# MP100 SERIES LENGTH CONTROL SYSTEMS

MODEL MP101

SHEAR CONTROLLER

REFERENCE MANUAL

(20 BATCH VERSION)

V. 2.XX

AMS APPLIED MICROSYSTEMS
ST. LOUIS, MISSOURI

# MODEL MP101
# SHEAR CONTROLLER

The MP101 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 MP101's capabilities and ease of use make this an ideal retrofit which will enable your operation to realize increased production and efficiency.

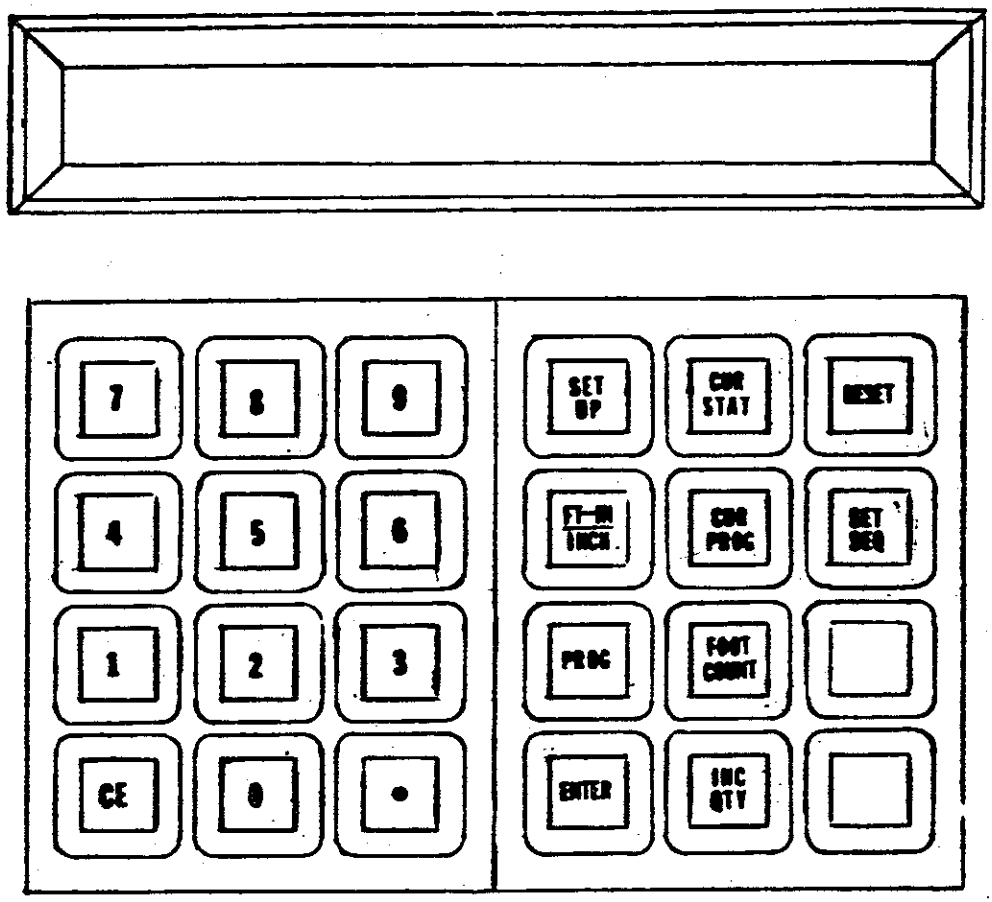
This controller is contained in a rugged industrial enclosure utilizing military-type connectors to maximize reliability and ensure trouble free operation.

The MP101 provides the following features:

- -Ability to program up to 20 batches specifying quantity and length
- -Length Totalizer
- -Ability to enter a correction factor for precise lengths
- -Both decimal inch and feet, inch, 32nd units
- -Capable of operating on a wide variety of coil processing equipment
- -Ability to program batches while previously programmed batches are being fabricated
- -Selectable batch control
- -Ability to increment the quantity of the batch being run
- -Battery back up for data retention during power loss
- -Ability to program a pause time between batches
- -Setup lockout capability for program security

APPLIED MICROSYSTEMS, INC.
9410 Aero Space Drive
St. Louis, MO 63134
(314) 429-4009

ALTERNATE UNITS




MODEL MP101

FRONT PANEL LAYOUT

## FRONT PANEL COMPONENTS AND DESCRIPTION

The Model MP101 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 inches or feet, inch, 32nd (when lit) mode of operation.

### KEYPADS

The keys provide the functions as listed below:

| | |
|---|---|
| SET UP | Programs initial set-up parameters |
| CUR STAT | Displays current batch status |
| RESET | Forces the line to reset and restart batch |
| FT-IN/INCH | Switches between decimal inches and feet, inch, 32nd mode |
| CUR PROG | Displays original batch values programmed |
| SET SEQ | Programs batch sequence execution |
| PROG | Programs batch parameters |
| FOOT COUNT | Displays total length of good material run |
| ENTER | Stores values entered in programming mode |
| INC QTY | Adds one to the current quantity of the batch in process |
| CE | Clear key - restores original value |

### 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 | Not Used |
| LED 5 | Shear |
| LED 6 | Forward |
| LED 7 | Run |
| LED 8 | Reset (Auto Crop will occur on start-up when flashing) |

## PROGRAMMING

The three programming modes are Setup, Program, and Set Sequence. These modes can be entered by depressing the 'SET UP', 'PROG', and 'SET SEQ' keys. Note that the Setup and Sequence modes control operational functions of the system. Changing these values when the line is running would cause unpredictable operation. For this reason, these modes can only be entered when the line is halted.

