Henson 3200

User Instruction Manual

INSTRUCTION MANUAL FOR HENSON 3200

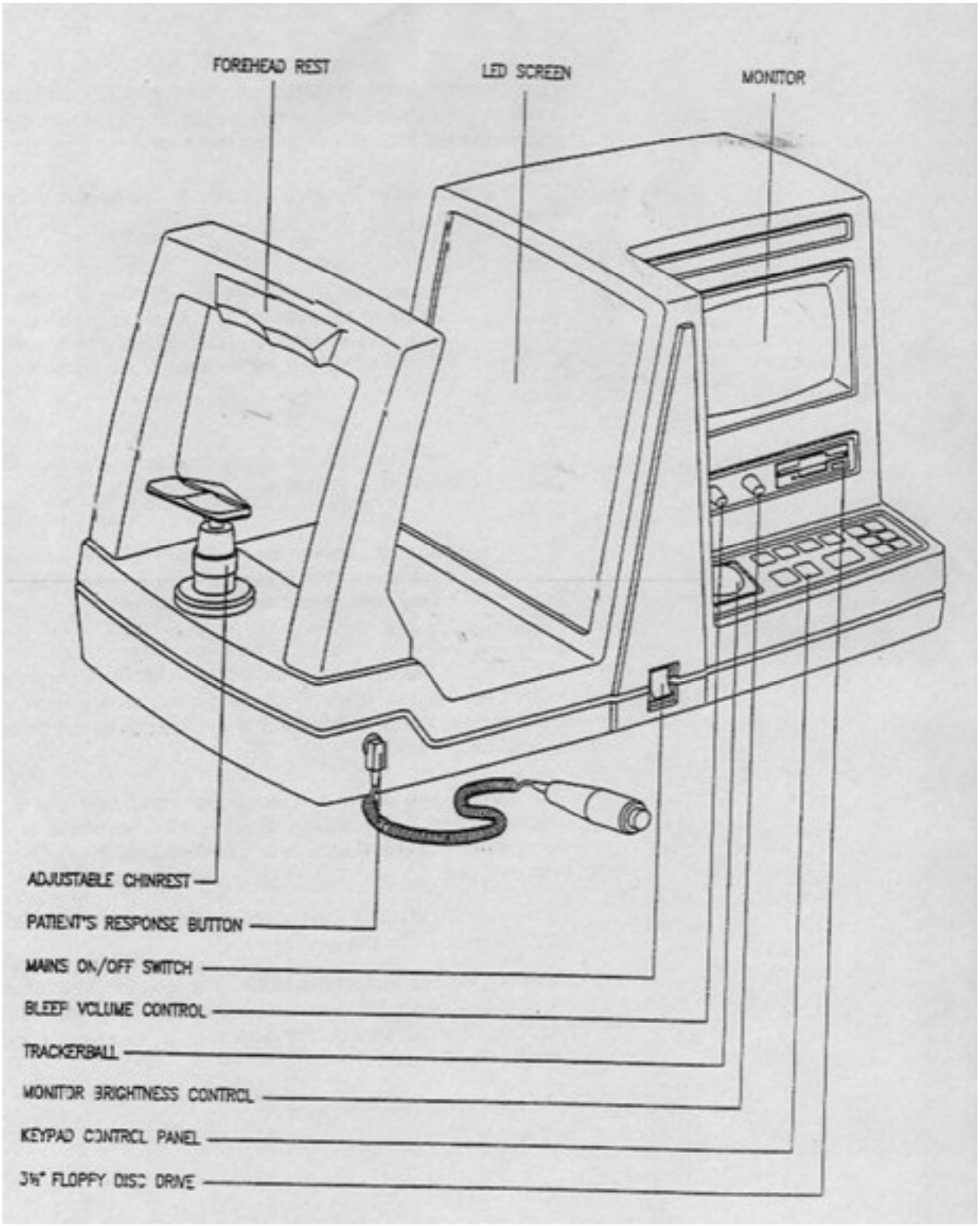
C H A P T E R 1

GETTING STARTED

The Henson 3200 is simplicity itself to use. Like almost all modern instruments it uses a series of pull down menus and operator help facilities to guide the new user through its many facilities.
The operator console has a monitor and a keyboard, see figure 1.

- The **monitor** presents the operator with a series of menus, details of the type of test, state of the test, etc. Much more about what is displayed on this monitor will be discussed in the later sections of this manual.

■ **FIGURE 1**
Diagram of the Henson 3200 perimeter



- The keyboard is used when selecting programs, presenting stimuli, etc.

- The left hand side of the console incorporates a **trackerball**. This is used, during an examination, to add, delete, and re-test selected locations.

Above the keyboard are a series of additional controls and a 1.4MB floppy disk drive. The main controls are here to adjust the brightness of the monitor, and the volume of the bleeps used to cue the patient.

The floppy disk drive can be used to update the perimeter programs and, if the additional QWERTY keyboard is fitted, to store/retrieve patient data and transfer data to other computer systems, etc.

The visual field data can also be printed out on the ink jet printer attached to the perimeter.

The best way to learn how to use the Henson 3200 is to turn it on and practise with a colleague. In this way you will quickly find out how to select the appropriate strategy, conduct an examination, etc.

The main power on/off switch is located below the keyboard along to the left.

START UP

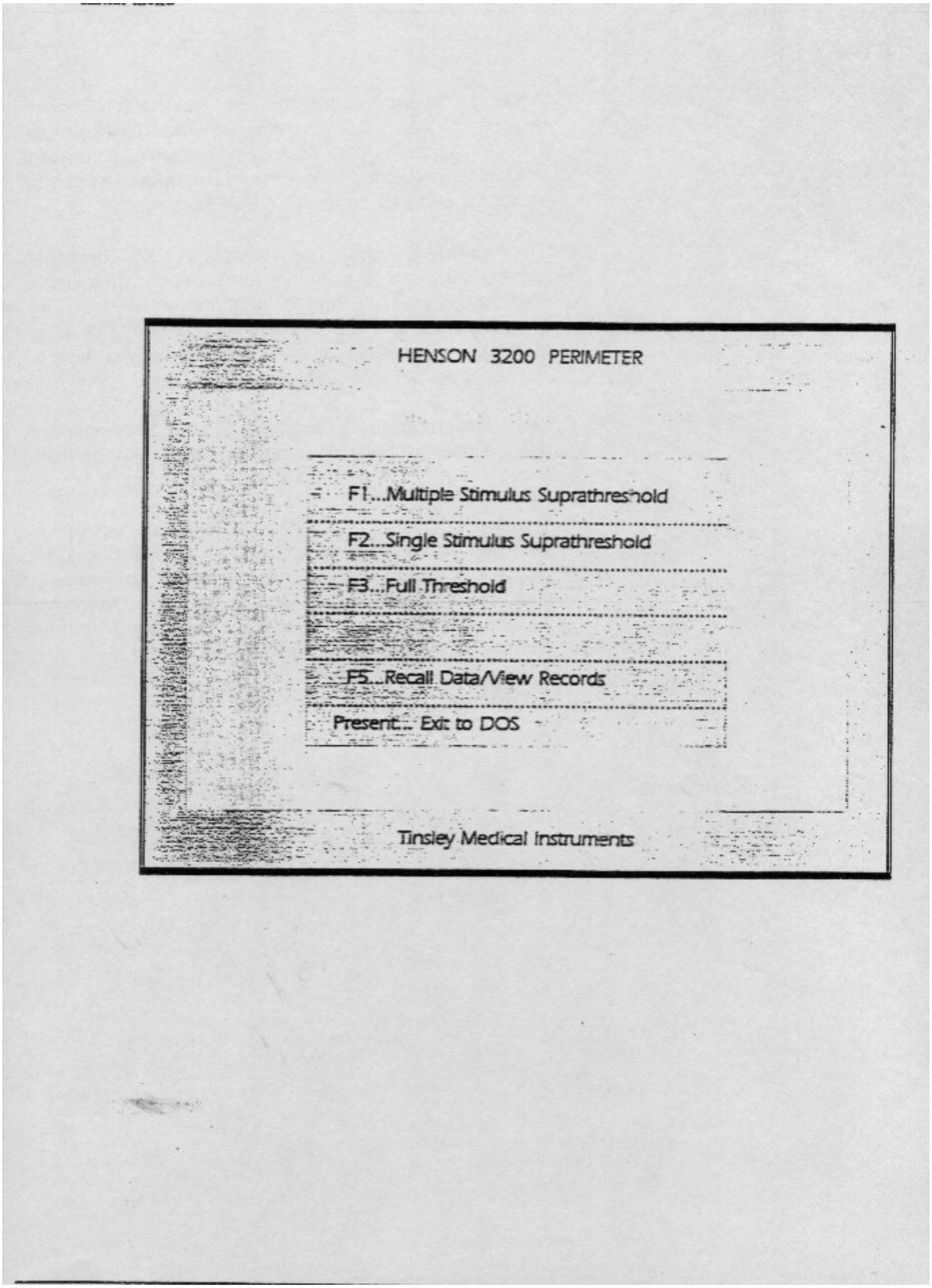
When the operator turns the unit on, the 3200 goes through a series of memory checks, background luminance checks, etc. When it has finished doing this you will be presented with a screen menu asking you to select the required strategy.

The multiple and single stimulus supra-threshold strategies are used primarily for screening the visual field while the full threshold strategy is used for measuring the extent of a visual field defect. The latter technique is popular with ophthalmologists who wish to monitor a patient with established loss.

The Recall facility (only available if additional keyboard fitted) allows the perimetrist to recall data stored on disk. (More about this in Chapter 9.)

The Exit to DOS option takes the computer out of the perimeter programs and into its disk operating system (MSDOS). When in DOS the perimetrist can transfer files from the perimeter's RAM disk drive (see Appendix 7), load new programs, and alter the perimeter's start-up options, etc. (More about this in Appendix 3.)

Initial menuC H A P T E R 2



THE GRAPHICAL INTERFACE

After you have selected a test strategy (multiple stimulus supra-threshold, single stimulus supra-threshold or full threshold) and in the case of the full threshold strategy the area of the visual field you wish to test. The text screen will then be replaced with a screen similar to that shown in figure 3. This screen forms an important part of the interface between the perimetrist and the perimeter. All three test strategies offer a similar graphical interface to the perimetrist.

THE MENU BAR

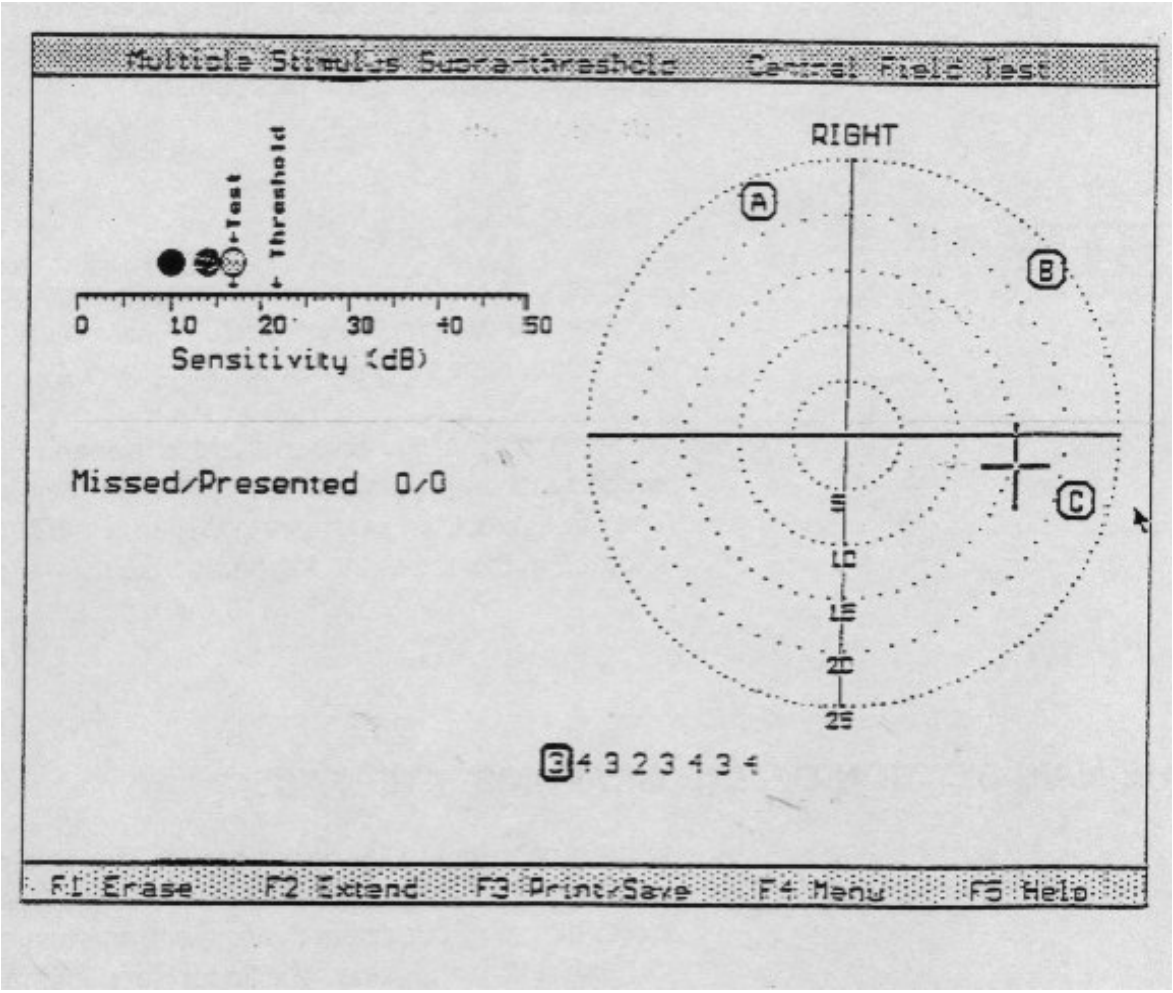
The top line of the graphics screen incorporates a message indicating which strategy has been selected and which region of the field is being tested.

At the bottom of the screen there is a menu bar listing which function keys are active and what their action is. The five function keys are labelled **F1**-**F5** and are situated at the top of the special keyboard.

THE MAIN SECTION OF THE GRAPHICS INTERFACE

On the right hand side of the screen is a field chart on which the current status of the test is displayed. The exact nature of the display varies with the test strategy. On the left hand side additional test information is provided. This again varies with the type of strategy used.

■ **FIGURE 3**
Example of startup screen



C H A P T E R 3

THE HELP FACILITY

One of the function keys, **F5,** is reserved for the help facility. Pressing this key will open up a help window. Within the window will be a help message telling the perimetrist about the current state of the field examination.

Any testing of the visual field will be suspended while the help message is displayed. The help window is removed by pressing **F5**. The program will then return to where it was prior to the help message being displayed.

C H A P T E R 4

CONCEPTS BEHIND THE DESIGN OF THE 3200

Before describing the various controls found within each test strategy, it would be useful to say a word or two about some of the concepts incorporated in the 3200.

First, all test programs are extendible using the pro-extend facility. The tests start off testing a certain number of locations. When these have all been tested the perimetrist is given the option of extending the test to include additional locations. Such 'extendibility' was introduced in the Henson CFA3000. In the 3200 it has been developed to include both full threshold and supra-threshold tests.

Second, all test programs allow the perimetrist to intervene during the test to check a response, make corrections, etc. It is also possible to add additional test locations that were not included in the original program.

These two concepts increase the flexibility of the perimeter. When the perimetrist finds that some locations have been missed and suspects these are due to an artefact, such as the spectacle lens rim, then he can easily re-test those locations and correct the display accordingly. If the perimetrist finds a scotoma he can add additional test spots around the area of the scotoma to map its extent more precisely.

Most importantly these facilities allow the perimetrist to adjust or customise the program according to the results. It is no longer necessary for the perimetrist to decide exactly which regions of the field he wants to test and then, as the results start to appear, have no means of adjusting the test.

CHAPTER 5

SELECTING A STRATEGY

The Henson 3200 offers three different strategies:

multiple stimulus supra-threshold,
single stimulus supra-threshold,
full threshold,

Which one is best for your needs?

- **If you want to screen the visual field** then you should select one of the supra-threshold strategies.

- **If speed is important,** the multiple stimulus supra-threshold strategy is approximately twice as fast as the single stimulus supra-threshold strategy in patients with little if any defect.

- **If your patient has a known defect** then the single stimulus strategies, where the patient presses a response button every time he sees a stimulus, are better. In this situation the frequent failure of the patient to see all the stimuli in a multiple stimulus strategy results in repeated questioning that slows down the test and can lead to frustration for both the patient and the perimetrist.

- **If you wish to accurately measure the depth of a defect** then use the full threshold strategy.

- **If you wish to test a large number of stimulus locations** then choose a supra-threshold strategy.

- **If you wish to quantify the extent of loss** with the indices-mean defect, loss variance and fluctuation, then use the full threshold strategy.

