Beck Automation

Sierra Series Users Guide
Closed Loop

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CD 601M, Rev A 8/02

Table of Contents

I.   Interface

The Sierra Series controller is a high performance motion controller with an easy to use interface. The controller has a built in 7.4" LCD display with large text that is easy to read in an industrial environment. Data is entered using the keypad below the LCD.

1. Keypad

Soft Keys

The gray keys at the top of the keypad are called Soft Keys because the software defines their function. Each screen will have Soft Keys to perform functions related to that screen. When the fifth Soft Key is labeled "MORE" there are multiple layers of Soft Keys.

Number keys

The number keys and the decimal point are used to enter new values in a data field.

Help Key

The help key will give you more information about the current field you are entering data or the current screen you are viewing.

Screen Keys

The three keys below the help key will transition to a specific screen for any other screen. The STATUS key will return to the main status screen where production may be viewed and the sequence of jobs may be changed. The SETUP key will bring up the screen to enter setup data. The PROGRAM key, will transition to the screen where more jobs are entered.

Arrow Keys

The up and down arrow keys are used to scroll around on the different screens. The left and right arrows move from one data field to another on screens that have multiple data entry fields on one line. If currently editing a field, the left and right arrow keys will move the cursor within that field. The shift key will alter the function of the arrow keys.

CE Key

While entering data in a field, the CE key will revert back to the previous value if pressed before pressing the enter key.

If current on a data field but not entering data, the CE key will allow you to edit the current value. For example, if a value of 12 is keyed into a data field, and the enter key is pressed, the value of that field will be 12. If the correct value was 123, pressing CE will bring up the current value of 12 with the cursor following the 2 for more data to be keyed in.

Enter Key

The ENTER key is used to assign data to a field. To change the value of a data field numbers are keyed in. After the correct value as been keyed in, pressing the enter key finishes the process and assigns the new value to that field.

Shift Key

The Shift key is used to select page up and page down when pressing the up and down arrow keys. Pressing the Shift key and then the down arrow key will take you to the bottom of the page or page down into the next page if you are at the bottom already.

II.   Status Display

This is the operator's main screen. It will display the jobs and items in memory and their status. The arrow keys will allow the operator to scroll up and down the orders and items and change the sequence in which they are run. The operator may return to this screen at any time by pressing the STATUS key.

The top two status lines of this screen will be shown on all screens. The following information will then be available to the operator at all times:
- Current Job
- Distance of leading edge past the shear
- Line speed
- Time of day

```
12:32 PM          225FPM          102.625"
JOB: 153904-33
             PRODUCTION STATUS
BATCH    QTY    DONE     LENGTH       STAT
JOB:153904-33
1        100    0        120.000"     WORK
2        200    0        144.000"     NEXT




 +0.030   -0.030   1-EXTRA   SETNEXT   MORE
```

2. Initial Soft Keys.

The following soft keys will be present on the main status screen. Anytime the user returns to the screen, these are the keys that will be shown.

Key Title	Action
+x.xxx	The value of x.xxx is determined by the setup parameter "Correction +/- Change". Pressing this key will adjust the Correction Factor, such that parts of the current length will be longer by an amount equal to "Correction +/- Change."
-x.xxx	Similar to +x.xxx, except the correction factor is adjusted to make the parts shorter by that amount.
1-EXTRA	Makes one additional part.
SET NEXT	Sets the status of the current highlighted order to next.
MORE	Brings up next set of soft keys

3. Second set of Soft Keys

These keys are made available by pressing the "MORE" key from the Main Screen.

Key Title	Action
MOVE-UP	Moves the highlighted batch up within the job, or moves the highlighted job up before the previous one.
MOVE-DN	Moves the highlighted batch down within the job, or moves the highlighted job down after the following one.
HOLD	Sets the status of the current highlighted items to hold. If a job is highlighted, each item in that job will be set to hold. A status of hold causes the batch to be ignored and not run. To later run the batches, simply highlight the batch again and press HOLD. This will set the batch status to ready.
DELETE	Deletes the line that is highlighted.
MORE	Brings up the next set of soft keys.

4. Third set of Soft Keys

FOOTAGE	Transitions to the Footage data screen. This screen will also show the footage totals for produced good material and scrap.
PURGE	Removes all batches and jobs, with a status of delete, from memory.
1-LESS	Takes one part away from the quantity being made.
MORE	Returns to the initial set of soft keys.

III.   Footage Information

To get to this screen press the FOOTAGE soft key from the status screen. This screen displays the amount of good material produced and the amount of scrap in terms of feet. The information will update in real time while the line is running.

```
12:32 PM              0FPM            0.000"
JOB:
              FOOTAGE INFORMATION


   Good:  1200 ft.
  Scrap:  17 ft.
  Total:  1217 ft.

Last Cleared 12:00 AM   1:1 :2000




  CLEAR                              EXIT
```

1. *Soft Keys.*

Key Title	Action
CLEAR	Resets the footage information to zero and sets Last Cleared to the current date and time.
EXIT	Exits the screen and returns to the Status screen.

