8255A – STUDY CARD

1. INTRODUCTION

Electro Systems Associates Private Limited (ESA) manufactures trainers for most of the popular microprocessors viz 8085, Z-80, 8031 8086/88, 68000 and 80196. ESA offers a variety of modules, which can be interfaced, to these trainers. These modules can be effectively used for teaching/ training in the Laboratories.

The 8255A PPI card incorporates Intel's 8255A. This Interface is designed to explain all the facilities available in 8255A.

Functional description of 8255A, implementation of the circuit and some simple software programs are presented in this manual.

2. DESCRIPTION OF THE CIRCUIT

The interface has 4 Dipswitches mentioned as SW1, SW2, SW3 and SW4. The 8255A port A and port B can be configured in software as output by using the control word and keeping the switches SW1 and SW3 in O/P position and switches SW2 and SW4 will have no effect. Configure 8255A port A as input in software while keeping SW1 in I/P position. After executing the program it reads the status of SW2 position. Similarly for port B, configure 8255A port B as input in software while keeping SW3 in I/P position. After executing the program it reads the status of SW4 position. 8 RED LEDs are provided to read the status of port A and 8 GREEN LEDs are provided to read the status of port B and YELLOW LEDs are provided to read the signal status mentioned on the interface.

Switches S1, S2 and S3 are provided to simulate STB* or ACK* signals in Mode 1 and in Mode 2. Provision is made for connecting buffered external interrupt (RST 7.5 etc.,) to J5 and keeping the jumper JP2 at PC_0 or PC_3 depending on the type of Mode. The interface has got 4 connectors named as J2, J3, J4 and P1. J3 and J4 are reserved for MPS85-2 trainer and P1 is reserved for ESA85-2 trainer. All the 24 I/O lines are brought out to the J2 connector. But port C lines are used as handshake signals so user cannot use those lines. (Only port A and port B lines are available to user).

3.0 INSTALLATION AND CONFIGURATION

The Connector details for connecting the Study Card to different Trainers are mentioned below.

TRAINER	CONNECTORS ON TRAINER	CONNECTORS ON STUDY CARD ADAPTER	CONNECTORS ON STUDY CARD
MPS 85-3	J3 (26 PIN) J4 (26 PIN)	No Adapter required	J3 (26 PIN) J4 (26 PIN)
ESA 85-2	P1 (50 PIN)	No Adapter required	P1 (50 PIN)
ESA 86/88-2/3 *	J1 (50 PIN) J2 (50 PIN)	J1 (50 PIN) | J3 (26 PIN) J2 (50 PIN) | J4 (26 PIN)	J3 (26 PIN) J4 (26 PIN)
ESA 86E	J6 (26 PIN) J7 (26 PIN)	No Adapter required	J3 (26 PIN) J4 (26 PIN)
ESA 31/51 *	J5(50 PIN)	J1(50 PIN) | J3(26 PIN) J4(26 PIN)	J3 (26 PIN) J4 (26 PIN)
ESA51E VER.3 *	J4(50 PIN)	P3(50 PIN) | P1(26 PIN) P2(26 PIN)	J3 (26 PIN) J4 (26 PIN)
ESA 51E VER.4	J4 (26 PIN) J6 (26 PIN)	No Adapter required	J3 (26 PIN) J4 (26 PIN)

*** External Study Card Adapter is required to connect the Study Card with the Trainer**

Connect the Study Card by following the above-mentioned connectors with FRCs respectively.

Switch Off Power to the Trainer while connecting the Study Card. Press Reset after giving power to the Trainer.

8255A

PROGRAMMABLE PERIPHERAL INTERFACE

The Intel 8255A is a general-purpose programmable, parallel I/O device designed for use with Intel Microprocessor. It can be programmed to transfer data under various conditions from simple I/O to Interrupt I/O.

The 8255A has 24 I/O PINS that can be grouped primarily in two 8 Bit parallel ports A & B, with the remaining 8 bits as port C. The 8 bits of port can be used as individual bits or be grouped in two 4bit ports. C_{upper} and C_{lower}. The functions of these ports are defined by writing a control word in the control register.

Figure 1 shows all the functions of 8255A, classified according to two modes: the Bit Set/Reset (BSR) mode and the I/O mode. The I/O mode is further divided into three modes: Mode 0, Mode 1, and Mode 2. . In mode 0, all ports function as simple I/O ports. Mode 1 is a handshake mode whereby ports A and /or B use bits from port C as handshake signals. In the handshake mode, two types of I/O data transfer can be implemented: status checks and interrupt. In Mode 2, port A can be set up for bi-directional data transfer using handshake signals from port C, and port B can be set up either in Mode 0 or Mode 1.

8255A Modes

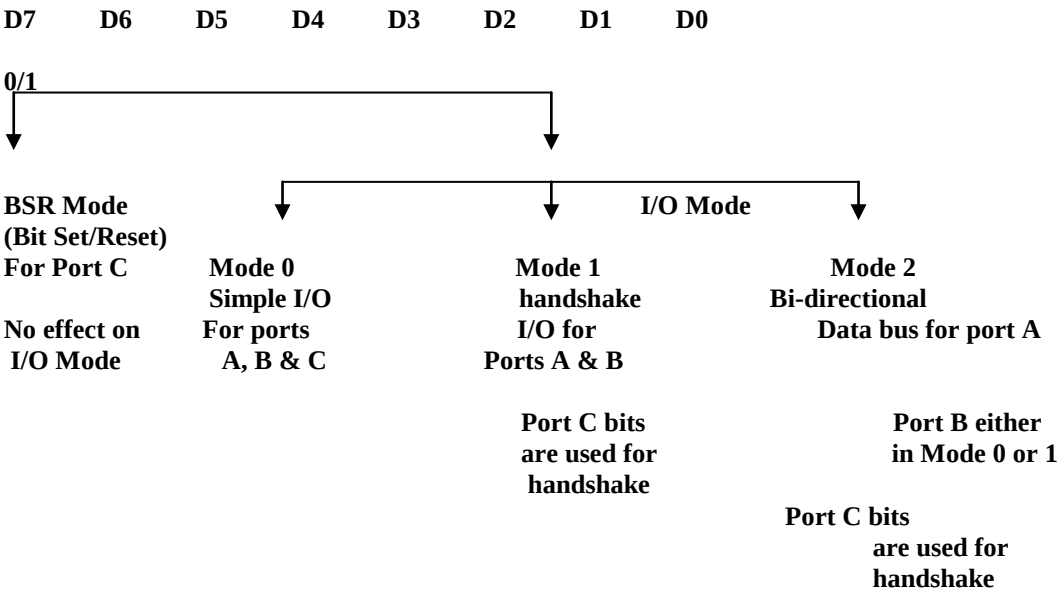


FIG-1

The BSR Mode is used to set or reset the bits in port C. The I/O mode is further divided into three modes. Mode 0, Mode 1 and Mode 2. In Mode 0 all ports functions as simple I/O ports. Mode 1 is a Handshake mode where by ports A&B use bits from port C as Handshake signals.

BLOCK DIAGRAM OF THE 8255A

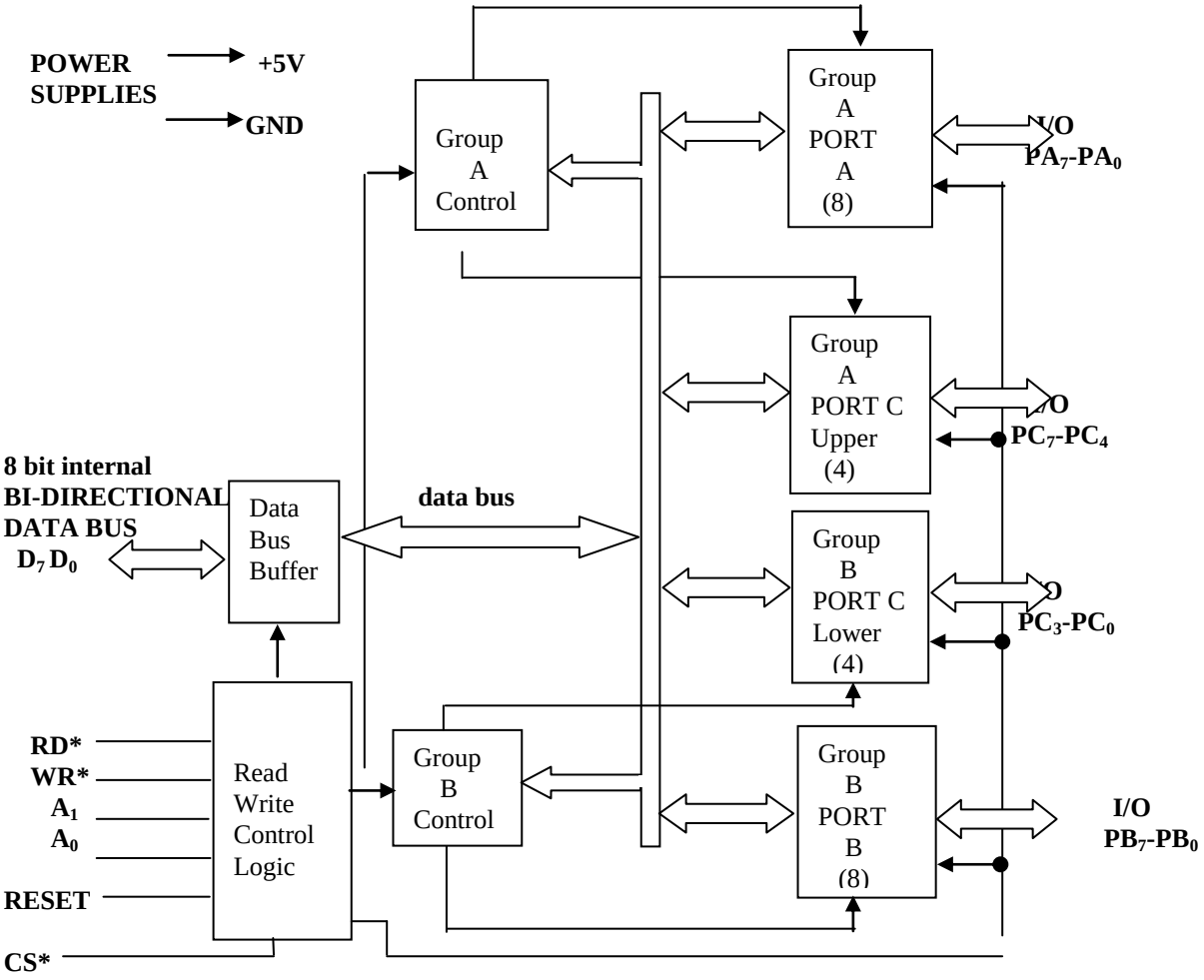


FIG-2

The block diagram shows two 8 bit ports (A&B) and two 4 bit ports ((C_U and C_L), the data bus buffer and control logic.

CONTROL LOGIC:

The control section has six lines. Their functions and connections are as follows

.

RD * (Read) : This control signal enables the Read operation When the signal is low, the CPU reads data from a selected I/O port of the 8255A.

WR* (Write) : This control signal enables the write operation. When the signal goes low, the CPU writes into a selected I/O port or the control register.

RESET (Reset): This is an active high signal, it clears the control register and sets all ports in the input mode.

CS*, A_0 and A1: These are device select signals. CS* is connected to a decoded address and A0 & A1 are generally connected to CPU address lines A_0 & A1 respectively. The 8255A BASIC operation is given in table 1.

Control word Format

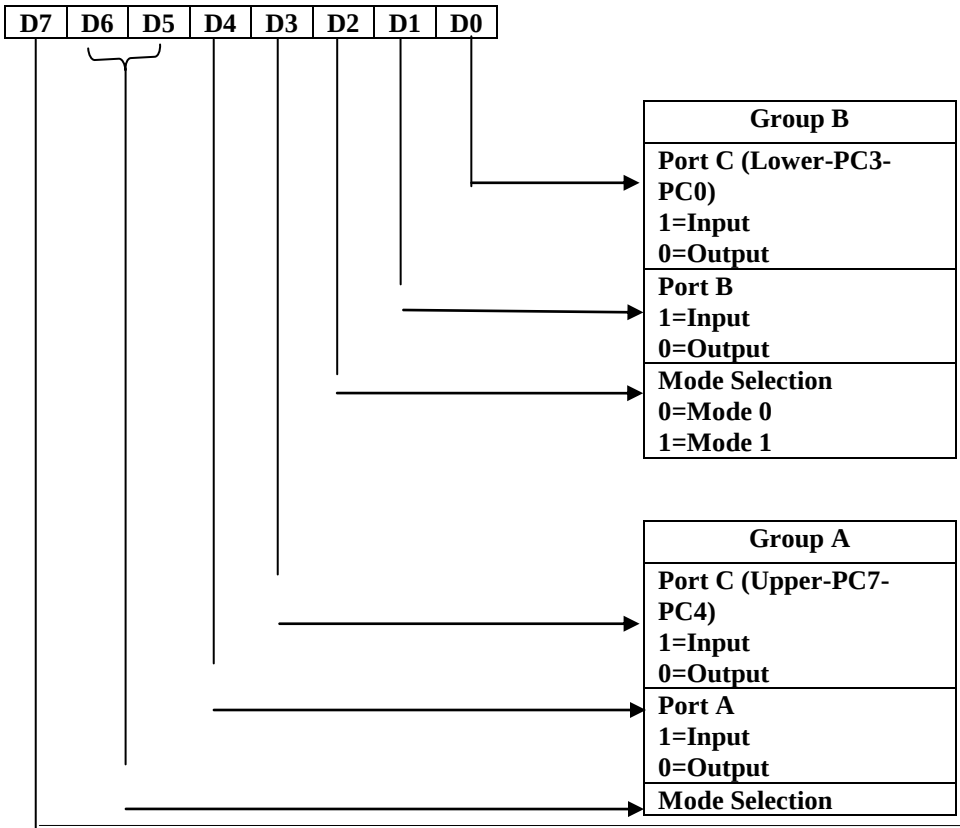
Figure 3 shows a register called the control register. The contents of this register, called the Control word, specify an I/O function for each port. This register can be accessed to write a control word when A0 and A1 are at logic 1, as mentioned previously. The register is not accessible for a Read operation.

Bit D7 of the control register specifies either the I/O function or the Bit Set/Reset function, as classified in Figure 3. If bit D7=1, bits D6-D0 determine I/O functions in various modes, as shown in Figure fig-3. If bit D7=0, port C operates in the Bit Set/Reset (BSR) mode. The BSR control word does not affect the functions of ports A and B (the BSR mode will be described later).

To communicate with peripherals through the 8255A, three steps are necessary:

Determine the addresses of ports A, B, and C and of the control register according to the Chip Select logic and address lines A0 and A1.
Write a control word in the control register.
Write I/O instructions to communicate with peripherals through ports A, B, and C.

Control word



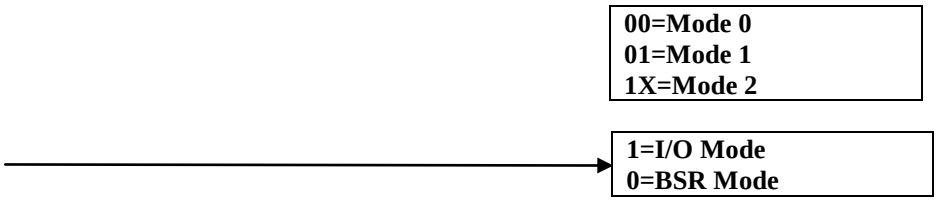


FIG -3

8255A BASIC OPERATION

A_1	A_0	RD*	WR*	CS*	INPUT OPERATION (READ)
0	0	0	1	0	PORT A => DATA BUS
0	1	0	1	0	PORT B => DATA BUS
1	0	0	1	0	PORT C = >DATA BUS
					OUTPUT OPERATION (WRITE)
0	0	1	0	0	DATA BUS => PORT A
0	1	1	0	0	DATA BUS => PORT B
1	0	1	0	0	DATA BUS => PORT C
1	1	1	0	0	DATA BUS = >CONTROL
					DISABLE FUNCTION
X	X	X	X	1	DATA BUS => 3 STATE
1	1	0	1	0	ILLEGAL CONDITION
X	X	1	1	0	DATA BUS => 3 STATE

8255A OPERATIONAL DESCRIPTION

Mode 0 (Basic Input/Output): This functional configuration provides simple Input and Output operations for each of the three ports. No handshaking is required.