C H A P T E R 6

MULTIPLE STIMULUS SUPRA-THRESHOLD PROGRAMS

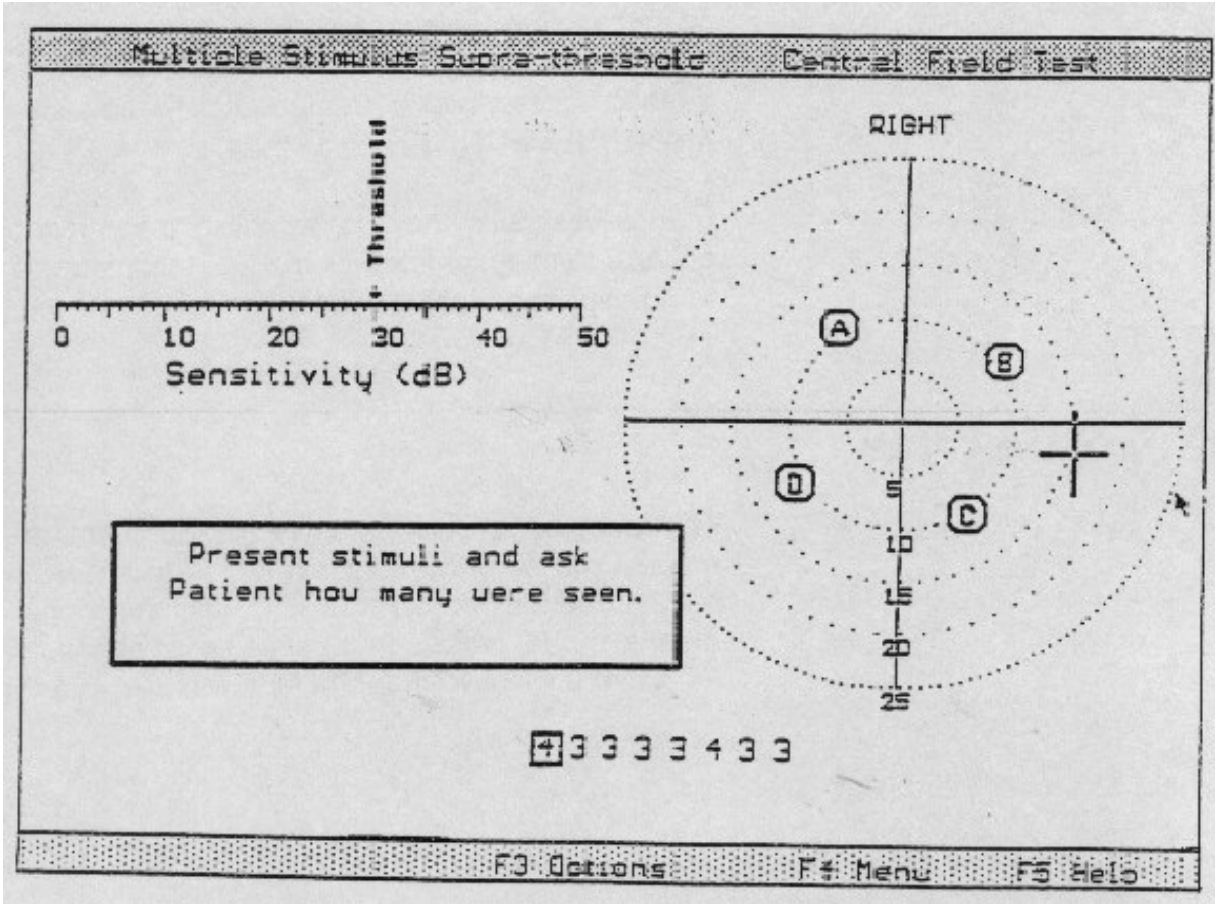
The multiple stimulus supra-threshold tests are all designed to be operated in a threshold related manner. This means you start the test off by deriving an estimate of the patient's threshold and then step the intensity up (5dB above the 50% seeing threshold) to a supra-threshold test level at which all the stimuli are initially presented.

Before describing how to establish the threshold with either a semi-automated or manual technique, it is best to go over some basic points.

THE INITIAL DISPLAY

The menu bar shows that three (or four if you are in the manual mode) of the function keys are active. Leaving out **F1** for the moment as it is only functional in the manual mode, pressing **F3** opens up an options window, **F4** a menu window and **F5** a help window.

■ **FIGURE 4**
Initial display at onset of multiple stimulus supra-threshold strategy



Note. When a window is open it over-rides all other controls. The only functioning keys are those itemised in the window and their function is as per described in the window. All non-help windows also offer the option of going back, or cancelling, by pressing **Present.**

F3: THE OPTIONS WINDOW

If you press **F3** an options window appears on the screen. While in the options window selecting:

- **F1** changes the patient's fixation target. There are two types, a single red fixation spot or a cross of four red fixation spots. The cross of four spots is used when the patient has no central field. The patient being instructed to fixate the centre of the four dot pattern. More details about this can be found in Appendix 4. For the moment just remember that if you press **F1** you will switch from one type of fixation target to the other, i.e. if the fixation target is currently a four spot one then selecting **F1** will switch it to a single one and visa versa.

- **F2** allows you to enter a threshold value. This is sometimes used when you are repeating an examination and want to ensure that the stimuli are at the same intensity as in the previous examination.

- **F5** displays a help message.

- **Present** Cancels the options window.

F4: THE MENU WINDOW

If you press **F4** a menu window appears on the screen. While in the menu window selecting:

- **F1** takes you back to the beginning of the threshold phase of the test. Press this if things have gone wrong and you

wish to re-start from the threshold phase of the multiple stimulus test.

- **F2** allows you to tranfer to a single stimulus supra threshold strategy. Any data that you have already collected will be retained.

- **F3** swaps over the eyes.

- **F4** exits from the multiple stimulus strategy. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** displays a help message.

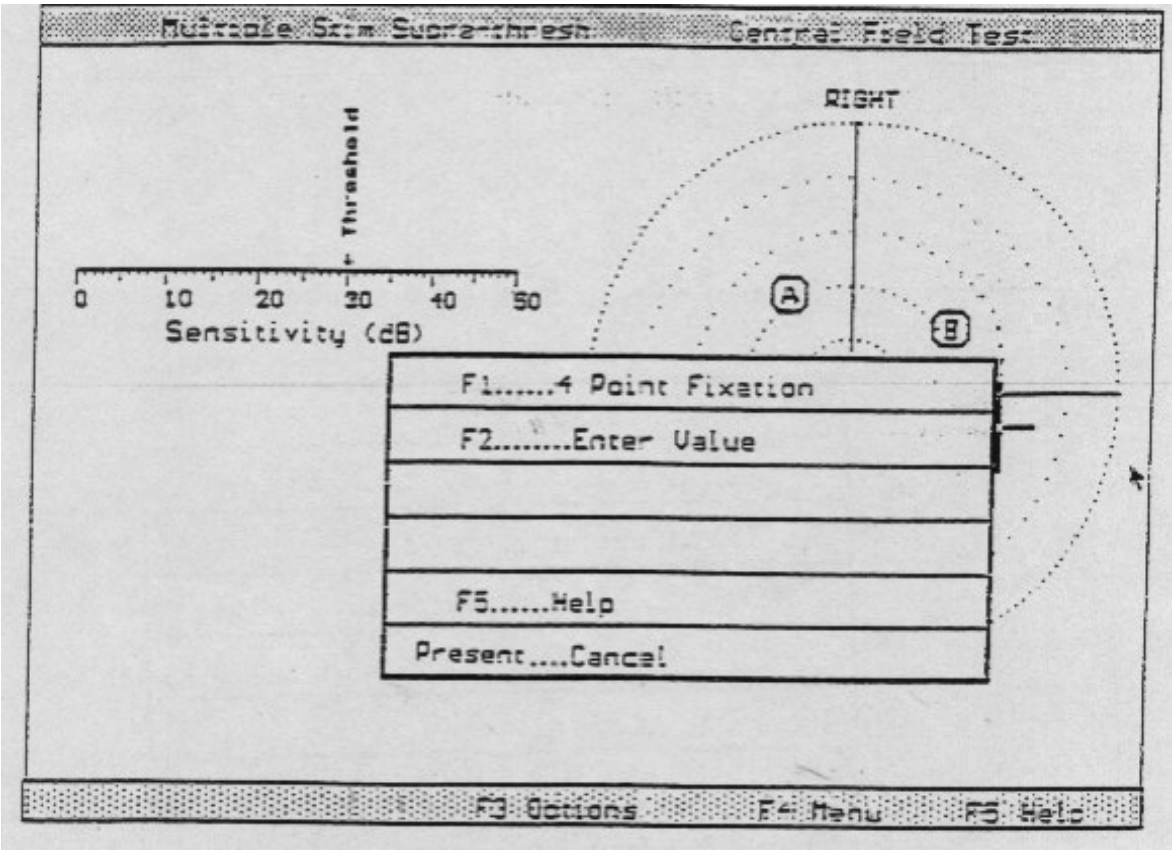
- **Present** Cancels the menu window.

ESTABLISHING THE THRESHOLD

A supra-threshold test program requires stimuli to be presented at a level above the patient's threshold. The first step in any supra-threshold program, therefore, is to establish the patient's threshold.

There are two ways in which the 3200 can be set up to derive the initial threshold estimate: a semi automated technique and a manual technique.

■ **FIGURE 5**
Menu window



Which technique your perimeter uses is decided by the options settings put into your perimeter when initially installed. If you wish to change these settings then refer to Appendix 3.

THE SEMI AUTOMATED TECHNIQUE

With this technique the perimeter guides the perimetrist through the thresholding procedure with a series of instructions presented on the screen. At the end of a pre-determined sequence of presentations and responses the perimeter will automatically advance to the supra-threshold test phase of the examination. All the perimetrist has to do is follow the instructions presented on the screen.

When establishing the threshold with the semi-automated technique it is important to carefully explain the task to the patient. A typical set of instructions are:

"I am going to present to you a series of patterns of lights. In each pattern there will be either 2, 3 or 4 lights. I want you to tell me how many lights there are in each presentation. The lights will be getting dimmer and dimmer with each presentation until they are so dim that you will not be able to see any of them. Throughout the test you must keep looking at the small red light. Are you ready to begin?"

It is also important to emphasise to the patient that they **should not guess**. If they are unsure about whether they saw any stimuli then they should report that they saw none.

The exact sequence used to establish the threshold with the semi-automated technique is described in Appendix 5.

Note. In some circumstances the perimetrist may feel that the perimeter is starting off at an intensity level that is a long way off the patient's expected threshold. The starting intensity can be changed, in either direction, by holding down the appropriate arrow key. If you do this halfway through establishing the threshold then the perimeter will start again from the new level.

The 3200 automatically changes the pattern of stimuli after each response has been entered. The right and left arrow keys can be used to change the currently selected pattern.

THE MANUAL TECHNIQUE

With this technique the perimetrist is free to set the intensity at whatever level he likes, to present whichever pattern of stimuli he likes, as many or as few times as he likes. It is intended that the perimetrist will adjust the intensity (with the up and down arrow keys) and stimulus location (with the left and right arrow keys) until an intensity is found at which approximately 50% of the presented stimuli are seen.

Once this level has been reached the perimetrist simply presses **F1** to increment the intensity by 5dB ready to start testing at the supra-threshold level.

Selecting **F1** is slightly different from the other function keys as it does not open up a window but simply advances the test to the supra-threshold phase of the examination.

THE MAIN SUPRA-THRESHOLD PHASE

After you have finished establishing the threshold the graphics screen will change to that shown in figure 6.

On the sensitivity scale three symbols will have appeared. These represent the three supra-threshold intensity levels used in the 3200. They are set at 5, 8 and 12dB above the threshold sensitivity that is still marked on the scale. The current test level is indicated by the 'Test' label and small arrow. Selecting the up and down arrows on the operator's keyboard will change the current test intensity.

Underneath the sensitivity scale is a message telling you how many stimuli have been presented and missed.

The **Present** and ← and → keys have the same functions as they did in the threshold phase, i.e. they present the stimuli in the currently selected pattern and change the currently selected pattern.

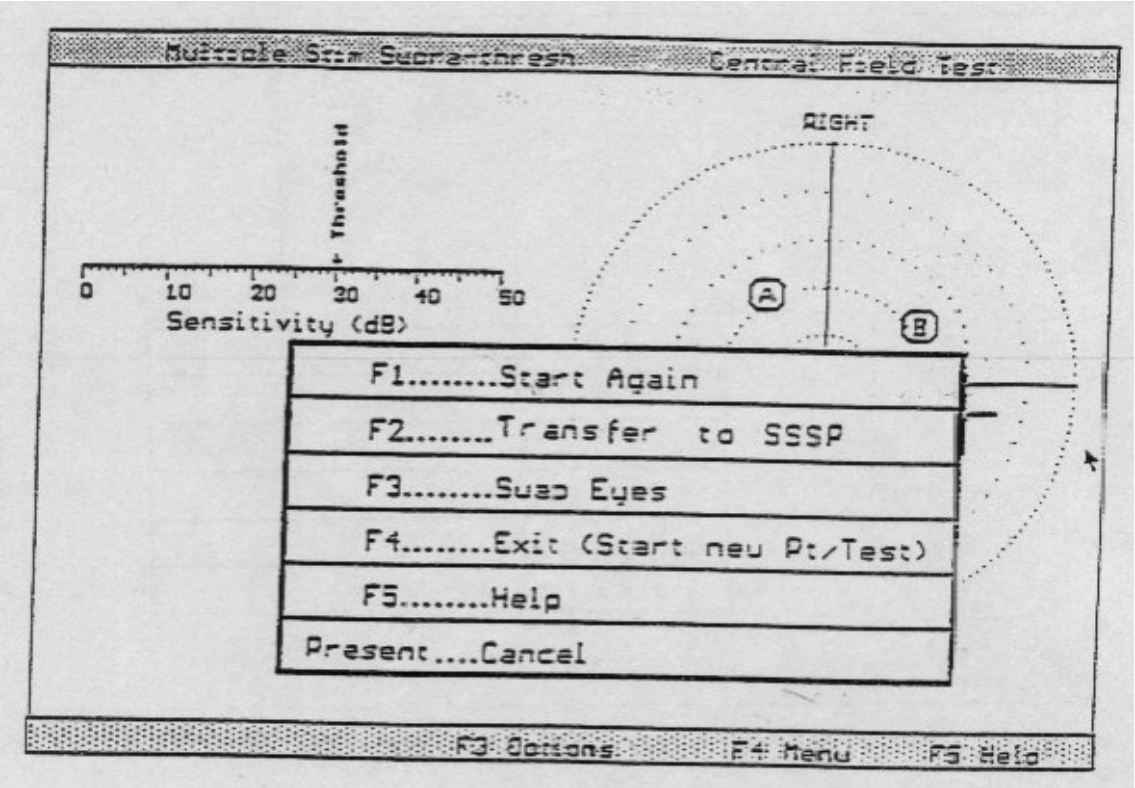
Note. The ← and → keys, which change the selected pattern of stimuli, have a roll over action. If you press the →key when you are on the last pattern then the cursor will move to the first pattern. Similarly, if you press the ← key when you are on the first pattern then the cursor will move to the last pattern.

It is advisable at this stage to give some new instructions to the patient. A typical set would be:

"You have completed the first part of the examination. I am now going to present another series of patterns and the lights will be brighter this time. Just tell me the number of lights that you see in each pattern remembering to keep your eye on the central red light".

The perimetrist's task now is to present each of the patterns to the patient asking how many lights were seen after each presentation.

■ **FIGURE 6**
Display during the supra-threshold phase of the multiple stimulus supra-threshold strategy



After you have presented a pattern of stimuli the corresponding number in the pattern line will change from black to white. This allows you to see, at a glance, which patterns have been presented. Along with this black dots will appear on the field chart at the tested locations. These allow you to see which areas of the field have been tested.

If a patient fails to see the correct number of lights then you should re-present the pattern. In the majority of cases the patient will now report the correct number in which case you simply proceed as if nothing had happened. If the patient still reports the incorrect number then you should ask where the lights were seen. It often helps if you tell the patient to consider the display as a clock face and give the hour positions of the stimuli.

Once you have deduced which stimulus/i were missed, then simply press the appropriate missed stimuli key/s (A, B, C or D).

At the location of the missed stimulus/i the black dot will be replaced by a symbol which represents the current test intensity and the corresponding pattern number will be highlighted to indicate that the pattern contains a miss.

Note. If you are in the first level of a central field test and the location of the missed stimulus is not in the blind spot region then a message will appear recommending you to extend the test. More about this later.

Stimuli missed at 5 or 8dB above the threshold sensitivity should be re-tested at the higher intensities. To do this press ↑. This will increase the intensity to the next level, remember the currently selected level is indicated by the 'Test' label on the sensitivity scale. You should now re-test patterns which contain a miss/es and again ask the patient how many stimuli were seen. If there are still errors then ask again where the stimuli they saw were and deduce which are being missed. Press the appropriate missed stimuli keys in order to update the displayed symbol.

Note. An alternative way of testing missed stimuli is to use the trackerball. See later section.

In the supra-threshold phase of the examination five of the function keys are now active. **F1** erases any missed stimuli in the currently selected pattern. This allows you to correct for any changes/errors. These corrections can also be made with the trackerball (see later section). **F2** extends the test to the next level. Remember each test is divided into a number of phases. **F3** opens up a print/save window, **F4** a menu window and **F5** a help window.

