

4135(1)

# ICL

## Automatic Pattern Grading

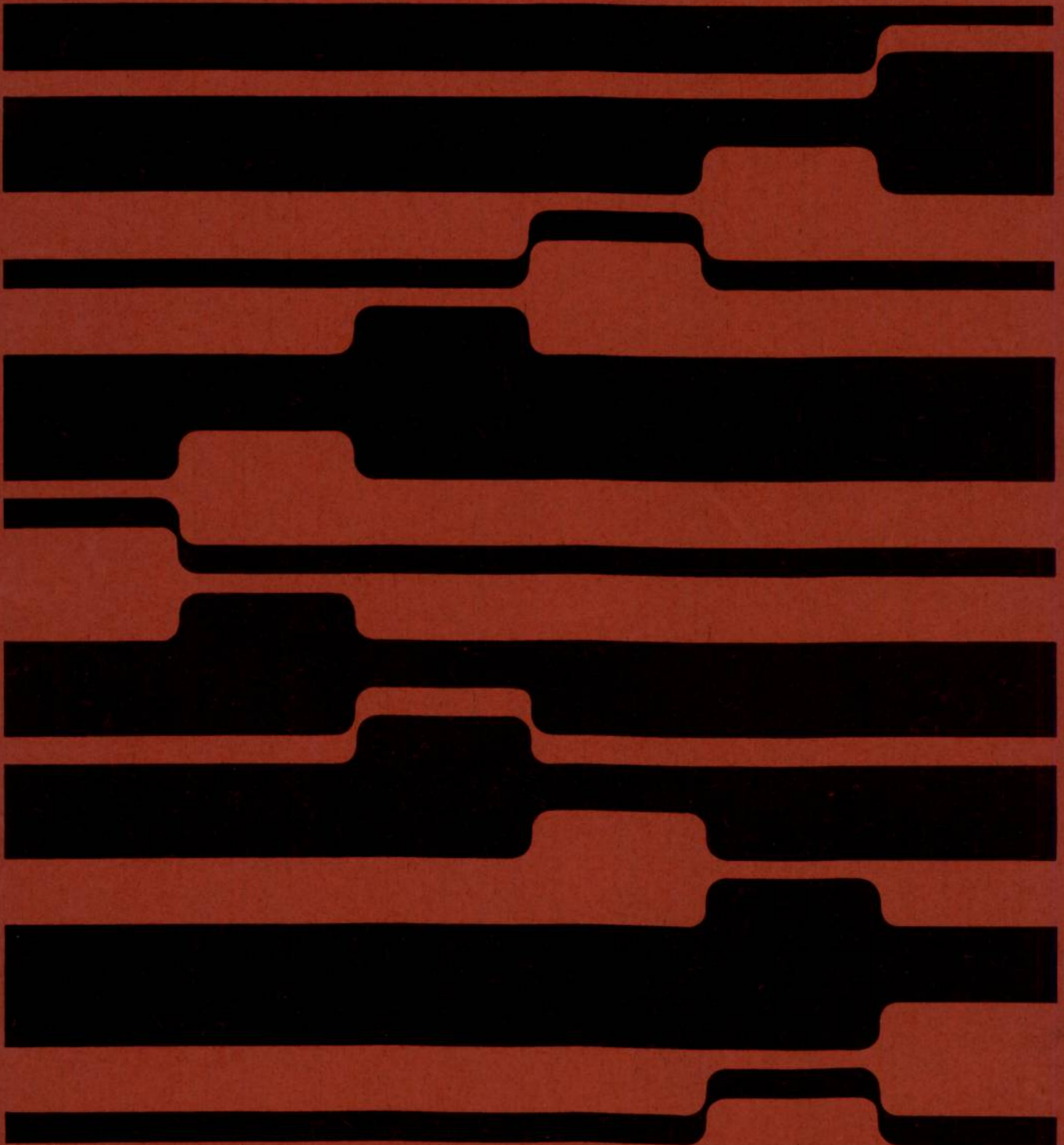
## 1900 Series

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MANUAL (NOTICE NO.)

16/4/69

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AUTOMATIC PATTERN GRADING (1)

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### AUTOMATIC PATTERN GRADING MANUAL

The following points should be noted:

- 1 As per the notice GENERAL 1900 Series (40) dated 12/2/69 the following restrictions apply:

In order that #X2G6 may be run on the minimum configuration specified it is necessary to overlay the program, using magnetic tape as the overlay medium. Consequently the graph plotter off-lining option will not be available in the first issue of #X2G6.

Furthermore, there will be no facility for outputting markings and descriptive text on patterns drawn by the plotter.

- 2 Page 3, lines 15/16: The phrase "... or to supply a small program to satisfy the requirements of particular users..." should be deleted.

Line 32, "maxima" should read "extremities".

- 3 Care should be taken in reading the card formats given in Chapters 3, 4 and 7 as the columns tend to be unevenly spaced. Header cards and initial data cards particularly have no punching in column 5.

- 4 Page 10, line 31: "... columns 6 to 18..." should read "... columns 6 to 17...".

- 5 Page 11, line 9: "... points ..." should read "... point ...".

Line 21: IPTS should read IPIE.

- 6 Page 15, Section headed Sequence, second and third paragraphs. This should read as follows:

All sequences are in strict ascending order: No two groups of data can have the same table piece or line number. Errors in sequence will cause all data associated with the offending key to be disregarded for processing purposes.

For example, if the header card for a particular piece of a certain table is found to have a lower piece number than that of a previous header card for another such piece the offending card and all the associated table data will be invalidated.

7 In the first two diagrams on page 23 the angle of intersection of the two lines should be  $90^\circ$ .

8 Page 26, line 6. This paragraph should read:

To apply the rotation alone (that is without magnification) the R code procedure should be used as described, and an entry made in a subsequent grading line specifying a D type grade (see page 26) to be applied to point 21 with point 19 as the base point. The amount of change in length should be specified as 0.0 units.

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8/10/69

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AUTOMATIC PATTERN GRADING (3)

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### AUTOMATIC PATTERN GRADING

The Mark 2 versions of the pattern grading programs #X2G4 and #X2G5 have now been superseded with Mark 3 versions #X2G4/3 and #X2G5/3. The result is an increase in running efficiency of the programs and the removal of some minor programming errors, which had been causing invalid carried forward files to be created by #X2G4 and #X2G5 when operating in the update mode.

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MANUAL (NOTICE NO.)

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AUTOMATIC PATTERN GRADING (4)

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### AUTOMATIC PATTERN GRADING

The pattern grading program #X2G6/2 has now been superseded by a new version, #X2G6/3, in order to produce complete compatibility with the programs #X2G4/3 and #X2G5/3 issued previously.

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MANUAL (NOTICE NO.)

3/2/71

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AUTOMATIC PATTERN GRADING (5)

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#### AUTOMATIC PATTERN GRADING MANUAL

When this manual was first written, it was stated in the Preface that certain additional sections, which would aid the user in running the package, were to be issued at a later date.

There are, however, at the moment, no plans to amend this manual, and that statement, on page iii of the manual, is hereby withdrawn. Apologies are expressed for any inconvenience this decision causes to users.

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# ICL

# Automatic Pattern Grading

# 1900 Series

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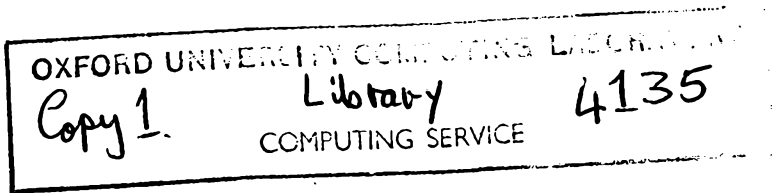
Technical Publication 4135

© International Computers Limited 1968

First Edition March 1969

Issued by Technical Publications Service  
International Computers Limited  
Head Office: ICL House, Putney, London SW15  
and printed in Great Britain by  
ICL Printing Services, Letchworth, Hertfordshire

# Preface



This manual describes the ICL Automatic Pattern Grading system in which clothing patterns are graded automatically by computer.

The system is intended for use by the manufacturer who may experience bottlenecks in production between the stages of designing a garment and manually drafting patterns for the range of sizes in which it is to be produced.

The manual provides detailed information on the input and output for each of the three constituent programs and, in the appendices, the suggested format for tables on which data for grading and scaling is to be set out. The formats of the Master Pattern Co-ordinates file and the Grading and Scaling file are also given in the appendices, as well as a specimen grading table.

The minimum 1900 Series configuration required is:

- 16K core store,
- 4 magnetic tape decks (non-cassette),
- 1 digital incremental plotter,
- 1 line printer (96 character positions or above),
- 1 card reader, or
- 1 paper tape reader.

*To be issued at a later date:*

- 1 Fuller details of the printer listings output from Programs 1, 2 and 3.
- 2 Fuller details of the validity checks carried out by Programs 1, 2, 3 and the action taken by the programs when errors are detected.
- 3 Complete example showing the use of the pattern grading package.
- 4 Limits on the number of points that may be used to define a pattern shape, the number of lines in any one grading table etc.



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# Chapter 1 Description of the system

The overall system for Automatic Pattern Grading is composed of three separate programs: #X2G4, #X2G5 and #X2G6, which will be referred to in the following text as Programs 1, 2 and 3 respectively.

*Program 1* Creation or updating of a Master Patterns' Co-ordinates File.

*Program 2* Creation or updating of a Grading and Scaling File.

*Program 3* Grading and drawing of selected patterns in selected sizes using the files created in programs 1 and 2.

In the first two programs, files are created from input data relating to the original pattern and the sizes to which it is to be graded. These files are input, together with steering information and parameters, to the third program which then outputs the graded patterns on a digital incremental (graph) plotter. An optional facility exists, for each of the first two programs, for listing the new data input, and for the third program of listing the co-ordinates of the graded patterns.

The principle on which the system is based is that a garment pattern may be translated into computer input by *digitizing* significant points on its periphery. This may be done either manually or with an automatic digitizer and consists of selecting a sufficient number of points for the shape of the pattern to be apparent when these are connected by lines drawn on the digital incremental plotter. The co-ordinates of the points are determined in relation to two rectangular axes and are input to Program 1 to create a file. Another file is created by Program 2 from the data in the *grading* and *scaling* tables. Program 3 uses the grading and scaling data to cause the displacement, in a specified manner, of each point to be graded. After all points have been graded in this way they are output on the plotter. Depending on the specification in the scaling table grading may be repeated for a range of sizes. The graded patterns may be drawn individually or nested together.

The complete system is summarised in the systems flowchart on page 2.

