1.3 EQUIPMENT DESCRIPTION.

1.3.1 PHYSICAL DESCRIPTION. The system is made up of five main components: a Micro-10 Microdensitometer, a Terminal, a Magnetic Tape System, an optional X-10 Interface to a Host Computer, and an optional D1010A Photographic Playback System.

1.3.2 FUNCTIONAL DESCRIPTION. Figure 1-2 is the block diagram of the Micro-10 Microdensitometer System. Even though all parts of the system are interdependent, the following general description of each separate element of the system provides a helpful functional overview.

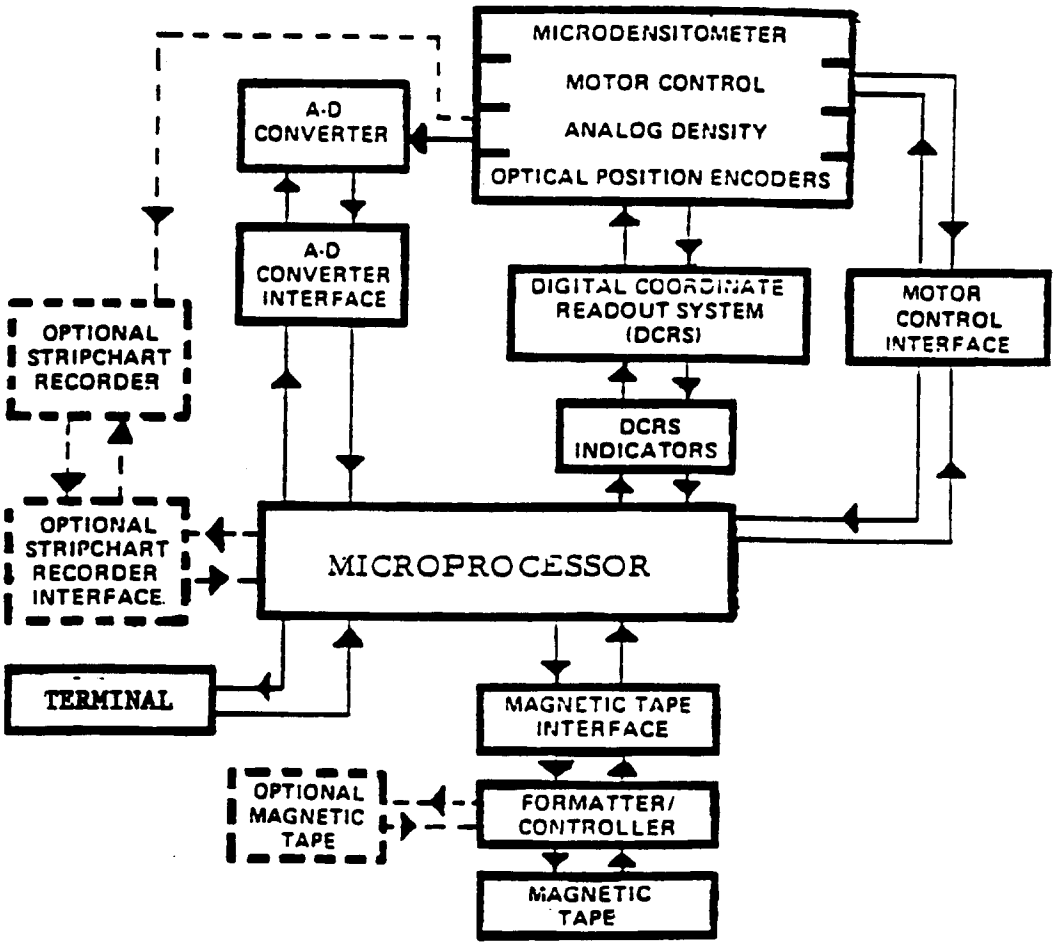

FIGURE 1-2. The Micro-10 System Block Diagram.

1.3.2.1 **Micro-10 Microdensitometer**. The Micro-10 Microdensitometer (Figure 1-3) consists essentially of three subsystems: One for measuring density or transmission information, one for moving the stage in either or both X and Y directions, and one for generating precise stage position information.

