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EDITOR'S APOLOGY

The reader will note that the main text pages of this manual are numbered from 95 through 176, and that the first page of each chapter is not numbered. This was a computer composition error and will be corrected in subsequent releases.

The manual is otherwise correct. There are no missing pages.

CHAPTER 1
INTRODUCTION

1.1 SCOPE

This manual explains how to operate the Information International FR 80 Computer Output Microfilm Recorder. It is suggested that the reader study the FR 80 User's Manual before learning the operation of the FR 80. The User's Manual serves as an introduction to the FR 80, familiarizing the reader with its hardware and software systems and capabilities.

1.2 SPECIAL SYMBOLS AND ABBREVIATIONS

← is used to represent a carriage return, which is executed by pressing the RE-TURN key on the Teletype keyboard.

↑ indicates that the number is octal.

CDC is an abbreviation for Control Data Corp.

DEC is an abbreviation for Digital Equipment Corp.

PERTEC is an abbreviation for PERTEC Corp.

CHAPTER 2

HARDWARE OPERATING INSTRUCTIONS

2.1 ABBREVIATED OPERATING PROCEDURES

- a. (tape system only)
Mount the system tape (par. 2.8).
- b. Startup the FR 80 (par. 2.2).
- c. Install the proper camera (par. 2.14).
- d. Check the electrical focus of the light source and set the intensity level for the job being run (par. 2.24).
- e. Load the program to be used (par. 3.1).
- f. Mount the data tape (par. 2.8).

The FR 80 is now prepared for making film.

Tape System (triple-I 15 Computer)

2.2

TAPE SYSTEM STARTUP PROCEDURES

NOTE

The two knobs below the monitor screen are used to adjust the intensity (left knob) and the focus (right knob) of the monitor screen display. Be sure that the intensity knob is turned up enough to reveal a good picture.

- a. Turn the POWER switch on the Operator Console to ON.
- b. Mount a system tape. Select unit #3.
- c. Turn the LINE/OFF/LOCAL switch on the Teletype to LINE.
- d. Set the BANK MODE switch to the on position (all other switches off).
- e. Set the ADDRESS switches to 40↑.
- f. Set the DATA switches to 0.
- g. Turn the READ IN MODE switch to MT.
- h. Press the STOP and RESET switches simultaneously.
- i. Press the READ IN switch. The computer should load the SYSTEM MAINTENANCE program and the Teletype should type *MONITOR.

NOTE

If the step i response does not occur, proceed with step j.

- j. Turn the READ IN MODE switch to PT.
- k. Load the MONITOR BOOTSTRAP paper tape into the paper tape reader and place the START/STOP/FREE switch at START.
- l. Press the STOP and RESET switches simultaneously.
- m. Press the READ IN switch. When the paper tape reader has finished reading the paper tape, the computer will load the SYSTEM MAINTENANCE program and the Teletype will type *MONITOR.
- n. If there is still no response from the computer, notify the Field Service Department of Information International, Inc.

Disk System (triple-I 15 Computer)

2.3 DISK SYSTEM STARTUP PROCEDURES

NOTE

The two knobs below the monitor screen are used to adjust the intensity (left knob) and the focus (right knob) of the monitor screen display. Be sure that the intensity knob is turned up enough to reveal a good picture.

- a. Turn the POWER switch on the Operator Console to ON and wait 60 seconds for the disk to come up to speed.
- b. Turn the LINE/OFF/LOCAL switch on the Teletype to LINE.
- c. Set the BANK MODE switch to the on position (all other switches off).
- d. Set the DATA switches to 0.
- e. Turn the READ IN MODE switch to DISC.
- f. Press the STOP and RESET switches simultaneously.
- g. Press the READ IN switch. The Teletype should do a line feed/return and the monitor screen should display DEBUG, a symbolic representation of the current core image.

NOTE

If the step g response does not occur, proceed with step h.

- h. Set the ADDRESS switches to 17735↑ (-42↑).
- i. Turn the READ IN MODE switch to PT.
- j. Load the DISK UNSAVE paper tape into the paper tape reader and place the START/STOP/FREE switch at START.
- k. Press the STOP and RESET switches simultaneously.
- l. Press the READ IN switch. When the paper tape reader has finished reading the paper tape, the step g response should occur.

NOTE

If the step g response does not occur, it will be necessary to reload the disk from magnetic tape. This tape, containing the FR 80 disk software, is created with the DISK DUMPER program. The "disk dump" tape must contain R BINARY in the SYS directory. Proceed with step m.

- m. Mount a disk dump tape. Select unit #3.
- n. Set the ADDRESS switches to 40↑.
- o. Turn the READ IN MODE switch to MT.

Disk System (triple-I 15 Computer)

- p. Press the STOP and RESET switches simultaneously.
- q. Press the READ IN switch. When the disk dump tape has stopped moving, select unit #1 and the computer will load and start the TAPE DUMP RELOADER program. The Teletype will type the title of the disk dump tape.
- r. Reload the disk according to the instructions for the TAPE DUMP RELOADER program.
Typing WIPE ← (to initialize the disk), then ALL ←, will reload the entire tape.
- s. Return control to DEBUG by typing LSYS;D ← .
- t. If there is still no response from the computer, notify the Field Service Department of Information International, Inc.

Tape and Disk Systems (triple-I 15 Computer)

2.4

SHUTDOWN PROCEDURES

NOTE

The EMERGENCY OFF and POWER RESET switch on the Power Control Panel may be used in case of emergency to turn off all power.

- a. Place the computer in either MONITOR (tape system) or DEBUG (disk system).
- b. Turn the LINE/OFF/LOCAL switch on the Teletype to OFF.
- c. Press the STOP and RESET switches simultaneously.
- d. Turn the POWER switch to OFF.
- e. Turn the power off on the magnetic tape transport(s) by pressing the POWER switch.

Tape System (PDP-9/L and PDP-15 Computers)

2.5

TAPE SYSTEM STARTUP PROCEDURES

NOTE

The two knobs below the monitor screen are used to adjust the intensity (left knob) and the focus (right knob) of the monitor screen display. Be sure that the intensity knob is turned up enough to reveal a good picture.

- a. Turn the ON/OFF switch on the Operator Console to ON.
- b. Turn the LINE/OFF/LOCAL switch on the Teletype to LINE.
- c. On the PDP-15 only, set the BANK MODE switch to the on position (all other switches off).
- d. Set the ADDRESS switches to 40↑.
- e. Set the DATA switches to 0.
- f. Press the STOP and I/O RESET switches simultaneously.
- g. Press the START switch. The Teletype should type *MONITOR.

NOTE

If the step g response does not occur, proceed with step h.

- h. Mount a system tape. Select unit #3 (PERTEC or CDC transports) or unit #7 (DEC transports).
- i. Load the MONITOR BOOTSTRAP paper tape into the paper tape reader and place the START/STOP/FREE switch at START.
- j. Press the STOP and I/O RESET switches simultaneously.
- k. Press the READ IN switch. When the paper tape reader has finished reading the paper tape, the computer will load the SYSTEM MAINTENANCE program and the Teletype will type *MONITOR.
- l. If there is still no response from the computer, notify the Field Service Department of Information International, Inc.

Disk System (PDP-9/L and PDP-15 Computers)

2.6 DISK SYSTEM STARTUP PROCEDURES

NOTE

The two knobs below the monitor screen are used to adjust the intensity (left knob) and the focus (right knob) of the monitor screen display. Be sure that the intensity knob is turned up enough to reveal a good picture.

- a. Turn the ON/OFF switch on the Operator Console to ON and wait 60 seconds for the disk to come up to speed.
- b. Turn the LINE/OFF/LOCAL switch on the Teletype to LINE.
- c. On the PDP-15 only, set the BANK MODE switch to the on position (all other switches off).
- d. Set the ADDRESS switches to 17777↑.
- e. Set the DATA switches to 0.
- f. Press the STOP and I/O RESET switches simultaneously.
- g. Press the START switch. The Teletype should do a line feed/return and the monitor screen should display DEBUG, a symbolic representation of the current core image.
- h. Type D\$J on the Teletype.

NOTE

If the step g response does not occur, proceed with step i.

- i. Set the ADDRESS switches to 17735↑ (-42↑).
- j. Load the DISK UNSAVE paper tape into the paper tape reader and place the START/STOP/FREE switch at START.
- k. Press the STOP and I/O RESET switches simultaneously.
- l. Press the READ IN switch, then follow these steps:
 - (1) PDP-9/L COMPUTERS
 - (a) After the paper tape reader finishes reading the paper tape, set the ADDRESS switches to 17777↑.
 - (b) Press the STOP and I/O RESET switches simultaneously.
 - (c) Press the START switch.
 - (d) If the step g response does not occur, proceed with step m.
 - (2) PDP-15 COMPUTERS

Disk System (PDP-9/L and PDP-15 Computers)

- (a) Skip to the NOTE following step p.
- m. Set the ADDRESS switches to 17755↑ (-22↑).
 - n. Load the RELOAD DEBUG paper tape into the paper tape reader and place the START/STOP/FREE switch at START.
 - o. Press the STOP and I/O RESET switches simultaneously.
 - p. Press the READ IN switch. When the paper tape reader has finished reading the paper tape, the step g response should occur.

NOTE

If the step g response does not occur, it will be necessary to reload the disk from magnetic tape. This tape, containing the FR 80 disk software, is created with the DISK DUMPER program. The "disk dump" tape must contain R BINARY in the SYS directory. Proceed with step q.

- q. Mount a disk dump tape. Select unit #3 (PERTEC or CDC transports) or unit #7 (DEC transports).
- r. Set the ADDRESS switches to 40↑.
- s. Load the MONITOR BOOTSTRAP paper tape into the paper tape reader and place the START/STOP/FREE switch at START.
- t. Press the STOP and I/O RESET switches simultaneously.
- u. Press the READ IN switch. When the paper tape reader has finished reading the paper tape and the disk dump tape has stopped moving, select unit #1; the computer will load and start the TAPE DUMP RELOADER program. The Teletype will type the title of the disk dump tape.
- v. Reload the disk according to the instructions for the TAPE DUMP RELOADER program .
Typing WIPE ← (to initialize the disk), then ALL ←, will reload the entire tape.
- w. Return control to DEBUG by typing LSYS;D ← .
- x. If there is still no response from the computer, notify the Field Service Department of Information International, Inc.

Tape and Disk Systems (PDP-9/L and PDP-15 Computers)

2.7 SHUTDOWN PROCEDURES

NOTE

The EMERGENCY OFF and POWER RESET switch on the Turn On Control Panel may be used in case of emergency to turn off all power except that going to the computer.

- a. Place the computer in either MONITOR (tape system) or DEBUG (disk system).
- b. Turn the LINE/OFF/LOCAL switch on the Teletype to OFF.
- c. Press the STOP and I/O RESET switches simultaneously.
- d. Turn the ON/OFF switch to OFF.
- e. Turn the power off on the magnetic tape transport(s) by pressing the POWER switch.

PERTEC Transport

2.8

MOUNTING A REEL OF MAGNETIC TAPE ON THE PERTEC TRANSPORT

- a. Turn the power on by pressing the POWER switch.
- b. Place the reel on the lower hub with the write enable ring groove facing inward. If you wish to write on the tape, insert a write enable ring in the groove. Press the center plunger and press the reel against the back flange of the hub. Release the center plunger.
- c. Thread the tape along the path shown in Figure 2-1. It will be necessary to rotate and hold the flux gate away from the head during tape threading. Wrap the tape leader onto the takeup reel so that the tape will wind onto the reel when it is rotated clockwise. Wind several turns onto the takeup reel, then turn the supply reel counterclockwise until all slack tape has been taken up.
- d. Press the LOAD switch.

CAUTION

Check to see that the tape is positioned correctly on all guides or tape damage may result.

- e. Press the LOAD switch a second time.

NOTE

If the tape has passed load point and continues to move forward, press the REWIND switch.

- f. Turn the UNIT SELECT switch to the number desired (select 3 for a system tape).
- g. Press the ON LINE switch.

2.9

UNMOUNTING A REEL OF MAGNETIC TAPE FROM THE PERTEC TRANSPORT

- a. Press the ON LINE switch to put the unit off line.
- b. Press the REWIND switch. If the tape was at load point, it will unload. If not, it will rewind to load point, after which you should press the REWIND switch a second time.
- c. Wind the end of the tape onto the reel.
- d. Depress the center plunger and remove the reel.

PERTEC Transport

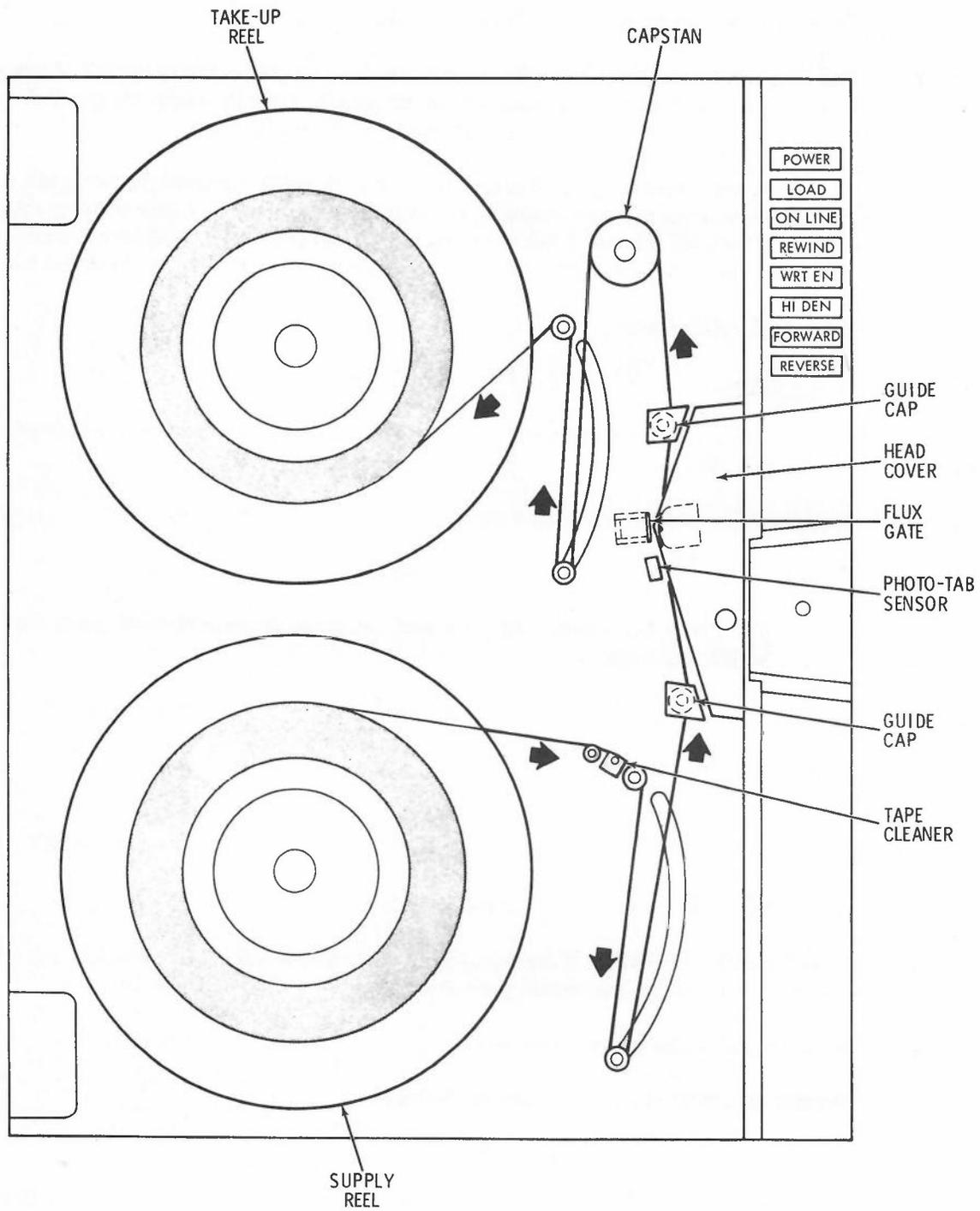


Figure 2-1. Tape Path and Controls.

CDC Transport

2.10

MOUNTING A REEL OF MAGNETIC TAPE ON THE CDC TRANSPORT

- a. Turn the power on by pressing the POWER switch.
- b. Place the reel on the right hub with the write enable ring groove facing inward. If you wish to write on the tape, insert a write enable ring in the groove. Press the reel against the hub stop and close the reel knob latch.
- c. Unwind about 4 feet of tape and thread it along the tape path as follows:
 - (1) Place the tape under the tape guide that is located near the supply reel and then under the head assembly, pushing down the shield arm assembly if necessary.
 - (2) Place the tape under the tape guide that is located near the takeup reel and then onto the takeup reel.
 - (3) Hold the end of the tape in place and turn the takeup reel clockwise several turns.

NOTE

During a load operation, tape is drawn into the vacuum columns from both reels. Wind sufficient tape onto the takeup reel to allow this.

- (4) Turn the takeup reel clockwise until all slack tape has been taken up.
- d. Press the shield arm assembly release lever; the pad should move up and contact the tape and the head assembly.
- e. Close the window assembly.
- f. Press the LOAD switch.

NOTE

If the tape has passed load point and continues to move forward, press the CLEAR and REWIND switches in succession.

- g. Turn the UNIT SELECT switch to the number desired (select 3 for a system tape).
- h. Press the READY switch.

2.11 UNMOUNTING A REEL OF MAGNETIC TAPE FROM THE CDC TRANSPORT

- a. Press the CLEAR switch.
- b. Press the REWIND switch. If the tape was at load point, it will unload. If not, it will rewind to load point, after which you should press the REWIND switch a second time.
- c. Open the window assembly, push down the shield arm assembly, and wind the end of the tape onto the reel.
- d. Open the reel knob and remove the reel.

DEC Transport

2.12

MOUNTING A REEL OF MAGNETIC TAPE ON THE DEC TRANSPORT

- a. Turn the power on by pressing the POWER switch.
- b. Place the reel on the upper turntable with the write enable ring groove facing inward. If you wish to write on the tape, insert a write enable ring in the groove.
- c. Hold the reel against the back lip of the turntable and allow the free end of the tape to hang down about one foot below the bottom of the door.
- d. Lock the reel in place by turning the center of the turntable clockwise.
- e. Hold the TAPE DRIVE switch at BRAKES and turn the takeup reel until its finger holes are vertically aligned.
- f. Thread the tape through the transport mechanism and lay the free end down over the top inside surface of the takeup reel.
- g. Place your right finger on the tape in the top hole of the takeup reel, hold the TAPE DRIVE switch at BRAKES with your left finger, and wind the reel clockwise several turns. Release the switch.
- h. Move the TAPE DRIVE switch firmly to the START position and hold it there momentarily.
- i. Press the FWD (forward) switch.

NOTE

If the tape has passed load point and continues to move forward, press the RESET and REWIND switches in succession.

- j. Turn the UNIT SELECT switch to the number desired (select 7 for a system tape).
- k. After the tape has reached load point, press the ON LINE switch.

2.13

UNMOUNTING A REEL OF MAGNETIC TAPE FROM THE DEC TRANSPORT

- a. Press the OFF LINE switch.
- b. If the tape is not at load point, press the REWIND switch and wait until the tape reaches load point.
- c. In succession, press the REVERSE, RESET, and REWIND switches.
- d. Hold the TAPE DRIVE switch at BRAKES and wind the end of the tape onto the reel.
- e. Unlock the upper reel by turning the center of the turntable counterclockwise and remove the reel.

Removing Cameras

2.14 REMOVING THE 16mm AND 35mm CAMERAS

- a. Disconnect the electrical cable from the rear of the camera.
- b. Loosen the four captive thumbscrews that fasten the camera base to the hat.
- c. Grasp the camera housing (do not use magazines as lifting points) and carefully lift the camera off of the hat.

2.15 REMOVING THE 105mm CAMERA

- a. Set the POWER switch to the off position.
- b. Disconnect the electrical cables from the camera.
- c. Detach the vacuum hose from the camera.
- d. Loosen the four captive thumbscrews that fasten the camera base to the hat.
- e. Grasp the camera housing (do not use magazines as lifting points) and carefully lift the camera off of the hat.

2.16 REMOVING THE HARDCOPY CAMERA

- a. Set the ON/OFF switch to the OFF position.
- b. Disconnect the electrical cable from the rear of the camera.
- c. Detach the vacuum hose from the camera.
- d. Rotate the access panel retaining screws counterclockwise 180 degrees and remove the access panel.
- e. Loosen the four captive thumbscrews that fasten the camera base to the hat.
- f. Grasp the camera housing and carefully lift the camera off of the hat.

2.17 INSTALLING THE 16mm AND 35mm CAMERAS

- a. Grasp the camera housing (do not use magazines as lifting points) and carefully lower the camera over the hat on the light source so that the four thumbscrews in the camera base are located over the mounting holes in the hat.

NOTE

If the camera mount is the type with a stopblock, it will be necessary to carefully turn the camera in a counterclockwise direction until the locating pin on the mounting flange firmly engages the stopblock on the hat.

- b. Secure the camera to the hat by tightening the four thumbscrews.
- c. Connect the electrical cable to the rear of the camera.

2.18 INSTALLING THE 105mm CAMERA

- a. Grasp the camera housing (do not use magazines as lifting points) and carefully lower the camera over the hat on the light source so that the four thumbscrews in the camera base are located over the mounting holes in the hat.
- b. Secure the camera to the hat by tightening the four thumbscrews.
- c. Set the POWER switch to the off position.
- d. Connect the electrical cables to the camera.
- e. Attach the vacuum hose to the camera.
- f. If the camera is loaded, set the POWER switch to the on position.

