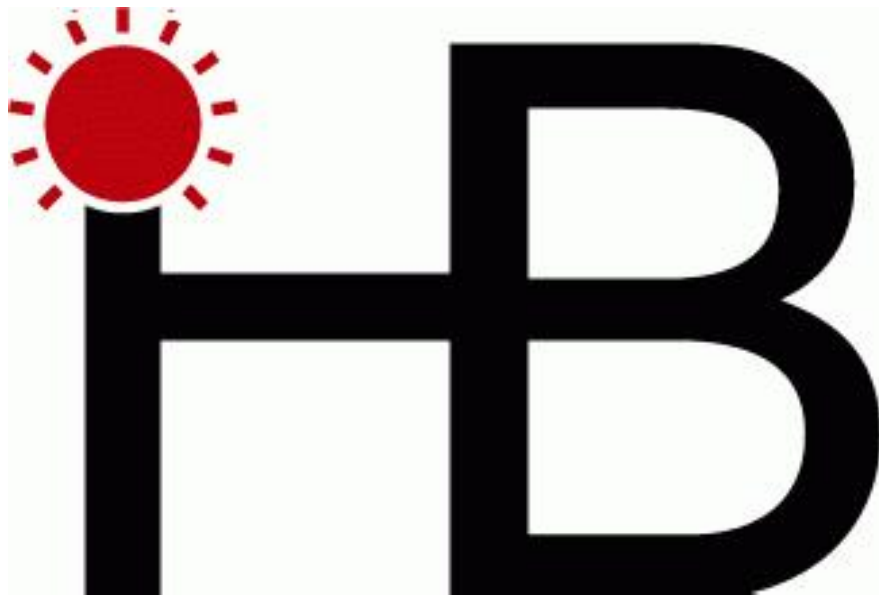


# USER'S GUIDE

# ATM4004A

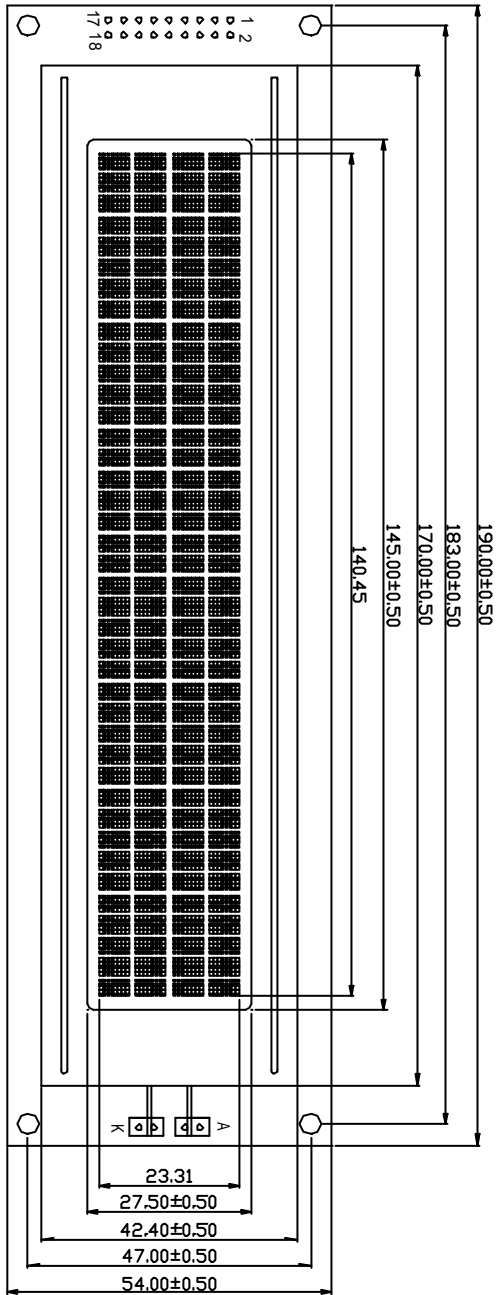
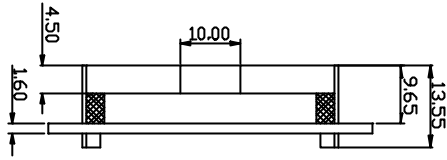
Liquid Crystal Display Module