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 'ENTER' key stores the value shown in the display and proceedes 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. If too many digits are programmed an error message is produced. Zero's are added in 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 Program mode is entered. If the data retention test passes, the Program mode is entered directly.

Pressing the 'FT-IN/INCH' key will cycle from decimal inches to the feet, inch, 32nd mode. The LED to the left of the display will be illuminated when in the feet, inch mode. When in the feet, inch mode all lengths programmed and displayed will show feet followed by a decimal point and then inches followed by a second decimal point and then 32nds of an inch.

## SETUP MODE

The following values are programmed in the order shown below.

| DISPLAY | FUNCTION |
|---|---|
| SH. 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. |
| SH. PAU. | Pause time after a shear cycle until the line restarts. 0.00 to 99.99 seconds. Used only on slowdown-stop type lines. |
| bA. PAU. | Pause time between batches. 0.00 to 99.99 seconds. If not set to zero the run output turns off and the line halts between batches. A run switch must be closed to restart the line. |
| LE SLO | Length to run in slow. Set to zero to make a flying cutoff line. 0.00 to 99.99 decimal inches or 0 to 9 feet 11 and 31/32 inches. |
| LE Scr | Length of scrap upon restart. Defines a minimum length to be run to insure the line is at full speed. 0.00 to 99.99 inches or 0 to 9 feet 11 and 31/32 inches. |
| LE Slu | Length of slug removed by shear. 0.00 to 99.99 decimal inches or 9 feet 11 and 31/32 inches. |
| Corr | Correction factor. 0.50000 to 1.50000. (See page 11 for additional information) |
| Accu | Total length counter. 0 to 999999 feet. |
| dIrECtION | Direction flag (1 or 0) for CW/CCW rotation of the encoder. |

(See page 12 for a form to record the setup parameters of your equipment.)

## PROGRAM MODE

There are 20 batches which can be programmed. To programm a batch a batch number, quantity, and length are entered.

| DISPLAY | FUNCTION |
|---|---|
| bA. No. | Number of batch to be programmed. 0 to 20. If zero is entered then an exit from the program mode is done. After batch 20 is programmed an exit is automatically done. The batch number is automatically incremented after each batch is programmed. |
| PC. XX | Number of pieces to be run for batch number XX. 0 to 9999. If set to zero the batch is skipped. |
| LE. XX | Length of part for batch number XX. 0.01 to 999.99 decimal inches or 1/32 inch to 99 feet 11 and 31/32 inches. |

## 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. Pressing the `INC QTY` key will add one to the current quantity of the batch in process. This key can be used at any time and in any mode. When using the key the Current Status mode is entered as described above. This key does not change the original quantity shown under the Current Program mode.

## RESET

Pressing the reset key while halted will force the line to reset and restart when the Run mode is entered.

## SEQUENCE MODE

To enter the Sequence programming mode press the 'SET SEQ' key. This allows a range of batch numbers to be programmed. If both numbers are the same then only one batch will be run. When entering the run mode the first batch number entered will be run first. All batches from first to last will be run until all quantities are zero. When entering the Sequence mode, the display will show:

FI.-LA. ff-ll

where ff indicates the first batch number from 1 to 20 and
ll indicates the last batch number from 1 to 20 to be run.

If no numbers have been entered then hitting a clear will exit the Sequence mode. To program the first number, enter the one or two digit batch number desired. If only one digit has been entered press the '.' key to get a '-', indicating end of programming of the first batch number. Then continue by programming one or two digits for the second batch number. If a clear key is pressed after the numbers are being entered then a restart of the programming sequence is done. Press the enter key to save the numbers and exit the mode. If the first batch number is larger than the last, the sequence will run from the first batch number entered up to batch number 20, then from batch 1 to the last batch number entered. For example, if 19-3 was programmed then the sequence would be 19, 20, 1, 2 and 3. If the Set Sequence mode is entered the unit will start running at the first number of the sequence. If this mode is not entered, the unit will start running at the batch that it was working on when it was halted.

## ERROR MESSAGES

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

Error X

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

1 Correction factor not in the range of 0.50000 to 1.50000
2 Batch number not in the range of 1 to 20
3 Not used
4 Too many numbers entered
5 Too many decimal points entered
6 Zero length is not allowed
7 A run was attempted with all batches at zero quantity
8 Setup key was depressed when locked out

## STATUS KEYS

The three status keys are CUR STAT, CUR PROG, and FOOT COUNT. Pressing one of the keys sets the mode to display the information relating to each key. If not in a program mode the display will be continous until another status or program key is entered. If in a program mode the information will be displayed for about 3 seconds and then the programming information will be redisplayed.

CUR STAT displays information about the current status of the batch being run. The information displayed from left to right is batch number currently being run, quantity remaining in batch, and current length run since 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 -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 batch number and quantity and between quantity and length. In order to insure this, one or two decimal digits for the length may not be displayed in some cases.

CUR PROG displays information about the original values of the batch being run. From left to right the display shows current batch number, original quantity and total length of part to be run. As described above the number of digits displayed could be 11 or 12. Unlike the above mode it may not be desirable to shift the decimal digits off of the display. Therefore, the data is packed together with the space between the batch number and quantity eliminated first.

FOOT COUNT displays the total length of "good" material run since it was last cleared. The total length counter only counts material that has been sheared off by the processor and considered a valid part. It does not count any material run as scrap, any material removed by the operator by a manual crop while running or any material in front of the shear when starting up after a RESET has been done.