2.19 INSTALLING THE HARDCOPY CAMERA

- a. Rotate the access panel retaining screws counterclockwise 180 degrees and remove the access panel.
- b. Grasp the camera housing and carefully lower the camera over the hat on the light source so that the four thumbscrews in the camera base are located over the mounting holes in the hat.
- c. Secure the camera to the hat by tightening the four thumbscrews.
- d. Connect the electrical cable to the rear of the camera.
- e. Attach the vacuum hose to the camera.

16mm and 35 mm Unsprocketed Cameras

2.20 LOADING THE 16mm AND 35mm UNSPROCKETED CAMERAS

- a. Load the supply magazine as follows:
 - (1) To facilitate loading, cut a 12-inch strip of scrap film to use as a "shoehorn". From the outside of the magazine, insert the shoehorn between the two visible rollers. Position the shoehorn so that it lies halfway into the magazine.
 - (2) Go dark. Open the film can and remove the film. Place the roll into the magazine (wound emulsion in) while holding the film footage counter arm away from the shaft. The film must be placed on the shaft so that it will unwind in a counterclockwise direction.
 - (3) Using the shoehorn as a guide, direct the film through the rollers until it protrudes outside the magazine. Remove the shoehorn.
 - (4) Install the lid (aligning the index button on the lid with the one on the magazine) and fasten it down with the two thumbscrews.
- b. Attach the supply magazine as follows:
 - (1) Insert the film protruding from the magazine into the camera and place the magazine into the recessed area on top of the camera, sliding it to the right so that the lip on the magazine fits into the groove in the camera.
 - (2) Secure the magazine by tightening the thumbscrew.
 - (3) Plug the "10 FT. LEFT" cable into the jack on the film metering plate.
- c. Thread the film through the camera, letting it protrude a few inches at the takeup end. Thread the film according to the diagram on the inside of the camera door. When threading the film around the capstans, withdraw their respective pressure rollers.
- d. Attach the takeup magazine as in steps b (1) and (2), inserting the film protruding from the camera into the magazine. How the film is attached to the core or the leader will depend upon the method of processing being used.
- e. Before closing the camera door and installing the lid on the takeup magazine, push the FILM ADVANCE button several times. Check to see that the film is moving through the camera and into the takeup magazine properly.

16mm and 35mm Sprocketed Cameras

2.21

LOADING THE 16mm AND 35mm SPROCKETED CAMERAS

- a. Load the supply magazine as follows:
 - (1) To facilitate loading, cut a 12-inch strip of scrap film to use as a "shoehorn". From the outside of the magazine, insert the shoehorn between the two visible rollers. Position the shoehorn so that it lies halfway into the magazine.
 - (2) Go dark. Open the film can and remove the film. Place the roll into the magazine (wound emulsion in) while holding the film footage counter arm away from the shaft. The film must be placed on the shaft so that it will unwind in a counterclockwise direction.
 - (3) Using the shoehorn as a guide, direct the film through the rollers until it protrudes outside the magazine. Remove the shoehorn.
 - (4) Install the lid (aligning the index button on the lid with the one on the magazine) and fasten it down with the two thumbscrews.
- b. Some sprocketed cameras are used for both 16mm and 35mm film. If this is the case, and you are changing from one film width to the other, follow these steps:
 - (1) Adjust the flanges of the supply capstan pressure roller for the proper film width.
 - (2) After loosening the two thumbscrews, remove the movement.
 - (3) Install the new movement as follows:
 - (a) Align the bar on the motor disk with the slot in the movement disk.
 - (b) Seat the movement by hand.
 - (c) Tighten the two thumbscrews.
- c. Attach the supply magazine as follows:
 - (1) Insert the film protruding from the magazine into the camera and place the magazine into the recessed area on top of the camera, sliding it to the right so that the lip on the magazine fits into the groove in the camera.
 - (2) Secure the magazine by tightening the thumbscrew.
 - (3) Plug the "10 FT. LEFT" cable into the jack on the film metering plate.
- d. Thread the film through the camera, letting it protrude a few inches at the takeup end. Thread the film according to the diagram on the inside of the camera door and the following instructions:
 - (1) When threading the film around the supply capstan, withdraw the pressure roller.
 - (2) When threading the film around the sprockets of the movement, withdraw the eccentric film guides by turning them 180 degrees.

16mm and 35mm Sprocketed Cameras

- (3) When threading the film through the aperture area, open the film gate. Place the perforations of the film over the shuttle pins of the movement. Hold the film in that position and carefully close the gate.
- e. Attach the takeup magazine as in steps c (1) and (2), inserting the film protruding from the camera into the magazine. How the film is attached to the core or the leader will depend upon the method of processing being used.
- f. Attach the takeup drive spring belt to the takeup drive pulley on the side of the magazine.
- g. Before closing the camera door and installing the lid on the takeup magazine, push the FILM ADVANCE button several times. Check to see that the film is moving through the camera and into the takeup magazine properly.

105mm Camera

2.22

LOADING THE 105mm CAMERA

- a. Load the supply magazine as follows:

NOTE

If you are using 16mm magazines (with adapters) refer to par. 2.20, LOADING THE 16mm AND 35mm UNSPROCKETED CAMERAS.

- (1) Insert the flange adapter over the shaft.
- (2) Go dark. Open the film can and remove the film. Place the roll into the magazine (wound emulsion in) so that it will unwind in a counterclockwise direction.
- (3) Guide the film through the light trap until it protrudes outside the magazine.

NOTE

There are brake release buttons on the bottom of some magazines. If present, these buttons must be pressed in while the film is being guided through the light trap.

- (4) Insert the flange adapter and release the spring-loaded spindle latch.
 - (5) Close the magazine door.
- b. Install the proper control disk as follows:
- (1) Open the door at the lower right corner of the camera, withdraw the latch, and tip the photocell arm forward.

CAUTION

The control disk is fragile and must be handled very carefully.

- (2) Remove the disk by taking hold of its hub and sliding it off the shaft.
 - (3) Install the new disk, holding it in the same manner. Slide it over the shaft, aligning the slot in the hub with the tapered pin of the disk shaft flange.
 - (4) Tip the photocell arm back, secure it with the latch, and close the door.
- c. Install the proper aperture plate as follows:
- (1) Place both loop arms in the unlatched (horizontal) position.
 - (2) Place the carriage in the midposition. Press down on the aperture gate, unlatch it, and open it.

CAUTION

105mm Camera

When removing or replacing the aperture plate be very careful not to scratch it. Always lay the aperture plate down on its backside.

- (3) Press down on the aperture plate, unlatch it, and remove it.
 - (4) Install the new aperture plate, carefully sliding it to the rear of the carriage recess. Press down to insure that the pins on the aperture plate slide into the socket at the rear of the carriage recess.
 - (5) Press down on the aperture plate and latch it.
- d. Place both loop arms in the latched (vertical) position.
- e. Set both selector knobs for the proper film width. Be sure that they are oriented properly so that the film guide assemblies can close fully.

NOTE

For 16mm film, set the left selector knob to 105 and the right selector knob to 16.

- f. Set the LOAD/UNLOAD switch to the UNLOAD position.
- g. Set the POWER switch to the on position.
- h. Attach the supply magazine as follows:
- (1) Have approximately four inches of film protruding from the magazine. Hold the magazine above the camera with the door to the rear and insert the film into the left slot. It will be necessary to open the left film guide assembly to allow the film to pass through it.
 - (2) Swivel the magazine into position under the cleat and over the register pins.
 - (3) Engage the latch.
- i. Press the FILM FEED switch to the right. Film will be driven into the camera until the switch is released. Repeat this action as necessary while loading the camera.
- j. Guide the film to the left of the loop arm. Leave enough slack to form a takeup loop.
- k. Place both loop arms in the unlatched (horizontal) position.
- l. Place the carriage in the midposition. Open the aperture gate and guide the film through. Carefully close the gate and check to see that the spring-loaded flange guides are bearing against the front edge of the film.
- m. Set the LOAD/UNLOAD switch to the LOAD position.
- n. Place the right loop arm in the latched (vertical) position.
- o. Guide the film to the right of the loop arm and into the guide assembly. Leave enough slack to form a takeup loop. It will be necessary to open the guide assembly to allow the film to pass

105mm Camera

through it. Pass the film through the right slot until it protrudes well outside the camera.

- p. Place the right loop arm in the unlatched (horizontal) position.
- q. Attach the takeup magazine, with the door to the front, as in steps h (2) and (3). How the film is attached to the core or the leader will depend upon the method of processing being used. If you wish to insert the film protruding from the camera into the magazine before attaching a leader, follow these steps:
 - (1) Trim the film so that it protrudes less than 1/4" above the camera.
 - (2) Attach the magazine.
 - (3) Press the FILM FEED switch until a sufficient amount of film has moved into the magazine.
- r. Before closing the camera and takeup magazine doors, press the FILM FEED switch for a few moments. Check to see that the film is moving through the camera and into the takeup magazine properly.

Hardcopy Camera

2.23 LOADING THE HARDCOPY CAMERA

- a. Load the supply magazine as follows:
 - (1) Open the magazine and lay it before you with the latch to your right.
 - (2) Go dark. Open the paper box and remove the paper. Slide the roll over the shaft (wound emulsion in) until it rests firmly against the fixed flange. Attach the removable flange so that it locks into the inner groove.
 - (3) Place the roll into the magazine so that the fixed flange is to your left and the paper will unwind in a clockwise direction (facing the magazine from the latch end).
 - (4) Pull out enough paper so that it will protrude outside the magazine. Close the magazine and secure the latch.
- b. Attach the supply magazine as follows:
 - (1) Insert the paper protruding from the magazine into the camera, press back on the clutch control lever, and place the magazine into position with the latch to the front.
 - (2) Release the clutch control lever and the front spring latch.
 - (3) See that the magazine is seated properly.
- c. Hold the camera top open (by its handle) and move the wrap roller control arm to the open position.
- d. Load the takeup magazine as in step a, inserting a core over the shaft.
- e. Attach the takeup magazine as in step b and then open it.
- f. Thread the paper over the supply roller and guide rails, between the capstan and wrap roller, and over the takeup roller.

NOTE

As it becomes necessary to pull more paper from the supply magazine, place your hand beneath the magazine and press upwards. This will lessen the tension put upon the paper by the clutch.

- g. Tape the paper to the core.
- h. Set the ON/OFF switch to the ON position.
- i. Press the READY switch.
- j. Push the CLEAR button twice to wind sufficient paper onto the core to allow for the capstan wrap.
- k. Hold the camera top open (by its handle) and move the wrap roller control arm to the wrap position.

Hardcopy Camera

1. Before installing the access panel and closing the camera top and magazine, push the CLEAR button. Check to see that the paper is moving through the camera and into the takeup magazine properly. Be sure that the paper lies flat on all rollers (between the flanges) and across the guide rails.

2.24 **SETTING THE INTENSITY LEVEL AND CHECKING THE ELECTRICAL FOCUS OF THE LIGHT SOURCE**

- a. If the computer has just been turned on, allow 30 minutes for stabilization.
- b. After having loaded a film-making program, type FOCUS/ ← . This will cause the focusing image to appear on both the monitor screen and the light source.
- c. Turn the MULTIPLIER knob on the Light Sensor Control Panel to either 1X, 5X, 10X, or 20X. The intensity reading indicated on the adjacent meter is a multiple of the MULTIPLIER setting. For example, a reading of 40 can be attained by multiplying 1X (knob setting) and 40 (meter reading), 5X and 8, 10X and 4, or 20X and 2.
- d. At the Light Source Control Panel, adjust the INTENSITY knob until the multiplied intensity reading on the Light Sensor Control Panel is near the desired level for the job being run.
- e. The actual focus is accomplished by nulling the FOCUS, QUAD, and IN PHASE knobs on the Light Source Control Panel:
 - (1) Turn each knob so that it causes the meter needle to move down on the scale. When the needle reaches a certain point, it will start back up the scale. Adjust the knob so that the needle is positioned at its lowest point.
 - (2) Perform this adjustment with each of the knobs until the needle is nulled as much as possible. Locking the knobs will prevent them from being moved accidentally later on.
- f. Readjust the INTENSITY knob until the multiplied intensity reading on the Light Sensor Control Panel corresponds to the desired level for the job being run. This value is a reference number which indicates the light source intensity level necessary to obtain the correct exposure.
- g. Upon completion of the focusing procedure, return control to MONITOR by typing CTRL I on the Teletype keyboard.

2.25

FILM EXPOSURE

Exact recommendations for film exposure cannot be given. Exposure must be determined empirically, giving full consideration to the following variables:

- a. Type of camera
- b. Type of film
- c. Desired end product: positive or negative film, hardcopy, etc.
- d. Method of processing:
 - (1) Type of processor
 - (2) Chemistry
 - (3) Temperature of chemicals
 - (4) Processor transport speed

It will be necessary to determine the proper intensity level (multiplied intensity reading) for each combination of the forenamed variables that will be used. To determine the proper exposure, record a series of test frames at many different intensity levels. Be sure that these tests are processed to the "end product" before examining them and selecting the intensity level which produced the best results.

CHAPTER 3

SOFTWARE OPERATING INSTRUCTIONS

3.1 SOFTWARE CONTROL

After the system has been initialized (see par. 2.2) it will be in either MONITOR (tape system) or DEBUG (disk system).

(disk system only)

DEBUG is an interactive supervisor that permits the modification and loading of programs under control of the Teletype keyboard. Utility programs can be used to audit, load, and dump the disk.

Production operations are usually only concerned with the loading and operation of the film-making programs described in this manual.

To load a program from DEBUG, type the name of the disk directory in which the program resides, a semicolon, the program name, and then \$J. To load the 4020 INTERPRETER, for example, type MON;4020\$J. The program will then be in MONITOR. To load another program from DEBUG, you must first type CTRL D to transfer control from MONITOR to DEBUG.

(tape and disk systems)

MONITOR is an interactive supervisor that permits the loading, modification, and operation of film-making programs under control of the Teletype keyboard. Many programs have a display which looks similar to the command list which can be created with the ? command. To load another program from MONITOR, use the LOAD command as described in TABLE 3-1.

3.2 AVAILABILITY OF COMMANDS

Programs are assembled to match particular machine configurations and to meet particular software requirements. Commands and/or parameters which are not required are often omitted to allow a larger buffer area. Special versions of some programs may be assembled with especially large buffers to allow the processing of large blocks of data, large forms, or multiple buffering.

In addition, some commands may be available only until a GO or FORM command has been activated. This allows the operator to set a parameter, and then increases the buffer size by eliminating the command.

The ? command (see TABLE 3-1) can be used to list the commands available to a particular program.

3.3 TYPING COMMANDS

- a. Type enough characters to uniquely identify the command, then type a /. The Teletype will type the remainder of the command and conclude it with the /.

- b. If the command requires a parameter(s), enter it after the / (before the ←).
- c. To activate a command, type a ← .
- d. Upon completion of a command the program will respond by typing OK or MONITOR or FORMAT ERROR, etc.

NOTE

Special commands such as ? and CTRL I are typed as individual characters. CTRL characters are typed by simultaneously pressing the CTRL key and the designated character key.

COMMANDS OF MOST PROGRAMS AND REFERENCE TO OTHERS

TABLE 3-1

NOTE

Each of the commands in the following tables is followed by a / ← . When parameters may be entered, lower case letters or other comments appear between the / and the ← . Brackets around a parameter indicate that it is not required.

COMMAND RESULTING ACTION

ABUT-LOWER, DELTA, UPPER

See TABLE 3-3.

ABUT - SIZE,PULLDOWN

See TABLES 3-5, 3-6 and 3-7.

ADVANCE/[n] ←

Advances the film n frames. Each frame advance is equal to the number of steps set with the PULLDOWN command. If omitted, n = 1.

NOTE

With 105mm film, the camera will advance n fiche.

ALWAYS FLASH

See TABLES 3-4 and 3-9.

APERTURE (NUMBER,TYPE,SIZE)

See TABLE 3-8.

ASA CONTROLS

See TABLES 3-9 and 3-12.

ASSEMBLE FORM

See TABLE 3-12.

AXES - INTENSITY, SPOT

See TABLE 3-5.

BACK/[n]←

Backspaces the data tape to the start of the current file if no parameter is entered. If a number is entered, the tape will backspace that number of records. If you are already at the beginning of a file, the tape will backspace to the beginning of the previous file. If at loadpoint, it does nothing. When backspacing records, file marks stop the tape. Thus, BACK/9999 ← sends the tape to the end of the previous file.

TABLE 3-1

BLOCK ADVANCE

See TABLE 3-7.

BLOCK PAUSE

See TABLE 3-7.

BOTTOM

See TABLES 3-7 and 3-8.

BY COLUMNS

See TABLES 3-5 and 3-9.

BY ROWS

See TABLES 3-5 and 3-9.

CAMERA/n←

Selects a camera so that the program can limit the area of the light source which you can use in order to be compatible with the aperture of the camera being used. The program will also set the number of steps required to complete the CLEAR command. Select n as follows:

<i>Parameter</i>	<i>Camera</i>	<i>Addressable Points</i>
0	full screen	16,384 x 16,384
1	35mm unsprocketed	16,384 x 12,965
2	16mm unsprocketed	16,384 x 13,470
3	35mm sprocketed	12,510 x 16,384
4	16mm sprocketed	7,353 x 10,172
5	16mm unsprocketed strip fiche	16,364 x 9,016
11	hardcopy	16,384 x 11,652

NOTE

If you are using a camera for which no parameter exists, it will be necessary to use a program assembled for that particular camera.

CENTER

See TABLES 3-9 and 3-13.

CHARACTER SIZE

See TABLE 3-5.

CHARACTERS - SIZE,SPACE,FEED

See TABLES 3-9 and 3-13.

CLEAR/←

Advances the camera sufficiently to move all exposed film into the takeup magazine.

COMMANDS OF MOST PROGRAMS AND REFERENCE TO OTHERS

TABLE 3-1

COMMERCIAL See TABLES 3-9 and 3-13.

CONTINUE/[n] ←

Restarts the program at the location where it was last interrupted. The film is not advanced. n specifies the number of frames to be made. If n is omitted, the job will continue until normal completion.

COPY See TABLE 3-3.

CREATE SYSTEM

See TABLE 3-3.

CTRL A Interrupts the program after the next frame advance and returns control to MONITOR.

CTRL D (tape system)

Transfers control to PATCH MODE (see APPENDIX D - TAPE SYSTEM PATCH MODE).

(disk system)

Interrupts the program instantly and transfers control to DEBUG.

CTRL G See TABLE 3-9.

CTRL I Interrupts the program instantly and returns control to MONITOR.

CTRL X See TABLE 3-9.

CURRENT PAGE/n ←

Sets the starting page count number to n.

NOTE

If the CURRENT PAGE command is not available, its contents can be found and/or reset at PATCH+1 (using PATCH MODE) or at PICNUM (using DEBUG).

CUT MARK See TABLE 3-6.

DELTA/n ← Increases or decreases all characters n sizes. n may be positive or negative.

DUMP/program name ←

(tape system only)

Dumps a program onto the system tape. If the program name is identical to one already on the system tape, the new program will replace the old one (see NEW COPY?, TABLE 3-2). If the program name is new, the program will be dumped onto the end of the system tape.

TABLE 3-1

NOTE

For programs that do not have a DUMP command, you may read in the DUMPER paper tape, following the same procedure as that used for the MONITOR BOOTSTRAP paper tape (see par. 2.2). The Teletype will type DUMP/ and you may then complete the command as instructed above, except that you will not be able to replace an old program.

EDIT CODE See TABLES 3-9 and 3-12.

END JOB See TABLE 3-10.

EQUIVALENCE CODE

See TABLES 3-9 and 3-12.

ERROR FORM/ ←

Loads a form. This command is similar to FORM except that an ERROR FORM will only flash on a page where a TAPERROR response occurs and the operator types CONTINUE. This command is not valid unless a common form has been loaded first. See FORM.

EXAMINE See TABLE 3-9.

FIXED BLOCKING

See TABLE 3-9.

FOCUS/[m],[n] ←

Causes the focusing image to appear on the monitor screen and the light source. You may select an intensity (m) and spot size (n). The range for both is from 0 to 7. If omitted, m = 7 and n = 0.

In some programs the FOCUS command may be used to make notations on film. Follow these steps:

- a. Activate the FOCUS command.
- b. Type any character. This will stop the display of the focusing image and advance the film one frame. If this feature is not available in the program being used, the program will return control to MONITOR.
- c. At this point, characters typed on the Teletype will flash on both the monitor screen and the light source, exposing the film. A ← may be used to create additional lines.
- d. Type CTRL I. The program will advance the film one frame and return control to MONITOR.

FORM/←

(tape system)

Loads a form from the paper tape reader.

TABLE 3-1

(disk system)

Loads a form from the appropriate directory on the disk. Type the name of the form after the /.

(tape and disk systems)

Following the FORM command, the program will type the size of the remaining forms storage area.

The first form loaded becomes the common form; it contains the format parameters and will be recorded on every page. A null form, which contains no commands to expose film, may be used for the purpose of entering format parameters into a program.

If multiple forms are to be used, they will be identified by the program by the order in which they are loaded. The second form loaded becomes form number one; the third, number two; etc. (see APPENDIX A - CARRIAGE CONTROLS). A null form may be used where no form is desired.

If you are not using multiple forms, and two forms are loaded, the second will become part of the first (common form). This allows you to rejoin the parts of a form which was divided because it was too big for the FORMS ASSEMBLER. If there will be only one image per frame, a third part may be loaded as an OVERALL FORM.

FRAME/n ← Sets the starting frame count number to n.

GO/[m],[n],[o] ←

Advances the film one frame and starts the program. The program will record m frames or n files. When recording multiple files, it will advance o frames between files.

If no parameters are entered, the job will continue until normal completion. If m is specified, the program will record m frames or until normal completion, whichever comes first. If n is specified, the program will record n files or to a DOUBLE END OF FILE, whichever comes first. If omitted, o = 1.

