8.1 INTRODUCTION

The total software design has been done for the following software packages-

1. Interactive menu driven software for programming the base station before the start of operation. The software is meant to set - i) System-parameters, and ii) Trigger-parameters of individual remote station. Trigger parameters may be same for all remote stations or may be different also.

2. Software for - i) the acquisition of fresh data samples from the remote stations after every 3.3 mili seconds, and ii) for subsequent processing on it.

3. Software for- the detection of true event at the level of individual remote station by computing STA/LTA ratio trigger algorithm on the field data received from that remote station.

4. Software for - i) taking in the seismic clock data after every second, ii) forming the 'Header information' with it alongwith some other information and finally storing this header information after every 'Synch- word' into the circular memory.

5. Software for the detection of true event at the local seismic network level within the given Time-Window on the basis of the event occurrence status provided by the
desired remote stations which have been selected for this purpose.

6. Software for- i) the transfer of pre event, event and post event data in real time mode from each processor card (8 channels) via Interface controller' module to active memory of PC/XT, ii) transferring the so stored data block of 9.6 K byte into the hard disk one after the other as and when such block is ready without loosing any data from remote stations.

7. Software module for "Real time Monitoring" of the total system in the form of "Histogram" to gather information on the proper functioning of the remote stations of the total network array.

The total software has been written in "Assembly language". The software architecture is modular and distributed. These complex software packages needed to operate different electronic modules/assemblies have been got developed through highly technical experts. Finally the hardware and software have been integrated together to configure the system to function as per worked out design.

When power is put 'ON', the system gets initialized i.e. all the input/output devices get their ports programmed as follows-

8.2 INITIALIZATION OF SYSTEM HARDWARE

a) Initialization of processor cards of IFEH module

All the eight processor cards of IFEH module are
initialized identically. Each card of the module contains three pieces of 8255 (PPI) and these have been initialized as follow-

**8255-1 (processor card)**

Port PA - Input port - For taking in the bytes of programmed data (PD-IN) available during programming time.

Port PB - Output port - For sending out PD-IN bytes during verification mode (PD-V).

Port PC - Input port - For taking in bytes of clock data. Each byte contains two digits in BCD form.

**8255 - II (processor card)**

Port PA - Input port - For taking in the first byte of sample data which is made available by data recovery logic after every 3.3 ms.

Port PB - Output port - For sending out first byte of event data (ED) when true event has been detected or first byte of data for real time monitoring (RTM).

Port PC - Input port -

PCO - Execute command issued from
8255-I (PC/XT).

PC1 - Not used.
PC2 - Event true (ET) signal generated by Interface controller module at its 8255-III (IC).
PC3 - Signal 'T' issued from Interface controller module for RTM detection at 8255-III
PC4 - PD-IN signal from 8255-I (PC/XT)
PC5 - PD-V signal from 8255-I (PC/XT)

8255 - III (processor card)

Port PA - Input port - For taking in 2nd byte of data sample made available after every 3.3 ms by its data recovery logic.

Port PB - Output port - For sending out the 2nd byte of ED/RTM data.

Port PC - Output port -
   PC0 - Clock Interrupt burst pulses after every second
   PC1 - Not used
   PC2 - To reset the flip flap used to take clock IN
   Rest not used

8085 (processor card)

INT - RST 7.5 - Used to take seismic data in after
every 3.3 ms (edged trigger)

INT - RST 6.5 - To take clock data IN after every second

INT - RST 5.5 - PD-IN and PD-V (For programming and verification)

TRAP - Not used

Besides above initialization, a number of Flags and Counters have been set in the memory of each processor card of IFEH module. Every processor card of IFEH module is initialized in identical manner as described above.

b) Initialization of Intelligent controller (IC)

The card of Intelligent controller contains three pieces of 8255 (PPI) and 8085 micro-processor. These have been initialized as follows-

8255 - I (IC)

Port PA - Input port - To take in the byte of programmed data (PD-IN) from the output port PA of 8255-I (PC/XT).

Port PB - Output port - To send out the byte of PD-IN data to input port PA of 8255-I of every processor card of IFEH module.

