

Model
MP328CL
Closed Loop Backgauge Controller
Reference Manual

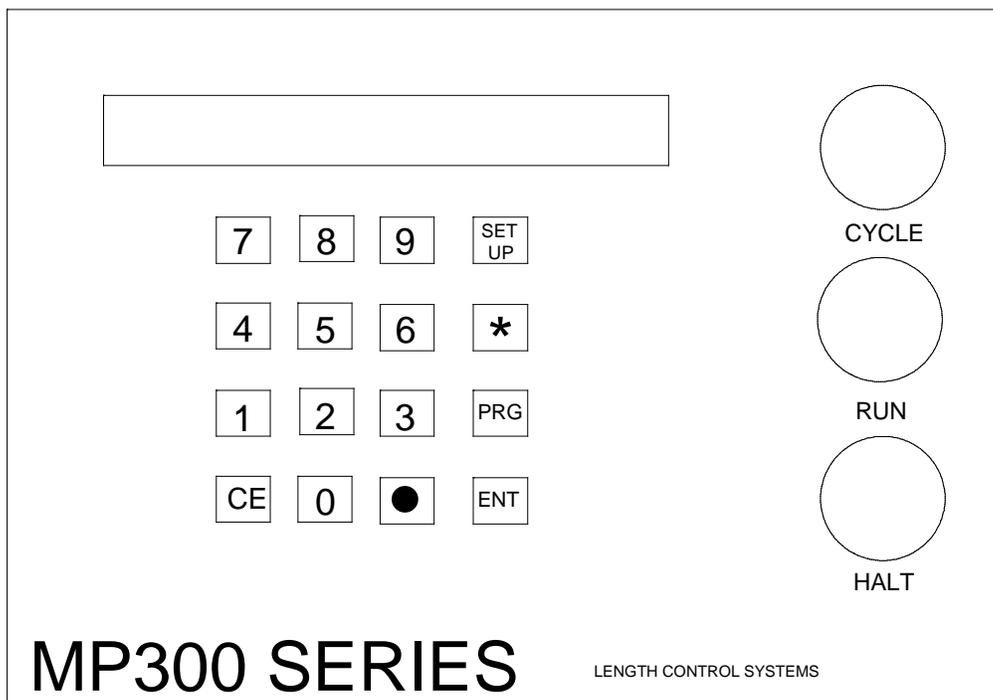
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MP328CL Gripper Controller

AMS Controls has been supplying length control systems to the metal fabricating industry since 1978 and has built a reputation of producing high quality and reliable controllers.

The **MP328CL** Gripper controller is a cost effective controller designed to perform multiple bends on a sheet of metal and will use a gripping function to hold the metal and to sequence it through each bend..

The **MP328CL** is housed in a compact 8.00" x 12.50" wide x 2.25" deep enclosure and requires a single 24 VDC power supply for operation.



Front Panel Components and Description

The Model **MP328CL** front panel has three push button switches, a 16 key keypad, and a two line 48 character liquid crystal display.

The three push buttons provide the following functions:

- **CYCLE** This push button will open the gripper jaws and will reset the sequence
- **RUN** Press to initiate an automatic move sequence
- **HALT** Press to manually stop the guide movement

The keys provide the following functions:

- **SETUP** Press to enter the setup mode. The setup mode is used to enter specific parameters about the Gripper.
- ***** Press the asterisk key to exit the setup or programming modes. Also known as the STATUS key to display current position, etc.
- **PRG** Press to program a new set position. While in the program mode, the new position will flash.
- **ENT** Press to store the values entered in the setup and program modes.
- **CE** Press to clear an incorrect entry value before the "ENT" key is pressed. Also used to clear any errors reported by the controller.

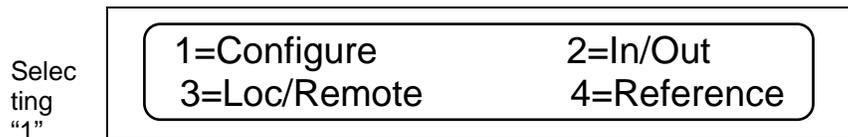
Setup Mode

Note: The following descriptions include all possible **SETUP PARAMETERS** and there are some parameters that are not used for every application. Only use the ones that apply for your particular machine.

The SETUP mode is used when the **MP328CL** is initially installed to configure it to the particular characteristics of the Gripper. The SETUP mode is entered by pressing the “Set Up” key and the mode can be exited by pressing the “*” key. When power is applied to the controller, the built-in diagnostics check the memory for data retention.