NOTE

Setting DATA switch 03 to the one position will cause the program to suppress all Teletype output except for responses which either indicate errors or halt the program. Responses which halt the program, such as END OF FILE and TAPERROR, will always be typed. Setting DATA switch 00 to the one position will cause the program to suppress error responses such as UNKNOWN CONTROL and BAD OPCODE.

Setting DATA switch 08 to the one position will cause the program to reset the FRAME and TIME commands to zero and an incrementing fiche number in a fiche TITLE to one.

Setting DATA switch 12 to the one position will cause the program to blank the monitor screen after the next character is typed.

HEAVY - INTENSITY, SPOT

See TABLE 3-5.

TABLE 3-1

HITS-CHAR,VEC,PTS,TITLE,CUT/[m],[n],[o],[p],[q]] ←

Sets the program to hit characters, vectors, points, fiche titles, and fiche cut marks m,n,o,p, and q times, respectively. Omitted parameters remain unchanged.

HORIZONTAL TAB POSITIONS

See TABLES 3-9 and 3-12.

IBM BLOCKING

See TABLES 3-9 and 3-12.

IGNORE

See TABLE 3-7.

IGNORE - BEG,END,BLOCK

See TABLES 3-9 and 3-12.

IMAGES-FICHE

See TABLE 3-10.

INDEX

See TABLE 3-3.

INITIAL X,Y

See TABLES 3-7 and 3-8.

INTENSITY/[m],[n],[o],[p],[q],[r],[s],[t]]] ←

Sets up a conversion table for all intensities, whether specified by the program or the data. Intensities 0 through 7 will be converted to intensities m through t, respectively. Omitted parameters remain unchanged.

LEFT

See TABLES 3-7 and 3-8.

LIGHT - INTENSITY, SPOT

See TABLE 3-5.

LINE SIZE

See TABLES 3-9 and 3-13.

LOAD/[program name] ←

(tape system)

Loads a program from the system tape. You need only type enough characters to uniquely identify the program.

If the program name is omitted and the system tape is on unit # 1, the next program on the tape will be loaded. This makes it convenient to LOAD and DUMP a series of programs from one tape to another.

TABLE 3-1

(disk system)

Loads a program from the MON directory on the disk.

MAKE FILM/[n] ←

Sets the program to either the make film (n = 1) or the view only (n = 0) mode. The view only mode suppresses the film advance, eliminates some typeouts, and blanks the light source so that no film will be exposed. If n is omitted, the mode will be changed.

MARK

See TABLE 3-5.

MARK IS

See TABLES 3-9 and 3-12.

MEASURE PLOT

See TABLE 3-8.

NO CARRIAGE CONTROLS

See TABLES 3-9 and 3-12.

OFFSET- X,Y

See TABLE 3-4.

OTHER CONTROL CODES

See TABLES 3-9 and 3-12.

OVERALL FORM/ ←

Loads a form. This command is similar to FORM except that an OVERALL FORM will always flash once per frame, even when many images appear. This command is not valid unless a common form has been loaded first. See FORM.

PAGE SIZE

See TABLES 3-9 and 3-13.

PARITY/n←

Sets the program to read a data tape with either even (n = 0) or odd (n = 1) parity.

PAUSE

See TABLE 3-4.

PITCH-MARGIN

See TABLE 3-10.

PLOT BLOCK

See TABLE 3-7.

POSITION OF CONTROL

See TABLES 3-9 and 3-12.

PULLDOWN/n←

Sets the program to do n steps for each frame advance. For sprocketed cameras, n must be a multiple of four. Step sizes are given in APPENDIX G - CAMERAS AND FILM FORMATS.

TABLE 3-1

PUNCH	See TABLE 3-3.
REWIND/[n]←	Rewinds the magnetic tape on unit #n. If omitted, n is equal to the current parameter of the USE command.
ROTATED/[n] ←	Sets the program to record in either the upright (n = 0) or the rotated (n = 1) mode. In the rotated mode the image is rotated counterclockwise 90 degrees. If omitted, n = 0. Also see TABLE 3-13.
RUB OUT	Voids any command or typing error (if typed before the ←).
SAVE	See TABLE 3-12.
SCALE - C,F	See TABLE 3-7.
SCALE - G,F	See TABLE 3-8.
SCAN JOB,FRAME,COMMAND	See TABLE 3-4.
SCIENTIFIC	See TABLES 3-9 and 3-13.
SET SIZE	See TABLE 3-4.
SET SIZE,PULLDOWN	See TABLES 3-5 and 3-6.
SIZE OF TITLE	See TABLE 3-10.
SKIP/[n]←	Positions the data tape at the start of the next file if no parameter is entered. If a negative number is entered, the tape will skip that number of files. If a positive number is entered, the tape will skip that number of records. When skipping records, file marks stop the tape.
SPACING	See TABLES 3-9 and 3-13.
SPOT SIZE/[m][,][n][,][o][,][p][,][q][,][r][,][s][,][t]]]]]]] ←	Sets up a conversion table for all spot sizes, whether specified by the program or the data. Spot sizes 0 through 7 will be converted to spot sizes m through t, respectively. Omitted parameters remain unchanged.
STANDARD LABELS/ ←	Sets the program to process a data tape with standard IBM labels. Before data processing begins, the program will do the following:

TABLE 3-1

- a. Verify the standard volume label at the beginning of the reel (volume).
- b. Extract the following data from header label number two:
 - (1) Physical record format (FIXED, IBM, or VARIABLE BLOCKING)
 - (2) Physical record length
 - (3) Logical record length
 - (4) Carriage control set (ASA, 360, or NO CONTROLS)
- c. Skip one tape mark.

UNLABELLED negates this command.

STRIP FICHE See TABLES 3-9 and 3-13.

TAB UP See TABLE 3-9.

TAPE TYPE - 2,5,8 OR 9/n ←

Sets the program to read a data tape which is either 7- or 9-track and is either 200, 556, 800, or 1600 bpi. Select n as follows:

PARAMETER	BPI	TRACK
2	200	7
5	556	7
8	800	7
9	800 OR 1600	9

TIME/nnnn← Allows you to enter the starting time. Enter a four-digit number, the first two digits representing the hour, the last two representing the minutes. TIME is based on a 24-hour clock. For example, type 1320 for 1:20 p.m.

TITLE See TABLE 3-10.

TRY AGAIN/[n] ←

Makes repeated attempts to read after there has been an indicated TAPERROR. n specifies the number of attempts you wish to make. This number will be used as the new re-try count. If omitted, n remains unchanged.

UNLABELLED/ ←

Negates the STANDARD LABELS command.

USE/n← Sets the program to read data from unit n.

TABLE 3-1

NOTE

If the program was assembled with the multivolume feature, two data tapes may be mounted at the same time. Select units # 1 and #2. The program will read from # 1, then #2, then # 1, etc.

VARIABLE BLOCKING/ ←

See TABLES 3-9 and 3-13.

VECTORS - INTENSITY, SPOT

See TABLE 3-5.

VOLUME SEQUENCE/n ←

Sets the program to accept volume n as the next volume to be processed. Setting n to 0 terminates volume sequence checking. The STANDARD LABELS command must be in effect.

WHERE CHANNELS ARE

See TABLES 3-9 and 3-12.

X - NUMBER UP

See TABLE 3-5.

X -# ,STEP,LEFT

See TABLES 3-9 and 3-13.

Y - NUMBER UP

See TABLE 3-5.

Y -# ,STEP,TOP

See TABLES 3-9 and 3-13.

1401 CONTROLS

See TABLES 3-9 and 3-12.

360 CONTROLS

See TABLES 3-9 AND 3-12.

.TAPE CODES (BLOCK,PARAMETERS)

See TABLE 3-8.

...PARAMETER ENTRY

See TABLE 3-8.

COMMANDS OF MOST PROGRAMS AND REFERENCE TO OTHERS

TABLE 3-1

?	Lists all commands known to the program. After those commands for which it is appropriate, the current status will be typed following an =.
command=	Prints the status of a single command.
/notation←	Allows you to type a notation on the Teletype paper.

TABLE 3-2

NOTE

All MONITOR responses are preceded by an *.

<i>RESPONSE</i>	<i>MEANING</i>
AMBIGUOUS	You have not typed enough characters before the / to uniquely identify the command. Also see TABLE 3-12.
BAD FUNCTION FRAME	See TABLE 3-6.
BAD MODE FRAME	See TABLE 3-6.
BAD OPCODE	See TABLE 3-5.
CONFLICTS WITH	(tape system only) When executing a DUMP command, this response will be typed if the name which you have just entered contains the entire name of a program already on the system tape.
DEBUG	(disk system only) The computer is in DEBUG.
DEFINE PERMANENT PICTURE?	See TABLE 3-4.
DELETE PERMANENT PICTURE?	See TABLE 3-4.
DISK ERROR	(disk system only) A checksum error has been found on the disk.
DOUBLE END OF FILE	When processing multiple files, this response will be typed when the program encounters a DOUBLE END OF FILE mark on the data tape.
END JOB	An END JOB command was encountered on the data tape.
END OF FILE	An END OF FILE mark was encountered on the data tape.

RESPONSES OF MOST PROGRAMS AND REFERENCE TO OTHERS

TABLE 3-2

END OF FILE	n	When processing multiple files, this response will be typed when the program encounters an END OF FILE mark on the data tape. n is the number of files recorded. The REWIND command sets n to zero.
END OF JOB		When the STANDARD LABELS command is in effect, this response will be typed when the program encounters an END OF JOB label on the data tape. Processing will continue.
END OF VOLUME		When the STANDARD LABELS command is in effect, this response will be typed when the program encounters an END OF VOLUME label on the data tape. When the VOLUME SEQUENCE command is in effect, the volume number (n) will be typed. Processing will continue if a data tape containing the next volume is mounted on another tape unit. See the STANDARD LABELS command.
FILES DONE		When processing multiple files, this response will be typed when the program has recorded n files as specified with the GO command.
FORMAT ERROR		The parameter(s) entered after the / is not appropriate for the command.
FRAMES DONE		A GO or CONTINUE command (which had a parameter) has been completed.
IMPROPER		The form you have attempted to load was assembled with a FORMS ASSEMBLER which is not compatible with the program being used.
INDEX FULL		(tape system only) When executing a DUMP command, this response will be typed if there are too many characters in the index record. To alleviate this problem you must dump the program under a shorter name. It may be necessary to shorten the names of other programs on the system tape by loading and redumping them onto another tape.
LABEL FORMAT ERROR		When the STANDARD LABELS command is in effect, this response will be typed when the program encounters an unrecognizable label on the data tape.
LEVEL PAUSE		See TABLE 3-4.
LONG RECORD		A record was encountered on the data tape which does not fit into the buffer space allocated.
MONITOR		The program is in MONITOR.
MORE THAN ONE UP		See TABLE 3-5.
NEGATIVE X COORDINATE		See TABLE 3-7.

TABLE 3-2

NEW COPY?	(tape system only)
	When executing a DUMP command, this response will be typed when you are dumping a program whose name is identical to one already on the system tape. This is to insure that you wish to replace the old program. If you do, type YES ← . Typing anything else will void the entire command.
NO FILM LEFT	
	There is no film left in the camera. GO and CONTINUE will be void until the camera is reloaded.
NO FILM?	
	When executing a GO or CONTINUE command, this response may be typed when in the view only mode. If you do not wish to MAKE FILM, type ← . Typing anything else will void the entire command.
NO NAME	(tape system only)
	When executing a DUMP command, this response will be typed if a parameter (a program name) was not entered after the /.
NO RING	(tape system only)
	You have attempted to write onto a magnetic tape without having inserted a write enable ring in the groove. To return control to MONITOR, set the ADDRESS switches to 40↑ and press the START switch.
NO TAB	See TABLE 3-9.
NONPERMANENT PICTURE NEEDED	
	See TABLE 3-4.
NOT PUNCHED	See TABLE 3-9.
OK	The command has been completed.
OUTPUT ONLY	You have attempted to enter a parameter which is an output parameter only.
PAUSE	See TABLES 3-6, 3-7 and 3-9.
PERMANENT PICTURE NEEDED	
	See TABLE 3-4.
START JOB	A START JOB command was encountered on the data tape.
TAPERROR	Either the parity and/or density of the magnetic tape do not agree with the tape characteristics you have instructed the program to accept or the tape has unreadable data on it.
Teletype bell	
	See TABLE 3-12.

TABLE 3-2

time, frame, and page numbers (typed in numerical form)

This response occurs whenever the program is interrupted either by the operator or by a response such as END OF FILE or FRAMES DONE. Time is followed by the current frame number. The current frame number is followed by the current page number if they differ. For example: 9'32.3" FRAME 3 PAGE 584

TOO BIG The parameter you have attempted to enter requires an image size larger than the aperture of the camera.

Or, the form you have attempted to load will not fit into the buffer area.

TOO SMALL The parameter you have attempted to enter requires a character size smaller than size 0.

TOP OF SCREEN

See TABLE 3-7.

UNKNOWN You have typed a command, program name, form name, etc., that is unknown to the program.

UNKNOWN CONTROL

See TABLE 3-9.

VOID The last characters you typed have been voided.

VOLUME SEQUENCE ERROR n

When the VOLUME SEQUENCE command is in effect, this response will be typed when the program encounters an out-of-sequence volume (n).

Y LIMIT SWITCH

See TABLE 3-7.

10 FT. LEFT There is only 10 feet of film left in the supply magazine. CONTINUE will allow the program to continue without further notification until there is NO FILM LEFT.

TABLE 3-3

<i>COMMAND</i>	<i>RESULTING ACTION</i>
ABUT-LOWER, DELTA, UPPER/m,n,o ←	

NOTE

The abut test is used to determine the proper image size for abutted frames. Since the image size must be equal to the frame advance, the PULLDOWN command must be set before the test is recorded.

Records a series of sets of grid patterns. Each set consists of three patterns of the same size; the first pattern in each set contains its size and the PULLDOWN being used for the test. m and o specify the size of the patterns in the first and last sets, respectively. m must be less than o. n specifies the increment at which the patterns increase in size from one set to the next. All parameters are in scope points.

COPY/[date and/or title] ←

(tape system only)

Copies the system tape (select unit #1) onto another tape (select unit #3). You may enter a new date and/or title.

CREATE SYSTEM/[date and/or title] ←

(tape system only)

Creates a system tape out of the magnetic tape hanging on unit #3. You may enter a new date and/or title.

INDEX/ ←

(tape system only)

Lists an index of the programs on the system tape as follows:

7-TRACK or 9-TRACK (refers to transport on which tape is mounted)

DATE and/or TITLE

LIST OF PROGRAM NAMES (including buffer size in decimal words [in brackets] where appropriate)

END OF TAPE

PUNCH/[n] ←

(tape system only)

Punches either a MONITOR BOOTSTRAP (n = 1) or a DUMPER (n = 2) from the paper tape punch. If omitted, n = 1.

TABLE 3-4

NOTE

Both permanent and nonpermanent pictures may be defined and then executed whenever required. Permanent pictures remain defined until they are either deleted or redefined. Nonpermanent pictures remain defined only through the current job.

While picture definitions usually occur on the data tape, pictures may be defined on special tapes created with the FORMS ASSEMBLER (see the O command, TABLE 3-13). To run a job requiring one of these special tapes, mount the tape and type GO. The picture(s) will be loaded and you may then mount the data tape and start the job.

When using the FORMS ASSEMBLER, nonpermanent pictures are defined and executed with the N command as described in TABLE 3-13. Permanent pictures are defined or redefined with the !N command and executed with the !' command.

Additional information pertaining to the use of pictures is given in the explanations of many of the commands below.

COMMAND **RESULTING ACTION**

ALWAYS FLASH/n ←

Causes the permanent picture n to be recorded on every page. While only one picture may be selected, it may call others.

OFFSET- X,Y/[m],[n] ←

Moves the image in the X (m) and/or Y (n) axes. m and n, which may be positive or negative, are in scope points. An OFFSET command encountered on the data tape will override this command. Omitted parameters remain unchanged.

PAUSE/n ←

Sets the pause level to be used in conjunction with those of any pause commands encountered on the data tape. If the pause levels encountered are higher than that set with this command, the program will stop. If lower or equal, the program will continue. The range is from 0 to 14 (default is 14).

SCAN JOB,FRAME,COMMAND/[m],[n],[o] ←

Moves the data tape forward m START JOB commands, n FRAME ADVANCE commands, and/or o CHECK POINT DELIMITER commands. Omitted parameters equal 0. If no parameters are entered the data tape will move forward to the first valid CHECK POINT DELIMITER command.

SET SIZE/n ←

Sets the image size. n is the number of scope points to be used to represent 16,384 scope points.

RESPONSE **MEANING**

DEFINE PERMANENT PICTURE n?

The permanent picture definition n was encountered. This response is to insure that you wish to

TABLE 3-4

define or redefine the picture. If you do, type ←; if you do not, type any other character. The program will respond by typing either YES or NO.

DELETE PERMANENT PICTURE n?

The instruction to delete permanent picture n was encountered. This response is to insure that you wish to delete the picture. If you do, type ←; if you do not, type any other character. The program will respond by typing either YES or NO.

LEVEL n* PAUSE

A pause command was encountered on the data tape which has a higher level (n) than that set with the PAUSE command.

NONPERMANENT PICTURE n NEEDED

The nonpermanent picture n, which was not defined, was called for. If the picture is required, it will have to be loaded and the job restarted. If the picture is not required, type CONTINUE and the program will continue recording without the picture.

PERMANENT PICTURE n NEEDED

The permanent picture n, which was not defined, was called for. If the picture is required, it will have to be loaded and the job restarted. If the picture is not required, type CONTINUE and the program will continue recording without the picture.

TABLE 3-5

<i>COMMAND</i>	<i>RESULTING ACTION</i>												
ABUT - SIZE,PULLDOWN/[m],[n] ←	Sets the image size (m) and the PULLDOWN (n) for the 4020 expand mode. m is determined with the abut test as described in TABLE 3-3. An omitted parameter remains unchanged.												
AXES - INTENSITY, SPOT/[m],[n] ←	Sets the intensity (m) and the spot size (n) for 4020 axes. An omitted parameter remains unchanged.												
BY COLUMNS/ ←	Sets the program to step vertically down a column of images before stepping across to the next column when there are multiple images in each frame.												
BY ROWS/ ←	Sets the program to step horizontally across a row of images before stepping down to the next row when there are multiple images in each frame.												
CHARACTER SIZE=	Prints the character size being used to simulate CHARACTRON characters. This is an OUTPUT ONLY command.												
HEAVY - INTENSITY, SPOT/[m],[n] ←	Sets the intensity (m) and the spot size (n) for heavy characters. An omitted parameter remains unchanged.												
LIGHT - INTENSITY, SPOT/[m],[n] ←	Sets the intensity (m) and the spot size (n) for light characters. An omitted parameter remains unchanged.												
MARK/n ←	Selects the mark(s) to be exposed on the film. Select n as follows:												
	<table border="0" style="margin-left: 40px;"> <thead> <tr> <th style="text-align: left;"><i>Parameter</i></th> <th style="text-align: left;"><i>Mark(s)</i></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>none</td> </tr> <tr> <td>1</td> <td>cut</td> </tr> <tr> <td>2</td> <td>image count</td> </tr> <tr> <td>3</td> <td>cut and image count</td> </tr> <tr> <td>4</td> <td>Stromberg retrieval</td> </tr> </tbody> </table>	<i>Parameter</i>	<i>Mark(s)</i>	0	none	1	cut	2	image count	3	cut and image count	4	Stromberg retrieval
<i>Parameter</i>	<i>Mark(s)</i>												
0	none												
1	cut												
2	image count												
3	cut and image count												
4	Stromberg retrieval												

TABLE 3-5

5

cut and Stromberg retrieval

SET SIZE,PULLDOWN/[m],[n]/ ←

Sets the image size (m) and the PULLDOWN (n). m is the number of FR 80 scope points to be used to represent 1,024 4020 raster units. An omitted parameter remains unchanged.

VECTORS - INTENSITY, SPOT/[m],[n] ←

Sets the intensity (m) and the spot size (n) for 4020 vectors. An omitted parameter remains unchanged.

X - NUMBER UP/n ←

Sets the program to record n images per frame in the X axis.

Y - NUMBER UP/n ←

Sets the program to record n images per frame in the Y axis.

RESPONSE *MEANING*

n BAD OPCODE

An opcode (n, in decimal) was encountered on the data tape which is not a legal 4020 opcode.

MORE THAN ONE UP

You have attempted to change SET SIZE with more than one image per frame. When there is more than one image per frame in the X and/or Y axes, the image size is calculated by the program.

ADDITIONAL COMMANDS AND RESPONSES FOR THE META INTERPRETER

TABLE 3-6

<i>COMMAND</i>	<i>RESULTING ACTION</i>
ABUT - SIZE,PULLDOWN/[m],[n] ←	Sets the image size (m) and the PULLDOWN (n) for the META expand mode. m is determined with the abut test as described in TABLE 3-3. An omitted parameter remains unchanged.
CUT MARK/n ←	Sets the program to record either with (n = 1) or without (n = 0) a cut mark.
SET SIZE,PULLDOWN/[m],[n] ←	Sets the image size (m) and the PULLDOWN (n). m is the number of FR 80 scope points to be used to represent 4,096 4060 raster units. An omitted parameter remains unchanged.
<i>RESPONSE</i>	<i>MEANING</i>
m BAD FUNCTION FRAME n	A byte (m, in decimal) was encountered on the data tape which is not a legal IGS function code. n is the number of the frame in which it occurred.
m BAD MODE FRAME n	A bad mode set (m, in decimal) was encountered on the data tape. n is the number of the frame in which it occurred.
PAUSE	A PAUSE command was encountered on the data tape.