Port PC - Output port - To send out the interrupt signals to all processor cards of IFEH module for taking in the byte available at input
port PA of 8255-I (IFEH). Line PC0 to PC7 have been used for this purpose. PC0 goes to first card and PC7 goes to last card.

8255 - II (IC)
Port PA - Input port - To take in first byte of ED/RTM available at the output port PB of 8255-II (of all the processor cards).
Port PB - Input port - To take in 2nd byte of ED/RTM available at output port PB of 8255-III (of all the processor cards).
Port PC - Output port - To send out ED/RTM data byte after byte over to the input port of 8255-I (PC/XT).

8255 - III (IC)
Port PA - Output port - One line of this output port is connected to one processor card of IFEH module to enable the buffers set. Thus PA0 is connected to first processor card and likewise PA1 is connected to 2nd card and so on.
Port PB - Output port

Line PB0 has been used to issue a pulse to PC/XT at PC1 of 8255-I (PC/XT) for lifting ED/RTM data.

Port PC - PC0 to PC3 (output port)

PC0 - INT signal to PC to take in the ED/RTM data
PC1 - Event true signal
PC2 - To reset the DF/flop
PC3 - To issue signal 'T'

PC4 to PC7 (Input port)

PC4 & PC5 - Not used
PC6 - Handshake signal for ED/RTM
PC7 - One level on it, commands that data will be sent to PC/XT
      '0' level on it will command that data is not to be sent.

8085 - (IC)

INT 7.5 - To take clock data IN i.e. either code 0000 or 0001 as the case may be after every second when event is not true
INT 6.5 - To take IN ED/RTM data from IFEH module.
INT 5.5 - PD-IN interrupt at first stage to take program data from PC/XT to IC.

Besides this, many FLAGS and counters have been set into at some predetermined location of memory of Intelligent controller.
c) Initialization of PC/XT - Hardware

The plug in card of PC/XT contains two pieces of 8255 (PPI) and 8088 micro-processor. These have been initialized as follows-

**8255 - I (PC/XT)**

Port PA - Output port - To send out data of PD-IN byte after byte to input port PA of 8255-I (IC).

Port PB - Input port - To take in the ED/RTM data byte after byte from output port PC of 8255-III (IC).

Port PC - Output port

- **PC0** - PD-IN interrupt signal for RST 5.5 of IC
- **PC1** - To receive a signal from port PB0 of 8255-III (IC) during ED/RTM data transfer.
- **PC2** - Signal to show that PD-IN has been performed
- **PC3** - Signal to show that PD-V operation is over
- **PC4** - To reset D flip flop used for sending interrupt
- **PC5** - Execute command
- **PC6** - Hand shake signal issued to 8255-III(IC) for RTM/ET identification.
PC7 - Hand shake signal issued to 8255-III (IC) to indicate if PC/XT is free or not.

8255- II (PC/XT)

Port PA- Input port - To take in data corresponding to PD-V in byte after byte form from the PB output ports of 8255-II (IFEH) and 8255-III (IFEH) of each processor card.

Port PB- Output port - One line of this port is connected to one set of buffer of one processor card. On each line a pulse is generated one after the other to enable the buffer set mounted on its card. Thus the signals on these lines are used to take in the data corresponding to PD-V, in byte form one after the other from PB output port of 8255-I (IFEH).

Port PC- Output - Each line of it is used to generate interrupt signal for RST 5.5 of each processor card of IFEH module.

8088 (PC/XT)

INT - Used to take several data into PC in byte by byte
Keeping into consideration the overall functional requirement of the total system and with a view for operating it in interactive and friendly user's mode, the following necessary Commands, Instructions and Formats have been designed. The software packages to realize these commands/instructions have been got developed. The design worked out for these commands, instructions and tables is as below—

8.3 DESIGN OF INTERACTIVE COMMANDS AND INSTRUCTIONS

When power is put "ON", the system boots and on the screen we get prompt in C-drive. After this, the password "ELEC" is typed and return is pressed. On the screen, the following message is displayed—

***********************************************************
* *
* DO YOU HAVE A COLOR MONITOR ----------(Y/N). *
* *
***********************************************************

The software goes into a loop and keep on waiting for appropriate key depression. Two cases have been considered—
a) Press the key "Y". In response to this key depression, the following message is displayed on v.d.u.
Software goes into wait loop for key depression. Whenever any key is pressed at anytime, the following is displayed on the VDU.