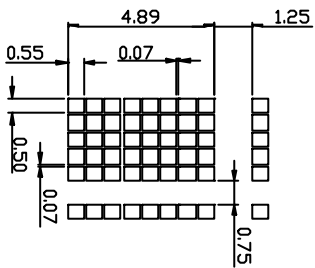
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# 1.0 Mechanical Diagram



- PERFORMANCE FEATURES**
1. LC Fluid: TN, STN (YELLOW-GREEN)
  2. Polarizer: Reflective, Transfletive, Transmissive
  3. Backlight: LED
  4. Temperature Range: Standard, Wide
  5. Controller: S6A0069X01-COCX



PIN	1	2	3	4	5	6	7	8	9
SIGNAL	VSS	VDD	V0	R <sub>s</sub>	R/W	NC	R1	R2	DB0
PIN	10	11	12	13	14	15	16	A	K
SIGNAL	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-

4									
3	LCM NO	ATM000A							
2	DRAWING	CHECK	APPROVAL	UNIT:					
1	REVISION RECORD	DATE: 2003.05.09							

## 2.0 Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature (Standard)	Top	0	-	50	°C
Storage Temperature (Standard)	Tst	-20	-	70	°C
Operating Temperature (Wide Temperature)	Top	-20	-	70	°C
Storage Temperature (Wide Temperature)	Tst	-30	-	80	°C
Input Voltage	Vin	Vss		Vdd	V
Supply Voltage For Logic	Vdd- Vss	2.7	-	5.5	V
Supply Voltage For Lcd Drive	Vdd- Vo	3.0	4.6	6.5	V

\*Wide Temperature range is available (operating/storage temperature as wide as -20 ~ +70/-30 ~ +80 ).

## 3.0 Description Of Terminals

PIN NO.	PIN NAME	INPUT/ OUTPUT	EXTERNAL CONNECTION	FUNCTION
1	VSS	—	Power	VSS:GND
2	VDD	—	Supply	VDD: +5V
3	V0	—		V <sub>LCD</sub> adjustment (need Dismount R12)
4	RS	INPUT	MPU	Register select signal “0”:Instruction register (when writing) Busy flag & address counter (When reading) “1”:Data register (when writing & reading)
5	R/W	Input	MPU	Read/write select signal “0” for writing , “1” for reading
6	VEE	—	MPU	VEE:-5V
7	E1	Input	MPU	Operation (data read/write) enable signal
8	E2	Input	MPU	Operation (data read/write) enable signal
9 / 16	DB0-DB7	Input	MPU	Data bit 0~Data bit 7
17 / 18	LED “ + ” LED “ - ”	Input	LED BACKLIGHT POWER SUPPLY	LED “ + ” VOLTAGE TYPE:4.2V MAX : 4.5V LED “ - ” : GND

## 4.0 Optical Characteristics

for TN Type Display Module ( $T_a=25$  ,  $V_{DD}=5.0V \pm 0.25V$ )

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Viewing Angle (Horizontal)	$\theta$	$Cr \geq 4.0$	-25	-	-	Deg
Viewing Angle (Vertical)	$\phi$	$Cr \geq 4.0$	-30	-	30	Deg
Contrast Ratio	Cr	$\phi=0^\circ, \theta=0^\circ$	-	2	-	
Response Time (Rise)	Tr	$\phi=0^\circ, \theta=0^\circ$	-	120	150	Ms
Response Time (Fall)	Tf	$\phi=0^\circ, \theta=0^\circ$	-	120	150	Ms

for STN Type Display Module ( $T_a=25$  ,  $V_{DD}=5.0V \pm 0.25V$ )

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Viewing Angle (Horizontal)	$\theta$	$Cr \geq 2.0$	-60	-	35	Deg
Viewing Angle (Vertical)	$\phi$	$Cr \geq 2.0$	-40	-	40	Deg
Contrast Ratio	Cr	$\phi=0^\circ, \theta=0^\circ$	-	6	-	
Response Time (Rise)	Tr	$\phi=0^\circ, \theta=0^\circ$	-	150	250	Ms
Response Time (Fall)	Tf	$\phi=0^\circ, \theta=0^\circ$	-	150	250	Ms

