

MODEL MP46  
SHEAR CONTROLLER  
REFERENCE MANUAL

## MP46 SHEAR CONTROLLER

The Model MP46 microprocessor controller is used to control an automatic metal shearing machine. The MP46 can be used on either a 2-speed stopping line or a non-stop flying die machine. It is capable of storing up to 99 batches or sets of quantities and lengths. Also, a coil number can be assigned to each batch and the computer will tabulate the total amount of material used for that coil number. Up to 100 different coils can be retained at one time.

The operation of the machine itself is quite simple. The position of the strip of metal is sensed by an incremental shaft angle transducer which generates an exact number of pulses to the computer for an exact amount of material movement. The computer then counts the pulses and activates the shear when the programmed movement has occurred. In a two speed machine, the computer switches from fast speed to slow speed at an early warning point so that a more accurate cut can be made. In a non-stop machine, no slowdown takes place and the die is accelerated up to strip speed when the shear is made.

The MP46 is programmed using a display and keyboard similar to an electronic calculator. The display acts as a prompt for the operator by indicating what data is to be entered. The procedure for entering data is discussed in detail in a later section called ENTERING A NUMBER.

## FRONT PANEL CONTROLS

On the front panel of the MP46 there are 6 lighted pushbutton switches and a 16 key keypad. The functions of these keys are as follows:

### HALT

The HALT key is used to stop the machine from running material. The red lamp indicates that the FORWARD or REVERSE outputs are not on.

### RUN

The RUN key is used to initiate the processing of batches programed. The green lamp indicates that the FORWARD or REVERSE outputs are on.

### METRIC WHEN LIT

The METRIC WHEN LIT key is used to toggle between inch units and centimeter units. When the lamp is lit, all lengths are displayed in centimeters and all lengths entered are interpreted by the computer as being centimeters. When the lamp is off, lengths are displayed in inches and all lengths entered are interpreted by the computer as being inches. The actual measurements of the computer are in inches with resolution to the nearest 0.01 inches. When metric units are used, the metric units are converted to the nearest inch equivalent. If a roundoff does occur, the amount of the roundoff can be seen by checking the number a second time. The computer takes lengths stored in inches and converts to the nearest 0.01cm. The value displayed may be different

from what was programed by 0.01cm but it will reflect the actual length that will be used. The difference will be less than the resolution of the system.

#### MANUAL SHEAR

The MANUAL SHEAR key is used to cycle the shear output when the line is stopped. It also acts to reset the computer and startover on any partially completed part and causes a leading edge trimming shear when the line is started. The MANUAL SHEAR key need only be used when a new coil is loaded in and the computer must re-reference itself to the shear. The yellow lamp indicates that the SHEAR output is on.

#### COILS

The COILS key is used to enter the COILS REVIEW mode which allows the operator to check the length totalizers. It is also used to notify the user that a change of coils is necessary. The yellow lamp has two functions. If it is on solidly, then the COILS REVIEW mode has been entered. If the lamp is flashing, then a change of coils is necessary.

#### SLOW

The SLOW key has no function but the lamp indicates that the SLOW output is on.

#### SET UP

The SET UP key is used to enter the SET UP mode which allows the entry of machine parameters.

END

The END key is used to exit the PROGRAM, SET UP, or COILS REVIEW modes.

PRG

The PRG key is used to enter the PROGRAM mode where batch data is entered.

ENT

The ENT key is the ENTER key and it is used to terminate an entry of an item of data.

CLR

The CLR key is used to clear out a partial entry in a data item and revert back to the previous value.

The number keys and decimal point are used in entering a numerical value.

## SET UP MODE

The SET UP mode is used to enter information about the machine that the computer needs to know in order to complete its function. This data may vary from machine to machine and cannot be permanently set into the computer. However, the computer has re-chargeable batteries that maintain power to memory circuits so that this data can be retained when power is off. The batteries are automatically charged whenever the unit is on. If the batteries should discharge, then the SET UP mode will automatically be entered to force the operator to re-enter the data. The data required in the SET UP mode is as follows:

### SHEAR TIME

The SHEAR TIME is the time required for the SHEAR output to be on to complete the operation. If this time is set to zero, then a special case is entered. There is a provision for an input switch to be sensed by the computer. This switch would perform a SHEAR COMPLETE function. If the shear time is set to zero, then when a shear is required, the computer would turn the SHEAR output on until the switch is closed.

### PAUSE AFTER SHEAR

The PAUSE AFTER SHEAR parameter is the time delay after a shear that the line would be stopped. The purpose of this would be to put some spacing between parts. This function would not apply to a non-stop line.

