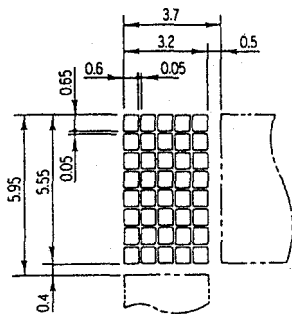
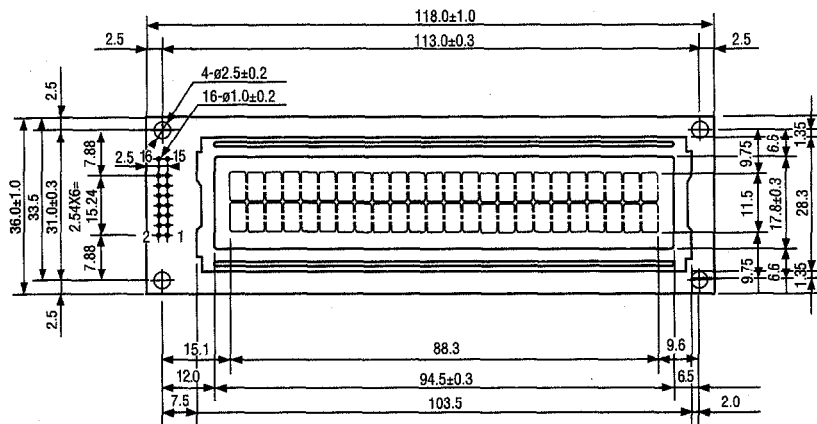


L2462B1J000	L2432B1J000	2 x 24	STN	118.0 x 36.0 x 15.8	60	94.5 x 17.8	3.20 x 4.85	0.60 x 0.65	0.05	630
L2462B1P000	L2432B1L000	2 x 24	WTSTN	118.0 x 36.0 x 15.8	60	94.5 x 17.8	3.20 x 4.85	0.60 x 0.65	0.05	630
L4052B1J000	L4042B1J000	2 x 40	STN	182.0 x 33.5 x 16.3	95	154.4 x 15.8	3.20 x 4.85	0.60 x 0.64	0.05	1080
L4052B1P000	L4042B1L000	2 x 40	WTSTN	182.0 x 33.5 x 16.3	95	154.4 x 15.8	3.20 x 4.85	0.60 x 0.64	0.05	1080
L4044B1J000	M40247DY	4 x 40	STN	190.0 x 54.0 x 16.3	140	147.0 x 29.5	2.78 x 4.27	0.50 x 0.55	0.07	2010

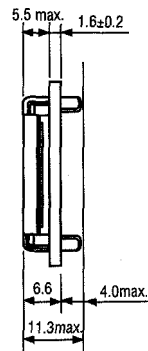
# L2462

(2x24) Unit: mm General Tolerance  $\pm 0.5$  mm

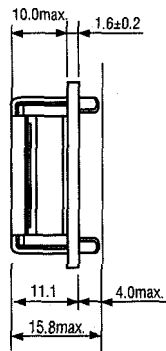


\*LED Powered  
through pins  
15 & 16

Reflective/EL Backlight



LED Backlight



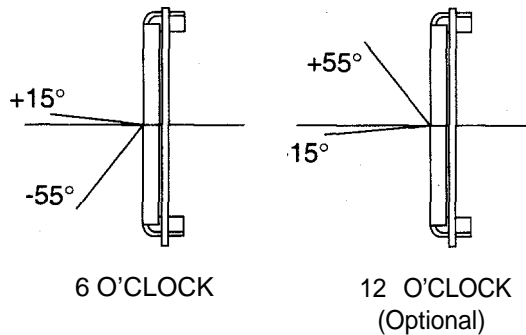
## PIN FUNCTIONS

No.	Name	Function
1	V <sub>SS</sub>	GND
2	V <sub>DD</sub>	Power supply voltage + 5 V
3	V <sub>LC</sub>	Liquid crystal driving voltage
4	RS	L: Instruction code input. H: Data input
5	R/W	L: Data write from MPU to LCM. H: Data read from LCM to MPU
6	E	Enable
7	DB0	Databusline
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DE6	Data bus line
14	DB7	Databusline
15	V <sub>c</sub> *	Anode
16	V <sub>c</sub> *	Cathode