If an error is detected, the memory is automatically cleared and the SETUP mode is entered to indicate that this data should be reentered. The setup values are entered in the order shown below and an explanation of each parameter is given. A form is provided in the back of this manual for recording the setup parameters of your machine. This form should be completed after your machine has been installed and properly adjusted.

To enter the SETUP mode, press the “Set Up” key. The following display will appear.



will allow the operator to adjust the following parameters:

Reference Mode

The REFERENCE MODE parameter tells the **MP328CL** where the reference switch is located. The reference point is the center of the brake where the bend occurs. If the switch is close to the reference point and most of the moves of the Gripper occur “behind” the switch, the REFERENCE MODE is NEAR. If the switch is behind the Gripper and most of the moves are in “front” of the switch, the REFERENCE MODE is FAR. Use any number key to toggle the choices.

The switch for a NEAR REFERENCE MODE must be normally closed and remain open as long as the Gripper is on the switch or closer to the reference point than the switch. The switch for a FAR REFERENCE MODE must be normally open and remain closed as long as the Gripper is on the switch or farther away from the reference point than the switch.

Ref. Pos.

The REFERENCE POSITION is the distance from the reference point to the inside jaws of the gripper after being referenced.

Lip Size

If this parameter is greater than zero, a lip will be added to the beginning of each sheet. The acceptable range of values are 0.0000" to 50.0000".

Metal Flow

This parameter specifies whether the metal is fed from one side of the brake and the formed parts comes out of the other (NORMAL); or if it is fed through the backside of the brake, (REVERSE). If this parameter is set to NORMAL, the machine should move to the total sheet length plus the CLEARANCE DISTANCE when there is a new program. When REVERSE is selected, it will move to the new CLEARANCE DISTANCE.

Clearance Dist

This parameter determines the point at which the gripper will move to when a new program is entered or after completion of a sequence. CLEARANCE DIST plus ACTUAL PART LENGTH will determine the position of the guide between sequences.

Brake Dwell Dn

BRAKE DWELL DOWN is the time it takes for the brake to move from the top of the stroke to the bottom of the stroke. The range of time allowed is 0.001 to 9.999 seconds and can be set to the nearest millisecond.

Brake Dwell Up

BRAKE DWELL UP is the time necessary for the brake to return from the bottom to the top of its stroke

NOTE:

If the LOOP ENABLE input is used while the brake is activated, the LOOP ENABLE input must be reactivated before the total BRAKE DWELL (down and up) is completed.

Loop Gain

LOOP GAIN is a parameter which sets the sensitivity of the servo loop. Lowering this number will make the drive less responsive. Raising this number will make the system move sensitive and responsive. If the LOOP GAIN is too high, the system will become unstable and oscillate.

Great care should be used in changing this number. Make gradual changes.

The acceptable range of values for this parameter is 0.100 through 500.00 and the default value is 1.000

Jog Velocity

The JOG VELOCITY sets the speed that the line moves during jogging, referencing, and calibration, measured in feet per minute (FPM). The accepted range of values for this parameter is 1 FPM through 50 FPM and the default value is 10 FPM.

Max Velocity

The MAX VELOCITY parameter sets the maximum speed (speed used during the RUN sequence), in FPM.

Acceleration

ACCELERATION sets the rate of change of velocity in inches per second, per second (inches/second)². This parameter controls both the acceleration and deceleration of the travel. The accepted range of values for this parameter is 1 In/S² through 3500 In/S², and the default value is 10 In/S².

Offset Volts (Auto)

The OFFSET VOLTS is the voltage required to cause the positioning system to come to a complete stop. This parameter is automatically adjusted by the AMS controller but it can be changed by the user when the loop is not enabled. This would only be done if the initial value is grossly off, and it would take too long for the controller to integrate out the error. The more common usage of this parameter is for monitoring the amount of offset and making external adjustments to the drive. This parameter should be kept as close to zero as possible to give the controller the maximum control range.

Offset Integral

The OFFSET INTEGRAL defines the integral time constant for the removal of position error (drift), when the closed loop servo system attempt to hold the line in a locked position. An OFFSET INTEGRAL time constant of 100 seconds is recommended.

Derivative

On systems that use hydraulics or have a lot of inertia, it is possible that the system may have a slow response time. If this is the case, it may be possible to have a faster response by entering a DERIVATIVE value. The sluggish response of the machine will result in an error, and the purpose of the DERIVATIVE is to anticipate the rate of change in the error, and amplify the rate of change to improve performance.

