AMS APPLIED MICROSYSTEMS

MP57

CONTROLLER

REFERENCE MANUAL

INTRODUCTION

The Model MP57 Controller is a special purpose computer designed to control a non-stop sheet metal processing machine. The machine converts stock sheet material into parts with 2 possible punches and 20 possible holes. The MP57 allows the customer the ability to make right-hand or left-hand orientated parts separately or simultaneously.

The controller itself is designed to make it easy for the operator to program. The operator only has to enter the type of part desired, the finished length and the desired hole and punch spacing. The computer then calculates the required offsets and patterns based on this information and some internal dimensional constants.

The operation of the machine itself is straight forward. The position of the strip of metal is sensed by a photo sensor and 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 outputs when the programmed movement has occured.

The MP57 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.

The MP57 hardware consists of the following elements: an LED display, a 16 key keypad, 6 illuminated pushbutton switches, five external input switches, a rotopulser and 5 output lines. The layout of the keypad, pushbuttons and LED display are shown in Figure 1.
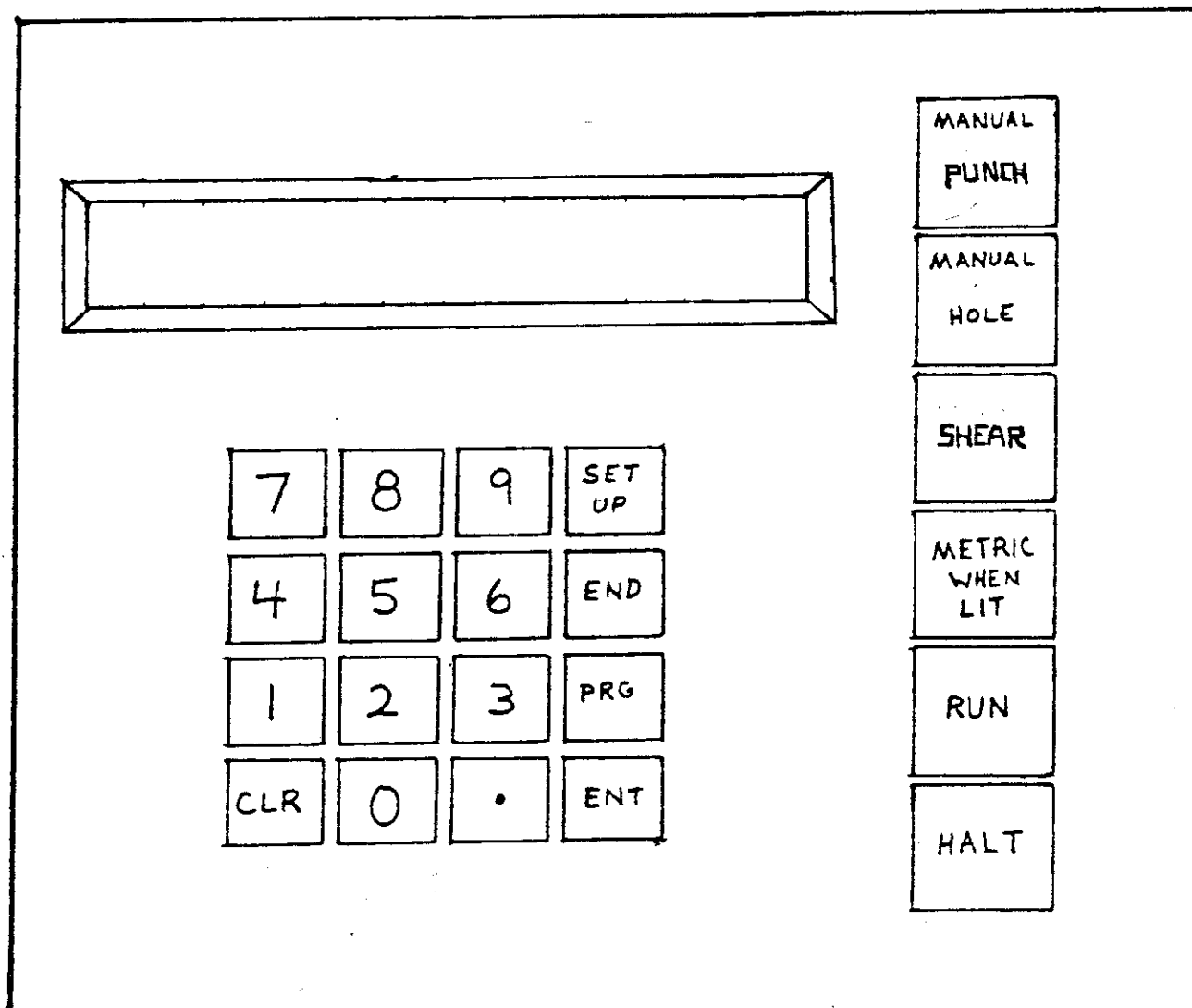
Figure 1. MP57 Front Panel