F3: THE PRINT/SAVE WINDOW

Selecting **F3** opens a print/save window. While in the print/save window selecting:

- **F1** (only available if additional keyboard fitted) allows you to enter patient details (name, date of birth, etc.). Once entered these details will appear on any printout. It is not essential to enter these details before printing out a set of data the perimeter will simply leave blank spaces for you to fill in afterwards.

- **F2** prints the results from both eyes out on the printer.

- **F3** (only available if additional keyboard fitted) saves the results from both eyes on the disk system. More details on of data on disk is given in Chapter 9.

- **F4** exits from the multiple stimulus strategy. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** opens up a help message.

- **Present** cancels the print/save window.

F4: THE MENU WINDOW

Selecting **F4** opens up a menu window. While in the menu window selecting:

- **F1** gives you the option of re-testing the same eye. This takes you back to the stage where you establish the threshold.

- **F2** allows you to tranfer to a single stimulus supra threshold strategy. Any data that you have already collected will be retained. After the transfer the 3200 will revert back to the right eye. If you wish to test the left eye then select Menu (**F4**) and then the option Swap Eyes (**F3**).

- **F3** swaps over the eyes. If the other eye has not been tested then selecting this key will take you to the beginning of the examination. If the other eye has already undergone some testing then selecting this key will return you to the stage where you left off. You can swap eyes as many times as you like. Remember to move the patient chin and swap over the eye patch.

- **F4** ends the current examination and takes you back to the beginning ready to test another patient. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** opens up a help message.

- **Present** cancels the menu window.

USE OF THE TRACKERBALL

During the testing phase of the multiple stimulus strategy the trackerball (situated to the left of the operator's console) can be used to both add additional test locations and to re-test/correct already tested locations.

To activate these options simply move the arrow cursor, which is normally located on the right hand side of the screen, into the test chart. The cursor is moved by simply rolling the trackerball in the correct direction.

Once the cursor is within the area of the chart you will notice that the former pattern of stimuli has been replaced by a single stimulus location, still labelled either A, B, C or D, which moves around the chart in discrete steps which correspond to the possible stimulus locations. The menu bar will also change to signify the new functions of the function keys.

- **To add a stimulus**

Simply move the cursor to the location you wish to test and press **Present**. The test intensity is the same as that shown on the 'Sensitivity' scale and can be changed by pressing either the ↑ or ↓ keys. After presenting the stimulus ask the patient if he saw a light. If he did then you can continue testing additional locations etc. A black dot will be placed at the tested location indicating that a stimulus has been seen at this location. If no light was seen then press **F2**. The appropriate missed stimulus symbol will then appear on the chart.

- **To re test a location**

Simply move the cursor to the location you wish to re-test and press **Present**.

- **To enter a miss**

Move the cursor to the location you wish to enter the miss and press **F2**. The missed stimulus symbol will correspond to the current test intensity which can be changed with the ↑ and ↓ keys.

- **To erase a stimulus already recorded as missed**

Place the cursor over the location of the stimulus and press **F1**.

Note: The functions of the trackerball buttons are described in the help window. Press **F5** to open this window.

The trackerball can be used at any stage of the testing phase. If, after re-testing or adding some additional stimuli,

you wish to return to presenting patterns of stimuli then simply move the cursor out of the chart.

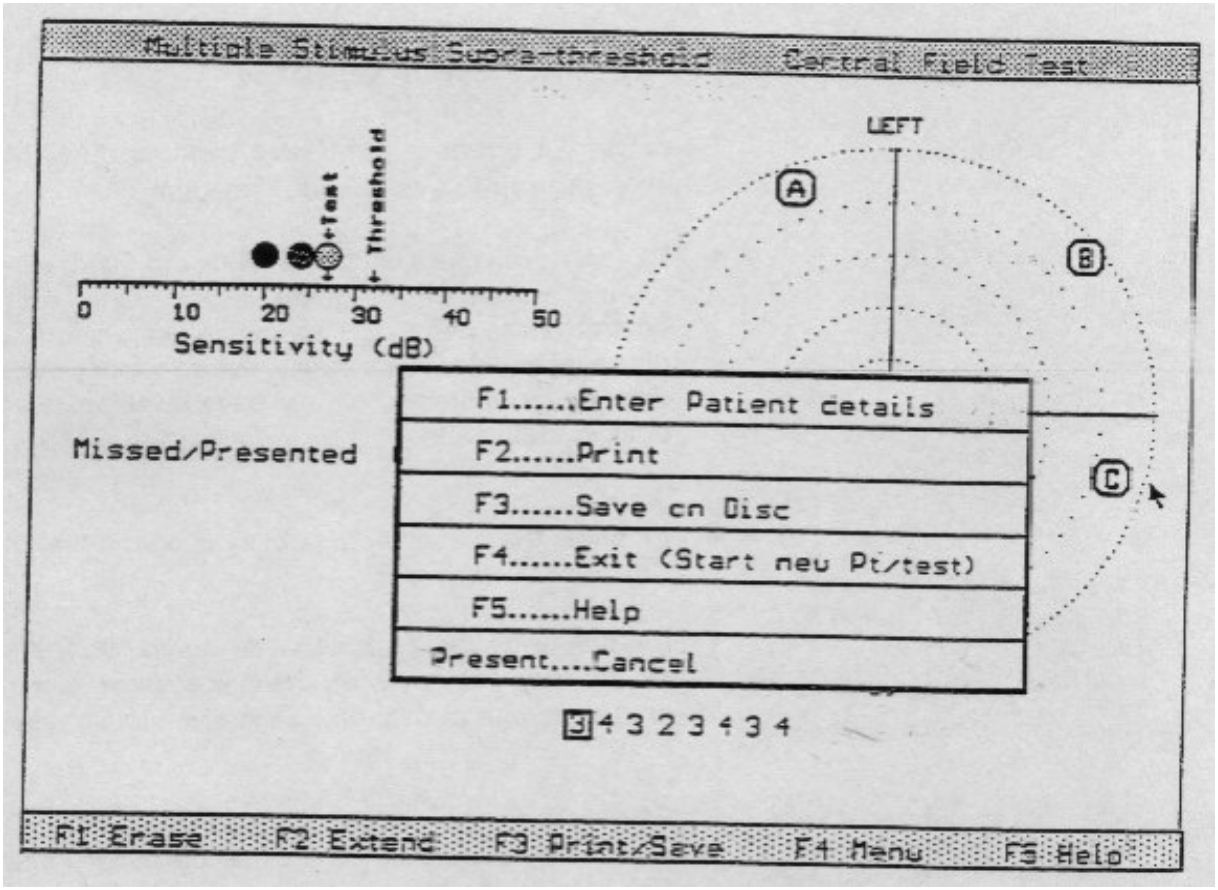
QUANTIFYING FIELD LOSS

When testing the central field the 3200 incorporates a quantification system which indicates the likelihood of a visual field defect existing. This system switches in when the program is extended to the second level, after the **F2** (Extend) button has been pressed.

The quantification analysis is represented by an arrow and a dial which appear in the bottom left hand side of the screen, see figure 8.

The dial is divided into three sections, 'Normal', 'Suspicious' and 'Defective'. When the arrow enters the defective range of the scale there is a less than 1 in 1000 chance that the displayed result comes from a patient with a normal visual field. In performing the analysis for this system the number, depth, and clustering properties of the missed stimuli are taken into account.

■ **FIGURE 8**
Display screen showing the quantification dial



C H A P T E R 7

SINGLE STIMULUS SUPRA-THRESHOLD PROGRAMS

Before describing how to run a single stimulus supra-threshold test it is best to go over some basic points.

1) Once the test has been started the stimuli will be presented automatically, the perimetrist does not have to press the **Present** key.

2) The patient responds to each stimulus seen by pressing the patient response button. As the name implies only one stimulus will be presented at a time.

3) The perimetrist can vary the interval between each presentation, the response time, by pressing either the ← or → keys. ← shortens the response time (increases the speed of presentations), while → increases the response time. An indication of the current speed is given by the cursor on the response time bar underneath the field chart. (See figure 9)

4) A message is displayed on the screen telling the perimetrist to press **F2** in order to start the demonstration routine.

THE INITIAL DISPLAY

The menu bar shows that all five function keys are active. Selecting **F1** starts the main test skipping out the demonstration routine (more about this later), **F2** starts the demonstration routine, **F3** opens up an options window, **F4** a menu window and **F5** a help window.

F3: THE OPTIONS WINDOW.

If you press **F3** an options window appears on the screen. While in the options window selecting:

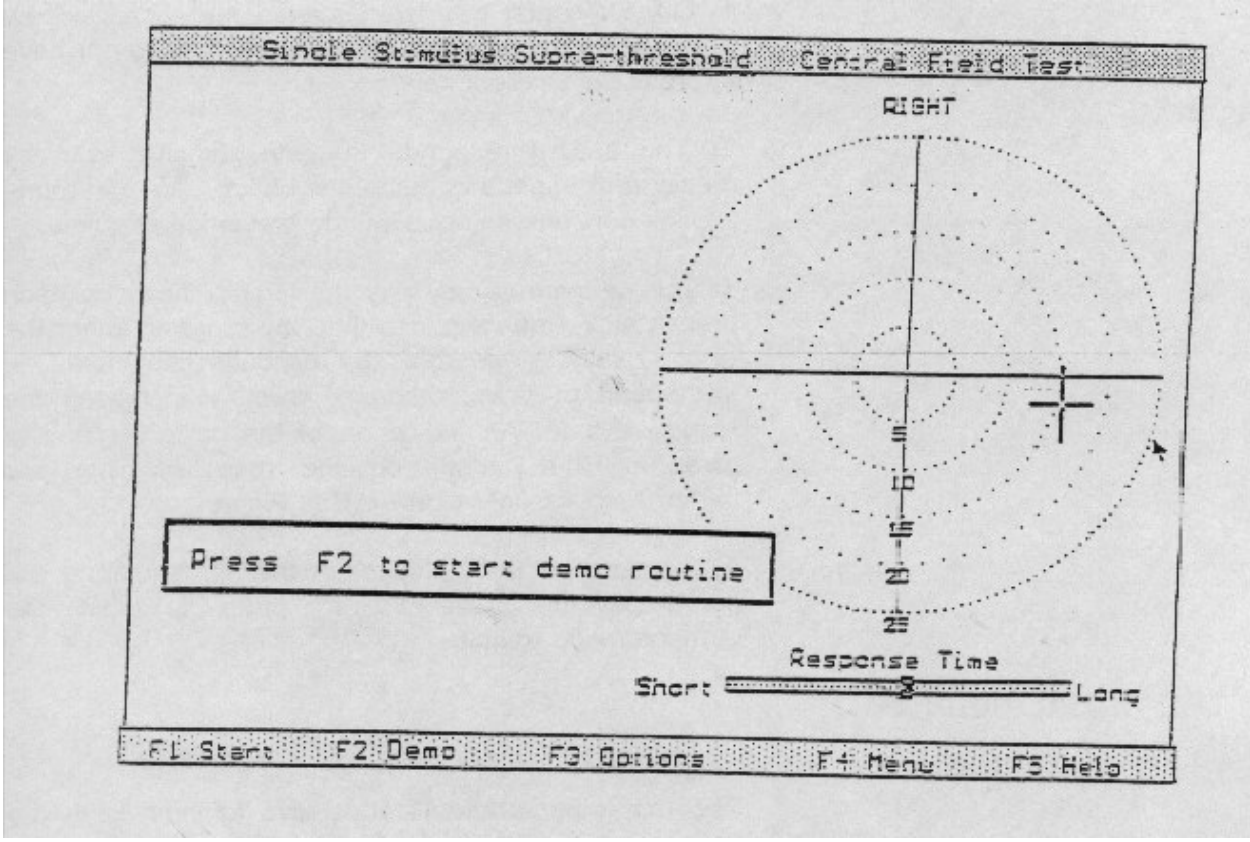
- **F1** changes the patient's fixation target. There are two types, a single red fixation spot or a cross of four red fixation spots. The cross of four spots is used when the patient has no central field. The patient being instructed to fixate the centre of the four point pattern. More details about this can be found in Appendix 4. For the moment just remember that if you press **F1** you will switch from one type of fixation target to the other, i.e. if the fixation target is currently a four spot one then selecting **F1** will switch it to a single one and visa versa.

- **F2** allows you to enter a threshold value. This is sometimes used when you are repeating an examination and want to ensure that the stimuli are at the same intensity as in the previous examination.

- **F5** displays a help message.

- **Present** returns you to the previous display i.e. cancels the options window.

■ **FIGURE 9**
Initial display screen of the single stimulus supra-threshold strategy



F4: THE MENU WINDOW

If you press **F4** a menu window appears on the screen. While in the menu window selecting:

- **F1** takes you back to the beginning of the test. Press this if things have gone wrong and you wish to re-start.

- **F3** swaps over the eyes. Remember to move the patients chin and swap the eye patch over.

- **F4** exits from this phase, taking you back to the previous menu, ready to test another patient. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** displays a help message.

- **Present** Returns you to the previous display i.e. cancels the menu window.

DEMONSTRATION ROUTINE

Selecting **F2** starts the demonstration phase of the examination.

During this phase the perimeter repeatedly tests four different locations, in a random order, but does not record any of the patient responses. This phase is designed to train the patient as to the nature of the task, which is to press the response button every time a stimulus is seen. The perimetrist should emphasise that the patient must keep looking at the central red light and only press the response button if they are confident a light was seen.

The patient should also be told that they can pause the test by holding down the response button. The test will resume from where it left off as soon as the key is released.

During this demonstration phase the perimetrist should adjust the speed with which the stimuli are presented (🡐 and 🡒 keys) to a value which is comfortable for the patient.

The demonstration phase is open ended, continuing for as long as the perimetrist likes. Once the perimetrist is happy that the patient understands the test and has established that fixation is good then the next phase of the test can be started by selecting **F1**.

During the demonstration routine the menu bar indicates that four of the function keys are active.

ESTABLISHING THE THRESHOLD

In this phase of the single stimulus supra-threshold program, the 3200 establishes the threshold at four different locations, the locations varying with the area of field tested. To find the threshold it uses the same repetitive bracketing strategy as that used in the full threshold programs.

The threshold of the eye is taken as the second most sensitive of the four threshold locations. If the value is below 12dB then it is set at 12dB.

When the threshold has been established at these locations the 3200 then automatically increases the intensity by 5dB above the estimated threshold ready to start the next phase of the examination which is the supra-threshold phase.

THE MAIN SUPRA-THRESHOLD TEST PHASE

It is in this phase that the supra-threshold testing actually takes place.

An example of the display during this phase is given in figure 10.

Several additions have now been made to the display. The first of these is a sensitivity scale which indicates both the threshold level derived from the previous phase of the examination and the current test level.

Underneath this appear three fractions giving the number of missed and presented stimuli, and the number of false positives and false negatives.

False positives
Occasionally the perimeter goes through the motions of presenting a stimulus but does not actually present one. If the patient presses the response key then this is recorded as a false positive.

False negatives
On other occasions the perimeter re-tests a location at an intensity which is above that previously seen. If the patient fails to press the response button then this is recorded as a false negative.

The numbers of false positives and false negatives are displayed on the monitor in the form of a fraction. The numerator is the number of errors while the denominator is the number of trials

Whenever the patient correctly responds to a presentation a black dot will be placed at the appropriate position on the screen.

If the patient fails to respond to a presentation then the 3200 will, at some later stage, re-test this location at the same intensity. If the second presentation is seen then a black dot is placed on the chart indicating that a stimulus has been seen. If it is missed a second time then a 5dB missed stimulus symbol will be placed on the chart. This location will, at a later stage, be re-tested at 8dB above the threshold estimate. If missed at this intensity then the displayed symbol will be updated and, at a later stage, the location will be tested at 12dB above the estimated threshold.

