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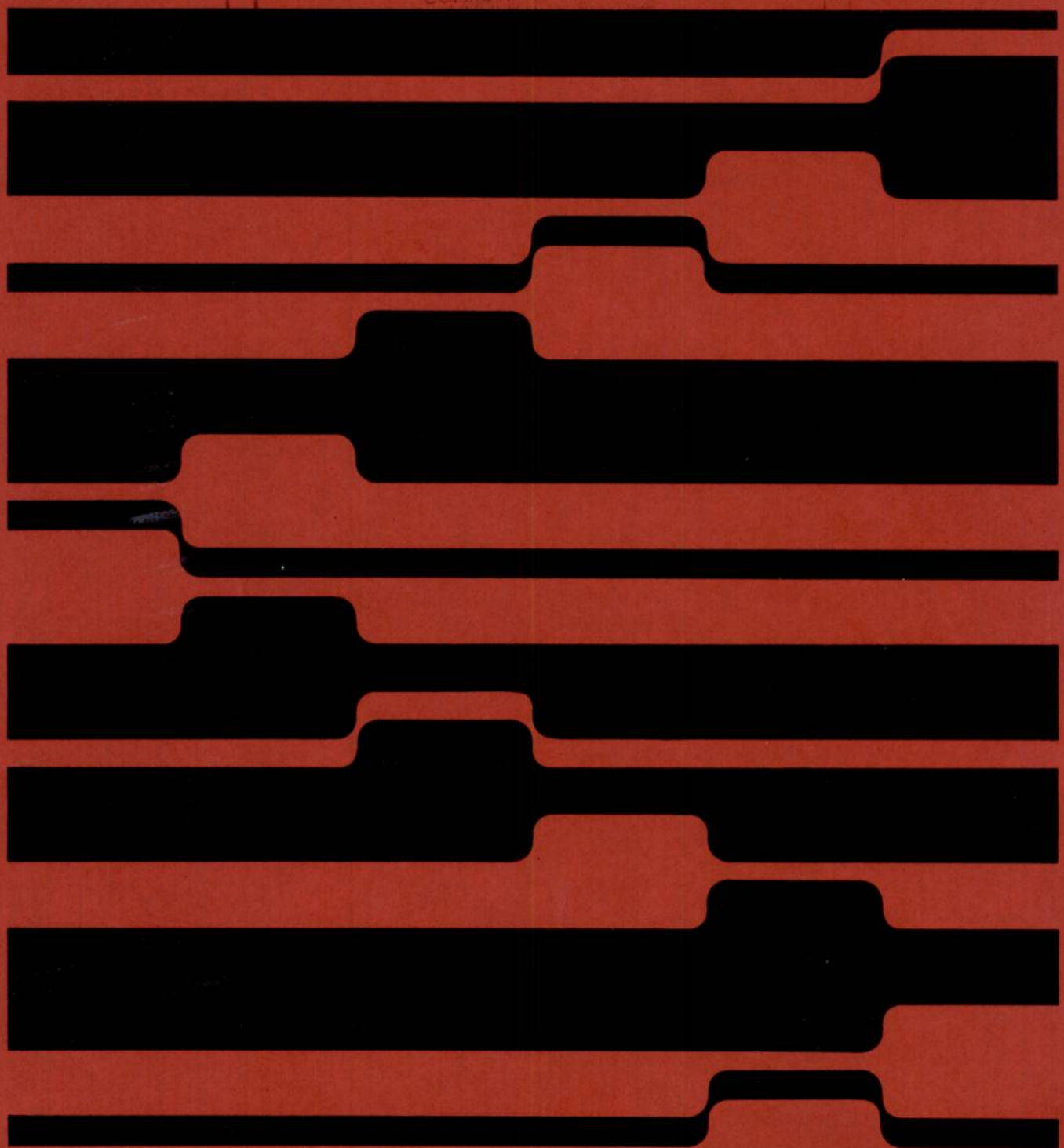
SCAN System 2 for inventory management

1900 Series



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1900 Series

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Preface

The size of company's inventory has always been of importance to Management. To-day, in the face of increasing competition and rapid technological change, the skill with which an inventory is managed can have a far-reaching influence on both financial management and trading success. Traditional methods of control of inventories are no longer adequate: they do not provide the information that progressive management needs; moreover, their response to changes in management policy in the face of changing conditions tend to be slow and uncertain. When managers themselves attempt to fill this deficiency by close personal attention to the detail of stock control, the cost in management man-hours is high and, particularly in an environment of expansion, the strain on the organization may be considerable.

In recognizing this vital need, I.C.T. has developed its SCAN System of Inventory Management for use with the 1900 series computers.

SCAN is a re-order point control system which has its main application where demand cannot be known in advance with any precision and where stock is replenished at intervals. It is, therefore, particularly suited to the control of finished goods warehouse stocks, production raw materials, and some classes of component stocks, consumable stores and maintenance spares.

In order to reduce the control of each item largely to a matter of routine, and yet obtain economical use of the computer, I.C.T. has recognized the need to provide a selection of control system techniques designed to progressively lead the smaller computer user and those users not familiar with advanced mathematical techniques, along the path to optimal control of their inventories, and eventually to the more powerful techniques available in SCAN System 1.

Effective control of inventory, once management has decided the overall stockholding policy, depends upon two major factors: first, that it must be possible to exercise detailed control of inventory precisely and consistently in line with that policy and second, that the system itself must feed back information to management so that the need to amend operating policy is notified with the minimum of delay and that adjustments to policy may be made smoothly.

By developing SCAN System 2, I.C.T. has provided the means by which the user may transfer his inventory progressively to a computer based system, with a choice of continuing control ranging from his own selected re-order points and re-order quantities through to automatic calculation of the re-order points and quantities based on the rate of demand for each selected stock item.

The I.C.T. SCAN System 2 is fully described in this manual, including details of computer programs, file and report formats, and operating instructions, and has been written with two main classes of readers in mind. Busy managers and those requiring only a general appreciation of the system need read only chapters 1 and 2. The remaining chapters are intended for the personnel concerned with implementing the system who require a more detailed understanding. Chapter 3 will particularly interest the systems analysts and programmers

A bibliography is included for those wishing to made a study of the basic methods of inventory management.

Chapter 1 Introduction

The I.C.T. 1900 SCAN System 2 for inventory management is a re-order point control system designed to progressively lead the smaller computer user, and those users not familiar with advanced mathematical techniques, along the path to optimal control of their inventories.

Re-order point control allows stock to fall, with no replenishment action, until the stock reaches the re-order level or point. At this point a replenishment order is placed upon a supplier.

The underlying philosophy of all stock control systems whose requirements are not fixed in advance by a production programme is governed by two basic rules:

1 When should an order be placed on a supplier (or factory).

2 What quantity should the order cover.

By developing this system, I.C.T. has provided the means by which the user may transfer his inventory progressively to a computer based system, with a choice of continuing control ranging from his own selected re-order levels and re-order quantities through to automatic calculation of the re-order levels and re-order quantities based on the rate of demand for each selected stock item (variable re-order point control).

SCAN System 2 comprises a suite of computer programs designed, collectively, to perform three functions, namely:

File Creation and Maintenance

Inventory Analysis

Operational Control of Inventory

FILE CREATION 1.1

The file creation routines are used to produce the magnetic tape files needed, but not created automatically by the system. The major routine is used to first create the two master files required by the system and subsequently to maintain them.

Two ancillary programs are provided for use in special circumstances. The first allows the user to generate a skeleton demand history master file directly from the stock master file and the second permits one or more item records to be listed from either master file.

Another routine writes stock transactions directly to a magnetic tape file for use in the operational control system.

INVENTORY ANALYSIS 1.2

The Analysis routines may be used to classify the inventory on the basis of both frequency of movement and sales value. This provides a valuable aid to management to facilitate the allocation of one or more types of control to the inventory. In addition, they may be used for the regular, say, annual, review of inventory.

OPERATIONAL CONTROL OF INVENTORY 1.3

A suite of programs is provided, designed to process the most commonly met forms of stock transactions against a Stock Master file, update balances, allocate available physical stock to each customer demand, issue reports of stock allocations, replenishment requisitions, over maximum and under minimum stock items, forecast demands, evaluate re-order points, re-order quantities and provide entry points to other business system areas.

MINIMUM MACHINE CONFIGURATION 1.4

All programs have been written to run on a 1900 series computer to the following minimum specification:

- 8K central processor with console typewriter and floating point facilities (hardware or extracode)
- 4 magnetic tape units (20 kch/s or 10 kch/s - cassettes)
- 1 line printer with 120 print positions
- 1 card or paper tape reader

In general, PLAN 3 has been used as the program source language. Some programs have been written in Compact COBOL and, in one case only, the processing segment has been written in 1900 FORTRAN.

Chapter 2 General Description

SYSTEM CHARACTERISTICS 2.1

The routines described in Chapter 3 form the basis of an integrated system for:

1 analyzing demand history in order to classify items on the basis of both frequency of movement and annual usage value and to assist the selection of control techniques for each class,

2 processing stock transactions in order to update stock balances,

3 allocating physical stock to each demand in accordance with a predetermined system of priorities,

4 providing exception reports of allocated and unallocated demands, replenishment order requisitions, over maximum stock level items, under minimum stock level items,

5 monitoring the forecasting error i.e.: the difference between the actual demand and the corresponding forecast, between acceptable limits - for those items selected for demand forecasting,

6 providing entry points to other business system areas such as:

Purchase and Manufacturing Order Control

Sales Invoicing Procedures

Product Sales Analysis

Production Scheduling

Cost Accounting

Continuous Stock Audit Control

The criterion by which the system operates is that a replenishment order for stock is placed whenever available stock falls to or below a re-order point.

This may be on the day the event occurs (random ordering) or the user may choose to generate replenishment orders at the end of a selected time period (cyclical ordering).

This re-order point is the control trigger which determines 'when to order' and, in the case of those items selected for demand forecasting, is computed to account for fluctuations in demand.

The re-order quantity - again, for forecasted items - is computed to give management the opportunity to:

1 minimize the sum of supply and stockholding costs or order only the minimum necessary (subject to managment constraints) to maintain system stability,

2 order at specified regular intervals.

It indicates 'how much to order' when the system calls for replenishment action.

By monitoring the errors between actual demands and predicted demands (forecasts) within specified limits the system warns management of any loss of forecasting efficiency.

The system is particularly suitable for the control of finished product warehouse stocks, but the techniques employed may be used in many other areas of inventory management where the stock holding is not directly dictated by a production programme.

OUTLINE OF SYSTEM ROUTINES 2.2

The routines forming the basis of the system fall into three classes:

1 File Creation/Maintenance

2 Analytical

3 Operational

The integrated control system flowchart (see Figure 17) shows this natural division and how the routines are related one to another. Chapter 4 suggests methods of integrating this control system with other important user commercial routines.

Where applicable, all routines will accept punched card or paper tape input under operator control.

File Creation Routines 2.2.1

These routines are required

1 initially to create, and subsequently maintain the master files used in the system,

2 provide a facility for examining, on demand, the contents of one, or more, item records in the master files,

3 regularly to write all period stock transactions to a magnetic tape file.

Master File Create/Maintenance Routine

All business systems require master files to be created initially before any attempt is made to operate the system regularly on the computer. Thereafter, in the normal course of events, changes to the item records held on the master files occur periodically, and provision must be made to allow these changes to be effected quickly and easily without hindrance to the system.

The system described within this manual uses two such master files: *Stock Master* and *Demand History* files.

Stock Master File

This is the central file of the system. It must contain details of every item in the inventory. In addition to price and descriptive information, each item record contains all the balances required by the system, together with supplementary information designed to measure control efficiency. This file is regularly updated by the system to record the effect of stores transactions: it serves to initiate reports of unacceptable or dangerously low item stock levels, stock-out occurrences, replenishment order requisitions and unsatisfied customer demands. It also accumulates the data for the regular updating of the Demand History file - see below - and may be used by user routines to provide periodic stock lists, stock status reports and detailed stock evaluations.

Demand History Files

Keeping a record of historical demands for each item in the inventory is desirable in any stock recording system. This permits the review of this demand history at any time when need arises.

So that access to this information may be obtained at reasonably short notice, the system provides for regular updating of a magnetic tape file containing this information. A demand history extending up to 104 time periods (weeks or months) is allowed for, the length of the time period being decided by the user when the system is first set up.

This file may be used in several ways:

(a) for the analysis of a sample of inventory items during preliminary study in order to establish the inventory profile, i.e. the way in which the stock holding is distributed across the items relative to their contribution to annual stock turnover value;

(b) for the analysis and classification of the total inventory if this is desired prior to setting the system to work, and again when review of control performance is required - usually this review will be required annually;

(c) for the review of special sections of the inventory, e.g. slow movers, when required;

(d) for the examination of the demand history of specific items;

(e) to make it a simple matter to take advantage of the more powerful techniques available in SCAN System 1 should this need arise after use of SCAN System 2.

The Demand History file is also used, as a matter of routine, by SCAN System 2 for those items controlled on a variable re-order point basis.

For both files the following functions are available:

CREATE Master file on magnetic tape: this function is designed to create a master file containing the item records. A list is printed giving details of each item record and may be used as a master file reference.

MERGE files: normally, file creation is a 'one off' task when preparing files prior to running a system but if it is desired to build up a master file gradually, the data forming each part of the file may be used to create a number of part files. The Merge function will allow any two part files to be brought together at any one run and a single master file to be created in the desired sequence.

EXTRACT records: this function is to allow selected records from a master file to be extracted and written to an output magnetic tape file. These records are deleted from the master file. After performing some action on these records - depending upon the circumstances - the extracted records may be merged with the main file for operational control.

DELETE records: this function simply deletes any required item record from the master file and records the action on a listing.

INSERT records: this function is designed to place a new item record in its correct sequence in the master file.

AMEND records: any field or number of fields within an item record for either master file may be updated or altered by using this function. A list is printed of such amendments together with the old (or previous) field values.

Note: With all the above functions, except MERGE, a list recording the action is printed.

Skeleton History File Generate Routine

This program is ancillary to the Master File Create routine. Part of the information in the Demand History file is common to the Stock Master file. Therefore, to save the extra cost and increased risk of error if this information were punched twice, this program copies the common information from the Stock Master file to the Demand History file. If the latter file omits certain items, the information is copied only for those items present on the Demand History file.

Where there is no special information to be recorded on the Demand History file this program will create this latter file automatically from the Stock Master file, entering only the common information and leaving the rest of the item record blank.

Situations affecting the use of this program are as follows:

1 If it is desired neither to enter the analytical routines nor to forecast demand, but to use the Demand History file to accumulate data, a 'skeleton' Demand History file may be created directly from the Stock Master file.

2 If historical demand data is not available and inventory analysis cannot, therefore, be performed until sufficient demand history has been accumulated, a 'skeleton' Demand History file may be created directly from the Stock Master file, as explained above. However, in order to use variable re-order point control for certain items, it is necessary to add certain additional information to the appropriate item records. This may be affected by the use of the Master File Maintenance program. All other records in the Demand History file will be treated as fixed re-order point items, but the system will progressively accumulate the demand history for all items in the Demand History file.

3 If historical demand data is available and analysis is required, prior to setting up the system, it will be necessary first to create the Demand History file and then add the common data.

If selected records from the Stock Master file are required, a part file must be created first, containing the selected item records and then matched against the Stock Master file to transfer the 'common' data.

Magnetic Tape File Record List Routine

This routine is designed to allow users to examine the contents of one or more selected item records held in either the Demand History or Stock Master files.

Any number of item records may be printed in one run and the listed record contains the name of the fields as well as their alphanumeric values. This program could also be used to provide a permanent master file reference.

These routines, collectively, perform the item classification based on both frequency of movement and sales value. They consist of three programs:

1 Stock Profile Analysis

2 ABC Analysis

3 Control System Selection

The Stock Profile Analysis may be used on a regular (say annual) basis to provide an evaluation of the continuing system performance.

During the course of time, an individual item classification may change. Depending on the frequency of these changes the analytical routines could be used to re-establish the classifications.

The third program is optional and may be used to assign Control Systems automatically to the individual item records on the Stock Master file on the basis of their classification within the inventory.

Stock Profile Analysis Routine

The function of this routine is to analyze demand history and determine, i.e. by calculating the frequency of movement, the most suitable time interval for automatic demand forecasting (if required) in terms of the basic time unit in which demand figures have been collected.

With reference to Figure 5, if demand data were collected in weekly increments, a forecast interval of '1' means that a prediction of demand may be made once a week.

This enables Management to select the fast moving items from their total inventory for possible inclusion in an adaptive (i.e. variable re-order point) control system. Any item with a recommended forecast interval of greater than four weeks should not normally be included in an adaptive system because the frequency of movement is such that the item falls into the 'medium' or 'slow' moving category for which other forms of control are more suitable.

In some circumstances it may be necessary that data be aggregated in four weekly or calendar monthly increments; i.e. a forecast interval of '1' then means that a forecast of future demands for that item may be made monthly or every four weeks.

Each item processed in this routine is evaluated, over the demand history supplied, in terms of average annual sales (or usage), total current stock holding (i.e. stock on hand at the time of the analysis) and the marginal value (i.e. gross profit margin) of the average annual demand. A printed report (listing selected classes of item) may be provided if required and a summary, grouping the items by recommended forecast interval, of cumulative item count, sales value, stock value and marginal value for all items processed in this routine may also be printed if required (see section 3.5.1).

The list may be used as a comparative study both before and after implementing the control system to evaluate the stock holding position.

If a further classification on the basis of sales value is required a magnetic tape file containing the evaluated item details (as above) together with the totals for all items is produced by this program.

ABC Analysis Routine

An extension to the Stock Profile Analysis to enable Management to classify their inventory into three categories according to sales value as well as by frequency of demand is provided by this routine. This will allow a maximum of nine classifications, any one of which will apply to each stock item. A further program (see Control System Selection routine - below) will transfer these classifications to the Stock Master File and allocate a control system to each item according to Management decisions.

The ABC Analysis is traditionally used to indicate high, medium and low usage values in order to pin-point areas for Management investigation.

By combining sales (usage) value with frequency of movement, it is possible to allocate a suitable type of control system to each item.

The ABC Analysis program requires a magnetic tape file output from the Stock Profile Analysis as input. This would normally be in descending sales value sequence, but not necessarily.

If the Control System Selection routine is to be used next, the ABC classification is transferred to an output magnetic tape file by this routine. The Control System Selection routine is optional and, in any case, Management may wish to study the results of the ABC Analysis before proceeding further. Various

options are provided for selective printing from the analysis together with an ABC Analysis Summary Table giving the breakdown of sales value, stockholding, gross margin and item counts within each classification.

A preliminary Analysis Summary under the same headings but in 5% increments is also provided.

Control System Selection Routine

As stated earlier, this program is optional, but if automatic control system allocation is desired, Management may specify the type of control to be used for each of the nine possible classes of item and this program will record the appropriate control system marker for each item in the Stock Master file. The operational routines will then operate upon each item record according to the type of control designated by the system marker. If at any time it is desired to alter the system marker for a particular item to effect some other type of control, the file maintenance program may be used for this purpose.

A list of all items, including the classifications, may be printed at user option. For SCAN System 2 up to six possible control systems may be allocated to the inventory. In association with the above routines, standard sort software must be used as indicated in Chapter 3.

Operational Routines 2.2.3

The operational routines provided in SCAN System 2 could form the basis of a user's data processing system. All stock transactions are 'captured' on magnetic tape and processed against the Stock Master file to provide updated stock balances. These, in turn, are used to provide exception reports for Management action and magnetic tape files for entry to computer routines in other business systems areas. In this way, the user may expand the system to include all desired areas of data processing.

It is not strictly necessary to enter the analytical routines: arbitrary classifications may be given on the basis of the Stock Controller's knowledge, and thereafter the operational routines would provide the desired control. However, it is a valuable experience for Stock Controllers to process their inventory records through the analytical routines described above. As described elsewhere, it is highly desirable to keep a check on the system performance by their use.

Magnetic Tape Creation Routine - Transaction File

This routine is described under the heading of operational routines because it is the point at which all stock transactions are 'captured'. This then provides the entry point to the operational routines.

A common input format is provided for each type of transaction and the transactions may be written to a magnetic tape file in any sequence.

The following types of transaction may be input to this program:

(a) *Audit Request:* this may contain details of the current physical stock position for the item to be matched against the Master file record.

(b) *Stock Adjustment:* any correction to the physical (or on-hand) stock balance.

(c) *Stock Receipt and Scrap:* any goods or stock received from a supplier or factory. The facility for processing data on scrap is provided.

(d) *Returns Outward:* this caters for stock which has been returned to the supply source (not rejects).

(e) *Unscheduled Issue:* if stores issues are made such that the normal system is by-passed the Stock Master file must be updated in arrears. However, the issue normally requires invoicing and a later program carries the relevant data forward.

(f) *Returns Inward:* normally, this records the return of an unscheduled issue or a return of goods from a customer for credit.

(g) *Replenishment Order Adjustment:* provided to amend the stock on order balance.

(l) *Demand:* these are orders placed by customers (or factory on a store).

In addition to creating a magnetic tape file each transaction is listed on the printer for reference. A facility is provided for batch control totals if required.

Sort/Merge Routines

Standard sort/merge software may be used either to sort the transaction file into the required sequence for processing in the next routine or to merge a recirculating file (containing outstanding transactions) with the current transaction file and sort the combined records into one file in the required sequence - normally, priority code within due date within transaction code within item number.

Stock Updating and Allocation Routine

This routine constitutes the 'hub' of the control system from which most 'exception' reports and data for use in other routines are generated.

Besides maintaining a record of stock availability and applying re-order point control to all stock items, it also feeds the Stock Forecasting and Monitoring routine with the necessary demand data to effect variable re-order point control on selected stock items and to build an historical demand array for all items for future analysis.

It is recognized that not all items in an inventory will require the same control techniques and, consequently, this routine updates all Stock Master file item records affected by current stock transactions and applies to each item the selected form of re-order point control as indicated by the numeric value of a system marker contained within the record.

Before updating the various balances for an item, an audit request, if present, is processed to give current stock-on-hand information.

After each record has been updated, stock allocation is effected by processing each customer demand separately against the stock-on-hand balance, in the sequence in which they are presented to this program.

Where each demand is fully satisfied a record is created for output. This record is eventually used, via user routine, for invoice/despatch note, etc., preparation and possibly for sales statistics, credit control and cost accounting routines.

If a demand cannot be satisfied, an unallocated demand (or back-order) record is created.

This record is recirculated back into the system, so that, upon entry to the Stock Updating and Allocation program next time, it may be given prior attention for allocation before processing new demands.

In addition, a priority code may be used for each, or selected demands to control priority of allocation for those customer demands.

A user option may be exercised, via operator control, to back-order each demand that cannot be fully satisfied, or only that part of a demand which cannot be satisfied from physical stock.

Individual customer demands not requiring immediate allocation are written to an output magnetic tape file from this program and recirculated until such time as their due-date falls within one lead time period from the current processing date. These demand records will then be classified as forward demands and added to the demand accumulators. A further option is provided to set a date such that when the due-date of these forward demands comes within the range of this date option, allocation of these demands will then be attempted.

The user may decide to extract such demands not required for immediate allocation and exercise some other form of control or processing.

Upon completion of allocation the available (on-hand minus back-orders plus on-order) stock is compared with the re-order point and a replenishment order requested, if the re-order point is not less than the available stock. The order may be a minimum quantity set by Management, an economic order computed to conform to parameters pre-set by Management, or an order computed to last over a pre-selected ordering interval, based upon the usage rate. A maximum order size may also be specified.

A facility for cyclical ordering is provided, i.e. replenishment orders are generated at regular intervals - not necessarily each time the Stock Updating routine is processed. Cyclical ordering has a definite fixed time interval between successive replenishment order generations.

In addition to creating replenishment orders, an exception report is printed giving details of such orders.

If the replenishment orders are adjusted before submission to a supplier, the amount of the adjustment must be notified to the system; otherwise the on-order balance will be incorrect.

All receipt and issue transactions will be output with cost data for use in costing routines developed by the user.

The physical stock balance is checked to see if it is outside the range of minimum and maximum stock limits set by management. If it is outside this range a record is output to magnetic tape to enable a report to be printed by a subsequent program. Such reporting may be dispensed with at user option, but the system will always report any items on shortage and any items where the available stock does not cover the known forward demand.

A summary of stock activity and opening and closing balances is printed to enable controls to be balanced and to provide management with a summarized report on stores activity since the previous Stock Updating run.

Allocation Report Routine

In addition to producing 'exception' reports for management action, entry points to other business system areas are provided by magnetic tape files created by this routine. Primarily, the program is designed to print a report of all demand allocations and back-orders resulting from the Stock Updating and Allocation routine. Additionally the program will provide entry points to Purchase Order Control and Invoicing, etc., routines.

If automatic purchase order control is used, a file of outstanding or unplaced replenishment orders will likely be merged with current replenishment orders generated by the previous program.

This will depend upon the frequency of processing of the various routines adopted by the user. If, for example, the frequency of updating were daily, but purchase order control were weekly, then a replenishment orders file would be merged each day with the file produced by this program in order to add new orders. At the end of the week (say), the user's purchase order control routines would be entered and the replenishment order file processed.

Note: The user is, of course, at liberty to amend the recommended order quantities; however, any such amendments must be fed back into the system in order to adjust the stock on order balance held on the Stock Master file - if this is not already catered for in the user routine.

Under Minimum/Over Maximum List Routine

This routine is designed to print two exception reports:

1 Under Minimum Stock Level list

2 Over Maximum Stock Level list

The user has the option of either including meaningful values for these stock limits in the Stock Master file or setting the maximum stock level to zero to prevent generation of the Over Maximum report. If an under minimum stock level report is printed, definite progress action on the listed items is required if stock-out is to be avoided.

Management may, or may not, take action to reduce the stock investment, in the case of an over maximum stock level report, depending upon the reasons why the physical stock exceeds this Management limit.

Additional to the two reports, three magnetic tape files are produced, one of which extracts the over maximum records (if any) from the input file.

This file is then rewound to produce the second report. A second file is designed as an entry point to user cost accounting and invoice checking routines by extracting the priced receipt records. The third file is used to recirculate the remaining record types back into the system. If audit records are present, this circulating file becomes an entry point to an Audit Control routine as well.

Stock Forecasting and Monitoring Routine

This routine is the key to adaptive control if required; each item included in the adaptive control system is processed and a new predicted demand for the next time period is computed by one of two forecasting techniques available, chosen by Management independently for each item. These techniques are:

1 Moving averages with a time base specified by Management

2 Single exponential smoothing

Using the new predicted demand, the re-order point and a re-order quantity for the next period are computed.

If economic ordering is desired, the re-order quantity is determined from parameters selected by Management.

Only those items due for reforecasting at that point in time are processed. If an item has a seasonal demand pattern, seasonal factors specified by Management are used in making the forecast of demand.

Demand history is updated during this routine so that a demand history file is always available for re-analysis at any time.

Control over the continuing validity of the prediction parameters is affected by automatic monitoring of the forecasting performance.

All items held on the Demand History file are processed but a forecast is made *only* for those items having the appropriate system marker within the record.

Note: Recalculation of the re-order point for those items involved may raise the re-order point above the available stock level. If stock updating and allocation is performed frequently enough, new replenishment orders will be generated quickly. However, if there is a significant time lag between forecasting and normal updating it will be necessary to re-enter the Stock Updating and Allocation routine immediately in order to generate any additional replenishment orders now required.

Chapter 3 System Description

GENERAL 3.1

This chapter describes the basic specification of the I.C.T. SCAN System 2, comprising:

1 File Creation routines

2 Analytical routines

3 Operational routines

Each routine is described under the following headings:

Objective

System Flowchart

Input

Processing

Output

Peripherals

Note: See Chapter 1 for the system configuration.

INPUT/OUTPUT RECORDS 3.2

The punched card/paper tape and magnetic tape file records described in Chapter 5 and referred to in this chapter contain, besides the necessary fields to produce the results indicated on the report formats shown, additional fields in common use for throughput to the entry points provided to other commercial systems areas.

PROCESSING FUNCTIONS 3.3

The major processing functions of I.C.T. SCAN System 2 are as follows:

1 From an analysis of demand history, the classification of the complete inventory into nine categories (classes) based on a combination of sales value and frequency of movement.

This analysis will also determine the minimum forecast interval and allow management to allocate any one of six control systems to each classification.

2 The provision of audit facilities for stock quantities.

3 The admission of a number of common transaction types.

4 The allocation of stock to each demand.

5 The choice of back-ordering all, or part, of a demand not completely allocated.

6 Application of a suitable replenishment order strategy including fixed or variable re-order points and quantities.

7 Preparation of reports indicating allocated and unallocated demands, replenishment requirements, over maximum/under minimum stock level items.

8 Monitoring of forecast errors.

9 Provision of entry points to other commercial sub-systems.

The system issues the following control information for Management action on a routine basis:

1 Replenishment order quantities selected either:

to ensure the maintenance of customer service at any specified level, and

(a) minimize the sum of supply and stockholding costs over time (economic re-order quantity), or

(b) maintain system stability (minimum statistical re-order quantity), or

(c) observe management ordering policy (minimum or maximum re-order quantities),

or

to conform to a fixed size chosen by management.

2 The replenishment order quantities may be generated on a random basis i.e. as required, or on a fixed cycle e.g. once a month.

3 A report of all items whose forecast errors exceed stated limits.

4 A report of all stock items below a minimum stock level

5 A report of all stock items above a maximum stock level

6 A report of all allocated demands showing quantities allocated and unallocated (back-ordered).

Master File Create/Maintenance Routine 3.4.1

Objectives

1 To create a magnetic tape file from data input on punched cards or paper tape.

2 To merge two part files.

3 To insert a new record or records into a magnetic tape file.

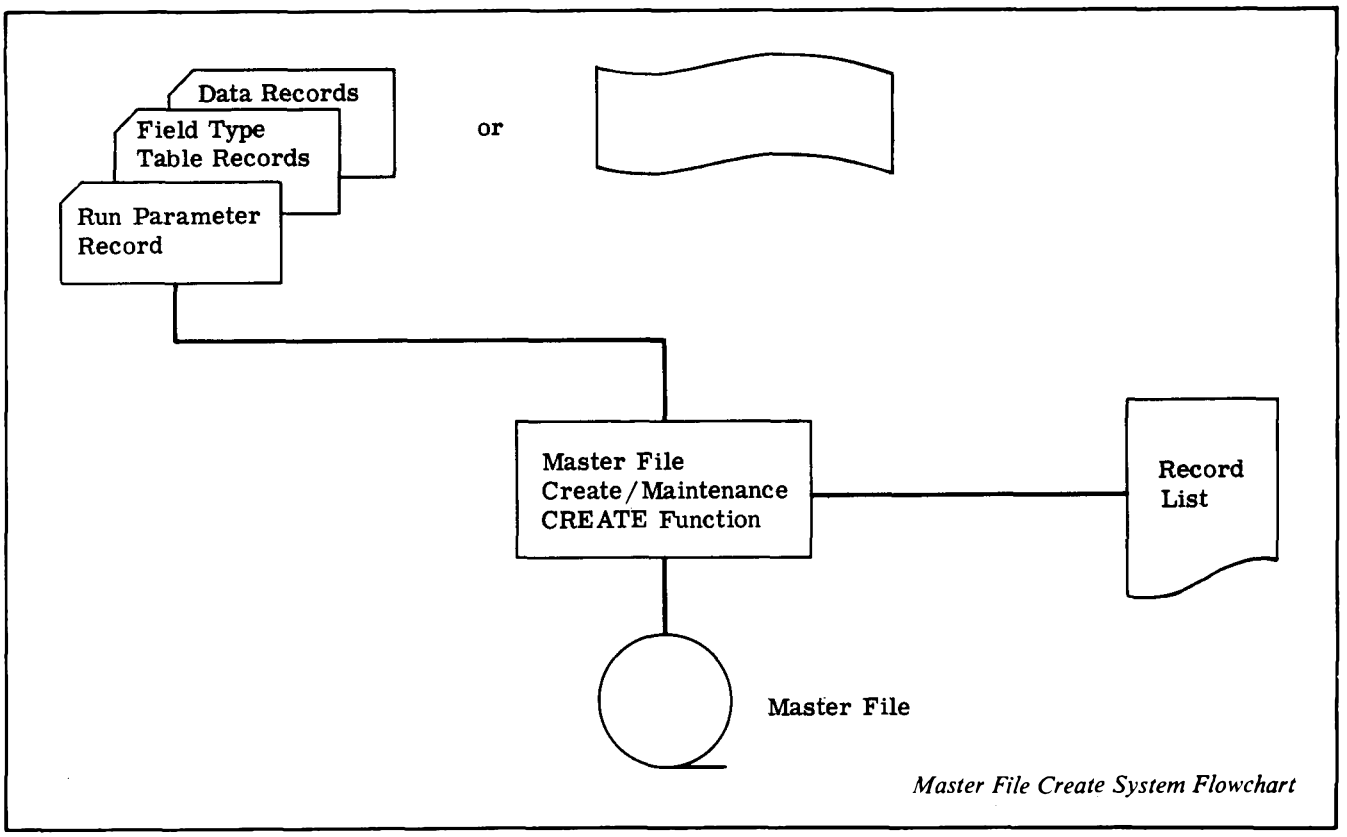
4 To amend any field of any item on a magnetic tape file.

5 To delete any record from a magnetic tape file.

6 To extract a record or records from one magnetic tape file and produce two part files.

Note: This routine applies only to the two master files used in I.C.T. SCAN System 2, see Demand History file and Stock Master file.

Input, processing and output is as follows for each program function separately:



Master File Create System Flowchart

DATE 01/07/67 — I.C.T. 1900 SCAN SYSTEM — TAPE FILE CREATION/MAINTENANCE ROUTINE — PAGE 1

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01        0111  1   1  1  0.000  2   1  0.10  0.00  EACH  267.171  01.992  02.142     2      963  104  52
02        0111  A1  15  QTBTS J HAIG
03        0111    0  556 568 600 700 939 1100 1017 858 802 798 750 749 633 600
03        0111   14  550 350 280 317 323 350 382 395 400 450 576 600 678 600
03        0111   28  593 581 550 450 449 439 420 400 415 421 450 500 509 520
03        0111   42  509 450 448 500 514 527 550 552 580 650 675 677 700 800
03        0111   56  772 768 750 718 603 590 500 308 237 298 287 300 345 360
03        0111   70  375 530 540 550 540 530 540 550 540 409 400 396 380 384
03        0111   84  386 376 295 347 244 246 378 244 691 190 200 293 356 388
03        0111   98  288 536 588 594 446 806 999999
04        0111    0  1.97 1.99 2.08 2.40 2.74 2.99 2.83 2.52 2.25 2.22 2.00
04        0111   11  1.69 1.39 1.44 1.34 1.04 1.00 1.08 1.12 1.41 1.47 1.51
04        0111   22  1.50 1.57 1.78 1.84 1.95 1.62 1.59 1.57 1.49 1.34 1.34
04        0111   33  1.30 1.15 1.20 1.06 1.07 1.33 1.19 1.92 1.14 1.14 1.19
04        0111   44  1.35 1.42 1.29 1.71 1.82 1.83 1.64 2.33 999999

