

710 STAGE 1  
**S-C 4020 COMPUTER RECORDER**

*information manual*



**STROMBERG-CARLSON**  
A DIVISION OF **GENERAL DYNAMICS**

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**AUGUST 1964**

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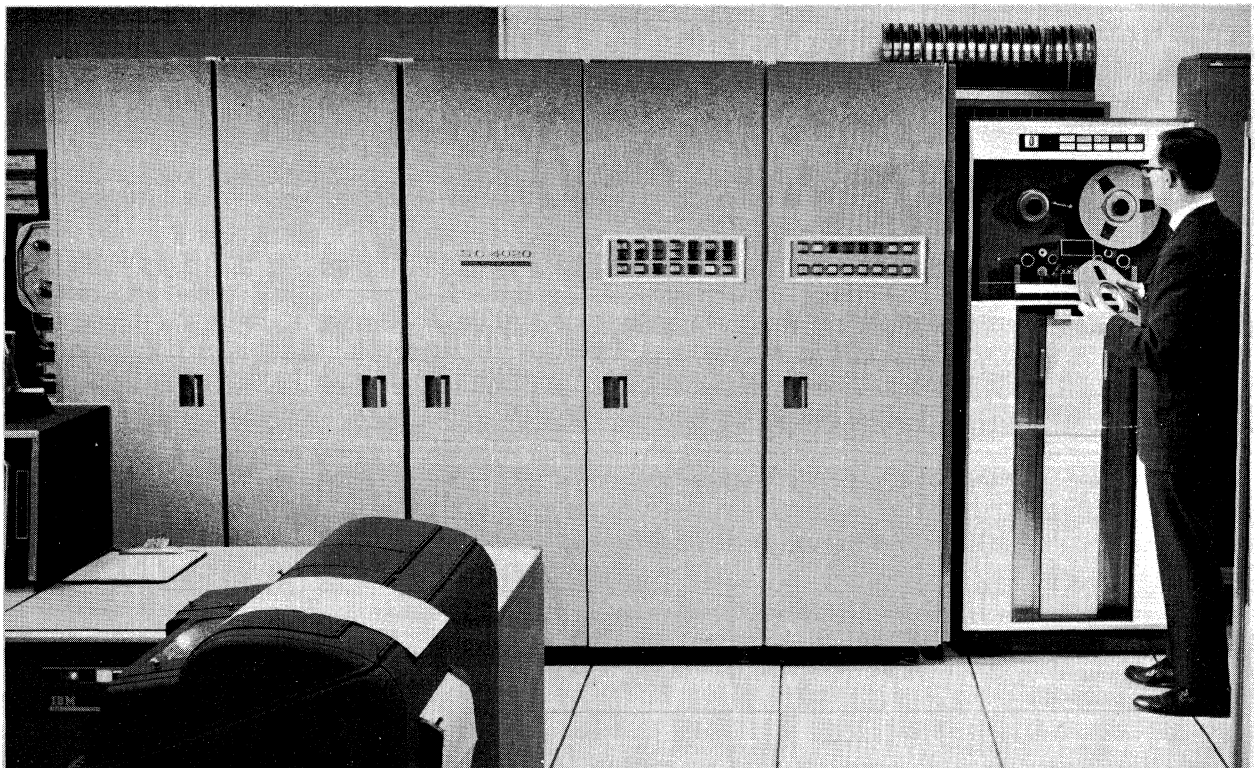
## INTRODUCTION

The data processing industry has made tremendous advances in the past few years and is now producing central processors that are several magnitudes faster and more efficient than systems available previously. Unfortunately, comparable increases in speed have not been achieved in the areas of input and output equipment. The user of today's high speed data processing equipment is still input and output limited.

Several methods of eliminating the input bottleneck are presently being considered. However, until recently the approach to eliminating the output barrier has been to order more and more output equipment. This has been a brute force approach to the problem and has produced a situation where the cost of computer output devices exceeds the cost of the main frame.

One piece of equipment, the S-C 4020 High-Speed Computer Recorder (Figure 1), not only solves the output problem, but also makes it feasible for many more departments to take advantage of the increased efficiency and speed of modern data processing equipment.

This manual describes the features and capabilities of this extremely high-speed, versatile equipment.



*Figure 1. S-C 4020 High-Speed Computer Recorder*

## WHAT IS THE S-C 4020?

The S-C 4020 is an electronic system capable of accepting digital signals off-line from magnetic tape or on-line from a digital computer. It then converts binary or BCD codes into combinations of alphanumeric printing, curve plotting and line drawings. The equipment records the information at high speeds on both microfilm and photo-recording paper. The recorder's microfilm output is compatible with existing film storage and retrieval systems.

The S-C 4020's ability to translate coded data into complex annotated graphs and drawings at high speed makes it an ideal peripheral output tool for either the scientific or commercial computing center, (see Figure 2). This flexibility of printing output in visual form, makes the computer center more useful to more departments within the company.

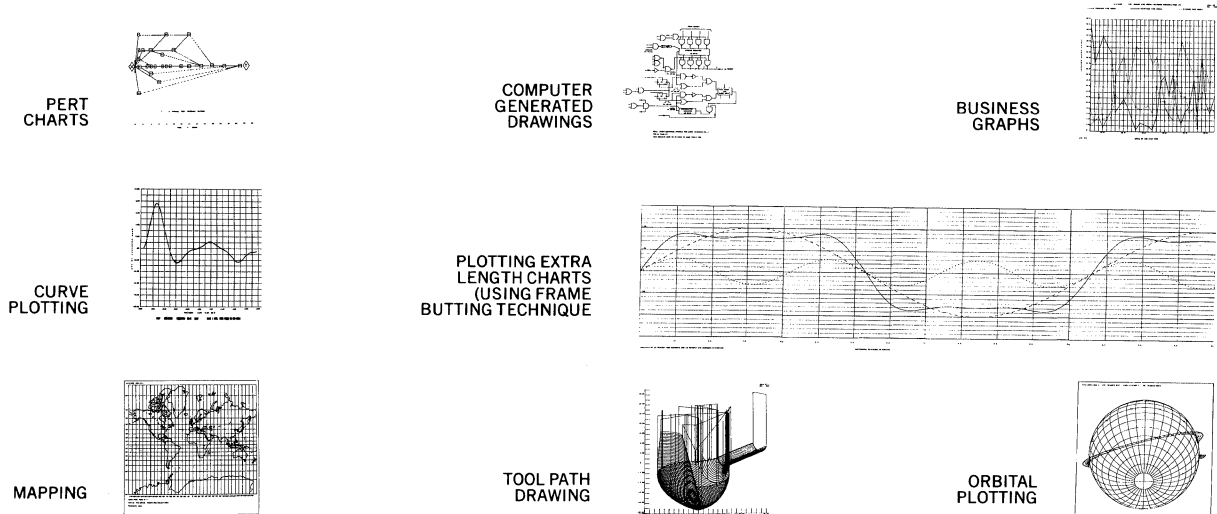


Figure 2. Samples of S-C 4020 Output

## WHAT ARE THE ECONOMICS?

The Stromberg-Carlson recorder can be leased or purchased. Also, service bureaus are in operation on east and west coasts where you can lease S-C 4020 time and try some of your own problems on the machine for evaluation.

The system has economically justified its use in more than 30 major computer labs in the United States and Europe. For example, one user performs a complex plotting job for an engineering analysis group. The work was previously done in several days by 100 draftsmen. The S-C 4020 produces the same annotated curves, complete with grids, axis lines and titles in minutes at considerably less cost.

The equipment's high density input tape adapter results in minimum use of computer time for tape preparation. Part of the lease or sales price includes trained customer engineers to install and maintain the system at the user's facility.

#### HOW DOES THE S-C 4020 WORK?

The S-C 4020 uses a CHARACTRON® shaped beam tube (Figure 3) as a generator for characters, lines or curves. Heart of the tube is the stencil-like matrix, a thin disc with alphanumeric and symbolic characters etched through it. This matrix is placed within the neck of the tube, in front of an electron gun.