TABLE 3-7

<i>COMMAND</i>	<i>RESULTING ACTION</i>
ABUT - SIZE,PULLDOWN/[m],[n] ←	Sets the image size (m) and the PULLDOWN (n) for abutted frames. m is determined with the abut test as described in TABLE 3-3. An omitted parameter remains unchanged.
BLOCK ADVANCE/ ←	Sets the program to advance the film each time a block address is encountered. Positioning parameters will be reinitialized and recording will continue.
BLOCK PAUSE/ ←	Causes the program to halt each time a block address is encountered. The block address and the PAUSE response will be typed. To continue recording, type either an A or a space. A will cause the film to advance and the positioning parameters to be reinitialized; space will not.
BOTTOM/n ←	Moves the plot in the Y axis. n, which may be positive or negative, is in scope points.
IGNORE/ ←	Negates the BLOCK ADVANCE and BLOCK PAUSE commands.
INITIAL X,Y/[m],[n] ←	Selects starting coordinates for the lower left corner of the frame. m and n, which must be positive, are in CalComp units. An omitted parameter remains unchanged.
LEFT/n ←	Moves the plot in the X axis. n, which may be positive or negative, is in scope points.
PLOT BLOCK/[m],[n] ←	Sets the program to plot blocks m to, but not including, n. If n is omitted, plotting will continue from m to the END OF FILE. Omitting both parameters negates this command.
SCALE - C,F/m,n ←	Sets the image size by scaling CalComp half increments (m) to FR 80 scope points (n). Input data is multiplied by the ratio m/n.
<i>RESPONSE</i>	<i>MEANING</i>
NEGATIVE X COORDINATE	The X coordinate has gone off the screen in the negative direction.
TOP OF SCREEN	The Y coordinate has gone off the screen in the positive direction.

TABLE 3-7

Y LIMIT SWITCH

The Y coordinate has gone off the screen in the negative direction.

n PAUSE

See the BLOCK PAUSE command.

TABLE 3-8

<i>COMMAND</i>	<i>RESULTING ACTION</i>
<p>APERTURE (NUMBER,TYPE,SIZE)/[m[,n,o[,p]]] ←</p>	<p>Specifies the aperture number, type, and size. m is the aperture number; the range is from 1 to 24. (Specifications for aperture numbers for which no entries are made will remain at default.) n is a character which specifies the aperture type as follows:</p> <p>C = filled round</p> <p>D = doughnut</p> <p>S = filled square</p> <p>+ = cross</p> <p>o specifies the aperture size in Gerber units (inches times 10,000). For the four aperture types, o has the following meanings:</p> <p>C = diameter</p> <p>D = outside diameter</p> <p>S = length of a side</p> <p>+ = height (or width)</p> <p>Used only with aperture D, p specifies the inside diameter.</p> <p>If no parameters are entered, the specifications for the entire aperture set will be typed. If only the aperture number (m) is entered, the specifications for that aperture alone will be typed.</p>
<p>BOTTOM/n ←</p>	<p>Moves the plot in the Y axis. n, which may be positive or negative, is in scope points.</p>
<p>INITIAL X,Y/m,n ←</p>	<p>Selects starting coordinates for the frame. m and n, which may be positive or negative, are in Gerber units.</p>
<p>LEFT/n ←</p>	<p>Moves the plot in the X axis. n, which may be positive or negative, is in scope points.</p>
<p>MEASURE PLOT/[n] ←</p>	<p>Causes the program to scale and center the plot as follows:</p> <ol style="list-style-type: none"> a. All plot data is read, but not recorded. b. The coordinate extremes are typed if DATA switch 01 is set to the one position. Coordinates are in Gerber units (inches times 10,000). c. The scaling and centering commands are set up; the commands will be typed if DATA switch 01 is set to the one position.

TABLE 3-8

To record the plot after "measuring", reposition the data tape, type MAKE FILM, and then type GO.

n is the size, in scope points, of the square in which the plot will be centered. If omitted, n = 12000.

SCALE - G,F/m,n ←

Sets the image size by scaling the size of the Gerber plot (m) to FR 80 scope points (n). m is the size of the plot in inches times 10,000. Input data is multiplied by the ratio m/n.

.TAPE CODES (BLOCK,PARAMETERS)/m,n ←

Specifies the octal tape codes for two delimiters used in the Gerber language. m is the delimiter to indicate parameter entry; n is the code for the data block delimiter.

...PARAMETER ENTRY/[/]string ←

Specifies Gerber plotting parameters usually specified to the Gerber device. string is a character string of legal Gerber commands. // clears the parameter table.

Example: *FSLIX24Y24\$*

- * - delimiter, indicating beginning of parameter entry
- FS - indicates that a format statement follows
- L - indicates that leading zeros are suppressed from coordinates
- I - indicates incremental (relative) format
- X24 - indicates that there are six digits associated with an X coordinate with two digits before and four digits after the implied decimal point
- Y24 - indicates the format for a Y coordinate
- \$ - delimiter, indicating end of preceding string of parameters
- * - delimiter, indicating end of parameter entry

ADDITIONAL COMMANDS AND RESPONSES FOR THE PRINT PROGRAM

TABLE 3-9

NOTE

Commands which are not available to a particular program (see par. 3.2) may be entered through the FORMS ASSEMBLER. See the NOTE in TABLE 3-12.

<i>COMMAND</i>	<i>RESULTING ACTION</i>
ALWAYS FLASH/ ←	Simulates the always flash feature of the 4440. The form will flash with each page advance.
ASA CONTROLS/[list] ←	Sets the program to interpret ASA carriage controls. Additional controls may be entered as in the OTHER CONTROL CODES command.
BY COLUMNS/ ←	Sets the program to step vertically down a column of pages before stepping across to the next column when there are multiple images in each frame.
BY ROWS/ ←	Sets the program to step horizontally across a row of pages before stepping down to the next row when there are multiple images in each frame.
CENTER/ ←	Causes the image to be recentered using all of the current parameters.
CHARACTERS - SIZE,SPACE,FEED/[m],[n],[o] ←	<p>Specifies the character size (m), space (n), and line feed (o) values. Character sizes range from 0 to 63; space and line feed values are in scope points. Omitted parameters remain unchanged.</p> <p>If a FORM is loaded, n and o, which will be set to the values of the S command in the form, may not be reset.</p>
COMMERCIAL/ ←	Selects the commercial character set for BCD programs.
CTRL G	Advances the film one frame and starts the program. This command is similar to GO except that it is not valid unless entered while in the EXAMINE mode. The next line of data will become the top line on the first page.
CTRL X	Interrupts the program and causes it to enter EXAMINE mode or vice versa.
EDIT CODE/XXXX ←	Simulates the edit feature of the 4400 and 4440. XXXX are four characters which must be X's or digits.
EQUIVALENCE CODE/list ←	Changes the conversion table for character codes. Enter numbers as pairs, preceding each pair

TABLE 3-9

with a /. Each pair consists of the octal code for the character on the data tape, a comma, and the Information International octal code for the character you wish to convert it to.

EXAMINE/ ← Blanks the light source and displays the form (if any) on the monitor screen along with the first line of data. Typing any character will cause the next line of data to be displayed. CTRL I returns control to MONITOR. Also see CTRL G and CTRL X.

FIXED BLOCKING/[n] ←

Sets the program to read blocks of fixed size from the data tape. If this command is not entered, the program will determine the size of the first block of data and use that number as the FIXED BLOCKING size. If the data tape has blocks of variable size, you may enter the size of the largest block. This will enable the program to use a multiple buffer (if n is less than half the buffer size), which generally provides greater speed than is available with the VARIABLE BLOCKING command.

HORIZONTAL TAB POSITIONS/list ←

Simulates the horizontal tab feature of the 4360, 4400, and 4440. Enter numbers as pairs, preceding each pair with a /. Each pair consists of the tab number, a comma, and the tab position.

IBM BLOCKING/ ←

Sets the program to process a data tape with the standard IBM variable blocked format. (The first four bytes of each block give the size of the block; the first four bytes of each record give the size of the record.) The LINE SIZE command will be ignored.

IGNORE - BEG,END,BLOCK[m],[n],[o] ←

Causes the program not to print any number of characters at the beginning (m) or end (n) of each line of data, or at the beginning of each block of data (o) on the data tape. Omitted parameters remain unchanged.

LINE SIZE/n ←

Specifies the maximum number of characters per line of data, including the carriage control and record mark.

MARK IS/n ← Specifies the record mark character in octal.

NO CARRIAGE CONTROLS/ ←

Causes the program to interpret all characters as data.

OTHER CONTROL CODES/[/]list ←

Sets the program to interpret control codes other than ASA, 1401, or 360. Enter numbers as pairs, preceding each pair with a /. Each pair consists of the Information International octal code for the carriage control character, a comma, and the Information International carriage control code for the corresponding function (see APPENDIX A - CARRIAGE CONTROLS). // clears the existing table; codes following a / will be added to the existing table.

TABLE 3-9

PAGE SIZE/n ←

Specifies the maximum number of lines per page.

POSITION OF CONTROL/n ←

Specifies the carriage control's position within a line. This equals zero when the NO CARRIAGE CONTROLS command is in effect.

SCIENTIFIC/ ←

Selects the scientific character set for BCD programs.

SPACING/n ←

Causes the program to single-space (n = 1), double-space (n = 2), or triple-space (n = 3) lines of print.

STRIP FICHE/n ←

Sets the program to produce groups of images on roll film suitable for cutting and creating microfiche. n is the number of scope points corresponding to one pulldown on the camera.

NOTE

When using this command, select either BY COLUMNS (and ROTATED=1) or BY ROWS and use the X - #,STEP,LEFT and Y - #,STEP,TOP commands as described in their explanations. Use the PULLDOWN command to set the distance between the groups of images.

TAB UP/ ←

Simulates the tab up feature of the 4360, 4400, and 4440 LPS mode. Page advances will be suppressed on all channel skips except channel one. A skip to channel one will cause a page advance if the tab position is not higher than the current position.

VARIABLE BLOCKING/ ←

Sets the program to read blocks of variable size from the data tape. Reading will be single-buffered.

WHERE CHANNELS ARE/[/]list ←

Sets up a table of line numbers for each of the 12 channels referenced by carriage controls. Enter numbers as groups, preceding each group with a /. Each group consists of a channel number followed by the line positions for that channel; numbers are separated by commas. A total of 16 line positions may be entered. // clears the existing table; a channel number followed by no line positions clears the entries for that channel alone.

X -# ,STEP,LEFT/[m],[n],[o] ←

Specifies (horizontally) the number of images per frame (m), the distance between images (n), and the location of the left edge of the frame (o). n and o are in scope points. Omitted parameters remain unchanged.

TABLE 3-9

NOTE

When creating horizontal (BY ROWS) STRIP FICHE, use the parameters as follows:

- # Specifies the number of images in a group. Each group will become a row on the fiche.
- STEP Specifies the distance between images in a group.
- LEFT Specifies the location of the left edge of the first image in a group. This parameter is normally 0.

Y -# ,STEP, TOP/[m],[n],[o] ←

Specifies (vertically) the number of images per frame (m), the distance between images (n), and the location of the top of the frame (o). n and o are in scope points. Omitted parameters remain unchanged.

NOTE

When creating vertical (BY COLUMNS and ROTATED=1) STRIP FICHE, use the parameters as follows:

- # Specifies the number of images in a group. Each group will become a column on the fiche.
- STEP Specifies the distance between images in a group.
- TOP Specifies the location of the top of the first image in a group. This parameter is normally 16383.

1401 CONTROLS/[list] ←

Sets the program to interpret 1401 carriage controls. Additional controls may be entered as in the OTHER CONTROL CODES command.

360 CONTROLS/ ←

Sets the program to interpret Information International carriage controls as specified in APPENDIX A - CARRIAGE CONTROLS.

RESPONSE **MEANING**

IMPROPER FICHE PARAMETERS

When creating STRIP FICHE, this response will be typed if the parameters of the STRIP FICHE and STEP commands total more than 16,384 scope points.

n NO TAB A tab number (n) for which there is no corresponding tab position was encountered on the data tape.

ADDITIONAL COMMANDS AND RESPONSES FOR THE PRINT PROGRAM

TABLE 3-9

n* NOT PUNCHED

A channel skip carriage control (n) for which there is no corresponding line number was encountered on the data tape.

PAUSE

A pause command was encountered on the data tape.

n* UNKNOWNCONTROL

A carriage control character (n) unknown to the program was encountered on the data tape.

NOTE

If the character is not in the Teletype character set, the Teletype will print the octal representation of the tape code for the character. The first eight different unknown controls encountered will only be typed once. Additional unknown controls will be typed each time they are encountered. An UNKNOWN CONTROL is interpreted as a "space one before printing".

3.4 SPECIAL INSTRUCTIONS FOR CREATING MICROFICHE

The microfiche camera is a multiformat microimage recorder which operates with moving film and a fixed lens. Figure 3-1 shows typical formatting. Note that the film is stepped across its width row by row from A1 to A6. After recording has been completed in the last row (A6), the film returns to the first row while simultaneously advancing one column. This brings the film to position B1.

The stepper motor system controls the distance between the center lines of the columns. The servomotor and control disk control the distance between the center lines of the rows. The number of columns and rows is set with the IMAGES-FICHE command.

The column pitch is the distance between the columns; the margin setting is the distance between fiche. Both parameters are set in one-quarter millimeters with the PITCH-MARGIN command. The formula for the margin setting is:

$$\text{left margin} + \text{right margin} + (\text{column pitch}/2)$$

The formula for the total length of a fiche is:

$$\begin{aligned} &(\text{columns per fiche} \times \text{column pitch}) \\ &+ \text{left margin} + \text{right margin} \end{aligned}$$

The desired image size is acquired in the normal manner, i.e., through the use of the operator commands available to the particular program being used.

When recording on 16mm film in linear mode, use the modified 16-1 control disk. The frame advance distance is set in one-quarter millimeters with the PULLDOWN command.

TABLE 3-11 shows operating parameters for standard microfiche formats. The format may be selected by the operator using the commands in TABLE 3-10.

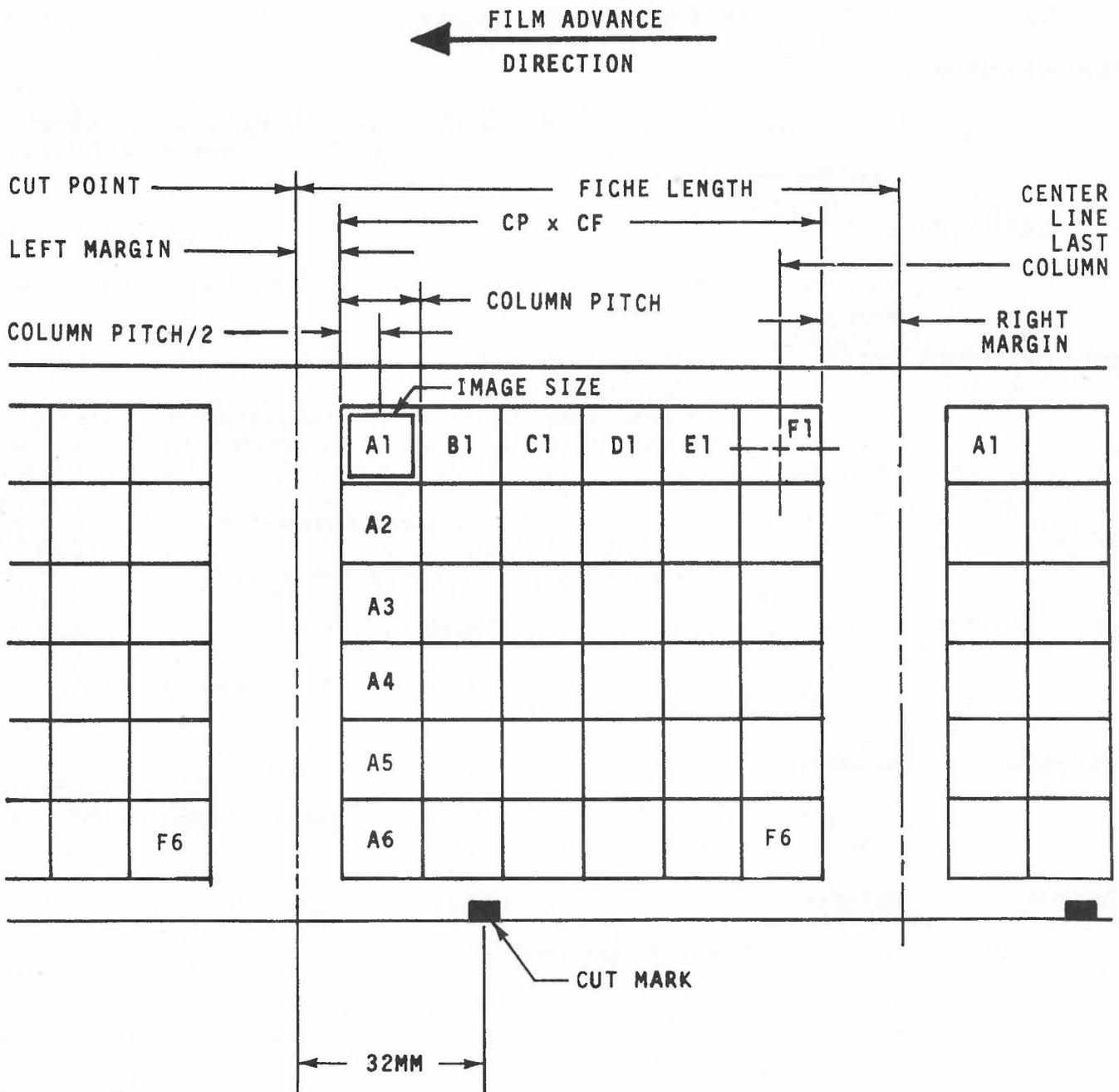


Figure 3-1. Microfiche Format.

TABLE 3-10

<i>COMMAND</i>	<i>RESULTING ACTION</i>
END JOB/←	Completes the titling of a partial fiche at the end of a job.
IMAGES-FICHE/m,n ←	Sets the program to produce a fiche with m columns and n rows (including titles). n must be equal to or less than the maximum number of rows which it is possible to record with the control disk being used.
PITCH-MARGIN/m,n ←	Sets the program to produce a fiche with a column pitch of m and a margin setting of n (see par. 3.4).
SIZE OF TITLE/m,n ←	Specifies the horizontal (m) and vertical (n) dimensions of an image area. These parameters are used by the program to calculate character size, spacing, and line feed values for titling. The formulas are: <div style="text-align: center;"> $m = \text{column pitch in mm} \times \text{scope points per mm}$ $n = \text{row advance in mm} \times \text{scope points per mm}$ </div>
NOTE	
Changing m and n will not affect a title which has already been entered into the program; the title must be reentered.	
TITLE/titling	information ← Specifies the format and content of fiche titles to be recorded on all subsequent fiche until another titling command is encountered. See par. 3.5.
<i>RESPONSE</i>	<i>MEANING</i>
TITLE ERROR	The format of the titling information is illegal.

TABLE 3-11. PARAMETERS FOR STANDARD MICROFICHE FORMATS.

NMA format	Model 8025 Microfiche Camera 24X and 42X Magnification				Model 8032 Microfiche Camera 48X and 42X Magnification			
	A1	A3	A4*	A5*	*	*	A4*	A5*
Reduction ratio	24X	24X	42X	42X	48X	48X	42X	42X
Page size (inches)	8.5x11	14x11	8.5x11	14x11	8.5x11	14x11	8.5x11	14x11
Control disk	105-8	105-8	105-14	105-14	105-16	105-16	105-14	105-14
Row advance (mm).....	12.5	12.5	7	7	6.25	6.25	7	7
IMAGES-FICHE (columns,rows)	14,8	9,8	25,14	16,14	28,16	18,16	25,14	16,14
PITCH-MARGIN (column pitch,margin setting).	40,53	62,66	22,54	35,51	20,43	31,51	22,54	35,51
SIZE OF TITLE (X,Y)	8200, 10250	12710, 10250	4510, 5740	7175, 5740	9100, 11375	14105, 11375	10010, 12740	15925, 12740
(triple-I 15 computer) CHARACTERS - SIZE,SPACE,FEED	17,86,143	17,86,143	8,49,81	8,49,81	19,96,160	19,96,160	23,110,183	23,110,183
(PDP-9/L & PDP-15 computers) CHARACTERS - SIZE,SPACE,FEED	15,86,143	15,86,143	7,49,81	7,49,81	17,96,160	17,96,160	20,110,183	20,110,183

*Not NMA Format and Coding Standard per NMA Appendix B MS2-1971.

3.5 FICHE TITLING FORMAT

A fiche title may occupy any number of rows across the top of a fiche. (In the example, two rows are used.)

An integral number of title character positions (horizontally and vertically) may be assigned to each fiche image area in the title rows. The character size used for the title is determined by the number of characters specified horizontally per image. (In the example, the words "FICHE TITLE" have four character positions horizontally and two line positions vertically.)

Up to 128 characters (not including spaces) may be displayed in the title. Up to 16 different messages may be put into the title area.

The input for the titling may be either the Teletype (see TITLE, TABLE 3-10) or records on the data tape. In either case, the format is the same. On a print tape, a comma in the carriage control position causes characters from the printing positions to be interpreted as titling information.

Titling information will be in the following format:

- a. The first character will be:

T Beginning of title. (This title will supersede the previous title.)

C Continuation of title information.

space (from tape only) Step to next fiche with same title. (All subsequent characters will be ignored.)

- b. The second character will be ignored unless the first character is a T, in which case it will be a digit telling how many rows will be used for the title.

- c. Subsequent characters are in a free format, specifying titling parameters for the following titling message. Blanks are ignored. Each parameter specification consists of a letter followed by one or two numbers (separated by commas). The letter designates which parameter(s) will be set and the number the value to be assigned. A \$ indicates that parameter assignments continue in the next record.