## EXTERNAL INPUTS

When the SETUP LOCKOUT contact is closed (by grounding pin T of connector J3 via a switch) the setup mode cannot be entered. Instead an error message is displayed.

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

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

When the RUN/HALT switch is closed the run mode is entered if the following conditions are met. The operator cannot be in any of the three programming modes. The jog inputs must be off and the shear output must be off. At least one of the batches in the range programmed must have a non zero quantity. If all of the conditions are met, a run is started. If the reset key has been depressed the line will restart at the first non zero batch programmed. If not reset a test is done. If the length of the part plus the slug length is less than the current counter length plus the scrap length then an automatic reset is done. Otherwise the line restarts at the point it was halted. The line will continue to run until all batches 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:

- Fast Forward
- Slow Forward
- Run
- Shear

J3 (Switch/Input Cable 3311-7) handles the following inputs:

- Manual Shear
- Shear Complete
- Run
- Setup Lockout

## OPERATING CONSIDERATIONS

At the end of a run the controller will turn all outputs off and wait for the run switch to open. If the run switch is left closed the controller will not accept any keyboard inputs until the run switch is opened.

There are limitations on programming the batch that currently is being run. The quantity that is being run cannot be changed. This is not allowed because of the difficulty in trying to program an accurate number while shearing is going on. The length can be changed, but the new length will not be used until the current part is finished.

The RESET LED will flash on and off whenever a crop will automatically be done when the line is restarted. This will flash if the shear point is within the current length minus the scrap length. If the line is reversed past this point the LED will quit flashing and crop will not be done. If the reset key is depressed or when the controller is first powered up the line will always do an auto-crop.

# DETERMINING THE PROPER CORRECTION FACTOR

The following describes how to determine the Correction Factor to enter in the setup mode of operation:
First determine the resolution with the following formula:
  Encoder Wheel Circumference/(Encoder Line Count x 4)=Resolution
Then determine the Correction Factor as follows:
  .01/Resolution = Correction Factor

For example, given a wheel circumference of 12" and an encoder with a line count of 256, the Correction Factor is figured:
  12/(256 x 4) = 12/1024 = .012 Resolution
  Then .01/.012 Resolution = .83333 Correction Factor
  (Remember the Correction Factor can be from .50000 to 1.50000)

To further fine-tune your line 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 manufacture'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:
  New Correction Factor = Old Correction Factor x (PL/AL)
    Where PL is the programmed length
      and AL is the actual measured length
For example, with the old Correction Factor at .83333, a 100 inch part was programmed with the result being a 100.25 inch part being produced. The new Correction Factor would be:
  New Correction Factor = .83333 x (100/100.25)
                        = .83333 x .99751
                        = .83126
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 MP101

SETUP DATA

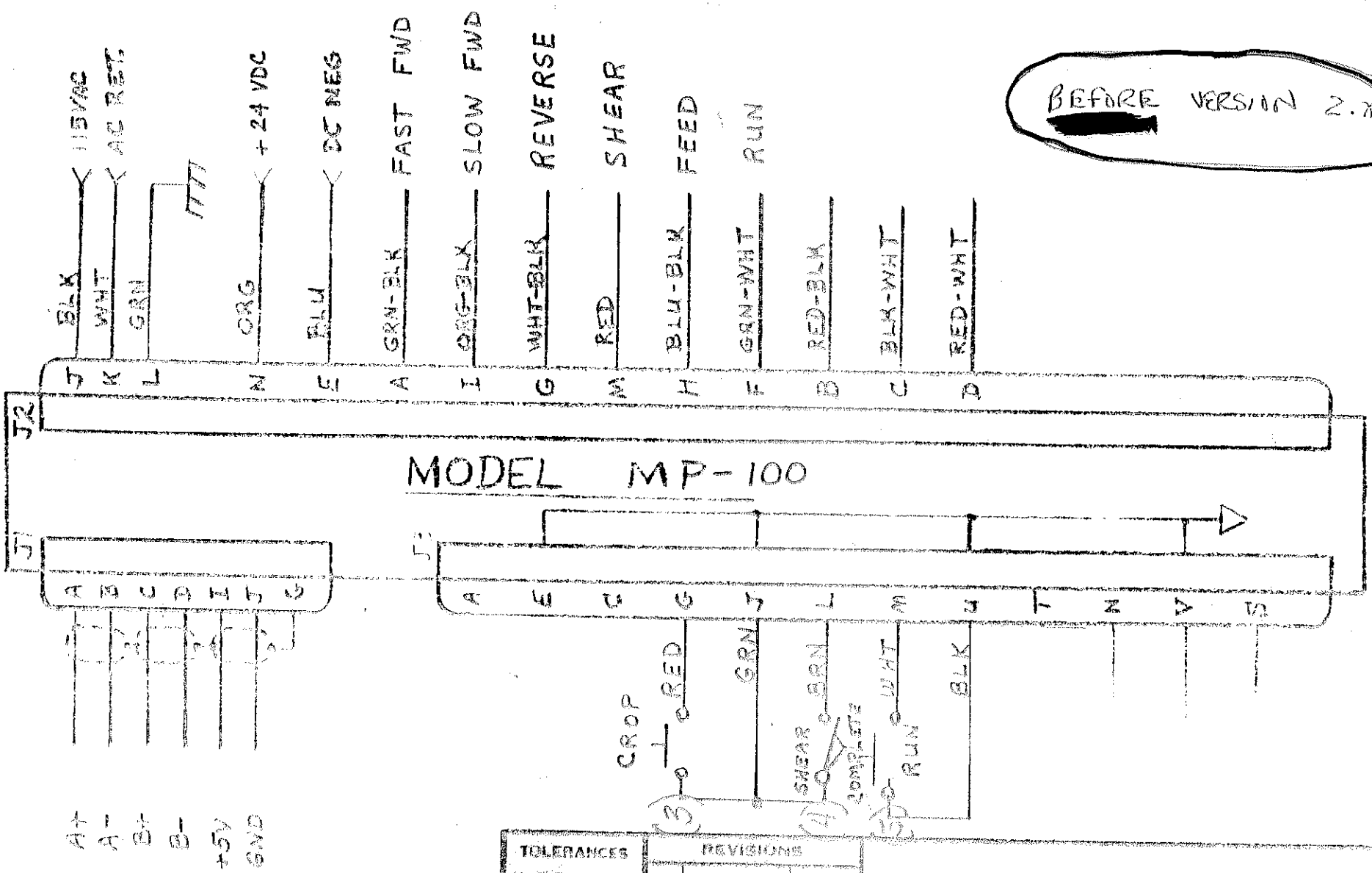
| | | |
|---|---|---|
| Shear Cycle (SH. SEC.) | 0.00 to 99.99 seconds | _____ |
| Shear Pause (SH. PAU.) | 0.00 to 99.99 seconds | _____ |
| Batch Pause (bA. PAU.) | 0.00 to 99.99 seconds | _____ |
| Length in slow (LE SLO) | 0.00 to 99.99 inches | _____ |
| | 0 to 9 feet 11 and 31/32 inches | _____ |
| Scrap Length (LE Scr) | 0.00 to 99.99 inches | _____ |
| | 0 to 9 feet 11 and 31/32 inches | _____ |
| Slug Length (LE Slu) | 0.00 to 99.99 inches | _____ |
| | 0 to 9 feet 11 and 31/32 inches | _____ |
| Correction Factor (Corr) | 0.50000 to 1.50000 | _____ |
| Encoder Rotation (dIrECtION) | 1 for clockwise or | _____ |
| | 0 for counter cw | |