If it is determined that this parameter is to be used, start with a value of 10 seconds (or less), and then decrease the value until a change in pitch or "hum" is heard in the motor which indicates that the controller is overcorrecting the error. When this occurs, increase the value until the system stops oscillating.

CAUTION:

Changing this value will amplify any noise in the system, as well as the error, which can cause problems in the system. This parameter may also increase the tolerance of the system which could cause variation errors. Entering a zero for DERIVATIVE will disable the parameter.

Tolerance

On the machine, the controller can check for the Gripper to be within a specified TOLERANCE before activating the brake. If the machine has not stopped within this TOLERANCE, the controller will halt and an error will be displayed.

The TOLERANCE should be set small enough to get acceptable parts but wide enough to avoid production interruptions. The controller allows values from 0.0005 inches to 10.0000 inches. The default value for TOLERANCE is 1.0000 inches.

Grip Delay

The GRIP DELAY is a delay that can be entered into the controller to adjust for the gripper hitting the part, and the part bouncing off of the gripper so that the jaws of the gripper do not grab the part properly. When the part enters the jaws of the gripper it will activate the gripper so that the jaws will clamp down on the part. A small delay can be entered so that the jaws do not close immediately. The acceptable range of values for this parameter is 0.0 to 5.0 seconds.

Resolution

The RESOLUTION parameter defines the length of the Gripper movement for each increment of the motor encoder. It is a function of the distance traveled by the gripper during one revolution of the motor encoder, and the number of counts per revolution of the motor encoder. The formula for calculating RESOLUTION is as follows:

$$\text{Resolution} = \frac{\text{Distance of Gripper movement}}{4 \times \text{Encoder Count}}$$

The encoder used will typically be a motor encoder or an encoder mounted in such as way as to simulate the motor movement.

Correction (TO BE SPECIFIED)

The CORRECTION FACTOR adjusts for errors in the GRIPPER movement. It is expressed as a percentage, with 100% being no correction. Increasing the CORRECTION FACTOR causes the GRIPPER movement to become longer and decreasing the value shrinks the GRIPPER movement.

Calculate the CORRECTION FACTOR using the following steps:
1) Make the GRIPPER move to the same position ten times and take an accurate measurement of this value (OR) 2) Bend a piece of metal each of the ten times that the GRIPPER moves.
3) Find the average length by adding up all ten measurements and dividing by ten. 4) Use the following formula for the new CORRECTION FACTOR, using the average of the ten parts for "actual measured position.":

New CORR. FACTOR = (Programmed Length ÷ Actual Measured Position) x Old CORR. FACTOR

Filter Constant

The FILTER CONSTANT can be adjusted in order to improve accuracy. A low value should be used on machines with very stable line speeds. A high value (greater than 50 Hz) should be used when rapid fluctuations in line speeds occur. Some trial may be necessary to achieve an accurate value. The default value is 32 Hz, which is considered to be on the high side of the low values. The controller will allow values from 1.0 Hz to 200.0 Hz.

Units

Length measurements can be programmed and displayed as either English inches, Metric millimeters, or Metric centimeters. Press any number key to toggle through the choices.

Pressing the "*" key will show the current "Set Position" and "Current Position". If the "Set Up" key is pressed again other options are available.

1=Configure	2=In/Out
3=Loc/Remote	4=Reference

In: If "2" is pressed, the INPUT/OUTPUT screen can be viewed.
Out: This can be helpful as a troubleshooting aid if the machine is not working properly.

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Pressing the "Set Up" key will allow you to exit this screen.

Pressing "3" while viewing the SETUP screen enters the LOCAL/REMOTE function. If the programming for the machine is to be done with this controller, select the LOCAL mode. If another controller will program the machine, select REMOTE.

Selecting "4" while viewing the SETUP screen, will cause you to enter the REFERENCE mode. The machine will immediately locate the reference switch and then stop. This is done to set a REFERENCE for the machine. If this is not manually done, it will automatically find the reference switch when RUN is pressed.

Referencing

The controller must be referenced to a known position each time power is removed and restored to the unit. The fixed reference point will be a home switch.

Near referencing with a home switch:

1. The **MP328CL** determines the state of the Home Switch. If the switch is OPEN, skip to step # 3.
2. The **MP328CL** moves the gauge in the forward direction until the Home Switch is OPEN. It then skips to step # 5.
3. The controller moves the gauge in the reverse direction until the Home Switch is CLOSED.
4. The **MP328CL** moves the gauge in the forward direction until the Home Switch is OPEN.
5. At the CLOSED -> OPEN transition of the Home Switch, the encoder interrupt captures the encoder count and sets it equal to the reference position.