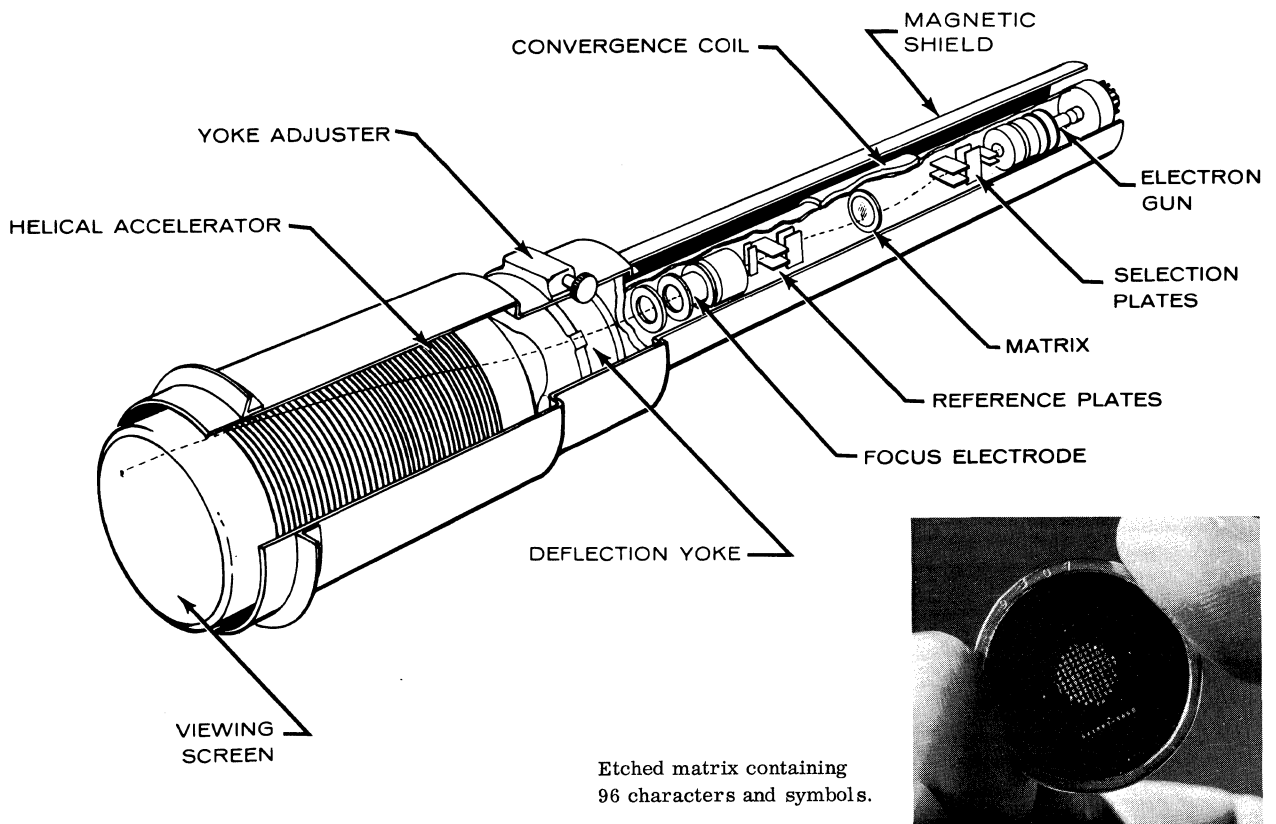


Figure 3. CHARACTRON Shaped Beam Tube

The stream of electrons emitted from the gun is extruded through the matrix, cutting the desired character from the beam. When the shaped beam impinges on the phosphor-coated face of the tube, the character is reproduced.

The typical matrix contains 64 characters in an 8 x 8 array. Each character is selected by a 6-bit binary code. The selected character can be positioned to any of 1024 positions vertically or 1024 positions horizontally. (See Figure 4.)

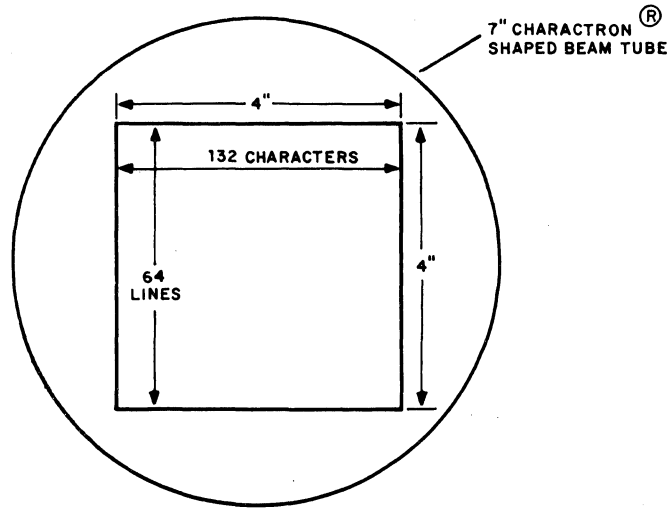
Images on the face of the tube are recorded by either a 35mm or 16mm camera positioned above the tube face. Information can be recorded simultaneously on photorecording paper by using the optional hardcopy camera.

Standard formats which do not vary from frame to frame, such as business forms, company logotypes or maps, can be superimposed on the variable data by using the forms projector, saving valuable computer time and the cost of preprinted forms.

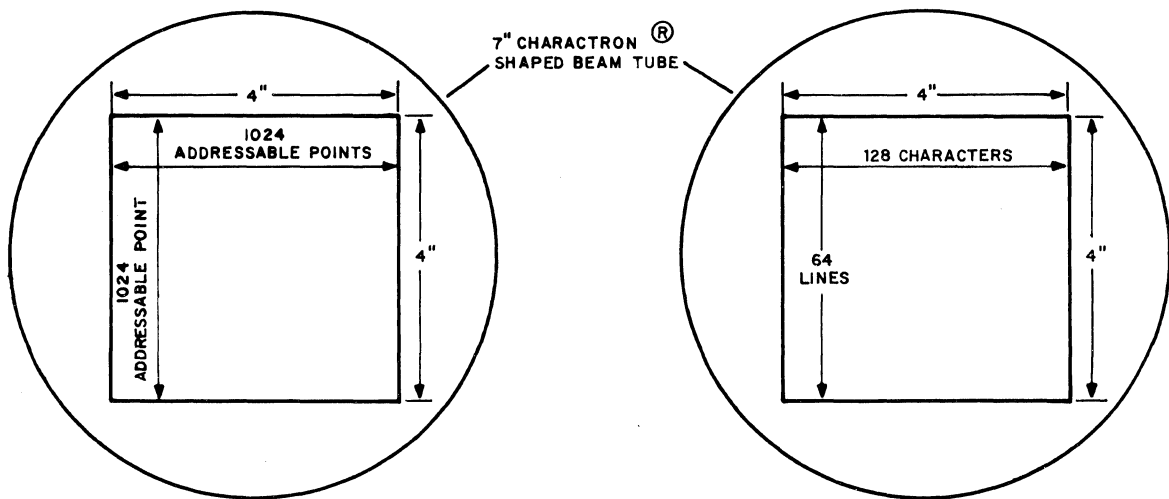
HOW FAST IS THE S-C 4020?

The S-C 4020 will accept data from magnetic tape at rates up to 90,000 six-bit characters per second. It records this data at speeds up to 17,000 alphanumeric or symbolic characters per second. The S-C 4020 will record up to 7000 lines per minute when used in the typewriter mode. Completely annotated complex graphs can be recorded in a fraction of a second.





PRINT FORMAT (BCD PRINT NORMAL)



PLOT FORMAT

TYPEWRITER FORMAT

Figure 4. Print and Plot Formats

## S-C 4020 BASIC UNIT

The S-C 4020 basic unit contains all the necessary power supplies and electronics for the presentation of digital data on the face of the CHARACTRON tube. Standard features include the following:

### TYPEWRITER SIMULATOR

This feature allows the S-C 4020 to interpret the incoming codes 6 bits at a time and print one alphanumeric character for each 6-bit code in a typewriter fashion. The printing starts in the upper left corner of the frame and continues until a line of 128 characters has been printed, or a carriage-return code is programmed to cause the line advance. Successive lines are printed until the 64th line has been printed, or a frame-advance code is programmed to cause the start of a new frame.

BCD PRINT NORMAL MODE: When the S-C 4020 is operated in BCD Print-normal mode from tapes prepared for 1401/1403 computers, the typewriter simulator will produce a format of 132 characters per line, 64 lines per page.

### VECTOR GENERATOR

The vector generator makes it possible to connect any two addressable points with a straight line made up of line segments or groups of line segments. The maximum vector length is 1/16th of maximum deflection.

### VARIABLE STOP POINT AXIS GENERATOR

Using this feature it is possible to draw a continuous horizontal or vertical line by addressing the end points of the line.

### FORMS PROJECTOR

With this feature any fixed data may be superimposed on the variable data generated by the CHARACTRON tube. The fixed data which can take the form of a grid, business form, map, or drawing format is produced on a glass slide.

The glass slides are mounted in holders and can be inserted one at a time into the forms projector (Figure 5). A strobe light in the forms projector can be flashed under program control which causes superpositioning of the image on the glass slide on the CHARACTRON tube image.