MODE 0 Basic Functional Definitions:

- **Two 8-bit ports and two 4-bit ports.**
- **Any port can be input or output.**
- **Outputs are latched.**
- **Inputs are not latched.**
- **16 different Input / Output configurations are possible in this Mode.**

MODE 1 (Strobed Input / Output). This functional configuration provides a means for transferring I/O data to or from a specified Port in conjunction with strobes or "handshaking" signals. In mode 1, Port A and Port B use the lines on Port C to generate or accept these "handshaking" signals.

Mode 1 Basic Functional Definitions:

- **Two Groups (Group A and Group B).**
- **Each group contains one 8-bit data port and one 4-bit control / data port.**
- **The 8-bit data port can be either input or output. Both inputs and outputs are latched.**
- **The 4-bit port is used for control and status of the 8-bit data port.**

Input Control Signal Definition

STB (Strobe Input). A "low" on this input loads data into the input latch.

IBF (Input Buffer Full F / F)

A "high" on this output indicates that the data has been loaded into the input latch; in essence, an acknowledgement IBF is set by STB input being low and is reset by the rising edge of the RD Input.
INTR (Interrupt Request)

A "high" on this output can be used to interrupt the CPU when an input device is requesting service. INTR is set by the STB* is a one", IBF is a "one" and INTE is a "one". It is reset by the falling edge of RD*. This procedure allows an input device to request service from the CPU by simply strobing its data into the port.

INTE A
Controlled by bit set / reset of PC_4.
INTE B
Controlled by bit set / reset of PC_2.

Output Control Signal Definition
OBF* (Output Buffer Full F/F). The OBF output will go "low" to indicate that the CPU has written data out to the specified port. The OBF F/F will be set by the rising edge of the WR input and reset by ACK input being low.

ACK*(Acknowledge input). A "low" on this input informs the 8255A that the data from port A or port B has been accepted. In essence, a response from the peripheral device indicating that it has received the data output by the CPU.

INTR (Interrupt Request). A "high" on this output can be used to interrupt the CPU when an output device has accepted data transmitted by the CPU. INTR is set when ACK is a "one", OBF is a "one". It is reset by the falling edge of WR.

INTE A
Controlled by bit set/reset of PC_6.

INTE B
Controlled by bit set/reset of PC_2.

MODE 2 (Strobed Bi-directional Bus I/O). This functional configuration provides a means for communicating with a peripheral device or structure on a single 8-bit bus for both transmitting and receiving data (bi-directional bus I/O). "Handshaking" signals are provided to maintain proper bus flow discipline in a similar manner to MODE 1. Interrupt generation and enable/disable functions are also available.
MODE 2 Basic Functional Definitions:

- **Used in Group A <u>only.</u>**
- **One 8-bit, bi-directional bus Port (Port A) and a 5-bit control Port (Port C).**
- **Both inputs and outputs are latched.**
- **The 5-bit control port (Port C) is used for control and status for the 8-bit, bi-directional bus port (Port A).**

Control Signal Definition Bi-directional Bus I/O
INTR (Interrupt Request). A high on this output can be used to interrupt the CPU for both input or output operations.

Output Operations

OBF* (Output Buffer Full). The OBF output will go "low" to indicate that the CPU has written data out to port A.

ACK* (Acknowledge). A "low" on this input enables the tri-state output buffer of port A to send out the data. Otherwise, the output buffer will be in the high impedance state.

INTE 1 (The INTE Flip-Flop Associated with OBF). Controlled by bit set/reset of PC_6.

Input Operations

STB* (Strobe Input)

STB (Strobe input). A "low" on this input loads data into the input latch.

IBF (Input Buffer Full F/F). A "high" on this output indicates that data has been loaded into the input latch.

INTE 2 (The INTE Flip-Flop Associated with IBF). Controlled by bit set/reset of PC_4.

4. DEMONSTRATION PROGRAMS FOR 8085 SERIES KIT

4A : DEMONSTRATION PROGRAMS FOR MPS 85-3 TRAINERKIT

Example 1:
Configure 8255A such that Port A & Port B as an Output Port. Execute the program at 8000H.

```
Port A            EQU          80H
Port B            EQU          81H
Control Register  EQU          83H
```

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 80		MVI A,80	Port A and Port B as
8002	D3 83		OUT 83	an Output Port.
8004	3E 55	BACK:	MVI A,55	Output 55 to Port A
8006	D3 80		OUT 80	(Corresponding LEDs
8008	3E AA		MVI A,AA	glows).
800A	D3 81		OUT 81	Output AA to Port B
800C	C3 04 80		JMP BACK	(Corresponding LEDs glows). Repeat the same.

Example 2:
Configure 8255A such that Port A as on Output and Port B as an Input. Execute the program at 8000H.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 82		MVI A,82	PortB as Input and
8002	D3 83		OUT 83	PortA as Output.
8004	DB 81		IN 81	ReadtheDipSwitchesthr
8006	D3 80		OUT 80	oughportB.
8008	EF		RST 5	Output to Port A Stop the Program.

Example 3:
Configure 8255A such that Port A as an Input and Port B as an Output. Execute the program at 8000H.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 90		MVI A,90	Port A as Input and Port B as
8002	D3 83		OUT 83	Output.
8004	DB 80		IN 80	Read the Dipswitches through
8006	D3 81		OUT 81	Port B.
8008	EF		RST 5	Output to Port B. Stop the Program.

SINGLE BIT SET/RESET FEATURE

Important Note: Any of the eight bits of Port C can be set or reset using a single OUT instruction. But before that user will have to initialize 8255 in an out put mode because during reset condition 8255 ports are in input mode.

EXAMPLE 4 : PROGRAMS FOR BSR MODE

Write a BSR control word to set bits PC7 and reset them after certain delay.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 80		MVI A, 80H	
8002	D3 83		OUT 83	
8004	3E 0F		MVI A, 0FH	
8006	D3 83		OUT 83	SET PC7
8008	CD 10 80		CALL DELAY	SOME DELAY
800B	3E 0E		MVI A, 0EH	
800D	D3 83		OUT 83H	RESET PC7
800F	76		HLT	
8010	3E FF	DELAY:	MVI A,0FFH	
8012	0E FF	L2:	MVI C,0FFH	
8014	0D	L1:	DCR C	
8015	C2 14 80		JNZ L1	
8018	3D		DCR A	
8019	C2 12 80		JNZ L2	
	C9		RET	

From the analysis of the routine the following points can be noted.

1) To Set/Reset bits in port C, a control word is written in the control register and not in port C

2) BSR control word affects only one bit in port C

3) The BSR control word does not affect the I/O mode.

EXAMPLE 5: PROGRAMS FOR MODE 1

NOTE: For testing the Mode 1 and Mode 2 operation, connect buffered external interrupt to J5 of the interface.

1. The following program initializes 8255A Port A as on Input in Mode 1 and Port B as an Output in Mode 0.

Read through Input & Output to the data field of the trainer display. If you change the Input and the same will be repeated at data field & Port B. Press S2 switch to simulate STB_A* signal.

Note: Put the jumper at PC_3 connect External interrupt from J4 of pin 7 (i.e RST 5.5) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E B0		MVI A, B0	PortA as input in Mode1
8002	D3 83		OUT 83	
8004	3E 09		MVI A, 09	Set $INTE_A$.
8006	D3 83		OUT 83	
8008	3E 0E		MVI A, 0E	Enable RST 5.5.
800A	30		SIM	
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
8FB3	C3 00 90		JMP 9000	
9000	DB 80	UP:	IN 80	Read through Port A and
9002	D3 81		OUT 81	Output to port B
9004	06 00		MVI B, 00	&
9006	32 F1 8F		STA 8FF1	display it on data field
9009	CD 4C 04		CALL 044C	of the trainer display.
900C	C3 00 90		JMP UP	

Example 6: The following program initializes 8255 Port B as Input in Mode 1 and Port A as on Output in Mode 0. Read through Port B and Output to Port A as well as data field of the trainer display the program is in a continuous loop. If you change the Input the same thing will be repeated at Port B LEDs as well as data field of the trainer display. Press S1 switch to simulate STB_B* signal.

Note: Put the jumper at PC_0. Connect external interrupt from J4 of pin 7 (i.e RST 5.5) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 86		MVI A,86	PortB as an input in Mode1 &
8002	D3 83		OUT 83	Port A as an output in Mode0
8004	3E 05		MVI A,05	Set $INTE_B$
8006	D3 83		OUT 83	
8008	3E 0E		MVI A,0E	Enable RST 5.5
800A	30		SIM	
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
8FB3	C3 00 90		JMP 9000	
9000	DB 81	UP:	IN 81	Read through Port B and
9002	D3 80		OUT 80	output to Port A and display
9004	06 00		MVI B, 00	it on data field of the
9006	32 F1 8F		STA 8FF1	the trainer display
9009	CD 4C 04		CALL 044C	
900C	C3 00 90		JMP UP	

Example 7: The following program initializes 8255 Port A as an Input in Mode1 and Port B as an Output in Mode 0. Read through Input and Output to the data field of the trainer display. Press S2 switch to simulate STB_A*.
Note: Put the jumper at PC3. Connect external interrupt from pin 3 of J3 (i.e. Buffered RST 6.5) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E B0		MVI A, B0	PortA as an input in Mode1
8002	D3 83		OUT 83	&

8004	3E 09		MVI A, 09	PortB as an output in Mode
8006	D3 83		OUT 83	0
8008	3E 0D		MVI A, 0D	Set $INTE_A$
800A	30		SIM	
800B	FB		EI	Enable RST 6.5
800C	C3 0C 80	Loop:	JMP Loop	
8FB9	C3 00 90		JMP 9000	
9000	DB 80	UP:	IN 80	Read through Port A &
9002	D3 81		OUT 81	output to port B
9004	06 00		MVI B, 00	&
9006	32 F1 8F		STA 8FF1	display it on data field of
9009	CD 4C 04		CALL 044C	the trainer display
900C	C3 00 90		JMP UP	

Example 8: The following program initializes 8255A Port B as Input in Mode 1 and Port A as an Output in Mode 0 Read through Port B and Output to Port A as well as data field of the trainer display press S1 switch to simulate STB_B* signal.
Note:Put the jumper at PC0. Connect external interrupt from pin3 of J3. (i.e.RST6.5) to J5 of interface

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 86		MVI A, 86	PortB as an input &
8002	D3 83		OUT 83	PortA as an output
8004	3E 05		MVI A, 05	Set $INTE_B$,
8006	D3 83		OUT 83	
8008	3E 0D		MVI A, 0D	Enable RST 6.5
800A	30		SIM	
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
8FB9	C3 00 90		JMP 9000	
9000	DB 81	UP:	IN 81	Read through portB &
9002	D3 80		OUT 80	output through portA
9004	06 00		MVI B, 00	&
9006	32 F1 8F		STA 8FF1	display it on datafield
9009	CD 4C 04		CALL 044C	of
900C	C3 00 90		JMP UP	the trainer display.

Example 9:. The following program initializes 8255 Port A as an Input in Mode 2 and Port B as Output in Mode 0 press S2 switch.
Note: Put the jumper at PC_3 connect external interrupt RST 6.5 signal to J5 of interface S2 switch to simulate STB_A*.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E D0		MVI A, D0	PortA as on input in Mode2 &
8002	D3 83		OUT 83	portB as on output in Mode 0
8004	3E 09		MVI A, 09	Set $INTE_A$
8006	D3 83		OUT 83	
8008	3E 0D		MVI A, 0D	Enable RST 6.5
800A	30		SIM	

800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
8FB9	C3 00 90		JMP 9000	
9000	DB 80	UP:	IN 80	Read through port A &
9002	D3 81		OUT 81	output through port B
9004	06 00		MVI B, 00	&
9006	32 F1 8F		STA 8FF1	display it on data field of
9009	CD 4C 04		CALL 044C	the trainer display
900C	C3 00 90		JMP UP	

Example 10: The following program initializes 8255A Port B as an Output in Mode1 press S1 switch to simulate ACK_B*.
Note: Put the jumper at PC_3 and connect external interrupt RST 7.5 signal to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E A4		MVI A, A4	Port B an output in Mode
8002	D3 83		OUT 83	1.
8004	3E 05		MVI A, 05	
8006	D3 83		OUT 83	Set $INTE_B$.
8008	3E 1B		MVI A, 1B	
800A	30		SIM	Enable RST 7.5.
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
8FBF	C3 00 90		JMP 9000	
9000	3E 55		MVI A, 55	
9002	06 00		MVI B, 00	Load Accumulator with 55
9004	32 F1 8F	UP:	STA 8FF1	& display it on datafield
9006	CD 4C 04		CALL 044C	of the trainer display. &
9009	D3 81		OUT 81	On the corresponding LEDs
900B	C3 00 90		JMP UP	of port B

Example 11: The following program initializes 8255A Port A as on Output in Mode1. Use RST 7.5 as an interrupt signal press switch to simulate ACK_A*.

Note: Put the jumper at PC_3 and connect external interrupt RST 7.5 signal to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E A0		MVI A, A0	PortA as an output in
8002	D3 83		OUT 83	Mode1
8004	3E 0D		MVI A, 0D	
8006	D3 83		OUT 83	Set $INTE_A$
8008	3E 1B		MVI A, 1B	

800A	30		SIM	Enable RST 7.5
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
8FBF	C3 00 90		JMP 9000	
9000	3E 55	UP:	MVI A, 55	
9002	06 00		MVI B, 00	Load Accumulator with 55
9004	32 F1 8F		STA 8FF1	& display it on datafield
9006	CD 4C 04		CALL 044C	of the trainer display &
9009	D3 80		OUT 80	On the corresponding LEDs
900B	C3 00 90		JMP UP	of port A

Example 12: The following program initializes 8255A Port A as an Input in Mode1 and Port B as an output in Mode 0. Press S2 switch to simulate STB_A*.

Note: Put the jumper at PC0 connect external interrupt RST 7.5 signal to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E B0		MVI A, B0	PortA as an input in Mode1
8002	D3 83		OUT 83	PortB as an output in
8004	3E 09		MVI A, 09	Mode0. Set $INTE_A$
8006	D3 83		OUT 83	
8008	3E 1B		MVI A, 1B	Enable RST 7.5
800A	30		SIM	
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
8FBF	C3 00 90		JMP 9000	
9000	DB 80	UP:	IN 80	Read through Port A &
9002	D3 81		OUT 81	output to Port B
9004	06 00		MVI B, 00	&
9006	32 F1 8F		STA 8FF1	display it on at data
9009	CD 4C 04		CALL 044C	field of the trainer
900C	C3 00 90		JMP UP	display

Example 13: The following program initializes 8255A Port B as an Input in Mode1 and Port A as an output in Mode 0. Press S1 switch to simulate STB_B*.

Note: Put the jumper at PC0 connect external interrupt RST 7.5 signal to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 86		MVI A, 86	PortB as an input in
8002	D3 83		OUT 83	Mode1.PortA as an output
8004	3E 05		MVI A, 05	in Mode0. Set $INTE_B$
8006	D3 83		OUT 83	
8008	3E 1B		MVI A, 1B	Enable RST 7.5
800A	30		SIM	

800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
8FBF	C3 00 90		JMP 9000	
9000	DB 81	UP:	IN 81	Read through Port B &
9002	D3 80		OUT 80	Output to Port A
9004	06 00		MVI B, 00	&
9006	32 F1 8F		STA 8FF1	display it on datafield
9009	CD 4C 04		CALL 044C	of the trainer display
900C	C3 00 90		JMP UP	

8255A MODE 2 Bi-directional Input/Output

Example 14: The following program initializes 8255 in Mode 2 .
Press S3 switch to simulate ACK_A*.
Note: Put the jumper at PC3. Connect external interrupt from JP10 (i.e RST 7.5) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E C0		MVI A, C0	PortA as an output in Mode2
8002	D3 83		OUT 83	
8004	3E 0D		MVI A, 0D	Set $INTE_1$
8006	D3 83		OUT 83	
8008	3E 1B		MVI A, 1B	
800A	30		SIM	Enable RST 7.5
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
FE12	C3 00 90		JMP 9000	
9000	DB 80	UP:	IN 80	READ DIP SWITCH2 POSITION
9002	D3 81		OUT 81	AND DISPLAY IT ON THE DATA
9004	06 00		MVI B, 00	FIELD OF THE TRAINER AND ON
9006	32 75 FE		STA FE75	THE PORT B LEDs.
9009	CD 78 05		CALL 0578	
900C	3E F0		MVI A,F0	SHOW F0 ON PORT A LEDS .
900E	D3 80		OUT 80	AFTER PUTINGING DIPSWITCH 1
9010	C3 00 90		JMP UP	IN OFF POSITION AND THEN
				PRESSING AND HOLDING S3.