The Micro-10 measures the film density or transmission value, sends out digital signals to the Digital Coordinate Readout System (DCRS), and allows the computer to accurately describe the location of the spot being measured. The signal describing the measured density or transmission value is sent, first, as an analog voltage to an Analog-to-Digital Converter (A/D C) and then as digital information to the Microprocessor. Analog signals may also be sent from the Microdensitometer directly to a Strip Chart Recorder for continuous recording and visual examination.

Density measurement is accomplished by passing a beam of light from the Lower Optical System, through the sample being tested, and on to the Upper Optical System which is symmetrical to the Lower Optical System. A Photomultiplier Tube, in turn, converts the light intensity into a voltage signal which varies proportionally to the intensity of the light. After being amplified by a Logarithmic Converter, the resultant voltage represents the film density and is expressed in the following manner:

$$\text{DENSITY} = \text{Log}_{10} \ (1/\text{TRANSMISSION})$$

Transmission is represented by the original linear signal which is taken directly from the Photomultiplier Tube.

Low inertia dc servo motors are used to move the stage in the X and Y direction. One motor controls the X-axis motion while the second motor controls the Y-axis movement. Linear Optical Encoders are used to determine the precise location of the stage.

1.3.2.2 **Model 6800 Microprocessor Control System**. The Model 6800 Microprocessor Control System controls the automatic operation of the complete Micro-10 Microdensitometer System (according to its program instructions) and consists of the Microprocessor and the Terminal. The processor operates either according to the external programs and instructions loaded into it through the Terminal or by using its internal programs which are stored in Read Only Memory (ROM).

In the Automatic mode of scanning, the processor controls all Micro-10 operations. That is, the processor transmits a series of signals to the Digital Coordinate Readout System (DCRS), continually monitors the X and Y stage positions, initiates Analog-to-Digital conversions, and stores the data. The processor further formats these signals and sends the resulting information to the Magnetic Tape Unit where the digital information is loaded onto the tape. The processor can also send this information to the Terminal which can print out the data as a columnar table that provides both density readings and X/Y axis location.

The X/Y location information is given in reference to the starting point on the film. X coordinates are distances from the starting point in a left-to-right or right-to-left direction. Stage movement to the right is the positive X direction, while stage movement to the left is the negative X direction. The Y coordinates are given as distances from front-to-back of the starting point. In the standard configuration (1010M), the stage moves in the positive Y direction when it moves toward the operator and in the negative Y direction when it moves away from the operator. On the granite-based configurations (1010GM and 2020GM), movement in the Y axis is accomplished by moving the column rather than the stage. In this case, motion of the column from front-to-back is the positive Y direction while motion from back-to-front is the negative Y direction.

The Microprocessor Control System will initiate stage movement in the X and Y directions, accept digital information from the Analog-to-Digital Converter, pack the data for the Magnetic Tape System, and perform the calculations necessary for controlling the Micro-10 System. Digital data and stage coordinates are also transferred to the Magnetic Tape System with the help of the Magnetic Tape Formatter. When a selected area has been completely scanned or the operator interrupts the computer cycle, the computer will terminate the scanning action.

1.3.2.3 **Magnetic Tape System.** The Magnetic Tape System provides magnetic tape storage and retrieval capabilities for the information contained in the memory of the Model 6800 Microprocessor Control System. The end product of the complete system is either a magnetic tape from the Magnetic Tape Recorder, a typed table from the Terminal, a recording from the Strip Chart Recorder, or a new photograph from the Photographic Playback System.

The tandem operation of the Model 6800 Microprocessor Control System and the Magnetic Tape System make it possible to transform the obtained digital data into an analog signal which can then be plotted on the Strip Chart Recorder. The Magnetic Tape System and any other additional peripheral equipment such as a Strip Chart Recorder will be mounted in a single bay cabinet.

If further information regarding the operation of these peripheral components to the Micro-10 System (shown in Figure 1-1 with the Micro-10) is desired, please refer to the respective manual for that particular piece of equipment.

1.3.2.4 **Digital Coordinate Readout System (DCRS).** The DCRS, functionally a part of the Microdensitometer, monitors and displays the X and Y stage positions in microns. The DCRS also provides reset capabilities which allow the system operator to define any stage position such as the scanning origin.