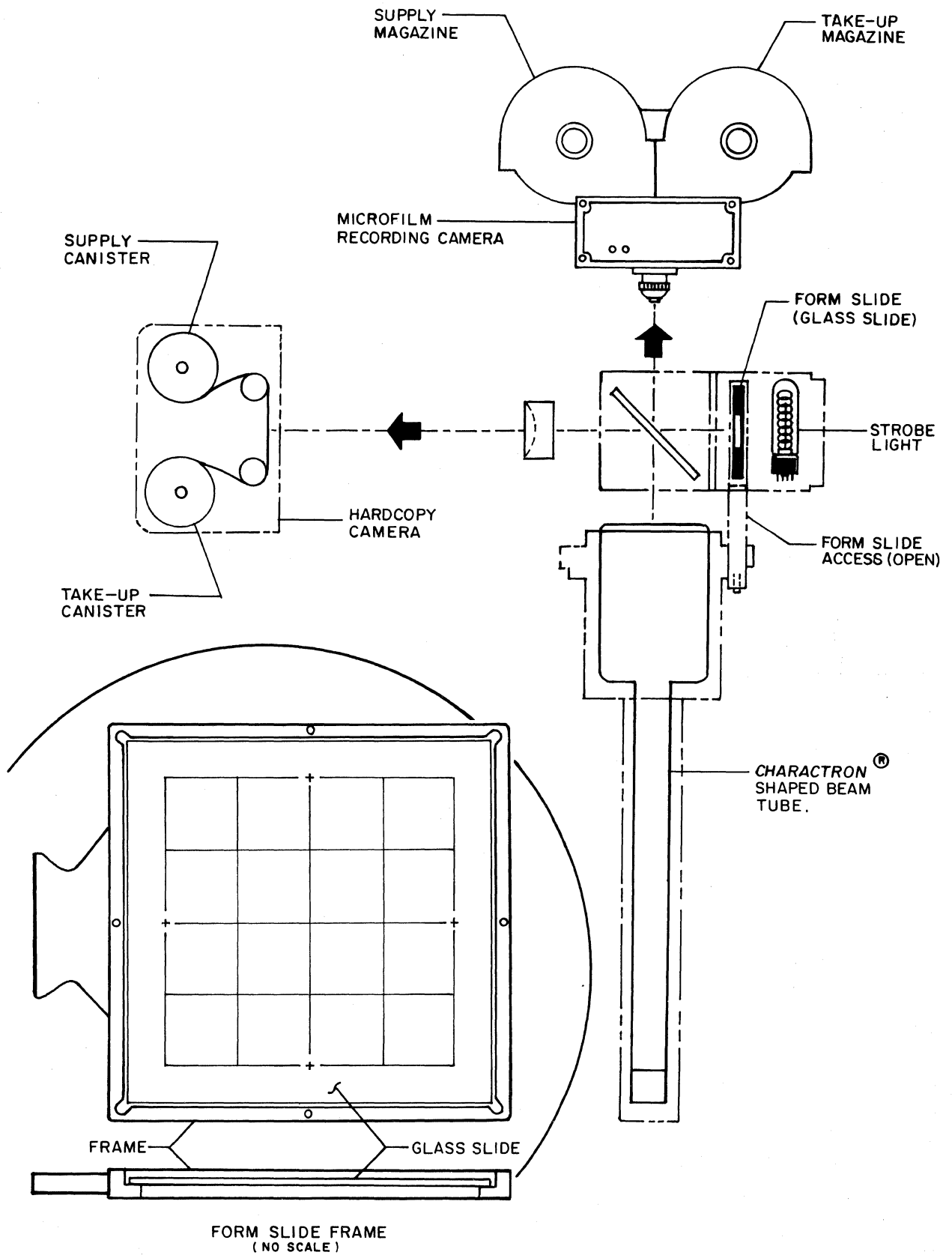


Figure 5. Forms Projector Feature

## ROTATABLE TUBE MOUNT

This feature permits the rotation and accurate indexing of the tube at 0°, 90°, 180° and 270°. Rotation of the tube is accomplished by removing two locking pins and positioning the tube to the desired indexed position.

The various orientations of the tube permit the recording of an image in any of the following forms (Figure 6): 1) Cine Output - top of the image to the left when viewing the tube, 2) Inverted Cine Output - top of the image to the right when viewing the tube, 3) Comic Strip Output - top of the image to the top when viewing the tube, and 4) Inverted Comic Strip Output - top of the image at the bottom when viewing the tube.

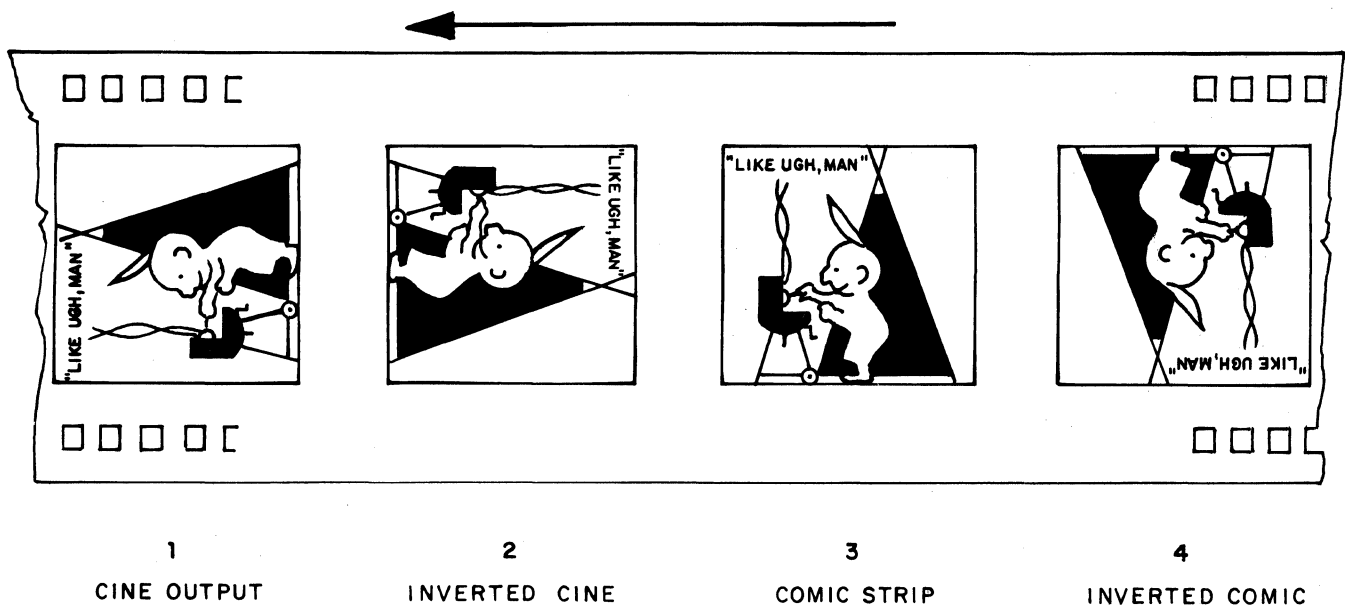


Figure 6. Orientations in Which Image May Be Recorded

## PROGRAMMABLE EXPANDED IMAGE

Because of this feature the programmer may select either of two predetermined format sizes on the tube display. The normal format size is 4" x 4"; the maximum expanded image for two-axis expansion would be approximately 4.5" x 4.5". Larger expansion can be accomplished in a single axis. The purpose of this feature is to allow the abutment of frames on the microfilm or hardcopy in order to obtain presentations having continuity from frame to frame (see Figure 7). Some additional setup time is required to obtain accurate abutment.

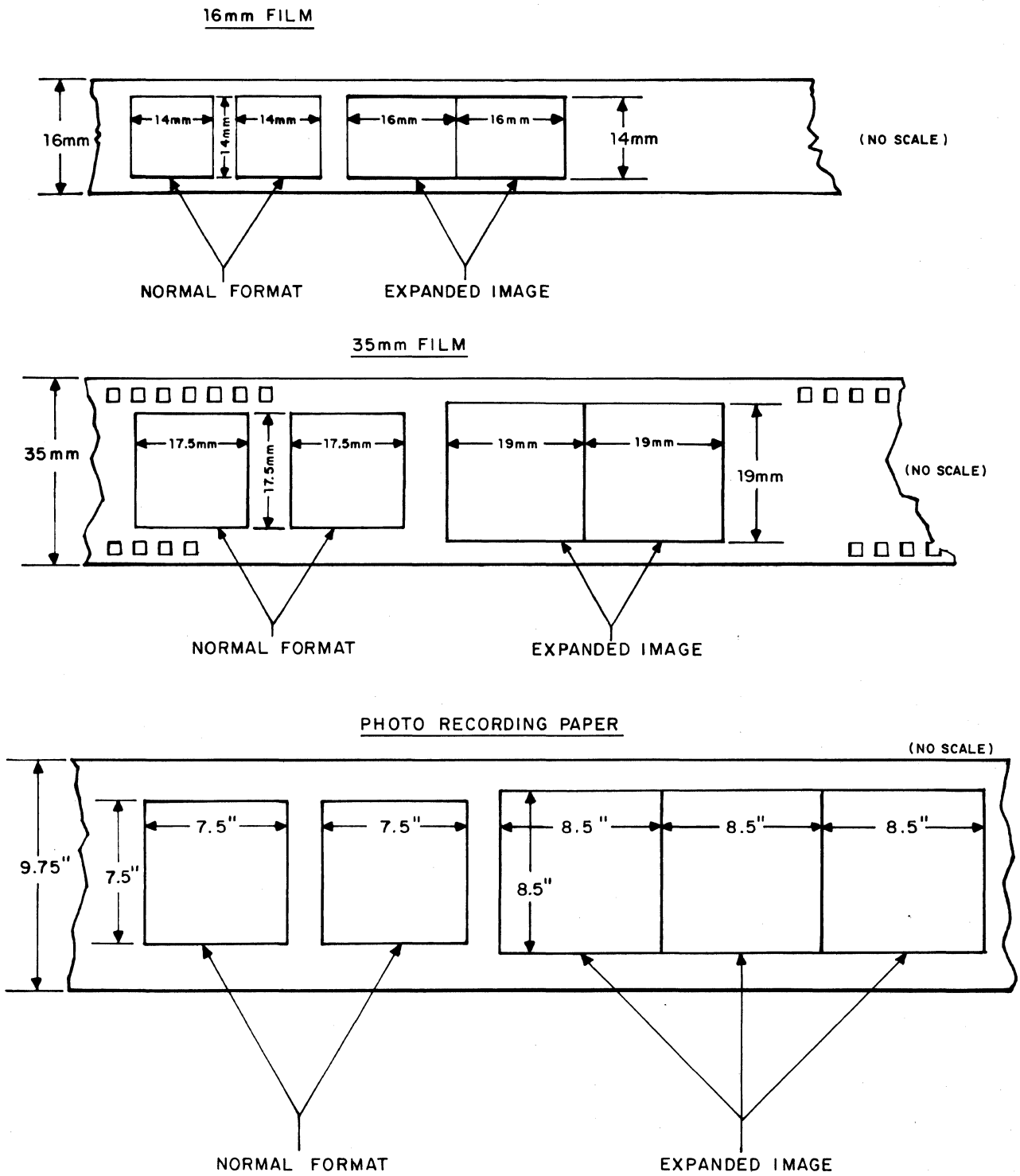
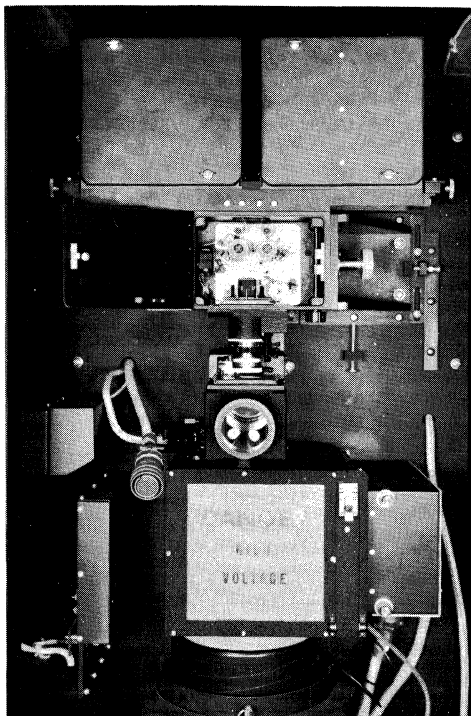


Figure 7. Expanded Image Feature

## RECORDING CAMERAS

The customer may specify that a 16mm or 35mm recording camera be included as part of the standard S-C 4020 equipment. The cameras are interchangeable and more than one can be supplied at an additional cost.

