8051 AND ADVANCED PROCESSOR ARCHITECTURES –
Lesson-4: Serial Data Communication Input/Output

Serial Interface SI

programmable for

- half duplex synchronous serial or
- full duplex asynchronous UART mode

Two 8-bit SFRs

- **SBUF** (8 serial received bits or transmission bits register depending upon instruction is using SBUF as source or destination)

- **SCON** (8-serial modes cum control bits register) and SFR **PCON.**7 bit

SBUF

- Single SFR address for transmit and received byte buffers when the serial output or input is sent.

- 0x99 the address of SI buffers.

- SFR holds the SI transmission 8-bits when it is written.

- MOV 0x99, *A* instruction writes *A* into transmission buffer from *A* register

- MOV R1, 0x99 instruction read R1s register from the receive buffer

SCON

- SFR to control the SI interface.

- Three upper bits programs the modes as 0 or 1 or 2 or 3.

- Mode 0 is half duplex synchronous.

- Modes 1 or 2 or 3 are full duplex asynchronous modes.

- Bit SCON.4 enables or disables SI receiver functions.

SCON

- Two bits SCON.3 and SCON.2 specify the 8th bit to be transmitted and 8th bit received when the mode is 2 or 3. A bit SCON.1 enables or disables SI transmitter interrupts (TI) on completion of transmission.

- Bit SCON.0 enables or disables SI receiver interrupts (RI) on completion of transmission.

Mode 0 functions – Input or output

Depends upon instruction using SBUF as source or destination

- Synchronous serial mode data and clock inputs, or
- Synchronous serial mode data and clock outputs

Mode 0 when SCON bits 7 and 6 (mode-bits) are 00

Mode 1 – Input or output

- 10 bit (start plus 8- serial data plus stop total 10 bits) UART mode serial input or output

- Input or output whether SBUF used for read or write in instruction

- Baud rate programmable using T1 or T0 timers (T2 in 8052)

- Mode 1 when SCON bits 7 and 6 are 01

Mode 2 Input or Output

- Eleven bit (start plus 8- serial data plus RB8 or TB8 bit plus stop total 11 bits) UART mode serial input and output

- Input or output whether SBUF used for read or write in instruction

- Fixed baud rate of $(f/32) \div 12$ or $(f/64) \div 12$ Mbaud/s where f = crystal frequency depending upon PCON 7 bit SMOD = 1 or 0, respectively

Mode 2 when SCON bits 7 and 6 are 10

Mode 3 Input or Output

- 11 bit (start plus 8- serial data plus RB8 or TB8 bit plus stop total 11 bits) UART mode serial input and output

- Input or output whether SBUF used for read or write in instruction

- Baud rate with programmable using T1 or T0 timers (T2 in 8052)

Mode 3 when SCON bits 7 and 6 are 1,1

SI Full duplex signals Mode 1, 2 or 3

SBUF Serial
transmit/receive data
buffer

TxD/CLK, RxD/Data pins
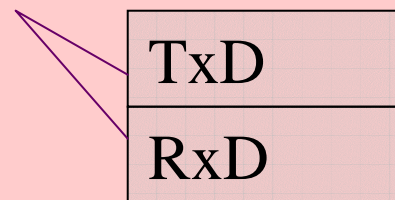
TxD	At receiver input from a transmitter output
RxD	At transmitter output for a receiver input

Processor

Processor

UART

Processor

TxD		TxD
RxD		RxD

UART

SI Half duplex signals Mode 0

SBUF Serial transmit/receive data buffer

TxD/CLK, RxD/Data Pins

CLK
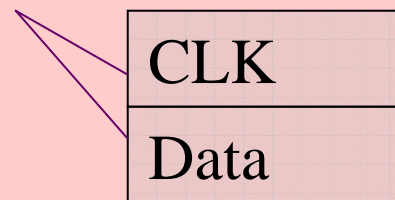
Data

From a transmitter Processor output at receiver input

At transmitter output for a receiver Processor input

Processor

Processor

Processor
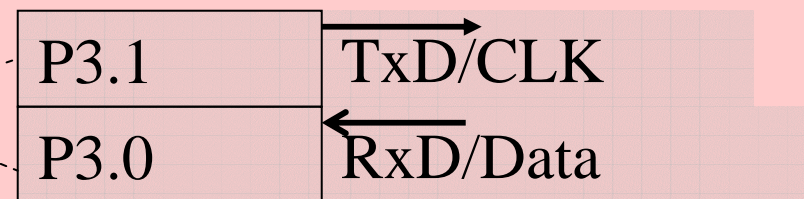
CLK

Data

CLK

Data

synchronous

8051 SI signals at Port P3.1 and P3.0

TxD/CLK, RxD/Data Pins

SBUF Serial transmit/receive data buffer

Programmed as per mode selected and SBUF read or write instruction executed

P3.1	TxD/CLK
P3.0	RxD/Data

P3

8051 SI Features

1. Mode 0– Half- duplex synchronous mode of operation

2. T8 and R8 for the inter-processor communication in 11- bit format

3. Mode 1 or 2 or 3 – Full- duplex asynchronous serial communication

4. Signals not programmable for RxD or TxD no DDR in 8051

Summary

Chapter-2 L4: "Embedded Systems - Architecture, Programming and Design",
Raj Kamal, Publs.: McGraw-Hill Education

We learnt

- Serial Interface functions
- Half duplex synchronous serial mode 0 or
- Full duplex asynchronous UART mode 1, 2 or 3
- SBUF
- SCON

Chapter-2 L4: "Embedded Systems - Architecture, Programming and Design", Raj Kamal, Publs.: McGraw-Hill Education

End of Lesson 4 of Chapter 2