## 5.0 Electrical Characteristics

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Input Voltage (High)	Vih	H Level	2.2	-	Vdd	V
Input Voltage (Low)	Vil	L Level	0	-	0.6	V
Recommended Lc Driving Voltage (Standard Temp)	Vdd - Vo	0°C	-	4.8	5.4	V
		25°C	4.2	4.6	-	
		50°C	3.9	4.3	-	
Recommended Lc Driving Voltage (Wide Temp)	Vdd - Vo	-20°C	-	6.4	7.2	V
		0°C	-	4.8	-	
		50°C	-	4.3	-	
		70°C	3.7	4.2	-	
Power Supply Current	Idd	Vdd=5.0v, Fosc=270khz	-	1.0	2.0	Ma
Led Power Supply Voltage	Vfled	R=6.8Ω	-	4.3	5.0	V
Led Power Supply Current	Ifled	R=6.8Ω	-	500	800	Ma

## 6.0 Timing Characteristics

ITEM	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Enable Cycle Time	$T_c$	Fig. A, Fig. B	500	-	-	Ns
Enable Pulse Width	$T_w$	Fig. A, Fig. B	220	-	-	Ns
Enable Rise/Fall Time	$T_r, T_f$	Fig. A, Fig. B	-	-	25	Ns
Rs, R/W Set Up Time	$T_{su}$	Fig. A, Fig. B	40	-	-	Ns
Rs, R/W Hold Time	$T_h$	Fig. A, Fig. B	10	-	-	Ns
Data Delay Time	$T_d$	Fig. B	-	-	120	Ns
Data Set Up Time	$T_{dsu}$	Fig. A	60	-	-	Ns
Data Hold Time	$T_{dh}$	Fig. A, Fig. B	20	-	-	Ns

### Write Timing

#### Read Timing

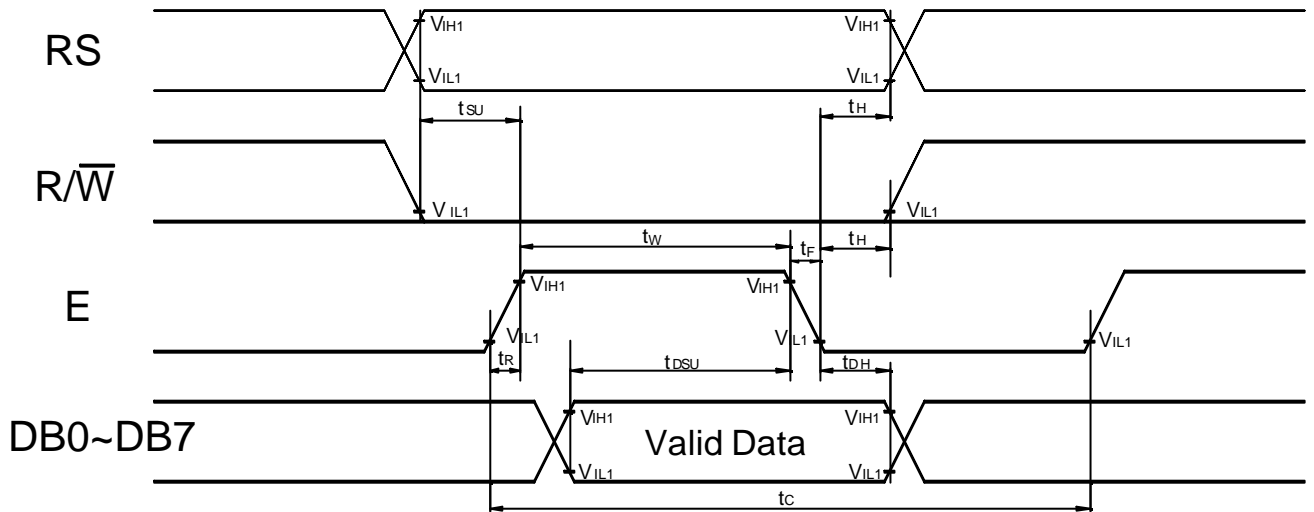


Fig. A Interface Timing (Data Write)