**STANDARD 35MM CAMERA:** This camera (Figure 8) uses 35mm perforated film. The 4-inch-square image displayed on the tube is recorded as a 17.5mm square on the film with 16 frames per foot. This film can be used in aperture cards, 35mm roll film viewers, and the Xerox Copyflo machines. The image is compatible with standard 35mm movie projectors or it can be reduced, using standard Cine equipment, to 16mm for use in the more commonly available 16mm movie projectors. The 35mm camera operates at speeds up to 10 frames per second.

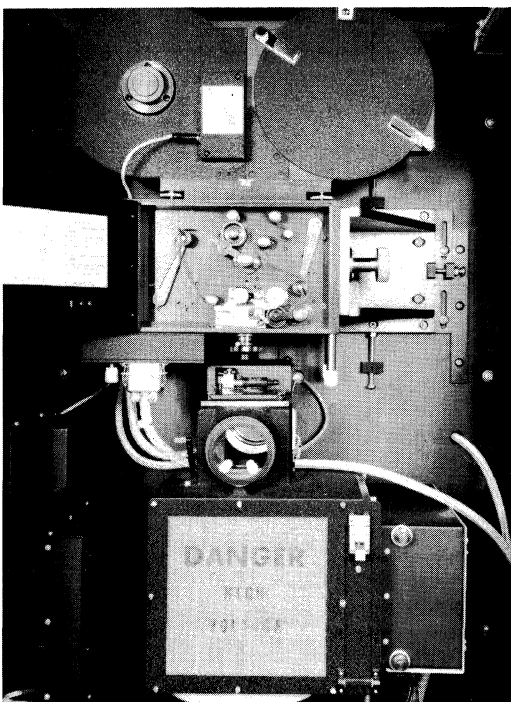


*Figure 8. Standard 35MM Recording Camera*

The 35mm camera is equipped with separate take-up and supply magazines. The magazines have a capacity of up to 400 feet of film. The magazines must be loaded in a dark room or film change bag. Loading and unloading of the camera is a daylight operation. The take-up magazine can be removed for processing at the completion of any run.

**SPECIAL 35MM RECORDING CAMERA:** This special camera, now in the preliminary design stage, uses 35mm non-perforated film. The image size and film advance are expected to meet the requirements of MIL-9868. The normal film advance for 1.00-inch film chips for "D" size aperture cards will be produced by a double frame advance. Maximum frame rate will be 5 frames per second.

**16MM RECORDING CAMERA:** This camera (Figure 9) uses 16mm non-perforated film. The 4-inch image displayed on the CHARACTRON shaped beam tube is recorded as a 14mm image on the film at 19 frames per foot.



*Figure 9. Standard 16MM Recording Camera*

The film from this camera is especially suited to roll film retrieval systems such as that manufactured by the Recordak Corporation. The film can also be used in 16mm viewers and on the Xerox Copyflo machines.

The 16mm camera comes equipped with separate take-up and supply magazines. The magazines have a capacity of up to 400 feet of film. The magazines must be loaded in a dark room or film change bag. Loading and unloading of the camera is a daylight operation. The take-up magazine can be removed for processing at the completion of any run.

**SPECIAL 16MM CAMERA:** Preliminary design work is in progress to provide a camera having the capability of recording Kodamatic indexing marks on the film. This camera is expected to allow the coding of the film simultaneously with the recording of data from magnetic tape. The 4-inch image displayed on the tube will be recorded on film as an image. The Kodamatic index lines will be recorded on the film between data images.

A special logic arrangement will be required in the S-C 4020 to interpret incoming codes. These incoming codes will then be converted to signals that select the proper light pattern for exposing the Kodamatic index lines. Maximum frame rate is 10 frames per second.

Another special 16mm camera is planned for recording MIRACODE retrieval patterns on microfilm. This camera will be equipped with a dual film advance mechanism. The image film advance is 0.44 inch and requires 0.12 second to execute. The code column advance is 0.11 inch and requires 0.06 second to execute. A secondary light source is built into this camera and is imaged at the film plane. The light source control will require a special logic arrangement in the S-C 4020. This logic will interpret the incoming codes to produce a column of MIRACODE in the secondary light source.

#### NON-STANDARD OPTIONS

Non-standard options for the S-C 4020 which are available on special request include: (1) Specified plot intensity and (2) Non-standard word length. Other custom features will be designed and priced as required.



## STANDARD OPTIONS

### F-80 HARDCOPY CAMERA OPTION

This option (Figure 10) makes it possible to record the displayed information on photorecording paper or photographic film in widths up to 9-3/8". The 4" x 4" display on the CHARACTRON shaped beam tube is recorded as a 7-1/2" square on the paper or film. The standard pulldown in this camera is a nominal 9-1/2". A pulldown other than 9-1/2" can be specified when ordering the equipment. The F-80 requires 0.75 second to initiate a frame advance.

The camera comes equipped with separate take-up and supply magazines. The magazines hold up to 350 feet of photorecording paper and must be loaded in a dark room or film change bag. Loading and unloading of the camera is a daylight operation. The take-up magazine can be removed for processing at the completion of any run.

### F-165 CAMERA PROCESSOR

The F-165 is a dual-purpose hardcopy camera (Figure 11). It is a self-contained camera-processor enclosed in a cabinet attached to the left end of the S-C 4020. When this unit is installed, it becomes an integral part of the S-C 4020. The F-165 replaces the F-80. The F-165 can be set up to operate in either of two modes:

**CAMERA-PROCESSOR MODE:** When used as an on-line camera-processor, the F-165 delivers "quick-look" output at a rate of approximately one page per second. The exposed information is available for viewing approximately 4 seconds after exposure. The rapid processor is an integral part of the camera unit. A special paper is required when operated in this mode.

**CAMERA MODE:** As a hardcopy camera for off-line processing, the F-165 functions in the same manner as the F-80. (The F-85 is used for off-line processing.) Maximum paper width that can be handled in this camera in either mode is 9". The standard pulldown in this unit is 9.00" ± .04". A pulldown other than 9" can be specified when ordering. Abutted frames on the hardcopy can be achieved by specifying an 8-1/2" pulldown and adjusting for a single-axis expansion on the CHARACTRON shaped beam tube.

### F-85 HARDCOPY PROCESSOR

The F-85 is a standard processor which automatically processes the photorecording paper used in the F-80 or F-165 hardcopy camera. Processing occurs at 15 feet