MP101 V2.07 (20 BATCH)

SETUP DATA

| | | BA | PC | LE |
|---|---|---|---|---|
| SH. SEC. | _____ | 1 | 70 | 120 |
| SH. PAU. | _____ | 2 | | |
| BA. PAU. | _____ | 3 | | |
| LE. SLO. | _____ | 4 | | |
| LE SCR. | _____ | 5 | | |
| LE SLU. | _____ | 6 | | |
| CORR. | _____ | 7 | | |
| ACCU | _____ | 8 | | |
| DIRECTION | _____ | 9 | | |
| | | 10 | | |
| | | 11 | | |
| | | 12 | | |
| | | 13 | | |
| | | 14 | | |
| | | 15 | | |
| | | 16 | | |
| | | 17 | | |
| | | 18 | | |
| | | 19 | | |
| | | 20 | | |

BEFORE [redacted] VERSION 2.XX




| TOLERANCES | REVISIONS | | |
|---|---|---|---|
| (UNLESS OTHERWISE NOTED) | NO. | DATE | BY |
| DECIMAL | - | | |
| ± | A | | |
| FRACTIONAL | B | | |
| ± | C | | |
| ANGULAR | D | | |
| ± | E | | |

MACHINE INTERFACE DWG, MODEL MP

CUSTOMER - ASC MACHINE

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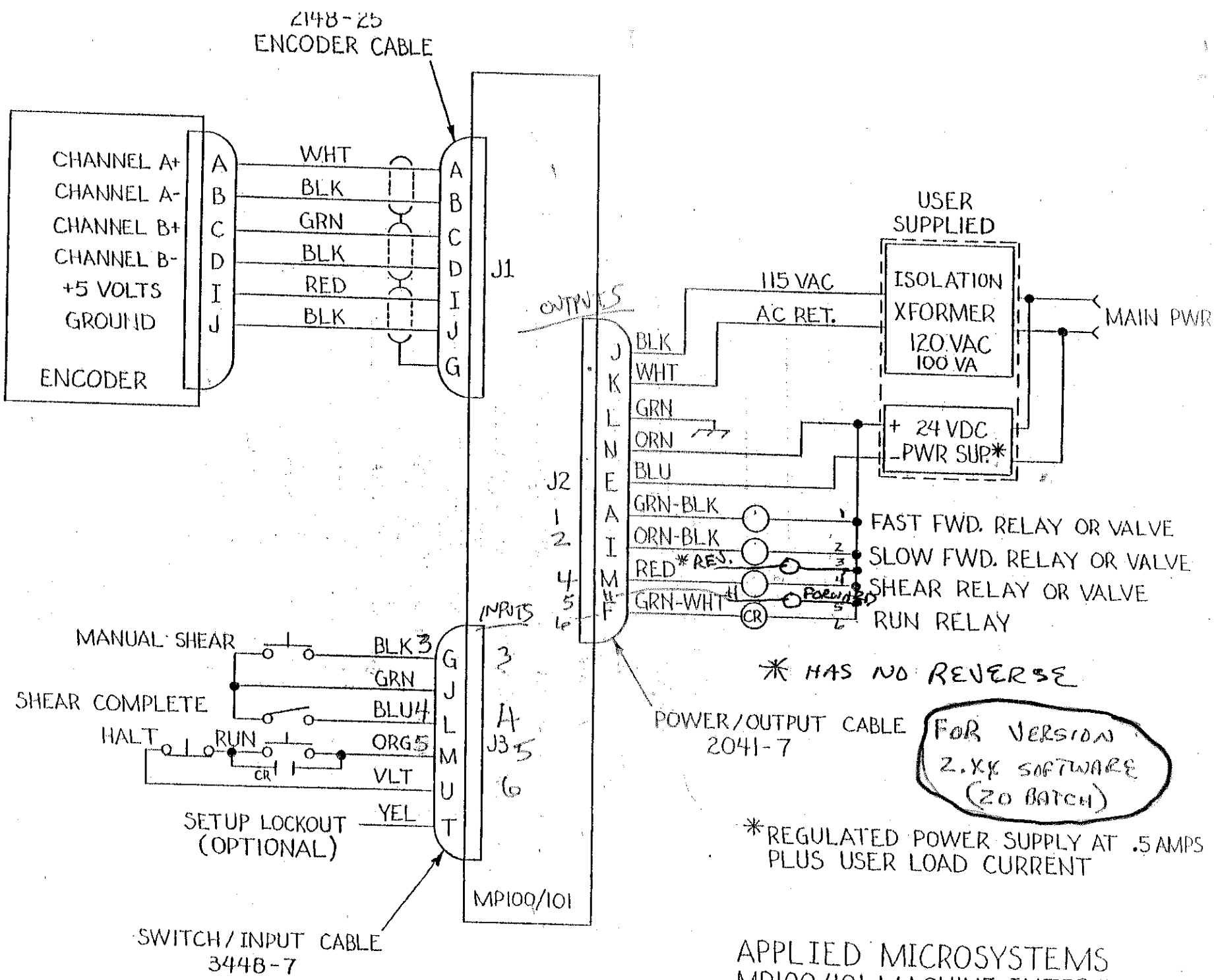
|---|---|---|
| CHK'D | DATE | DRAWING NO. |
| TRACED | APP'D | MP-100 |