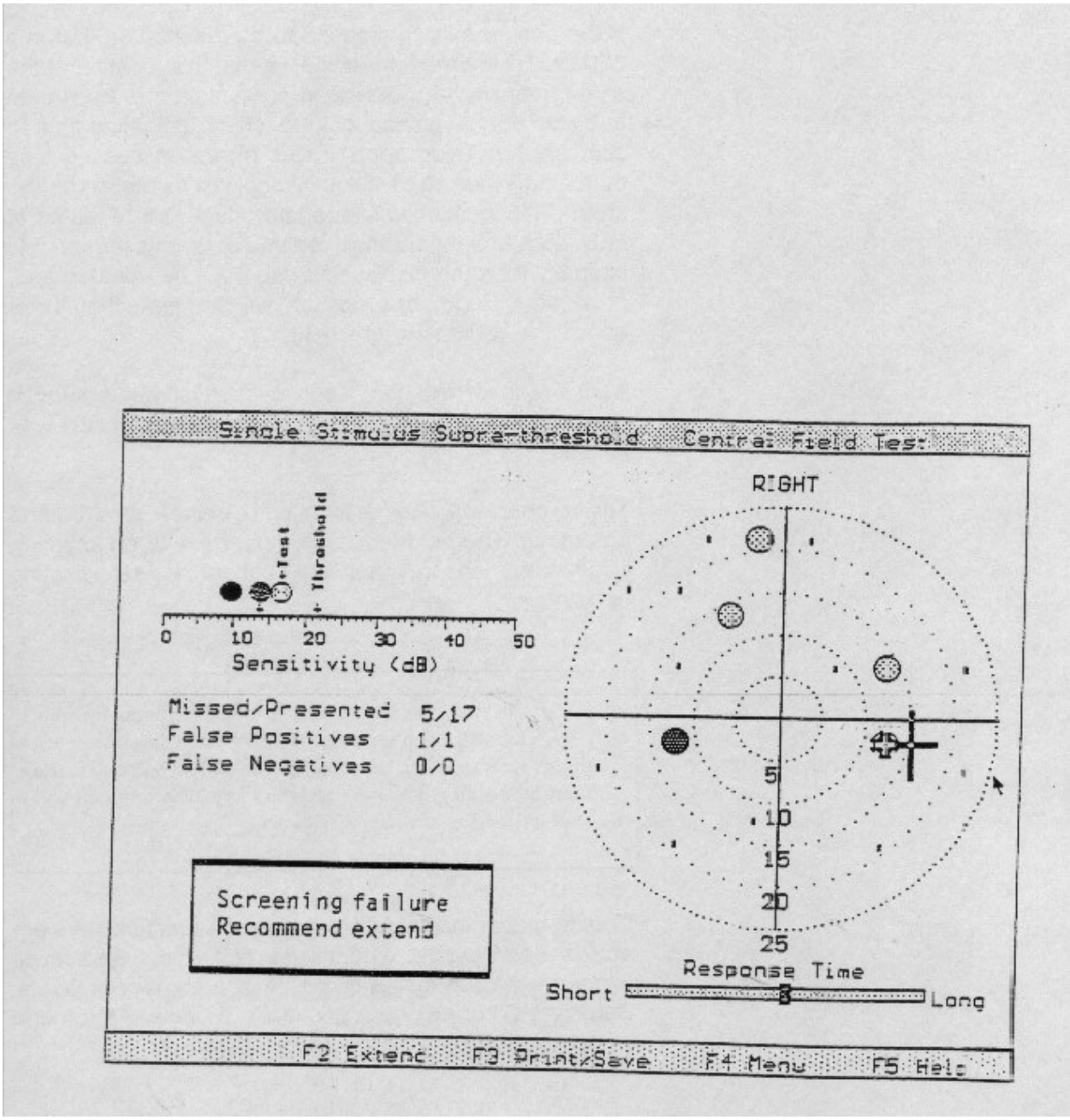
At the end of the test each missed stimulus symbol refers to the highest intensity at which the stimulus was missed.

The re-checking of each location is entirely random and automatic. The perimetrist does not have to do anything other than ensure that the patient is still fixating accurately.

Note: If you wish to stop the test then simply press the help key **F5**. This will open up a help window and suspend the test until this is removed by pressing **F5**. The patient can also pause the test by holding down the response key. The program will re-start as soon as the key is released.

The menu bar indicates that four of the function keys are active. Selecting **F2** extends the test to the next level. Remember each test is divided into a number of levels. Selecting **F3** opens up a print/save window, **F4** a menu window and **F5** a help window

■ **FIGURE 10**
Display during the main supra-threshold testing phase



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F3: THE PRINT/SAVE WINDOW

Selecting **F3** opens up a print/save window. While in the print/save window selecting:

- **F1** (only available if additional keyboard fitted) allows you to enter patient details (name, date of birth, etc.). Once entered these details will appear on any printout. It is not essential to enter these details before printing out a set of data the perimeter will simply leave blank spaces for you to fill in afterwards.

- **F2** prints the results from both eyes out on the printer.

- **F3** (only available if additional keyboard fitted) saves the results from both eyes on the disk system. More details on the saving of data on disk is given in Chapter 9.

- **F4** ends the current examination and takes you back to the beginning ready to test another patient. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** opens up a help message.

- **Present** cancels the print/save window.

F4: THE MENU WINDOW

Selecting **F4** opens up a menu window. While in the menu window selecting:

- **F1** gives you the option of re-testing the same eye. This takes you back to the stage where you establish the threshold.

- **F3** swaps over the eyes. If the other eye has not been tested then selecting this key will take you to the beginning of the examination. If the other eye has

already undergone some testing then selecting this key will return you to the stage where you left off. You can swap eyes as many times as you like.

- **F4** ends the current examination and takes you back to the beginning ready to test another patient. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** opens up a help message.

- **Present** cancels the menu window.

USE OF THE TRACKERBALL

During the testing phase of the single stimulus strategy the trackerball (situated to the left of the operator's console) can be used to both add additional test locations and to re-test/correct already tested locations.

To activate these options simply move the arrow cursor, which is normally located on the right hand side of the screen, into the test chart. The cursor is moved by simply rolling the trackerball in the correct direction.

Once the cursor is within the area of the chart you will notice that the stimulus indicator cross moves in discrete steps which correspond to the possible stimulus locations.

- **To add a stimulus** Simply move the cursor to the location you wish to test and press **Present**. The test intensity is the same as that shown on the 'Sensitivity' scale and can be changed by pressing either the ↑ or ↓ keys. If the patient presses the response button within the response time a black dot will be placed at the tested location indicating that a stimulus has been seen at this location. If the patient does not press the response button the appropriate missed stimulus symbol will be placed at the tested location indicating that the stimulus has been missed.

- **To re-test a location** Simply move the cursor to the location you wish to re-test and press **Present**. The displayed symbol will be updated according to the patient's response.

- **To enter a miss** Move the cursor to the location you wish to enter a miss and press **F2**. The missed stimulus symbol will correspond to the current test intensity which can be changed with the up and down arrow keys.

- **To erase a stimulus already recorded as missed.** Place the cursor over the location of the stimulus and press **F1**.

Note: The trackerball can be used at any stage of the testing phase. As soon as the cursor enters the chart the automatic presentation of stimuli will be suspended. If, after re-testing or adding some additional stimuli, you wish to return to the automatic presentation of stimuli, assuming that you had not finished, then simply move the cursor out of the chart.

QUANTIFYING FIELD LOSS

When testing the central field the 3200 incorporates a quantification system which indicates the likelihood of a visual field defect existing. This system switches in when the program is extended to the second level, after the extend button has been pressed.

The quantification analysis is represented by an arrow and a dial which appear in the bottom left hand side of the screen.

The dial is divided into three sections, 'Normal', 'Suspicious' and 'Defective'. When the arrow enters the defective range of the scale there is a less than 1 in 1000 chance that the displayed result comes from a patient with a normal visual field. In performing the analysis for this system the number, depth, and clustering properties of the missed stimuli are taken into account.

When you have finished the single stimulus supra-threshold test press **F4** to open up the Menu window and then press **F4** to exit. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you exit.

C H A P T E R 8

FULL THRESHOLD PROGRAMS

These programs are designed to provide the perimetrist with a threshold measure at a number of pre-selected test location.

Once you have selected the Full Threshold Strategy from the first menu (figure 2) the 3200 will present you with a second menu from which you can select one of three tests which vary according to the position and number of test locations. Details on each test can be found in Appendix 1. Remember each test is divided into a number of levels designed to run consecutively.

Selecting **Present** returns you to the previous menu. Remember at every stage of an examination there is always an option to go back.

Before going on to describe how the different phases of the full threshold strategy operate it is best to go over some basic points.

- Once the test has been started the stimuli will be presented automatically, the perimetrist does not have to press the **Present** key.

- The patient responds to each stimulus they see by pressing the patient response button. Stimuli are presented one at a time.

- When the program is running a hollow square on the field chart indicates the location being tested.

ENTERING THE PATIENT AGE

Once you have selected the area of the field you wish to test the menu will be replaced by a message asking you to

enter the patients age. This information is needed in order to calculate the indices mean defect, loss variance and corrected loss variance (see later section of this chapter). If you have an additional keyboard fitted then the age can be entered via the number keys (you can correct any errors with the backspace key). If you do not have the additional keyboard then use keys **F2** and **F3** to increment and decrement the displayed value and when this is correct press **F1**.

Pressing **F4** takes you back to the previous menu and **F5** opens a help window.

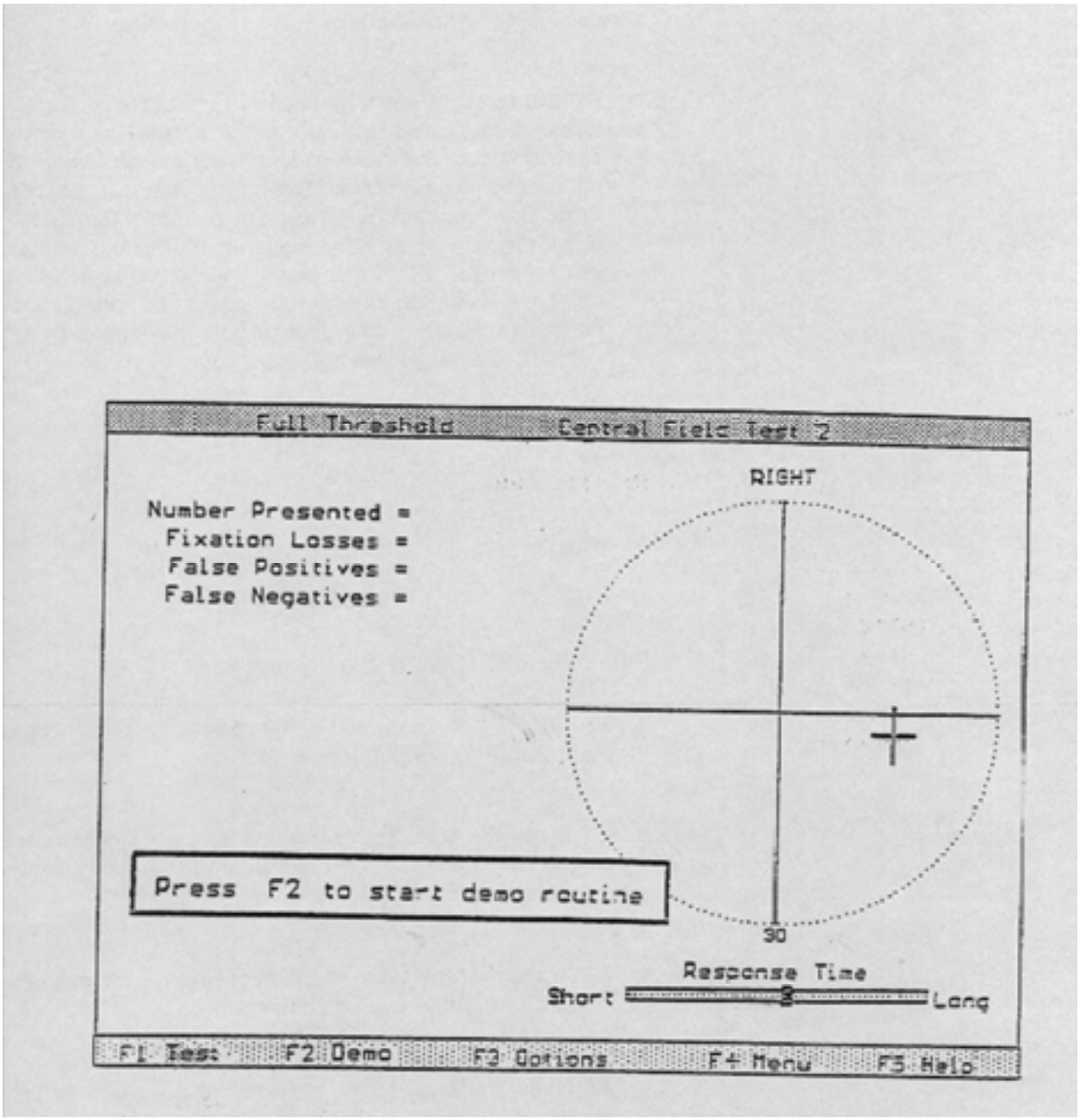
THE INITIAL DISPLAY

Once you have entered the patients age the screen will change to that shown in figure 11.

A message is displayed on the screen telling the perimetrist to press **F2** in order to start the demonstration phase.

The menu bar now shows that all five function keys are active. Selecting **F1** starts the next phase of the test (blind spot location), **F2** starts the demonstration, **F3** opens up an options window, **F4** opens a menu window and **F5** opens a help window.

■ **FIGURE 11**
Display at beginning of the full threshold strategy.



F3: THE OPTIONS WINDOW

If you press **F3** an options window will appear on the screen. While in the options window selecting:

- **F1** changes the patient's fixation target. There are two types, a single red fixation spot or a cross of four red fixation spots. The cross of four spots is used when the patient has no central field. The patient being instructed to fixate the centre of the four point pattern. More details about this can be found in Appendix 4. For the moment just remember that if you press **F1** you will switch from one type of fixation target to the other, i.e. if the fixation target is currently a four spot one then selecting **F1** will switch it to a single one and visa versa.

- **F5** displays a help message.

- **Present** returns you to the previous display.

F4: THE MENU WINDOW

If you press **F4** a menu window appears on the screen. While in the menu window selecting:

- **F1** starts the test. This skips out of the demonstration phase and takes you directly into the blind spot location phase.

- **F3** swaps over the eyes. Remember to move the patients chin and swap the eye patch over.

- **F4** takes you back to the previous menu, ready to test another patient. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** displays a help message.

- **Present** returns you to the previous display i.e. cancels the menu window.

DEMONSTRATION PHASE

During this phase the perimeter repeatedly tests four locations, in a random order, but does not save any of the patient responses. This phase is designed to train the patient as to the nature of the task which is to press the response button every time a stimulus is seen. The perimetrist should emphasise to the patient that they must keep looking at the central red light and that they should only press the response button when they are sure that they have seen an additional light.

The patient should also be told that they can pause the test by holding down the response button and that the test will resume, from where it left off, as soon as the button is released.

The perimetrist should also check the patient's fixation. If fixation is unsteady then the perimetrist should re-instruct the patient.

During this phase of the test the perimetrist can also adjust the interval between each presentation, the response time, by selecting either the ← or → keys. The ← key shortens the response time (increases the speed of presentations) while the → key increases the response time. An indication of the current speed is given by the cursor on the response time bar underneath the field chart.

The demonstration phase continues for as long as the perimetrist likes. Once the perimetrist is happy that the patient understands the test and has established that their fixation is good, the next phase can be started by pressing **F1**.

LOCATING THE BLIND SPOT

The full threshold programs use the Heijl-Krakau technique to derive an index of fixation accuracy.

Programs that use the Heijl-Krakau technique occasionally present a stimulus in the blind spot. If seen it is assumed that fixation is inaccurate. The results of these checks are displayed in the form of a fraction in which the numerator indicates the number of errors and the denominator the number of samples.

In order to perform this form of fixation check, it is essential that, at the beginning of the examination, the perimeter establish the location of the patient's blind spot.

This is achieved by presenting a stimulus in the expected location of the blind spot and then checking to see if the patient presses the response button. If the patient sees the stimulus then the 3200 selects another location, there being a total of 11 locations. The 3200 will repeatedly cycle through these 11 locations until either the patient fails to press the response button, in which case the last location is taken as falling within the blind spot, or until the operator interrupts the routine by selecting one of the function keys.

During this routine you will see the 3200 moving the location of the blind spot cross on the field chart as it searches for the correct location.

The menu bar shows that two of the function keys are active during this phase of the full threshold programs. Selecting **F4** opens up the a menu window and selecting **F5** opens up a help window.

F4: THE MENU WINDOW

If you press **F4** a menu window appears on the screen. While in the menu window selecting:

- **F1** continues the examination without a blind spot location being established. Occasionally the 3200 blind spot routine is unable to find a location where the patient is unable to see the stimulus. In these situations the perimetrist can proceed to the next phase of the examination by selecting this option. If selected the following test will show no blind spot cross on the field chart and will not perform any blind spot checks.

- **F3** swaps over the eyes. Remember to move the patients chin and swap the eye patch over.

- **F4** takes you back to the previous menu, ready to test another patient. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** displays a help message.

- **Present** returns you to the blind spot routine, i.e. cancels the menu window.

THE THRESHOLD PHASE

In this phase of the full threshold program the 3200 establishes the threshold of the patient's eye at a series of predetermined locations, (the test locations for each program are given in Appendix 1).

When establishing the threshold, the Henson 3200 uses a repetitive bracketing strategy. It starts off at an intensity estimated to be above the patient's threshold. If the patient sees this stimulus then at the next presentation its intensity will be dimmed by 4dB. If not seen it will be increased by 4dB. This is repeated until the patient response changes (for a given stimulus location), i.e. he either fails to see a stimulus seen on the last presentation or sees a stimulus which was not seen on the last presentation. This is known as the first reversal.

After the first reversal the direction of the intensity increment/decrements alters so that a brighter stimulus now gets dimmer and a dimmer stimulus now gets brighter. This is why it is called a reversal because the direction of the intensity steps has reversed.

In addition to changing the direction of the steps the size of the step also changes from 4dB to 2dB. The test continues changing the intensity in the new direction until there is a second reversal of response by the patient (for this particular location). The threshold is then taken as lying between the last two values.

It is important to realise that the 3200 does not complete the testing of one location before it goes onto another. It starts off testing four locations, randomly switching from one to another. These four locations are known as seed locations. Once the threshold has been established at a seed location the 3200 will start to test locations neighbouring the seed one. It uses the value of the threshold found at the seed location to decide at what intensity to start testing the neighbouring locations. By doing this it reduces the number of presentations necessary to establish the thresholds.