### BATCH HALT

The BATCH HALT function is a toggle entry where any numerical key would toggle back and forth between YES and NO. The option provided is for the line to either stop at the end of a batch or continue on to the next batch.

#### LENGTH OF SLOWDOWN

The LENGTH OF SLOWDOWN parameter is the distance required to shift into slow speed before the shear point. If this parameter is set to zero, then a non-stop line is assumed.

#### ACCELERATOR LENGTH

The ACCELERATOR LENGTH is the distance before the shear that the ACCEL output is turned on. This output is used to start the die moving before the shear occurs.

#### MINIMUM LENGTH

The MINIMUM LENGTH parameter is the minimum length of part that can be run when the line is started up. If the shear were actually a large punching die, short parts may not feed out of the die properly. This parameter allows that a minimum length be specified and if a shorter piece would result, then the computer would run more material in order to avoid the short part.

#### LENGTH AT RESTART

The LENGTH AT RESTART parameter is used in flying die lines and is the distance required for the line to reach full speed from a stopped condition. Since in a non-stop line it is necessary for all shears to be made with the line moving

at same speed, the computer will, from a restart condition, feed extra material until the line has moved this amount before making a trim cut.

#### LENGTH OF SLUG

The LENGTH OF SLUG parameter is the amount of material that the shear removes from the strip when the shear occurs.

#### DIRECTION

The length transducer provides direction of flow information but it can be mounted on the machine so that for forward movement of the material, either clockwise or counter clockwise rotation of the transducer will occur. This parameter allows the operator to change the counting direction by pressing any numerical key and toggling between a zero and a one display. One of these settings will be correct for your installation.

#### CORRECTION FACTOR

The CORRECTION FACTOR is a number that is used to compensate for slight errors in the diameter of the measuring wheel. With no correction required, the value would be 1.00000. A larger number would result in larger parts and a smaller number would result in smaller parts. Refer to the section called LENGTH CALIBRATION for further details.



PROGRAM MODE

The program mode is used to enter batch data on quantities and lengths that are to be run. Information required is the batch number, the number of pieces required for the batch, the length of the parts, and the coil reference number. The programming chart for these parameters is as follows:

PARAMETER	PROMPT	UNITS	FORM	RANGE
BATCH NUMBER	BA. No.	NONE	XX	1-99
QUANTITY	Pc. N	NONE	XXXX	0-9999
LENGTH	LE. N	IN/CM	XXXX.XX	.01-9999.99
COIL NUMBER	Cc. N	NONE	XX-XXX or XXXXXX	1-999999

where N is the batch number being programmed.

When the PRG key is pressed, the computer will prompt for the batch number of the next empty batch number after the batch that is currently being run. At this point, the operator has the option of selecting a different batch number by entering that number or accepting the shown batch by pressing the ENT key. Normally, one would just continue programming batches by consecutive number. However, the operator can use the program mode to review what has been programmed previously and not yet run. He would press PRG and the starting batch number that he wishes to check. He can then step through the data by repeatedly pressing the ENT key.

Data is entered in the order shown above. If the quantity should

be zero, then the length and coil number prompts are skipped for that batch. Thus a batch can be deleted by programming the quantity to zero. If new data has been entered, the coil number will be initialized to the coil number of the previous batch. It is assumed that users would want to group jobs together that use the same coil in sequential batches in order to minimize the coil changes. By presetting the coil number to the value in the previous batch, the operator need only press ENT to enter the coil number, unless a change is required.

As shown, the coil number can be up to 6 digits. However, the operator can use the dash in the coil number to perhaps indicate the gauge and width of the coil. As an example, a 20 gauge 48 inch wide coil would be designated as 20-48. The dash is entered using the decimal point key. Only two digits above the dash and three digits below the dash can be used.

The PROGRAM MODE can be entered while the machine is running out previously programmed batches. This allows the operator to enter a few batches and then start the machine processing them. While those batches are being run, he may re-enter the PROGRAM MODE and key in additional batches.

## COILS REVIEW MODE

The total length used of up to 100 different coils is kept by the computer of the MP46. This information can be reviewed by the operator by pressing the COILS switch on the front panel. The display will show the coil number of the first coil used on the left side of the display. If this is the coil desired, press the ENT key. If not, then enter the desired coil number. The display will then show the coil number on the right side of the display and the total footage used on the left side. The units used are feet in the inch mode and meters in the metric mode. The operator can continue pressing ENT and reviewing all of the programmed coils or he can exit the COILS REVIEW MODE by pressing the END key. The only modification that the operator can do to this information is to clear one of the accumulators by pressing the CLR key when the total length is shown. This would be done when the coil has been completely depleted and is to be removed from the MP46 controller.