DISPLAY

The display on the front panel is a 12 character, 7-segment LED display that is used to show data and prompt the operator for information.

KEYPAD

The function of each key is as follows:

SETUP

The SETUP key is used to enter the SETUP mode. The SETUP mode is used to enter semi-permanent data about the machine such as the die spacing, cycle duration, die size, flow direction, etc....

END

The END key is used to exit the PROGRAM or SETUP mode and return to the HALT or RUN mode display.

PRG

The PRG key is used to enter the PROGRAM mode to enter batch data on the parts to be run.

ENT

The ENT key is the data ENTER key and it is used by the operator to indicate to the computer to take the data that is present in the display window.

CLR

The CLR key is the data CLEAR key and is used to erase a key entry before the ENTER key.

PUSHBUTTON SWITCHES

The function of each illuminated pushbutton switch is as follows:

MANUAL PUNCH

The MANUAL PUNCH pushbutton switch is used to manually cycle the PUNCH output when the line is in the HALT mode. The lamp indicates when the PUNCH output is on in both the HALT and RUN modes.

MANUAL HOLE

The MANUAL HOLE pushbutton is used to manually cycle the HOLE output when the line is in the HALT mode. The lamp indicates when the HOLE output is on in both the HALT and RUN modes.

MANUAL SHEAR

The MANUAL SHEAR pushbutton is used to reset the system, but does not fire the shear punch. A system reset is needed after setup or batch parameters are changed to put the changes into effect. The lamp does indicate when the shear is being activated in the RUN mode. See the section titled 'RUN MODE' for more information on the RESET condition.

METRIC WHEN LIT

The METRIC WHEN LIT pushbutton is used to switch between metric and English units of measurements. When the lamp is lit, data is entered and displayed in centimeters. When the lamp is not lit, the data is displayed and entered in inches.

RUN

The RUN pushbutton is used to initiate an automatic run of the machine. The green lamp indicates when the controller is in the RUN mode.

HALT

The HALT pushbutton is used to abort an automatic run of the
machine. The red lamp indicates that the controller is in the
HALT mode.

EXTERNAL SWITCHES

There are five external input switches into the MPS7. The function of
each is explained below.

JOG FORWARD

The JOG FORWARD input switch is used to jog the metal in the
forward direction. It is not functional in the RUN mode and will
be ignored if the MPS7 is currently running.

JOG REVERSE

The JOG REVERSE input switch is used to jog the metal in the
reverse direction. It in not functional in the RUN mode and will
be ignored if the MPS7 is currently running.

REMOTE RUN

The REMOTE RUN switch serves the same function as the RUN
pushbutton on the front panel. From a reset condition, the
switch has to be closed twice to initiate a run. Once the RUN
mode is entered the switch need not remain closed.

REMOTE HALT

The REMOTE HALT switch serves the same function as the HALT
pushbutton on the front panel. If the MPS7 detects a REMOTE HALT
switch closure while it is in the RUN mode, the MPS7 will enter
the HALT state. A closure of the switch must be detected, a
closed HALT switch as the RUN mode is entered has no effect.

MOTOR STARTER

The MOTOR STARTER input is used by the MP57 to insure that the systems motor has been engaged before performing any operation. This input must be closed for the MP57 to begin a batch and must remain closed throughout the run. If the MOTOR STARTER input opens during a run the MP57 will enter the HALT mode and cannot be run again until the input is closed.

ROTOPULSER

Material movement is sensed by the MP57 through the rotopulser (rotary pulse generator) which is an incremental optical shaft angle encoder. This device generates a precise number of pulses for each revolution of its shaft. On the shaft is a precision measuring wheel which rides on the material. As the material moves through the machine, it turns this wheel and thus causes the rotopulser to generate pulses. The computer counts these pulses and by knowing the counts per revolution of the rotopulser and the circumference of the wheel, the computer can detect the amount of material that has moved through the machine.