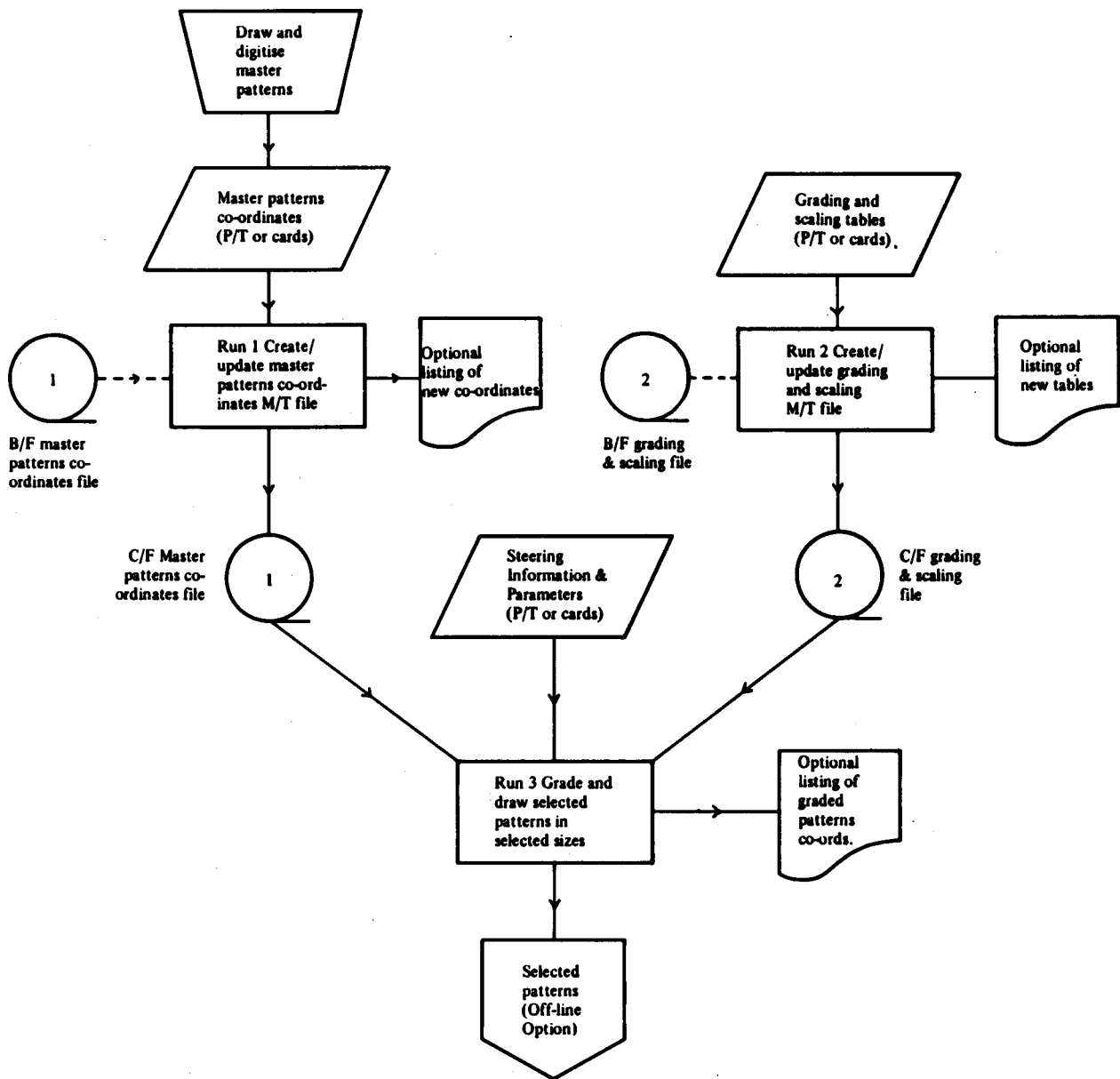


Figure 1 Automatic pattern grading systems flowchart

## DIGITIZING

Once the master drawing of a new pattern or pattern piece has been manually drafted, it is necessary to express the drawing in a form suitable for input to a computer. This is done by selecting key points of the pattern and punching the co-ordinates of these points, relative to two arbitrarily selected rectangular axes, into paper tape or punched cards. This process is known as *digitizing*.

At the same time a unique number is assigned to each digitized point. It is recommended that points be numbered upwards from 01.

The data so formed is input to Program 1 of the system, together with similar data for other patterns if desired. The data is then validated and transcribed to a magnetic tape known as the Master Patterns' Co-ordinates file.

Digitizing of the drawings of master patterns may be done in two ways:

- 1 By reading the co-ordinates of the key points with the aid of a ruler or a similar measuring device; or
- 2 By utilising one of the many automatic co-ordinate readers or digitizers.

In the latter case it will probably be impossible to arrange for the format of the output from the digitizer to correspond with that required for input to Program 1 of the system. However, where possible, arrangements will be made to amend the input portion of the program to satisfy the requirements of particular users, or to supply a small program to satisfy the requirements of particular users, or to supply a small program for translating users' data into the acceptable format for the pattern grading system.

The user should digitize at least all points used in the grading of a pattern as well as the defining points of any *construction lines*. (i.e. lines defining the direction along which one is to grade. The term is not used in the usual drawing sense). Construction lines may or may not be drawn on the plotter, output depending on requirements (see *Output*). Additional points may have to be digitized in order to complete the definition of the shape of a pattern. It should be noted, however, that for purely shape defining purposes the only co-ordinates required are those of the end points of straight lines and curves plus, in the latter case, a sufficient number of extra points to enable the program to generate a curve closely resembling the original.

No hard and fast rule exists for the number of points required to define a curve except that there must be at least four. It is evident that the smaller the radius of curvature, the closer together the defining points should be.

During the grading of a pattern (see Chapter 7) the computer retains the maximum and minimum X and Y co-ordinates of the set of all digitized points that are to be output to the graph plotter. These are used to ensure that all drawings will fit the width of graph plotter paper and that one drawing does not overlap the next. In order to assist this check it is advised that the extreme points of the master drawing are always digitized. Thus in Figure 2 points A and C are the maxima on the Y axis, and points D and B are the maxima on the X axis. Points A, B, C and D should all be digitized.

The origin selected when digitizing a pattern is arbitrary since the program considers only the relative positions of the defining points. When drawn on the plotter the orientation of the pattern to the plotter axes will be the same as that of the original drawing to the digitizing axes.

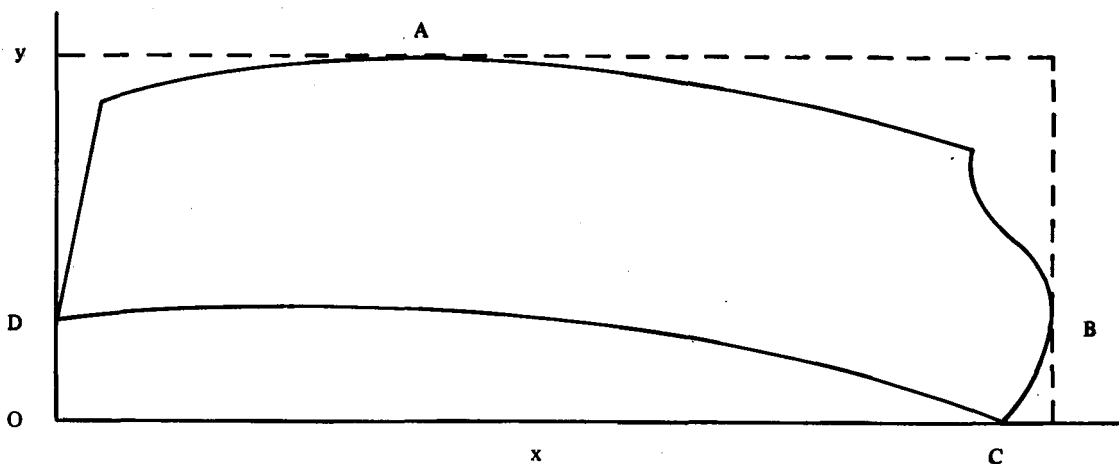


Figure 2 Example of the extreme points of a pattern.

It may be necessary sometimes to digitize a point more than once, giving it a different number each time. This would occur if the user wanted to grade a point but also preserve its original co-ordinates to assist in the grading of another part.

It should be noted that patterns may be digitized in either centimetres or inches. Independent of the units chosen patterns may be plotted on either centimetre or inch plotters.

## **PROGRAM 1: CREATION OR UPDATING OF A MASTER PATTERNS' CO-ORDINATES FILE**

This program validates and transcribes the input data to create or update the Master Patterns' Co-ordinates File (M.P.C.F.).

### **Modes**

It has two entry points: The first, point 0, is used when a new Master Pattern Co-ordinates File is to be created; the second, point 1, is used when an existing file is to be updated by the input data, either by amending or deleting existing records on the file or by inserting new records, or parts of records, into the file. The entry point will thus determine the mode of the run: The *create* mode will result from entry point 0 and the *update* mode from point 1.

## GRADING AND SCALING

In order that the patterns on the M.P.C.F. may be graded, a Grading and Scaling file must be created. Each record on the Grading and Scaling file is referenced by one or more records on the M.P.C.F. In addition to supplying information on how to grade the patterns the Grading and Scaling records also define the method of joining the key points of the pattern and give details of any marking or text that is to be drawn on the pattern.

Each grading table is initially drawn up on a pre-printed form (see Appendix 1) and is accompanied by an associated scaling table which is entered on a second pre-printed form (see Appendix 2).

The function of the latter table is to modify the grading instructions of the former table. Certain instructions may determine how the master pattern is to be graded to give only one other size of pattern. In order to obtain the whole range of pattern sizes a reference is made in the grading table (*Scale Ref.* Column) to a line of the scaling table containing a list of scaling factors which will be multiplied, by the program, by the amount of displacement of the basic grade (see page 33).

## PROGRAM 2: CREATION OR UPDATING OF A GRADING AND SCALING FILE

The data from the grading and scaling tables is punched into paper tape or cards and then input to Program 2 of the system. The program validates the data and transcribes it to a magnetic tape known as the Grading and Scaling File.

Program 2 has two entry points, point 0 and point 1; their use is analogous to that of the entry points of Program 1.

## PROGRAM 3: GRADING AND DRAWING OF SELECTED PATTERNS

In order to produce graded patterns from the two magnetic tape files created by programs 1 and 2 of the system a third program is required.

The two files are input to this program together with certain steering information and parameters which are input on punched cards or paper tape. The steering information gives details of the various peripherals used by the program; the parameters specify, for example, which pieces of which patterns are to be graded and in what range of sizes they are to be drawn.

For each piece of each pattern to be drawn the program reads in the appropriate Master Patterns' Co-ordinates record and Grading and Scaling records and from these calculates the sets of key point co-ordinates for the various pattern sizes required. Each set of graded co-ordinates is connected by the method indicated in the grading table and the resultant graded pattern is drawn on a digital incremental plotter otherwise known as a *graph plotter*.

For a particular piece of a particular pattern the various sizes of graded pattern may be drawn either separately or nested together in one or more groups of sizes. The drawings may be produced either on-line or by a pseudo off-line technique by which the plotter driving instructions are written to a magnetic tape which is later read by a special library program, #XJGA, which causes the plotter instructions to be obeyed.

## OPTIONAL LISTING FACILITY

An optional facility exists in each of the three programs whereby certain information can be printed out by a line printer during the running of the program. This information consists of the data input to the program and in the case of programs 1 or 2, selected records of the magnetic tape file created by the program, or, for program 3, the co-ordinates of the patterns drawn on the plotter.

# Chapter 2 Input and output

## INPUT

Disregarding the use of magnetic tape files the input to any one of the three programs may be on either punched cards or paper-tape. Mixed card/paper-tape input is not permissible.

One unit of data consists of one 80 column punched card or its equivalent in 8-track paper-tape, i.e. one block of paper-tape terminated by a newline character. The input to each run is terminated by a card or paper tape block with asterisks punched in the first four character positions.

For the sake of simplicity the description of the input is expressed only in terms of punched cards, although a similar format is used for paper-tape.

### Field formats

Unless specifically stated otherwise all fields must conform to a fixed format, dependent on the type of field only. Integer quantities must be right justified, i.e. the least significant figure of the number must occupy the right-most character position of the field and no spaces should appear between successive digits. Non significant zeros, i.e. zeros at the beginning of the field, may be left blank or punched with space characters if so desired. However the integer zero must be signified by punching at least one zero at the right hand end of the field, not by leaving the whole field blank. Fractional quantities must be punched with the decimal point occupying a fixed character position of the field. The whole number part is punched according to the rules stated above for integer quantities, being right-justified to the decimal point; the fractional portion must have all its characters punched, including all zeros. Character fields, for example pattern numbers, table numbers, piece numbers, point numbers, line numbers, etc., must be punched in full i.e. zeros must not be suppressed to spaces.

## KEYS

In each of the three programs two important keys are used to identify each pattern: The *pattern number* and the *piece number*. Both keys consist of alphanumeric characters.

The major key is the pattern number and is composed of ten characters. The purpose of this key is to identify the patterns on the Master Patterns' Co-ordinates file, each pattern being given a unique number.

*Pattern*, in this sense, refers to the set of patterns for any single garment such as a jacket, or group of garments such as a suit. Each pattern may be sub-divided into one or more *pattern pieces*, the usual method of division being into the individual pieces which will eventually be cut out and sewn together to make the complete garment.

Each pattern number consists of two parts, a group number and a member number, each five characters long. The latter number serves to distinguish the individual members of a group and must be unique for each member of any one group of patterns.

A group of patterns has the following characteristics:

- 1 All member patterns have the same number of pattern pieces.
- 2 Each piece is of a similar shape to the corresponding piece of any other member pattern in the group.
- 3 Each piece is also defined by the same number of points as a corresponding piece.

Furthermore every piece of every member of a group must be graded in an identical manner to its associates. For example a group could consist of patterns of mens' suits, all of similar style and each pattern consisting of a fixed number of pattern pieces.

Each piece of a particular pattern is identified by a unique two character piece number - the second key. It is important that all corresponding pattern pieces in a group of patterns be given identical piece numbers.

All members of a group of patterns are graded by using the same set of grading and scaling tables. Each grading and scaling table has a five character table number which is identical to the group number of the patterns utilising it. Identification of the grading and scaling tables is completed by a piece number which is identical to that of the pattern piece being referenced.