FOLLOWING PROCEDURE SHOULD BE FOLLOWED FOR USING THIS PROGRAM IN MODE 2

1. **KEEP DIP SWITCH 1 IN ON POSITION AND DIP SWITCH 2 IN POSITION CORRESPONDING TO THE DATA WHICH U WANT TO SEND AS IN PUT FROM PORT A.**
2. **INTERRUPT 7.5**
3. **KEEP DIP SWITCH1 IN OFF POSITION**

4. PRESS S3 AND HOLD IT .THE CORRESPONDING PORT A LEDs WILL SHOW F0. THIS DISPLAY CAN BE CHANGED BY CHANGING THE OPERAND OF MVI A INSTRUCTION AT MEMORY LOCATION 900C IN ABOVE PROGRAM .

NOTE : DON'T PRESS S1 OR S2 SWITCH AFTER PUTTING DIP SWITCH 1 IN OFF POSITION.

WHILE PRESSING AND HOLDING S3 YOU CAN SEE THAT THE PORT A WORKING AS OUTPUT PORT.

4B: DEMONSTRATION PROGRAMS FOR ESA 85-2 TRAINER KIT

RAM addresses for Interrupts

RST 5.5 → FE06H
RST 6.5 → FE0CH
RST 7.5 → FE12H

Example 1:
Configure 8255A such that Port A & Port B as an Output Port. Execute the program at 8000H.

```
Port A           EQU        80H
Port B           EQU        81H
Control Register EQU        83H
```

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 80		MVI A,80	Port A and Port B as an Output Port.
8002	D3 83		OUT 83	
8004	3E 55	BACK:	MVI A,55	Output 55 to Port A (Corresponding LEDs glows).
8006	D3 80		OUT 80	
8008	3E AA		MVI A,AA	Output AA to Port B (Corresponding LEDs glows). Repeat the same.
800A	D3 81		OUT 81	
800C	C3 04 80		JMP BACK	

Example 2:
Configure 8255A such that Port A as on Output and Port B as an Input. Execute the program at 8000H.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 82		MVI A,82	PortB as Input and PortA as Out put.Read the Dip Switches through port B. Output to Port A Stop the Program.
8002	D3 83		OUT 83	
8004	DB 81		IN 81	
8006	D3 80		OUT 80	
8008	DF		RST 3	

Example 3:
Configure 8255A such that Port A as an Input and Port B as an Output. Execute the program at 8000H.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 90		MVI A,90	Port A as Input and Port B as
8002	D3 83		OUT 83	Output.
8004	DB 80		IN 80	Read the Dipswitches through
8006	D3 81		OUT 81	PortB.
8008	DF		RST 3	Output to Port B.
				Stop the Program.

SINGLE BIT SET/RESET FEATURE
Any of the eight bits of Port C can be set or reset using a single OUT instruction. But before that user will have to initialize 8255 in an out put mode, because during reset condition, the 8255 ports will be in input mode.

Example 4: PROGRAMS FOR BSR MODE
Write a BSR control word to set bits PC7 and reset them after certain delay.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 80		MVI A, 80H	
8002	D3 83		OUT 83	
8004	3E 0F		MVI A, 0FH	
8006	D3 83		OUT 83	SET PC7
8008	CD 10 80		CALL DELAY	SOME DELAY
800B	3E 0E		MVI A, 0EH	
800D	D3 83		OUT 83H	RESET PC7
800F	76		HLT	
8010	3E FF	DELAY:	MVI A,0FFH	
8012	0E FF	L2:	MVI C,0FFH	
8014	0D	L1:	DCR C	
8015	C2 14 80		JNZ L1	
8018	3D		DCR A	
8019	C2 12 80		JNZ L2	
	C9		RET	

From the analysis of the routine the following points can be noted.
1) To Set/Reset bits in port C, a control word is written in the control register and not in port C
2) BSR control word affects only one bit in port C
3) The BSR control word does not affect the I/O mode.

Example 5: PROGRAMS FOR MODE 1
NOTE: For testing the Mode 1 and Mode 2 operation, connect <u>buffered</u> external interrupt to J5 of the interface.
1. The following program initializes 8255A Port A as on Input in Mode 1 and Port B as an Output in Mode 0.
Read through Input & Output to the data field of the trainer display. If you change the Input and the same will be repeated at data field & Port B. Press S2 switch to simulate STB_A* signal.
Note: Put the jumper at PC_3 connect External interrupt from JP12 of trainer (i.e RST 5.5) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E B0		MVI A, B0	PortA as input in Mode1
8002	D3 83		OUT 83	
8004	3E 09		MVI A, 09	Set $INTE_A$.
8006	D3 83		OUT 83	

8008	3E 0E		MVI A, 0E	Enable RST 5.5.
800A	30		SIM	
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
FE06	C3 00 90		JMP 9000	
9000	DB 80	UP:	IN 80	Read through Port A and
9002	D3 81		OUT 81	Output to port B
9004	06 00		MVI B, 00	&
9006	32 75 FE		STA FE75	display it on datafield of
9009	CD 78 05		CALL 0578	the trainer display.
900C	C3 00 90		JMP UP	

Example 6: The following program initializes 8255 Port B as Input in Mode 1 and Port A as on Output in Mode 0. Read through Port B and Output to Port A as well as data field of the trainer display the program is in a continuous loop. If you change the Input the same thing will be repeated at Port B LEDs as well as data field of the trainer display. Press S1 switch to simulate STB_B* signal.
Note: Put the jumper at PC_0. Connect external interrupt from JP12 of trainer (i.e RST 5.5) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 86		MVI A,86	PortB as an input in Mode1 &
8002	D3 83		OUT 83	Port A as an output in Mode0
8004	3E 05		MVI A,05	Set $INTE_B$
8006	D3 83		OUT 83	
8008	3E 0E		MVI A,0E	Enable RST 5.5
800A	30		SIM	
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
FE06	C3 00 90		JMP 9000	
9000	DB 81	UP:	IN 81	Read through Port B and
9002	D3 80		OUT 80	output to Port A and display
9004	06 00		MVI B, 00	it on data field of the
9006	32 75 FE		STA FE75	the trainer display
9009	CD 78 05		CALL 0578	
900C	C3 00 90		JMP UP	

Example 7: The following program initializes 8255 Port A as an Input in Mode1 and Port B as an Output in Mode 0. Read through Input and Output to the data field of the trainer display. Press S2 switch to simulate STB_A*.
Note: Put the jumper at PC3. Connect external interrupt from JP11 of trainer (i.e Bufferd RST 6.5) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E B0		MVI A, B0	PortA as an input in Mode1 &
8002	D3 83		OUT 83	PortB as an output in Mode 0
8004	3E 09		MVI A, 09	Set $INTE_A$
8006	D3 83		OUT 83	
8008	3E 0D		MVI A, 0D	Enable RST 6.5

800A	30		SIM	
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
FE0C	C3 00 90		JMP 9000	
9000	DB 80	UP:	IN 80	Read through Port A &
9002	D3 81		OUT 81	output to port B
9004	06 00		MVI B, 00	&
9006	32 75 FE		STA FE75	display it on data field of
9009	CD 78 05		CALL 0578	the trainer display
900C	C3 00 90		JMP UP	

Example 8:The following program initializes 8255A Port B as Input in Mode 1 and Port A as an Output in Mode 0 Read through Port B and Output to Port A as well as data field of the trainer display press S1 switch to simulate STB_B* signal.

Note: Put the jumper at PC0. Connect external interrupt from JP11 of trainer (i.e. RST 6.5) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 86		MVI A, 86	PortB as an input &
8002	D3 83		OUT 83	PortA as an output
8004	3E 05		MVI A, 05	Set $INTE_B$,
8006	D3 83		OUT 83	
8008	3E 0D		MVI A, 0D	Enable RST 6.5
800A	30		SIM	
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
FE0C	C3 00 90		JMP 9000	
9000	DB 81	UP:	IN 81	Read through port B &
9002	D3 80		OUT 80	output through port A
9004	06 00		MVI B, 00	&
9006	32 75 FE		STA FE75	display it on data field
9009	CD 78 05		CALL 0578	of
900C	C3 00 90		JMP UP	the trainer display.

Example 9: The following program initializes 8255 Port A as an Input in Mode 2 and Port B as Output in Mode 0.
Note: Put the jumper at PC_3 connect external interrupt from JP11 of trainer (i.e RST 6.5 signal) to J5 of interface.

Press S2 switch to simulate STB_A*.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E D0		MVI A, D0	PortA as on input in Mode2 &
8002	D3 83		OUT 83	PortB as on output in Mode 0
8004	3E 09		MVI A, 09	Set $INTE_A$
8006	D3 83		OUT 83	

```
8008    3E 0D          MVI  A, 0D   Enable RST 6.5
800A    30             SIM
800B    FB             EI
800C    C3 0C 80  Loop: JMP  Loop

FE0C    C3 00 90       JMP  9000

9000    DB 80     UP:  IN   80     Read through port A &
9002    D3 81          OUT  81     Output through port B
9004    06 00          MVI  B, 00          &
9006    32 75 FE       STA  FE75   display it on datafield of
9009    CD 78 05       CALL 0578   the trainer display
900C    C3 00 90       JMP UP
```

Example 10:The following program initializes 8255A Port B as an Output in Mode1 press S1 switch to simulate ACK_B*.

Note: Put the jumper at PC_3 and connect external interrupt from JP10 of trainer (i.e RST 7.5 signal) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E A4		MVI A, A4	Port B an output in Mode 1.
8002	D3 83		OUT 83	
8004	3E 05		MVI A, 05	Set $INTE_B$.
8006	D3 83		OUT 83	
8008	3E 1B		MVI A, 1B	Enable RST 7.5.
800A	30		SIM	
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
FE12	C3 00 90		JMP 9000	
9000	3E 55	UP:	MVI A, 55	Load Accumulator with 55
9002	06 00		MVI B, 00	& display it on datafield of
9004	32 75 FE		STA FE75	the trainer display & On the
9006	CD 78 05		CALL 0578	corresponding LEDs of port B
9009	D3 81		Out 81	
900B	C3 00 90		JMP UP	

Example 11: The following program initializes 8255A Port A as on Output in Mode1. Use RST 7.5 as an interrupt signal press switch S3 to simulate ACK_A*.
Note: Put the jumper at PC_3 and connect external interrupt from JP10 of trainer (i.e RST 7.5 signal)to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E A0		MVI A, A0	PortA as an output in Mode1
8002	D3 83		OUT 83	
8004	3E 0D		MVI A, 0D	Set $INTE_A$
8006	D3 83		OUT 83	
8008	3E 1B		MVI A, 1B	Enable RST 7.5
800A	30		SIM	
800B	FB		EI	

800C	C3 0C 80	Loop:	JMP Loop	
FE12	C3 00 90		JMP 9000	
9000	3E 55	UP:	MVI A, 55	Load Accumulator with 55
9002	06 00		MVI B, 00	& display it on datafield of
9004	32 75 FE		STA FE75	the trainer display & On the
9006	CD 78 05		CALL 0578	corresponding LEDs of port A
9009	D3 80		OUT 80	
900B	C3 00 90		JMP UP	

Example 12: The following program initializes 8255A Port A as an Input in Mode1 and Port B as an output in Mode 0. Press S2 switch to simulate STB_A*.

Note: Put the jumper at PC3 connect external interrupt from JP10 of trainer (i.e RST 7.5 signal) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E B0		MVI A, B0	PortA as an input in Mode1
8002	D3 83		OUT 83	
8004	3E 09		MVI A, 09	Set $INTE_A$
8006	D3 83		OUT 83	
8008	3E 1B		MVI A, 1B	Enable RST 7.5
800A	30		SIM	
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
FE12	C3 00 90		JMP 9000	
9000	DB 80	UP:	IN 80	Read through Port A &
9002	D3 81		OUT 81	output to Port B
9004	06 00		MVI B, 00	&
9006	32 75 FE		STA FE75	display it on at data field
9009	CD 78 05		CALL 0578	of the trainer display
900C	C3 00 90		JMP UP	

Example 13: The following program initializes 8255A Port B as an Input in Mode1 and Port A as an output in Mode 0. Press S1 switch to simulate STB_B*.

Note: Put the jumper at PC0 connect external interrupt from JP10 of trainer (RST 7.5 signal) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E 86		MVI A, 86	PortB as an input in Mode1
8002	D3 83		OUT 83	
8004	3E 05		MVI A, 05	Set $INTE_B$
8006	D3 83		OUT 83	
8008	3E 1B		MVI A, 1B	Enable RST 7.5
800A	30		SIM	

800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
FE12	C3 00 90		JMP 9000	
9000	DB 81	UP:	IN 81	Read through Port B &
9002	D3 80		OUT 80	Output to Port A
9004	06 00		MVI B, 00	&
9006	32 75 FE		STA FE75	display it on datafield of
9009	CD 78 05		CALL 0578	the trainer display
900C	C3 00 90		JMP UP	

8255A MODE2 Bi-directional Input/Output

Example 14: The following program initializes 8255 in Mode 2 .
Press S3 switch to simulate ACK_A*.
Note: Put the jumper at PC3. Connect external interrupt from JP10 (i.e RST 7.5) to J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	3E C0		MVI A, C0	PortA as an output in Mode2
8002	D3 83		OUT 83	
8004	3E 0D		MVI A, 0D	Set $INTE_1$
8006	D3 83		OUT 83	
8008	3E 1B		MVI A, 1B	
800A	30		SIM	Enable RST 7.5
800B	FB		EI	
800C	C3 0C 80	Loop:	JMP Loop	
FE12	C3 00 90		JMP 9000	
9000	DB 80	UP:	IN 80	READ DIP SWITCH2 POSITION
9002	D3 81		OUT 81	AND DISPLAY IT ON THE DATA
9004	06 00		MVI B, 00	FIELD OF THE TRAINER AND ON
9006	32 75 FE		STA FE75	THE PORT B LEDs.
9009	CD 78 05		CALL 0578	
900C	3E F0		MVI A,F0	SHOW F0 ON PORT A LEDS .
900E	D3 80		OUT 80	AFTER PUTING DIPSWITCH 1 IN
9010	C3 00 90		JMP UP	OFF POSITION AND THEN
				PRESSING AND HOLDING S3.

FOLLOWING PROCEDURE SHOULD BE FOLLOWED FOR USING ABOVE PROGRAM IN MODE 2

1. **KEEP DIP SWITCH 1 IN ON POSITION AND DIP SWITCH 2 IN POSITION CORRESPONDING TO THE DATA WHICH U WANT TO SEND AS IN PUT FROM PORT A.**

2. **INTERRUPT 7.5**

3. **KEEP DIP SWITCH1 IN OFF POSITION**

4. **PRESS S3 AND HOLD IT .THE CORRESPONDING PORT A LEDs WILL SHOW F0. THIS DISPLAY CAN BE CHANGED BY CHANGING THE OPERAND OF MVI A INSTRUCTION AT MEMORY LOCATION 900C IN ABOVE PROGRAM .**

NOTE : DON'T PRESS S1 OR S2 SWITCH AFTER PUTTING DIP SWITCH 1 IN OFF POSITION. WHILE PRESSING AND HOLDING S3 YOU CAN SEE THAT THE PORT A WORKING AS OUTPUT PORT.

5 : DEMONSTRATION PROGRAMS FOR 8051 SERIES KIT

5A: EXAMPLE PROGRAM FOR ESA 31 TRAINER KIT

Configuration and Setting details:

For interfacing the study cards with ESA 31 trainers study card adapter is provided with the study cards. Connect by using 50 pin FRC from Study card adapter to ESA 31 kit J5 connector. Connect by using two 26 pin FRC between J3 and J4 of study card adapter with the study card respectively

Connector J2 of 8255A Study Card can be interfaced with any ESA Interfaces (e.g. Logic Controller).

