Getting Started on the PC-2. Easy-to-read tutorial manual covers commands and programming tips. **26-3620** 12.95

Carry Case. Holds printer (with PC-2 installed) and AC adapter/charger. Padded vinyl. **26-3608** 29.95

Replacement Pens. 3 black. **26-1480** 2.95

Replacement Pens. 1 each: red, green, blue. **26-1481** 2.95

Printer Paper. Cash register-type. 2 1/4" wide. **26-3606** 6 Rolls/2.49

4K RAM Module. 26-3615 ..... 69.95

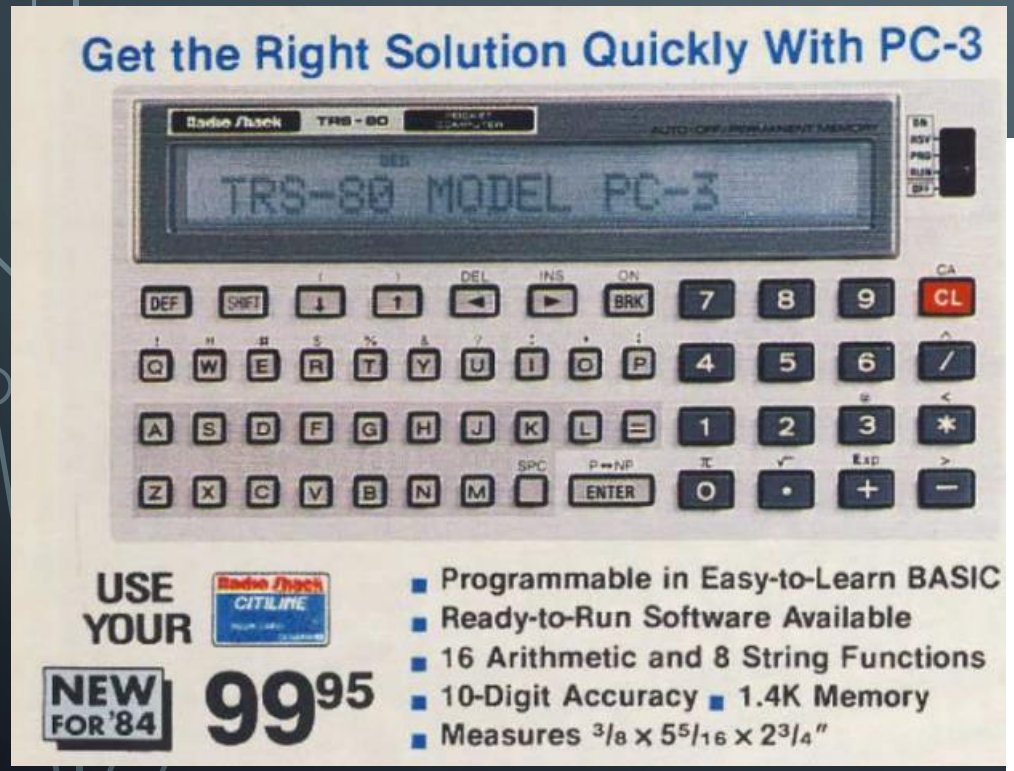
8K RAM Module. 26-3616 ..... 139.95

PROGRAMMING POCKET COMPUTERS

Connectivity – back in the day

PROGRAMMING POCKET COMPUTERS

Connectivity – back in the day



PROM Application Note
Programming CF-Series Flash Cards

This application note discusses the considerations in writing programs for the CF Series of Flash Cards for the Sharp PC-1270 Pocket Computer. It also addresses converting a program written for a RAM card to run on a Flash Card.