## **OUTPUT**

The output from programs 1 and 2 consists primarily of the carried forward Master Patterns Co-ordinates file and the carried forward Grading and Scaling file respectively. These two files constitute the main input to Program 3, the remaining input consisting of steering information and parameters.

An optional facility exists for a line printer listing in one of three forms.

For program 1 these will be:

- All data input to the run, with all unacceptable cards flagged with an asterisk;

- The details of all pattern pieces to be amended, inserted into or deleted from the M.P.C.F.;

- A combination of the foregoing two listings.

For Program 2 the three forms will be:

- All data input to the run, with all unacceptable cards flagged with an asterisk;

- The details of the grading and scaling tables to be amended, inserted into or deleted from the Grading and Scaling magnetic tape file;

- A combination of the foregoing two listings.

For Program 3 the output consists of the graded patterns as drawn out by the digital incremental plotter (or stored on magnetic tape for plotting at a later date - the off-line option) and an optional line printer listing in one of three forms:

- All data input to the run with all unacceptable cards flagged with an asterisk;

- The co-ordinates of all sizes of all pieces of all patterns selected for grading and drawing;

- A combination of the two foregoing listings.

The choice of any of the optional facilities is indicated in the steering information contained in the steering card for each program.

# Chapter 3 Program 1

This program validates and transcribes the input data to create or update the Master Patterns' Co-ordinates file.

## INPUT TO PROGRAM I

The input to Program 1 is dependent on the program's mode of running. If the program is being run in the *create* mode the input consists of a steering card and a parameter specifying the file generation number of the Master Patterns' Co-ordinates file to be created, followed by the data necessary for the creation of the file. If the update mode is in operation a brought forward M.P.C.F. must also be supplied together with its file generation number parameter.

### Steering card

*Columns* 1 2 3 4 5 6 7 ...

*Punching* L P , x

where: x = 0, no line printer output is required,  
x = 1, listing of input data only required,  
x = 2, listing of details of pattern pieces amended, inserted or deleted only required.  
x = 3, a combination of both the foregoing listings is required.

### File generation number parameter card

*Columns* 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 ...

*Punching* B F G N x x x x C F G N y y y y

x x x x = Brought forward (input) Master Patterns' Co-ordinates fgn.

y y y y = Carry forward (output) Master Patterns' Co-ordinates fgn.

The characters BFGN and CFGN must always be present. For a create run the first file generation number is left blank. If this number is left blank or zero on an updating run no check will be made on the file generation number of the input file. If the output file generation number is left blank the carried forward file is supplied with a generation number one greater than that of the brought forward file, or if the run is in create mode, with a generation number of 1.

### Master patterns' co-ordinates data cards

The master patterns' co-ordinates data for any one run is divided into one or more groups of data, one group for each pattern. Each group is sub-divided into one or more sub-groups, each containing the data for one piece of the whole pattern.

### MAIN GROUP HEADER CARDS

Each of the main groups of data is headed by a card punched in one of the following three ways:

*Columns* 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 ...

*Form*

(1) A P A T x x x x x x x x x x , y

(2) I P A T x x x x x x x x x x , y

(3) D P A T x x x x x x x x x x

where xxxxxxxxxx = pattern number of the current group,

y = I if co-ordinate data is in inches,

y = C if co-ordinate data is in centimetres.

The first form of this card indicates that the pattern number xxxxxxxxxx already exists on the M.P.C.F. and that the data following it is intended to update current information on this file i.e. Amend PATtern xxxxxxxxxx. Similarly the final form is used for Deleting a PATtern from the M.P.C.F. Columns 16 and 17 need only be punched on an APAT card if the wrong co-ordinate units were specified when the pattern was introduced originally to the M.P.C.F. and need to be rectified.

The second of the three formats is used when an entirely new pattern is to be inserted into the tape file i.e. Insert PATtern xxxxxxxxxx.

It should be noted that any one pattern number should have only one pattern header-card; any subsequent header cards will be considered invalid. Hence it is not possible, for example, to insert a new pattern into the M.P.C.F. and then proceed immediately to amend or delete it. Any such action must take place on a subsequent run of the program.

During the creation of a M.P.C.F. all the header cards will be of the second type.

#### SUB GROUP HEADER CARDS

Each sub-group of master patterns' co-ordinates data is headed by one of the following three types of cards.

*Columns*      1 2 3 4 5 6 7...

*Form*

(1)            A P I E    x x

(2)            I P I E    x x

(3)            D P I E    x x

where xx = piece number of the current sub-group.

The meaning of these cards is similar to that of the main group header cards: Amend PIEce xx, Insert PIEce xx, and Delete PIEce xx. As with the main header cards only one header card must exist for any piece of any pattern.

Furthermore all sub-groups of a group headed with an IPAT xxxxxxxxxx card must be headed with IPIE xx cards since no pattern pieces will exist on the M.P.C.F. to which amendments or deletions can be made.

A group headed with DPAT xxxxxxxxxx will have no sub-groups.

#### DESCRIPTION CARD

Following an APIE or IPIE sub-group header card is a card giving a description of the piece to be amended or inserted. This card is identified by having the characters DESC punched in columns 1 to 4; columns 6 to 18 give the requisite description and may contain any combination of characters from the 64 character card code set.

*Example:*

*Columns*      1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18....

*Punching*    D E S C   B R E A S T   P A N E L

If the description card is not present then no description will be given to an inserted piece, and no amendment will be made to an existing piece, whichever case applied.

#### DATA CARDS

The data cards are input after the description card. These cards contain the co-ordinates of the relevant points of the pattern piece specified. These co-ordinates will either amend the definition of existing points on the M.P.C.F. or will define new points for insertion into the file.

Points cannot be deleted from the file but effective deletion can be obtained by removing any reference made to the point by the Grading and Scaling file, thus preventing the point from being drawn by the graph plotter.

Amendment data and insertion data for a particular pattern piece must be grouped separately for input to the program, the amendment data being input first.

Preceding the amendment data must be a card with the format:

*Columns*     1 2 3 4 5 6 7 8 9 ...  
*Punching*    A P T S    x x

where xx is the number of points to be amended.

Following this card are xx cards giving the point numbers and new co-ordinates of all points to be amended. The format of each card is as follows:

*Columns*     1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 ...  
*Punching*    P n n    x x x . x x x    y y y . y y y

where P is used to identify the card as a Point co-ordinate data card;

nn is the number of the points to be amended, and  
xxx.xxx and yyy.yyy are the new x and y co-ordinates to be assigned to the point.

Both co-ordinates must be specified even though only one may have been an amendment to the original.

Similarly each set of point insertion data must be headed with a card of the format:

*Columns*     1 2 3 4 5 6 7 8 ...  
*Punching*    I P T S    x x

where xx = number of points to be inserted.

Immediately after this card are xx cards which give the co-ordinates of the points to be inserted. Their format is the same as that of the co-ordinate data for amended points.

If for a particular pattern piece there are no amendments to be made or no new points to be inserted the appropriate header card may be omitted rather than the number of points being punched as zero.

For any sub-group of data headed by an IPTS card there will be no APTS card nor its associated amendment data.

For a pattern piece that has been deleted (headed with a DPIE card) there must be no amendments or insertions to the point data.

#### Sequence

The master patterns' co-ordinates data must be presented to Program 1 in a strict sequence. Groups of data for individual patterns must appear in ascending order of pattern numbers; within the group of data for any one pattern the data must be in ascending order of piece number.

Finally, within each piece the order must be: amendment data followed by insertion data with ascending point numbers in each category.

All sequences are in strict ascending order which means, for example, that no two separate groups of data can have the same pattern number. Errors in sequence will cause all data associated with the offending key to be disregarded for processing purposes.

For example, if the header card for a particular piece of a certain pattern is found to have a lower piece number than that of a previous header card for another such piece the offending card and all the point data cards referring to the piece in question will be invalidated.

#### Summary

To summarise, the master patterns' co-ordinates data gives details of all patterns to be amended, inserted into or deleted from the Master Patterns' Co-ordinates magnetic tape file. Where applicable additional information defines the particular pieces of a pattern which are to be amended, inserted into or deleted from, and, for amendments and insertions, the co-ordinates of the relevant points.

#### END CARD

The data for any run of Program 1 must be terminated with a card of the following format:

*Columns*     1 2 3 4 5 ...  
*Punching*    \* \* \* \*

**Brought forward master patterns' co-ordinates magnetic tape file**

This file will be present only when Program 1 is run in the update mode. Details of the file are as given in the section on the *carried forward M.P.C.F.* on page 12 .

**OUTPUT FROM PROGRAM 1**

The output from Program 1 consists of a carried forward Master Patterns' Co-ordinates magnetic tape file and an optional Line Printer Listing.

**Carried forward master patterns' co-ordinates magnetic tape file**

The layout of this file is given in Appendix 3. All fields of each record are derived directly from the data input to Program 1 with the exception of word seven, character 3, which is set by the program to the letter L for the last record of any particular pattern and to zero for all other records. All character fields are as they appear on the input paper tape or cards. Point co-ordinates are expressed as a binary number of one thousandths of a unit (centimetre or inch) rather than a six figure decimal number as with the input data. No point numbers appear in the file records. Instead the records are such that the co-ordinates of point 01 are always stated in words 8 and 9 of a record; the co-ordinates of point 02 in words 10 and 11, and so on.

The record length depends on the number of defining points.

When patterns are digitized points should always be numbered in steps of one starting with point number 01. This prevents wastage of space in the master file records. If a point number within a range is not utilised i.e. is not assigned co-ordinates then the appropriate pair of words of the master file record are set to #40000000.

**Line printer listing**

The form of the line printer listing depends on the form of the steering card or paper tape block supplied to the program. If the steering information indicates that the option of a printed listing is not required no printer is allocated to the program unless an error is detected in the input data or, where applicable, during the searching of the brought forward M.P.C.F. In this case a line printer is automatically allocated to the program and details of the error and any subsequent errors are printed. If the option of a listing is required it may take one of three forms:

A listing of all the data input to the program, with all cards unacceptable to the program flagged with an asterisk;

Details of all pattern pieces amended, inserted into or deleted from the M.P.C.F.;

A combination of both of these listings.

If a listing of the input data only is required each unit of data, i.e. one card or one block of paper tape, is printed on a separate line. Printing proceeds until all the data has been listed. However, if details of the M.P.C.F. are also required then the input data for each pattern piece is printed as a separate entity.

When all the data for any one piece has been printed the line printer throws to the head of a new page and prints the updated details of the pattern piece as they will appear on the carried forward M.P.C.F. Another throw to head of page is executed and the input data for the next pattern piece is listed. This process is repeated until all the data has been listed.

If details of updated pattern pieces only are required the printout takes the same form as described above except that the pages listing input data are omitted.

Each page of printout is headed AUTOMATIC PATTERN GRADING, #X2G4 LISTING; followed by the date of the run and the page number.

**Example**

AUTOMATIC PATTERN GRADING, #X2G4 LISTING - 08/06/68 PAGE 7.

If any input card or block of data has been invalidated by the program this is indicated on the printout by flagging the line of data with an asterisk on the left hand side.

# Chapter 4 Program 2

The data from the Grading and Scaling tables is punched into paper tape or cards and then input to Program 2 of the system. The program validates the data and transcribes it to a magnetic tape where it constitutes the Grading and Scaling file.

## INPUT TO PROGRAM 2

When the program is being run in the create mode the input consists of a steering card and a parameter card which gives the file generation number of the Grading and Scaling file to be created. These are followed by the data to be used in creating this file. For an updating run a brought forward Grading and Scaling file must also be supplied and the parameter card must include the file generation number to be given to this file.

### Steering card

*Columns*      1 2 3 4 5 6 7 . . . . .

*Punching*     L P , x

where x = 0, no line printer output required.

x = 1, listing of input data only required.

x = 2, listing of details of grading tables and scaling tables amended, inserted or deleted only required.

x = 3, a combination of the two foregoing listings required.

### File generation number parameter card

*Columns*      1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 . . .

*Punching*     B F G N x x x x C F G N y y y y

where xxxx = brought forward (input) Grading and Scaling fgn.

yyyy = carried forward (output) Grading and Scaling fgn.

The characters BFGN and CFGN must always be present. For a create run the first file generation number is left blank. If this number is left blank or zero on an updating run no check will be made on the file generation number of the input file. If the output file generation number is left blank the carried forward file is supplied with a generation number one greater than that of the brought forward file, or if the run is in create mode, with a generation number of 1.