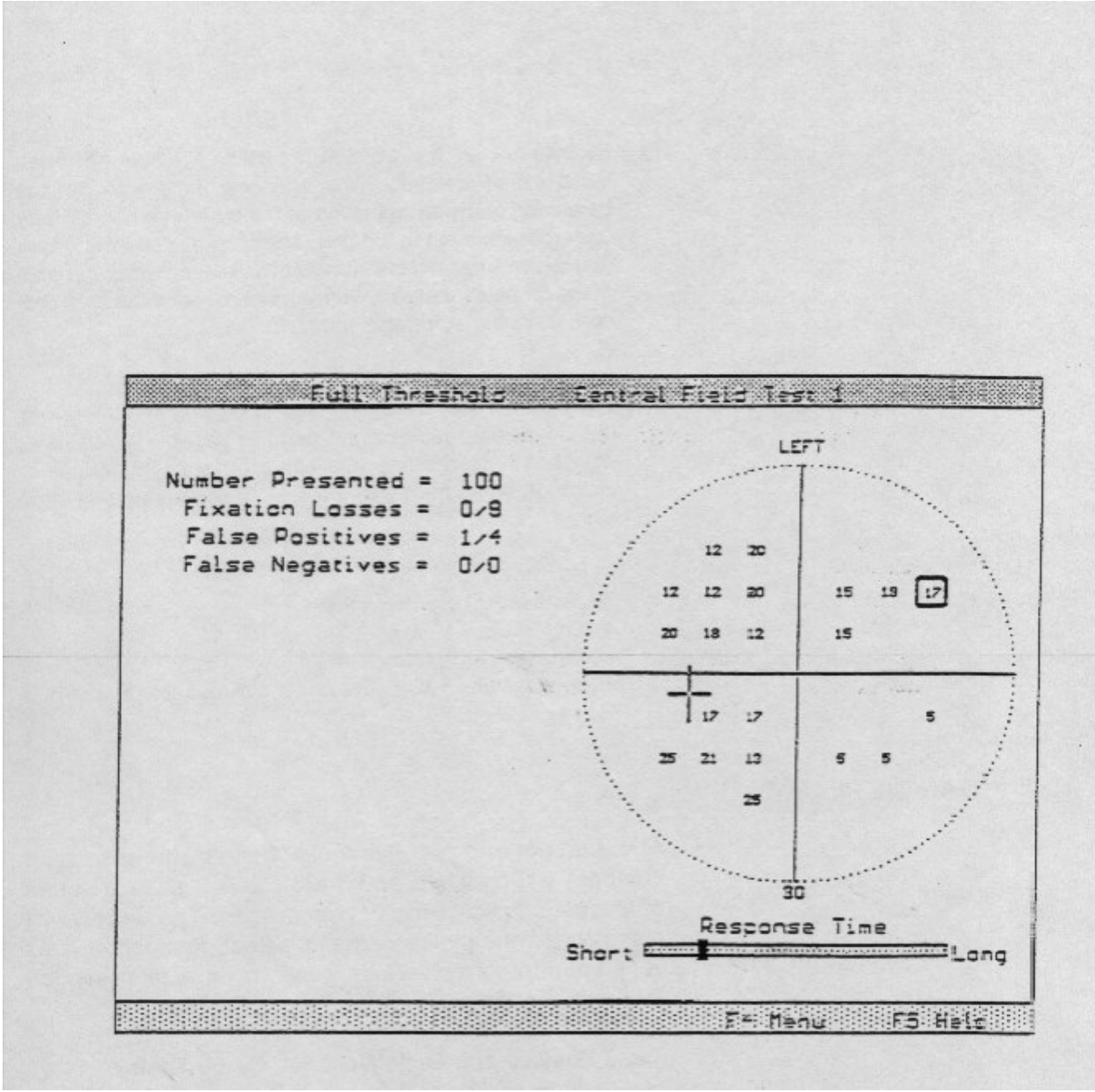
All this sounds much more complicated than it really is. The best way for you to understand what is going on during this phase of the examination is to find a colleague and to have a go at being both the patient and the operator.

The display, during the threshold phase, tells the perimetrist which stimuli are being tested and the status of all the tested spots. Figure 12 gives an example of this display. The red square indicates the position of the current test spot.

The numbers on the display tell you the intensity/threshold values. They start off being dark gray and are changed to white once the threshold has been established. Remember high numbers correspond to a high sensitivity and dim lights.

The menu bar shows that two of the function keys are active during this phase, see figure 12. Selecting **F4** opens up a menu window and selecting **F5** opens up a help window.

■ **FIGURE 12**
Display during the thresholding phase of the full threshold strategy



F4: THE MENU WINDOW

If you press **F4** a menu window appears on the screen. While in this window selecting:

- **F1** starts the test again, from the demonstration phase.

- **F3** swaps over the eyes. If the other eye has not been tested then selecting this key will take you to the beginning of the examination. If the other eye has already undergone some testing then selecting this key will return you to the stage where you left off. You can swap eyes as many times as you like. Remember to move the chin rest and swap the eye patch over.

- **F4** ends the current examination and takes you back to the beginning ready to test another patient. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** displays a help message.

- **Present** returns you to the threshold routine, i.e. cancels the menu window.

THE FINAL DISPLAY

At the end of the main threshold phase all the displayed numbers will be white and the 3200 will make a series of bleeps to indicate that it has finished. The display will also contain the indices:- mean defect, loss variance, corrected loss variance and fluctuation, see later section for more details.

False Positive and False Negative Catch Trials

During the threshold phase of a full threshold examination the 3200 will conduct a series of catch trials.

Occasionally the perimeter goes through the motions of presenting a stimulus but does not present one. If the patient presses the response key then this is recorded as a false positive.

On other occasions the perimeter re-tests a location whose threshold has already been determined at an intensity which is above the threshold value. If the patient fails to press the response button then this is recorded as a false negative.

The number of false positives and false negatives is displayed on the perimetrist monitor in the form of a fraction. The numerator is the number of errors while the denominator represents the number of trials.

Fixation Checks
Every now and again the 3200 will present a stimulus in the patient's blind spot, the position of the blind spot having been established at an earlier phase of the full threshold examination. If the patient presses the response button then this is recorded as a fixation error. The number of fixation errors along with the number of trials is displayed on the monitor in the form of a fraction, the numerator representing the number of errors and the denominator representing the number of trials.

All five function keys are now active. Selecting **F1** opens up a display window, **F2** extends the test if it is not already fully extended, **F3** opens up a print/save window, **F4** a menu window and **F5** a help window.

F1: THE DISPLAY WINDOW

Selecting **F1** will open up a display window. While in this window selecting:

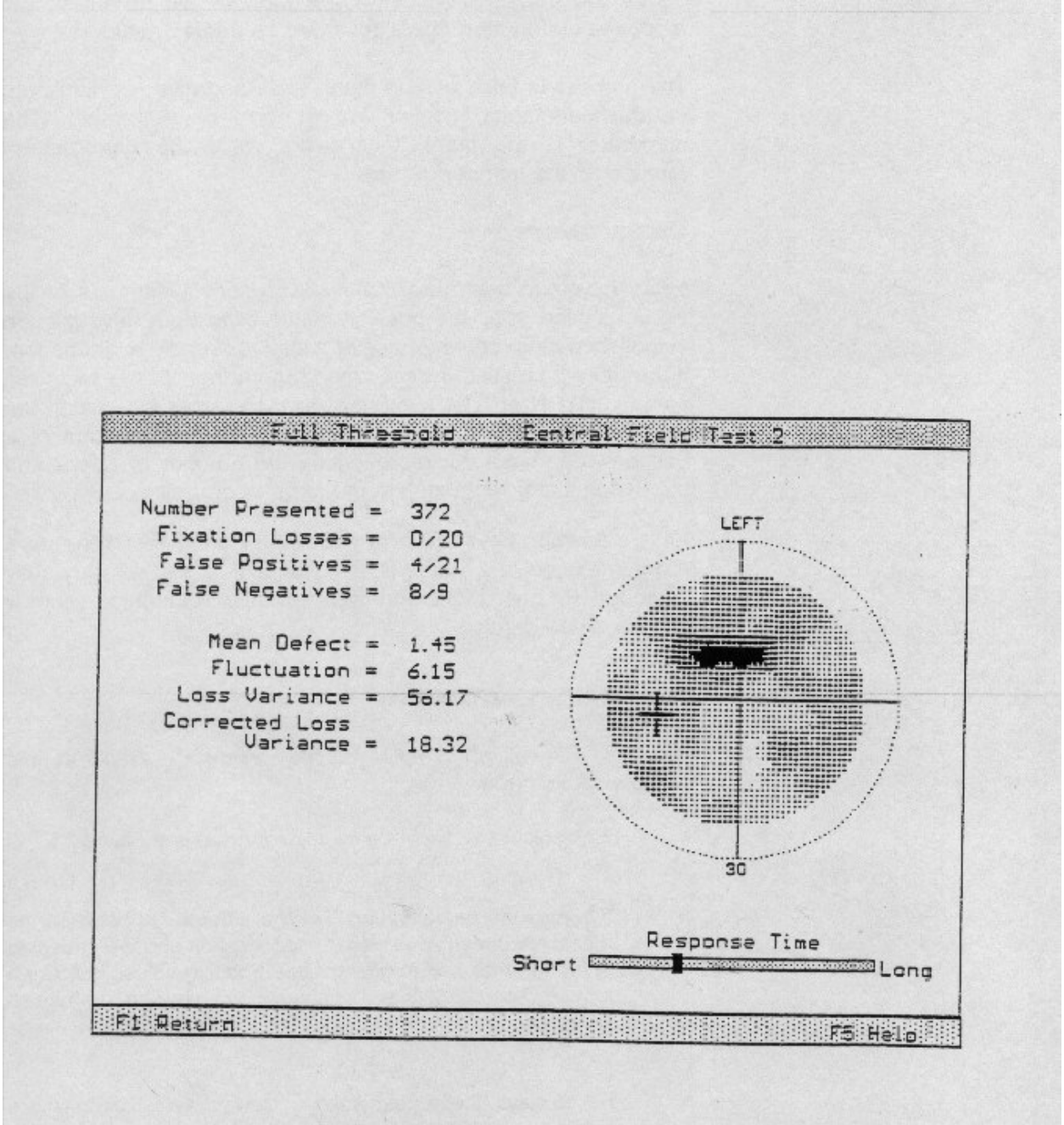
- **F1** displays the data in grey scale format, see figure 13.

- **F2** gives the defect values, i.e. the differences between the measured threshold at each tested location and the threshold of an age matched normal patient. Positive values indicate a reduced sensitivity and negative values an enhanced sensitivity.

- **F3** displays the repeat values. Certain test locations are automatically tested twice in order to calculate the index fluctuation. Other locations can be tested twice with the

use of the trackerball, see later section. When **F3** is pressed both of the threshold estimates for those locations that have been tested twice will be displayed. The one in square brackets is the first estimate.

■ **FIGURE 13**
Display showing a grey scale representation of the visual field results from the full threshold strategy



- **F4** ends the current examination and takes you back to the beginning ready to test another patient. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** opens up a help message.

- **Present** cancels the display window.

F2: EXTENDING THE TEST

Selecting **F2** extends the test, i.e. increases the number of test locations. The number of extensions and the stimulus locations are given for each of the test programs in Appendix 1. The number of test locations can also be increased through the use of the trackerball, see later section.

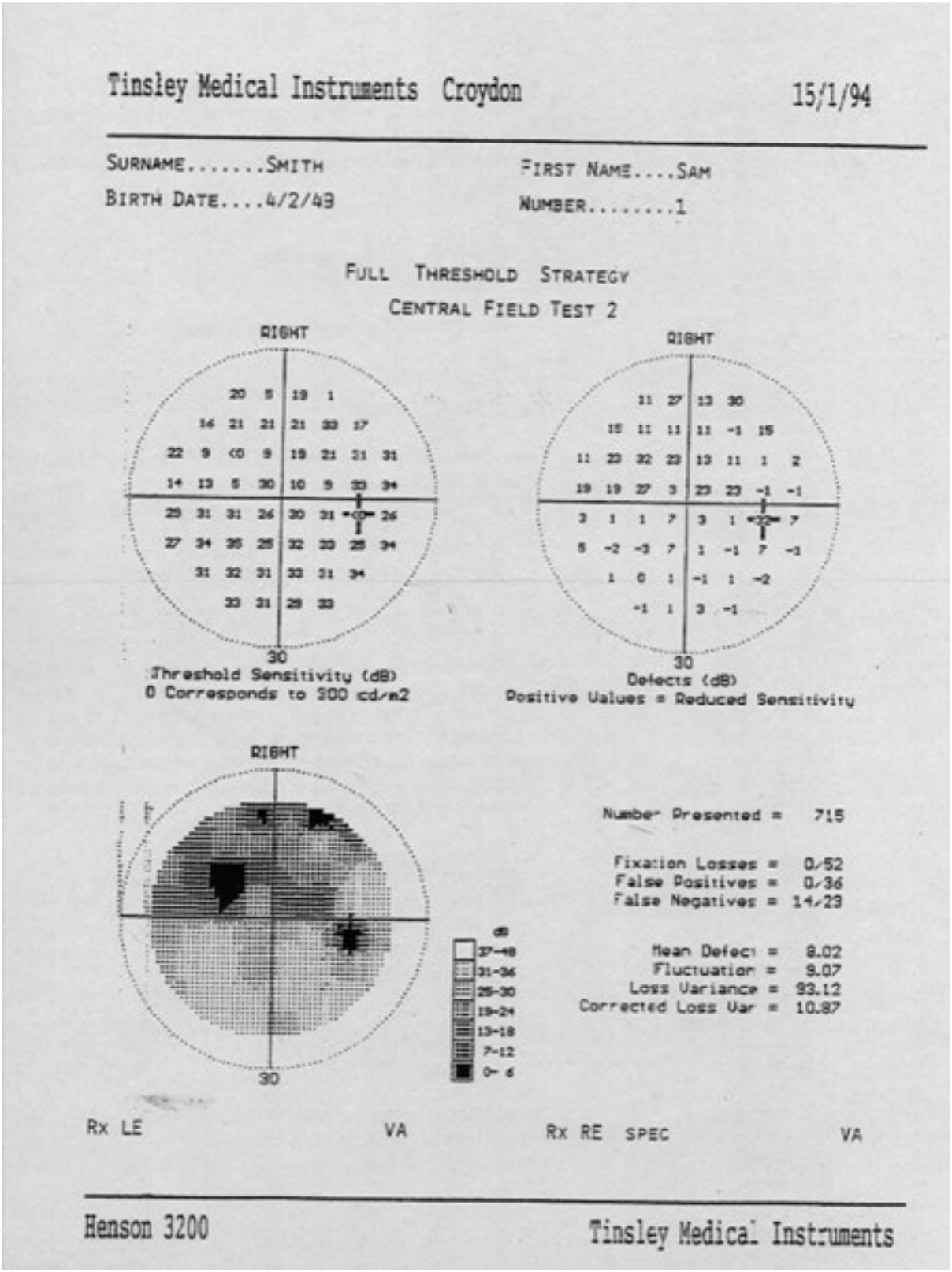
F3: THE PRINT/SAVE WINDOW

Selecting **F3** will open up a Print/save window. While in this window selecting:

- **F1** (only available if additional keyboard fitted) allows you to enter patient details (name, date of birth, etc.). Once entered these details will appear on any printout. It is not essential to enter these details before printing out a set of data, the perimeter will simply leave blank spaces for you to fill in afterwards.

- **F2** prints the data from both eyes onto the printer, (see figure 14 for an example of the print out).

■ **FIGURE 14**
Example of a print out from the full threshold strategy



- **F3** (only available if additional keyboard fitted) gives you the option of saving the current data on disk, (see Chapter 9 for more details of this).

- **F4** ends the current examination and takes you back to the beginning ready to test another patient. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** opens up a help message.

- **Present** cancels the print/save window.

F4: THE MENU WINDOW

Selecting **F4** opens a menu window. While in the menu window selecting:

- **F1** starts the test again, from the demonstration phase. Any data already collected from the currently displayed eye will be lost.

- **F3** swaps over the eyes. If the other eye has not been tested then selecting this key will take you to the beginning of the examination. If the other eye has already undergone some testing then selecting this key will return you to the stage where you left off. You can swap eyes as many times as you like. Remember to move the patient's chin and swap the eye patch over.

- **F4** ends the current examination and takes you back to the beginning ready to test another patient. If you have not already stored the data either on paper (printing) or disk then the current data will be lost when you press this key.

- **F5** displays a help message.

- **Present** returns you to the threshold routine, i.e. cancels the menu window.

USE OF THE TRACKERBALL TO RE-TEST AND DELETE RESPONSES

During the threshold phase of a full threshold test the trackerball (situated to the left of the operators console) can be used to both add additional test locations and to re-test/correct already tested locations.

To activate these options simply move the arrow cursor, which is normally located on the right hand side of the screen, into the test chart. The cursor is moved by simply rolling the trackerball in the correct direction.