In the computer there is a CURRENT LENGTH COUNTER which indicates the amount of material since the last RESET occurred and it is continually updated as the material is moved. The computer does not store this length in a coil accumulator until a reset occurs. When the current coil is reviewed, the previously stored amount is added to the CURRENT LENGTH COUNTER and displayed. If the coil in use is cleared, only the previously stored amount is cleared. Thus the display would continue to show the CURRENT LENGTH COUNTER amount.

## RUN MODE

When data has been programed, the parts can be fabricated by entering the RUN mode. This is done by pressing the RUN key. The display will show:

StArt bAtch N

where N is the next higher programed batch number above the previous batch run. If this is the batch desired, then press RUN a second time. The machine will then start up and run out those parts. If a different batch is desired, then key in that batch number and press RUN.

There is a condition called a RESET condition in the computer when a special sequence of operation takes place. If a RESET condition exists, then the machine will feed out a length of material equal to the LENGTH OF RESTART or MINIMUM LENGTH dimensions (depending on which value is greater) and then cycle the shear. This shear is a leading edge trim cut and is not counted as a part. The conditions for a RESET condition are as follows:

1. When the MP46 is turned on.
2. When the SHEET DETECTOR switch opens indicating a change of the coil.
3. When the MANUAL SHEAR has been cycled.
4. When the length of part to be run is less than the current length counter (for example, trying to run a 10 inch part with 20 inches out past the shear).

While the machine is running out parts, more parts can be

programed by the operator. Also, a different batch can be selected while it is running by pressing the RUN key and entering a new batch number. The computer will decide whether the current part being run can be the new part length or must remain the old length. In either case, only complete parts will be made and no parts will be lost in the process.

In the SET UP mode a parameter called BATCH HALT is provided so that the operator has the option of either halting the line after each batch or only halting when all parts programed are completed or a change of coils is required. The option would depend on the the users capacity of handling the resultant part production.

In the RUN mode the display will show:

5 25 23.34

which indicates that batch number 5 is running or is next to run, there are 25 pieces remaining in batch 5, and the amount of material out past the shear is 23.34 inches or centimeters.

## OPERATING PROCEDURES

### PROGRAMING A BATCH

1. Press PRG key
2. If batch number shown is correct, press ENT. If not, enter correct batch number.
3. Enter the number of pieces required.
4. Enter the length required.
5. If the coil number is the same as shown, then press ENT. If not then enter the coil number.
6. If more sequencial batches are to be entered then go back to step 2. If not press END.

### DELETING A BATCH

1. Press PRG key
2. Enter batch number to be deleted.
3. Enter zero pieces.
4. Press END key.

### CHANGING DATA IN A BATCH

1. Press PRG key.
2. Enter batch number to be changed.
3. If quantity is to be changed, then enter new quantity.

If not press ENT.

4. If length is to be changed, then enter new length. If not then press ENT.
5. Change coil number.

#### RUNNING A BATCH

1. Press the RUN key.
2. If batch number shown is correct then press RUN key a second time. If not then key in correct batch number and press RUN.

#### CHANGING COILS

1. Remove the old coil and load in the new coil so that good material is under the shear. This toggles the sheet detect input and informs the computer to begin accumulation on a new coil.

#### READING A COIL LENGTH ACCUMULATOR

1. Press the COILS switch.
2. If the coil number shown is correct then press ENT. If not then enter the correct number.
3. The current total amount of material used should be shown on the right side of the display.
4. Press the END key.

#### CLEARING A COIL ACCUMULATOR

1. Press the MANUAL SHEAR key.
2. Press the COILS key.
3. If the coil number shown is correct then press ENT. If not then enter the correct number.
4. Press the CLR key. Accumulator is now cleared.
5. Press the END key.



