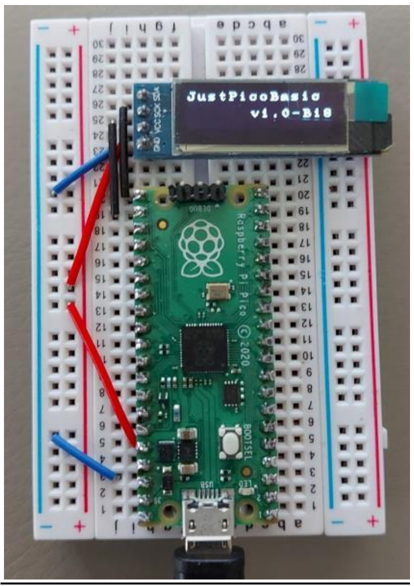
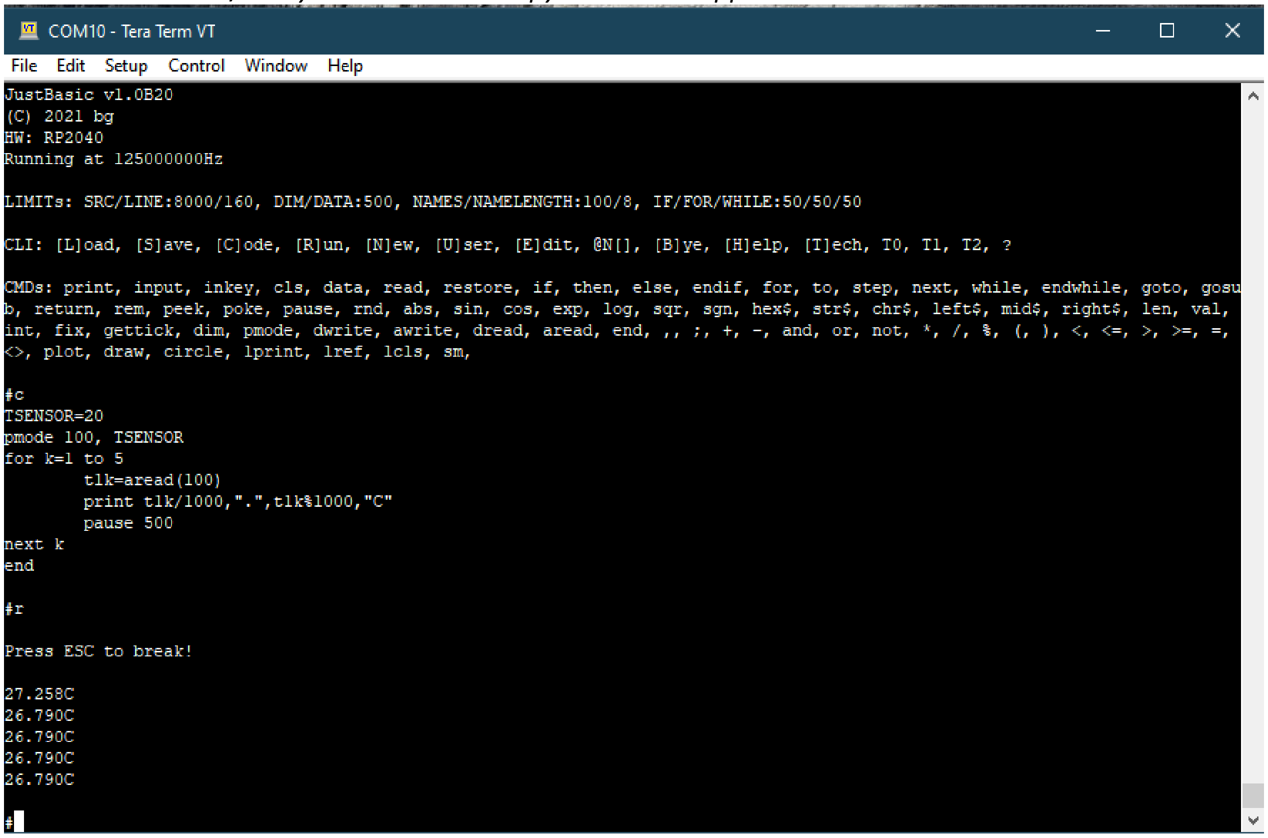
#JustPicoBasic manual