01        0112  1   1  1  0.000  2   1  0.20  0.00  EACH  227.832  00.333  00.355     2     1212  104   1
02        0112  A1  15  4 OZ FLASKS J HAIG
03        0113    0  221 239 371 295 287 189 221 238 271 311 252 247 271 297
03        0112   15  273 208 215 263 292 199 273 247 239 281 285 271 261 283
 .         .     .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
 .         .     .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
 .         .     .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
 .         .     .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
```

Figure 1 Master File Create Record List - Demand History File

MASTER FILE CREATE

Input

1 Run Parameter record - defined in section 5.6.1

This record names the output magnetic tape file.

2 Field Type Table records - defined in section 5.6.2.

3 Data records - defined in Chapter 5:

Section 5.1 for the Demand History file

Section 5.2 for the Stock Master file

Processing

This function is designed to create a master file containing item records in the standard MT (or CT) format with header label, qualifier block, data, trailer label.

File creation is achieved by specifying the name of the output file together with other parameters on the Run Parameter record followed by Field type table records, followed by the appropriate Data records containing item record details. A list is printed giving details of each item record and may be used as a master file reference.

Note: The data records can be in any sequence within item number. Batches of item numbers need not be in sequence.

Output

1 One magnetic tape file, either Stock Master or Demand History (defined in section 5.5).

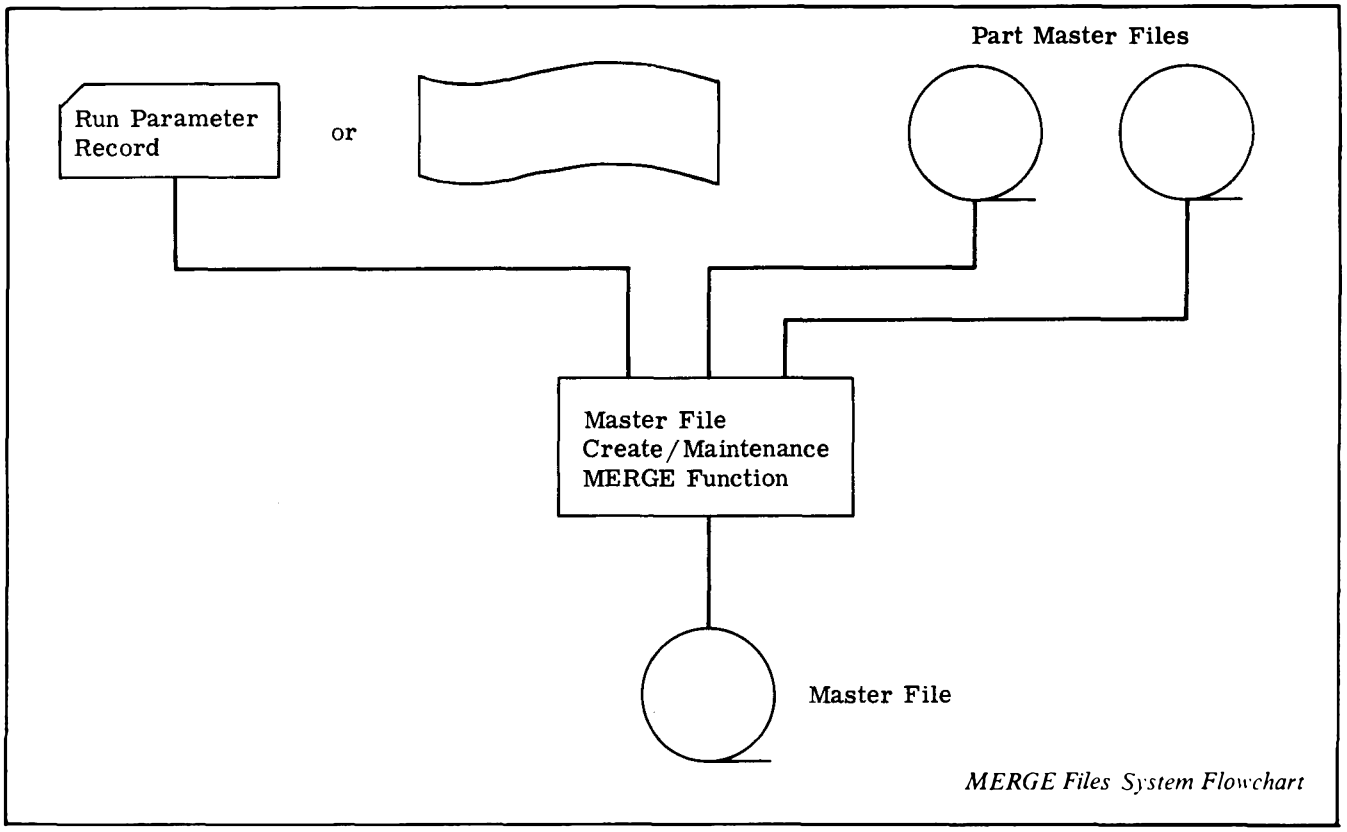
2 Printed list of item record details.

Peripherals

1 card reader or paper tape reader

1 magnetic tape unit

1 line printer



MERGE Files System Flowchart

MERGE Files

Input

1 Two magnetic tape files, either Stock Master or Demand History

2 Run Parameter record

Processing

Normally, file creation is a 'one off' task when preparing files prior to running a system, but, if it is desired to build up a master file gradually, the data forming each part of the file may be used to create a number of part-files.

The Merge function will allow only two part-files to be brought together and a single master file created in the correct sequence.

A 'merge' is signalled to the program by giving identical names to both input files and one output file on the Run parameter record.

Thereafter, each record is read off the input files (after verifying the file names) and written to an output file. This is given a file generation number 1 greater than the larger of the input file generation numbers.

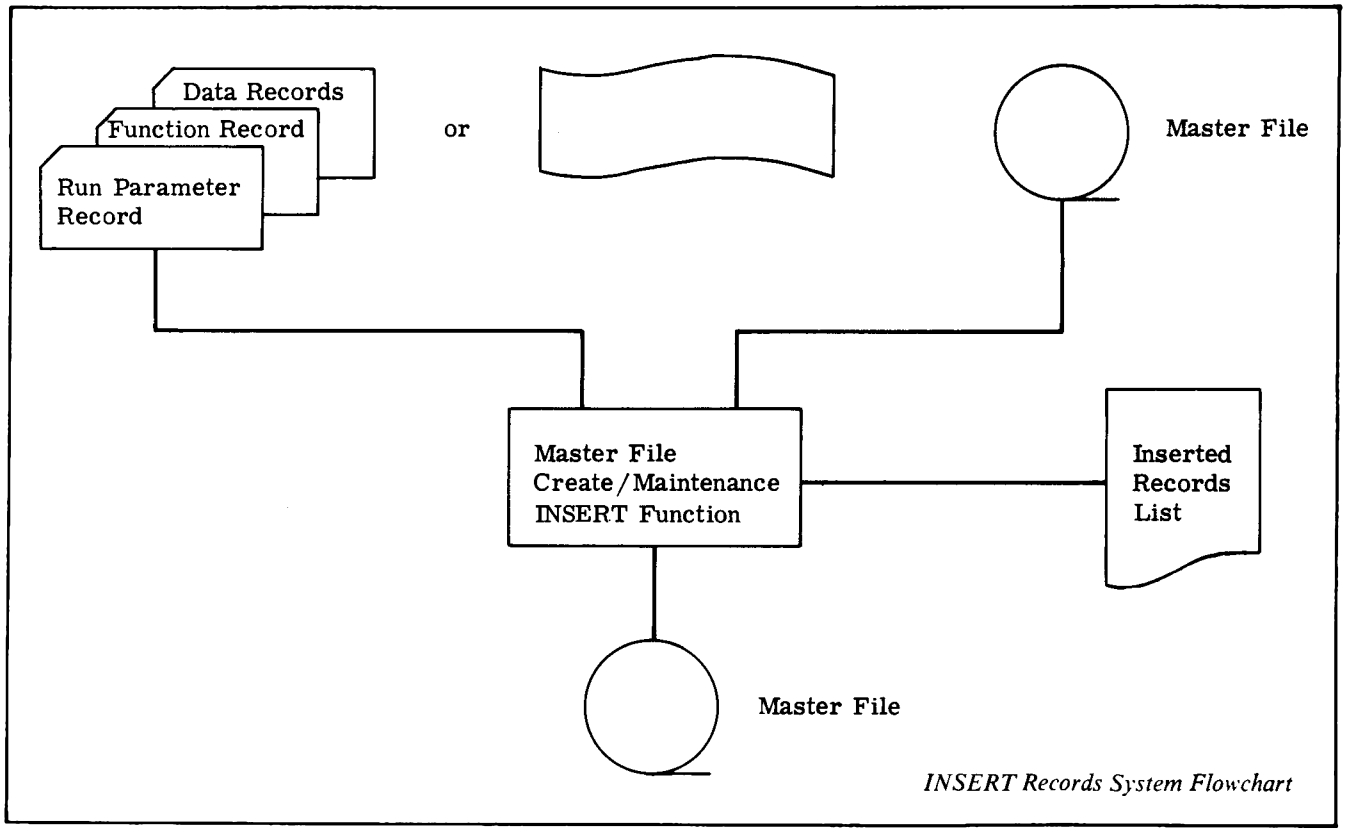
Output

One magnetic tape file either Stock Master or Demand History

Peripherals

1 card or paper tape reader

3 magnetic tape units



INSERT Records System Flowchart

INSERT Records

Input

1 One magnetic tape file either Stock Master or Demand History

2 Run Parameter record

3 Function record, type '31' - see Section 5.6.3.

4 Data records, either Stock Master or Demand History

Processing

This function is designed to place a new item record in its correct sequence in a master file and is achieved by comparing item numbers on the input magnetic tape file and Function records until the correct position is found. An updated master file is output together with a printed list of each inserted item record details.

The input file name is checked against that specified on the Run Parameter records; Function record type '31' tells the program to perform the INSERT function as well as holding the item number of the record to be inserted.

Each batch of data records pertaining to an item is preceded by a Function record

Output

1 One magnetic tape file, either Stock Master or Demand History

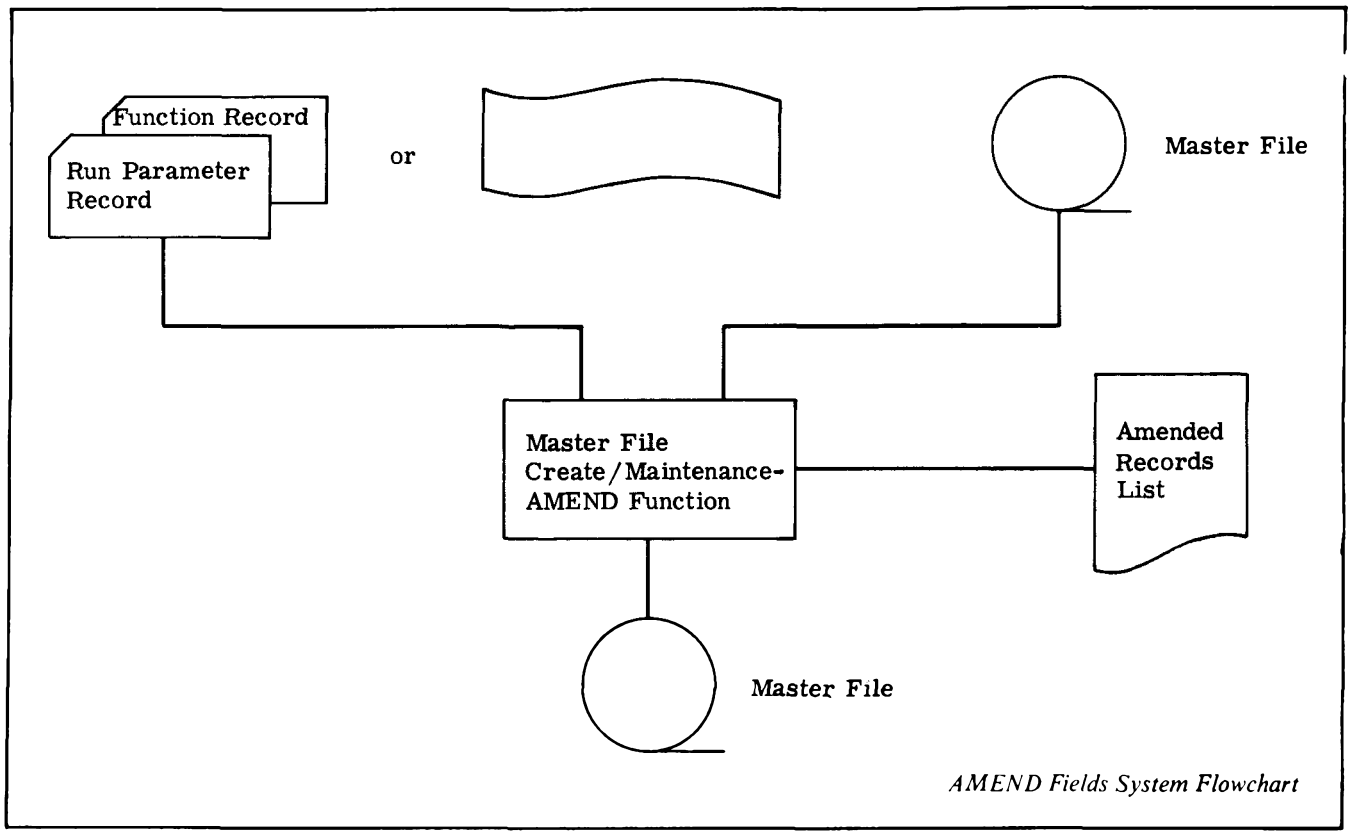
2 Printed list of inserted item record details

Peripherals

1 card or paper tape reader

2 magnetic tape units

1 line printer



AMEND Fields System Flowchart

AMEND Fields

Input

1 One magnetic tape file, either Stock Master or Demand History

2 Run Parameter record

3 Function record, type '32' - see Section 5.6.3.

Processing

Any word or number of words within an item record for either master file may be altered by using this function.

After verifying the correct input tape label with the Run Parameter record, each Function record item number is matched against the master file records.

Immediately following the item number on the Function record is the word number corresponding to the field within the item record which is to be amended. The Function record may contain one or more pairs of word number and field values.

The word number is used by the program to amend the corresponding field.

An amended master file magnetic tape is output together with a list of all such amendments including the previous field values.

Output

1 One magnetic tape file, either Stock Master or Demand History

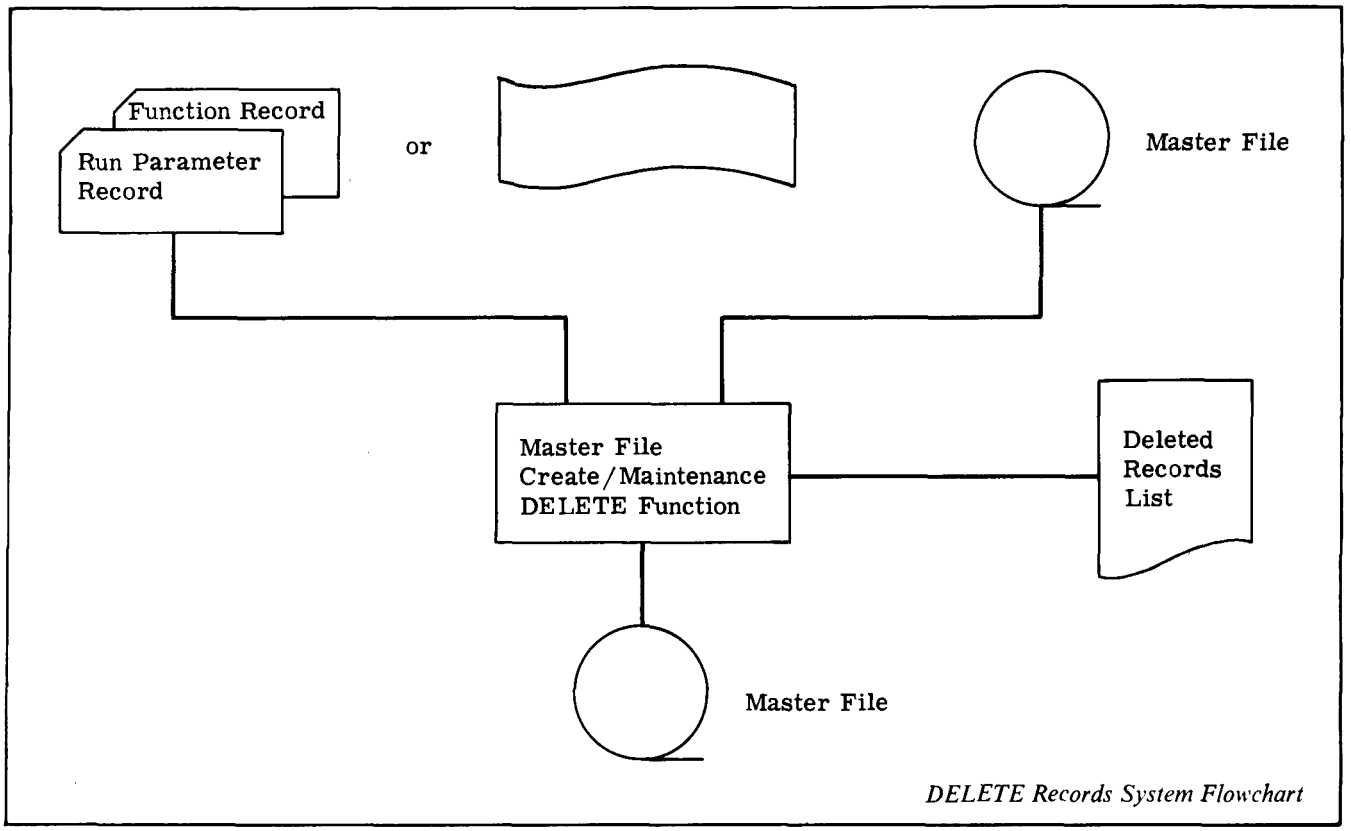
2 Printed list of each amendment together with old field value

Peripherals

1 card or paper tape reader

2 magnetic tape units

1 line printer



DELETE Records System Flowchart

Input

1 Magnetic tape file, either Stock Master or Demand History

2 Run Parameter record

3 Function records, type '33' - see Section 5.6.3.

Processing

This function simply deletes any required item record from the master file and records the action on a listing.

After verifying the correct input tape label with the Run Parameter record, each Function record (containing the item number of the record to be deleted) is matched against the input file. A magnetic tape file is output excluding the deleted records.

Output

1 One magnetic tape file, either Stock Master or Demand History

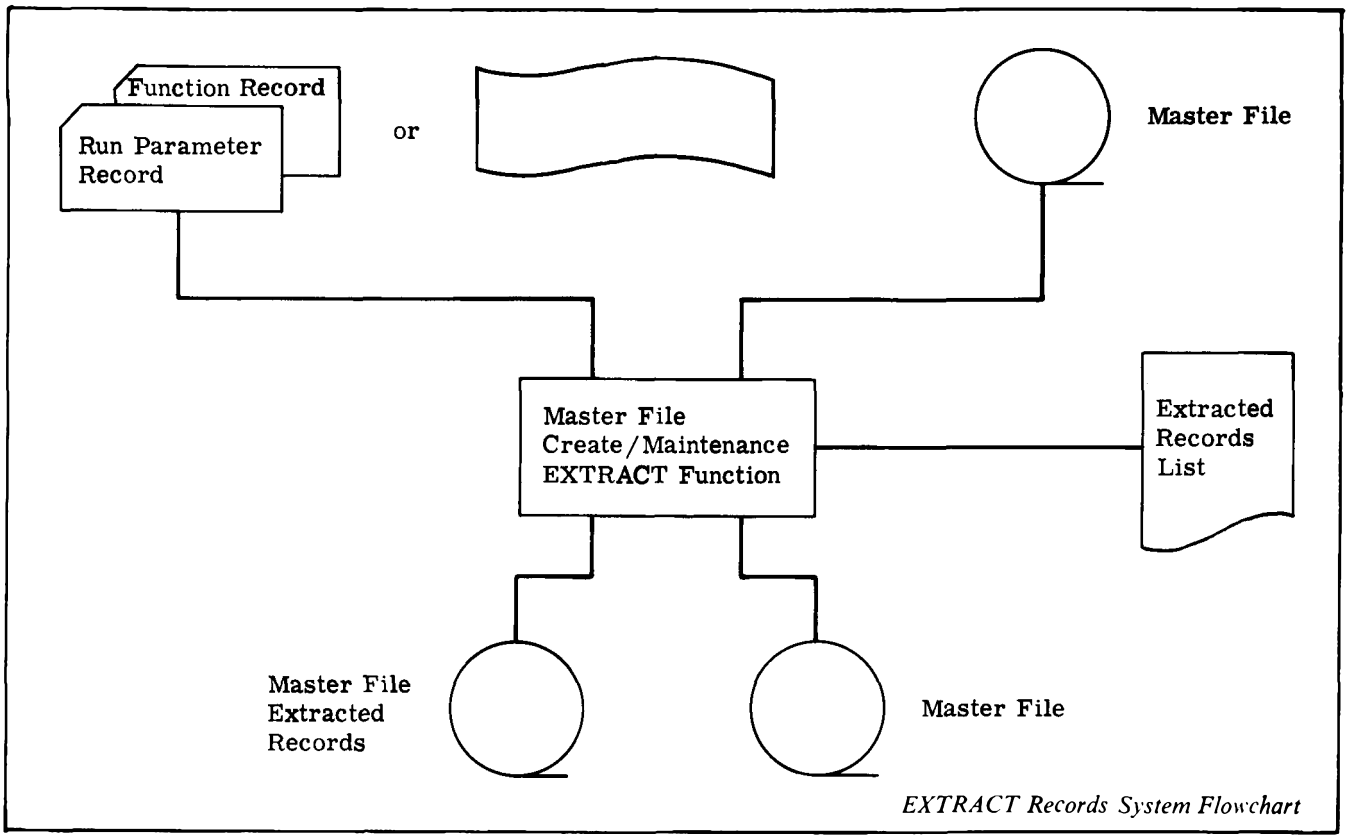
2 Printed list of deleted items

Peripherals

1 card or paper tape reader

2 magnetic tape units

1 line printer



EXTRACT Records System Flowchart

```
DATE 01/07/67                    I.C.T. 1900 SCAN SYSTEM                    PAGE 1
                          TAPE FILE CREATION/MAINTENANCE ROUTINE

 01          0113  1   1  1  0.000  2   1  0.10  0.00  EACH          01.87    2.142    2     748   28   1
 02          0113  A1  15  PINT BOTTLE BON CHARLIE
 03          0113   0  968 687 622 621 618 587 598 601 628 697 685 627 639 682 691
 03          0113  15  600 600 632 600 580 575 510 564 521 610 616 620 635 999999

