BECK
Automation

Sierra Series Users Guide
Open Loop

BECK Automation, LLC
11412 Nora Ct.
St. Louis, MO 63044

Phone (314) 209-9224
Fax (314) 209-9252
www.BeckAutomation.com

CD 600M, 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.   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

Upon entering this screen, the operator will be prompted for a job number. The default job number is (New Job). To enter a new job, key in the job number at the prompt.

After pressing the enter key, the operator is prompted to enter a material. The material field is simply for record keeping and is optional. If no material is desired, simply press enter on that field. After pressing the enter key on the material field, the batch screen comes up to enter items data for the current job.

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.

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: 3902-45
                  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 necessary. 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.

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.

IV. 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.

3. Programming Parts

Upon entering this screen, the operator will be prompted for a part number. This number corresponds to the batch's part number. The description code is optional and may be left blank. After pressing the enter key on the description field, the punch entry screen is displayed.

V.   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.

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:  6.000      Ref: Even Spacing
Tool:  2   Pos: 10.000      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.

VI.   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 have to be adjusted with changes in room lighting and temperature.
LIGHTER	Each press of this key will lighten the display contrast. The contrast may have to be adjusted 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. Setup Parameters

Depending on the model, some of these setups may not apply to your controller. Also, the setups
may be arranged in a different order.

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 wheel turns to make the
Encoder Resolution	85.3333 Cnt/In	The number of counts received from the 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.
Correction Factor	100.000%	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 the shear up output remains on. The Shear up comes on when the shear down turns off.
Shear Reaction Time	0.0 Sec	The time it takes the controller to give the cut command until the shear blade makes contact with the material. This time will turn the shear on early, based on velocity, to make all cuts more accurate.
Shear Boost Dwell Time	0.0 Sec	The time the shear boost output will remain on. The boost output will turn on at the shear target, and will turn on early by the Shear Boost Reaction time. The shear boost output is independent of the shear output.
Shear Boost Reaction Time	0.0 Sec	The time the shear boost will turn on early from the shear target location.
Press 2 Dwell Time	0.0 Sec	The time it takes the press to cut through the material. If the shear does not cut through the material, increase this time.
Press 2 Dwell Up Time	0.0 Sec	The time the press up output remains on. The press up comes on when the shear down turns off.

Press 2 Reaction Time	0.0 Sec	The time it takes the controller to give the punch command until the punch tool makes contact with the material. This time will turn the punch on early, based on velocity, to make all punches more accurate.
Press 2 Boost Dwell Time	0.0 Sec	The time the punch boost output will remain on. The boost output will turn on at the punch target, and will turn on early by the Punch Boost Reaction time. The punch boost output is independent of the punch output.
Press 2 Boost Reaction Time	0.0 Sec	The time the punch boost will turn on early from the punch target location.
Press 2 Offset	0.0 In	This is the physical measured distance from the shear to the punch.
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	0.0 In	This is the distance from the Shear to the Encoder. The parameter is used in conjunction with a switch to detect the presence of material. When new material first makes contact with the switch the length past shear is set to the negative of the distance back to this switch. This will allow for a more accurate scrap calculation when the leading edge of a new coil is jogged under the shear and cut off.
Shear Slug Width	0.0 In	This is the amount of material removed by the shear.
Control Tolerance	0.050 In	The amount of error allowed without halting the line and displaying an out of tolerance error message. The number can be reduced until mechanical inaccuracies cause frequent error messages.

3. Feed to stop Parameters

Time to Stop	0.000 Sec	The time required to stop the line. When the shear target is a distance equal to line velocity times this stop time, from the target, it halts the line.
Auto Correct Time to Stop	NO	If set to NO, the stop time will remain at whatever is entered. If set to YES, the stop time will dynamically correct itself based on past errors.
Deceleration Rate	50 In/Sec^2	The rate at which the line slows from Fast to Slow. This is used to determine when to shift into slow when using two-speed logic.
Minimum Slow Distance	4.000 In	The minimum distance the line should be in slow. Setting this to zero will disable two-speed logic.

		Setting this to a number larger than zero will cause the controller to shift into slow such that after it decelerates to slow, based on the rate entered, it should remain in slow for this distance. This number can be smaller if the deceleration rate is very accurate for all speeds. A larger value will help insure the line is moving at the slow velocity making stops more accurate.

VII. 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:

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

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.

VIII. 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
                 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.

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 below the input or output number indicates that it is on and zero indicates that is it 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
CAL-ADJ	Transitions to an interactive screen that allows for part length calibration.
DONE	Returns to previous screen.

