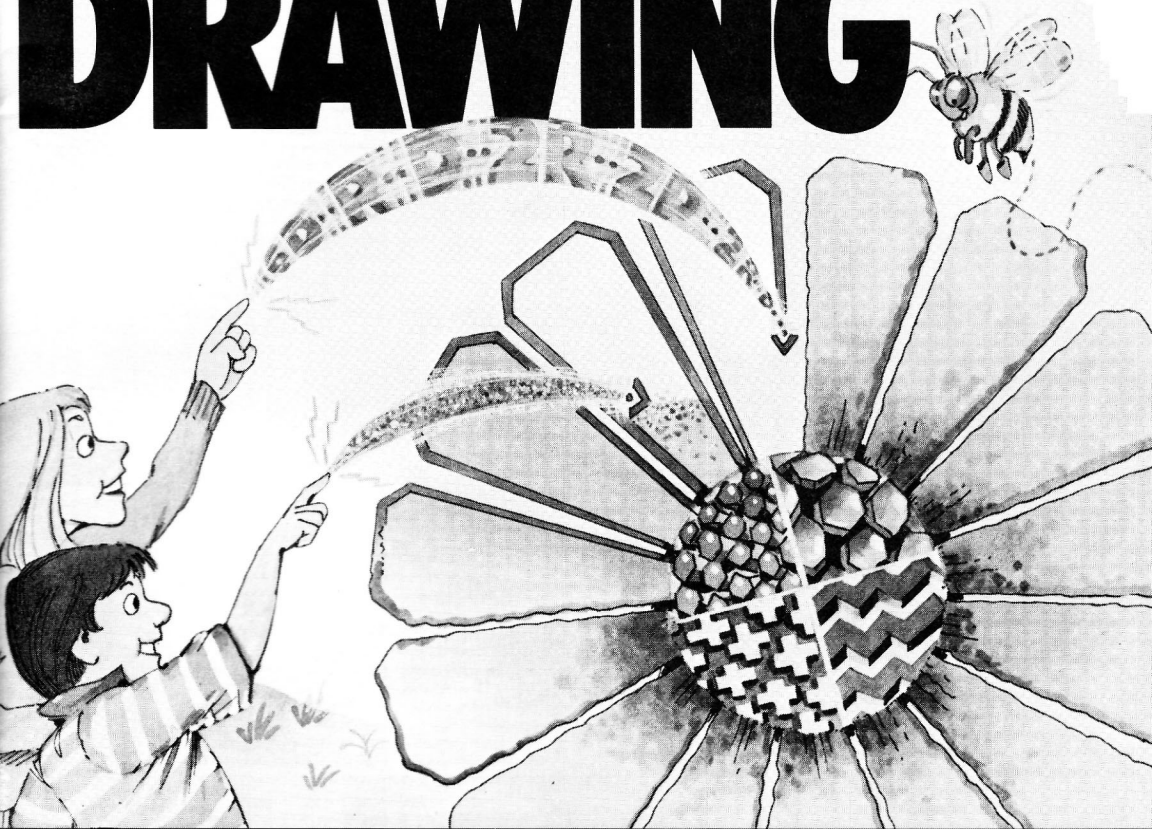
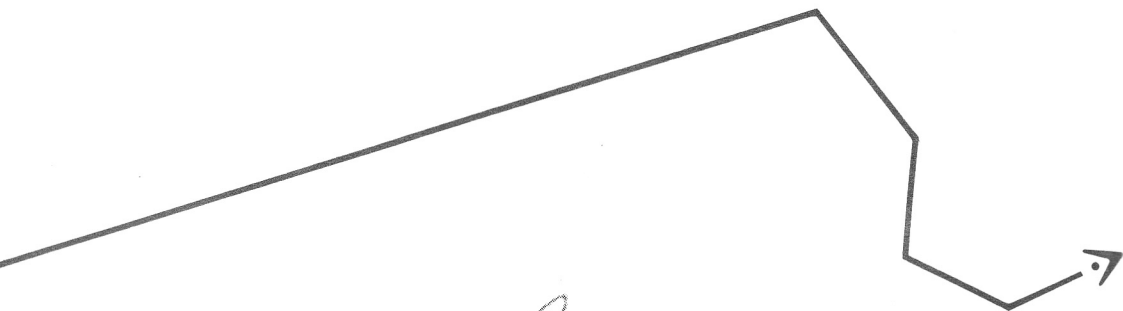


DELTA DRAWING™



DELTA DRAWING™ USER'S GUIDE





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INTRODUCTION

Imagine using a computer to draw a picture, create a game, or design a space ship. Welcome to the world of DELTA DRAWING™ Computer Graphics.

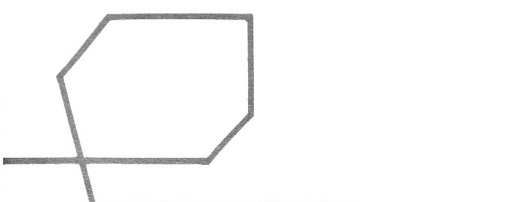
DELTA DRAWING is a computer program for children. It enables children to create their own colorful drawings on a computer screen by pressing a few keys on the computer keyboard. It's exciting. It's creative. And it helps kids learn about computers.

It's lots of fun to draw with a computer, and DELTA DRAWING makes it easy. You draw on the computer screen with the DELTA cursor. You control its movements by giving it commands. You give the DELTA cursor commands by pressing a key (or sometimes two keys) on the computer keyboard.

Start the program and the DELTA cursor appears in the center of the screen. Press one key to make the DELTA cursor turn, press another to make it draw.

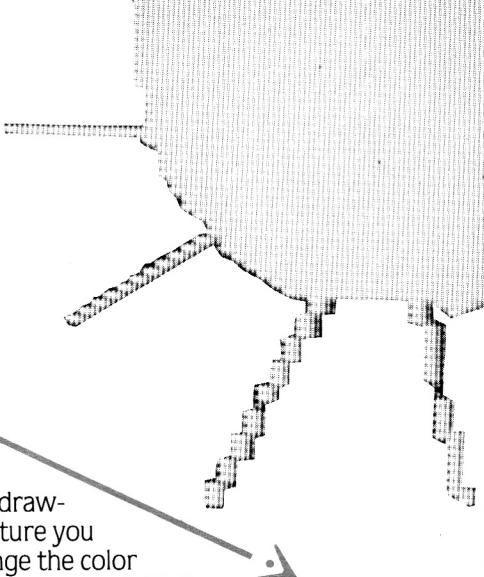
Most of the commands are single-key. And they make sense. D for draw. L for left turn. E for erase. It's easy to draw, edit, and color with just a few commands. And once children learn these few commands they can draw by themselves. DELTA DRAWING does not require reading, writing, typing, or programming skills. Even a preschooler can master DELTA DRAWING's single-key commands.

Drawing with the DELTA cursor on a computer screen is somewhat like drawing with a crayon on a pad of paper, but there are important differences. The first difference between the DELTA cursor and a crayon is a major one. With a crayon you can draw a continuous straight or curved line, but with the DELTA cursor you draw one step at a time. Every turn, move, or line segment you draw requires a separate keystroke. With DELTA DRAWING children learn to construct a picture one keystroke at a time.



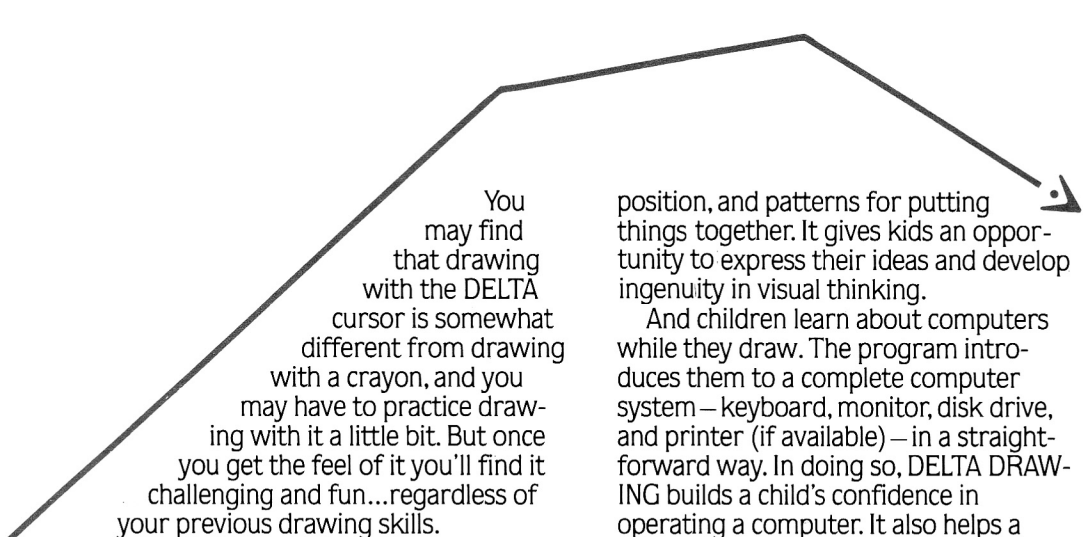
A crayon can't remember what it draws, but the DELTA cursor can. Every time a child draws a picture, the computer records each keystroke and writes a program. This drawing program is stored in the computer's memory. The program can reproduce the child's picture on the screen any time he or she presses a program key. And because one or more drawing programs can be nested inside another program, children can build up complex pictures, patterns, and designs from simple parts.

DELTA DRAWING uses the screen in two ways—for graphics and for text. In graphics mode the screen displays the picture. In text mode the screen shows the program. A child can draw pictures in graphics or write programs in text and switch back and forth between them. This makes it easy for children to see the relationship between pictures and programs, and that's an important first step in understanding how computers work.



While you are drawing a picture you can change the color of the line that the DELTA cursor draws, you can place the DELTA cursor's blinking dot inside an enclosed area of a drawing and fill it with color, or you can add color to the entire background of a drawing. It's as if the DELTA cursor contained a whole box of crayons.

You can also keep your DELTA drawings. You can save a whole set of drawings on a disk, or if you have a printer and a compatible printer card you can print copies of your programs and your pictures.



You may find that drawing with the DELTA cursor is somewhat different from drawing with a crayon, and you may have to practice drawing with it a little bit. But once you get the feel of it you'll find it challenging and fun...regardless of your previous drawing skills.

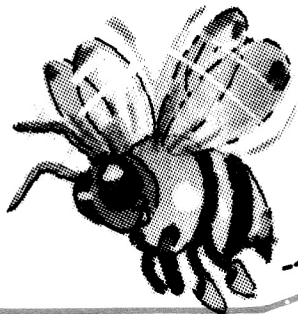
DELTA DRAWING is friendly and forgiving. It lets children draw their own pictures, in their own way, at their own pace. And it allows them to do it by trial and error. They can try out an idea, and if they don't like the picture they can change it. With DELTA DRAWING, there are no mistakes, only unexpected results. And it's simple to make a change—just erase step-by-step or clear the screen and start over. There are no syntax errors to frustrate an eager learner. And if a key other than a command key is pressed, nothing happens.

DELTA DRAWING helps children learn about lines and shapes, colors and com-

position, and patterns for putting things together. It gives kids an opportunity to express their ideas and develop ingenuity in visual thinking.