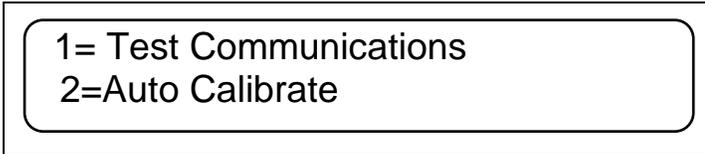
Far referencing with a home switch:

1. The **MP328CL** determines the state of the Home Switch. If the switch is OPEN, the controller moves the gauge in the reverse direction until the Home Switch is CLOSED.
2. The controller moves the gauge in the forward direction until the Home Switch is OPEN.
3. The **MP328CL** moves the gauge in the reverse direction until the Home Switch is CLOSED.
4. At the OPEN -> CLOSED transition of the Home Switch, the encoder interrupt captures the encoder count and sets it equal to the reference position.

NOTES:

- If near referencing is used, the home switch must be wired N/C (normally closed). Far referencing requires that normally open contacts be used.

If the "Set Up" key is pressed twice, the following screen appears:



While in the second SETUP screen, pressing "1" will test the communications with another controller if they are interfaced together. If there is no communications, the messages "No Data Received" and "No Data Sent" will be seen.

Pressing "2" while in the second SETUP screen allows the controller to perform a calibration of the machine automatically. If you enter a calibration value, the machine will move to that point and prompt the operator for a measured value to that point. The machine will then calculate the correction value and ask the operator if they want this value updated.

(THIS MAY CHANGE!!)

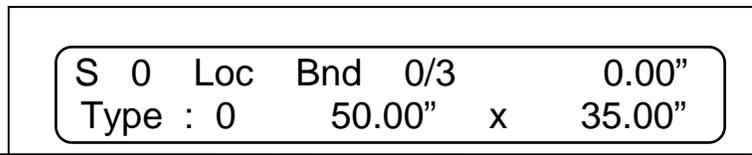
Program Mode

The program mode is entered by pressing the "PRG" key. The part "type" will start to flash, indicating that the controller is waiting for the entry of the new type of part that is to be made. The operator need only to press any number key to toggle through the choices, and press the "ENT" key to lock the selection in., the choices are:

- Single Piece. Only the lip is bent, if programmed.
- L L-Shaped. Two bends are made (including the lip).
- U U-Shaped. Three bends (including the lip).
- 0 Full wrapper. One piece is made that is bent four times (with the lip), to form a complete section of duct.

After the TYPE is selected, the HEIGHT and WIDTH measurements can then be entered. Again use the "ENT" key to lock the selection in. Only height will be used for (-) type parts.

PROGRAM SCREEN

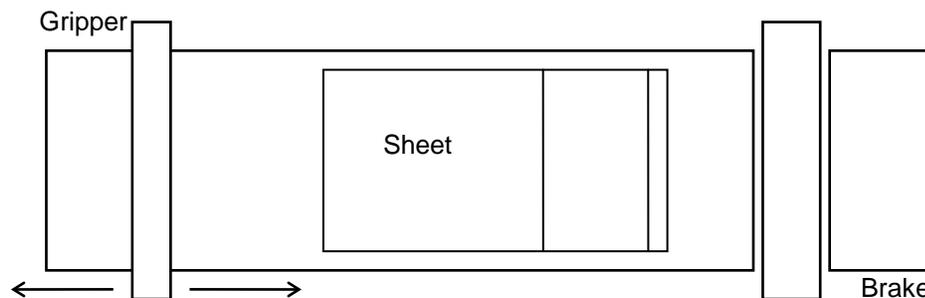


After the part is programmed, the STATUS screen will be shown, listing the line velocity, whether the controller is in the LOCAL or REMOTE mode, the current bend that is being made, the current position, the part TYPE, and the part dimensions.