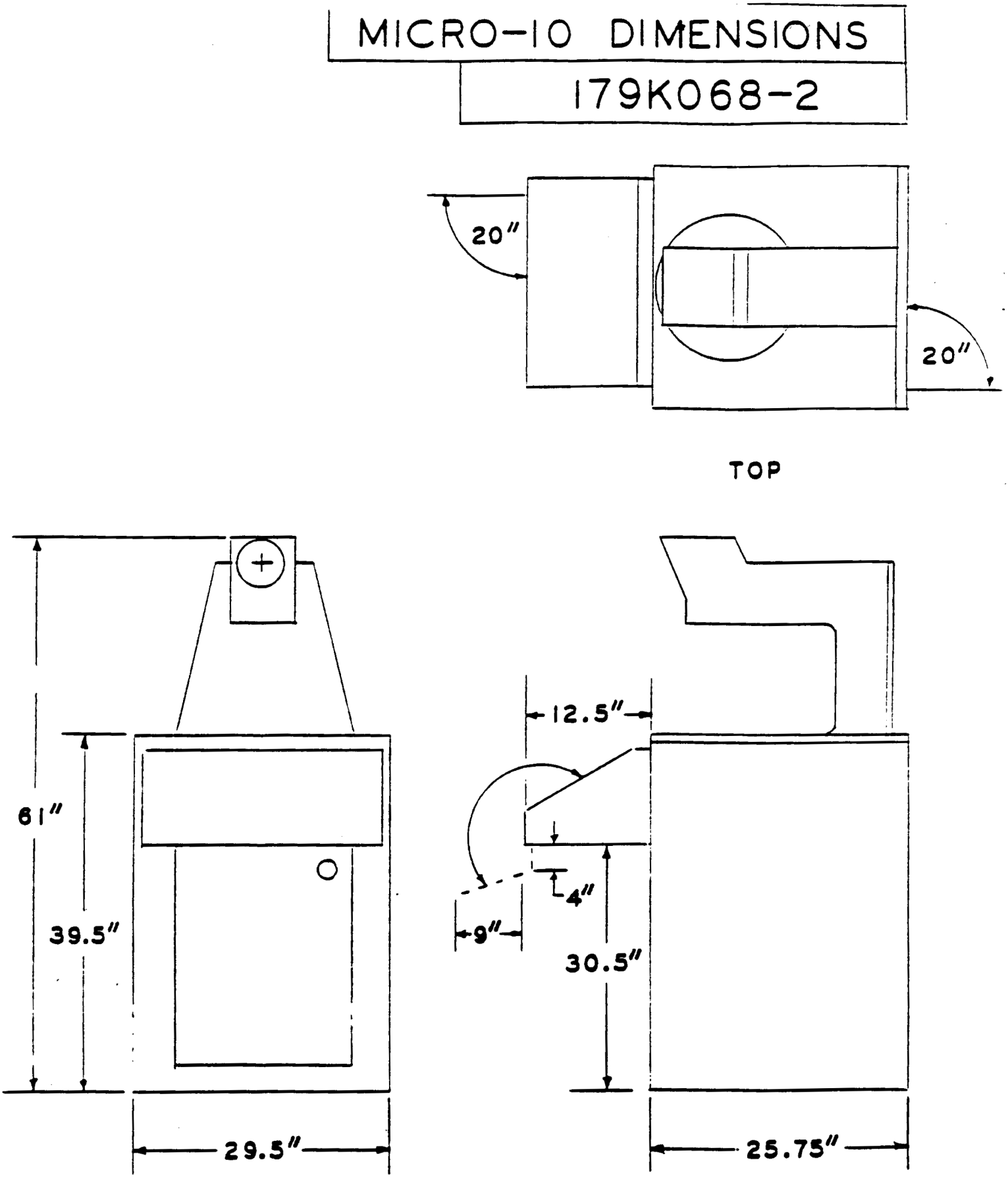

FIGURE 2-2. Layout Dimensions of the Microdensitometer.

