XL270 CL

Release One

Supplement

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Chapter 1: Overview

The XL270CL controller is specially designed for use with the Formia tile machine that has, in sequence, an entry shear, a roll-former, one forming press, and an exit shear.

This manual is a supplement to the A*MS Controls XL200CL Technical Reference and Installation Guide*. Therefore, be sure you are familiar with the XL200CL material sand have a copy of the guide handy.

Note: Although the XL270CL is currently designed primarily to make parts and work out press sequences, machine limitations, and programming limitations, more feature and functionality are scheduled for development.

Theory of Operation

Typical Part

Figure 1 shows a typical part:

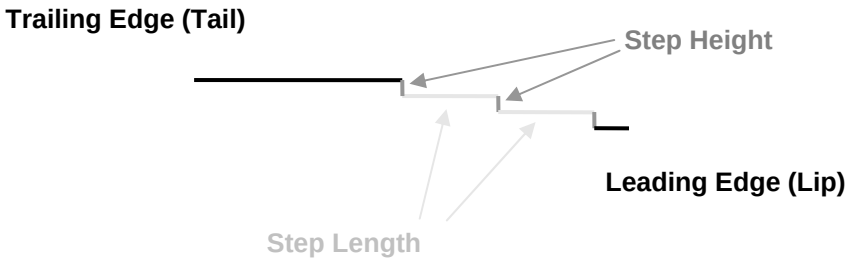

Figure 1: Typical Part

After the material is roll formed, it is step formed.

The programmed part length is the linear distance between the two edges (the *linear coverage distance*). The step height is not considered in the part length measurement, but the tail is subject to a minimum allowed length.

Each step is equidistant from the previous step and the next step, and the *step length* is a critical dimension.

The leading edge of the part has a small lip before the first step. This lip is a critical dimension.

The last section on the trailing edge, the tail, is variable depending on the programmed part length.

The step does not run as a straight line across the part; rather, it is a wave that restricts how close a straight shear can occur to the step (Figure 2).

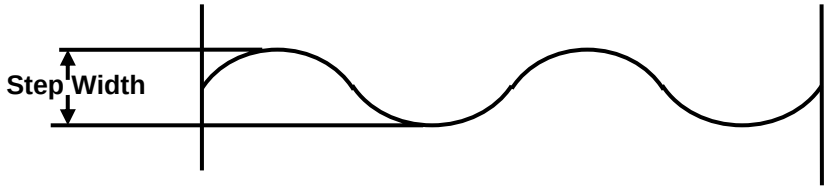

Figure 2: Looking Down On the Step from Above

The amplitude of the wave is the *step width.*

Typical Step Forming Press

Figure 3 shows a typical step forming press (material flows from left to right).

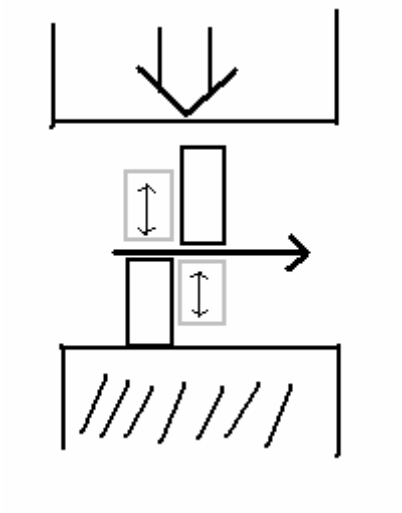

Figure 3: Typical Step Forming Press

The step forming die has two sides. The top of the entry side and the bottom of the exit side move up and down independently of the top exit and bottom entry pieces of the die, and are controlled hydraulically with the forming tools.

The controller has press down, press up, and forming tool outputs to control this press. The forming tool output sequence primarily concerns the lower forming tool to prevent the formed step from interfering with the upper forming tool.

So the entire press sequence is:

1. The forming tool is on at the beginning of the press stroke. It applies pressure while on.
2. The Press Down output comes on until the Press Complete input comes on or until the dwell expires.
3. The forming tool turns off and the Press Up output comes on until the press up complete input turns on or the dwell expires. Turning the forming tool off relieves pressure and causes the tool to stay in place.
4. The forming tool stays off until the formed step clears the lower tool during the next feed.
5. The forming tool turns on and rises back up for the next press cycle.

