March 2010

Electronic Cutting with 3M Graphic Films

What is Electronic Cutting?

Electronic cutting is a term used to describe the cutting of adhesive-backed film by computer-driven knives. The process of electronically cutting graphics is referred to as Computer Aided Signmaking, or CAS. The device that performs the cutting operation may be referred to as either a plotter or a cutter. For this talk, we will use the term “cutter” to refer to all types of plotters and cutters.

Electronic cutters are also used to cut other materials such fabric or cardboard. In addition, the cutting blades can be switched to pens for drawing designs on paper or film.

Types of Cutters

There are three distinctive types of cutters, each of which is described and pictured in this paper.

- Sprocket fed/pin fed
- Friction fed
- Flatbed

Cutting Speed

The type of cutter determines cutting speed and its ability to process the information being sent to it.

Sprocket Fed or Pin Fed Cutters

Description

- 15 inches or 30 inches wide.
- Both edges of the film are punched with a hole pattern that match pins on the drive wheels of the cutter. These wheels traverse the film through the cutter.

Cutting Action

- The film moves back and forth.
- The knife head moves side to side.
- The knife blade changes direction.

Advantages

- Convenient size for smaller shops.
- Accurate tracking.
- Speed.

Disadvantages

- Films must have holes punched to use this cutter.
- Limited widths.

Manufacturers

Gerber Scientific Products has long been a leader in sprocket/pin fed cutting devices. They currently sell 15 inch and 30 inch sprocket fed models. Some other manufacturers include Allen-Datagraph and Newing-Hall.

Friction Fed Cutter

Description

- Cutters accept 4 to 60 inch material widths.
- Uses a two wheel drive system to move unpunched film. The bottom wheel is usually knurled and acts as a drive wheel. The top wheel is usually rubber. The film is driven by being pinched between the wheels.

Cutting Action

- The film moves back and forth.
- The knife head moves side to side.
- The knife blade changes direction.

Advantages

- Can handle a variety of film widths.
- Does not require punched film, but can use punched film.

Disadvantages

- Film can slip, resulting in inaccurate cuts or inability to make long or numerous cuts accurately.

Manufacturers

- Gerber
- Summagraphics
- Graphtec
- Ioline
- Roland DGA Corp.
- Anagraph Inc.
- Allen- Datagraph Inc.

Flatbed Cutters

Description

- Flatbed cutters have long been the standard of electronic cutting, especially in Europe. They evolved from garment and box cutters.
- Sizes range from 2 feet x 3 feet to 8 feet x 10 feet.
- The cutter uses vacuum to hold the film in place during cutting.

Cutting Action

- The knife head moves back and forth across the web.
- The knife blade changes direction.

Advantages

- Most accurate cutting since the film does not move.
- Does not require punched film, but can use punched film.
- Decreases the amount of overlaps on large graphics.
- On large graphics film can be advanced automatically after the current panel has been cut.

Disadvantages

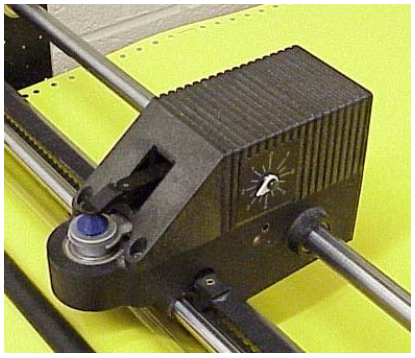
- Requires a large work area.
- Expensive compared to other types of cutters.

Manufacturers

- Zund
- Graphtec
- Aristo
- Wild (now owned by Zund)

Types of Cutting Heads

There are two standard types of cutting heads used in computer aided sign making. They are easily distinguished by their cutting methods.



Tangential

A tangential cutter head uses a servomotor. This type of head moves the cutting blade around the pattern using a drop, cut-lift, turn method each time the design changes direction. The only exceptions are the letter O and the numeral 0, which are cut in one continuous movement. As an example, the blade cuts, lifts and turns 12 times to cut the letter H in Helvetica type face.

