# 8279 KEYBOARD AND DISPLAY INTERFACING

Features:

➤ It is designed by Intel

➤ It is support 64 contact key matrix with two more keys "CONTROL" and "SHIFT"

➤ It provides 3 operating modes

 1.Scanned keyboard mode 2.Scanned sensor matrix mode 3.Strobed Input mode.

➤ It has inbuilt debounce key .

- It provides 16 byte display RAM to display 16 digits and interfacing 16 digits.
- It provides two output modes:
  1. Left entry (Typewriter type).
  2. Right entry (Calculator type).
- Simultaneous keyboard and display operation facility allows to interleave keyboard and display software.
- The interrupt output of 8279 can be used to tell CPU that the key press is detected, this eliminates the need of software polling.
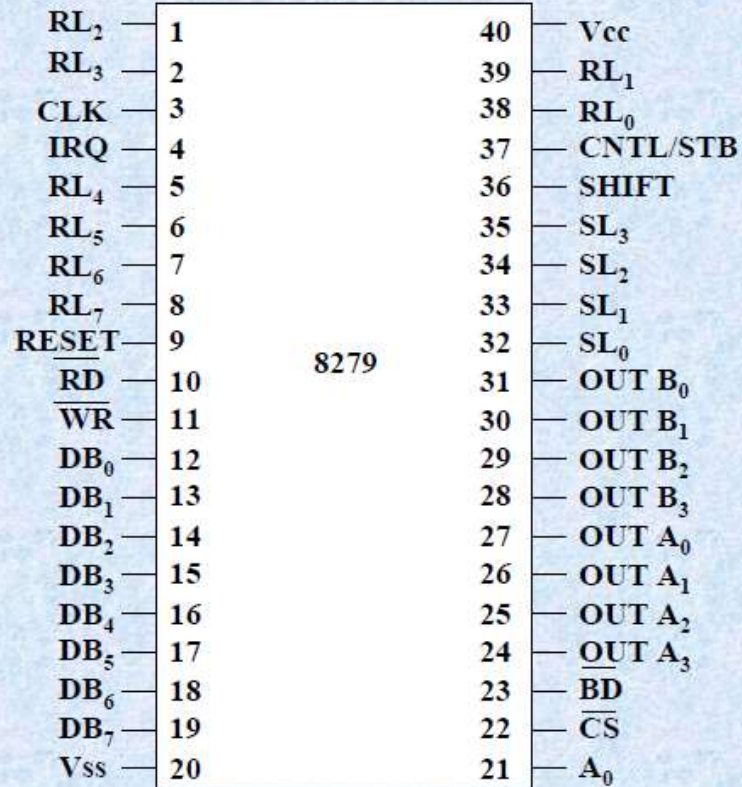
8279 Pin Configuration