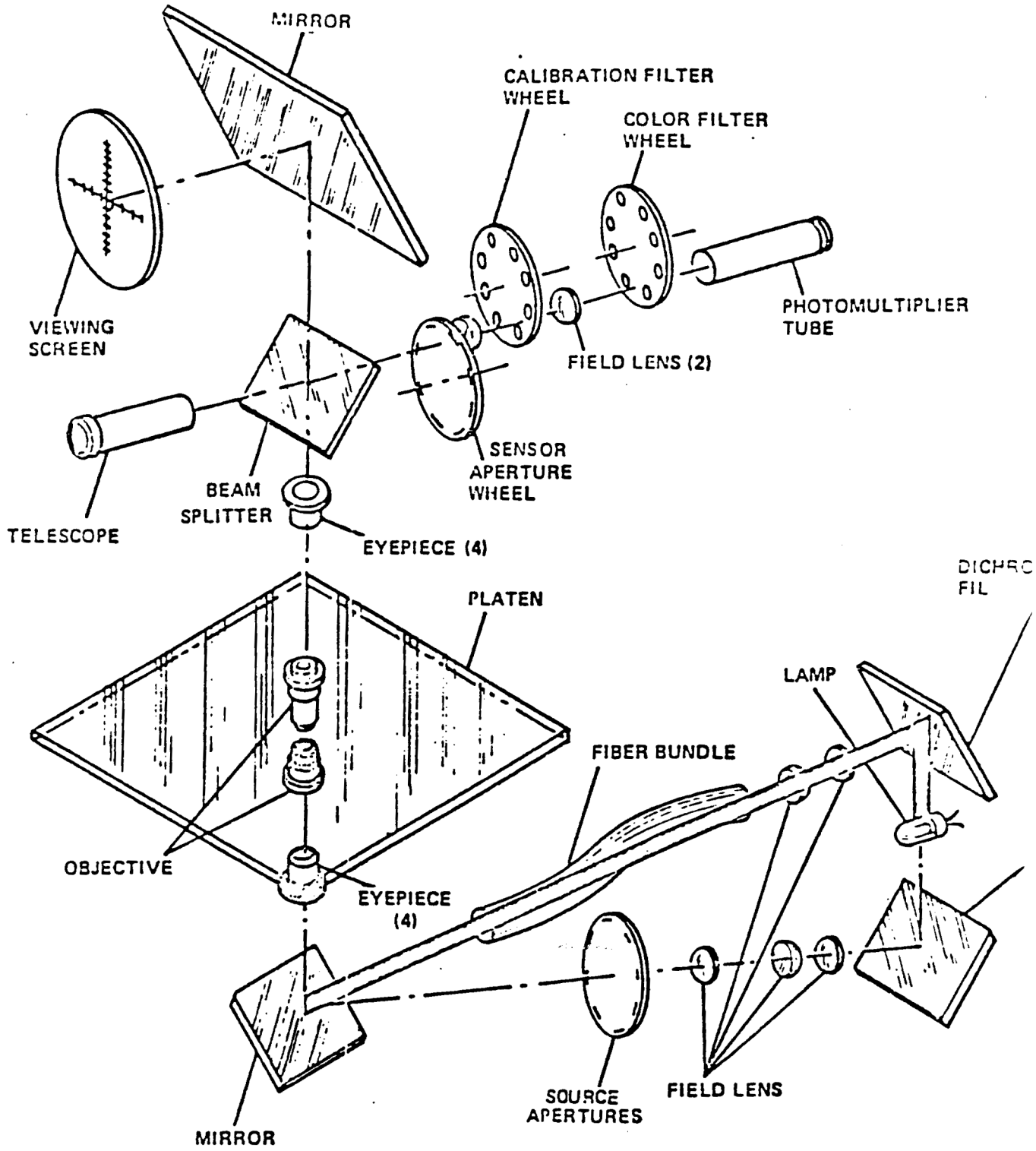

FIGURE 3-4. Light Path In Full Field Position.