IV.   Job Program Display

This screen is used to program jobs and then transition to programming the batches for that job. To get to this screen at any time, press the program key.

```
12:32 PM              0FPM            0.000"
JOB: 3902-45
                   PROGRAM JOBS
JOB:3902-45
JOB:3594-63




PARTS              DELETE   MOVE-UP MOVE-DN
```

1. *Soft Keys.*

Key Title	Action
PARTS	Transitions to the Part entry screen to program the part punch pattern.
DELETE	Sets the status of the items in the highlighted order to delete.
MOVE-UP	Moves the highlighted Job up before the previous one.
MOVE-DN	Moves the highlighted Job down after the following one.

2. *Programming Jobs*

Depending on the state of the setup parameter "Programming Mode" different level of input will be required.

Programming Mode set to NO JOBS will take you immediately into the BATCH ENTRY screen. At this point you enter in the batch, quantity, length, and part number if applicable.

Programming Mode set to JOBS will take you to the PROGRAM JOBS screen where the operator is prompted to enter a Job number. The default job number is (New Job). To enter a new job, key in the job number at the prompt.

Programming Mode set to JOBS & MATERIAL will take you to the PROGRAM JOBS screen where the operator is prompted to enter in a Job number and a Material number.

Programming Mode set to JOBS & PROFILE will take you to the PROGRAM JOBS screen where the operator is prompted to enter in a Job number and a Profile number. Profile is active only if a network number is used, i.e. SmartComm™ is active.

Programming Mode set to JOBS, MAT, PROFILE will take you to the PROGRAM JOBS screen where the operator is prompted to enter in a Job number, Material number, and a Profile number. Profile is active only if a network number is used, i.e. SmartComm™ is active.

The job screen also allows previously programmed jobs to be edited. Scrolling to a job allows the job number or material to be changed. After pressing enter on the material field of a previously programmed job, the batch screen comes up allowing the batches to be changed or new batches to be added.

V.   Batch Entry Display

This screen is used to enter or edit batches for a job from the previous screen.

```
12:32 PM              0FPM           0.000"
JOB:
                  BATCH ENTRY
JOB: 43095-23
BATCH   QTY    DONE    LENGTH     PART   STAT
1       100    0       120.000"   252    NEXT
2       200    0       144.500"   321    RDY




PARTS             DELETE   MOVE-UP  MOVE-DN
```

1. Batch F-Keys.

Key Title	Action
PARTS	Transitions to the Part Entry Screen
DELETE	Deletes the Highlighted Item
MOVE-UP	Moves the Highlighted Item up prior to the previous item.
MOVE-DN	Moves the Highlighted Item after the next item.

2. *Programming Batches*

Upon entering this screen, the operator will be prompted for a batch number. The default batch number is 1 if the job has no batches. If the job has batches already, the default batch number will be the number of the last existing batch.

After entering a batch number, enter the quantity desired, enter a desired length, and then a part if applicable. If no part is desired, simply press the enter key on that field to keep it at zero. A part of zero means that no part will be used for that batch resulting in a part with no holes. If the controller is configured for shear only a part number will not be displayed.

Reference (REF) is used to pick up on a reference notch or counting multiple notches or holes. When in reference mode the controller allows you to program a number of notches to count. The controller will count until the appropriate number is reached and then setup the target, in memory, to activate the cutoff.

The up and down arrow keys may be used to edit existing batches. The right and left arrows will move between the data fields for the current batch.

VI.   Part Program Display

This screen is used to program punch patterns and then transition to programming the operations for that part.

```
12:32 PM              0FPM            0.000"
JOB: 3049-34
                   PROGRAM PARTS
NUMBER: 20    MARK:




 COPY              DELETE   MOVE-UP   MOVE-DN
```

1. *Part F-Keys.*

Key Title	Action
COPY	Makes a duplicate of the highlighted part and places it at after the last part.
DELETE	Deletes the highlighted Part.
MOVE-UP	Moves the highlighted Part up before the previous one.
MOVE-DN	Moves the highlighted Part down after the following one.

2. *Programming Parts*

Upon entering this screen, the operator is prompted for a part number. This number corresponds to the batch's part number. The MARK code is optional and may be left blank. MARK is used to describe the part or it is used with an ink jet printer to put the desired marking on the part. After pressing the enter key on the description field, the punch entry screen is displayed.

VII.   Punch Entry Display

This screen is used to enter operations for a part from the previous screen.

```
12:32 PM            0FPM            0.000"
JOB: 3049-34
 PROGRAM PUNCHES FOR PART:  255
Tool:2    Pos:  12.000"   Spacing Start
Tool:2    Pos:  24.000"   Even Spacing
Tool:2    Pos:  12.000"   Spacing End




     PARTS              DELETE MOVE-UP MOVE-DN
```

1. *Punch F-Keys.*

The following Function keys will be initially be present on the program jobs screen. Anytime the user returns to the screen, these are the keys that will be shown.

Key Title	Action
PARTS	Transitions to the Part Entry Screen.
DELETE	Deletes the current Operation
MOVE-UP	Moved the current operation ahead of the previous one.
MOVE-DN	Moved the current operation after of the next one.