Following / Tracing

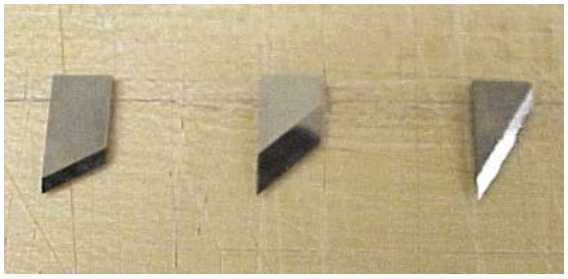
A following or tracing cutter head uses bearings that allow the blade to swivel in a holder. With this type of mechanism, the blade drops into the first position and traces around the design without lifting until it has returned to the original starting position.

Because of its greater speed and complete cuts, the industry appears to be moving more toward the following or tracing cutter heads.

Types of Knife Blades

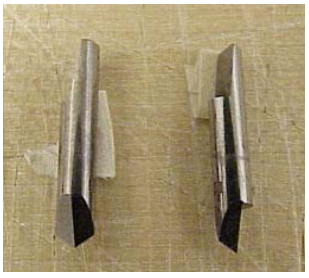
There are several types of knife blades ranging from dual edge 40 degree blades for cutting standard electronically-cuttable film to a single edge 60 degree blade for finer detail cutting as well as cutting thicker materials. Refer to the instruction manual for each cutter to determine the types of blades that can be used and the required pressures.

Gerber Gerber Gerber



Tracing/Following

Flat Bed Flat Bed



3M Films Designed for Electronic Cutting

Electronically-cut graphics are used in a variety of ways and markets: fleet, awnings, signs, and even stencils. Technically, all films from Commercial Graphics can be electronically cut. However, each film has different minimum cutting heights, minimum stroke widths and ease of weeding. See the table on page 5 for additional details

Films Designed or Used for Gerber Scientific Products Cutters and Plotters

Films designed for the Gerber Scientific Cutters and Plotters have punched edges which are used by the machines to guide them. Click on the link to open the associated Product Bulletin.

3M™ Scotchcal™ Special Effects Graphic Film Series 210-300 (Dusted and Frosted Crystal
3M™ Scotchcal™ Special Effects Graphic Film Series 210-400 (Fluorescent)
3M™ Scotchcal™ Deluxe Silver Film 210-420
3M™ Scotchcal™ Deluxe Gold Film 210-431
3M™ Scotchcal™ Deluxe Graphic Film Series 210SG
3M™ Scotchcal™ Graphic Film Series 220
3M™ Scotchcal™ Graphic Film Series 225
3M™ Scotchcal™ Translucent Graphic Film Series 230
3M™ Scotchlite™ Reflective Graphic Film Series 280
Scotch® #519Y Sandblast Stencil
Scotch® #1532 Sandblast Stencil
3M™ Lminescent Film 6900
3M™ Controltac™ Graphic Film Series 180

Films Designed for Other Cutters and Plotters

3M™ Controltac™ Graphic Film Series 180
3M™ Scotchcal™ Translucent Graphic Film Series 3630
3M™ Scotchcal™ Graphic Film Series 50
3M™ Scotchcal™ ElectroCut™ Graphic Film Series 7125
3M™ Scotchcal™ ElectroCut™ Graphic Film Series 7725
3M™ Scotchcal™ ElectroCut™ Graphic Film Series 7725SE
3M™ Scotchlite™ Reflective Graphic Film Series 680
3M™ Scotchlite™ Reflective Graphic Film 5100
3M™ Scotchlite™ Removable Reflective Graphic Film Series 5100R

Liners

Films designed for electronic cutting are available on either a 78 pound kraft paper or a synthetic liner, depending on the film series.

Cutting Specifications

The 3M Product Bulletin for each film specifies the minimum cutting heights and stroke widths. These dimensions are based on upper case Helvetica medium letters.

When using other fonts, the operator is responsible for testing and determining acceptable minimum dimensions.