PIN DIAGRAM OF 8279
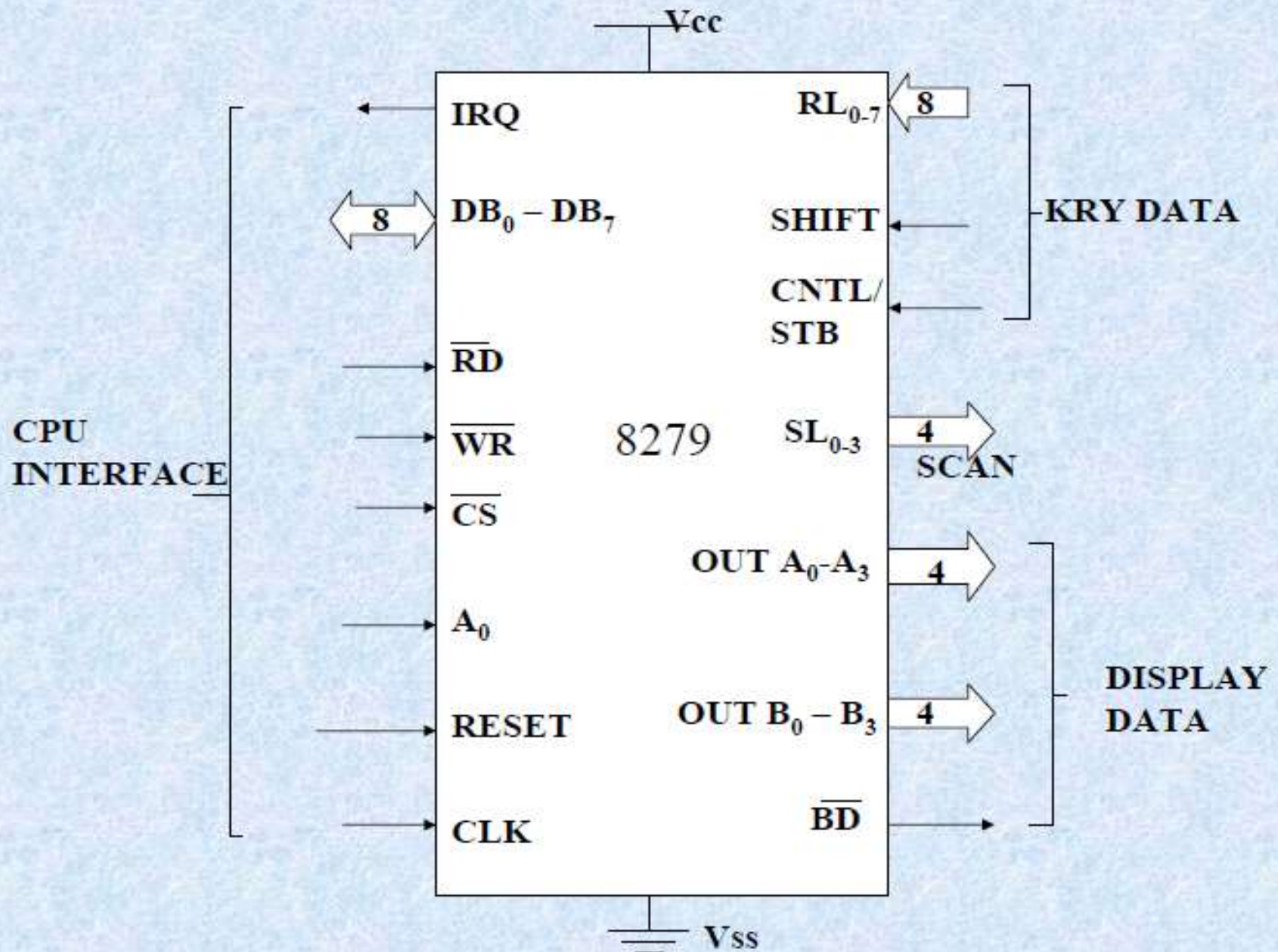
Cpu interface pins:

- **DB_0-DB_7 :** These are bidirectional data bus lines. The data and command words to and from the CPU are transferred on these lines.

- **$\overline{RD}$, $\overline{WR}$ (Input / Output) READ/WRITE :** These input pins enable the data buffers to receive or send data over the data bus.

- **A0(Address lines) :** A high on this line indicates the transfer of a command or status information. A low on this line indicates the transfer of data. This is used to select one of the internal registers of 8279.

➢ **CS :** Chip Select – A low on this line enables 8279 for normal read or write operations. Other wise, this pin should remain high.

➢ **RESET :** This pin is used to reset 8279. A high on this line reset 8279. After resetting 8279, its in sixteen 8-bit display, left entry encoded scan, 2-key lock out mode. The clock prescaler is set to 31.

➢ **CLK :** This is a clock input used to generate internal timing required by 8279.