Software goes into a loop waiting for appropriate keys depression. Suppose, the operator presses key "F1" the following is displayed on the screen.
INSTRUCTIONS

THIS SYSTEM IS CONFIGURED TO RUN ON THE IBM PC/XT OR COMPATIBLE UNITS. ALL INPUT DATA MUST BE WITHIN THE PRESCRIBED RANGES AND LEADING ZEROES USED WHEREEVER REQUIRED. USE [BACKSPACE] FOR CORRECTIONS, ENTER DATA WITH THE [RETURN] KEY.

TRIGGER WINDOW MEANS TRIGGERING OF DIFFERENT CHANNELS AT THE SAME TIME.

PRE EVENT RECORD LENGTH XXX TO XXX SECONDS
POST EVENT RECORD LENGTH XXX TO XXX SECONDS
LONG TERM AVERAGE LENGTH 1 SECOND TO 99 SECONDS
SHORT TERM AVERAGE LENGTH 0.1 SECOND TO 9.9 SECONDS
TRIGGER RATIO [STA/LTA] 1 TO 20 INTEGER
CHANNEL NUMBER 1 TO 8
NOTE: LTA must be at least three times STA.

F1: INSTRUCTION F2: TRIGGER F4: MAIN MENU
ABORT (EXIT THE PROGRAM) : ESC

Software again goes into a loop waiting for any appropriate key depression for assuming new task.
If "F2" is pressed. The following is displayed on the screen.
Software goes into a loop waiting for depression of either key "Y" or key "N".
Now two cases have been considered.
Case-1: When "N" is pressed, the following is displayed on the VDU.

and so on. With every depression of key "N", the next channel is addressed. After channel number eight, if again key "N" is pressed, the following message is displayed on
the screen.

***********************************************************
* *
* TRIGGER SELECTION MENU *
* *
* CHANNEL NUMBER.........[1] *
* *
* DO YOU WANT TO PROGRAM THIS CHANNEL...........[Y/N] *
* *
***********************************************************

Case-2: When key "Y" is pressed. The following is displayed on the VDU.

***********************************************************
* *
* TRIGGER SELECTION MENU *
* *
* PRE EVENT RECORD IN SOUND [- ] *
* POST EVENT RECORD IN SECOND [ ] *
* SINGLE/THREE COMPONENT [ ]... [B] *
* LENGTH OF LTA IN SECOND [ ] *
* LENGTH OF STA IN SECOND [ ] *
* TRIGGER VALUE RATIO [ ] *
* CHANNEL NUMBER [ ] *
* *
* F1:INSTRUCTION  F2:TRIGGER  F4: MENU; ESC; ABORT *
* *
***********************************************************

After filling 5 digits in each brackets when < CR > is pressed, the following message is displayed on the screen in addition to the earlier displayed information:

***********************************************************
* *
* "ANY CHANGE TO MAKE? [Y/N]" *
* *
***********************************************************
The software goes into wait loop. Now two cases have been considered.

Case-1: When key "Y" is pressed, then the following message is displayed on the screen when the operator is programming the channel no "1".

***********************************************************
* *
* TRIGGER SELECTION MENU *
* *
* CHANNEL NUMBER-----------------[1] *
* *
* DO YOU WANT TO PROGRAM THIS CHANNEL--------[Y/N]? *
* *
***********************************************************

Software goes into waiting loop. If the operator now presses the key "Y", then the table designated as "B" for channel parameters is displayed on the on the screen as before. Wherever changes are desired, the new changed value are filled in the bracket as before and the process is repeated.

Case-2: When key "N" is pressed, the following is displayed on the screen.