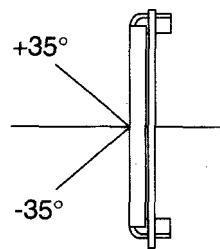
**14052**

# OPTIMUM VIEWING ANGLE / CONTRAST ADJUSTMENT CIRCUIT

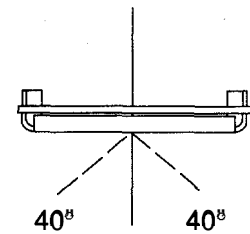
All Supertwist Character Modules Except  
L1681 & L1692 Series



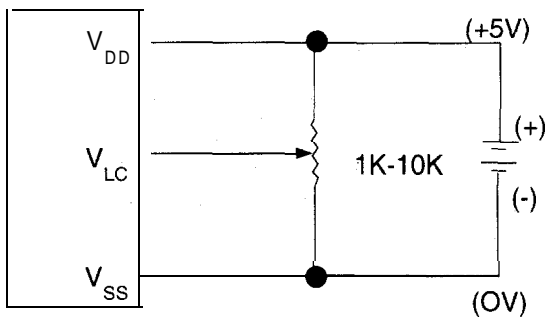
L1681 & L1692  
Series (only)



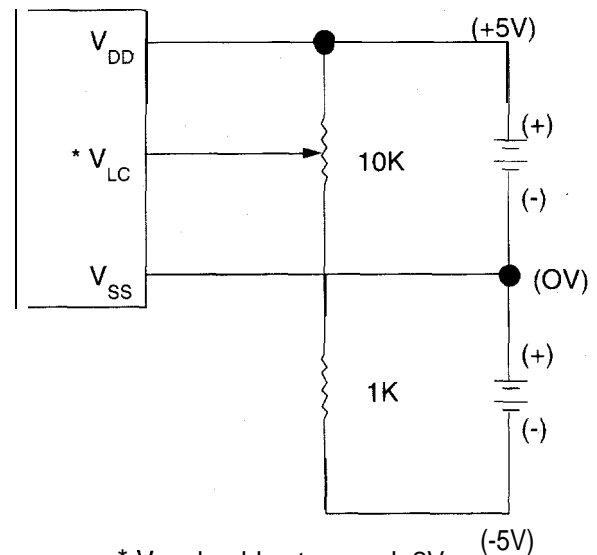
Side Viewing Angles on  
Super-twist Character Modules



## STANDARD STN & L2022



## WIDE TEMPERATURE STN



\*  $V_{LC}$  should not exceed -2V.

- ▶ The above schematic applies to all **Seiko Instruments** standard temperature supertwist character modules except L2022. A variable or fixed resistor must be used on any LCD module as it appears in the above schematic.
- ▶ A variable resistor is advisable, especially for stationary equipment. The variable resistor allows the user to adjust the voltage, to get maximum contrast in relationship to whatever angle the user is viewing the LCD (within the optimum viewing range). A variable also allows the user to adjust the voltage for any temperature fluctuations between 0° and 50°C.
- ▶ A fixed resistor limits the LCD to a finite voltage and therefore a very limited viewing angle. Fixed resistors should be used in those applications where the display can be adjusted to the particular user (i.e., hand-held products).