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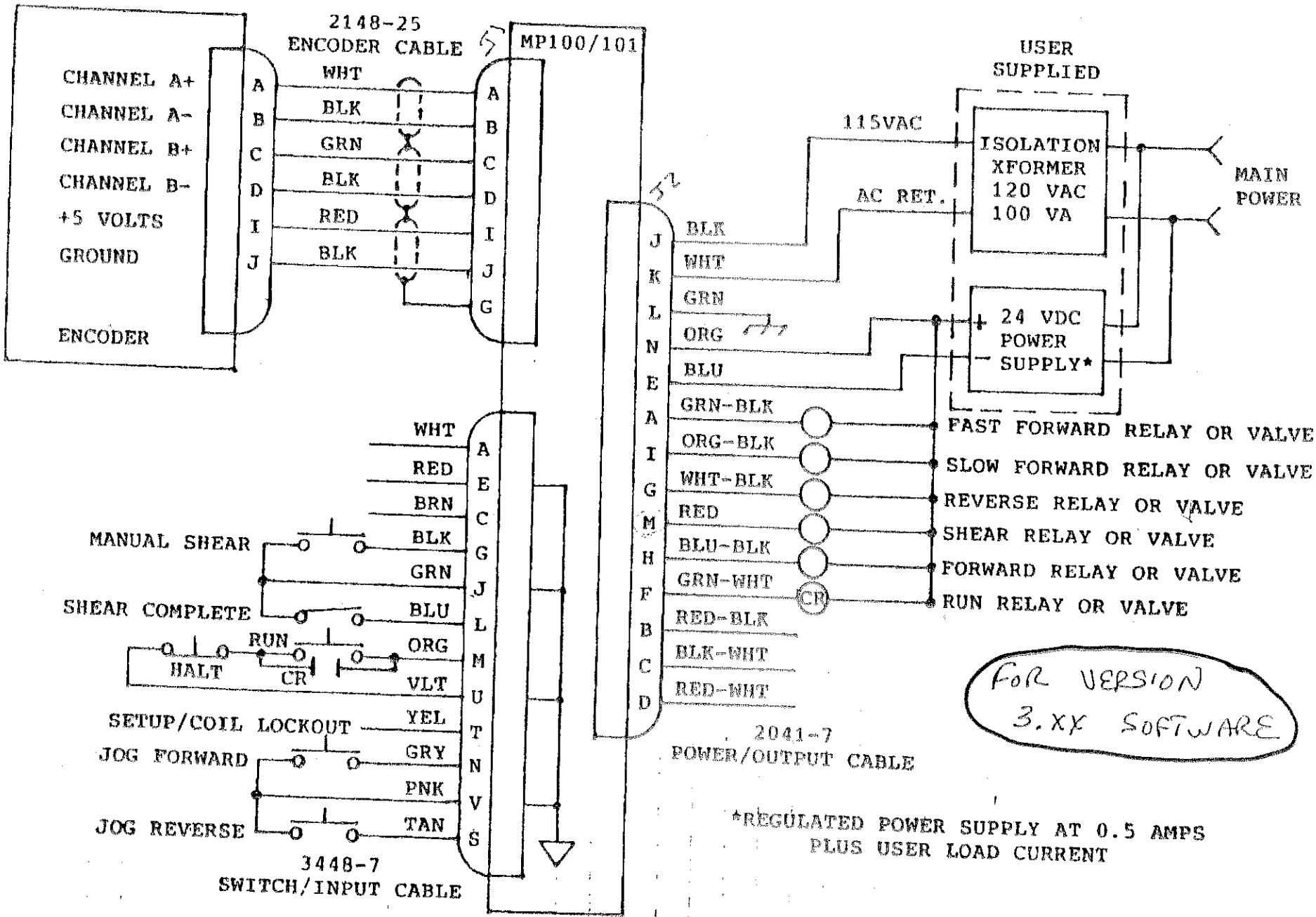
MP100/101 MACHINE INTERFACE

