

System Monitor and Hardware

Reference Chart

 MICRO COMPUTER **SMC-70**

 Sony Corporation
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 3-795-472-21 (2)

SUMMARY OF MNEMONIC AND ANN

r, r' ... Register A, B, C, D, E, H, or L
 ss ... BC, DE, HL, or SP
 pp ... BC, DE, IX, or SP
 rr ... BC, DE, IX, or SP
 n ... 8-bit value (00H-FFH)
 mn ... 16-bit value (0000H-FFFFH)
 d ... 8-bit displacement
 b ... Number of 0-7 representing bit number

Change in flag
 0 : Becomes 0
 1 : Becomes 1
 () : Affected according to the result of operation
 * : Unchanged
 - : Unknown
 P : Parity flag
 V : Overflow flag
 IFF : 0 when interrupt disabled
 1 when interrupt enabled

8-bit load instructions

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
LD r, n	r=n						Destination ← source
LD r, r'	r=r'						
LD r, (HL)	r=(hl)						
LD r, (IX+d)	r=(ix+d)						
LD r, (IY+d)	r=(iy+d)						
LD (HL), n	(hl)=n						
LD (HL), r	(hl)=r						
LD (IX+d), n	(ix+d)=n						
LD (IX+d), r	(ix+d)=r						
LD (IY+d), n	(iy+d)=n						
LD (IY+d), r	(iy+d)=r						
LD A, (BC)	a=(bc)						Destination ← source
LD A, (DE)	a=(de)						
LD A, (mn)	a=(mn)						
LD A, I	a=I						
LD A, R	a=R						
LD (BC), A	(bc)=a						
LD (DE), A	(de)=a						
LD (mn), A	(mn)=a						
LD I, A	I=a						
LD R, A	R=a						

16-bit load instructions

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
LD ss, mn	ss=mn						Destination ← Source
LD ss, (mn)	ss=(mn)						
LD IX, mn	ix=mn						
LD IX, (mn)	ix=(mn)						
LD IY, mn	iy=mn						
LD IY, (mn)	iy=(mn)						
LD (mn), ss	(mn)=ss						
LD (mn), IX	(mn)=ix						
LD (mn), IY	(mn)=iy						
LD SP, HL	sp=hl						
LD SP, IX	sp=ix						
LD SP, IY	sp=iy						

Push/Pop instructions

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
PUSH AF	ss=af						Register SP-2 ← SP-1 ← SP
PUSH BC	ss=bc						
PUSH DE	ss=de						
PUSH HL	ss=hl						
PUSH IX	ss=ix						
PUSH IY	ss=iy						
POP AF	af=ss						
POP BC	bc=ss						
POP DE	de=ss						
POP HL	hl=ss						
POP IX	ix=ss						
POP IY	iy=ss						

Block transfer instructions

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
LDI	(de+)= (hl+)						(DE)←(HL) DE←DE+1 HL←HL+1 BC←BC-1
LDD	(de-)= (hl-)						
LDIR	(de+)= (hl+)						Repeat LDI until BC=0
LDDR	(de-)= (hl-)						

Exchange instructions

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
EX AF, AF	af:af						AF←AF DE←HL (SP+1)←H (SP)←L (SP+1)←H (SP)←L (SP+1)←H (SP)←L BC←BC DE←DE HL←HL
EX DE, HL	de:hl						
EX (SP), HL	(sp):hl						
EX (SP), IX	(sp):ix						
EX (SP), IY	(sp):iy						
EXX	*:*						