***********************************************************
* *
* DO YOU WANT TO MAKE ANY CHANGE---------[Y/N] *
* *
***********************************************************

When key "N" is pressed, the following message is displayed on the screen:

***********************************************************
* *
* DOES THIS CHN COME UNDER TRIGGER WINDOW CRITERIA--[Y/N] *
* *
***********************************************************

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and the following also happens.
A. The earlier table remains unchanged.
B. Foot note remains unchanged and the message

DO YOU WANT TO MAKE ANY CHANGE ...........[Y/N]

goes off the screen and in place of this, the following new message is displayed.
The software goes to waiting loop for key depression in response to above message.
Now again two cases have been considered.

Case-1: When key "Y" is pressed, the earlier message

DOES THIS CHANNEL COMES UNDER TRIGGER CRITERIA .....[Y/N]

is replaced by the following new message

***********************************************************
* *
* IS CHANNEL PROGRAMMING OVER.......[Y/N] *
* *
***********************************************************

Case-2: When this channel does not fall under the set of selected channels then key "N" is pressed. The following message is displayed on the VDU.

***********************************************************
* *
* IS CHANNEL PROGRAMMING OVER--------[Y/N] *
* *
***********************************************************

The earlier table with different variable values filled in it along with foot note remains there.
Software goes to a loop waiting for appropriate key depression.
Now as before two cases have been considered.
Case-1: When key "N" is pressed, the following is displayed.

***********************************************************
* TRIGGER SELECTION MENU *
* CHANNEL NUMBER........[1] *
* DO YOU WANT TO PROGRAM THIS CHANNEL.......[Y/N] *
***********************************************************

Now suppose, the operator desires to program channel number "4", then by pressing successively key "N" three times, the desired channel would be selected. In this manner, all the channels can be selected.

Case-2: When key "Y" is pressed, then, the following message is displayed on the screen:

***********************************************************
* INPUT PARAMETER FOR STA/LTA HAS BEEN TRANSMITTED *
* TO CORRESPONDING PROCESSOR CARD *
* *
* *
* DO YOU WANT TO VERIFY DATA OF CHANNEL [1]-----[Y/N] *
***********************************************************

Software is waiting for the depression of either key "Y" or key "N". Two cases have been considered.

Case-1: Suppose key "Y" is pressed, then the following is displayed:
This information comes back on the screen from the corresponding channel module. Only the values of the parameters is transferred back from the corresponding processor card whereas the format as such is retained within the PC. Table disappears after sometime and in place of this table, the following message is displayed.

The software goes into wait loop. Two cases have been considered.

If again key "Y" is pressed, the same operation as before is repeated this time again for channel-1.

Case-2: When key "N" is pressed, the following is displayed
The software again goes to wait loop for key depression of either key "Y" or "N". As before, two cases have been considered. The case for key "Y" has already been discussed. Suppose, the operator again presses key "N", then on the screen, the following is displayed:

The above process continues with each depression of key "N" till the following message is displayed on the screen-

Suppose the key "N" is again pressed, then the following message is displayed on the screen-

The software goes into wait loop for the depression of either key "Y" or "N"-

Case-1: Key "Y" is pressed. Then the following is displayed
The software goes to wait loop and keeps on waiting for depression of either key 'Y' or key 'N'. If key 'Y' is pressed, the cursor goes to the start of data entry in this table. If key 'N' is pressed, the HISTOGRAM is displayed on the screen with following message.

**HISTOGRAM**

PRESS KEY: F5 FOR RTM,  
PRESS KEY: F9 FOR EVENT DATA

![HISTOGRAM Graph](image-url)
When key F5: is again pressed, the histogram with upgraded value of data from remote stations is displayed on the screen after every second and this is done for 60 times in a minute. After one minute, the histogram remains displayed with the last value of real data obtained from the remote stations for this purpose.

When key F9 is pressed, the following is displayed on the screen-

******************************************************************************
* *
* COMPUTER IS BOOKED FOR TRUE DATA *
* PRESS F10 FOR REAL TIME MONITORING *
* OR *
* PRESS KEY ESC TO EXIT *
******************************************************************************

If key 'ESC' is pressed then the system starts a fresh.