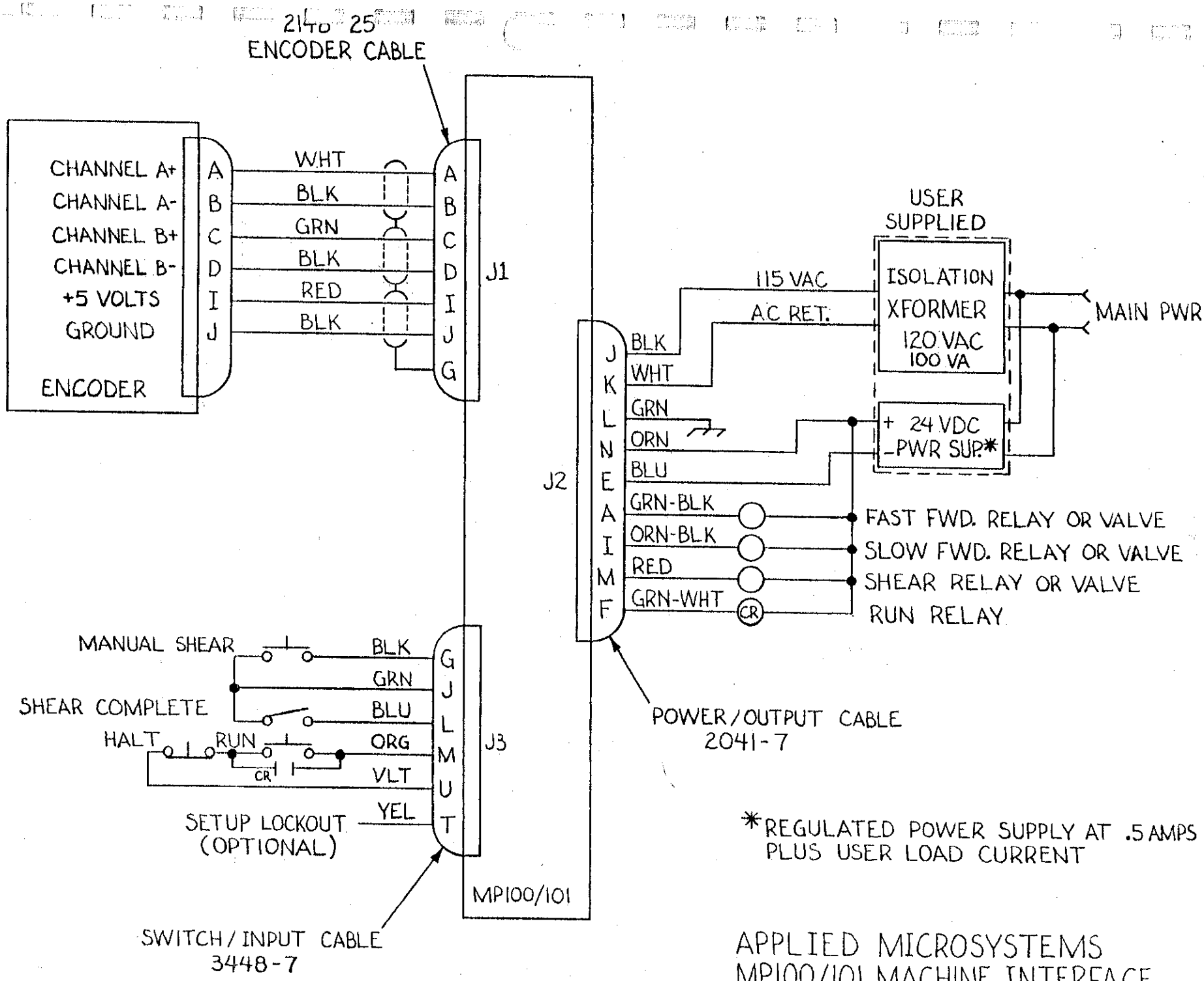
FOR. VERSION 3.XX




FOR VERSION 3.XX SOFTWARE

AMS APPLIED MICROSYSTEMS

MP100/101 MACHINE INTERFACE


2140-25
ENCODER CABLE
CHANNEL A+
CHANNEL A-
CHANNEL B+
CHANNEL B-
+5 VOLTS
GROUND
ENCODER
A
B
C
D
I
J
WHT
BLK
GRN
BLK
RED
BLK
A
B
C
D
I
J
G
J1
USER SUPPLIED
ISOLATION XFORMER
120 VAC
100 VA
115 VAC
AC RET.
MAIN PWR
+ 24 VDC
-PWR SUP.*
J2
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RED
GRN-WHT
CR
FAST FWD. RELAY OR VALVE
