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# **MP100 SERIES**

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**LENGTH CONTROL SYSTEM**

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MP100

SHEAR CONTROLLER

REFERENCE MANUAL

MODEL MP100  
SHEAR CONTROLLER  
(ENHANCED VERSION)

The MP100 is a versatile shear line controller which employs microprocessor technology to provide state-of-the-art features and performance. We have designed this system with the specific needs of the metal fabricating industry in mind. So not only is this controller very flexible and powerful, but it is also easy to use and provides features not found on other controllers.

The MP100's capabilities and ease of use make this an ideal retrofit to replace flag switches, mechanical stops, and single batch controllers which will enable your operation to realize increased production and efficiency.

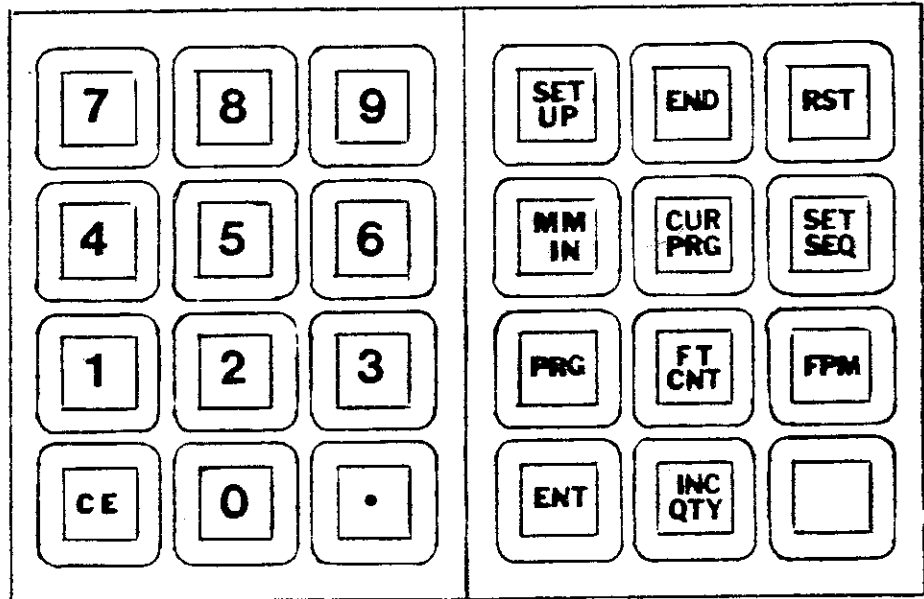
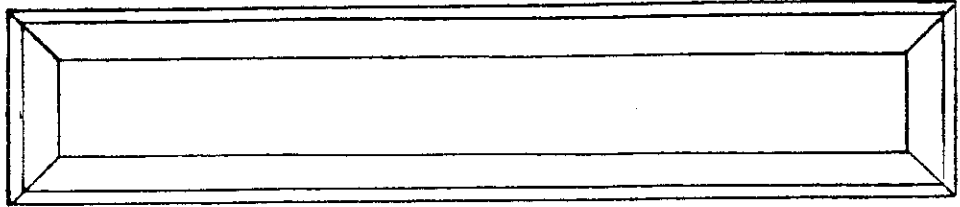
The MP100 is contained in a rugged industrial enclosure utilizing military-type connectors to maximize reliability and ensure trouble free operation.

The MP100 provides the following features:

- Ability to program up to 50 jobs specifying quantity and length
- Three Length Totalizers - Total amount of metal run by job and the total amount of metal run and the amount made into good parts by coil
- Ability to enter a correction factor for precise lengths
- Both decimal inch and metric (mm) units
- Capable of operating on a wide variety of coil processing equipment
- Ability to program new jobs while previously programmed jobs are being run
- Selectable job control
- Ability to increment the quantity of the job being run
- Battery back up for data retention during power loss
- Ability to run continuously or halt between jobs
- Setup lockout capability for program security

APPLIED MICROSYSTEMS, INC.  
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○  
ALTERNATE  
UNITS



○ ○ ○ ○ ○ ○ ○ ○  
FAST SLOW REV P1 SHR FWD RUN RESET

MODEL MP100

FRONT PANEL LAYOUT

## FRONT PANEL COMPONENTS AND DESCRIPTION

The Model MP100 front panel has two 12 key keypads and a 12 digit seven segment light emitting diode (LED) display for programming and displaying various parameters. Eight LED's across the bottom indicate the state of the various outputs and one LED next to the display indicates if the controller is in the decimal inch or metric (when lit) mode of operation.