Once the cursor is within the area of the chart you will notice that the black hollow square which formerly indicated which location was being tested, moves around the chart in discrete steps which correspond to the possible stimulus locations.

To add/re-test a stimulus
Simply move the cursor to the location you wish to test and press **F1**. A gray number will appear inside the hollow square indicating the intensity level at which testing will start once the cursor has been taken out of the chart. Note that you may select several additional stimuli before removing the cursor from the chart.

To repeat a measurement
To repeat a measurement, that is to obtain a second threshold estimate, simply place the cursor over the location of a stimulus that has been tested once and press **F2**.

To erase a stimulus location.
Place the cursor over the location of the stimulus and press **F3**. If the location has been tested twice then this will erase the latest threshold estimate. Press the right button a second time if you wish to also erase the first estimate.

The trackerball can be used at any stage of the threshold phase. The testing/re-testing of selected locations will not start until after the cursor has been taken out of the area of the field chart.

Note: It is better to select several locations for testing/re-testing before moving the cursor out of the region of the chart as this will mean that the subsequent presentations will not all be at the same location.

Once the Henson 3200 has completed testing/re-testing additional locations or, where locations have been deleted, when the cursor is moved out of the chart area, the indices mean defect, loss variance and corrected loss variance will be re-calculated.

The trackerball functions are especially valuable when a perimetrist has completed an examination in which it is felt that an artefact, such as a spectacle rim, is adversely affecting the results. With the trackerball it is possible to re-test these locations or to delete them from the analysis and re-calculate the indices.

It is also useful when a defect has been established and the perimetrist needs to precisely map its extent. With the trackerball you can simply add test locations in the desired area.

FULL THRESHOLD VISUAL FIELD INDICES

Visual field tests which use the full threshold strategy automatically quantify the results at the end of the examination (phase) giving the following global indices:

1) Mean defect,
2) Loss variance,
3) Fluctuation,
4) Corrected loss variance.

When performing these calculations only those results that come from within the central 30 degrees are used.

MEAN DEFECT

The mean defect, or as it is sometimes called mean depression, tells you how the patient's overall field compares to the normal reference field. For example, if the mean defect was 3.4 then the patient's results are on average 3.4 dB below those of an age matched norm.

This statistic is useful for looking at overall depression in sensitivity which may occur as a result of glaucoma and/or lens clouding. The mean defect will also change if there is some localised loss, although it is not very sensitive to this type of change.

In mathematical terms:

$$\text{Mean Defect} = \frac{1}{n}\sum_{i=1}^{n}(z_i - x_i)$$

z_i = Age corrected normal value at test location i

n = Number of test locations.

x_i = Measured sensitivity at test location i

LOSS VARIANCE

Loss variance, which is similar to pattern standard deviation, is designed to be sensitive to localised losses in sensitivity. It measures the dispersion of defect values (differences between measured thresholds and those from age matched normal eyes). Patients with a localised loss will show a large dispersion of defect values; high defect values in areas of loss and low defect values in areas of normal sensitivity.

In mathematical terms:

$$\text{Loss Variance} = \frac{1}{n-1}\sum_{i=1}^{m}(x_i + MD - z_i)^2$$

z_i = Age corrected normal value at test location i

x_i = Measured sensitivity at test location i

MD = Mean Defect

n = Number of test locations

The defect values are squared in order to overcome the difficulty of positive and negative values.

FLUCTUATION

Fluctuation, or more precisely, the short term fluctuation, is a measure of how variable a patient is. It is obtained by testing twice a given number of test locations. In

mathematical terms, it is known as the root mean square (RMS) value and it indicates, on average, how much the repeated thresholds differ from each other.

In mathematical terms:

$$\text{Fluctuation}^2 = \frac{1}{m}\sum_{i=1}^{m}\frac{\sum_{k=1}^{R}(x_{ik} - \bar{x}_i)^2}{R-1}$$

$\bar{x}_i$ = Mean sensitivity at location i

x_{ik} = Sensitivity at location i repetition k

m = Number of locations with repeat values

R = Number of repetitions, normally 2

CORRECTED LOSS VARIANCE

Corrected loss variance, which is similar to corrected standard deviation, is a measure of dispersion that has been corrected for patient variability.

The loss variance statistic (defined above) gives a measure of dispersion that is the product of both variability due to physiological changes and normal variability. The short term fluctuation is an estimate of patient variability. By subtracting normal patient variability from the loss variance, a superior estimate of the variability due to physiological processes is obtained.

In mathematical terms:

$$\text{Corrected loss variance} = \text{Loss variance} - (\text{Fluctuation})^2$$

Chapter 9

Saving, recalling and viewing a sequence of records.

Instruments fitted with the additional QWERTY keyboard include a facility to save and recall visual field data on floppy discs and a facility to view a series of stored records.

SAVING DATA

When the 3200 is installed, the sales engineer will ask you for the name you wish to allocate to the file in which the data is stored. This file name can have up to 7 characters and should always be followed by **.DAT**, e.g. FIELD.DAT. This name can, of course, be changed at a later date.

When you select **Save** (**F3**) from any of the print/save windows the 3200 will present you with a dialogue box in which you are to enter the patient's name, date of birth etc.

Use the **QWERTY** keyboard to enter this data. **Backspace** will delete the previous character within any field. **Enter** will transfer you to the next line. If you have made a mistake and wish to correct one of the entries then repeatedly press the **Enter** key until you return to the field you wish to correct.

You can leave certain fields blank but you should always fill in the name, date of birth and date of test.

If you have already entered the patient details, via pressing **F1** while in the print save window, then these will automatically appear in the dialogue box where they can, if necessary, be edited.

When you are happy with the data, hold down the **Ctrl** key and then press **Enter** to save the data. Alternatively you can press **Esc** to return without saving the data.

The Henson 3200 will always save the data from both eyes. You do not have to save the data from the right eye separately to that from the left eye.

After saving the data the perimeter will return you back to the test program, with the right eye displayed. (You can

change to the left eye by selecting **F4** (Menu) and then **F3** (Swap eyes).

Note: The default name for the file containing the data is **FIELD.DAT** whose default path is **B:**

See Appendix 3 for details on how to alter the path and file name.

The built in recall facility is limited to approx. 200 patient records within a single file. The number of files is limited solely by the capacity of the disc.

The amount of space taken up by each patient record varies with the type of test and the number of test locations. As a rough guide each record takes approximately 1K bytes, i.e. a single floppy can hold over 1000 patient records (2000 eyes) in 5 or more files.

Although each file on a disc can hold up to 200 records the time taken to read and process stored data will be dependent upon the length of the file. In order to retain reasonable response times it is not advisable to keep more than 50 records in a file.

The format of data storage has been designed for easy transfer to other software packages such as data bases, spreadsheets, practice management systems etc. Such packages will offer many additional facilities for the storage, sorting, charting etc. of visual field data along with the option of including additional clinical data.

RECALLING VISUAL FIELD DATA

There are two ways in which the 3200 can recall previously stored data. The first of these, **Recall a Record,** lets you bring a record back into the perimeter from where it can be printed out modified etc. In fact, once it has been recalled you can perform all the functions that would be available if you had just collected the data. The second way of examining previously stored data is to **View a Sequence of Records**. This allows the clinician to quickly step through a series of stored records. This facility is designed to help the clinician make decisions concerning the progression of any defect. By viewing the records one after the other (two complete records are presented on the screen at any particular time) the clinician can see what changes have taken place.

RECALLING A RECORD

From the menu that comes up when the perimeter is first turned on select the option **Recall Data/View Records.** You will then be presented with a window in which the file record number, patient's first name, patients surname, patient's number, test date and test type are displayed for the last 12 sets of stored data. You can view other records by either pressing ↑ and ↓ keys or the **page up** or **page down** keys.

There are menu bars across the top and the bottom of the screen telling you which keys are active. To recall a record press **F1 Select**. A dialogue box will open asking you whether you wish to recall a single record or select records for sequencial analysis. Select **F1 Recall a Record.** You will then be presented with a second dialogue box asking you to enter the record number of the data you wish to recall. Simply type in the record number and press enter.

Note: The file record numbers are not unique to a specific set of data. They will change when you sort the data or delete a record. The field record number should not, therefore, be used as an identifier in a patient's written record. The patient number can be used as a unique identifier. It is up to the clinician to devise the protocol for allocating patient numbers and ensuring that they are entered correctly.

VIEWING A SEQUENCE OF RECORDS

Go through the same proceedure as that outlined above for recalling a single record only this time when the dialogue box comes up press **F2 Select records for Sequential Analysis** . You will then be presented with a second dialogue box asking you to enter the record numbers of the data you wish to recall. Simply type in the record numbers and press return.

Note: You can enter several records by either separating each number by a comma or by separating the first and last record numbers by a horizontal dash.
For example:

1,3,5 would select records 1, 3 & 5.
1-3,5,8-10 would select records 1, 2, 3, 5, 8, 9 & 10.

If you wish to select all the records from a given patient then it is a good idea to sort the records first on the basis of either name or patient number before pressing select. This will place all the records from each patient in consecutive record numbers.

You can select a second set of records, these will then be appended to those already selected, by repeating the above. You can even append records from different files/discs by first of all changing the data file via **F3 File** (see below for more details).

Once you have selected all the files you wish to view press **F5 Display/Quit**. You will then be presented with the data two records at a time. You can advance through the records by pressing **F3** or **F4**, you can change the format of the display by pressing **F2** or graph all the data from a patient (one test type at a time) by pressing **F5**. You can also print out any screen by pressing **F1 File** followed by **F3**. When you wish to return select **Exit** from the **F1 File** dialogue box.

In addition to the facility to recall either a single record or group of records there are a number of other options available after selecting **Recall Data/View Records** from the main menu. These include:

- **F2 Edit**

Selecting this option will open up a dialogue box with two further options, Edit a record and Delete a record/s.

Edit a record allows you to change the name, date etc. of a stored record. For example, if you inadvertently entered a record with the wrong patient number you could correct this error via the edit facility. You first have to enter the record number you wish to edit and then enter correct name, date etc.

Delete a record/s permanently deletes a record form the file. You will initially be presented with a dialogue box asking you to enter the record number/s of the data you wish to delete. If you wish to delete a single record then simply type in the record number and press enter. **Once**

deleted the field record cannot be recalled at a later date.

Note: You can delete more than one record by entering a series of record numbers separated by commas. You can also delete a range of numbers by separating the first and last record numbers by a horizontal dash.
For example:
1,3,5 would delete records 1, 3 & 5.
1-3,5,8-10 would delete records 1, 2, 3, 5, 8, 9 & 10.
3 would delete record 3.

- **F3 File**

Pressing F3 gives you access to a number of different file handling routines:

Backup data disc
Rename data disc
Change data file
Erase data file.

More details on these options are given below.

- **F4 Sort**

When you first select the recall facility the data is presented in order of the test date, i.e. the earliest record in the file is at the top (record number 1) and the latest at the bottom.

There will be instances when you wish to have the data sorted in a different way. For example, if you wish to look at all the records in the file for a given patient then it would be better to have them sorted according to the surname of the patient. To do this open up the sort menu box by pressing **F4** and then press **F2** (surname). All the patients records with the same name will now be grouped together. Other sort options are patient first name, record number and test date.

- **F5 Display/Quit**

Pressing F5 will, if data has been selected for sequential display, display the data or, if no data has been selected quit the recall facility and take you back to the main menu.

FILE OPTIONS WHEN RECALLING DATA

A number of different file handling routines are available **F3** to display a menu box from which a specific routine can be selected. Details of these routines are as follows.

Note: In addition to these file handling routines all the file handling facilities of MSDOS are available via the exit to DOS option of the first menu.

- **F1 Backup data disc**

This routine can be used to create backup copies of your data files.

Follow the instructions on the screen. Note the source disc is the disc which contains the data you wish to copy.

Note: Any files on the target disc will be erased. If the target disc has not been formatted then this will carried out automatically.

Note: The floppy disc drive on which you can store and recall data is labelled B:. The 3200 also has drives A: and C:
A: cannot be written to and C: is only a temporary store. Any files saved on C: will be lost when the machine is turned off.

- **F2 Rename data file**

When a data file has reached a certain size it is a good idea to rename it. Remember the maximum number of records that can be held in a **single file** is 200 although the recommended number on a floppy disc system is 50. Remember a single disc can have many different files.

When you select this option a dialogue box will pop up telling you what the current data path and file name is and asking you to enter the new data path and file name.

You cannot rename across directories, i.e. the path you enter has to be the same as the current path. The file name can be any MSDOS acceptable form.

As an example let us assume that the current path and file name is **b:\field.dat** and you want to rename the file **field.dat** to **oldfld.dat**

1) In the dialogue box type
b:oldfld.dat and then press **Enter**

If the current data path was your start up option then when you next save some data this file will be opened again ready to start collecting a whole new file of records.

- **F3 Change data file**

Data files other than the one currently specified in the start up options can be accessed by the change data file routine.

On selecting this option the perimetrist will be presented with a dialogue box in which the current data file path and name is given with a request to enter the data path and file name of the file you wish to access.

A second window will be opened telling you the names of all the files in the currently selected directory.

As an example, suppose data relating to a glaucoma clinic has been stored on a floppy disk under the file name GLAUCOMA.DAT and you wish to recall one of the records.

1) Insert the floppy disk into drive B.
2) In the dialogue box type B:GLAUCOMA.DAT.
3) Press Enter.

You will now be presented with a list of all the records stored in this file. If you recall a set of data or exit the recall program then the 3200 will automatically return to the file specified in the start up options.

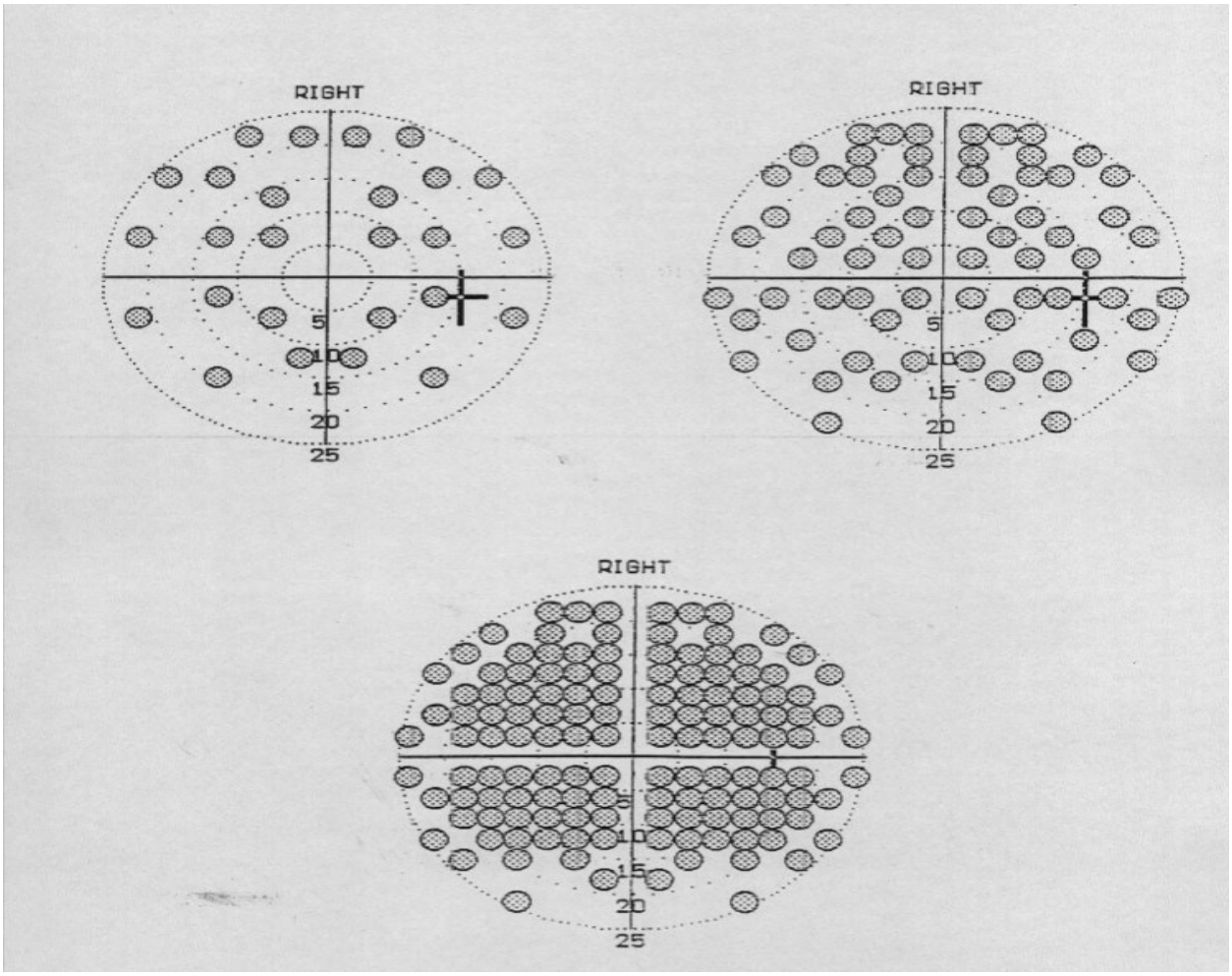
- **Shift/F1 Erase data file**

As the name implies this option allows you to erase a complete data file.