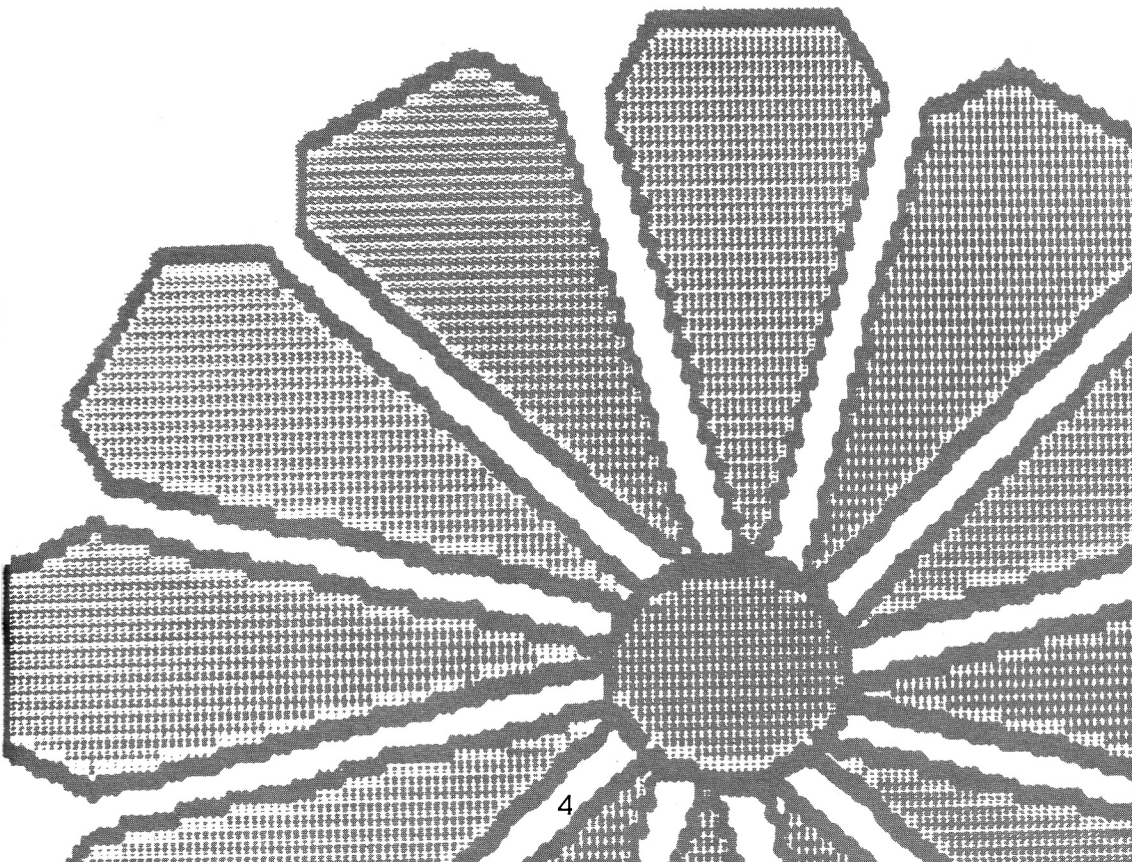
And children learn about computers while they draw. The program introduces them to a complete computer system—keyboard, monitor, disk drive, and printer (if available)—in a straightforward way. In doing so, DELTA DRAWING builds a child's confidence in operating a computer. It also helps a child build an understanding of some fundamentals of computer programming and of procedural thinking—the kind of step-by-step thinking required for solving problems with computers. With DELTA DRAWING, a child begins by drawing pictures that produce computer programs and soon learns to write computer programs that draw pictures.

Part of the fun of DELTA DRAWING is introducing children to the program and seeing the imaginative drawings they produce. The program has been designed to encourage and support children's experiments in both visual and procedural thinking. And it permits them to discover their own individual interests



and abilities in drawing with a computer. Perhaps one of the most important ideas children learn while using DELTA DRAWING is that they can try it – themselves.

DELTA DRAWING is a great way for children to start using a computer. Try it yourself – then draw your own conclusion.



HOW TO USE THIS GUIDE

Although DELTA DRAWING is designed for children, this Guide is written for adults—parents and teachers who will introduce DELTA DRAWING to children and help them get started using the program.

The DELTA DRAWING USER'S GUIDE is divided into five parts. You can use this Guide in a number of different ways to get started drawing pictures. If you are an experienced computer user, you may want to turn immediately to Part 5, the DELTA DRAWING COMMAND SUMMARY. One side of this card contains instructions for loading the DELTA DRAWING program. The other side contains the type of command, the name, and the keys for all of the commands included in the DELTA DRAWING program. You can try various command keys to discover how they operate. If you have any questions about any of the commands, turn to the appropriate section in Part 2 of this Guide for the answer. You will want to keep this quick-reference card close at hand while you are using the program until you become familiar with all of the DELTA DRAWING commands.

Whether you are an experienced or inexperienced computer user, you may want to get a quick start without a lot of reading. You can do this by using Part 5, the DELTA DRAWING COMMAND SUMMARY, in conjunction with Part 4, the DELTA DRAWING CARDS. First, follow the instructions for loading the program on the back of the summary card. Once the DELTA DRAWING program is loaded into your computer you can use the DELTA DRAWING CARDS to begin drawing right away. This set of cards introduces the basic DELTA DRAWING commands in a step-by-step sequence that will help you start quickly to create your own drawings. The DELTA DRAWING CARDS do not introduce you to all of the commands in the DELTA DRAWING program. You can turn to Part 2 of the Guide for information about other commands or to find answers to any of your questions.

You will find the DELTA DRAWING CARDS a useful tool later on to help kids get started using DELTA DRAWING.

Part 1, GETTING GOING, is designed to help you get going at a moderate pace. At a fundamental level, the DELTA DRAWING program is easy to under-



stand and easy to use. The best strategy for learning to use it is to start drawing with the DELTA cursor as soon as you learn a few things about the cursor, the keyboard, and the basic commands. The first part of this Guide will help you do that.

Part 1 includes instructions on how to load the DELTA DRAWING program into your computer, it describes the DELTA cursor and the keyboard, and it gives you a step-by-step introduction to the fundamentals of the program. It does not introduce or explain all of the commands contained in DELTA DRAWING.

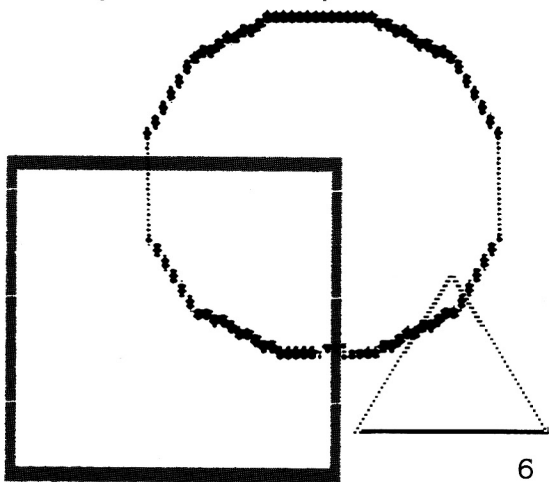
Part 2, DELTA DRAWING COMMANDS, is designed as a reference manual that explains the functions and operation of all the commands in the program. Although a child can quickly learn to draw pictures on the computer screen

with the DELTA cursor, the DELTA DRAWING program contains some sophisticated computer graphics capabilities that will challenge and intrigue any adult. As you develop some facility in drawing with the DELTA cursor, you will want to learn about the additional commands and capabilities of the program. The second part of this Guide will help you do that.

Part 2 includes an overview of the DELTA DRAWING command structure and a separate section on each of the eight types of commands included in the program. Whenever you have a question about using the program you should be able to find the answer in this part of the Guide.

Part 3, GLOSSARY OF DELTA DRAWING TERMS, is included to help clarify the limited technical vocabulary that is used to explain DELTA DRAWING commands. When reading this Guide you will encounter a few technical terms and some common words and phrases used in a technical sense. If you are unsure of what a word or phrase means, check the glossary.

No matter which way you choose to get into DELTA DRAWING, we believe you'll find it easy to begin drawing your own pictures. And once you have started you'll find it continuously challenging as you discover more and more features of the program.



1

GETTING GOING LOADING DELTA DRAWING

DELTA DRAWING is designed for use with the Apple® II or Apple® II Plus computer with 48K memory, one disk drive, and DOS 3.3. The program requires an Apple computer disk controller card, which must be installed in slot #6. DELTA DRAWING can also be used with the Apple® III in emulation mode. The DELTA DRAWING program will operate with a black and white or color monitor, and with or without a printer.

This version of DELTA DRAWING (2.0) is written in MicroMotion FORTH-79, version 2. The instructions for loading DELTA DRAWING are written for the Apple® II Plus. If you do not have an Apple® II Plus, refer to your Apple user's manual for instructions on loading a program into disk drive #1.

Loading Procedure

1. Turn on the peripherals: monitor, fan, printer – whichever peripherals you usually use.
2. Insert the DELTA DRAWING program disk into disk drive #1 and leave the disk drive door open.
3. Turn the computer on.
4. Shut the disk drive door.

DELTA DRAWING is loaded into your computer when the DELTA DRAWING program title and publication data are displayed on your monitor. It is a good practice to remove the DELTA DRAWING program disk immediately after loading and put it in a safe place.

If your computer is already on when you decide to load DELTA DRAWING, you should first make sure the disk drive is empty. Then turn the computer off for at least 30 seconds. Follow the above Loading Procedure beginning with step two.

To end a DELTA DRAWING session, make sure the disk drive is empty before you turn off the computer.

Configuring Your Computer System

After loading the DELTA DRAWING program the screen displays the title and publication data and the following prompt: "TO CONTINUE, PRESS SPACE BAR."

Apple II, Apple II Plus and Apple III are registered trademarks of Apple Computer, Inc.
DOS 3.3 is a copyright of Apple Computer, Inc.,
1980-81.

When you press the space bar you are presented with the first of several questions. These questions must be answered in order to configure your computer system properly. To answer a question, type Y for yes or N for no, or press the number identifying the kind of printer card you have. The questions are:

ARE YOU USING A COLOR MONITOR?

If you answer "no," the program will operate with the Apple computer's high resolution black and white screen. The Reverse Color and Fill Shape commands are the only DELTA DRAWING commands affecting color that will operate in this mode. If you answer "yes," all of the DELTA DRAWING commands that affect color are usable.

ARE YOU USING A PRINTER?

If you answer "no," you are advanced to the start of DELTA DRAWING. If you answer "yes," you are advanced to the next question.

WHICH PRINTER CARD?

Type 1 for Parallel Card

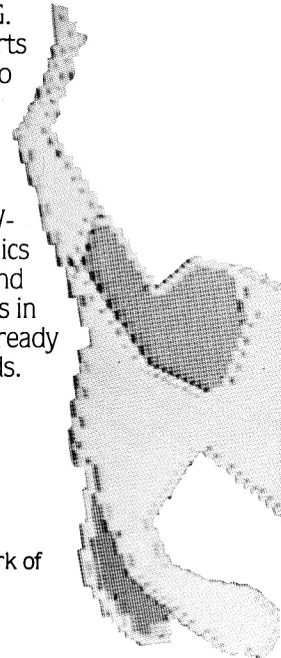
Type 2 for THE GRAPPLER™ card
Type 3 for other or unknown

If you select #1, Centronics-parallel type printer card, you are only able to use one of the DELTA DRAWING Printing Commands to print the text history. You cannot print pictures.

If you select #2, THE GRAPPLER™ printer interface card, you are able to use both of the DELTA DRAWING Printing Commands to print the text history and any pictures you create. You can print pictures in small or large versions.

If you select #3, another type of printer card, you are advanced to the start of DELTA DRAWING. The program only supports printing with the first two types of printer cards.

After answering the configuration questions you are advanced to the start of the DELTA DRAWING program – the graphics display is on the screen and the DELTA cursor appears in the center of the screen, ready to receive your commands.



THE GRAPPLER is a trademark of Orange Micro.

THE DELTA CURSOR AND COMMAND KEYS

DELTA DRAWING transforms a computer into a drawing machine. The program enables you to draw pictures on the computer screen by controlling the movements of the DELTA cursor.

The DELTA cursor is a small pointer that appears on the screen when you start DELTA DRAWING. It is your drawing instrument. You can make it move, turn, or draw a line by pressing keys on the computer keyboard.

When you start DELTA DRAWING you will see a line drawn around the edge of a clear black screen. If you are using a color monitor this line is blue. The DELTA cursor appears in the center of the screen, pointing up. It

will draw with a white line on the black screen until you change the color. This is called the DELTA cursor's **start state**. You

start every new drawing with the DELTA cursor in the start state.

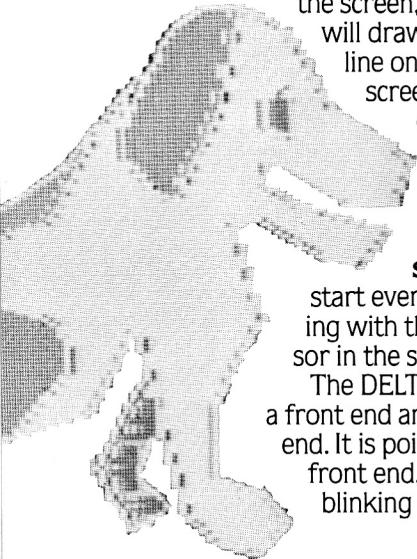
The DELTA cursor has a front end and a back end. It is pointed at its front end, and it has a blinking dot at its

back end. The blinking dot marks the exact position from which the DELTA cursor will draw, move, or turn.

The DELTA cursor has two major characteristics: **position** and **heading**. It is always located at some position on the screen, and it is always heading in some direction. You draw with the DELTA cursor by changing its position and its heading.

You make the DELTA cursor go forward to change its position. And you turn it to change its heading. The DELTA cursor only moves forward, not backward. To move in the opposite direction you must turn it around by pressing a key on the computer keyboard. You cannot make the DELTA cursor go forward and turn at the same time; these are separate steps which require separate keystrokes.