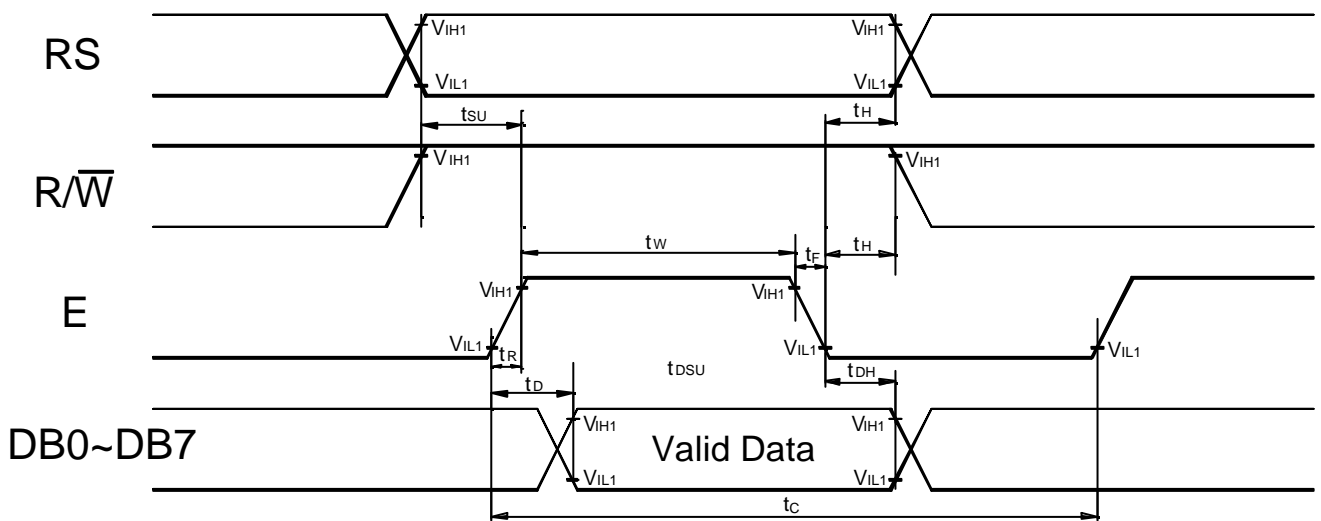
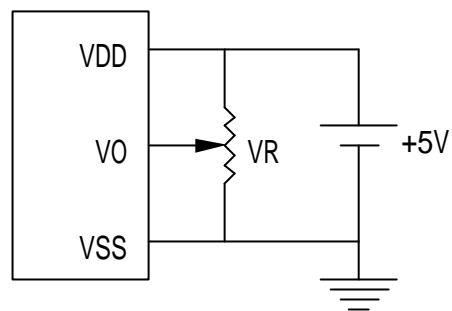
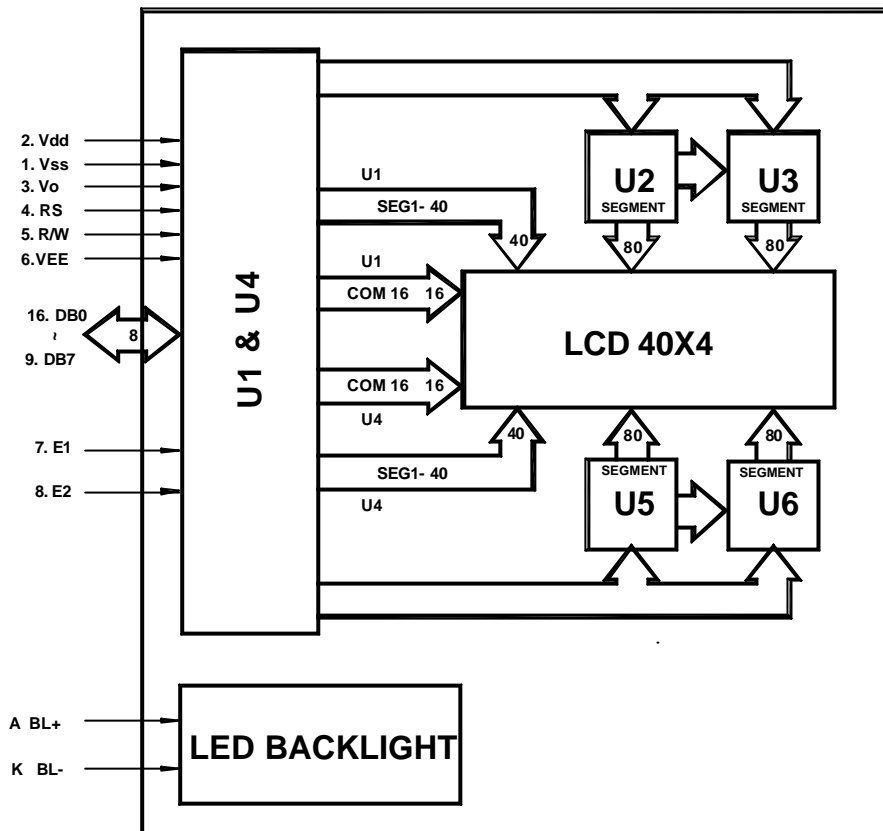
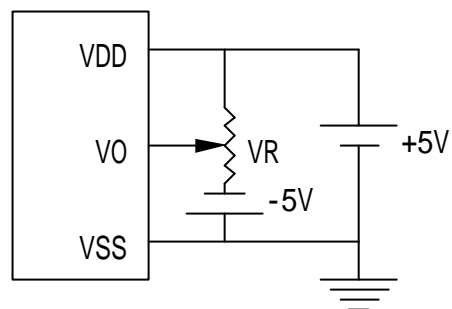