2. *Entering Punches*

Each punch entry consists of three important parts that must be entered. First, the tool number is the tool that will be performing the punch operation. Next, the position is the location of that operation from some reference. Lastly, the reference defines where the position is measured. The shear tool is 1 and the punch tool is 2. A shear tool is not needed because the overall length programs this.

After pressing the enter key on the reference field the operator is prompted for another punch. The default tool on a new punch is a star. This is an invalid tool number and that will cause the operation to be deleted after leaving the screen. Only the operations that had valid tool numbers entered will be retained for the part.

3. *Reference Definitions*

A punch definition can have one of several reference definitions.

Leading Edge

With this reference, the position of the current punch definition is measured from the leading edge of the part.

Trailing Edge

With this reference, the position of the current punch definition is measured from the trailing edge of the part.

Leading Center

With this reference, the position of the current punch definition is measured from the center of the part toward the leading edge. If a 120-inch part is programmed and the punch position is 10 inches from leading center, the part will be punched at 50 inches.

Trailing Center

With this reference, the position of the current punch definition is measured from the center of the part toward the trailing end of the part edge. If a 120-inch part is programmed and the punch position is 10 inches from trailing center, the part will be punched at 70 inches.

Spacing Start

This is used to specify the location of the first hole for Even Spacing punch references. This is optional for even spaced operations. If it is used, it must be specified above the even space reference. *See Even Spacing for more details.*

Spacing End

This is used to limit an even spacing punch reference from locating a punch too close to the end of a part. This specifies the minimum distance from the end of a part that an even spaced punch can occur. This parameter is optional for even spaced operations. If it is used, it must be specified above the even space reference. *See Even Spacing for more details.*

Even Spacing

This causes the specified tool to fire repeatably, spaced at the specified amount. To prevent punches form occurring too close to the ends of a part, the Spacing Start and Spacing End reference may be defined before this reference is entered.

```
Example:
Tool:  2    Pos: 12.000        Ref: Spacing Start
Tool:  2    Pos: 24.000        Ref: Even Spacing
Tool:  2    Pos: 12.000        Ref: Spacing End
```

This pattern would cause punches every 6 inches starting at 12 inches, with no punch closer than 10 inches form the end to the part. Without Spacing Stop specified, the last punch could occur up to the end of the part. Without Spacing Start specified, the first hole would be at 6 inches, the even spacing distance.

Multiple Even spacing operations may be set within a given part. For each one Spacing Start and Spacing End must be re-entered if they are desired.

Continuous

Continuous operation allows the punch to operate continuous through the part with no interruptions. An example is a line that has a die set that punches 12" at a time but produces parts that are 12' 6" long. The cutoff must cut in between the 12" hole pattern every other part.

VIII.   Machine Setup Parameters

This screen is used to enter machine specific information and specify operator preferences. To access this screen at any time, press the SETUP key on the keypad.

```
12:32 PM              0FPM           0.000"
JOB:
      MACHINE CONFIGURATION PARAMETERS




DARKER   LIGHTER    IN/OUT    TIME     MORE
```

1. Soft Keys.

Key Title	Action
DARKER	Each press of this key will darken the display contrast. The contrast may need adjusting with changes in room lighting and temperature.
LIGHTER	Each press of this key will lighten the display contrast. The contrast may need adjusting with changes in room lighting and temperature.
IN/OUT	Displays the inputs and outputs of the controller. It also allows the setting of the press dwell times.
TIME	Transitions to the screen where the time is set.
MORE	Goes to the Calibration Adjustment screen.

2. Second Set of Soft Keys.

Key Title	Action
CAL-ADJ	Transitions to an interactive screen that allows for part length calibration.
C-LOOP	Transitions into a Closed Loop Setup and Testing Screen.
DONE	Returns to previous screen.

3. Setup Parameters

Parameter	Default Value	Description

Programming Mode	JOBS	JOBS, the controller prompts for a Job number. JOBS & MATERIAL, the controller prompts for a Job number and a Material number. JOBS & PROFILE, the controller prompts for a Job number and a Profile number. JOBS, MAT, PROFILE, the controller prompts for a Job number, a Material number, and a Profile number. NO JOBS, when pressing Program the controller takes you directly into the Batch programming screen. * Profile only works with SmartComm™.
Numeric Entry Mode	DECIMAL	DECIMAL allows part lengths to be entered in decimal inch format, for example 131.625" FRACTIONAL allows part lengths to be entered in fractional format, for example 12' 11- 5/8"
Halt Line for a New	NO STOP	NO STOP, runs the line continuous. ITEM, stops the line for each line item on the display, regardless of the batch number. BATCH, stops the line when a new batch starts. JOB, stops the line when a new Job starts.
Encoder Direction	CW	The direction that the material encoder wheel turns to make the encoder count positive.
Encoder Resolution	85.3333 Cnt/In	The number of counts received from the material encoder for each inch of material that passes. The number of counts is four times the pulse rate. For a 256 pulse encoder with wheel having a 12-inch circumference, the resolution would be: 256 * 4 / 12 = 85.3333.
Motor Resolution	4000 Cnt/In	The number of counts received from the encoder for each inch of movement of the shear.
Motor Direction	CW	This determines if clockwise or counter-clockwise rotation is forward for the shear.
Motor Polarity	POS	This determines if a positive or negative output signal causes forward motion for the shear.
Punch Motor Res.	4000 Cnt/In	The number of counts received from the encoder for each inch of movement of the punch.
Punch Motor Direction	CW	This determines if clockwise or counter-clockwise rotation is forward for the punch.
Punch Motor Polarity	POS	This determines if a positive or negative output signal causes forward motion for the punch.
Correction Factor	100.0000 %	The correction factor will compensate for non-exact measurement of the encoder wheel. Formula for calculating a new correction factor. $$\frac{\Pr ogrammedLength}{MeasuredLength} \times OldCorrectionFactor$$
Correction +/- Change	0.030 In	Defines the amount that the part length will change for every press of the status screen's correction soft keys.
Delay After Shear	0.0 Sec	This is the time that the machine will stop movement after a shear cut has taken place.
Shear Dwell Time	0.0 Sec	The time it takes the shear to cut through the material.