8-bit arithmetic calculation

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
ADD A, n	a=a+n						A←A+Source
ADD A, r	a=a+r						
ADD A, (HL)	a=a+(hl)						
ADD A, (IX+d)	a=a+(ix+d)						
ADD A, (IY+d)	a=a+(iy+d)						
ADC A, n	a=a+n						
ADC A, r	a=a+r						
ADC A, (HL)	a=a+(hl)						
ADC A, (IX+d)	a=a+(ix+d)						
ADC A, (IY+d)	a=a+(iy+d)						
SUB n	a=a-n						A←A-Source
SUB r	a=a-r						
SUB (HL)	a=a-(hl)						
SUB (IX+d)	a=a-(ix+d)						
SUB (IY+d)	a=a-(iy+d)						
SBC A, n	a=a-n						
SBC A, r	a=a-r						
SBC A, (HL)	a=a-(hl)						
SBC A, (IX+d)	a=a-(ix+d)						
SBC A, (IY+d)	a=a-(iy+d)						

16-bit arithmetic calculation

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
ADD HL, ss	hl=hl+ss						HL←HL+ss IX←IX+pp IY←IY+rr HL←HL+ss+CY HL←HL-ss-CY
ADD IX, pp	ix=ix+pp						
ADD IY, rr	iy=iy+rr						
ADC HL, ss	hl=hl+ss						
SBC HL, ss	hl=hl-ss						

Increment by 1/Decrement by 1 instructions

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
INC r	r+						r←r+1 (HL)←(HL)+1 (IX+d)←(IX+d)+1 (IY+d)←(IY+d)+1 r←r-1 (HL)←(HL)-1 (IX+d)←(IX+d)-1 (IY+d)←(IY+d)-1 ss←ss+1 IX←IX+1 IY←IY+1 ss←ss-1 IX←IX-1 IY←IY-1
INC (HL)	(hl)+						
INC (IX+d)	(ix+d)+						
INC (IY+d)	(iy+d)+						
DEC r	r-						
DEC (HL)	(hl)-						
DEC (IX+d)	(ix+d)-						
DEC (IY+d)	(iy+d)-						
INC ss	ss+						
INC IX	ix+						
INC IY	iy+						
DEC ss	ss-						
DEC IX	ix-						
DEC IY	iy-						

Logic calculation

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
AND n	a=a&n						A←A&Source
AND r	a=a&r						
AND (HL)	a=a&(hl)						
AND (IX+d)	a=a&(ix+d)						
AND (IY+d)	a=a&(iy+d)						
OR n	a=a n						
OR r	a=a r						
OR (HL)	a=a (hl)						
OR (IX+d)	a=a (ix+d)						
OR (IY+d)	a=a (iy+d)						
XOR n	a=a^n						A←A^Source
XOR r	a=a^r						
XOR (HL)	a=a^(hl)						
XOR (IX+d)	a=a^(ix+d)						
XOR (IY+d)	a=a^(iy+d)						
RL r	<1>←(hl)						
RL (HL)	<1>←(hl)						
RL (IX+d)	<1>←(ix+d)						
RL (IY+d)	<1>←(iy+d)						
RR r	>1>←(hl)						
RR (HL)	>1>←(hl)						
RR (IX+d)	>1>←(ix+d)						
RR (IY+d)	>1>←(iy+d)						

Comparison

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
CP n	a-n						A←Source Register A constant only flag changes
CP r	a-r						
CP (HL)	a-(hl)						
CP (IX+d)	a-(ix+d)						
CP (IY+d)	a-(iy+d)						

CP1	a-(hl+)						A←(HL), only flag changes HL←HL+1 BC←BC-1
CPD	a-(hl-)						A←(HL), only flag changes HL←HL-1 BC←BC-1
CPIR	a-(hl+)						CPI will be repeated until A=(HL) or BC=0
CPDR	a-(hl-)						CPD will be repeated until A=(HL) or BC=0

Bit manipulation

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
BIT b, r	r, b?						If bit b of the source is zero, Z flag=1. If bit b of the source is not zero, Z flag=0.
BIT b, (HL)	(hl), b?						
BIT b, (IX+d)	(ix+d), b?						
BIT b, (IY+d)	(iy+d), b?						
SET b, r	r, b=1						
SET b, (HL)	(hl), b=1						
SET b, (IX+d)	(ix+d), b=1						
SET b, (IY+d)	(iy+d), b=1						
RES b, r	r, b=0						
RES b, (HL)	(hl), b=0						
RES b, (IX+d)	(ix+d), b=0						
RES b, (IY+d)	(iy+d), b=0						