Entry Kerf and Exit Kerf

Material consumed by the press in a forming process is called *kerf*. All the material consumed by the press in producing a part is the *total kerf*.

In the step forming process, the press consumes material from both directions. (see Figure 4). Material pulled from the exit shear, or exit side, of the press is called *exit kerf*. Material pulled out of the roll-former as the forming operation occurs is called *entry kerf*.

Note: Entry kerf is tracked by the encoder; exit kerf is not.

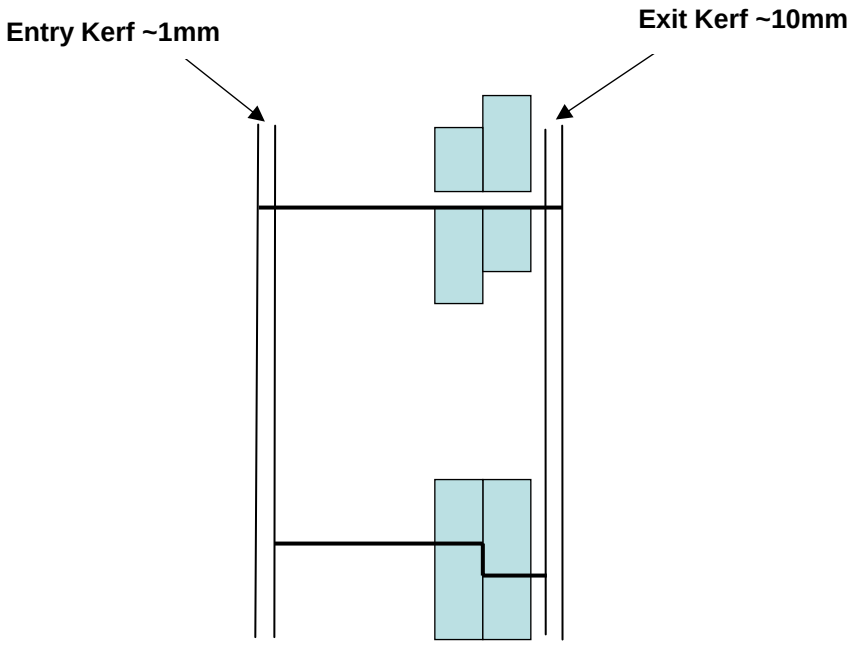

Figure 4: Entry Kerf and Exit Kerf

Three conditions must be considered with regard to exit shear and exit kerf while in automatic mode.

- Shear and forming operations are coincidental.
- The shear occurs following a short move.
- A forming operation causes a material crash with the shear -- these forming crashes with the shear must be tested for and prevented.

Coincidental Shear and Forming Operations Sequence

Figure 5 shows coincidental shear and forming operations.

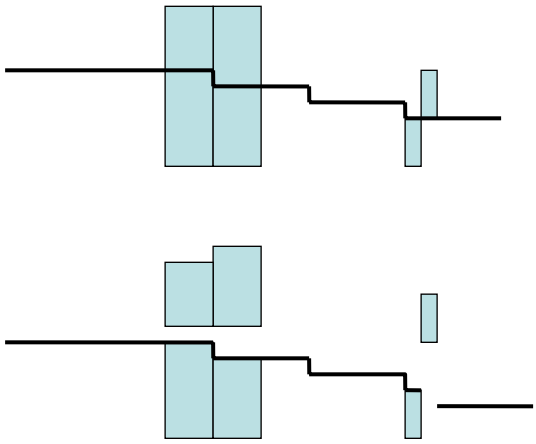

Figure 5: Coincidental shear and forming operations

1. The forming press closes, pulling the shear point back into position.
2. The forming press stays down until the shear reaches the bottom of its stroke.
3. Both presses open together.
4. The forming tool operates a s described in *Typical Step Forming Press*, page 3.

Short Feed Between Forming Operation and Shear Operation

Figure 6 shows the operation of the presses when there is a short feed between the forming operation and the shear operation.