OUTPUT LINES

The MP57 has 5 outputs. These are 5 ampere, open collector transistors that switch load current to the DC ground. The function of each is as follows:

FWD

The FWD output is used to turn the machine drive rolls in the forward direction. This output stays on throughout the the run and while jogging.

REV

The REV output is used to turn the machine drive rolls in the reverse direction.

SHEAR

The SHEAR output is used to engage the shear.

HOLE

The HOLE output is used to engage the hole punch.

PUNCH

The PUNCH output is used to engage the punch.

The control of all of the above mentioned hardware is provided by a microprocessor and its associated memory components. The operating program of the computer is contained in read-only-memory (ROM). User data, such as setup parameters and batch data, is contained in random-access-memory (RAM) that normally would not retain the information when power is off except that there is a rechargable ni-cad battery in the unit that provides power to the RAMs when the unit is shut off. This battery is constantly charged when the unit is in operation.

MODES OF OPERATION

There are five modes of operation in the MP57: SETUP, PROGRAM, RUN, HALT, and ERROR. It is possible to be in two modes at the same time. This will become clearer upon explanation of the two "types" of modes. One type can be called the display mode, and the other can be called the machine mode. The display modes are SETUP, PROGRAM, RUN, or HALT. This refers to what the computer is showing on the display and what keys it will respond to. The machine modes are RUN and HALT and they refer to what the machine is doing. The ERROR mode can be entered from either type of mode depending on the nature of the error. By making this distinction between the two types of modes, an operator can, for example, put the machine in the RUN mode and then put the display in the PROGRAM mode and thus program new data while previously programmed batches are being run.

SETUP MODE

The SETUP mode is used to enter machine parameters and some seldom changed part parameters. The mode is entered by pressing the SETUP key and is exited by pressing the END key or by stepping through all of the parameters. Figure 2 and Figure 3 provide a physical picture of the paramaters. Table 1 shows a table of these parameters with the prompts used and the range of allowed values. A place to write in the proper values for your machine is provided. The setup parameters and their function in the machine are as follows:

ACCUMULATOR

The ACCUMULATOR prompt indicates the total amount of material that has passed through the machine since the accumulator was last cleared. The operator can only clear this amount to zero

using the CLR key and he cannot set it to a number.

HOLE PUNCH TO SHEAR DISTANCE

The HOLE PUNCH TO SHEAR DISTANCE is the distance from the center of the hole punch die to the center of the shear die.

PUNCH TO SHEAR DISTANCE

The PUNCH TO SHEAR DISTANCE is the distance from the center of the punch die to the center to the shear die.

SHEAR TIME

The SHEAR TIME parameter sets the time duration for the shear press cycle.

HOLE TIME

The HOLE TIME parameter sets the time duration for the HOLE press cycle.

PUNCH TIME

The PUNCH TIME parameter sets the time duration for the HOLE and the PUNCH press cycle.

BATCH HALT

The BATCH HALT function allows the operator to select either an automatic return to the HALT mode after each batch is run or a continuing run of the next batch. In either case the next batch may have been started by the machine with partial pattern being produced but no complete parts will have been made if the BATCH HALT is set to YES. This may be required in some installations to allow for packaging of the previous batch or for a required change of some downstream machinery because of a dimensional change in the parts being run.

CORRECTION FACTOR

The CORRECTION FACTOR is a constant that allows for the correction of the length of a part due to wear of the measuring

wheel.

MINIMUM LENGTH

The MINIMUM LENGTH parameter allows for a limit to be set for the smallest part that can be run through the machine. This may be necessary because a short part may become jammed in the machine.

START LENGTH

The START LENGTH is the distance required to get a line up to speed before a press operation can take place.

SLUG LENGTH

The SLUG LENGTH is the width of the slug that the shear may remove when it is cycled. This is automatically added to each part run with half being added to the front edge and half added to the rear edge.

DIRECTION

In different machines, the rotopulser can be mounted so that forward motion for the material can produce either an up or a down count in the computer depending on whether the shaft turns clockwise or counterclockwise. The DIRECTION parameter allows for an easy direction change.