Note: Once you have deleted a data file you will not be able to get any of the data stored in that file back. You must ensure that any data you wish to keep is backed up prior to using this routine.

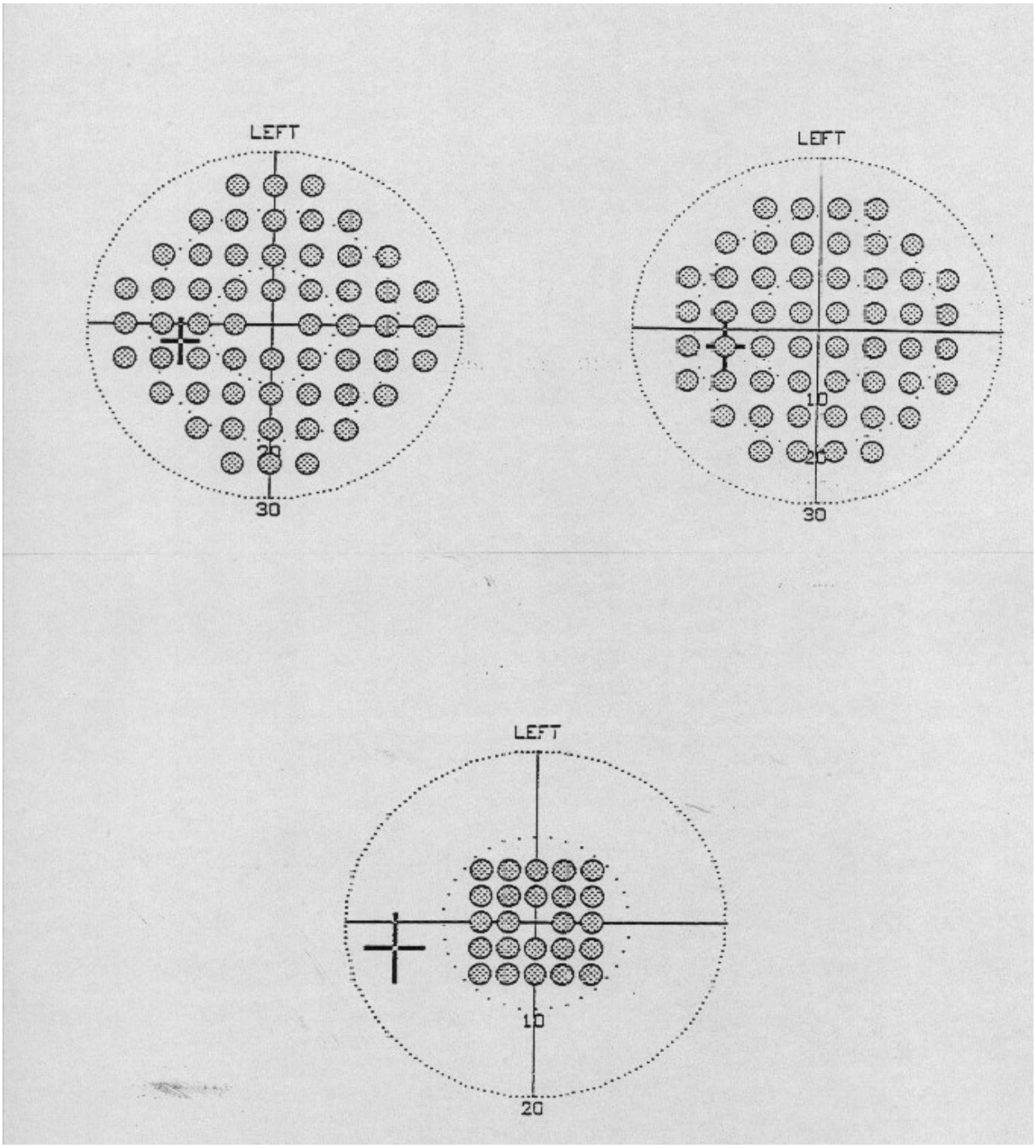
A. APPENDIX 1 - POSITION OF STIMULI

- **FIGURE 15**
  Position of stimuli
  Multiple stimulus supra-threshold strategy, central field test, levels 1, 2 and 3 (26, 68 and 136 stimuli).

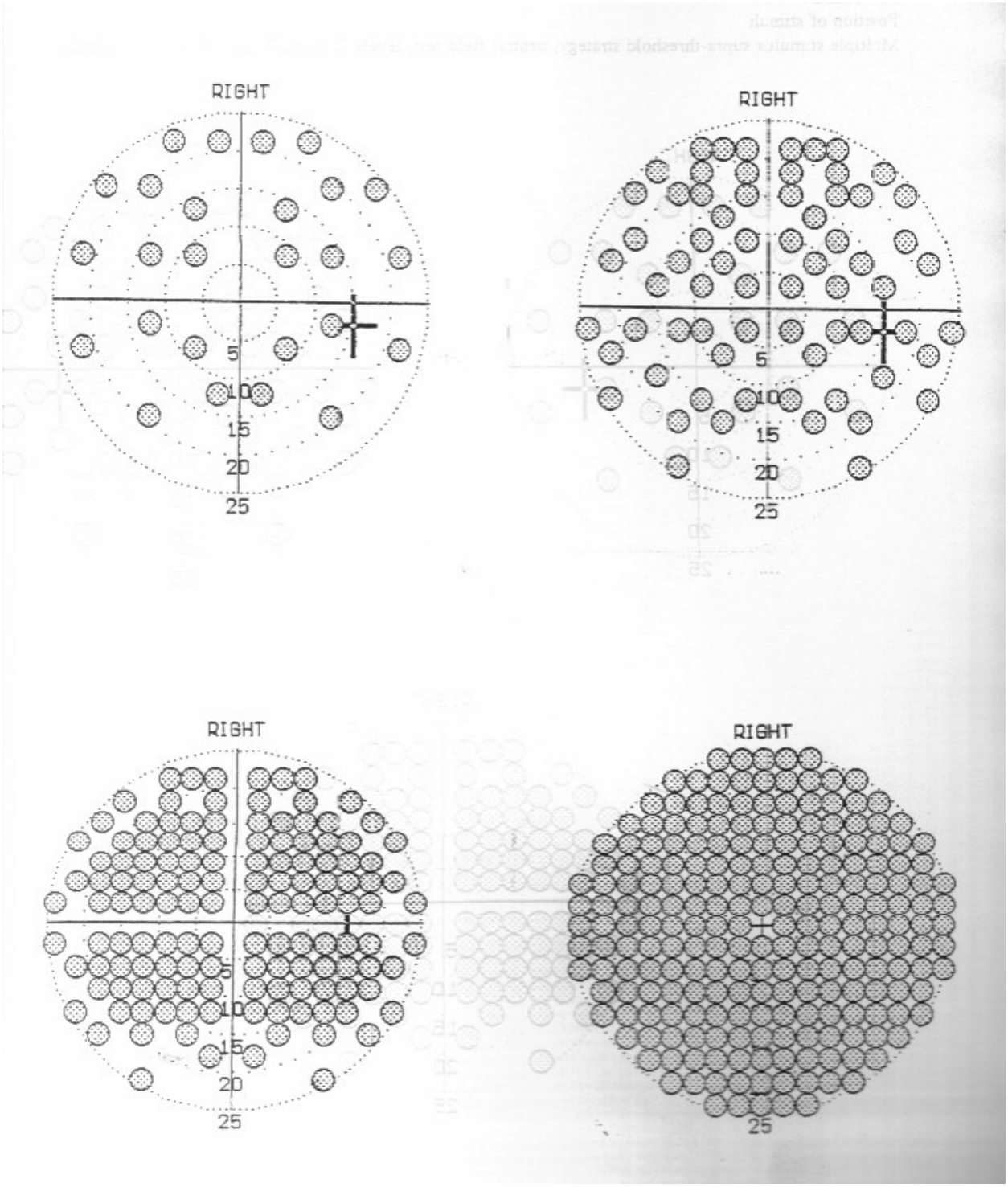


■ **FIGURE 16**
Position of stimuli
Single stimulus supra-threshold strategy, central field test, levels 1, 2 and 3 (26, 68 and 136 stimuli).

■ **FIGURE 17**
Position of stimuli
Full threshold strategy, central field test 24/1 (56 stimuli).



■ **FIGURE 18**
Position of stimuli
Full threshold strategy, central field test 24/2 (52 stimuli).



B. APPENDIX 2 BACKGROUND LUMINANCE

The Henson 3200 continuously monitors the background luminance and keeps it at the correct level. If this sytem is unable to set the correct level due, for example, to one of the bulbs failing or the main room lights being left on then a message will appear on the screen at the beginning of the next examination.

Details on how to replace a bulb can be found in Appendix 11.

C. APPENDIX 3 ALTERING START-UP OPTIONS

The Henson 3200 keeps a record of the practice name and address, and certain other preferred options. To change these a keyboard (an IBM pc AT compatible or a PS2 Keyboard with adaptor) and the program back-up disk is required. To change the options follow the procedure below :

1. Plug the keyboard into the Henson 3200 and switch unit on.

2. From the main menu enter DOS (press the PRESENT key)

3. Insert the program back-up disk into the floppy disk drive B.
4. Type OPTIONS <enter>.
5. After a short time the display will show the current settings of the options.

6. To edit the practice name use the cursor control keys and the delete key, then to accept the tab key to step to the practice address and edit as above.

7. To edit the start -up mode, the thresholding set or if an external keyboard is installed use the tab key to step to the required option to edit then use the cursor keys to select the setting.

8. After setting all options use the tab key to step to the SAVE OPTIONS buttons and press the enter key. A message box will ask you ARE YOU SURE? And inform you that the process of saving will take approx. 20 minutes. Using the tab key select the YES or NO button then press enter.

9. If you selected YES then the screen will clear and ask for a disk to be placed in drive B: and then press any key. As the disk should still be in the disk drive press any key to start the process of writing the new options file. This is a good time for a cup of coffee, at the end the Henson 3200 main program will start.

10. If you selected NO then the Henson 3200 main program will start.

11. Remove the program back-up disk and store in a safe place away from magnetic fields and excessive heat.

D. APPENDIX 4 FIXATION STIMULI

Two types of fixation stimulus are available. A single red spot, for patients with `normal' vision and a cross of 4 red spots for patients with a central scotoma. These patients are asked to look at the centre of the four spot pattern. Each spot is at an eccentricity of 7.5 degrees along the 0, 90, 180, and 270 degree meridians.

The fixation stimulus can be changed at the beginning of each test via the options window.

E. APPENDIX 5 THE SEMI-AUTOMATED THRESHOLD SEQUENCE

One of the options in the multiple stimulus supra-threshold strategy is to use a semi-automated technique to establish the threshold prior to the supra-threshold stage of the examination.

The exact way in which the threshold is established is represented in the flow chart of figure 20.

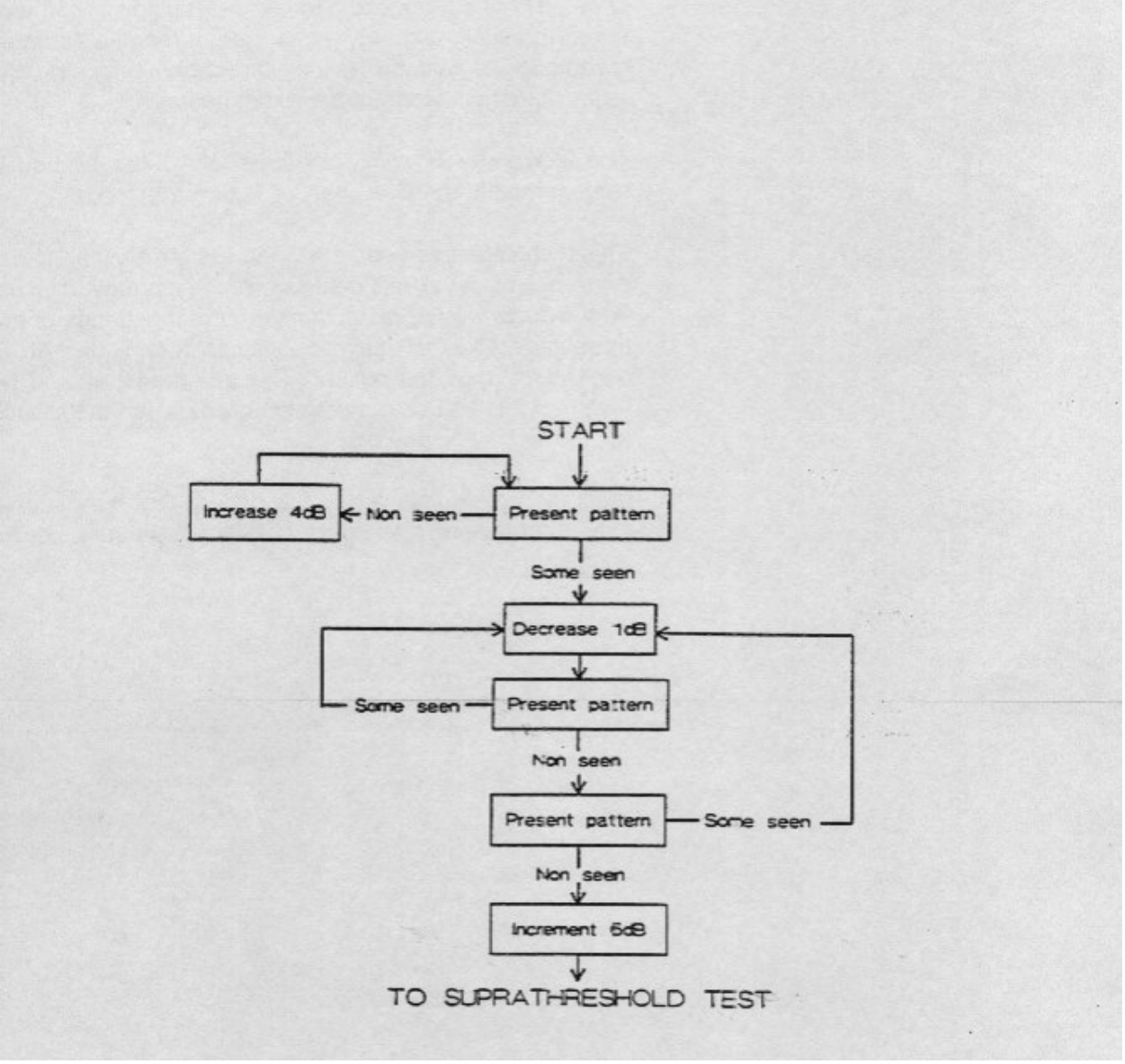
This technique has been designed to be robust as to the existence of visual field defects, i.e. the majority of visual field defects will not result in an incorrect estimate of the threshold. Like all psychophysical techniques it is dependent upon the patient. The perimetrist should be aware of this and be ready to intervene when the results appear to be going wrong.

It should be emphasised to the patient that they should only report seeing a stimulus when they are sure, i.e. no guessing.

■ **FIGURE 20**

Flow chart giving the sequence of measurements used in the semi automated technique of establishing the threshold in the multiple stimulus supra-threshold strategy.

F.



APPENDIX 6 PRINTER SET UP

The Henson 3200 has been programmed to operate with a Canon BJ-200 printer operating in its LQ mode. This mode emulates the Epson LQ series of printers and the software should operate with any Epson LQ compatible printer (the Epson LQ series are 24 pin printers, the 3200 will not operate correctly on 9 pin printers). Some printers are advertised as being 'compatible' when they simulate most, but not all, of the Epson LQ functions. The only sure way to establish whether the 3200 will work with a `compatible' printer is to try it out.

The printer can be turned on or off at any stage. The 3200 will recognise when the printer is off and when it runs out of paper. You will not loose any data.

Note: The Canon BJ-200 has some built in memory that can lead to certain problems when you run out of paper. For trouble free operation it is best to turn the printer off, put some more paper in the tray and then turn the printer back on, this will clear the printers memory. While this is occurring the 3200 will simply return to where it was prior to you selecting the print option, i.e. ready for you to select print again.

When printing out data, the 3200 will automatically print the name and address of the practice at the top left hand corner of the chart. This name and address is stored on the 3200's disk drive at the time of installation.

If the patient's details were entered prior to selecting print then these will automatically be placed at the correct locations in the print out. If not, blank spaces will be left for the perimetrist to fill in afterwards.