ITEM NO       0113 INSERTED

ITEM NO       0114 WORD NO 005 AMENDED FROM A1                              TO A2

ITEM NO       0129 DELETED

ITEM NO       0137 DELETED

ITEM NO       0145 EXTRACTED

ITEM NO       0149 EXTRACTED

ITEM NO       0158 DELETED

ITEM NO       0187 DELETED

ITEM NO       0190 WORD NO 022 AMENDED FROM  2                              TO  3

ITEM NO       0196 DELETED

   .             .     .
   .             .     .
   .             .     .
```

Figure 2 Master File Maintenance List - Demand History File

EXTRACT Records

Input

1 One magnetic tape file either Stock Master or Demand History

2 Run Parameter record

3 Function record, type '34' - see Section 5.6.3.

Processing

This function is designed to allow selected records from a master file to be extracted and written to a magnetic tape file. These records are then deleted from the master file. Its main purpose is to allow item records to be re-analyzed if circumstances warrant this action. After such analysis the extracted records may be merged with the main file for operational control.

Afrer verifying the input tape label with that on the Run Parameter record, the Function records are matched with the input file. Where an item number is matched, the tape record is written to one output tape file. If there is no match, the input tape record is written to an output master file tape.

A printed list of all such extracted items is also output.

Output

1 One magnetic tape file containing extracted item records

2 One magnetic tape file containing records not extracted from the input file

Note: either Stock Master or Demand History

3 Printed list of extracted item numbers

Peripherals

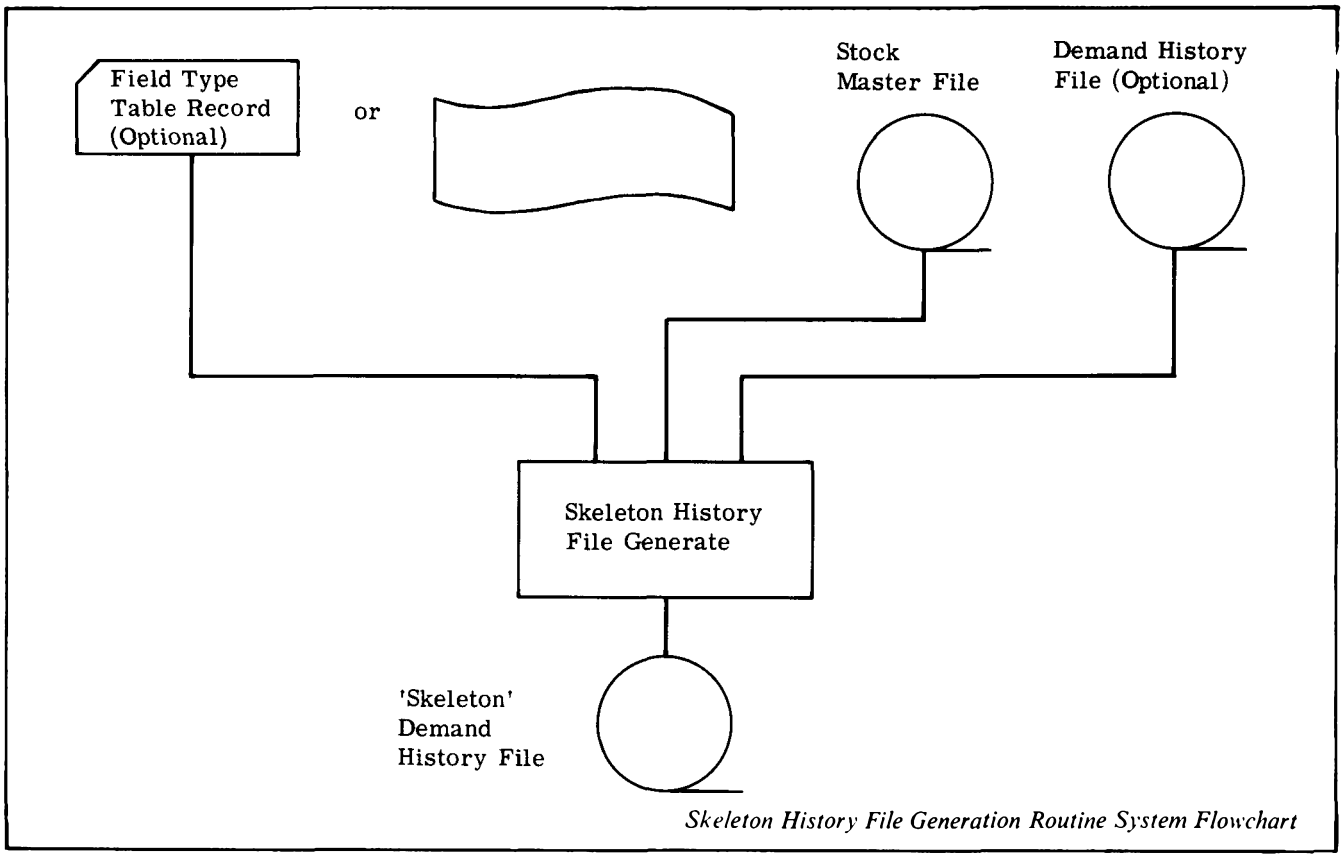
1 card or paper tape reader

3 magnetic tape units

1 line printer

Source Language (for all functions)

PLAN 3



Skeleton History File Generation Routine System Flowchart

Objective

To create, or add data to a Demand History magnetic tape file from a Stock Master magnetic tape file and thus reduce the amount of keypunching required to produce data common to both files, with a consequent reduction in transcription errors.

Input

1 Stock Master magnetic tape file

2 Demand History magnetic tape file containing item number and, possibly, fields *not* common to both files.

Note: This second file is optional and may be present only if selected item records are required from the Stock Master file.

3 Field Type Table records

Note: Optional - required only if no Demand History file is present.

Processing

1 If a complete skeleton Demand History file is required from the Stock Master, a switch is set 'ON', via the console, and the program writes a Demand History magnetic tape file containing the following data common to both files.

Item number
Class code
Description
Location code
Unit of measure
Cost price
Sales price
Lead time
Closing stock balance
System marker

Note: Mean absolute deviation of errors is given a value = 1.

The field type table records contain data used for file maintenance and are present only if no input Demand History file is present.

2 If a Demand History file is present as input, together with a Stock Master file, no Field Type Table records are required as the necessary data would have been entered when creating the Demand History file.

No switch is set and each item on the Demand History file is matched against the Stock Master file.

Where a match is obtained, a record will be written to an output Demand History file, containing the original data present on the input Demand History file and the data common to both files (see (1) above).

Output

Demand History magnetic tape file

Note: See Chapter 2 for a description of the situations affecting the use of this program.

Peripherals

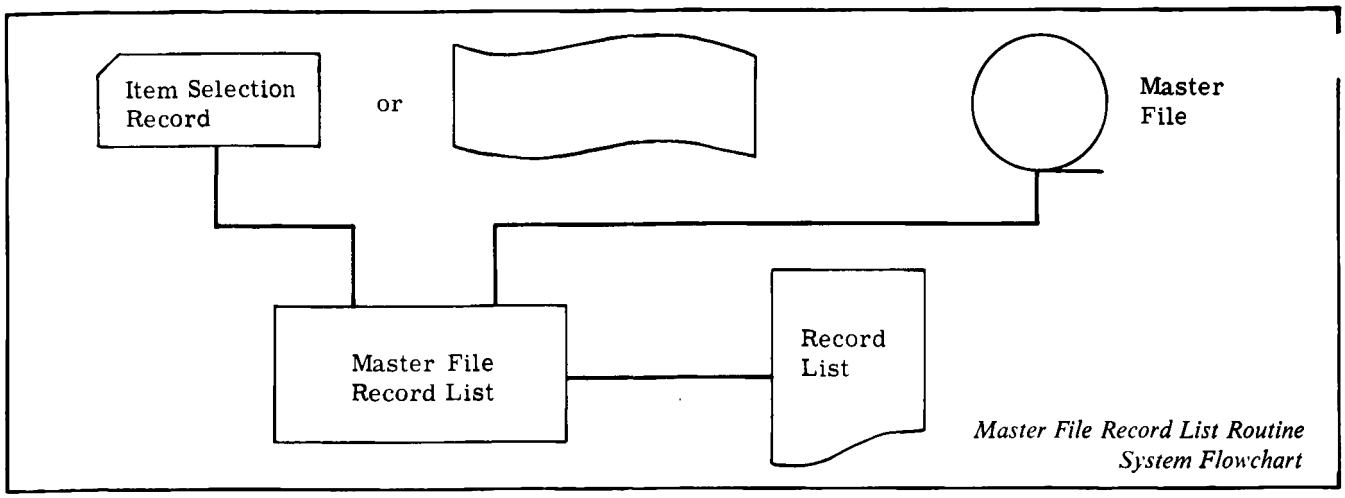
1 card or paper tape reader (optional)

2 or 3 magnetic tape units

Note: See Input section.

Source Language

PLAN 3



Master File Record List Routine System Flowchart

I.C.T. SCAN SYSTEM LISTING
DEMAND HISTORY FILE

DATE 01/07/67

ITEM NUMBER	0111	DESCRIPTION	QTBTS J HAIG		
CLASS CODE	A100	LOCATION CODE	1500	UNIT OF MEASURE	EACH
COST PRICE	01.992	SALES PRICE	02.142	ORDERING COST	0.000
LEADTIME	2.00	AVERAGE DEMAND	511.365	STD. DEVIATION OF DEMAND	0.000
DESEASONALIZED FORECAST	267.171	CUMULATIVE SUM OF ERRORS	22.625	STD. DEVIATION OF ERRORS	0.000
SMOOTHED ERROR	15.218	SMOOTHED M.A.D. OF ERRORS	35.938	CLOSING STOCK	963
SERVICE LEVEL GROUP	1	ORDERING INTERVAL	1	INVESTMENT RATE GROUP	0
SYSTEM MARKER	2	O.P.P.R. INCLUSION MARKER	1	SERIES LENGTH	104
FORECAST INTERVAL	1	FORECAST INTERVAL COUNT	0		
CYCLE BASE	52	CYCLE BASE COUNT	20		
FACTOR ONE	0.10	FACTOR TWO	0.00		

SEASONAL FACTORS

P	FACTOR	P	FACTOR	P	FACTOR	P	FACTOR	P	FACTOR	P	FACTOR	P	FACTOR	P	FACTOR
1	1.97	2	1.99	3	2.08	4	2.40	5	2.74	6	2.99	7	2.83	8	2.52
9	2.25	10	2.22	11	2.00	12	1.69	13	1.39	14	1.44	15	1.34	16	1.04
17	1.00	18	1.08	19	1.12	20	1.41	21	1.47	22	1.51	23	1.50	24	1.57
25	1.78	26	1.84	27	1.95	28	1.62	29	1.59	30	1.57	31	1.49	32	1.34
33	1.34	34	1.30	35	1.15	36	1.20	37	1.06	38	1.07	39	1.33	40	1.19
41	1.92	42	1.14	43	1.14	44	1.19	45	1.35	46	1.42	47	1.29	48	1.71
49	1.82	50	1.83	51	1.64	52	2.33								

DEMAND HISTORY

P	DEMAND	P	DEMAND	P	DEMAND	P	DEMAND	P	DEMAND	P	DEMAND	P	DEMAND	P	DEMAND
1	556	2	568	3	600	4	700	5	939	6	1100	7	1017	8	858
9	802	10	798	11	750	12	749	13	633	14	600	15	580	16	350
17	280	18	317	19	323	20	350	21	382	22	395	23	400	24	450
25	576	26	600	27	678	28	600	29	593	30	581	31	550	32	450
33	449	34	439	35	420	36	400	37	415	38	421	39	450	40	500
41	509	42	520	43	509	44	450	45	488	46	500	47	514	48	527
49	550	50	552	51	580	52	650	53	675	54	677	55	700	56	800
57	772	58	768	59	750	60	718	61	603	62	590	63	500	64	308
65	237	66	298	67	287	68	300	69	345	70	360	71	375	72	530
73	540	74	550	75	540	76	530	77	540	78	550	79	540	80	409
81	400	82	396	83	380	84	384	85	386	86	376	87	295	88	347
89	244	90	246	91	378	92	244	93	691	94	190	95	200	96	293
97	356	98	388	99	288	100	536	101	588	102	594	103	446	104	806

Figure 3 Master File Record List - Demand History File

I.C.T. SCAN SYSTEM LISTING
STOCK MASTER FILE

DATE 01/07/67

ITEM NUMBER	0111	DESCRIPTION	QTBTS J HAIG		
CLASS CODE	A1	LOCATION CODE	15	UNIT OF MEASURE	EACH
COST PRICE	01.992	SALES PRICE	02.142	PURCHASE TAX	0.000
LEADTIME	2.000	UNIT WEIGHT/TIME	0.000	SET UP TIME	0.000
DISCOUNT CODE	70	SUPPLIER CODE	2376	SCRAP FACTOR %	0
MINIMUM ORDER QUANTITY	48	MAXIMUM ORDER QUANTITY	0	CYCLE BASE	52
BIN LOCATION	3721	SYSTEM MARKER	2	MINIMUM STOCK LEVEL	100
REORDER POINT	2161	REORDER QUANTITY	774	MAXIMUM STOCK LEVEL	2000
CLOSING STOCK	963	FORWARD DEMAND BALANCE	974	PERIOD DEMAND	597
BACKORDERS	0	STOCK ON ORDER BALANCE	576	CUMULATIVE DEMAND	6093
CUMULATIVE RECEIPTS	7152	CUMULATIVE SCRAP	0	CUMULATIVE BACKORDERS	9
RECEIPTS COUNT	12	STOCK-OUT COUNT	1	NON-MOVE COUNT	0

Figure 4 Master File Record List - Stock Master File

Objective

To permit inspection of one, or more, selected item record details from either

(a) the Stock Master magnetic tape file or

(b) the Demand History magnetic tape file.

Input

1 Either Stock Master magnetic tape file, or Demand History magnetic tape file

2 One, or more, punched cards (or paper tape blocks) with the item number punched in the first 16 columns - see Section 5.6.4.

Processing

Selection of the appropriate magnetic tape file is by console instruction (entry point).

Each item number must be in the same sequence as the master file.

When a match is obtained between item numbers, the record details are printed.

After the last card (or paper tape block) is processed the input file is rewound.

Output

Printed report of selected item details

1 per page - Demand History file (see Figure 3)

4 per page - Stock Master file (see Figure 4)

Peripherals

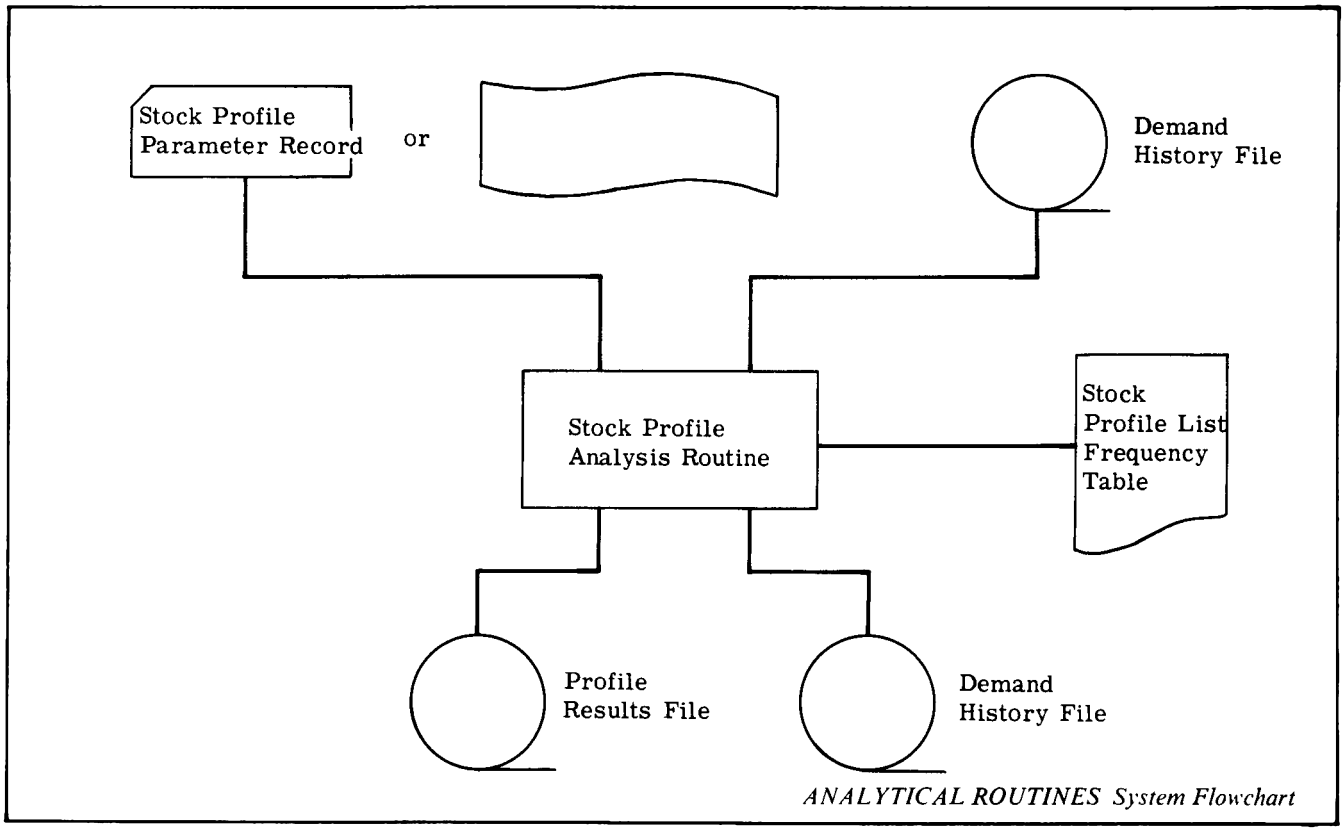
1 card or paper tape reader

1 magnetic tape unit

1 line printer

Source Language

PLAN 3



ANALYTICAL ROUTINES System Flowchart

Stock Profile Analysis Routine 3.5.1

Objectives

1 To examine the historical demands for each inventory item and determine a recommended minimum time interval at which a forecast should be made, based on frequency of movement.

2 To evaluate for each item; total average annual sales value, current stock value and average annual marginal value.

3 To provide a 'profile' of the total inventory within each recommended forecast interval.

4 To provide an entry point to the ABC Analysis routine.

Input

1 Stock Profile Parameter record - see Section 5.6.5
Four parameters are required for this record:

Selective listing

Frequency table

Profile results

Currency unit

Selective Listing parameter: If this parameter is set, only those stock items with a frequency greater than or equal to the equivalent value of the parameter will be output on the Stock Profile list. The value of this parameter is the selected forecast interval. If set to 27 or over, all stock items will be listed; if zero, the list is suppressed.

Frequency Table parameter: If this parameter is set to '0' the four unit totals together with the frequency table, as illustrated by Figure 5, will be accumulated and output.

If set to '1', the Stock Profile list only will be printed according to 'Selective Listing' above.

Profile Results parameter: If this parameter is set to '0', no Profile Results magnetic tape file is produced.

If set to '1', the Profile Results magnetic tape file is output.

Currency Unit parameter: This is used as a literal for printer output, e.g. £ or FR.

2 Demand History magnetic tape file
The only fields used in this program are as follows:

Item number

Cost price

Sales price

Closing stock-on-hand

Demand history

Series length

Description

Processing

The Stock Profile Parameter record is read into store and a switch set by operator control if a Demand History magnetic tape file is required as output.

Each item record on the Demand History file is scanned and the following calculations performed.

1 Frequency of movement equals movement count divided by demand history length (series length).

Note: Movement count is the number of basic time units, in each of which a demand has occurred, and is obtained by scanning the demand history array.

STOCK PROFILE LIST DATE 01/07/67 PAGE 1

ITEM NUMBER	ITEM DESCRIPTION	MINIMUM FORECAST INTERVAL	ANNUAL DEMAND	ANNUAL SALES VALUE £	STOCK QUANTITY	STOCK VALUE £	ANNUAL GROSS MARGIN £	SERIES LENGTH
A001	CHARAPYNE	1	5950	3571	482	256	416	104
A002	SODA THAWPIT	1	9680	3872	972	291	968	104
A003	LEMON DRINK SUMMER GOLD	2	3859	5017	328	361	771	104
A004	ORANGE DRINK SUMMER GOLD	1	3920	5097	371	408	784	104
A005	CAT FOOD PAWS	4	2000	5001	187	392	800	104
A006	LASSIE LARGE	1	1218	4872	132	475	487	104
A007	LASSIE SMALL	1	3113	4981	425	531	1089	104
A010	CHAPPIE LARGE	1	1561	4527	148	377	546	104
A011	SWOOP WILD BIRD FOOD	1	1902	3996	173	294	761	104
A012	TRILL BUDGIE SEED LARGE	1	2272	4999	157	298	682	104
.			.	.	.	.	.	
.			.	.	.	.	.	
TOTALS			2853721	2057891	230252	150491	226368	

FREQUENCY ANALYSIS DATE 01/07/67 PAGE 9

FORECAST INTERVAL	NO OF ITEMS	CUMULATIVE ITEM COUNT %	CUMULATIVE SALES VALUE %	CUMULATIVE STOCK VALUE %	CUMULATIVE GROSS MARGIN %
1	128	21.48	94.38	92.18	91.37
2	287	48.15	96.21	96.70	93.68
4	362	60.74	96.46	98.13	95.51
13	.				
26	.	100.00	100.00	100.00	100.00
TOTALS	596		2057891	150491	226368

END OF RUN

Figure 5 Stock Profile Analysis - List and Frequency Table

2 The total demand is summed over the demand history provided and the sales value (at sales price) and gross margin (at difference between cost and sales prices) is calculated, based on the average annual demand, i.e. the total demand is divided by the number of demand points provided and multiplied by the number of demand points in a year (52 for weekly data, 13 for four-weekly data and 12 for monthly data).

3 The stock value equals closing stock quantity multiplied by cost price.

Note: Forecast interval is related to frequency of movement as follows (the alternatives in column 3 are for basic time intervals of one week and one month respectively):

Probability of at least one movement per basic time interval or unit	*Forecast Interval*	*Time Period between Successive forecasts*
⩾ 0.5	1	Week or month
⩾ 0.25	2	Fortnight or two months
⩾ 0.125	4	Month or four months
⩾ 0.0385	13	Other
⩾ 0	26	Other

Output

1 Demand History magnetic tape file. This is an optional file and, if output, will include the minimum forecast interval computed for each item.

2 Profile Results magnetic tape file - see Section 5.5. This is also an optional file but, if ABC Analysis is required, it must be output. See Profile Results parameter above.

3 Stock Profile list - optional - see Selective Listing parameter. As illustrated opposite: this list may contain all items with a frequency equal to or greater than that specified by input parameter or it may contain all items on the input file.

4 Frequency Analysis

This is obtained by setting the appropriate parameter value - see Frequency Table parameter.

Peripherals

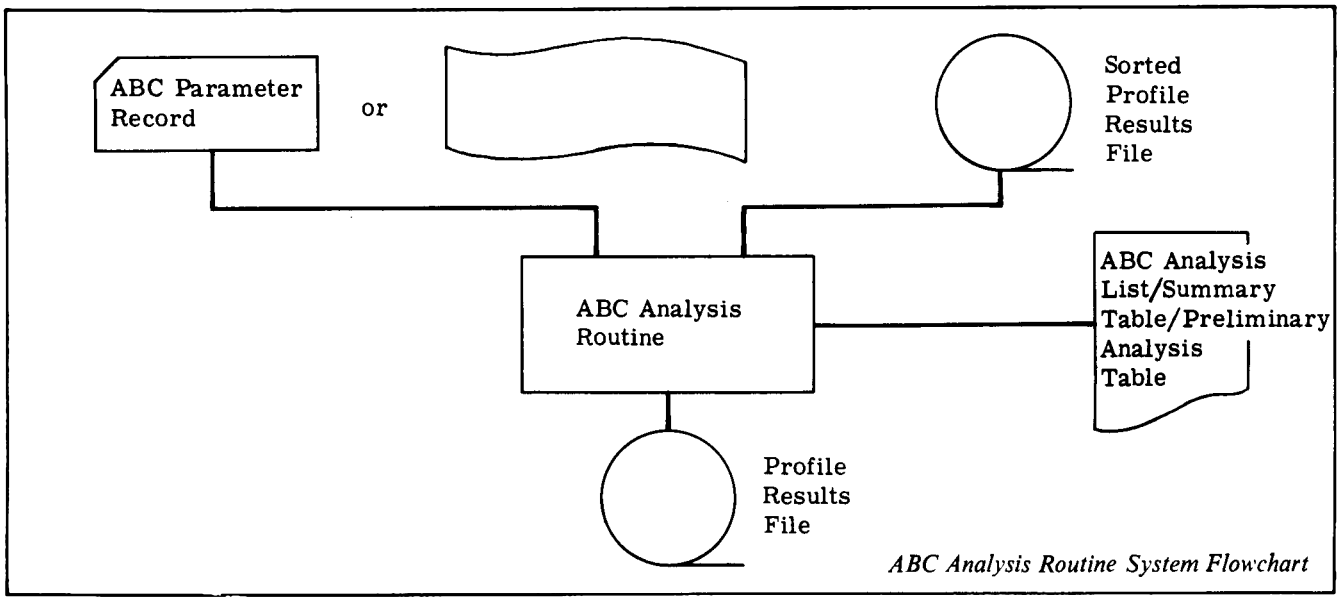
1 card or paper tape reader

1 to 3 magnetic tape units (see Output section)

1 line printer

Source Language

PLAN 3



ABC Analysis Routine System Flowchart

A.B.C. ANALYSIS DATE 01/07/67 PAGE 1

ITEM NUMBER / DESCRIPTION	UNIT OF MEAS	C C	L C	S L	ANNUAL USAGE UNITS	ANNUAL USAGE £	STOCKHOLDING UNITS	STOCKHOLDING £	GROSS MARGIN £	ITEM COUNT	CUMULATIVE PERCENTAGES USAGE VALUE	STOCK VALUE	MARGIN	ITEM COUNT
A101 CHUNKY MARMALADE 1S ST. MARTIN	CASE	A1	01	104	9632	25043	872	1831	4816	1	1.2	1.2	2.1	.1
A103 FLOUR PLAIN MCDOUGALLS 1S	CASE	A1	01	104	8931	22550	885	1770	4465	2	2.3	2.4	4.1	.3
A105 FLOUR S.R. MCDOUGALLS 1S	CASE	A1	01	104	8879	21753	821	1724	3107	3	3.4	3.5	5.5	.5
A109 FLOUR S.R. MCDOUGALLS 3S	CASE	A1	01	104	5028	20112	416	1456	2514	4	4.3	4.5	6.6	.7
C008 NESCAFE SACHETS	GRSS	A1	01	104	8260	19824	772	1621	2478	5	5.3	5.6	7.7	.8
C109 NESCAFE 2OZ	CASE	A1	01	104	973	14595	83	1037	2432	6	6.0	6.3	8.8	1.0
C390 NESCAFE 8 OZ	CASE	A1	01	104	2572	12860	217	911	2057	7	6.6	6.9	9.7	1.2
C821 NESCAFE 1 1/2 LBS	CASE	A1	01	104	1101	11560	110	946	2091	8	7.2	7.5	10.6	1.3
C001 NESCAFE 4 OZ JAR	CASE	A1	01	104	1296	11534	121	943	1425	9	7.8	8.1	11.2	1.5
C010 NESCAFE CONTINENTAL 2 OZ	CASE	A1	01	104	1838	11028	158	742	2389	10	8.3	8.6	12.3	1.7
C007 NESCAFE CONTINENTAL 4 OZ	CASE	A1	01	104	1757	10717	147	837	703	11	8.8	9.2	12.6	1.8
C100 INSTANT COFFEE 4 OZ	CASE	A1	01	104	3261	10435	197	492	2282	12	9.3	9.5	13.6	2.0
D002 NESQUICK STRAWBERRY 8 OZ	CASE	A1	01	104	8962	9858	693	623	1792	13	9.8	9.9	14.4	2.2
S100 MARIE ELIZABETH SARDINES	CASE	A1	01	104	3897	9742	340	612	2727	14	10.3	10.3	15.6	2.3
A028 STEWED STEAK IRISH 15 1/2 OZS	CASE	A1	01	104	1387	7212	118	566	554	15	10.6	10.7	15.8	2.5
P311 KENNOMEAT SMALL	CASE	A1	01	104	1953	6835	163	440	1562	16	11.0	11.0	16.5	2.7
P102 KATTOMEAT SMALL	CASE	A1	01	104	1875	6750	165	462	1500	17	11.3	11.3	17.2	2.9
D801 TIDYSAN 13 X 10	CASE	A1	01	104	8581	6006	721	288	2574	18	11.6	11.5	18.3	3.0
P101 TOP CAT HANDY	CASE	A1	01	104	4076	5298	376	338	1630	19	11.8	11.7	19.0	3.2
					. . .		. . .		. . .					
LIST TOTALS					2057891		150491		226368					

Figure 6 ABC Analysis List

Objectives

1 To enable Management to classify their inventory into three categories according to sales value as well as by frequency of movement of demand, giving a maximum of nine classifications, any one of which will apply to each stock item.

2 To provide a guide to Management to select the final percentages in which to group the three categories based on Sales Value. To provide the entry point to the automatic Control System Selection routine.

3 To provide the entry points to the automatic Control System selection routine, if required.

4 To provide a listing of items in the sequence: stock value, gross margin, item number or class code.

Input

1 Profile Results magnetic tape file

2 A parameter card (or paper tape block) containing six options as follows - see Section 5.6.7:

(a) *Print option:* this allows selective listing of the ABC analysis viz:

(i) fast movers only

(ii) medium movers only

(iii) slow movers only

(iv) high value items only

(v) medium value items only

(vi) low value items only

(vii) a complete list of all items

An ABC analysis summary table is printed with each of the above selections.

(viii) a preliminary analysis table only

(b) *File Sequence indicator:* this indicates to the program which sequence must be checked:

(i) descending sequence of sales value

(ii) descending sequence of stock value

(iii) descending sequence of gross margin

(iv) ascending sequence of item number

(v) ascending sequence of class code

(c) *Class 'A' Limit:* this is used in conjunction with parameter (b) (i). If this parameter has a zero value no ABC classification will be performed. This will produce a preliminary analysis table only.

Any other value of this parameter will set the limit for classifying the class 'A' items e.g. 20 would progressively classify each item as 'A' items until the first 20% of total sales value has been reached.

(d) *Class 'B' Limit:* this delimits the percentage of total sales within which the items will be classified as 'B', e.g. 60 would progressively classify each item as 'B' items from the 'A' limit until the first 60% of sales had been reached. All items beyond this limit will be classified as 'C' items.

(e) *Output File Control:* an output Profile Results file identical to the input file but containing the ABC classifications may be written.

(f) *Medium Mover Limit:* this delimits the forecast interval used to classify items as medium and slow movers. Fast movers will always be classified as those items having a forecast interval of 'one'.

A.B.C. ANALYSIS DATE 01/07/67 PAGE 51

CLASS CODE	ANNUAL USAGE £	ANNUAL USAGE CUM %	STOCKHOLDING £	STOCKHOLDING CUM %	GROSS MARGIN £	GROSS MARGIN CUM %	ITEM COUNT UNITS	ITEM COUNT CUM %
A1	830937	40.4	68548	45.5	81980	36.2	75	12.6
A2	397213	59.7	28721	64.6	41237	54.4	88	27.3
A3	13716	60.3	1092	65.4	1583	55.1	5	28.2
B1	679631	93.4	40732	92.4	85328	92.8	339	85.1
B2	87291	97.6	7016	97.1	10921	97.7	48	93.1
B3	1525	97.7	130	97.2	185	97.7	1	93.3
C1	45727	99.9	3842	99.7	4931	99.9	38	99.7
C2	960	99.9	180	99.8	105	99.9	1	99.8
C3	891	100.0	230	100.0	98	100.0	1	100.0
TOTALS	2057891		150491		226368		596	

A.B.C. ANALYSIS DATE 01.07.67 PAGE 1

Figure 7 ABC Analysis - Summary Table

PERCENTAGE ANNUAL USAGE	ANNUAL USAGE £	ANNUAL USAGE CUM %	STOCKHOLDING £	STOCKHOLDING CUM %	GROSS MARGIN £	GROSS MARGIN CUM %	ITEM COUNT UNITS	ITEM COUNT CUM %
5	109282	5.3	8402	5.6	17380	7.7	5	.8
10	102329	10.3	7143	10.3	17898	15.6	9	2.3
15	102123	15.3	7318	15.2	12003	20.9	9	3.9
20	101072	20.2	7526	20.2	9927	25.3	9	5.4
25	101578	25.1	7412	25.1	6529	28.2	10	7.0
30	102837	30.1	7521	30.1	6219	30.9	10	8.7
35	102973	35.1	11631	37.8	6828	33.9	11	10.6
40	103221	40.1	11258	45.3	5087	36.2	11	12.5
45	103118	45.1	7501	50.3	9937	40.6	18	15.1
50	102966	50.1	7488	55.3	10869	45.4	20	18.8
55	102998	55.1	7475	60.3	11621	50.5	24	22.8
60	102793	60.1	7301	65.1	10032	54.9	28	27.5
65	102985	65.1	7218	69.9	12938	60.6	35	33.4
70	102894	70.1	6817	74.4	14892	67.2	42	40.4
75	101262	75.0	5838	78.3	14999	73.8	50	48.8
80	103116	80.1	5488	81.2	14582	80.3	55	58.1
85	103005	85.1	7458	86.9	13923	86.4	57	67.6
90	102816	90.1	7215	91.7	12268	91.8	71	79.5
95	101936	95.0	5053	95.0	9268	95.9	65	90.4
100	102587	100.0	7428	100.0	9168	100.0	57	100.0
TOTALS	2057891		150491		226368		596	

Figure 8 ABC Analysis - Preliminary Analysis Table

Processing

The parameter record is read into store and the input magnetic tape file scanned to give the results required according to the parameter settings described above.

If the preliminary analysis table is required first (to provide a guide to the selection of the A, B limits) parameter (a) is set to 'T'. This will cause the program to aggregate the sales, stock and marginal values in 5% increments and print the preliminary analysis table.

Note: No output profile results file is produced with this table and the input file must be in descending sales value sequence.

If the ABC list and classification is required, parameter (a) is set to 'L', parameter (b) set to '0' (zero), parameters (c) and (d) set to required values and parameter (e) set to '1'.

This will cause the program to classify each item, print the ABC Analysis list and summary and produce an output file for entry to the next routine - Control System Selection.

The ABC Analysis Summary table is printed to give a summary of each of the classes A1, A2, A3, B1, etc; Sales Value, Stockholding, gross margins and item counts are accumulated for each class, including cumulative percentages.

Output

1 Profile Results magnetic tape file. This is optional, unless the next program is required (Control System Selection).

2 ABC Analysis list - optional
3 ABC Analysis Summary table (with list)
4 Preliminary Analysis table - optional

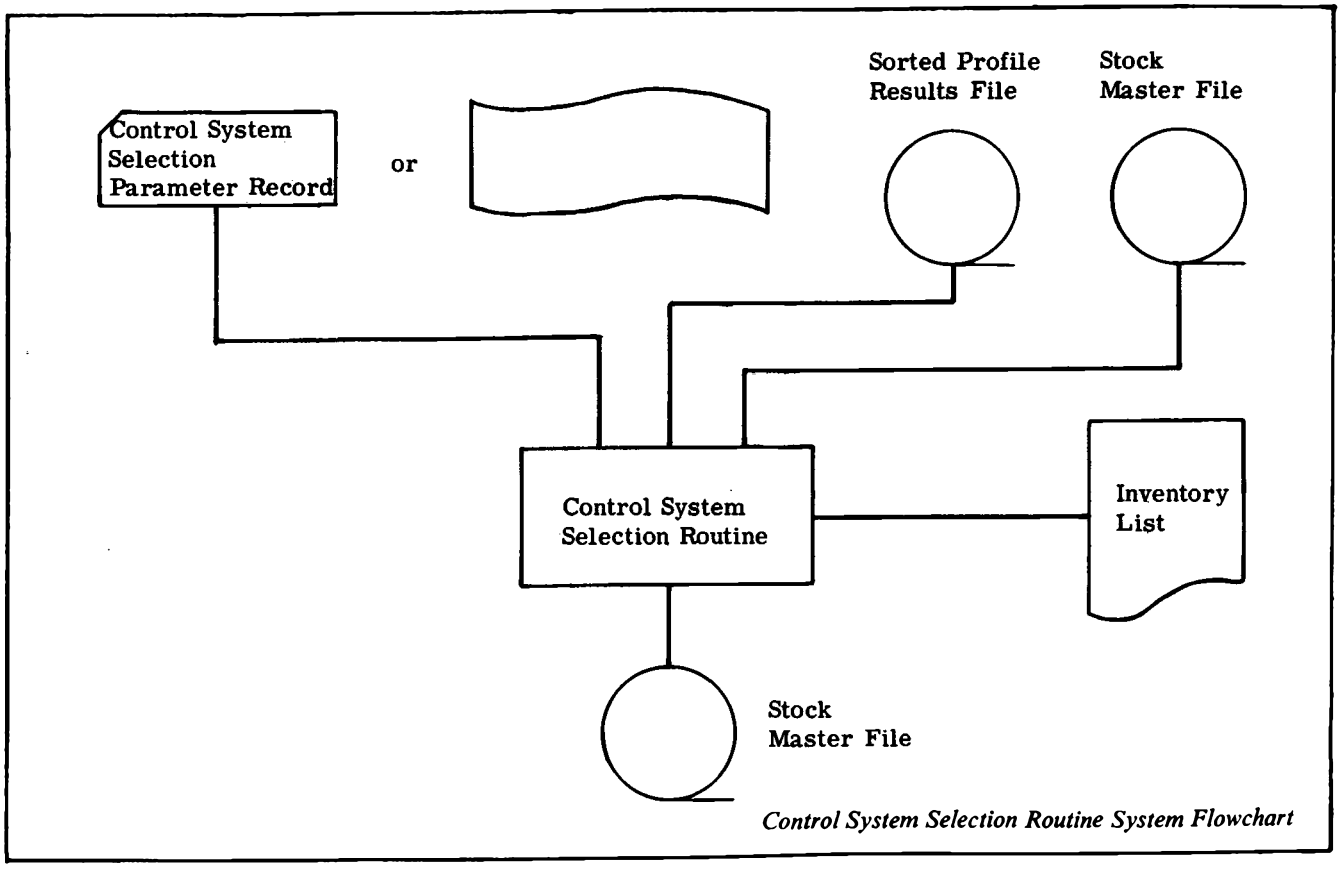
} see Figures 6, 7 and 8

Peripherals

1	card or paper tape reader
1 or 2	magnetic tape units
1	line printer

Source Language

Compact COBOL



Control System Selection Routine System Flowchart

INVENTORY LISTING DATE 01/07/67 PAGE 1

ITEM NUMBER	DESCRIPTION	UNIT OF MEAS	C C	S M	L C	S L	ANNUAL USAGE UNITS	ANNUAL USAGE £	STOCKHOLDING UNITS	STOCKHOLDING £	GROSS MARGIN £
A001	CHARAPYNE	CASE	B1	2	01	104	5950	3571	482	256	416
A002	SODA THAWPIT	CASE	B1	2	01	104	9680	3872	972	291	968
A003	LEMON DRINK SUMMER GOLD	CASE	A1	2	01	104	3859	5017	328	361	771
A004	ORANGE DRINK SUMMER GOLD	CASE	A1	2	01	104	3920	5097	371	408	784
A005	CAT FOOD PAWS	CASE	A1	2	01	104	2000	5001	187	392	800
A006	LASSIE LARGE	CASE	A1	2	01	104	1218	4872	132	475	487
A007	LASSIE SMALL	CASE	A1	2	01	104	3113	4981	425	531	1089
A010	CHAPPIE LARGE	CASE	B1	2	01	104	1561	4527	148	377	546
A011	SWOOP WILD BIRD FOOD	CASE	B1	2	01	104	1902	3996	173	294	761
A012	TRILL BUDGIE SEED LARGE	CASE	A1	2	01	104	2272	4999	157	298	682
A013	TRILL BUDGIE SEED SMALL	CASE	A1	2	01	104	1952	4880	168	353	781
A014	WINALOT LARGE	CASE	B3	0	01	104	853	1280	79	71	512
A015	WINALOT SMALL	CASE	B3	0	01	104	2276	1821	195	78	910
A016	KATKINS	CASE	A1	2	01	104	2402	4564	237	356	960
A017	WHISKAS HANDY	CASE	A1	2	01	104	1321	4227	129	361	528
A018	KIT-E-KAT HANDY	CASE	A1	2	01	104	2124	4673	237	403	1062
A019	PAL MEAT LARGE	CASE	A1	2	01	104	1184	4972	113	396	829
								.		.	.
								.		.	.
								.		.	.
								.		.	.
LIST TOTALS								2057891		150491	226368

Figure 9 Control System Selection Routine Inventory Listing

Objective

To provide Management with the facility to allocate automatically any one of six control systems to each item in the inventory.

Input

1 Stock Master magnetic tape file

2 Profile Results magnetic tape file (output from the ABC Analysis routine; sorted to Stock Master file sequence).

3 A punched card (or paper tape block) containing nine numbers selected to correspond with the control system marker allocated to each item classification - see Section 5.6.9.

Notes:

1 The nine numbers may be selected from the list given below.

2 Some, or all, numbers may be identical, i.e. the same control system may be applied to more than one classification.

Control System list:

0 = fixed re-order point, random ordering

2 = variable re-order point, random ordering, single exponential smoothing

3 = variable re-order point, random ordering, moving averages

5 = fixed re-order point, cyclical ordering

7 = variable re-order point, cyclical ordering, single exponential smoothing

8 = variable re-order point, cyclical ordering, moving averages

See Chapter 4 - Implementation - for suggested control system to classification selection.

Processing

The Control System Selection parameter record is read into store, after which the Profile Results magnetic tape file is examined, record by record.

Each corresponding record on the Stock Master magnetic tape file is written to an output file updated by the ABC classification and the corresponding selected system marker.

Note: Output Stock Master file will contain *all* input Stock Master file records.

A printed list of each item giving the classifications etc., may be output by testing a switch entered by operator control.

Note: The list is taken from the Profile Results file.

If the Stock Master and Profile Results file do not contain corresponding item records an error message indicating this condition may be suppressed by console switch.

Output

1 Stock Master magnetic tape file, containing ABC classifications and selected system markers.

2 Inventory list as illustrated opposite - optional

Peripherals

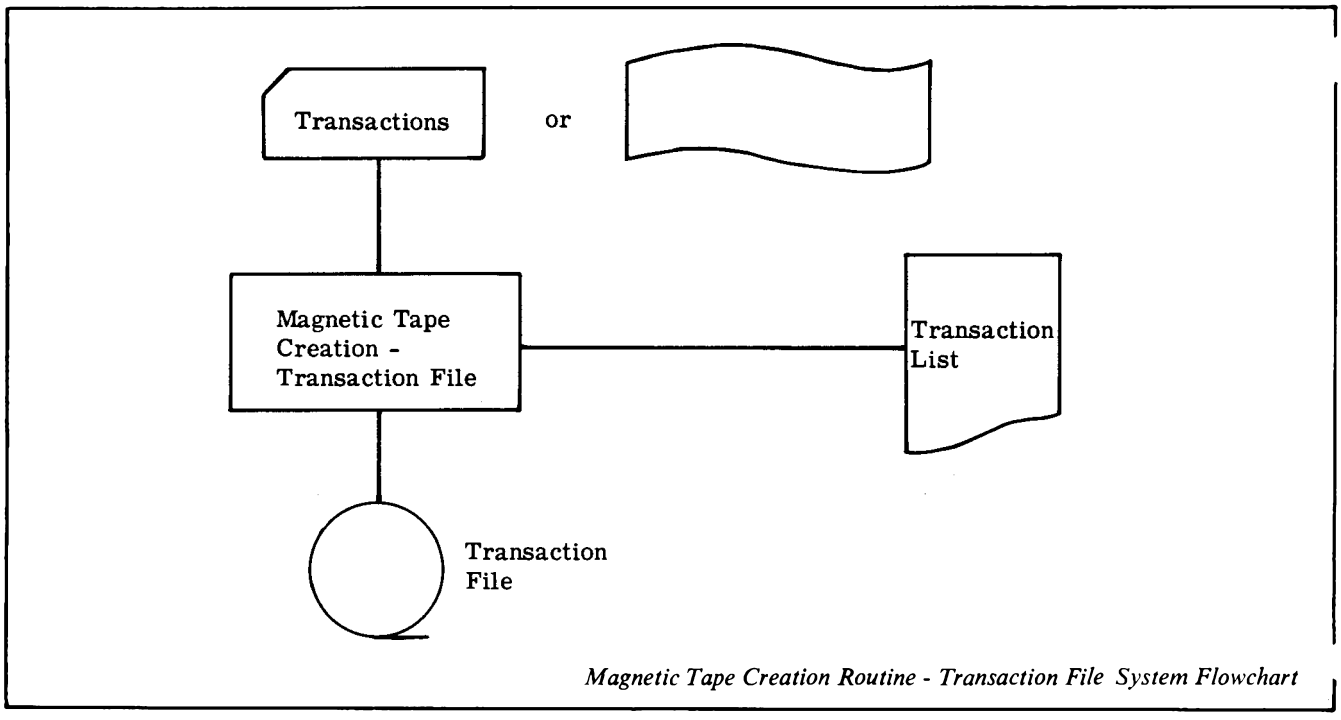
1 card or paper tape reader

3 magnetic tape units

1 line printer (optional)

Source Language

Compact COBOL



Magnetic Tape Creation Routine - Transaction File System Flowchart

STORES TRANSACTIONS LIST DATE 28/02/67 PAGE 1

TRANS TYPE	LOC CODE	LEDGER A/C NO.	INT.ORDER REFERENCE	DATE	ITEM NO.	U.O.M.	QUANTITY-1	QUANTITY-2	SECOND DOC.REF	DUE DATE	PRIORITY
11	15		A1311	280267	0111	EACH	963				
12	15		C921	280267	0111	EACH	17		87		
13	15	2376	16098	270267	0111	EACH	798	18	87		
17	15	A731	15937	270267	0111	EACH	17	17	11839		
21	15	A831		280267	0111	EACH	83		19327	170467	01
21	15	A785		280267	0111	EACH	37		1A732	120467	01
21	15	A797		280267	0111	EACH	42		83112	150367	02
21	15	A731		280267	0585	EACH	25		18721	120367	01
21	15	A831		280267	0586	EACH	13		19211	120367	03
19	15	A732	18576	260267	0731	EACH	50				
15	15	A731	B7218	280267	0112	EACH	17		93		
14	15	A932	18736	280267	0112	EACH	15		G7318		
• 20	15	A797		270267	0738	EACH	25		2A837	120367	01
21	15	A831		280267	0111	EACH	10		19732	180367	01
12	15		C936	280267	0591	EACH	8		88		
11	15		A1312	280267	0631	EACH	1027				
13	15	2478	16095	270267	0112	EACH	256		85		
13	15	2581	16003	270267	0136	EACH	523		85		
17	15	A831	16021	280267	0111	EACH	5		11837		
21	15	A731		280267	0287	EACH	215		29871	070367	02
					314	19	4087	35			
99			956	010367	334	20	4112	35			
21	16	A931		280267	0110	EACH	36		18732	100367	01
.	.	.		.	.	.	.		.	.	.
.	.	.		.	.	.	.		.	.	.
.	.	.		.	.	.	.		.	.	.

END OF RUN 317 TRANSACTIONS

Figure 10 Transaction File Creation - Transaction List

Magnetic Tape Creation Routine - Transaction File 3.6.1

Objectives

1 To create a magnetic tape file from a number of transaction types commonly used in a stock control system.

2 To provide the entry point to the I.C.T. SCAN System 2 operational routines.

Input

1 One or more batches of transactions (punched on either cards or paper tape) separated by batch control total records if desired.

Note: Subsequent programs in I.C.T. SCAN System 2 process the following list of transactions:

Audit requests

Stock adjustments

Stock receipt and scrap

Returns outwards

Unscheduled issues

Returns inwards

Replenishment order balance adjustments

Demands

Refer to: Chapter 4 for a description of these transactions, Chapter 5, for the record formats

Processing

Each transaction record is written to an output magnetic tape file after performing validity checks on the type of field content. At the same time a listing of each transaction is printed.

No transactions with an invalid transaction code will be accepted.

Batch control records, if present, will cause accumulated totals of the transaction codes and quantity fields to be printed, as well as the contents of the batch control record, before resuming the transaction listing.

Note: It is not necessary to sort transactions prior to processing; once the file has been created, standard I.C.T. Sort software may be used.

Output

1 Transaction magnetic tape file - see Section 5.5.

2 Transaction list - see Figure 10.

Peripherals

1 card or paper tape reader

1 magnetic tape unit

1 line printer

Source Language

PLAN 3

Notes:

1 Provision has been made within this program for a user to insert his own CHECKDIGIT subroutine for item numbers.

2 The presence of an asterisk on the list indicates an error in the transaction record. This record is not written to the output magnetic tape.

Sort

The Transaction magnetic tape file output from the previous program may be in any sequence. (See Section 5.6.10).

Standard I.C.T. Sort software may be used to sort the file according to the preferred sequence.

Provision has been made to allocate a priority code to each demand. This allows important demands to receive priority allocation, especially useful if the stock is limited. The highest assignable priority is 99.

Due date may be used also to assign priority allocation.

1 If due date overrides priority code (i.e. priority codes choose only between demands due on the same day) the Transaction file will be sorted to:

Item number/Transaction Code/Due date /Priority,

where the first key is the most significant.

2 If priority is to override the due date, even if the item is overdue and has already been back-ordered, both the Transaction file and Recirculating file (see next program) must be sorted to:

Item number/Priority Code/Transaction Code/Due date.

3 If priority code is not used it will be necessary only to sort the Transaction file by

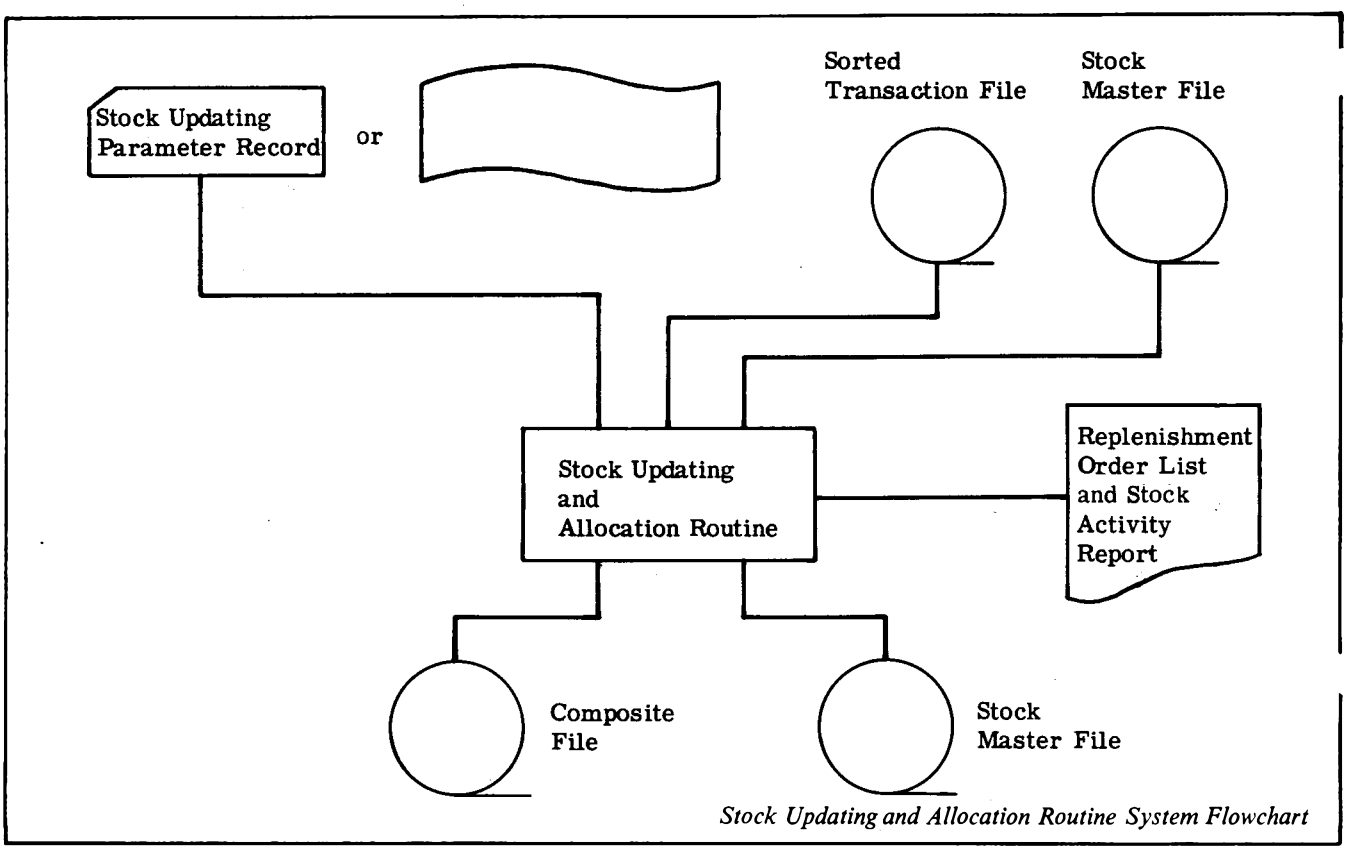
Item number/Transaction code/Due date.

All the above keys are ascending sequences except priority code which is descending sequence.

Merge

The sorted Transaction file may have to be merged with a recirculating Composite file (in the same record format). Standard I.C.T. Merge software may be used, and care must be taken that both files are in the same sequence. (See Section 5.6.11).

The magnetic tape file output from the 'Merge' will contain stock transactions in a sequence suitable for processing in the next program; see Stock Updating and Allocation Routine.



Stock Updating and Allocation Routine System Flowchart

Objectives

1 To update the stock position and maintain stock balances.

2 To allocate physical stock to each demand.

3 To issue a report of all stock items requiring replenishment.

4 To provide a link to other commercial system areas.

5 To provide the facility for a continuous stock audit on selected items.

6 To apply reorder point control to all stock items.

7 To provide control information on an exception basis.

Input

1 Stock Master magnetic tape file

2 Transaction magnetic tape file

3 Parameter record (punched card or paper tape) - see section 5.6.12.

Processing

Items are processed serially in ascending sequence of item reference number. One, or more, transactions may be in various sequences within each item number.

The normal sequence is:

Item number

Transaction code

Due date

Priority - although see section 3.6.2 for other possible sequences.

Unmatched records in the Stock Master are written to the updated Stock Master file unchanged.

Unmatched records on the Transaction file are notified by error message.

For each item the processing is as follows:

1 An audit request, Transaction Code '11', if present, is processed first. This will generate an output record on the Composite magnetic tape file, containing the 'counted' stock balance together with the file record on-hand stock balance. The priority code field is changed to '300' upon output.

Subsequent transactions for this item will be output with a priority code equal to '200' provided that the audit request is present. If an audit request is input with a priority code of '300', no further action is taken, except to write the record directly to output. However, all new transactions for that item will be processed and then output with a priority code equal to '200'.

A later user routines must extract all such audit records and associated transactions from the Composite file for reconciliation by the Stores Auditor.