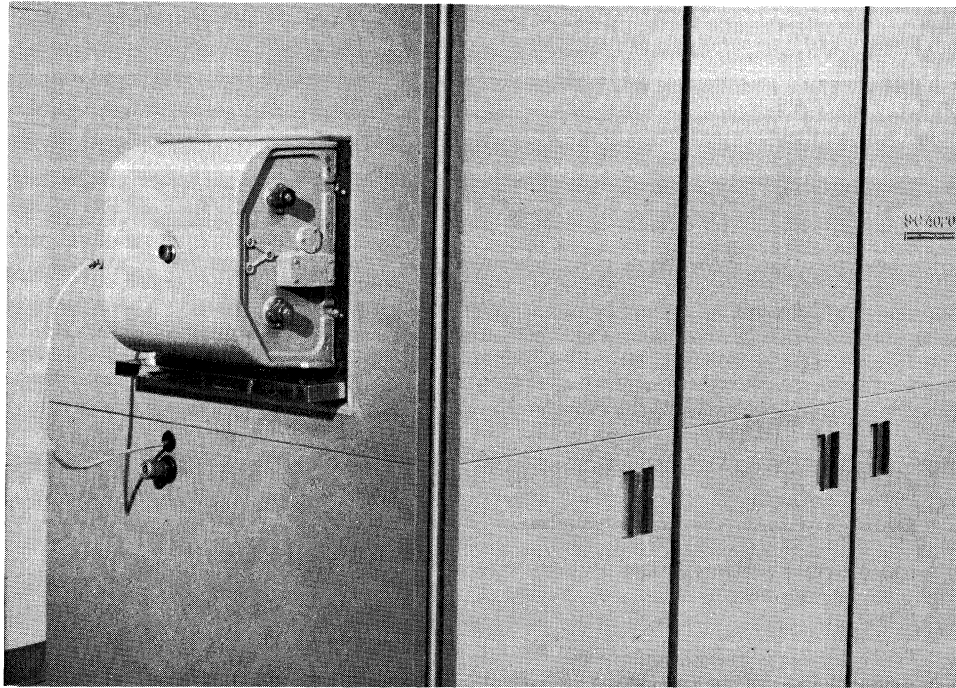


Figure 10. F-80 Hardcopy Camera Option

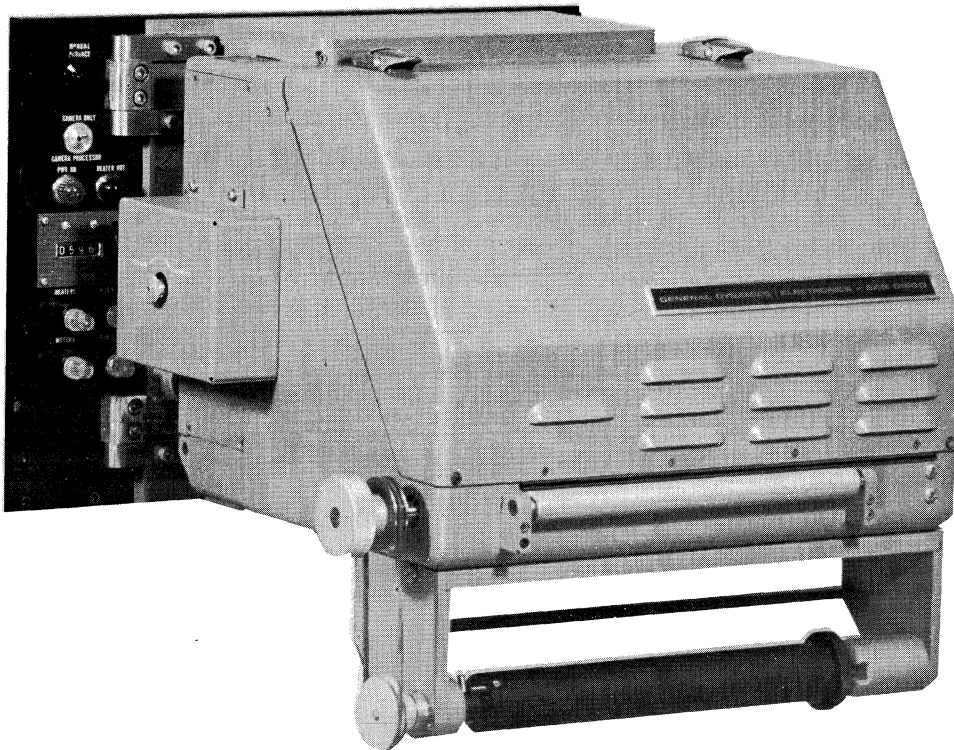
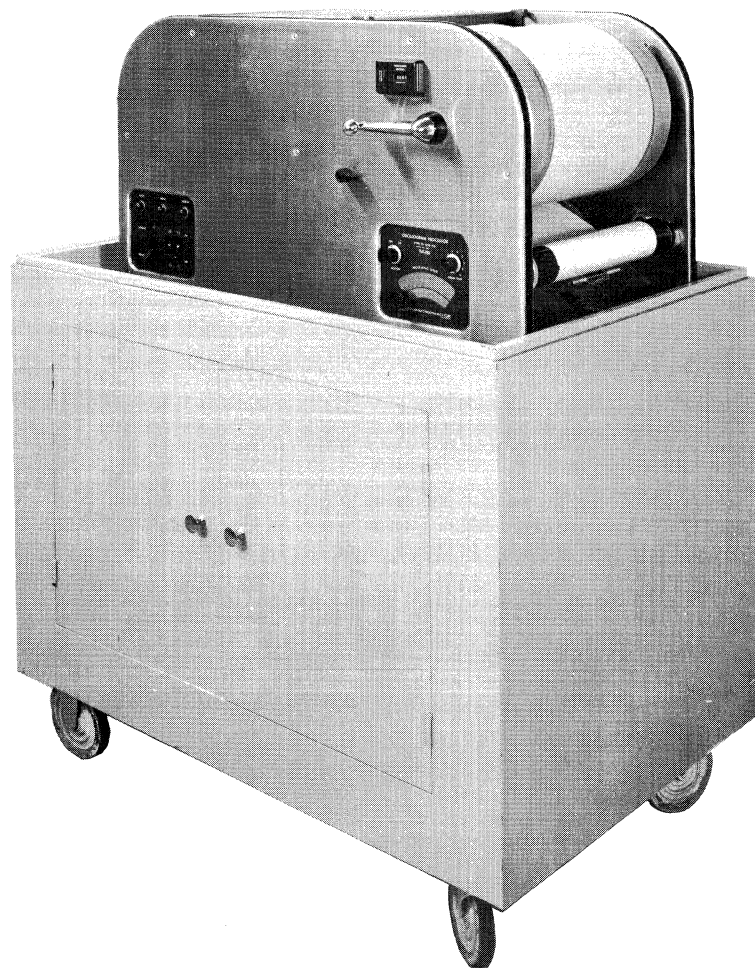


Figure 11. F-165 Camera Processor

per minute. The processed paper is dry and ready for immediate use. This unit is completely self contained and requires only the specified electrical power to operate. (See Figure 12.)

#### F-88 MICROFILM PROCESSOR

This processor accepts either the 16mm or 35mm magazines from the S-C 4020 and can be set up for high-speed negative or reversal processing of either the 16mm or 35mm film. This unit operates at a nominal speed of 25 feet per minute and produces a processed film of high quality, completely dry and suitable for immediate use or archival storage. Dry-to-dry time in this processor is approximately 7 minutes. The F-88 is equipped for daylight operation. Hot and cold water, a chemical drain and the specified power are required to operate this machine. (See Figure 13.)



*Figure 12. F-85 Hardcopy Processor*

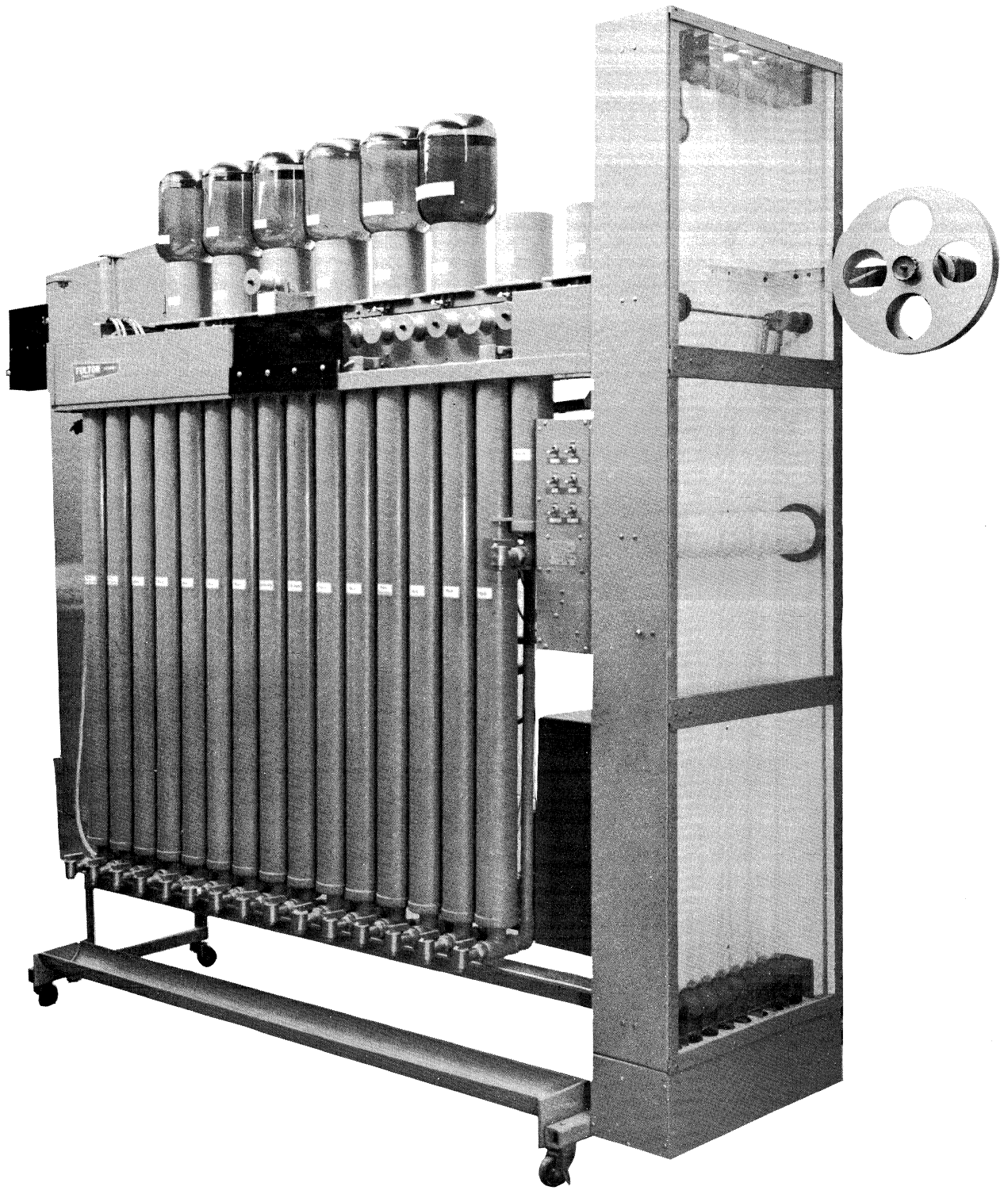


Figure 13. F-88 Microfilm Processor

## OFF-LINE OPERATION

The F-53 off-line tape unit buffer is designed to serve as a buffer between the S-C 4020 and its data source, a magnetic tape unit. This unit will accept data at any rate from an IBM 7330, 729 II, 729 IV, 729 V or 729 VI tape unit. Compatibility with other tape units will be supplied on request.

The F-53 is equipped with core storage available in capacities of either 1024 or 4096 seven-bit characters. The operation of the F-53 is block sequential. Under control of the F-53, a block of data is transferred from tape to core. The tape unit is then stopped and restarted after the first block of data has been processed and transferred to the S-C 4020. Longitudinal and lateral parity are checked during the transfer from tape to core. A detected error will initiate an automatic re-read of the complete record block. A machine stop will occur if a read error repeats. Re-read and/or proceed may be executed manually by the operator after a machine stop.

The F-53 normally is delivered to operate at two densities with a specified tape unit. Both the tape unit and density pair must be specified when ordering the equipment. Compatibility with other than the specified tape unit or densities can be accomplished with a field change. Capability of reading all three densities can be supplied as a special extra-cost feature.

Depending upon the configuration of the F-53 specified when ordering, this unit can operate in any one of several modes. The configurations presently available are listed below.