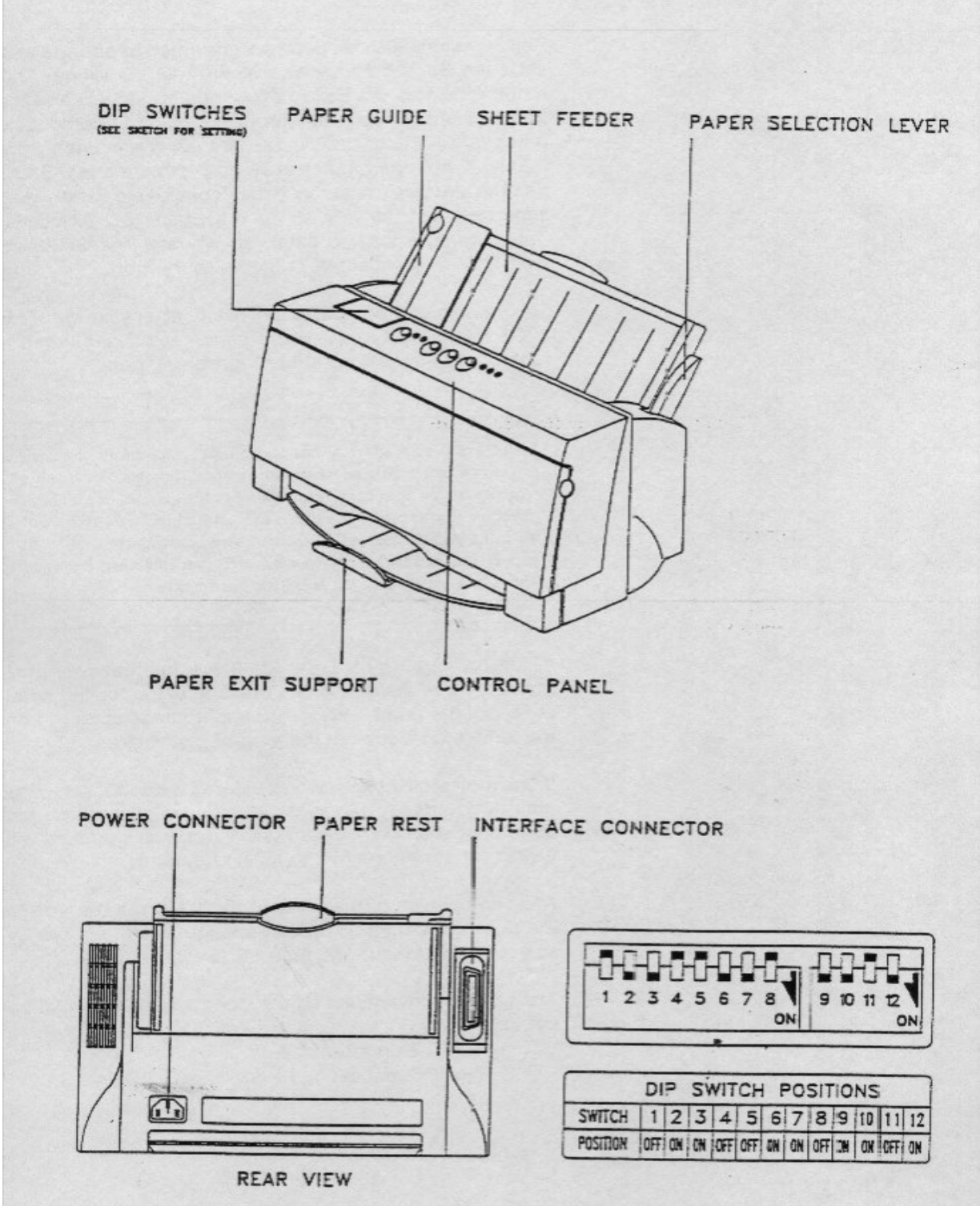
After completion of the printout the 3200 returns you to the right eye's data. (You can change to the left eye by selecting **F4** (Menu) and then **F3** (Swap eyes).

The DIP switch settings on the Canon BJ-200 should be set to:

1-off, 2-on, 3-on, 4-off, 5-off, 6-on,
7-on, 8-off, 9-on, 10-on, 11-off, 12-on.

■ **FIGURE 21**
The BJ-200 printer.

G.



APPENDIX 7 THE DISK OPERATING SYSTEM (DOS)

This section is for the computer mad and those who must know what goes on inside, if you do not fit this category there is no need to read on, but skip this page.

The Henson 3200 software runs on an IBM compatible computer and uses a disk operating system called ROM DOS, this is similar in operation to the more common MSDOS (Microsoft's disk operating system but is better suited to running from a solid state disk drive such as the type fitted in the Henson 3200.

At this stage it is best pointed out that the C: drive is not the usual hard disk drive but a ram drive, this means anything copied to this drive will be lost when the unit is switched off. The A: drive is a solid state drive, this drive is not a read/write device in the same way as conventional drives. The A: drive has to be completely erased and then rewritten and this operation requires special software not found in DOS. The B:drive is a conventional 1.44 Mb floppy disk drive mounted on the front and above the keyboard.

You are given the option of leaving the perimeter programs and going into DOS at the start-up menu. Selecting this option will give you the familiar (if you are used to using a computer) C: prompt.

It is possible to run programs on the Henson that will run on an IBM compatible using the B: drive but as the machine boots up frm the A: drive where the CONFIG.SYS and AUTOEXEC.BAT files are held some of the settings may not be correct for the program you wish to run.

H. APPENDIX 8 TO RE-LOAD HENSON SOFTWARE FROM BACKUP DISK

If it ever becomes necessary to re-load the Henson 3200 software or update the softwre the procedure is similar to setting the options:

A keyboard (an IBM pc AT compatible or a PS2 keyboard with adaptor) and the program back-up disk (or the new issue disk) is required.

Follow the procedure 1 to 7 for settings the options in Apendix 3.

At the end of checking the options settings (and if necessary editing them) select the SAVE OPTIONS button and answer YES to the next prompt. This will write the options file and load the Henson 3200 software to the solid state disk drive.

At the end of loading the software the unit will then start the Henson 3200 software.

I. APPENDIX 9 TECHNICAL SPECIFICATION

1.

2. TYPE

Computerised perimeter capable of measuring the visual field out to an eccentricity of 24 degrees. Chart distance 33 cm's. Background luminance 0.25cd/m^2.

3. STIMULI

LEDs with broad spectral output ranging from 540-590nm (3dB down). Angular subtense - 0.5 degrees (Goldmann III). Luminance - 0.016 - 300 cd/m^2 (0.05 - 1000 asb). Presentation time - 200ms.

4. FIXATION MONITOR

Heijl-Krakau technique in full threshold programmes.

5. FIXATION TARGETS

Red LED or cross pattern of red LED`s with broad spectral output of 625 - 675nm.

6. COMPUTER

Built in *IBM PC compatible with 386 processor 2Mb RAM, 1.44Mb 3.5 inch floppy disk.

7. OUTPUT

To Epson LQ compatible printer via Centronics parallel port. To other computer systems via removable floppy disks or via RS232 serial communications port.

8. DIMENSIONS

744 x 416 x 455mm

9. WEIGHT

18 kgm

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10. ELECTRICAL SPECIFICATION

Mains Input
Voltage 90-132V AC or 180-264V - universal input
Frequency 45 to 65Hz
Power 250W
Fuses T1.0A 180-264V
T1.6A 90-132V
Connector filtered IEC plug

Mains Output
Voltage - as power input
Frequency - as power input
Power - 70VA max.
Fuses - T0.5A 180-264V
T1.0A 90-132V
Connector shuttered IEC socket

11.

12. CLASSIFICATION

Mains operated
Class 1
Type B
Continuous operation
Equipment not suitable for use in presence of flammable anaesthetic mixtures with air or oxygen or nitrous oxide.
Ordinary equipment without protection against ingress of water.

13.

14. EXPLANATION OF SYMBOLS

Type B
Mains OFF
Mains ON
Protective earth
Time delay (anti surge fuses)
High Voltage
~ AC Mains

Fuses marked in PSU "**F1**" 1 1/4" **F5**A-250V

Battery marked on computer board "BT1" 3.6V 60mAH

15.

16. ACCESSORIES, OPTIONAL ACCESSORIES AND DETACHABLE PARTS

The Henson 3200 is supplied with the following accessories and detachable parts:

Set of spares in case consisting of fuses and bulbs
Patient response button and cable assembly
Trial lens holder
Mains lead for printer
Interface cable for printer
Mains lead for Henson 3200

17. OPTIONAL EXTRAS

Additional QWERTY keyboard
Canon Printer BJ-200
Printer Stand
Wall Bracket for Printer
Electric Table
Table Top

J. APPENDIX 10 INSTALLATION

1. LOCATION

The electrical installation of the room where the Henson 3200 is to be operated must comply with the "Regulation for the electrical equipment of buildings" published by the Institution of Electrical Engineers.

The Henson 3200 must be located in a position to give at least 50mm clearance adjacent to the air output grills on the top right hand side face of the instrument to allow sufficient air flow. It must also be standing on a hard surface to allow air inflow through the grills on the underside.

Do not cover the air inlet or outlet grills as this may cause the unit to shut down permanently.

The unit must be protected from ingress of liquids and flammable anaesthetic mixtures.

2.

3. MAINS SUPPLY

The mains supply required is 250VA at either 90 to 132V AC or 180 to 264V AC. An IEC approved mains lead must be used with conductors of at least 0.75mm^2 cross sectional area.

4.

5. ACCESSORIES

Connect the printer mains lead supplied between the IEC socket on the rear of the printer and the power output connector on the rear of the Henson 3200. (See figure 22).

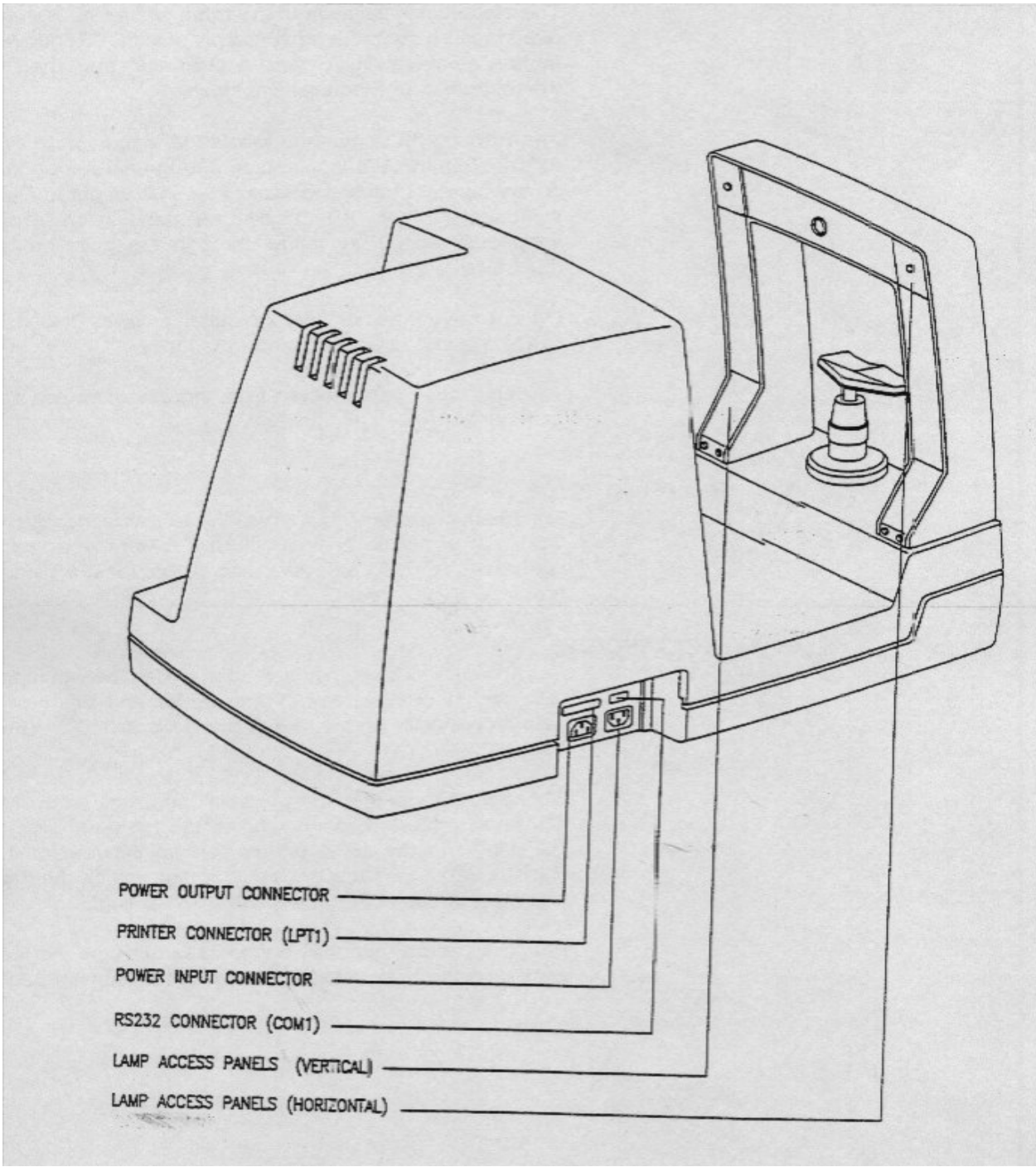
Connect the printer data cable supplied from the Centronics interface connector on the left hand side of the printer to the LPT1 printer port on the rear of the Henson 3200. Ensure the leads do not trail on the floor and are not subject to abrasion on sharp edges.

Plug the patient response button assembly into the jack socket on the bottom left front face of the Henson 3200.

6.

■ **FIGURE 22**
Rear view of Henson 3200 perimeter.

7.



AMBIENT TEMPERATURE AND HUMIDITY

For use the equipment should only be operated if the ambient temperature is betw een 10 and 40 degrees Celsius and the humidity is betw een 30% and 75% non condensing and pressure betw een 700 and 1060 m bar.

For storage and transport the ambient temperature must be betw een 0 and 60 degrees Celsius, the humidity betw een 10% and 80% non condensing and pressure betw een 500 and 1060 m bar.

8.

9. INSTRUCTIONS

The Henson 3200 must be used in accordance w ith the operating instructions. Please read the instructions before attempting operation.

K. APPENDIX 11 MAINTENANCE

1. CLEANING INSTRUCTIONS

HOUSING

The housing should be kept clean by wiping with a damp cloth. Do not use abrasive cleaners.

SCREEN

N.B. The screen must not be touched as finger marks will tend to leave greasy marks which cannot be easily removed without damaging its optical properties. Wear soft gloves when cleaning. Clean using a dry soft brush e.g. paint brush. Brush from the centre of the screen outwards. Do not use an air line to blow out as this may contain oil or water.

HEADREST

The brow bar and chinrest should also be kept clean using a damp cloth.

2.

3. PREVENTATIVE MAINTENANCE AND INSPECTION

Every six months it is recommended that all mains leads should be inspected and replaced if there is any sign of damage to the insulation etc.

The background illumination lamps should be checked periodically. This can be done by covering the sensor tube on the headrest assembly with an opaque cloth or your thumb with the unit on. Check that all 4 lamps on the headrest assembly are on, behind the translucent filter material.

4.

5. REPLACEMENT OF BACKGROUND ILLUMINATION BULBS

■ **FIGURE 3**
View of Henson 3200 perimeter.

PREPARATION

BACKGROUND ILLUMINATION BULB REPLACEMENT

Switch the unit off and isolate from the mains supply. Remove the 2 screws from the 2 top corners of the headrest assembly - see Figure 23. Next remove the 3 pieces of translucent filter material. Remove the faulty bulb and replace with another bulb of the screw type and rating. All bulbs must be 12V 3W festoon types.

These special bulbs can be purchased through your local T.M.I agent.

Refit the 3 pieces of translucent filter material and retain using the 2 fixing screws.

6. REPLACEMENT OF FUSES ON BASE PANEL

Switch unit off and disconnect from the mains. Remove the fuse holders using a tool e.g. screwdriver. Check which fuses are faulty and if necessary replace faulty fuses.

Reinsert fuses into fuse holders checking that the correct value and type has been used as specified next to the fuse holder noting the mains voltage that is being used.

Position the unit back on its feet on a bard surface.

Connect the mains supply and switch on.

7. FAULT FINDING

1. If the unit appears faulty, switch off, return the brilliance set fully checking, wait 10 seconds and switch on again. If the monitor appears to work proceed to 2. If not - check the unit is switched on and is connected to a working mains supply. Check the fuses are OK in the mains plug. Check the fuses are OK in the Henson 3200.

2. If the main Menu appears on the large control monitor, proceed to 3. If not check for messages on the screen, "LED driver board failure" with an intermittent bleep indicates that there is a hardware fault.

"Bad command or file name" means that the software is corrupted **reload** back up copy of Henson 3200 software. See Appendix 8.

3. If the 3200 operates correctly but does not print out correctly - Check that the printer is powered and turned on and there is a green light near the power button. Check that it is 'on line', a second green light should be on near the printer on line button. Check that a data cable is connected from the printer to the Henson 3200 and that the dip switches are set up correctly. See Appendix 6.

8.

9. REPAIRS

The Henson 3200 contains no user serviceable parts except for replacement of bulbs and fuses. It must only be serviced by an appropriately qualified person. In case of difficulty please contact:-

Tinsley Medical Instruments
275 King Henrys' Drive
New Addington
CROYDON
Surrey CR0 0AE

TEL 44-(0)1689-846700
FAX 44-(0)1689-800310

T.M.I will make available on request circuit diagrams, component parts, description, calibration instructions, etc. to assist appropriately qualified technical personnel in repair.

10.

11. WARRANTY

If within twelve months from the date of despatch any defect is discovered in any apparatus in respect of material or workmanship and reasonably within our control, we undertake to make good the defect at our own expense, provided notice is given to us as soon as it is discovered and that the apparatus is immediately forwarded to our works, carriage paid, and with seals unbroken.

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