MEMORY RESET OPTION

The memory reset option, or FRESH, allows the operator to clear all setup and batch parameters by entering the code '1984'. If this code is entered, all batch and setup parameters will have to be re-entered before operation can resume.

SETUP DATA SHEET

PARAMETER	PROMPT		RANGE
LENGTH TOTALIZER	Accu.	_ _ _ _ _	0-999.99 IN
HOLE TO SHEAR DIST.	LE. S-H	_ _ _ _ _	0-999.99 IN
PUNCH TO SHEAR DIST.	LE. S-P	_ _ _ _ _	0-999.99 IN
SHEAR TIME	SH. SEC	_ _ _ _ _	0-99.99 SEC
HOLE TIME	H1. SEC	_ _ _ _ _	0-99.99 SEC
PUNCH TIME	P1. SEC	_ _ _ _ _	0-99.99 SEC
BATCH HALT	BA. HALT	_ _ _ _ _	YES/NO
CORRECTION FACTOR	Corr	_ _ _ _ _	.20-5.00000
MINIMUM LENGTH	LEAST	_ _ _ _ _	0-999.99 IN
START LENGTH	START	_ _ _ _ _	0-999.99 IN
SLUG LENGTH	LE. SLU	_ _ _ _ _	0-999.99 IN
DIRECTION	dirEction	_ _ _ _ _	0/1
MEMORY RESET	FRESH	_ _ _ _ _	1984

Table 1. Setup Mode Data

SLUG

LE S-H

LE S-P

SHEAR   PUNCH   HOLE
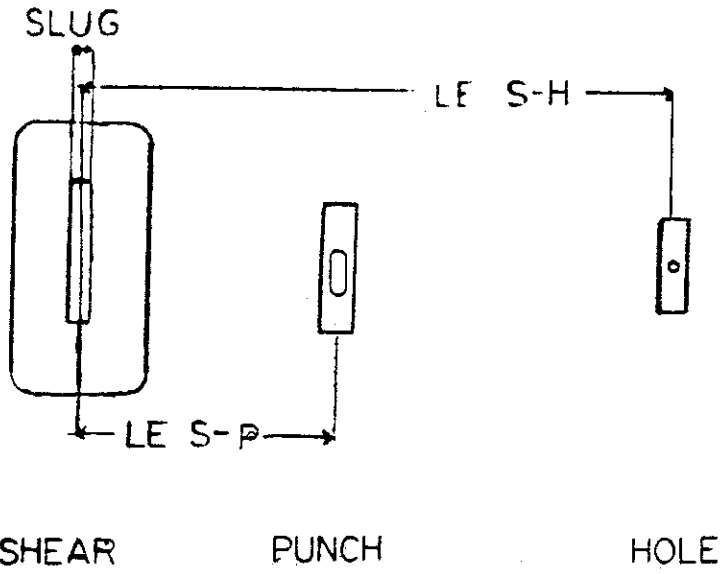
Figure 2. Machine Layout