The interface derives its power via system connector. No external power supply is required. Provision is made for external power supply also.

EXAMPLE PROGRAMS FOR ESA 31 TRAINERS IN MODE 0

Example 1: Configure 8255A such that Port A & Port B as an Output Port. Execute the Program at 8000H

PORT A = F180H
PORT B = F181H
PORT C = F182H
CTRL REG = F183H

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	
8003	74 80		MOV A,#80	PORT A & B AS OUTPUT PORTS
8005	F0		MOVX @DPTR,A	
8006	90 F1 80		MOV DPTR,#F180	
8009	74 55		MOV A,#55	
800B	F0		MOVX @DPTR,A	
800C	74 66		MOV A,#66	
800E	A3		INC DPTR	
800F	F0		MOVX @DPTR,A	
8010	80 FE		SJMP 8010	

Example 2. Configure 8255A such that Port A as an Output & Port B as an Input
Execute the Program at 8000H

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS

8000	90 F1 83		MOV DPTR,#F183	
8003	74 82		MOV A,#82	PORT A AS
8005	F0		MOVX @DPTR,A	O/P PORT B
8006	90 F1 81		MOV DPTR,#F181	AS I/P
8009	E0		MOVX A,@DPTR	
800A	15 82		DEC 82	
800C	F0		MOVX @DPTR,A	DPL=82
800D	80 F7		SJMP 8006	

Example 3. Configure 8255A such that Port A as an Input & Port B as an Output. Execute the Program at 8000H

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	
8003	74 90		MOV A,#90	PORT A AS
8005	F0		MOVX @DPTR,A	I/P PORT B
8006	90 F1 80		MOV DPTR,#F180	AS O/P
8009	E0		MOVX A,@DPTR	
800A	A3		INC DPTR	
800B	F0		MOVX @DPTR,A	
800C	80 F8		SJMP 8006	

EXAMPLE PROGRAM OF BSR MODE

SINGLE BIT SET/RESET FEATURE

Any of the eight bits of Port C can be set or reset using a single OUT instruction. But before that programmer will have to initialize 8255 in any input/out put mode.

Example 4 : PROGRAMS FOR BSR MODE

Write a BSR control word to set bits PC7 and reset them after certain delay. This is a continuous loop PC7 will set and reset continuously.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	74 80		MOV A,#80	
8002	90 F1 83		MOV DPTR,#0F183	
8005	F0		MOVX @DPTR,A	
8006	74 0F		MOV A,#0F	
8008	F0		MOVX @DPTR,A	
8009	12 80 13		LCALL 8013	CALL DELAY
800c	14		DEC A	
800D	F0		MOVX @DPTR,A	
800E	12 80 13		LCALL 8013	CALL DELAY
8011	80 80 06		SJMP 8006	
8013	7F FF		MOV R7,#0FF	DELAY SUB RUTINE
8015	7E FF		MOV R6,#0FF	
8017	DE FE		DJNZ R6,8017	
	DF FA		DJNZ R7,8015	
	32		RET	

From the analysis of the routine the following points can be noted.

1) **To Set/Reset bits in port C, a control word is written in the control register and not in port C**

2) **BSR control word affects only one bit in port C**

3) The BSR control word does not affect the I/O mode.

EXAMPLE PROGRAMS FOR MODE 1

NOTE: For testing the Mode 1 and Mode 2 operation, Connect buffered external interrupt to J5 of the interface.

Example 5: The following program initializes 8255 Port A as Input configuration in Mode 1. Reading through the Port A(Input) , output to the Port B.

If you change the input the same thing will be repeated. Press S2 switch. To simulate STB_A * signal

NOTE: Put the jumper at PC3. INTERRUPT ENABLE REGISTER ADDRESS IS = 0A8

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	INITIALIZE
8003	74 B0		MOV A,#0B0	8255 PORT A AS
8005	F0		MOVX @DPTR,A	INPUT IN MODE1
8006	74 09		MOV A,#09	SET INTEA
8008	F0		MOVX @DPTR,A	
8009	75 A8 84		MOV 0A8,#84	ENABLE
800C	80 FE		SJMP 800C	INTERRUPT
FFF3	02 90 00		LJMP 9000	
9000	90 F1 80		MOV DPTR,#F180	
9003	EO		MOVX A,@DPTR	
9004	90 F1 81		MOV DPTR,#F181	
9007	F0		MOVX @DPTR,A	
9008	02 90 00		SJMP 9000	

Example 6: The following program initializes 8255 Port B as Input configuration in Mode 1. Reading through Port B and Output to Port A .
If you change the input the same thing will be repeated at Port A LEDs. Press S1 switch to simulate STB_B * signal.

Note: Put the jumper at PC0. INTERRUPT ENABLE REGISTER ADDRESS IS = 0A8

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	Initialize 8255 Port B as input in mode1
8003	74 86		MOV A,#86	
8005	F0		MOVX @DPTR,A	
8006	74 05		MOV A,#05	Set INTEB
8008	F0		MOVX @DPTR,A	
8009	75 A8 84		MOV 0A8,#84	Enable interrupt
800c	80 FE		SJMP 800C	

FFF3	02 90 00		LJMP 9000	
9000	90 F1 80		MOV DPTR,#F181	
9003	EO		MOVX A,@DPTR	
9004	90 F1 81		MOV DPTR,#F180	
9007	F0		MOVX @DPTR,A	
9008	80 F6		SJMP 9000	

Example 7: The following program initializes Port A as output port in Mode 1 and writes the Data 55H to Port A, upon giving ACK_A* signal it will interrupt the processor.

Press S3 switch to simulate ACK_A*signal. Then it will write Data AAH to port A.

Note: **Put the jumper at PC3.** **INTERRUPT ENABLE REGISTER ADDRESS IS = 0A8**

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	Initialize 8255 Port A as input in mode1
8003	74 A0		MOV A,#0A0	
8005	F0		MOVX @DPTR,A	
8006	74 0D		MOV A,#0D	Set INTEA
8008	F0		MOVX @DPTR,A	
8009	74 55		MOV A,#55	
800B	90 F1 80		MOV DPTR,#F180	
800E	F0		MOVX @DPTR,A	
800F	75 A8 84		MOV 0A8,#84	Enable interrupt
8012	80 FE		SJMP 8012	
FFF3	02 90 00		LJMP 9000	Interrupt routine
9000	74 AA		MOV A,#AA	
9002	90 F1 80		MOV DPTR,#F180	
9005	F0		MOVX @DPTR,A	
9006	80 F8		SJMP 9000	

Example 8: The following program initializes Port B as output port in Mode 1 and writes the Data 55H to Port B. upon giving ACK_B* signal it will interrupt the processor.

Press S1 switch to simulate ACK_B*signal. Then it will write Data AAH to port B.

Note: Put the jumper at PC0. **INTERRUPT ENABLE REGISTER ADDRESS IS = 0A8**

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS

8000
8003
8005
8006
8008
8009
800B
800E
800F
8012
 	
FFF3
 	
9000
9002
9005
9006
	90 F1 83
	74 84
	F0
	74 05
	F0
	74 55
	90 F1 81
	F0
	75 A8 84
	80 FE
	
	02 90 00
	
	74 AA
	90 F1 81
	F0
	80 F8
			MOV DPTR,#F183
			MOV A,#084
			MOVX @DPTR,A
			MOV A,#05
			MOVX @DPTR,A
			MOV A,#55
			MOV DPTR,#F181
			MOVX @DPTR,A
			MOV 0A8,#84
			SJMP 8012
			
			LJMP 9000
			
			MOV A,#AA
			MOV DPTR,#F181
			MOVX @DPTR,A
			SJMP 9000
				Initialize 8255 Port A as input in mode1
				
				Set INTEA
				
				Enable interrupt

Example 9: The following program initializes 8255A in Mode 2. Press S3 switch To simulate STB_A * signal

Note: Put the jumper at PC3. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS

8000
8003
8005
8006
8008
8009
800c
 	
FFF3
 	
9000
9003
9004
9005
9006
9008
900B
900D
900F
9010
	90 F1 83
	74 C0
	F0
	74 0D
	F0
	75 A8 84
	80 FE
	
	02 90 00
	
	90 F1 80
	E0
	A3
	FO
	75 60
	12 01 9B
	74 F0
	15 82
	F0
	80 EE
			MOV DPTR,#F183
			MOV A,#0C0
			MOVX @DPTR,A
			MOV A,#0D
			MOVX @DPTR,A
			MOV 0A8,#84
			SJMP 800C
			
			LJMP 9000
			
			MOV DPTR,#F180
			MOVX A,@DPTR
			INC DPTR
			MOVX @DPTR,A
			MOV 60,A
			LCALL 019B
			MOV A,#0F0
			DEC 82
			MOVX @DPTR,A
			SJMP 9000
				Initialize 8255 Port A as input in mode2
				
				Set INTEA
				
				Enable interrupt
				
				READ DIP SWITCH2 POSITION AND DISPLAY IT ON THE DATA FIELD OF THE TRAINER AND ON THE PORT B LEDs.
				
				SHOW F0 ON PORT A LEDS . AFTER PUTING DIPSWITCH 1 IN OFF POSITION AND THEN PRESSING AND HOLDING S3.

FOLLOWING PROCEDURE SHOULD BE FOLLOWED FOR USING ABOVE PROGRAM IN MODE 2

- **ADJUST DIP SWITCH 1 IN ON POSITION AND DIP SWITCH 2 IN POSITION CORRESPONDING TO THE DATA WHICH U WANT TO SEND AS IN PUT FROM PORT A.**
- **INTERRUPT 7.5**
- **ADJUST DIP SWITCH1 IN OFF POSITION**
- **PRESS S3 AND HOLD IT .THE CORRESPONDING PORT A LEDs WILL SHOW F0. THIS DISPLAY CAN BE CHANGED BY CHANGING THE OPERAND OF MVI A INSTRUCTION AT MEMORY LOCATION 900C IN ABOVE PROGRAM .**

NOTE : DON'T PRESS S1 OR S2 SWITCH AFTER PUTTING DIP SWITCH 1 IN OFF POSITION. WHILE PRESSING AND HOLDING S3 YOU CAN SEE THAT THE PORT A WORKING AS OUTPUT PORT.

5B: DEMONSTRATION PROGRAMS FOR ESA 51 TRAINER KIT

EXAMPLE PROGRAMS FOR ESA 51 TRAINERS IN MODE 0

Example 1: Configure 8255A such that Port A & Port B as an Output Port.
Execute the Program at 8000H

PORT A = F180H
PORT B = F181H
PORT C = F182H
CTRL REG = F183H

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	
8003	74 80		MOV A,#80	PORT A & B AS OUTPUT PORTS
8005	F0		MOVX @DPTR,A	
8006	90 F1 80		MOV DPTR,#F180	
8009	74 55		MOV A,#55	
800B	F0		MOVX @DPTR,A	
800C	74 66		MOV A,#66	
800E	A3		INC DPTR	
800F	F0		MOVX @DPTR,A	
8010	80 FE		SJMP 8010	

Example 2: Configure 8255A such that Port A as an Output & Port B as an Input
Execute the Program at 8000H

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS

8000	90 F1 83		MOV DPTR,#F183	
8003	74 82		MOV A,#82	PORT A AS
8005	F0		MOVX @DPTR,A	O/P PORT B
8006	90 F1 81		MOV DPTR,#F181	AS I/P
8009	E0		MOVX A,@DPTR	
800A	15 82		DEC 82	
800C	F0		MOVX @DPTR,A	DPL=82
800D	80 F7		SJMP 8006	

Example 3:Configure 8255A such that Port A as an Input & Port B as an Output
Execute the Program at 8000H

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	PORT A AS
8003	74 90		MOV A,#90	I/P PORT B
8005	F0		MOVX @DPTR,A	AS O/P
8006	90 F1 80		MOV DPTR,#F180	
8009	E0		MOVX A,@DPTR	
800A	A3		INC DPTR	
800B	F0		MOVX @DPTR,A	
800C	80 F8		SJMP 8006	

Example 4: PROGRAM OF BSR MODE
SINGLE BIT SET/RESET FEATURE
Any of the eight bits of Port C can be set or reset using a single OUT instruction. But before that user will have to initialize 8255 in an output mode, because by reset the 8255 ports will be input condition.
EXAMPLE: PROGRAMS FOR BSR MODE
Write a BSR control word to set bits PC7 and reset them after certain delay. This is a continuous loop PC7 will set and reset continuously.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	74 80		MOV A,#80	
8002	90 F1 83		MOV DPTR,#0F183	
8005	F0		MOVX @DPTR,A	
8006	74 0F		MOV A,#0F	
8008	F0		MOVX @DPTR,A	
8009	12 80 13		LCALL 8013	CALL DELAY
800c	14		DEC A	
800D	F0		MOVX @DPTR,A	
800E	12 80 13		LCALL 8013	CALL DELAY
8011	80 YY		SJMP 8006	
8013	7F FF		MOV R7,#0FF	DELAY SUB RUTINE
8015	7E FF		MOV R6,#0FF	
8017	DE FE		DJNZ R6,8017	
	DF FA		DJNZ R7,8015	
	32		RET	

From the analysis of the routine the following points can be noted.
1) To Set/Reset bits in port C, a control word is written in the control register and not in port C
2) BSR control word affects only one bit in port C
3) The BSR control word does not affect the I/O mode.

EXAMPLE PROGRAMS FOR IN MODE 1

NOTE: For testing the Mode 1 and Mode 2 operation, Connect buffered external interrupt to J5 of the interface.

Example 5: The following program initializes 8255 Port A as Input in Mode 1.
Reading through the Port A(Input) , output to the Port B.
Press S2 switch to simulate STB_A * signal

Note: Put the jumper at PC3. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	Initialize
8003	74 B0		MOV A,#0B0	8255 Port A as
8005	F0		MOVX @DPTR,A	input in mode1
8006	74 09		MOV A,#09	Set INTEA
8008	F0		MOVX @DPTR,A	Enable
8009	75 A8 84		MOV 0A8,#84	interrupt
800c	80 FE		SJMP 800C	
FFF3	02 90 00		LJMP 9000	
9000	90 F1 80		MOV DPTR,#F180	
9003	EO		MOVX A,@DPTR	
9004	90 F1 81		MOV DPTR,#F181	
9007	F0		MOVX @DPTR,A	
9008	80 F6		SJMP 9000	

Example 6: The following program initializes 8255 Port B as Input in Mode 1. Reading through Port B and Output to PortA the program is in a continuous loop. Press S1 switch to simulate STB_B * signal.

Note: Put the jumper at PC0. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	Initialize 8255 Port
8003	74 86		MOV A,#86	B as input in mode1
8005	F0		MOVX @DPTR,A	
8006	74 05		MOV A,#05	Set INTEB
8008	F0		MOVX @DPTR,A	
8009	75 A8 84		MOV 0A8,#84	Enable interrupt
800c	80 FE		SJMP 800C	
FFF3	02 90 00		LJMP 9000	
9000	90 F1 80		MOV DPTR,#F181	
9003	EO		MOVX A,@DPTR	
9004	90 F1 81		MOV DPTR,#F180	
9007	F0		MOVX @DPTR,A	
9008	80 F6		SJMP 9000	

Example 7: The following program initializes Port A as output port in Mode 1 and writes the Data 55H to Port A. upon giving ACK_A* signal it will interrupt the processor. Press S3 switch to simulate ACK_A*signal. Then it will write Data AAH to port A.

Note: Put the jumper at PC3. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183H	Initialize 8255 Port A as Out Put in mode1
8003	74 A0		MOV A,#0A0H	
8005	F0		MOVX @DPTR,A	
8006	74 0D		MOV A,#0D	Set INTEA
8008	F0		MOVX @DPTR,A	
8009	74 55		MOV A,#55	
800B	90 F1 80		MOV DPTR,#F180	
800E	F0		MOVX @DPTR,A	
800F	75 A8 84		MOV 0A8,#84	
8012	80 FE		SJMP 8012	Enable interrupt
FFF3	02 90 00		LJMP 9000	
9000	74 AA		MOV A,#AA	Interrupt Routine
9002	90 F1 80		MOV DPTR,#F180	
9005	F0		MOVX @DPTR,A	
9006	80 F8		SJMP 9000	

Example 8: The following program initializes Port B as output port in Mode 1 and writes the Data 55H to Port B. upon giving ACK_B* signal it will interrupt the processor. Press S1 switch to simulate ACK_B*signal. Then it will write Data AAH to port B.