		If the shear does not cut through the material, increase this time.
Shear Dwell Up Time	0.0 Sec	The time it takes the shear to travel from the bottom of the cut to the top-of-stroke.
Press 2 Dwell Time	0.0 Sec	The time it takes the punch to punch through the material. If the punch does not punch through the material, increase this time.
Press 2 Dwell Up Time	0.0 Sec	The time it takes the punch to travel from the bottom of the punch to the top-of-stroke.
Press 2 Offset	0.000 In	The distance between the shear and the punch. With material under both the shear and the punch, cycle both the shear and the punch, job the material out and carefully measure from the end of the part to the hole reference location.
Minimum Part Length	0.0 In	This is the minimum part length that should be run on the machine. If a value shorter than this minimum is entered in, an error will occur and the line will not run.
Scrap Length	0.0 In	This is the length of part that will be run at the leading edge of the coil. Enter 0.0" for the first piece to be the programmed part length. There may be parts that are made which do not have some or all of the holes.
Shear to Encoder Distance	0.000 In	This is the measured distance from the shear to the material encoder.
Shear Slug Width	0.0 In	This is the amount of material removed by the shear.
External Reference Mode	NO	This enable the controller to pick up on a notch for referencing the edge of the piece. Yes, selects the reference mode. No, de-selects the reference mode Switch, allows the mode to be changed using a selector switch on the panel.
Minimum Reference Spacing	1.000 In	This is the closest that the notches or holes can be and still be picked up. This can be used to mask between holes.
Shear to Reference Detector	0.000 In	This is the physical measured distance between the cutoff and the reference switch.
Control Tolerance	0.050 In	The target must be in this tolerance for the shear to fire. This window is the error calculated by the control loop. This does not include mechanical inaccuracies that the controller cannot measure or take into account.
Jog Velocity	10 Ft/Min	The speed the motor moves when jogging forward or reverse.
Proportional Gain	5.0	This is the proportional gain value of the control loop for the Shear. A higher gain makes the system more accurate and responsive. A value too large will cause oscillations and instability.
Integral Gain	0.5	This is the integral gain value of the control loop for the shear. A higher value will cause errors to integrate out faster and the system will reach steady-state sooner. A value too large will cause

		oscillations and instability.
Velocity Compensation (Auto)	0.0	This is a proportional adjustment made automatically by the controller for the shear. This number is a result of not knowing the exact voltage required per RPM of motor. If the motor jams causing this to become unreasonable, you may zero its value.
Return Home Velocity	50 Ft/Min	This is the maximum velocity that the shear will return home after a cut is made.
Acceleration	50 In/Sec^2	The rate the shear motor accelerates. A larger value reduces time for motion to reach the desired velocity. However, a larger value will require more energy from the motor.
Minimum Shear Location	4.0 In	The minimum distance the shear moves before checking tolerance to turn on the Shear output.
Maximum Shear Location	8.0 In	The maximum distance the shear will move if tolerance is not met. It will then return the shear home and display an out-of-tolerance error.
Punch Proportional Gain	5.0	This is the proportional gain value of the control loop for the Punch. A higher gain makes the system more accurate and responsive. A value too large will cause oscillations and instability.
Punch Integral Gain	0.5	This is the integral gain value of the control loop for the punch. A higher value will cause errors to integrate out faster and the system will reach steady-state sooner. A value too large will cause oscillations and instability.
Punch Velocity Comp. (Auto)	0.0	This is a proportional adjustment made automatically by the controller for the punch. This number is a result of not knowing the exact voltage required per RPM of motor. If the motor jams causing this to become unreasonable, you may zero its value.
Punch Return Home Velocity	50 Ft/Min	This is the maximum velocity that the punch will return home after a punch is made.
Punch Acceleration	50 In/Sec^2	The rate the punch motor accelerates. A larger value reduces time for motion to reach the desired velocity. However, a larger value will require more energy from the motor.
Minimum Punch Location	4.0 In	The minimum distance the punch moves before checking tolerance to turn on the Punch output.
Maximum Punch Location	8.0 In	The maximum distance the punch will move if tolerance is not met. It will then return the punch home and display an out-of-tolerance error.
Network Baudrate	57600	This is the baud rate for the network communications with SmartComm™.
Network Unit Number	0	A unique number used to address the controller on a network with an office computer. A value of zero will disable network communication.