### Grading and scaling data cards

The grading and scaling data for any one run is divided into one or more groups of data, each group supplying the information necessary to grade one piece of any member of a particular pattern group. (see Chapter 2). Within each group grading data always precedes the associated scaling data. Groups of data are batched together so that each batch has a common table number. This table number is punched on a *batch header card*:

### BATCH HEADER CARD

*Columns*      1 2 3 4 5 6 7 8 9 10 . . .

*Form*

1            A T A B   x x x x x

2            I T A B   x x x x x

3            D T A B   x x x x x

where xxxxx = table number. The three forms of this card indicate that the data following is intended to Amend, Insert or Delete information in TABLE xxxxx. Comments made on APAT, IPAT and DPAT cards in the section on Master Patterns' Co-ordinates Data Cards (page 9) are equally applicable here. This is also true of the group header cards described below.

#### GROUP HEADER CARD

Each group of data within a table batch is headed by one of the following three cards:

*Columns*     1 2 3 4 5 6 7 ...

*Form*

1            A P I E    x x

2            I P I E    x x

3            D P I E    x x

where xx = piece number of the pattern piece that is to be graded using the data following, and the letters A, I and D have their usual meaning. Immediately following an IPIE header card is the grading data for the piece quoted in the header card and this is followed by the associated scaling data. An APIE header card may be followed by either grading data or scaling data or both depending on which tables are to be amended.

#### DATA CARDS

Grading data must always be preceded by a card of the following format:

*Columns*     1 2 3 4 5 6 7 8 ...

*Punching*    G R A D    x x

where xx = total number of grading lines that are to be amended and/or inserted into the current grading table. Immediately after this card will be xx cards giving the contents of these grading lines.

Similarly scaling data must be preceded by a card of the format:

*Columns*     1 2 3 4 5 6 7 8 ...

*Punching*    S C A L    x x

where xx = total number of scaling lines that are to be amended and/or inserted into the current scaling table. Immediately after this card will be xx cards giving the contents of these scaling lines. If there are no amendments or insertions to be made to a grading table or scaling table the appropriate header card, GRAD or SCAL, may be omitted rather than punched with a zero in column 7.

The grading data is initially created by drawing up a list of grading instructions on a pre-printed form (Appendix 1) and the resulting table is then transcribed directly to punched cards or paper tape for input to Program 2.

On the form each line of a grading table has a line number and the order in which the lines of grading are executed by the computer is given by a column headed *Next Line in Sequence*. When amendments are being made to a particular grading table the line number of each amending line is compared with the line number of the last line of the existing table. If it is less than this number the contents of the appropriate line are updated. Otherwise the line is added to the end of the table. In this case it is usually necessary to amend the *Next Line in Sequence* column of a second card in order to accommodate execution of the grading instructions of the new card at the appropriate moment.

For example, suppose that in a grading table of 25 lines execution of line 11 follows immediately after that of line 10 but it is desired to insert additional grading information between them. This could be done by adding a new line, number 26, to the table and amending the *Next Line in Sequence* column of line 10 to read 26 instead of 11. The *Next Line in Sequence* of line 26 would read 11. If several amendments and insertions are to be made to a table it may prove easier to amend the whole table or to delete the whole table and insert a new one at a later date.

Individual lines of a table cannot be deleted. However effective deletions may be obtained either by ensuring that the line of instructions is never executed or by amending the line to a blank line, i.e. spaces in columns 4 to 67.

As with the grading data the scaling data is a direct transcription to punched cards or paper tape of the information

entered in the scaling table. The function of the scaling table will be fully described later but it is sufficient to say at present that it qualifies the grading instructions of the grading table. Each line of the scaling table has a line number which is referenced by one or more lines of the grading table. During an updating run of Program 2 the line number of each line of scaling data is compared with those of the existing scaling table. If a match is found the appropriate scaling line is amended, otherwise the new scaling line is added to the current table on the file.

#### **Sequence**

The Grading and Scaling data must be presented to Program 2 in a strict sequence. This is as follows: Groups of data for individual tables must appear in ascending order of table number; within each group the data must be in ascending order of piece number, with the grading data for each piece always preceding its associated scaling data. The grading or scaling data for any one piece is presented as a direct transcription of the entries made on the grading and scaling forms, in order of line number.

All sequences are in strict ascending order which means, for example, that no two separate groups of data can have the same pattern number. Errors in sequence will cause all data associated with the offending key to be disregarded for processing purposes.

For example, if the header card for a particular piece of a certain pattern is found to have a lower piece number than that of a previous header card for another such piece the offending card and all the point data cards referring to the piece in question will be invalidated.

#### **Summary**

The grading and scaling data consist of details of all tables to be amended, inserted into or deleted from the Grading and Scaling magnetic tape file. Where applicable, additional information defines the particular lines to be amended or inserted and the contents of these lines.

#### **END CARD**

The data for any run of Program 2 must be terminated with a card of the following format:

<i>Columns</i>	1	2	3	4	5	6	...
<i>Punching</i>	*	*	*	*			

**Brought forward grading and scaling magnetic tape file**

This file will be present only when Program 2 is being run in the update mode, as opposed to the create mode. Details of the file are as given in the section on the carried forward Grading and Scaling file on page 17.

## OUTPUT FROM PROGRAM 2

The output from Program 2 consists of a carried forward Grading and Scaling magnetic tape file and an optional line printer listing.

### Carried forward grading and scaling magnetic tape file

The layout of this file is given in Appendix 4. All fields of each record are derived directly from the data input to Program 2 with the exception of word 2, character 3 which is set by the program to the letter G for grading records and S for scaling records. All character fields are as they appear on the input paper tape or cards. Grading amounts are expressed as binary numbers of ten thousandths of a unit (centimetre or inch) rather than as five figure floating point decimal numbers as with the input data. No line numbers appear in either grading records or scaling records. Each line of a grading table is transcribed to one record on the magnetic tape file with the first record of each table corresponding to line 01 of the original table, the second record to line 02, etc. Because of this one should avoid leaving blank lines when compiling a grading table. Similarly, although the scaling factors associated with a grading table are all entered in the same record of the tape file, blank lines in the scaling table will cause wastage of space on the file.

### Line printer listing

The form of the line printer listing depends on the steering card or paper tape block supplied to the program. If the steering information indicates that printer listing is not required no printer is allocated to the program unless an error is detected in the input data or during the searching of the brought forward Grading and Scaling magnetic tape file. In this case a printer is automatically allocated to the program and details of the error and any subsequent errors are printed. If the option of a listing is required it may take one of three forms:

A listing of all the data input to the program, with all unacceptable cards flagged with an asterisk;

Details of all grading and scaling tables amended, inserted into or deleted from the Grading and Scaling magnetic tape file;

A combination of both these listings.

If a listing of the input data only is required, each unit of data, i.e. one card or one block of paper tape, is printed on a separate line and printing proceeds until all the data has been listed. However, if details of the Grading and Scaling magnetic tape file are also required then the input data for each grading table and/or its associated scaling table is printed as a separate list. When all the data for any one pair of tables has been printed the printer throws to the head of a new page and prints the updated details of the tables as they will appear on the carried forward Grading and Scaling file. Another throw to head of page is executed and the input data for the next grading table and/or scaling table is listed. This process is repeated until all the data has been listed. If only details of updated grading and scaling tables are required the printout takes the same form as just described except that the pages listing input data are omitted.

Each page of printout is headed with the title

**AUTOMATIC PATTERN GRADING, #X2G5 LISTING**

followed by the date of the run and the page number.

### Example

**AUTOMATIC PATTERN GRADING, #X2G5 LISTING - 08/06/65 PAGE 15.**



## Chapter 5 The grading table

The grading table is the hub of the Pattern Grading System. It is used to tabulate the set of instructions required to grade the defining points of the master pattern into the range of production sizes required. From it too the program derives information on how the graded sets of defining points are to be joined together. Details of any markings and descriptions to be drawn on the patterns are also entered in this table.

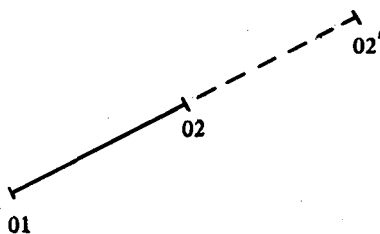
The grading table is constructed by entering the instructions for grading any one piece of any one pattern on one or more *grading sheets* commencing at line 01 of the first sheet. Instructions must be entered on consecutive lines until the grading table is complete; if continuation sheets are required for a table the line numbers of these must be altered to follow on from the previous sheet.

Execution of the grading instructions for a particular pattern piece commences with line number 01 and proceeds in the order given by the column headed *Next Line in Sequence*. The number of the point to be graded is given in the second column of the form. Connection of the points defining a pattern commences with the first line encountered in which the *Type of Join* column is not blank. The point referenced in this line is joined to the point referenced in the next such line and so on until the complete pattern has been connected. The method of joining is determined by the code in the *Type of Join* column of the first of each pair of points. These codes are explained later in this chapter.

Every point to be graded has one or more lines of the grading table associated with it. Each line determines a movement of the point concerned by a specified *amount* and the final graded position of the point is the sum of these movements. The component movements are determined by either one or two conditions that the new position of the point must satisfy in relation to its original position. In general these conditions are expressed in terms of a base, for example a point, line or direction, and a displacement of the point relative to this base by an amount which is either absolute or dependent on a matching point or distance. If the amount is absolute the grading table will indicate how only one graded co-ordinate of the point is to be calculated. The grader must then select a line of the scaling table which will contain a set of suitable scaling factors. He must enter the number of this scaling line in the *Scale Ref.* column of the grading table. During a run the program will reference this line and multiply the factors by the basic absolute amount of displacement to give the displacement of the point for all other graded sizes of patterns.

If for any line of the grading table only one condition - 1st CONDITION - to be satisfied by the point is specified this completely defines the new position of the point.

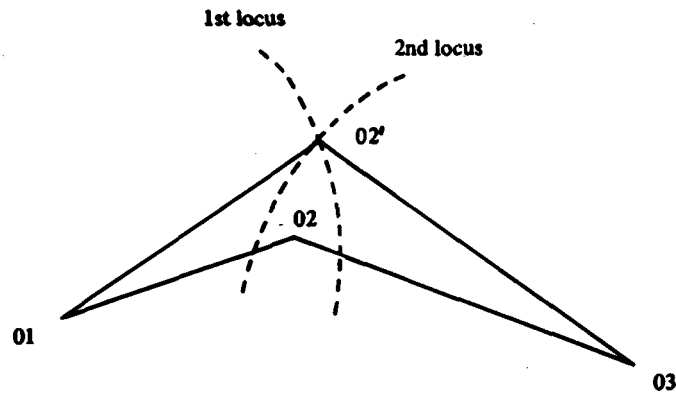
For example:



Point 02 is moved so that the radius 01-02 is increased by a certain amount. 02', the new position of 02, will be on the original line 01-02.

If two conditions are specified each defines a locus of points i.e. a geometrical line, straight or curved, all of whose points satisfy a particular geometrical condition; the condition in this case being the one declared in the grading table. The new position of the point being graded is given by the intersection of the two loci and as such satisfies the requirements of both the conditions of the table.

For example:



Point O2 is to be graded so that it satisfies two conditions:

- 1 That the radius O1-O2 is to be increased by a certain amount defining a locus of points whose distance from point O1 is the new length, i.e. a circle with centre point O1 and radius equal to the new length;
- 2 That the radius O3-O2 is increased to a certain length determining a second locus, also a circle.

The new position of point O2, point O2', is at the intersection of the two circles. Thus O2' satisfies both conditions stipulated in the grading table. This example could be used, for instance, to grade a point in such a way as to ensure that two seams which meet at the point are of known length.

When two loci intersect at more than one point as in the above example, the program selects the one that is nearest to the position of the point just prior to grading. In general this should have the effect of ensuring geometrical similarity between master pattern and graded patterns. For instance in the above example the graded position of point O2 lies to the same side of the line joining points O1 and O3. This would not be the case if the second point of insertion of the two circles were chosen as the graded position.

## THE FIELDS OF THE GRADING TABLE

The following is a detailed description of the various fields of the grading table.

### Identifier G

The first character of each Grading line is the letter G which is used purely for identification purposes.

### Line No.

This field is printed on the grading sheet and is used as a line reference. If more than one grading sheet is required in order to construct a particular table the line numbers of the continuation sheets must be re-numbered so that they follow on in strict order from the preceding sheet. Filling in of grading sheets should begin at line 01 and continue from line to line with none left blank.