Note: Put the jumper at PC0. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	Initialize 8255 Port B as out put in mode1
8003	74 84		MOV A,#084	
8005	F0		MOVX @DPTR,A	
8006	74 05		MOV A,#05	Set INTEB
8008	F0		MOVX @DPTR,A	
8009	74 55		MOV A,#55	
800B	90 F1 81		MOV DPTR,#F181	
800E	F0		MOVX @DPTR,A	
800F	75 A8 84		MOV 0A8,#84	Enable interrupt
8012	80 FE		SJMP 8012	
FFF3	02 90 00		LJMP 9000	
9000	74 AA		MOV A,#AA	
9002	90 F1 81		MOV DPTR,#F181	
9005	F0		MOVX @DPTR,A	
9006	80 F8		SJMP 9000	

Example 9: The following program initializes 8255A in Mode 2. Press S3 switch To simulate STB_A * signal

Note: Put the jumper at PC3. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS

8000
8003
8005
8006
8008
8009
800c
 	
FFF3
 	
9000
9003
9004
9005
9006
9008
900B
900D
900F
9010
	90 F1 83
	74 C0
	F0
	74 0D
	F0
	75 A8 84
	80 FE
	
	02 90 00
	
	90 F1 80
	E0
	A3
	FO
	75 60
	12 01 9B
	74 F0
	15 82
	F0
	80 EE
			MOV DPTR,#F183
			MOV A,#0C0
			MOVX @DPTR,A
			MOV A,#0D
			MOVX @DPTR,A
			MOV 0A8,#84
			SJMP 800C
			
			LJMP 9000
			
			MOV DPTR,#F180
			MOVX A,@DPTR
			INC DPTR
			MOVX @DPTR,A
			MOV 60,A
			LCALL 019B
			MOV A,#0F0
			DEC 82
			MOVX @DPTR,A
			SJMP 9000
				Initialize 8255 Port A as input in mode2
				
				Set INTEA
				
				Enable interrupt
				
				READ DIP SWITCH2 POSITION AND DISPLAY IT ON THE DATA FIELD OF THE TRAINER AND ON THE PORT B LEDs.
				
				SHOW F0 ON PORT A LEDS . AFTER PUTING DIPSWITCH 1 IN OFF POSITION AND THEN PRESSING AND HOLDING S3.

FOLLOWING PROCEDURE SHOULD BE FOLLOWED FOR USING ABOVE PROGRAM IN MODE 2

- **ADJUST DIP SWITCH 1 IN ON POSITION AND DIP SWITCH 2 IN POSITION CORRESPONDING TO THE DATA WHICH U WANT TO SEND AS IN PUT FROM PORT A.**
- **INTERRUPT 7.5**
- **ADJUST DIP SWITCH1 IN OFF POSITION**
- **PRESS S3 AND HOLD IT .THE CORRESPONDING PORT A LEDs WILL SHOW F0.**
- **THIS DISPLAY CAN BE CHANGED BY CHANGING THE OPERAND OF MVI A INSTRUCTION AT MEMORY LOCATION 900C IN ABOVE PROGRAM .**

NOTE : DON'T PRESS S1 OR S2 SWITCH AFTER PUTTING DIP SWITCH 1 IN OFF POSITION. WHILE PRESSING AND HOLDING S3 YOU CAN SEE THAT THE PORT A WORKING AS OUTPUT PORT.

5C: DEMONSTRATION PROGRAMS FOR ESA 51E / ESA 51E VER 4.00 TRAINER KIT

EXAMPLE PROGRAMS FOR ESA 51E TRAINERS IN MODE 0

Example 1: Configure 8255A such that Port A & Port B as an Output Port.
Execute the Program at 8000H

PORT A = F180H
PORT B = F181H
PORT C = F182H
CTRL REG = F183H

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	
8003	74 80		MOV A,#80	PORT A & B AS OUTPUT PORTS
8005	F0		MOVX @DPTR,A	
8006	90 F1 80		MOV DPTR,#F180	
8009	74 55		MOV A,#55	
800B	F0		MOVX @DPTR,A	
800C	74 66		MOV A,#66	
800E	A3		INC DPTR	
800F	F0		MOVX @DPTR,A	
8010	80 FE		SJMP 8010	

Example 2: Configure 8255A such that Port A as an Output & Port B as an Input
Execute the Program at 8000H

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	
8003	74 82		MOV A,#82	PORT A AS O/P PORT B AS I/P
8005	F0		MOVX @DPTR,A	
8006	90 F1 81		MOV DPTR,#F181	
8009	E0		MOVX A,@DPTR	
800A	15 82		DEC DPL	
800C	F0		MOVX @DPTR,A	DPL=82
800D	80 F7		SJMP 8006	

Example 3: Configure 8255A such that Port A as an Input & Port B as an Output. Execute the Program at 8000H

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	
8003	74 90		MOV A,#90	PORT A AS I/P PORT B AS O/P
8005	F0		MOVX @DPTR,A	
8006	90 F1 80		MOV DPTR,#F180	
8009	E0		MOVX A,@DPTR	
800A	A3		INC DPTR	
800B	F0		MOVX @DPTR,A	
800C	80 F8		SJMP 8006	

Example 4: PROGRAM OF BSR MODE
SINGLE BIT SET/RESET FEATURE

Any of the eight bits of Port C can be set or reset using a single OUT instruction. But before that user will have to initialize 8255 in an out put mode., Because during the reset condition 8255 port lines will be input mode.

EXAMPLE: PROGRAMS FOR BSR MODE

Write a BSR control word to set bits PC7 and reset them after certain delay. This is a continuous loop PC7 will set and reset continuously.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	74 80		MOV A,#80	
8002	90 F1 83		MOV DPTR,#0F183	
8005	F0		MOVX @DPTR,A	
8006	74 0F		MOV A,#0F	
8008	F0		MOVX @DPTR,A	
8009	12 80 13		LCALL 8013	CALL DELAY
800c	14		DEC A	
800D	F0		MOVX @DPTR,A	
800E	12 80 13		LCALL 8013	CALL DELAY
8011	80 YY		SJMP 8006	
8013	7F FF		MOV R7,#0FF	DELAY SUB RUTINE
8015	7E FF		MOV R6,#0FF	
8017	DE FE		DJNZ R6,8017	
	DF FA		DJNZ R7,8015	
	32		RET	

From the analysis of the routine the following points can be noted.

1) To Set/Reset bits in port C, a control word is written in the control register and not in port C

2) BSR control word affects only one bit in port C

3) The BSR control word does not affect the I/O mode.

EXAMPLE PROGRAMS FOR MODE 1

NOTE: For testing the Mode 1 and Mode 2 operation, Connect buffered external interrupt to J5 of the interface.

Example 5:The following program initializes 8255 Port A as Input in Mode 1. Reading through the Port A(Input), output to the Port B. Press S2 switch to simulate STB_A * signal.

Note: Put the jumper at PC3. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	Initialize 8255
8003	74 B0		MOV A,#0B0	Port A as input
8005	F0		MOVX @DPTR,A	in mode1
8006	74 09		MOV A,#09	Set INTEA
8008	F0		MOVX @DPTR,A	
8009	75 A8 84		MOV 0A8,#84	Enable interrupt
800c	80 FE		SJMP 800C	
FFF3	02 90 00		LJMP 9000	
9000	90 F1 80		MOV DPTR,#F180	
9003	EO		MOVX A,@DPTR	
9004	90 F1 81		MOV DPTR,#F181	
9007	F0		MOVX @DPTR,A	
9008	80 F6		SJMP 9000	

Example 6: The following program initializes 8255 Port B as Input in Mode 1.Reading through Port B and Output to Port A the program is in a continuous loop. Press S1 switch to simulate STB_B * signal.

Note: Put the jumper at PC0. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183H	Initialize 8255
8003	74 86		MOV A,#86H	Port B as input
8005	F0		MOVX @DPTR,A	in mode1
8006	74 05		MOV A,#05	
8008	F0		MOVX @DPTR,A	Set INTEB
8009	75 A8 84		MOV 0A8,#84	Enable interrupt
800c	80 FE		SJMP 800C	
FFF3	02 90 00		LJMP 9000	
9000	90 F1 81		MOV DPTR,#F181	
9003	EO		MOVX A,@DPTR	
9004	90 F1 80		MOV DPTR,#F180	
9007	F0		MOVX @DPTR,A	
9008	80 F6		SJMP 9000	

Example 7.The following program initializes Port A as output port in Mode 1 and writes the Data 55H to PortA upon giving ACK_A* signal it will interrupt the processor. Press S3 switch to simulate ACK_A*signal. Then it will write Data AAH to port A.

Note: Put the jumper at PC3. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	Initialize 8255
8003	74 A0		MOV A,#0A0	Port A as input
8005	F0		MOVX @DPTR,A	in mode1
8006	74 0D		MOV A,#0D	Set INTEA
8008	F0		MOVX @DPTR,A	
8009	74 55		MOV A,#55	
800B	90 F1 80		MOV DPTR,#F180	
800E	F0		MOVX @DPTR,A	
800F	75 A8 84		MOV 0A8,#84	Enable interrupt
8012	80 FE		SJMP 8012	
FFF3	02 90 00		LJMP 9000	
9000	74 AA		MOV A,#AA	Interrupt
9002	90 F1 80		MOV DPTR,#F180	routine
9005	F0		MOVX @DPTR,A	
9006	80 F8		SJMP 9000	

Example 8: The following program initializes Port B as output port in Mode 1 and writes the Data 55H to PortB upon giving ACK_B* signal it will interrupt the processor.
Press S1 switch to simulate ACK_B*signal. Then it will write Data AAH to port B.
Note: Put the jumper at PC0. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV DPTR,#F183	
8003	74 84		MOV A,#84	
8005	F0		MOVX @DPTR,A	Initialize 8255
8006	74 05		MOV A,#05	Port B as input
8008	F0		MOVX @DPTR,A	in mode1
8009	74 55		MOV A,#55	Set INTEB
800B	90 F1 81		MOV DPTR,#F181	
800E	F0		MOVX @DPTR,A	Enable interrupt
800F	75 A8 84		MOV 0A8,#84	
8012	80 FE		SJMP 8012	
FFF3	02 90 00		LJMP 9000	
9000	74 AA		MOV A,#AA	
9002	90 F1 81		MOV DPTR,#F181	
9005	F0		MOVX @DPTR,A	
9006	80 F8		SJMP 9000	

Example 9: The following program initializes 8255A in Mode 2. Press S3 switch To simulate STB_A * signal

Note: Put the jumper at PC3. Connect external interrupt from J4 of pin 7 (i.e. INT 1) to the J5 of interface.

ADDRESS	OPCODE	LABLE	MNEMONIC	COMMENTS
8000	90 F1 83		MOV	Initialize 8255 Port A
8003	74 C0		DPTR,#F183	as input in mode2
8005	F0		MOV A,#0C0	
8006	74 0D		MOVX @DPTR,A	Set INTEA
8008	F0		MOV A,#0D	
8009	75 A8 84		MOVX @DPTR,A	Enable interrupt
800c	80 FE		MOV 0A8,#84	
			SJMP 800C	
FFF3	02 90 00			
			LJMP 9000	
9000	90 F1 80			READ DIP SWITCH2
9003	E0		MOV	POSITION AND DISPLAY
9004	A3		DPTR,#F180	IT ON THE DATA FIELD
9005	FO		MOVX A,@DPTR	OF THE TRAINER AND ON
9006	75 60		INC DPTR	THE PORT B LEDs.
9008	12 01 9B		MOVX @DPTR,A	
900B	74 F0		MOV 60,A	SHOW F0 ON PORT A LEDS
900D	15 82		LCALL 019B	. AFTER PUTING
900F	F0		MOV A,#0F0	DIPSWITCH 1 IN OFF
9010	80 EE		DEC 82	POSITION AND THEN
			MOVX @DPTR,A	PRESSING AND HOLDING
			SJMP 9000	S3.

FOLLOWING PROCEDURE SHOULD BE FOLLOWED FOR USING ABOVE PROGRAM IN MODE

5. ADJUST DIP SWITCH 1 IN ON POSITION AND DIP SWITCH 2 IN POSITION CORRESPONDING TO THE DATA WHICH U WANT TO SEND AS IN PUT FROM PORT A.

6. INTERRUPT 7.5

7. ADJUST DIP SWITCH1 IN OFF POSITION

8. **PRESS S3 AND HOLD IT .THE CORRESPONDING PORT A LEDs WILL SHOW F0. THIS DISPLAY CAN BE CHANGED BY CHANGING THE OPERAND OF MVI A INSTRUCTION AT MEMORY LOCATION 900C IN ABOVE PROGRAM .**

NOTE : DON'T PRESS S1 OR S2 SWITCH AFTER PUTTING DIP SWITCH 1 IN OFF POSITION.
WHILE PRESSING AND HOLDING S3 YOU CAN SEE THAT THE PORT A WORKING AS OUTPUT PORT.

6: DEMONSTRATION PROGRAMS FOR 8086 SERIES KITS.

6A: DEMONSTRATION PROGRAMS FOR ESA 86/88 –2 TRAINER KIT

For Interfacing Study cards with ESA 86-2 trainer kit, study card adapter is required. Study card adapter contains two 50 pin Male Connectors namely J1 and J2 and two 26 pin Male Connectors namely J3 and J4.
Connectors J1 and J2 of ESA 86-2 must be connected with J1 and J2 connectors of adapter using two 50 pin FRC.Connectors J3 and J4 of adapter must be with J3 and J4 connectors of study card using two 26 pin FRC.

Example 1: PROGRAMS FOR 8255 MODE 0 CONFIGURATION

ADDRESS	OPCODE	LABLE	MNEMONICS	COMMENTS
			ORG 2000	
0000:2000	B0 80		MOVB AL,#80	PORT A & B AS OUTPUT PORTS
0000:2002	BA 86 00		MOVW DX,#0086	
0000:2005	EE		OUTB DX	
0000:2006	B0 55		MOVB AL,#55	
0000:2008	BA 80 00		MOVW DX,#0080	
0000:200B	EE		OUTB DX	
0000:200C	B0 AA		MOVB AL,#AA	
0000:200E	BA 82 00		MOVW DX,#0082	
0000:2011	EE		OUTB DX,AL	

0000:2012	E9 F1 FF		JMP	

Example 2: Configure 8255A such that PORT A as an output & PORT B as an input. Execute the program at 2000H

ADDRESS	OPCODE	LABLE	MNEMONICS	COMMENTS

0000:2000
0000:2003
0000:2005
0000:2006
0000:2009
0000:200A
0000:200C
0000:200F
0000:2010
	BA 86 00
	B0 82
	EE
	BA 82 00
	EC
	F6 D0
	BA 80 00
	EE
	E9 F3 FF
		LOOP:	MOVW DX,#0086
			MOVB AL,#82
			OUTB DX
			MOVW DX,#0082
			INB DX
			NOTB AL
			MOVW DX,#0080
			OUTB DX,AL
			JMP LOOP
				PORTA AS OUTPUT
				PORTB AS INPUT

Example 3: Configure 8255A such that PORT A as an Input & PORT B as an Output. Execute the program at 2000H

ADDRESS	OPCODE	LABLE	MNEMONICS	COMMENTS

0000:2000
0000:2003
0000:2005
0000:2006
0000:2009
0000:200A
0000:200C
0000:200F
0000:2010
	BA 86 00
	B0 90
	EE
	BA 80 00
	EC
	F6 D0
	BA 82 00
	EE
	E9 F3 FF
		LOOP:	MOVW DX,#0086
			MOVB AL,#90
			OUTB DX
			MOVW DX,#0080
			INB DX
			NOTB AL
			MOVW DX,#0082
			OUTB DX,AL
			JMP LOOP
				PORT A AS OUTPUT
				PORT B AS INPUT

EXAMPLE 4: PROGRAM FOR BSR MODE
The following program initializes the 8255 ports and then it write a BSR control word to set bit PC7 and reset it after certain delay.

```
MOV AL,0FH
MOV DX,0086H
```

```
        OUT DX,AL
        CALL DELAY
        MOV AL,0EH
        MOV DX,0086H
        OUT DX,AL
        INT 3
DELAY:
        PUSH AX
        PUSH CX
        MOV CX,0030H
L2:     MOV AX,0FFFH
L1:     DEC AX
        JNZ L1
        LOOP L2
        POP CX
        POP AX
        RET
```

From the analysis of the routine the following points can be noted.