Table of Contents

PROGRAMMING POCKET COMPUTERS

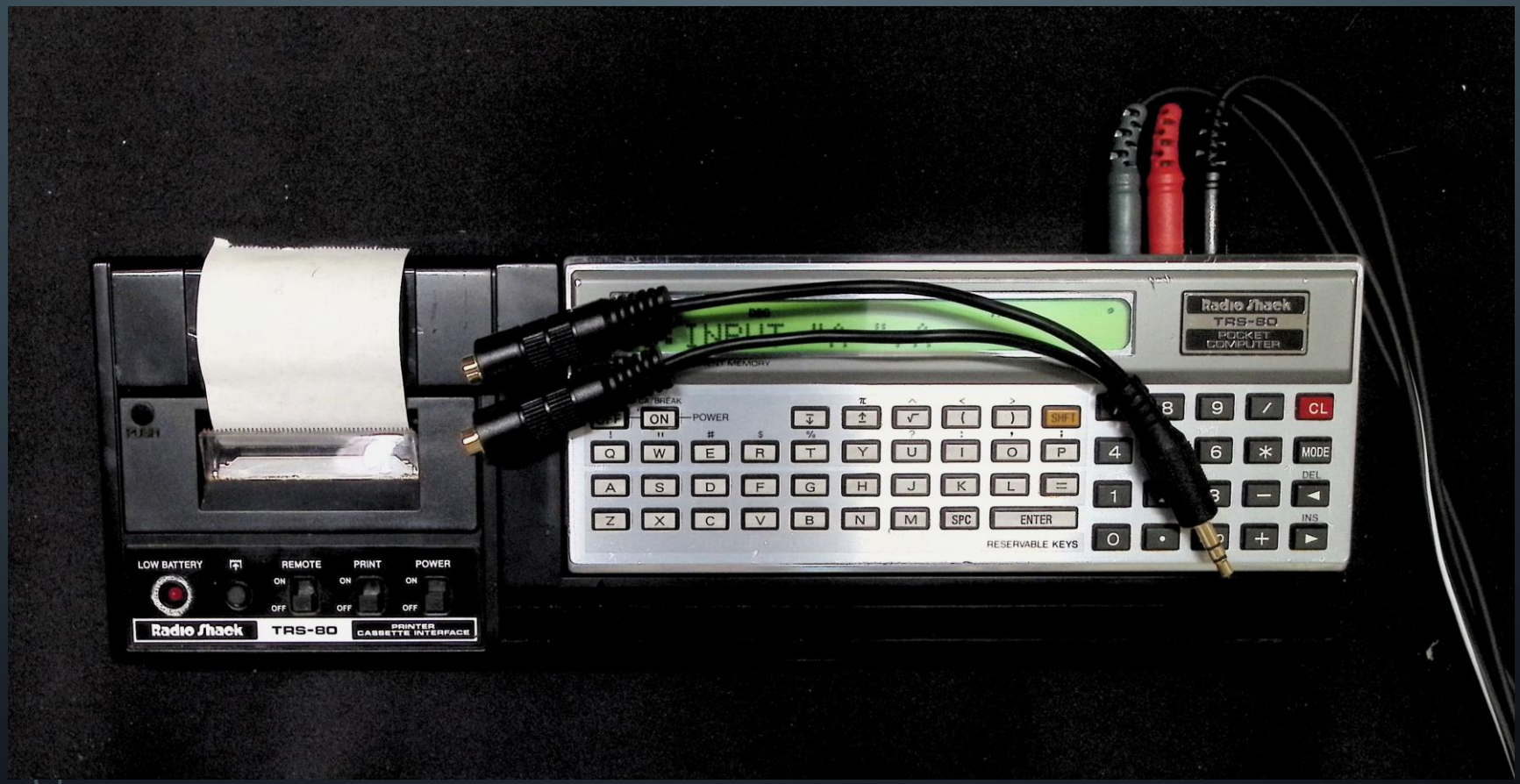
Connectivity – back in the day

PROGRAMMING POCKET COMPUTERS

Connectivity – today

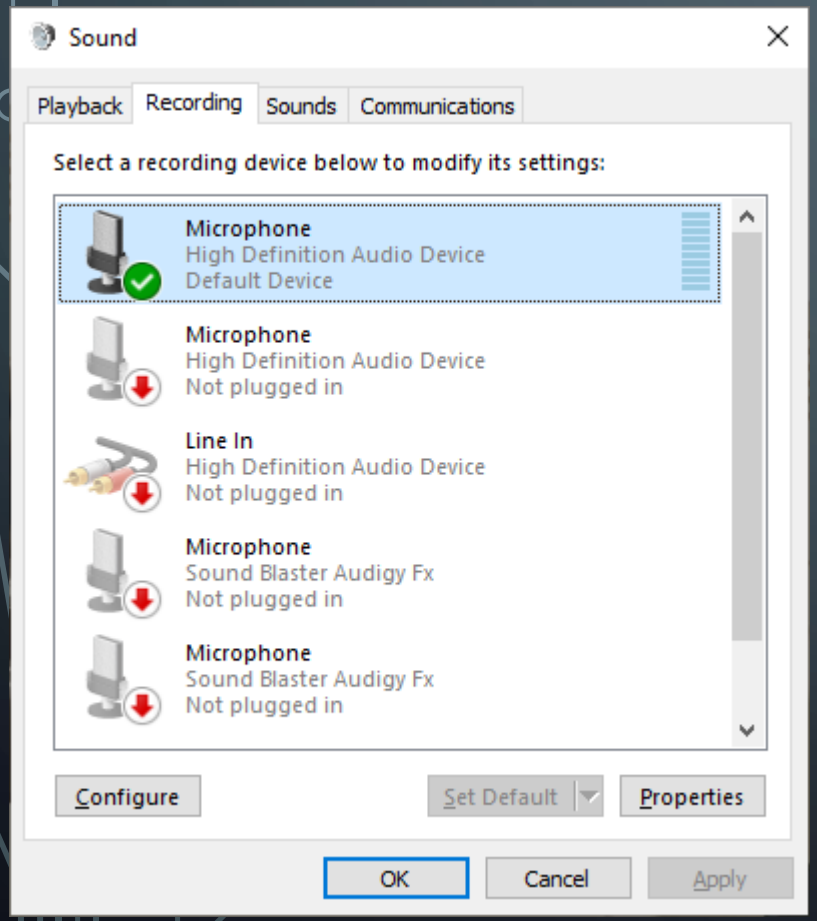
PROGRAMMING POCKET COMPUTERS

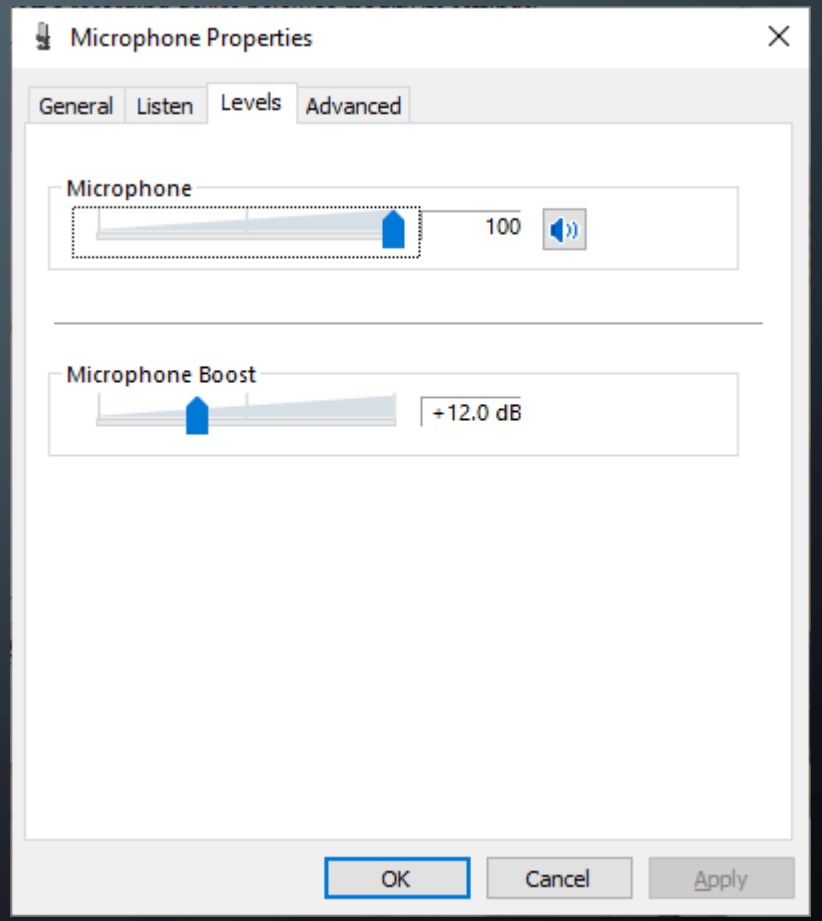
Connectivity – today



PROGRAMMING POCKET COMPUTERS