### Point No.

This column will contain the number of the point to be graded which it was assigned during digitizing.

### 1st and 2nd conditions

#### *Type*

As stated above the 1st and 2nd CONDITIONS are geometric conditions that must be satisfied by the graded position of the point in question. Each condition is expressed in terms of one of several functions each of which has an associated code letter. To apply one of the standard functions to a point the appropriate code is entered in the column headed *Type*. The use of the other fields of the 1st and 2nd CONDITIONS vary according to the type of functions in use and are described in the following list of standard function codes. If a field is not mentioned in the description of a function then it serves no purpose in modifying that function and should be left blank.

#### *Base Point*

Whenever a code uses one but not two base points the point number must be entered in the *Base Point 1* column.

#### *Amount*

When the *Amount* column is used the amount must be left justified, i.e. must start in column 12 or 31. It may be either an integer or a decimal number with a floating point, i.e. the number of digits before or after the decimal point may be chosen at will. The amount may or may not be preceded by + or a - sign in column 11 or 30; unsigned numbers are assumed to be positive.

For example:

<i>Columns</i>	...	30	31	32	33	34	35...
		+	2	.	5		
		-	.	7	5		
			0	.	1	2	5

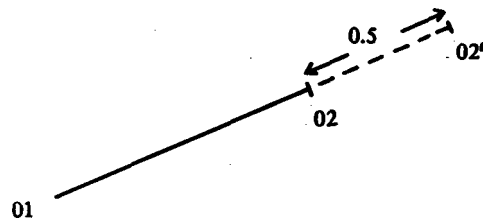
**P CODE**

A displacement Parallel to and in the direction of the *base* line by a certain *amount*. The direction of the base line is taken as being from base point 1 to base point 2. The co-ordinates of the points used in defining the base line are those of the original, ungraded master pattern. If no base line is specified it is taken to be the X axis of the co-ordinate system used in the digitizing of the master pattern. In order to obtain a complete range of graded sizes the basic amount of the grade is multiplied by the appropriate factors of the scaling line specified in the column headed: *Scale Ref.*

*Examples (see Examples Sheet, Appendix 5)*

1 Line 01 of examples sheet:

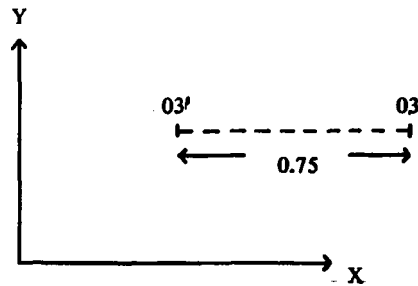
Point 02 is displaced 0.5 units in the direction of the base line 01-02 using line 01 of the scaling table.



It is assumed in this diagram that points 01 and 02 have not been graded yet.

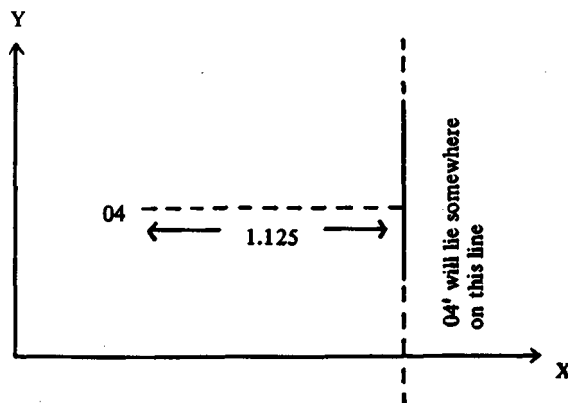
2 Line 02 of examples sheet:

Point 03 is displaced - 0.75 units in the direction of the X axis using line 01 of the scaling table.



3 Line 03 of examples sheet:

Since a 2nd CONDITION is specified in this line each of the conditions defines a locus of points and the new position, 04', of point 04 is the intersection of the two loci. For the 1st CONDITION the locus is the straight line all of whose points have an X co-ordinate 1.125 units larger than that of the original position of point 04.

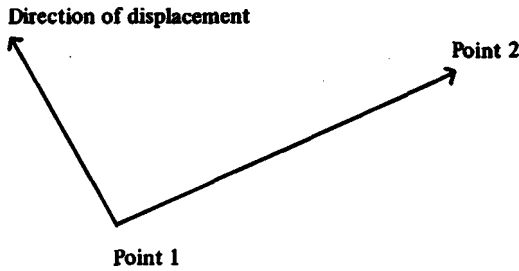


The absolute position of 04' is given in example (2) of the description of the D code.

**N CODE**

A displacement Normal or perpendicular to the *base* line by a certain *amount*. The amount may be either positive or negative, but if unsigned is assumed to be positive. It is multiplied by the factors in the line of the scaling table given in the *Scale Ref.* column in order to give a complete range of graded points. The direction of the displacement is to the left of the direction going from base point 1 to base point 2.

For example

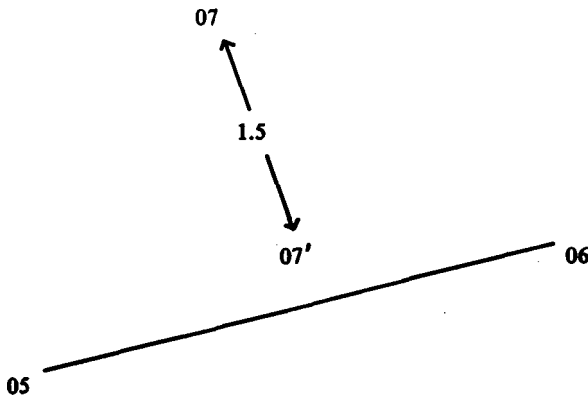


If no base line is specified it is taken to be the X axis of the basic co-ordinate system defining the master pattern; in other words grading will take place parallel to the Y axis of the system. The co-ordinates of the points used in defining the base line are those of the original, ungraded master pattern.

**Examples**

1 Line 04 of examples sheet:

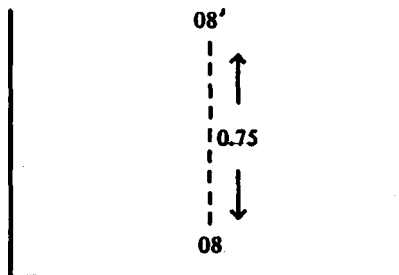
Point 07 is displaced - 1.5 units in a direction normal to the base line 05-06 using line 01 of the scaling table.



Note: The same effect can be obtained by reversing the points of the base line and reversing the sign of the amount of displacement.

2 Line 05 of examples sheet:

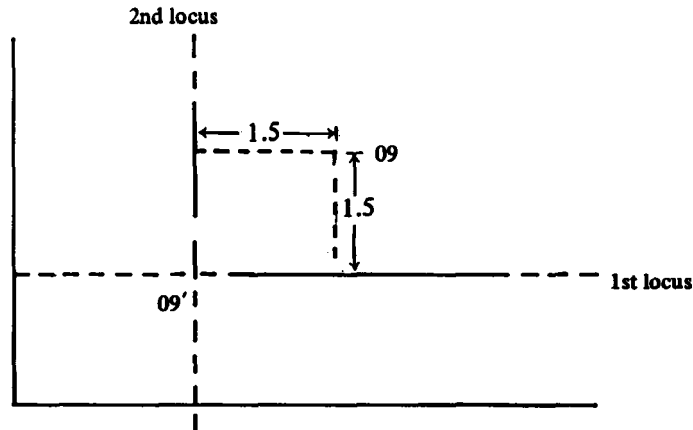
Point 08 is displaced 0.75 units in a direction normal to the X axis of the basic co-ordinate system i.e. parallel to the Y axis, using line 02 of the scaling table.



### 3 Line 06 of examples sheet:

Since a 2nd CONDITION is specified in this line each of the conditions defines a locus of points and the new position, 09', of point 09 is the intersection of the two loci. For the 1st CONDITION the locus is the straight line all of whose points have a Y co-ordinate 1.5 units less than that of the original position of point 09.

The 2nd CONDITION locus is the straight line all of whose points have an X co-ordinate 1.5 units less than that of the original position of point 09.



09' satisfies both grading conditions, i.e. it has both X and Y co-ordinate values 1.5 units less than its original.

#### R CODE

A displacement that is dependent on the displacements to date of the two *base points* specified, in that the Ratios of the distances between the three points, i.e. the point currently being graded and the two base points, are made to be the same as those for the original master pattern. The sense of all angles will be preserved. Any displacements of the base points that take place after (later in the sequence of grading as governed by the column headed *Next Line in Sequence*) the encounter of the R code will have no effect on this code. Since the use of this code defines the new position of the point to be graded absolutely it will never be used in conjunction with a 2nd CONDITION to be satisfied by the point.

Three special cases of this code are of particular interest:

- 1 When the point to be graded lies on the straight line joining the two base points;
- 2 When the point lies on a curve which, in the shape of the original pattern, connects two base points;
- 3 When one of the two base points is not graded.

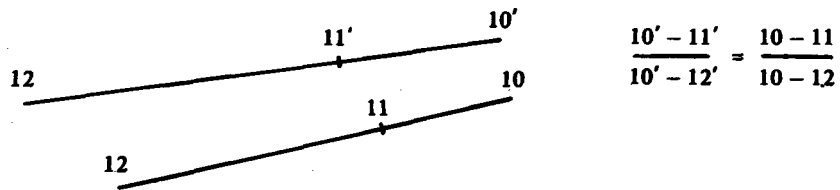
These three cases are demonstrated in the examples below.

#### Examples

##### 1 Line 07 of examples sheets:

Point 11 will be displaced in such a way that the ratio  $\frac{10 - 11}{10 - 12}$  is kept constant. In other words if point 11

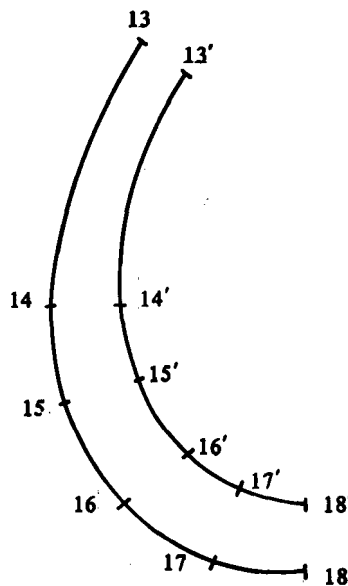
represents, for example, the position of a dart that is 1/3 of the way along the seam 10 — 12 on the master drawing then this dart position will appear 1/3 of the way along the seam for all the sizes of pattern graded.



Similarly the R code could be used to ensure the correct positioning of buttons, pockets etc.

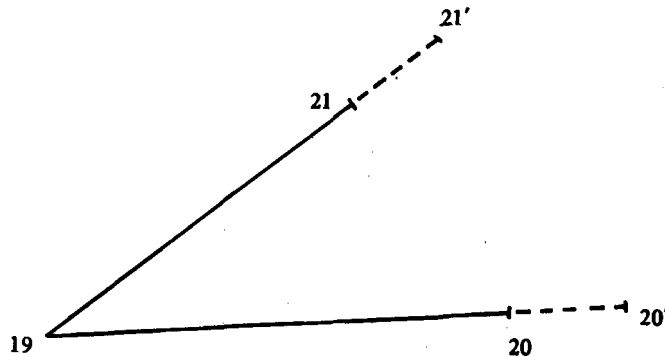
2 Line 08 of examples sheet:

Point 14 will be displaced in such a way that the triangle bounded by points 13', 14' and 18' is exactly similar to that bounded by the points 13, 14 and 18 of the original master pattern. If the R code is used to grade all the intermediate defining points of the curve (14, 15, 16 and 17 in the diagram) then each graded curve will be exactly similar to the original, although it may possibly differ in size depending on the method used for grading the end points 13 and 18.



3 Line 09 of examples sheet:

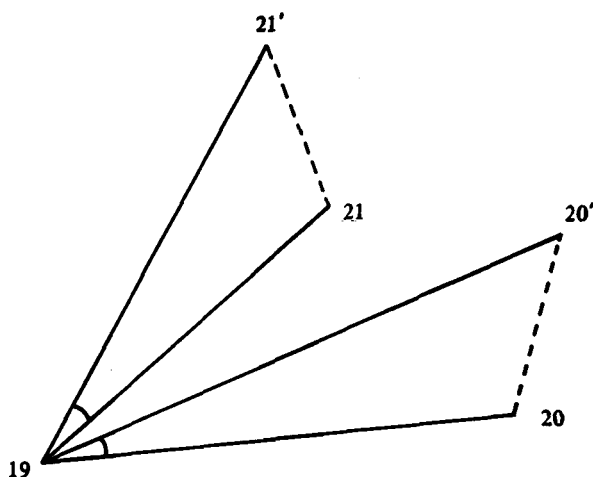
In this example it is assumed that the point to be graded, point 21, does not line on the line 19 — 20 and that point 19 has not been graded. Since triangles 19, 20, 21 and 19', 20', 21' are similar, the percentage increase in length of the radius 19 — 21 will be the same as that of the radius 19 — 20.



