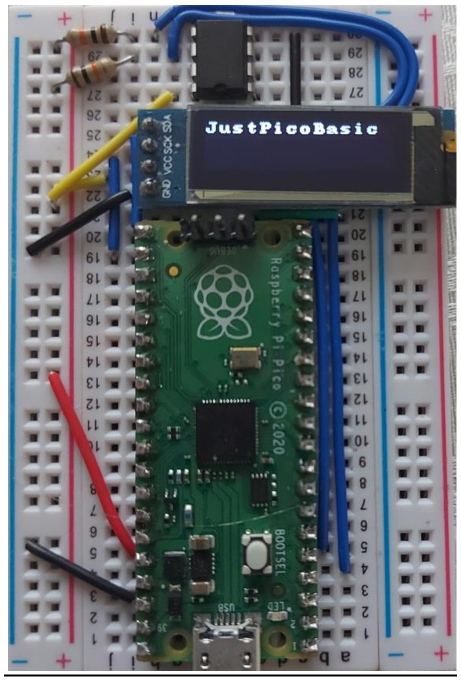
#JustPicoBasic manual

The best way to see how it works is to run a few examples available at:
https://github.com/bgolab/JustBasic/tree/main/examples

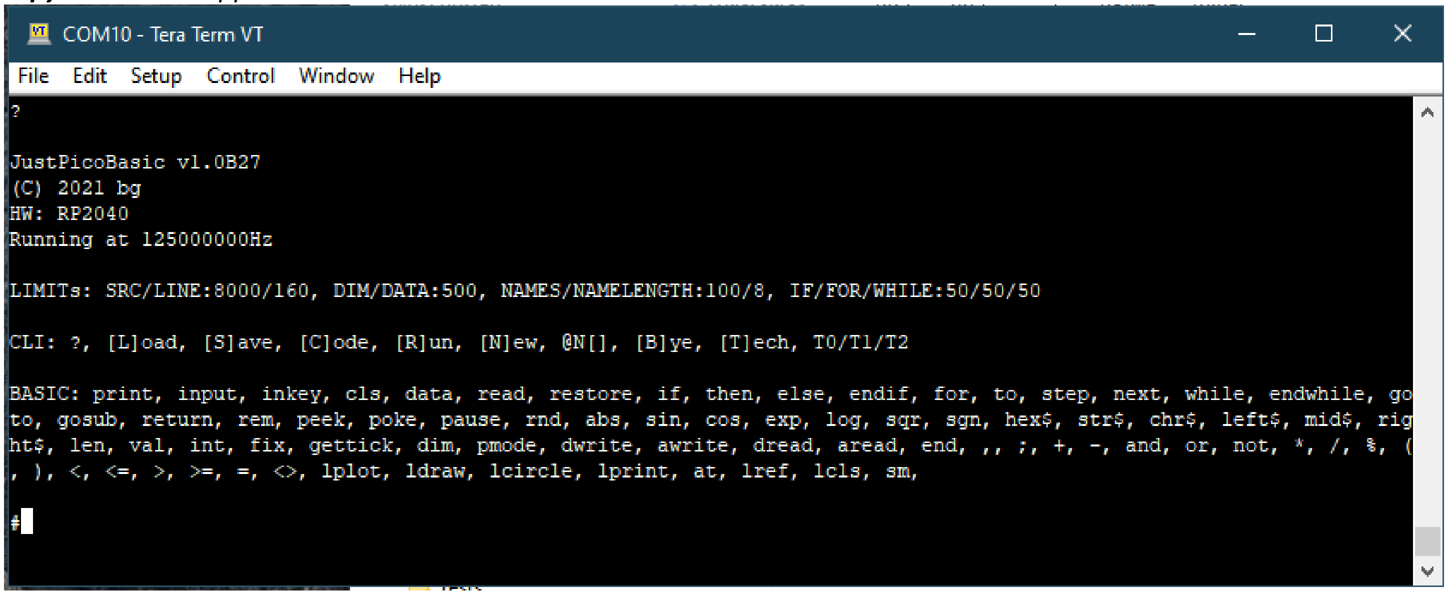
Wiring

Hardware components: ***RPI PICO, OLED 0.91" I2C, EEPROM 24c64 I2C, 2x resistors 10kohm***



Terminal emulator

JustPicoBasic was tested with ***Putty*** *and* ***TeraTerm*** *applications. Terminal settings:* ***9600,8,N,1***
Copy & Paste *is supported.*



```
?

JustPicoBasic v1.0B27
(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, @N[], [B]ye, [T]ech, T0/T1/T2

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

#
```

Get started

Power the PICO through the USB. Start the terminal emulator.
Drag & Drop the current UF2 file (e.g. JustBasic-1.0b30.uf2) into the PICO emulated disk. The JustPicoBasic will boot.
*Enter '**?**' (the question mark) and press ENTER. You will see available commands (CLI & BASIC commands).*
Enter the following program:

```
pmode 25,1
for k=1 to 5
dwrite 25,1
pause 500
dwrite 25,0
pause 500
next k
end
```