### KEYPADS

The keys provide the functions as listed below:

SET UP	Programs initial set-up parameters
END	Exits any of the program or status modes
RST	Resets the controller and causes a piece equal to the startup length entered in the setup mode to be sheared when the line is started (Used after a new coil has been loaded)
MM IN	Switches between decimal inches and millimeters
CUR PRG	Displays original job values programmed
SET SEQ	Programs job sequence execution
PRG	Programs job parameters (quantity and length)
FT CNT	Foot Count - Displays length totalizer values
FPM	Displays current line speed in feet/minute
ENT	Enter - Stores values entered in programming mode
INC QTY	Adds one piece to the quantity of the job in process each time the key is pressed
CE	Clear key - restores original value and clears the length totalizers when lengths are displayed

### LIGHT EMITTING DIODES

The 8 LED's across the bottom of the panel display the status of the outputs as listed below (from left to right):

LED 1	Fast Forward
LED 2	Slow Forward
LED 3	Reverse
LED 4	Punch (Not Used)
LED 5	Shear
LED 6	Forward
LED 7	Run
LED 8	Reset

## PROGRAMMING

The three programming modes are Setup, Program, and Set Sequence. These modes can be entered by depressing the "SET UP", "PRG", and "SET SEQ" keys.

The Setup and Program are identical as to programming rules and are discussed below. The Sequence mode is different and will be discussed in more detail under the Sequence Mode heading. When each value is first displayed a message is displayed on the left side of the display and the current value is displayed on the right side. When the first number or decimal point is entered the right side of the display is blanked and numbers are shifted in to the left. Pressing the clear key (CE) restores the original value. Pressing the "ENT" key stores the value shown in the display and proceeds onto the next value. All values have a range specified below. For example, 0.00 to 99.99 indicates only four digits are allowed two above and two below the decimal point. Zeros to the right of the decimal point are added in automatically after an entry has been made and a decimal point is automatically entered after the maximum number of digits is entered. This allows faster programming by minimizing the number of keys which must be pressed.

When power is applied to the unit the memory is checked for data retention. If an error is detected the memory is cleared and the Setup mode is entered. After the Setup values are all entered the current status mode is entered. If the data retention test passes, the current status mode is entered directly.

Pressing the "MM IN" key will cycle from decimal inches to the metric mode. The LED to the left of the display will be illuminated when in the metric mode. When in the decimal inch mode all lengths programmed and displayed will be in inches with the exception of the total length which is in feet. When in the metric mode all lengths programmed and displayed will be in millimeters with the exception of the total length which is in meters.

MODEL MP100  
SETUP MODE

The following values are programmed in the order shown below.

DISPLAY	FUNCTION
CountS	Number of counts or pulses per revolution generated by encoder. 100 to 1000 counts. Applied Microsystems 256Z encoder generates 256 counts.
diSt.	Distance traveled with one revolution of the encoder wheel (Encoder wheel circumference). 0.250 to 20.000 inches.
Corr.	Correction factor or rate multiplier. 90.000 to 110.000. Begin by setting value to 100.000. See page 12 for additional information.
dirEction	Direction of encoder wheel to produce positive counting. 1 for clockwise and 0 for counter c/w.
SLO. LE.	Length to run in slow. Set to 0 for a flying cutoff line. 0.00 to 99.999 in. or 999.99 mm.
StArt	Startup scrap length. Defines a minimum length to be run to insure that the line is at full speed before cycling a press. 0.00 to 99.999 in. or 999.99 mm.
LEAST	Length of the shortest part the controller will produce. Designed to prevent scrap jam up on lines using large die sets. 0.00 to 99.999 in. or 999.99 mm.
bAc. LE	Maximum length that the line will run in reverse. After a line has been manually halted, the distance to the next shear operation may be less than the startup length. The controller will back the metal up so that the distance to the shear operation is equal to the startup length and eliminate producing a piece of scrap. If set to zero, the controller will not cause the line to back up. 0.00 to 99.999 in. or 999.99 mm.
SLU. LE.	Length of slug removed by shear. 0.00 to 99.999 in. or 999.99 mm.
Shr. SEC.	Time of shear cycle. 0.00 to 99.99 seconds. If set to 0 then the shear output will stay on until an external shear complete switch is closed.