OUTPUT

RIGHT

H3
H2
P2
H1
P1
LA

LEFT

LA
H3
H2
P2
H1
P1

BOTH

LA
H3
H2
P2
H1
P1

R

LA
H3
H2
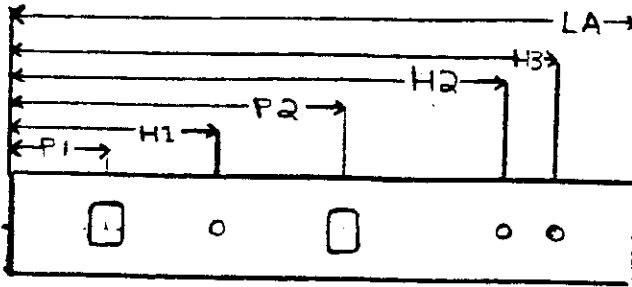P2
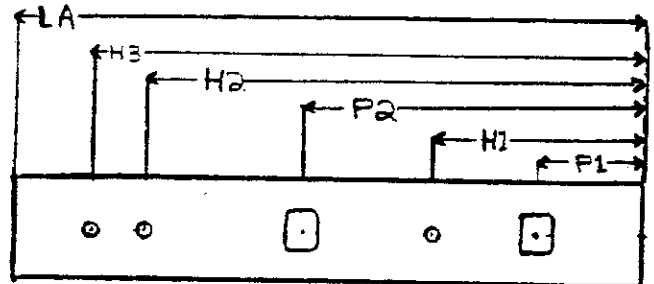H1
P1
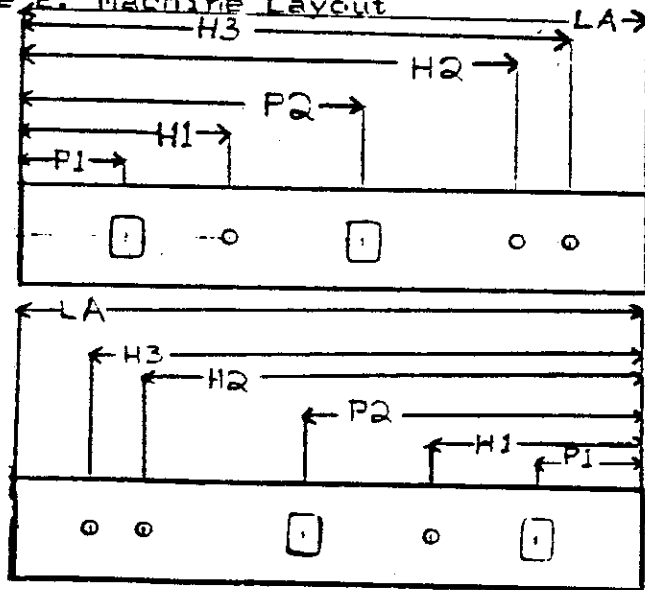
L

Figure 3. Sample Part

PROGRAM MODE

The PROGRAM mode is used to enter batch information on the type of part to run.

The PROGRAM mode is entered by pressing the PRG key and is exited by pressing the END key. The first entry required is the batch number. It is initially set to the first empty batch number after the batch that is currently being run. If you are running batch 1, and batches 2 through 10 have been programed, then it will begin with batch 11. If this is the batch desired, then press the ENT key. If another batch is desired, enter that number. The display will then prompt for the TYPE, which can be from 1 to 4. The display will then go through a sequence of prompts, asking for the data required for each particular type. See Table 2 below for the possible types.

TYPE	HOLE	PUNCH
1	NO	NO
2	NO	YES
3	YES	NO
4	YES	YES

Table 2. Pattern Types

After a type is selected, the operator is asked for the number of pieces desired. If a zero quantity is entered, the batch will be deleted and the next batch will be ready to program. With a non-zero quantity entered, the operator will then be prompted for the finished

length of the part. Once the operator has entered the length, the MPS7 will request the type of part output: right, left, or both. A description of each is below:

RIGHT

Hole and punch locations are calculated from the leading edge of the part.

LEFT

Hole and punch locations are calculated from the trailing edge of the part.

BOTH

This type of layout is used in an application when a number of right and left hand parts are needed. This layout actually produces 2 pieces, a left and a right, that serve as a set and are therefore counted as 1 part. If a quantity of 10 is specified and an output of BOTH is chosen, 10 left hand and 10 right hand parts are produced. (Left and right parts produced alternately).

With the output type chosen, the operator will then be asked to supply the locations of any punches(P1-P2) and holes(H1-H20); depending on the previous type selected(1-4). An entry of zero terminates that batch entry and the next batch will be ready to program. For example, if only 2 holes need to be programed, entering 0 on H3 terminates that batch entry.

RUN MODE

The RUN mode is used to actually produce the parts. The mode is entered by pressing the RUN key and is exited by pressing the HALT key. Pressing the RUN key enables the computer to cycle the appropriate outputs when the programed length is encountered.

There are two conditions in which the RUN mode can be entered. The first is the RESET condition which means that the computer will begin processing the material from the furthest required press and that the material from that point to the shear will be scrapped. The second condition is the NON-RESET condition which means that the computer will pick up from where it last left off and no scrap will be generated.

If in the RESET condition, the display will prompt for a batch number to be run. If a different batch is desired enter the new number and the run will begin. If in the NON-RESET condition, no prompt will be given and the line will continue normally.

The RESET condition occurs under the following conditions:

1. From the first time the unit is turned on.

2. When any manual cycle of a press occurs or the SHEAR button is pushed.

3. When all programed parts have been run.

4. When the length counter is greater than the next shear length.

Once set running, batches will be run in numerical order provided that they are programed. The programed batches are searched for in ascending order until batch 50 is reached. Then the search is begun

over starting at batch 1.