Rotate and shift

Mnemonic	ANN	Change in flag					Operation
		S	Z	H	P/V	N C	
RL r	<1>←(hl)						Unconditionally, If the condition is satisfied, Jump to the indicated address. Unconditionally, If the condition is satisfied, Jump by e byte. B←B-1, if B≠0, jump by e byte. if B=0, do not jump.
RL (HL)	<1>←(hl)						
RL (IX+d)	<1>←(ix+d)						
RL (IY+d)	<1>←(iy+d)						
RR r	>1>←(hl)						
RR (HL)	>1>←(hl)						
RR (IX+d)	>1>←(ix+d)						
RR (IY+d)	>1>←(iy+d)						
RLA	<1>←(hl)						
RRA	>1>←(hl)						
RLC r	<1>←(hl)						Same as RLC A
RLC (HL)	<1>←(hl)						
RLC (IX+d)	<1>←(ix+d)						
RLC (IY+d)	<1>←(iy+d)						
RRC r	>1>←(hl)						
RRC (HL)	>1>←(hl)						
RRC (IX+d)	>1>←(ix+d)						
RRC (IY+d)	>1>←(iy+d)						
RLCA	<1>←(hl)						
RACA	>1>←(hl)						

RLD	a<&
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SYSTEM MONITOR COMMANDS

Descriptions in [] may be omitted.
Video RAM addressing is provided with V.

Command	Format	Function
A	A [Execution start address]	Line by line program input
B	B [Low address][, High address]	Shift mode to Sony BASIC.
C	C	Call for disk operating system.
D	D [Start address][, End address]	Dump memory contents.
E	E [Start address][, End address]	List program by ANN.
F	F Top address[V], End address[V], Data	Fill memory with a data.
G	G [Start address][,/Break point[, Break point[, Break point]]]	Execute program.
H	H Summand (Minuend), Addend (Subtrand)	Addition/subtraction of two values
I	I I/O port address I Video RAM address (replacement of 8 bits of higher and lower orders) I Video RAM address V	Enter 1-byte data from I/O port.
J	J Top address[V], End address[V]	Memory cell check
L	L[G]["filename[. type]"]	Load file from the cassette tape. Load and execute file with LG.
M	M Buffer top address[V], Buffer end address[V], Top address to be addressed[V]	Block transfer of memory contents
O	O I/O port address, Output data O Video RAM address (replacement of 8 bits of higher and lower orders), Output data O Video RAM address V, Output data	Send 1-byte data to I/O port.
P	P [Execution start address]	Peek and poke memory contents.
Q	QS QD, QD3, QD8	Tape recorder check Disk drive check
R	R R[G] I/O port address R[G] "filename[. type]"	List file name of ROM pack. Load program from the ROM pack, load and execute with RG.
S	S "filename[. type]" File starting address, Program starting address, File length	Save the file on the casstte tape.
T	T[N] [Number of steps]	Trace program execution by the program counter address.
U	U $U \begin{Bmatrix} 1 \\ N \end{Bmatrix} \begin{Bmatrix} 0 \\ 5 \end{Bmatrix}$	525 rasters/frame, non-interlace, normal 1...inversed character N...normal character 0...525 rasters/frame, non-interlace 1...625 rasters/frame (625-1), non-interlace 2...625 rasters/frame (625-2), non-interlace 3...525 rasters/frame, interlace 4...625 rasters/frame (625-1), interlace 5...625 rasters/frame (625-2), interlace
V	V Buffer top address[V], Buffer end address[V], Top address of compared area[V]	Comparison of memory contents of two areas
W	W	Switch between 40 characters/line mode and 80 characters/line mode.
X	X X Name of register	Display all registers and flags of CPU. Display and change of the designated register.
Y	Y YS Month Day Year, Weekday code, Hour Minute Second	Display the date and time. Set the timer.
Z	Z Data for setting RS-232C mode	Set RS-232C mode.

