

Programmer's Aid for VIC 20™ Computer \$3.98

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MICRO-WARE D.I.

BASIC KEYWORDS

Words	Definition	Tokens	
		Dec.	Hex
ABS	Absolute Value	182	B6
AND	Logic operation	175	AF
ASC	Returns value of ASCII	198	C6
ATN	Arctangent	193	C1
CHR\$	String Character	199	C7
CLOSE	Closes file	160	A0
CLR	Clears Variables	156	9C
CMD	Output to device or file	157	9D
CONT	Continue program	154	9A
COS	Cosine	190	BE
DATA	Data to be read	131	83
DEF	Define function	150	96
DIM	Demention array	134	86
END	End program	128	80
EXP	VAL of "e" to power	189	BD
FN	Variable prefix	165	A5
FOR	Used for loop	129	81
FRE	Bytes available	184	B8
GET	Accept single character	161	A1
GOSUB	Execute subroutine	141	8D
GO TO	Execute at line	137	89
IF	Logic operation	139	8B
INPUT	Accept value	133	85
INPUT#	Accept value	132	84
INT	Returns Integer	181	B5
LEFT\$	Left part of string	200	C8
LEN	Character in string	195	C3
LET	Assign value	136	88
LIST	Basic program list	155	9B
LOAD	Basic program load	147	93
LOG	Returns Logarithm	188	BC
MID\$	Center of string	202	CA
NEW	Remove basic program	162	A2
NEXT	Used for Loop	130	82
NOT	Logic operation	168	A8
ON	Use with goto or gosub	145	91
OPEN	Open file or device	159	9F
OR	Logic operation	176	B0
PEEK	Returns number value in memory	194	C2
POKE	Places number value in memory	151	97
POS	Print position	185	B9
PRINT	Prints to screen	153	99
PRINT#	Prints to file	152	98
READ	Obtains data	135	87
REM	Remark	143	8F
RESTORE	Reread data	140	8C
RETURN	Returns after Gosub	142	8E
RIGHT\$	Right part of string	201	C9
RND	Random number	187	BB
SAVE	Save basic program	148	94
SGN	Returns sign	180	B4
SIN	Trig function sine	191	BF
SPC	Prints spaces	166	A6
SQR	Square root	186	BA
STEP	Specifies increments	169	A9
STOP	Stop basic program	144	90
STR\$	String of a number	196	C4
SYS	Transfer to sub system	158	9E
TAB	Specific column print	163	A3
TAN	Tangent	192	C0
THEN	Used with IF statement	167	A7
TO	Used with FOR statement	164	A4
USR	Pass machine lang. parameter	183	B7
VAL	Return value of string	197	C5
VERIFY	Checks specific program	149	95
WAIT	Stops basic program execution	146	92

ASCII CODES

CODE	Hex	CHAR	CODE	Hex	CHAR	CODE	Hex	CHAR
000	00	NULL	040	28	(080	50	P
001	01	SOH	041	29)	081	51	Q
002	02	STX	042	2A	*	082	52	R
003	03	ETX	043	2B	+	083	53	S
004	04	EOT	044	2C	.	084	54	T
005	05	ENQ	045	2D	:	085	55	U
006	06	ACK	046	2E	-	086	56	V
007	07	BEL	047	2F	/	087	57	W
008	08	BS	048	30	0	088	58	X
009	09	HT	049	31	1	089	59	Y
010	0A	LF	050	32	2	090	5A	Z
011	0B	VT	051	33	3	091	5B	[
012	0C	FF	052	34	4	092	5C	backslash
013	0D	CR	053	35	5	093	5D]
014	0E	SO	054	36	6	094	5E	↑
015	0F	SI	055	37	7	095	5F	←
016	10	DLE	056	38	8	096	60	SPC
017	11	DC1	057	39	9	097	61	a
018	12	DC2	058	3A	:	098	62	b
019	13	DC3	059	3B	<	099	63	c
020	14	DC4	060	3C	=	100	64	d
021	15	NAK	061	3D	>	101	65	e
022	16	SYN	062	3E	?	102	66	f
023	17	ETB	063	3F	@	103	67	g
024	18	CAN	064	40	A	104	68	h
025	19	EM	065	41	B	105	69	i
026	1A	SUB	066	42	C	106	6A	j
027	1B	ESC	067	43	D	107	6B	k
028	1C	FS	068	44	E	108	6C	l
029	1D	GS	069	45	F	109	6D	m
030	1E	RS	070	46	G	110	6E	n
031	1F	US	071	47	H	111	6F	o
032	20	SPC	072	48	I	112	70	p
033	21	!	073	49	J	113	71	q
034	22	"	074	4A	K	114	72	r
035	23	#	075	4B	L	115	73	s
036	24	\$	076	4C	M	116	74	t
037	25	%	077	4D	N	117	75	u
038	26	&	078	4E	O	118	76	v
039	27	'	079	4F		119	77	w
						120	78	x
						121	79	y
						122	7A	z