This manual is common for both Windows- and PICO-based BASIC interpreter versions.
I believe that the best way to see how it works is to follow the provided program examples:
https://github.com/bgolab/JustBasic/tree/main/examples



Terminal

JustPicoBasic was tested w/ Putty and TeraTerm. Copy & Paste is supported.



```
JustBasic v1.0B20
(C) 2021 bg
HW: RP2040
Running at 125000000Hz

LIMITs: SRC/LINE:8000/160, DIM/DATA:500, NAMES/NAMELENGTH:100/8, IF/FOR/WHILE:50/50/50

CLI: [L]oad, [S]ave, [C]ode, [R]un, [N]ew, [U]ser, [E]dit, @N[], [B]ye, [H]elp, [T]ech, T0, T1, T2, ?

CMDs: print, input, inkey, cls, data, read, restore, if, then, else, endif, for, to, step, next, while, endwhile, goto, gosu
b, return, rem, peek, poke, pause, rnd, abs, sin, cos, exp, log, sqr, sgn, hex$, str$, chr$, left$, mid$, right$, len, val,
int, fix, gettick, dim, pmode, dwrite, awrite, dread, aread, end, ,, ;, +, -, and, or, not, *, /, %, (, ), <, <=, >, >=, =,
<>, plot, draw, circle, lprint, lref, lcls, sm,

#c
TSENSOR=20
pmode 100, TSENSOR
for k=1 to 5
        t1k=aread(100)
        print t1k/1000,".",t1k%1000,"C"
        pause 500
next k
end

#r

Press ESC to break!

27.258C
26.790C
26.790C
26.790C
26.790C

#
```

Code formatting

You can freely format the code – can put many commands in single line, etc. Capital and small letters accepted for keyword. Names recognizes small and capital letters.

Example
print "Hi" for k=1 to 10 print k next k
end

Program structure
Command 'end' should follow the last line of the code. Subroutines shall follow the 'end' command otherwise they will be wrongly interpreted.

```
code
end
subroutines
```

Example

```
print "Hi!"
gosub doitagain
end
doitagain:
        print "Hi!"
return
end
```

System modes
There are two systems modes using different prompts: user ('>' prompt) and enhanced ('#' prompt)

U-MODE *(aka single-line mode) can be entered by issuing: 'U' command; useful to run single line programs, for example:*
m=3 data 2, 3, 4 sum=0 for i=1 to m read a sum=sum+a next i print "s=", sum, ", av= ", sum/m end
E – enter E-mode

E-MODE *(aka enhanced mode); can be entered by issuing: 'E' command; this mode supports many system commands:*
? - shows quick info about the VM (version, list of available commands)
H – help – shows some program examples
U – enter U-mode
C – code – list current program code (use: 'SM LN 0' to see program using 'c' without line numbers)
R – run program
N – new – clear VM memory and code
B – bye – reboots the PICO in USB disk mode, in Windows version exists the VM
L - load / save program from / to persistent memory (auto.bas) - TBD

Built-in editor
Every command is appended to the existing code (at the end).
'C' shows code and internal line numbers used for @N commands.
@N (e.g. @3) – removes Nth line of code (use C to see the line numbers)
@N cmd (e.g. @4 PRINT 5 – inserts 'PRINT 5' before line 4) inserts the new code line following the @N before the Nth line

Built-in program flow tracing
T0 – disables tracing
T1 – enables stepping mode (can step program, and see next command, variables)
T2 – normal run with tracing (full run rate with tracing enabled to track program flow)