The DELTA cursor has a left side and a right side. As you sit facing the screen with the DELTA cursor in the start state, your right and left sides are the same as the DELTA cursor's right and left sides. When it is heading up toward the top of the screen and you press the key to make it turn right, it will turn to your right. But if the DELTA cursor is heading down toward the bottom of the screen and you press the key to make it turn right, it will turn to your left. The DELTA cursor turns to its right and its left. Young children find it helpful to "play



DELTA" – to imagine themselves in the position of the DELTA cursor, facing the same way it is heading, to decide whether they want it to turn to its right or to its left.

You can draw with the DELTA cursor only in the area of the screen that is inside the boundary line. If the DELTA cursor touches this line and goes out of bounds it will be automatically returned to an in-bounds position in one of two ways, and you can select either mode of return.

You control the movements of the DELTA cursor by giving it commands. A command is an instruction in the programming language that directs the computer to perform a specific operation, such as "turn the DELTA cursor left," "make the DELTA cursor draw a line," or "change the DELTA cursor's drawing color to blue."

You give the DELTA cursor commands by pressing keys on the computer keyboard. DELTA DRAWING uses 36 of the 51 keys on the Apple computer keyboard as command keys. When you press one (or sometimes two) of these keys you execute a command, and the computer immediately performs the operation defined by that command.

When you press a command key you see the result on the screen. For example, if you press R for Right Turn, you will immediately see the DELTA cursor

take a turn to the right. However, the computer must complete one command before you execute another one. Therefore, when you press a command key several times in succession, pause briefly between each keystroke. If you press command keys too rapidly you may go too fast for the computer to respond to each keystroke. On the other hand, if you press a command key and nothing happens, pause and press it again.

If you press many different command keys at the same time, it is unlikely, but possible, to overload the computer with commands. Command overload stops the DELTA DRAWING program. When this happens you must turn the computer off for at least 30 seconds and then start the DELTA DRAWING program over from the beginning. To avoid the possibility of command overload remember to construct your DELTA drawings one command at a time.

When you start DELTA DRAWING and press a command key you will hear a tone, or "beep." This tone is the DELTA cursor's voice. The "beep" means that the computer has completed the operation defined by that command and is ready to accept the next command. By listening for the tone before pressing another command key you will quickly learn how to pace your keystrokes. You can turn the voice off or on at any time by pressing V.

DELTA DRAWING COMMAND KEYS

Most of the DELTA DRAWING commands are single-key commands; that is, you only have to press one key to execute the command.

But some commands require that you press two keys at the same time. The CTRL (control) key, the REPT (repeat) key, and the SHIFT key are called auxiliary command keys. When you use a command that requires one of these auxiliaries, press the auxiliary key first and hold it down, then press the other command key.

Several commands require an input; that is, a number that must be entered after the first command. The commands which require an input are:

Open Program	CTRL O
Selected Automatic	CTRL A
Select Color	C

The input varies. Open Program and Selected Automatic require a program number; Select Color requires a color number. The computer will wait for the proper input. It will not accept another command (except Escape or Reset) until it receives this input. Be sure to enter an input when the command requires it.

With DELTA DRAWING you control the computer. The DELTA cursor draws the picture you want to draw by following the instructions that you give it.

DRAWING	DRAW D
	HALF DRAW CTRL D
EDITING	
PROGRAM	1 2
DISPLAY	GRAPHICS TEXT G T
COLOR	SELECT COLOR C
REPEAT	REPEAT REPT
SYSTEM	ESCAPE ESC
PRINTING	PRINT P

MOVE M		LEFT TURN L		RIGHT TURN R		U TURN U	
HALF MOVE CTRL M		HALF LEFT TURN CTRL L		HALF RIGHT TURN CTRL R		RANDOM SHIFT ?	
ERASE E		ERASE PICTURE CTRL E		OPEN PROGRAM CTRL O		ZAP CTRL Z	
3 4		5 6		7 8		9	
WRAP BOUNCE W B		VOICE V		HIDE CENTER H X		REVERSE COLOR CTRL C	
FILL SHAPE CTRL F				ADD BACKGROUND SHIFT +			
AUTOMATIC A				SELECTED AUTOMATIC CTRL A			
DISK SYSTEM CTRL S			RESET RESET				
LARGE PICTURE PRINT CTRL P							

FUNDAMENTALS OF DELTA DRAWING

This section of the guide will introduce you to the fundamentals of DELTA DRAWING. It is designed to help you get going, but it does not cover all of the commands included in the program. For additional commands and further information turn to Part 2, DELTA DRAWING COMMANDS.

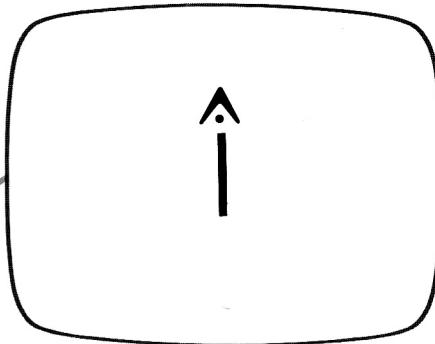
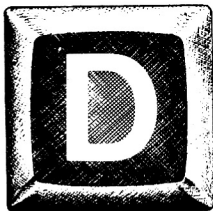
You may want to read this section of the guide at your computer so that you can try pressing the command keys and do the drawing exercises as they are presented.

If you have not already done so, follow the Loading Procedure: load the DELTA DRAWING program into your computer, answer the configuration questions, and advance to the start of DELTA DRAWING.

Basic Drawing

You only need to know a few basic commands to draw on the screen with the DELTA cursor. One of these is the Draw command.

Press D



When you press D you execute the Draw command. The DELTA cursor goes forward one step and draws a line. The DELTA cursor only goes forward, it does not go backward. It goes forward in the direction it is heading, one step at a time.

Press D two times

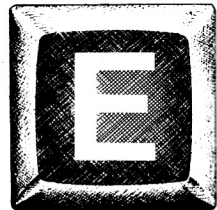
When you press D twice the DELTA cursor draws a line two steps long. You can draw a line as long as you like by pressing D repeatedly. If you draw a line that is too long you can erase it.

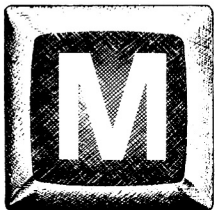
Press E

The last step of the line you drew was erased. When you press E you execute the Erase command.

Press E two times

Now the DELTA cursor is back in its start position. Pressing E repeatedly enables you to erase previous commands one at a time.





Press M
When you press M you execute the Move command. The DELTA cursor goes forward one step, but it does not draw a line.

Press M two times

Use the Move command whenever you want to move the DELTA cursor around the screen without drawing lines. You can erase Move commands just like you erased Draw commands by pressing E.

Press E three times

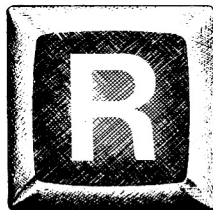
The DELTA cursor is back in its start position again.

You can only draw with the DELTA cursor on the area of the screen that is inside the boundary line. If you give the DELTA cursor a Draw or Move command that makes it touch the boundary line it will disappear, wrap around the screen, and reappear inside the boundary on the opposite side of the screen. It will reappear on the same heading it had when it disappeared.

If you like this result you can continue to draw with the DELTA cursor from its new screen position. If you don't like this result, you can erase the last command (Press E), and the DELTA cursor will return to its previous screen position.

You can make the DELTA cursor turn to its right, turn to its left, or turn around so

that it is heading in the opposite direction.
Press R



When you press R you execute the Right Turn command. The DELTA cursor turns 30° to its right.

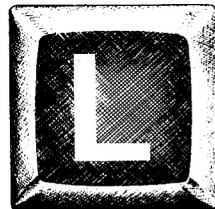
To make it turn 90° to its right you would have to press R two more times ($3 \times 30^\circ = 90^\circ$).

Press R two times

Now the DELTA cursor is heading 90° to the right of its start position. To make it return to its start position you could press E three times or execute three Left Turn commands.

Press L three times

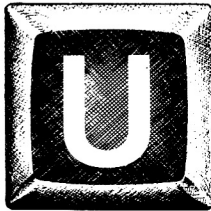
When you press L you execute the Left Turn command. The DELTA cursor turns 30° to its left every time you press L.



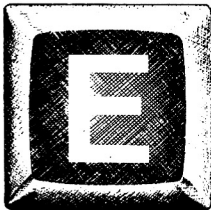
When you press R or L the DELTA cursor turns right or left, one turn at a time. A turn equals 30°. It takes 12 R or L keystrokes to turn the DELTA cursor around in a complete circle ($12 \times 30 = 360^\circ$). When the DELTA cursor turns it changes its heading, but it does not change its position. It simply rotates in place.

Press U

When you press U you execute the U-Turn command. The DELTA cursor turns around (180°) and heads the other way. Because the DELTA cursor only goes forward, the U-Turn command saves keystrokes when you want the DELTA cursor to go in the opposite direction.



As you practice drawing, you may start a picture and then decide to erase all of it and start over. You could erase the picture one command at a time with the Erase command. However, if you used many commands to draw the picture this might be too slow. Instead, you can erase the entire screen by using the Erase Picture command. You execute this command by pressing the Control (CTRL) key and holding it down while pressing E.



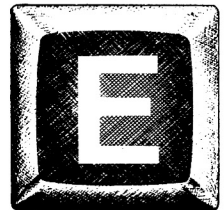
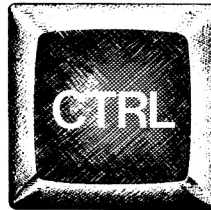
Press E

You can erase all of the turn commands, one turn at a time, by pressing E.

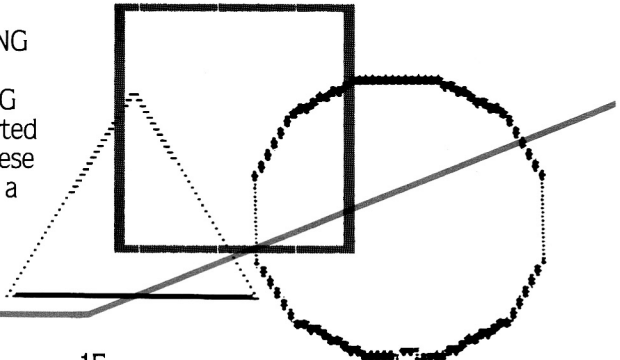
Draw, Move, Right Turn, Left Turn, and U-Turn are the five

basic Drawing Commands in DELTA DRAWING. You may now want to practice using these commands to draw some pictures or create your own designs on the screen.

A separate set of DELTA DRAWING CARDS is included as Part 4 of this Guide. You can use DELTA DRAWING CARDS #1, #2, and #3 to get started drawing with the DELTA cursor. These three cards show you how to draw a square, circle, and triangle.



All of the commands that you have used to draw the current picture will be erased, the screen will be cleared, and the DELTA cursor will return to its start state.



Drawing Programs

With DELTA DRAWING the computer remembers everything you draw with the DELTA cursor (unless you erase). And it can reproduce your drawing on the screen at any time, as often as you like.

When you draw a picture with the DELTA cursor you also write a computer program. This drawing program is stored in the computer's memory. The program consists of the sequence of commands used to produce the picture. The computer can reproduce your picture exactly the way you drew it by repeating this sequence of commands.

You can make a drawing program with any sequence of Drawing, Program, or Color commands simply by numbering it. Let's make a drawing program!

Press D three times

Press R three times

Press 1

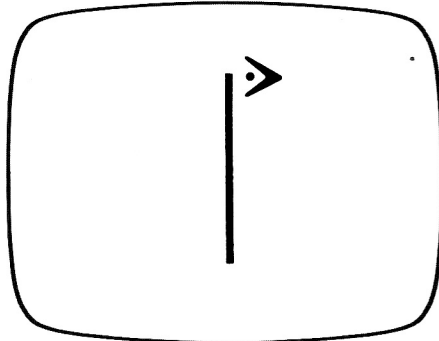
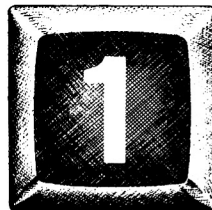
The screen is cleared and the DELTA cursor is back in its start position. What happened?

When you pressed 1, you executed the First Program command. This command instructed the computer to save the previous sequence of six commands (3 Draws followed by 3 Right Turns) as a drawing program.

Now, whenever you want to reproduce that drawing on the screen you simply press 1.

Press 1

Your drawing is now reproduced on the screen.

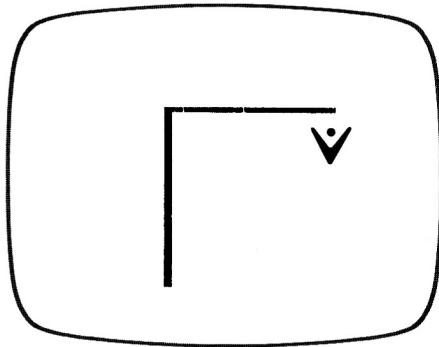


What will happen if you press 1 again?

Try it!