Note: If the user fails to extract such records the recirculating Composite file will continue to collect transaction records affecting the item.

2 The following transactions, if present, will be processed next; but see reference to priority codes below:

Stock adjustment: (Code 12) - this will alter the stock-on-hand balance.

Stock receipt and scrap: (Code 13) - the quantity good will be added to the stock-on-hand balance and to the cumulative receipts balance and deducted from the stock-on-order balance. Scrap will be deducted from the stock-on-order balance and added to the scrap accumulator. One is added to receipts count for each receipts transaction.

Returns outward: (Code 14) - this is processed as though it were a negative receipt, except that receipts count is not adjusted.

Unscheduled issues: (Code 15) - this is deducted from the stock-on-hand and added to both the period demand accumulator and cumulative demand to date.

Returns inwards: (Code 17) - this is processed as though it were a negative issue (see Section 4.4.2).

Replenishment order adjustment: (Code 19) - this simply adjusts the stock-on-order balance.

After the above transactions have all been processed the stock position is ready for allocation, if required.

All of the above transactions, with the exception of Transaction Code 19, are output to the Composite file with certain data added from the Stock Master file record, and with the priority code set to '150' except where an audit request is present, in which case the priority code is set to '200'.

Note:

1 If the transaction was input with a priority code of '250' no processing is performed except to write the record to output unchanged.

The value '250' relates to transactions previously processed and also under 'audit' (hence recirculating).

2 If the transaction was input with a priority code of '150' no processing is performed except to write the record to output unchanged.

The value '150' relates to transactions previously processed.

These transactions should have been extracted subsequent to a previous update run.

3 Allocation is normally performed by processing back-ordered demands (Code 20) before normal demands.

Stock-on-hand is progressively reduced by the amount back-ordered, and, if the allocation is sucessful an allocated demand record is output to the Composite file. If partially successful, a switch is tested, set by parameter record, to determine whether all, or the unallocated portion of the back-order, should remain as a back-order.

If acceptable, the portion allocated is written to the output composite file as an allocated demand.

All stock allocated from back-orders will reduce the back-order balance.

After processing back-order records, demands (Code 21) are next progressively allocated stock by subtracting each quantity from the Stock-on-hand Balance and writing an Allocated Demand record to the Composite file. Exceptions are as follows:

(a) Where the due date is not yet within one lead time from the current date, in which case the demand is output to the composite file without allocation.

(b) Where the due date is within one lead time but further away than a time interval from the current date specified by an input parameter. If the second quantity field is zero the demand will be added to the Forward Demand Balance and the period demand accumulator.

This record would not be allocated but would be output to the composite file with the demand quantity copied into the second quantity field.

(c) Under the same conditions as (b) but with the second quantity field non-zero the record would not be allocated and simply written to the Composite file.

All such allocated demand records described above have a priority code of '150' and a transaction code changed to '18'. The period demand accumulator is updated if the second quantity field is zero, otherwise the amount in the second quantity field is subtracted from the Forward Demand Balance.

Exceptions to this are where the allocated demands affect an audit request, in which case the priority code becomes '200'. If an input Allocated Demand record (Code 18) is detected, it will simply be written to the Composite file.

Part shipment is allowed by option (see above), however, and when an Allocated Demand record is written to output the first quantity field contains the allocated portion of the total demand and the second quantity field contains the unallocated portion (if any).

Note: The first time a demand is back-ordered two output records are written:

(i) an Unallocated Demand record (Code 20).

(ii) an Allocated Demand record (Code 18) with the first quantity field equal to zero or the portion allocated and the second quantity field equal to the unallocated portion.

4 After updating and allocating stock the following control action is performed:

(a) If either stock on hand or stock on order is negative, an error report is printed and the field is zeroised. These conditions should be investigated by the user as they may indicate submission of an invalid transaction.

(b) For randomly ordered items, the re-order point or level is compared with the available stock (i.e. sum of stock-on-hand, plus stock-on-order, less back-orders) and, if the re-order point is lower, no action is taken. Otherwise, a replenishment order record is written to the output composite file and details printed on the replenishment order list.

Note: the normal replenishment order quantity is the system re-order quantity plus the re-order point less the available stock, increased by the scrap factor percentage.

A switch within the program (see parameter record) will allow ordering for those items selected for cyclical ordering, only during the time the switch is set. If the switch is set, for these items having an order interval count of zero an order is calculated which is equal to the reorder point minus the available stock. The order interval count is then set to minus one to inhibit further small orders in the same system time period. If the available stock is greater than the re-order point, no order is calculated but the count field is still set to minus one, since sufficient available stock exists to last until the end of the next order interval. Items selected for random ordering are not affected by this switch.

The computed re-order quantity is then compared with the minimum order quantity and, if less, the minimum order quantity is output. Otherwise, if the minimum order quantity is not unity, the computed order quantity is increased to an integer multiple of the former. The new order quantity is then compared with the maximum order quantity, and, if greater, is reduced to the latter. The excess quantity is noted on the replenishment order list as well as the amount actually ordered. The stock on order balance is increased by the order quantity finally output, but not the excess.

(c) Stock-on-hand less back-orders is then compared with the minimum stock level. If the former is greater than the latter no action is taken, otherwise an under minimum record is output to the Composite file. An under minimum record is also output if the available stock does not exceed the Forward Demand Balance, unless this balance is zero.

(d) If stock-on-hand is greater than the maximum stock level, an over maximum record is output to the Composite file.

After all items have been processed, a stock activity report is printed giving details of opening and closing balances and transactions within the headings - demands, new orders, receipts and scrap.

Notes:

1 Re-order point or level is the expected demand over the next replenishment delivery time (lead time) plus safety stock.

2 Re-order quantity is the expected demand over the subsequent replenishment order interval plus the re-order point less available stock - but see Appendix E.

Output

1 Updated Stock Master magnetic tape file

2 Composite magnetic tape file - see Section 5.5.5 - containing the following types of records.

Audit requests

Stock adjustments

Stock receipts

Returns outward

Unscheduled issue

Returns inward

Back-orders

Allocated demand

REPLENISHMENT ORDER LIST DATE 01/07/67 PAGE 1

ITEM NUMBER/ DESCRIPTION	CC	LC	S M	UOM	FORWARD DEMAND	STOCK ON ORDER	STOCK ON HAND	BACK ORDERED	REORDER POINT	ORDER QUANTITY	LOAD INDEX	LEAD TIME	SUPPLIER CODE
A001 CHARAPYNE	B1	01	2	CASE	10	68	482	0	642	492	2952.00	1.0	20064
A006 LASSIE LARGE	A1	01	2	CASE	0	15	132	0	228	201	1005.00	1.0	19588
A013 TRILL BUDGIE SEED SMALL	A1	01	2	CASE	0	11	168	0	193	158	711.00	1.0	18732
A019 PAL MEAT LARGE	A1	01	2	CASE	0	23	113	0	198	163	2037.50	1.0	19721
A028 STEWED STEAK IRISH 15 1/2 OZS	A1	01	2	CASE	48	38	372	0	481	125	2062.50	4.0	20122
A035 CREAM STERILISED NESTLES 4 OZS	A1	01	2	CASE	12	71	128	0	228	139	1772.25	1.0	18655
A048 SHAPES SPILLERS SMALL	A1	01	1	CASE	0	85	228	0	399	163	2200.50	2.0	19633
. . . . .	.	.	.	.	.	.	.	.	.	.	.	.	.
. . . . .	.	.	.	.	.	.	.	.	.	.	.	.	.
. . . . .	.	.	.	.	.	.	.	.	.	.	.	.	.

Figure 11 Stock Updating and Allocation - Replenishment Order List

STOCK ACTIVITY REPORT (BY VALUE) DATE 01/07/67

	TOTAL	STOCK ON HAND	STOCK ON ORDER	UNALLOCATED DEMAND
OPENING BALANCES		125281	9278	85
ADJUSTMENTS		32	85	
RECEIPTS AND ADJUSTMENTS	8871	8802	8871	69
NEW DEMAND	12382	12382		0
NEW ORDERS	6237		6237	
SCRAP	0		0	
CLOSING BALANCES		121733	6729	16

END OF RUN

Figure 12 Stock Updating and Allocation - Stock Activity Summary

Replenishment orders

Demand

Under minimum records

Over maximum records

3 Replenishment Order List
4 Stock Activity Summary
} see Figures 11 and 12

Peripherals

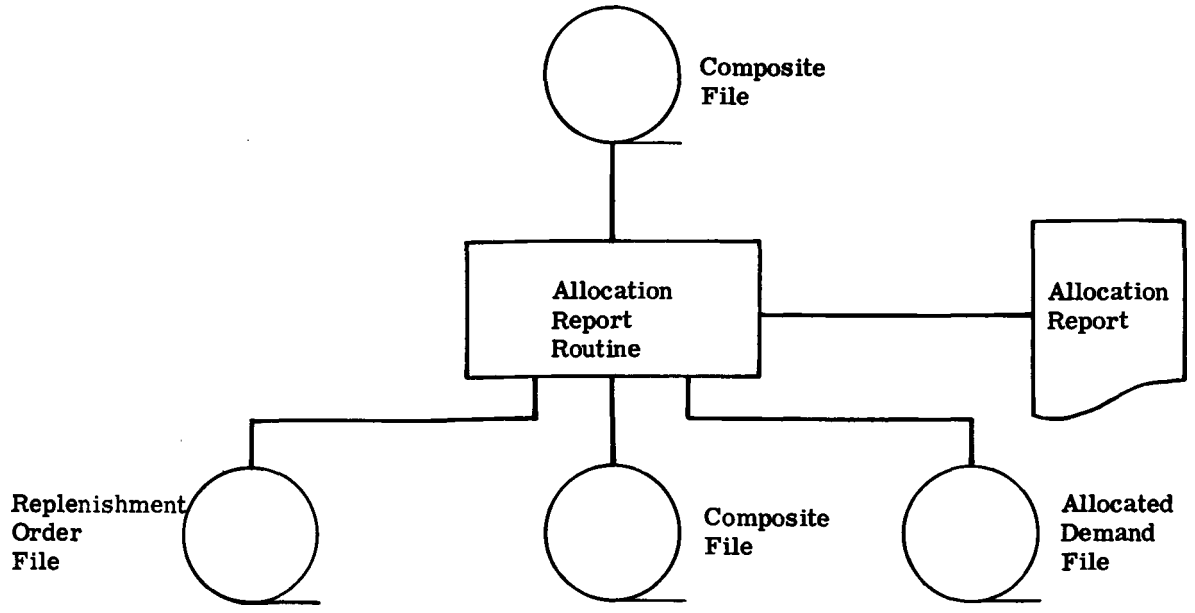
1 card or paper tape reader

4 magnetic tape units

1 line printer

Source Language

PLAN 3



Allocation Report Routine System Flowchart

ALLOCATION REPORT DATE 01/07/67 PAGE 1

ITEM NO	CLASS CODE	LOC	SYST MARK	UOM	DESCRIPTION	BACK ORDERED	ALLOC DEMAND	ORDER NO	DUE DATE	CUSTOMER CODE
A001	B1	01	2	CASE	CHARAPYNE		15	2789	04/07/67	87
A001	B1	01	2	CASE	CHARAPYNE		27	A371	04/07/67	23
A001	B1	01	2	CASE	CHARAPYNE		72	93182	07/07/67	59
							114			
A002	B1	01	2	CASE	SODA THAWPIT		28	5721	04/07/67	25
A002	B1	01	2	CASE	SODA THAWPIT		35	A371	04/07/67	23
A002	B1	01	2	CASE	SODA THAWPIT		15	9978	06/07/67	81
A002	B1	01	2	CASE	SODA THAWPIT		69	1281	07/07/67	59
							147			
A003	A1	01	2*	CASE	LEMON DRINK SUMMER GOLD		21	A371	04/07/67	23
							21			
A004	A1	01	2*	CASE	ORANGE DRINK SUMMER GOLD		87	A371	04/07/67	23
A004	A1	01	2*	CASE	ORANGE DRINK SUMMER GOLD		39	87132	06/07/67	61
A004	A1	01	2*	CASE	ORANGE DRINK SUMMER GOLD		18	2789	07/07/67	87
							144			
.	.	.	.	.	.		.	.	.	.
.	.	.	.	.	.		.	.	.	.
B008	A1	01	2	CASE	CHOC DROPS FOR DOGS		32	1681	04/07/67	31
B008	A1	01	2	CASE	CHOC DROPS FOR DOGS		76	9721	04/07/67	33
B008	A1	01	2	CASE	CHOC DROPS FOR DOGS	27	5	A371	04/07/67	23
B008	A1	01	2	CASE	CHOC DROPS FOR DOGS	35		8218	05/07/67	58
						62	113			
.	.	.	.	.	.		.	.	.	.
.	.	.	.	.	.		.	.	.	.

END OF ALLOCATION REPORT. NUMBER OF BACKORDERS 8. NUMBER OF ALLOC. DEMANDS 153. NUMBER OF ITEM NOS. 51.

An asterisk next to the System Marker denotes a seasonal item (see Section 5.5.3)

Figure 13 Allocation Report

Objectives

1 To print a list of all demands allocated and unallocated during the previous Stock Updating and Allocation program.

2 To provide an entry point to invoicing/credit note procedures.

3 To provide an entry point to purchase order control procedures.

Input

Composite magnetic tape file, output from Stock Updating and Allocation routine.

Processing

The Composite magnetic tape file is scanned and all replenishment order records (Transaction Code 23) are written to an output magnetic tape file.

Similarly, all Allocated Demand records (giving details of both allocated and unallocated demands) are both printed and written to a further magnetic tape file (Transaction Code 18). All unscheduled issues (Code 15) and returns inward (Code 17) are written to the same output file for invoicing procedures.

Exceptions to this are:

1 Where the incoming records have a priority code of '250'. No action is taken except to write the records to an output Composite magnetic tape file.

2 Where the incoming records have a priority code of '200' (denoting new records with an audit request present). In this case the records are processed as above and, in addition to writing the records to an invoicing tape, identical records are written to the Composite tape file. All other records with transaction codes other than 15, 17, 18, 23 are written directly to the output Composite magnetic tape file.

Output

1 Composite magnetic tape file excluding replenishment orders (Code 23), Allocated Demands (Code 18), Returns Inward (Code 17), and unscheduled issues (Code 15). (See Processing, paragraphs (1) and (2).)

2 Allocated Demand magnetic tape file - see Section 5.5.5 - containing Allocated Demands (Code 18), Returns Inward (Code 17), and unscheduled issues (Code 15).

3 Replenishment Order magnetic tape file - see Section 5.5.5.

4 Allocation report - see Figure 13.

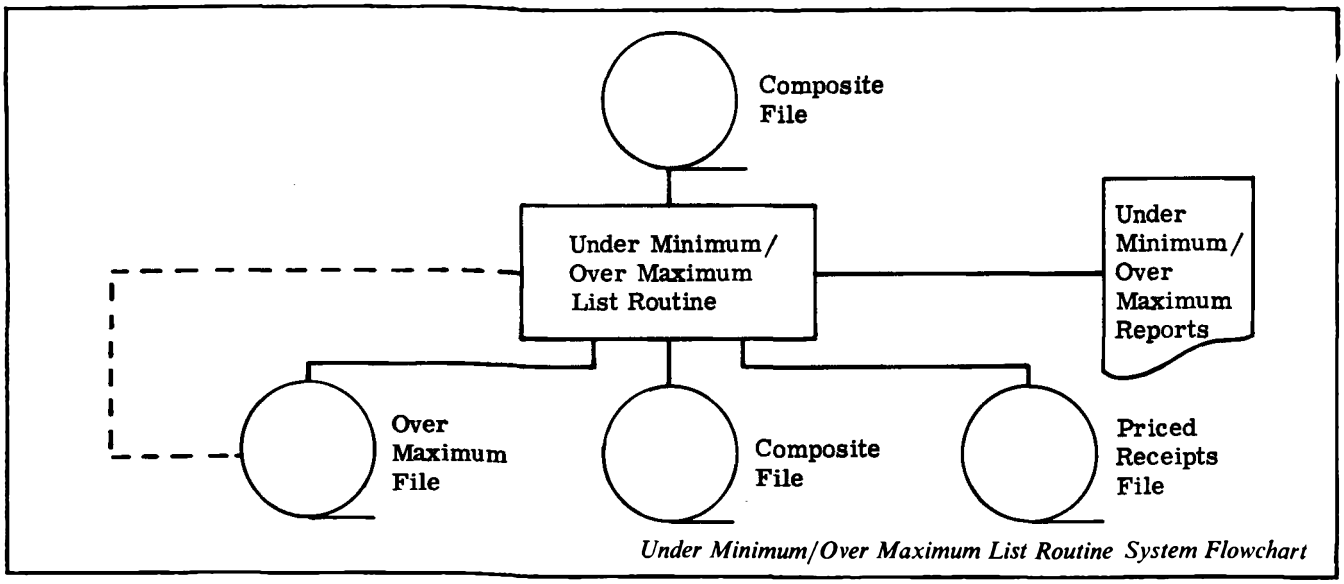
Peripherals

4 magnetic tape units

1 line printer

Source Language

Compact COBOL



Under Minimum/Over Maximum List Routine System Flowchart

STOCK UNDER MINIMUM LIST — DATE 01/07/67 — PAGE 1

ITEM NO	CLASS	LOC CODE	SYST MARK	UOM	FORWARD DEMAND	STOCK ON ORDER	STOCK ON HAND	BACK ORDERED	MINIMUM STOCK	FREE STOCK	STOCK VALUE	LEAD TIME	SUPPLIER CODE
B008 CHOC DROPS FOR DOGS	A1	01	2	CASE	80	327	0	62	0	265	0	2.0	19633
C831 SPECIAL MILK NESTLES 1 3/4 PTS	A1	01	2	CASE	23	83	0	8	0	75	0	1.0	18721
C937 BONIOS SPRATTS SMALL	A1	01	2	CASE	0	15	0	1	0	14	0	2.0	19635
E811 TIDYSAN 17 X 11	B1	01	2	CASE	0	39	0	15	0	24	0	1.0	15283
G008 TEA TYPHOO	B2	01	2	CASE	0	8	0	2	0	6	0	2.0	16211
K117 MIXED OVALS SPRATTS SMALL	B3	01	0	CASE	8	15	0	3	0	12	0	2.0	19635
.	.	.	.	.	.	.	.	.	.	.	.	.	.

END OF LIST. NUMBER OF ITEMS 38. — TOTAL STOCK VALUE 0

Figure 14 Under Minimum Stock Level Report

STOCK OVER MAXIMUM LIST — DATE 01/07/67 — PAGE 1

ITEM NO	CLASS	LOC CODE	SYST MARK	UOM	FORWARD DEMAND	STOCK ON ORDER	STOCK ON HAND	BACK ORDERED	MAXIMUM STOCK	FREE STOCK	STOCK VALUE	LEAD TIME	SUPPLIER CODE
A003 LEMON DRINK SUMMER GOLD	A1	01	2*	CASE	69	483	528	0	500	1011	580	2.0	18971
A014 WINALOT LARGE	B3	01	0	CASE	10	61	291	0	250	352	262	3.0	20638
C008 NESCAFE SACHETS	A1	01	2	CASE	8	10	1093	0	1000	1103	2295	1.0	17833
D801 TIDYSAN 13 X 10	A1	01	2	CASE	83	58	758	0	750	816	303	1.0	16560
P101 TOP CAT HANDY	A1	01	2	CASE	88	30	501	0	500	531	451	1.0	20086
.	.	.	.	.	.	.	.	.	.	.	.	.	.

END OF LIST. NUMBER OF ITEMS 27. — TOTAL STOCK VALUE 13873

Figure 15 Over Maximum Stock Level Report

Objectives

1 To print a report of all items whose physical stock less back-orders is equal to or less than a minimum stock level or whose available stock is less than the Forward Demand.

2 To print a report of all items whose physical stock is greater than a maximum stock level.

3 To provide an entry point to receipt costing routines.

Input

Composite magnetic tape file (output from previous program - allocation report).

Processing

The Composite file is scanned and all 'over maximum' records (Code 25) are written to an output magnetic tape. Similarly, all Receipts (Code 13), Stock Adjustments (Code 12) and Returns Outward (Code 14) are written to another magnetic tape as an entry point to costing procedures.

Under Minimum Stock Level records are printed (Code 24).

If input records with a priority code of '250' are detected, they are written to an output Composite magnetic tape file, unprocessed.

In the case of records written to the costing tape, if they have a priority code of '200', identical records are written to the output Composite tape but with the priority code changed to '250'.

Other records with a priority code of '200' are written to the output Composite tape with the priority code changed to '250'.

All input records with the exception of Transaction Codes 24, 25, 12, 13, 14 are written directly to the output Composite tape.

After processing the input Composite file, the magnetic tape containing the Over Maximum Stock Level items is rewound and a list printed giving details of each record.

Output

1 Over Maximum Stock Level Items magnetic tape file - see Section 5.5.5.

2 Priced Receipts magnetic tape file - see Section 5.5.5.

3 Composite magnetic tape file, excluding Receipts (Code 13),

Stock Adjustments (Code 12),

Returns Outward (Code 14),

Under Minimum records (Code 24),

Over Maximum records (Code 25),

(see Processing).

4 Under minimum Stock Level report

5 Over Maximum Stock Level report

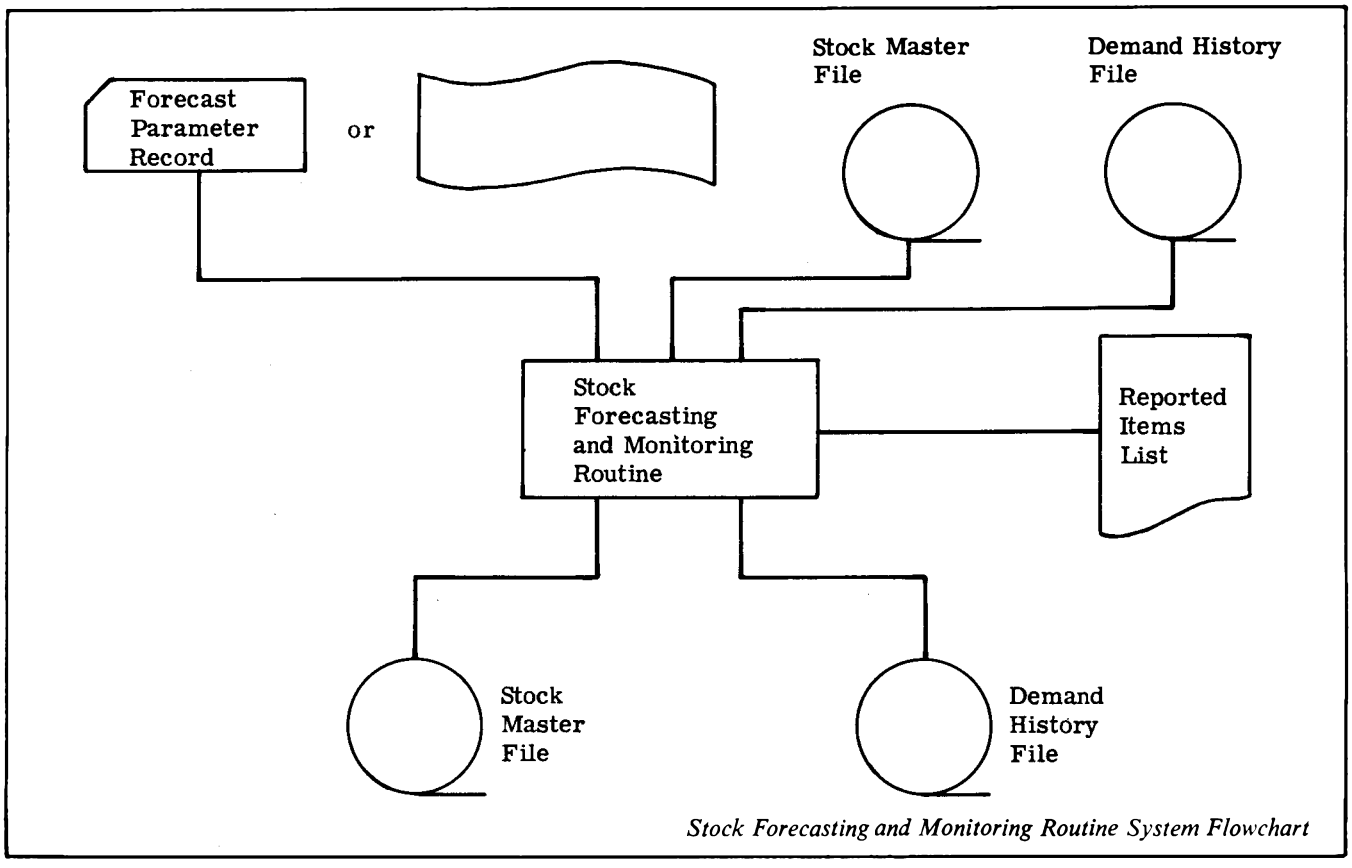
Peripherals

4 magnetic tape units

1 line printer

Source Language

Compact COBOL



Stock Forecasting and Monitoring Routine System Flowchart

REPORTED ITEMS LIST DATE 01/07/67 PAGE 1

ITEM NUMBER	DESCRIPTION	STOCK ON HAND	STOCK ON ORDER	DEMAND LAST PERIOD	FORECAST LAST PERIOD	FORECAST INTERVAL	SYSTEM MARKER
A007	LASSIE SMALL	408	15	381	128	1	2
A011	SWOOP WILD BIRD FOOD	159	97	126	69	2	2
A018	KIT-E-KAT HANDY	188	45	187	45	1	2
B008	CHOC DROPS FOR DOGS	0	327	178	108	1	2
C001	NESCAFE 4 OZS JAR	101	49	120	83	1	2
D002	NESQUICK STRAWBERRY 8 OZS	587	87	382	148	1	2
D801	TIDYSAN 13 X 10	758	58	487	351	1	2
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.

END OF RUN

Figure 16 Stock Forecasting and Monitoring - Reported Items List

Objectives

1 To estimate future demands for items selected for variable re-order point control.

2 To recalculate the re-order point and re-order quantities for items selected for variable re-order point control.

3 To monitor the variable re-order point systems performance and provide control information.

4 To update demand history.

Input

1 Demand History magnetic tape file containing all necessary fields to produce period ahead demand forecasts.

2 Stock Master magnetic tape file containing updated stock positions from previous Stock Updating and Allocation runs.

3 Forecast Parameter record - see section 5.6.13.

The following management parameters are held in this record:

(a) *Four customer service levels:* chosen by Management (expressed as percentages) and their associated factors (*K*) (see Appendix A). The appropriate service level factor is related to the service level group field in the Demand History file item record.

(b) *Ordering cost selected:*

(c) *Investment rate:* (expressed as a percentage) selected.

(d) *The investment rate:* (as (c) for each of ten investment rate groups - any one of which may be held in the Demand History file item record.

Notes:

1 Parameters (b) and (c) are used as 'blanket' values in the formula for economic order quantities. If (c) is set to zero, parameter (d) is used provided that the ordering cost field in the item record is not zero, otherwise no economic order is computed for that item.

2 If the parameter (c) is non-zero, parameter (d) is not necessary and the third card or paper tape block (see Section 5.6.13) is omitted.

Processing

Unmatched item records on the input Stock Master file are written directly to an output Stock Master file.

Unmatched item records on the input Demand History file are notified by error message and written directly to an output Demand History file.

For all matched item records processing depends upon the control system marker present in each record as follows:

1 *System Marker value '0':* fixed re-order point, random ordering. The only processing performed is to place the period demand from the input Stock Master file item record in the demand history array held on the output Demand History file - item record and update the series length, closing stock, non-move count and ordering interval count.

2 *System Marker value '2':* variable re-order point, random ordering, single exponential smoothing.

(a) All system control counts are updated, e.g.

Forecast interval count
Cycle base count } increased by 'one'
Non-move count (if necessary)

Ordering interval count - reduced by 'one'.

(b) The demand array length (series length) is updated and the latest demand placed in its correct position in the demand array (as 1 above).

(c) The closing stock-on-hand is transferred from the input Stock Master to the output Demand History item record.

If the forecast interval equals the forecast interval count the following fields are updated:

(d) Smoothed forecast error

(e) Smoothed mean absolute deviation of errors

(f) The tracking signal is calculated and compared against statistical limits (see Appendix D).

If the limit is exceeded, details are printed in the Reported Item list.

(g) The next period's forecast of demand is computed using single exponential smoothing.

(h) The new re-order point is calculated, using the input parameter customer service level appropriate to the item. Decimal parts of the re-order point are rounded up to the next integer.

(i) An order quantity is computed based on the demand forecast extrapolated over the order interval, and considering seasonal factors, if appropriate, (statistical order quantity) Input parameter (b) is examined. Decimal parts of the re-order quantity are rounded up to the next integer.

If zero, the ordering cost field in the item record is examined, if this is zero also, no economic order quantity is calculated and the previously calculated statistical order quantity is output.

If either ordering cost field is non-zero an economic order quantity is computed using either:

(i) the input parameter (c) - as the investment rate for the item (blanket value for the whole inventory), or, if this value is zero,

(ii) the value of input parameter (d) corresponding to the investment rate group for that item.

The greater quantity, of either economic order or statistical order, is output as the system re-order quantity.

3 *System Marker value '3':* variable re-order point, random ordering, moving averages.

(a) Processing is as for system marker '2' above, up to and including 2(c).

(b) Monitoring is effected by comparing demand to the old forecast and reporting the item if the new demand exceeds three times this value.

(c) The next period's forecast of demand is computed using the moving average technique with a time base held in the factor one field.

(d) The new re-order point is calculated, allowing for safety stock by increasing the lead time by the extra period held in the factor two field.

(e) Processing continues as for 2(i).

4 *System Marker value '5':* fixed re-order point,

cyclical ordering.

Processing is identical to system marker '0' above.

5 *System Marker value '7':* varaible re-order point, cyclical ordering, single exponential smoothing.

Processing is identical to system marker '2' above except that the re-order calculation is based on the extrapolation of the period ahead demand forecast over the lead time plus the ordering interval, and the re-order quantity is set to zero.

6 *System Marker value '8':* variable re-order point, cyclical ordering, moving averages.

Processing is identical to system marker '3' except that the re-order point and the re-order quantity are identical to system marker '7'.

It may be adviseable at the start of operational running to initialise the Stock Master file using the forecast routine. This ensures that a reorder point and a reorder quantity are present on the Stock Master file for all forecast items, before stock updating is attempted. These parameters are estimated either from the deseasonalised forecast entered by the user on creation of the Demand History file, or from the most recent demand history. If the user has entered his own estimates of reorder point and quantity for any item, these will not be altered by initialisation. If entries have been made for all items, the initialising run is not necessary.

Output

1 Updated Stock Master magnetic tape file

2 Updated Demand History magnetic tape file

3 Reported Items list - see Figure 16.

Peripherals

4 magnetic tape units

1 card or paper tape reader

1 line printer

Source Language

PLAN 3 and 1900 FORTRAN

Notes:

1 Either moving averages or single exponential smoothing may be used for forecasting demand; these two techniques cannot be used together.

2 If the factor one field is blank or zero following file creation, this program assumes 0.1 as the value for those items selected for control using exponential smoothing and 12 for the time base used for calculating the moving averages.

Chapter 4 System Implementation and Integration

GENERAL 4.1

Where the file formats used by this system are acceptable to the user, the programs may be used unmodified.

It will be necessary for the user to write the programs required to complete an integrated system and a later section in this chapter will suggest a possible system method.

Total integrated business system concepts may be such that a user may prefer to write all the programs to suit his needs, whilst still using the logic contained in this manual.

The rest of this chapter will deal with problems of data collection, basic data required, suggested starting values, internal and external system relationships and operational control.

DATA COLLECTION 4.2

A major problem associated with implementing a new system is data collection.

There is, in general, no easy solution to this problem.

The record formats provided for Master File creation in this sytem are subdivided so that each relevant department within the business may provide its own data as follows:

Stock Master File: normally the first file created for an operational system.

The punching document for this file is designed such that the Stores, Purchasing and Sales departments may each add data to the document - see Figure 20.

Demand History File: Required for Analysis and Forecasting

The punching document for this file is designed so that generalized item details are recorded in one area.

Supplementary item data, demands, seasonal factors are each recorded in other areas and, furthermore, need not be present if no data is available.

Transaction File: Required for Day to Day Stock Transactions.

Each transaction type is recorded on a separate record with a common format so that only one punching document is required. The transaction code identifies the type of transaction - see Section 5.3.

If no demand data is available, analysis cannot be performed until sufficient demand data has been collected. The Stock Forecasting routine may be used to collect demand data provided that the necessary record is created on the Demand History file.

How much data is required depends upon circumstances, although at least one year's demand data should be available for a valid ABC Analysis. This does not preclude the user from submitting less than one year's data and the program provides average annual results.

Collection of sales (or preferably demand) figures, etc, will be a greater or lesser problem depending upon the business and it is not intended to discuss this area in this manual.

BASIC DATA 4.3

(a) For an initial analysis of demand history the following fields are required in the item records forming the Demand History file.

Record length

Item number

Cost price

Sales price

Closing stock-on-hand (optional)

Demand history length (series length)

Demand history

* Description

Unit of measure

* Class code

Note If closing stock-on-hand is not provided, the Stock Profile list, etc., will print zero against the heading Stock Quantity and Stock Value.

Those fields marked '*' are for reference purposes and may be omitted.

(b) After analysis, the new class code, forecast interval and system marker for each item is transferred to the appropriate master files - see Chapter 3.

For those items selected for variable re-order point control using either single exponential smoothing or moving averages as the forecasting technique, the following values are suggested for initializing the system:

Field	*Initial Value*
Forecast interval (if analysis is not performed)	1
Cycle base (length of season)	(i) 1 for non-seasonal items, and (ii) one year (i.e. 12,13 or 52 for seasonal items, depending on the time units in which demand is aggregated. (Calendar month, 4 week period, or week.)
* Seasonal factors (seasonal items only)	Computed by Management on the basis of past experience or 'weighted' to account for expected future market activity.
** Factor One	Demand Pattern:

	Seasonal	*Trend*	*Other*
Single Exponential Smoothing:	0.3	0.3	0.1
Moving Averages:	Quarterly (13) for weekly data Annually (12, 13) for monthly data		

Factor Two	Selected by Management to extend the lead time to give extra order cover (for safety stock) - moving averages only
Deseasonalized Demand Forecast	Latest demand or best estimate
System Marker	Selected to apply control to each item as defined in Section 3.5.3
Re-order point	(i) An estimate of expected demand over the next lead time plus an allowance for safety stock - in the case of random ordering. (ii) An estimate of demand over the next lead time plus ordering interval with an allowance for safety stock - in the case of cyclical ordering.
Re-order quantity	(i) An estimate of the expected demand over the subsequent ordering interval in the case of random ordering. (ii) Zero in the case of cyclical ordering

Notes

1 '*' see appendix B for a suggested method of calculating seasonal factors.

2 '**' If seasonal factors represent the contours of the season reliably, a low value of Factor One will give acceptable results in computing a forecast of demand. If a higher value is used, the system may become over-sensitive and respond rapidly to any minor change in the demand. This is especially serious if the lead time is long relative to the forecasting interval.

If seasonal factors are badly in error the forecast is completely swamped and the item would undoubtedly appear on the Reported Items list.

In the case of trend items a lag will occur using either forecasting techniques described above.

A high value of Factor One using single smoothing will tend to track the actual demand more closely, although, again, the system will respond quickly to minor fluctuations in demand. For a relatively small lead time/forecast interval ratio (say 4 to 1), the forecast error may be satisfactorily compensated for in the safety stock element of the reorder point.

(c) Lead times. If lead times (or replenishment delivery times) are fixed or firmly promised, then the value appropriate to a given supplier for that item is used. More often, lead times are variable.

There are three suggested approaches to this problem:

(i) Use the maximum known lead time.

(ii) Perform a distribution (or frequency) analysis of the lead time history and compute a value corresponding to one or two standard deviations above the mean value (see below).

(iii) Smooth the lead time history and produce a lead time forecast.

The first choice may give rise to higher stock holdings depending upon the difference between the highest and lowest values of the lead time but will increase the customer service level. Where there is wide variation in lead times, the second choice is suggested, i.e. one standard deviation above the mean value of the distribution is equivalent to saying that approximately 84% of all lead times encountered in practice will be covered by this value. Similarly, two standard deviations added to the mean will cover up to 97.5% of all lead times. This method therefore eliminates the extremely long lead time from consideration.

Note: The percentages will differ for a non-normal distribution but generally the method is acceptable for most distributions.

For the third method the user would have to write a program to 'smooth' the lead time history if sufficient 'current' data warranted that action. The uncertainty associated with any forecast applies equally in this case.