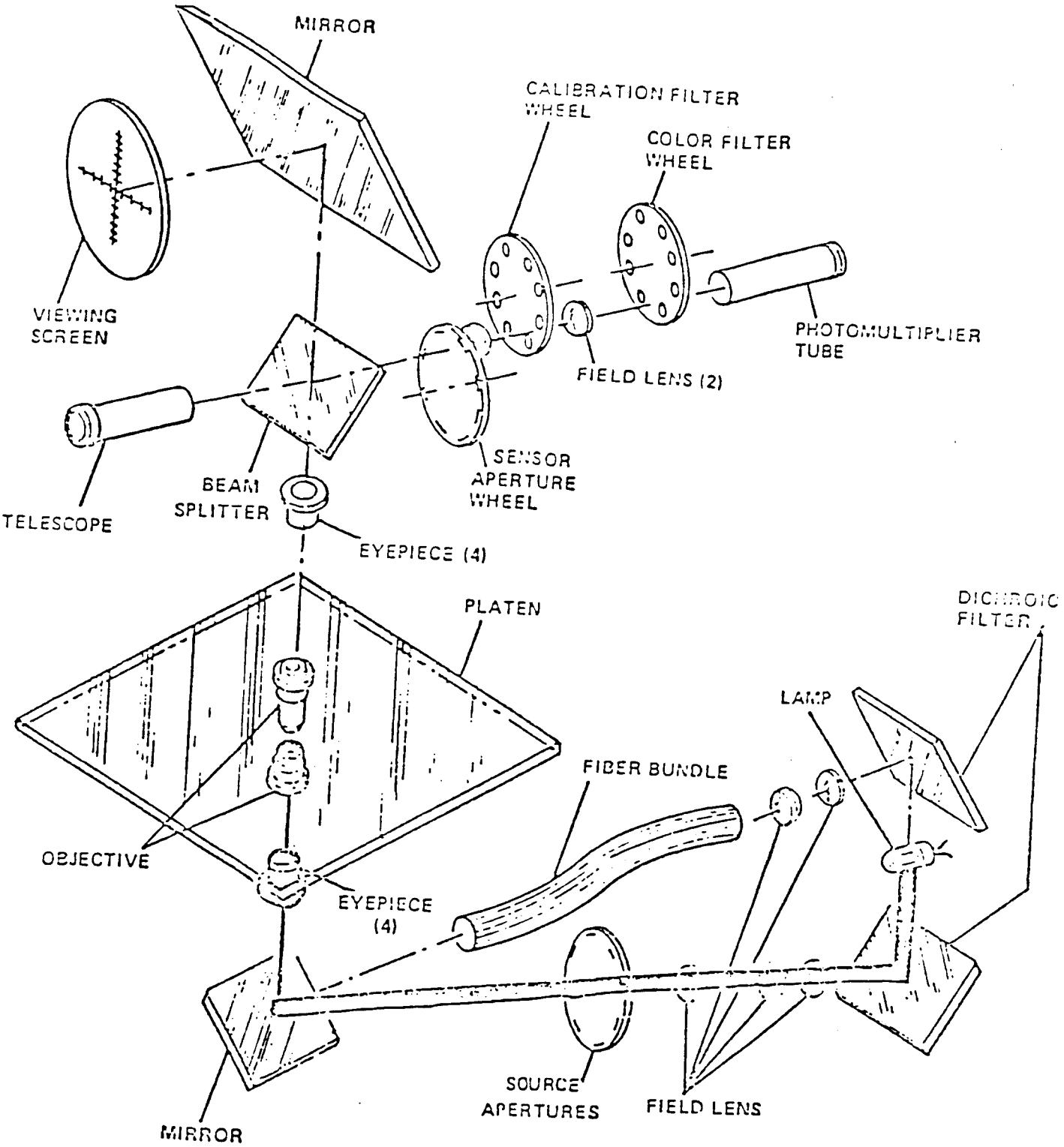

FIGURE 3-3. Light Path In Source Aperture Position.

TABLE 3-3. Nominal Apertures and Magnifications.

MAGNIFICATIONS		APERTURES	
Objectives	Eyepieces	Sensor Apertures in mm	
1. 10x	1. 5x	A. 1.0 Dia.	E. 0.5 x 20
	2. 10x	B. 1.0 Sq.	F. 1.5 x 20
	3. 15x	C. 2.5 Sq.	G. 2.5 x 10
	4. 20x	D. 0.5 x 10	H. 2.5 x 20
		Source or Playback Apertures in mm	
1. 10x	1. 5x	A. 1.5 Dia.	E. 1.0 x 21
	2. 10x	B. 1.5 Sq.	F. 2.0 x 21
	3. 15x	C. 3.0 Sq.	G. 3.0 x 11
	4. 20x	D. 1.0 x 11	H. 3.0 x 21

TABLE 3-4. Nominal Pixel Sizes In Microns.