SLOW FWD. RELAY OR VALVE
SHEAR RELAY OR VALVE
RUN RELAY
POWER/OUTPUT CABLE
2041-7
MANUAL SHEAR
SHEAR COMPLETE
HALT
RUN
CR
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GRN
BLU
ORG
VLT
YEL
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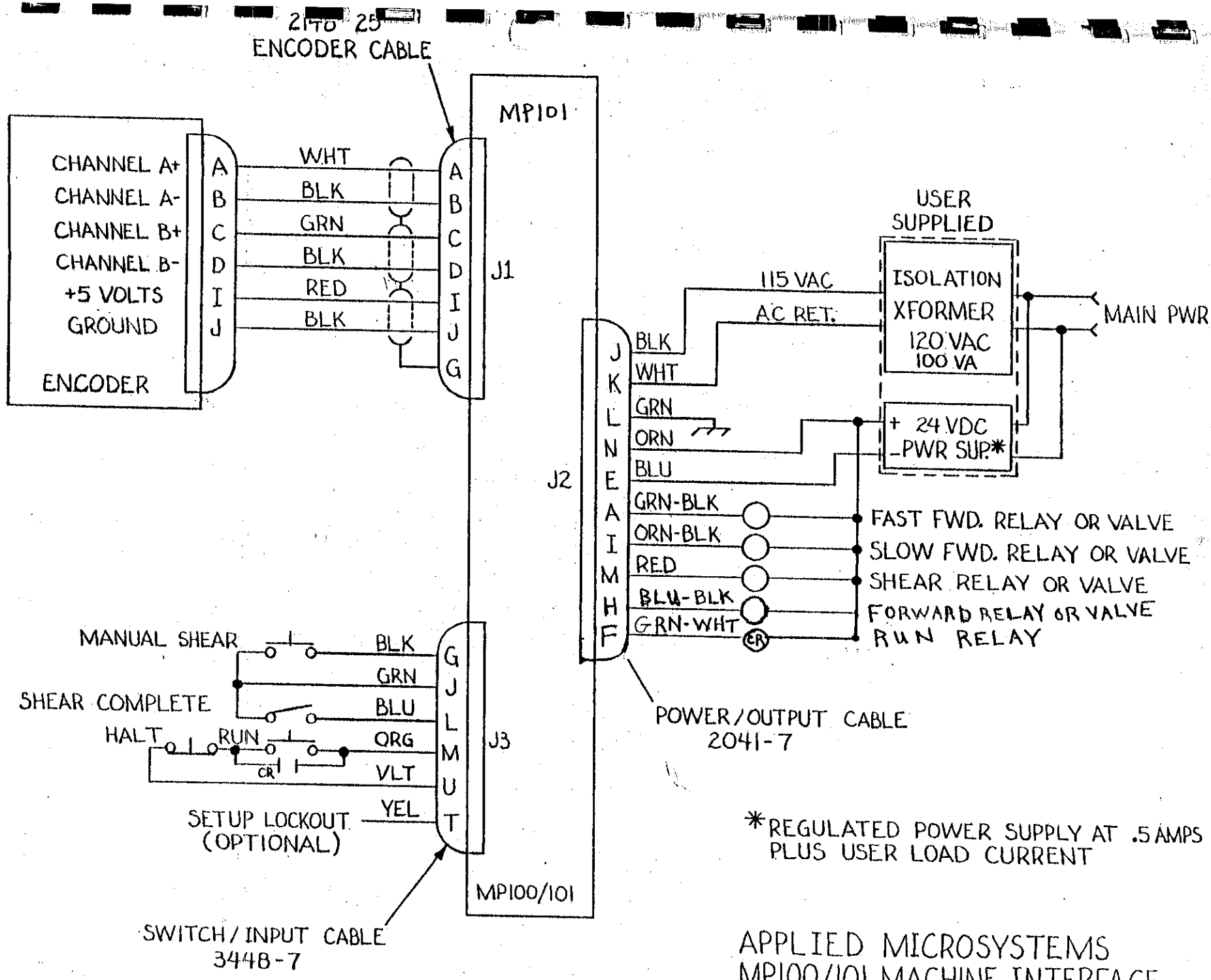
T
J3
SETUP LOCKOUT
(OPTIONAL)
MP100/101
SWITCH/INPUT CABLE
3448-7
*REGULATED POWER SUPPLY AT .5 AMPS
PLUS USER LOAD CURRENT
APPLIED MICROSYSTEMS
MP100/101 MACHINE INTERFACE