When the computer starts into the RUN mode, it sets up all of the operations that are required from a point 24 inches before the longest press distance. These operations are placed in memory in a place called the work stack. Since memory in the computer is not infinite, there is a finite number of operations that can be placed in the work stack. This finite number is 200. This means that for a large machine there could be many parts between the shear and the furthest press. If the number of operation in these parts time the number of parts between these points exceeds 200 then an Error 9 will occur. While in the RUN mode three numbers will be seen on the LED display. The number on the left side of the display indicates the batch currently being run. The number in the middle of the display indicates the number of pieces remaining to be run for that batch. The number on the right side indicates the current position.

ERROR MODE

The MP57 computer can detect certain operational errors and it displays a message that shows 'Error N' where N is the error number. The MP57 will only respond to the CLR key in order to clear the error message. The description of each error is as follows:
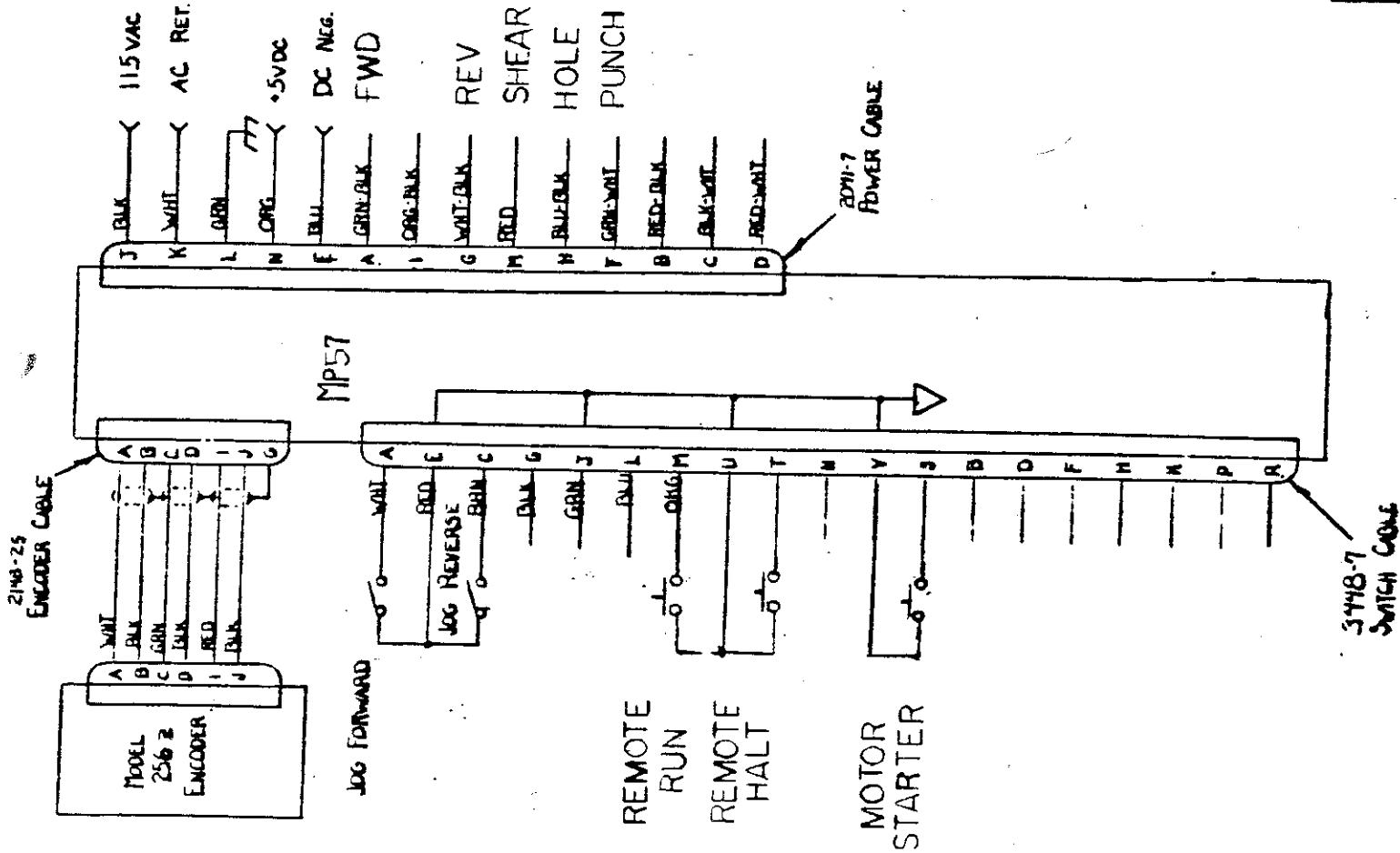
Error 0	Number entered is out of range
Error 1	Zero entry is not allowed
Error 6	Type number error
Error 9	More than 200 operations in work stack