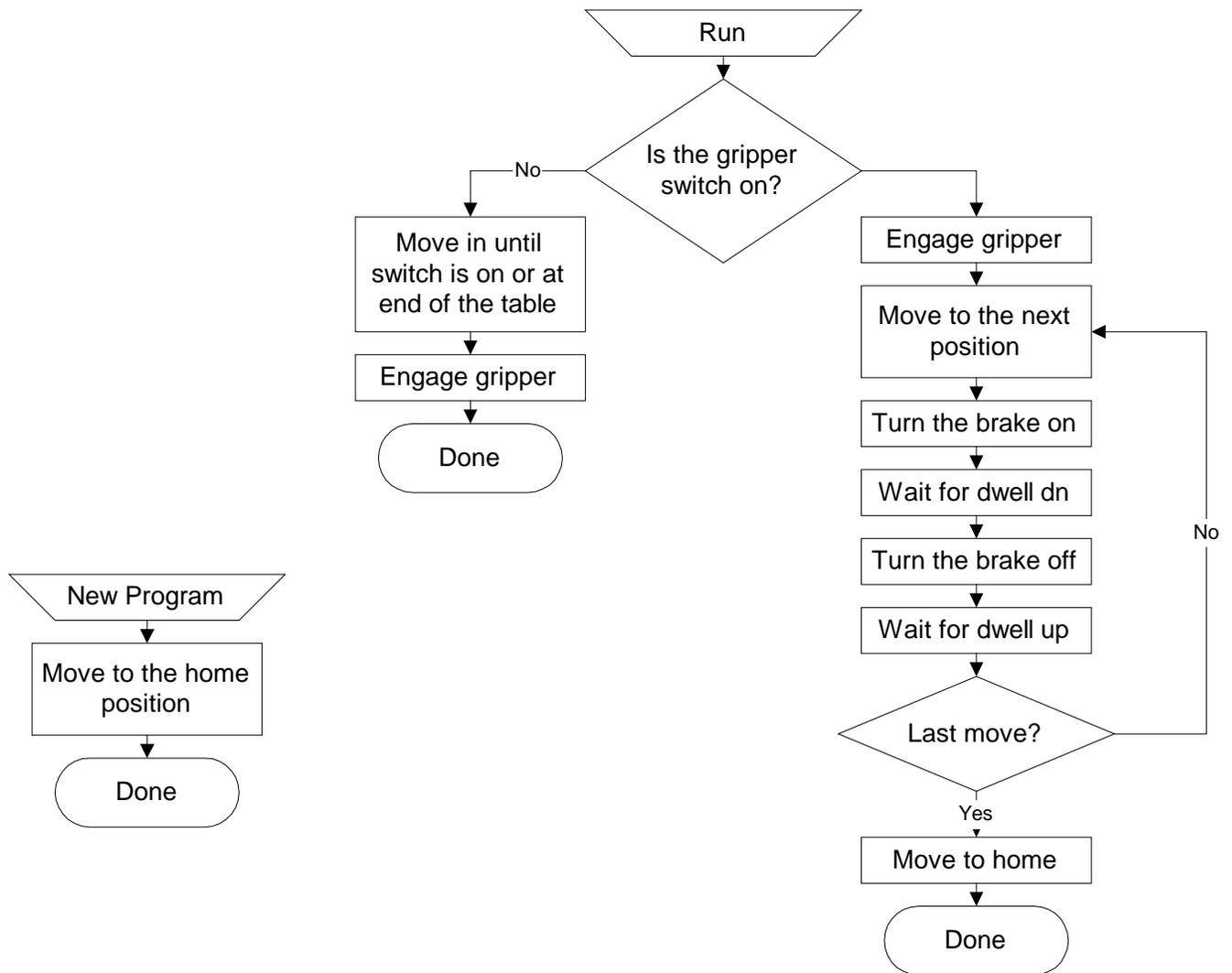
STATUS SCREEN

Type	Height	Width
--	0.00"	0.00"

Run Operation



With this style of machine, the gripper has a sheet detect switch. When the run button is first pressed, and there is no sheet in the gripper, the controller should move the gripper in until the sheet is found, and engage the gripper. When the run button is pressed and a sheet is detected by the gripper, the controller should grip the metal, if it has not already, position to the first bend, engage the brake (wait for the dwell time), then move to the next position. When all bends are made, it should return to the clearance position (as programmed in the configuration).



When part information is programmed, and the RUN button is pressed the gripper will try to find the part in the forward direction. As long as the programmed part is shorter than the clearance position, the part will be processed. If the part is physically longer than the clearance position, the gripper must be jogged back to allow the part to be accepted. This must be done on the first part of that length, and the machine will readjust itself for the remaining parts.