INTERNAL SYSTEM RELATIONSHIP 4.4

The analysis routines require only one magnetic tape file - the Demand History file - although if automatic control system selection is used, the Stock Master file is required.

The operational routines in addition require the Stock Master file to be created initially and a Transaction file to be created prior to each stock updating. All other files used in the system are generated by the relevant programs on a routine basis.

Figure 17 indicates the sequence of routines for both analysis and operation of the system.

Chapter 2 describes the use of each program in general terms but the following notes may be regarded as useful supplementary comments.

File Creation Routines: the programs are described in Chapter 2 together with the input record formats in Chapter 5.

A comprehensive Master File Create/Maintenance program is provided and the only function which requires extra careful attention is the 'AMEND' function. It is absolutely imperative that the correct field location reference (word number) is used.

Irrespective of the type of inventory control system to be established these programs improve on the traditional ABC Analysis since they pay regard to the frequency of movement of each item. Annual usage value has always been a valuable criterion to guide selection of the stores items first to be subjected to a computer based system of inventory control, but it is the fast moving items that will respond soonest to control action. It is better, therefore, to use frequency of movement and annual usage value as joint criteria in the making of this selection.

It is recommended that variable reorder point control be applied only to those items with a frequency of movement of at least one demand in eight weeks. This limit corresponds to a forecast interval of four weeks.

If weekly demand data are presented to the Stock Profile Analysis program, the first selection will, therefore, be those items with recommended forecast intervals of 1, 2 and 4. The Frequency Analysis table shows what this means in terms of annual sales (or usage value), gross margin and stockholding values relative to the total of items included for analysis.

The demand history presented to the Stock Profile Analysis program should refer to a constant number of demand points if possible, so that all items are comparable, although the program will pro-rate the annual demand in any case.

The Stock Profile Analysis may be used to review the control performance by comparing reports produced during the previous analyses. This comparison shows:

1 how the balance of stock-holding has changed in relation to annual sales value,

2 how the stock turnover ratio has changed for each section of the inventory,

3 how the stockholding and number of non-moving or slow-moving items has changed.

The ABC Analysis program provides the user with a preliminary analysis table in 5% steps to enable a close estimate to be made of the desired high and medium usage value groupings.

Having thus established classes of inventory items based on the combination of usage value and frequency of movement, the user may then apply automatic control system selection based on the following suggested table:

Class	*System Marker*	
	Random Ordering	*Cyclical Ordering*
A1	2	7
A2	2	7
A3	0	5
B1	2	7
B2	2	7
B3	0	5
C1	0	5
C2	0	5
C3	0	5

Note: System marker '3' (moving averages) may be used instead of '2' (single exponential smoothing); similarly, for cyclical ordering, system marker '8' may be used instead of '7'.

Operational Routines 4.4.2

Transaction File Creation:

Data for each transaction type (see Section 5.3) is punched into a separate record, which contains two quantity fields.

Both these fields may not always be used but each may in some cases be negative. The negative sign is contained in the first character position of the field, a space indicating a positive figure. All the fields used in SCAN System 2 are right-justified unless otherwise stated.

Only integer values are allowed for quantities.

The date is always punched as day, month, year and is converted in this program to year, month, day in two words, right-justified.

Priority codes will only be used in Demands (transaction Code 21). All other transaction types will be output on magnetic tape with a priority of 100 except for Audit requests (transaction Code 11), which will have a priority code of '200'. In the case of a blank priority code field in the Demand transaction, zero will be assumed.

Batch control records may be used, but must be in the same record format as the transactions. (see Section 5.3).

Audit Requests: (Transaction Code 11). If a system of continuous stock auditing is used it is highly likely that the time at which the stock is counted is not coincident with the time at which stock is balanced in the Stock Updating routine.

If a transaction affecting the stock balance occurs between the two times, the stock count will not agree with the computer balance. The two figures must then be reconciled by the stores auditor. To assist this the system will output a file of transactions covering the period of time between the stock count and the nearer balancing date or time.

It is assumed that the stores auditor will draw up a list of items to be checked between successive updatings. This list could be drawn up in arrears provided that the list is available in time to feed details to the Stock Updating run immediately following the stock count of the selected items.

The presence of an audit request will cause the system to circulate all transactions affecting the stock of that item. Normally, these transactions would be removed from the system before entering the next stock updating run, although the system caters for items recirculating.

If the user does not wish to use this facility no audit request will be submitted.

Stock Adjustment: (Transaction Code 12) If the stock-on-hand balance is found to be in error for any reason, a stock adjustment card may be used to correct the balance (possibly following an audit).

Stock Receipt and Scrap: (Transaction Code 13) A receipt (i.e. quantity good of a total receipt) is recorded in the first quantity field. However, if any quantity is rejected for replacement or rework, this quantity will be punched as scrap in the second quantity field only if it is desired to record the rejects in the Stock Master file or if it helps the user Invoice Checking routines. If this is so recorded, an Order Adjustment record (Transaction Code 19) must be raised from the documents returning the rejects to the supplier.

If the above requirements do not apply, the quantity rejected will be omitted and only the good stock recorded and any genuine scrap which will not be replaced.

Returns Outward: (Transaction Code 14) This transaction will be used for items in stock which are returned to the supply source for some reason. It will not be used for rejects which have not been posted as receipts.

Unscheduled Issue: (Transaction Code 15) When unplanned stores issues are made or where an issue is made urgently and the normal system is bypassed, the Stock Master record must be updated in arrears.

The transaction will still be treated as a demand for preposting except that the allocation of stock will be assumed successful.

Returns Inward: (Transaction Code 17) This transaction is treated as though it was a negative issue, but will update both the stock-on-hand and the cumulative demand to date, unless the second quantity field is non zero, in which case it will also update the period demand accumulator. Normally, it will be used only to record the return of an unscheduled issue or the return of goods from a customer for credit.

If the goods were returned for replacement and are to be scrapped a Stock Adjustment record (Transaction Code 12) must also be prepared to write the goods off and be available for the user costing routine.

If the original demand was received in a previous period, the second quantity field will be left blank.

If it is necessary to correct the demand history this will be effected by use of the File Maintenance program.

Replenishment Order Balance Adjustment:(Transaction Code 19) This will simply be used to adjust the stock on order balance for a given item. It may be created directly or as a result of a user's Purchase order procedures.

Demands:(Transaction Code 21) These records represent new demands, which may or may not be required for immediate allocation.

There is a facility provided (see Section 3.6.3) to enable the user to specify a time interval (from the current date) which will allow all demands with a due-date coming within this time interval to be allocated stock.

Demands not due for allocation are classed as:

(a) forward demands if their due date is beyond the time interval specified but within a lead time from the current date;

(b) future demands if their due date falls outside the lead time plus current date.

As stated elsewhere, the transactions are written to a magnetic tape file in the sequence in which they are presented, and a subsequent sort places the records in the sequence for further processing.

Stock Updating and Allocation.

As stated, not all demand is for immediate satisfaction and, where this occurs, the issue must not be pre-posted until the item is due for despatch. It is, however, desirable to know this future commitment and, where demand is forecast automatically to set the re-order level, this demand should be recorded as soon as it is received. Demand should, therefore, be advised to the system as soon as it is known.

When the demand becomes due it will automatically be deducted from the Forward Demand Balance and be available for immediate allocation.

The stores handling time varies from user to user. If, for example, it takes on average three days to service a demand, a demand due in three days time must now be allocated and pre-posted as an issue if stock is available, or back-ordered if stock is not available.

This facility may also be used for manufacturing order control. Constituent requirements for planned manufacture may be fed to the Stock Updating program as forward demand. Stock will be allocated for all demands for, say, the next 14 days and shortages reported as back-orders.

To avoid the inclusion of very long term demand in the Forward Demand Balance, a forward demand will be ignored until the due date is within one lead time from the current date. However, the demand will be recirculated on magnetic tape until action is required.

Unallocated demands are the due and overdue demand which cannot be met from stock and which have, therefore, been back-ordered.

Transaction records for back-orders will be recirculated until stock is received and the demands can then be met.

A user option (specified by parameter) decides if part shipment is permitted. If it is, all physical stock available will be allocated to the demand as it is received. If part shipment is not allowed, stock will be allocated only if the demand may be satisfied in full.

Stock-on-order is the total quantity of outstanding orders to replenish the stock. Orders are requisitioned by the system automatically and will be assumed to be placed immediately. Any variation in quantity between that requisitioned and that actually ordered must be reported to the system as soon as possible. The same remarks apply if there is likely to be a serious delay in placing the order.

The total quantity received will be assumed to be in satisfaction of outstanding orders, i.e. all rejects will be assumed to be scrapped. Any rejects returned for replacement, or re-work, must be re-entered to the system by means of an Order Adjustment.

If more is received than the quantity ordered, the order balance will be understated and may go negative. If the excess quantity is accepted, an Order Adjustment must be entered to correct the order balance (unless the excess is credited to a following order). Similarly, if less that the quantity ordered is accepted in full satisfaction of the order, an Order Adjustment must be entered to clear the balance of that order from the order balance in the Stock Master record.

The period demand accumulator accepts all demands due within one lead time from the current date. Periodically, by use of the Forecasting routine, this accumulated demand is entered into the Demand History file and the accumulator zeroized.

Other Balances are as follows:

Cumulative Receipts to date: all receipts less returns outward are added to this accumulator. It is available to the user in conjunction with the Scrap Balance.

Cumulative Scrap to date: this is used to accumulate the total scrap reported when goods are received.

Cumulative Demand to date: this records the total demands and unscheduled issues since the accumulator was last zeroized.

Cumulative Back Orders to date: read in conjunction with the cumulative demand it gives one indication of customer service.

Receipt Count: incremented by one every time a receipt occurs.

Back Order Count: incremented by one every time a quantity is added to the cumulative back order accumulator.

Non-move Count: incremented by one each time the Demand accumulator is transferred to the Demand History file, provided the balance is zero.

Note: The user must zeroize the last seven balances at the appropriate time.

Allocation Report Routine and Under Minimum/Over Maximum Report Routine

Two programs supplementary to the main Stock Updating routine are used to provide control information and entry points to other system areas.

A composite magnetic tape file output from the stock updating run contains the results of the processing which are progressively 'split-off' to the reports and entry points (see Chapter 3). This file is finally recirculated back into the system containing back-orders, forward and future demands and possibly audit records (if not extracted).

Stock Forecasting and Monitoring Routine

Three basic methods of control are permissible:

1 Variable re-order point and variable re-order quantity using moving averages for demand forecasting.

2 As above but using exponential smoothing (single point) and arbitrary smoothing constants.

3 Fixed re-order point, fixed re-order quantity.

Any of these systems may operate with cyclical ordering. In this case the re-order point cover will be increased each time to a lead time plus an ordering interval.

The function of this routine is to make a forecast of demand for the next time period for those items selected for variable re-order point control. Re-order points and quantities are then adjusted to consider the new rate of demand.

To provide some measure of control over the forecasting efficiency an automatic monitoring feature is built into the system.

If exponential smoothing is used to forecast demand, the safety stock (and hence customer service) is computed to consider the forecast errors.

Similarly, the re-order point contains the safety stock allowance determined from the service level desired by Management. The system order quantity may be based on the demand forecast extrapolated over the ordering interval (considering seasonal factors) or it may be an economic order quantity computed to conform to parameters set by Management.

Monitoring is based on calculating a tracking signal from the forecasting errors and comparing it with pre-set limits (see Appendix D).

If moving averages are used a simple approach is used to determine the reorder point - safety stock. In this case a time interval is added to the lead time to increase the order cover - specified by Management - see Appendix A.

Monitoring is effected by reporting if demand is equal to or greater than three times the forecast.

Fixed reorder points and quantities will be decided by Management and entered during File creation/ maintenance.

All items held on the Demand History file will automatically collect demand data from the Stock Master file during the program.

If the forecast results in the available stock falling to or below the new reorder point, it may be necessary to run the Stock Updating routine with no Transaction file present in order to generate new replenishment orders. This is only necessary if considerable time elapses between the Stock Forecasting run and the next Stock Updating run.

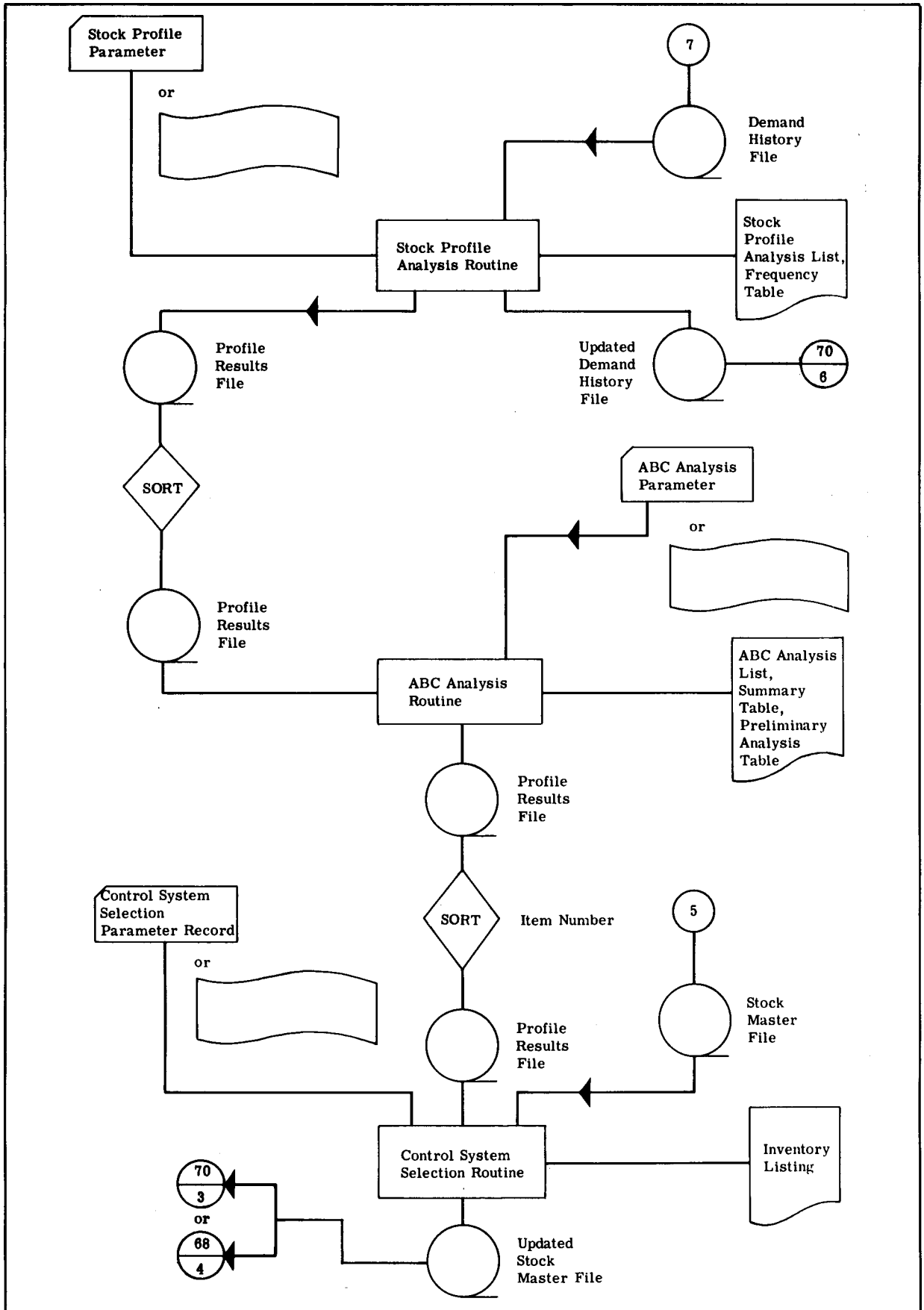


Figure 17 (a) I.C.T. SCAN System 2 Interrelationship of Routines - Analysis

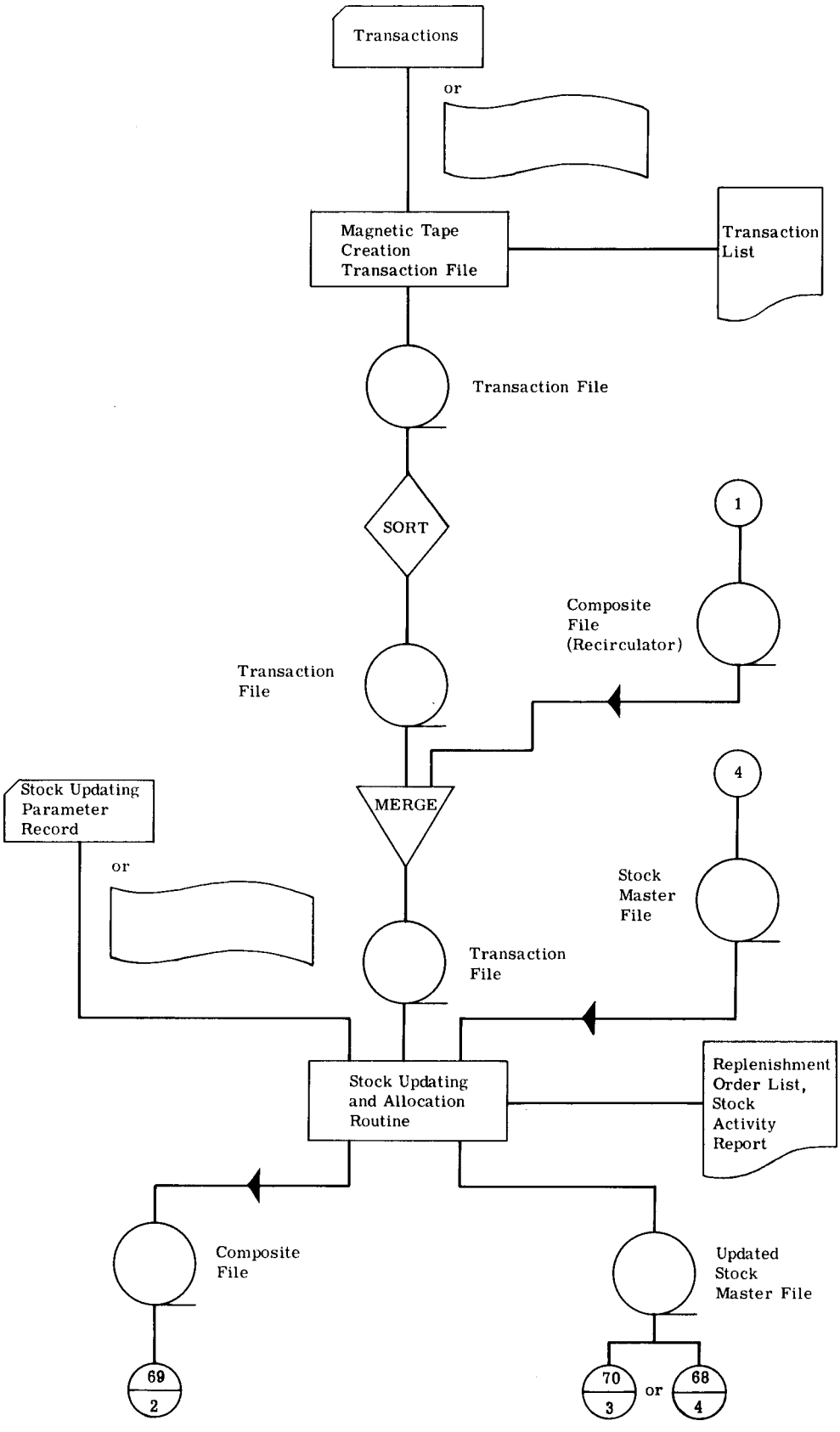


Figure 17 (b) I.C.T. SCAN System 2 Interrelationship of Routines - Stock Updating and Allocation (1)

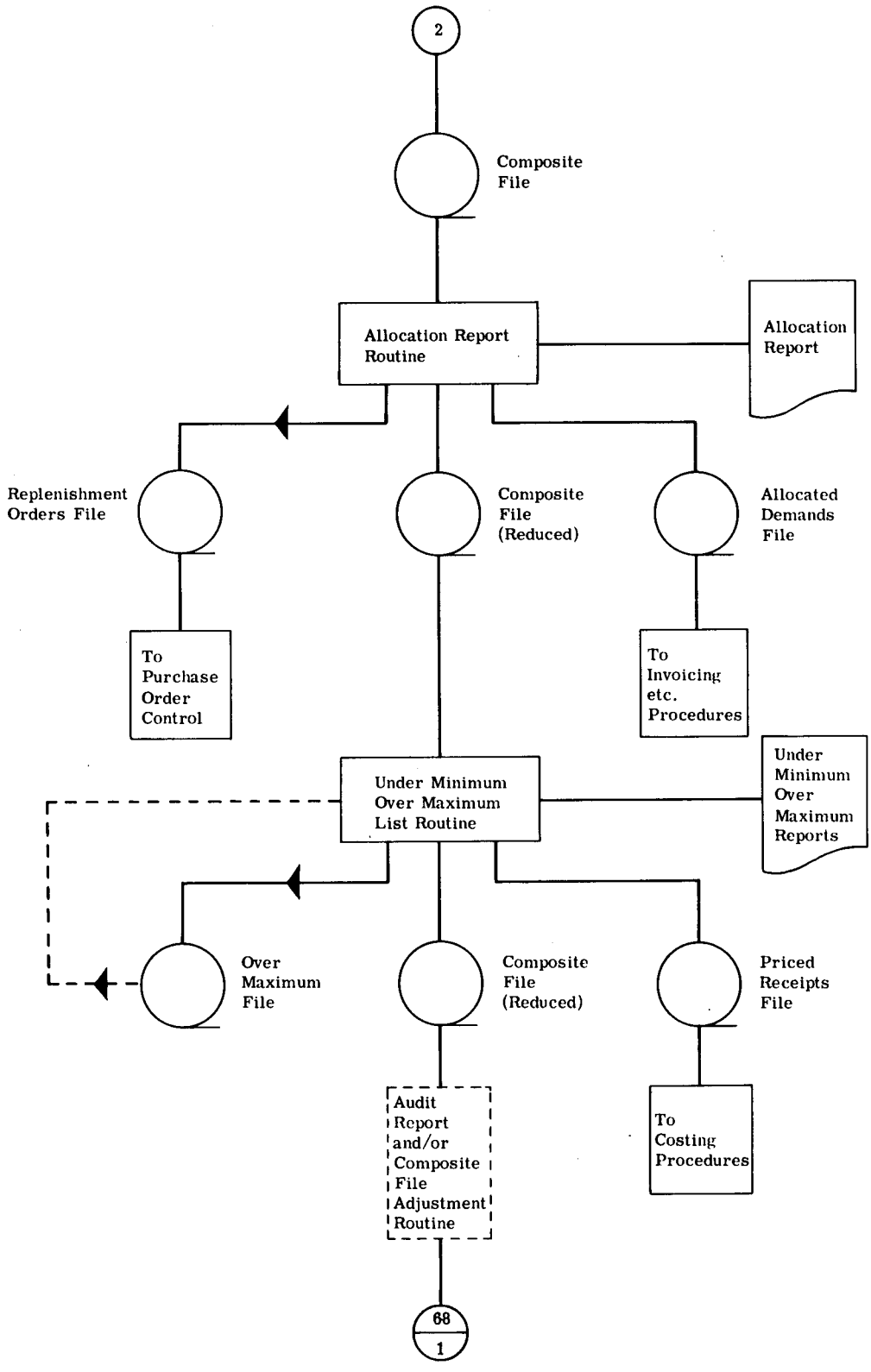


Figure 17 (c) I.C.T. SCAN System 2 Interrelationship of Routines - Stock Updating and Allocation (2)

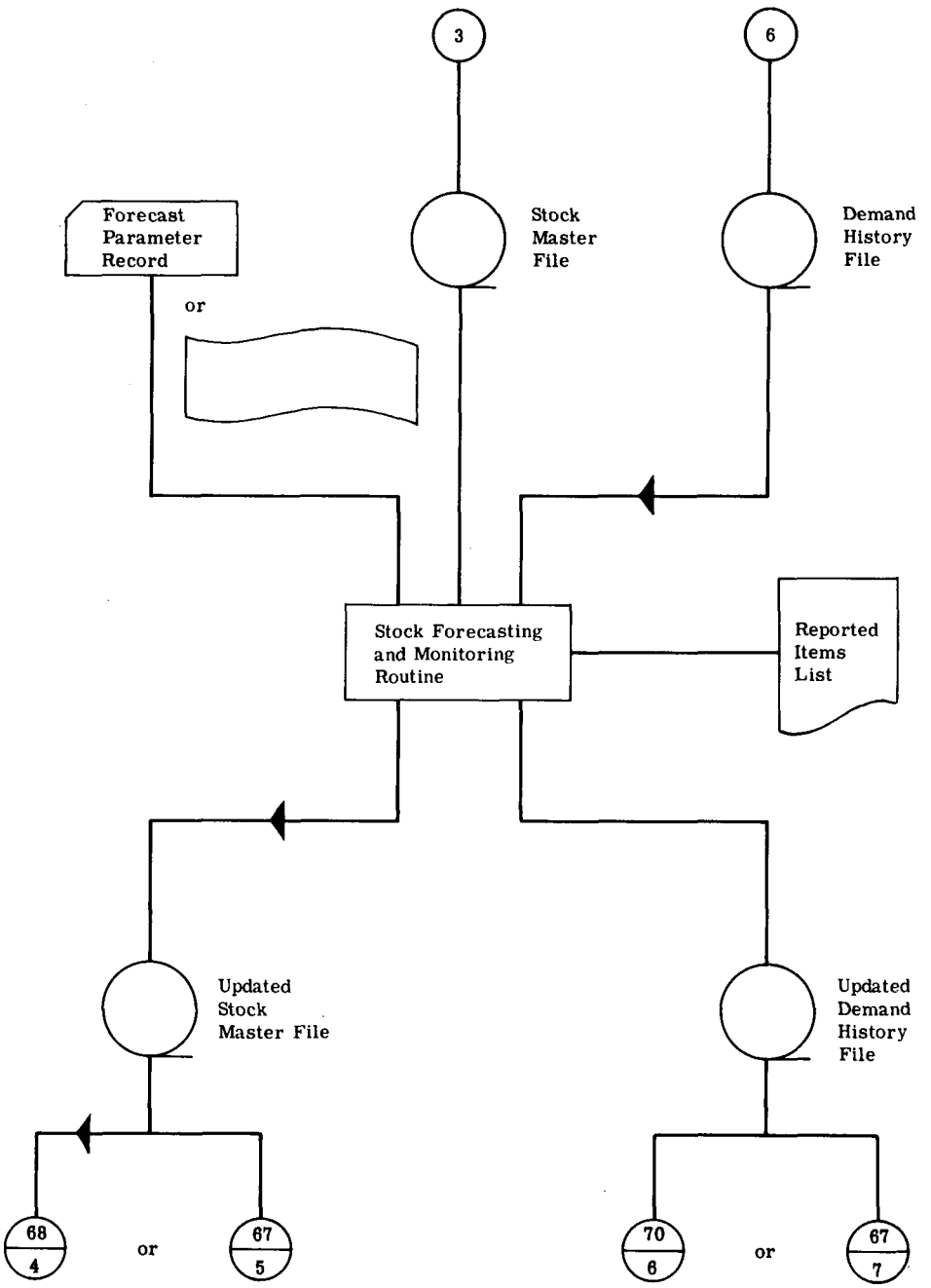


Figure 17 (d) I.C.T. SCAN System 2 Interrelationship of Routines - Stock Forecasting and Monitoring

The I.C.T. SCAN System provides a framework upon which an integrated commercial data processing system may be developed. Control of stock is a major factor in a company's profitability and ability to give prompt, efficient service where needed, at the time it is needed.

The following charts (Figure 18) give a suggested expansion of the entry points provided by this system into other commercial areas.

The Stock Updating and Allocation routine provides a printed report of all order requisitions which, it is expected, will be validated by the Buying department before final Purchase Orders are printed. Any amendments must be advised to the system.

Invoicing may easily be effected by using the Allocated Demands magnetic tape file produced during the Allocation Report routine.

Usually, an invoice set consists of:

invoice copy

daybook copy (accounts)

production control copy (progressing order) - if appropriate

consignment or advice note copy - with goods to customer

dispatch note copy

The allocated demand record contains the following data pertinent to invoicing:

Customer number and/or code

Internal order or batch reference number

Date of demand

Item number

Unit of measure

Quantity allocated

Quantity unallocated (to follow)

Date required

Cost price

Sales price

Purchase tax

Discount code

Location code

Bin location (store reference location)

Unit weight

An Allocated Demand (Transaction Code 18) would be processed to provide an invoice; similarly, an Unscheduled Issue (Transaction Code 15) would require an invoice.

A Returns Inward (Transaction Code 17) would be processed to provide a credit note.

Any of the above transactions may be held on the Allocated Demands tape file and there are several ways in which the file may be sorted prior to processing.

1 A straight-forward invoice/credit note procedure normally requires a sort by customer number, item number, transaction code.

This tape would be matched against a customer master file containing names and addresses etc.

Invoice sets would be prepared and an output tape written containing credit note details.

Upon completion of invoicing, the credit note tape would be rewound, changing the stationery on the printer before printing the credit notes.

2 The unit weights extended by quantity may be used in conjunction with route numbers (held on the customer master file) to schedule deliveries and vehicles (or transport).

In this case, the credit notes would be printed first and an output tape containing extended invoices together with the transport route numbers produced. This tape would be sorted by transport route number and the invoice sets printed. Concurrently the total weights could be aggregated and vehicles scheduled.

Development of sales statistics depends entirely upon the needs of the user but generally falls within two broad classifications.

1 Customer sales statistics which might reflect year to date (YTD) sales in total and/or by department including percentage changes in previous year's performance.

Another useful measure is customer sales and profit to company by product group as monthly and YTD figures, with perhaps a comparison with last year's corresponding figures.

2 Product statistics which reflect sales by product including number of times sold, bought, balance, profit, interest on stock value etc.

Note: The foregoing discussion is included simply to show how the SCAN System 2 may be expanded and, in fact, the whole section dealing with external system relationship is concerned with *suggestions.* Obviously, the size of the user configuration will determine the complexity of invoicing and related sales statistics, production scheduling (if the unallocated demand and/or forward and future demands are to be made by the user, rather than bought outside), purchase control, credit control etc., routines.

If errors between predicted and actual demands are excessive, the monitoring feature will detect this and output details. Excessive errors may be due to one of the following causes:

1 Large orders for an item or items. These may be sporadic. If a large order were expected, then a dummy product should be set up outside the system and stocks built up separately so that normal demands for that item are not influenced.

Alternatively, the item stocks should be built up in advance although re-ordering would not occur automatically (available stock much greater that the re-order point) until the large demand had been serviced. If this large demand were not expected then, by the time the system could react, it would be too late to prevent a serious stock depletion or stock-out.

Management must then consider if there is a likelihood of this occurring again and set their safety stock at a higher level to cope with the situation.

2 Combination of two or more products causing changes in the market demand pattern for each individually.

3 Marketing activity causing erratic trends in the demand pattern necessitating closer control.

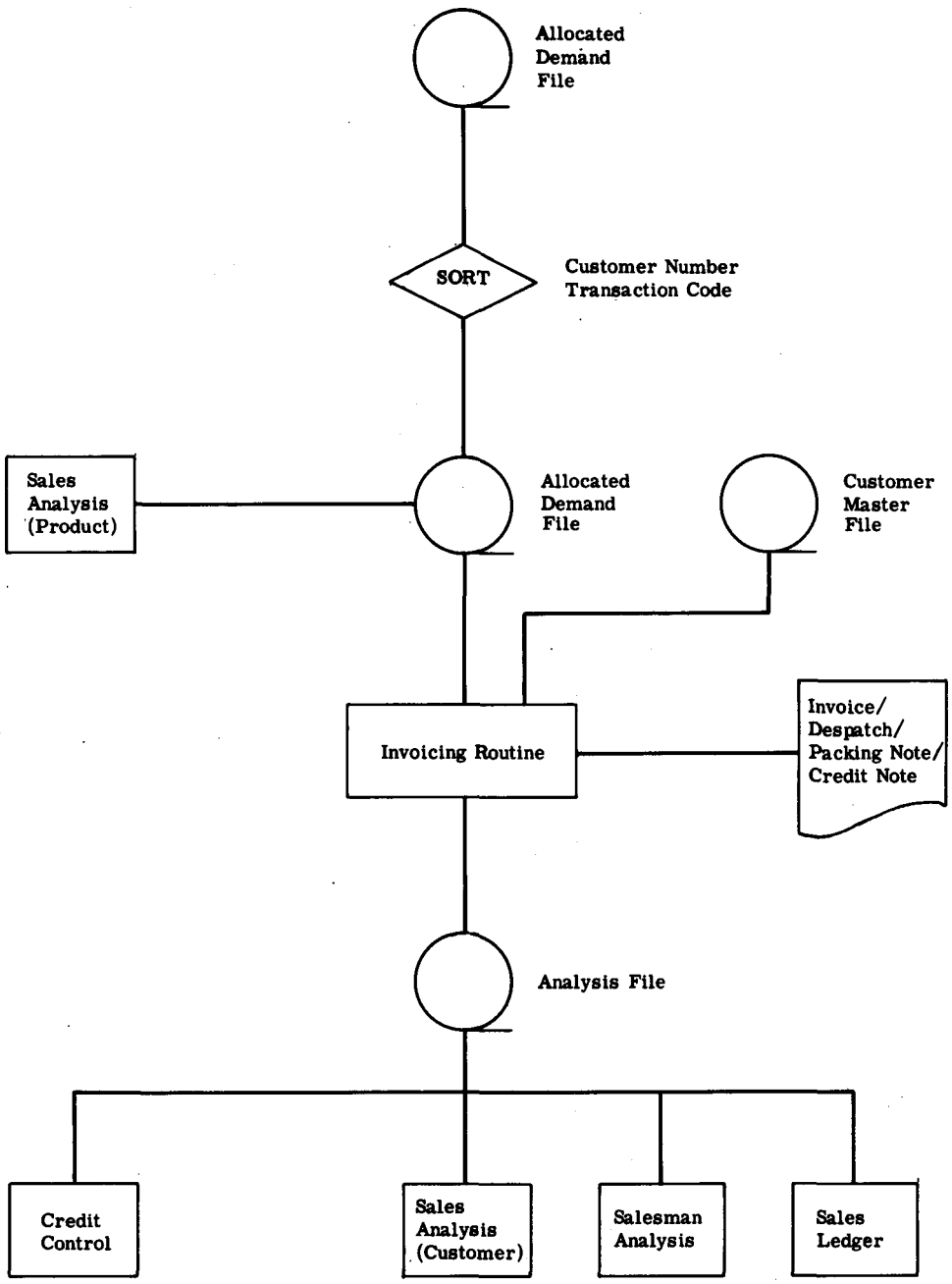


Figure 18 (a) External System Relationship - Invoicing and Related Procedures Finished Goods Stocks

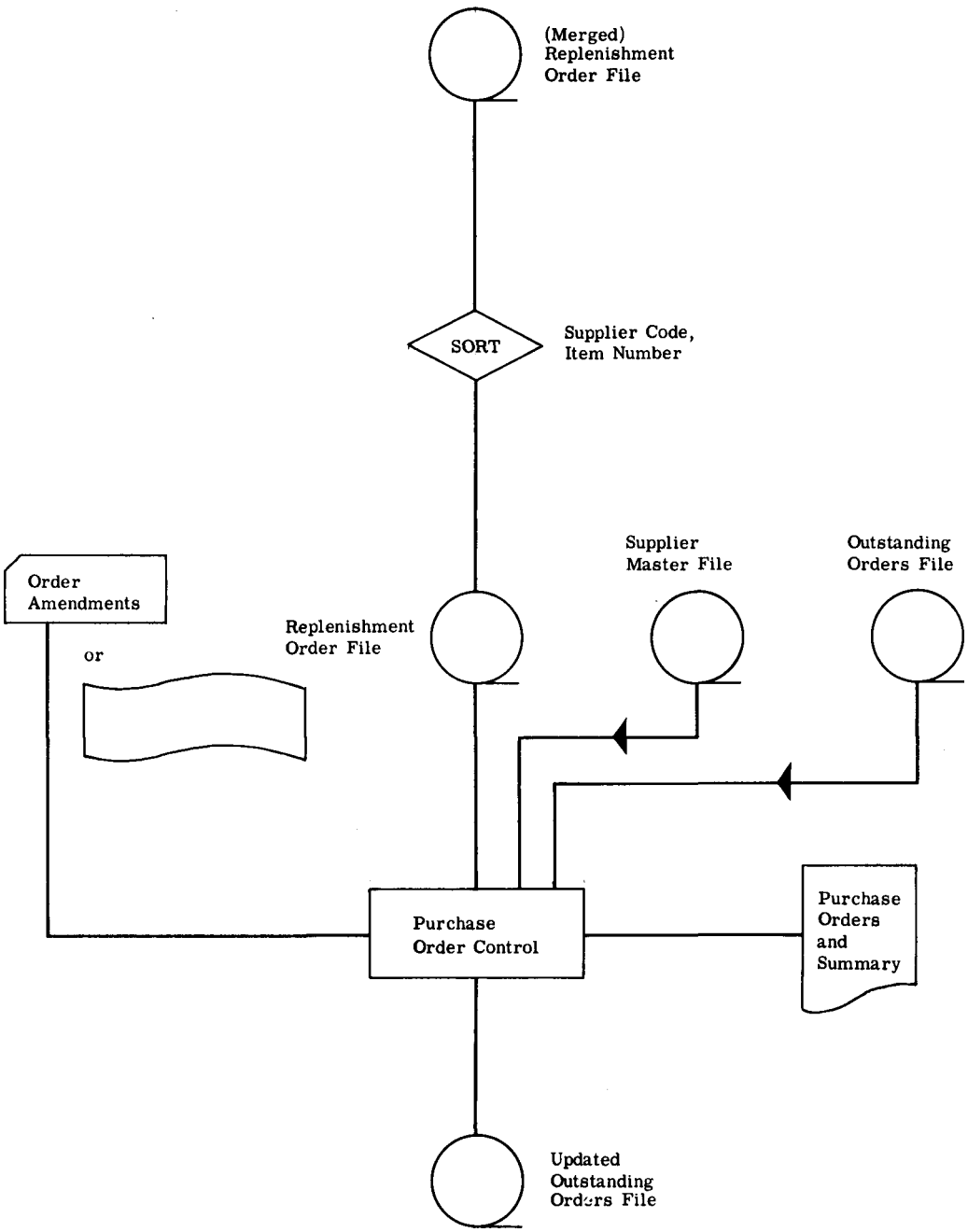


Figure 18 (b) External System Relationship - Purchase Order Routine

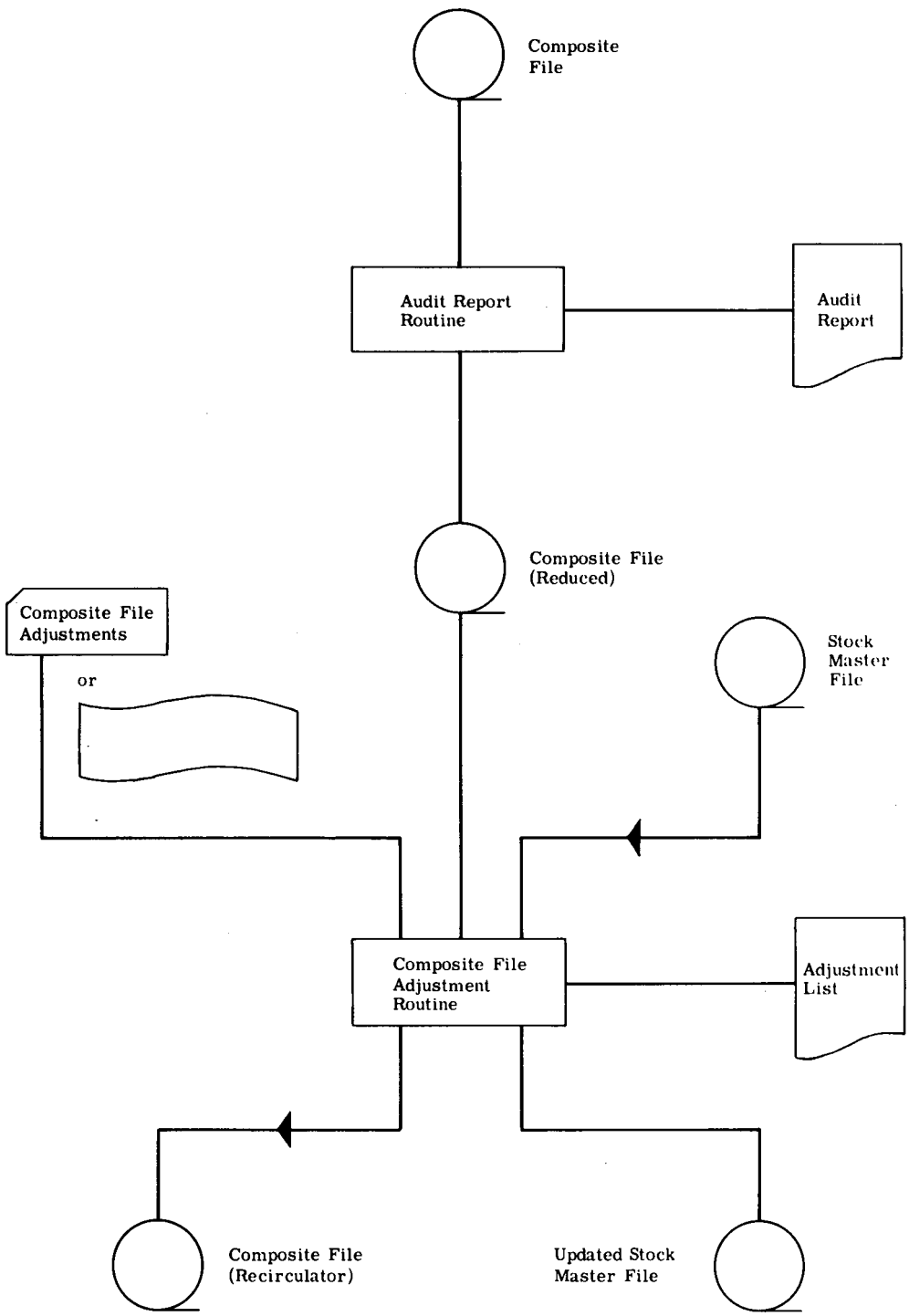


Figure 18 (c) External System Relationship - Audit Report and Composite File Adjustment Routines

FREQUENCY OF PROCESSING 4.6

Analytical Routines 4.6.1

If demand history is available for analysis, all three programs will be used at least once, in order to derive the classes into which each item in the inventory is classified. The ABC Analysis may be used more than once before acceptable levels are determined for the A and B groups.

It must be remembered that these analytical programs are guides to Management. Any automatic decision may be overruled.

Once established, the control system selected for each item may be changed at will, although a small number of changes would not require re-analysis.

An annual review of inventory is recommended, although the Stock Profile Analysis gives an excellent comparison of the effect of control on an item basis as well as in total.

Operational Routines 4.6.2

This is entirely at the user's discretion, but Stock Updating and the associated programs should be processed at least as often as the Stock Forecasting routine.

If the demand data is aggregated on a weekly basis and the recommended minimum forecast interval is '1', the Stock Forecasting routine should be processed weekly and the remaining programs possibly daily. It may be desirable, because of data collection/preparation problems, to process the Stock Forecasting routine once a month and update stock balances etc., as a weekly routine.

Demand data would be aggregated on a monthly basis, thus allowing time for data communication from remote warehouses, stores, etc., to a centralized computer.

In general, the response to monthly forecasting is not as good as for weekly forecasting, although more uniform monthly demand data may compensate since it may lead to more uniform sized orders on a supplier, or on a production line where the facility of manufacturing in batches is available.

OPERATIONAL CONTROL 4.7

The I.C.T. SCAN System may produce up to seven schedules which relate only to these items requiring attention (except in the case of the transaction list, allocation report and stock activity report).

Transaction list

Replenishment Order list

Stock Activity report

Allocation report

Under Minimum report

Over Maximum report

Reported Items list

Transaction List 4.7.1

This is a listing of each transaction detail as it is written to magnetic tape and is produced each time the Transaction file is created.

Items in error are indicated with an asterisk on the printed report as well as an error type message reference together with the item number on the console typewriter. Batch controls are admitted, if desired, computed on the transaction codes and both quantity fields.

Replenishment Orders List 4.7.2

This report is produced by the Stock Updating and Allocation routine and is a request to the user to place a replenishment order for a specified minimum quantity; if also provides the necessary information for validation by the Purchasing Department prior to their proceeding with an ordering system.

In general, all the order requisition magnetic tapes produced by the Allocation Report routine must be merged, sorted and updated (if necessary) before implementing the Purchase Order Control routine - written by the user.

The load index has two uses:

1 If the 'set-up time' field in the Stock Master item record has a value (other than zero), the load index expresses the total time required to set-up and manufacture the replenishment order, i.e. order quantity times unit time, plus set-up time.

2 If the 'set-up time' field has zero value and unit weight is entered instead of unit time, the load index expresses the total weight of the replenishment order.

Stock Activity Report 4.7.3

Also produced during the Stock Updating run, this report summarizes all transactions, e.g. receipts, demands, orders, scrap. (By value at cost price).

Allocation Report 4.7.4

Produced during the Allocation Report routine, this is a listing of all demands allocated during the previous Stock Updating and Allocation routine. It also includes the amounts unallocated (if appropriate).

Under Minimum Report 4.7.5

The minimum stock level may be set by Management or left at zero.

In the first case the report will contain a list of all items whose physical stock less back-orders is below or equal to the minimum level that Management wishes to tolerate. In the second case, if the back-orders exceed the physical stock a report of all stock shortages will be produced. It is, essentially, a progress document and may be used by the progress chaser or expediter in conjunction with a list of individual orders placed during the Purchase Order routines.

Note: Free Stock is Available Stock minus Forward Demand.

Over Maximum Report 4.7.6

The maximum stock level set by Management may represent a maximum financial limit to the physical stock (or, alternatively, the stock quantity representing a fixed warehouse area limit). However set, if the physical stock exceeds the maximum level a report will be produced. If the level is left at zero, no report is produced.

Reported Items List 4.7.7

This report is produced during the Stock Forecasting routine and indicates those items for which errors between predicted and actual demands exceed preset limits - in the case of those items for which exponential smoothing is used to forecast demand.

For those items using moving averages a simple test is applied which outputs item details if the demand exceeds three times the forecast.

The report cannot say why this event occurred: Management must investigate the reason and decide what action, if any, to take.

Parallel Run 4.7.8

It is strongly recommended that, before attempting to control stocks using the SCAN System, a pilot or parallel run be effected alongside the existing system for a period sufficiently long to allow:

1 Control factors and computed demand forecasts, re-order points, re-order quantities etc., to be realistic.

2 Personnel to become familiar with the necessary procedures and the system.

3 Any errors to be eliminated from the user supporting programs, before accepting the results as valid.

4 The monitoring feature to detect obviously incorrect choices of the smoothing constants.

The period could be from 6 to 26 weeks depending on difficulties encountered.

The implementation of the stock control system could result in a reduction in stock holding value of 20% or more and, in all cases, reduces the major part of the control activity to a machine function, enabling Management to devote more time to solving non-routine problems.

The recommended method of initializing the system is to run the stock updating and supporting programs for the whole of the first forecasting interval (either one or several runs), then enter the forecasting routine.

Note: Until the latter has occurred the re-order point will be zero unless a figure is entered via file creation/maintenance, and hence no orders will be generated.

Chapter 5 File Formats

DEMAND HISTORY FILE 5.1

The Stock Profile Analysis and Stock Forecasting and Monitoring routines require a Demand history file as input. This may be created from either

1 punched cards or paper tape (see Figure 19), or

2 a Stock Master magnetic tape file, if it is desired to reduce key-punching and, consequently, transcription errors.

In the latter situation, a skeleton Demand History file is created with data common to both files. It is then necessary to amend the file with additional data before full advantage may be taken of the facilities offered by this file. Chapter 3 describes the program which creates the 'skeleton' Demand History file.

In the former situation, a record for one item in the Demand History file may be created by cards or paper tape of four codes as follows:

Record Code 1 - Item Details

Item Number: this field must contain the item reference number in alphanumeric form. If the item number is less than the 16 characters shown on the standard punching form, care must be taken to punch one or more preceding zeros so that a correct item number sequence is obtained in Sort routines.

Service Level Group (S.L.G.): punched as 1, 2, 3 or 4, according to which service level category is desired for the item (see Section 3.6.6). The program inserts a value 1 if a quantity outside the range 1 to 4 is specified.

Ordering Interval: selected to give the appropriate average number of periods between orders; maximum value of 27.

Investment Rate Group: punched as a number in the range 0 to 9. This number associates the item with a selected investment rate used in the Stock Forecasting and Monitoring routine.

Ordering Cost: right-justified with a decimal point punched followed by a fraction. The value shown here should be in terms of the currency unit at the head of the sheet.

Note: Ordering cost is used as a parameter in the economic order quantity formula. If either a blanket ordering cost or no economic ordering is required, this field may be left blank.

System Marker: punched as a number in the range 0 tc 9. This field indicates the control system to be applied to this item. If analysis is intended this field may be left blank. During operational control the selected number must agree with a similar field in the Stock Master file (see Section 3.5.3).