MODEL MP100  
SETUP MODE  
(CONTINUED)

Shr. PAU.      Pause time after a shear cycle until the line  
                 restarts. 0.00 to 99.99 seconds. Used only on  
                 slowdown-stop lines.

HALt            Sets controller to halt between jobs if desired.  
                 Pressing any numbered key will toggle yes or no.

FrESh          Used to clear all system memory. Enter "1984" to  
                 clear all setup and job data.

(See page 13 for a form to record the setup parameters of your  
equipment.)

## PROGRAM MODE

There are 50 batches or jobs which can be programmed. To program a job a job number, quantity, and length are entered in response to prompts from the controller as listed below. The program mode is entered by pressing the "PRG" key and exited by pressing the "END" key.

DISPLAY	FUNCTION
Job No.	Number of job to be programmed. 1 to 50. The job number is automatically incremented after each job is programmed. If the job number displayed is the desired job number, simply press the "ENT" key.
PC. XX	Number of pieces to be run for job number XX. 0 to 9999. If set to zero the job is skipped.
LE. XX	Length of part for job number XX. The maximum length which may be entered is 9999.999 inches or 99999.99 mm.

## INCREMENT QUANTITY

During a run parts may, for various reasons, be determined to be unusable. To make up the difference an Increment Quantity key (INC QTY) has been provided. Each time the "INC QTY" key is pressed, an additional piece will be added to the current quantity of the job in process.

## RESET

Pressing the reset key (RST) when the line is halted resets the system and causes a piece equal to the startup length entered in the setup mode to be produced. This key should be used after a new coil has been loaded.



## SEQUENCE MODE

To enter the sequence programming mode press the "SET SFQ" key. This allows a range of job numbers to be run. If both numbers are the same then only one job will be run. When entering the run mode the first job number entered will be run first. All jobs from first to last will be run until all quantities are zero. When entering the sequence mode, the display will read "FirSt" followed by the job number to be run first. To enter a new job number to be run first, press the appropriate numbered keys followed by the "ENT" key. The display will now read "LAST" followed by the job number to be run last. To enter a new job number to be run last, press the appropriate numbered keys followed by the "ENT" key. An exit from the sequence mode is done automatically.

If the first job number is larger than the last, the sequence will run from the first job number entered up to job number 50, then from job 1 to the last job number entered. For example, if job 49 to job 3 was programmed then the sequence would be 49, 50, 1, 2 and 3.

## ERROR MESSAGES

An error message will be displayed when an illegal operation is attempted. The display will show:

Error XX

where XX is a number relating to the type of error performed. To clear an error message press the "CE" key. The error numbers used are:

- 1 The number of encoder cycles per revolution is out of the accepted range. Must be 100 to 1000.
- 2 The circumference of the encoder wheel is out of the accepted range. Must be 2.50 to 20.00 inches.
- 3 The rate multiplier is out of the accepted range. Must be 90.000 to 110.000.
- 4 An illegal batch number was entered in the program mode. Must be 1 to 50. Or an attempt was made to change the data of a job in process.
- 5 A programmed length of zero was entered. All lengths programmed must be greater than zero.
- 6 A length shorter than the minimum allowed established in the setup mode was programmed. Check "LEAST" value.
- 7 A run was attempted with all jobs between the first and last jobs in the sequence mode at zero quantity.
- 8 An illegal batch number was entered in the sequence mode. Must be 1 to 50.
- 9 An attempt to change a setup value or clear the totalizers was made with the setup/coil lockout switch on.