UTILITY SUBROUTINES

HOW TO CALL

LD C, N (N=function call number)
LD D, N' (N'=sub-number)
(If necessary, further entry conditions are set).
CALL 0005H

N : 0	System monitor warm start, internal status initialization																	
Entry	Register C : 00H																	
Return	None																	
N : 1	Enter 1 byte from keyboard, echo it back to CRT																	
Entry	Register C : 01H																	
Return	Register A : Input data																	
N : 2	Send 1 byte data to CRT																	
Entry	Register C : 02H																	
Return	Register E : Data to be sent																	
N : 5	Send 1 byte data to printer																	
Entry	Register C : 05H																	
Return	Register E : Data to be sent																	
N : 6	Direct input/output																	
Entry	Register C : 06H																	
Return	Register E : For input, FFH For output, data to be sent																	
N : 7	Check printer status																	
Entry	Register C : 07H																	
Return	Register A : 00H (Printer BUSY) FFH (Printer NOT BUSY)																	
N : 9	Output buffer contents of the memory to CRT																	
Entry	Register C : 09H																	
Return	Register DE : Buffer top address Buffer last byte : 00H																	
N : 10	Store input from keyboard in the memory buffer																	
Entry	Register C : 0AH																	
Return	Register DE : Buffer top address First byte in buffer : (Data length+1) Second byte in buffer : Number of bytes of the input data																	
N : 11	Check status of the data from the keyboard																	
Entry	Register C : 0BH																	
Return	Register A : 00H (Data NOT READY) FFH (Data READY)																	
N : 12	Set RS-232C mode																	
Entry	Register C : 0CH																	
Return	Register E : Data for setting the RS-232C mode																	
None																		
Construction of the data for setting the mode																		
<table><tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>S₁</td><td>S₂</td><td>EP</td><td>PEN</td><td>L₁</td><td>L₂</td><td>B₁</td><td>B₂</td></tr></table>			7	6	5	4	3	2	1	0	S ₁	S ₂	EP	PEN	L ₁	L ₂	B ₁	B ₂
7	6	5	4	3	2	1	0											
S ₁	S ₂	EP	PEN	L ₁	L ₂	B ₁	B ₂											
S ₁ , S ₂ ...01 : Stop bit 1																		
10 : Stop bit 1 1/2																		
11 : Stop bit 2																		
EP...0 : Parity odd																		
1 : Parity even																		

PEN...0 : Parity check disabled	
1 : Parity check enabled	
L ₁ , L ₂ ...00 : Character length 5 bits	
01 : 6 bits	
10 : 7 bits	
11 : 8 bits	
B ₁ , B ₂ ...00 : Operation impossible	
01 : Asynchronous/Divided into 1	
10 : Asynchronous/Divided into 1/16	
(Be sure to set set this data.)	
11 : Asynchronous/Divided into 1/64	
N : 13	Input 1 byte data from RS-232C port
Entry	Register C : 0DH
Return	Register A : Input data
N : 14	Output 1 byte data to RS-232C port
Entry	Register C : 0EH
Return	Register E : Output data
N : 15	Read and write standard label
Entry	Register C : 0FH
Return	Register DE : Top address in standard label area Register B : 00H (Read label of the specified file from the tape.) 01H (Read label of the first found file from the tape.) 02H (Write standard label on the tape.) 03H (Read label of the specified file from ROM pack.) 04H (Read label of the first found file from ROM pack.)
Return	Register A : 00H (Terminated without error.) 01H (For tapes, ESC key break occurs.) 02H (Command error) 03H (Start-up command is provided.) 04H (No ROM pack of the specified file is provided) FFH (Check sum error for tapes)
N : 16	Load file (128 bytes)
Entry	Register C : 10H
Return	Register DE : Top address of the memory area to be loaded Register B : 00H (Loading from tape) 01H (Loading from ROM pack) 00H (Terminated without error) 01H (ESC key break occurred during loading from tape) 02H (Command error) 03H (Standard label has not been read before loading from ROM pack) FFH (Load error)
N : 17	Save file on cassette tape (128 bytes)
Entry	Register C : 11H
Return	Register DE : Top address of a file Register A : 00H
N : 18	Set character-string to function keys
Entry	Register C : 12H
Return	Register B : Other than 00H Register DE : Top address of the memory having character-string
Return	First byte of a character-string : One of 30H-39H None
N : 22	Input 1 byte data from keyboard, without echo-back
Entry	Register C : 16H
Return	Register A : Input data