If “metal flow” is set to NORMAL, the home position will be at the total sheet size plus the clearance distance. If it is REVERSE, then the home position is at the clearance distance only. In the first case, the operator will be placing a sheet on a transfer table in front of the brake. The clearance position of the gripper should be far enough away so that it will not interfere with the operator

putting the sheet on the table. In the second case, the sheet is fed from the other side of the brake into the gripper. As soon as the gripper "sees" the metal, it clamps. Because of this arrangement, it is necessary to feed the metal only a short distance.

MP328CL Switch Settings

Switch	Description
1	Unit ID Must be OFF
2	Unit ID Must be ON
3	Unit ID Must be ON
4	Analog Polarity
5	Encoder Direction
6	Not Used Must be OFF
7	Unit ID Must be OFF

The proper Unit ID switch setting for the **MP328CL** is: switches 2 and 3 ON. Some systems have the capability of having 2 **MP328CLs**, and the Unit ID switch setting for the second controller is: switches 1, 2, and 3 ON.

MP328CL Inputs/Outputs

Inputs	Description
1	Jog Forward
2	Jog Reverse
3	Home
4	Run Enable
5	Setup/Lockout
6	E-Stop
7	Sheet Detect
8	Loop Enable

Outputs	Description
1	Drive Enable
2	Not Used
3	Not Used
4	Run
5	No Brake
6	Not Used
7	Gripper
8	Brake
Pin 14	Analog +
Pin 15	Analog -

Mounting Details

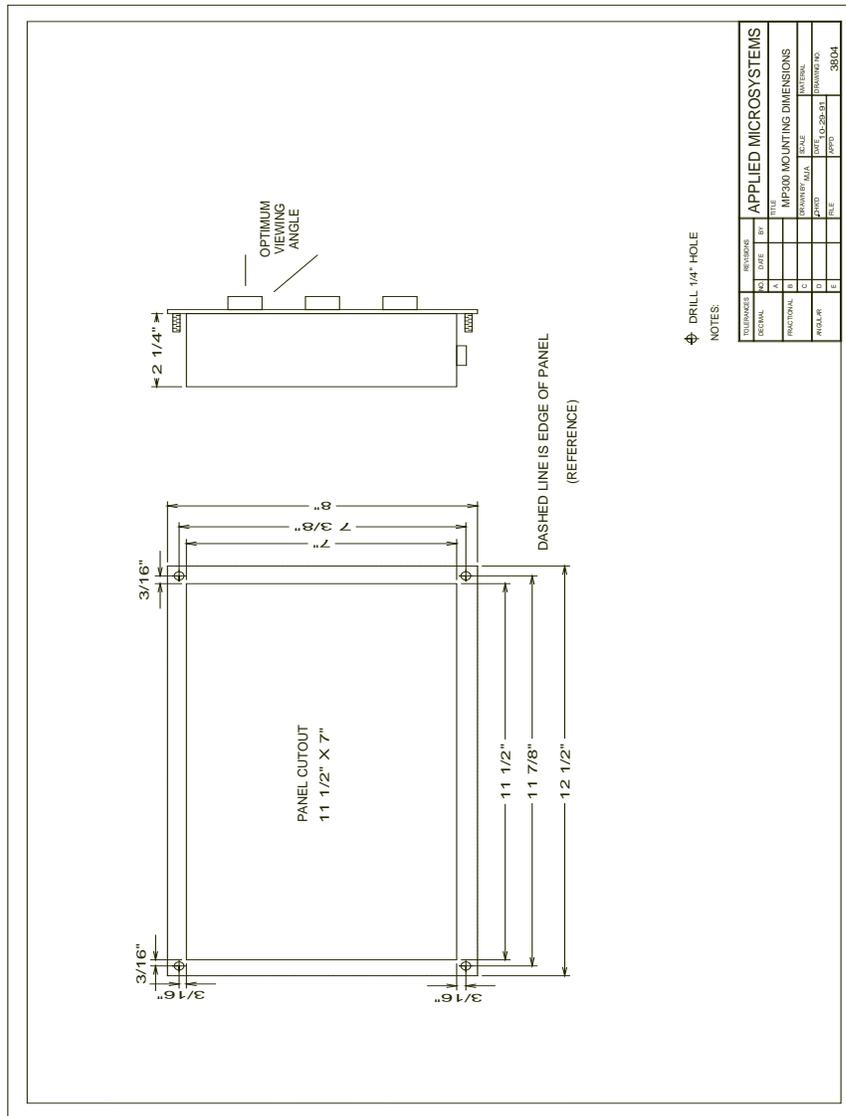


Figure B-1. Panel Mount Mounting Dimensions