Example: enables stepping mode, runs program, can select [S] to step or [G] to go
T1 or T2 – to enable particular tracing mode
R – to run program end enter particular tracing mode

The programming language

MISC
-ESC - break program when loading or running;
-SM ENTITY 1|0 - system mode command to set system configuration
  SM ESC 1|0 (default=enabled) – enable / disable ESC key check (disable to boost performance – temporary fix)
  SM OLED 1|0 (default=disabled) – enable OLED hw (cannot be disabled now)
  SM LN 1|0 (default=enabled) – enable / disable line numbering in 'c' command
-REM – comment

Example
REM Initial procedure

-CLS – clear screen

VARIABLES, EXPRESSIONS
-var types (suffix matters): INT (no suffix, name=expr), FLOAT (suffix '#', name#=expr), STRING (suffix '$', name$=expr)
-variable name: up to 8chars letter&digits starting w/ a letter(digits, '#", '$', '_', ':' accepted),
-var initialization: 1st-reference creates var(value=0); any variable can be assigned an expressions: var=expr;
*-expressions: INT/FLOAT, +, -, *, /, %,(,), vars;*
-array:1-dimension; INT/FLOAT supported; STRING arrays NOT supported; DIM name(size); name(item)=expr
-strings supports only '+' in expressions + string functions and variables

Example: int, float, string variables
hi5=2
w#=2.5
name$="John"

Example: int, float arrays
DIM a(3)
a(0)=3
DIM(b#(3)
b#(0)=2.5

Example: complex expressions
*sy=2*abs(-15) + a*20*
v#=fexpr; b#=a#-2(2+3)+abs(-1.0)+aa#(2);*

Example
v$="a"+a$+left$(str$(13),1);
PRINT sexpr; VAL("-1")->-1

LOOPS & PROGRAM FLOW
-label name: up to 8chars letter & digits starting w/ a letter('_' accepted),
-loop/if nesting supported
-FOR var=expr TO expr [STEP expr] [] NEXT var; if STEP[default=1] is negative var decreases; FLOAT supported

Example
FOR i = 5 TO 1 STEP -1 NEXT I END

-WHILE expr1 op expr2 [code] ENDWHILE; FLOAT supported;

Example:
a=0 while a<5 print a a=a+1 endwhile end

-GOTO – label (aka name with colon); can be located everywhere (before and after the GOTO): Label: [code] GOTO label

Example

```
k=1
again:
print k k=k+1
if k<5 then goto again: endif
end
```

-GOSUB – label can be located everywhere (before and after the GOTO): Label: [code] RETURN GOSUB label

Example

```
gosub task0
end
task0: print “done” return
```

-IF conditions THEN [code] [ELSE] [code] ENDIF; FLOAT supported; AND/OR/NOT) supported

Example

```
if a>1 and b#>3.4 then print “good” else print “bad” endif
```

-END last instruction (GOSUB labels can be located behind the END)

INPUT, OUTPUT, DATA

-PRINT expr, sexpr,…(separate items by ‘,’); ‘;’ at the end to skip NEW LINE;

Example

```
PRINT "How:", 6/3 ;
PRINT 1 (prints 1 w/ NEW LINE); PRINT 1; (prints 1 w/o NEW LINE)
```

-INPUT – assignes int/float/string values to var or array element: INPUT var, array_element, a$, …;

Example

```
INPUT a(2), d#, name$
print a(2), d#, name$
```

-DATA expr, fexpr, str; READ a, b#, d$; RESTORE clears data pointer; INT/FLOAT/STR supported

Example

```
DATA 1.5, 2*a; READ v, v#, v(), v#();
```

BUILT-IN FUNCTIONS

-LEFT$/RIGHT$/MID$, LEN/VAL(sexpr)

-HEX$/STR$/CHR$(expr);