- **IRQ :** This interrupt output lines goes high when there is a data in the FIFO sensor RAM. The interrupt lines goes low with each FIFO RAM read operation but if the FIFO RAM further contains any key-code entry to be read by the CPU, this pin again goes high to generate an interrupt to the CPU.
- **Vss, Vcc :** These are the ground and power supply lines for the circuit.
- **SL0-SL3-Scan Lines :** These lines are used to scan the key board matrix and display digits. These lines can be programmed as encoded or decoded, using the mode control register.
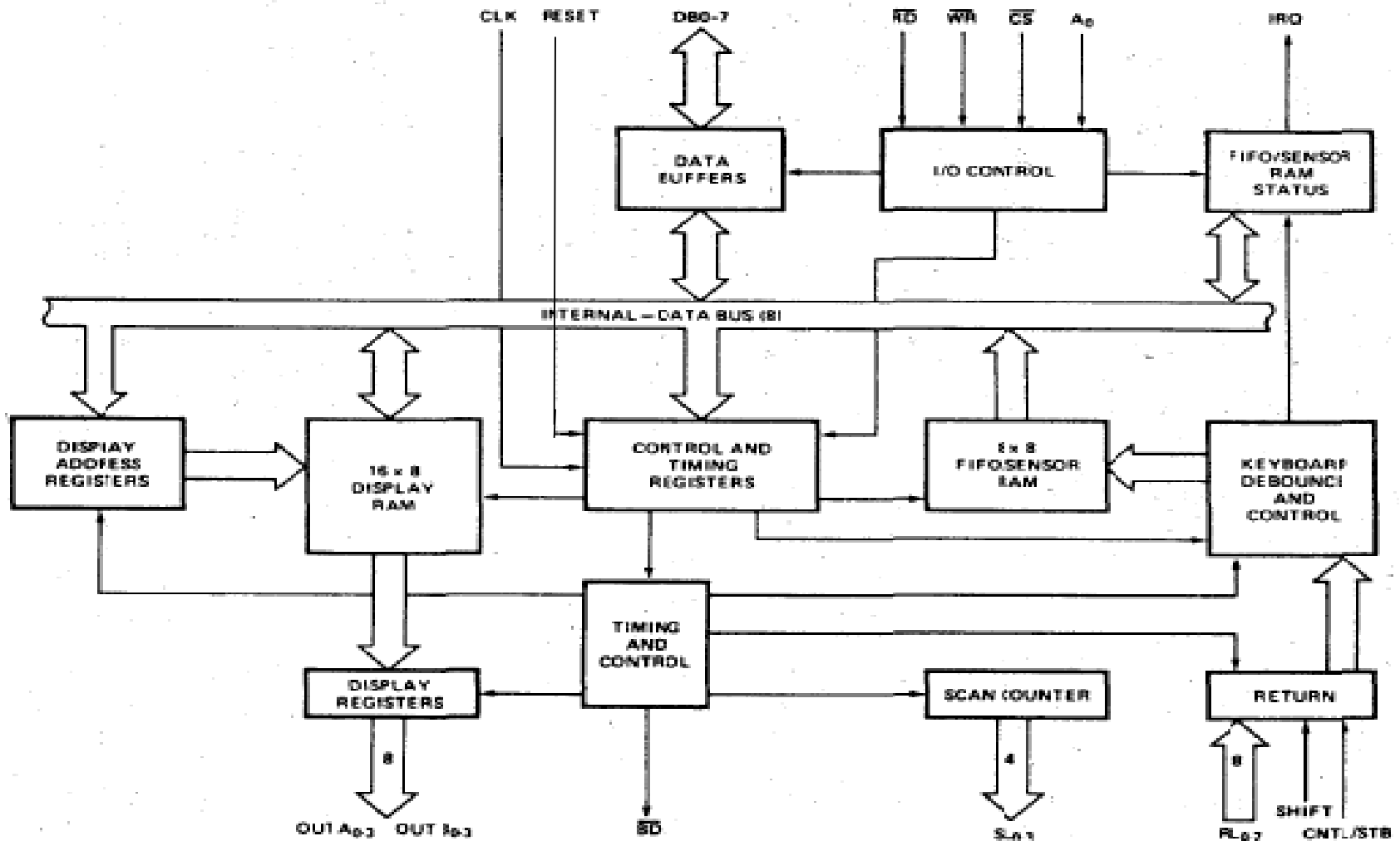
Key board Data:

➢ **RL0 - RL7 – Return Lines :** These are the input lines which are connected to one terminal of keys, while the other terminal of the keys are connected to the decoded scan lines. These are normally high, but pulled low when a key is pressed.

➢ **SHIFT :** The status of the shift input lines is stored along with each key code in FIFO, in scanned keyboard mode. It is pulled up internally to keep it high, till it is pulled low with a key closure.

➢ **CNTL/STB- CONTROL/STROBED I/P Mode :** In keyboard mode, this lines is used as a control input and stored in FIFO on a key closure. The line is a strobed lines that enters the data into FIFO RAM, in strobed input mode. It has an interrupt pull up. The lines is pulled down with a key closer.