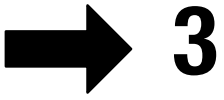
The proper cutting depth should result in the liner being *lightly* scored. The purpose of scoring the liner is to ensure that the blade has cut completely through the adhesive. Too deep a cut can cause liner splitting, increased knife wear and material lifting during cutting. Too light a cut can cause incomplete cutting of the film and adhesive, which can cause difficulty in weeding.

Weeding

Weeding is the removal of unwanted film.

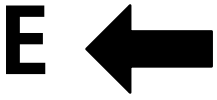
Before weeding, inspect each element (letters, numerals, etc.) to detemrine which side has the most open cuts, and start weeding from the side. This reduces unnecessary waste.

For example, most letters have open areas on the right side, so weed from right to left. Conversely, most numerals have open areas on the left side, so weed from left to right.



Open cuts of numerals are generally on the left.

WEED LEFT TO RIGHT



Open cuts of letters are generally on the right'

WEED RIGHT TO LEFT

Electronically-cut Graphics Require an Application Tape

Electronically-cut graphics always require an application tape after cutting. The application tape protects the graphic during storage, transport and application. It also allows you to apply the graphics in one piece. Because application tape has a lower adhesion to the film than the film has to the substrate, the tape can be removed after the graphics are applied without altering the registration.

Films Recommended for Electronic Cutting

- All films listed have a paper liner unless otherwise noted. Minimum cutting heights are based on upper case Helvetica medium font.
- All other fonts and designs must be tested by the cutter operator to determine minimum performance characteristics.

3M Film Number	Appearance	Liner *	For Gerber Cutters **	For Other Cutters	No. of Colors	Type of Cutter			Minimum Cutting Heights
						Sprocket/ Pin Fed	Friction Fed	Flatbed	
Series 180	Opaque	P	◆		9	◆	◆	◆	3”
Film 210-314	DustedCrystal	P	◆		1	◆	◆	◆	3/8”
Film 210-324	Frosted Crystal	P	◆		1	◆	◆	◆	3/8”
Series 210-400	Fluorescent	P	◆		5	◆	◆	◆	1/2”
Film 210-420	Deluxe Silver	P	◆		1	◆	◆	◆	3/8”
Film 210-421	Deluxe Gold	P	◆		1	◆	◆	◆	3/8”
Series 220	Opaque	P	◆		91	◆	◆	◆	3/8”
Series 225	Opaque	S	◆		20	◆	◆	◆	1/4”
Series 230	Translucent	P	◆		50	◆	◆	◆	1”
Series 280	Reflective	P	◆		11	◆	◆	◆	2”
Film 6900	Photoluminescent	P	◆		1	◆	◆	◆	1”
#1532 Stencil	Opaque	P	◆		1	◆	◆	◆	1”
#519Y Stencil	Opaque	P	◆		1	◆	◆	◆	1”
Series 3630	Translucent	P		◆	50		◆	◆	1”
Series 50	Opaque, removable	P		◆	28	◆	◆	◆	3/8”
Series 7125	Opaque	P		◆	62		◆	◆	3/8”
Series 7725	Opaque	S		◆	62		◆	◆	1/4”
Film 7725SE-314	Dusted Crystal	P		◆	1		◆	◆	3/8”
Film 7725SE-324	Frosted Crystal	P		◆	5		◆	◆	3/8”
Series 7725SE-400	Fluorescent	P		◆	6		◆	◆	1/2”
Series 5100	Reflective	P		◆	15	◆	◆	◆	1”
Series 5100R	Reflective, removable	P		◆	15	◆	◆	◆	1”
Series 680	Reflective	P		◆	11		◆	◆	1”

* P = Paper liner; S = Synthetic liner (transparent)

** Films in the 2XX series are made exclusively for and sold by Gerber Scientific Products, Inc.

Film Facts

Film Series 7725 and Film Series 225

Film series 7725 and film series 225 for electronic cutting feature a synthetic liner, which offers important advantages in production environments, where size, accuracy and speed count.