- ▶ The above schematic applies to all **Seiko Instruments** supertwist character modules with Wide Temperature Fluid. A variable or fixed resistor must be used on any LCD module as it appears in the above schematic.
- ▶ A variable resistor is advisable, especially for stationary equipment. The variable resistor allows the user to adjust the voltage, to get maximum contrast in relationship to whatever angle the user is viewing the LCD (within the optimum viewing range). A variable also allows the user to adjust the voltage for any temperature fluctuations between -20° and 70°C.
- ▶ A fixed resistor limits the LCD to a finite voltage and therefore a very limited viewing angle. Fixed resistors should be used in those applications where the display can be adjusted to the particular user (i.e., hand-held products).

# OPERATING INSTRUCTIONS

## INTRODUCTION

**Seiko instruments** intelligent dot matrix liquid crystal display modules have on-board controller and LSI drivers, which display alpha numerics, Japanese KATA KANA characters and a wide variety of other symbols in either 5 x 7 dot matrix.

The internal operation in the KS0006 controller chip is determined by signals sent from the MPU. The signals

include: 1) Register select RS input consisting of instruction register (IR) when RS = 0 and data register (DR) when RS = 1; 2) Read/write (R/W); 3) Data bus (DB7~ DBO); and 4) Enable strobe (E) depending on the MPU or through an external parallel I/O port. Details on instructions data entry, execution times, etc. are explained in the following sections.

## READ AND WRITE TIMING DIAGRAMS AND TABLES

The following timing characteristics are applicable for all of Seiko's LCD dot matrix character modules.

### READ TIMING CHARACTERISTICS

$V_{DD}=5.0V\pm5\%$ ,  $V_{SS}=0V$ ,  $T_A=0^\circ C$  to  $50^\circ C$

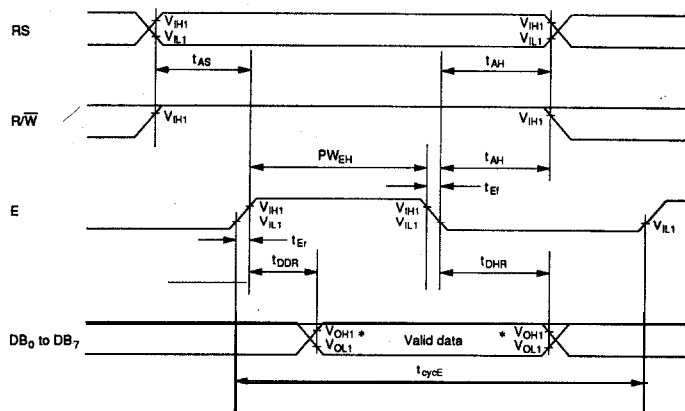
Item	Symbol	Standard		Unit
		Min.	Max.	
Enable cycle time	$t_{CYCE}$	500	—	ns
Enable pulse width High Level	$PW_{EH}$	230	—	ns
Enable rise and fall time	$t_{ER}, t_{EF}$	—	20	ns
Setup time RS,R/W—E	$t_{AS}$	140	—	ns
Address hold time	$t_{AH}$	10	—	ns
Data delay time	$t_{DDR}$	—	160	ns
Data hold time	$t_H$	5	—	ns

### WRITE TIMING CHARACTERISTICS

$V_{DD}=5.0V\pm5\%$ ,  $V_{SS}=0V$ ,  $T_A=0^\circ C$  to  $50^\circ C$

Item	Symbol	Standard		Unit
		Min.	Max.	
Enable cycle time	$t_{CYCE}$	500	—	ns
Enable pulse width High Level	$PW_{EH}$	230	—	ns
Enable rise and fall time	$t_{ER}, t_{EF}$	—	20	ns
Setup time RS,R/W—E	$t_{AS}$	140	—	ns
Address hold time	$t_{AH}$	10	—	ns
Data delay time	$t_{DDR}$	80	—	ns
Data hold time	$t_H$	10	—	ns