Fig. B Interface Timing (Data Read)

## 7.0 Block Diagram



STANDARD TEMP RANGE



WIDE TEMP RANGE

$$VR = 10K\Omega \sim 20K\Omega$$

VDD-Vo: LCD DRIVING VOLTAGE

VR: 10K-20K

## 8.0 Display command

PARAMETER	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	NOTE	EXECUTING TIME FOSC=270 KHZ
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC	1.52ms
Cursor home	0	0	0	0	0	0	0	0	1	*	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed	1.52ms
Entry Mode Set	0	0	0	0	0	0	0	1	1/D	S	ASSIGN CURSOR MOVING DIRECTION AND ENABLE THE SHIFT OF ENTIRE DISPLAY	38 μs
Display on/off	0	0	0	0	0	0	1	D	C	B	Set display(D), cursor(C), and blinking of cursor(B) on/off control bit.	38 μs
Cursor / Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data.	38 μs
Function Set	0	0	0	0	1	DL	N	F	*	*	SET INTERFACE DATA LENGTH (DL: 8-BIT/4-BIT), NUMBERS OF DISPLAY LINE (N: 2-LINE/1-LINE) AND, DISPLAY FONT TYPE (F:5X10 DOTS/5X8 DOTS)	38 μs
Set CG RAM Address	0	0	0	1	Ac5	Ac4	Ac3	Ac2	Ac1	Ac0	Set DDRAM address in counter	38 μs
Set DD RAM Address	0	0	1	Ac6	Ac5	Ac4	Ac3	Ac2	Ac1	Ac0	Set DDRAM address in counter	38 μs
Read Busy Flug/Address Counter	0	1	BF	Ac6	Ac5	Ac4	Ac3	Ac2	Ac1	Ac0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read	
Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	38 μs
Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	38 μs



## 9.0 Reliability and Life Time

### 1. Reliability Test

Storage Condition	Content	EVALUATIONS AND ASSESSMENT*			
		Current Consumption	Oozing	Contrast	Other Appearances
Operation At High Temperature And Humidity	40°C,90% Rh,240hrs	Twice Initial Value Or Less	None	More Than 80% Of Initial Value	No Abnormality
High Temperature Storage	60°C, 240hrs	Twice Initial Value Or Less	None	More Than 80% Of Initial Value	No Abnormality
Low Temperature Storage	-20°C, 240hrs	Twice Initial Value Or Less		More Than 80% Of Initial Value	No Abnormality

\*Evaluations and assessment to be made two hours after returning to room temperature (25°C±5°C).

\*the lcds subjected to the test must not have dew condensation.

### 2. Liquid crystal panel service life

50,000 hours minimum at 25 ± 10 °C, 45 ± 20%RH.