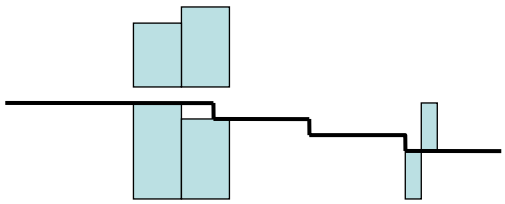

Figure 6: Short Feed Between Forming Operation and Shear Operation

1. The forming operation occurs and material pulls back under the shear, but not enough for it to get into position.
2. The controller feeds and then shears. Notice that the forming tool is still down during the shear.
3. The forming tool must wait until the step has fed out of the tool, possibly even after the shear operation has finished.

Potential Material Crash Condition

Figure 7 shows a potential material crash condition. Certain combinations and ranges of sheet length and step lengths re invalid because of the possibility of the forming operation pulling a previous step into the lower shear blade.

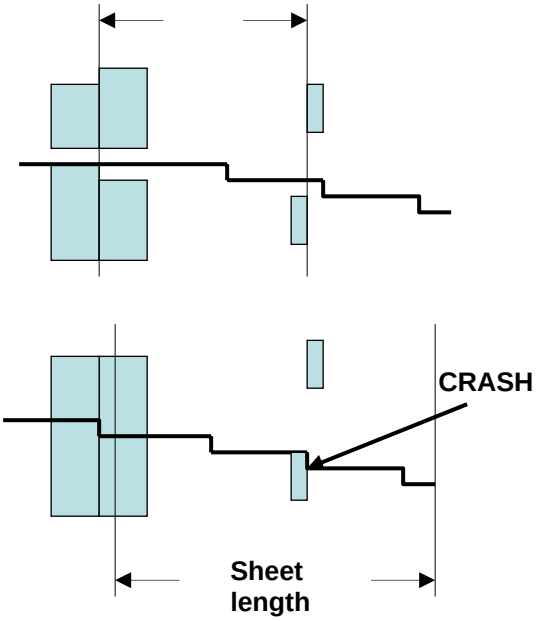

Figure 7: Potential Material Crash Condition

The step width also factors into this crash condition. Since the step is wavy and in some cases the shear is straight, the step width must also be considered in the test for preventing crashes.

Note: Though an individual part that causes a crash is prevented, no current test prevents a crash as a result of a change in part length.

Entry Kerf and Entry Shear

As a step forming operation occurs, material is pulled from the roll former. This material movement may cause missed shear targets for the entry shear if part lengths and tool offsets line up perfectly such that a forming operation occurs just prior to an entry shear operation.

The material encoder monitors this movement so the controller can account for it.

Note: Under some circumstances, as the forming operation occurs, enough material may be pulled to draw the entry shear target past the shear, out of tolerance, so that it cannot fire.

Upcoming releases of the XL270 CL software will address and handle this issue. However, in general this issue is of limited concern because, in order for the roll former to position the last forming operation, the last part run must have a scrap piece added to the end of it in order to reach the step forming press. So, as long as the added scrap isn't too short, accuracy is not important for the last automatic cut.

Chapter 2: Model Customization

Input/Output Definitions

I/O Configuration

The XL270 CL I/O definitions are similar to the standard XL266 Model I/O definitions; some inputs have been changed to support inputs such as E-Stop, Feed OK, and Slow Run.

- Inputs and outputs reserved for future use and releases are listed in *italics* and are not available in this release
- Inputs that change for the Open Loop Controller are also listed in *italics*.

Note: The XL270 OL controller is currently unavailable.

I/O#	Inputs	Outputs
1	Jog Forward	Fast
2	Jog Reverse	Slow
3	Run	Reverse
4	(E-Stop, CL)|*(Manual Punch 2, OL)*	Run
5	Setup Lockout	Item Complete
6	Manual Shear	Forward
7	Manual Punch 1	*(Future Print Flush)*
8	Tail Out	*(Future Print Trigger)*
9	Press 0 Complete, Shear	Press 0 Down, Shear
10	Press 1 Complete	Press 1 Down , Forming
11	*(Future Press 2 Complete)*	*(Press 2 Down, Future Forming)*
12	Press 3 Complete, Entry Shear	Press 3 Down, Entry Shear
13	Not Used	Not Used
14	(Manual Punch 2 CL)|*(Not Used OL)*	Not Used

15	Press 0 Up Complete	Press 0 Up, Shear
16	Press 1 Up Complete	Press 1 Up, Forming
17	*(Future Press 2 Up Complete)*	*(Press 2 Up, Future Forming)*
18	Press 3 Up Complete	Press 3 Up, Entry Shear
19	(Stacker Complete, CL)|*(Not Used, OL)*	Not Used
20	(Manual Stacker, CL)|*(Not Used, OL)*	Press 1 Forming Tool
21	*(Future Asynchronous Print Detect)*	*(Future Press 2 Forming Tool)*
22	(Feed Ok, CL)|*(Manual Stacker, OL)*	Stacker
23	(Slow Run, CL)|*(Stacker Complete, OL)*	Not Used
24	Not Used	Not Used

Switch Configuration

This release requires no Model Configuration.