SENSOR APERTURES	MAGNIFICATION			
	1 (50x)	2 (100x)	3 (150x)	4 (200x)
A	20 Dia.	10 Dia.	6.67 Dia.	5.0 Dia.
B	20 Sq.	10 Sq.	6.67 Sq.	5.0 Sq.
C	50 Sq.	25 Sq.	16.7 Sq.	12.5 Sq.
D	10 x 200	5.0 x 100	3.3 x 66.7	2.5 x 50
E	10 x 400	5.0 x 200	3.3 x 133.3	2.5 x 100
F	30 x 400	15 x 200	10 x 133.3	7.5 x 100
G	50 x 200	25 x 100	16.7 x 66.7	12.5 x 50
H	50 x 400	25 x 200	16.7 x 133.3	12.5 x 100
SOURCE OR PLAYBACK APERTURES				
A	30 Dia.	15 Dia.	10 Dia.	7.5 Dia.
B	30 Sq.	15 Sq.	10 Sq.	7.5 Sq.
C	60 Sq.	30 Sq.	20 Sq.	15 Sq.
D	20 x 220	10 x 110	6.67 x 73.3	5.0 x 55
E	20 x 420	10 x 210	6.67 x 140	5.0 x 105
F	40 x 420	20 x 210	13.3 x 140	10 x 105
G	60 x 220	20 x 110	20 x 73.3	10 x 55
H	60 x 420	30 x 210	20 x 140	10 x 105

NOTE

Any filter, aperture or any density can be used as a reference, but the system must be calibrated using whatever combination one chooses, prior to actual operation.

4.6 POWER SUPPLIES.

4.6.1 MICROPROCESSOR POWER SUPPLY. The Micro-10 Microprocessor Power Supply is located in the lower rear portion of the Microdensitometer cabinet and provides the following five output voltages:

a. Plus (+) 5 volts - A single output used for all the logic supply requirements.

b. Plus and Minus (±) 15 volts - These two voltages are used for the Analog Signal Boards, the DCRS Board, and the A/D D/A Board.

c. Plus and Minus (±) 20 volts - These outputs are used to supply power to the servo motor power output amplifier stages, and also the switch illumination lamps.

The ac power is supplied through the multiple outlet box previously described (see Figure 4-1). All of the output voltages are connected to the card rack via a bulkhead connector located on the back side of this chassis. The power buses of the card rack are connected to a cable which plugs into this bulkhead connector, enabling the removal of either the power supply or the card rack.

4.6.2 POWER SUPPLY FUSES. There is 3AG-3A SB ac power input fuse located on the front panel of the power supply which should be replaced with the same value, should replacement become necessary. Also, there is a fuse internally located on the +5 volt and ±15 volt supply. In the event this fuse needs replacement, it will be necessary to remove both the power supply, and back cover. This fuse should also be replaced with the same type because changing the values of the fuses will void the warranty on these units.

4.6.3 MODULAR POWER SUPPLY. There is also a small modular power supply located adjacent to the Analog Amplifier Box (which is located in the housing of the Main Control Panel). This modular supply provides the following three additional output voltages:

a. Plus and Minus (±) 15 volts - These two voltages are used for the analog signal processing within the Analog Amplifier Box.

b. Plus (+) 5 volts - This voltage is used for an isolated supply for the Digital Panel Meter. This floating supply is required to eliminate any possibility of extraneous noise and ground-loops that would exist if the +5 volt logic supply were used.

4.7 SYSTEM OVERLOAD PROTECTION.

There are six (6) fuses throughout the Micro-10 System which protect the Electronic System should an overload occur. These fuses are located on the Microprocessor Power Supply, the ac outlet box, and on each Servo Motor Board. Table 4-1 below provides a listing of these fuses and their locations.

TABLE 4-1. Micro-10 System Overload Fuses.

DESIGNATION	DESCRIPTION	TYPE
	AC OUTLET BOX	
F1	Main Power	3AG - 15 Amp Slow Blow
F2	High Voltage Supply	AGC - 1 Amp Fast Blow
	MICROPROCESSOR	
F1	X Servo Motor	1 Amp Slow Blow
F2	Y Servo Motor	1 Amp Slow blow
F3	Power Supply	(Internally located in Power Supply)
F4	±20 Volt Supply	3 Amp Slow Blow

4.8 ANALOG SYSTEM.

The Analog System consists of the Photomultiplier Tube and its power supply, the Log Converter, the Panel Meter, and the Photoamplifier System in the Main Control Panel, along with its associated controls: the CALIB. and DENS./TRANS. switches, the OFFSET, GAIN and LOG controls. See Schematic 178S028 illustrates the circuit while Section 6 of this manual fully describes the Analog System.