1. **To Set/Reset bits in port C, a control word is written in the control register and not in port C.**
2. **BSR control word affects only one bit in port C.**
3. **The BSR control word does not effect the I/O mode.**

EXAMPLE 5: PROGRAMS FOR 8255A MODE 1 CONFIGURATION

NOTE: For testing the Mode 1 and Mode 2 operation, Connect Buffered external interrupt to J5 of the interface.

1. The following program initializes the 8255 Port A as Input in mode1 and Port B as on output in Mode 0.

Read through input port A and ouptut to Port B the same thing will displayed on the data field of the trainer display. Press S2 switch to simulate STB_A * signal.

Note: Put the jumper at PC3.

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	INIT:	MOVW SP,#3000	Initialize 8255
0000:2003	B0 B0		MOVB AL,#0B0	PortA in Mode1
0000:2005	BA 86 00		MOVW DX,#0086	Input Port Bin
0000:2008	EE		OUTB DX ,AL	Mode0 Output
0000:2009	B0 09		MOVB AL,#09	Set /INTE(A)
0000:200B	BA 86 00		MOVW DX,#0086	In BSR mode
0000:200E	EE		OUTB DX,AL	Interrupt vector table
0000:200F	C7 06 24 01 00 21		MOVW 0124,#2100	
0000:2015	C7 06 26 01 00 00		MOVW 0126,#0000	
0000:201B	BA F4 FF		MOVW DX,#FFF4	Initialize 8259
0000:201E	B0 13		MOVB AL,#13	
0000:2020	EE		OUTB DX ,AL	
0000:2021	BA F6 FF		MOVW DX,#FFF6	
0000:2024	B0 48		MOVB AL,#48	
0000:2026	EE		OUTB DX ,AL	
0000:2027	B0 03		MOVB AL,#03	
0000:2029	EE		OUTB DX ,AL	
0000:202A	B0 FD		MOVB AL,#FD	
0000:202C	EE		OUTB DX ,AL	Automatic end Of conversion
0000:202D	FB		STI	
0000:202E	E9 FC FF	WI:	JMP WI	
			ORG 2100H	
0000:2100	E9 11 00		JMP ISR	
0000:2103	0A 0A		DB 0AH,0AH	
0000:2105	0D		DB 0DH	
0000:2106	50 6F 72 74		DB 50H,6FH,72H,74H,	
0000:210A	20 56 61 6C 75	MES:	20H,56H,61H,6CH,75H	
0000:210F	65 20 3D 20		,65H,20H,3DH,20H,	
0000:2113	00		00H	
0000:2114	B8 00 00		MOVW AX,#0000	
0000:2117	8E C0	ISR:	MOVW ES,AX	
0000:2119	8E C8		MOVW CS,AX	
0000:211B	2E		CS	
0000:211C	8D 16 03 21		LEA DX,2103	
0000:2120	8B C2		MOVW AX,DX	Display routine
0000:2122	9A 55 1B 00 FE		CALLS FE00:1B55	Read from PortB
0000:2127	A8 00 80		MOVW DX,#0080	Display in both
0000:212A	EC		INB DX	Serial mode and
0000:212B	BA 82 00		MOVW DX,#0082	Data field of trainer.
0000:212E	EE		OUTB DX	
0000:212F	9A 64 1B 00 FE		CALLS FE00:1B64	
0000:2134	9A 0A 0B 00 FF		CALLS FF00:0B0A	
0000:2139	B0 0D		MOVB AL,#0D	
0000:213B	9A 50 1B 00 FE		CALLS FE00:1B50	
0000:2140	CF		IRET	

Example 6: The following program initializes 8255 Port B as Input in mode 1 asn Port A as on output in Mode 0. Reading through Port B and Output to Port A as well as data field of the trainer display .The program is in the continuous loop. I f you change the Input the same thing will be repeated at port B LEDs as well as data field of the trainer display. Press S1 Switch to simulate STB_B* signal. Note: Put the jumper at PC0

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	INIT:	MOVW SP,#3000	
0000:2003	B0 86		MOVB AL,#86	Initialize 8255
0000:2005	BA 86 00		MOVW DX,#0086	PortB in Mode1
0000:2008	EE		OUTB DX ,AL	Input
0000:2009	B0 05		MOVB AL,#05	PortA in Mode0
0000:200B	BA 86 00		MOVW DX,#0086	Output
0000:200E	EE		OUTB DX,AL	Set /INTE(B)
0000:200F	C7 06 24 01 00 21		MOVW 0124,#2100	In BSR mode
0000:2015	C7 06 26 01 00 00		MOVW 0126,#0000	Interrupt vector table
0000:201B	BA F4 FF		MOVW DX,#FFF4	
0000:201E	B0 13		MOVB AL,#13	
0000:2020	EE		OUTB DX ,AL	
0000:2021	BA F6 FF		MOVW DX,#FFF6	Initialize 8259
0000:2024	B0 48		MOVB AL,#48	
0000:2026	EE		OUTB DX ,AL	
0000:2027	B0 03		MOVB AL,#03	
0000:2029	EE		OUTB DX ,AL	
0000:202A	B0 FD		MOVB AL,#FD	Automatic end
0000:202C	EE		OUTB DX ,AL	Of conversion
0000:202D	FB		STI	
0000:202E	E9 FC FF	WI:	JMP WI	
			ORG 2100H	
0000:2100	E9 11 00		JMP ISR	
0000:2103	0A 0A		DB 0AH,0AH	
0000:2105	0D	MES:	DB 0DH	
0000:2106	50 6F 72 74		DB 50H,6FH,72H,74H,	
0000:210A	20 56 61 6C 75		20H,56H,61H,6CH,75H	
0000:210F	65 20 3D 20		,65H,20H,3DH,20H,	
0000:2113	00		00H	
0000:2114	B8 00 00		MOVW AX,#0000	
0000:2117	8E C0		MOVW ES,AX	
0000:2119	8E C8	ISR:	MOVW CS,AX	
0000:211B	2E		CS	
0000:211C	8D 16 03 21		LEA DX,2103	Display routine
0000:2120	8B C2		MOVW AX,DX	Read from PortB
0000:2122	9A 55 1B 00 FE		CALLS FE00:1B55	
0000:2127	BA 82 00		MOVW DX,#0082	Display in both
0000:212A	EC		INB AL,DX	Serial mode and
0000:212B	BA 80 00		MOVW DX,#0080	Data field of
0000:212E	EE		OUTB DX,AL	trainer.
0000:212F	9A 64 1B 00 FE		CALLS FE00:1B64	
0000:2134	9A 0A 0B 00 FF		CALLS FF00:0B0A	
0000:2139	B0 0D		MOVB AL,#0D	
0000:213B	9A 50 1B 00 FE		CALLS FE00:1B50	
			IRET	

Example 7: he following program initializes the 8255A in Input in Mode 2 and Port B as output in Mode 0. Press S2 switch to simulate STB_A*.

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	INIT:	MOVW SP,#3000	Initialize 8255
0000:2003	B0 B0		MOVB AL,#86	PortA in Mode1
0000:2005	BA 86 00		MOVW DX,#0086	Input
0000:2008	EE		OUTB DX ,AL	Port Bin Mode0
0000:2009	B0 09		MOVB AL,#05	Output
0000:200B	BA 86 00		MOVW DX,#0086	Set /INTE(A)
0000:200E	EE		OUTB DX,AL	In BSR mode
0000:200F	C7 06 24 01 00 21		MOVW 0124,#2100	Interrupt vector table
0000:2015	C7 06 26 01 00 00		MOVW 0126,#0000	
0000:201B	BA F4 FF		MOVW DX,#FFF4	
0000:201E	B0 13		MOVB AL,#13	Initialize 8259
0000:2020	EE		OUTB DX ,AL	
0000:2021	BA F6 FF		MOVW DX,#FFF6	
0000:2024	B0 48		MOVB AL,#48	
0000:2026	EE		OUTB DX ,AL	
0000:2027	B0 03		MOVB AL,#03	
0000:2029	EE		OUTB DX ,AL	Automatic end
0000:202A	B0 FD		MOVB AL,#FD	Of conversion
0000:202C	EE		OUTB DX ,AL	
0000:202D	FB		STI	
0000:202E	E9 FC FF	WI:	JMP WI	
			ORG 2100H	
0000:2100	E9 11 00		JMP ISR	
0000:2103	0A 0A		DB 0AH,0AH	
0000:2105	0D		DB 0DH	
0000:2106	50 6F 72 74		DB 50H,6FH,72H,74H,	
0000:210A	20 56 61 6C 75		20H,56H,61H,6CH,75H	
0000:210F	65 20 3D 20	MES:	,65H,20H,3DH,20H,	
0000:2113	00		00H	
0000:2114	B8 00 00		MOVW AX,#0000	
0000:2117	8E C0		MOVW ES,AX	
0000:2119	8E C8		MOVW CS,AX	
0000:211B	2E		CS	
0000:211C	8D 16 03 21		LEA DX,2103	Display routine
0000:2120	8B C2		MOVW AX,DX	Read from portB
0000:2122	9A 55 1B 00 FE	ISR:	CALLS FE00:1B55	Display in both
0000:2127	A8 00 80		MOVW DX,#0082	Serial mode and
0000:212A	EC		INB AL,DX	Data field of
0000:212B	BA 82 00		MOVW DX,#0080	trainer.
0000:212E	EE		OUTB DX,AL	
0000:212F	9A 64 1B 00 FE		CALLS FE00:1B64	
0000:2134	9A 0A 0B 00 FF		CALLS FF00:0B0A	
0000:2139	B0 0D		MOVB AL,#0D	
0000:213B	9A 50 1B 00 FE		CALLS FE00:1B50	
0000:2140	CF		IRET	

Example 8: The following program initializes 8255A port B as output in Mode1. press S1 switch to simulate ACK_B *
Note: Put the jumper at PC0 to connect external interrupt INT1 signal to J5 of interface

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	Init	MOVW SP,#3000	Initializes 8255 with Port B in mode 1(o/p)
0000:2003	B0 84		MOVB AL,#84	
0000:2005	BA 86 00		MOVW DX,#0086	
0000:2008	EE		OUTB DX,AL	
0000:2009	B0 05		MOVB AL,#05	Set /INTE B in BSR mode
0000:200B	BA 86 00		MOVW DX,#0086	
0000:200E	EE		OUTB DX,AL	
0000:200F	BE 24 01		MOVW SI,#0124	Interrupt Vector table
0000:2012	B8 00 21		MOVW AX,#2100	
0000:2015	89 04		MOVW [SI],AX	
0000:2017	46		INCW SI	
0000:2018	46		INCW SI	
0000:2019	B8 00 00		MOVW AX,#0000	
0000:201C	89 04		MOVW [SI],AX	
0000:201E	BA F4 FF		MOVW DX,#FFF4	
0000:2021	B0 13		MOVB AL,#13	Initializes 8259
0000:2023	EE		OUTB DX	
0000:2024	BA F6 FF		MOVW DX,#FFF6	
0000:2027	B0 48		MOVB AL,#48	
0000:2029	EE		OUTB DX	
0000:202A	B0 03		MOVB AL,#03	Automatic end of conversion
0000:202C	EE		OUTB DX	
0000:202D	B0 FD		MOVB AL,#FD	
0000:202F	EE		OUTB DX,AL	
0000:2030	FB	WI	STI	
0000:2031	E9 FC FF		JMP WI	
			ORG 2100	
0000:2100	BA 80 00		MOVW DX,#0080	
0000:2103	B8 55 00		MOVW AX,#0055	
0000:2106	BB 10 00		MOVW BX,#0010	
0000:2109	F6 D0		NOTB AL	Count Value
0000:210B	EE		OUTB DX,AL	
0000:210C	B9 FF FF	BACK	MOVWCX,#FFFF	
0000:210F	E2 FE	:	LOOP 210F	
0000:2111	4B		DECW BX	
0000:2112	75 F5		JNE BACK	
0000:2114	CF		IRET	

Example 9: The following program initializes 8255A port A an an output in Mode1 press S3 switch to simulate ACK_A *
Note: Put the jumper at PC3 to connect external interrupt INT1 signal to J5 of interface

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	Init	MOVW SP,#3000	Initializes 8255 with
0000:2003	B0 A0		MOVB AL,#A0	Port A in mode 1(o/p)
0000:2005	BA 86 00		MOVW DX,#0086	
0000:2008	EE		OUTB DX,AL	
0000:2009	B0 0D		MOVB AL,#0D	Set /INTE A in BSR mode
0000:200B	BA 86 00		MOVW DX,#0086	
0000:200E	EE		OUTB DX,AL	
0000:200F	BE 24 01		MOVW SI,#0124	Interrupt Vector table
0000:2012	B8 00 21		MOVW AX,#2100	
0000:2015	89 04		MOVW [SI],AX	
0000:2017	46		INCW SI	
0000:2018	46		INCW SI	
0000:2019	B8 00 00		MOVW AX,#0000	
0000:201C	89 04		MOVW [SI],AX	
0000:201E	BA F4 FF		MOVW DX,#FFF4	
0000:2021	B0 13		MOVB AL,#13	Initializes 8259
0000:2023	EE		OUTB DX	
0000:2024	BA F6 FF		MOVW DX,#FFF6	
0000:2027	B0 48		MOVB AL,#48	
0000:2029	EE		OUTB DX	
0000:202A	B0 03		MOVB AL,#03	Automatic end of conversion
0000:202C	EE		OUTB DX	
0000:202D	B0 FD		MOVB AL,#FD	
0000:202F	EE	WI	OUTB DX,AL	
0000:2030	FB		STI	
0000:2031	E9 FC FF		JMP WI	
			ORG 2100	
0000:2100	BA 82 00		MOVW DX,#0082	
0000:2103	B8 55 00		MOVW AX,#0055	
0000:2106	BB 10 00		MOVW BX,#0010	
0000:2109	F6 D0		NOTB AL	Count Value
0000:210B	EE	BACK	OUTB DX,AL	
0000:210C	B9 FF FF	:	MOVWCX,#FFFF	
0000:210F	E2 FE		LOOP 210F	
0000:2111	4B		DECW BX	
0000:2112	75 F5		JNE BACK	
0000:2114	CF		IRET	

Example 10:The following program initializes 8255A in Mode2.This program simulates output operation of mode2.

Press S3 switch to simulate ACK_A *

Note: Put the jumper at PC3 to connect external interrupt INT1 signal to J5 of interface

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	Init	MOVW SP,#3000	Initializes 8255A Mode 2
0000:2003	B0 C0		MOVB AL,#C0	
0000:2005	BA 86 00		MOVW DX,#0086	
0000:2008	EE		OUTB DX,AL	
0000:2009	B0 0D		MOVB AL,#0D	Set /INTE1 in BSR mode
0000:200B	BA 86 00		MOVW DX,#0086	
0000:200E	EE		OUTB DX,AL	
0000:200F	BE 24 01		MOVW SI,#0124	Interrupt Vector table
0000:2012	B8 00 21		MOVW AX,#2100	
0000:2015	89 04		MOVW [SI],AX	
0000:2017	46		INCW SI	
0000:2018	46		INCW SI	
0000:2019	B8 00 00		MOVW AX,#0000	
0000:201C	89 04		MOVW [SI],AX	
0000:201E	BA F4 FF		MOVW DX,#FFF4	
0000:2021	B0 13		MOVB AL,#13	
0000:2023	EE		OUTB DX	Initializes 8259
0000:2024	BA F6 FF		MOVW DX,#FFF6	
0000:2027	B0 48		MOVB AL,#48	
0000:2029	EE		OUTB DX	
0000:202A	B0 03		MOVB AL,#03	
0000:202C	EE		OUTB DX	Automatic end of conversion
0000:202D	B0 FD		MOVB AL,#FD	
0000:202F	EE		OUTB DX,AL	
0000:2030	FB	WI	STI	
0000:2031	E9 FC FF		JMP WI	
			ORG 2100	
0000:2100	BA 80 00		MOVW DX,#0080	
0000:2103	B8 55 00		MOVW AX,#0055	
0000:2106	BB 10 00		MOVW BX,#0010	
0000:2109	F6 D0		NOTB AL	
0000:210B	EE		OUTB DX,AL	Count Value
0000:210C	B9 FF FF	BACK	MOVWCX,#FFFF	
0000:210F	E2 FE	:	LOOP 210F	
0000:2111	4B		DECW BX	
0000:2112	75 F5		JNE BACK	
0000:2114	CF		IRET	

6B: DEMONSTRATION PROGRAMS FOR ESA 86/88-3 TRAINER KIT.