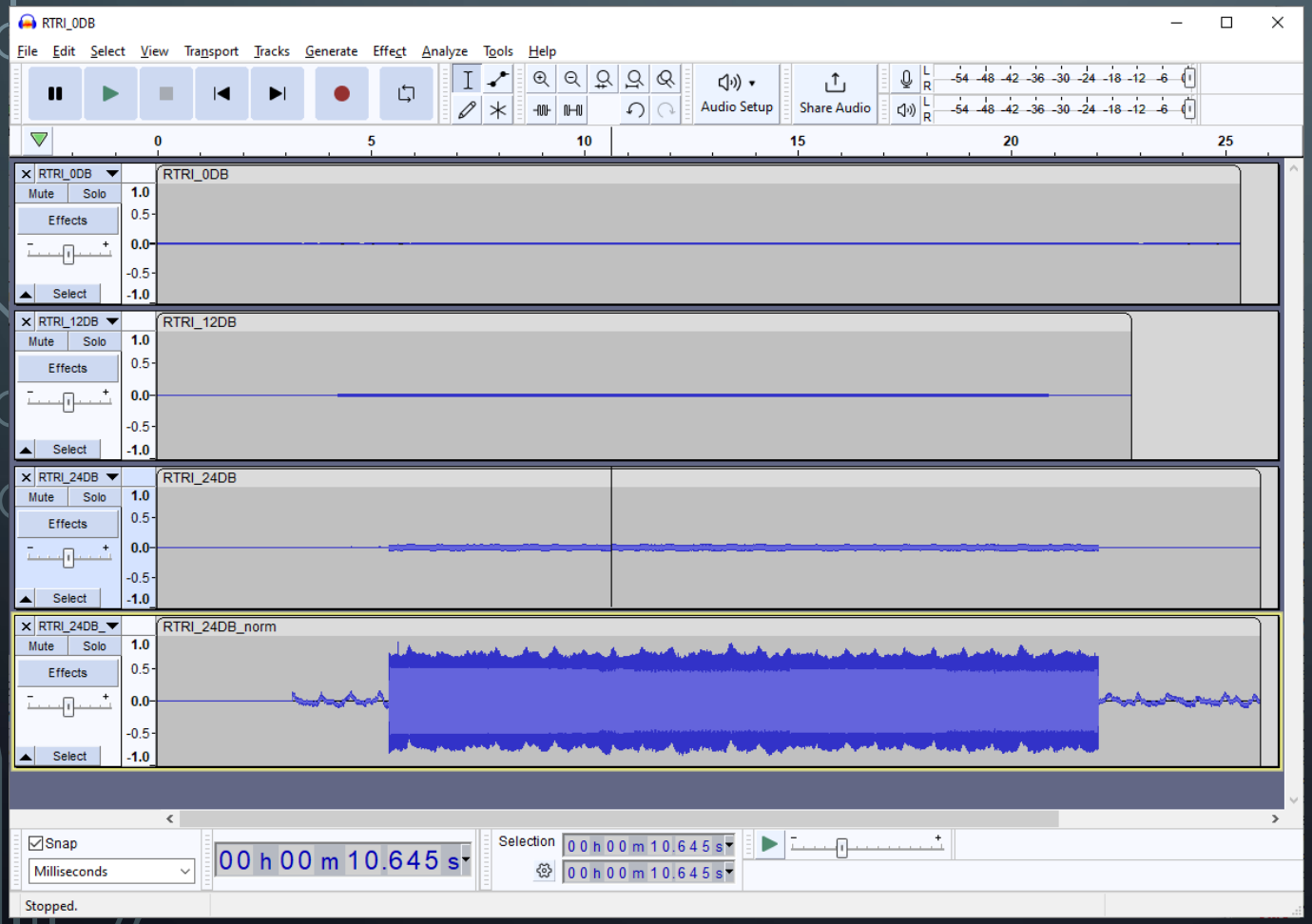
Connectivity – today





PROGRAMMING POCKET COMPUTERS

Connectivity – today



0DB boost

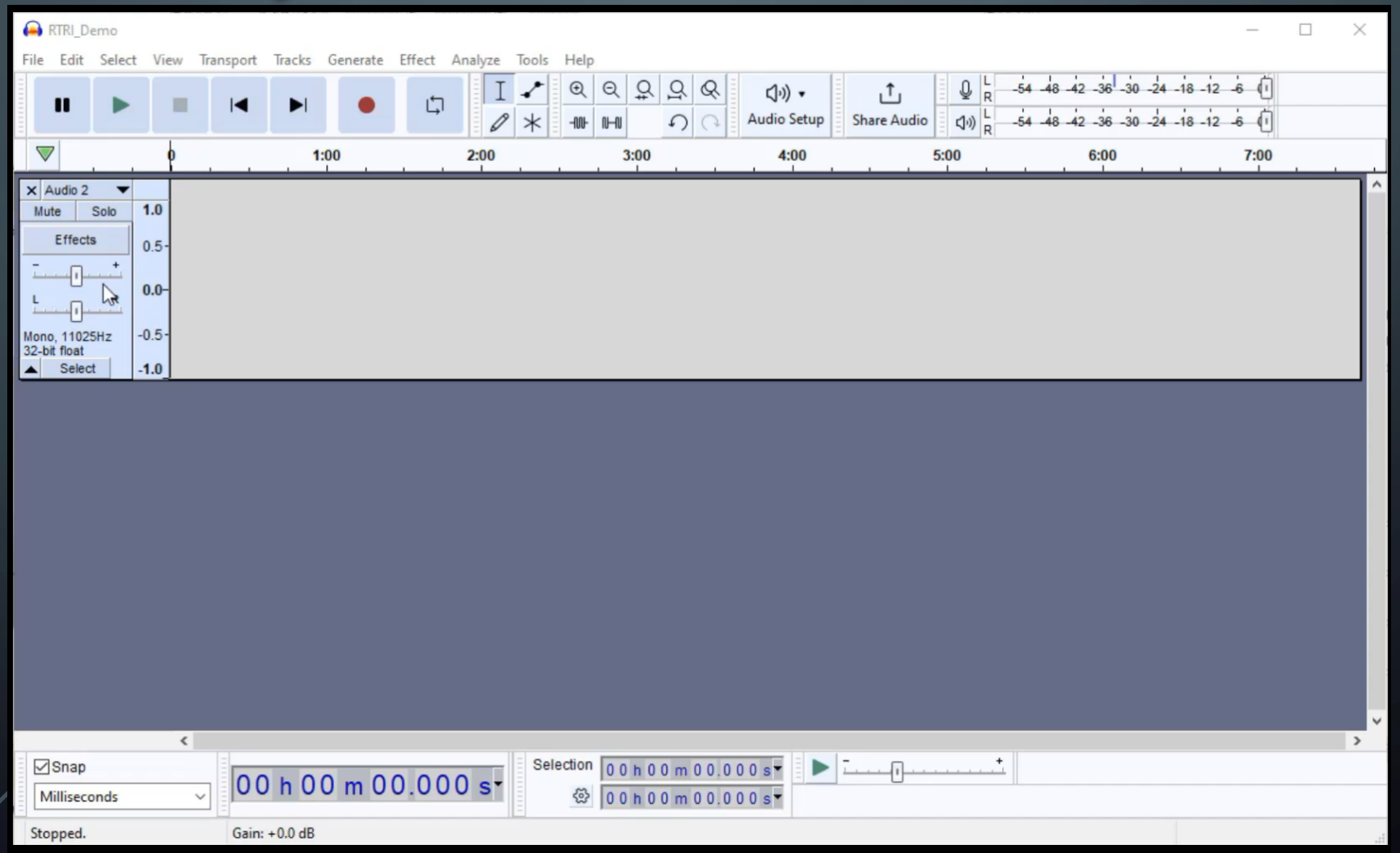
12DB boost

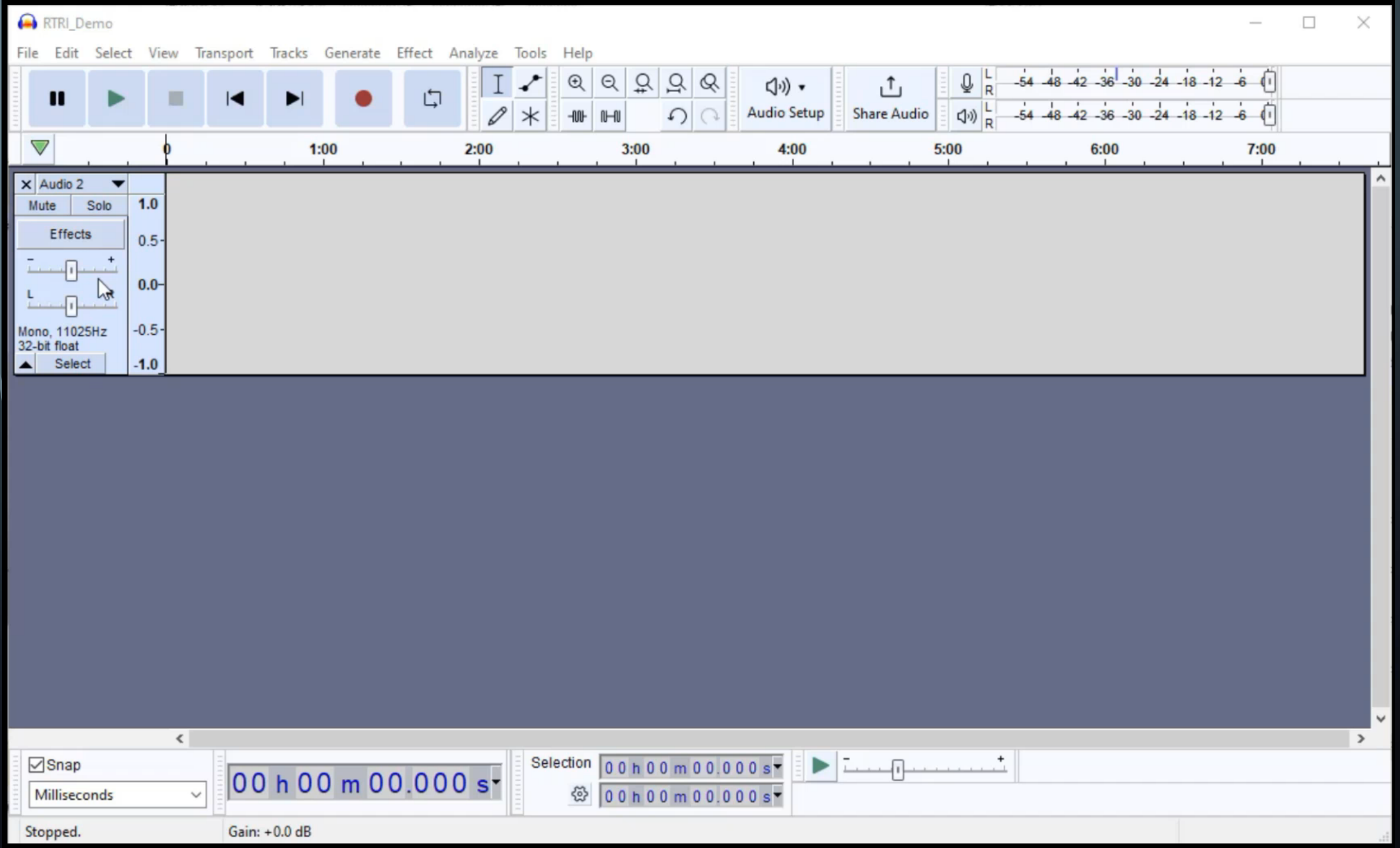
24DB boost

24DB boost, Norm.

PROGRAMMING POCKET COMPUTERS

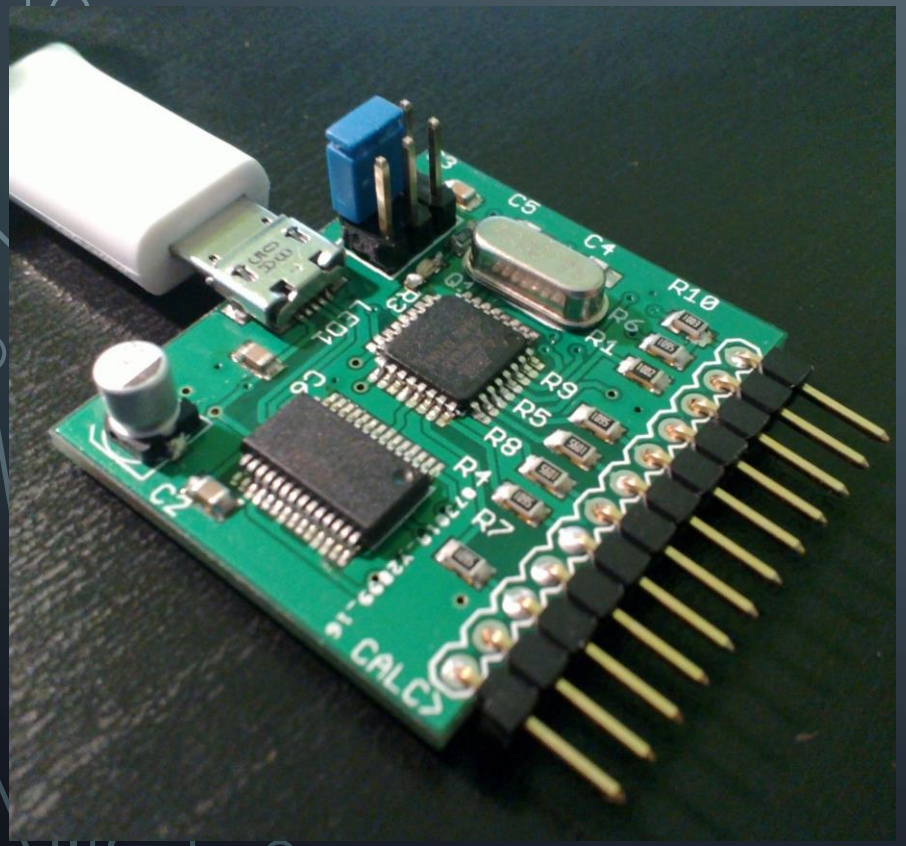
Connectivity – Demo PC-1




RTRI_Demo
File Edit Select View Transport Tracks Generate Effect Analyze Tools Help
Audio Setup
Share Audio
-54 -48 -42 -36 -30 -24 -18 -12 -6
0 1:00 2:00 3:00 4:00 5:00 6:00 7:00
Audio 2
Mute Solo
Effects
L
Mono, 11025Hz
32-bit float
Select
1.0 0.5 0.0 -0.5 -1.0
Snap
Milliseconds
00 h 00 m 00.000 s
Selection
00 h 00 m 00.000 s
00 h 00 m 00.000 s
Stopped.
Gain: +0.0 dB