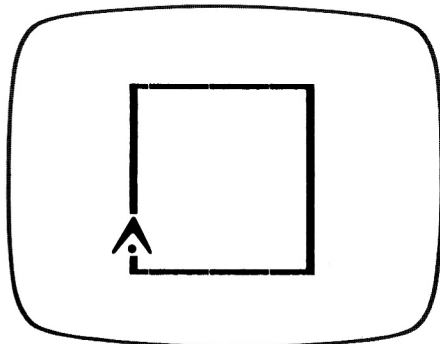
Press 1





Your drawing was reproduced but now it makes a horizontal line on the screen instead of a vertical one. That's because drawing programs are reproduced from the DELTA cursor's current position and heading.

You always start a new drawing program from the DELTA cursor's start position, but when you "call" a program from memory to reproduce it on the screen the DELTA cursor will re-draw it from its current position and heading.
Press 1 two times



Repeating your first drawing program four times produces a square. By using drawing programs you can create complex figures, designs, or pictures from simple parts. And you can nest one or more programs in another program.

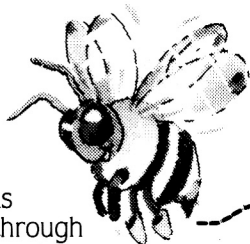
For example, let's take the square that you made and make it your second program. To do that you have to number it.

Press 2

You have numbered two drawings and stored them in memory. You now can reproduce either of those drawings at any time by executing the First or Second Program commands – by pressing either 1 or 2.

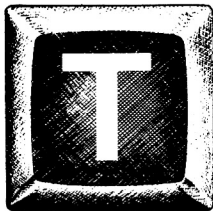
With DELTA DRAWING you can create up to nine separate drawing programs and use all of them to draw a tenth picture. The number keys 1-9 are the Program Command keys. Number your first drawing one, your second drawing two, your third drawing three, and so forth.



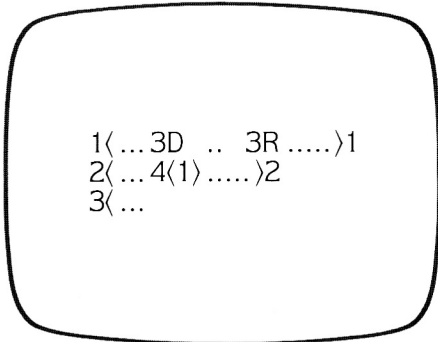


You must number your drawing programs in sequence from one through nine. For example, you can't number your third drawing program by pressing 5; nothing will happen. On the other hand, when drawing programs have been numbered they can be "called" in any sequence.

Any time that you want to see the list of commands included in the drawing program you have written you can do so by using the Text command. Press T



You are now looking at the text display.



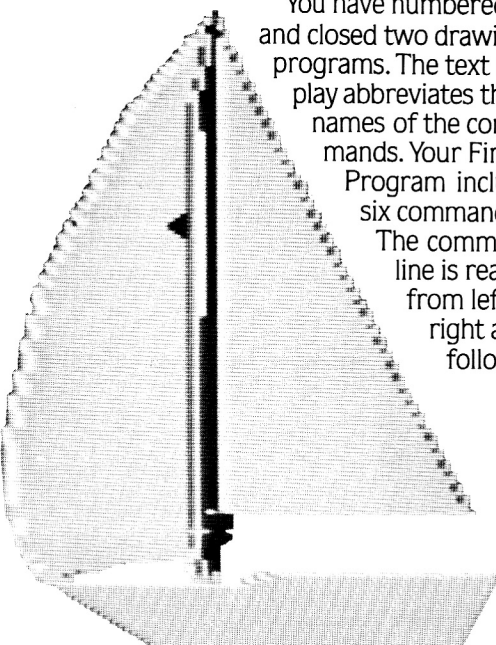
It displays the list of commands in the two drawing programs you have created.

DELTA DRAWING has two modes of display – graphics and text. Most of the commands you use to create your drawing programs are simultaneously recorded on both the graphics and text displays. When you are in the graphics mode your current drawing is displayed on the screen. When you are in the text mode the screen displays the lists of commands that describe your drawing programs. You can execute commands in either text or graphic mode. And you can switch back and forth between graphics and text as often as you like without affecting the picture or program.

The notation scheme used on the text display is fairly simple. A number (1-9) followed by the < symbol represents the beginning bracket of a drawing program. The > symbol followed by a number (1-9) represents the end bracket of a drawing program.

A drawing program is considered **open** when a sequence of commands has a beginning bracket but no end bracket. A drawing program is **closed** when it has both a beginning and end bracket. You close a drawing program and give it an end bracket when you number it.

You have numbered and closed two drawing programs. The text display abbreviates the names of the commands. Your First Program includes six commands. The command line is read from left to right as follows:

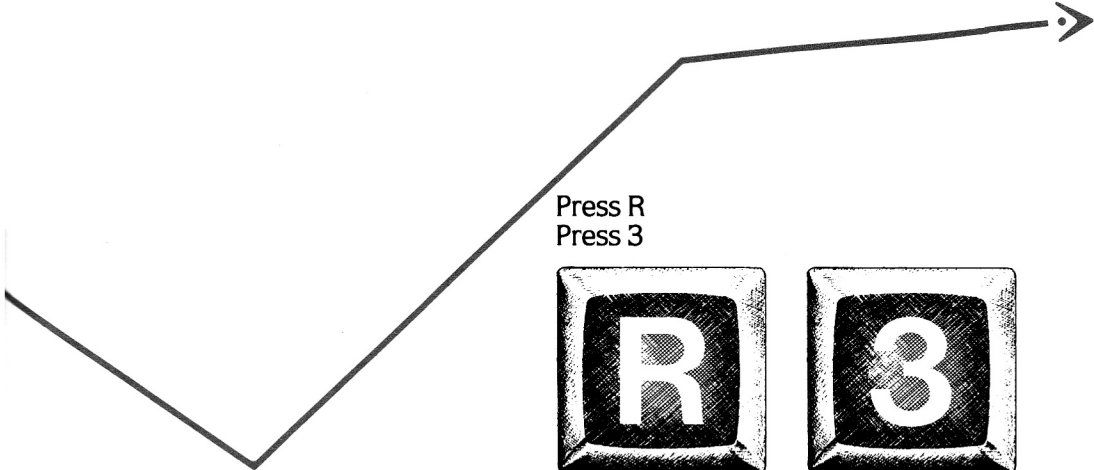


Three Draws Three Right Turns

1<... 3D .. 3R>1

The list for your Second Program, which is a square, is read as follows:
Four First Programs

2<... 4<1>>2



Press R
Press 3



You can create drawing programs in either text or graphics, so let's write one. Notice the 3 followed by the < symbol. This is the beginning bracket for your third drawing program. When you close a program the computer automatically inserts the beginning bracket for the next program. Any commands that you now execute will be included in your third program.

Press 2



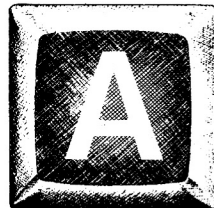
Whenever you want to return to the graphics display you can press G.

Press G

Now let's get the computer to re-draw your Third Program repeatedly until you want it to stop. The Automatic command (A) repeats the last closed drawing program continuously until you stop it with the Escape Command (ESC).

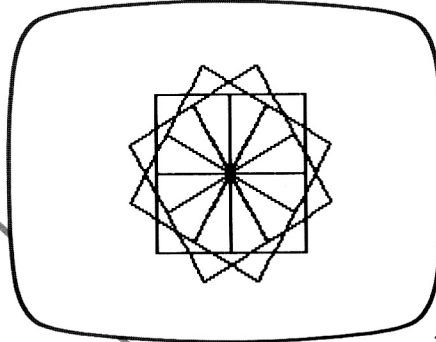
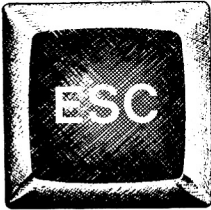


Press A



Notice the message, "WORKING," at the bottom of the screen. This indicates that the computer is working to complete the execution of your command on the graphics display. When the message disappears you can proceed with the execution of the next command.

To stop this program from repeating, press ESC.

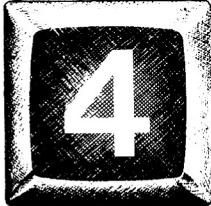


When you pressed 3 you called your third program from memory and the DELTA cursor drew your square with a turn on the screen. You can erase it by using the Erase command. **Press E**

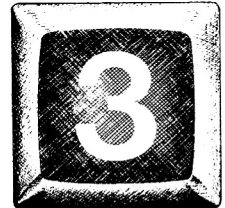
Pressing E erases the drawing on the screen, but it does not erase your drawing program. Your third drawing program is still stored in the computer's memory. Let's make sure.

Press 3 three times

You can save the geometric figure that you just made by numbering this drawing. **Press 4**



You can erase Program Commands in the same way that you erased other commands, by pressing E. For example:



Press 3

It's still there. The Erase Picture command (CTRL E) works the same way. You can use this command to clear the screen, but it does not erase drawing programs from memory.

Press CTRL E

The screen is clear, but your third drawing program is still stored in the computer's memory.

Let's suppose that you liked the geometric figure you drew with your fourth program, but you want to make it bigger.

You can edit your drawing programs by using the Open Program command, CTRL O. This command requires an

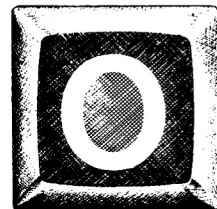
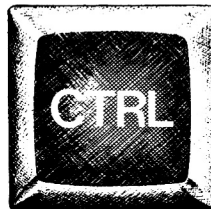
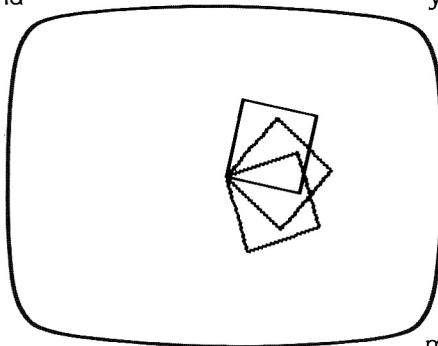
input—the number of the drawing program you want to open and edit. When you press CTRL O, you will see a message that prompts you to press the number key of the program to be opened. (In DELTA DRAWING you can have only one open program at a time. Therefore, if you have a current drawing on the screen, or any commands in the current

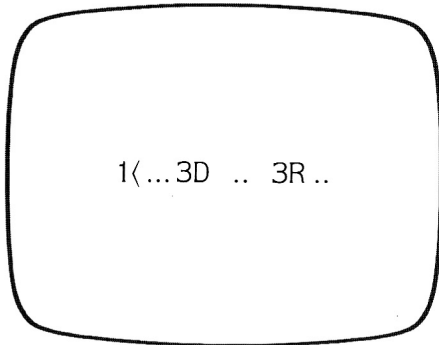
open program, they must be erased or the program must be closed before you can use the Open Program command.)

We will edit the first program to increase the size of the geometric figure.

Press CTRL O

Press 1





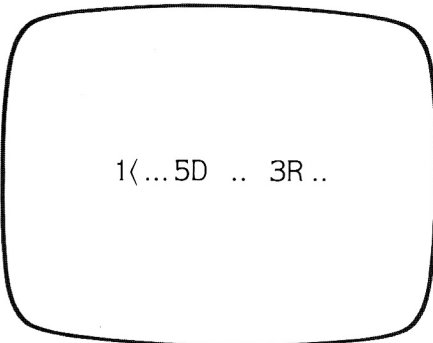
The end bracket of the first program has been erased, so we can now erase and change the commands in this program.

Remember, this program draws the side of a square. The three Draw commands make the side three steps long. Let's make the side five steps long by adding two more Draw commands.

Press E three times

Press D two times

Press R three times

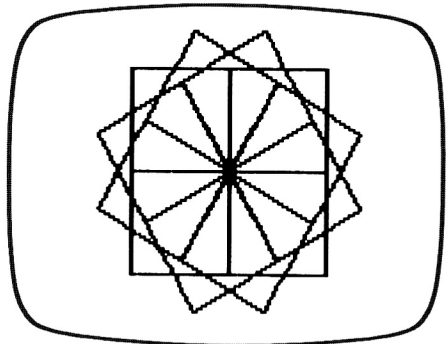


You have to close this program by pressing the same number key that you used to open it.

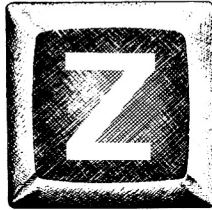
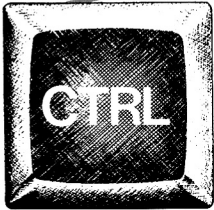
Press 1

Now, you have changed your first program, which is included in your second program, which is included in your third program, which is included in your fourth program. Will this make your geometric figure bigger? Try it!