Parameter input will be terminated by a /, which initiates input of text for this title message.

- d. Parameters:

Cn Number of character positions into which an image area will be divided (horizontally).

Hm,n Horizontal position for the first character of a message.

m = column number

n = character position within column (left character = 1)

Ln Number of line positions into which an image area will be divided (vertically).

Vm,n Vertical position for the first character of a message.

m = row number

n = line position within row (top line = 1)

- e. Text for a message may be any character in the printing set of the particular program being used. The \$ is used as an escape code and the following character is a control code. Control characters are:

\$ Put \$ into title message.

L Line return; return to initial character position of this message one line position lower.

C Text continues in the next record beginning with the third character.

M End of message; parameter assignments for the next message follow.

T End of title.

- a digit The digit represents the number of characters to be used as a fiche number. The following n digits will be used as the initial fiche number (leading digits may be spaces). The fiche number will be incremented by one on each subsequent fiche.

Examples:

- a. The following example will produce the title shown in Figure 3-2:

T2C4H1,1L2V1,1/FICHE TITLE\$M\$C

C C6H1,1L2V2,1/OCTOBER 12, 1970\$M\$C

C C8H4,1L4V1,3/RECORDED\$L\$L ON THE\$C

C \$L\$L FR 80\$M\$C

C C4H5,2L2V1,1/NO. \$3 1\$T

- b. The following example will produce a title with two lines of n characters in the top row. There will be five character positions across each image area:

T1C5H1,1L2V1,1/(n characters)\$C

C \$L(n characters)\$T

C O L U M N

Fiche Tiling

1 2 3 4 5 6

1	FICHE	TITLE			NO.	1
2	OCTOBER 12, 1970		RECORDED	ON THE	FR 80	
3						
4						
5						
6						
7						

R O 3

Figure 3-2. Sample Fiche Tiling.

TABLE 3-12

<i>COMMAND</i>	<i>RESULTING ACTION</i>
ASSEMBLE FORM/name ←	<p>(disk system only)</p> <p>Instructs the program to assemble the symbolic form whose name you type after the /.</p>
EQUIVALENCE CODE	<p>See description in TABLE 3-9.</p>
SAVE/ ←	<p>(tape system)</p> <p>Instructs the program to punch the binary form in core from the paper tape punch.</p> <p>(disk system)</p> <p>Instructs the program to store the binary form in core on the disk under the name which you type after the /.</p> <p>(tape and disk systems)</p> <p>Following the SAVE command, the program will type the size of the form.</p>

NOTE

The following commands establish parameters to be used by the PRINT program in conjunction with a form. They are described in TABLE 3-9. Additional commands, whose parameters may be entered directly into the form as form design syntax, are listed in TABLE 3-13.

ASA CONTROLS

EDIT CODE

HORIZONTAL TAB POSITIONS

IBM BLOCKING

IGNORE - BEG,END,BLOCK

MARK IS

NO CARRIAGE CONTROLS

OTHER CONTROL CODES

POSITION OF CONTROL

WHERE CHANNELS ARE

TABLE 3-12

1401 CONTROLS

360 CONTROLS

RESPONSE *MEANING*

AMBIGUOUS (disk system only)

Following a SAVE command, this response will be typed if the name you type after the / already exists on the disk. The form will not be saved.

Teletype bell

The program has encountered illegal syntax. The page and line number on which it occurred will be typed by the Teletype.

TABLE 3-13

NOTE

The parameters preceding the following commands are to be interpreted as follows:

h - number of horizontal units

i - number of horizontal user units

j - number of vertical user units

m,n - numbers

v - number of vertical units

x - number of FR 80 scope points in the X (horizontal) axis

y - number of FR 80 scope points in the Y (vertical) axis

Many of the parameters are enclosed in brackets to indicate that they are not required. When a parameter is not specified it is assumed to be either one (for draw and/or move commands) or default (for most other commands). Exceptions will be noted.

The number in parentheses after a command character indicates the number (if any) of 18-bit words of storage required for the command. When the character N appears in parentheses, refer to the NOTE.

Four special commands may be used to calculate parameters. + (or space), -, *, and : may be used to add, subtract, multiply, and divide, respectively. Expressions are evaluated from left to right. Parentheses are illegal.

COMMAND**MEANING**

[i]A (1) Draw horizontal vector and change current position to end point.

[m][,n]B (N) Set intensity (m) and spot size (n) for all subsequent characters, vectors, and points until another B command is encountered. Both range from 0 to 7 (default is 7,0), unless the machine being used has the 64-level gray scale option. In this case, the parameter entered to represent one of the 64 intensities is found by translating the intensity (0 to 63) to octal, reversing the digits, and then translating it back to decimal. The following table may be used:

0=0	1=8	2=16	3=24	4=32	5=40	6=48	7=56
8=1	9=9	10=17	11=25	12=33	13=41	14=49	15=57
16=2	17=10	18=18	19=26	20=34	21=42	22=50	23=58
24=3	25=11	26=19	27=27	28=35	29=43	30=51	31=59

TABLE 3-13

32=4 33=12 34=20 35=28 36=36 37=44 38=52 39=60
 40=5 41=13 42=21 43=29 44=37 45=45 46=53 47=61
 48=6 49=14 50=22 51=30 52=38 53=46 54=54 55=62
 56=7 57=15 58=23 59=31 60=39 61=47 62=55 63=63

NOTE

Setting either m or n requires one word. Setting both requires two.

j[,j]C (1) Set character size (height) for unjustified text. Also restrict size of justified text.

NOTE

A single argument will be interpreted as a number of units. Two arguments will be interpreted as a fraction of units, the first number being the numerator, the second the denominator.

[m][,n]D (0) Set deltas (default is 1,1).

NOTE

This command sets the current user units by multiplying the basic horizontal unit by m and the basic vertical unit by n. The basic units may be defined with either the S and Z commands, for print, or the X and Y commands, for plot. The default basic units are 1,1 scope points.

i[,i]E (1) Set character spacing for unjustified text. See NOTE following C command.

j[,j]F (1) Set character line feed for unjustified text. See NOTE following C command.

[m][,n]G (1) Display page or frame number. Output is determined by the status of the CURRENT PAGE and FRAME commands. m is the number of digit positions being allowed. n is defined as follows:

<i>n</i>	<i>Meaning</i>
8	frame number; leading zeros blanked
12	frame number; leading zeros printed
16	page number; leading zeros blanked
20	page number; leading zeros printed

This command must be preceded by the C and E commands, used as they are for unjustified text. Default parameters are 4,16.

[i]H (1) Draw horizontal vector without changing current position.

TABLE 3-13

[i]I	(1)	Move in X axis without drawing.
[j]J	(1)	Move in Y axis without drawing.
i,jL	(2)	Draw vector without changing current position.
i,jM	(2)	Draw vector and change current position to end point.
[n]N	(N)	With new parameter, name picture definition that follows. With no parameter, end definition. With old parameter, execute picture definition. The execution of a picture definition leaves the current position unchanged.

NOTE

If the picture being defined is to be used in conjunction with the FR 80 DISPLAYER, see the NOTE in TABLE 3-4.

Naming a picture definition requires three words plus the word requirements of the commands within the definition. Recalling a definition requires two.

[n]O	(FR 80 version only)	
		Dump the binary form in core onto magnetic tape (select unit #1). The film will advance n pulldowns when the tape is read. If no parameter is specified, the film will advance one frame. See the NOTE in TABLE 3-4.
x,yP	(2)	Move to new (absolute) position.
[m],[n]Q	(1)	Plot a point. With no parameters, the intensity (m) and spot size (n) set with the B command will be used. If parameters are specified, they will affect the plotting of this point only.
[n]R	(N)	Repeat n times. With no parameter, end repeat.

NOTE

A repeat usually requires two words plus the word requirements of the commands within the repeat. The exception is a repeat larger than 511, which requires an additional word.

x,yS	(0)	(PRINT versions only)
		Define basic horizontal and vertical units. These units will be used by the PRINT program as spacing and line feed values.
T	(tape system only)	
		Read syntax from paper tape.
[j]U	(1)	Draw vertical vector and change current position to end point.
[j]V	(1)	Draw vertical vector without changing current position.

TABLE 3-13

nW	(0)	Establish border area around text within a box (default is 8).										
h,xX	(0)	(plot versions only) Scale horizontal units to scope points to define basic horizontal unit.										
v,yY	(0)	(plot versions only) Scale vertical units to scope points to define basic vertical unit.										
m,nZ	(0)	(PRINT versions only) Specify the smallest fractions (1/m and 1/n) of basic horizontal and vertical units to be used as user units.										
[j],[n]!A	(3)	Draw clockwise arc with center at current position and number of degrees specified by !L. j is the radius and n is the starting position in 1.5-degree increments clockwise from vertical (default is vertical).										
n!C	(0)	Set text mode: <table border="0" style="margin-left: 40px;"> <tr> <td><i>n</i></td> <td><i>Justification</i></td> </tr> <tr> <td>0</td> <td>unjustified</td> </tr> <tr> <td>1</td> <td>left-justified</td> </tr> <tr> <td>2</td> <td>centered</td> </tr> <tr> <td>3</td> <td>right-justified</td> </tr> </table>	<i>n</i>	<i>Justification</i>	0	unjustified	1	left-justified	2	centered	3	right-justified
<i>n</i>	<i>Justification</i>											
0	unjustified											
1	left-justified											
2	centered											
3	right-justified											
n!F	(1)	(FR 80 version only) Interpolate n lines between the next two vectors drawn. After completion, the current position will be restored to its location at the time the !F command was encountered.										
[m],[n]!G	(0)	Assign number of green (m) and blue (n) hits for subsequent data. This command must be followed by the H command										
[m],[n]!H	(2)	Assign number of clear (m) and red (n) hits for subsequent data.										

NOTE

With the H and G commands, zero may be used as a parameter to mean no hits. If all four parameters are set to zero, one hit of the clear filter (which is default) will occur.

n!L	(0)	Specify arc length; n is number of 1.5-degree segments to be drawn (default is 240 segments, a complete circle).
[n]!N	(N)	(FR 80 version only) See NOTE, TABLE 3-4.

TABLE 3-13

Text mode set left-justified, centered, or right-justified: The current position should be at the lower left corner of the imaginary box used to justify the text. The arguments describe the size of the "box". Current position will be unchanged.

NOTE

Text mode set unjustified: Entering character mode requires one word. Each pair of characters within requires an additional word. If the total number of characters in the text is odd, the odd character requires one word. A carriage return is equal to one character. The requirement for exiting character mode is equal to one character.

Text mode set left-justified, centered, or right-justified: Entering character mode requires two words. Each line within requires two additional words plus one word for each pair of characters. If the total number of characters in a line is odd, the odd character requires one word. A carriage return, to be added to the line it follows, is equal to one character. The requirement for exiting character mode is equal to one character.

The following commands establish parameters to be used by the PRINT program in conjunction with a form:

[x][,y]\B (0)	Set STEP size in X and Y axes.
j\C (0)	Set CHARACTER SIZE (height). See NOTE following C command.
n\D (0)	Set SPACING parameter.
n\F (0)	Select either COMMERCIAL (n = 0) or SCIENTIFIC (n = 1) character set for BCD programs.
[x][,y]\I (0)	Set LEFT in X axis and TOP in Y axis.
n\L (0)	Set LINE SIZE parameter.
[i][,j]\O (0)	Offset data i spaces and j line feeds from top left of form.
n\P (0)	Set PAGE SIZE parameter.
ij\S (0)	Indicate overall size of form to CENTER image.
[m][,n]\U (0)	Set # of images in X and Y axes.
1\V (0)	Specify VARIABLE BLOCKING.
x\Z (0)	Set STRIP FICHE parameter.
\← (0)	Specify ROTATED=1.

The following commands establish parameters to be used by the 4020 INTERPRETER and the META INTERPRETER in conjunction with a form:

[m][,n]\A (0)	Set ABUT - SIZE,PULLDOWN parameters.
[m][,n]\T (0)	Set SET SIZE,PULLDOWN parameters.

3.6

SPECIAL INSTRUCTIONS FOR THE FORMS ASSEMBLER

- a. Activating the GO command will do the following:
- (1) Cause the form in core (if one exists) to display on the monitor screen.
 - (2) Enable you to type form design syntax directly into the program. The syntax will be interpreted and displayed on the monitor screen.
- b. When typing syntax, use the following controls:
- (1) At the Operator Console:
 - (a) Set DATA switch 17 to the one position. This will cause the Teletype to print the syntax as you type it.
 - (b) Set DATA switch 15 to the one position. This will cause a slash mark to appear on the monitor screen to show current position.
 - (2) At the Teletype Console:
 - (a) Depress the ALT MODE key to enter or exit character mode.
 - (b) Depress the RUB OUT key to delete a character while in character mode.
- c. To film test frames of a form you are designing, perform the following operations at the Operator Console:
- (1) Set DATA switch 13 to the one position. This will stop the display on the monitor screen and allow you to unblank the light source.
 - (2) Toggle DATA switch 04 to flash the form once on the light source, exposing the film.
 - (3) Toggle DATA switch 03 to advance the film.
- d. (disk system only)

When creating a form by typing the syntax into the TEXT EDITOR, it is possible to display the form (usually incomplete) on the monitor screen. To do this, the appropriate FORMS ASSEMBLER (named A BINARY) must exist in the same directory as the symbolic form.

Under the foregoing conditions (and with the DATA switches set to 0), typing EG ← (see APPENDIX C - TEXT EDITOR) will cause the FORMS ASSEMBLER to interpret the text and display the form on the monitor screen. You may now type form design syntax directly into the program, film test frames, and/or SAVE the form. CTRL E will return control to the TEXT EDITOR, CTRL I to MONITOR.

CHAPTER 4

PREVENTIVE MAINTENANCE

CLEANING MATERIALS
TABLE 4-1

<i>Item</i>	<i>Detail</i>	<i>Suggested Vendor (Product Identification)</i>
alcohol	laboratory grade, denatured	Van Waters and Rogers (Red Ban)
camel hair brush	made for cleaning lenses	any photographic supply
cotton swab	on a wooden stick	any household supply
freon	in a pressurized can	Miller-Stephenson Chemical Co. (MS-180 "FREON" TF Degreaser)
glass cleaner	mild, household	any household supply
lens cleaner	made for cleaning lenses	any photographic supply (Kodak Lens Cleaner)
lens tissue	made for cleaning lenses	any photographic supply (Kodak Lens Cleaning Paper)
small brush	1" camel hair brush or soft paint brush	any photographic supply (Kodak Camel Hair Brush 1)
wiper	lint-free, sulphur-free, disposable	Kimberly-Clark (Product No. 3415)

16mm and 35mm Unsprocketed Cameras

4.1

CLEANING THE 16mm AND 35mm UNSPROCKETED CAMERAS AND THE LIGHT SOURCE

The camera and the light source should be cleaned after every 8 hours of operating time or after 1600 feet of film have been run, whichever comes first.

NOTE

High humidity may make it necessary to clean the camera more often.

- a. Place the camera in an area away from the FR 80. Clean the top of the camera and the inside of the camera housing with a small brush to remove any dust or film chips.
- b. Clean the base of the camera with a wiper moistened with alcohol.

CAUTION

To prevent scratching, remove all jewelry from your hands before cleaning any lens or the light source.

- c. Check the lens. Normally, it will not need cleaning. If it does, it should be brushed lightly with a camel hair brush. Do not use the brush used to clean out the camera. If a residue still remains, it can be removed with lens tissue moistened with alcohol.
- d. Clean the top of the hat on the light source with a wiper moistened with alcohol.
- e. Clean the light source with lens tissue moistened with alcohol.
- f. Install the camera.
- g. Clean the supply capstan by holding a wiper moistened with lens cleaner against it and moving the supply loop tension arm so that the capstan rotates.
- h. Clean the film index pressure roller by holding a wiper moistened with lens cleaner against it and pushing the FILM ADVANCE button so that the roller rotates.
- i. Clean the film index capstan as in the previous step.
- j. Clean all points of film contact not mentioned above except for those that are part of the pressure plate assembly. Use wipers moistened with lens cleaner.

CAUTION

When removing or replacing the pressure plate assembly, place a strip of film in the aperture to prevent scratching. Always lay the pressure plate assembly down on its backside.

- k. After loosening the two slotted thumbscrews, remove the pressure plate assembly and clean it with lens tissue moistened with lens cleaner. Also clean the area around the aperture, and, for the 35mm camera, the glass aperture plate. Replace the pressure plate assembly.
- l. Clean the magazines with a small brush and wipers moistened with lens cleaner as in steps a and j.

16mm and 35mm Sprocketed Cameras

4.2 CLEANING THE 16mm AND 35mm SPROCKETED CAMERAS AND THE LIGHT SOURCE

The camera and the light source should be cleaned after every 8 hours of operating time or after 1600 feet of film have been run, whichever comes first.

NOTE

High humidity may make it necessary to clean the camera more often.

- a. Place the camera in an area away from the FR 80. Clean the top of the camera and the inside of the camera housing with a small brush to remove any dust or film chips.
- b. Clean the base of the camera with a wiper moistened with alcohol.

CAUTION

To prevent scratching, remove all jewelry from your hands before cleaning any lens or the light source.

- c. Check the lens. Normally, it will not need cleaning. If it does, it should be brushed lightly with a camel hair brush. Do not use the brush used to clean out the camera. If a residue still remains, it can be removed with lens tissue moistened with alcohol.
- d. Clean the top of the hat on the light source with a wiper moistened with alcohol.
- e. Clean the light source with lens tissue moistened with alcohol.
- f. Install the camera.
- g. Clean all points of film contact except for those that are part of the movement. Use wipers moistened with lens cleaner.
- h. After loosening the two thumbscrews, remove the movement and clean all points of film contact. Open the film gate to clean the aperture area. Use wipers moistened with lens cleaner.
- i. Check the lens as in step c.
- j. Replace the movement as follows:
 - (1) Align the bar on the motor disk with the slot in the movement disk.
 - (2) Seat the movement by hand.
 - (3) Tighten the two thumbscrews.
- k. Clean the magazines with a small brush and wipers moistened with lens cleaner as in steps a and g.

105mm Camera

4.3

CLEANING THE 105mm CAMERA AND THE LIGHT SOURCE

The camera and the light source should be cleaned after every 8 hours of operating time or after 1600 feet of film have been run, whichever comes first.

NOTE

High humidity may make it necessary to clean the camera more often.

- a. Place the camera in an area away from the FR 80. Clean the top of the camera and the inside of the camera housing with a small brush to remove any dust or film chips.

NOTE

The rubber vacuum hose may be used to clean the camera. Be extremely careful that it does not come in contact with the lens.

- b. Clean the base of the camera with a wiper moistened with alcohol.

CAUTION

To prevent scratching, remove all jewelry from your hands before cleaning any lens or the light source.

- c. Check the lens. Normally, it will not need cleaning. If it does, it should be brushed lightly with a camel hair brush. Do not use the brush used to clean out the camera. If a residue still remains, it can be removed with lens tissue moistened with alcohol.
- d. Clean the top of the hat on the light source with a wiper moistened with alcohol.
- e. Clean the light source with lens tissue moistened with alcohol.
- f. Install the camera.
- g. Place both loop arms in the latched (vertical) position.
- h. Hold the left film guide assembly open and clean all points of film contact with wipers moistened with alcohol.
- i. Clean the right film guide assembly as in the previous step.
- j. Clean both loop arm rollers with wipers moistened with alcohol. Place them in the unlatched (horizontal) position.
- k. Place the carriage in the midposition. Open the aperture gate and remove the aperture plate.
- l. Clean the capstan, pinch, and film guide rollers. Use wipers moistened with alcohol.

NOTE

When cleaning the capstan rollers, press the FILM FEED switch to cause them to rotate.

- m. Clean the vacuum platen with a wiper moistened with alcohol.
- n. Check the lens as in step c.

105mm Camera

- o. Clean the aperture plate with lens tissue moistened with alcohol. Replace the aperture plate.
- p. Clean the magazines with a small brush and wipers moistened with alcohol as in steps a and h.

Hardcopy Camera

4.4

CLEANING THE HARDCOPY CAMERA AND THE LIGHT SOURCE

The camera and the light source should be cleaned after every 8 hours of operating time or after 700 feet of film have been run, whichever comes first.

- a. Place the camera in an area away from the FR 80. Clean the inside of the camera housing with a small brush to remove any dust or paper shavings.

NOTE

The rubber vacuum hose may be used to clean the camera. Be extremely careful that it does not come in contact with the lens.

- b. Clean the base of the camera with a wiper moistened with alcohol.

CAUTION

To prevent scratching, remove all jewelry from your hands before cleaning any lens or the light source.

- c. Check the lens. Normally, it will not need cleaning. If it does, it should be brushed lightly with a camel hair brush. Do not use the brush used to clean out the camera. If a residue still remains, it can be removed with lens tissue moistened with alcohol.
- d. Clean the top of the hat on the light source with a wiper moistened with alcohol.
- e. Clean the light source with lens tissue moistened with alcohol.
- f. Install the camera.
- g. Clean the vacuum platen, guide rails, and supply, takeup, and wrap rollers. Use wipers moistened with alcohol.
- h. Clean the capstan with wipers moistened with water.
- i. Check the lens as in step c.
- j. Clean the magazines with a small brush as in step a.
- k. Clean all points of film contact within the magazines. Use wipers moistened with alcohol.

PERTEC Transport

4.5 CLEANING THE PERTEC MAGNETIC TAPE TRANSPORT

The tape transport should be cleaned after every 8 hours of operating time.

CAUTION

The use of any solvent other than a laboratory grade alcohol may result in damage to the head lamination adhesive.