X.   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
```

1. Soft Keys.

Key Title	Action
CLEAR	Resets the footage information to zero and sets Last Cleared to the current date and time.

XI.   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.
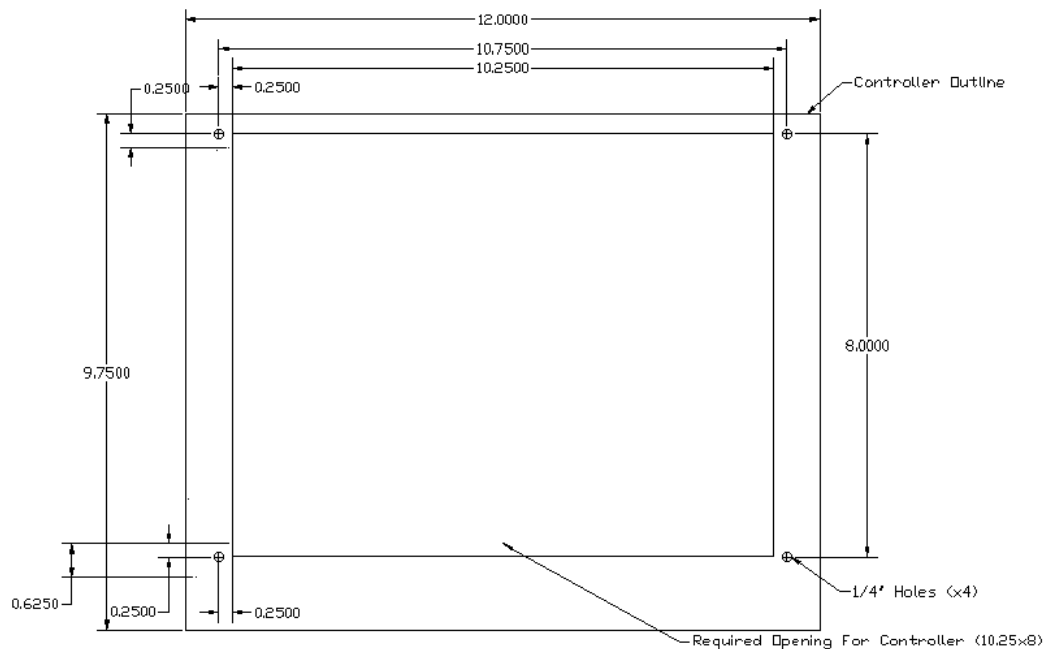
2. Electrical Connections

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.
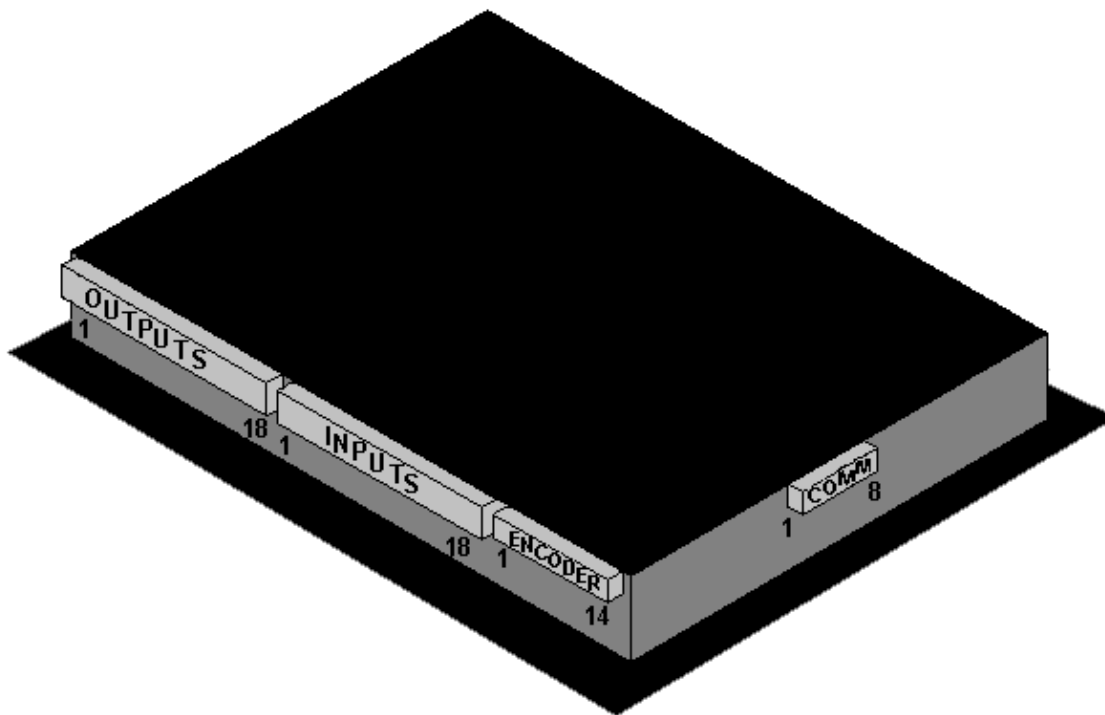
Output Connector

The first 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.

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.

Pin Number	Function	Description
1	+24VDC I/O Supply	This connection is used to supply power for the I/O.
2	I/O Ground	This is the ground connection for I/O.
3	Run Output	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	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	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	This output is used to signal the line to move in reverse. This output comes on while jogging backward.
7	Shear Output	The controller turns on this output to activate the shear press.
8	Shear Boost or Up	The controller turns on this output to activate the boost or Up for the shear press.
9	Punch Output	The controller turns on this output to activate the punch press.
10	Punch Boost or Up	The controller turns on this output to activate the boost or Up for the punch press.
11 to 18	Outputs	These outputs are not used on this model.

Input Connector

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 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.

Pin Number	Function	Description
1	E-Stop	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	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	This input is used to jog the line forward.
4	Jog Reverse	This input is used to jog the line in reverse.
5	Manual Shear	This input is used the cycle the shear

		press.
6	Manual Punch	This input is used to cycle the punch press.
7	Unused	
8	No Material	This input is activated to tell the controller the material has run out.
9 to 16	Unused	
17	Digital GND	Ground for electronics
18	+24V Digital Supply	+24 supply for electronics

Encoder Connector

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

Pin Number	Function	Description
1	+5	5VDC supply to power an encoder
2	GND	Ground for encoder power supply.
3	Not Used	
4	Not Used	
5	Not Used	
6	Not Used	
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	Not Used	
14	Not Used	

Communication Connector

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

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