Press 4



There is a way to erase drawing programs from memory. You use the Zap command. The Zap command erases both the text and graphics displays and returns you to the start of DELTA DRAWING. You execute the Zap command by pressing the Control (CTRL) key and holding it down while pressing Z. If you are ready to erase the drawing programs you have just created,

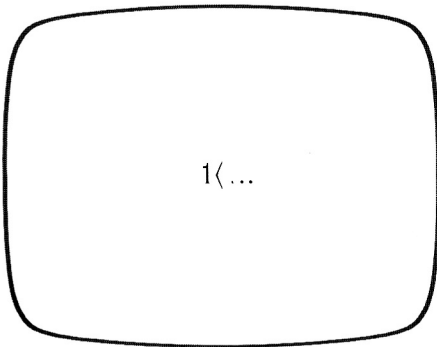


Press CTRL Z

Now all four of your drawing programs are erased from memory. Just to make sure, try pressing any of the first four number keys. Nothing happens!

You can continue to draw with the DELTA cursor. However, you would now press 1 to number a drawing program, since the Zap command has erased everything and put you back at the start of DELTA DRAWING. You can always check the number of the drawing program you are currently working on by viewing the text display.

Press T



This is what the text display looks like

at the start of DELTA DRAWING. There is no text history recorded on the display. Any Drawing commands that you execute now will be included in your first program.

Press G

You are now viewing the graphics display and the DELTA cursor is ready for you to begin drawing again. You now may want to practice creating some of your own drawing programs. You can use DELTA DRAWING CARDS #4, #5, and #6 to get started creating, repeating, and editing drawing programs.

Drawing with Color

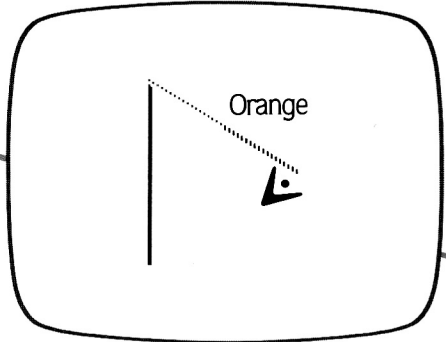
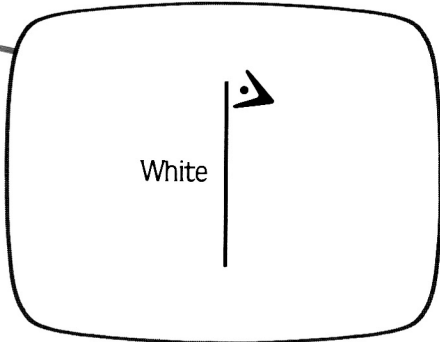
With DELTA DRAWING, you can draw in color if you have a color monitor. You can color the line with which you draw, fill in shapes in a drawing with different colors, and add a color background to your drawings.

Select Color (C) is the basic Color Command. When you press C you are presented with a menu of colors from which to choose. Each color on the menu is identified by a number. You make your color selection by pressing the number key associated with the color you want to use.

When you start DELTA DRAWING, the DELTA cursor will draw a white line on a black background. To change the color of the line you use the Select Color command.

Press D six times

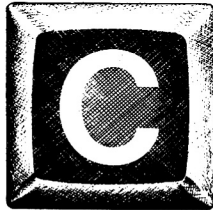
Press R four times



Now, let's draw a triangle with a different colored line on each side. You are ready to select a color for the second side of the triangle.

Press C

The color menu displayed on the screen gives you five choices. To select a color, press the number key that identifies the color you want to use. If you decide that you don't want to change color, you can get out of the color selection routine by pressing ESC.



Let's make the second side of the triangle orange.

Press 2

Now the next time you execute a Draw command the DELTA cursor will draw with an orange line.

Press D six times

Press R four times

How about making the third side of the triangle green?

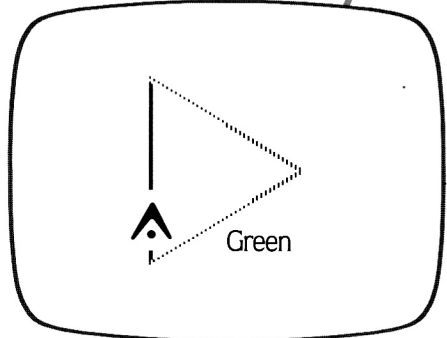
Press C

Looking at the color menu, you'll see that green can be selected by pressing 3.

Press 3

Press D six times

Press R four times



You have constructed a triangle with three different colored sides. You can save this drawing by numbering it. Before you do that, however, it's normally a good strategy to reset the color to white before closing a program. The DELTA cursor draws in the last color selected; so, unless you want to continue drawing with a green line every time you call and use this program, you should change the color to white.

Press C

Press 1

Now you are ready to close the program.

Press 1

Let's use your first drawing program.

Press 1

Press U

Press 1

With DELTA DRAWING you can also fill any shapes that you have made with different colors. To do this you use the Fill Shape command, which you execute by pressing CTRL F.

To fill a shape with color the DELTA cursor's blinking dot must be inside the shape to be filled. And you must put the blinking dot inside the shape with a Move (or Half Move) command. If the DELTA cursor's blinking dot is touching a shape boundary line or a line segment that it has just drawn, the Fill Shape command will not operate. Let's put the DELTA cursor's blinking dot inside the second triangle.

Press R

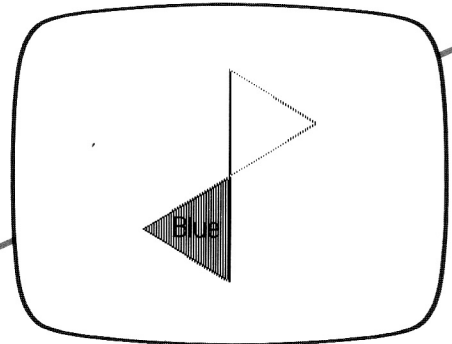
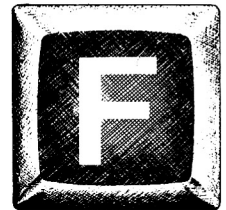
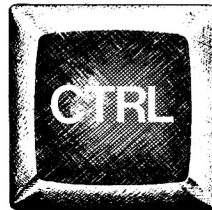
Press M

Now the DELTA cursor's blinking dot is inside the triangle; you can select the color.* How about blue?

Press C

Press 4

Press CTRL F



If you have the DELTA cursor's voice on you will hear it "beep" when it has completed the fill routine. This means it is ready to accept the next command.

*You cannot select #1. The Fill Shape command will not fill a shape with white.

Again, it's a good strategy to reset the color to white before closing a drawing program that contains one or more Color Commands. Let's change the color to white and number this picture.

Press C

Press 1

Press 2

With the DELTA DRAWING program there is a third way to color your drawings—by adding color to the background. To do this you use the Add Background command, which you execute by pressing the Shift key and holding it down while pressing the key with the + sign on it.

Let's try it using the Add Background command. First, call your second drawing program.

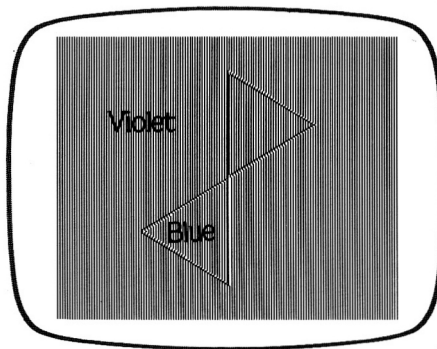
Press 2

When the DELTA cursor has reproduced your second drawing you are ready to select a background color.

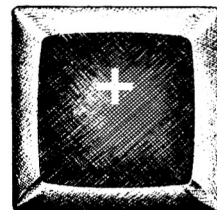
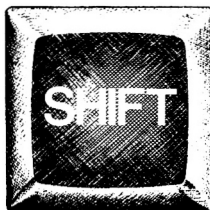
Press C

How about selecting violet for the background?

Press 5



Press SHIFT +



It takes a few seconds to fill the entire background of your drawing with color. Notice what happens! All of the screen that was black is filled in with violet, including the black area inside the first triangle of your drawing. The DELTA DRAWING program cannot discriminate between the foreground and background of your drawing. It simply treats all black areas of the screen as if they were "background." When you add background color to a drawing, the color will be added to all of the black areas of the screen, including any black areas inside shapes you have drawn.

Suppose you didn't want to fill in the black area inside the first triangle in your drawing. You would use the Fill Shape command instead of the Add Background command. Fill Shape will color only the black area around your

drawing (the negative shape). Add Background adds color to all black areas of the screen.

Let's clear the screen and start over again.

Press **CTRL E**

Press **2**

Press **L** three times

Press **M** one time

Press **C**

Press **5**

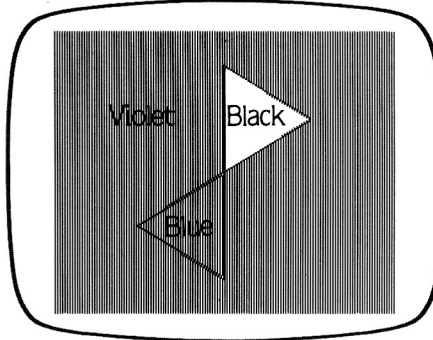
Press **CTRL F**

The Fill Shape command fills the negative area around your drawing with violet, but it does not fill in the black area inside your first triangle.

You can erase and change the Color Commands that you use in your drawing programs, but the procedures for editing are slightly different from those used in editing Drawing and Program Commands. For instructions on editing Color Commands, see Color Commands, page 55.

Use the Zap command to erase the drawing programs you have created.
Press **CTRL Z**

You are back at the start of DELTA DRAWING. You can now use DELTA DRAWING CARDS #7 and #8 to get started drawing with a colored line and filling enclosed areas of your drawings with color.



Getting Going

We have briefly covered the fundamentals of DELTA DRAWING. You may want to practice using the commands that have been presented here to create a variety of different drawings.

You can draw whatever you like, and if you don't like what you see you can change it. DELTA DRAWING has been designed to permit and encourage an experimental approach to computer graphics. You can always try a drawing idea to see how it works. And whether it works or not, the fun is in doing it. DELTA DRAWING CARDS #9, #10, #11, and #12 will give you some idea of the different kinds of drawings you can create with DELTA DRAWING. Try them!

As you get going using the DELTA DRAWING program, you can refer to Part 2 of this Guide for additional commands and a more detailed explanation of how each command operates. DELTA DRAWING is an easy program to use, but it is sufficiently rich in capabilities to thoroughly challenge your imagination and skill in drawing with a computer.

2 DELTA DRAWING COMMANDS COMMAND STRUCTURE

The DELTA DRAWING program has 42 commands. This range of commands makes the program versatile. To make these commands easy to learn and remember the DELTA DRAWING program has been organized into eight types of commands. Each type includes a group of commands that have a similar function.

Type of Command

DRAWING

EDITING

PROGRAM

DISPLAY

COLOR

REPEAT

SYSTEM

PRINTING

These are the commands you use to:

Turn and move the DELTA cursor and make it draw.

Erase other commands when editing your picture and text.

Number, store, and reproduce pictures that you draw. These are user-defined commands.

View either the text or the graphics displays, turn the DELTA cursor's voice off or on, choose a boundary mode, turn the center screen marker off or on, hide or show the DELTA cursor, or reverse the colors in a picture.

Select a drawing color, fill a shape with color, or add a color to the background.

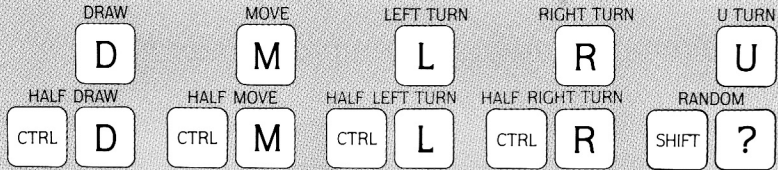
Repeat other commands.

Escape from or stop the execution of a command, stop and reset the DELTA DRAWING program, or save or load pictures or text from a disk.

Print copies of your text history if you have a printer and a Centronics-type printer card, or print drawings and text history if you have THE GRAPPLER™ printer card.

DRAWING COMMANDS

DRAWING



There are ten Drawing Commands in DELTA DRAWING. These are used to move and turn the DELTA cursor and make it draw. With just five basic Drawing Commands you can make the DELTA cursor draw a line: D, move without drawing a line: M, turn right: R, turn left: L, or make a U-turn: U.

Draw (D) and Move (M)

The DELTA cursor only goes forward one step at a time, and it goes in a straight line in the direction it is heading. Each D or M keystroke produces one step. Press D and the DELTA cursor goes forward one step and draws a line. Press M and the DELTA cursor goes forward one step, but it does not draw a line. You make the DELTA cursor draw a line or move more than one step with multiple

D or M keystrokes. To draw a line five steps long, press D five times. In DELTA DRAWING you cannot execute five Draw commands by pressing 5 then D. You must press D five times. To make the DELTA cursor move five steps without drawing a line, press M five times.