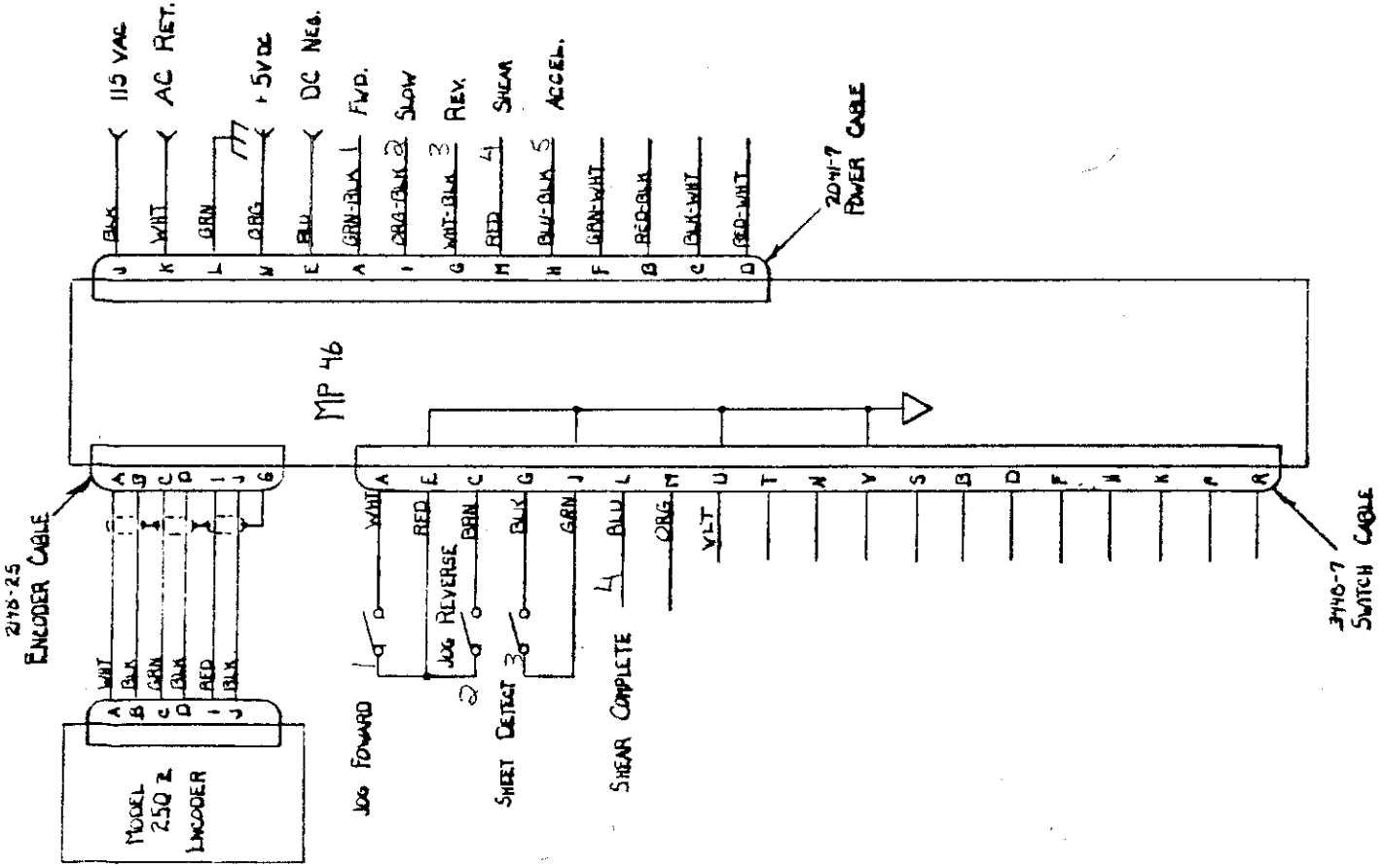
## ERROR MESSAGES

The following error numbers may appear if the operator makes a mistake. Press the CLR key to remove the error.

- Error 0      Error in range of Correction Factor (.50000-1.50000)
  
- Error 1      Length of zero programed
  
- Error 2      In COILS REVIEW mode, selected coil number not found
  
- Error 3      No batches to run when RUN switch pressed.
  
- Error 4      Selected batch to be run is empty

MP46 SET UP REFERENCE CHART

PARAMETER	PROMPT	VALUE	UNITS	FORMAT	RANGE
SHEAR TIME	SH. SEC.	____.____	SECONDS	XX.XX	0-99.99
PAUSE TIME	SH. PAU.	____.____	SECONDS	XX.XX	0-99.99
BATCH HALT	bA. HALt	_____	NONE		YES OR NO
SLOW LENGTH	LE. SLO	____.____	IN/CM	XXX.XX	0-999.99
ACCELERATOR	ACCEL.	____.____	IN/CM	XXX.XX	0-999.99
MINIMUM LEN.	LEAST	____.____	IN/CM	XXX.XX	0-999.99
RESTART LEN.	START	____.____	IN/CM	XXX.XX	0-999.99
SLUG WIDTH	LE. SLU.	____.____	IN/CM	XXX.XX	0-999.99
DIRECTION	dirEction	_____	NONE		0 OR 1
CORRECTION	Corr.	____.____	NONE	X.XXXXX	0.5-1.5



**NOTES.**  
 \* OPTIONAL INPUT, NOT WARED IN  
 \*\* WIRING HARNESS PROVIDED.

ENGEL SHEAR

REVISIONS		DATE		BY	
1	5-21-84	PKL			
2	10-15-84	PKL			
3					
4					
5					

APPLIED MICROSYSTEMS INC.	
MACHINE INTERFACE	
MP 46	
MP 46	