Thus having increased the length of one seam, for example, the user could ensure that a second seam would be increased in the same ratio.

In the above diagram 20' has been drawn to lie on the line 19 — 20 of the original pattern. A useful

application of the R code occurs when this is not the case.



Independent of how point 20 is graded point 21 is graded as though point 20 had been rotated through a certain angle about the base point 19, and the radius 19 — 20 had then been magnified by a certain factor. Applying the R code to point 21 will cause it to be rotated through an identical angle and magnified by an identical factor. In fact a whole section of the pattern could be rotated and magnified in this manner.

To apply the rotation alone (i.e. without magnification) the R code procedure just described should be used and, as a 2nd CONDITION on the same grading line, a D type grade (see page 26) should be applied to point 21 with point 19 as the base point. The amount of change in length should be specified as 0.0 units.

#### D CODE

A change in the Distance between two points, the *base* point and the point to be graded, by a certain specified amount. The change is measured in relation to the distance between the points drawn on the original ungraded master drawing, not to the distance between the points immediately before the application of the D type grade. The change in distance arises solely by the displacement of the grade point, the position of the base point remaining unaltered.

Normally one would expect the base point to be fully graded at the time of application of a D code since any subsequent grading would most likely destroy the effect of the code.

The amount may be either positive or negative; if unsigned it is assumed to be positive.

An entry must be made in the *Scale Ref.* column in order for the amount of the basic grade to be multiplied by the appropriate factors to give the complete range of graded patterns. This information is taken from the appropriate line of the scaling table.

If only one condition - 1st CONDITION - is contained in a grading line the position of a point operated on by a type D grade will be on the line joining the base point to the position of the graded point just prior to the grade. In other words the line is simply retracted or extended. If a 2nd CONDITION is stipulated the D formula will merely restrict the graded point to lie on the circle whose radius about the base point is equal to the new length, the absolute position of the point being given by the intersection of this circle with the locus defined under the second condition.

#### Examples

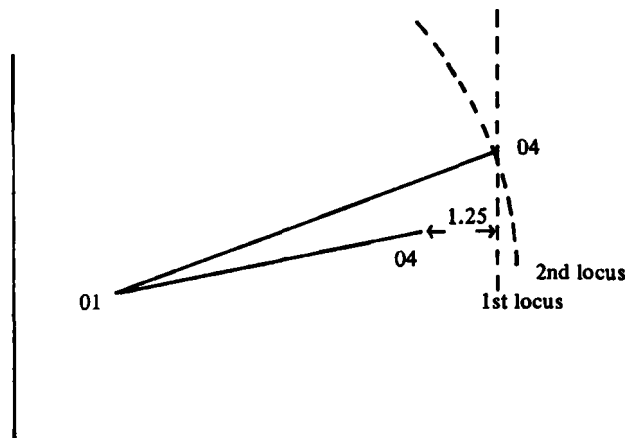
##### 1 Line 10 of examples sheet:

Point 23 is displaced along the line 22 — 23 so that the final length of the line is 0.25 units shorter than the original. Line 03 of the scaling table enables displacements for the complete range of graded patterns to be calculated.

##### 2 Line 03 of examples sheet - 2nd CONDITION

Since two conditions are specified in this line, each defining a locus of points the new position, 04', of point 04 is at the intersection of the two loci. The locus defined by the 1st CONDITION is given in example 3 of the P code. The 2nd CONDITION locus is the circle with centre point 01 and radius 1.75 units greater than the

original length of line 01 — 04 on the master pattern.



04' satisfies both conditions specified in line 03 of the grading table, i.e. it has an X co-ordinate 1.25 units larger than that of point 04 and its distance from point 01 is 1.75 units greater than the original length of line 01-04.

Later issues of the pattern grading package may include the facility whereby the D code may be used for adjusting the distance between two points so as to make it equal to a *Matching Length*. This matching length may be the distance between two points of either the same pattern piece as is currently being graded or of another piece of the same overall pattern. Hence it will be possible for example, to ensure that straight edged seams of different pieces will exactly match when sewn together.

#### C CODE

This code will not be available in the first issue of the pattern grading package but it may be available in subsequent issues.

The C code is very similar to the D code, the only difference being that it brings about a change in the length of a Curve rather than a straight-line distance. As with the D code the change in length is either by a specified amount or such that the new length is equal to a second, or matching length. By using the code in the second mode it is possible to ensure that curved seams of different pieces will exactly match when sewn together.

#### A CODE

Rotation of the grade point about the base point through a certain *Angle*. The angle is entered in the *Amount* column and may be positive or negative. Positive indicates an anti-clockwise rotation and negative a clockwise rotation; unsigned angles are assumed to be positive.

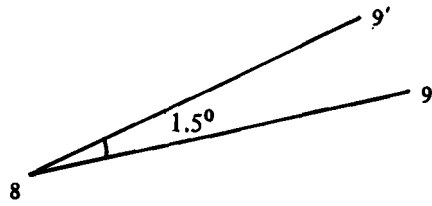
The angle of rotation must be within the range  $-360^{\circ} < \text{angle} < 360^{\circ}$ . The angle of rotation is multiplied by the factors of the scaling table line given in the *Scale Ref.* column in order to give the rotation required for the full set of graded patterns. The co-ordinates of the base point about which the grade point is rotated are those that exist immediately prior to the application of the A code and are therefore not necessarily those of the point as drawn on the original master pattern.

When only one condition - 1st CONDITION - is specified in a line of the grading table the position of a point graded by a type A code will be the same distance from the base point as it was before the A type grade. If a second condition is to be satisfied the A code merely restricts the graded point to lie on the radius through the base point which forms the required angle with the original line from base point to the point to be graded. The absolute position of the graded point is given by the intersection of this radius with the locus defined under the second condition.

#### Examples

1 Line 11 of examples sheet:

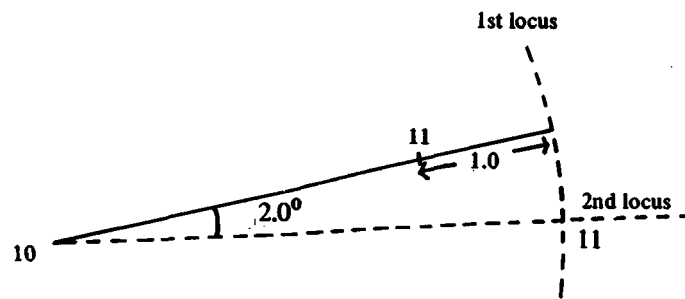
Point 09 is rotated about point 08 through an angle of  $1.5^{\circ}$ . A whole range of grading rotations are obtained by using the scaling factors in line 02 of the scaling table. The length 08 — 09<sup>a</sup> is equal to the length 08 — 09.



$$8 - 9 = 8 - 9$$

2 Line 12 of examples sheet - 2nd CONDITION -

Point 11 is rotated about point 10 through an angle of  $-2.0^\circ$  using line 02 of the scaling table. In addition the 1st CONDITION states that the distance of the graded point from the base point 10 must be 1.0 unit greater than that between the same points on the master pattern. Assuming that points 10 and 11 have not been graded before the execution of grading line 12 the grade may be represented as follows.



### Marking and Description

This field is split into two sub-fields; the first allows for the drawing of fixed markings on a pattern the second enables one to write any string of up to 20 characters on the output pattern. The requisite marking and/or character string are drawn at or in the vicinity of the point specified in the first column, *Point No.*, of each line of the grading table.

### Marking Code

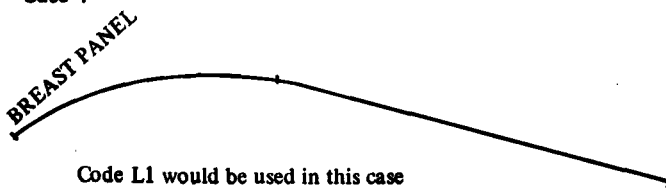
The drawing of fixed markings is effected by entering a *Marking Code* in the grading sheet. The code should be entered at the right hand side of the field, i.e. column 45. Certain codes must be preceded by the letter L or R in column 44 depending on whether the marking is to be made to the Left or the Right of the segment of pattern joining the marked point to the next point in the drawing sequence. In general these codes must not be used if there is no such join.

The marking codes available to the grader are set out below.

### L1 or R1

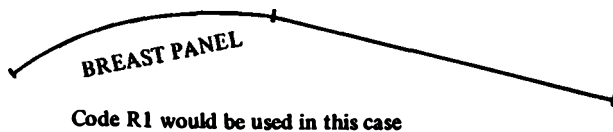
*Print* the description of the pattern piece, as derived from the Master Patterns' Co-ordinates file, to the left or to the right of the line or curve joining the point to be marked to the next point of the pattern. The string of characters comprising the description is printed in a straight line. If the pattern join is a straight line it is printed parallel to this line. If the pattern join is a curve the string is inclined either at an angle equal to the slope of the curve at the point to be marked or parallel to the imaginary straight line joining the point to be marked to the next point of the pattern, depending on whether the string is to be on the convex or the concave side of the curve.

### Example - Case 1



Code L1 would be used in this case.

### Case 2



Code R1 would be used in this case.

### L2 or R2

These codes are similar in meaning to L1 and R1 but the character string output is of the form: SIZE XXX, where XXX is the pattern size.

### L3 or R3

Draw a line 1/8" in length (or its equivalent in cms.) to the left or to the right of the line or curve joining the point to be marked to the next point of the pattern. The line is drawn at right angles to the slope of the pattern at the marked point.

### L4 or R4

As for L3 or R3 but the line will be 1/4" in length.

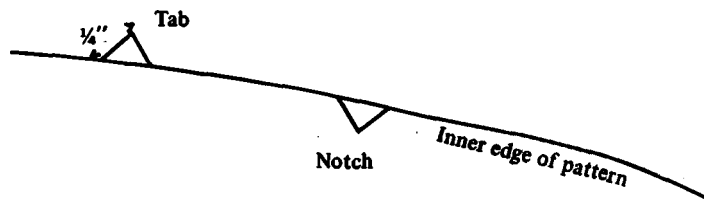
### L5 or R5

As for L3 or R3 but the line will be 1/2" in length.

#### L6 or R6

Draw a triangular notch or tab of side  $\frac{1}{4}$ " to the left or the right of the line or curve joining the point to be marked to the next point of the pattern.

#### Example



#### CODE 7

Draw a circle radius  $\frac{1}{8}$ " and centre the point to be marked.

#### CODE 8

Draw a circle radius  $\frac{1}{4}$ " and centre the point to be marked.

For codes 1 and 2 it is permissible to precede the code with the letter X or Y instead of L or R to indicate the fact that the character string is to be printed parallel to the X axis or Y axis respectively. This is to cater for cases when the pattern description and/or size are to be written, for example, in the centre of the pattern rather than along one of its edges.

#### Descriptive Text

The column headed *Descriptive Text* may contain any number of characters, up to a maximum of twenty, selected at will from the 1900 Series 64 character card code set. These will be written on the pattern according to the method specified for the type 1 marking code. Hence if it is required to print descriptive text on the pattern an entry - L, R, X or Y - must always be made in column 44 of the grading table even if there is to be no marking at the point or if the marking is a circle. Only one marking and/or string of text may be assigned to any one point. Furthermore details of marking and text must both be entered in the same line of the grading table.