IX.   Input and Output Status

To get to this screen press the IN/OUT soft key from the setup screen. This diagnostic screen view the current state of the controller inputs and outputs. A one "1" below the input or output number indicates that it is on and zero "0" indicates that it is off.

```
12:32 PM              0FPM            0.000"
JOB:
              INPUT & OUTPUT STATUS
INPUTS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0 0 0 0 0 0 0 0 0 0  0  0  0  0  0  0

OUTPUTS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0 0 0 0 0 0 0 0 0 0  0  0  0  0  0  0

   1-Shear Dwell Time        0.000 Sec
   2-Shear Dwell Up Time     0.000 Sec

            I/O Update is Active
 <<PREV   NEXT>>    EDIT    CYCLE    DONE
```

1. Soft Keys.

Key Title	Action
<<PREV	Transitions to the Previous press.
NEXT>>	Transitions to the Next press.
EDIT	Allows editing of the dwell parameters for the press. You must press EDIT again to return I/O to Active state.
CYCLE	This will activate or cycle the press that is associated with this screen.
DONE	Returns to previous screen.

X.   Time Entry

To get to this screen press the TIME soft key from the setup screen. This screen is used to set the controller's clock

```
12:32 PM              0FPM            0.000"
JOB:
               SET DATE AND TIME
           MONTH: 12
             DAY: 29
            YEAR: 2001
            HOUR: 11 AM
          MINUTE: 32




 Model:  SS2-0-0-2-2-2
 Compiled on Tue Oct 2 15:32:10 2001


   APPLY                             EXIT
```

1. Soft Keys.

Key Title	Action
APPLY	Updates the controller's clock with the new time information.
EXIT	Returns to previous screen without updating the time.

XI.   Calibration Adjust

To get to this screen press the CAL-ADJ soft key from the setup screen. This screen is used to calculate a new correction factor.

```
12:32 PM              0FPM            0.000"
JOB:
          CALIBRATION ADJUSTMENT


 DESIRED LENGTH OF PART: 120.000
 ACTUAL  LENGTH OF PART: 120.125

     CORRECTION FACTOR: 100.000
 NEW CORRECTION FACTOR:  99.895

 Press OK to accept the new value.  Or
 press CANCEL to abort any changes.

   OK    CANCEL
```

1. Soft Keys.

Key Title	Action
OK	After a new correction factor is displayed, this key will accept the new value.
CANCEL	Returns to previous screen without updating the correction factor.

2. Calculating new Correction Factor.

A new correction factor is calculated using this formula:

$$\frac{\text{Pr}ogrammedLength}{MeasuredLength} \times OldCorrectionFactor$$

This screen is used to automatically perform the calculation by prompting for the desired and the actual part lengths. Using the current correction factor and the entered information, a new correction factor will be calculated. The operator can accept this new value or leave the screen without updating the correction factor.

XII. Closed Loop Setup and Calibration Adjustment

To get to this screen press the C-LOOP soft key from the setup screen. This screen is used to calibrate the die accelerator parameters. The Dual Die Accelerator controller will allow you to select either the Shear or the Punch screen.

```
12:32 PM            0FPM           0.000"
JOB:
          CLOSED LOOP SHEAR SETUP
   DAC Output:  2048   0.1024  Volts
 Line Encoder: 1016
Motor Encoder: 2032      fwd




  Prop Gain: 5.000      Int Gain: 0.500

  ENABLE    TEST    GAINS  OFFSET    DONE
```

1. Soft Keys.

Key Title	Action
ENABLE	Enables the motor and puts the analog voltage output to correspond with the display. The ENABLE soft key changes to DISABLE to allow you to turn this mode off.
TEST	Transitions into the die accelerator test screen. Allowing the simulation of a line encoder.
GAINS	Allows editing of the Proportional and Integral Gain values.
OFFSET	Resets the voltage display to 0.000 when pressed.
DONE	Returns to previous setup screen.

2. *Calibrating the controller to the servo drive.*

Note: A trained qualified technician is needed to setup the controller and servo drive. Someone not qualified could damage the controller, servo, and the equipment.

When the ENABLE soft key is pressed the servo drive will be enabled. Pushing the same soft key, now labeled DISABLE will disable the servo drive. When the drive is enabled the up and down arrow keys will increase or decrease the voltage output. This is similar to putting a battery on the analog to the drive. There will not be a runaway condition. When pushing the up arrow the voltage will increase causing the X.XXXX Volts to display a more positive number. When pushing the down arrow the voltage will decrease causing the X.XXXX Volts to display a more negative number.

Steps for calibration:

1. The first thing to do is use the up and down arrow key to set the analog output to correspond with no motor movement. Press the up or down arrow keys until the FWD/REV almost flickers between them. The motor should be close to stopped. The motor only needs to be close to stopped. Press the OFFSET soft key to set the "Volts" to zero.

    Press the up arrow a few times, outputting a positive voltage, until the motor is steadily moving. It should be moving a slow creep speed. Examine the motor and determine if it is moving forward or reverse. Also, note the direction indicated on the display for the motor encoder. If everything is correct, they will both say forward. Use this chart to make corrections to setup parameters.