- a. Clean the heads and their associated tape guides with cotton swabs or folded wipers moistened with alcohol.
- b. Clean the perforated tape cleaner with a wiper moistened with alcohol.
- c. Clean the tension arm guides with a wiper moistened with alcohol.
- d. Clean the capstan with a wiper moistened with alcohol.

CDC Transport

4.6

CLEANING THE CDC MAGNETIC TAPE TRANSPORT

The tape transport should be cleaned after every 8 hours of operating time.

CAUTION

The tape cleaner blades are extremely sharp and brittle. Use care during cleaning.

- a. Clean the head assembly with a cotton swab or a folded wiper moistened with freon. Pay particular attention to the undersides of the read/write and erase heads and the area between the tape cleaner blades.
- b. Clean the glass panels of the loop boxes with wipers moistened with glass cleaner.
- c. Clean the interior surfaces of the loop boxes with wipers moistened with freon. Pay particular attention to the pneumatic ports and the screens at the bottom of each loop box.
- d. Clean all points of tape contact not mentioned above. Use wipers moistened with freon. These surfaces include the tape guides and rollers, the pad of the shield arm assembly, the capstans, the brake pad, and the load point/end of the tape sensor.

DEC Transport

4.7

CLEANING THE DEC MAGNETIC TAPE TRANSPORT

The tape transport should be cleaned after every 8 hours of operating time or whenever the gray pinchrollers start to become brown in color.

- a. Clean the heads with a cotton swab or a folded wiper moistened with alcohol.
- b. Clean the interior metal surfaces of the vacuum chambers and the inside surfaces of the glass covers with wipers moistened with alcohol.
- c. Clean the pinchrollers with cotton swabs or wipers moistened with alcohol.
- d. Clean the capstans with cotton swabs or wipers moistened with alcohol.
- e. Clean the tape cleaners and tape followers with cotton swabs moistened with alcohol.

Appendix A
CARRIAGE CONTROLS

TABLE A-1. ASA CARRIAGE CONTROLS.

InfoIntl char code (octal)	ASA carriage controls	Operation	InfoIntl control code (octal)
040	blank	Space 1 before printing	015
060	∅	Space 2 before printing	025
055	- (minus)	Space 3 before printing	035
053	+	Suppress space after printing	001
061	1	Skip to channel 1 before printing	215
062	2	Skip to channel 2 before printing	225
063	3	Skip to channel 3 before printing	235
064	4	Skip to channel 4 before printing	245
065	5	Skip to channel 5 before printing	255
066	6	Skip to channel 6 before printing	265
067	7	Skip to channel 7 before printing	275
070	8	Skip to channel 8 before printing	305
071	9	Skip to channel 9 before printing	315
101	A	Skip to channel 10 before printing	325
102	B	Skip to channel 11 before printing	335
103	C	Skip to channel 12 before printing	345

For the FR 80 the standard ASA control set is extended to handle the following:

044	\$	Clear film gate, don't print, and start new job with subsequent line. (Contents of the line will be typed, preceded by accounting information.)	377
052	*	Page synchronize	363
125	U	Page synchronize, and select form #1	012
126	V	Page synchronize, and select form #2	022
127	W	Page synchronize, and select form #3	032
130	X	Page synchronize, and select form #4	042
131	Y	Page synchronize, and select form #5	052
132	Z	Page synchronize, and select form #6	062
054	,	See Fiche Titling Format, par. 3.5.	353

TABLE A-2. 360 CARRIAGE CONTROLS.

360 carriage controls (octal)	Operation
1	Suppress space after printing
11	Space 1 after printing
21	Space 2 after printing
31	Space 3 after printing
211	Skip to channel 1 after printing
221	Skip to channel 2 after printing
231	Skip to channel 3 after printing
241	Skip to channel 4 after printing
251	Skip to channel 5 after printing
261	Skip to channel 6 after printing
271	Skip to channel 7 after printing
301	Skip to channel 8 after printing
311	Skip to channel 9 after printing
321	Skip to channel 10 after printing
331	Skip to channel 11 after printing
341	Skip to channel 12 after printing
13	Space 1 line without printing
23	Space 2 lines without printing
33	Space 3 lines without printing
213	Skip to channel 1 without printing
223	Skip to channel 2 without printing
233	Skip to channel 3 without printing
243	Skip to channel 4 without printing
253	Skip to channel 5 without printing
263	Skip to channel 6 without printing
273	Skip to channel 7 without printing
303	Skip to channel 8 without printing
313	Skip to channel 9 without printing
323	Skip to channel 10 without printing
333	Skip to channel 11 without printing
343	Skip to channel 12 without printing
3	NOP

NOTE: Since 360 controls are a subset of Information International carriage controls, no Information International control code equivalence is given.

TABLE A-3. 1401 CARRIAGE CONTROLS.

InfoInt1 char code (octal)	1401 carriage controls	Operation	InfoInt1 control code (octal)
061	1	Skip to channel 1 before printing	215
062	2	Skip to channel 2 before printing	225
063	3	Skip to channel 3 before printing	235
064	4	Skip to channel 4 before printing	245
065	5	Skip to channel 5 before printing	255
066	6	Skip to channel 6 before printing	265
067	7	Skip to channel 7 before printing	275
070	8	Skip to channel 8 before printing	305
071	9	Skip to channel 9 before printing	315
060	Ø	Skip to channel 10 before printing	325
043	#	Skip to channel 11 before printing	335
140	@	Skip to channel 12 before printing	345
101	A	Skip to channel 1 after printing	211
102	B	Skip to channel 2 after printing	221
103	C	Skip to channel 3 after printing	231
104	D	Skip to channel 4 after printing	241
105	E	Skip to channel 5 after printing	251
106	F	Skip to channel 6 after printing	261
107	G	Skip to channel 7 after printing	271
110	H	Skip to channel 8 after printing	301
111	I	Skip to channel 9 after printing	311
077	?	Skip to channel 10 after printing	321
056	.	Skip to channel 11 after printing	331
031	✕	Skip to channel 12 after printing	341
112	J	Space 1 before printing	015
113	K	Space 2 before printing	025
114	L	Space 3 before printing	035
057	/	Space 1 after printing	011
123	S	Space 2 after printing	021
124	T	Space 3 after printing	031

For the FR 80 the standard 1401 control set is extended to handle the following:

044	\$	Clear film gate, don't print, and start new job with subsequent line. (Contents of the line will be typed, preceded by accounting information.)	377
052	*	Page synchronize	363
125	U	Page synchronize, and select form #1	012
126	V	Page synchronize, and select form #2	022
127	W	Page synchronize, and select form #3	032
130	X	Page synchronize, and select form #4	042
131	Y	Page synchronize, and select form #5	052
132	Z	Page synchronize, and select form #6	062
054	,	See Fiche Titling Format, par. 3.5.	353

Carriage Controls

Bit definitions in Information International control code:

Bit Position in Code	0	0 means space count; 1 means channel #
	1	Count or channel # or form #
	2	
	3	
	4	
	5	0 means after, 1 means before
	6	0 means print, 1 means don't
	7	0 means select form, 1 means interpret bit 0

+400 Adding 400₈ to an Information International control code will cause a single space after the line in addition to performing the indicated action.

TABLE A-4. INFORMATION INTERNATIONAL CARRIAGE CONTROLS.

[Special FR 80 carriage control characters recognized]

InfoIntl control code (octal)	Operation
377	(Skip to channel 15 without printing) Clear film gate, don't print and start new job with subsequent line. (Contents of the line will be typed, preceded by accounting information.)
363	(Skip to channel 14 without printing) Page synchronize.
353	(Skip to channel 13 without printing) Fiche titling format (see par. 3.5)
012	Select form 1, 2, ..., 15 to be overlaid on subsequent data, and page synchronize.
022	
...	
...	
172	

NOTE: (Page synchronization normally applies only to applications where there is more than one page per frame.) Page synchronize means interpret all digits in the line as a position number; this number will be used to assign a position on the film frame to the page that follows. The line will not be printed. In addition:

1. If the number indicated is less than that of the current position, or if there is only one page per frame, the film will be advanced.
2. If there are no digits in the line, the next film frame position will be assigned.
3. A skip to channel 1 will be done.
4. If the next line requests a skip to channel 1, the second page advanced will be suppressed.

Appendix D
TAPE SYSTEM PATCH MODE

Typing CTRL D to a tape system program will cause control to be transferred from MONITOR to PATCH MODE. The program will type nnnn=PATCH, nnnn being the address of the starting location of the patch area. The contents of core may now be examined and/or changed (in octal), using the following commands:

n = signed octal integer
CA = currently addressed cell
CC = contents of CA

<u>Input</u>	<u>Action</u>
/	Types CC and enters Patch/examine mode.
n/	n→CA, types CC and enters Patch/examine mode.
n'	Starts program at location n (normally 40 ₈).
n!	Executes the instruction n; rings bell if instruction skips; exits Patch/examine mode.
n=	Types all locations containing n, starting at 40; any key stops search; exits Patch/examine mode.

The following commands are legal in Patch/examine mode only:

<u>Input</u>	<u>Action</u>
←	Exits Patch/examine mode.
n←	n→CC; exits Patch/examine mode.
↓	CA+1→CA; types CA/CC; remains in Patch/examine mode.
n↓	n→CC; CA+1→CA; types CA/CC; remains in Patch/examine mode.
↑	CA-1→CA; types CA/CC; remains in Patch/examine mode.
n↑	n→CC; CA-1→CA; types CA/CC; remains in Patch/examine mode.

- NOTES:
1. Any syntax error will cause the program to exit Patch/examine mode and type PATCH.
 2. PATCH+1 contains the CURRENT PAGE parameter where it is applicable but the MONITOR command does not exist.

Appendix F
CONTROL PANELS

LIGHT SENSOR CONTROL PANEL

The Light Sensor Control Panel (fig. F-1) is used in conjunction with the Light Source Control Panel (fig. F-2) when checking or adjusting the electrical focus of the light points displayed on the Recording CRT. Different intensity values are required for different types of film and exposures. Table F-1 explains the panel functions.

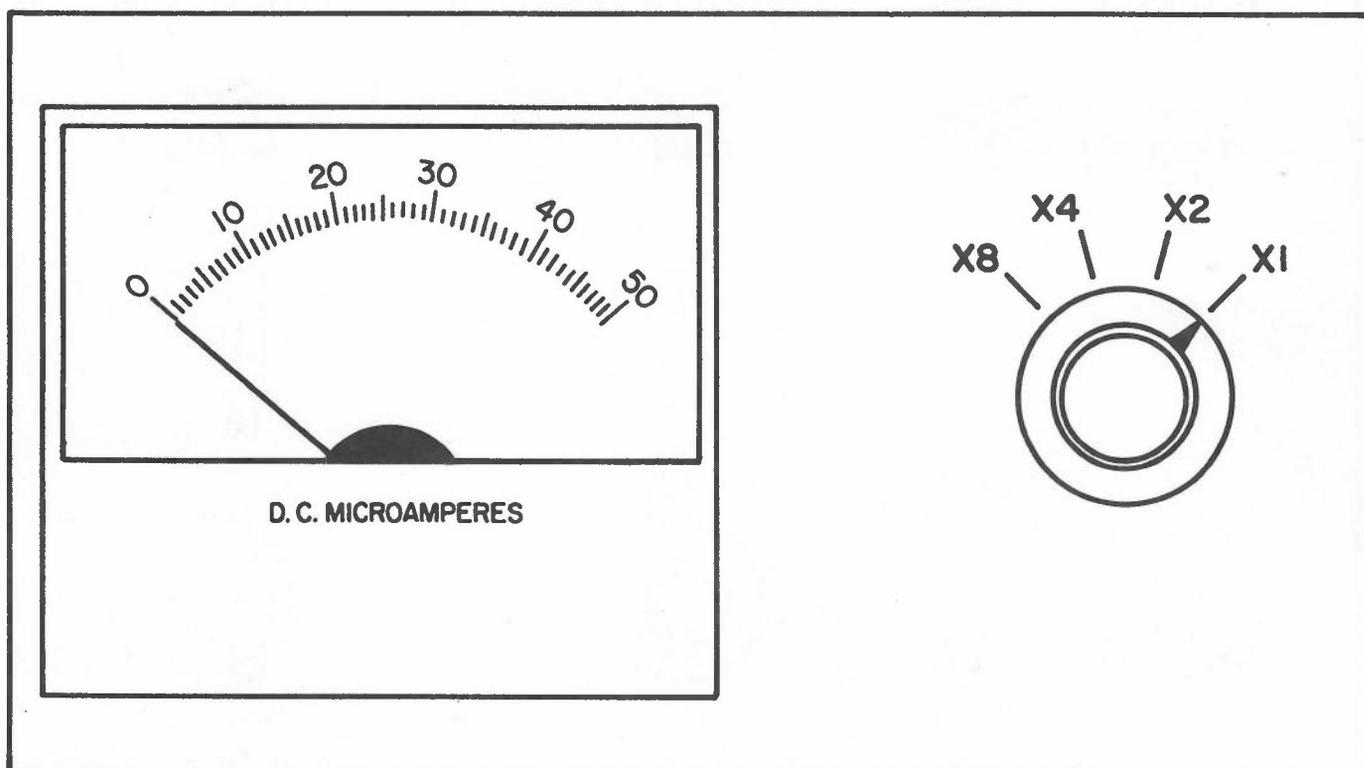


Figure F-1. Light Sensor Control Panel.

TABLE F-1. LIGHT SENSOR CONTROL PANEL.

Control	Function
INTENSITY meter	Number opposite needle is directly proportional to amount of light emitted by light source.
MULTIPLIER knob	X8, X4, X2, and X1 are multiplier settings. Product of knob setting and meter reading is intensity of light source light.

LIGHT SOURCE CONTROL PANEL

The Light Source Control Panel (Fig. F-2) is equipped with a power-on pushbutton switch, a manual film advance pushbutton, and five dial knobs that are used to regulate the size, shape, brightness, and contrast of the light source points displayed on the Recording CRT. Table F-2 explains the control functions.

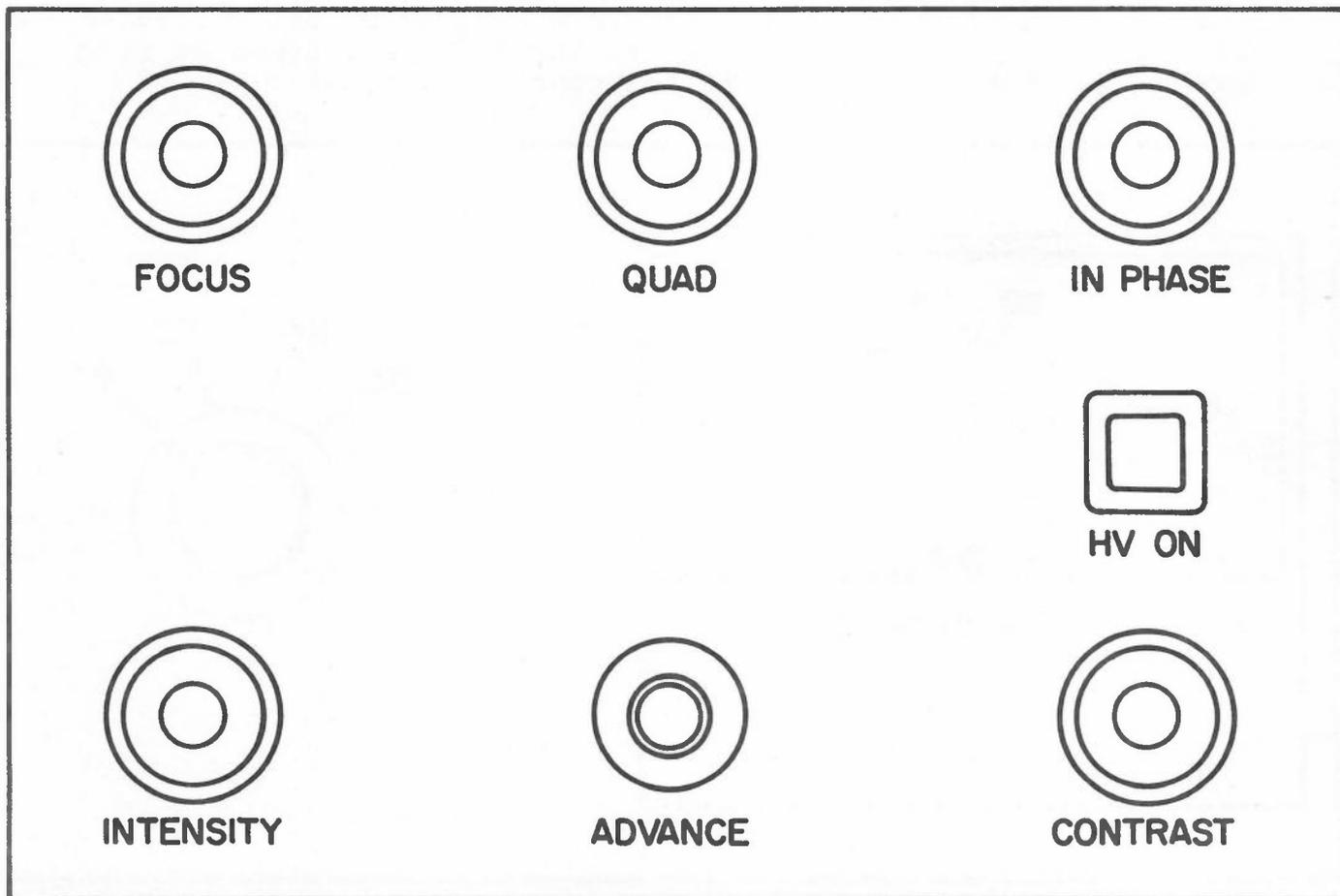


Figure F-2. Light Source Control Panel.

TABLE F-2. LIGHT SOURCE CONTROL PANEL.

Control	Function
FOCUS knob	Controls size of the light points displayed on Recording CRT.
QUAD and IN PHASE knobs	These knobs control the shape of the light points displayed on the Recording CRT. The knobs are adjusted so that the light points at the center of the CRT have a round shape. Vertical elongation of the light point, a form of astigmatism, can be controlled by the IN PHASE knob. Oblique elongation of the light point, another form of astigmatism, can be controlled by the QUAD knob.
HV ON switch/indicator	<p>When switch is depressed and its red light illuminates, ac power is being applied to the 25KV power supply for the Recording CRT, and this supply is otherwise being enabled by the power controller.</p> <p>When the light is off, ac power is not being applied to the 25KV power supply either because the switch has been depressed to its off position or because the power controller is not enabling the power supply because of an unsatisfactory condition.</p>
INTENSITY knob	Adjusts level of light source grid voltage, thus setting the basic intensity level of the points displayed on the Recording CRT. Clockwise rotation increases light source brightness. The programmable light source intensity levels are superimposed upon this basic intensity level.
FILM ADVANCE pushbutton	<p><u>For Model 8020 and 8021 cameras:</u> Each time this button is pushed, it will advance the film in the camera a distance equal to 2 times the specified film advance increment. For a listing of cameras and advance increment distances, please refer to Appendix G.</p> <p><u>For Model 8022, 8023, 8024, and 8026 cameras:</u> Same as above except that distance is 8 times the specified film advance increment.</p> <p><u>For Model 8025 (microfiche), Model 8027 (hardcopy), and Model 8028 (combination) cameras:</u> Pushbutton is inoperative. Operator controls the film advance distance by means of input commands typed on the Teletype keyboard.</p>
CONTRAST knob	Adjusts the contrast of the light points displayed on the Recording CRT.

OPERATOR CONSOLE, triple-I 15 COMPUTER

The operator console is equipped with toggle switches, lever switches, rotary switches, and indicator lights for operator control and monitoring of system operation. Typical console uses are:

1. Manual entry of instruction and/or data, and start/stop control of program execution.
2. Stepping through a program sequence by instruction or by machine cycle for debugging or maintenance purposes.
3. Visual examination of register contents and/or of system status.

Indicators on the panel show the existing binary states of specific register bits and control flip-flops by being lighted for binary 1's and being extinguished for binary 0's.

Table F-3 explains the functions of the console's switches and indicators with reference to the three categorical headings (INSTRUCTION, ADDRESS, DATA) under which they are physically grouped on the console panel.

INSTRUCTION

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
<input type="radio"/>																	

SINGLE			MODE			PI								
TIME	STEP	INST	CLOCK	EXTEND	BANK	REQ	ENA	RUN	DISC RUN	CLOCK	LINK			
<input type="radio"/>														
	LAMP TEST	IND INH	ADR STOP	REPEAT										
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	FAST	SLOW									
	<input type="radio"/>			<input type="radio"/>										

INFORMATION INTERNATIONAL

PRG	KEY	REG	ADDRESS														
00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
<input type="radio"/>																	
	<input type="radio"/>																

EXAMINE
DEPOSIT

START

RESET

STOP

CONTINUE

EXAMINE NEXT

DEPOSIT NEXT

PRG	KEY	REG	DATA														MEM	MA	MB	PC	AC	MQ	XR	LR	SC	IOB	IOA	DS	STA	TTI	RDR	X	Y
00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17																
<input type="radio"/>																																	
<input type="radio"/>																																	

READ IN

MT — PT — DISC

DATA SELECT

OFF — ON

Figure F-3. Operator Console.

TABLE F-3. OPERATOR CONSOLE.

Indicator	Function
00-17	The INSTRUCTION indicators 00-17 show the contents of the instruction register.
	<u>MAJOR STATES AND CONTROL FLIP-FLOP INDICATORS:</u>
PI	Program Interrupt
PI REQ	PI Request. Indicates that a program interrupt is pending service.
PI ENA	PI Enable. Indicates that the program interrupt system is enabled under program control.
RUN	Indicates that the program execution is in progress.
DISC RUN	Indicates that the disc (option) is active.
CLOCK	Indicates that the real-time clock facility is enabled.
LINK	Indicates the state of the link.
FETCH	Indicates that the processor is in the fetch state.
DEFER	Indicates that the processor is in the defer state.
XCT	Indicates that the processor is in the execute state.
BREAK	Indicates that the processor is in the break state.
INDEX	Indicates that the CPU is being operated in the index mode.
EXTEND	Indicates that the CPU is being operated in the extend mode.