PROGRAMMING POCKET COMPUTERS

Connectivity – today



PROGRAMMING POCKET COMPUTERS

PC-2

PROGRAMMING POCKET COMPUTERS

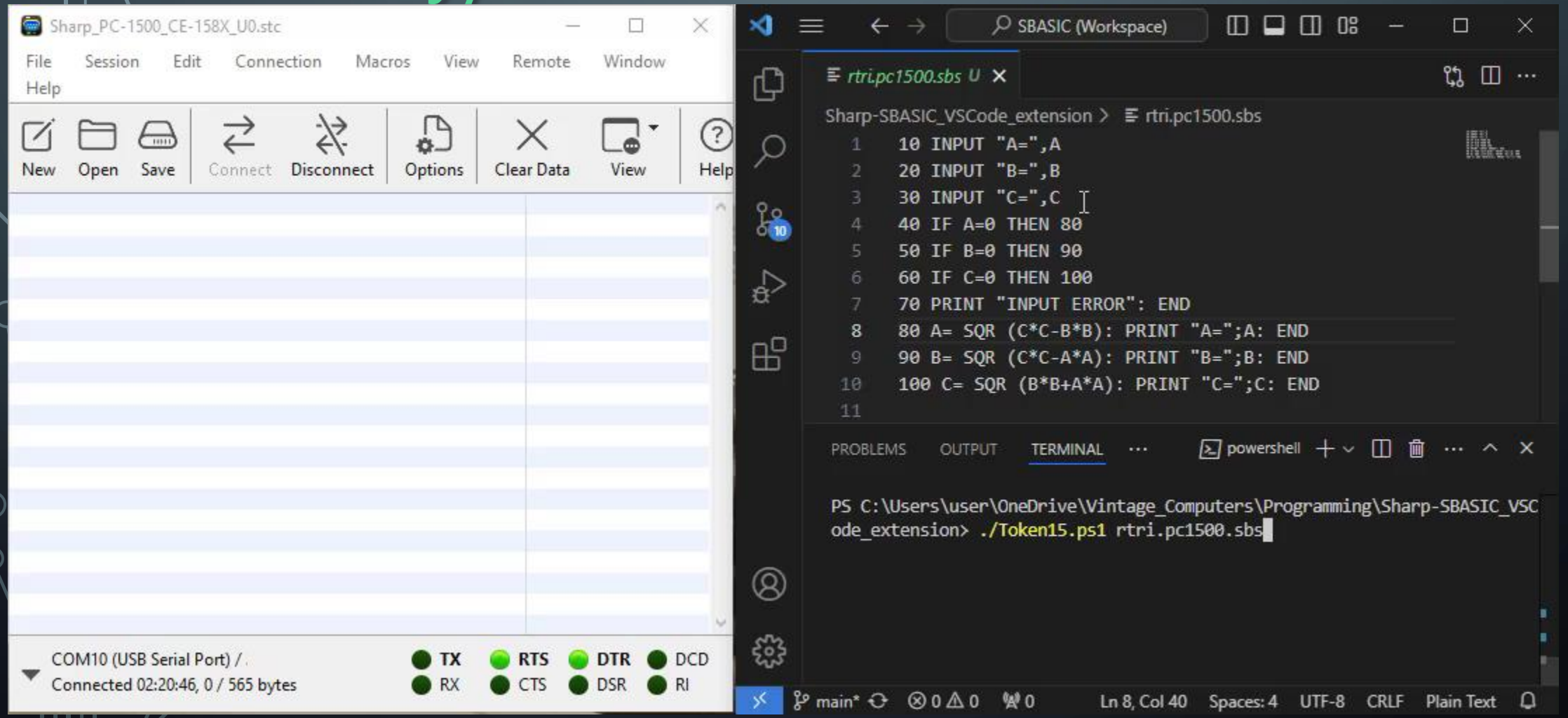
Connectivity - PC-2

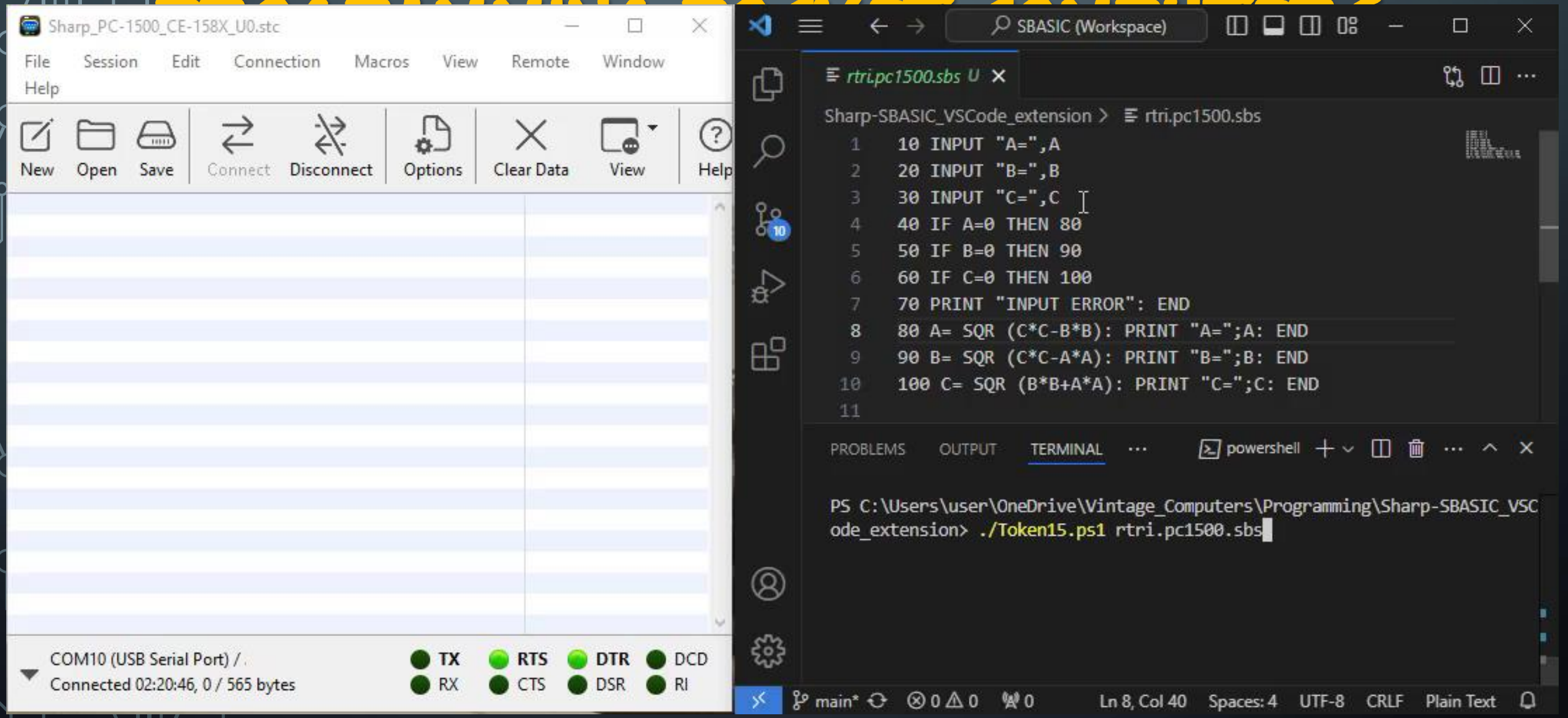
1) LHTOOLS -> suite of tools for creating BASIC/ML programs. Uses Z80 mnemonics.

2) Hey Birt! -> TASM extension for VS Code -> Suite of tools for use with VS Code. Tokenize/Detokenize BASIC, assemble ML, add CE-158 headers, etc.