Actual Direction	Displayed Direction	Voltage	Setup Parameter that needs changed
FWD	FWD	Positive	NONE
FWD	REV	Positive	Motor Encoder Direction
REV	REV	Positive	Motor Polarity
REV	FWD	Positive	Motor Polarity & Motor Encoder Direction
FWD	FWD	Negative	Motor Polarity
FWD	REV	Negative	Motor Polarity & Motor Encoder Direction
REV	REV	Negative	NONE
REV	FWD	Negative	Motor Encoder Direction

After correcting any setup parameters, return to the screen and repeat the test starting with step one. Verify that a positive voltage makes the motor move forward and the display says FWD. Also, verify that a negative voltage makes the motor move backward and the display says REV.

If something is incorrect, use the chart to make corrections. Always start over with setup one each time. **Do not** use the servo in any way (jogging, manual shear, die test, running, etc.) until you are certain the setup parameters are correct. Failure to verify these tests will cause the motor to take off as fast as possible when enabling the control loop.

2. Calculate the motor counts per inch of die movement and enter it into the setup parameter "Motor Resolution". Verify this by manually moving the die forward by 1", the Motor Encoder should increase by the counts per inch that was calculated.

3. Press the TEST soft key. Start with the Proportional Gain around 5.000 and the Integral Gain around 0.500. Press the manual shear push button to enable the servo motor. The controller's loop is now running and will position the motor. The Proportional and Integral parameters are now active and may need to be adjusted. This adjustment is made by looking at the motor stability and the graph on the setup screen. A trial and error approach needs to be performed to calibrate the controller with the servo system. The ideal setting will allow the tightest control of the motor while maintaining stability. Pressing the GAINS soft key puts the selected Gain parameter into an edit mode. Pressing the up and down arrow keys will adjust the value.

4. Set the length of test part by pressing the LENGTH soft key. Then, using the keypad, enter the desired part length to simulate and press the Enter key. Set the simulated line speed by pressing the up and down arrow keys to go faster or slower.

5. Press the START soft key to begin simulation and the STOP soft key to end simulation. While running, the Proportional and Integral Gains may be adjusted for fine-tuning. The speed can be increased or decreased while running, using the up and down arrow keys.

3. Second Set of Soft Keys.
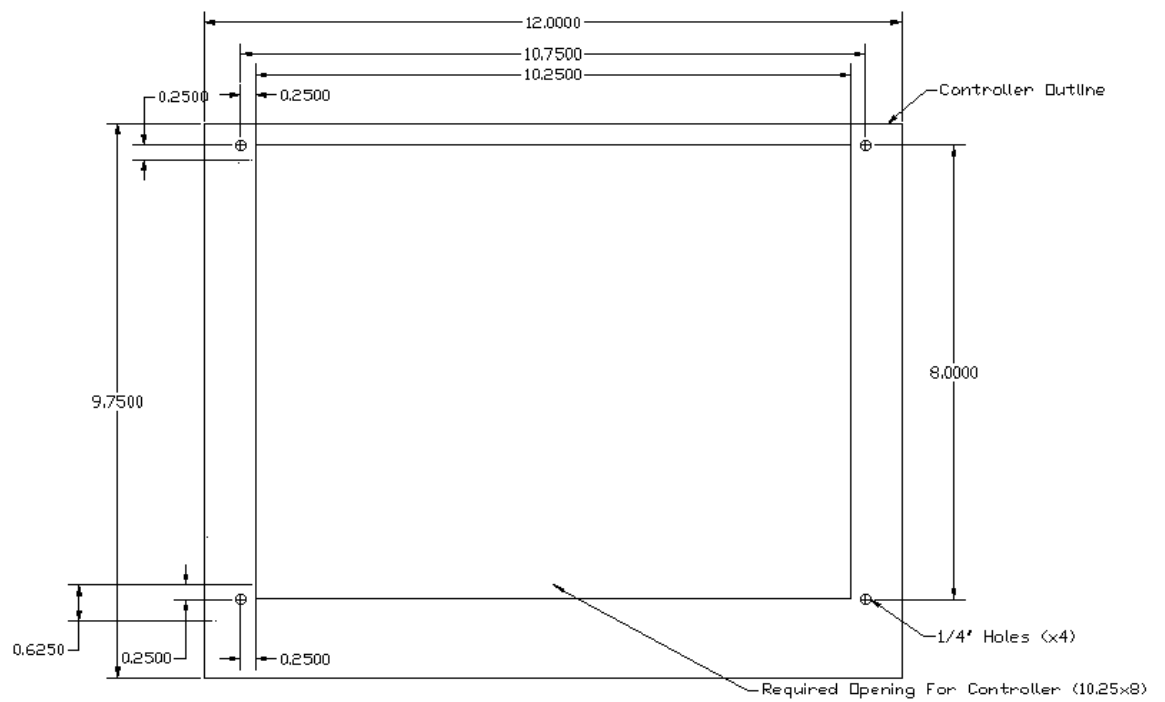
Key Title	Action
START	Starts the simulated run mode.
STOP	Stops the simulated run mode.
GAINS	Allows editing of the Proportional and Integral Gain values.
LENGTH	Allows the simulated length to be entered.
DONE	Returns to previous setup screen.