Switch #	OFF	ON
1	CW Encoder 1	CCW Encoder 1
2	CS Encoder 2	CCW Encoder 2
3	Normal Analog Polarity	Inverted Analog Polarity
4	NOT USED – MUST BE OFF	NOT USED – MUST BE OFF
5	Feed-to-Stop, One Encoder	Feed-to-Stop, Two Encoder
6	NOT USED – MUST BE OFF	NOT USED – MUST BE OFF
7	NOT USED – MUST BE OFF	NOT USED – MUST BE OFF
8	NOT USED – MUST BE OFF	NOT USED – MUST BE OFF
9	CRT Disabled	CRT Enabled
10	NOT USED – MUST BE OFF	NOT USED – MUST BE OFF

Tool Definitions

The shear tool is configured the same way here as on the XL200.

- The tool for the forming press is Tool 1 and must be configured as Press 1. The tool offset is calculated by loading material and firing first the forming press and then the shear, and is measured from the leading edge of the part to the leading edge of the step.

  Note: You must measure from the leading edge of the step in order for the test that prevents steps crashing into the shear to execute correctly.

- The tool for the entry shear is Tool 3 and must be configured as Press 3.
- The tool for the future, optional forming press is Tool 2 and must be configured as Press 2. Its tool offset is calculated in the same fashion as Tool 1.

Diagnostics

Last Entry Kerf

Displayed on the Press Information screen under the Diagnostic Menu, the Last Entry Kerf displays the last observed entry kerf value.

Average Entry Kerf

Displayed on the Press Information screen under the Diagnostic Menu, the Average Entry Kerf value field displays the average of the last ten observed Entry Kerf values. This average is cleared on a double shear or when a new product or material is used.

Chapter 3: Startup and Calibration

Calibration

To calibrate the tile machine, perform the following steps *in the order shown:*

1. Calibrate the correction factor on shear only parts.

   Note: Any adjustment to the correction factor will require that the next two steps be performed as well.

2. Calibrate the total kerf.

   Run a part with lots of steps. Assuming that the correction factor is accurate and that the majority of the error in the part length is attributed to the total kerf, divide the error by the number of steps and adjust the total kerf (displayed on the Tile Kerf menu under the Setup screen) by the calculated error value. This should bring the part length into tolerance and also ensure that the step length is accurate.

   Note: Calibrating kerf is essential to the correct operation of the tile machine, as the total kerf to must be added to the material in order for each step to be produced at the correct size.

3. Calibrate the leading step offset.

   Check the distance from the leading edge to the first step. Since each step pulls material from the encoder, each is shifted by some amount probably equal to the observed entry kerf. The observed entry kerf and an average of the observed entry kerfs can be viewed in the Diagnostics screen on the Press Information window.

   Use the Tile Kerf field (displayed on the Tile Kerf menu under the Setup screen), to adjust the leading step offset. You can add or subtract the error you see in the first step distance to this field.

Setup Parameters

Removed

- Press 2 Dwells are disabled.

Added

- Min. Forming Tool Feed
  - Range 0.0000” to 20.0000” inches
  - Locked by Setup Lockout Key.
  - Tis values should equal the amount of material that must feed in order for a formed step to clear the forming tool.
- Retract Collision Buffer
  - Range 0.0000” to 5.0000” inches
  - Locked by Setup Lockout Key.
  - Used in conjunction with the Retract After Cut parameter and the Min. Forming Tool Feed parameter, Retract Collision Buffer determines how far, if any, the material retracts before the up stroke of the shear press. It is a buffer, or safety, distance to keep the formed step from crashing into the forming dies.
- Tile Step Width
  - Range 0.0000” to 20.0000” inches
  - Locked by Setup Lockout Key.