N : 30	Read high memory address of Sony BASIC program area
Entry	Register C : 1EH
Return	Register HL : High memory address
N : 31	Read low memory address of Sony BASIC program area
Entry	Register C : 1FH
Return	Register HL : Low memory address
N : 33	Set entry point of Sony BASIC warm start
Entry	Register C : 21H
Return	Register DE : Entry point address

CRT control routines

N : 21 N' : 0	Move cursor
Entry	Register C : 15H
Return	Register D : 00H Register H : Y co-ordinates Register L : X co-ordinates
N : 21 N' : 1	Clear character display screen
Entry	Register C : 15H
Return	None
N : 21 N' : 2	Clear scroll area
Entry	Register C : 15H
Return	None
N : 21 N' : 3	Clear line from the cursor position to the end
Entry	Register C : 15H
Return	None
N : 21 N' : 4	Clear scroll area from the cursor position to the end
Entry	Register C : 15H
Return	None
N : 21 N' : 5	Set current attribute
Entry	Register C : 15H
Return	None
N : 21 N' : 6	Set attribute at the cursor position
Entry	Register C : 15H
Return	None
N : 21 N' : 7	Issue character with the specified attribute at the cursor position
Entry	Register C : 15H
Return	Register D : 07H Register E : Attribute data Register L : Character code to be issued
N : 21 N' : 8	Read character code at the specified position
Entry	Register C : 15H
Return	Register D : 08H Register H : Y co-ordinates Register L : X co-ordinates Register A : Input character code
N : 21 N' : 9	Read attribute data at the specified position
Entry	Register C : 15H
Return	Register D : 09H Register H : Y co-ordinates Register A : Input attribute data
N : 21 N' : 10	Read current attribute data
Entry	Register C : 15H
Return	Register D : 0AH Register A : Input attribute data
Return	FFH (40 characters/line mode) For attribute data, see "Color code".

N : 21 N' : 13	Move cursor to the upper leftmost position on the character display screen
Entry	Register C : 15H
Return	None
N : 21 N' : 14	Move cursor to the upper leftmost position on the scroll area
Entry	Register C : 15H
Return	None
N : 21 N' : 15	Move cursor to the left by one character
Entry	Register C : 15H
Return	None
N : 21 N' : 16	Move cursor to the right by one character
Entry	Register C : 15H
Return	None
N : 21 N' : 17	Move cursor upwards by one line
Entry	Register C : 15H
Return	None
N : 21 N' : 18	Move cursor downwards by one line
Entry	Register C : 15H
Return	None
N : 21 N' : 23	ON/OFF switching of cursor
Entry	Register C : 15H
Return	Register D : 17H Register E : 00H (Cursor off) 01H (Cursor on)
N : 21 N' : 24	Read cursor position
Entry	Register C : 15H
Return	None
N : 21 N' : 27	Switch the number of characters in a line
Entry	Register C : 15H
Return	Register D : 1BH Register E : 00H (80 characters/line) Other than 00H (40 characters/line)
N : 21 N' : 28	Set scroll area
Entry	Register C : 15H
Return	Register D : 1CH Register H : Scroll area start line Register L : Number of the lines in the scroll area
N : 21 N' : 29	Set scroll mode
Entry	Register C : 15H
Return	Register D : 1DH Register E : 00H (Scroll off) 01H (Scroll on) 02H (Scroll stop)
N : 21 N' : 30	Clear graphic RAM
Entry	Register C : 15H
Return	None
N : 21 N' : 31	Set border area color
Entry	Register C : 15H
Return	Register D : 1FH Lowest order 4 bits in Register E : Color code
N : 21 N' : 32	Check the number of characters in a line
Entry	Register C : 15H
Return	Register D : 20H Register A : 00H (80 characters/line mode) FFH (40 characters/line mode)