## STATUS KEYS

The three status keys are "CUR PRG", "FT CNT" and "FPM". Pressing one of the keys sets the mode to display the information relating to each key. Unless one of the program keys (PRG, SFT UP, SFT SEQ) or one of the status keys (CUR PRG, FT CNT, FPM) are pressed, the display will show the current status of the job being run. The information displayed from left to right is the job number currently being run, the quantity remaining in the job, and the current length run since the last shear. To prevent the numbers from blurring together during a run the display is updated once every quarter of a second. If the metal is jogged in reverse past the last shear point the current length counter will become a negative number and will count in reverse. This feature allows the distance displayed to be easily related to the shear point. For example, a display of 2.00 inches indicates the leading edge of the metal is 2 inches past the shear point, and a display of minus 2.00 inches indicates the leading edge of the metal to be 2.00 inches behind the shear point. Under certain conditions the total number of digits to be displayed could be equal to 11 or 12. To maintain readability of the display a space is always left between the job number and quantity and between the quantity and length. In order to insure this, one or two decimal digits for the length may not be displayed.

FT CNT is used to obtain the totals of the three length totalizers in the MP100. The following step-by-step instructions show how to display and clear the lengths in the totalizers.

### A. To Record the Total Metal Used for Each Job.

1. Press the "FT CNT" key. The display will show "Job Ft." followed by the total amount of metal used for the last job.
2. Record the amount displayed.
3. Press the "CE" key to clear the job totalizer. Failure to clear the job totalizer after each job is run will result in the job totalizer storing the amount used for several jobs.
4. Press the "END" key to continue programming or running additional jobs.

### B. To Record the Total Metal Used At Any Point.

1. Press the "RST" key.
2. Press the "FT CNT" key.
3. Press the "ENT" key. The display will show "total" followed by the total amount of metal run since the totalizer was last cleared.
4. Record the "Total" length displayed.
5. Press the "ENT" key. The display will show "Good" followed by the total amount of metal used to produce the programmed quantities and lengths (or the amount made into good parts). Subtracting the "Good" amount from the "Total" amount will provide the amount of scrap generated.
6. Record the "Good" length displayed.
7. Press the "CE" key. IMPORTANT - Pressing the "CE" key at this time will clear all three length totalizers. Be sure all lengths have been recorded before pressing the "CE" key.

## STATUS KEYS (CONTINUED)

CUR PRG displays information about the original programmed values of the job being run. From left to right the display shows the current job number, the original quantity, and the total length of the part to be run. As described above the number of digits displayed could be 11 or 12 and in order to maintain readability of the display one or two decimal digits for the length may not be displayed in some cases.

FPM displays the current line speed in feet/minute. This value is averaged over 1/4 second.

## OPERATING CONSIDERATIONS

There are limitations on programming the job that is currently being run. The quantity and length of the job in process cannot be reprogrammed. If the quantity or length of the job in process needs to be changed, halt the line, press the "RST" key, and reprogram the job with the correct data. Remember the increment quantity key (INC QTY) can be used to increase the quantity of the job in process.

Once the line is started, the jobs which have been completed can be reprogrammed with new batch data without stopping the line. To know which jobs have been completed and are available for reprogramming, observe which job number the controller is currently processing. For example, if the controller is working on job number 5, then jobs 1 through 4 can be reprogrammed. Enter the program mode by pressing the "PRG" key, program jobs 1 through 4, and exit the program mode by pressing the "END" key. After the controller has completed the last job originally programmed, it will without stopping run job number 1 again with the job data that was re-entered. Again, re-programming a completed job can be accomplished without stopping the line.

The controller will allow the shear to be manually cycled on a non-stop line without halting the line. Therefore with the line running, an operator can manually cycle the shear to cut out sections which cannot be used or to cut out sections for inspection. On a slowdown-stop line where a length in slow has been programmed in the setup mode, the controller will only allow the shear to be cycled manually when the line is halted.

## EXTERNAL INPUTS

When the SETUP/COIL LOCKOUT contact is closed (by grounding pin T of connector J3 via a switch) the values entered in the setup mode cannot be changed and the length totalizers cannot be cleared. Instead an error message is displayed.