XII.   Installation

1. Panel Mounting

The Sierra Series controller is designed for mounting in a panel.   The drawing below should be used to locate the required rectangular cut out and the four required mounting holes.

NOTE: The controllers threaded studs are used to ground the controller. Please make sure to remove any paint from the metal panel under the nuts in order to establish a good electrical connection. Also, be sure to use all four nuts and thread them down until they are snug.

12.0000

10.7500

10.2500

0.2500

0.2500

Controller Outline

9.7500

8.0000

0.6250

0.2500

0.2500

1/4" Holes (x4)

Required Opening For Controller (10.25x8)

2. *Electrical Connections*

Electrical Connections are made on one of four connectors. The connector location, along with their primary function, is shown on the drawing below. The first and last pin numbers are shown, too.

NOTE: The single axis version only has connectors X1 to X4 and the enclosure is thinner.
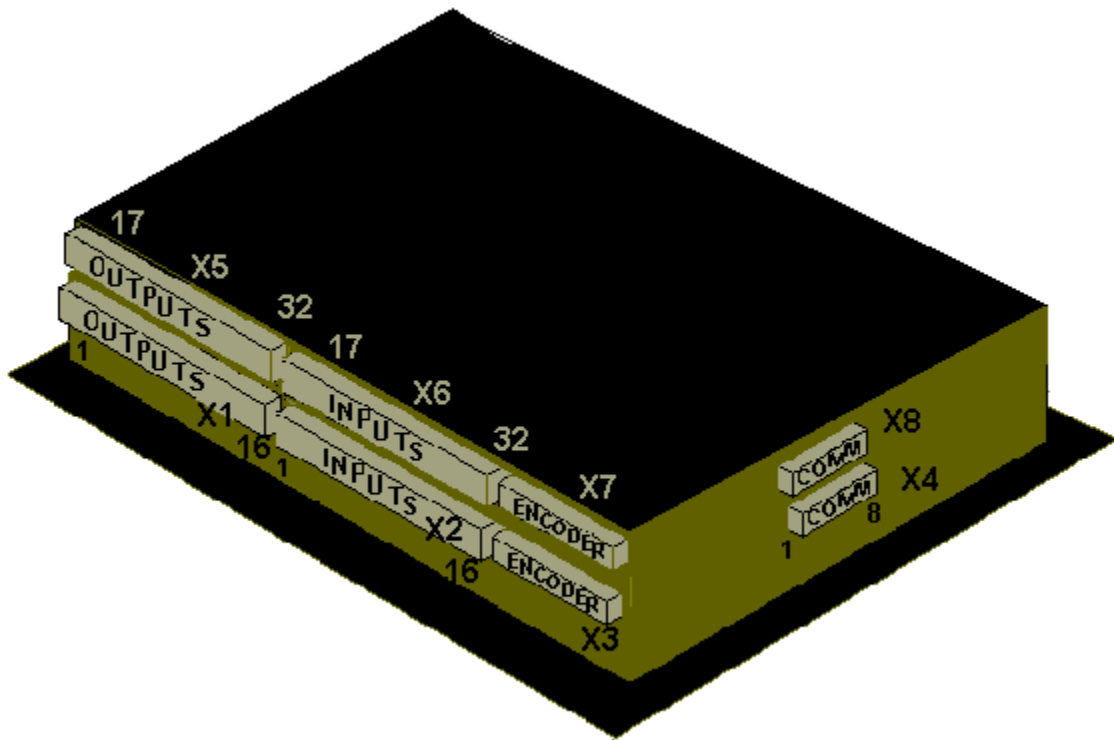
Output Connectors

The first two pins are used for the I/O power supply. It is recommended this be a different 24V DC supply than the supply used for the Digital supply.

The remaining pins, starting at pin 3, on the connector are for outputs 1 to 16 in numerical order.

The outputs are active low DC open drain outputs. They are able to sink 6-Amps of current continuously. The outputs are protected with TVS diodes and a low pass filter.

X1 Connector

Pin Number	Function	Description
1	+24V I/O Supply	+24 supply for the I/O
2	I/O GND	Ground for the I/O
3	Run Output 1	This output turns on when the controller enters run mode. This output should be used to latch up the run input. This output should <u>NOT</u> be used to control the motion or the line
4	Fast Output 2	This output is used to signal the line to move at a fast velocity. This output comes on when the line is in run mode and the controller is ready for the line to advance at normal speed.
5	Slow Output 3	This output is used to signal the line to move at a slow rate. This output comes on when jogging forward or reverse.
6	Reverse Output 4	This output is used to signal the line to move in reverse. This output comes on while jogging backward.
7	Shear Output 5	The controller turns on this output to activate the shear press.
8	Shear Up Output 6	The controller turns on this output to activate the shear press up output following the shear output.
9	Punch Output 7	The controller turns on this output to activate the punch press.
10	Punch Up Output 8	The controller turns on this output to activate the punch press up output following the punch output.
16	Punch Drive Enable Output 14	Drive enable for the punch servo.
18	Shear Drive Enable Output 16	Drive enable for the shear servo.
11,12,13,14, 15, 17	Outputs 9, 10, 11, 12, 13, 15	These outputs are not used on this model.