Material and Multiple Step Heights

Each material the machine uses to make tiles react differently to the forming process, and different step heights also affect the entry and exit kerf values. See *Tile Kerf Table*, page 14, for details.

Note: Many tile machines can make tiles of at least two different step heights. These different step heights affect the entry and exit kerf values, and must always be considered when setting up for a part.

Tile Kerf Table

On the Setup screen, the Tile Kerf table maintains the Entry and Total Kerf values for each Material and PCode combination (PCode is used to represent the step height).

Upon entering Run mode, the controller searches the Tile Kerf table for a record that has the same Material and PCode strings. If it finds one, it uses the values in the Entry and Total Kerf fields to calculate targets for each press and shear operation. If it doesn't find one, the controller exits run mode and prompts the operator with a request for all required kerf values.

- Total Kerf
    - Range 0.0000" to 20.0000" inches
    - Should equal the total amount of material pulled into the formed step.
- Entry Kerf
    - Range 0.0000" to 5.0000" inches
    - Should equal the amount if material pulled into the formed step that the encoder will see. Assuming the tool offset for the forming tool has been set correctly, this parameter should be adjusted to compensate for any overall shift in the steps from the leading edge of the part.

Programming Parts

Parts are programmed just as on any other AMS Controls XL200 series controller with multiple presses, but with a few notable exceptions.

These exceptions and assumptions eliminate options available in the standard roll-forming controller that are incompatible for a tile machine and would unnecessarily complicate the user interface and part calculation and, if allowed, create undesirable parts.

- The controller produces shear only parts by programming a pattern of 0 into the item.
- The Part Option field is disabled and defaults to a right-handed part.
- A non-zero pattern number is programmed into the item to specify the leading step, the step length, and the location of the final step. The only valid tool number in the pattern is tool 1, for the forming press. The pattern should have three operations:
    - *Leading edge reference,* to define the first step
    - *Even space,* with the offset equal to the step length

- *Spacing limit*, to limit how close the cut is to the last step. The offset should be larger than the step width.

Note: These rules are checked when the controller begins calculating a part to fill into the part queue.

- Macros are not supported.
- Leading Center, Trailing Center and Trailing Edge tool references are not supported.
- Mirrored, Left, and Alternating part references are not supported.

Controller Options

The only bit code option on the XL270CL controller is the “I” PLC Integration (MODBUS) option.

Appendix A: Glossary

Controller

A computerized device used to control roll forming machinery in production.

Die Set

A mechanical assembly containing any number of tools that punch, notch, or shear.

Entry Kerf

Material consumed by the forming process on the entry (feed) side of the part.

Exit Kerf

Material consumed by the forming process on the exit (shear) side of the part

Input/Output (also called I/O)

Input and output (referred to together as I/O) describe operations that transfer data from (or to) computer to (or from) a peripheral device. Every transfer is an output from one device and an input into another.

I/O

See *Input/Output*.

Kerf

Material consumed in a forming process.

Linear Coverage Distance

The distance between the leading and trailing edges of a part.

Lip

The first section on a part's leading edge.

Pattern

A set of tool operations that define most of the details of a finished part. Each entry has a tool number, a reference designation, and a dimension. For Y-axis machines, a Y-reference and Y-offset may also be necessary.

Press

A device that closes a die set that is to punch, notch or shear a given material. Air, hydraulics, or a mechanical flywheel may power the press. The Cutoff Press (Shear) is always considered press 0.

Referencing

The controller process for determining the current, actual position of what an encoder is measuring--material position, die position, or in some cases, both.

Roll Forming

A continuous bending operation where a sheet or strip of metal is gradually formed in tandem sets of rollers until a desired cross-section is shaped

Shear

A type of cutting operation in which the metal object is cut by means of a moving blade and fixed edge or by a pair of moving blades that may be either flat or curved. The type of force that causes, or tends to cause, two contiguous parts of the same body to slide relative to each other in a direction parallel to their plane of contact.

Soft Keyboard

A system that replaces the hardware keyboard on a computing device with an on-screen image map.

Tail

The last section on a part’s trailing edge

Tool

Any section or combination of sections of a die set that can be engaged with one cycle of a single press. The tool may produce a single hole, single notch, group of holes, or notches, or cut the part completely.

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