MUSICAL NOTE TABLE

Note	Decimal	Hex	Note	Decimal	Hex
C	135	87	G	215	D7
C#	143	8F	G#	217	D9
D	147	93	A	219	DB
D#	151	97	A#	221	DD
E	159	9F	B	223	DF
F	163	A3	C	225	E1
F#	167	A7	C#	227	E3
G	175	AF	D	228	E4
G#	179	B3	D#	229	E5
A	183	B7	E	231	E7
A#	187	BB	F	232	E8
B	191	BF	F#	233	E9
C	195	C3	G	235	EB
C#	199	C7	G#	236	EC
D	201	C9	A	237	ED
D#	203	CB	A#	238	EE
E	207	CF	B	239	EF
F	209	D1	C	240	F0
f#	212	D4	C#	241	F1

Voice1 POKE 36874,X Octaves 1,2,3
Voice2 POKE 36875,X Octaves 2,3,4
Voice3 POKE 36876,X Octaves 3,4,5
Noise POKE 36877,X
Volume POKE 36878,0 OFF
To POKE 36878,15 Maximum

PRINTER COMMAND CODES

CHR\$(14)	Double Width
CHR\$(10)	Line Feed
CHR\$(13)	Carriage return
CHR\$(8)	Graphic mode
CHR\$(15)	Standard
CHR\$(16)	Position addr.
CHR\$(27)	Dot Position
CHR\$(26)	Graphic repeat
CHR\$(17)	Upper/Lower
CHR\$(145)	Upper Case
CHR\$(18)	RVS ON
CHR\$(146)	RVS OFF

COLOR CODES

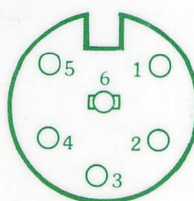
0	BLACK	8	ORANGE
1	WHITE	9	LT. ORANGE
2	RED	10	PINK
3	CYAN	11	LT. CYAN
4	PURPLE	12	LT. PURPLE
5	GREEN	13	LT. GREEN
6	BLUE	14	LT. BLUE
7	YELLOW	15	LT. YELLOW

SCREEN AND BORDER COLOR COMBINATIONS

Screen	Border							
	BLK	WHT	RED	Cyan	Pur	Grn	Blu	Yel
BLK	008	009	010	011	012	013	014	015
WHT	024	025	026	027	028	029	030	031
RED	040	041	042	043	044	045	046	047
CYAN	056	057	058	059	060	061	062	063
PUR	072	073	074	075	076	077	078	079
GRN	088	089	090	091	092	093	094	095
BLU	104	105	106	107	108	108	109	110
YEL	120	121	122	123	124	125	126	127
ORANGE	136	137	138	139	140	141	142	143
LT ORG	152	153	154	155	156	157	158	159
PINK	168	169	170	171	172	173	174	175
LT CYN	184	185	186	187	188	189	190	191
LT PUR	200	201	202	203	204	205	206	207
LT GRN	216	217	218	219	220	221	222	223
LT BLU	232	233	234	235	236	237	238	239
LT YEL	248	249	250	251	252	253	254	255

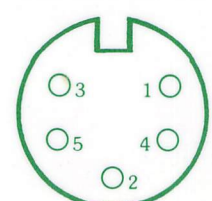
POKE 36879, (number from table above)