#### Type of Join

The use of this column has already been briefly described. Its purpose is to describe the method by which each defining point of a pattern is connected to the next. After each grading line has been executed the join column is inspected and if it contains an entry the current co-ordinates of the relevant point are noted. A similar process is carried out when the next line with a join entry is encountered. The two points are then joined according to the *Type of Join* code of the former. The interpretation of the join codes is as follows:

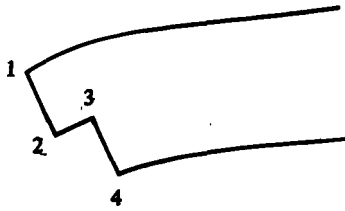
#### BLANK (no code entered in the column)

This indicates that no connection is to be drawn (at least not at present and possibly not at all) between the current point and the next point. Also, since the column is blank, no connection will be drawn between the last point and the current point. A blank *Type of Join* column would be used, for example, either if the current point was simply a construction point to assist in the grading of other points, or if the point had not yet been fully graded and continuation grading lines for the point were to follow, or if the point has been fully graded but it is not yet convenient to draw it. The latter case could arise for example if the grading of a point that appeared early on in the sequence of drawing were dependent in one way or another on the graded position of a point coming later in the sequence. In other words the latter point must be graded first but cannot be joined until some later time.

#### CODE NJ - NO JOIN

Again this indicates that no connection is to be drawn between the current point and the next point. However, since the *Type of Join* column is not blank the point will be connected to the last point graded that had an entry in the *Type of Join* column unless the join code for this last point was also NJ or if the current point is the first point of the pattern. This code would be used, for example, for jumping from the periphery of a pattern shape to a dart within the pattern. It can also be used if for any reason it is necessary to interrupt the natural sequence of connection of points.

For example:



The natural sequence of connecting points 01, 02, 03 and 04 is to connect point 01 to 02, 02 to 03 and 03 to 04. However, the method of grading these points may necessitate that they be joined in the order 01 to 02, 04 to 03 and then 03 to 02.

The user would not then require to join point 02 to point 04 and code NJ would be entered in the *Type of Join* column of point 02. However, departures from the natural sequence of joining should only be used when absolutely necessary since the drawing efficiency of the digital incremental plotter is reduced.

#### CODE SL - STRAIGHT LINE

Connect the current point to the next point that has an entry in its *Type of Join* column with a straight line.

#### CODE SC - START OF CURVE

This code indicates that the current point is the starting point of a smooth curve to be drawn on the plotter. At least four points - starting point, two intermediate points, and an end point - are needed to define a curve. Acute curves will probably require more than four points.

#### CODE CC - CONTINUATION OF CURVE

This code is used to indicate those points that are the intermediate defining points of a smooth curve to be drawn on the digital plotter. There must be at least two such points for any one curve.

Note: There is no code to indicate the end point of a curve; the end point is the first one encountered whose join code is neither CC nor blank i.e. it is, for example, the beginning of another curve or of a straight line.

#### Next Line in Sequence

The lines of a grading table are obeyed in order commencing with line 01 and continuing to the line number quoted in the *Next Line In Sequence* column. Completion of a grade is denoted by two asterisks in the sequence column. Normally it would be expected that the sequence is of strict ascending order but departure from this general rule may prove necessary when making amendments and insertions to an existing table. This aspect has already been described. - see pages 14 and 15.

#### Table Number and Piece Number

These columns serve merely as a means of identification checking when grading data is being read by the third program of the pattern grading system. They may be left blank if required and serve a purpose only when punched cards are being used as the input data medium.



# Chapter 6 The scaling table

The scaling table is used to modify certain grading formulae by supplying scaling factors to be multiplied by the basic amount of grade. Hence the grading amounts for the complete range of pattern sizes may be calculated.

The first character of each line of the scaling table is an identifier, S, which is followed immediately by a two figure line number.

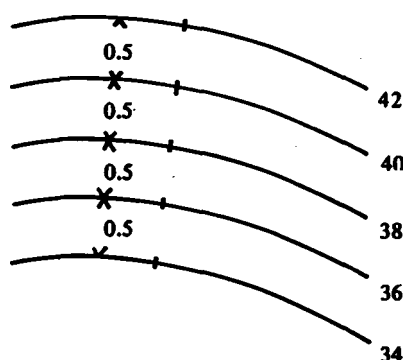
The first line - line 00 - of the table is used for listing the complete range of sizes, including the master pattern size, in which the pattern is to be graded. Each size is identified by a unique three character size number. Any combination of alphanumeric characters may be used as a size identifier. However, the larger the size the larger the size number must be. Size numbers must be entered in ascending order from left to right across the scaling table with the exception of the master size which is always entered in the first column. Up to 23 pattern sizes may be quoted in the scaling table. Line 01 and others following contain the actual scaling factors which should be right-justified, integer numbers in the range -99 to 100; unsigned numbers are assumed positive. In every line the scaling factor for the master size will be 0.

**Example**

S	0	0	0	3	8	0	3	4	0	3	6	0	4	0	0	4	2	
S	0	1			0		-	2		-	1			1			2	
S	0	2																

Size 38 is the master pattern size. The grader wishes to grade this master size into sizes 34, 36, 40, 42. Suppose an entry is made in the grading table which specifies an *Amount* of grade 0.5 inches and references scaling line 01 in the *Scale Ref.* column, Line 01 of the scaling table will inform the grading program that the point to be graded is to be displaced by the amounts (- 2 x 0.5), (- 1 x 0.5), (1 x 0.5) and (2 x 0.5) inches from its original position in order to give the position of the point as it is to be drawn on sizes 34, 36, 40 and 42 of the pattern respectively i.e. displacements of - 1.0, - 0.5, + 0.5 and + 1.0 units. In other words the pattern will be scaled down or up by 0.5 unit for each unit change in size.

**Example**



The table number and piece number of a scaling table are the same as those of its associated grading table. As with the grading table these numbers may be punched in columns 74 to 80 of the data cards derived from the table so as to serve as means of identification checking.



# Chapter 7 Program 3

This program uses the files created by programs 1 and 2, together with steering information and parameters, to produce the graded patterns which are output on the graph plotter.

## INPUT TO PROGRAM 3

The input to the program consists of a Master Patterns' Co-ordinate File, a Grading and Scaling file, steering information and parameters. The latter two may be punched on either paper tape or punched cards, although for simplicity this description will be in terms of cards only. The steering card must be input first followed by a file generation number parameter card, and finally the parameters specifying which sizes of which pieces of which patterns are to be selected for grading and drawing. The program must also have access to a scratch tape for working purposes.

### Steering card

*Columns*      1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16...

*Punching*    G P / m , x L P , y M T , z

where m = mark number of users' Digital Incremental Plotter  $1 \leq m \leq 6$

Note: Plotting of patterns digitized in centimetres on an inch plotter, or *vice versa*, is permissible.

x = 0 if on-line plotting is required;

  = 1 if pseudo off-line plotting is required.

y = 0, if no line printer output is required;

  = 1 if a listing of input details only is required;

  = 2 if a listing of the co-ordinates of all sizes of all patterns drawn on the plotter is required;

  = 3 if a combination of both the foregoing listings is required.

z = 0 if user's tape system has no "skip back past tape mark" facility.

  = 1 if user's tape system has the "skip back past tape mark" facility.

### File generation number parameter card

*Columns*      1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24...

*Punching*    M F G N x x x x G F G N y y y y P F G N z z z z

where x x x x = fgn of input Master Pattern Co-ordinate file;

  y y y y = fgn of input Grading and Scaling file;

  z z z z = fgn of off-line plotting tape.

The characters M F G N, G F G N and P F G N must always be present. If either of the input file generation numbers is left blank or is zero no check will be made on the relevant file. If the steering card (see previous section) stipulates that on-line plotting is required no file generation number should be entered in the third field of the parameter card. If off-line plotting is required the off-lining magnetic tape created by the programs will be supplied with the file generation number stipulated. If the field is left blank the file will be allocated a fgn of 1.

### Pattern card

*Columns* 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19...

*Punching* P A T T E R N x x x x x x x x x x

where x x x x x x x x x x = pattern number.

For every pattern that is to be drawn there must appear among the parameter cards one, and only one, pattern card giving the pattern number of the particular pattern.

Pattern cards must be placed with the input data cards in ascending order of pattern number.

### Scale card

*Columns* 1 2 3 4 5 6 7 8 9 10 11 12

*Punching* S C A L E x x . x x

where x x . x x is a fixed point decimal number.

A scale card can only follow immediately after a Pattern Card and indicates the scale to which all pieces of the pattern are to be drawn.

For example SCALE 0.50 would cause all the pattern pieces to be drawn half the original size.

If no scale card is present after a pattern card then the pattern pieces will be drawn to the scale of the last scale card read. If no previous scale card has been read the scale is taken to be 1.00 i.e. true size.

### Pieces card

Following every pattern card (or a scale card if one is present) there must be one or more pieces card. This card states which particular pieces of the pattern are to be graded and drawn on the graph plotter. The format of a pieces card is:

*Columns* 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20...

*Punching* P I E C E S , j x x x x x x etc.

where j is a card sequence number, and

x x are the piece numbers of the pattern pieces to be drawn.

Card sequence numbers must be in the range  $1 \leq j \leq 9$ , starting at 1 for the first card and increasing in steps of 1 from one card to the next. The pattern numbers quoted on the cards must be in strict ascending sequence, both within each card and from one card to the next. Up to 19 pattern pieces may be quoted on any one card. No number may be repeated.

No blanks must be left within the list of pieces or numbers on any card, except after the last one punched. If grading and drawing all the pieces of a pattern is required this may be effected by punching a pieces card of the form:

*Columns* 1 2 3 4 5 6 7 8 9 10 11 12...

*Punching* P I E C E S , 1 A L L

### Sizes cards

Following each batch of pieces cards there is one or more size card. These cards list all the sizes that the preceding lists of pieces are to be drawn in. At least one size card must follow a batch of pieces cards. Following the size cards there will either be a new pattern card or, in the case of the last pattern having been processed an end card.

Example *Columns* 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18...

*Punching* S I Z E S , j x x x x x x etc.

where j is a card sequence number.

x x x are the sizes of pattern to be drawn.

The size numbers must be in strict ascending order by size, both within each card and from one card to the next. Up to 19 different sizes may be punched on any one card. No blanks must be left in the list of sizes on any one card except after the last one punched. If grading and drawing the complete range of sizes of the requisite pattern

pieces is required this may be effected by punching a sizes card of the form:

*Columns*     1 2 3 4 5 6 7 8 9 10 11 12 13  
*Punching*    S I Z E S , 1     A L L

When patterns are being graded for the first time one may wish that all the sizes of each pattern piece be drawn nested together rather than separately. This will assist in checking the instructions of the grading table and may be attained by punching the word NEST in columns 9 to 12 of the first sizes card.

*Examples*

*Columns*     1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 ...  
1            S I Z E S , 1 , N E S T            3 6            3 8 etc.  
2            S I Z E S , 1 , N E S T     A L L

The second example would cause all sizes of each pattern piece quoted to be graded and nested together.

When patterns are drawn in a nested fashion any markings or descriptions to be included on the pattern drawings are, for the purpose of clarity, made only on the master size of pattern. Furthermore each of the defining points of the master pattern shape are marked with an asterisk to assist in the checking of the initial digitizing of the pattern. If one wishes to draw just the master pattern and yet still have the defining points marked with an asterisk it is perfectly permissible to punch a sizes card stipulating nesting of the patterns but which only quotes one pattern size, i.e. the master pattern size.

*Example*

*Columns*     1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 ...  
*Punching*    S I Z E S , 1 , N E S T            4 0  
where 40 is the master pattern size.

**End Card**

As with the input to Programs 1 and 2 the last card input to Program 3 must be of the form:

*Columns*     1 2 3 4 5 6 7 ...  
*Punching*    \* \* \* \*

**Master Patterns' Co-ordinates Magnetic Tape File**

Details of this file are given on page 12.

**Grading and Scaling Magnetic Tape File**

Details of this file are given on page 17.

### OUTPUT FROM PROGRAM 3

The output from Program 3 consists of the drawings of selected sizes of the pieces of patterns input, and an optional line printer listing. The drawings are either made directly on a Digital Incremental Plotter or are stored on magnetic tape for plotting at a later date.

When off-line plotting is required the format of the off-lining tape conforms to that required by the pseudo off-lining program #XJGA. The tape is supplied with the file name GRADED PATNS a retention period of 100 days and a file generation number as supplied by the fgn input parameter.

#### Line Printer Listing

The form of the line printer listing depends on the form of the steering card or paper tape block supplied to the program. If the steering information indicates that a line printer listing is not required no printer is allocated to the program unless an error is detected in the input data or during the searching of the Master Patterns' Co-ordinates file or the Grading and Scaling file. In this case a printer is automatically allocated to the program and details of the error and any subsequent errors are printed. If a listing is required it may take one of three forms:

- A listing of all data input to the program with all cards unacceptable to the program flagged with an asterisk;
- the co-ordinates of all sizes of the pieces of all patterns selected for grading and drawing by the program;
- a combination of both these listings.