Right Turn (R) and Left Turn (L)

The DELTA cursor rotates left or right one turn at a time. When the DELTA cursor rotates it changes heading, but it does not change position. It simply rotates in place. And it rotates to its left or right. Each L or R keystroke produces a turn angle of 30°. Press R and the DELTA cursor turns 30° to its right. Press L and the DELTA cursor turns 30°

to its left. You can make the DELTA cursor rotate more than one turn by pressing R or L several times. To turn the DELTA cursor 90° to the right, press R three times ($3 \times 30^\circ = 90^\circ$).

U-Turn (U)

Because the DELTA cursor only goes forward, the U-Turn command saves keystrokes when you want to turn the DELTA cursor around. When you press U the DELTA cursor turns 180° so that it is heading in the opposite direction.

The CTRL (control) key enables you to make the DELTA cursor take half-steps and half-turns for more finely detailed drawings.

Half-Draw (CTRL) (D) and Half-Move (CTRL) (M)

You can draw a line or move the DELTA cursor forward one-half step by using the Half-Draw or Half-Move commands—press CTRL first and hold it down while pressing D or M.*

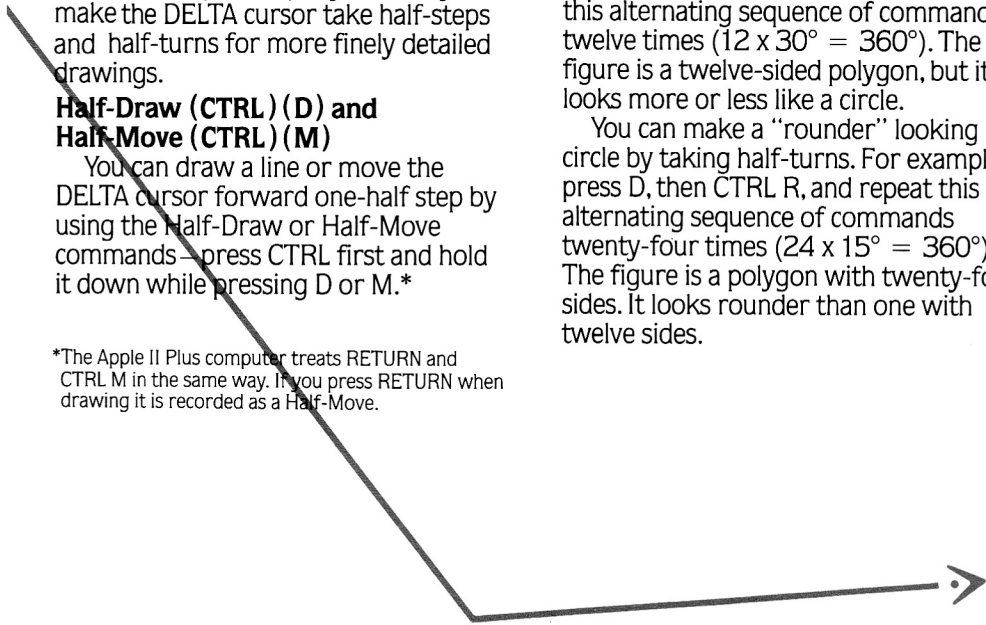
*The Apple II Plus computer treats RETURN and CTRL M in the same way. If you press RETURN when drawing it is recorded as a Half-Move.

Half-Right Turn (CTRL) (R) and Half-Left Turn (CTRL) (L)

You give the DELTA cursor Half-Right Turn and Half-Left Turn commands by pressing CTRL and either R or L. These commands produce a turn angle of 15°.

Curves and Lines. A DELTA drawing is made up entirely of straight lines. The illusion of a curve is produced by a series of straight lines drawn at different angles. You can produce a curve by alternating D with L or R. For example, to make a circle, press D, then R, and repeat this alternating sequence of commands twelve times ($12 \times 30^\circ = 360^\circ$). The figure is a twelve-sided polygon, but it looks more or less like a circle.

You can make a “rounder” looking circle by taking half-turns. For example, press D, then CTRL R, and repeat this alternating sequence of commands twenty-four times ($24 \times 15^\circ = 360^\circ$). The figure is a polygon with twenty-four sides. It looks rounder than one with twelve sides.



Random (SHIFT)(?)

Random is a specialized Drawing Command that enables you to make drawings that are unpredictable and unique. With it, you randomize the number of steps the DELTA cursor will take when you give it move or draw commands, and you randomize the number of degrees the DELTA cursor will turn when you give it right or left turn commands.

You can randomize any Drawing Command except U-Turn. To randomize one of the Drawing Commands press SHIFT ?, then execute the Drawing Command.

The Random command operates on the next Drawing Command whenever it is encountered. For example, if after executing Random you "call" a program that includes a Drawing Command, that command will be randomized and the picture produced by the program will be changed.

Random Steps. Random operates on the next Drawing Command and thereby affects the outcome of that command. Ordinarily, a Draw D or Move M command is one DELTA cursor step in length. A DELTA cursor step is equivalent to about eight picture elements, the smallest unit of display on the screen. By using Random before using D or M, the length of a step is affected so that it can vary from 0 to 48 picture elements. Thus, the command sequence SHIFT ? D might produce a line 1 DELTA cursor step long, or $3\frac{1}{4}$ steps long, or $5\frac{1}{2}$ steps long, or any number of steps from 0 to 6. SHIFT ? CTRL D or SHIFT ? CTRL M can produce a line or move that can vary from 0 to 24 picture elements; that is, from 0 to about 3 DELTA cursor steps in length.

Random Turns. Turn commands are similarly affected by the Random command. Ordinarily, a turn is in 30° increments to the right or left. But by using Random (SHIFT ? R, for example) the DELTA cursor may turn in any direction to any of the twelve possible headings between 30° and 360° . A clockface is

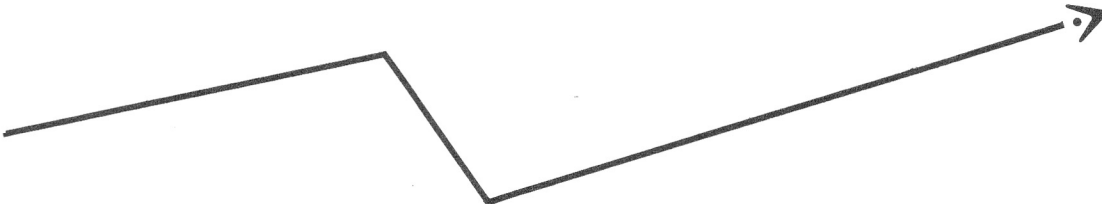
divided into 30° segments. When you think of the clockface, think of SHIFT ? R producing a turn to any of the hour numbers: 1, 2, 3,...12. A random turn to the left could have the same consequence as a random turn to the right. In fact, the notion of a right or left turn does not apply once a turn command has been randomized. The result might just as well have been achieved by pressing L rather than R, or vice versa.

With the half-turns the situation is different. SHIFT ? CTRL L always turns left from 0 to 12 turns in 15° increments. SHIFT ? CTRL R always turns right from 0 to 12 turns in 15° increments. In the case of half-turns, the notions of right and left do apply. Using the clockface once again, think of SHIFT ? CTRL R producing a turn to one of the twelve half-hour positions between 12 and 6 on the right-hand side of the clockface. SHIFT ? CTRL L turns in the opposite direction to one of the twelve half-hour positions on the left-hand side of the clockface.

If a drawing program containing a Random command is repeated, it is possible, although highly unlikely, that the same picture or pattern will be produced twice. When you use Drawing Commands at the beginning of a drawing program, then randomize a command, you may find that you cannot make lines meet exactly or that you are unable to close shapes. Therefore, it is often best to randomize the last command in a drawing program.

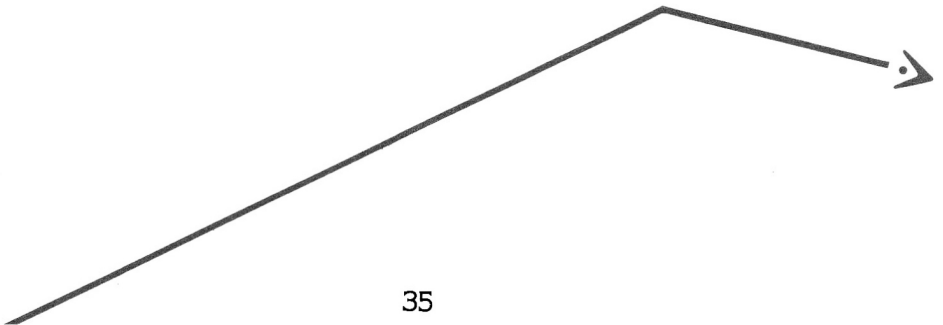
Editing Random. When erasing a randomized line segment, move, or turn the normal correspondence between the text and graphics displays will most likely break down (see Display Commands). This is because the Erase command treats a randomized Drawing Command as if it were a standard Drawing Command.

Therefore, erasing a randomized Drawing Command will eliminate it from the text display, but it will only eliminate one or one-half steps of it or one or one-half turns of it from the graphics display. It is likely, however, that the random Drawing Command produced a larger or smaller step or turn.



For example, pressing SHIFT ? D might produce a $5\frac{1}{4}$ -step line segment on the graphics display. Press E and the Draw Command will be eliminated from the text display, but only one DELTA cursor step will be erased from the graphics display. Press E again to eliminate the Random command from the text, but you will be left with a $4\frac{1}{4}$ -step line segment on the screen. This line segment cannot be erased with E. If you continue to press E it would simply erase any commands executed prior to the Random command. Thus, the graphics display will not correspond with the text display.

The best way to edit a randomized draw, move, or turn command is to close the program after erasing the Random command (see Program Commands). This will save all of the commands in the program prior to the Random command, clear the graphics display, and return the DELTA cursor to the start state. Then you can use the Open Program command to open the program, press G to reproduce your drawing in graphics, and continue to draw.



DRAWING COMMANDS

COMMAND	KEY(S)	TEXT DISPLAY	COMMAND FUNCTION
Draw	D	D	To make the DELTA cursor go forward one step and draw a line
Move	M	M	To make the DELTA cursor go forward one step (no line)
Right Turn	R	R	To make the DELTA cursor turn right 30°
Left Turn	L	L	To make the DELTA cursor turn left 30°
U-Turn	U	U	To make the DELTA cursor turn 180°
Half-Draw	CTRL D	^D	To make the DELTA cursor go forward 1/2 step and draw a line
Half-Move	CTRL M	^M	To make the DELTA cursor go forward 1/2 step (no line)
Half Right-Turn	CTRL R	^R	To make the DELTA cursor turn right 15°
Half Left-Turn	CTRL L	^L	To make the DELTA cursor turn left 15°
Random	SHIFT ?	?	To randomize the next Drawing Command (except U-Turn)

With the ten Drawing Commands you can change the position and heading of the DELTA cursor intentionally or randomly; move it around the screen; draw your own pictures, diagrams, graphs, letters, or numerals; and create your own designs and games.

EDITING COMMANDS

EDITING

ERASE

E

ERASE PICTURE

E

OPEN PROGRAM

O

ZAP

CTRL

Z

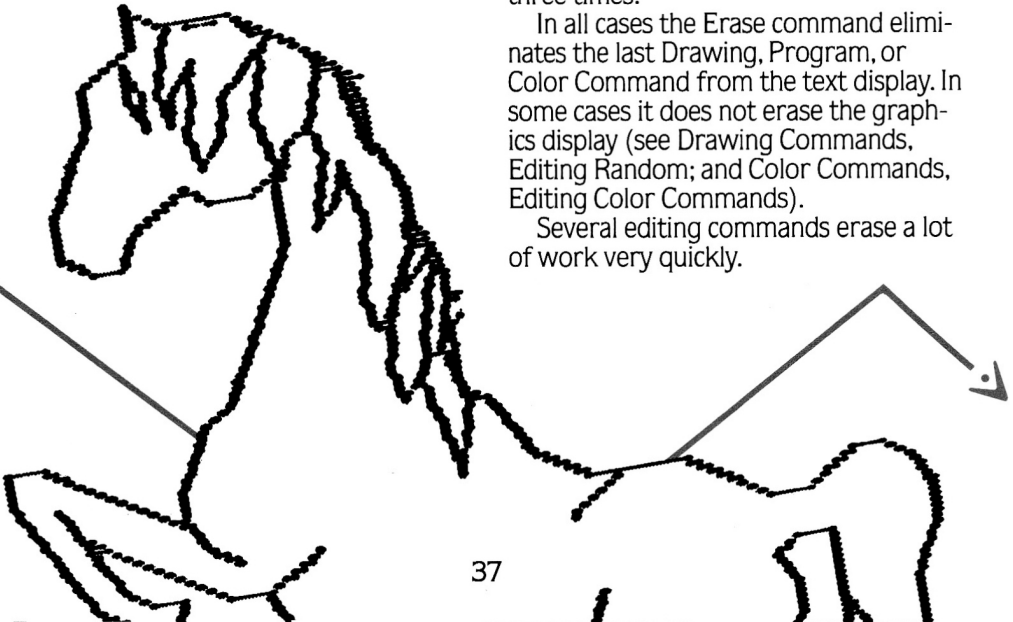
In DELTA DRAWING, the computer remembers the Drawing, Program, and Color Commands you give it unless you tell it to forget. You tell the computer to forget, or erase, by using one of the four Editing Commands. The Editing Commands are not recorded on the text display, and therefore are not included in the sequence of commands that make up a drawing program.