TABLE F-3. OPERATOR CONSOLE--Continued.

Switch	Function
SINGLE TIME	Two-position toggle switch. In conjunction with the CONTINUE switch, it permits the manual stepping of the program through individual time states of each major state.
SINGLE STEP	Two-position toggle switch. In conjunction with the CONTINUE switch, it permits the manual stepping of the program through individual major states of each instruction.
SINGLE INST	Two-position toggle switch. In conjunction with the CONTINUE switch, it permits the manual stepping of the program one instruction at a time.
CLOCK MODE	Two-position toggle switch. Inhibits the real-time clock.
EXTEND MODE	Two-position toggle switch. When on, depressing START causes the system to start in extend mode.
BANK MODE	Two-position toggle switch. When on, depressing START causes the system to start in bank mode.
LAMP TEST	Two-position toggle switch. Tests the indicator lamps for major states and control flip-flops.
IND INH	Two-position toggle switch. Causes DSPREG and DSPADR commands to be inhibited (ignored).
ADR STOP	Three-position toggle switch. In the off (down) position, no address stop occurs. In the center position, <u>and if the DATA SELECT switch is in the MEM position, the program halts whenever the memory location determined by the setting of the ADDRESS switches is accessed for either read or write.</u> In the up position, a halt occurs under the same conditions if, and only if, the memory cell is accessed for write into memory. In either case, the DATA Group indicators are forced into the KEY state and the contents of the memory location are displayed if and when accessed.
REPEAT FAST	Two-position toggle switch. With this switch on, the processor will repeat the key function depressed by the operator at the full machine rate.
REPEAT SLOW	Two-position toggle switch. With this switch on, the processor will repeat the key function depressed by the operator at a 60-cycle rate.

TABLE F-3. OPERATOR CONSOLE--Continued.

Indicator	Function
00-17	ADDRESS indicators 00 through 17 comprise an 18-bit display which indicates the existing binary states of the program counter or the ADDRESS switches, or may be loaded under program control. The significance of these indicators as a function of other indicators and controls is described in the following entries.
PRG	Indicates that the ADDRESS indicators 00-17 are being loaded from the AC under program control by execution of a DSPADR (IOT 3702) command. See also IND INH switch (INSTRUCTION Group).
KEY	Indicates that the ADDRESS indicators 00-17 are being loaded from the ADDRESS switches by virtue of an EXAMINE or DEPOSIT key function.
REG	Indicates that the ADDRESS indicators 00-17 are being loaded from the program counter. The REG state is entered by changing the position of the DATA SELECT switch or by actuating the START, RESET, CONTINUE, or READ IN switch.

TABLE F-3. OPERATOR CONSOLE--Continued.

Switch	Function
01-17	Seventeen two-position toggle switches. Specifies the memory address when used in conjunction with the START, DEPOSIT, EXAMINE, and ADR STOP switches and the MEM position of the DATA SELECT switch.
START	Spring-loaded, three-position lever switch, locking in the up position and momentary in the down position. Initiates program execution by performing the instruction in the memory location specified by the setting of the ADDRESS switches.
RESET	Spring-loaded, momentary-contact lever switch. Clears major control flip-flops and flags. Pressing both the STOP and RESET switches provides a DC system reset that will perform the reset function in the event the system clock has stopped.
STOP	Spring-loaded, momentary-contact lever switch. Terminates program execution when the instruction in progress has been executed.
CONTINUE	Spring-loaded, three-position lever switch, locking in the up position and momentary in the down position: (1) Resumes program execution at the point that it was halted, determined by the contents of the program counter. (2) In conjunction with other control switches (SING TIME, SING STEP, SING INST) steps the program sequentially through the desired time states, major states, or instructions. Also may be used, while the CPU is running, to return to REG state from KEY state.
EXAMINE/ EXAMINE NEXT	Spring-loaded, three-position, momentary lever switch:
EXAMINE	Up position of switch. Places the contents of memory location specified by ADDRESS switches in the memory buffer and DATA indicators 00 through 17. EXAMINE may be performed while the CPU is running.
EXAMINE NEXT	Down position of switch. Places the contents of the memory location specified by the ADDRESS switches, plus the number of times the NEXT switch is depressed, into the memory buffer register and the DATA indicators 00-17. EXAMINE NEXT does not function if the CPU is running.
DEPOSIT/ DEPOSIT NEXT	Spring-loaded, three-position, momentary-contact lever switch:

TABLE F-3. OPERATOR CONSOLE--Continued.

Switch	Function
DEPOSIT	Up position of switch. Places the contents of the DATA switches into the memory location specified by the ADDRESS switches. DEPOSIT may be performed while the CPU is running.
DEPOSIT NEXT	Down position of switch. Places the contents of the DATA switches into the memory location specified by the ADDRESS switches plus the number of times the NEXT switch is depressed. DEPOSIT NEXT does not function if the CPU is running.

TABLE F-3. OPERATOR CONSOLE--Continued.

Indicator	Function
00-17	DATA indicators 00 through 17 comprise an 18-bit display which indicates the existing binary states of a selected register. The register to be displayed is selected primarily by the DATA SELECT switch, as used in conjunction with other console switches and certain program operations. The significance of these indicators as a function of other indicators and controls is described in the following entries.
PRG	Indicates that the DATA register display is being loaded from the AC under program control by execution of a DSPREG (IOT 3722) command. See also IND INH switch (INSTRUCTION Group).
KEY	Indicates that the DATA register is showing the contents of the memory location determined by the setting of the ADDRESS switches <u>and</u> that: <ul style="list-style-type: none"> 1. The DEPOSIT or EXAMINE switch has been actuated to read or write that data into that selected memory cell. <p style="text-align: center;">or</p> <ul style="list-style-type: none"> 2. The DATA SELECT switch is in the MEM position and the specified memory location has been accessed by the program in progress.
REG	Indicates that the DATA register is showing the contents of the register selected by the DATA SELECT switch. The REG display mode may be entered by changing the setting of the DATA SELECT switch or by actuation of the START, RESET, CONTINUE, or READ IN switches.
DATA SELECT INDICATORS (MEM, MA, MB,, Y)	The DATA SELECT indicators, MEM through Y, indicate the position of the 17-position DATA SELECT switch. As the switch is rotated clockwise (counterclockwise), the illuminated indicators will step progressively to the right (left). <p>In the KEY state, the DATA indicators 00-17 represent the contents of the memory location set into the ADDRESS switches, irrespective of the position of the DATA SELECT switch.</p> <p>Likewise, in the PRG state, the DATA indicators are loaded from the program, independent of the switch position.</p>

TABLE F-3. OPERATOR CONSOLE--Continued.

Indicator	Function
	In the REG state, the quantity displayed by the DATA indicators as a function of DATA SELECT position is as follows:
MEM	Not changed
MA	Memory address register
MB	Memory buffer
PC	Program counter
AC	Accumulator
MQ	Multiplier quotient register
XR	Index register
LR	Limit register
SC	Step counter
IOB	IO bus data lines
IOA	IO bus address lines
DS	Data switches
STA	IO status
TTI	Teletype input buffer
RDR	Paper tape reader buffer
X	Vector generator status
Y	Reserved for special options

TABLE F-3. OPERATOR CONSOLE--Continued.

Switch	Function
00-17	Eighteen two-position toggle switches. Provides binary data that can be read either into the accumulator by execution of an OAS instruction, or into memory under control of the DEPOSIT or DEPOSIT NEXT switches.
READ IN	Spring-loaded, momentary-contact lever switch. In conjunction with the READ IN MODE switch, initiates the hardware read-in process from magnetic tape, paper tape, or disc.
READ IN MODE	Three-position rotary switch. Selects hardware read-in mode as magnetic tape, paper tape, or disc:
MT	MT (magnetic tape) selects the magnetic tape mode of hardware read-in. When the READ IN switch is depressed, rewinds the tape and reads the first record of tape into memory at the address specified by the ADDRESS switches. The last word of this record is then executed.
PT	PT (paper tape) selects the paper tape mode of hardware read-in. When the READ IN switch is depressed, data are read into memory at the location specified by the ADDRESS switches, and the CPU starts executing the last word from the tape, which has a hole 7 punched.
DISC	Selects the disc mode of hardware read-in. When the READ IN switch is depressed, reads the last block (1777) of data on the disc into the first 400 ₈ memory locations and then executes cell 0.
DATA SELECT	Seventeen-position rotary switch for indicators MEM through Y. As switch is rotated clockwise (counterclockwise), the illuminated indicators will step progressively to the right (left).
POWER	Two-position rotary switch. Controls AC power to entire system.

OPERATOR CONSOLE, PDP-9/L COMPUTER

The Operator Console, Figure F-4, is equipped with rocker switches, rotary switches, and indicator lights for operator control and monitoring of system operation. Typical console uses are:

1. Manual entry of instruction and/or data, and start/stop control of program execution.
2. Stepping through a program sequence by instruction or by machine cycle for debugging or maintenance purposes.
3. Visual examination of register contents and/or of system status.

Table F-4 details the use of the items on the console. Indicators on the panel show the existing binary states of specific register bits and control flip-flops by being lighted for binary 1's and being extinguished for binary 0's.

The Operator Console can be electrically locked by a control on the Marginal Check Panel to prevent undesired alteration of the program in progress. While the console is locked, the operation of any switch (except the data switches) will not affect the system.

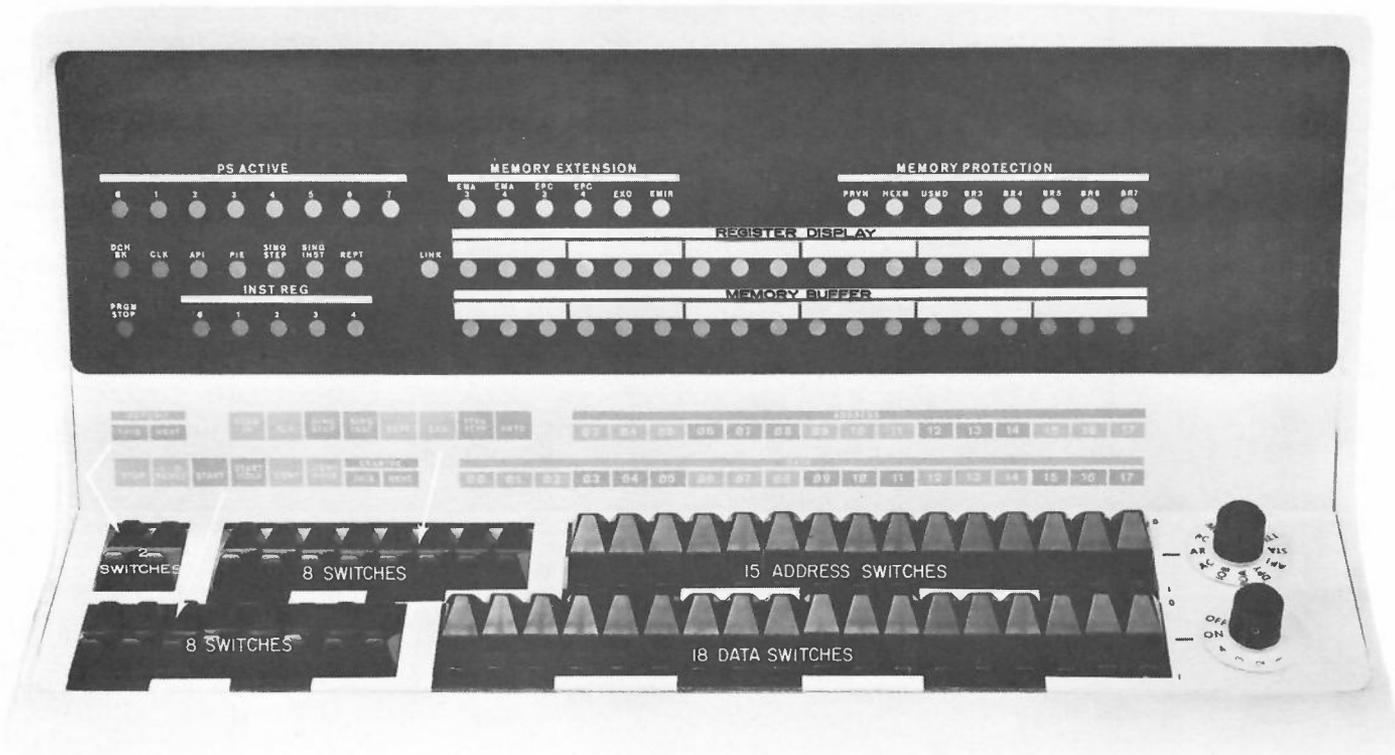


Figure F-4. Operator Console.

TABLE F-4. OPERATOR CONSOLE.

Switch and/or Indicator	Function
START and START HOLD switches	Depressing START begins program execution at location specified by ADDRESS switches. START HOLD is used for maintenance purposes.
IO RESET switch	Two positions: <u>off</u> and <u>operate</u> (down, spring-loaded return). Depressing switch generates CAF (clear all flags) instruction to clear all I/O device flags; clears the AC, MQ, and Link; turns off real-time clock, program interrupt facility, and API system; and disables memory protection and extended memory modes.
STOP switch	Two positions: <u>off</u> and <u>operate</u> (down, spring-loaded return). <u>Operate</u> halts program execution at completion of <u>current</u> instruction.
CONT and CONT HOLD switches	Depressing CONT resumes program execution from point at which it stopped. CONT HOLD facilitates use of REPT (repeat) function for single instruction and single step provisions.
EXAMINE THIS and EXAMINE NEXT switches	<p>Depressing either switch stops computer operation after current cycle. Depressing EXAMINE THIS transfers contents of memory location specified by ADDRESS switches from memory to the MB. After transfer, contents of ADDRESS switches appear in AR as address of memory location examined.</p> <p>Depressing EXAMINE NEXT increments contents of AR by one and transfers contents of newly addressed memory location from memory to MB. EXAMINE NEXT facilitates monitoring of sequential memory locations, as the ADDRESS switches need only be set to lowest memory location. Use of EXAMINE THIS transfers contents of this location to MB and enters lowest order address in AR. Thereafter, use of EXAMINE NEXT step-advances addresses through sequential memory locations.</p>
DEPOSIT THIS and DEPOSIT NEXT switches	Depressing either switch stops computer operation after current cycle. Depressing DEPOSIT THIS deposits its contents of DATA switches in memory location specified by ADDRESS switches. After transfer, contents of ADDRESS switches appear in AR as address of memory location in which data were entered.

TABLE F-4. OPERATOR CONSOLE--Continued.

Switch and/or Indicator	Function
DEPOSIT THIS and DEPOSIT NEXT switches (continued)	<p>Depressing DEPOSIT NEXT increments AR contents by one and deposits contents of DATA switches in memory location specified by new address. DEPOSIT NEXT facilitates entering of data and/or instruction words in sequential memory locations, as the ADDRESS switches need only be set to the lowest order address.</p> <p>The DEPOSIT THIS function deposits DATA switch word in this location and transfers address to AR. Thereafter, DEPOSIT NEXT function step-advances addresses through sequential memory locations.</p>
READ IN switch	<p>Two positions: <u>off</u> and <u>operate</u> (down, spring-loaded return). Depress switch to initiate read-in of paper tape punched in binary code (each set of three 6-bit lines read from tape forms one 18-bit computer word). Storage of words read in begins at memory location specified by ADDRESS switches. At completion of tape read-in, computer reads last word from core memory and executes it. Read-in occurs at selected repeat speed.</p>
REPT (repeat) control and System ON/OFF switch	<p>With REPT switch and CONT HOLD up, control establishes one of four speeds at which single-step or single-instruction operations repeat without operator intervention. Repeating speeds range from approximately 40 usec (position 1) to 8 sec (position 5).</p>
REGISTER DISPLAY control and display control and REGISTER DISPLAY indicators	<p>Eleven-position switch: Each position interrogates a specific register and displays its contents in REGISTER DISPLAY indicators, which display contents of selected register only when machine is stopped. Moving selection switch while program is running has no effect. Position functions are as follows:</p> <p>RDR Display contents of paper tape reader information buffer.</p> <p>TTI Display contents of teletype keyboard information buffer.</p>

TABLE F-4. OPERATOR CONSOLE--Continued.

Switch and/or Indicator	Function
REGISTER DISPLAY CONTROL and display control and REGISTER DISPLAY indicators (continued)	STAT Display status of flags for I/O devices connected to status reading facility of I/O system.
	API (Option not provided on FR 80.) Display activity of automatic priority interrupt system's four device-oriented priority levels.
	DPY (For DEC displays; not provided on FR-80.) Display 34 display X, Y buffers. The X buffer is displayed in nine most significant REGISTER indicators; the Y buffer is displayed in nine least significant indicators. The least significant bit of each buffer is not displayed.
	IOA Display 15-bit address word present on address lines of I/O bus for data channel and API operation.
	IOB Display 18-bit data word present on data lines of I/O bus for program controlled and data channel data transfers.
	AC Display contents of AC.
	AR Display contents of AR.
	PC Display contents of PC and status bits as stored during this instruction.
	MQ Display contents of MQ.
PRTC switch and indicator	(Option not provided on FR 80.) The <u>up</u> position causes memory protection mode to be entered by operation of START switch. In either position, mode may be enabled or disabled by program control. While console is locked, switch is electrically in <u>down</u> position, regardless of its actual position. The indicator is lit while mode is in effect. (Memory protection is a system option.)

TABLE F-4. OPERATOR CONSOLE--Continued.

Switch and/or Indicator	Function
EXD switch and indicator	(Not relevant to systems with 8K or less.) The <u>up</u> position causes extend mode of addressing to be entered by operation of START switch. In either position, mode may be enabled or disabled by program control. While console is locked, switch is electrically in <u>down</u> position, regardless of its actual position. The indicator remains lit while mode is in effect. (Extend mode is a system option.)
CLK switch and indicator	The <u>up</u> position disables real-time clock facility. The <u>down</u> position allows program control to enable or <u>disable</u> clock. The indicator remains lit while clock is enabled. While console is locked, switch is electrically in <u>down</u> position, regardless of its actual position.
SING STEP indicator and switch	Indicator lights when associated switch is <u>up</u> . This enables single-step mode, which halts program execution at each machine cycle. Repetitive depressing of the CONT HOLD switch, while mode is enabled, steps program through its sequence one instruction at a time. When console is locked, this switch is disabled.
SING INST indicator and switch	Indicator lights when associated switch is <u>up</u> . This enables single instruction mode, which halts program execution at completion of each instruction. Repetitive depressing of the CONT HOLD switch, while mode is enabled, steps program through its sequence one instruction at a time. When console is locked, this switch is disabled.
TTYH/TTYF switch	Determines whether teletype operation is half or full duplex. (All Information International programs assume full duplex setting.)
REPT indicator and switch	Indicator lights when associated switch is <u>up</u> . This enables repeat function. This function causes operations initiated by actuation of CONT HOLD, EXAMINE NEXT, or DEPOSIT NEXT switches to repeat while key remains in an operator position. The repeat speed control establishes rate of repetition.

TABLE F-4. OPERATOR CONSOLE--Continued.

Switch and/or Indicator	Position
ADDRESS switches (3-17)	Establish a 15-bit core memory address to be entered in PC by operation of START switch, or in AR by operation of EXAMINE THIS or DEPOSIT THIS switch. Switch is placed up for a 0 bit and <u>down</u> for a 1 bit. The 13 switches to the right (5-17) set up address of a location within an 8192-word memory block. The two switches to the left (3 and 4) are for extended memory addressing of locations, in up to three other 8192-word memory blocks of the system.
DATA switches	Establish an 18-bit data or instruction word to be read into memory by DEPOSIT THIS or DEPOSIT NEXT operation, or to be entered in AC by a programmed LAS (load DATA switches) instruction. <u>Up</u> position of switch is a binary 0; <u>down</u> position is a binary 1.
PRGM STOP indicator	Lights when RUN flip-flop has been cleared to stop program execution.
INST REG	The five indicators reveal contents of IR, being lit for 1 bits and extinguished for 0 bits, to show operation code of instruction just executed or in progress, and indirect address occurrence.
DCH BK	Lights to indicate that data channel activity is in progress; i.e., data are being transferred between core memory and a data channel I/O device via I/O bus.
PS ACTIVE indicators	(Option not provided on FR 80.) Each indicator, relating to one of the API system's eight priority levels, individually lights to show priority program interrupt request currently being serviced. Indicators 0, 1, 2, and 3 show activity resulting from device-initiated requests; indicators 4, 5, 6, and 7 show activity resulting from program-initiated requests. The priority levels for each set decrease in rank from left to right, with any device request having higher priority than any program request.
PIE indicator	Lights when PI system is enabled by program control.
API indicator	(Option not provided on FR 80.) Lights when PI system is enabled by program control.
LINK indicator	Shows content of Link register.
MEMORY BUFFER indicators	Shows contents of MB register.

OPERATOR CONSOLE, PDP-15 COMPUTER

The Operator Console, Figure F-5, contains the switches and indicators required for operator initiation, control, and monitoring of the system. Up to twenty-four 18-bit registers can be displayed to provide the operator with visual indication of all registers and buses. Console controls and indicators are respectively described in Tables F-5 and F-6.

Some of the features of the console are:

1. A READ-IN switch to initiate the reading of binary paper tapes.
2. REGISTER indicators and REGISTER DISPLAY switches for continuous monitoring of key points in the system such as the accumulator, index register, limit register, multiplier-quotient register, program counter, memory address, interrupt status, input/output bus, input output address, and I/O status.
3. DATA switches to establish an 18-bit data or instruction word to be read into memory by the DEPOSIT switch, to be entered into the accumulator by a program instruction, or to be executed as an instruction by pressing the EXECUTE key.
4. EXAMINE switch initiates the manual examination of the contents of any memory location specified by the ADDRESS switches.