I/O PORT ALLOCATION

Application	Port No.	Remarks
Display control	Character RAM	00H 07H
	Attribute RAM	08H 0FH
	PCG	10H 17H
	Graphic RAM	80H FFH
	CRT controller	18H 19H
Keyboard	Keyboard data	1AH
	Keyboard status/ command	1BH
Printer	Printer output data	22H
	Printer strobe	1CH/1DH
RS-232C	Printer status	1DH
	Transmitting/ receiving data	26H
Timer	Mode/command/ status	27H
	Interrupt	1EH/1FH
Others	Write data/ addressing	24H
	Read data	25H
60 Hz interruption control	21H	Only bit 0 is effective.
	Various status and control data	1CH 1DH

I/O OF EXTERNAL INTERFACE

I/O device	Port No.
Floppydisk™ control	No. 1
	No. 2
RS-232C	No. 3
Cache disk unit	38H~3BH
IEEE-488 interface	40H~47H
ROM pack	Auto start ROM
	IEEE-488 interface ROM
	Reserved
	Others
System reserved	3CH~3FH
	48H~50H
Not used	51H
	54H~59H
	5AH~5BH
	52H~53H
	5CH~6FH

HOW TO USE PORT 20H

—Allocation of GCW bit—

Display mode		Bit NO.
Character mode	80-character mode	7 6 5 4 3 2 1 0
	Page 1 (Even number address)	0
40-character mode	Page 2 (Odd number address)	1 1
	Page 1	 0 0 0 0
Graphic	Low resolution mode (160 x 100)	 0 0 0 1
	Page 2	 0 0 0 1
	Page 3	 0 0 1 1
	Page 4	 0 1 . . .
Standard mode (320 x 200)	Type 1 (4 colors including blue)	. . . 0 1 0 . .
	Type 2 (4 colors including white)	. . . 1 . 1 0 . .
Super-high resolution mode (640 x 400)		. . . 1 1 1 . .

* Bit 4 is a switching bit of interlace/non-interlace.

HOW TO USE PORT 1CH AND 1DH

A. READ

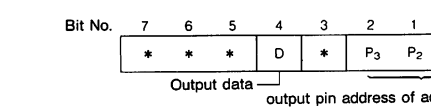
Port 1CH

Bit No.	Function	Meaning of data
7	Reset status	1 : Power-on reset 0 : Manual reset
6	Invalid	
5	Light pen address	100 000
4		101 001
3		110 010
2	Invalid	
1	Status of AUTO START switch	11 : OFF 10 : ROM 00 : DISK

Port 1DH

Bit No.	Function	Meaning of data
7	Cassette input	Serial data from cassette
6	Invalid	
5	Light pen strobe	1 : Input is received from light pen.
4	Printer busy	1 : Being processed
3	Printer acknowledge	1 : Strobe being received
2	Invalid	
1	Status of AUTO START switch	Same as port 1CH

B. WRITE (BOTH 1CH AND 1DH)



Output pin address of addressable latch	Meaning of the outp
0	RAM/ROM switching 0 :
1	Video suppression signal 1 : Video signal=Black level
2	625/525 (Switching flag of tota rasters of display monitor)
3	RGB/COMP (Switching flag of input)
4	Motor ON/OFF (Start/stop of c 1 : ON
5	Speaker ON/OFF 1 : ON
6	Printer strobe 1 : ON
7	Cassette output