SPECIFICATION

Resolution	.012 in. with 12 in. wheel
Accuracy	Output turned on within 1 count (does not include errors of the machine)
Maximum Line Speed	200 FPM
Maximum Length Part	9999.99 inches
Pattern Types	4 (1-4)
Input Power	115 VAC +/-10%, 50-60 Hz, 1 Amp max, 5-24 VDC, 1 amp (excluding loads)
Outputs	5(FWD, REV, SHR, HOLE, PUNCH)
Inputs	5(JOG FWD, JOG REV, RUN, HALT, M.S)
Physical Size	6 in. X 9 in. X 10 in. with a 1 in. flange on the front panel
Weight	13 pounds

BATCH DATA SHEET

PARAMETER	PROMPT		RANGE
PART TYPE	type	_____	1-4
QUANTITY	pc.	_____	0-9999
LENGTH	LA.	_____	1-9999.99
OUTPUT TYPE	Out	_____	LEFT/RIGHT/BOTH
PUNCH LOCATION 1	P1	_____	1-length of part
PUNCH LOCATION 2	P2	_____	1-length of part
HOLE LOCATION 1	H1	_____	1-length of part
HOLE LOCATION 2	H2	_____	1-length of part
HOLE LOCATION 3	H3	_____	1-length of part
HOLE LOCATION 4	H4	_____	1-length of part
HOLE LOCATION 5	H5	_____	1-length of part
HOLE LOCATION 6	H6	_____	1-length of part
HOLE LOCATION 7	H7	_____	1-length of part
HOLE LOCATION 8	H8	_____	1-length of part
HOLE LOCATION 9	H9	_____	1-length of part
HOLE LOCATION 10	H10	_____	1-length of part
HOLE LOCATION 11	H11	_____	1-length of part
HOLE LOCATION 12	H12	_____	1-length of part
HOLE LOCATION 13	H13	_____	1-length of part
HOLE LOCATION 14	H14	_____	1-length of part
HOLE LOCATION 15	H15	_____	1-length of part
HOLE LOCATION 16	H16	_____	1-length of part
HOLE LOCATION 17	H17	_____	1-length of part
HOLE LOCATION 18	H18	_____	1-length of part
HOLE LOCATION 19	H19	_____	1-length of part
HOLE LOCATION 20	H20	_____	1-length of part

STD. CONNECT

APPLIED MICROSYSTEMS INC.

MACHINE INTERFACE MP57

NOTES:
* OPTIONAL INPUT, NOT WIRED IN WIRING HARNESS PROVIDED.

115 VAC
AC RET.
+5 VDC
DC NEG.
FWD
REV
SHEAR
HOLE
PUNCH

BLK — J
WHT — K
GRN — L
ORG — N
BLU — E
GRN-BLK — A
ORG-BLK — I
WHT-BLK — G
RED — M
BLU-BLK — H
GRN-WHT — V
RED-BLK — B
BLK-WHT — C
RED-WHT — D

20141-7 POWER CABLE

MP57

2140-25 ENCODER CABLE

A — WHT
B — BLK
C — GRN
D — BRN
I — RED
J — BLK

MODEL 2562 ENCODER

A WHT
B BLK
C GRN
D BRN
I RED
J BLK

JOG FORWARD

A — WHT
E — RED
C — BRN
G — BLK
J — GRN
L — BLU
M — ORG
U
T
N
Y
J
B
D
F
H
K
P
R

JOG REVERSE

REMOTE RUN

REMOTE HALT

MOTOR STARTER

3448-7 SWITCH CABLE