## 10.0 Display Instruction Table

COMMAND	R S	R/ W	DB 7	DB 6	DB 5	DB 4	DB 3	DB 2	DB 1	DB 0	DESCRIPTION	EXECUTING TIME FOSC=250K HZ
CLEAR DISPLAY	0	0	0	0	0	0	0	0	0	1	CLEARs DISPLAY & RETURNS TO ADDRESS 0.	1.64MS
CURSOR AT HOME	0	0	0	0	0	0	0	0	1	X	RETURNS CURSOR TO ADDRESS 0. ALSO RETURNS THE DISPLAY BEING SHIFTED TO THE ORIGINAL POSITION. DDRAM CONTENTS REMAIN UNCHANGED.	1.64MS
ENTRY MODE SET	0	0	0	0	0	0	0	1	I/D	S	I/D: SET CURSOR MOVING DIRECTION I/D=1: INCREMENT I/D=0: DECREMENT S: SPECIFY SHIFT OF DISPLAY S=1: THE DISPLAY IS SHIFTED S=0: THE DISPLAY IS NOT SHIFTED	40µS

DISPLAY ON/OFF CONTROL	0	0	0	0	0	0	1	D	C	B	DISPLAY D=1: DISPLAY ON D=0: DISPLAY OFF CURSOR C=1: CURSOR ON C=0: CURSOR OFF BRINK B=1: BRINK ON B=0: BRINK OFF	40µS
CURSOR / DISPLAY SHIFT	0	0	0	0	0	1	S/C	R/L	X	X	MOVES CURSOR OR SHIFTS THE DISPLAY W/O CHANGING DD RAM CONTENTS S/C=0: CURSOR SHIFT (RAM UNCHANGED) S/C=1: DISPLAY SHIFT (RAM UNCHANGED) R/L=1: SHIFT TO THE RIGHT R/L=0: SHIFT TO THE LEFT	40µS
FUNCTION SET	0	0	0	0	1	DL	N	F	X	X	SETS DATA BUS LENGTH (DL), # OF DISPLAY LINES (N), AND CHARACTER FONTS (F). DL=1: 8 BITS F=0: 5X7 DOTS DL=0: 4 BITS F=1: 5X10 DOTS N=0: 1 LINE DISPLAY N=1: 2 LINES DISPLAY	40µS
SET CG RAM ADDRESS	0	0	0	1	CHARACTER GENERATOR (CG) RAM ADDRESS						SETS CG RAM ADDRESS. CG RAM DATA IS SENT AND RECEIVED AFTER THIS INSTRUCTION.	40µS
SET DD RAM ADDRESS	0	0	1	DISPLAY DATA (DD) RAM ADDRESS / CURSOR ADDRESS						SETS DD RAM ADDRESS. DD RAM DATA IS SENT AND RECEIVED AFTER THIS INSTRUCTION.	40µS	
BUSY FLAG ADDRESS READ	0	1	B	ADDRESS COUNTER USED FOR BOTH DD & CG RAM ADDRESS						READS BUSY FLAG (BF) AND ADDRESS COUNTER CONTENTS.	40µS	
WRITE DATA	1	0	WRITE DATA						WRITES DATA INTO DDRAM OR CGRAM.	46µS		
READ DATA	1	1	READ DATA						READS DATA FROM DDRAM OR CGRAM.	46µS		

# 11.0 Standard Character Pattern

Lower 4 Bits \ Upper 4 Bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)		0	a	P	`	P				-	夕	三	α	ρ	
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	△	β	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	×	ρ	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	ε	ε	ε
xxxx0100	(5)		\$	4	D	T	d	t			、	エ	ト	⊥	μ	ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	⊥	σ	ω
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	π
xxxx0111	(8)		'	7	G	W	g	w			ヲ	キ	ヌ	ラ	g	π
xxxx1000	(1)		(	8	H	X	h	x			ィ	ク	ネ	リ	γ	×
xxxx1001	(2)		)	9	I	Y	i	y			ウ	ケ	ル	ル	γ	γ
xxxx1010	(3)		*	:	J	Z	j	z			エ	コ	ハ	レ	J	≠
xxxx1011	(4)		+	;	K	[	k	[			オ	サ	ヒ	ロ	*	≠
xxxx1100	(5)		,	<	L	¥	l	l			カ	シ	フ	ワ	⊕	≠
xxxx1101	(6)		-	=	M	]	m	]			ユ	ス	ハ	シ	≠	÷
xxxx1110	(7)		.	>	N	^	n	→			ヨ	セ	ホ	°	≠	
xxxx1111	(8)		/	?	O	_	o	+			ッ	ソ	マ	°	ö	■

Note: the character generator ram is the ram with which the user can rewrite character patterns by program.