PROGRAMMING POCKET COMPUTERS

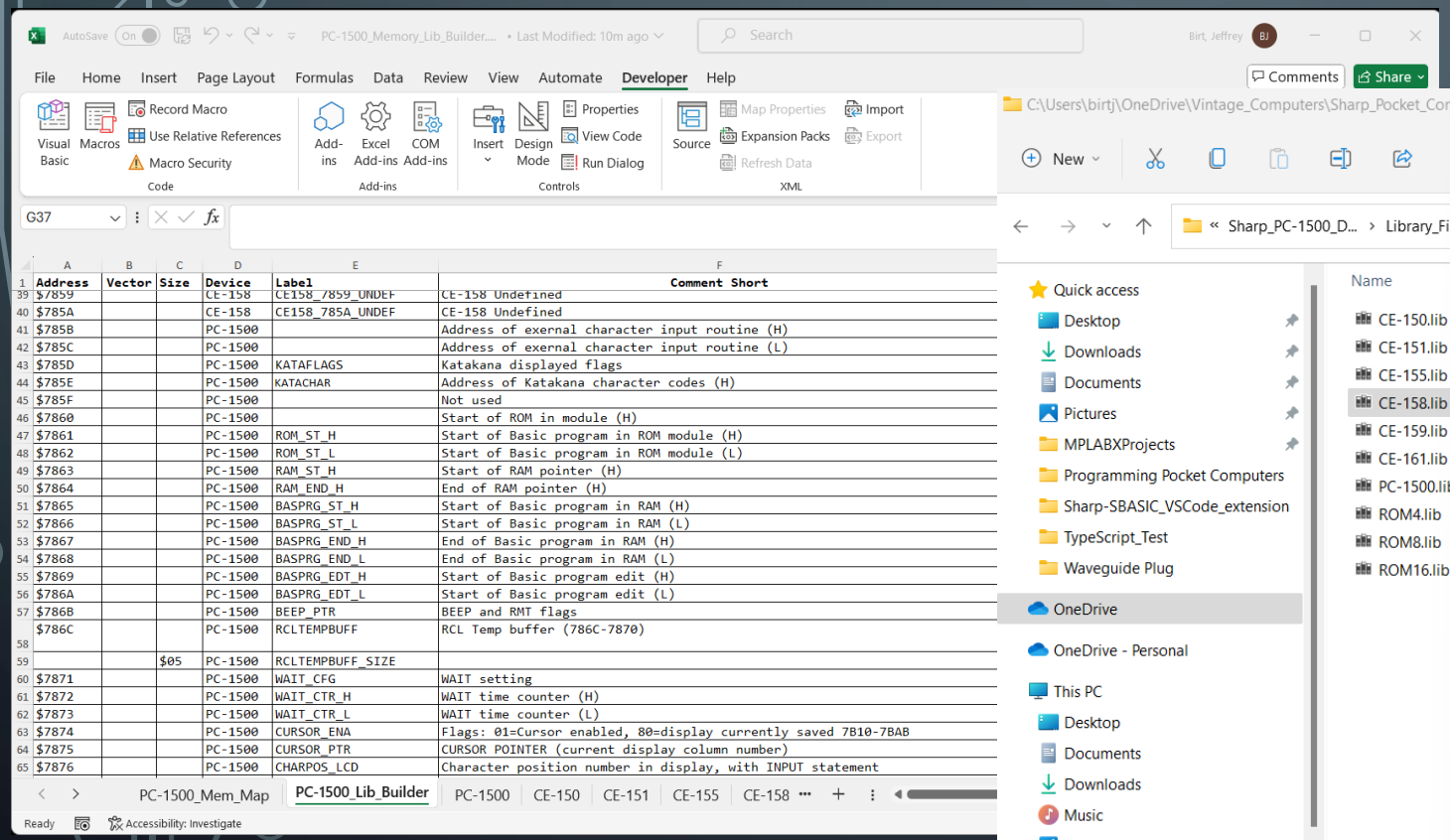
Connectivity/Tools – PC-2 BASIC Tokenization




Sharp_PC-1500_CE-158X_U0.stc
File Session Edit Connection Macros View Remote Window Help
New Open Save Connect Disconnect Options Clear Data View Help
COM10 (USB Serial Port) /.
Connected 02:20:46, 0 / 565 bytes
TX RX RTS CTS DTR DSR DCD RI
SBASIC (Workspace)
rtri.pc1500.sbs U
Sharp-SBASIC_VSCode_extension > rtri.pc1500.sbs
10 INPUT "A=",A
20 INPUT "B=",B
30 INPUT "C=",C
40 IF A=0 THEN 80
50 IF B=0 THEN 90
60 IF C=0 THEN 100
70 PRINT "INPUT ERROR": END
80 A= SQR (C*C-B*B): PRINT "A=";A: END
90 B= SQR (C*C-A*A): PRINT "B=";B: END
100 C= SQR (B*B+A*A): PRINT "C=";C: END
PROBLEMS OUTPUT TERMINAL powershell
PS C:\Users\user\OneDrive\Vintage_Computers\Programming\Sharp-SBASIC_VSCode_extension> ./Token15.ps1 rtri.pc1500.sbs
main* 0 0 0 Ln 8, Col 40 Spaces: 4 UTF-8 CRLF Plain Text