If only a listing of the input data is required each unit of data, i.e. one card or one block of paper tape, is printed on a separate line and printing proceeds until all the data has been listed. However, if the graded co-ordinates are also required the input data for each pattern to be drawn is printed as a separate entity and the printer then throws to the head of a new page and prints the co-ordinates of all the requisite graded sizes of the selected pattern pieces as calculated by the computer. These co-ordinates are expressed relative to the original co-ordinate axes chosen for digitizing the master pattern and are not necessarily the same as those output to the graph plotter. When all the co-ordinates have been printed the input data for the next pattern is read and processed. The procedure is repeated until all input data has been read, listed and processed. If only graded co-ordinates are to be listed the printout takes the form just described except that the pages listing input data are omitted.

Each page of printout is headed with the title AUTOMATIC PATTERN GRADING, #X2G6 LISTING followed by the date of the run and the page number.

#### Example

AUTOMATIC PATTERN GRADING, #X2G6 LISTING - 08/06/68 PAGE 37

# Chapter 8 Operating instructions and exception conditions

The information in this chapter is intended for the user's computer operating staff.

## #X2G4 OPERATING INSTRUCTIONS

### *Narrative*

- 1 Load or find #X2G4:
- 2 Load a scratch tape with a write permit ring. This tape will form the carried forward Master Patterns' Co-ordinates file.
- 3 If the program is being run in the update mode load the brought forward Master Patterns' Co-ordinates tape without a write permit ring.
- 4 Load input data in appropriate reader.
- 5 Set sense switch 1 if input data is to be read from paper tape.
- 6 If program is to be run in the create mode:  
If program is to be run in the update mode:
- 7  
Run successfully completed

### *Console Message*

LØ #X2G4 or FI #X2G4

ØN 1 or ØN #X2G4 1

GØ #X2G4 20

GØ #X2G4 21

HALTED: END OF #X2G4

## #X2G4 EXCEPTION CONDITIONS

### *Narrative*

- 1  
Where *Contents* refers to the contents of the steering line. Reload the input data with correct steering line at its head, and input:
- 2  
Where *Contents* refers to the contents of the fgn parameter. Amend the input data and position the amended data so that the next card or block of paper tape to be read is the fgn parameter, and input:
- 3  
Allocate the appropriate card reader or tape reader and input:
- 4  
Allocate a line printer to the program and input:

### *Console Message*

DISPLAY: INVALID STEERING LINE  
HALTED: *Contents*

GO #X2G4

DISPLAY: INVALID F.G.N. PARAMETER  
HALTED: *Contents*

GO #X2G4

HALTED: CR or HALTED: TR

GO #X2G4

HALTED: LP

GO #X2G4

*Narrative*

5 If a block of paper tape is read that contains a number of characters exceeding 80, excluding the newline character, the program will output this message:

When a misread is suspected reposition the block in the reader and input:

Otherwise  
will cause the program to ignore the offending block and read the next one.

6 Indicates that paper is low in the printer. Renew paper and input:

*Console Message*

HALTED: P/T LONG BLOCK

GO #X2G4 22  
GO #X2G4

HALTED: PL

GO #X2G4

### #X2G5 OPERATING INSTRUCTIONS

#### Narrative

- 1 Load or find #X2G5:
- 2 Load a scratch tape with a write permit ring. This will form the carried forward Grading and Scaling file.
- 3 If program is being run in the update mode load the brought forward Grading and Scaling file without a write permit ring.
- 4 Load input in appropriate reader
- 5 Set sense switch 1 if input data is to be read from paper tape
- 6 If program is to be run in the create mode:  
If program is to be run in the update mode:
- 7 Run successfully completed

#### Console Message

LØ #X2G5 or FI #X2G5

ØN 1 or ØN #X2G5 1

GØ #X2G5 20

GØ #X2G5 21

HALTED: END OF #X2G5

### #X2G5 EXCEPTION CONDITIONS

#### Narrative

- 1 Where *Contents* refers to the contents of the steering line. Reload the input data with correct steering line at its head, and input:
- 2 Where *Contents* refers to the contents of the fgn parameter. Amend the input data and position the amended data so that the next card or block of paper tape to be read is the fgn parameter, and input:
- 3 Allocate the appropriate card reader or tape reader and input:
- 4 Allocate a line printer to the program and input:
- 5 If a block of paper tape is read that contains a number of characters exceeding 80, excluding the newline character, the program will output this message:  
  
When a misread is suspected reposition the block in the reader and input:  
Otherwise  
will cause the program to ignore the offending block and read the next one.

#### Console Message

DISPLAY: INVALID STEERING LINE  
HALTED: *Contents*

GO #X2G5

DISPLAY: INVALID F.G.N. PARAMETER  
HALTED: *Contents*

GO #X2G5

HALTED: CR or HALTED: TR

GO #X2G5

HALTED: LP

GO #X2G5

HALTED: P/T LONG BLOCK

GO #X2G5 22  
GO #X2G5

*Narrative*

- 6 Indicates that paper is low in the printer. Renew paper and input:

*Console Message*

HALTED: PL  
GO #X2G5

**#X2G6 OPERATING INSTRUCTIONS**

*Narrative*

- 1 Load or find #X2G6:
- 2 Load a scratch tape with a write permit ring for use by the program as a work tape.
- 3 If off line plotting is required load a second scratch tape with a write permit ring.
- 4 Load appropriate Master Patterns' Co-ordinates file without a write permit ring.
- 5 Load appropriate Grading and Scaling file without a write permit ring.
- 6 Load input into the appropriate reader
- 7 Set sense switch 1 if input data is on paper tape:
- 8 Activate program:
- 9 Run successfully completed

*Console Message*

LØ #X2G6 or FI #X2G6

ØN 1 or ØN #X2G6 1

GØ #X2G6 20

HALTED END OF #X2G6

**#X2G6 EXCEPTION CONDITIONS**

*Narrative*

- 1 Where *Contents* refers to the contents of the steering line. Reload the input data with correct steering line at its head, and input:
- 2 Where *Contents* refers to the contents of the fgn parameter. Amend the input data and position the amended data so that the next card or block of paper tape to be read is the fgn parameter, and input:
- 3 Allocate the appropriate card reader or tape reader and input:
- 4 If a block of paper tape is read that contains a number of characters exceeding 80, excluding the newline character, the program will output this message:

*Console Message*

DISPLAY: INVALID STEERING LINE  
HALTED: *Contents*

GO #X2G6

DISPLAY: INVALID F.G.N. PARAMETER  
HALTED: *Contents*

GO #X2G6

HALTED: CR or HALTED: TR

GO #X2G6

HALTED: P/T LONG BLOCK

*Narrative*

When a misread is suspected reposition the block in the reader and input:  
Otherwise will cause the program to ignore the offending block and read the next one.

5

Indicates that paper is low in the printer. Renew paper and input:

***THE GRAPH PLOTTER - paper-low test***

The graph plotter has no automatic test for the paper low condition. The operator must visually inspect the paper supply after each plotting operation. When the supply is low he should set sense switch 2 by typing:

Whenever the program has completed the plotting of a pattern piece or set of nested patterns it tests the switch and if it is set the program halts with the message:

The operator may then renew the paper in the plotter and reactivate the program by typing:

The program will unset switch 2 automatically. If it is not necessary to renew the paper the operator may simply type:

The next pattern piece will then be drawn and the program will halt again with the message:

unless the operator has unset sense switch 2 in the meantime.

*Console Message*

GO #X2G6 22  
GO #X2G6

HALTED: PL

GO #X2G6

ON 2 or ON #X2G6 2

HALTED: GP

GO #X2G6 21

GO #X2G6

HALTED: GP







# Appendix 2 Layout of the scaling table

Line number		Automatic Pattern Grading Program		Scaling Table		Table number		Piece number																					
1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110



## Appendix 3 Details of master patterns' co-ordinates magnetic tape file

File name	MASTERCOORDS
Retention period	100 days
File Generation number	Set by parameters
Record size	Variable
Block size	as yet unspecified
Sequence	Point number within piece number within pattern number

### Record Layout

Word	Character 0	Character 1	Character 2	Character 3	Description
0	R E C O R D L E N G T H				Binary Variable
1	GROUP NUMBER	G R O U P N U M B E R			} Alphanumeric characters (group + member numbers = pattern number)
2		M E M B E R N U M B E R			
3		MEMBER	NUMBER	PIECE NUMBER	
4	D E S C R I P T I O N O F				} Alphanumeric characters
5	P I E C E A N D / O R				
6	P A T T E R N				
7	SPARE	SPARE	=L for the last record of a particular pattern		
8	X	CO-ORDINATE OF PATTERN POINT 01			Binary - <u>1</u> 1000's unit*
9	Y	CO-ORDINATE OF PATTERN POINT 01			Binary - <u>1</u> 1000's unit*
10	X	CO-ORDINATE OF PATTERN POINT 02			Binary - <u>1</u> 1000's unit*
11	Y	CO-ORDINATE OF PATTERN POINT 02			Binary - <u>1</u> 1000's unit*
12	X	CO-ORDINATE OF PATTERN POINT 03			Binary - <u>1</u> 1000's unit*

\* Centimetres or inches

**User Sentinels**

Preceding the set of records for any one pattern number on the Master Patterns' Co-ordinates file is a user sentinel whose main purpose is to facilitate the procurement of records back-referenced by other records of the same pattern. The first ten characters of the sixteen words of user's information of each sentinel are set equal to the pattern number of the set of records immediately following the sentinel and are used for normal record searching purposes. The next two characters are space characters. Word 4 contains the character I in character position 3 if the pattern has been digitized using inches; if the unit of measurement is centimetres the character is set to C. All other characters and words of the user's information are as yet unused and their value is immaterial.

# Appendix 4 Details of the grading and scaling magnetic tape file

File name	GRADE $\gamma\gamma$ SCALE
Retention period	100 days
File Generation Number	Set by parameters
Record size	Grading record - 20 words; Scaling record-variable
Block size	As yet unspecified
Sequence	Line number within table type (grading table first, scaling table next) within piece number within table number.

## Record layout - grading record

Word	Character 0	Character 1	Character 2	Character 3	Description
0	R E C O R D L E N G T H				Binary - 20 words
1	T A B L E N U M B E R				Alphanumeric characters
2	TABLE NUMBER	PIECE NUMBER		IDENTIFIER = G	Alphanumeric characters
3	POINT NUMBER		TYPE OF JOIN		Ch. 0 to 1: numeric characters Ch. 2 to 3: coded alpha characters
4	MARKING		NEXT LINE IN SEQUENCE		Ch. 0 to 1: coded alphanumeric characters. Ch. 2 to 3: numeric characters.
5	BASE POINT 1		BASE POINT 2		Numeric characters.
6	TYPE OF MOVEMENT	SPARE	SCALE REFERENCE		Ch. 0: coded alpha characters. Ch. 2 to 3: numeric characters.
7	A M O U N T O F		M O V E M E N T		Binary - $\frac{1}{10,000}$ unit *
8	SPARE	SPARE	PIECE NUMBER OF MATCHING POINT OR DISTANCE		Ch. 2 to 3: Alphanumeric characters.
9	MATCHING POINT 1		MATCHING POINT 2		Numeric characters.
10	BASE POINT 1		BASE POINT 2		Numeric characters.
11	TYPE OF MOVEMENT	SPARE	SCALE REFERENCE		Ch. 0: coded alpha characters. Ch. 2 to 3: numeric characters.
12	A M O U N T O F		M O V E M E N T		Binary - $\frac{1}{10,000}$ unit *
13	SPARE	SPARE	PIECE NUMBER OF MATCHING POINT OR DISTANCE		Ch. 2 to 3: Alphanumeric characters
14	MATCHING POINT 1		MATCHING POINT 2		Numeric characters

1st CONDITION

2nd CONDITION

<i>Word</i>	<i>Character 0</i>	<i>Character 1</i>	<i>Character 2</i>	<i>Character 3</i>	<i>Description</i>											
15	D	E	S	C	R	I	P	T	I	V	E	T	E	X	T	} Alphanumeric characters.
16	D	E	S	C	R	I	P	T	I	V	E	T	E	X	T	
17	D	E	S	C	R	I	P	T	I	V	E	T	E	X	T	
18	D	E	S	C	R	I	P	T	I	V	E	T	E	X	T	
19	D	E	S	C	R	I	P	T	I	V	E	T	E	X	T	

\* Centimetres or inches