*Then enter '**c**' to see the code.*
*Use '**r**' to run the code. The built-in LED will blink a couple of times.*
*'**n**' clears the program memory.*
*You can use **@N** (e.g. @0) to delete Nth line or **@N <code>** (@0 print 1) to insert the line of code.*
You can freely format the code – can put many commands in single line, etc. Capital and small letters accepted for keyword (i.e. 'CLS' and 'cls' are the same). Names recognizes small and capital letters (i.e. 'as' is different than 'AS')

Program structure

Program Structure	***Description/Comments***	***Example***

*code
gosub subr1
end
subr1:
[subr1 code]
return*
	Command 'end' has to follow the last line of the main code. Subroutines have to follow the 'end'.	*print "Hi!"
		gosub callme
		end
		callme:
		    print "Hi!"
		return*

System commands

Command	***Description/Comments***	***Example***
ESC key	*Break the program while Running or prevent from Loading.*	
?	*Shows info about the VM (ver, available commands)*	
c	*Show code ('SM LN 0' prevents from displaying line numbers)*	
r r <code>	*Run – run code from SRAM memory Run - run single line of code NOT stored in memory (ad-hoc)*	*r n=2 data 2, 3 s=0 for i=1 to n read a s=s+a next i print "s=", s end*
n	*New – clear VM memory and code*	
b	*Bye: PICO – reboot VM in disk mode, Windows - exist*	
l s	*l - Load program from EEPROM (auto.bas) s - Save program to EEPROM (auto.bas)*	
ee ed	*ee - EEPROM erase – to decide if required, now disabled ed - EEPROM dump – show EEPROM content*	
is	*I2C scan – show I2C devices on both I2C buses*	
t0|t1|t2	***Program Flow Tracing**: t0 - Disable Tracing; t1 - Stepping Mode; t2 - Run with Tracing*	*T1|T2 - enable particular tracing mode R – run program in T1 or T2 mode*
@N @N <code>	***Pico Editor.** Normally new code is appended at the end; @N delete Nth line; @N <code> insert <code> before Nth line*	*@3 – removes 3rd line of code @4 CLS – inserts 'CLS' before line 4*

The language

MISC

Command	***Description/Comments***	***Example***
SM <entity> 1|0	*System Mode command for system entities configuration. Entities: ESC (default=enabled) – enable / disable ESC key check (disable to boost perf) OLED (default=disabled) – enable OLED hw (cannot be disabled now) LN (default=enabled) – enable / disable line numbering for 'c' command*	*SM ESC 0 SM OLED 1 SM LN 0*
REM	*Comment*	*REM MyProc*
CLS	*Clear Screen*	

VARIABLES & EXPRESSIONS

-variable name: up to 8chars letter&digits starting w/ a letter(digits, '#", '$', '_', ':' accepted)

*-expr: combination of INT/FLOAT and ops/brackets(+, -, *, /, %,(,)) and INT/FLOAT vars;*

-sexpr: combination of string, string functions (with suffix $) and string vars (with suffix $) and '+' op

-variable type differentiation through the suffix (no suffix – integer, '#' suffix – float, '$' suffix – string

STRING arrays NOT supported yet

Command	***Description/Comments***	***Example***
var=expr	*INT var, name=expr, 1st-reference creates var(value=0);*	*sy=2*abs(-15) + a*20*
var#=expr	*FLOAT var (# suffix), name#=expr, 1st-reference creates var w/ value=0*	*w#=2*a#+abs(-1.0)*
var$=sexpr	*STR var ($ suffix), name$=sexpr*	*v$=a$+left$(str$(13),1)*
DIM var(size), var#(size),..	*INT/FLOAT array, 1-dimension; multi-array declaration supported (array names separated by comma)*	*DIM a(3), b#(4)*
var(expr)=expr	*INT: name(item)=expr*	*a(0)=3*
var#(expr)=expr	*FLOAT: name#(item)=expr*	*b#(0)=2.5*

Suffixless varname type syntax (experimental phase)

-variable needs to be declared (if not declared integer type is assumed), multi-declaration in single command supported

-var suffix is no longer used for variable type differentiation

-initialization during the declaration phase is not supported yet

- STRING arrays NOT supported yet

Command	***Description/Comments***	***Example***
integer vname, vname2(size), ….	*Declare integer var or array type, value=0 is set*	*integer a, b(10) b(1)=1*
float vname, vname2(size), ….	*Declare float var or array type, value=0 is set*	*float c, d(10) d(1)=1.0*
string vname	*Declare float var or array type, value=NULL string*	*string a a="yes"*

PROGRAM FLOW CONTROL

-cond: logical expression e.g. a>5 and b<10

Command	***Description/Comments***	***Example***
FOR v=expr TO expr [STEP expr] [code] NEXT var	*if STEP[default=1] is negative var decreases; INT/FLOAT supported; nesting supported*	*FOR i = 5 TO 1 STEP -1 NEXT I END*
WHILE cond [code] ENDWHILE	*INT/FLOAT supported; nesting supported; cond: AND/OR/NOT supported;*	*a=0 while a<5 print a a=a+1 endwhile end*
IF cond THEN [code] [ELSE] [code] ENDIF	*INT/FLOAT supported; nesting supported AND/OR/NOT) supported;*	*if a>1 and b#>3.4 then print "ok" else print "bad" endif*
label: *GOTO label*	*Label name starts with a letter, terminated by colon; up to 8 letter & digits(plus '_');*	*k=1 again: print k k=k+1* *if k<5 then goto again: endif*
GOSUB label	*Label must be located after END*	*gosub task0 end*
label: RETURN	*label: [code] RETURN*	*task0: print "done" return*
END	*Last instruction. GOSUB labels follows END*	