Erase (E)

The Erase command eliminates the last Drawing, Program, or Color Command and returns the DELTA cursor to the position, heading, or color of the previous command. For example, if you drew a line with the DELTA cursor one step too long, you could press E to erase the last step of your drawing. If you drew a line three steps too long, press E three times.

In all cases the Erase command eliminates the last Drawing, Program, or Color Command from the text display. In some cases it does not erase the graphics display (see Drawing Commands, Editing Random; and Color Commands, Editing Color Commands).

Several editing commands erase a lot of work very quickly.



Erase Picture (CTRL) (E)

If you were drawing with a crayon on a pad of paper and decided that you didn't like the drawing you started, you could tear off the sheet of paper and start over. In DELTA DRAWING you can achieve the same effect with the Erase Picture command.

To prevent accidentally erasing a picture you must press both CTRL and E to use this command. When you press CTRL E , the current drawing on the graphics display is erased and the DELTA cursor returns to its start state. On the text display, all of the commands in the open program are erased. The Erase Picture command will not erase any drawing programs you have previously numbered and stored in the computer's memory.

Open Program (CTRL) (O)

This command enables you to open a selected drawing program for editing (see Editing Program Commands). In DELTA DRAWING you can only have one open program at a time. Therefore, if you have a drawing on the screen, or if there are any commands in the open program, you must first erase them (press CTRL E) or number and close the program before you can use CTRL O .

When you press CTRL O the text screen is displayed automatically so that you can review the command list of the program you intend to edit.

The Open Program command requires an input—the number of the drawing program you want to open and edit. The DELTA DRAWING program prompts you to supply this input by displaying, at the bottom of the screen, a list of the programs that you can open. You select the program to be opened by pressing the number key that you assigned to it.

When you open a program you can eliminate commands, change commands, or add new commands. You cannot, however, add a program command that has a number equal to or greater than the number of the program you have opened. To change a command in the middle of the program you erase the commands that come after it. You begin erasing at the end of the program and work backward toward the beginning. To erase all of the commands in the program, use CTRL E.

If you aren't sure what changes you want to make in the open program you can view the graphics display by pressing G . On the graphics display the DELTA cursor redraws all of the commands in the program you have opened. When the DELTA cursor stops, you can modify the drawing in any manner you wish. To close the program you must press the same number key you pressed to open it.

If, after pressing CTRL O, you decide not to do any editing, press ESC to escape from the Open Program command's input routine and return to the graphics display.

Zap (CTRL)(Z)

The Zap command is a big eraser. It not only erases the current picture on the screen, it also erases all drawing programs you have previously created. To use the Zap command you press CTRL Z . When you press CTRL Z you erase everything on both the text and graphics displays and return to the start of DELTA DRAWING.

The Editing Commands make it easy to draw with the DELTA cursor. If you draw a line too long or turn too much you can always erase. And you can erase one command at a time, one program at a time, or Zap everything and start over. You also can open any drawing program at any time and change it. With DELTA DRAWING there are no mistakes, only unexpected results. If you don't like what you see, change it, and keep changing it until you get the line, figure, design, or effect you want.

You don't have to know how to draw something before you start. With DELTA DRAWING you can always try it—conduct your own drawing experiment. DELTA DRAWING experiments are like scientific experiments; you learn something by doing them, whether or not they turn out the way you expected.

EDITING COMMANDS

COMMAND	KEY(S)	TEXT DISPLAY	COMMAND FUNCTION
Erase	E	NONE	To erase the last Drawing, Program, or Color command
Erase Picture	CTRL E	NONE	To erase all of the commands in the open drawing program and clear the graphics display
Open Program	CTRL O	NONE	To open a selected drawing program for editing. Requires a program number as an input. The open program line must be empty (use CTRL E if necessary)
Zap	CTRL Z	NONE	To erase all text and graphics and return to the start of DELTA DRAWING

PROGRAM COMMANDS



PROGRAM



When you draw a picture with the DELTA cursor you also write a drawing program. The program consists of the sequence of commands used to produce your picture. Your drawing programs can be as simple or as complex as you like. For example, if you press D, then press R, and do this twelve times in succession, this sequence of twenty-four keystrokes will produce a circle on the screen. The circle is your picture. The drawing program that produces this picture consists of a sequence of draw and right turn commands repeated twelve times. You can make the computer store this sequence of commands in its memory and re-draw your picture (the circle) by using a Program Command.

In DELTA DRAWING there are nine Program Commands—the first nine numbers on the keyboard are the Program Command keys. A Program Command is used to number and store a drawing program and to “call” it whenever you want to reproduce your picture on the screen. Giving a drawing program a number is a handy way to refer to it. You only have to remember that drawing program #1 is, for example, your “circle picture.”

When you start DELTA DRAWING the nine Program Commands are undefined. You define them by numbering drawing programs.

First Program (1)

You begin every DELTA drawing with the DELTA cursor in the start state. When you press the command keys to make the DELTA cursor turn, move, or draw the computer remembers and records the keys you press and the sequence in which you used them. When you have completed your first picture and want to store it as a drawing program, you execute the First Program command by pressing 1 . The entire sequence of commands used to produce your picture is assigned this number and stored as a drawing program in the computer’s memory.

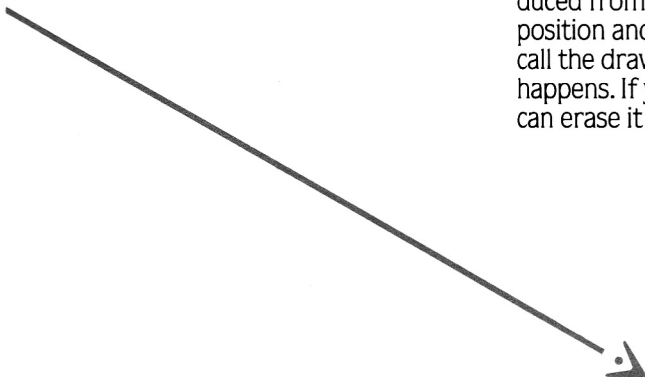
When you number a drawing program, the graphics display clears and the DELTA cursor returns to its start state. To see the list of commands included in your drawing program you can switch to the text display by pressing T (see Display Commands).

The sequence of commands that produce your drawing is listed on the text display (from left to right) between two program brackets: 1< is the beginning bracket for the first program, and >1 is the end bracket. A drawing program is considered open when a sequence of commands has a beginning bracket but no end bracket. A drawing program is closed when it has both a beginning and an end bracket. In DELTA DRAWING only one program may be open at any time.

The beginning bracket is inserted automatically when you start DELTA DRAWING. By pressing 1, you insert the end bracket and close the first program. The computer automatically inserts the beginning bracket 2< for the second drawing program. You are now ready to draw a new picture. To return to the graphics display, press G.

Second - Ninth Programs(2)-(9)

When drawing your second picture you can use 1 just like any other DELTA DRAWING command key. When you press 1, the DELTA cursor will re-draw your first picture as an element in your second picture. The DELTA cursor will re-draw your first picture from its **current** position and heading. Remember, you start every drawing program with the DELTA cursor in its start state—in the center of the screen heading up. The DELTA cursor repeats the sequence of commands used to draw the picture initially. But if the DELTA cursor is not in the center of the screen heading up when you call the drawing program, the picture it draws may look different from the one you drew initially. Consequently, before you “call” a drawing program (by pressing the number key assigned to that program), try to visualize what the drawing will look like when it is reproduced from the DELTA cursor’s current position and heading. Or you can try it—call the drawing program and see what happens. If you don’t like the result you can erase it by pressing E .



With DELTA DRAWING you can create and use up to nine separate drawing programs. The first drawing program can become a part of your second drawing. The first and second programs can become parts of your third drawing, and so forth up to a tenth drawing. You can use all nine drawing programs in a tenth drawing, but you cannot number the tenth drawing or store it as a drawing program.

Drawing programs must be numbered and closed in sequence. You must number your first program before using the Second Program command. You cannot use the Third Program command until you have numbered your first and second programs, and so forth.

If you can't remember the number of the program on which you are currently working, press T to view the text display. On the text display you can see the number of the open program on which you are working. (The "open program" has a beginning bracket but no end bracket.) You must use this number to close your drawing program. For example, to number the second program you must use the Second Program command by pressing 2. If you press a Program Command key with a number larger than two, nothing happens.

On the other hand, once you have numbered drawing programs you can call them in any sequence. For example, if you have numbered the first five drawing programs, you could call and use the fourth and second programs as part of your sixth drawing.

Editing Programs. You can change or erase drawing programs with editing commands, but these editing commands are not included in drawing programs. For example, if you are working on your second picture and you call your first program (press 1), your first picture will be re-drawn as a part of your second picture. If you don't like the result, erase it by pressing E. Remember, E erases the last command, and in this case your last command was 1, First Program.

It's one thing to edit an instance of a program (as in the example above); it's another to edit the contents of a program. The contents of a program are the specific commands in a particular sequence. Change the commands or change their sequence and you've changed the program.*

*It's possible to change the program without changing the appearance of the picture. For example, you might substitute a U for 6R in a drawing program. The contents of the program have changed, but the result—the picture produced on the screen—is the same.

With DELTA DRAWING it is possible to produce the same picture with different drawing programs, and, in some cases, the same program will produce different pictures. (see Random in Drawing Commands)

When you call a program the computer produces an instance of that program. E can be used to edit an instance of a program. The example below shows the text display of the contents of the first program and an instance of that program as it appears in the second program. (For instructions on reading command lists, see Display Commands.)

```
1< ... 5D .. 4M .. 3D .. 2M ..... >1  
2< ... 2D .. 3R .. 4D .. 2L .. <1>
```

<1> is an instance of the first program. In this example it is a part of the second program, which is open. Press E and that instance of the first program will be edited out of the second program.

```
1< ... 5D .. 4M .. 3D .. 2M ..... >1  
2< ... 2D .. 3R .. 4D .. 2L
```

But the contents of the first program are still intact; they have not been edited. Editing proceeds in a stepwise fashion, just as drawing a picture does. By pressing CTRL E you can quickly erase all the commands back to the beginning program bracket. This is shown in the example below in which the second program is empty.

```
1< ... 5D .. 4M .. 3D .. 2M ..... >1  
2< ...
```

An open program is empty when it does not contain any commands. You cannot number and close an empty program.

In order to edit the contents of a closed program you must first open the program by erasing the end bracket. CTRL O erases program brackets and opens a selected drawing program. It is the only command that will do so. After pressing CTRL O you will be switched to the text display if you are viewing graphics, and a message on the screen will prompt you to supply an input. Press the number of the program you want to edit. You can only execute CTRL O when the open program is empty (as in the example above). If the open program contains any commands, these commands must be erased, or you must number and close the program. If the open program is not empty and CTRL O is pressed, nothing happens.

Using the previous example, if you press CTRL O, then press 1, the text display will show that the end bracket for the first program has been eliminated.

```
1< ... 5D .. 4M .. 3D .. 2M ..
```

The first program is now open for editing, and additions or deletions can be made. Any changes now would affect the contents of the program. And if you have used your first program as a part of any other drawing program, the changes you make in it will affect these other drawing programs as well.

You can erase commands and edit your programs while viewing either the text display or the graphics display (see Display Commands). Use whichever is most convenient for you. Although all commands can be edited out of the command list on the text display, there are some special situations in which the result of editing may not be visible or accurate on the graphics display. These are discussed in the Drawing Commands, Display Commands, and Color Commands sections of this Guide.

Drawing programs give you a great deal of flexibility to draw with the DELTA cursor. With a simple drawing program you can create very elegant designs by repeating the program over and over again (see Repeat Commands). You can construct complex pictures from a set of component pictures; create and play simple games; write numbers, letters, and words; or make charts and diagrams.

DELTA DRAWING allows you to exercise your analytical and problem-solving abilities when creating pictures, and it tests your ingenuity in visual thinking. With DELTA DRAWING you can draw pictures that write programs, or write programs that draw pictures. And you can switch back and forth between graphics and text to see the relationship between your pictures and programs. This is a first, and important, step in learning the fundamentals of computer programming.