F-53-2: 1024-character core - accepts binary tapes only.

F-53-2A: Same as F-53-2 with 4096-character core.

F-53-1: A 1024-character core - 1401/1403 simulator. The 1401/1403 simulator makes it possible to read BCD print tapes prepared for the 1403 printer and record the information on microfilm with the S-C 4020. The F-53-1 will sense the single-space, double-space, page-eject control codes on the 1403 tape, but will not sense the intermediate skips used with the carriage control tape on the 1403. The block lengths on the tape must be less than 1020 characters.

F-53-1A: Same as F-53-1 with 4096-character core.

F-53-3: This machine has all the capabilities of the F-53-1 plus the ability to accept BCD coded data for plotting.

F-53-3A: Same as F-53-3 with 4096 core.

F-53-4: This machine has all the capabilities of the F-53-1 plus the ability to accept tape files containing both BCD and Binary blocks randomly mixed. The F53 may be set to process either Binary and/or BCD blocks in a file.

F-53-4A: Same as F-53-4 with 4096 core.

F-53-5: Identical to F-53-2 except it is designed to operate with UNIVAC Uniservo III C tape unit only.

Other configurations of the F-53 will be designed and priced as the demand requires.

#### PRINT-NORMAL AND PRINT-LIST MODES

One of two modes of operation can be selected when printing from BCD tapes prepared for the 1401/1403.

**PRINT NORMAL MODE:** This mode is selected for tapes wherein the data format is as follows:

- a. Each record contains from 2 to 134 tape characters. The first character is a non-printable control character and the last character is a record mark (also non-printable) designating the end of record. One record contains one line of print.
- b. The control character (first character in each record) will be as follows:

| <u>Code</u> | <u>Function</u> | <u>Corresponding Symbol</u> |
|-------------|-----------------|-----------------------------|
| BA8421      |                 |                             |
| 010000      | Single space    | Blank                       |
| 001010      | Double space    | 0 (Zero)                    |
| 000001      | Page eject      | 1                           |
| 001111      | End of file     |                             |

Any other code appearing in the first character position will be interpreted as a "single space" command, and the printing will be suppressed.

The end-of-file code must occur as the first character of a block and be preceded by an inter-record gap; otherwise it will not be acknowledged.

Printing will commence at the first line of the page (regardless of the control code). Subsequent lines will be printed with single or double spacing between lines according to corresponding control codes.

A page-eject code will cause the film to be advanced and printing will be resumed on the first line of a new page (film frame). If a page-eject code is not sensed before the 64th line, the equipment will automatically advance to the next page. This sequence will repeat until an end-of-file code is sensed, at which time a system stop will occur.

**PRINT-LIST MODE:** This mode of operation permits processing of tapes on a line-for-line basis that may or may not contain control codes. That is, all control codes except end-of-file and record mark are ignored and printing occurs continuously at 128 characters or fewer per line and 64 lines per page

In all modes, tapes are recorded in BCD code format. The appropriate code transpositions and special commands necessary for the operation of the S-C 4020 will be automatically executed by the F-53. Lateral and longitudinal redundancy will be performed with the appropriate conventions.

The two modes of operation described will permit printout of print tape generated for IBM 1401/1403 systems provided the stipulated record length and block length are not exceeded. The resultant print format may, however, differ considerably since the flexibility of vertical tab control of the IBM 1403 is not duplicated. The data contained on tape will, nevertheless, be generated line for line with the page format compressed by varying degrees depending on the mode selected and the tape format concerned.

## CONNECTION OF F-53 TO TAPE UNITS

Connections between the F-53 and the IBM tape units to be used in conjunction with the F-53 is by way of standard IBM cables. This equipment arrangement requires that the tape unit involved be used exclusively with the S-C 4020.

If using the tape unit exclusively for the S-C 4020 is not desirable, the use of switchable tape units in the off-line equipment configuration shown in Figure 14 can be applied with certain limitations.

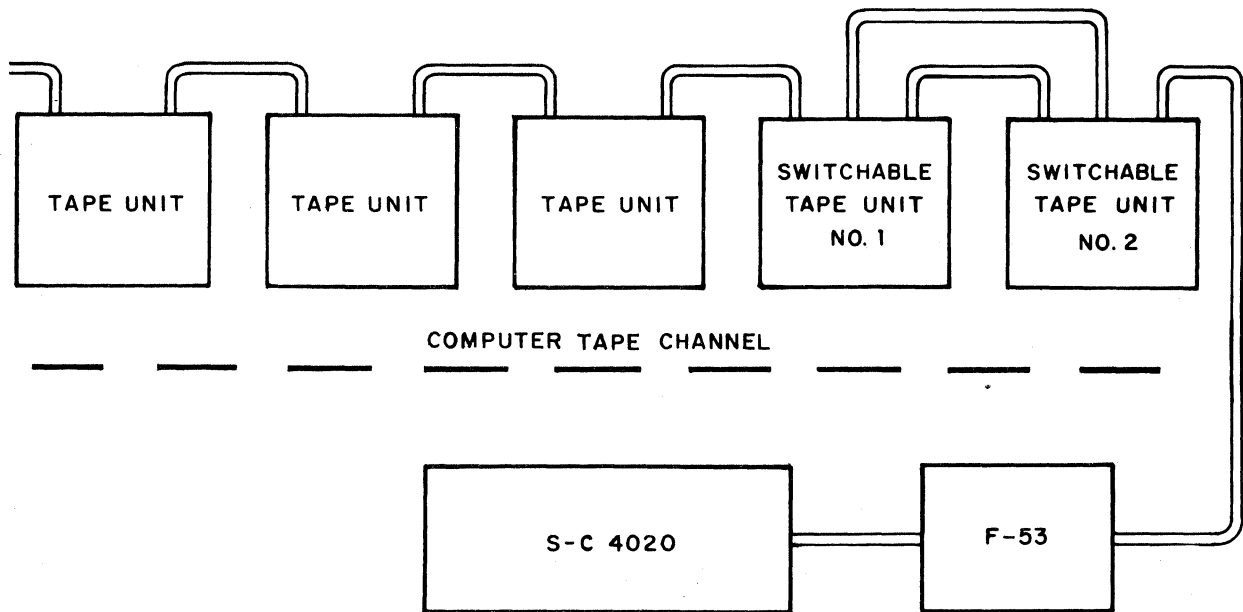


Figure 14. Operation With Switchable Tape Units

This equipment configuration is made possible by the availability of switchable tape units. The configuration permits specified tape units to be transferred from the computer tape channel to off-line status for use with the S-C 4020. Switching is accomplished by a remote control switch on the main console. This, of course, allows for sharing the tape units on an "as-required" basis. In operation, the computer by way of the tape adapter unit can write tapes for the S-C 4020, and then under switch control, transfer this tape unit so that this tape may now be read into the S-C 4020. No physical handling of the tape is necessary in this method of operation.

The switchable tape unit as described is the same as that used in many installations when switching tapes between the 7090 computer and the 1401 computer is required.



Costs for this feature are an additional \$25.00 per month rent per tape unit, plus \$40.00 to \$100.00 per month for the remote control depending on the number of tape units so equipped. The cost savings in the S-C 4020 system would, therefore, be the differential between approximately \$125.00 per month and the cost of the tape unit used exclusively by the S-C 4020/F-53.

It is possible to make two such tape units accessible to the S-C 4020. This might be essential if output requirements are such that while the S-C 4020 is reading a tape previously prepared, the computer is preparing another tape for the S-C 4020. With the single switchable tape unit, the only way this could be handled would be to physically transport tapes between tape units.

This equipment configuration comes very close to actual on-line operation of the S-C 4020 and eliminates the disadvantages involved in tying the S-C 4020 directly on-line.

In this configuration, consideration must be given to the cable lengths involved. The total cable length must not exceed the maximum allowed as specified by IBM.

## ON-LINE OPERATION

Several on-line configurations of the S-C 4020 now exist. The S-C 4020 is presently operational on-line with the following computers: (1) CDC 160A, 1604 and (2) GE 225.

Other on-line configurations contemplated in the near future include IBM 7040, and CDC 3200. On-line operation with other computers is also possible.

If the S-C 4020 is used to accept data directly from the computer, the computer must be capable of presenting the data to the basic S-C 4020 at a rate of 36 bits at a time. The computer must also be capable of transferring this data at rates compatible with the S-C 4020 and in the format required by the S-C 4020. If the computer does not inherently have this compatibility, it can be established by use of special data channels available from the computer manufacturer or by designing a special interface. The interface design can be undertaken by either the computer manufacturer or Stromberg-Carlson.

On-line operation of the S-C 4020 with a peripheral computer or the main frame of the central processor offers several advantages including: (1) Reduced systems cost, (2) Increased flexibility of operation, and (3) Reduced main frame time in the case of on-line operation with a peripheral computer.

Several on-line configurations are outlined in Figures 15-20.