Layflat

This liner does not absorb moisture so it stays flat when it's on a flatbed cutter and it stays flat when it has an application tape and is stacked. The layflat feature helps avoid complete cut-through of the liner which prevents knife and bed damage. On friction feed cutters, there is no liner growth due to moisture absorption, which helps prevent tracking problems on long jobs. The layflat feature also helps ensure that the graphics don't pop off the liner during storage.

Excellent Cutting

The unique properties of the synthetic liner allow cutting heights as small as ¼ inch or even smaller with the proper adjustment of the cutter. This allows for a greater variety of graphics. In addition, a synthetic liner won't split as a paper liner does if the cut depth is too deep.

Faster Weeding Speed

Weeding is faster due to how the adhesive sticks to the liner. It is less likely that letters will lift away during weeding, so more graphics can be weeded more quickly.

Water Resistance

If a paper liner gets wet during a wet application, the liner splits and it is difficult to remove it cleanly. Water may also damage the graphic. A synthetic liner does not absorb water.

Multi-Color Assembly

Synthetic liners are transparent, making it easier to register graphics on jobs requiring multiple colors. The applicator can clearly see each color when overlaying them, providing 100% confidence in the graphic. Another advantage of the multi-color lay up is that the entire graphic can be assembled on a single piece of liner with a single sheet of application tape, which saves material cost and application labor. 3M offers a warranty of up to 8 years for unprinted pigmented color films, while digital printing with an overlaminate has up to a 5 year warranty.

Anti-Static Properties

The synthetic liner has a built-in anti-static treatment that helps protect nearby electronic circuitry from the risk of static discharge. Static discharge can cause cutters to shut down in the middle of a cut, damaging the cutter and the graphic. This anti-static feature also helps protect users from shocks when performing the weeding operation.

Troubleshooting

Problem	Cause	Solution
Film won't track on friction fed cutter.	Friction feed system is dirty or out of tolerance.	Clean all rollers and feed mechanisms; adjust spring tension on pinch rollers. Contact manufacturer.
Sensors don't recognize a black film.	The sensors on most cutters read off of light reflected from the liner. When all the light is absorbed, the machine indicates that there is no film loaded. This usually happens with black film because the light shines through the liner and is absorbed by the black film, indicating an empty cutter.	Block the sensors with white tape or paper. Turn off the sensors and put the machine in manual mode (if available).
Poor cutting and weeding.	Poor cutting and weeding is rarely a film problem. It is usually the result of poor cuts and non-closure of corners, which indicates a cutter or knife problem.	Ensure that the cutting pattern is accurate. Check the blades. Adjust the knife. Adjust the cutter. Contact the manufacturer, providing samples for evaluation.
Graphics remain on liner when removing application tape.	Using the incorrect application tape. Incorrectly removing the application tape.	Use a higher tack tape. Wipe with Isopropyl Alcohol. Use heat over application tape.
Application tape won't stick to liner.	Not using the correct 3M application tape.	Use 3M™ Scotchcal™ Premask Tape SCPS-2.

Problem	Cause	Solution
Static problem.	The liner of film 7725 has a build-in anti-stat so this problem is unlikely.	Send in a sample to Technical Service for evaluation.
Environmental concerns.	Some users think plastic is less environmentally friendly than paper.	This film takes the same landfill space as a paper product, and it uses 20% recycled material in its manufacture.
Problems with kiss cutting or die cutting.	Dull dies. Improper press adjustment.	Sharpen the dies. Adjust the heat and pressure on the press.
Application bubbles.		Small bubbles disappear over time.
Can't tear liner.		Cut the liner with a knife or scissors.
Liner takes too much room in trash.		Roll up the liner before disposal.
Difficulty weeding small graphics due to liner.	This film uses a synthetic liner that does slide more than paper.	Tape down one edge of the graphic. Try weeding the graphic while it is on the vacuum table, if available.
Logo on liner is visible.		This will disappear after application.

Sales and Technical Service

We would be happy discuss your electronic cutting needs and recommend the right film for your environment. Please contact your 3M sales representative or call us at 1-800-328-3908.

3M

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