PROGRAMMING POCKET COMPUTERS

Connectivity/Tools – PC-2 Machine Language

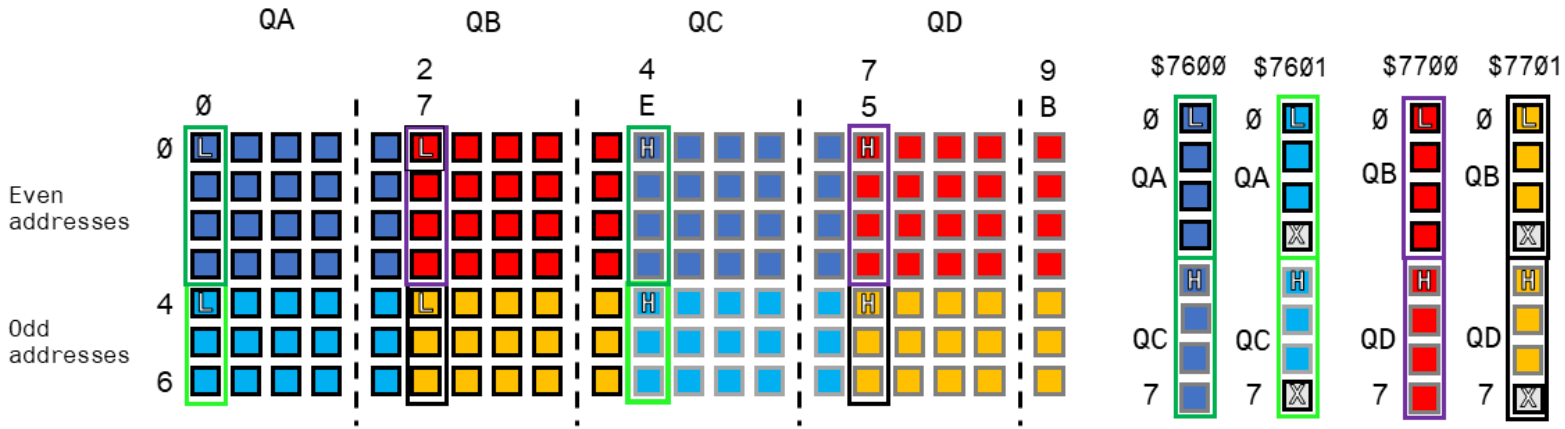


Address	Vector	Size	Device	Label	Comment Short
$7859			CE-158	CE158_7859_UNDEF	CE-158 Undefined
$785A			CE-158	CE158_785A_UNDEF	CE-158 Undefined
$785B			PC-1500		Address of exernal character input routine (H)
$785C			PC-1500		Address of exernal character input routine (L)
$785D			PC-1500	KATAFLAGS	Katakana displayed flags
$785E			PC-1500	KATACHAR	Address of Katakana character codes (H)
$785F			PC-1500		Not used
$7860			PC-1500		Start of ROM in module (H)
$7861			PC-1500	ROM_ST_H	Start of Basic program in ROM module (H)
$7862			PC-1500	ROM_ST_L	Start of Basic program in ROM module (L)
$7863			PC-1500	RAM_ST_H	Start of RAM pointer (H)
$7864			PC-1500	RAM_END_H	End of RAM pointer (H)
$7865			PC-1500	BASPRG_ST_H	Start of Basic program in RAM (H)
$7866			PC-1500	BASPRG_ST_L	Start of Basic program in RAM (L)
$7867			PC-1500	BASPRG_END_H	End of Basic program in RAM (H)
$7868			PC-1500	BASPRG_END_L	End of Basic program in RAM (L)
$7869			PC-1500	BASPRG_EDT_H	Start of Basic program edit (H)
$786A			PC-1500	BASPRG_EDT_L	Start of Basic program edit (L)
$786B			PC-1500	BEEP_PTR	BEEP and RMT flags
$786C			PC-1500	RCLTEMPBUFF	RCL Temp buffer (786C-7870)
		$05	PC-1500	RCLTEMPBUFF_SIZE	
$7871			PC-1500	WAIT_CFG	WAIT setting
$7872			PC-1500	WAIT_CTR_H	WAIT time counter (H)
$7873			PC-1500	WAIT_CTR_L	WAIT time counter (L)
$7874			PC-1500	CURSOR_ENA	Flags: 01=Cursor enabled, 80=display currently saved 7B10-7BAB
$7875			PC-1500	CURSOR_PTR	CURSOR POINTER (current display column number)
$7876			PC-1500	CHARPOS_LCD	Character position number in display, with INPUT statement

```
 ; CE-158 library file
OUTSTAT_REG       = $7850 ; CE-158 OUTSTAT value
RS232C            = $7851 ; CE-158 Console 1 (RS232C)
CONSOLE2          = $7852 ; CE-158 Console 1 (///)
CE158_UNDEF1      = $7853 ; CE-158 Undefined
CE158_UNDEF2      = $7854 ; CE-158 Undefined
CRLF_REG          = $7855 ; CE-158 Codes CR or LF
ZONE_REG          = $7856 ; CE-158 ZONE
SETDEV_REG        = $7857 ; CE-158 SETDEV value
SETCOM_REG        = $7858 ; CE-158 SETCOM
CE158_7859_UNDEF  = $7859 ; CE-158 Undefined
CE158_785A_UNDEF  = $785A ; CE-158 Undefined
CE158_REG_79DD    = $79DD ; Used for BPD command flags
CE158_REG_79DE    = $79DE ; Unknown use
CE158_REG_79DF    = $79DF ; Used for CLOAD/CSAVE BUSY annunciator blink counter
CE158_REG_79FA    = $79FA ; Used by CE-158
CE158_REG_79FB    = $79FB ; Used by CE-158
CE158_REG_79FC    = $79FC ; Used by CE-158
CE158_REG_79FD    = $79FD ; Used by CE-158
CE158_REG_79FE    = $79FE ; Used by CE-158
CE158_7B08        = $7B08 ; Used in CE-158 Low Bank
CE158_DIV_RESET   = $D004 ; CE158_DIVIDER_RESET (ME1)
CE158_UREG_OUTP   = $D005 ; CE158_U_REG_OUTPUT  (ME1)
CE158_SER_XFR     = $D006 ; CE158_SERIAL_XFR  (ME1)
CE158_FREG_LDIV   = $D007 ; CE158_F_REG_LD/DIV  (ME1)
CE158_PRT_C       = $D008 ; CE158_PRT_C  (ME1)
CE158_G_REG       = $D009 ; CE158_G_REG  (ME1)
CE158_MSK_REG     = $D00A ; CE158_MSK_REG  (ME1)
CE158_IF_REG      = $D00B ; CE158_IF_REG  (ME1)
```

PROGRAMMING POCKET COMPUTERS

Connectivity/Tools – PC-2 Machine Language



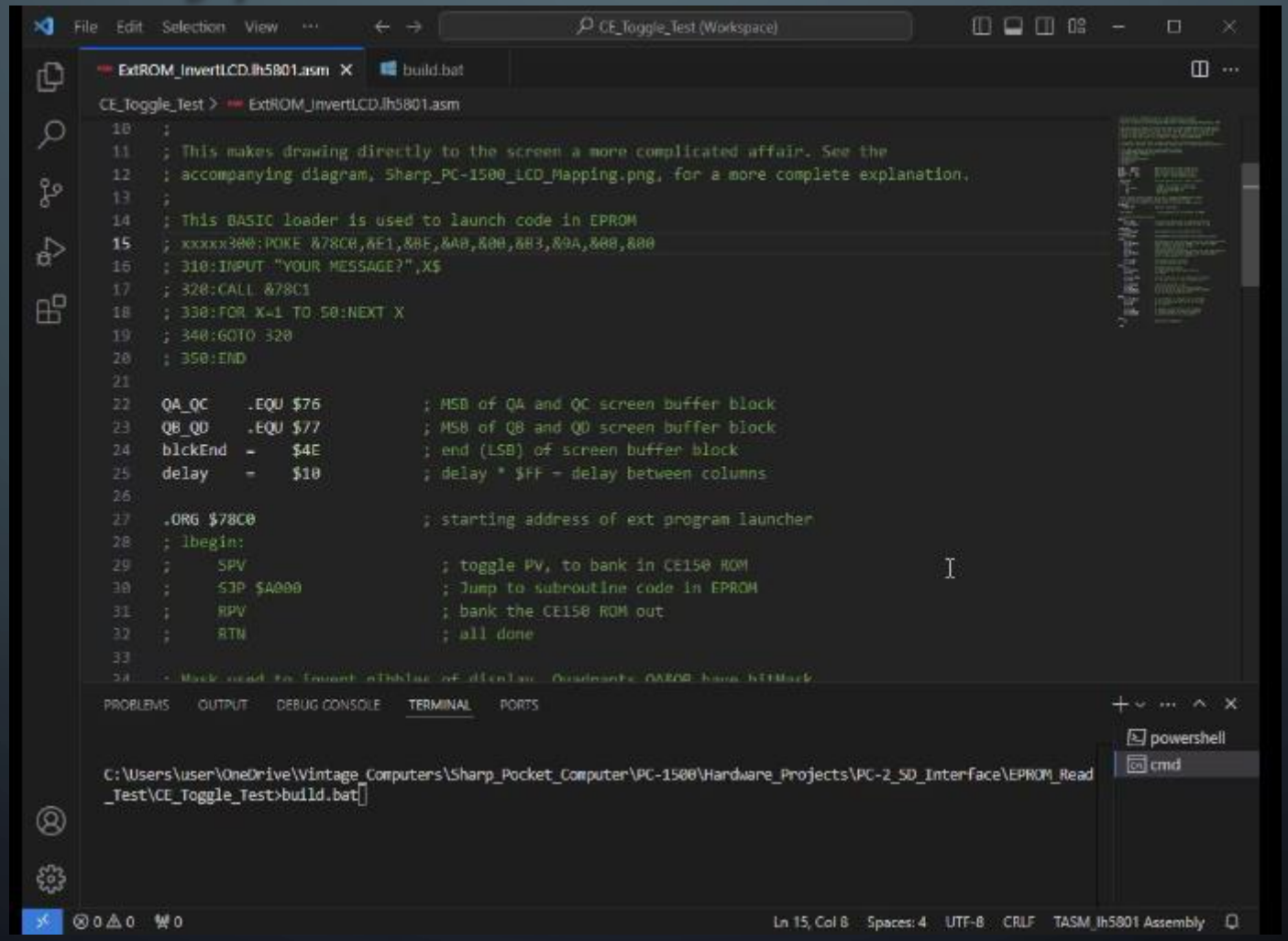
The LCD screen is 156x7 pixels in size. The origin (00h,00h) is in upper left corner with the opposite corner being (9Bh, 06h). The screen is divided horizontally into four quadrants, QA, QB, QC, QD. You draw the screen by writing to the LCD screen RAM buffer which is made up of two distinct memory blocks 7600h-764Dh (QA, QC) and 7700h-774Dh (QB,QD).