2 TO 25
ENCODER CABLE
MP101
CHANNEL A+
CHANNEL A-
CHANNEL B+
CHANNEL B-
+5 VOLTS
GROUND
ENCODER
A
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CR
115 VAC
AC RET.
USER SUPPLIED
ISOLATION XFORMER
120 VAC
100 VA
+ 24 VDC
-PWR SUP.*
MAIN PWR
FAST FWD. RELAY OR VALVE
SLOW FWD. RELAY OR VALVE
SHEAR RELAY OR VALVE
FORWARD RELAY OR VALVE
RUN RELAY
POWER/OUTPUT CABLE
2041-7
MANUAL SHEAR
SHEAR COMPLETE
HALT
RUN
CR
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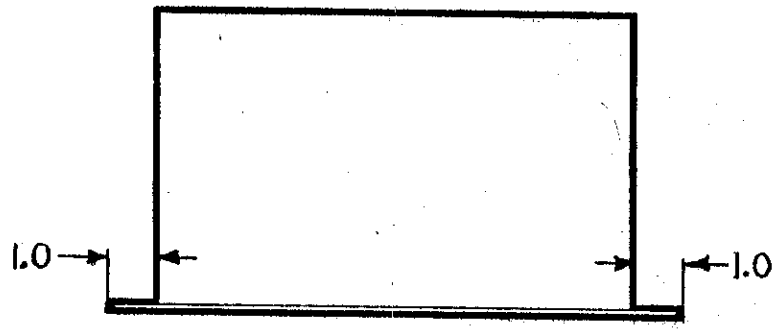
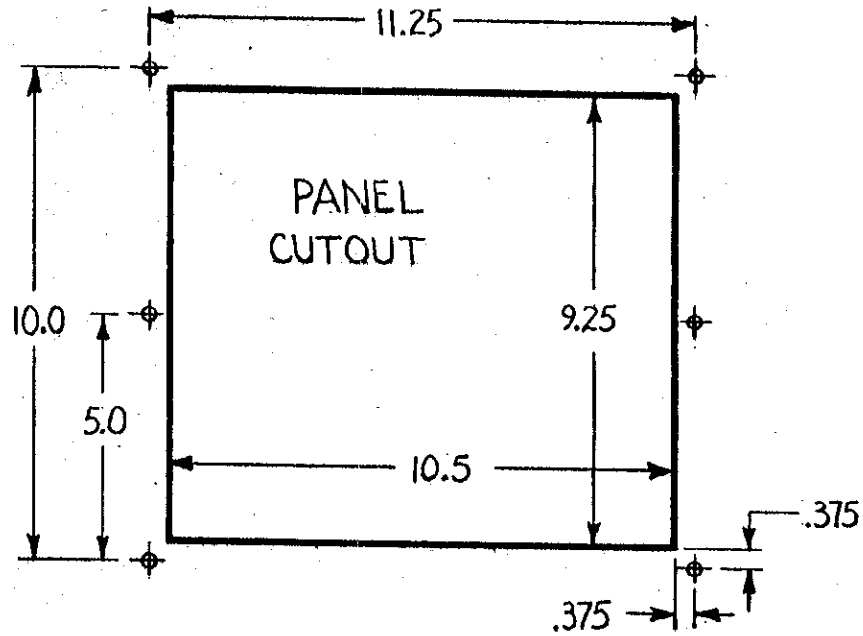
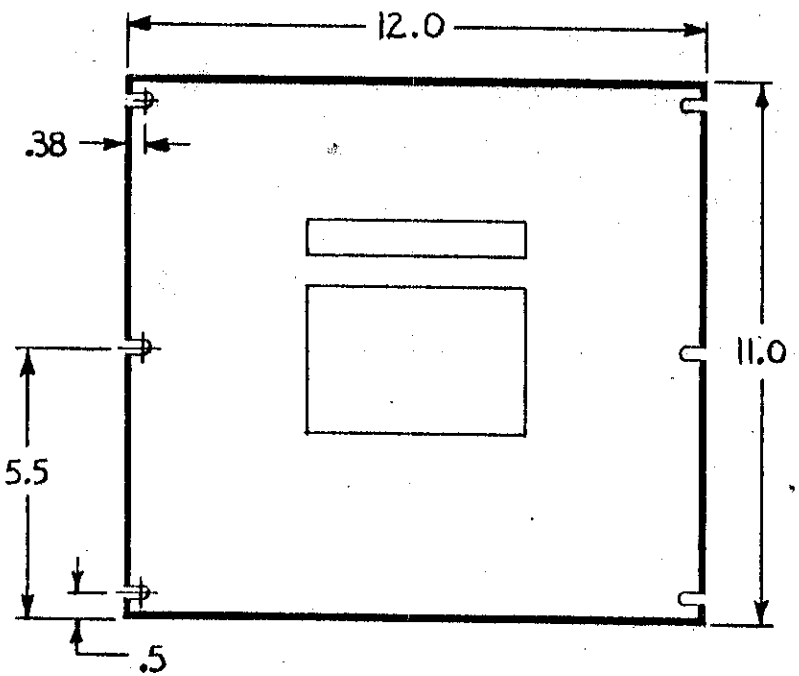
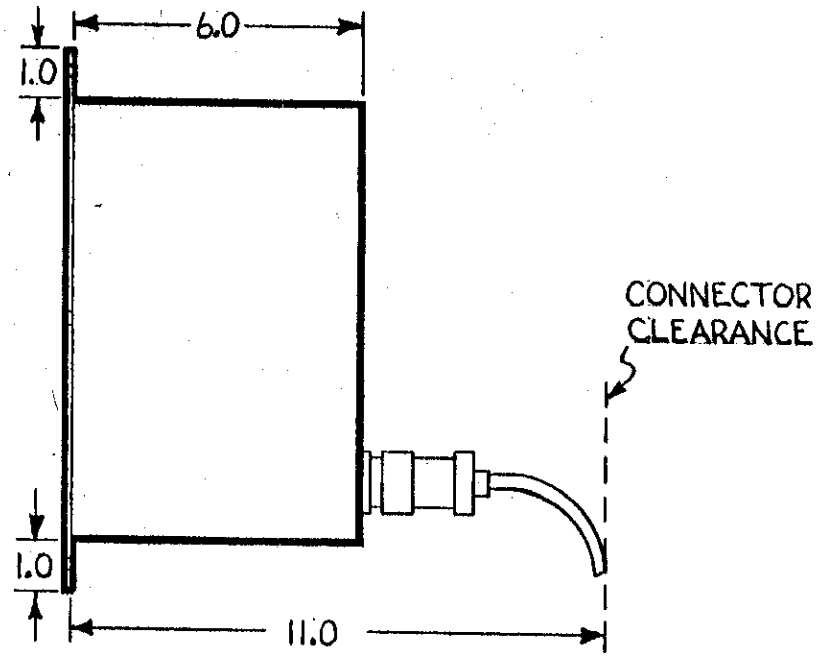
SETUP LOCKOUT
(OPTIONAL)
MP100/101
SWITCH/INPUT CABLE
3448-7
*REGULATED POWER SUPPLY AT .5 AMPS
PLUS USER LOAD CURRENT
APPLIED MICROSYSTEMS
MP100/101 MACHINE INTERFACE

ALL DIMENSIONS IN INCHES

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MP100 SERIES INSTALLATION DRAWING