Forecast Interval: this may be selected by Management or, if analysis is preferred, left blank. It is used to indicate the time interval, in terms of the basic time unit of the system, between each forecast of demand. This applies only to those items included in a variable re-order control system.

Factor One: used as a prediction parameter for these items for which a forecast of demand is to be made. This is a numeric field, right-justified, with a floating decimal point.

In the case of the exponential smoothing forecasting technique, the value entered will correspond to α (alpha) in the usual formula. If moving averages are to be used, the value entered will correspond to the time base of the average, i.e. for weekly demand data, a '13.0' punched means a quarterly moving average.

Factor Two: used to increase the lead time to provide additional order cover (safety stock) for those items controlled using moving averages.

Unit of Measure: alphanumeric field. Must always be identical wherever used in the system. Normally, it indicates the standard measure of the item i.e. feet, dozen, gross, etc.

I·C·T Data processing planning aid

1900 SCAN system for inventory management

Demand history record

Company name J. SOAP Co. Ltd.

Part Number 0111

Currency unit £

Time unit WEEKLY DATA

ITEM DETAIL CARD

Card code	Item number	S.L.G.	Order int.	I.R.G.	Ordering Cost	S.M.	Forecast int.	Factor one	Factor two	Unit of measure*	Deseasonalised forecast	Cost price	Sales price	Lead-time	Closing stock	Series length	Cycle base
01	0111	1	1	0	0	2	1	0·10	0·00	EACH	267·171	01·992	02·142	2	963	104	52

ITEM SUPPLEMENTARY CARD

Card code	Item number	Class code	Loc'n code	Description
02	0111	A1	15	QTBTS J HAIG

DEMAND HISTORY CARDS

DEMAND HISTORY (Last data item must be followed by field terminator and 999999.)

Card code	Item number	No. of previous items	Demand history													
03	0111	000	556	568	600	700	939	1100	1017	858	802	798	750	744	633	600
03	0111	014	550	350	280	317	323	350	382	395	400	450	576	600	678	600
03	0111	028	593	581	550	450	449	439	420	400	415	421	450	500	509	520
03	0111	042	509	450	486	500	514	527	550	552	580	650	675	677	700	800
03	0111	056	772	768	750	718	603	590	500	308	237	298	287	300	345	360
03	0111	070	375	530	540	550	540	530	540	550	540	409	400	396	380	384
03	0111	084	386	376	295	347	244	246	378	244	691	190	200	293	356	388
03	0111	098	288	526	588	594	446	806	999999							
03																

SEASONAL FACTOR CARDS

SEASONAL FACTORS (Last factor must be followed by field terminator and 999999.)

Card code	Item number	No. of previous factors	Seasonal factors											
04	0111	000	1·97	1·99	2·08	2·40	2·74	2·99	2·83	2·52	2·25	2·22	2·00	1·69
04	0111	012	1·39	1·44	1·34	1·04	1·00	1·08	1·12	1·41	1·47	1·51	1·50	1·57
04	0111	024	1·78	1·84	1·95	1·62	1·59	1·57	1·49	1·34	1·34	1·30	1·15	1·20
04	0111	036	1·06	1·07	1·33	1·19	1·92	1·14	1·14	1·19	1·35	1·42	1·29	1·71
04	0111	048	1·82	1·83	1·64	2·33	999999							

Figure 19

4047 (9.67)

Deseasonalized Demand Forecast: this field may be left blank if the item is not to be subjected to forecasting. However, if the item is to be forecast, an 'educated guess' should be made as to the likely value initially. This will reduce the initial error in making a forecast, before the system settles down.

Cost Price and Sales Price: right-justified numeric fields with a floating decimal point (as for Ordering Cost). The value shown here must be in terms of the currency unit at the head of the sheet.

Lead Time: selected by Management to represent the expected replenishment delivery time. Again this is a right-justified, floating decimal, numeric field and must be in terms of the basic time unit of the system, i.e. if demand is accumulated in weekly aggregates, the lead time must be in weeks.

Closing Stock: the stock-on-hand balance for that item (this must not be a negative quantity).

Series Length: the number of demand points in the demand history provided (maximum of 104). If no demand points are entered, a single demand point of zero is included in the record by program and the series length is set to 1.

Cycle Base: the time interval between a repeat of the seasonal cycle. If an item is not subject to seasonal influence in its demand pattern, this field must be punched with 1.

Record Code 2 - Item Supplementary Details

Item Number: as for Record Code 1

Class Code: alphanumeric field, may be left blank if analysis is intended.

Location Code: alphanumeric field intended as reference to stock location i.e. warehouse or store number; may be left blank.

Description: alphanumeric field

Note: This card may be omitted.

Record Code 3 - Demand History Details

Item Number: as for Record Code 1

Number of previous demand points: the number of previous demand points on preceding cards (or paper tape blocks), e.g. 000 (as shown for first card), if this first card contained ten demands, then the field in the second Code 3 card would be 010. If this second card also contained ten demands, then the field in the third card would be 020.

Demand History: variable length demand fields separated by a space and terminated by 999999 following the last demand.

Note: If no demand history is available, this card may be omitted.

Record Code 4 - Seasonal Factor Details

As Demand History cards but containing seasonal factors (or Management weighting factors).

Note: If there are no seasonal factors this card may be omitted.

I·C·T

Data processing planning aid

1900 SCAN system for inventory management

Company name J. SOAP Co. Ltd

Part numbers 0111

Currency unit £

Time unit WEEKLY DATA

Stock master records

1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 20 1 2 3 4 5 6 7 8 9 30 1 2 3 4 5 6 7 8 9 40 1 2 3 4 5 6 7 8 9 50 1 2 3 4 5 6 7 8 9 60 1 2 3 4 5 6 7 8 9 70 1 2 3 4 5 6 7 8 9 80

STORES DETAIL CARD

Card code	Item number	Loc'n code	Bin Location	Unit of measure	Re-order point	Minimum stock level	Maximum stock level	Re-order quantity	Closing stock	S.M.
05	0111	15	3721	EACH	2161	100	20000	774	9632	

SUPPLY DETAIL CARD

Card code	Item number	Class code	Supplier code	Lead-time	Cost price	Minimum order qty	Maximum order qty	Stock on order	Unit weight or time	Set-up time	Scrap factor
06	0111	A1	2376	20	1·992	48	0	576	0	0	0

SALES DETAIL CARD

Card code	Item number	Disc. code	Sales price	Purchase Tax		Description	Cycle base
07	0111	7	002·142	0		QTBTS J HAIG	52

STORES DETAIL CARD

Card code	Item number	Loc'n code	Bin location	Unit of measure	Re-order point	Minimum stock level	Maximum stock level	Re-order quantity	Closing stock	S.M.
05										

SUPPLY DETAIL CARD

Card code	Item number	Class code	Supplier code	Lead-time	Cost price	Minimum order qty	Maximum order qty	Stock on order	Unit weight or time	Set-up time	Scrap factor
06											

SALES DETAIL CARD

Card code	Item number	Disc. code	Sales price	Purchase tax		Description	Cycle base
07							

Figure 20

To implement the operational routines, a Stock Master magnetic tape file must be created. The user may write a conversion program to provide a magnetic tape with the record formats required by SCAN System 2 if a user file already exists. If this course of action is not desired, the Stock Master file may be created directly from punched cards or paper tape using all three of the codes as follows:

Record Code 5 - Stores Details

Item Number: as for Record Code 1

Location Code: as for Record Code 2

Bin Location: alphanumeric field. Normally used to indicate the actual location reference of stock within the warehouse or store.

Unit of Measure: as for Record Code 1

Re-order Point: the level of stock at which a replenishment order should be issued. In the case of those items selected for variable re-order point control this field is continually updated by the Stock Forecasting and Monitoring program to adjust for variations in demand.

Minimum Stock: a level of stock on hand, set by Management, at or below which a report is generated.

If this field is left blank, zero will be inserted in the corresponding field in the magnetic tape record.

Maximum Stock: a level of stock-on-hand, set by Management, over which a report is generated. If this field is left blank, zero will be inserted in the corresponding field in the magnetic tape record.

Re-order Quantity: the amount of stock required to be placed on order. In the case of items selected for variable re-order point control this field may be updated by the Stock Forecasting and Monitoring program to adjust for variations in demand or an economic order size.

Note: This quantity is increased by the difference between the re-order point and available stock.

Closing Stock (on-hand) Balance: as for Record Code 1

System Marker: as for Record Code 1

Record Code 6 - Supply Details

Item Number: as for Record Code 1

Class Code: as for record Code 2

Supplier Code: alphanumeric field. Normally used for purchase order control routines.

Lead Time: as for Record Code 1

Cost Price: as for Record Code 1

Minimum Order Quantity: the lowest order quantity permitted by the system. May be set at unity or used by Management to ensure that multiples of a given batch size are ordered. If left blank, unity will be assumed.

Maximum Order Quantity: the maximum sized order permitted by the system. This may represent a production capacity constraint.

On-order Balance: the stock on order at the time of file creation

Unit Weight or Time: either the weight of a single stock unit or the time taken to produce a single stock unit.

Set-up Time: the time required to set-up/tear-down a production unit for the given item

Scrap Factor Percentage a factor used to increase the replenishment order quantity to account for possible scrap.

If left blank zero will be assumed.

Record Code 7 - Sales Details

Item Number: as for Record Code 1

Discount Code: alphanumeric field for use in user's invoicing procedures

Sales Price: as for Record Code 1

Purchase Tax: for use in user's invoicing routines

Description: as for Record Code 2

Cycle Base: as for Record Code 1

This file is the entry point to the operational control system and consists of eight different transaction types which, collectively, embrace most of those commonly met in a stock and order processing system.

The file may be created directly from punched cards or paper tape as follows:

Audit Request

Columns	
1 and 2	Record Code 11 - Audit Request
3 and 4	Location Code - as for Record Code 2
13 to 20	Document Reference - alphanumeric field used to enter audit authority reference
21 to 26	Date - date of audit request (DDMMYY)
27 to 42	Item Number - as for Record Code 1
43 to 46	Unit of Measure - as for Record Code 1
47 to 53	Stock Count - actual physical (on-hand) stock balance - may be left blank.

Stock Adjustment

Columns	
1 and 2	Record Code 12 - Stock Adjustment
3 and 4	Location Code - as for Record Code 2
13 to 20	Authority Reference - alphanumeric field
21 to 26	Date - as for Record Code 11
27 to 42	Item Number - as for Record Code 1
43 to 46	Unit of Measure - as for Record Code 1
47 to 53	Adjustment Quantity - amount by which stock-on-hand is to be adjusted. The leftmost position is used for the sign - blank positive, minus negative.
61 to 68	Cost Code - a reference for accounting purposes

Stock Receipt and Scrap

Columns	
1 and 2	Record Code 13 - Stock Receipt and Scrap
3 and 4	Location Code - as for Record Code 2
5 to 12	Supplier or Department Code - as for Record Code 6
13 to 20	Order or Batch Number - alphanumeric field used as reference to order placed originally on a supplier.
21 to 26	Date of Receipt - punched as DDMMYY
27 to 42	Item Number - as for Record Code 1
43 to 46	Unit of Measure - as for Record Code 1
47 to 53	Quantity Good - right-justified numeric field
54 to 60	Quantity Scrap - right-justified numeric field
61 to 68	Cost Code or GRN - alphanumeric field which may be used as either a reference for accounting purposes or for the goods received note or other document reference.

I·C·T Data processing planning aid

1900 SCAN system for inventory management

Company name J. SOAP Co Ltd.

Part numbers 0111

Currency unit £

Time unit DAILY DATA

Transaction records

Card code	Loc'n code	Customer, supplier, or department code	1st Document Reference No.	Date of issue/ receipt	Item number	Unit of measure	Quantity 1	Quantity 2	2nd Document Reference No.	Due date	Priority code
1	1	5	A131	280267	0111	EACH	963				
1	2	5	C921	280267	0111	EACH	-17		87		
1	3	5	2376	160987	270267	EACH	798	18	87		
1	7	5	A731	159371	270267	EACH	17	17	118391		
2	1	5	A831	280267	0111	EACH	83		193271	170467	01
2	1	5	A785	280267	0111	EACH	37		1A7321	204671	01
2	1	5	A797	280267	0111	EACH	42		831121	503670	2

Figure 21

Returns Outward

Columns

1 and 2	Record Code 14 - Returns Outward
3 and 4	Location Code - as for Record Code 2
5 to 12	Supplier or Source Code - as for Record Code 6
13 to 20	Order Number - alphanumeric field, normally used as reference to original order placed on supplier.
21 to 26	Date of Issue - punched as DDMMYY
27 to 42	Item Number - as for Record Code 1
43 to 46	Unit of Measure - as for Record Code 1
47 to 53	Quantity Returned - right-justified numeric field
61 to 68	Advice Note Number - alphanumeric field used as reference if appropriate.

Unscheduled Issue

Columns

1 and 2	Record Code 15 - Unscheduled Issue
3 and 4	Location Code - as for Record Code 2
5 to 12	Customer or Department Code - alphanumeric field, normally used for invoicing procedures.
13 to 20	Internal Order Reference Number - alphanumeric field used as authority for issue
21 to 26	Date of Issue - punched as DDMMYY
27 to 42	Item Number - as for Record Code 1
43 to 46	Unit of Measure - as for Record Code 1
47 to 53	Quantity Issued - right-justified numeric field
61 to 68	Cost Code - as for Record Code 12

Returns Inward

Columns

1 and 2	Record Code 17 - Returns Inward
3 and 4	Location Code - as for Record Code 2
5 to 12	Customer or Department Code - as for Record Code 15
13 to 20	Order Number - or other internal reference
21 to 26	Date of Return - punched as DDMMYY
27 to 42	Item Number - as for Record Code 1
43 to 46	Unit of Measure - as for Record Code 1
47 to 53	Quantity - right-justified numeric field, normally used for credit note procedures
54 to 60	Adjustment - right-justified numeric field, used to adjust the demand accumulator for the current period. If the 'return' is related to a previous demand period, this field is left blank and adjustment to the appropriate period demand must be effected through the use of file maintenance.
61 to 68	Customer Order Number - alphanumeric field used either as reference for adjustment to a previously allocated demand or as a goods received note reference.

Note: If scrap is included in the return, it should be recorded on a Stock Adjustment card (Record Code 12) in order to reduce the stock balance.

Replenishment Order Adjustment

Columns

1 and 2	Record Code 19 - Replenishment Order Adjustment
3 and 4	Location Code - as for Record Code 2
5 to 12	Supplier Code - as for Record Code 6
13 to 20	Order Number - alphanumeric field used to reference original order placed on the supplier
21 to 26	Date of Order - punched as DDMMYY
27 to 42	Item Number - as for Record Code 1
43 to 46	Unit of Measure - as for Record Code 1
47 to 53	Quantity - amount by which on-order balance is to be adjusted
69 to 74	Due Date - punched as DDMMYY, it usually refers to the date that receipt of original order was expected.

Note: If the user has catered for this transaction in his own purchase order print routine it will not be necessary to use the above card type.

Demand

Columns

1 and 2	Record Code 21 - Demand
3 and 4	Location Code - as for Record Code 2
5 to 12	Customer Code - alphanumeric user code identifying customer for invoicing etc., procedures
13 to 20	Internal Order or Batch reference - alphanumeric field used to identify customers' orders.
21 to 26	Date of Demand - punched as DDMMYY
27 to 42	Item Number - as for Record Code 1
43 to 46	Unit of Measure - as for Record Code 1
47 to 53	Quantity - Amount of demand
61 to 68	Customer Order Number - alphanumeric customer reference
69 to 74	Date Required - punched as DDMMYY and refers to delivery date (due date).
75 and 76	Priority Code - numeric field used to arrange demands for the same item in a particular sequence so that allocation of available physical stock to a particular customer is given priority over the remaining demands.

Batch Control Record - Optional record

Columns

1 and 2	Record Code '99' - batch control
3 to 12	Blank
13 to 20	Batch number
21 to 26	Date
27 to 36	Blank
37 to 42	Sum of transaction codes in batch
43 to 46	Number of transactions in batch
47 to 53	Sum of Quantity 1 field
54 to 60	Sum of Quantity 2 field

Note: Any of these fields may be left blank except columns 21 to 26 and 37 to 42.

End Run Record

Columns

1 to 4 '****' This record is inserted at the back of the transaction pack.

PAPER TAPE FORMATS 5.4

Paper tape formats for the Demand History, Stock Master and Transaction File records must be identical to the corresponding card formats, with the addition that a Newline character must be punched at the position which would be occupied by column 81 on each card.

MAGNETIC TAPE FILE FORMATS 5.5

In addition to creating three magnetic tape files by using the Master File Create/Maintenance and Transaction File Create routines, the system itself will create a further five magnetic tape files. The file formats for all eight magnetic tapes are given below.

All magnetic tapes defined in the system contain:

Header label

Qualified block

Data blocks

Trailer label

Multi-reel files are permitted

Demand History File 'STATISTICAL∇' 5.5.1

Record length from 63 to 217 words

Block length 1 record (minimum); 4 records (maximum)

The first data block contains 88 words:

Word	*Field Content*	*Comments*
0	88	Record length
1 to 4	0	
5 to 24	I.C.T. 1900 SCAN system Run on dd/mm/yy with fortnightly demand data	Note: 'Fortnightly' may be 'Weekly' or 'Monthly' at user's choice – located in word 18 (character 3), 19, 20, 21 (characters 0, 1)
25	52	Numbers of time periods in year (could be 12 or 13)
26	£ (for example)	Currency unit
27 to 87		Field type location table for use in file maintenance

Subsequent records contain fields in the following sequence:

	Field	*Words*	*Type*	*Word Number*
S	Record length	1	Integer	0
C	Item Number	4	Character	1 to 4
XC	Class Code (e.g. *A* 1)	1	Character	5
C	Description	8	Character	6 to 13
C	Location Code	1	Character	14
C	Unit of Measure	1	Character	15
C	Cost Price (C_p)	2	Decimal (24.24)	16 and 17
C	Sales Price	2	Decimal (24.24)	18 and 19
	Order Cost (C_o)	2	Decimal (24.24)	20 and 21
OC	Lead Time (L)	2	Decimal (24.24)	22 and 23
*	Average demand ($\bar{y}$)	2	Decimal (24.24)	24 and 25
*	Standard deviation of demand (σ_y)	2	Decimal (24.24)	26 and 27
	Deseasonalized demand forecast ($\hat{X}_T$)	2	Decimal (24.24)	28 and 29
*	Cumulative sum of errors (Σe)	2	Decimal (24.24)	30 and 31
	Standard deviation of errors (σ_e)	2	Decimal (24.24)	32 and 33
	Smoothed forecast errors ($\hat{e}_T$)	2	Decimal (24.24)	34 and 35

	Field	*Words*	*Type*	*Word Number*
S	Mean absolute deviation of errors ($\hat{d}_T$)	2	Decimal (24.24)	36 and 37
XC	Closing Stock Balance (S_T)	1	Integer	38
S	Service Level Group	1	Integer	39
	Ordering Interval (W)	1	Integer	40
	Investment Rate Group	1	Integer	41
XC	System Marker	1	Character	42
	OPPR Inclusion Marker	1	Integer	43
S	Demand history length (series length) (N)	1	Integer	44
	Forecast Interval (T)	1	Integer	45
	Forecast Interval count	1	Integer	46
S	Cycle Base (seasonal length) (M)	1	Integer	47
	Cycle Base count	1	Integer	48
	Factor One (γ_0)	1	Decimal (8.16)	49
	Factor Two (γ_1)	1	Decimal (8.16)	50
	Spare	10		51 to 60
S	Cycle (seasonal) factors(s)	1 to 52	Decimal (16.8)	61 to 112
S	Demand History (y)	1 to 104	Integer	113 to 216
	Total	63 to 217 words		

Note: Spare words are reserved for I.C.T. use.

Field types designated e.g. (24.24) refer to the bit position of the binary point of the number.

The position of the demand history series is variable depending on the number of seasonal factors present.

When using X42B, fields marked with S are set by X42B; fields marked with C are copied from the Stock Master file.

When using forecasting, fields marked X are copied across from the Stock Master and are used in the forecast run. The field marked 0 is used from Stock Master but is not copied across.

Fields marked * are not used in SCAN System 2.

Stock Master File 'STOCK$_\nabla$MASTER'

Record length 64 words

Block length 2 or 4 records

The first data block contains:

Word	*Field Content*	*Comments*
0	91	Record length
1 to 4	0	
5 to 24	I.C.T. 1900 SCAN System run on dd/mm/yy with fortnightly demand data	Note: as for Demand History file
25	52	Number of time periods in year
26	£	Currency unit
27 to 90		Field type location table for use in file maintenance.

Subsequent records contain fields in the following sequence:

	Field	*Words*	*Type*	*Word Number*
	Record length	1	Integer	0
	Item number	4	Character	1 to 4
	Class code	1	Character	5
	Description	8	Character	6 to 13
	Location code	1	Character	14
	Unit of measure	1	Character	15
	Cost price	2	Decimal (24.24)	16 and 17
	Sales price	2	Decimal (24.24)	18 and 19
	Purchase tax	2	Decimal (24.24)	20 and 21
	Lead time	2	Decimal (24.24)	22 and 23
	Unit weight or time	2	Decimal (24.24)	24 and 25
	Set-up time	1	Decimal (16.8)	26
	Discount code	1	Character	27
	Supplier code	2	Character	28 and 29
	Minimum order quantity	1	Integer	30
	Maximum order quantity	1	Integer	31
	Scrap factor %	1	Integer	32
	Spare	4		33 to 36
	Bin location	2	Character	37 and 38
	System marker	1	Character	39
	Re-order point	1	Integer	40
	Minimum stock level	1	Integer	41
	Maximum stock level	1	Integer	42
	Re-order quantity	1	Integer	43
X	Cycle base (seasonal length)	1	Integer	44
	Stock-on-hand Balance	1	Integer	45
	Forward Demand Balance	1	Integer	46
	Back-order Balance	1	Integer	47
	Stock-on-order Balance	1	Integer	48
	Period demand accumulator	1	Integer	49
	Cumulative receipts to date	2	Integer	50 and 51
	Cumulative scrap to date	2	Integer	52 and 53
	Cumulative demand to date	2	Integer	54 and 55
	Cumulative back - orders to date	2	Integer	56 and 57
	Receipts count	1	Integer	58
	Back order count	1	Integer	59
	Non-move count	1	Integer	60
	Ordering interval count	1	Integer	61
	Spare	2		62 and 63
	Total	64 words		

Notes

1 During forecasting the field marked X is overwritten from the Statistical file.

2 All programs which process the Stock Master file produce 128 word blocks if switch 16 is set, and 256 word blocks otherwise.

Transaction File 'TRANSACTIONS' 5.5.3

Record length 50 words

Block length 5 records

All transactions will have a common record format including certain records created during the Stock Updating and Allocation routine, intended to recirculate back into the system.

The basic record format is as follows:

Field	*Words*	*Type*	*Word Number*	*Source*
Record length	1	Integer	0	FC
Transaction code	1	Integer	1	FC/SU
Item number	4	Character	2 to 5	FC
Class code	1	Character	6	SMR
Description	8	Character	7 to 14	SMR
Location code	1	Character	15	FC
Unit of measure	1	Character	16	FC
Cost price	2	Decimal (24.24)	17 and 18	SMR
Sales price	2	Decimal (24.24)	19 and 20	SMR
* Purchase tax	2	Decimal (24.24)	21 and 22	SMR
* Discount code	1	Character	23	SMR
* Customer/Supplier code	2	Character	24 and 25	FC
* Bin location	2	Character	26 and 27	SMR
* 1st document reference	2	Character	28 and 29	FC
Transaction date	2	Character (00YYMMDD)	30 and 31	FC
Quantity 1	1	Integer	32	FC
Quantity 2	1	Integer	33	FC/SU
* 2nd document reference	2	Character	34 and 35	FC
Date required	2	Character (00YYMMDD)	36 and 37	FC
Priority	1	Character	38	FC
Spare	3		39 to 41	
System marker/cycle indicator	1	Character	42	SMR
Spare	7		43 to 49	
Total	50 words			

Note: Source key refers to media from which field is obtained.

FC = File Create stage

SU = Stock Updating routine

SMR = Stock Master record.

Certain fields marked '*' are not used by the I.C.T. SCAN System but will be transferred unaltered to the appropriate entry points for other commercial routines.

First Document Reference contains data transferred from input card columns 13 to 20.

Second Document Reference contains data transferred from input card columns 61 to 68.

Quantity 1 contains data transferred from input card columns 47 to 53 and Quantity 2, data from columns 54 to 60.

During stock updating, Quantity 1 and Quantity 2 fields may be altered. (See Chapter 3).

Replenishment Order Requisition Records

(Created during the Stock Updating and Allocation program)

Field	*Words*	*Type*	*Word Number*
Record length	1	Integer	0
Transaction code	1	Integer	1
Item number	4	Character	2 to 5
Class code	1	Character	6
Description	8	Character	7 to 14
Location code	1	Character	15
Unit of measure	1	Character	16
Cost price	2	Decimal (24.24)	17 and 18
Lead time	2	Decimal (24.24)	19 and 20
Spare	3		21 to 23
Supplier code	2	Character	24 and 25
Bin location	2	Character	26 and 27
Spare	2		28 and 29
Date (order generated)	2	Character (00YYMMDD)	30 and 31
Re-order quantity	1	Integer	32
Spare	3		33 to 35
Due date	2	Character (00YYMMDD)	36 and 37
Spare	12		38 to 49
Total	50 words		

Under Minimum/Over Maximum Records

(Created during the Stock Updating and Allocation program)

Field	*Words*	*Type*	*Word Number*
Record length	1	Integer	0
Transaction code	1	Integer	1
Item number	4	Character	2 to 5
Class code	1	Character	6
Description	8	Character	7 to 14
Location code	1	Character	15
Unit of measure	1	Character	16

Field	*Words*	*Type*	*Word Number*
Cost price	2	Decimal (24.24)	17 and 18
Lead time	2	Decimal (24.24)	19 and 20
Spare	3		21 to 23
Supplier code	2	Character	24 and 25
Spare	4		26 to 29
Date generated	2	Character (00YYMMDD)	30 and 31
Maximum/Minimum stock level	1	Integer	32
Free stock	1	Integer	33
Spare	4		34 to 37
Stock-on-hand	1	Integer	38
Forward Demand Balance	1	Integer	39
Unallocated Demand Balance	1	Integer	40
Stock-on-order Balance	1	Integer	41
System marker/cycle indicator	1	Integer	42
Spare	7		43 to 49
Total	50		

The following file formats relate to these files produced by SCAN System 2.

Profile Results File 'PROFILE$_{\nabla}$RSLT' 5.5.4

Created initially by the Stock Profile Analysis routine

Record length 28 words

Block length 9 records

Data Records

Field	*Words*	*Type*	*Word Number*
Record length	1	Integer	0
Item number	4	Character	1 to 4
Class code	1	Character	5
Description	8	Character	6 to 13
Location code	1	Character	14
Unit of measure	1	Character	15
Series length	1	Integer	16
Forecast interval	1	Integer	17
Annual demand	2	Integer	18 and 19
Annual sales	2	Integer	20 and 21
Closing stock balance	2	Integer	22 and 23
Stock value	2	Integer	24 and 25
Gross annual margin	2	Integer	26 and 27
Total	28 words		

Last Data Record

Field	*Words*	*Type*	*Word Number*
Record length	1	Integer	0
Spare (contains zeros)	14		1 to 14
Currency	1	Character	15
Item count	1	Integer	16
Spare (contains zeros)	3		17 to 19
Total annual sales	2	Integer	20 and 21
Spare (contains zeros)	2		22 and 23
Total stock value	2	Integer	24 and 25
Total gross margin	2	Integer	26 and 27
Total	28 words		

The last data record contains accumulated totals as a result of processing during the Stock Profile Analysis; subsequent use of this file will place this record in the first data record position.

Composite File 'COMPOSITE ▽▽▽ ' 5.5.5

Output from the Stock Updating and Allocation routine.

This file contains various record types as a result of processing - all identical to the Transaction file record formats, where applicable, or created during the Stock Updating and Allocation routine.

These record types are progressively extracted from the Composite file, during the next two routines, to form the following output files intended as entry points to user routines.

Replenishment Order Requisition File 'REPLENFILE ▽▽'
Allocated Demands File 'ALLOCFILE ▽▽▽'
} from the Allocation Report routine.

Priced Receipts File 'RECEIPTSFILE'
Over Maximum Stock Level File 'OVERMAXFILE ▽'
} from the under minimum/over maximum routine.

The balance of the composite file is recirculated back into the system with Unallocated Demand (back-order), Forward Demand, and Audit records (if present).

Note: The Audit records may be extracted from the Composite Recirculating file in a user Audit Report routine.

General

All programs referred to in this manual require one or more parameter records with the exception of;

#X42C Magnetic Tape Creation routine - Transaction file.

#X42L (or #X4CL) Allocation Report routine

#X42P (or #X4CP) Under Minimum/Over Maximum List routine

Run Parameter Record 5.6.1

Used in the Master File Creation/Maintenance routine - program #X42A.

This record must contain at least four fields, each terminated by a comma. The first and second fields give the input file names and the third and fourth fields the output file names.

File names must be twelve characters long but if any file is not present, (when there is only one input file for example), the appropriate field must contain a single zero. It should be noted that, for the file creation function, additional parameter fields will be punched immediately following the four file name fields. The following are the file descriptions for the different functions:

Magnetic tape creation	0,0,FILENAME$_{\nabla\nabla\nabla\nabla}$,0,
MERGE	FILENAME$_{\nabla\nabla\nabla\nabla}$,FILENAME$_{\nabla\nabla\nabla\nabla}$, FILENAME$_{\nabla\nabla\nabla\nabla}$,0,
INSERT AMEND DELETE	FILENAME$_{\nabla\nabla\nabla\nabla}$,0,FILENAME$_{\nabla\nabla\nabla\nabla}$,0,
EXTRACT	FILENAME$_{\nabla\nabla\nabla\nabla}$,0,FILENAME$_{\nabla\nabla\nabla\nabla}$, FILENAME$_{\nabla\nabla\nabla\nabla}$,

Note: FILENAME$_{\nabla\nabla\nabla\nabla}$ is either:

STATISTICAL$_{\nabla}$ for the Demand History file, or

STOCK$_{\nabla}$MASTER for the Stock Master file.

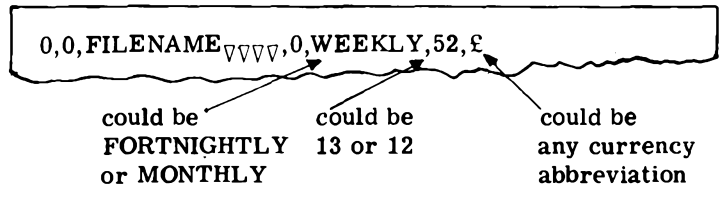
The following additional fields must be punched on the Run Parameter record for the CREATE function:

basic time unit of data, e.g. WEEKLY, or MONTHLY, etc. (maximum 11 characters)

number of time intervals in a year, e.g. 52 or 13 or 12 (maximum 2 characters)

currency unit literal, e.g. £, $, DM, FR, etc. (maximum 4 characters)

Run Parameter record: One punched card (or paper tape block)



Used in Master File Creation/Maintenance routine - program #X42A 'CREATE' function - and are placed behind (or following) the Run Parameter record - see Section 5.6.1.

Also used in the Skeleton History File Generate routine - program #X42B - if NO input Demand History file is present. In this case, no Run Parameter record is required.

The format is fixed for I.C.T. SCAN System 2 and, for the appropriate master file, must be punched exactly as illustrated. Their purpose is to indicate the size and type of field for file maintenance purposes and the table is held in the first data block of each master file.

Each field in the record is terminated by a comma and refers to the corresponding word in the magnetic tape record (excluding spare words). An asterisk terminates the record.

The following code is used:

Card or paper tape field	*Magnetic tape word*
Negative integer	Character field: the value of the integer denotes the number of characters remaining in the field.
Zero	Binary integer
Unity	Mid-point number
Positive integer other than unity	Integer-fraction word: the value of the integer denotes the number of binary bits holding the fractional part.

Note: For the Demand History File, fields need only be entered up to word 60 of the tape record i.e. not for seasonal factors or demand history.

Field Type Table record: Two punched cards (or paper tape blocks)

Demand History file