SERIAL I/O



Pin	Function
1	SERIAL SRQ IN
2	GND
3	SERIAL ATN IN/OUT
4	SERIAL CLK IN/OUT
5	SERIAL DATA IN/OUT
6	RESET

AUDIO VIDEO



Pin	Function
1	+5V, REGULATED
2	GND
3	AUDIO
4	VIDEO LOW
5	VIDEO HIGH

KERNAL ROUTINES

Name	Address Decimal	Hex	Description
ACPTR	65445	\$\$FA5	Input A Byte Serial Port
CHKIN	65478	\$\$FC6	Open channel for Input
CHKOUT	65481	\$\$FC9	Open channel for output
CHRIN	65487	\$\$FCF	Input char. from channel
CHROUT	65490	\$\$FD2	Output Char. to channel
CIOUT	65488	\$\$FA8	Output Byte Serial Port
CLALL	65511	\$\$FE7	Close all channels+files
CLOSE	65475	\$\$FC3	Close a specified logical file
CLRCHN	65475	\$\$FC3	Close I/O channels
GETIN	65512	\$\$FE4	Get char. from Buffer
IOBASE	65523	\$\$FF3	Return I/O Base addr.
LISTEN	65457	\$\$FB1	Command serial to listen
LOAD	65493	\$\$FD5	Load RAM from device
MEMBOT	65436	\$\$F9C	Read/Set memory bottom
MEMTOP	65433	\$\$F99	Read/Set memory top
OPEN	65472	\$\$FC0	Open a logical file
PLOT	65520	\$\$FF0	Read/set X,Y cursor position
RDTIM	65502	\$\$FDE	Read clock
READST	65463	\$\$FB7	Read I/O status word
RESTOR	65415	\$\$FB8A	Restore I/O Vectors
SAVE	65496	\$\$FD8	Save RAM to device
SCNKEY	65439	\$\$F9F	Scan keyboard
SCREEN	65517	\$\$FED	Return X,Y organization of screen
SECOND	65427	\$\$F93	Send secondary addr.
SETLFS	65466	\$\$FBA	Set Logical, 1st + 2nd addresses
SETMSG	65424	\$\$F90	Control KERNAL messages
SETNAM	65469	\$\$FBD	Set Filename
SETTIM	65499	\$\$FDB	Set clock
SETTMO	65422	\$\$FA2	Set Serial Bus timeout
STOP	65505	\$\$FE1	Scan stop key
TALK	65460	\$\$FB4	Command serial Bus device to talk
TKSA	65430	\$\$F96	Send secondary addr. after talk
UDTIM	65514	\$\$FEA	Increment clock
UNLSN	65454	\$\$FAE	Command serial bus to unlisten
UNTLK	65451	\$\$FAB	Command serial bus to untalk
VECTOR	65412	\$\$F84	Read/Set Vectored I/O

KERNAL ERROR CODES

0	Routine ended by stop key	5	Device not present
1	Too many open files	6	File is not an INPUT file
2	File already open	7	File is not an OUTPUT file
3	File not open	8	File name missing
4	File not found	9	Illegal device number

MEMORY MAP

Address	Function
\$00	\$FF Page zero, Pointers, Accumulators, Flags
\$100	\$13E Tape Error Log
\$100	\$1FF Microprocessor Stack
\$100	\$10A Floating/String work area
\$200	\$258 Basic Input Buffer
\$259	\$292 Operating system, tables, flags, keyboard
\$293	\$294 VIC Chip
\$295	\$2FF Operating system, RS232 pointers, etc.
\$300	\$301 Error message link
\$302	\$32F Vectors
\$330	\$3FB Tape I/O
\$400	\$\$\$ 3K Expansion RAM
\$1000	\$1DFF User Basic RAM (unexpanded VIC")
\$1E00	\$1FFF Basic memory screen area (unexpanded VIC")
\$2000	\$3FFF 8K Expansion area
\$4000	\$5FFF 8K Expansion area
\$6000	\$7FFF 8K Expansion area
\$8000	\$8FFF Character generator ROM
\$9000	\$900F VIC Chip (6560)
\$9110	\$912F VIA Chip (6522)
\$9400	\$95FF Color RAM area
\$9600	\$97FF Color RAM area
\$9800	\$9BFF I/O Block 2
\$9C00	\$9FFF I/O Block 3
\$A000	\$BFFF Expansion ROM
\$C000	\$DFFF Basic ROM
\$E000	\$\$\$\$ ROM Kernal Operating System

USER PORT

Pin	Function	Pin	Function
1	GND	A	GND
2	+5V	B	CB1
3	RESET	C	PBO
4	JOY0	D	PB1
5	JOY1	E	PB2
6	JOY2	F	PB3
7	LIGHT PEN	H	PB4
8	CASSETTE SWITCH	J	PB5
9	SERIAL ATN IN	K	PB6
10	+9V	L	PB7
11	GND	M	CB2
12	GND	N	GND