X5 Connector

Pin Number	Function	Description
1	+24V I/O Supply	+24 supply for the I/O
2	I/O GND	Ground for the I/O

Note: I/O supply signals must be connected to both X5 and X1 in order for the I/O to work.

Input Connectors

The first sixteen pins on this connector are used for the controller's inputs. All of the controller's inputs are active low DC inputs. They are protected with TVS diodes and a low pass filter network.

The last two pins on this connector are used for the digital power supply and its ground. A separate regulated 24VDC power supply should be used to power the controller and connect to these two pins. It is recommended that the supply is mounted in the same cabinet as the controller and the +24V and ground wires are twisted together and routed to the controller.

X2 Connector

Pin Number	Function	Description
1	E-Stop Input 1	This input is used to signal an E-STOP condition. For the controller to enter run mode, this input must be activated. If this input is dropped, the controller will immediately exit the run mode.
2	Run Input 2	This input is used to put the controller to enter run mode and start running parts. If the controller is able to enter run mode, it will turn on the run output, which should be used to latch this input on.
3	Jog Forward Input 3	This input is used to jog the line forward.
4	Jog Reverse Input 4	This input is used to jog the line in reverse.
5	Manual Shear Input 5	This input is used the cycle the shear press.
6	Manual Punch Input 6	This input is used to cycle the punch press.
7	Setup Lockout Input 7	This input locks the setup parameters so that they cannot be changed.
8	No Material Input 8	This input is activated to tell the controller the material has run out.
9	Shear Die Jog Fwd Input 9	Jogs the shear press forward
10	Shear Die Jog Rev Input 10	Jogs the shear press in reverse
11	Die Home Input 11	Shear die home input.
12	Shear Comp. Input 12	Turns off the shear down output and on the shear up output.
13	Punch Comp. Input 13	Turns off the punch down output and on the punch up output.
14 to 16	Unused	
17	Digital Ground	This is the ground connection for Digital.
18	+24VDC Digital Supply	This connection is used to supply power for the Digital.

X6 Connector

1	Punch Die Jog Fwd Input 17	Jogs the punch press forward
2	Punch Die Jog Rev Input 18	Jogs the punch press in reverse
3	Die Home Input 19	Punch die home input.
9 to 16	Unused	
17	Digital Ground	This is the ground connection for Digital.
18	+24VDC Digital Supply	This connection is used to supply power for the Digital.

Note: Digital supply signals must be connected to X6 in order for the controller to power up.

Encoder Connectors

The encoder connector is used to connect up to two encoders. It also contains the analog output signals for a servo drive.

X3 Connector

Pin Number	Function	Description
1	+5	5VDC supply to power an encoder
2	GND	Ground for encoder power supply.
3	(Shear Servo) 2B+	Encoder 2's channel B positive signal
4	2B-	Encoder 2's channel B negative signal
5	2A+	Encoder 2's channel A positive signal
6	2A-	Encoder 2's channel A negative signal
7	Shield	Connect the shield of a shielded encoder or analog cable to this pin.
8	(Line encoder) 1B+	Encoder 1's channel B positive signal
9	1B-	Encoder 1's channel B negative signal
10	1A+	Encoder 1's channel A positive signal
11	1A-	Encoder 1's channel A negative signal
12	Shield	Connect the shield of a shielded encoder or analog cable to this pin.
13	Pos. Analog Shear	Positive side of a +10/-10vdc differential command signal for a servo drives.
14	Neg. Analog Shear	Negative side of a +10/-10vdc differential command signal for a servo drive.

X7 Connector

Pin Number	Function	Description
1	+5	5VDC supply to power an encoder
2	GND	Ground for encoder power supply.
3	(Punch Servo) 4B+	Encoder 4's channel B positive signal
4	4B-	Encoder 4's channel B negative signal
5	4A+	Encoder 4's channel A positive signal
6	4A-	Encoder 4's channel A negative signal
7	Shield	Connect the shield of a shielded encoder or analog cable to this pin.
8	3B+	Encoder 3's channel B positive signal
9	3B-	Encoder 3's channel B negative signal
10	3A+	Encoder 3's channel A positive signal
11	3A-	Encoder 3's channel A negative signal
12	Shield	Connect the shield of a shielded encoder or analog cable to this pin.
13	Pos. Analog Punch	Positive side of a +10/-10vdc differential command signal for a servo drives.
14	Neg. Analog Punch	Negative side of a +10/-10vdc differential command signal for a servo drive.

Communication Connectors

The communication connector is used to access the RS232 port and two RS485 ports.

X4 Connector

Pin Number	Function	Description
1	1 – B	RS485 Port signal B
2	1 – A	RS485 Port signal A
3	Shield	Connect the shield of a communication cable to this pin.
4	2 – B	RS485 Port signal B
5	2 – A	RS485 Port signal A
6	GND	Use this Ground pin for the RS232 connection.
7	TX	RS232 Port Transmit connection
8	RX	RS232 Port Receive connection

X8 Connector
Note: This connector is not used by this model.