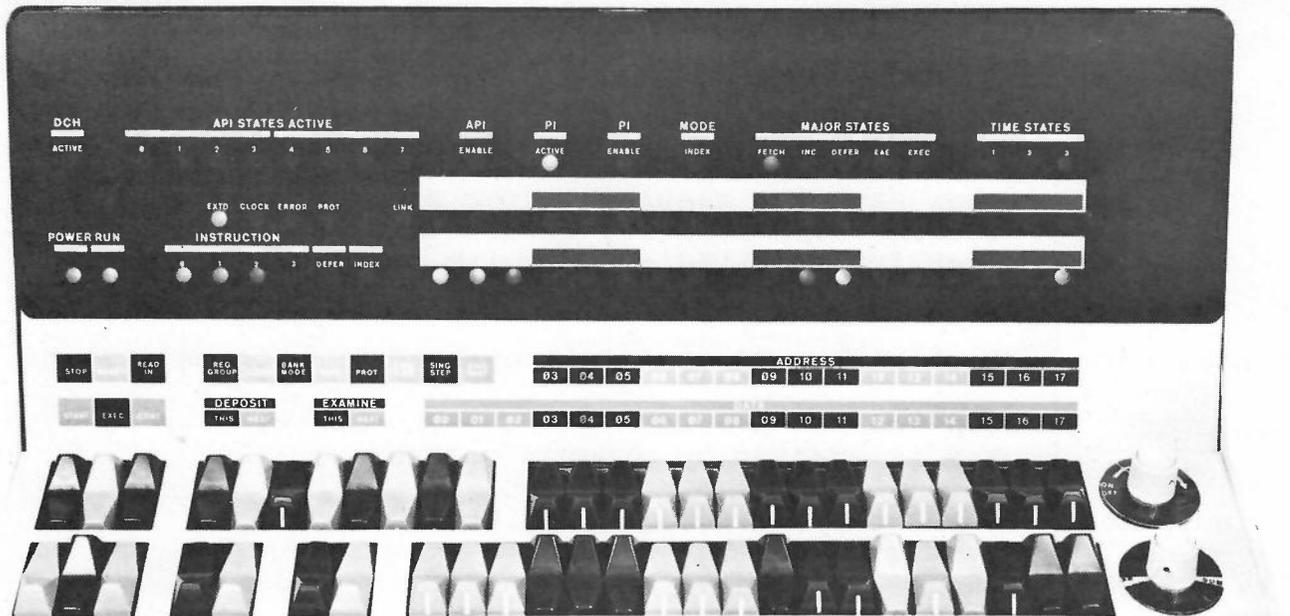


Figure F-5. Operator Console.

TABLE F-5. OPERATOR CONSOLE CONTROLS.

Control	Function
Repetition Speed/ System Power	Potentiometer/Switch: Controls the rate of repeat activity when the system is in repeat mode. The repeat rate is continuously variable from 1 Hz to 10 kHz. When rotated beyond detent at full counter-clockwise position, removes all power to system.
DATA	Eighteen two-position rocker switches: Word length (bits 00-17) register switches to provide binary data that can be read either into the accumulator by execution of an OAS (or the switch content with the accumulator content) instruction, or into memory under control of the DEPOSIT and EXEC switches.
ADDRESS	Fifteen two-position rocker switches: Specifies the effective memory location. These switches are used in conjunction with the START, DEPOSIT and EXAMINE switches.
START	Spring-loaded momentary-contact switch: Initiates program execution by performing the instruction in the memory location specified by the setting of the ADDRESS switches.
CONT	Spring-loaded momentary-contact switch: a) Resumes program execution at the point that it was halted, determined by the contents of the program counter (PC). b) In conjunction with other control switches (SING TIME, SING STEP, SING INST), steps the program sequentially through the desired time states (SING TIME) major states (SING STEP) or instruction (SING INST). (NOTE: Operation of the DEPOSIT THIS/NEXT and EXAMINE THIS/NEXT switches does not affect the AC, LINK, XR, LR and PC registers.)
DEPOSIT THIS	Spring-loaded, momentary-contact rocker switch: Places the contents of the DATA switches in the memory location designated by the ADDRESS switches.
DEPOSIT NEXT	Spring-loaded momentary-contact rocker switch: Places the contents of the DATA switches in succeeding memory locations; the location is specified by the ADDRESS switches plus the number of times the NEXT switch is depressed.
EXAMINE THIS	Spring-loaded momentary-contact rocker switch: Places the contents of memory location specified by the ADDRESS switches in the memory buffer (MB) register.

TABLE F-5. OPERATOR CONSOLE CONTROLS--Continued.

Control	Function
EXAMINE NEXT	Spring-loaded momentary-contact rocker switch: Places the contents of the memory location specified by the ADDRESS switches plus the number of times the NEXT switch is depressed into the memory buffer (MB) register.
STOP	Spring-loaded momentary-contact rocker switch: Terminates program execution when the instruction that is in progress has been executed. (NOTE: Operation of the STOP switch does not inhibit I/O data channel activity.)
EXEC	Spring-loaded momentary-contact rocker switch: Causes the instruction specified by the setting of the DATA switches to be executed. Program will stop following execution of the one instruction.
RESET	Spring-loaded momentary-contact rocker switch: Clears major registers (MB, AC, LINK, PC, IR, XR, LR) and control flip-flops (flags, option select). The clearing prevents any overlap of previous operations from interfering with new operations. Typically RESET is activated prior to reading in programs from paper tape. (NOTE: STOP is the only switch active while the machine is running. If, at any time, the machine must be reset while the RUN light is on, RESET and STOP switches should be depressed simultaneously.)
READIN	Spring-loaded momentary-contact rocker switch: Initiates the hardware read-in process when transferring information from paper tape into memory. The data is read into memory starting at the location specified by the ADDRESS switches.
REG GROUP	Two-position rocker switch: Determines which group of registers the Register Select switch can access for display in the REGISTER indicators. When the front of the REG GROUP switch is depressed, the contents of the register specified in the left-hand window of the Register Select switch are displayed in the REGISTER indicators. When the rear of the REG GROUP switch is depressed, the register, bus, or status information specified in the right-hand window of the Register Select switch are displayed on the REGISTER indicators; typically this second group is used for maintenance purposes.

TABLE F-5. OPERATOR CONSOLE CONTROLS--Continued.

Control	Function
Register Select AC PC OA MQ PL/SC XR LR DSR I/OB STA MO	<p>Twelve-position rotary switch: In conjunction with the REG GROUP switch, selects the register, bus, or status data and control signals to be displayed in the REGISTER indicators.</p> <p>With REG GROUP switch down (left-hand Register Select switch window determines REGISTER Display) the REGISTER indicators display the contents of:</p> <p>Accumulator register Program Counter register Operand Address register Multiplier Quotient register (EAE option) Priority Level/Step Counter Index Register Limit Register Data Storage Register Input/Output Bus Input/Output Status (indicates only when the processor is stopped) Memory Output register</p>
ABU BBU CBU SBU I/OA SUM M1	<p>With REG GROUP switch up (right-hand Register Select switch window determines REGISTER display) the REGISTER indicators display contents of:</p> <p>A bus B bus C bus Shift bus Input/Output address Sum bus Control Discretes Group 1 00 - Division shift to the D bus 01 - Multiply shift to the D bus 02 - Single left rotate (RAL) to the D bus 03 - Single right rotate (RAR) to the D bus 04 - Double left rotate (RTL) to the D bus 05 - Double right rotate (RTR) to the D bus 06 - No shift to the D bus 07 - Console switches to the D bus 08 - C bus to the A bus 09 - A bus to the C bus inverted 10 - Index register to the A bus 11 - Read-in 12 - Shift left 6 to the A bus 13 - I/O address to the A bus 14 - ADDRESS switches to the A bus 15 - Operand address register (OA) to the A bus 16 - Data in 17 - Data out</p>

TABLE F-5. OPERATOR CONSOLE CONTROLS--Continued.

Control	Function
Register Select Switch (continued)	With REG GROUP switch up (right-hand Register Select switch window determines REGISTER display) the REGISTER indicators display contents of:
M2	Control Discretes Group 2 00 - SKIP(1)H 01 - Memory Input register (MI) inverted to the B bus 02 - Limit Register (LR) to the C bus 03 - AND to the B bus 04 - Load the Accumulator (AC) 05 - Load the Memory Output register (MO) 06 - Load the Program Counter (PC) 07 - Load the Operand Address register (OA) 08 - Load the Limit Register (LR) 09 - Load the Index Register (XR) 10 - Buffered AC to the C bus 11 - Index Register (XR) to the B bus 12 - I/O bus to the C bus 13 - Exclusive OR to the C bus 14 - Central Processor Memory Request CP MEM REQ(1)H 15 - Start READ 16 - Start WRITE 17 - Request Central Processor Memory Release REQ CP MRLS(1)H
MMA MMB	Memory Address register Memory Buffer register
SING TIME	Two-position rocker switch: In conjunction with the Continue (CONT) switch, permits the manual stepping of the program through individual time states of each major state.
SING STEP	Two-position rocker switch: In conjunction with the Continue (CONT) switch, permits the manual stepping of the program through individual major states of each instruction.
SING INST	Two-position rocker switch: In conjunction with the Continue (CONT) switch, permits the manual stepping of the program through one instruction at a time.

TABLE F-5. OPERATOR CONSOLE CONTROLS--Continued.

Control	Function
REPT	<p>Two-position rocker switch: With this switch in the ON position, the processor will repeat the key function depressed by the operator at the rate specified by the repeat clock.</p> <p>START - program execution will restart at the repeat speed after the machine halts.</p> <p>EXECUTE - the instruction in the data switches will be executed at the repeat clock rate.</p> <p>CONTINUE - program execution will continue at the repeat speed after halting.</p> <p>DEPOSIT: - the Deposit This; Deposit Next or THIS, NEXT Examine This; Examine Next function EXAMINE: will be repeated. THIS, NEXT</p> <p>Depressing STOP or turning off the Repeat (REPT) switch will halt the repeat action.</p>
PROT	<p>(Option not provided on FR 80.) Two-position rocker switch: When set (back half of switch depressed) depressing START causes the system to start in protect (user) mode. When not set (front half depressed) the system will leave protect mode when START is depressed. This switch is active only when the KM15 protect option is installed.</p>
BANK MODE	<p>Two-position rocker switch: When set (back half of switch depressed) depressing START causes the System to start in bank mode permitting direct addressing of 8,192 (17777₈) words of core memory. When switch is not set (front half depressed) depressing START causes the System to start in page mode permitting direct addressing of 4,096 (7777₈) words of core memory.</p>
CLOCK	<p>Two-position rocker switch: Inhibits program control of the real-time clock. Program control of the real-time clock resumes when the CLOCK switch is OFF.</p>

TABLE F-6. OPERATOR CONSOLE INDICATORS.

Indicator	Function
POWER	Indicates that the power supply voltages are at operating levels.
RUN	Indicates that the program execution is in progress.
EXTD	Always on.
CLOCK	Indicates that the real-time clock facility is enabled.
ERROR	(Option not provided on FR 80.) Indicates that a memory parity error has been detected.
PROT	(Option not provided on FR 80.) Indicates that the memory protect mode is enabled.
DCH ACTIVE	Lights when the data channel is being serviced, i.e., data is being transferred between core memory and a device via the I/O bus.
API ENABLE	(Option not provided on FR 80.) Lights when the automatic priority interrupt system is in service.
API STATES ACTIVE	(Option not provided on FR 80.) Indicates API level(s) active.
0-3	Hardware levels.
4-7	Software levels.
MAJOR STATES	
FETCH	Indicates that the processor is in the fetch state.
INC	Indicates that the processor is in the increment state.
DEFER	Indicates that the processor is in the defer state.
EAE	Indicates that the processor is in the EAE (extended arithmetic element instruction) state.
EXC	Indicates that the processor is in the execute state.
TIME STATES	
1,2,3	Indicates the time states of the major states for each instruction step. When all time states are off machine is in time state 2A of the ADD instruction.

TABLE F-6. OPERATOR CONSOLE INDICATORS--Continued.

Indicator	Function
PI ACTIVE	Indicates that a program interrupt is pending service.
PI ENABLE	Indicates that the program interrupt system is enabled (under program control).
MODE INDEX	Indicates that the processor is operating in page mode and therefore indexing can be accomplished.
LINK	Displays state of the Link bit.
INSTRUCTION	Displays contents of the 6-bit program word instruction field.
0-3	Displays the instruction operation code.
DEFER	Indicates that the operand is indirectly addressed.
INDEX	Indicates that the operand address is indexed when in page mode or that the upper 4K (of an 8K bank) is addressed when in bank mode.
MEMORY BUFFER	Displays the contents of the currently accessed memory address.
00-17	
REGISTER	In conjunction with the setting of the REG GROUP and Register Select switches, displays:
00-17	<ul style="list-style-type: none"> a. data in a register. b. data on a bus. c. control signal levels.

Appendix G
CAMERAS AND FILM FORMATS

Please turn page



CAMERAS AND FILM FORMATS

Operator-Interchangeable Cameras:	Model 8020 35mm sprocketed Movie/Repro Master	Model 8021 16mm sprocketed Movie	Model 8022 16mm unsprocketed Retrieval	Model 8023 35mm unsprocketed Aperture Card	Model 8024 16mm unsprocketed Strip Fiche	Model 8025 105mm unsprocketed Microfiche	Model 8026 ^a 35mm unsprocketed High-Resolution Aperture Card	Model 8027 216mm (8½") unsprocketed Hardcopy	
Film Type	35mm perforated	16mm perforated	16mm unperforated	35mm unperforated	16mm unperforated	105mm unperforated	35mm unperforated	Paper	
Film Specification	ANSI #PH22.34 (BH-1870)	ANSI #PH22.5 (2R-3000)	NMAS #MS2-71					216mm x 106m (8½" x 350') Spec. 1	
Film Thickness	0.1mm (0.004") — See footnote b for Camera Models 8022, 8023, 8024, & 8026.							0.07mm (0.0027")	
Aperture	20.3mm x 25.4mm (0.800" x 1.000")	8.9mm x 10.5mm (0.350" x 0.415")	17.5mm x 14.7mm (0.690" x 0.580")	41mm x 30.4mm (1.615" x 1.197")	27.9mm x 14.7mm (1.100" x 0.580")	22.4mm x 102.1mm (0.88" x 4.02")	41mm x 30.4mm (1.615" x 1.197")	292.1mm x 206.4mm (11.50" x 8.12")	
Maximum Image	18.9mm x 24.9mm (0.748" x 0.980")	7.6mm x 10.5mm (0.300" x 0.415")	16.9mm x 13.9mm (0.669" x 0.550")	^c 37.3mm x 28.8mm ^c (1.467" x 1.133")	25.4mm x 13.9mm (1.000" x 0.550")	20.0mm x 16.5mm (0.787" x 0.650")	^c 37.3mm x 28.8mm ^c (1.467" x 1.133")	285.8mm x 203.2mm (11.25" x 8.00")	
Addressable Points	12,510 x 16,384	7,353 x 10,172	16,384 x 13,470	16,384 x 12,965	16,384 x 9,016	16,384 x 13,530	16,384 x 12,965	16,384 x 11,652	
Addressable Points Per MM (Per inch) on Film	658/mm (16,722/')	965/mm (24,510/')	965/mm (24,510/')	450/mm (11,442/')	645/mm (16,384/')	820/mm (20,828/')	450/mm (11,442/')	57.3/mm (1,456/')	
Advance Increment	^d 18.9mm ± 0.01mm ^d (0.748" ± 0.0004")	^d 7.6mm ± 0.01mm ^d (0.300" ± 0.0004")	2.9mm (0.1175")	8.6mm (0.3385")	^e Various	^f Various	8.6mm (0.3385")	0.12mm (0.005")	
Frame Advance			11.9mm ± 0.05mm (0.470" ± 0.002")	51.6mm ± 0.4mm (2.031" ± 0.016")			51.6mm ± 0.4mm (2.031" ± 0.016")	279.5mm ± 0.5mm (11.00" ± 0.02")	
Frame Advance Time	74 msec			98 msec	Not applicable		98 msec	1 sec	

^a Similar to Model 8023 but with increased light efficiency at higher resolution. Compatible with high-resolution, slower-speed films. Capable of up to 80 line pairs per millimeter resolution on reversed AHU-type film.

^b Camera will operate satisfactorily with only one film thickness. Standard film thickness is 0.1mm (0.004"). Camera may be set for other thicknesses at factory.

^c Digitally addressable area is 36.4mm x 28.8mm (1.433" x 1.133"), equivalent to 30X reduction of E-size drawing less 12.7mm (0.5") right and left border. Characters may be recorded and vectors may extend into border area.

^d Pin-registered film advance.

^e Operator may select any "effective frame advance" from 0.0mm to 20mm. Film advance speed is equivalent to that of Model 8022.

^f Operator may select any "frame index" (X) or "frame advance" (Y) to generate standard microfiche image spacings on 105mm film.

Model 8028 127mm (5")/70mm Sprocketed Combination Camera

Film Type 127mm (5")/70mm perforated

Film Specification Spec. 997

Film Thickness Optionally 0.1mm (0.004") or 0.15mm (0.0055");
however, change of film thickness will require refocusing.

Aperture 152.40mm x 116.84mm (6.000" x 4.600")

Maximum Image 114.3mm x 114.3mm (4.5" x 4.5")

Addressable Points 16,384 x 16,384

Addressable Points 143/mm (3,641/")
Per MM (Per Inch) on
Film

Advance Increment 0.12mm (0.005")

Frame Advance 25 perforations, which is 118.7mm \pm 0.015mm
(4.675" \pm 0.0005"). NOTE: The tolerance is
relative to the perforations and does not
include film manufacturing tolerances.

Frame Advance Time 300 msec

Magazine Capacity 60m (200')

MAGAZINE CAPACITIES, ALL CAMERAS

Camera Model	8020	8021	8022	8023	8024	8025	8026	8027	8028
Film Capacity	180m (600')					60m (200')	180m (600')	160m (350')	60m (200')

Appendix K
CHARACTER SIZES

Please turn page



NOMINAL CHARACTER HEIGHTS IN SCOPE POINTS
FOR triple-I 15 COMPUTER

[Characters are assumed to be 14 strokes high]

Character size	Height in scope points
0	13
1	17
2	21
3	25
4	29
5	34
6	38
7	42
8	46
9	50
10	55
11	59
12	63
13	67
14	71
15	76
16	80
17	84
18	88
19	92
20	97
21	101
22	105
23	109
24	113
25	118
26	122
27	126
28	130
29	134
30	139
31	143

Character size	Height in scope points
32	147
33	151
34	155
35	160
36	164
37	168
38	172
39	176
40	181
41	185
42	189
43	193
44	197
45	202
46	206
47	210
48	214
49	218
50	223
51	227
52	231
53	235
54	239
55	244
56	248
57	252
58	256
59	260
60	265
61	269
62	273
63	277

NOMINAL CHARACTER HEIGHTS IN SCOPE POINTS
FOR PDP-9/L AND PDP-15 COMPUTERS

[Characters are assumed to be 14 strokes high]

Character size	Height in scope points
0	15
1	19
2	23
3	27
4	32
5	36
6	41
7	44
8	50
9	55
10	59
11	63
12	68
13	73
14	77
15	82
16	89
17	92
18	98
19	103
20	107
21	113
22	117
23	126
24	133
25	138
26	141
27	146
28	150
29	154
30	159
31	164

Character size	Height in scope points
32	174
33	181
34	186
35	191
36	196
37	202
38	209
39	216
40	220
41	226
42	232
43	239
44	247
45	252
46	256
47	272
48	276
49	281
50	290
51	298
52	305
53	309
54	316
55	322
56	330
57	340
58	347
59	351
60	356
61	361
62	366
63	370

Appendix L
SAMPLE FORM

The following form design language was used to create the "Monthly Inventory Statement" form shown on the next page.

```
/MONTHLY INVENTORY STATEMENT  
/FORM NO. 1038  
/10/23/72, PWC
```

```
/SCALING FOR 24X  
102,170S  
2,4Z  
2,4D
```

```
/PARAMETERS TO BE USED BY THE PRINT PROGRAM  
134\L  
64\P  
132,63\S  
0,4\0
```

```
/PARAMETERS TO BE TYPED TO THE FORMS PROGRAM  
/PUL/3  
/360/  
/SAV/1038
```

```
/PARAMETERS TO BE TYPED TO THE PRINT PROGRAM  
/CAM/2  
/FDR/1038
```

```
/MEDIUM LINES  
1N  
5,2B  
132A -63U -132A 63U  
-3J  
132H  
3J  
26I -63V  
46I -63V  
24I -63V  
12I -63V  
12I -63V  
N  
1N
```

(Continued
on page L-3)

/THIN LINES

2N
3,0B
-13J
5R 132H -10J R
N
2N

/DASHED LINES (THIN)

3N
,1D
3,1!V
,4D
-8J
6R 132H -10J R
N
3N

/BOLD TEXT

4N
6,3R
2!C
132,3"MONTHLY INVENTORY STATEMENT"
N
4N

/MEDIUM TEXT

5N
4,1B
-3J
4,5C
26,3"PART NUMBER" 26I
46"DESCRIPTION" 46I
24"VENDOR"
N
5N

/LIGHT TEXT

6N
3,0B
26+46+241 -3J
12"QUANTITY
IN
STOCK" 12I
"QUANTITY
ON
ORDER" 12I
"QUANTITY
BACK
ORDERED"
1D
-12-12-24-46-26*2-1I -60J
0!C 2!R
3,5*2C 1,2:2E
"FORM NO. 1038"