Example 1: Configure 8255A such that PORT A & PORT B as an output. Execute the program at 2000H

ADDRESS	OPCODE	LABLE	MNEMONICS	COMMENTS
			ORG 2000	
0000:2000	B0 80		MOVB AL,#80	PORT A & B AS
0000:2002	BA 86 00		MOVW DX,#0086	OUTPUT PORTS
0000:2005	EE		OUTB DX	
0000:2006	B0 55	LOOP	MOVB AL,#55	
0000:2008	BA 80 00		MOVW DX,#0080	
0000:200B	EE		OUTB DX	
0000:200C	B0 AA		MOVB AL,#AA	
0000:200E	BA 82 00		MOVW DX,#0082	
0000:2011	EE		OUTB DX,AL	
0000:2012	E9 F1 FF		JMP LOOP	

Example 2: Configure 8255A such that PORT A as an output & PORT B as an input. Execute the program at 2000H

ADDRESS	OPCODE	LABLE	MNEMONICS	COMMENTS
0000:2000	BA 86 00		MOVW DX,#0086	PORT A AS OUTPUT
0000:2003	B0 82		MOVB AL,#82	PORT B AS INPUT
0000:2005	EE		OUTB DX	
0000:2006	BA 82 00	LOOP:	MOVW DX,#0082	
0000:2009	EC		INB DX	
0000:200A	F6 D0		NOTB AL	
0000:200C	BA 80 00		MOVW DX,#0080	
0000:200F	EE		OUTB DX,AL	
0000:2010	E9 F3 FF		JMP LOOP	

Example 3: Configure 8255A such that PORT A as an Input & PORT B as an Output. Execute the program at 2000H

ADDRESS	OPCODE	LABLE	MNEMONICS	COMMENTS
0000:2000	BA 86 00		MOVW DX,#0086	PORT A AS OUTPUT
0000:2003	B0 90		MOVB AL,#90	PORT B AS INPUT
0000:2005	EE		OUTB DX	
0000:2006	BA 80 00	LOOP:	MOVW DX,#0080	
0000:2009	EC		INB DX	
0000:200A	F6 D0		NOTB AL	
0000:200C	BA 82 00		MOVW DX,#0082	
0000:200F	EE		OUTB DX,AL	
0000:2010	E9 F3 FF		JMP LOOP	

Example 4: PROGRAM FOR BSR MODE

The following program initializes the 8255 ports and then it write a BSR control word to set bit PC7 and reset it after certain delay.

```
                MOV AL,0FH
                MOV DX,0086H
                OUT DX,AL
                CALL DELAY
                MOV AL,0EH
                MOV DX,0086H
                OUT DX,AL
                INT 3
 DELAY:         PUSH AX
                PUSH CX
                MOV CX,0030H
    L2:         MOV AX,0FFFH
    L1:         DEC AX
                JNZ L1
                LOOP L2
                POP CX
                POP AX
                RET
```

From the analysis of the routine the following points can be noted.

4. **To Set/Reset bits in port C, a control word is written in the control register and not in port C.**
5. **BSR control word affects only one bit in port C.**
6. **The BSR control word does not effect the I/O mode.**

EXAMPLE PROGRAMS FOR 8255A IN MODE1 OPERATION

NOTE: For testing the Mode 1 and Mode 2 opertation, Connect Buffered external interrupt to J5 of the interface.

Example 5: The following program initializes the 8255 Port A as Input in mode1 and Port B as on output in Mode 0.

Read through input port A and ouptut to Port B the same thing will be displayed on the data field of the trainer display. Press S2 switch to simulate STB_A * signal.

Note: Put the jumper at PC3.

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	INIT:	MOVW SP,#3000	Initialize
0000:2003	B0 B0		MOVB AL,#0B0	8255
0000:2005	BA 86 00		MOVW DX,#0086	PortA in
0000:2008	EE		OUTB DX ,AL	Mode1
0000:2009	B0 09		MOVB AL,#09	Input
0000:200B	BA 86 00		MOVW DX,#0086	Port Bin
0000:200E	EE		OUTB DX,AL	Mode0
0000:200F	C7 06 24 01 00 21		MOVW 0124,#2100	Output
0000:2015	C7 06 26 01 00 00		MOVW 0126,#0000	Set
0000:201B	BA F4 FF		MOVW DX,#FFF4	/INTE(A)
0000:201E	B0 13		MOVB AL,#13	In BSR mode
0000:2020	EE		OUTB DX ,AL	Interrupt
0000:2021	BA F6 FF		MOVW DX,#FFF6	vector
0000:2024	B0 48		MOVB AL,#48	table
0000:2026	EE		OUTB DX ,AL	
0000:2027	B0 03		MOVB AL,#03	Initialize
0000:2029	EE		OUTB DX ,AL	8259
0000:202A	B0 FD		MOVB AL,#FD	
0000:202C	EE		OUTB DX ,AL	
0000:202D	FB		STI	
0000:202E	E9 FC FF	WI:	JMP WI	
			ORG 2100H	Automatic
0000:2100	E9 11 00		JMP ISR	end
0000:2103	0A 0A		DB 0AH,0AH	Of
0000:2105	0D		DB 0DH	conversion
0000:2106	50 6F 72 74		DB 50H,6FH,72H,74H,	
0000:210A	20 56 61 6C 75		20H,56H,61H,6CH,75H	
0000:210F	65 20 3D 20	MES:	,65H,20H,3DH,20H,	
0000:2113	00		00H	
0000:2114	B8 00 00		MOVW AX,#0000	
0000:2117	8E C0	ISR:	MOVW ES,AX	
0000:2119	8E C8		MOVW CS,AX	
0000:211B	2E		CS	
0000:211C	8D 16 03 21		LEA DX,2103	Display
0000:2120	8B C2		MOVW AX,DX	routine
0000:2122	9A 13 00 00 FE		CALLS FE00:0013	Read from
0000:2127	A8 00 80		MOVW DX,#0080	portB
0000:212A	EC		INB DX	Display In
0000:212B	BA 82 00		MOVW DX,#0082	Serial mode
0000:212D	EE		OUTB DX	OR
0000:212E	9A 52 00 00 FE		CALLS FE00:0052	Data field
0000:2133	B0 0D		MOVB AL,#0D	of trainer.
0000:2135	9A 00 00 00 FE		CALLS FF00:0000	
0000:213A	CF		IRET	

Example 6: The following program initializes 8255 Port B as Input in mode 1 as Port A as on output in Mode 0. Reading through Port B and Output to Port A as well as data field of the trainer display .The program is in the continuous loop. I f you change the Input the same thing will be repeated at port B LEDs as well as data field of the trainer display. Press S1 Switch to simulate STB_B* signal.

Note: Put the jumper at PC0.

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	INIT:	MOVW SP,#3000	Initialize 8255
0000:2003	B0 86		MOVB AL,#86	PortB in Mode1
0000:2005	BA 86 00		MOVW DX,#0086	Input
0000:2008	EE		OUTB DX ,AL	PortA in Mode0
0000:2009	B0 05		MOVB AL,#05	Output
0000:200B	BA 86 00		MOVW DX,#0086	Set /INTE(B)
0000:200E	EE		OUTB DX,AL	In BSR mode
0000:200F	C7 06 24 01 00 21		MOVW 0124,#2100	Interrupt vector table
0000:2015	C7 06 26 01 00 00		MOVW 0126,#0000	
0000:201B	BA F4 FF		MOVW DX,#FFF4	
0000:201E	B0 13		MOVB AL,#13	Initialize 8259
0000:2020	EE		OUTB DX ,AL	
0000:2021	BA F6 FF		MOVW DX,#FFF6	
0000:2024	B0 48		MOVB AL,#48	
0000:2026	EE		OUTB DX ,AL	
0000:2027	B0 03		MOVB AL,#03	
0000:2029	EE		OUTB DX ,AL	Automatic end
0000:202A	B0 FD		MOVB AL,#FD	Of conversion
0000:202C	EE		OUTB DX ,AL	
0000:202D	FB		STI	
0000:202E	E9 FC FF	WI:	JMP WI	
			ORG 2100H	
0000:2100	E9 11 00		JMP ISR	
0000:2103	0A 0A		DB 0AH,0AH	
0000:2105	0D	MES:	DB 0DH	
0000:2106	50 6F 72 74		DB 50H,6FH,72H,74H,	
0000:210A	20 56 61 6C 75		20H,56H,61H,6CH,75H	
0000:210F	65 20 3D 20		,65H,20H,3DH,20H,	
0000:2113	00		00H	
0000:2114	B8 00 00		MOVW AX,#0000	
0000:2117	8E C0		MOVW ES,AX	
0000:2119	8E C8	ISR:	MOVW CS,AX	
0000:211B	2E		CS	
0000:211C	8D 16 03 21		LEA DX,2103	Display routine
0000:2120	8B C2		MOVW AX,DX	Read from PortB
0000:2122	9A 13 00 00 FE		CALLS FE00:0013	
0000:2127	BA 82 00		MOVW DX,#0082	Display in
0000:212A	EC		INB AL,DX	Serial mode OR
0000:212B	BA 80 00		MOVW DX,#0080	Data field of
0000:212E	EE		OUTB DX,AL	trainer.
0000:212F	9A 52 00 00 FE		CALLS FE00:0052	
0000:2134	B0 0D		MOVB AL,#0D	
0000:2136	9A 00 00 00 FE		CALLS FF00:0000	
0000:213B	CF		IRET	

Example 7: The following program initializes the 8255A in Input in Mode 2 and Port B as output in Mode 0.

Press S2 switch to simulate STB_A*.

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	INIT:	MOVW SP,#3000	Initialize 8255
0000:2003	B0 B0		MOVB AL,#86	PortA in Mode1
0000:2005	BA 86 00		MOVW DX,#0086	Input
0000:2008	EE		OUTB DX ,AL	Port Bin Mode0
0000:2009	B0 09		MOVB AL,#05	Output
0000:200B	BA 86 00		MOVW DX,#0086	Set /INTEA
0000:200E	EE		OUTB DX,AL	In BSR mode
0000:200F	C7 06 24 01 00 21		MOVW 0124,#2100	Interrupt vector table
0000:2015	C7 06 26 01 00 00		MOVW 0126,#0000	
0000:201B	BA F4 FF		MOVW DX,#FFF4	
0000:201E	B0 13		MOVB AL,#13	Initialize 8259
0000:2020	EE		OUTB DX ,AL	
0000:2021	BA F6 FF		MOVW DX,#FFF6	
0000:2024	B0 48		MOVB AL,#48	
0000:2026	EE		OUTB DX ,AL	
0000:2027	B0 03		MOVB AL,#03	
0000:2029	EE		OUTB DX ,AL	Automatic end
0000:202A	B0 FD		MOVB AL,#FD	Of conversion
0000:202C	EE		OUTB DX ,AL	
0000:202D	FB	WI:	STI	
0000:202E	E9 FC FF		JMP WI	
			ORG 2100H	
0000:2100	E9 11 00		JMP ISR	
0000:2103	0A 0A		DB 0AH,0AH	
0000:2105	0D		DB 0DH	
0000:2106	50 6F 72 74	MES:	DB 50H,6FH,72H,74H,	
0000:210A	20 56 61 6C 75		20H,56H,61H,6CH,75H	
0000:210F	65 20 3D 20		,65H,20H,3DH,20H,	
0000:2113	00		00H	
0000:2114	B8 00 00		MOVW AX,#0000	
0000:2117	8E C0		MOVW ES,AX	
0000:2119	8E C8		MOVW CS,AX	
0000:211B	2E		CS	
0000:211C	8D 16 03 21	ISR:	LEA DX,2103	Display routine
0000:2120	8B C2		MOVW AX,DX	Read from portB
0000:2122	9A 13 00 00 FE		CALLS FE00:0013	Display in Serial mode OR
0000:2127	A8 00 80		MOVW DX,#0082	
0000:212A	EC		INB AL,DX	Data field of trainer.
0000:212B	BA 82 00		MOVW DX,#0080	
0000:212E	EE		OUTB DX,AL	
0000:212F	9A 52 00 00 FE		CALLS FE00:0052	
0000:2134	B0 0D		MOVB AL,#0D	
0000:2136	9A 00 00 00 FE		CALLS FF00:0000	
0000:213B	CF		IRET	

Example 8:The following program initializes 8255A port B as an output in Mode1. Press S1 switch to simulate ACK_B *
Note: Put the jumper at PC0 to connect external interrupt INT1 signal to J5 of interface

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	Init	MOVW SP,#3000	Initializes 8255 with Port B in mode 1(o/p)
0000:2003	B0 84		MOVB AL,#84	
0000:2005	BA 86 00		MOVW DX,#0086	
0000:2008	EE		OUTB DX,AL	
0000:2009	B0 05		MOVB AL,#05	Set /INTE B in BSR mode
0000:200B	BA 86 00		MOVW DX,#0086	
0000:200E	EE		OUTB DX,AL	
0000:200F	BE 24 01		MOVW SI,#0124	Interrupt Vector table
0000:2012	B8 00 21		MOVW AX,#2100	
0000:2015	89 04		MOVW [SI],AX	
0000:2017	46		INCW SI	
0000:2018	46		INCW SI	
0000:2019	B8 00 00		MOVW AX,#0000	
0000:201C	89 04		MOVW [SI],AX	
0000:201E	BA F4 FF		MOVW DX,#FFF4	
0000:2021	B0 13		MOVB AL,#13	Initializes 8259
0000:2023	EE		OUTB DX	
0000:2024	BA F6 FF		MOVW DX,#FFF6	
0000:2027	B0 48		MOVB AL,#48	
0000:2029	EE		OUTB DX	
0000:202A	B0 03		MOVB AL,#03	Automatic end of conversion
0000:202C	EE		OUTB DX	
0000:202D	B0 FD		MOVB AL,#FD	
0000:202F	EE	WI:	OUTB DX,AL	
0000:2030	FB		STI	
0000:2031	E9 FC FF		JMP WI	
			ORG 2100	
0000:2100	BA 80 00		MOVW DX,#0080	
0000:2103	B8 55 00		MOVW AX,#0055	
0000:2106	BB 10 00		MOVW BX,#0010	
0000:2109	F6 D0		NOTB AL	Count Value
0000:210B	EE		OUTB DX,AL	
0000:210C	B9 FF FF	BACK	MOVWCX,#FFFF	
0000:210F	E2 FE	:	LOOP 210F	
0000:2111	4B		DECW BX	
0000:2112	75 F5		JNE BACK	
0000:2114	CF		IRET	

Example 9: The following program initializes 8255A port A an output in Mode1 press S3 switch to simulate ACK_A *
Note: Put the jumper at PC3 to connect external interrupt INT1 signal to J5 of interface

Address	Opcode	Label	Mnemonics	Comments
0000:2000	BC 00 30	Init	MOVW SP,#3000	Initializes 8255 with
0000:2003	B0 A0		MOVB AL,#A0	Port A in mode 1(o/p)
0000:2005	BA 86 00		MOVW DX,#0086	
0000:2008	EE		OUTB DX,AL	
0000:2009	B0 0D		MOVB AL,#0D	Set /INTE A in BSR mode
0000:200B	BA 86 00		MOVW DX,#0086	
0000:200E	EE		OUTB DX,AL	
0000:200F	BE 24 01		MOVW SI,#0124	Interrupt Vector table
0000:2012	B8 00 21		MOVW AX,#2100	
0000:2015	89 04		MOVW [SI],AX	
0000:2017	46		INCW SI	
0000:2018	46		INCW SI	
0000:2019	B8 00 00		MOVW AX,#0000	
0000:201C	89 04		MOVW [SI],AX	
0000:201E	BA F4 FF		MOVW DX,#FFF4	
0000:2021	B0 13		MOVB AL,#13	Initializes 8259
0000:2023	EE		OUTB DX	
0000:2024	BA F6 FF		MOVW DX,#FFF6	
0000:2027	B0 48		MOVB AL,#48	
0000:2029	EE		OUTB DX	
0000:202A	B0 03		MOVB AL,#03	Automatic end of conversion
0000:202C	EE		OUTB DX	
0000:202D	B0 FD		MOVB AL,#FD	
0000:202F	EE	WI:	OUTB DX,AL	
0000:2030	FB		STI	
0000:2031	E9 FC FF		JMP WI	
			ORG 2100	
0000:2100	BA 82 00		MOVW DX,#0082	
0000:2103	B8 55 00		MOVW AX,#0055	
0000:2106	BB 10 00		MOVW BX,#0010	
0000:2109	F6 D0		NOTB AL	Count Value
0000:210B	EE		OUTB DX,AL	
0000:210C	B9 FF FF	BACK	MOVWCX,#FFFF	
0000:210F	E2 FE	:	LOOP 210F	
0000:2111	4B		DECW BX	
0000:2112	75 F5		JNE BACK	
0000:2114	CF		IRET	

Example 10: The following program initializes 8255A in Mode2.This program simulates output operation of mode2.