MANUAL SHEAR causes a shear cycle to start and clears the length counter displayed in the current status mode. It can be used any time.

SHEAR COMPLETE turns the shear output off and indicates a completed cycle to the controller.

JOG FORWARD and JOG REVERSE are inputs for the jogging functions.

When the RUN/HALT switch is closed the run mode is entered if the following conditions are met. The jog inputs must be off and the shear output must be off. At least one of the jobs in the range programmed must have a non zero quantity. If these conditions are met, a run is started. If the "RST" key has been pressed the line will restart at the first non-zero job programmed. If not reset a test is done. If the distance to the next shear operation is less than the startup length entered in the setup mode, an automatic reset is done. Otherwise the line restarts at the point it was halted. (Unless a backup length was entered in the setup mode in which case the controller will reverse the metal and not do an automatic reset.) The line will continue to run until all jobs in the range specified are zero or until the run switch is opened.

## REAR CONNECTORS

Three connectors on the rear interface the controller with the system. Connector J1 (Encoder Cable 2148-25) connects to the length encoder. 115 VAC and 5 to 24 VDC are brought in through J2 (Power/Output Cable 2041-7).

J2 also handles the following outputs: Forward, Fast Forward, Slow Forward, Reverse, Shear, and Run.

J3 (Switch/Input Cable 3448-7) handles the following inputs: Manual Shear, Shear Complete, Jog Forward, Jog Reverse, Setup Lockout, and Run.

## DETERMINING THE PROPER CORRECTION FACTOR

If the number of pulses per revolution of the encoder and the distance traveled per one revolution of the encoder wheel are entered accurately in the setup mode, the line should produce precision length parts. However if there is a difference between the length programmed and the length actually produced, the following steps should be taken.

First, run a large number of short parts and measure the variation in length from the shortest part to the longest part produced. This total variation should be within the machine's specified tolerance. If not, further attempts to fine-tune your line should not be attempted until this variation tolerance is met. Once it has been determined that your equipment is running within the manufacturer's specified tolerances you should run several parts as long as possible and, carefully measuring each part, find the average length. A new correction factor can then be determined as follows:

$$\begin{aligned} \text{New Correction Factor} &= \text{Old Correction Factor} \times (P/A) \\ \text{Where PL is the programmed length} \\ \text{and AL is the actual measured length} \end{aligned}$$

For example, with the old Correction Factor at 100.000, a 100 inch part was programmed with the result being a 100.25 inch part being produced. The new Correction Factor would be:

$$\begin{aligned} \text{New Correction Factor} &= 100.000 \times (100/100.25) \\ &= 100.000 \times .99751 \\ &= 99.751 \end{aligned}$$

This new value for the Correction Factor should then be entered into your system. Remember that this feature will also allow you to compensate for normal wheel wear and eliminate the need to purchase new wheels to maintain precise measurements.

MODEL MP100  
 SETUP DATA

Encoder Count (Counts)	100 to 1000	-----
Encoder Wheel Circumference (diSt.)	0.25 to 20.000 in.	-----
Correction Factor (Corr.)	90.000 to 110.000	-----
Encoder Rotation (dirEction)	1 for clockwise or 0 for counter cw	-----
Length in Slow (SLD. LE.)	0.00 to 99.999 inches	-----
	0.00 to 999.99 mm	-----
Startup Length (StArt)	0.00 to 99.999 inches	-----
	0.00 to 999.99 mm	-----
Minimum Length (LEASt)	0.00 to 99.999 inches	-----
	0.00 to 999.99 mm	-----
Reverse Length (bAc. LE)	0.00 to 99.999 inches	-----
	0.00 to 999.99 mm	-----
Slug Length (SLU. LE.)	0.00 to 99.999 inches	-----
	0.00 to 999.99 mm	-----
Shear Cycle (Shr. SEC.)	0.00 to 99.99 seconds	-----
Shear Pause (Shr. PAU.)	0.00 to 99.99 seconds	-----
Halt Between Jobs (HALt)	Yes or No	-----
Clear Memory (FrESH)	Enter "1984" to clear all memory. (Setup and Job data)	

OPERATOR INSTRUCTIONS  
FOR PROGRAMMING THE MP100 OR MP101  
USING DECIMAL INCH UNITS

This is an example of how to program the MP100 or MP101. In this example we will program 2 jobs or batches. The first job will have 8 pieces at 108.75 inches and the second job will have 15 pieces at 144.00 inches.