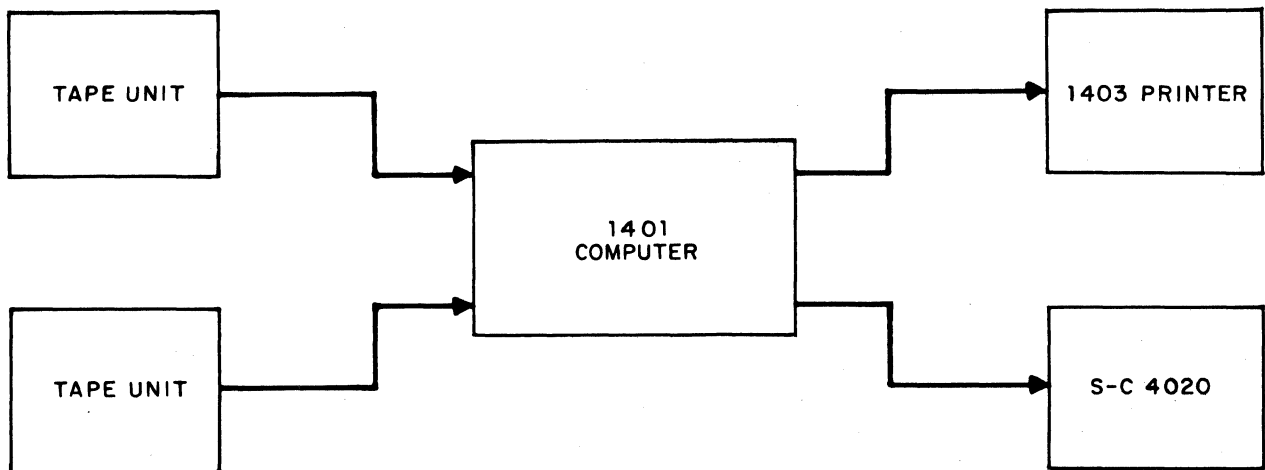


Figure 15. S-C 4020 On-Line With IBM 1401 Computer

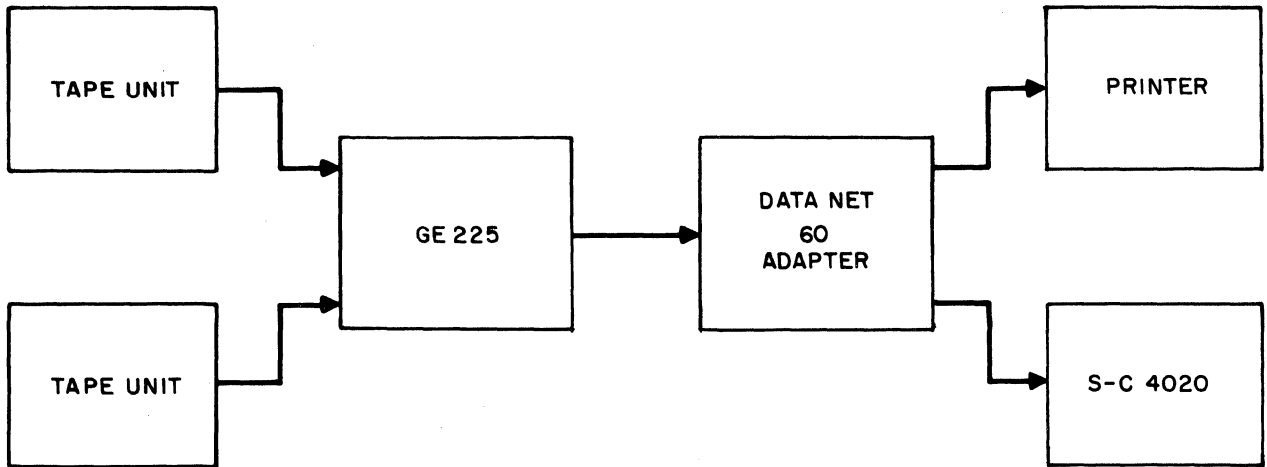


Figure 16. S-C 4020 On-Line With GE 225 Computer

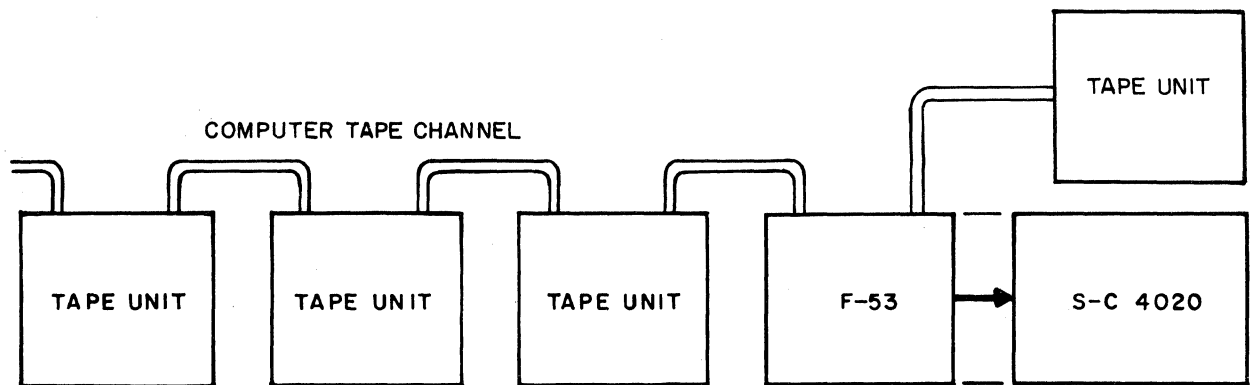


Figure 17. S-C 4020 On/Off-Line With Computer Tape Channel

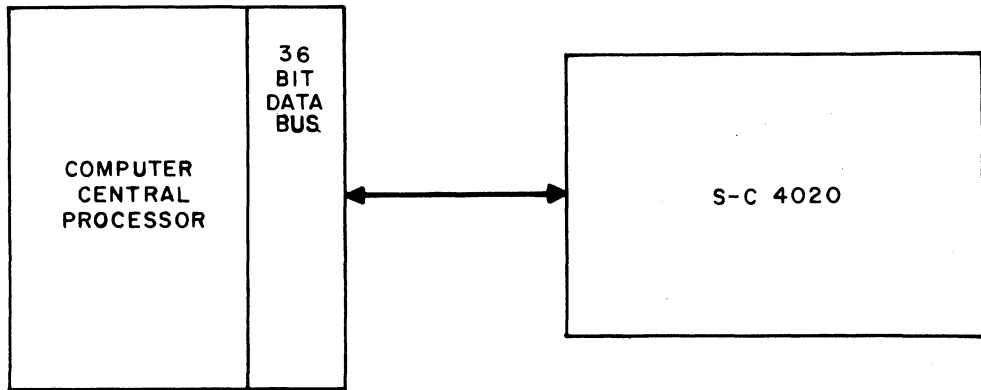


Figure 18. S-C 4020 On-Line With Computer Main Frame

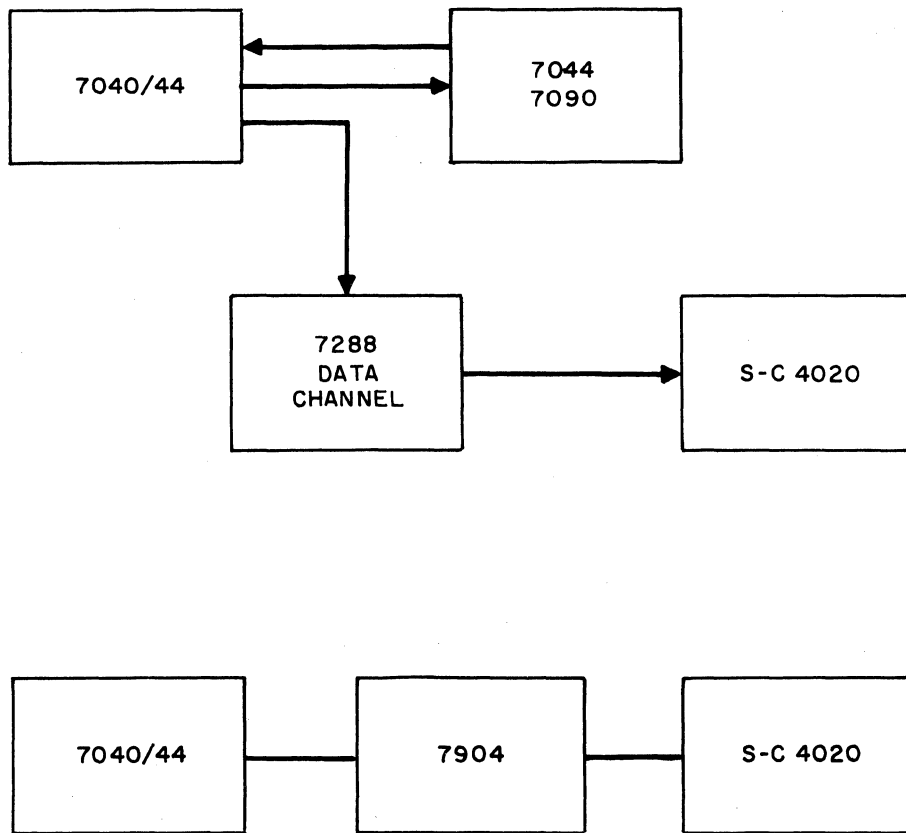


Figure 19. S-C 4020 On-Line With IBM 7040/44 Through 7288 Data Communications Channel or 7904 Data Channel

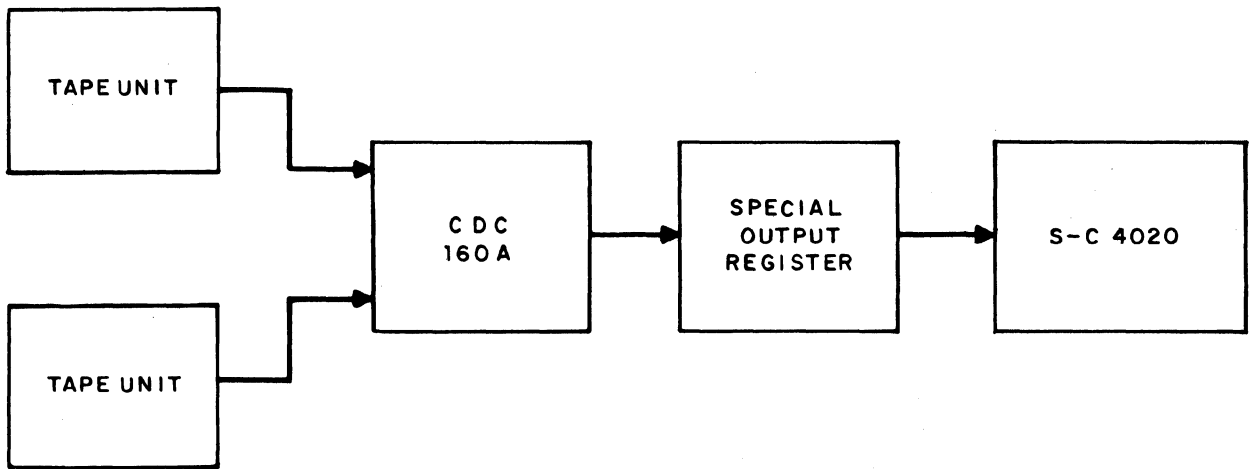


Figure 20. S-C 4020 On-Line With CDC 160A Computer

## COMPUTER COMPATIBILITY

### COMPUTER SOFTWARE

Software is presently available for the following computers:

1. IBM 704, 7040, 7030, 7044, 7090, 7094, 1401, 1410
2. UNIVAC 1107
3. CDC 160A, 1604
4. GE 225
5. Burroughs B-5000

The software packages now available permit the use of FORTRAN, FAP, and machine language programming. The FORTRAN programs allow the production of completely annotated graphs by writing one or two FORTRAN call statements.