The High Voltage Power Supply provides -200 to -1250 volts dc to the Photomultiplier Tube. The exact voltage is controlled through the COARSE and FINE adjustment controls on the Main Control Panel. Figure 4-2 illustrates the high voltage connections while Table 4-2 lists the nominal high voltage for the 11 positions on the COARSE adjustment control. The FINE adjustment is set to position 5 for these readings.

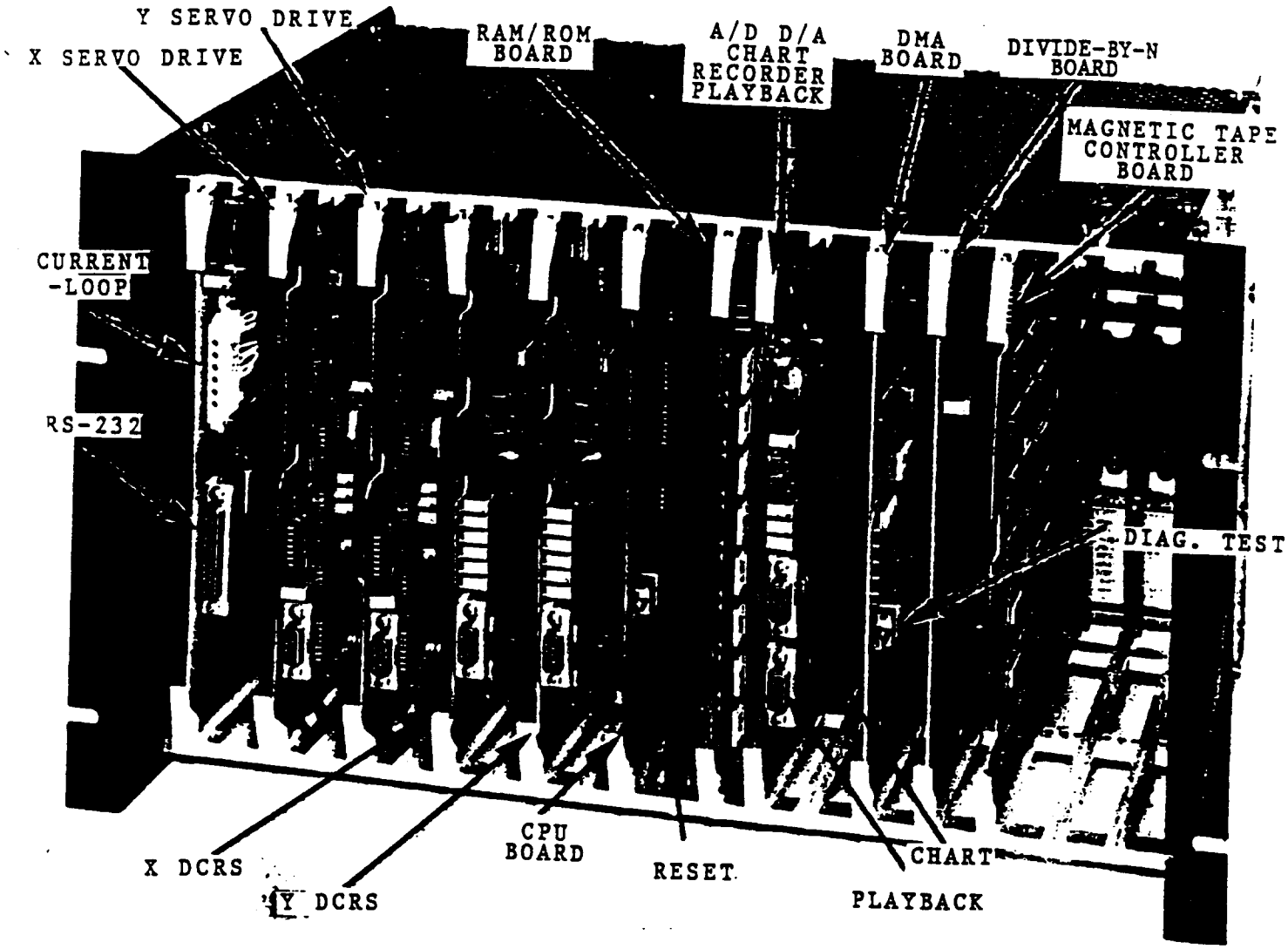

FIGURE 4-3. Microprocessor Electronics.

