Electronic Cutting with 3M Graphic Films

1. 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. In this document, 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.

2. Uses for Cut Graphics

Electronically-cut graphics are used in a variety of ways and markets: fleet vehicles, windows, awnings, signs, and even stencils.

3. Types of Cutters

There are three distinctive types of cutters, each of which is discussed in this document:

- Sprocket fed/pin fed
- Friction fed
- Flatbed

A. Cutting Speed

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

B. Sprocket Fed or Pin Fed Cutters

Description

- Cutters accept 15 or 30 inches material widths.
- 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

- ADSI Allen Datagraph Systems, Inc.
- Gerber Scientific, Inc.

C. 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

- ADSI Allen Datagraph Systems, Inc.
- Gerber Scientific, Inc.
- Graphtec America, Inc.
- Roland DGA Corporation
- Summa, Inc.

D. 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.
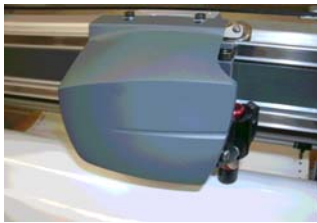
Disadvantages

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

Manufacturers

- ARISTO Cutting Solutions
- Graphtec America, Inc.
- Zund

4. Types of Cutting Heads

There are two standard types of cutting heads used in Computer Aided Signmaking. 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.
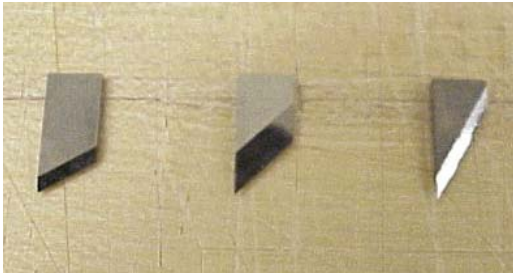
5. Types of Knife Blades

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

6. 3M Films Designed for Electronic Cutting

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.

The following films are our most popular for electronic cutting. For complete details on these films, refer to the 3M Product Bulletins at 3Mgraphics.com.

- 3M™ Scotchcal™ Graphic Film Series 50
- 3M™ Controltac™ Graphic Film Series 180
- 3M™ Controltac™ Graphic Film with Comply™ Adhesive Series 180C
- 3M™ Scotchlite™ Reflective Graphic Film Series 680
- 3M™ Scotchcal™ Translucent Graphic Film Series 3630
- 3M™ Envision™ Translucent Film Series 3730
- 3M™ Scotchlite™ Reflective Graphic Film 5100
- 3M™ Scotchlite™ Removable Reflective Graphic Film Series 5100R
- 3M™ Scotchcal™ ElectroCut™ Graphic Film Series 7125
- 3M™ Scotchcal™ ElectroCut™ Graphic Film Series 7725
- 3M™ Scotchcal™ ElectroCut™ Graphic Film Series 7725SE-400
- 3M also manufactures several films that are designed for Gerber Scientific Products and are sold exclusively by authorized Gerber distributors. Contact Gerber at 1-800-222-7446 or visit their website at www.gspinc.com to find a distributor near you.

A. Liners

Films designed for electronic cutting are available on a 78 pound kraft paper, a 94 pound polycoated paper or a synthetic liner, depending on the film series.

B. 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.

C. Weeding

Weeding is the removal of unwanted film.

Before weeding, inspect each element (letters, numerals, etc.) to determine 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.

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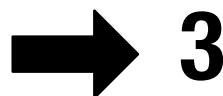
Open cuts of numerals are generally on the left.

WEED LEFT TO RIGHT

E ⬅
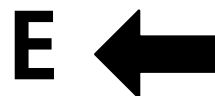
Open cuts of letters are generally on the right'

WEED RIGHT TO LEFT

D. 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.

Refer to [3M Product & Instruction Bulletin 4.3](#) for the correct application tape for your specific graphic construction.

E. 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.
- Refer to [Instruction Bulletin 4.1](#) for additional cutting information.

3M Film Number	Appearance	Liner*	No. of Colors**	Type of Cutter			Minimum Cutting Heights
				Sprocket/ Pin Fed	Friction Fed	Flatbed	
Series 50	Opaque, removable	P	28	◆	◆	◆	3/8" (0.9 cm)
Series 180	Opaque	P	44	◆	◆	◆	3" (7.5 cm)
Series 180C	Opaque	P	50	◆	◆	◆	3" (7.5 cm)
Series 680	Reflective	P	12		◆	◆	1" (2.5 cm)
Series 3630	Translucent	S	57		◆	◆	1" (2.5 cm)
Series 3730	Translucent	S	20		◆	◆	1" (2.5 cm)
Series 5100	Reflective	P	15	◆	◆	◆	1" (2.5 cm)
Series 5100R	Reflective, removable	P	15	◆	◆	◆	1" (2.5 cm)
Series 7125	Opaque	P	60		◆	◆	3/8" (0.9 cm)
Series 7725	Opaque	S	68		◆	◆	1/4" (0.6 cm)
Series 7725SE-400	Fluorescent Opaque	P	6		◆	◆	1/2" (1.3 cm)

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

** Visit the On-line Catalog at 3Mgraphics.com for the most current colors.

7. Films with Synthetic Liners

Films that feature a synthetic liner offer important advantages in production environments where size, accuracy and speed count.

A. 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.

B. Excellent Cutting

The unique properties of the synthetic liner allow cutting heights as small as ¼ inch (0.6 cm) 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.

C. 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.

D. 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.

E. 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.
F. 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.

8.   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.	Refer to the base film Product Bulletin or 3M Product & Instruction Bulletin 4.3 for the correct application tape for the graphic.
Static problem.	The liner of film series 7725 has a built-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.	Application technique.	Small bubbles disappear over time. Consider using a film with Comply adhesive.
Can't tear liner.	Not intended for tearing.	Cut the liner with a knife or scissors.
Liner takes too much room in trash.	Not preparing for disposal	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.	Only visible before and during application.	The logo will disappear after application.

9. 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.

10. Disclaimer

The information contained and techniques described herein are believed to be reliable, but 3M makes no warranties, express or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose.

The [3M Commercial Graphics Warranty Brochure](#), along with the applicable film Product Bulletins, provide the details to any warranty offered for the 3M graphics products described in this bulletin.

3M does not endorse any particular cutter type or manufacturer. The user is responsible for ensuring the cutter meets all of its intended performance requirements.

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Commercial Graphics

3M Center, Building 220-12E-04
St. Paul, MN 55144 USA
General & Technical
1-800-328-3908
Fax 1-651-736-4233

www.3Mgraphics.com

3M Canada

PO Box 5757
London, Ontario
Canada N6A 4T1
General 1-800-265-1840
Fax 519-452-6245

3M México S.A. de C.V.

Av. Santa Fe No. 55
Col. Santa Fe, Del. Alvaro Obregón
México D.F. 01210
General 5255-5270-0400
Fax 5255-5270-2277

3M Puerto Rico, Inc.

350 Chardon Avenue
Suite 1100
San Juan, PR 00918
General 787-620-3000
Fax 787-620-3018