Press the "PRG" key. The display will read:

Job No. 1

Press the "ENT" key. The display will now read:

PC. 1 0

PC. 1 means pieces for job number 1.

Since we want to make 8 pieces in job 1 press the "8" key and then press the "ENT" key. The display will now read:

LE. 1 0

LE. 1 means length for job number 1.

The display may show some number other than a 0 on the right side of the display but this is not important. Since we want to make parts 108.75 inches long the following keys must be pressed:

Press the "1" key.

Press the "0" key.

Press the "8" key.

Press the "." key.

Press the "7" key.

Press the "5" key.

Press the "ENT" key.

Job #1 has now been programmed and the display will read:

Job No. 2

Press the "ENT" key. The display will now read:

PC. 2 0

PC. 2 means pieces for job number 2.

Since we want to make 15 pieces in job 2 press the "1" key, then press the "5" key, and then press the "ENT" key. The display will read:

LE. 2 0

LE. 2 means length for job number 2.

The display may show some number other than a 0 on the right side of the display but this is not important. Since we want to make parts 144.00 inches long the following keys must be pressed:

Press the "1" key.

Press the "4" key.

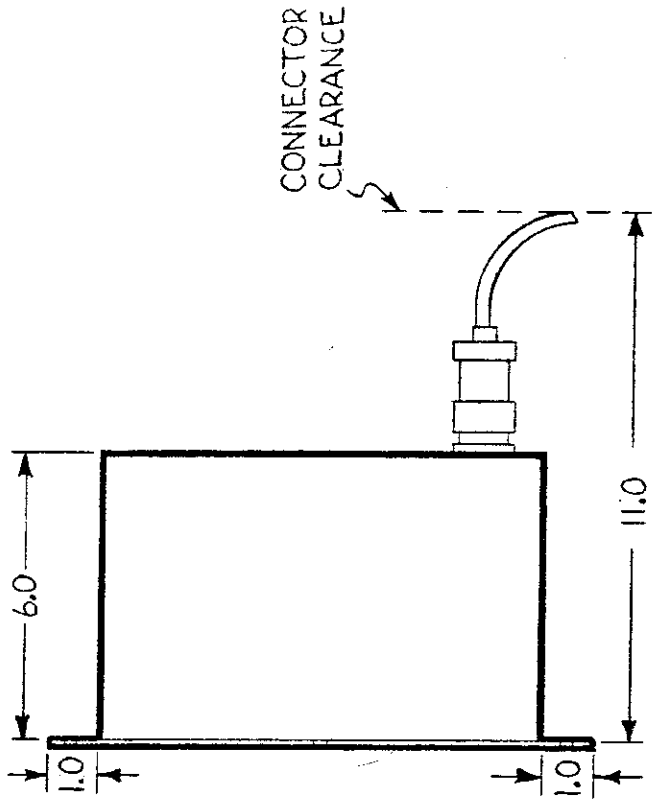
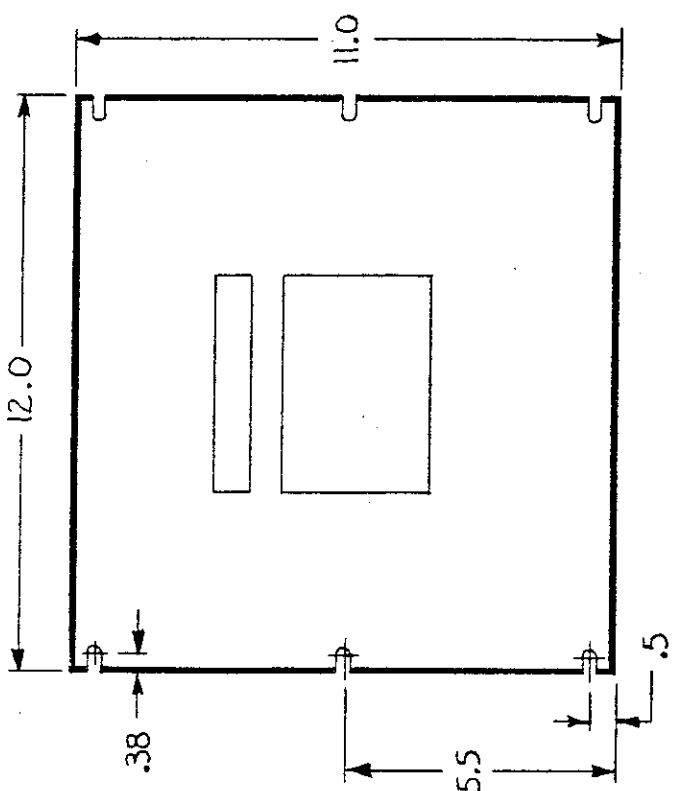
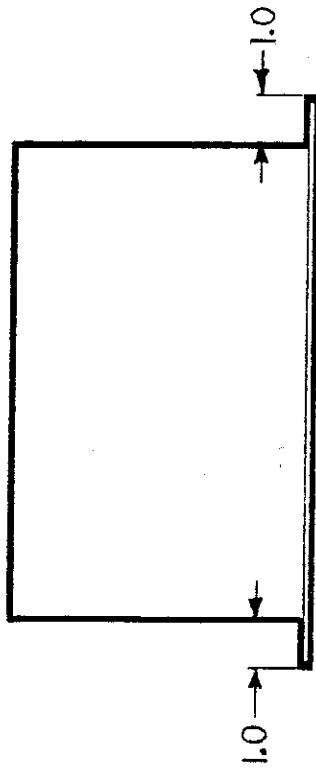
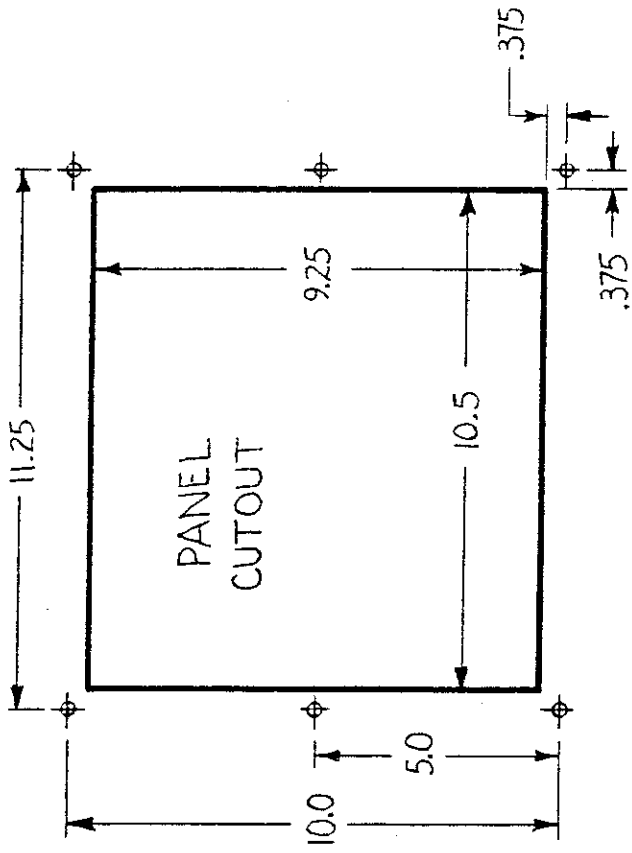
Press the "4" key.

Press the "ENT" key. Notice that you do not have to enter the ".00" part of the length. Job number 2 has now been programmed and the display will read:

Job No. 3

Since we only need to program 2 jobs and do not want to continue programming job number 3, we can now start the line by pressing the run button and the controller will cause the line to make 8 pieces at 108.75 inches and 15 pieces at 144.00 inches.

ALL DIMENSIONS IN INCHES



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MPI00 SERIES INSTALLATION DRAWING