Display data:

➢ **OUT A0 – OUT A3 and OUT B0 – OUT B3 :** These are the output ports for two 16*4 or 16*8 internal display refresh registers. The data from these lines is synchronized with the scan lines to scan the display and keyboard. The two 4-bit ports may also as one 8-bit port.

➢ **BD – Blank Display :** This output pin is used to blank the display during digit switching or by a blanking closure.

Block Diagram

➢ It consists 4 main section.
1. CPU interface and control section.
2. Scan section
3. Keyboard Section
4. Display section.

CPU INTERFACE AND CONTROL SECTION:
It consists of
1. Data buffers
2. I/O control
3. Control and timing registers.
4. Timing and control logic.

Data Buffers:

➢ 8-bit bidirectional buffer.

➢ Used to connect the internal data bus and external data bus.

I/O control:

➢ I/O control section uses the A0,$\overline{CS}$,$\overline{RD}$ and $\overline{WR}$ signals to controls the data flow.

➢ The data flow is enabled by $\overline{CS}$=0otherwise it is the high impedance state.

➢ A0=0 means the data is transferred.

➢ A0=1 means status or command word is transferred.

I/O control signals listed below

A0	$\overline{\text{RD}}$	$\overline{\text{WR}}$	Interpretation
0	1	0	Data from CPU to 8279
0	0	1	Data from 8279 to CPU
1	1	0	Command word from CPU to 8279
1	0	1	Status word from 8279 to CPU

TIMING AND CONTROL REGISTERS:

➤Store the keyboard and display modes and others operating condition programmed by the CPU.

➤The modes are programmed by sending proper command $A_0=1$.

TIMING AND CONTROL:

➤It consist timing counter chain.

➤First counter is divided by N prescalar that can be programmed to give an internal frequency of 100 KHz.

➢ The other counter is divide by basic internal frequency .Listed below

Parameter	Timings
Keyboard and time	5.1 msec
Keyboard and debounce time	10.3 msec
Key scan time	80 µ sec
Display scan time	10.3 msec
Digit ON time	480 µ sec
Blanking time	160 µ sec
Internal clock time	10 µ sec

Scan Section

➢ It has two modes,

1. Encoded mode
2. Decoded mode.

ENCODED MODE:

➢ It provide binary count from 0000 to 1111 by four scan lines(SC_3-SC_0)by active high inputs.

➢ It is externally decoded to provide 16 scan lines

- Display use all 16 lines to interface 16 digit 7 segment display.
- But keyboard use only 8 scan lines out of 16 lines.

- DECODED MODE:
- In this mode ,the internal decoder decodes the least 2 significant bits.
- It is provide four possible combination from (SC_0-SC_3) such as 1110 ,1101 ,1011 and 0111.
- This four active low outputs line is used to directly to interface 4 –digit 7-segment display ,8*4 matrix keyboard

Keyboard section

➢ This is consist of,

➢ Return buffers.

➢ Keyboard debounce control.

➢ FIFO / sensor RAM.

➢ FIFO / sensor RAM status.

RETURN BUFFERS:

➢ 8 return lines(RL_7-RL_0) are buffered and latched by when each row scan in scanned keyboard or sensor matrix mode.

➢ In strobed mode ,the contents of return lines are transferred to FIFO Ram.

KEYBOARD DEBOUNCE AND CONTROL:

➤ It is enabled only when keyboard mode is selected.

➤ In this mode , return lines are scanned whether any keys are closed in the row.

➤ If debounce circuit is detect any closed switch it wait about 10 msec.

➤ It is continued , the status of SHIFT and CONTROL keys are transferred into RAM.

➤ FIFO/SENSOR RAM:

➤ This is a dual function of 8*8 RAM.

➤

- In scanned key board mode and Strobed input mode , It is FIFO.
- Each new entry is written into successive RAM position and read in the order of entry.
- In sensor matrix mode it is a sensor RAM.
- Each sensor RAM is loaded with corresponding sensor RAM status.

- FIFO/SENSOR RAM status:
- This is used to tell the status of FIFO/SENSOR RAM.
- The status of logic also makes IRQ signal is High , When FIFO is empty.