Press S3 switch to simulate ACK_A *

Note: Put the jumper at PC3 to connect external interrupt INT1 signal to J5 of interface

Address	Opcode	Label	Mnemonics	Comments
			ORG 2000	
0000:2000	BC 00 30	Init	MOVW SP,#3000	Initializes 8255A Mode 2
0000:2003	B0 C0		MOVB AL,#C0	
0000:2005	BA 86 00		MOVW DX,#0086	
0000:2008	EE		OUTB DX,AL	
0000:2009	B0 0D		MOVB AL,#0D	Set /INTE 1 in BSR mode
0000:200B	BA 86 00		MOVW DX,#0086	
0000:200E	EE		OUTB DX,AL	
0000:200F	BE 24 01		MOVW SI,#0124	Interrupt Vector table
0000:2012	B8 00 21		MOVW AX,#2100	
0000:2015	89 04		MOVW [SI],AX	
0000:2017	46		INCW SI	
0000:2018	46		INCW SI	
0000:2019	B8 00 00		MOVW AX,#0000	
0000:201C	89 04		MOVW [SI],AX	
0000:201E	BA F4 FF		MOVW DX,#FFF4	
0000:2021	B0 13		MOVB AL,#13	
0000:2023	EE		OUTB DX	Initializes 8259
0000:2024	BA F6 FF		MOVW DX,#FFF6	
0000:2027	B0 48		MOVB AL,#48	
0000:2029	EE		OUTB DX	
0000:202A	B0 03		MOVB AL,#03	
0000:202C	EE		OUTB DX	
0000:202D	B0 FD		MOVB AL,#FD	Automatic end of conversion
0000:202F	EE	WI:	OUTB DX,AL	
0000:2030	FB		STI	
0000:2031	E9 FC FF		JMP WI	
			ORG 2100	
0000:2100	BA 80 00		MOVW DX,#0080	
0000:2103	B8 55 00		MOVW AX,#0055	
0000:2106	BB 10 00		MOVW BX,#0010	
0000:2109	F6 D0		NOTB AL	
0000:210B	EE		OUTB DX,AL	Count Value
0000:210C	B9 FF FF	BACK	MOVW CX,#FFFF	
0000:210F	E2 FE	:	LOOP 210F	
0000:2111	4B		DECW BX	
0000:2112	75 F5		JNE BACK	
0000:2114	CF		IRET	

6C: DEMONSTRATION PROGRAMS FOR ESA 86/88-E TRAINER KIT.

Example 1: Configure 8255A such that PORT A & PORT B as an output. Execute the program at 2000H

ADDRESS	OPCODE	LABLE	MNEMONICS	COMMENTS
0000:2000	BA C6 FF		ORG 2000	
0000:2003	B0 80		MOV DX,FFC6	Initialize 8255 ports
0000:2005	EE		MOV AL,80	As output
0000:2006	B0 55		OUT AL,DX	
0000:2008	BA C0 FF		MOV AL,55	
0000:200B	EE	RPT:	MOV DX,FFC0	Output data at Port A
0000:200C	F6 D0		OUT AL,DX	
0000:200E	BA C2 FF		NOT AL	Invert the data and output this value at port B
0000:2011	EE		MOV DX,FFC2	
0000:2012	E2 FE		OUT AL,DX	
0000:2014	E2 FE		LOOP 2012	Introduce delay
0000:2016	E9 EF FF		LOOP 2014	And repeat.
			JMP RPT	

Example 2.Configure 8255A such that PORT A as an output & PORT B as an input. Execute the program at 2000H. This program reads data from Port B and outputs the inverted value on Port A

ADDRESS	OPCODE	LABLE	MNEMONICS	COMMENTS
0000:2000	BA C6 FF		Org 2000H	
0000:2003	B0 82		MOVW DX,#0FFC6	Initialize 8255
0000:2005	EE		MOVB AL,#82	portA as o/p
0000:2006	BA C2 FF		OUTB DX	Port B as I/P
0000:2009	EC	LOOP:	MOVW DX,#0FFC2	
0000:200A	F6 D0		INB DX	Read value from PortB
0000:200C	BA C0 FF		NOTB AL	Invert the data
0000:200F	EE		MOVW DX,#0FFC0	And output this value
0000:2010	E9 F3 FF		OUTB DX,AL	At Port A
			JMP LOOP	Repeat process.

Example 3.Configure 8255A such that PORT A as an Input & PORT B as an Output. Execute the program at 0:2000H. This program reads the data from Port A and Output the same data on PortB.

ADDRESS	OPCODE	LABLE	MNEMONICS	COMMENTS
0000:2000	BA C6 FF		MOVW DX,#0FFC6	Initialize 8255
0000:2003	B0 90		MOVB AL,#90	PortB as o/p
0000:2005	EE		OUTB DX	Port A as I/P
0000:2006	BA C0 FF		MOVW DX,#0FFC0	
0000:2009	EC	LOOP:	INB DX	Read value from PortA
0000:200A	F6 D0		NOTB AL	Invert the data
0000:200C	BA C2 FF		MOVW DX,#0FFC2	And output this value
0000:200F	EE		OUTB DX,AL	At Port B
0000:2010	E9 F3 FF		JMP LOOP	Repeat process.

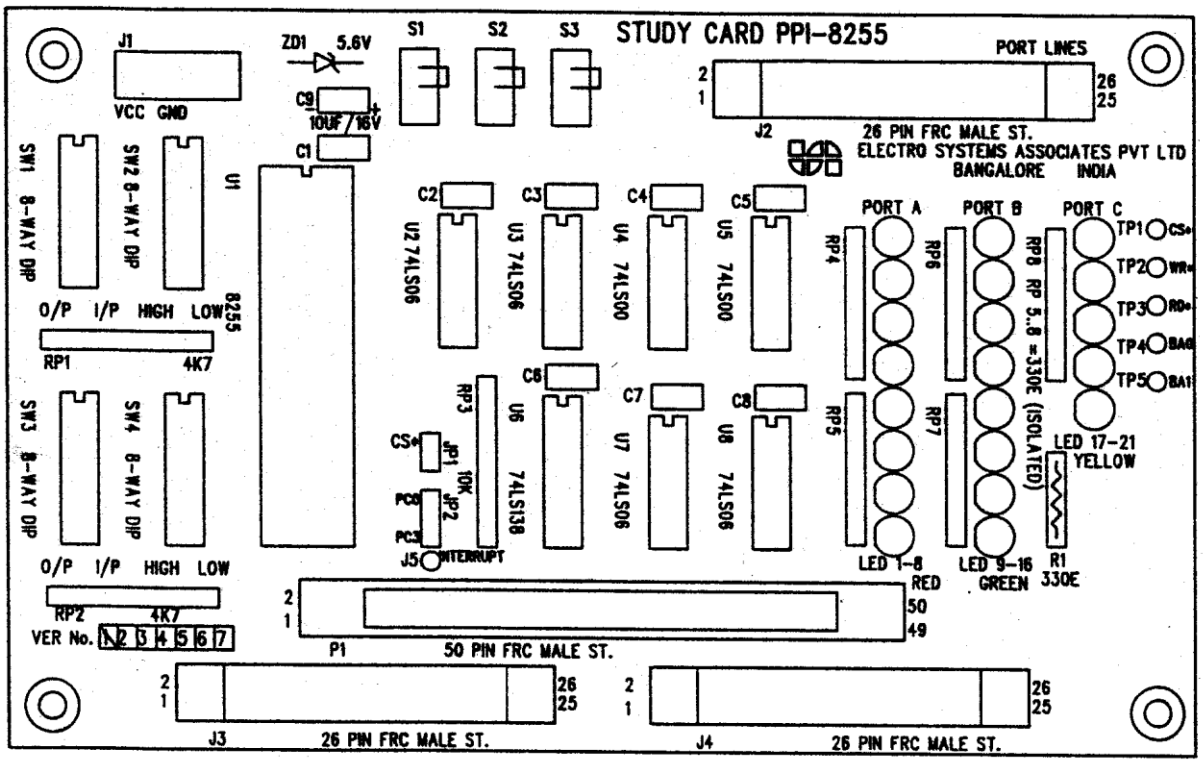
Example 4: PROGRAM FOR BSR MODE

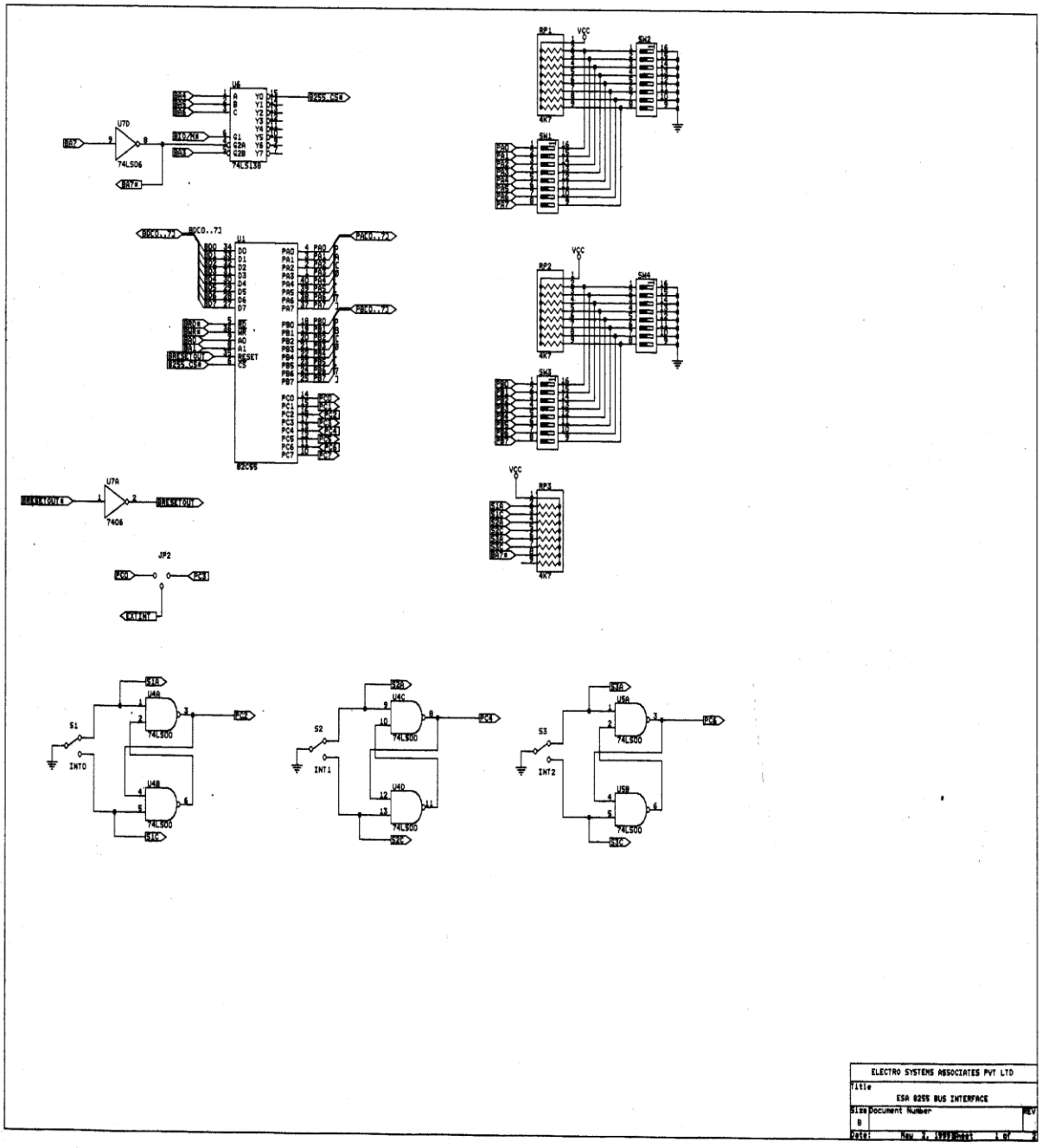
The following program initializes the 8255 ports and then it write a BSR control word to set bit PC7 and reset it after certain delay.

Address	Opcode	Label	Mnemonics	Comments
0000:2000	B0 80		MOV AL,80	Initialize 8255
0000:2002	BA C6 FF		MOV DX,FFC6	Port A ,B, & C
0000:2005	EE		OUT AL,DX	As ouptut.
0000:2006	B0 0F	RPT:	MOV AL,0F	
0000:2008	BA C6 FF		MOV DX,FFC6	Set PC7 using Bit
0000:200B	EE		OUT AL,DX	Set/Reset mode
0000:200C	E8 0B 00		CALL DELAY	
0000:200F	B0 0E		MOV AL,0E	
0000:2011	BA C6 FF		MOV DX,FFC6	Reset PC7
0000:2014	EE		OUT AL,DX	
0000:2015	E8 02 00		CALL DELAY	
0000:2018	E2 EC		LOOP RPT	
0000:201A	50	DELAY:	PUSH AX	Delay Routine
0000:201B	51		PUSH CX	
0000:201C	B9 30 00		MOV CX,0030	
0000:201F	B8 FF 0F		MOV AX,0FFF	
0000:2022	48		DEC AX	
0000:2023	75 FD		JNE 2022	
0000:2025	E2 F8		LOOP 201F	
0000:2027	59		POP CX	
0000:2028	58		POP AX	
0000:2029	C9		RET	

From the analysis of the routine the following points can be noted.

- **To Set/Reset bits in port C, a control word is written in the control register and not in port C.**
- **BSR control word affects only one bit in port C.**
- **The BSR control word does not affect the I/O mode.**


STUDY CARD PPI-8255
PORT LINES
26 PIN FRC MALE ST.
ELECTRO SYSTEMS ASSOCIATES PVT LTD
BANGALORE INDIA
J1
VCC GND
ZD1 5.6V
C9 10UF / 16V
C1
S1
S2
S3
J2
SW1 8-WAY DIP
SW2 8-WAY DIP
U1
8255
O/P I/P HIGH LOW
RP1 4K7
SW3 8-WAY DIP
SW4 8-WAY DIP
RP2 4K7
VER No. 1 2 3 4 5 6 7
C2
C3
C4
C5
U2 74LS06
U3 74LS06
U4 74LS00
U5 74LS00
C6
C7
C8
U6 74LS138
U7 74LS06
U8 74LS06
RP3
JP1
JP2
10K
CS
PC0
PC3
J5 INTERRUPT
PORT A
PORT B
PORT C
RP4
RP5
RP6
RP7
RP8 RP 5..8 =330E (ISOLATED)
LED 1-8 RED
LED 9-16 GREEN
LED 17-21 YELLOW
R1 330E
TP1 CS
TP2 WR
TP3 RD
TP4 BA0
TP5 BA1
P1
50 PIN FRC MALE ST.
J3
26 PIN FRC MALE ST.
J4
26 PIN FRC MALE ST.


ELECTRO SYSTEMS ASSOCIATES PVT LTD
ESA 8255 BUS INTERFACE