```
0,-16,-12,-8,-4,-4,-32,-28,-24,-20,-16,-12,-8,-4,-4,-4,1,1,1,1,1,1,1,1,1,1,1,
1,1,1,1,1,1,1,1,1,1,0,0,0,0,-4,0,0,0,0,0,0,16,16,*
```

Stock Master file

```
0,-16,-12,-8,-4,-4,-32,-28,-24,-20,-16,-12,-8,-4,-4,-4,1,1,1,1,1,1,1,1,1,1,8,-4,
-8,-4,0,0,0,0,0,0,0,-8,-4,-4,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,*
```

Note: punching starts in column 1.

Used in the Master File Creation/Maintenance routine - program #X42A (or #X4CA) for the functions: INSERT, AMEND, DELETE and EXTRACT. In any one run only one of these functions may be used for a particular item record, but they may all be used in the same run. The functions may be applied to either the Stock Master file, or the Demand History file, but not both in the one run.

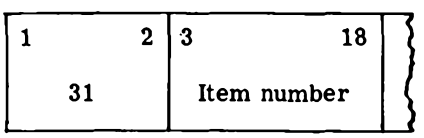
The Function records indicate the action to be taken: a set of function records, in Item Number sequence, follows the Run Parameter record defined in Section 5.6.1.

Each Function record must refer to only one of the four functions listed above, and to only one item record in the master file. The Function record may consist of one or more cards (or 80-character paper tape blocks). Every card (or block) must contain the function code in columns 1 and 2 and the item number in columns 3 to 18. Spare columns at the end of each card must be left blank: spare positions at the end of a paper tape block may be omitted if the Newline character is punched immediately after the last significant character in the block; this latter character will be a blank, a comma, or an asterisk, depending upon the circumstances.

The function codes are as follows:

INSERT	Code 31
AMEND	Code 32
DELETE	Code 33
EXTRACT	Code 34

INSERT Function record (Code 31)



Each Insert Function record must be followed by a set of data cards - either Card Codes 1 to 4 for the Demand History file (see Section 5.1) or Card Codes 5 to 7 for the Stock Master file (see Section 5.2).

Each set of records must be followed by a record containing the number 99 punched in the first two positions.

AMEND Function record (Code 32)

A Function record type 32 allows any word in a record in the master file to be amended (except Record Length and Item Number). Each Amend Function record contains all the amendments to be made to a particular item record in that run. The punching format depends upon the data format in the master file (integer, character or binary fraction) and the position in the item record of the field to be amended - see Section 5.5.1 (Demand History file) and Section 5.5.2 (Stock Master file).

The word number in the file format is used to identify the field to be amended: usually this is the word number of the first (most significant) word of a multi-word field, but there are certain exceptions to this and these are discussed below. The word number reference for the first amendment specified in an Amend Function record is punched in columns 19 to 21 of the first (or only) card of the record. Other amendments relating to the same item record may be punched in the same card and additional cards may be used if necessary.

Note: The sequence of amendments must follow the field sequence in the Item record.

All the cards comprising the Function record must be punched with the Function Code and the Item Number (columns 1 to 18) and a word number reference must always be punched in columns 19 to 21.

The word number reference is always a three digit field and non-significant zeros must be punched.

Integer Fields: the full amendment facility is only available for one word integer fields. In this case the word reference is punched as described above, and is immediately followed by the new value and then a comma. The whole of this data must be contained within one record. The new value may consist only of the decimal digits 0 to 9; non significant zeroes need not be punched, and a zero value may be punched as a single zero.

In the case of two word integer fields, the field can be modified by referencing each word separately. This will usually mean, however, that modification is restricted to zeroising the field unless the new value to be entered can be completely contained in the least significant word.

Character Fields: if the whole of a character field is to be amended, the word number reference must be that of the first word of the field. However, an amendment may start at character position 0 of any word of the field and the start word address is the word number reference of the first word to be amended. The amendment must always extend to character position '3' of the last (least significant) word of the field and must, therefore, always contain an integer multiple of four characters.

Some single word character fields do not use all four character positions in the word. These fields are right-justified at the time of file creation and if any is to be amended, the 'new' value must contain blank characters in the unused positions to the left of the significant characters. The System Marker field is the exception to this rule - the new value in an amendment to this field must be zero filled in character positions 0, 1 and 2.

The amendment to a character field must be punched as a continuous field:

Word number reference New value Comma

and the whole of this contained within one card. The full 1900 printable character set and the blank are permitted characters as far as the Amendment routine is concerned, but other routines may impose restrictions, e.g. the Class Code may contain only two characters of which the first is restricted to one of the three characters A, B and C and the second is restricted to one of the three digits 1, 2 and 3.

The Item Number field may not be amended by means of the Amend function. If this field is incorrect, the item record must be deleted and a correctly referenced item record inserted.

Decimal Fields: the word number reference must always be that of the most significant word of the field. If the new value has a zero decimal fraction, it may be punched as an integer without the decimal point, with the decimal point or with the decimal point and one following zero, i.e. 15.0 may be punched as 15 15. or 15.0 but the recommended form is 15.0 since this will make it easier to check the punching document prepared by the control clerk for the Parameter records.

Similarly, a zero value may be punched in any of the above forms, but 0.0 is the one preferred.

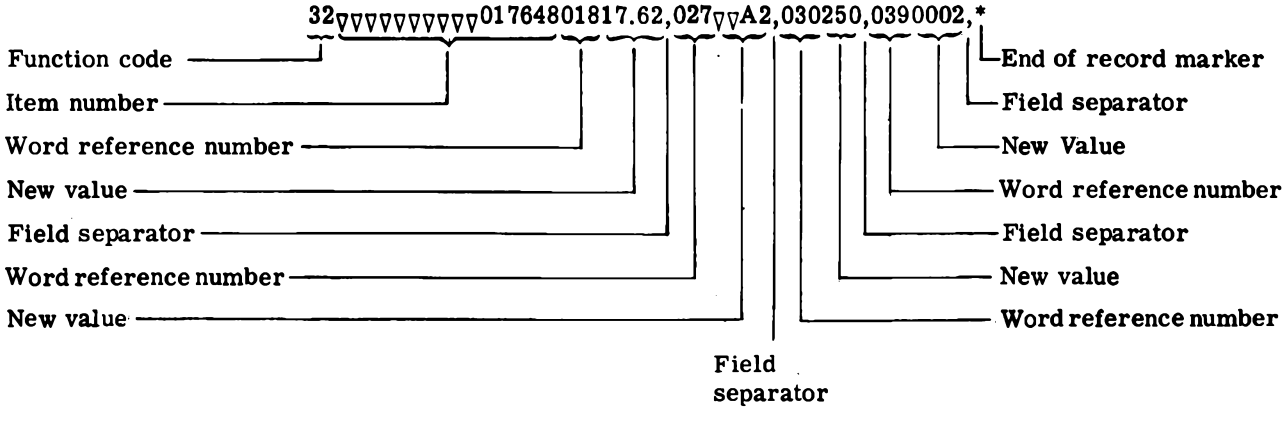
In all other cases the decimal point and at least one following digit must be punched.

Amendment to a decimal field must be punched:

Word number reference New value Comma

as a continuous field contained within the one card.

The following example will illustrate the method of amending the types of field discussed so far. Amendments to seasonal factors and demand history points in the Demand History file require special treatment and these are considered subsequently.



The above amendment will change:

Sales price (word 18)	to 17.62
Discount code (word 27)	to A2
Minimum order quantity (word 30)	to 250
System marker (word 39)	to 2

in the record for Item number 17648 in the Stock Master file.

Seasonal Factors (Demand History file only): extreme care must be exercised on the rare occasions when the seasonal factors require manual amendment. This should never be attempted without the Item record in question being first printed, using program #X42S, Master File Record List routine (see Section 3.4.3).

It cannot be assumed that the seasonal factor array in the Item record represents the same time span for every item - the current period's seasonal factor will be found at position (Cycle Base Count + 1) in the printed array and in word (61 + Cycle Base Count) in the Item record.

If the forecast interval is greater than '1' it is also necessary to look at (Forecast Interval Count + 1) to check how much of the current period remains before the seasonal factors can be pegged to the calendar.

It should also be remembered that the number of seasonal factors must equal the cycle base and that this, in turn, must equal the length of the year divided by the forecast interval. The length of the year is specified in the first block on the Demand History file - see Section 5.5.1.

The seasonal factors are expressed as ratios in such a way that the smallest non-zero factor is unity - see Appendix E. Any amendment to the seasonal factors must not destroy this relationship.

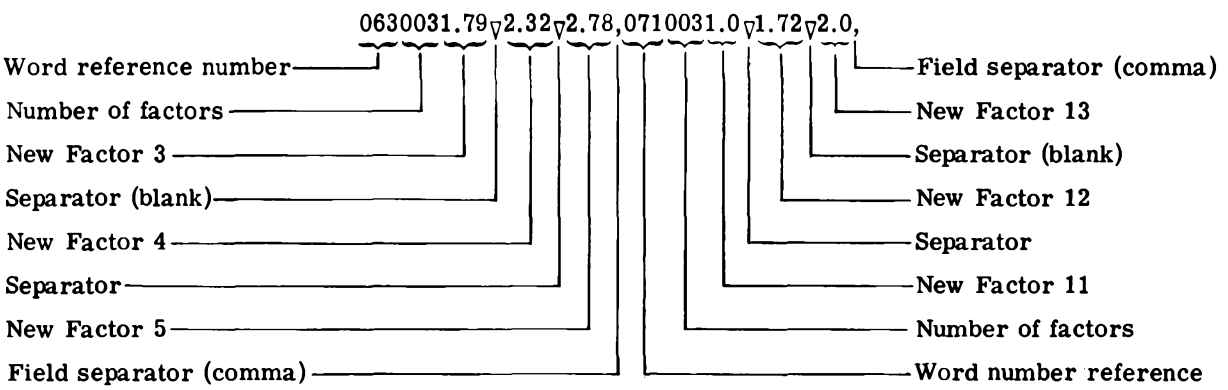
The three cases considered below will probably cover most of the situations that are likely to arise in practice. They are:

The amendment to a few seasonal factors

The replacement of the complete array of seasonal factors

The insertion of a complete array of seasonal factors into the record of an item previously treated as non-seasonal

1 The factors requiring amendment must first be identified in the seasonal factor array in the manner already discussed. The following example assumes that Factors 3, 4 and 5 and 11, 12 and 13 require amendment. The corresponding amendment field in the Amend Function record should be punched as follows:



The seasonal factor array starts in word 61 of the Item record. Thus, seasonal Factors 3, 4 and 5 will be stored in words 63, 64 and 65, whilst words 71, 72 and 73 will hold Factors 11, 12 and 13.

It will be noted that each group of new factors is considered as a separate amendment field terminating in a comma. The first three digits give the word number reference as before, the next three digits the number of factors to be amended by that field, followed immediately by the first of the new values. All of the new values, except the last, is followed by a blank: the last factor in the group is followed by a comma.

A group of factors may overrun from one card to the next provided that the first factor in the group is not separated from the opening six digits of reference data and that the last factor on the first card is followed by at least one blank. The word number reference of the first factor in the second card must be punched in columns 19 to 21 and followed immediately by the new value of that factor.

2 To exemplify the replacement of a complete array of seasonal factors it is assumed that there are 13 factors to be inserted and that they have been calculated so that the first of the new array refers to the current period. The word number reference of the current period is always (Cycle Base Count + 61), e.g. if the Cycle Base Count were '7', the word number reference of the current period would be 68. The opening six digits of the amendment field would then be 068013 to indicate

that 13 new factors are to be inserted starting in word 68 in the record. The insertion of the new factors is 'circular' such that the sixth new factor will be inserted in word 73 (Factor 13 of the array) and the seventh factor in word 61 (Factor 1 of the array).

The punching format is otherwise as for case (1).

3 To change an item from non-seasonal to seasonal, the Cycle Base must be amended from unity to the correct value (equal to the number of factors to be inserted). The Cycle Base Count is always zero for a non-seasonal item, but in case of error in the record it should always be zeroized in this circumstance. If the new factors are arrayed as for case (2) the word number reference is then 061. Otherwise the punching format is the same as for case (2).

Demand History Points (Demand History file only) irrespective of the number of seasonal factors present in the record, the word number reference of the first demand point is always 113. If some demand points are to be amended, the punching format is the same as for seasonal case (1). If the complete demand history is to be changed (an unlikely amendment) seasonal case (2) punching format applies, but note that any change in the number of demand points must be matched with a corresponding change in the Demand History Length in word 44 of the item record. Revised demand data must be entered in integer form.

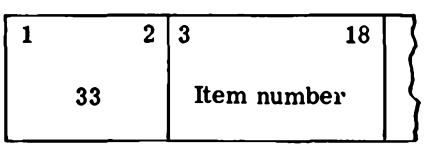
Note that the number of demand points in the record may vary from item to item and it is essential that a record list print of the item record be obtained before amendment of the demand history is attempted. The last demand point of the array always refers to the time interval between the last two forecasting runs. The demand since the last forecasting run is only to be found in word 49 of the Stock Master file. Note also that each demand point in each item record is the demand in the system's minimum forecasting interval: it is not dependent on the forecast interval of the item.

General Comment: each field in the Amend Function record is concerned with the amendment to a single field in the item record in the master file, except in the case of amendments to seasonal factors and demand history in the Demand History file, when the amendment is concerned with a contiguous group of items. Every amendment field in the function record starts with a three digit word number reference and ends with a comma. The first field in each card starts with its word number reference in columns 19 to 21. If more than one card is required for one amendment record, the break from one card to the next must follow a comma, or a blank (array amendments only).

The word number references within a single amendment record must be in ascending sequence.

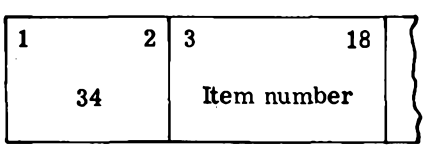
The final comma in the record must be followed immediately by an asterisk. This latter must be on the same card as the last amendment field or the last new value of an array amendment.

DELETE Function record (Code 33)



If duplicate records occur on a main file, either of them may be deleted at the user's choice. To delete the first record the standard deletion function is used. To delete the second record, the amendment function is used on the first record, any field of which may be "amended" to its existing value (for example, if the cost price is 1.5 amend to 1.5). This is followed by a deletion function.

EXTRACT Function record (Code 34)

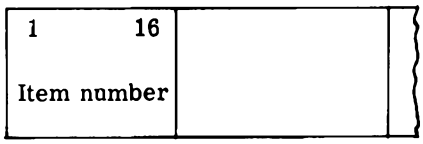


Item Selection Record 5.6.4

Used for the Master File Record List routine - program #X42S. Each item record that is required to be listed is matched from the appropriate master file with the item number held on the Item Selection record.

These records must be in the same sequence as the master file.

The item number must be punched exactly as the item number held on the Master File record.



The last card contains **** in columns 1 to 4 (a Newline character separates each item number in paper tape).

Note: One punched card (or paper tape block) is required for each item record to be listed.

Stock Profile Analysis Parameter Record 5.6.5

Used in the Stock Profile Analysis routine - program #X42D

Four parameters are required for this record:

Columns 1 and 2 Selective listing, e.g.

if 04, all items with a forecast interval of 1, 2 and 4 will be listed - see Section 3.5.1.

Column 3 Frequency table,

if value = 0, Frequency table and four unit totals will be output on printer;

if value = 1, Stock Profile list only will be printed (in conjunction with Selective listing above)

Column 4 Profile Results,

if value = 0, Profile Results magnetic tape (or cassette) file is suppressed;

if value = 1, Profile Results file output.

Columns 5 and 6 Currency Unit

Used as a literal for printer output, e.g.

∇£ or FR etc.

1 2	3	4	5 6
Forecast interval selective listing	Frequency Table parameter	Profile Results parameter	Currency unit

The Profile Results magnetic tape (or cassette) file output from the Stock Profile Analysis routine - program #X42D - may be sorted in one of several different sequences depending upon Management use of the ABC Analysis.

If the ABC classification is to be performed the only permissible sequence is descending sales value.

Parameters for #XSMC Magnetic Tape Sort

Card		*Field*			*Paper Tape*	
Number	*Columns*		*Name*	*Contents*	*Block*	*Position*
1	1 to 4		Identity	SORT	1	1 to 4 N/L
1	5 to 10		Current date	ddmmyy	2	1 to 6 N/L
1	11		Card number	1	-	
1	12 to 23	Input tape	File name	PROFILE∇RSLT	3	1 to 12 N/L
1	24 to 29		Reel sequence number	000000	4	1 to 6 N/L
1	30		File generation number check indicator	1	5	1 N/L
1	31 to 37		File generation number	ggggggg	6	1 to 7 N/L
1	38 to 49	Output tape	File name	PROFILE∇RSLT	8*	1 to 12 N/L
1	50 to 55		Reel sequence number	000000	9	1 to 6 N/L
1	56 to 58		Maximum block length	256	10	1 to 3 N/L
1	59		Number of tape decks	3 or 4	7*	1 N/L
1	60 to 80			Ignored		

Card		Field			Paper Tape		
Number	*Columns*	*Name*		*Contents*	*Block*	*Position*	
2	1 to 4		Identity	SORT	-		
2	5 to 10		Current date	ddmmyy	-		
2	11		Card number	2	-		
2	12 to 23	Input tape	File name	PROFILE▽RSLT	-		
2	24 to 29		Reel sequence number	000000	-		
2	30		Number of keys	1	11	1	N/L
	For sort in *descending* order of *ANNUAL SALES VALUE* continue:						
2	31		Key type	2	12	1	N/L
2	32		Direction of sequencing	1	13	1	N/L
2	33 to 35		Key position	020	14	1 to 3	N/L
2	36 to 38		Key length	000	15	1 to 3	N/L
2	39 to 80			Ignored	-		
or, for sort in *descending* order of *STOCK VALUE* continue:							
2	31		Key type	2	12	1	N/L
2	32		Direction of sequencing	1	13	1	N/L
2	33 to 35		Key position	024	14	1 to 3	N/L
2	36 to 38		Key length	000	15	1 to 3	N/L
2	39 to 80			Ignored	-		
or, for sort in *descending* order of *GROSS ANNUAL MARGIN VALUE* continue:							
2	31		Key type	2	12	1	N/L
2	32		Direction of sequencing	1	13	1	N/L
2	33 to 35		Key position	026	14	1 to 3	N/L
2	36 to 38		Key length	000	15	1 to 3	N/L
2	39 to 80			Ignored	-		
or, for sort in *ascending* order of *CLASS CODE* continue:							
2	31		Key type	0	12	1	N/L
2	32		Direction of sequencing	0	13	1	N/L
2	33 to 35		Key position	020	14	1 to 3	N/L
2	36 to 38		Key length	004	15	1 to 3	N/L
2	39 to 80			Ignored	-		
or, for sort in *ascending* order of *ITEM NUMBER* continue:							
2	31		Key type	0	12	1	N/L
2	32		Direction of sequencing	0	13	1	N/L
2	33 to 35		Key position	004	14	1 to 3	N/L
2	36 to 38		Key length	016	15	1 to 3	N/L
2	39 to 80			Ignored	-		

* Note block number sequence

Parameters for #XSKA Cassette Tape Sort

Card		Field			Paper Tape		
Number	*Columns*		*Name*	*Contents*	*Block*	*Position*	
1	1 to 4		Identity	SORT	1	1 to 4	
1	5 to 8		Current day and month	ddmm	1	5 to 8	N/L
1	9		Card number	1	-		
1	10 to 21	For input tape	File name	PROFILE$_{\nabla}$RSLT	2	1 to 12	
1	22 to 27		Cassette sequence number	000000	2	13 to 18	
1	28 to 34		File generation number	ggggggg	2	19 to 25	
1	35 to 37		Maximum block length	256	2	26 to 28	
1	38 to 40		Maximum record length	028	2	29 to 31	N/L
1	41 to 80		Spare	Ignored	-		
2	1 to 4		Identity	SORT	-		
2	5 to 8		Current day and month	ddmm	-		
2	9		Card number	2	-		
2	10 to 21	For output tape	File name	PROFILE$_{\nabla}$RSLT	3	1 to 12	
2	22 to 27		Cassette sequence number	000000	3	13 to 18	
2	28 to 34		File generation number	ggggggg	3	19 to 25	
2	35 to 37		Maximum Block length	256	3	26 to 28	
2	38 to 40		Retention period	100	3	29 to 31	N/L
2	41 to 80		Spare	Ignored			
3	1 to 4		Identity	SORT	-		
3	5 to 8		Current day and month	ddmm	-		
3	9		Card number	3	-		
3	10		Number of keys	1	4	1	

For sort in *descending* order by *ANNUAL SALES VALUE* continue, Card Number 3 Paper Tape Block Number 4 as:

3	11	Key type	5	4	2	
3	12 to 15	Key position	0020	4	3 to 6	
3	16 to 18	Key length	000	4	7 to 9	N/L
3	19 to 80		Ignored	-		

or, for sort in *descending* order of *STOCK VALUE* continue Card Number 3, Paper Tape Block Number 4 as:

3	11	Key type	5	4	2	
3	12 to 15	Key position	0024	4	3 to 6	
3	16 to 18	Key length	000	4	7 to 9	N/L
3	19 to 80		Ignored	-		

Card		Field		Paper Tape		
Number	*Columns*	*Name*	*Contents*	*Block*	*Position*	
or, for sort in ***descending*** order of *GROSS ANNUAL MARGIN VALUE* continue Card Number 3 Paper Tape Block Number 4 as:						
3	11	Key type	5	4	2	
3	12 to 15	Key position	0026	4	3 to 6	
3	16 to 18	Key length	000	4	7 to 9	N/L
3	19 to 80		Ignored	-		
or, for sort in *ascending* order of *CLASS CODE* continue Card Number 3, Paper Tape Block Number 4 as:						
3	11	Key type	0	4	2	
3	12 to 15	Key position	0020	4	3 to 6	
3	16 to 18	Key length	004	4	7 to 9	N/L
3	19 to 80		Ignored	-		
or, for sort in *ascending* order of *ITEM NUMBER* continue Card Number 3 Paper Tape Block Number 4 as:						
3	11	Key type	0	4	2	
3	12 to 15	Key position	0004	4	3 to 6	
3	16 to 18	Key length	016	4	7 to 9	N/L
3	19 to 80		Ignored			

For a fuller description see I.C.T. 1900 series Library Specifications for magnetic tape, programs #XSMC (20 kch/s) and #XSKA (10 kch/s).

Used in the ABC Analysis Routine - program #X42Q (or #X4CQ).

Six parameters are required for this record:

1 *Column 1 Print option*

1 = fast movers only

2 = medium movers only

3 = slow movers only

A = high value items only

B = medium value items only

C = low value items only

L = complete list of all items

T = preliminary analysis table only

2 *Column 2 File sequence indicator*

0 = descending sequence of sales value

1 = descending sequence of stock value

2 = descending sequence of gross margin

3 = ascending sequence of class code

4 = ascending sequence of item number

3 *Columns 3 and 4 Class 'A' limit*

Two-digit number representing percentage of Total Sales up to which items will be classified as high value 'A' items.

Note: if the value = 0, no ABC classification will be performed and Parameter 1 must be set to 'T'.

This, with the appropriate file sequence setting, will then produce a Preliminary Analysis Table.

4 *Columns 5 and 6 Class 'B' limit*

Two-digit number representing percentage of total sales up to which items will be classified as medium value - from the 'A' limit.

Note: if the value is set equal to the 'A' limit no 'B' classes will be produced and the classification will be high and low value items only, i.e. 'A' and 'C'.

5 *Column 7 Output file control*

0 = No Profile Results magnetic tape (or cassette) file required as output.

1 = Profile Results file required, containing the ABC classification.

6 *Columns 8 and 9 Medium Mover limit*

Two-digit number used to specify the boundary between medium and slow moving items in terms of the forecast interval, e.g. 04 means that medium movers will include those items with a forecast interval of 2 and 4. Slow movers would have a forecast interval greater than 4.

1	2	3 4	5 6	7	8 9
Print option	File sequence indicator	Class 'A' limit	Class 'B' limit	Output file control	Medium mover limit

SORT (Input to Control System Selection Routine) 5.6.8

The Profile Results magnetic tape (or cassette) file output from the ABC Analysis routine - program #X42Q (or #X4CQ) - must be sorted to the same sequence as the Stock Master file used as input to the Control System Selection routine - program #X42R (or #X4CR). Normally, the Stock Master file is in ascending item number sequence.

The sort parameter format is identical to that illustrated in Section 5.6.6 but uses the ascending item number sequence only.

Control System Selection Parameter Record 5.6.9

Used in the Control System Selection routine - program #X42R (or #X4CR)

1 The first nine columns (positions) must be used to allocate system markers to each item classification.

2 The numbers may be selected from the list given in Section 3.5.3.

3 Some, or all, of the numbers may be identical, i.e. the same control systems may be applied to more than one classification. (See limitation in use of forecasting techniques - Section 3.6.6.)

4 Blanks are valid in the appropriate position if it is known that a particular classification has been suppressed, e.g. no 'B' items.

1	2	3	4	5	6	7	8	9
A1 marker	A2 marker	A3 marker	B1 marker	B2 marker	B3 marker	C1 marker	C2 marker	C3 marker

e.g. the A1 marker is set by punching a number in the range 0 to 9 in column 1.

SORT(Transaction File) 5.6.10

The Transaction magnetic tape (or cassette) file, output from the Transaction File Creation routine - program #X42C - must be sorted, normally by:

Item number
Transaction code
Due date
Priority

The sort parameter format for the above sequence is as follows:

#XSMC Magnetic Tape Sort

Card		*Field*			*Paper Tape*		
Number	*Columns*	*Name*		*Contents*	*Block*	*Position*	
1	1 to 4		Identifier	SORT	1	1 to 4	N/L
1	5 to 10		Current date	ddmmyy	2	1 to 6	N/L
1	11		Card number	1			
1	12 to 23	For input tape	I/P file name	TRANSACTIONS	3	1 to 12	N/L
1	24 to 29		I/P reel sequence number	000000	4	1 to 6	N/L
1	30		F.G.N. check indicator	1	5	1	N/L
1	31 to 37		I/P F.G.N.	gggggggg	6	1 to 7	N/L
1	38 to 49	Output tape	O/P file name	TRANSACTIONS	8*	1 to 12	N/L
1	50 to 55		O/P Reel sequence number	000000	9	1 to 6	N/L
1	56 to 58		Maximum Block Size	256	10	1 to 3	N/L
1	59		Number of Tape decks	3 or 4	7*	1	N/L
1	60 to 68			Ignored	-		

Card		Field			Paper Tape		
Number	Columns		Name	Contents	Block	Position	
2	1 to 4		Identifier	SORT	-		
2	5 to 10		Current date	ddmmyy	-		
2	11		Card number	2	-		
2	12 to 23	For input tape	I/P file name	TRANSACTIONS	-		
2	24 to 29		I/P reel sequence number	000000	-		
2	30		Number of keys	4	11	1	N/L
2	31	For 1st key	Key type	0	12	1	N/L
2	32		Direction of sequence	0	13	1	N/L
2	33 to 35		Position of key	008	14	1 to 3	N/L
2	36 to 38		Length of key (chs)	016	15	1 to 3	N/L
2	39	For 2nd key	Key type	1	16	1	N/L
2	40		Direction of sequence	0	17	1	N/L
2	41 to 43		Position of key	001	18	1 to 3	N/L
2	44 to 46		Length of key (chs)	∇∇∇	19	1 to 3	N/L
2	47	For 3rd key	Key type	0	20	1	N/L
2	48		Direction of sequence	0	21	1	N/L
2	49 to 51		Position of key	144	22	1 to 3	N/L
2	52 to 54		Length of key (chs)	008	23	1 to 3	N/L
2	55	For 4th key	Key type	0	24	1	N/L
2	56		Direction of sequence	1	25	1	N/L
2	57 to 59		Position of key	152	26	1 to 3	N/L
2	60 to 62		Length of key (chs)	004	27	1 to 3	N/L

* Note block number sequence.

#XSKA Cassette Tape Sort

Card		Field			Paper Tape		
Number	Columns		Name	Contents	Block	Position	
1	1 to 4		Identity	SORT	1	1 to 4	
1	5 to 8		Current day and month	ddmm	1	5 to 8	N/L
1	9		Card number	1	-		
1	10 to 21	For input tape	File name	TRANSACTIONS	2	1 to 12	
1	22 to 27		Cassette sequence number	000000	2	13 to 18	
1	28 to 34		File generation number	ggggggg	2	19 to 25	
1	35 to 37		Maximumum block length	256	2	26 to 28	
1	38 to 40		Maximum record length	050	2	29 to 31	N/L
1	41 to 80		Spare	Ignored	-		

Card		Field			Paper Tape	
Number	*Columns*		*Name*	*Contents*	*Block*	*Position*
2	1 to 4		Identity	SORT	-	
2	5 to 8		Current day and month	ddmm	-	
2	9		Card number	2	-	
2	10 to 21	For output tape	File name	TRANSACTIONS	3	1 to 12
2	22 to 27	For output tape	Cassette sequence number	000000	3	13 to 18
2	28 to 34	For output tape	File generation number	ggggggg	3	19 to 25
2	35 to 37	For output tape	Maximum block length	256	3	26 to 28
2	38 to 40	For output tape	Retention period	100	3	29 to 31 N/L
2	41 to 80		Spare	Ignored	-	
3	1 to 4		Identity	SORT	-	
3	5 to 8		Current day and month	ddmm	-	
3	9		Card number	3	-	
3	10		Number of keys	4	4	1
3	11	For 1st key	Key type	0	4	2
3	12 to 15	For 1st key	Key position	0008	4	3 to 6
3	16 to 18	For 1st key	Key length	016	4	7 to 9
3	19	For 2nd key	Key type	2	4	10
3	20 to 23	For 2nd key	Key position	0001	4	11 to 14
3	24 to 26	For 2nd key	Key length	000	4	15 to 17
3	27	For 3rd key	Key type	0	4	18
3	28 to 31	For 3rd key	Key position	0144	4	19 to 22
3	32 to 34	For 3rd key	Key length	008	4	23 to 25 N/L
3	35 to 40		Spare	Ignored		
3	41 to 80		Spare	Ignored		
4	1 to 4		Identity	SORT	-	
4	5 to 8		Current day and month	ddmm	-	
4	9		Card number	4	-	
4	10		Spare	Space Character	-	
4	11	For 4th key	Key type	0	5	1
4	12 to 15	For 4th key	Key position	0152	5	2 to 5
4	16 to 18	For 4th key	Key length	004	5	6 to 8 N/L
4	19 to 40		Spare	Ignored	-	
4	41 to 80		Spare	Ignored	-	

The Sorted Transaction magnetic tape (or cassette) file, output from #XSMC (or #XSKA), must, normally, be merged with a recirculating Composite file in the same record format, prior to its use as input to the Stock Updating and Allocation routine.

The merge parameter format is as follows:

#XSMM Magnetic Tape Merge

Card		*Field*			*Paper Tape*	
Number	*Columns*	*Name*		*Contents*	*Block*	*Position*
1	1 to 4		Identity	XSMM	1	1 to 4
1	5 to 10		Current date	ddmmyy	1	5 to 10
1	11		Card type number	1	-	
1	12		Number of input files	2	1	11
1	13 to 24	Output tape	File name	TRANSACTIONS	1	12 to 23
1	25 to 30		Reel sequence number	000000	1	24 to 29
1	31 to 37		Generation number	ggggggg	1	30 to 36
1	38 to 43		Retention period	000100	1	37 to 42
1	44 to 46		Maximum block size	256	1	43 to 45 N/L
1	47 to 80			Blanks	-	
2	1 to 4		Identity	XSMM	-	
2	5 to 10		Current date	ddmmyy	-	
2	11		Card type number	2	-	
2	12		Number of keys	4	2	1
2	13	For 1st key	Key type	0	2	2
2	14		Direction of sequencing	0	2	3
2	15 to 18		Key position	0008	2	4 to 7
2	19 to 21		Key length	016	2	8 to 10
2	22	For 2nd key	Key type	0	2	11
2	23		Direction of sequencing	0	2	12
2	24 to 27		Key position	0004	2	13 to 16
2	28 to 30		Key length	004	2	17 to 19
2	31	For 3rd key	Key type	0	2	20
2	32		Direction of sequencing	0	2	21
2	33 to 36		Key position	0144	2	22 to 25
2	37 to 39		Key length	008	2	26 to 28
2	40	For 4th key	Key type	0	2	29
2	41		Direction of sequencing	0	2	30
2	42 to 45		Key position	0152	2	31 to 34
2	46 to 48		Key length	004	2	33 to 37 N/L
2	49 to 80			Blank	-	

Card		Field			Paper Tape	
Number	Columns	Name		Contents	Block	Position
3	1 to 4		Identity	XSMM	-	
3	5 to 10		Current date	ddmmyy	-	
3	11		Card type number	3	-	
3	12	First input tape	File generation number check indicator	1	3	1
3	13 to 24		File name	COMPOSITE$_{\nabla\nabla\nabla}$	3	2 to 13
3	25 to 30		File reel sequence number	000000	3	14 to 19
3	31 to 37		File generation number	ggggggg	3	20 to 26 N/L
3	38 to 80			Blank	-	
4	1 to 4		Identity	XSMM	-	
4	5 to 10		Current date	ddmmyy	-	
4	11		Card type number	3	-	
4	12	Second input tape	File generation number check indicator	1	4	1
4	13 to 24		File name	TRANSACTIONS	4	2 to 13
4	25 to 30		File reel sequence number	000000	4	14 to 19
4	31 to 37		File generation number	ggggggg	4	20 to 26 N/L
4	38 to 80			Blank	-	

#XSKB Cassette Tape Merge

Card		Field			Paper Tape	
Number	Columns	Name		Contents	Block	Position
1	1 to 4		Identity	XSKB	1	1 to 4
1	5 to 8		Current day and month	ddmm	1	5 to 8
1	9		Card type number	1	-	
1	10		Number of input files	2	1	9
1	11		Number of keys	4	1	10
1	12 to 19		Account code number	Optional	1	11 to 18 N/L
1	20 to 40		Spare	(Spaces)	-	
1	41 to 80			Ignored	-	
2	1 to 4		Identity	XSKB	-	
2	5 to 8		Current day and month	ddmm	-	
2	9		Card type number	2	-	
2	10 to 21	Output tape	File name	TRANSACTIONS	2	1 to 12
2	22 to 27		File cassette sequence number	000000	2	13 to 18
2	28 to 34		File generation number	ggggggg	2	19 to 25
2	35 to 37		Maximum block length	256	2	26 to 28
2	38 to 40		Retention period	100	2	29 to 31 N/L
2	41 to 80			Ignored	-	

Card		Field			Paper Tape	
Number	*Columns*		*Name*	*Contents*	*Block*	*Position*
3	1 to 4		Identity	XSKB	-	
3	5 to 8		Current day and month	ddmm	-	
3	9		Card type number	3	-	
3	10 to 21	First input tape	File name	COMPOSITE$_{\nabla\nabla\nabla}$	3	1 to 12
3	22 to 27		File cassette sequence number	000000	3	13 to 18
3	28 to 34		File generation number	gggggggg	3	19 to 25
3	35 to 37		Maximum block length	256	3	26 to 28 N/L
3	38 to 40		Spare	(spaces)	-	
3	41 to 80			Ignored	-	
4	1 to 4		Identity	XSKB	-	
4	5 to 8		Current day and month	ddmm	-	
4	9		Card type number	3	-	
4	10 to 21	Second input tape	File name	TRANSACTIONS	4	1 to 12
4	22 to 27		File cassette sequence number	000000	4	13 to 18
4	28 to 34		File generation number	gggggggg	4	19 to 25
4	35 to 37		Maximum block length	256	4	26 to 28 N/L
4	38 to 40		Spare	(spaces)	-	
4	41 to 80			Ignored	-	
5	1 to 4		Identity	XSKB	-	
5	5 to 8		Current day and month	ddmm	-	
5	9		Card type number	4	-	
5	10		Key card sequence number	0	-	
5	11	For 1st key	Key type	0	5	1
5	12 to 15		Key position	0008	5	2 to 5
5	16 to 18		Key length	0016	5	6 to 8
5	19	For 2nd key	Key type	0	5	9
5	20 to 23		Key position	0004	5	10 to 13
5	24 to 26		Key length	004	5	14 to 16
5	27	For 3rd key	Key Type	0	5	17
5	28 to 31		Key position	0144	5	18 to 21
5	32 to 34		Key length	008	5	22 to 24
5	35 to 40		Spare	(Spaces)	-	
5	41 to 80			Ignored	-	

Card		Field			Paper Tape	
Number	*Columns*		*Name*	*Contents*	*Block*	*Position*
6	1 to 4		Identity	XSKB	-	
6	5 to 8		Current day and month	ddmm	-	
6	9		Card type number	4	-	
6	10		Key card sequence	1	-	
6	11	For 4th key	Key type	0	5	25
6	12 to 15	For 4th key	Key position	0152	5	26 to 29
6	16 to 18	For 4th key	Key length	004	5	30 to 32 N/L
6	19 to 40		Spare	(spaces)	-	
6	41 to 80			Ignored	-	

Stock Updating Parameter Record 5.6.12

Used in the Stock Updating and Allocation routine - program #X42J.

This record consists of four parameters, each expressing a Management option as follows:

	Value	
Column 1	1	Part allocation allowed
	0	No part allocation
Column 2	1	Cyclical ordering required
	0	Cyclical ordering not required
Column 3	1	Supplementary ordering required (omit Transaction file input)
	0	Normal stock updating
Columns 4 to 6	'n'	Time interval, where 'n' is the number of days from current date - see Section 3.6.3, 3(b).

Forecast Parameter Record 5.6.13

Used in the Stock Forecasting and Monitoring Routine - programs #X42K, #X42U.

Two or three punched cards (paper tape blocks) are required, the third card (or paper tape block) being omitted if a certain condition is met - see below.

Para meter	*Punched Card*		*Field*		*Paper Tape*	
	Number	*Columns*	*Name*	*Contents*	*Block*	*Position*
1	1	1 to 4	Blank		1	1 to 4
2	1	5 to 9	Ordering Cost	e.g. ▽▽200 for 200 francs	1	5 to 9
3	1	10 to 13	Investment Rate	e.g. ▽▽15 for 15%	1	10 to 13 N/L

Notes

1 If it is desired to use the economic order quantity formula either the ordering cost field in the Stock Master Item record or parameter (2) above must have a value - parameter (2) is used as a 'blanket' value, over-riding the individual item record.

2 If parameter (3) is blank and the EOQ formula is to be used the third card or block must be used, otherwise parameter (3) is used as a 'blanket' value and the third card or block may be omitted.

3 If both parameter (2) and (3) are blank and the EOQ formula is not required, the third card or block may be omitted.

Para meter	Punched Card		Field		Paper Tape	
	Number	Columns	Name	Contents	Block	Position
4	2	1 to 4	Service level Group 1 %	e.g. ▽▽90 for 90%	2	1 to 4
5	2	5 to 8	Factor 1 (*k*)	e.g. 1.28	2	5 to 8
6	2	9 to 12	Service level Group 2 %	e.g. ▽▽95 for 95%	2	9 to 12
7	2	13 to 16	Factor 2	See appendix A	2	13 to 16
8	2	17 to 20	Service level Group 3 %	e.g. ▽▽99 for 99%	2	17 to 20
9	2	21 to 24	Factor 3	See Appendix A	2	21 to 24
10	2	25 to 28	Service level Group 4 %	e.g. 99.9 for 99.9%	2	25 to 28
11	2	29 to 32	Factor 4	See Appendix A	2	29 to 32 N/L

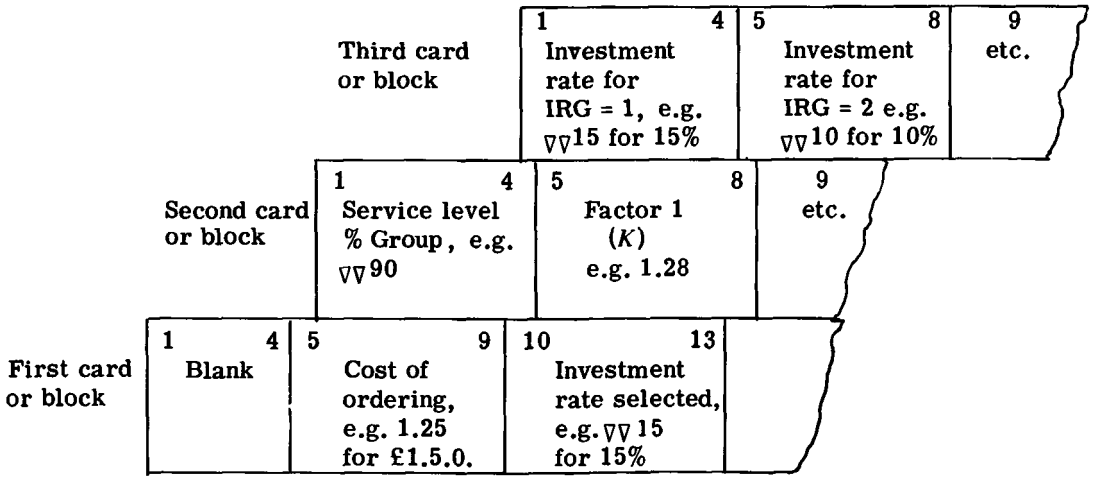
Note: if it is known that only one service level is being used, say, columns 1 to 8 only need be completed, with the service level group set to '1' in the corresponding item record - Demand History file.

12	3	1 to 4	Investment Rate Group 1 Percentage	e.g. ▽▽15 for 15%	3	1 to 4
13	3	5 to 8	Investment Rate Group 2 Percentage		3	5 to 8
14	3	9 to 12	Investment Rate Group 3 Percentage		3	9 to 12
15	3	13 to 16	Investment Rate Group 4 Percentage		3	13 to 16
16	3	17 to 20	Investment Rate Group 5 Percentage		3	17 to 20
17	3	21 to 24	Investment Rate Group 6 Percentage		3	21 to 24
18	3	25 to 28	Investment Rate Group 7 Percentage		3	25 to 28
19	3	29 to 32	Investment Rate Group 8 Percentage		3	29 to 32
20	3	33 to 36	Investment Rate Group 9 Percentage		3	33 to 36
21	3	37 to 40	Investment Rate Group 0 Percentage		3	37 to 40 N/L

Notes

1 This card (or paper tape block) may be omitted if parameter 3 (card/block 1) has a non-zero value.

2 It is not necessary to complete all ten fields if, for example, only two investment rate groups are being used. Columns (positions) 1 to 4 and 5 to 8 would be used only, in this case, with the appropriate settings in the investment rate group field in the item record - Demand History file.



Chapter 6 Operating Procedures

This chapter gives the key specification details and run instructions for all of the programs in the I.C.T. SCAN System 2.

Notes

1 #X42 program series refer to the 20 kch/s magnetic tape version

2 #X4C program series refer to the 10 kch/s cassette tape version

3 all programs assume the use of standard 11-inch printer stationery.

MASTER FILE CREATION/MAINTENANCE ROUTINE 6.1

This routine incorporates six separate functions:

CREATE master file

MERGE part files

INSERT records

AMEND fields

DELETE records

EXTRACT records

The CREATE and MERGE functions must each be used alone in separate runs. INSERT, AMEND, DELETE and EXTRACT may be used together in one run, but only one function may be used for each item to be processed.

Only one master file format may be handled in one run. Reference should be made to Chapter 5 for details of formats, as follows:

Section 5.1 Data record - Demand History file - used in CREATE and INSERT functions.

Section 5.2 Data record - Stock Master file - used in CREATE and INSERT functions.

Section 5.5.1 Demand History magnetic tape file - used in all functions.

Section 5.5.2 Stock Master magnetic tape file - used in all functions.

Section 5.6.1 Run Parameter record - used in all functions.

Section 5.6.2 Field Type Table record - used in CREATE function.

Section 5.6.3 Function record - used in INSERT (Code 31), AMEND (Code 32), DELETE (Code 33) and EXTRACT (Code 34) functions.

To avoid needless repetition, punched input data are described as being in punched cards, but in all cases punched paper tape may be used as an alternative input medium (the choice is under operator control): a paper tape block then replaces each punched card.

Program **#X42A**

Priority 70

Hardware Requirement 5,632 words of core store
1 line printer (120 print positions)
1 card/paper tape reader
1 magnetic tape unit (or cassette)

Use of Peripherals All peripherals are allotted by program.

Description See Section 3.4.1.

Input

1 Run Parameter record: one punched card
2 Field Type Table record: two punched cards
3 Data records: a set of punched cards for each item to be written to the output magnetic tape file.
4 Final card with '****' in columns 1 to 4.

Output

1 Magnetic tape file (or cassette): either Demand History (name 'STATISTICAL$_\nabla$') or Stock Master (name 'STOCK$_\nabla$MASTER')
Relative deck address: 2
File generation number: 1
2 List of input records - see Figure 1.

Run Instructions

	Narrative	*Console Message*
1	Load one scratch tape.	
2	Load program #X42A.	
3	Load Run Parameter record, Field Type Table record, Data records and Run Terminator in input peripheral.	
4	If cassette tapes are being used	ON 15
5	Start program by typing	
	for paper tape input:	GO 20
	for punched card input:	GO 21
6	At end of run the program will halt and type:	HALTED EN

Exception Conditions See Section 6.15.

Program **#X42A**

Priority 70

Hardware Requirement 5,632 words of core store

1 card/paper tape reader

3 magnetic tape units (or cassette)

Use of Peripherals All peripherals are allotted by program. Card/paper tape reader used initially to input Run Parameter record and released immediately.

Description See Section 3.4.1.

Input

1 Run Parameter record

2 Two magnetic tape (or cassette) master files in which no item record is duplicated in the other file: either two Demand History files (names 'STATISTICAL$_{\nabla}$') or two Stock Master files (names 'STOCK$_{\nabla}$MASTER').

Relative deck addresses: 0, 1

File generation numbers: various

Note: Input files must be in ascending sequence of Item Number

Output One magnetic tape (or cassette) master file (same name, format and sequence as input files) containing all records from two input files.

Relative deck address: 2

File generation number: greater of input F.G.N. + 1

Run Instructions

	Narrative	*Console Message*
1	Load one scratch tape.	
2	Load program #X42A	
3	Load two input tapes (both Demand History or both Stock Master files).	
4	Load Run Parameter record on input peripheral.	
5	If cassette tapes are being used	ON 15
6	If the input file generation numbers are to be checked, alter word 5 to the F.G.N. of the input file on relative deck address 0 by typing: (where n = input F.G.N.)	AL 5 n
7	If the input file generation numbers are to be checked, alter word 6 to the F.G.N. of the input file on relative deck address 1 by typing: (where n = input F.G.N.)	AL 6 n
8	Start program by typing	
	for paper tape input:	GO 20
	for punched card input:	GO 21
9	At end of run the program will halt and type:	HALTED EN

Exception Conditions See Section 6.15.

Program **#X42A**

Priority 70

Hardware Requirement 5,632 words of core store

1 line printer (120 print positions)

1 card/paper tape reader

2 magnetic tape units (or cassette) - unless EXTRACT function present in run, when 3 magnetic tape units (cassette) are required.

Use of Peripherals All peripherals are allotted by program

Description See Section 3.4.1.

Input

1 Run Parameter record

2 INSERT items: Function record (Code 31)

Set of Data records

Card punched with '99' in columns 1 and 2

3 AMEND items: Function record (Code 32)

4 DELETE items: Function record (Code 33)

5 EXTRACT items: Function record (Code 34)

Note: Items to be in ascending sequence of Item Number

6 For all items: Master magnetic tape (or cassette) file: either

Demand History file (name 'STATISTICAL$_{\nabla}$')

or Stock Master file (name 'STOCK$_{\nabla}$MASTER')

Relative deck address: 0

File generation number: various

Sequence: ascending Item Number

7 Final card with '****' in columns 1 to 4

Output

1 One master magnetic tape (or cassette) file (same name, format and sequence as input file) containing all items except EXTRACTED and DELETED items.

Relative deck address: 2

File generation number: input F.G.N. + 1

2 A second master magnetic tape file (same name, format and sequence as input file) containing all EXTRACTED items.

Relative deck address: 3

File generation number: input F.G.N. + 2

Note: this file will not be opened if no Code '34' Function records are present in the run.

3 List for record - see Figure 2.

Run Instructions

	Narrative	*Console Message*
1	Load one scratch tape.	
2	Load second scratch tape if EXTRACT function present.	
3	Load program ±X42A	
4	Load input data tape (either Demand History or Stock Master file)	
5	Load Run Parameter record, Function and Data records and Run Terminator in input peripheral.	
6	If cassette tapes are being used	ON 15
7	If the input file generation number is to be checked, alter word 5 to the F.G.N. of the input file on relative deck address 0 by typing: (where n = input F.G.N.)	AL 5 n
8	Start program by typing	