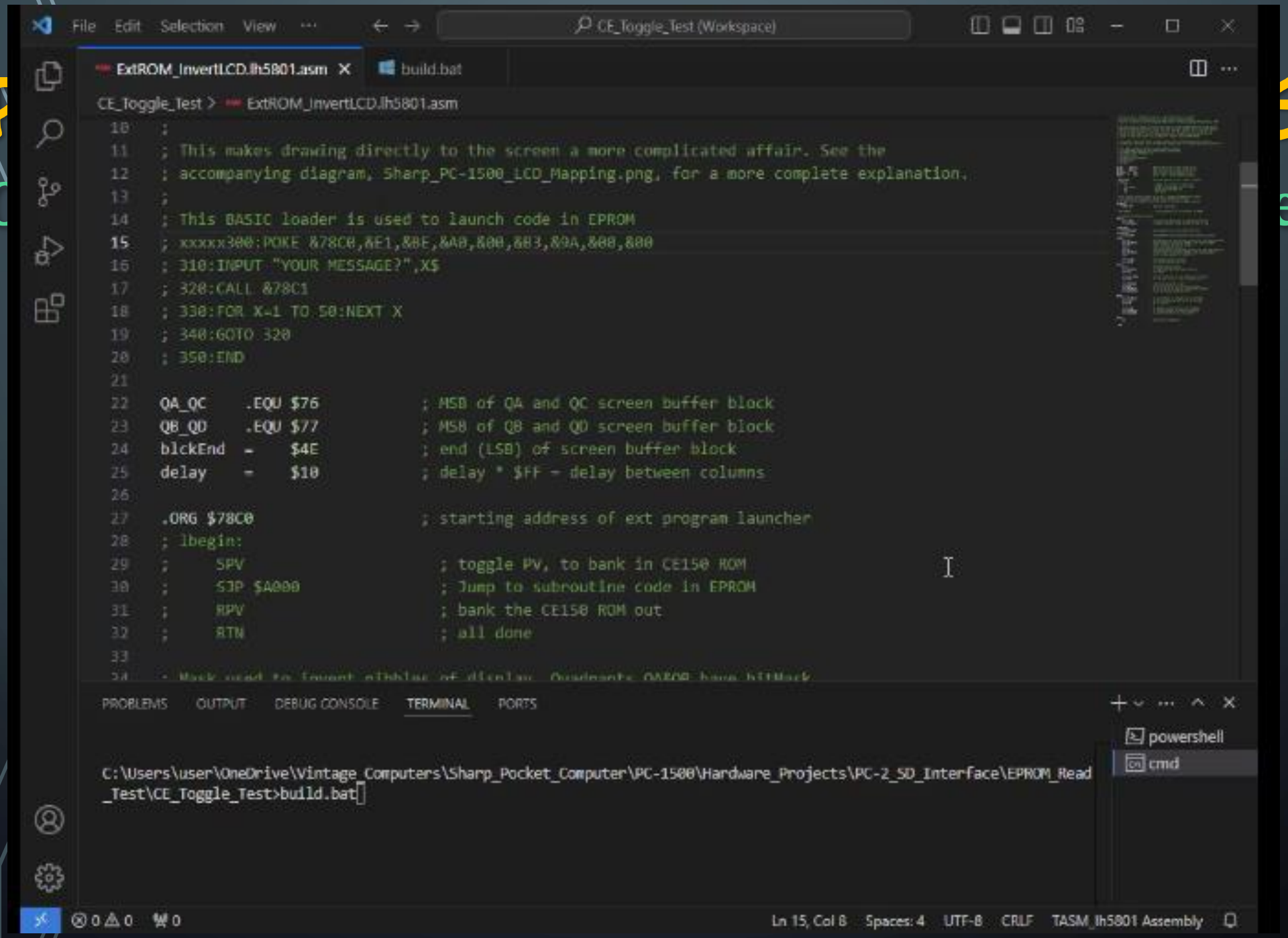
Additionally, each column is split into two parts with cells 0-3 coming from the low nibble of an even buffer address, while cells 4-6 come from the low nibble of the next odd address. For example, in QA column 00h starts at 7600h with its low nibble, bits 0-3, mapped to cells (0h,0h) to (0h,3h). Cells (0h,4h) to (0h,6h) are mapped to the low nibble, bits 0-3, of address 7601h. The high nibbles of 7600h and 7601h are mapped in a similar manner in QC in column 4E.

The second memory block, 7700h-774Dh, is mapped to QB and QD in the same manner. For example, in QB column 27h starts at 7700h with its low nibble, bits 0-3, mapped to cells (27h,0h) to (27h,3h). Cells (27h,4h) to (27h,6h) are mapped to the low nibble, bits 0-3, of address 7601h. The high nibbles of 7700h and 7701h are mapped in a similar manner in QD.

PROGRAMMING POCKET COMPUTERS

Connectivity/Tools – PC-2 Machine Language




File Edit Selection View ···
CE_Toggle_Test (Workspace)
ExtROM_InvertLCD.lh5801.asm
build.bat
CE_Toggle_Test > ExtROM_InvertLCD.lh5801.asm
;
; This makes drawing directly to the screen a more complicated affair. See the
; accompanying diagram, Sharp_PC-1500_LCD_Mapping.png, for a more complete explanation.
;
; This BASIC loader is used to launch code in EPROM
; xxxxx300:POKE &78C0,&E1,&8E,&A0,&00,&83,&9A,&00,&00
; 310:INPUT "YOUR MESSAGE?",X$
; 320:CALL &78C1
; 330:FOR X=1 TO 50:NEXT X
; 340:GOTO 320
; 350:END
QA_QC .EQU $76 ; MSB of QA and QC screen buffer block
QB_QD .EQU $77 ; MSB of QB and QD screen buffer block
blckEnd = $4E ; end (LSB) of screen buffer block
delay = $10 ; delay * $FF = delay between columns
.ORG $78C0 ; starting address of ext program launcher
; lbegin:
; SPV ; toggle PV, to bank in CE150 ROM
; SJP $A000 ; Jump to subroutine code in EPROM
; RPV ; bank the CE150 ROM out
; RTN ; all done
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
powershell
cmd
C:\Users\user\OneDrive\Vintage_Computers\Sharp_Pocket_Computer\PC-1500\Hardware_Projects\PC-2_SD_Interface\EPROM_Read_Test\CE_Toggle_Test>build.bat
Ln 15, Col 8 Spaces: 4 UTF-8 CRLF TASM_lh5801 Assembly

PROGRAMMING POCKET COMPUTERS

Questions?

PROGRAMMING POCKET COMPUTERS

Links

- Hey Birt!: https://github.com/Jeff-Birt?tab=repositories
- Sharp Pocket Tools: https://www.peil-partner.de/ifhe.de/sharp/
- Sharp Casio misc.: https://github.com/levindenooij/Pocket-Computer-PC-Tools/tree/main
- Sharp Tools: https://gist.github.com/tinue/c6c4fc4dc6ca26dd3dbfa44704a373a0
- Sharp CE-140F emulator: https://github.com/ffxx68/Sharp_ce140f_emul
- Casio tools: https://www.mvcsys.de/doc/casioutil.html