INPUT, OUTPUT, DATA

Command	***Description/Comments***	***Example***
PRINT expr[, sexpr], [;]	*Prints expr, sexpr separated by ',';* *';' to skip NEW LINE*	*PRINT "6/3=", 6/3 (with NEW LINE)* *PRINT 1; (w/o NEW LINE because of ';')*
INPUT var,…	*Assign int/float/str values to (array) var*	*INPUT a(2), d#, n$ print a(2), d#, n$*
DATA expr, sexpr;	*INT/FLOAT/STR supported*	*DATA 1.5, 2*a*
READ a, b#, d$	*Assign DATA specified input to vars*	*READ v, v#, v(), v#();*
RESTORE	*Reset data pointer*	

BUILT-IN FUNCTIONS

Command	***Description/Comments***	***Example***

LEFT$$(sexpr), RIGHT$$(sexpr), MID$(sexpr), LEN(sexpr), VAL(sexpr)	*Left$/right$/mid$ - string functions, len - string length, Val – converts string to value*	*k$=LEFT$("abcdefgh", 3) + "123" PRINT VAL("-1234")+1 i=12 i$=MID$(STR$(i),2,3) PRINT i$*
HEX$(expr), STR$(expr), CHR$(expr)	*Hex$ – expr to hex string, Str$ - expr to string, Chr$ - expr to ascii*	*PRINT HEX$(NOT(0x0F)) a=65 d$=chr$(a)*
SIN(expr), COS(expr), SQR(expr), EXP(expr), LOG(expr), SGN(expr), ABS(expr)	*Math functions*	*PRINT "S:", SQR(5), "E:", EXP(1), "L:", LOG(2.718), "S:",SIN(3.14/6)*
RND(max)	*Hw-based random generator with von Neuman extractor-whitenizer*	*PRINT "RND: ", RND(1000)*
GETTICK()	*Tick number*	*a=gettick()*
PAUSE msec	*Delay (blocking) in msec*	*PAUSE 2*500*
INKEY()	*Current key (pressed), otherwise 0; non-blocking (no-wating)*	
INT/FIX(expr)	*QBASIC like*	*a=INT(1.1) b=INT(-1.1) c=FIX(1.9) d=FIX(-1.9) PRINT a, ", ", b, ", ", c, ", ", d (1, -2, 1, -1)*
AND(expr,expr), OR(expr,expr), NOT(expr)		*PRINT AND(0x03,0x0F) PRINT OR(0x01,0x02) PRINT HEX$(NOT(0x0F))*

PICO HARDWARE SUPPORT

Command	***Description/Comments***	***Example***
PEEK(addr) POKE addr, value	*Memory read / write; hex supported*	*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*
PMODE pin, mode	*mode: 0-IN, 1-OUT, 2-PULLUP, 3-PULLDOWN, 10-ADC, 15-PWM, 20-TSENSOR*	
AREAD(pin)	*Read analog pin; pins=26-29 – analog pin; pin=100 –temperature virtual pin*	*pmode 26, 10 voltage=aread(26) pmode 100, 20 temp= aread(100)*
AWRITE pin, cycles	*PWM duty=cycles/65535 cycle: 0-65535)*	*pmode 22, 15 awrite 22, 16000*
DREAD(pin)	*Read digital pin*	*REM explorer buttons: a, b, x, y a=12 b=13 x=14 y=15 pmode y, 0 pmode y, 2 for k=1 to 2 step 0 pause 50 print dread(y) next k*
DWRITE pin, value	*Write digital pin*	*REM explorer led - pin 25 pmode 25, 1 dwrite 25,1 pause 3000 dwrite 25,0*

GRAPHIC LCD/OLED SUPPORT *(currently: OLED0.91 support)*

Command	***Description/Comments***	***Example***
SM OLED 1	*Enable OLED support*	
LPLOT X, Y	*Draw point at X, Y*	*for x=0 to 127 lplot x,fix(15+15*sin(2*3.14159*x/128)) next x lref*

LDRAW X, Y	*Draw line from the last PLOT / DRAW X, Y*	*plot 10,10 ldraw 20,20 lref*
LCIRCLE x, y, r	*Draw circle at x, y, r*	*lcircle 15, 15, 10*
LPRINT expr, sexpr [AT x, y]	*Prints expr, sexpr separated by ‘,’;* *optional AT x, y (default 0,0)*	*lprint “2+2=”, 2+2 AT 10,10* *lref*
LCLS	*Clear Screen*	*lcls*
LREF	*Refresh LCD (copy mem content to LCD)*	*lref*