Example: string functions

```
k$=LEFT$("abcdefgh", 3) + "1234"
PRINT VAL("-1234")+1
i=1234567
i$=MID$(STR$(i), 2, 3)
PRINT i$
PRINT MID$(STR$(i), 2, 3)
```

Example
```
PRINT HEX$(NOT(0x0F))
a=65
d$=chr$(a)
```

-SIN/COS/SQR/EXP/LOG;

Example
```
PRINT "FLOAT FUNC"
PRINT "SQR: ", SQR(5)
PRINT "EXP: ", EXP(1)
PRINT "LOG: ", LOG(2.718)
PRINT "SIN: ", SIN(30*3.14/180)
PRINT "COS: ", COS(60*3.14/180)
```

-RND/SGN/ABS

Example
```
PRINT "RND: ", RND(1000)
```

-GETTICK() – returns tick number
-PAUSE msec

Example
```
PAUSE 2*500
a=gettick()
```

-INKEY() – return current key (if pressed), otherwise 0; non-blocking (no-wating)

-INT/FIX (as in QBASIC)

Examples
```
a=INT(1.1)
b=INT(-1.1)
c=FIX(1.9)
d=FIX(-1.9)
PRINT a, ", ", b, ", ", c, ", ", d (1, -2, 1, -1)
```

-AND, OR, NOT

Example
```
PRINT "BIT OPS"
PRINT AND(0x03,0x0F)
PRINT OR(0x01,0x02)
PRINT HEX$(NOT(0x0F))
```

PICO HARDWARE SUPPORT
-PEEK(addr) – hex supported
-POKE addr, value – hex supported

Example
```
REM SYSTICK
```

```
SYSTCSR=0xe000e010
SYSTRVR=0xe000e014
SYSTCVR=0xe000e018
poke SYSTCSR, 0
poke SYSTRVR, 0x1e847
poke SYSTCSR, 5
for k=1 to 50
   print and(peek(SYSTCVR), 0x00FFFFFF)
   pause 1000
next k
end
```

- PMODE gpio_pin, mode
mode: 0-IN, 1-OUT, 2-PULLUP, 3-PULLDOWN, 10-ADC, 15-PWM, 20-TSENSOR

-AREAD(gpio_pin), pins=26-29 – read analog pin

Example: GPIO26 as analog input
```
pmode 26, 10
a=aread(26)
```

Example: read temperature sensor through virtual pin=100
```
pmode 100, 20
t= aread(100)
```

-AWRITE – PWM (cycle: 65535) – initial implementation

Example: PWM 25%
```
pmode 22, 15
awrite 22, 16000
```

- DREAD(gpio_pin) – read digital pin

Example
```
REM explorer buttons: a, b, x, y
a=12
b=13
x=14
pmode a, 0
pmode b, 0
pmode y, 0
y=15
pmode y, 0
pmode y, 2
REM modes: 0-IN, 1-OUT, 2-PULLUP, 3-PULLDOWN
for k=1 to 10 step 0
        pause 50
        print dread(y)
next k
```

-DWRITE gpio_pin, value – write to digital pin

Example

```
REM explorer led - pin 25
pmode 25, 1
for k=1 to 10 step 0
            pause 500
            dwrite 25,1
            pause 500
            dwrite 25,0
next k
end
```

-OLED0.91 support (commands may change in the future)

NOTE: enable the OLED hardware first with: SM OLED 1

DRAW X, Y – draws line from the last point (last PLOT/DRAW commands x, y)

PLOT X, Y – draws point

LPRINT x, y, "txt"

LCLS – clear lcd

LREF – refresh LCD (copy mem content to the LCD)

Example" enable OLD hw (disabled by default), clear screen

```
sm oled 1
lcls
```

Example: clear lcd screen, draw line

```
lcls
plot 10,10
draw 20,20
lprint 1, 1, "hi!"
lref
end
```

examples

```
REM OLED SINE
lcls
sineno=1
for x=0 to 127
            plot x,fix(15+15*sin(2*3.14159*x/128))
next x
lref
end
```