Display section:

It consists of,

1. Display RAM.
2. Display Address registers.
3. Display registers.

DISPLAY RAM:

➢ It is a 16*8 RAM.

➢ Which stores 16 digits display codes.

➢ It can be accessed by CPU directly.

➢ In Decoded mode,8279 uses only first four location of Display RAM.

➢ In Encoded mode,8279 uses only first eight location of Display RAM.

➢ And all 16 location for 16 digits display.

DISPLAY ADDRESS REGISTERS:

➤ Used to hold address of the byte currently write or read by the CPU and scan count value.

➤ In auto increment mode, address in the register is automatically incremented for each write or read.

DISPLAY REGISTERS:

➤ It is a Two 4-bit registers such as , A and B.

➤ They hold the bit patterns of character to be displayed.

➤ The content of display registers A and B can B blanked and inhibited individually.

Operating modes

- It is two types,
1. Input modes.
2. Display modes.

INPUT MODES:

➢ It is basically 3 types,
1. Scanned keyboard.
2. Scanned sensor matrix.
3. Strobed mode.

SCANNED KEYBOARD:

Key board can be scanned in two ways.

1. Encoded Scan   2. Decoded Scan.

ENCODED SCAN:

➢ In this scan, scan lines (SL_2-SL_0) are decoded externally to provide 8 scan lines.

➢ Additionally it provides 8 return lines.

➢ So the size of matrix keyboard is 8*8 (i.e Scan * Return)=64.

➢ When the key is pressed , it is stored the status of return lines , Scan lines ,SHIFT and CNTL/STB keys into FIFO RAM.

➢ The Scanned keyboard structure is,

B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0
CNTL	SHIFT	SCAN			RETURN		

Example:

➤ Find the key code for given condition below:

CNTL/STB SHIFT keys are open.

The pressed keys are to scan lines 2 and return lines 4.

SOLUTION:

B7	B6	B5	B4	B3	B2	B1	B0
1	1	0	1	0	1	0	0

- CNTL=1
- SHIFT=1
- Scan mode=010 (Scan line 2)
- Return mode=100 (Return line 4)
- Key code =D4 H

DECODED SCAN:

- In this mode ,internal decoder decodes the least significant bits of scan lines (SC3-SC0).
- That is provide the four combination such as 1110,1101,1011 and 0111.
- So the maximum size of keyboard is 8*4=32.
- The key code is similar to encoded code , only bit 5 (B_5) is always zero.

2-KEY LOCKOUT:

➢ In this mode, the two key depression is not allowed.

➢ When any key is depressed, the debounce logic is set and 8279 checks for any key depress next two scans.

➢ Three possible condition to avoid debouncing:

➢ Condition 1:

➢ If other key depression is not found during next two scan, it is a single key is depressed .Then the status of key code is entered into FIFO RAM along with the status of CNTL and SHIFT lines

- If FIFO RAM is empty , The CPU is entry the data.
- If FIFO RAM is full , The CPU does not entry the data.

Condition 2:

- If any other key depress is encountered , no entry to the FIFO can occur.
- When the key is released after that only Entry will be allowed.

Condition3:

- If the two key is pressed in simultaneously in a debounce cycle, both depression is not considered.

- N-KEY ROLLOVER:
- ➢ Each key is depression is treated as independently from all others.

SCANNED SENSOR MATRIX:

- ➢ In this mode , image of the sensor matrix is kept in the sensor RAM.
- ➢ The status of sensor switches are input directly to the sensor RAM.
- ➢ 8279 scans row one by one and store the status of each row in the corresponding memory location.
- ➢ STROBED INPUT MODE:
- ➢ The data is entered from Returned lines.

Display modes:

- It is basically two types,

1. Left entry (Type writer mode).
2. Right entry (Calculator mode).

LEFT ENTRY:

➢ In this mode , 8279 display characters from left to right.

➢ Like a typewriter.

AUTOINCREMENT IN LEFT ENTRY:

➢ In left entry mode , Autoincrement flag is set after each operation display RAM address is incremented.

RIGHT ENTRY:

➢ In this mode , 8279 display characters from Right to left.

➢ Like a Calculator.

AUTOINCREMENT IN RIGHT ENTRY:

➢ In right entry mode , Auto increment flag is set after each operation display RAM address is incremented.