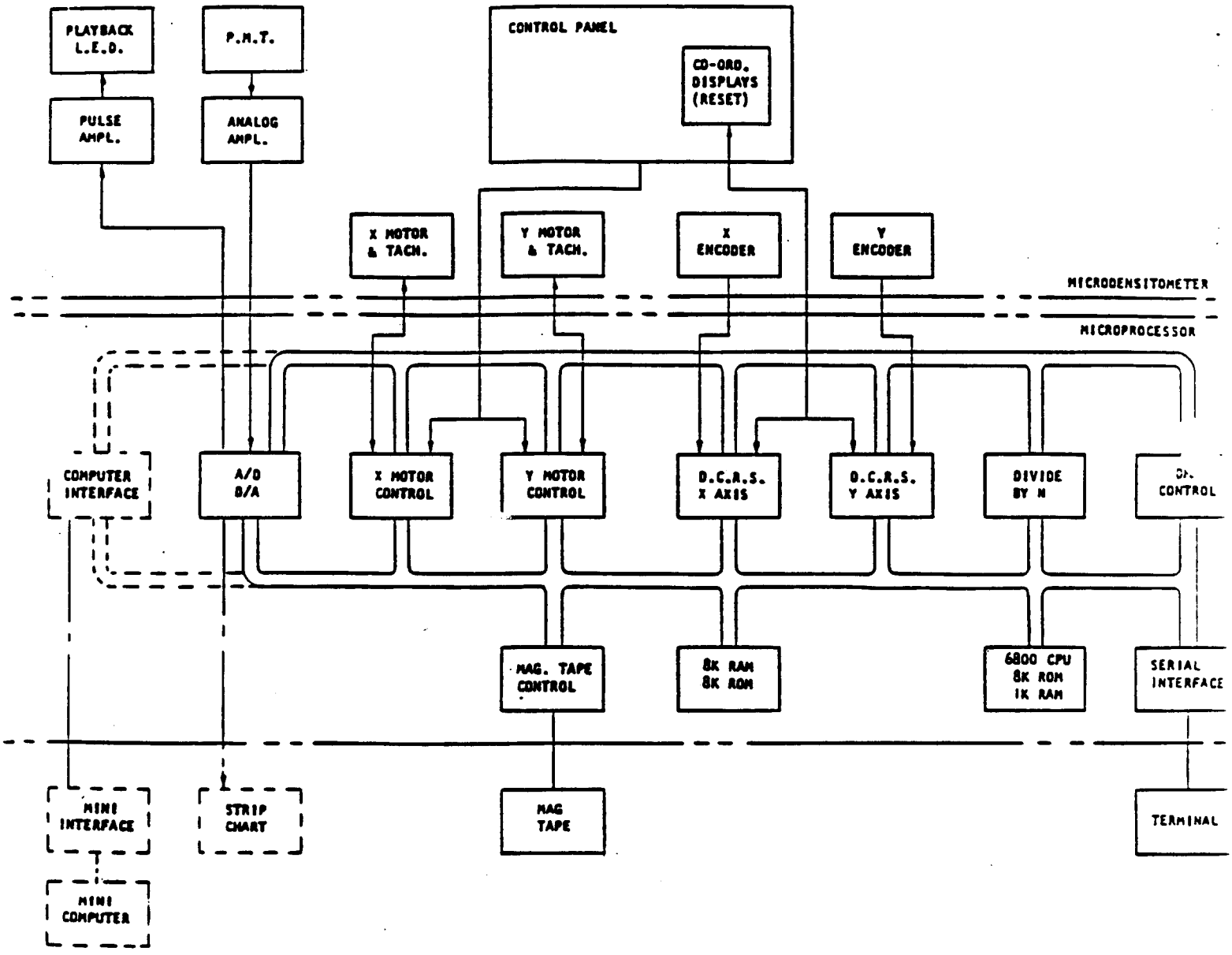

FIGURE 4-4. Block Diagram - Micro-10 Electronics.