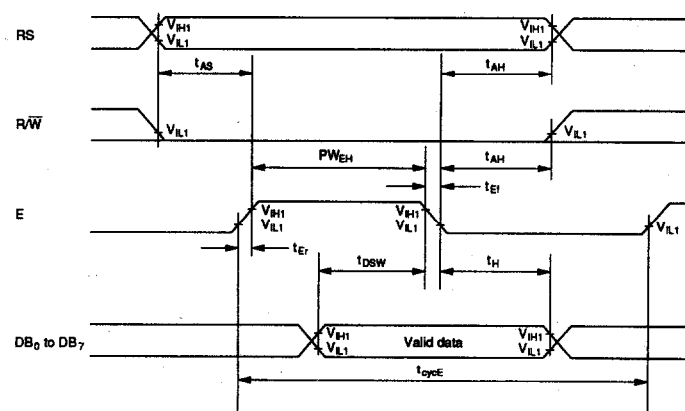
### READ OPERATION



Note: \*VOL1 is assumed to be 0.8 V at 2 MHz operation.

DATA READ FROM MODULE TO MPU

### WRITE OPERATION



DATA WRITE FROM MPU TO MODULE

# INSTRUCTION CODES

Instruction	Set		Instruction Code									Description	Execution Time (when $f_{cp}$ or $f_{osc}$ is 250 kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears all display memory and returns the cursor to the home position (Address 0).	82 $\mu s$ ~ 1.64ms	
Return Home	0	0	0	0	0	0	0	0	1	*	Returns the cursor to the home position (Address 0) shifted to the original position.. DD RAM contents remain unchanged.	40 $\mu s$ ~ 1.6ms	
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor move direction and specifies to or not to shift the display. These operations write and read.	40 $\mu s$ ~ 1.64ms	
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	(D) is display ON/OFF control; memory remains unchanged in OFF condition. (C) cursor ON/OFF (B) blinking cursor.	40 $\mu s$	
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without changing DD RAM contents.	40 $\mu s$	
Function Set	0	0	0	0	1	DL	N	F	*	*	Sets interface data length (DL), number of display lines (N), and character font (F).	40 $\mu s$	
Set CG RAM Address	0	0	0	1	$A_{CG}$						Sets the CG RAM address. CG RAM data is sent and received after this setting.		40 $\mu s$
Set DD RAM Address	0	0	1	$A_{DD}$							Sets the DD RAM address. DD RAM data is sent and received after this setting.		40 $\mu s$
Read Busy Flag & Address	0	1	BF	AC							Reads Busy Flag (BF) indicating internal operation is being performed and reads address counter contents.		1 $\mu s$
Write Data to CG or to DD RAM	1	0	Write Data									Writes data into DD RAM or CG RAM.	40 $\mu s$
Read Data from CG or DD RAM	1	1	Read Data									Reads data from DD RAM or CG RAM.	40 $\mu s$

\* Doesn't matter

DD RAM: Display data RAM  
CG RAM: Character generator RAM

$A_{CG}$ : CG RAM address  
ADD: DD RAM address corresponds to cursor address

AC: Address counter used for both DD RAM and CG RAM address

I/D = 1: Increment  
I/D = 0: Decrement  
S = 1: Display shift  
S = 0: No display shift  
D = 1: Display ON  
D = 0: Display OFF

C = 1: Cursor ON  
C = 0: Cursor OFF  
B = 1: Blink ON  
B = 0: Blink OFF  
S/C = 1: Display shift  
S/C = 0: Cursor movement  
BF = 1: Internal operation in progress  
BF = 0: Instruction can be accepted

R/L = 1: Right shift  
R/L = 0: Left shift  
DL = 1: 8 bits  
DL = 0: 4 bits  
N = 1: 2 lines (L1671)  
F = 0: 5 x 7 dot matrix

Execution times in the above table indicate the minimum values when operating frequency is 250 kHz.

When  $f_{osc}$  is 270 kHz:  $40\mu s \times 250/250 = 37\mu s$