Programming manuals are available for the IBM 7000 series computers and the UNIVAC 1107 computer.

### WORD LENGTH

The standard S-C 4020 accepts a 36-bit binary computer word. However, modifications are available that will allow the S-C 4020 to operate with computers having a word length other than 36 bits. Three machines have been modified to operate with the 64-bit word length of the IBM 7030 computer.

### COMPUTER OUTPUT TAPE

The off-line configuration of the S-C 4020 utilizes tape prepared by the computer, packed 200, 556, or 800 BPI in IBM 6-bit format.

## AUXILIARY EQUIPMENT

One of the major advantages of the S-C 4020 is its versatility. As demonstrated by the systems flow diagram (Figure 21), output may be produced in the form of microfilm and/or hardcopy. The film can then be used in various semi-automatic and automatic storage and retrieval systems. Also, multiple copies of output can be made by various standard reproduction methods.

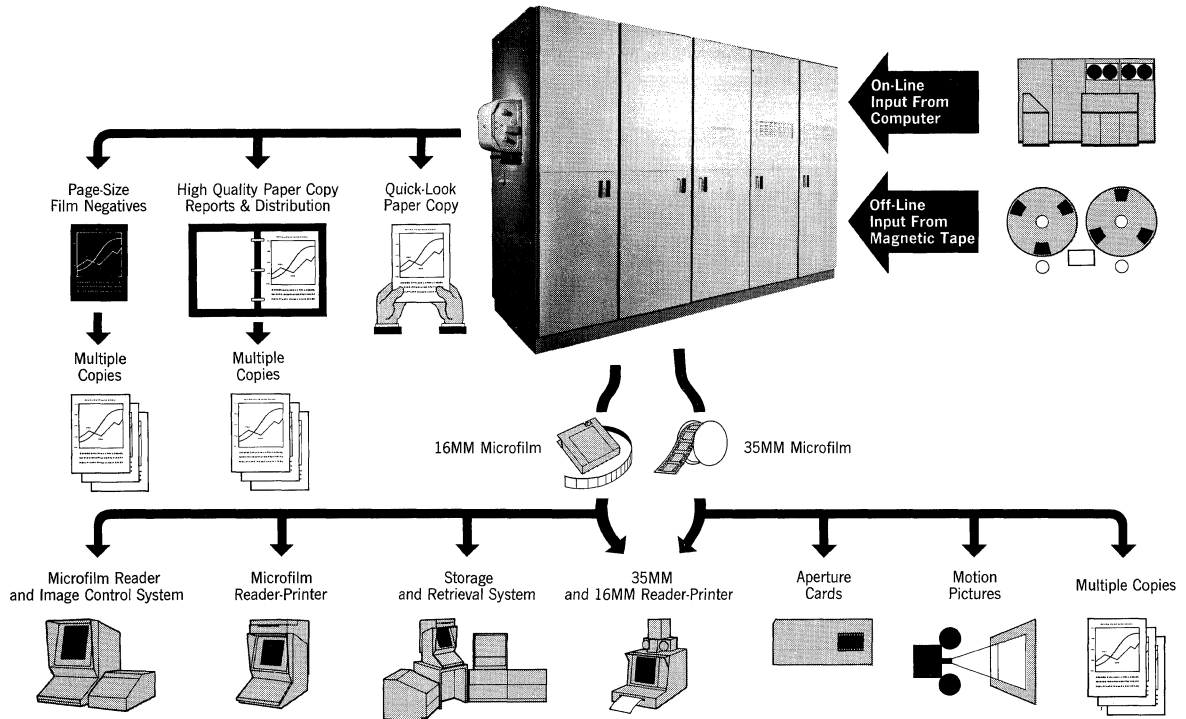


Figure 21. S-C 4020 Systems Flow Diagram

### READER-PRINTERS

Strips or rolls of processed microfilm can be viewed at various magnifications. Hardcopies of selected frames can be produced in approximately 15 seconds. Reader-printers are available in both 16mm and 35mm models. Some models will handle both film sizes.

### READERS

Good quality inexpensive viewers are available from several manufacturers. The viewers allow the user to look at an enlarged image of the microfilm, but do not have the capability of producing hardcopies.

#### MICROFILM TO HARDCOPY REPRODUCER

Equipment is available that will produce paper copies from the microfilm at rates up to 65 feet per minute. This equipment can also produce offset masters and vellums.

#### MICROFILM COPIES

Equipment that produces copies of the microfilm at rates up to 90 feet per minute is available from several manufacturers. Commercial copying service is also available in most major cities. The film copies can be used for distribution while the camera film is retained as a security reference.

#### FILM PROJECTORS

The 35mm and 16mm processed film produced by the S-C 4020 can be used in a strip film projector or mounted in slides for use in a 35mm slide projector. The image of the microfilm can be projected on a large screen for group presentations and evaluation of graphical data.

#### MICROFILM RETRIEVAL SYSTEMS

The film produced by the S-C 4020 is compatible with most of the high-speed microfilm retrieval systems now available. The special coding required for retrieval can be recorded simultaneously with the information displayed on the CHARACTRON shaped beam tube.



## MULTIPLE COPIES

### MULTIPLE PAPER COPIES

The requirement for multiple copies for reports will exist because of the numerous applications to which the S-C 4020 can be applied. The selection of equipment for the production of multiple copies will depend on: (1) The volume of documents to be copied and (2) The quality of reproduction desired.

By selecting the proper equipment or process, documents can be prepared in quantities of a few copies to several thousand copies for such things as technical reports, proposals, parts catalogs, point-to-point wire lists, reference manuals and management reports.

The cost per document of the reproduced documents will be directly proportional to the quality desired and inversely proportional to the number of copies printed. High-quality documents can be produced in volume at a cost of fraction of a cent per page.

### MULTIPLE FILM COPIES

Many of the microfilm retrieval applications require the production of microfilm copies. These copies can be produced at a high speed at a cost of approximately \$3.00 per hundred feet of film.

## USER'S SOCIETY

Two years ago, the users of the S-C 4020 Computer Recorder formed an organization called UAIDE (Users of Automatic Information Display Equipment).

Members of this organization are concerned principally with information display equipment and in promoting the free exchange of information on the use of such machines. The members are presently using the S-C 4020 to portray information in graphic form.

Development work by the various users may be exchanged, as programming requirements are compatible with nearly all of the commonly used data processing systems. Reduction of redundant effort among machine users is one of the main aims of the UAIDE organization.

A library of all programs submitted to UAIDE is maintained by Stromberg-Carlson. The UAIDE librarian distributes a library index and distributes available programs on request. Users of the S-C 4020 can become members by contacting Stromberg-Carlson.

## S-C 4020 APPLICATIONS

### PRINTING

The S-C 4020 can be used to record tabular and alphanumeric information such as stock lists, catalogs, computer program listings, reference files and statistical tables at speeds up to 17,000 characters per second. The information recorded on microfilm can be used in storage and retrieval systems or as an intermediate step in the production of hardcopy reports. (See Figure 22.)

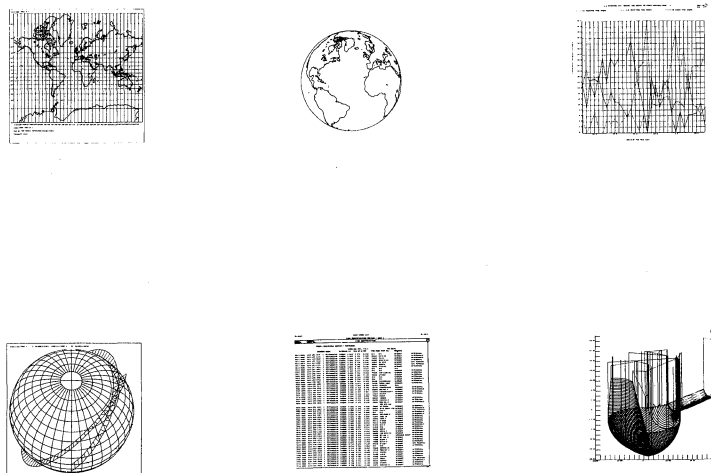


Figure 22. Typical S-C 4020 Applications

### PLOTTING

**SCIENTIFIC CURVES:** The S-C 4020 is used in many scientific computer labs to plot highly accurate curves involving one or more parameters. All axis and grid lines, annotations and titles are included in the program. Continuous graphs of infinite length can be recorded by butting the frames under program control. Typical curves include flight-test data, engine performance data, and trajectory simulations.

**BUSINESS GRAPHS:** The S-C 4020 is proving its usefulness in producing a variety of business charts and graphs, duplicating manual techniques such as line graphs, and bar charts. The machine is speeding decision making as well as saving time and money, through its ability to summarize data in visual form.