	for paper tape input:	GO 20
	for punched card input:	GO 21
9	At end of run the program will halt and type:	HALTED EN

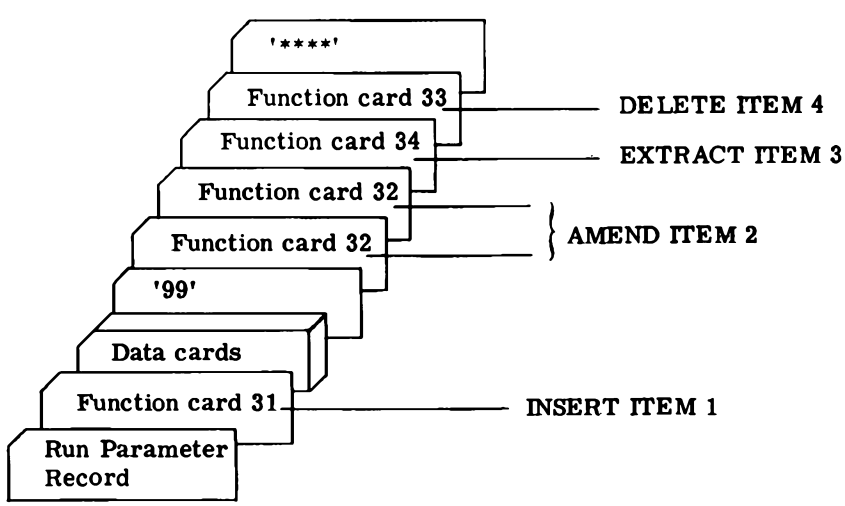
Exception Conditions — See Section 6.15.

Notes

1 A card (or paper tape block) containing '99' in columns 1 and 2 signifies the end of data cards for the INSERT function *per item*.

2 The end of a file maintenance run is indicated by a card (or paper tape block) containing '****' in columns 1 to 4.

3 An example of a typical punched card deck input to a file maintenance run is illustrated below.



Program **#X42B**

Priority 70

Hardware Requirement 2,752 words of core store

1 card/paper tape reader

2 or 3 magnetic tape units (or cassette)

Use of Peripherals All peripherals are allotted by program. Card/paper tape reader used initially to input parameters and released immediately.

Description See Section 3.4.2.

Input

1 Stock Master magnetic tape (or cassette) file, format as described in Section 5.5.2.

Name: 'STOCK$_{\nabla}$MASTER'

Relative deck address: 0

2 Demand History magnetic tape (or cassette) file, format as described in Section 5.5.2.

Name: 'STATISTICAL$_{\nabla}$'

Relative deck address: 1

Note: This is an optional input file.

3 Field Type Table records: two punched cards or paper tape blocks - see Section 5.6.2.

Note: only required if *no* input Demand History file present.

Output Demand History magnetic tape (or cassette) file.

Name: 'STATISTICAL$_{\nabla}$'

Relative deck address: 2

Generation number: 1 unless input Demand History present when F.G.N. = input Demand History F.G.N. + 1.

Run Instructions

	Narrative	*Console Message*
1	Load one scratch tape.	
2	Load program #X42B.	
3	Load one or two input tapes. Stock Master file - mandatory Demand History file - optional, see Section 3.4.2.	
4	Load Field Type Table records on card or paper tape reader. Note: only required if *no* input Demand History file present.	
5	If cassette tapes are being used	ON 15
6	If *no* input Demand History file present, Type:	ON 12

	Narrative	*Console Message*
7	If the input Stock Master file generation number is to be checked alter word 5 to the F.G.N. of the input file on relative deck address 0, by typing: (where n = input F.G.N.)	AL 5 n
8	If the input Demand History file generation number is to be checked alter word 6 to the F.G.N. of the input file on relative deck address 1 by typing: (where n = input F.G.N.)	AL 6 n
9	Start program by typing:	
	for paper tape input:	GO 20
	for punched card input:	GO 21
10	At the end of run the program will halt and type:	HALTED EN
Exception Conditions		See Section 6.15.

Program **#X42S**

Priority 70

Hardware Requirement 4,032 words of core store
1 line printer (120 print positions)
1 card/paper tape reader
1 magnetic tape unit (or cassette)

Use of Peripherals All peripherals are allotted by program.

Description See Section 3.4.3.

Input

1 Either

Stock Master magnetic tape (or cassette) file, format as described in Section 5.5.2

Name: 'STOCK$_{\nabla}$MASTER'

Relative deck address: 0

or

Demand History magnetic tape (or cassette) file, format as described in Section 5.5.1.

Name: 'STATISTICAL$_{\nabla}$'

Relative deck address: 0

2 Item Selection records: one, or more, punched cards or paper tape blocks - see Section 5.6.4.

Output Master File Record list - see Figures 3 and 4.

Run Instructions

	Narrative	*Console Message*
1	Load program #X42S	
2	Load one input tape, (either, Stock Master or Demand History file)	
3	Load Item Selection records on card or paper tape reader. If the complete main file is to be listed without using item selection records, type:	ON 17
4	If cassette tapes are being used	ON 15
5	Start program by typing	
	for paper tape input:	GO 20
	for punched card input:	GO 21
6	The program signifies correct CR or TR allocation by typing:	HALTED 01
7	If the input file generation number is to be checked, alter word 5 to the F.G.N. of the input file on relative deck address 0 by typing: (where n = input F.G.N.)	AL 5 n

	Narrative	*Console Message*
8	Select correct input Master file by typing:	
	for Demand History file:	GO 22
	for Stock Master file:	GO 23
9	At the end of run the program will halt and type:	HALTED EN
Exception Conditions		See Section 6.15.

Program **#X42D**

Priority 70

Hardware Requirement
4,096 words of core store
1 line printer (120 print positions)
1 card/paper tape reader
2 or 3 magnetic tape units (or cassette).

Use of Peripherals All peripherals are allotted by program. Card/paper tape reader used initially to input parameters and released immediately.

Description See Section 3.5.1.

Input

1 Demand History magnetic tape (or cassette) file, format as described in Section 5.5.1.
Name: 'STATISTICAL$_{\nabla}$'
Relative deck address: 0

2 Stock Profile Analysis Parameter record: one punched card or paper tape block - see Section 5.6.5.

Output

1 Profile Results magnetic tape (or cassette) file, format as described in Section 5.5.4.
Name: 'PROFILE$_{\nabla}$RSLT'
Relative deck address: 1
Generation number: 1

2 Demand History magnetic tape (or cassette) file
Name: 'STATISTICAL$_{\nabla}$'
Relative deck address: 2
Generation number: input F.G.N. + 1

3 Stock Profile List
4 Frequency Analysis Table } see Figure 5.

Note: One, or both, listings may be suppressed by input parameter.

Run Instructions

	Narrative	*Console Message*
1	Load one or two scratch tapes.	
2	Load program #X42D.	
3	Load one input tape (Demand History file).	
4	Load Stock Profile Parameter record on card or paper tape reader.	
5	If cassette tapes are being used:	ON 15
6	If an output Demand History file is required type:	ON 23
7	If the input Demand History file generation number is to be checked, alter word 5 to the F.G.N. of the input file on relative deck address 0 by typing: (where n = input F.G.N.)	AL 5 n

	Narrative	*Console Message*
8	Start program by typing	
	for paper tape input:	GO 20
	for punched card input:	GO 21
9	At the end of run the program will halt and type:	HALTED END OF STOCK PROFILE ANALYSIS
	Exception Conditions	See Section 6.15.

Program **#XSMC** (20 Kch/s tape)

#XSKA (10 Kch/s tape)

Priority 50

Hardware Requirement **#XSMC**

5,056 words of core store

3 or 4 magnetic tape units

1 card/paper tape reader

#XSKA

2,048 words of core store

4 cassette stations

1 card/paper tape reader

Use of Peripherals All peripherals are allotted by program. Card/paper tape reader used, initially, to input sort parameters and released immediately.

Description See Sections 3.5.2, and 5.6.6.

Input

1 Profile Results magnetic tape (or cassette) file, output from #X42D (or #X4CD), format as described in Section 5.5.4.

Name: 'PROFILE$_{\nabla}$RSLT'

2 Sort Parameter record - see Section 5.6.6 for format.

Output Sorted Profile Results magnetic tape (or cassette) file.

Name: 'PROFILE$_{\nabla}$RSLT'

Generation number: see sort parameters

Run Instructions

	Narrative	*Console Message*
#XSMC MAGNETIC TAPE SORT		
1	Load #XSMC	
2	Load input magnetic tape without write permit ring.	
3	Load n-1 scratch tapes (where n = total number of tape decks specified).	
4	Load sort parameter records on card or paper tape reader.	
5	Start program by typing:	
	for paper tape input:	GO 21
	for punched card input:	GO 20
6	Program will halt and type:	REMOVE INPUT REEL FROM UNIT XX
7	Replace input reel with a scratch tape.	
8	After continuing, program will, at end of run, type:	END OF SORT, FINAL O/P REEL ON UNIT YY
9	The program will delete itself.	

#XSKA CASSETTE TAPE SORT

1 Load program #XSKA.

2 Load input cassette.

3 Load scratch cassettes.

4 Load Sort Parameter records on card or paper tape reader.

5 Start program by typing:

for paper tape input:	GO 21
for punched card input:	GO 20

6 Dismount input cassette.

7 Load scratch cassette.

8 At end of run program will halt and type: DELETED HH

Note: For a full description see I.C.T. 1900 series Library Specifications for Magnetic Tape, programs #XSMC, #XSKA. Any amendments to the standard software will, of course, affect the appropriate sections of this manual including core store requirements.

Program **#X42Q (or #X4CQ)**

Priority 70

Hardware Requirement 5,440 words of core store

1 line printer (120 print positions)

1 card/paper tape reader

2 magnetic tape units.

Use of Peripherals All peripherals are allotted by program. Card/paper tape reader used, initially, to input parameters and released immediately.

Description See Section 3.5.2.

Input

1 Sorted Profile Results magnetic tape file (name: 'PROFILE$_{\nabla}$RSLT') - see Section 5.5.4 sorted to a sequence indicated in Section 3.5.2, and originally output from #X42D.

File number: 1

2 ABC Analysis Parameter record: one punched card or paper tape block - see Section 5.6.7.

Output

1 Profile Results magnetic tape file (name: 'PROFILE$_{\nabla}$RSLT').

File number: 2

Generation number: as specified

2 ABC Analysis List - see figure 6.

3 ABC Analysis Summary table - see figure 7.

4 Preliminary Analysis table - see figure 8.

Note: The Output Profile Results file and above reports are optional and may be suppressed by input parameter - see Section 5.6.7.

Run Instructions

	Narrative	*Console Message*
1	Load one scratch tape (optional)	
2	Load program #X42Q (or #X4CQ)	
3	Load input tape (Profile Result File)	
4	If the magnetic tape file generation number checks are to be omitted:	ON 0
5	If the number of lines per page is to be other than 60:	ON 2
6	Start program by typing:	
	for paper tape parameter	GO 20
	for card parameter	GO 21
7	If switch 2 was set on the program halts:	HALTED COBOL ACCEPT (SEE JOB SHEET) *nnnnnn* 1
8	Alter word 0 to the number of lines (*nn*) of print required per page and restart program	AL 0 *nn* GO

	Narrative	*Console Message*
9		HALTED:- LOAD FILE {03 / 04} ON unit no.
10	Load parameters on unit indicated and restart program.	GO
11		HALTED:- LOAD FILE 00 ON unit no.
12	Set up stationery and restart program.	GO
13	If switch 0 was set messages 14 to 17 will be suppressed and zero generation numbers will be assumed.	
14		HALTED SET FILE 01 GENERATION NO. IN WORD 0
15	Alter word 0 to the input Profile Results generation number (*n*) and restart program.	AL 0 *n* GO
16		HALTED SET FILE 02 GENERATION NO. IN WORD 0
17	If required, alter word 0 to the output Profile Results generation number (*n*) and restart program.	AL 0 *n* GO
18	At end of run the program halts:	HALTED END OF RUN

Exception Conditions See Section 6.15

Program **#XSMC** (20 Kch/s tape)
#XSKA (10 Kch/s tape)

Priority 50

Hardware Requirement As Section 6.5.

Use of Peripherals As Section 6.5.

Description See Sections 3.5.3, and 5.6.8.

Input

1 Profile Results magnetic tape (or cassette) file, output from #X42Q (or #X4CQ), format as described in Section 5.5.4.

Name: 'PROFILE$_{\nabla}$RSLT'

2 Sort Parameter record - see Section 5.6.8 for format.

Output As Section 6.5.

Run Instructions As Section 6.5.

Program **#X42R (or #X4CR)**

Priority 70

Hardware Requirement 5,312 words of core store

1 line printer (120 print positions)

1 card/paper tape reader

3 magnetic tape units

Use of Peripherals All peripherals are allotted by program. Card/paper tape reader used, initially, to input parameter and released immediately.

Description See Section 3.5.3.

Input

1 Stock Master magnetic tape file (name: 'STOCK$_{\nabla}$MASTER') - see Section 5.5.2.

File number: 1

2 Sorted Profile Results magnetic tape file, format as described in Section 5.5.4, output from #X42Q (or #X4CQ) and sorted (name: 'PROFILE$_{\nabla}$RSLT') - see Section 6.7.

File number: 2

3 Control System Selection Parameter record: one punched card or paper tape block - see Section 5.6.9.

Output

1 Stock Master magnetic tape file (name: 'STOCK$_{\nabla}$MASTER').

File number: 3 (128 Word Blocks)
or 4 (256 Word Blocks)

Generation number: as specified

2 Inventory list - see figure 9.

Note: The list is optional and may be suppressed by console switch.

Run Instructions

	Narrative	*Console Message*
1	Load scratch tape	
2	Load program #X42R (or #X4CR)	
3	Load input tapes (Stock Master and Profile Results files)	
4	If magnetic tape file generation number checks are to be omitted:	ON 0
5	If the number of lines per page is to be other than 60:	ON 2
6	If Output Stock Master file is to have short blocks:	ON 16
7	If reports of unmatched records are not required:	ON 22
8	If the inventory list is not required:	ON 23
9	Start program by typing:	
	for paper tape parameter	GO 20
	for card parameter	GO 21

	Narrative	*Console Message*
10	If switch 2 was set on the program will halt:	HALTED:- COBOL ACCEPT (SEE JOB SHEET) *nnnnnn* 1
11	Alter word 0 to the number of lines (*nn*) of print required per page and restart program.	AL 0 *nn* GO
12		HALTED:- LOAD FILE {05 / 06} ON unit no.
13	Load parameters on unit indicated and restart program.	GO
14		HALTED:- LOAD FILE 00 ON unit no.
15	Set up stationery and restart program	GO
16	If switch 0 was set messages 17 to 22 will be suppressed and zero generation numbers assumed	
17		HALTED SET FILE 01 GENERATION NO. IN WORD 0
18	Alter word 0 to the input Stock Master file generation number (*n*) and restart program	AL 0 *n* GO
19		HALTED SET FILE 02 GENERATION NO. IN WORD 0
20	Alter word 0 to the input Profile Results file generation number (*n*) and restart program	AL 0 *n* GO
21		HALTED SET FILE {03 / 04} GEN. NO. IN WORD 0
22	If required, alter word 0 to the output Stock Master file generation number (*n*) and restart program.	AL 0 *n* GO
23	At end of run, the program will halt	HALTED:- END OF RUN.

Exception Conditions See Section 6.15

Program **#X42C**

Priority 70

Hardware Requirement 1,856 words of core store
1 line printer (120 print positions)
1 card/paper tape reader
1 magnetic tape unit (or cassette)

Use of Peripherals All peripherals are allotted by program.

Description See Section 3.6.1.

Input
1 Transaction records, as described in Section 5.3 on punched cards or paper tape (last card contains '****' in columns 1 to 4).

Output
Transaction magnetic tape (or cassette) file, format as described in Section 5.5.3.
Name: 'TRANSACTIONS'
Relative deck address: 0
Generation number: 1
2 Transaction list - see Figure 10.

Run Instructions

	Narrative	*Console Message*
1	Load one scratch tape.	
2	Load program #X42C.	
3	Load Transaction records on card/paper tape reader.	
4	If cassette tapes are being used:	ON 15
5	Start program by typing:	
	for paper tape input:	GO 20
	for punched card input:	GO 21
6	At end of run the program will halt and type:	HALTED EN

Exception Conditions See Section 6.15.

SORT Routine (Input to MERGE and/or Stock Updating and Allocation Routine) 6.10.1

Program **#XSMC** (20 Kch/s tape)
#XSKA (10 Kch/s tape)

Priority 50

Hardware Requirement As Section 6.5.

Use of Peripherals As Section 6.5.

Description See Section 3.6.2.

Input

1 Transaction magnetic tape (or cassette) file, format as described in Section 5.5.3, output from #X42C

Name: 'TRANSACTIONS'

2 Sort Parameter records - see Section 5.6.10 for format.

Output Sorted Transaction magnetic tape (or cassette) file.

Name: 'TRANSACTIONS'

Generation number: see Sort parameters.

Run Instructions As Section 6.5.

Program **#XSMM** (20 Kch/s tape)
#XSKB (10 Kch/s tape)

Priority 70

Hardware Requirement **#XSMM**

3,072 words of core store

1 card/paper tape reader

3 or 4 magnetic tape units

#XSKB

2,048 words of core store

1 card/paper tape reader

4 cassette stations

Use of Peripherals As Section 6.5.

Description See Section 3.6.2.

Input

1 Sorted Transaction magnetic tape (or cassette) file, format as described in Section 5.5.3, output from #XSMC (or #XSKA).

Name: 'TRANSACTIONS'

2 Composite magnetic tape (or cassette) file, format as described in Section 5.5.5.

Name: 'COMPOSITE$_{\nabla\nabla\nabla}$'

3 Merge Parameter records - see Section 5.6.11 for format.

Output Merged Transaction magnetic tape (or cassette) file.

Name: 'TRANSACTIONS'

Generation number: as specified on Sort parameters.

Run Instructions

Narrative	*Console Message*
#XSMM MAGNETIC TAPE MERGE	
1 Load program #XSMM.	
2 Start the program by typing:	
for paper tape input:	GO 21
for punched card input:	GO 20
3 Load Merge parameters on card or paper tape reader as indicated by console typewriter.	
4 Switch unit on-line to read parameters.	
5 Remove Merge Parameter records from appropriate peripheral when unit released.	
6 Load two input tapes (Composite and Transaction files).	

	Narrative	*Console Message*
7	Load one scratch tape.	
8	Continue program.	
9	At end of run program will halt and type:	FINISHED FINAL OUTPUT REEL ON UNIT ZZ FILE NAME: ABCDEFGHIJKL REEL NO: XXXXXX

#XSKB CASSETTE TAPE MERGE

1	Load program #XSKB	
2	Load one scratch cassette.	
3	Load two input cassettes.	
4	Start program by typing:	
	for paper tape input:	GO 21
	for punched card input:	GO 20
5	Load merge parameters on card/paper tape reader unit as indicated by console typewriter.	
6	Continue program.	
7	At end of run program will halt and delete itself, typing:	DELETED: HH

For fuller details of these programs see 1900 series Library Specifications for Magnetic Tape, programs #XSMM and #XSKB. Any amendments to standard software will, of course, affect the appropriate sections of this manual, including the core store requirements.

Program **#X42J**

Priority 70

Hardware Requirement 3,904 words of core store

1 line printer (120 print positions)

1 card/paper tape reader

4 magnetic tape units (or cassette)

Use of Peripherals All peripherals are allotted by program.

Card/paper tape reader used initially to input parameters and released immediately.

Description See Section 3.6.3.

Input

1 Stock Master magnetic tape (or cassette) file, format as described in Section 5.5.2.

Name: 'STOCK$_{\nabla}$MASTER'

Relative deck address: 0

2 Transaction magnetic tape (or cassette) file, format as described in Section 5.5.3.

Name: 'TRANSACTIONS'

Relative deck address: 1

3 Stock Updating Parameter record: one punched card or paper tape block - see Section 5.6.12.

Output

1 Stock Master magnetic tape (or cassette) file

Name: 'STOCK$_{\nabla}$MASTER'

Relative deck address: 2

Generation : input F.G.N. + 1

2 Composite magnetic tape (or cassette) file, format as described in Section 5.5.5.

Name: 'COMPOSITE$_{\nabla\nabla\nabla}$'

Relative deck address: 3

Generation number: 1

3 Replenishment Order List - see Figure 11.

4 Stock Activity Summary - see Figure 12.

Run Instructions

	Narrative	*Console Message*
1	Load two scratch tapes.	
2	Load program #X42J	
3	Dismount MLT (or CLT) if four tape units only are available.	
4	Load two input tapes (Stock Master and Transaction files).	

	Narrative	*Console Message*
5	Load Stock Updating Parameter record on card/paper tape reader.	
6	If cassette tapes are being used:	ON 15
7	Type:	ON 16
8	If input Stock Master file generation number is to be checked, alter word 5 to F.G.N. of input file on relative deck address 0 by typing: (where n = F.G.N.)	AL 5 n
9	If input Transaction file generation number is to be checked, alter word 6 to F.G.N. of input file on relative deck address 1 by typing: (where n = input F.G.N.)	AL 6 n
10	Start program by typing:	
	for paper tape input:	GO 20
	for punched card input:	GO 21
11	At end of run program will halt and type:	HALTED EN
	Exception Conditions	See Section 6.15.

Program **#X42L (or #X4CL)**

Priority 70

Hardware Requirement 5,312 words of core store

1 line printer (120 print positions)

4 magnetic tape units

Use of Peripherals All peripherals are allotted by program

Description See Section 3.6.4.

Input Composite magnetic tape file (name: 'COMPOSITE$_{\nabla\nabla\nabla}$') - see Section 5.5.5 - output from #X42J.

File number: 1

Output

1 Composite magnetic tape file (name: 'COMPOSITE$_{\nabla\nabla\nabla}$').

File number: 2

Generation number: as specified

2 Allocated Demand magnetic tape file (name: 'ALLOCFILE$_{\nabla\nabla\nabla}$') - see Section 5.5.5.

File number: 3

Generation number: as specified

3 Replenishment Order magnetic tape file (name: REPLENFILE$_{\nabla\nabla}$') - see Section 5.5.5.

File number: 4

Generation number: as specified

4 Allocation report - see Figure 13.

Run Instructions

	Narrative	*Console Message*
1	Load three scratch tapes	
2	Load program #X42L (or #X4CL)	
3	Load input tape (composite file)	
4	If the magnetic tape file generation number checks are to be omitted:	ON 0
5	If the number of lines to be printed per page is to be other than 60:	ON 2
6	If the Replenishment Order file is not required:	ON 22
7	If the Allocated Demand file is not required:	ON 23
8	Start program by typing:	GO 20
9	If switch 2 was set on the program halts:	HALTED:- COBOL ACCEPT (SEE JOB SHEET) *nnnnnn* 1
10	Alter word 0 to the number of lines (*nn*) of print required per page and restart program	AL 0 *nn* GO

	Narrative	*Console Message*
11	The program will halt:	HALTED:- LOAD FILE 00 ON unit no.
12	Set up stationery and restart program	GO
13	If switch 0 was set on, messages 14 to 21 will be suppressed and zero generation numbers will be assumed	
14		HALTED SET FILE 01 GENERATION NO. IN WORD 0
15	Alter word 0 to the input Composite file generation number (*n*) and restart program	AL 0 *n* GO
16		HALTED SET FILE 02 GENERATION NO. IN WORD 0
17	If required, alter word 0 to the output Composite file generation number (*n*) and restart program	AL 0 *n* GO
18		HALTED SET FILE 03 GENERATION NO. IN WORD 0
19	If required, alter word 0 to the output Allocated Demand file generation number (*n*) and restart program	AL 0 *n* GO
20		HALTED SET FILE 04 GENERATION NO. IN WORD 0
21	If required, alter word 0 to the output Replenishment Orders file generation number (*n*) and restart program	AL 0 *n* GO #X42L
22	At end of run, the program halts:	HALTED END OF RUN

Exception Conditions See Section 6.15

Program **#X42P (or #X4CP)**

Priority 70

Hardware Requirement 5,248 words of core store
1 line printer (120 print positions)
4 magnetic tape units

Use of Peripherals All peripherals are allotted by program

Description See Section 3.6.5.

Input Composite magnetic tape file (name: 'COMPOSITE$_{\nabla\nabla\nabla}$') - see Section 5.5.5.
File number: 1

Output
1 Composite magnetic tape file (name: 'COMPOSITE$_{\nabla\nabla\nabla}$')
File number: 2
Generation number: as specified
2 Priced Receipts magnetic tape file (name: 'RECEIPTSFILE') - see Section 5.5.5.
File number: 3
Generation number: as specified
3 Over Maximum magnetic tape file (name: 'OVERMAXFILE') - see Section 5.5.5.
File number: 4
Generation number: 0
Note: This file is rewound during the program to produce the Over Maximum list.
4 Under Minimum list - see Figure 14
5 Over Maximum list - see Figure 15.

Run Instructions

	Narrative	*Console Message*
1	Load three scratch tapes	
2	Load program #X42P (or #X4CP)	
3	Load input tape (Composite file)	
4	If the magnetic tape file generation number checks are to be omitted:	ON 0
5	If the number of lines to be printed per page is other than 60:	ON 2
6	If the Priced Receipts file is not required:	ON 23
7	Start program by typing:	GO 20
8	If switch 2 was set on the program will halt:	HALTED:- COBOL ACCEPT (SEE JOB SHEET) *nnnnnn* 1
9	Alter word 0 to the number of lines (*nn*) of print required per page and restart program:	AL 0 *nn* GO

	Narrative	*Console Message*
10	The program will halt:	HALTED:- LOAD FILE 00 ON unit no.
11	Set up stationery and restart program	GO
12	If switch 0 was set on messages 13 to 17 will be suppressed and zero generation numbers will be assumed	
13	Alter word 0 to the input Composite file generation number (*n*) and restart program	HALTED SET FILE 01 GENERATION NO. IN WORD 0 AL 0 *n* GO
14		HALTED SET FILE 02 GEN. NO. IN WORD 0
15	If required, alter word 0 to the output Composite file generation number (*n*) and restart program	AL 0 *n* GO
16		HALTED SET FILE 03 GEN. NO. IN WORD 0
17	If required, alter word 0 to the output Priced Receipts file generation number (*n*) and restart program	AL 0 *n* GO
18	If an Over Maximum file is produced this file is closed and re-opened during the program	
19	The program halts	HALTED END OF RUN

Exception Conditions See Section 6.15

Program

#X42K -using the single Exponential Smoothing forecasting technique

#X42U -using the Moving Averages forecasting technique.

Priority 50

Hardware Requirement

5,549 words of core store (#X42K)

5,594 words of core store (#X42U)

1 line printer (120 print positions)

1 card/paper tape reader

4 magnetic tape units/or cassette)

Use of Peripherals All peripherals are allotted by program. Card/paper tape reader used, initially, to input parameters and released immediately.

Description See Section 3.6.6.

Input

1 Demand History magnetic tape (or cassette) file, format as described in Section 5.5.1.

Name: 'STATISTICAL$_{\nabla}$'

Relative deck address: 0

2 Stock Master magnetic tape (or cassette) file, format as described in Section 5.5.2.

Name: 'STOCK$_{\nabla}$MASTER'

Relative deck address: 2

3 Forecast Parameter record : two (or three) punched cards or paper tape blocks - see Section 5.6.13.

Output

1 Updated demand History magnetic tape (or cassette) file.

Name: 'STATISTICAL$_{\vee}$'

Relative deck address: 1

Generation number: input F.G.N. + 1

2 Updated Stock Master magnetic tape (or cassette) file.

Name: 'STOCK$_{\vee}$MASTER'

Relative deck address: 3

Generation number: input F.G.N. + 1

3 Reported Items list - see Figure 16.

Run Instructions

	Narrative	*Console Message*
1	Load two scratch tapes.	
2	Load program #X42K - if using single exponential smoothing or #X42U - if using moving averages.	
3	Dismount MLT (or CLT) if four tape units only are available.	

	Narrative	*Console Message*
4	Load two input tapes (Demand History and Stock Master files)	
5	Load Forecast Parameter record on card/paper tape reader.	
6	If cassette tapes are being used:	ON 15
7	For the initial run of the system, *only*, type:	ON 22
8	If the input parameters are on paper tape, type:	ON 23
9	If input Demand History file generation number is to be checked, alter word 5 to F.G.N. of input file on relative deck address 0 by typing: (where n = input F.G.N.)	AL 5 n
10	If input Stock Master file generation number is to be checked, alter word 6 to F.G.N. of input file on relative deck address 2 by typing: (where n = input F.G.N.)	AL 6 n
11	Start program by typing:	GO 20
12	At end of run the program will halt and type:	DELETED EN
	Exception Conditions	See Section 6.15.

Note: the forecasting routines will accept only a Stock Master file containing short blocks; long blocks cause HALTED HD (see page 150). If this routine is being used it is imperative that any SCAN processing of the Stock Master file immediately prior to forecasting using #X42A, #X42B, #X4CR or #X42R should have switch 16 set. If more than one of these routines precedes forecasting, only the last in the sequence need have the switch set.

1 Two or three character error codes have been used throughout the system, and, where possible, errors common to two or more programs have the same code.

2 The error codes, definitions and action to be taken are as follows:

Message		*Reason*
HALTED	AA	Sequence error - Stock Master file
HALTED	AB	Invalid file description
HALTED	AC	Incorrect file generation number
HALTED	AE	Incorrect file name
HALTED	BB	Sequence error - transactions
HALTED	CC*	Sequence error - class code
HALTED	CR**	Card reader not available
HALTED	DD	Sequence error - Demand History file
HALTED	DR	Data remaining in reader
HALTED	GM*	Sequence error - Gross Margin
HALTED	LP**	Line printer not available
HALTED	NN*	Sequence error - Item Number
HALTED	PP*	Parameter card invalid
HALTED	SS**	Sequence error - Sales Value
HALTED	TR**	Tape reader not available
HALTED	TT*	Sequence error - Stock Value
HALTED	XX*	File not classified

Action

Run normally abandoned, input media removed and error corrected, but see below.

After one of the halts indicated '*', the following action can be taken:

1 Type 'GO' to close files

2 GO at n (n = one more than the value in word 8) to ignore halt and continue run.

After one of the halts indicated '**', the peripheral should be allotted by the operator and program restarted.

Message			*Reason*
DISPLAY	AG	(Item Number)	Series length incorrect
DISPLAY	AH	(Item Number)	Cycle base incorrect
DISPLAY	AI	(Item Number)	Invalid character
DISPLAY	AJ	(Item Number)	Invalid record type
DISPLAY	AK	(Item Number)	Card (block) missing
DISPLAY	AL	(Item Number)	Invalid function
DISPLAY	AN	(Item Number)	Item Number for deletion not present
DISPLAY	AO	(Item Number)	Incorrect Demand History file
DISPLAY	AP	(Item Number)	Cycle base and forecast interval incompatible
DISPLAY	AQ	(Item Number)	Factor sequence check failure
DISPLAY	AR	(Item Number)	Incorrect number of seasonal factors input

Message		*Reason*
DISPLAY AS	(Item Number)	Incorrect word number following seasonal factors
DISPLAY AT	(Item Number)	Insufficient demand factors
DISPLAY AU	(Item Number)	Excess demand factors
DISPLAY AV	(Item Number)	Card (or block) out of sequence Item not on file (during file amendment) Item already on file (during item insertion)
DISPLAY AW	(Item Number)	Item on Demand History file not on Stock Master file (occurs during X42B operations)
DISPLAY AX	(Item Number)	Item numbers equal on merging
DISPLAY ER1	(Item Number)	Incorrect transaction item number
DISPLAY ER2	(Item Number)	Incorrect audit record sequence
DISPLAY SM	(Item Number)	Item not on Profile Results file

Action

Displays do not cause program halts but usually the error will require correcting upon completion of the run.

FILE GENERATION NUMBERS 6.16

1 The system has been designed to allow user flexibility in dealing with file generation numbers.

(a) Each program updates the input tape file generation number by 'one' upon output, except in the case of SORT/MERGE, where the use of the parameters is left to the user.

(b) Where a tape file is created during a program, the file generation number is set to 'one' upon output.

(c) COBOL programs X42L, X42P, X42Q, X42R, allow the output file generation number to be specified at run time via the console typewriter (this includes X4CL, X4CP, X4CQ, X4CR)

2 Testing for correct input file generation numbers may be effected by ALTERing words 5 and/or 6 to contain the expected file generation numbers. This is then tested within the program against the input file generation numbers.

If words 5 and/or 6 are not altered, no test is performed.

GENERAL INFORMATION

The following housekeeping error halts can occur while the SCAN programs are being used. In each case the program is non-restartable.

Message	*Reason*
HALTED HA	Record larger than maximum block size (writing).
HALTED HB	Parity error (writing)
HALTED HC	Block count discrepancy (reading)
HALTED HD	Long block (reading)
HALTED HE	Parity error (reading)

Appendix A Normal Probability Table/Customer Service

1 NORMAL PROBABILITY TABLE showing factors associated with various percentages

%	Factor (*K*)	%	Factor (*K*)
80	0.84	91	1.34
81	0.88	92	1.41
82	0.91	93	1.48
83	0.95	94	1.55
84	0.99	95	1.64
85	1.04	96	1.75
86	1.08	97	1.88
87	1.13	98	2.05
88	1.17	99	2.33
89	1.23	99.5	2.58
90	1.28	99.9	3.09

2 CUSTOMER SERVICE LEVEL

The calculation of customer service level used for those items controlled using a variable re-order point - exponential smoothing system, is based upon the continuous measurement of the mean absolute deviation of forecast errors within the Stock Forecasting and Monitoring routine, and attempts to maintain a given percentage or ordering cycles during which there will be no stock-out. For example, if a 95% customer service level is selected, on the average one in twenty ordering cycles will have an 'out of stock' situation - usually towards the end of the ordering cycle as stock is reduced and before a new receipt is received.

The system used does not attempt to measure the amount of stock 'short'.

If this figure is desired (i.e. demand met ex-stock) the Stock Master item records contain total demand and total shortages (to-date).

See Appendix E for the formulae used to derive the re-order point (and hence safety stock required to maintain the selected level).

Customer service for those items controlled using moving averages may be adjusted by Management in terms of 'extra cover' in determining the new re-order point. An additional period (selected by Management and held in the 'Factor Two' field) is added to the lead time and applied to the re-order point calculation.

Appendix B Seasonal Factors

A suggested method for calculating seasonal factors is to use corresponding periods in the most recent two years demand history to obtain a series of 'partial sums'. The minimum partial sum (not equal to zero) is divided successively into each partial sum to provide 'averaged' seasonal factors for one year with the minimum equal to 'one'.

Note: In the case of a partial sum value equal to zero, the corresponding seasonal factor would be zero.

For example, if considering monthly demand data over the period January 1965 to December 1966, the first partial sum would consist of the sum of January 1965 and January 1966 demands.

The second partial sum would be February 1965 plus February 1966, and so on.

The minimum partial sum (not equal to zero) would be divided into the first, second, etc., partial sums to provide 12 seasonal factors.

This method provides reliable results unless corresponding periods are badly out of phase. In this case Management must use some other method or judgement to provide the expected seasonal profile.

Items which have a cycle base (length of season) not equal to 'one' are regarded as seasonal items within the Stock Forecasting program.

If, therefore, Management wishes to impose special factors for one or more items, it will be necessary to amend the appropriate factor using the Master File Maintenance routine - AMEND function.

See Appendix E for formulae relating to seasonal factors and their use in the I.C.T. SCAN System.

Appendix C Moving Averages/Single Exponential Smoothing

In I.C.T. SCAN System 2 the above two techniques may be used to forecast demand for those items selected for variable re-order point control.

The choice of which technique to use is left to Management discretion and the Control System Selection routine is designed to assist Management in applying this selection. Once the type of control has been selected it is not necessary for Management to enter the appropriate smoothing constants etc., into the item record, unless a value other than $\alpha = 0.1$ (exponential smoothing) or a moving average base = 12 is required. The master File Maintenance program - AMEND function may be used to enter any other values.

Moving averages yield satisfactory results if the demand is stable, or changes only slowly with time and it has some advantages in dealing with seasonal variations in demand provided that the time base over which the average is computed corresponds with the period of the cylce (or season) and that there is no large change in mean level of demand between one cycle and the next.

However, unless this time interval is small, the moving average is sluggish in responding to step changes in demand and in following trends. Whilst the effect of an impulse (a large demand) is minimized by a long time interval, this effect is retained in the forecast for the full N periods (N = time interval over which the average is computed). Moreover, N must be changed in order to change the sensitivity of the system.

To overcome these disadvantages exponential smoothing has been developed in recent years. This technique allows the effect of the most recent demand to have more prominence in the final forecast. The effect of each successive past demand has diminishing prominence. The sensitivity of the system may be adjusted by altering the smoothing constant, although if too sensitive the system will respond to the slightest demand change. It is better to 'dampen' the forecast by applying a low value of smoothing constant (say 0.1) and allowing variations between actual demand and forecast to be accounted for in the safety stock calculations.

A value of 0.1 for the smoothing constant corresponds to a 19-period moving average, whilst 0.3 corresponds to six periods and 0.5 to three periods - all approximately.

Because the one period ahead forecast is extrapolated over the lead time in determining the re-order point an over-sensitive system will project any response to changes in demand. This is particularly serious if long lead times (in relation to the time interval over which demand data is collected) are involved, because the point at which an order is placed is affected; the forecast will affect the size of order in addition.

See Appendix E for the formulae used in making and applying the forecast to I.C.T. SCAN System 2.

Appendix D Tracking Signals

TRACKING SIGNAL - EXPONENTIAL SMOOTHING

The method of monitoring forecasting efficiency, in the case of those items selected for variable re-order point control using single exponential smoothing, is that proposed by TRIGG (1964) - see Bibliography.

By dividing the smoothed forecast error by the smoothed mean absolute deviation of forecast errors a value for the 'tracking signal' is obtained. This is compared with a pre-set value each time a demand forecast is made and, if the tracking signal exceeds this value, details are reported on the 'Reported Items list' for Management action, if any.

See Appendix E for appropriate formulae.

TRACKING SIGNAL - MOVING AVERAGES

A simpler view is taken of monitoring in the case of items selected for variable reorder point control using moving averages.

If the actual demand is greater than three times the forecast for that period details are reported for Management action, if any. This is intended as a warning to Management and no action, other than producing a report, is taken by the control system.

In both cases above, any changes to the forecast or re-order point resulting from Management action must be effected by using the Master File Maintenance routine.

Appendix E I.C.T. SCAN System 2 - Formulae

1 Moving Averages

$$\hat{y}_{T+1} = \frac{1}{N} \sum_{t=1}^{N} y_{T-N+t}$$

where $\hat{y}_{T+1}$ is the one period ahead forecast made at time T.

N is the time base period of the moving average.

2 Single Exponential Smoothing

$$\hat{y}_{T+1} = \alpha\, y_T + (1 - \alpha)\, \hat{y}_T$$

where y_T is the current demand. $\hat{y}_T$ is the forecast made one time period ago in respect of the current period.

α is the smoothing constant selected so that $0 < \alpha < 1$.

3 Re-order Point

(a) Using Exponential Smoothing

$$P_{T+1} = (\hat{y}_{T+1} / S_{T+1}) \sum_{j=1}^{L} S_{T+j} + 1.25\, \hat{d}_{T+1}\, L^{\frac{1}{2}}\, K$$

where P_{T+1} is the re-order point, recomputed each time a forecast is made.

S_{T+1} is the corresponding seasonal factor.

K is chosen to give the desired customer service level (See Appendix A).

$\hat{d}_{T+1}$ is the smoothed mean absolute deviation of forecast errors.

L is the selected lead time expressed in the same units as the time interval in which demand data is aggregated (but not necessarily forecast).

(b) Using Moving Averages

$$P_{T+1} = (\hat{y}_{T+1} / S_{T+1}) \sum_{j=1}^{L+n} S_{T+j}$$

where n is the extra period cover selected by Management for safety stock.

4 Re-order Quantity

(a) Using the forecast extrapolated over the ordering interval

$$Q_{T+1} = (\hat{y}_{T+1} / S_{T+1}) \sum_{j=1}^{W} S_{T+L+j}$$

where W is the ordering interval.

(b) Using the economic order formula

$$Q_{T+1} = (2\ C_O\ Y/C_p\ I_r)^{\frac{1}{2}}$$

where C_O is the cost of ordering.

Y is the annual demand, actually estimated by

$$Y = (\hat{y}_{T+1}/S_{T+1}) \sum_{J=1}^{M} S_{T+J}$$

where M multiplied by forecast interval equals one year.

Cp is the item cost price

Ir is the investment rate selected for that item to reflect the stockholding cost so that $Ir\ Cp$ is the annual cost of stocking one unit.

5 Smoothed Forecast Error

$$\hat{e}_{T+1} = \hat{e}_T + \alpha(e_T - \hat{e}_T)$$

where $\hat{e}_T$ is the previous smoothed error,

e_T is the current error. $\alpha = 0.17$

6 Smoothed Mean Absolute Deviation of Error

$$\hat{d}_{T+1} = \hat{d}_T + \alpha\ (/e_T/ - \hat{d}_T)$$

where $\hat{d}_T$ is the previous smoothed *MAD*.

$/e_T/$ is the absolute value of the current forecast error. $\alpha = 0.17$

7 Tracking Signal

(a) Actual

$$\tau = \hat{e}_{T+1}/\hat{d}_{T+1}$$

(b) Limit

$$\pm\ 2.4\ \alpha/(2\alpha - \alpha^2)^{\frac{1}{2}}$$

where $\alpha = 0.17$

8 Demand Partial Sum

$$S_t = \sum_{J=0}^{n-1} y_{t+Jm}$$

where i is the positional count within the cycle.

m is the cycle length.

n is the number of complete cycles analyzed - usually two.

y is demand.

9 Seasonal Factor

$$S_T = S_t\ /\ S_{min}$$

where S_{min} is the minimum non zero partial sum.

Applying these factors to the forecasting equations, the current demand is 'deseasonalized' i.e. divided by the corresponding seasonal factor before computing the new forecast. This deseasonalized forecast is then multiplied by the next period's seasonal factor to obtain the estimated forecast, i.e.

$$\hat{y}_{T+1} = \hat{x}_{T+1} \, S_{T+1}$$

where $\hat{x}_{T+1}$ is the deseasonalized forecast.

Appendix F Bibliography

Battersby, A., (1962)
A Guide to Stock Control Pitman: London.

Brown, R.G. (1959)
Statistical Forecasting for Inventory Control, McGraw-Hill: New York.

Coutie, G.A. et al., (1964)
Short-term Forecasting, I.C. Monograph No. 2, Oliver and Boyd: Edinburgh.

Muir, A. (1958)
"Automatic sales forecasting," Comp. J., Vol. 1., No 3, pp. 113-116.

Trigg, D.W. (1964)
"Monitoring a Forecasting System" *Operat. Res. Quart.* Vol. 15, No. 3, pp. 271-274.

Winters, P.R. (1960)
"Forecasting sales by exponentially weighted moving averages" *Mang. Sci.,* Vol. 6, No. 3, pp. 324-342.

Appendix G List of Programs Comprising I.C.T. SCAN System 2

X42A		Master File Creation/Maintenance
X42B		Skeleton History File Generate
X42C		Magnetic Tape Creation - Transaction file
X42D		Stock Profile Analysis
X42J		Stock Updating and Allocation
X42K		Stock Forecasting and Monitoring (Single Exponential Smoothing)
X42L	X4CL	Allocation Report
X42P	X4CP	Under Minimum/Over Maximum report
X42Q	X4CQ	ABC Analysis
X42R	X4CR	Control System Selection
X42S		Master File Record list
X42U		Stock Forecasting and Monitoring (Moving Averages)

AMENDMENT RECORD

Should any additions or amendments to this Manual be necessary, they will be issued in the form of Amendment Lists. When such changes have been incorporated, an appropriate entry should be made in the table on the left and the pink instruction sheet(s) should be filed behind this page.

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