CURRENT KEY BEING HELD

Memory Location 197 or \$C5

KEY	#	KEY	#	KEY	#	KEY	#
←	08	*	14	E	49	U	51
1	00	↑	54	F	42	V	27
2	56	:	45	G	19	W	09
3	01	:	22	H	43	X	26
4	57	:	37	I	12	Y	11
5	02	/	30	J	20	Z	33
6	58	CRS ↓	31	K	44	NONE	64
7	03	CRS →	23	L	21	SP BAR	32
8	59	F1	39	M	36	Commodore	
9	04	F3	47	N	28	Shift and	
0	60	F5	55	O	52	Control Key	
+	05	F7	63	P	13	PEEK(653) \$028D	
-	61	A	17	Q	48	IF BIT 0=Shift	
3	06	B	35	R	10	IF BIT 1=Commodore	
HOM	62	C	34	S	41	IF BIT 2=CTRL Key	
DEL	07	D	18	T	50		

VIC CHIP REGISTERS

Decimal	Hex	Description
36864	\$9000	BITS 0-6 Horiz. Centering
36865	\$9001	Vertical Centering
36866	\$9002	BITS 0-6 # of Columns
36867	\$9003	BITS 0-6 # of Rows
36868	\$9004	BIT 0 Sets Char. Height
36869	\$9005	BITS 0-3 Char. Gen. Addr.
		Bits
		0000 32768 \$8000
		0001 33793 \$8400
		0010 34816 \$8800
		0011 35840 \$8C00
		1000 00000 \$0000
		1001 XXXXX (unavailable) XXXX
		1010 XXXXX XXXX
		1011 XXXXX XXXX
		1100 4096 \$1000
		1101 5120 \$1400
		1110 6144 \$1800
		1111 7168 \$1000
36870	\$9006	Horiz. Pos. Light Pen
36871	\$9007	Vert. Pos. Light Pen
36872	\$9008	Paddle X
36873	\$9009	Paddle Y
36874	\$900A	Voice1
36875	\$900B	Voice2
36876	\$900C	Voice3
36877	\$900D	White Noise
36878	\$900E	Volume Bits 0-3
		Auxillary Color Bits 4-7
		Screen and Border colors
		Bits 4-7 Screen color
		Bit 3 RVS ON/OFF
		Bits 0-2 Border Color
36879	\$900F	

EXPANSION/CARTRIDGE CONNECTOR

Pin	Function	Pin	Function
1	GND	A	GND
2	CD0	B	CA0
3	CD1	C	CA1
4	CD2	D	CA2
5	CD3	E	CA3
6	CD4	F	CA4
7	CD5	H	CA5
8	CD6	J	CA6
9	CD7	K	CA7
10	BLK1	L	CA8
11	BLK2	M	CA9
12	BLK3	N	CA10
13	BLK5	P	CA11
14	RAM1	R	CA12
15	RAM2	S	CA13
16	RAM3	T	I/O2
17	VR/W	U	I/O3
18	CR/W	V	SO2
19	IRQ	W	NMI
20	NC	X	RESET
21	+5V	Y	NC
22	GND	Z	GND

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

A B C D E F H J K L M N P R S T U V W X Y Z

JOYSTICK CONTROL REGISTERS

Decimal	Hex	Description
37139	\$9113	DDR Port A
		Set to 0 Input
37137	\$9111	PORTA
		BIT2 = UP
		BIT3 = DOWN
		BIT4 = LEFT
		BIT5 = FIRE
37154	\$9122	DDR PORT B
		Set to 127 to read JOYSTICK
		255 for KEYS
37152	\$9120	BIT7 = RIGHT

SCREEN MEMORY LOCATIONS

Unexpanded VIC

Decimal	Hex
7680-8191	\$1E00-\$1FFF

Expanded VIC

Decimal	Hex
4096-4607	\$1000-\$11FF

COLOR RAM LOCATIONS

Unexpanded VIC

Decimal	Hex
38400-38911	\$9600-\$97FF

Expanded VIC

Decimal	Hex
37888-38399	\$9400-\$95FF

TO SET SCREEN TO COLOR C

POKE36879, (PEEK(36879) and 15)/ORC*16

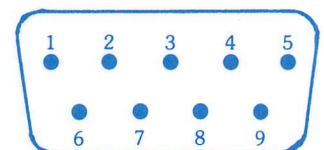
TO SET BORDER TO COLOR C

POKE36879, (PEEK(36879)and 248)/ORC

TO SET INVERSE VIDEO,

POKE36879, (PEEK(36879)and 247)

GAME PORT



Pin	Des.	Note
1	JOY0	
2	JOY1	
3	JOY2	
4	JOY3	
5	POTY	
6	LT PEN	
7	+5	100MA
8	GND	
9	POTX	