PROGRAM COMMANDS

COMMAND	KEY	TEXT DISPLAY	COMMAND FUNCTION
First Program	1	1⟨...⟩1 ⟨1⟩	To number and store the 1st program To call the 1st program
Second Program	2	2⟨...⟩2 ⟨2⟩	To number and store the 2nd program To call the 2nd program
Third Program	3	3⟨...⟩3 ⟨3⟩	To number and store the 3rd program To call the 3rd program
Fourth Program	4	4⟨...⟩4 ⟨4⟩	To number and store the 4th program To call the 4th program
Fifth Program	5	5⟨...⟩5 ⟨5⟩	To number and store the 5th program To call the 5th program
Sixth Program	6	6⟨...⟩6 ⟨6⟩	To number and store the 6th program To call the 6th program
Seventh Program	7	7⟨...⟩7 ⟨7⟩	To number and store the 7th program To call the 7th program
Eighth Program	8	8⟨...⟩8 ⟨8⟩	To number and store the 8th program To call the 8th program
Ninth Program	9	9⟨...⟩9 ⟨9⟩	To number and store the 9th program To call the 9th program

DISPLAY COMMANDS

DISPLAY

GRAPHICS TEXT

G

T

WRAP BOUNCE

W

B

VOICE

V

HIDE CENTER

H

X

REVERSE COLOR

CTRL

C

There are eight Display Commands in DELTA DRAWING. These commands are used to select the graphics or text display for viewing, to select wrap or bounce mode for drawing, to turn the DELTA cursor's voice on or off, to turn the center screen marker on or off, to hide or show the DELTA cursor, or to reverse the colors in a picture. None of the Display Commands are included in a drawing program; therefore, they are not recorded in text.

Graphics (G) and Text (T)

DELTA DRAWING has two different modes of display—graphics and text. Most of the commands you use to create your drawing programs are simultaneously recorded on both the graphics and text displays.* When you are in the graphics mode your current drawing is displayed on the screen. When you are in the text mode the screen displays the lists of commands that describe your drawing programs. You can execute commands in either text or graphic mode.

To see the text display, press T; to see the graphics display, press G. You can switch back and forth between text and graphics at any time by using G and T. Pressing either of these keys does not change your picture or the list of commands that describe your drawing program.

DELTA DRAWING starts on the graphics screen with the DELTA cursor in the start state. As you begin to draw you may want to see the list of commands used so far. Press T. The computer changes to the text display to show a sequential listing of the commands used to make your drawing, as well as the lists of commands that describe any previously numbered drawing programs. To return to your drawing, press G; the computer shows the graphics display. If your last command numbered and closed a drawing program, the DELTA cursor will return to its start state, ready to begin another program.

*In some cases the text and graphics displays do not correspond. In all cases, however, the text display accurately represents all of the commands included in a drawing program.

Text Display. The notation scheme used in the text display is fairly simple. A number (1, 2, 3...9) followed by the < symbol represents the beginning bracket of a drawing program. The > symbol followed by a number (1, 2, 3...9) represents the end bracket of a drawing program. When you start DELTA DRAWING the text displays the beginning bracket of the first program.

A drawing program is considered open when a sequence of commands has a beginning bracket but no end bracket. A drawing program is closed when it has both a beginning and an end bracket. Examples of both kinds of program are shown below.

```

                closed program
1< ... 3D .. 3R .. 3D .. 3R ..
  ... 3D .. 3R .. 3D ..... >1
    open program
2< ... 2M .. 3D ..

```

The text display abbreviates the names of the commands. The listing for the first program is read as follows: three Draw, three Right Turn, three Draw, three Right Turn, three Draw, three Right Turn, three Draw. This program draws a square with a side three steps long.



If you now called the first program as the sixth command in your second program, this program call would be represented in text by <1>. The text display would show the following:

```

1< ... 3D .. 3R .. 3D .. 3R
  ... 3D .. 3R .. 3D ..... >1
2< ... 2M .. 3D .. <1>

```

Commands are listed in the sequence in which they are executed, in horizontal lines across the screen. These command lines are read from left to right and down the screen, in the same way you read printed text in a book. Up to five elements are displayed on each command line. A command element can consist of one command, multiple keystrokes of the same command, or a program bracket. A command element, such as a Program Command, may describe literally hundreds of other commands.

The first command listed to the right of a beginning bracket is the first command used in a drawing. When you press the same command key two or more times in succession the number of successive keystrokes is listed immediately to the left of the command abbreviation. In the example of the first drawing program above, 3D represents the first three Draw commands: D was pressed three times. 3R represents the next three commands: R was pressed three times. In DELTA DRAWING you cannot execute three Draw commands by pressing 3 then D. You must press D three times.

A Random command is indicated by ?. The next Drawing Command (except U-Turn) listed will be randomized. For example, 1< ... 3M .. 2R .. ? .. U .. D >1 The Draw command is randomized in this instance. (Random does not operate on the U-Turn command.)

A change in drawing color is indicated by C:—, where the number of the drawing color selected—the input—is shown in place of the blank.

The Add Background command, SHIFT + , is recorded on the text display as + .

The Fill Shape command, CTRL F, which fills a shape with the previously selected drawing color, is abbreviated on the text display as ^F.

All CTRL commands are indicated on the text screen with ^. Thus, ^D is the abbreviation for CTRL D, or Half-Draw. ^M is CTRL M or Half-Move, etc.

The text display will continue to list lines of commands until the screen is full. Then the next command line will be

listed at the bottom of the screen while the first line scrolls off the top of the screen. In this way the text screen can record many command lines. If you press T while viewing the text display the text history will be re-written starting with the first line of the first drawing program.

If you are writing a program in the text mode and you execute a command (such as a Program or Fill Shape command) which requires some time to be completed on the graphics display, the word "WORKING" will be shown at the bottom of the text display. This indicates that the computer is working to complete the execution of your command on the graphics display. When the command has been executed it will be recorded on the text display, the message will disappear, and you can proceed with the execution of your next command.

The DELTA DRAWING program can record up to 858 command elements, or 171 complete command lines, on the text display. The command elements may be used in one program, or they may be used throughout the nine drawing programs and the tenth open program.

When you have recorded 858 command elements, you will receive the following message on the text display:

**** NOT RECORDING ****

The DELTA DRAWING program will not operate properly beyond this point. If you want to save the current drawing on the graphics display, you can use the DISK SYSTEM command, CTRL S, to save the picture on a file disk. Use CTRL Z to erase all of the programs on the text display. Then use CTRL S to load the picture into the computer again. You now have another 858 command elements available to continue drawing the picture.

To prevent your losing a picture that you have drawn, the program warns you that you are running out of memory. When you have recorded 833 command elements on the text display you will hear a **tone** every time you execute another Drawing, Program, or Color Command. The tone is a warning that

you only have a few more command elements before you will receive the "NOT RECORDING" message. To save the text or picture, use the Disk System or Printing routines when you hear the tone.

The text display only lists commands that are included in drawing programs. It does not list Editing, Display, Repeat, System, or Printing commands. However, if you use any of the Editing Commands while looking at the text screen you can immediately see the result—the commands you erase disappear from the screen.

For example, if the command list for your open drawing program looks like this:

```
1< ... D .. 3R .. D .. 3R ..... >1  
2< ... 3R ..
```

and you press E, the text will erase the last Right Turn command and display the following command lists:

```
1< ... D .. 3R .. D .. 3R ..... >1  
2< ... 2R ..
```

If you now use the Erase Picture command (CTRL E) all of the commands in the open drawing program will be erased and the text display will show:

```
1< ... D .. 3R .. D .. 3R ..... >1  
2< ...
```

To edit your first program, press CTRL O, then 1 to indicate the number of the program to be opened. After pressing CTRL O the text screen is displayed if you are not already in the text mode.

When you execute this command the text display will show:

```
1< ... D .. 3R .. D .. 3R ..
```

The end bracket of the first program has been erased and it is now open. You can erase commands, add other commands, or change the program as you like.

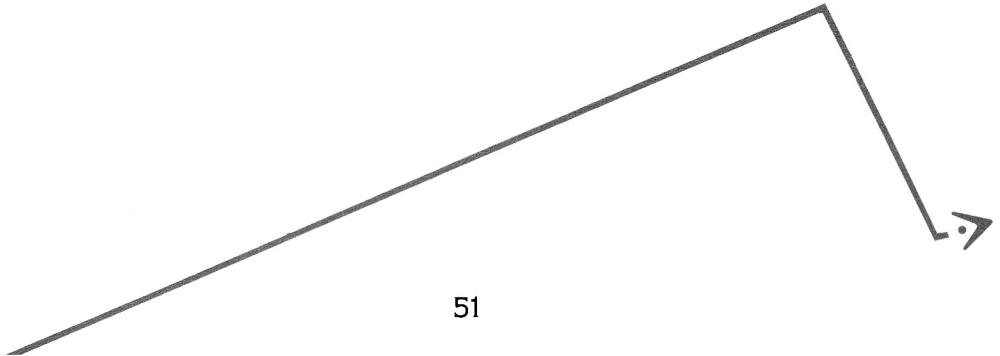
The Zap command clears both the graphics and the text displays and returns you to the start of DELTA DRAWING.

Wrap (W) and Bounce (B)

There are two screen boundary modes in DELTA DRAWING: wrap and bounce. You can select either mode at any time by executing the Wrap W or Bounce B commands.

The DELTA DRAWING program starts in the wrap mode. This is indicated on a color monitor by the blue boundary that surrounds the graphics display. In the wrap mode, if the DELTA cursor crosses the blue boundary line it will wrap around and reappear on the opposite side of the screen on the same heading. For example, if the DELTA cursor is heading southeast and crosses the boundary in the lower left-hand corner of the screen, it will reappear heading southeast in the upper right-hand corner of the screen.

By pressing B you can switch from wrap mode to bounce mode. The bounce mode is indicated by a violet boundary surrounding the graphics display. Instead of wrapping as it crosses the boundary, in bounce mode the DELTA cursor rebounds at an angle equal to the angle at which it struck the boundary. Like a billiard ball bouncing off the rail, the DELTA cursor carooms back into the drawing area of the screen.



The DELTA DRAWING program does not record or remember which boundary mode is in use. This enables you to create a program and try it in both modes. The difference is quite apparent, provided that the DELTA cursor touches the boundary. Although changing the mode in the middle of a program will have a noticeable effect on the screen at that time, because the boundary mode is not recorded on the text display you will be unable to duplicate the effect if the program is repeated. Changing modes in the middle of a program may make it impossible to erase properly. Strategically, it is best to change boundary modes before using any of the Drawing Commands in a program.

Editing Wrap and Bounce. The Erase command is useful if you give the DELTA cursor a Draw or Move command that sends it across the boundary line around the edge of the screen. When the DELTA cursor wraps and re-appears on the opposite side of the screen, press E. The DELTA cursor will return to the position and heading it had before it went out of bounds.

The Erase command works in a similar way in the bounce mode; press E and the DELTA cursor will return to its previous position. However, in bounce mode, editing is not always precise. When you press E the DELTA cursor may be returned to a slightly different position from the one it had before hitting the boundary line. This may happen if the DELTA cursor takes an extra step at the boundary line to compensate for round-off errors in calculating its previous position on the screen.

Voice (V)

The DELTA cursor has a voice, an audible tone, which you can turn on or off at any time by pressing V. When you start DELTA DRAWING the voice is on. You will hear its "beep" whenever you press a command key. The tone tells you that the computer has executed the command and it is ready to receive the next command. To turn off the voice, press V. To turn the voice on again, press V.

Center (X)

The Center command turns a center screen marker on or off. The center screen marker is useful for judging spacing or alignment when drawing. It is especially useful when creating symmetrical drawings. It is turned on or off by pressing X. When you start DELTA DRAWING the center screen marker is off.

Hide (H)

The Hide command enables you to hide or show the DELTA cursor on the graphics display. When you start DELTA DRAWING the DELTA cursor is shown on the screen.

When creating and playing games or displaying finished pictures you may want to hide the DELTA cursor so that it does not appear on the screen. Press H—the chevron disappears but the blinking dot remains visible. Whenever you want to show the DELTA cursor again, press H.

Reverse Color (CTRL) (C)

The Reverse Color command enables you to reverse the colors in your picture

to their opposite colors in Apple's HI-RES color graphics. The basic color pairs are: violet-green, orange-blue, and black-white. For example, suppose you have drawn a picture with white lines on a black background. It includes one shape filled with violet color and one shape filled with orange. When you execute the Reverse Color command by pressing CTRL C, the colors in the drawing will switch to black lines on a white background. The first shape will be filled with green and the second will be filled with blue. You can return the picture to its original colors by pressing CTRL C again. The Reverse Color command is not recorded in text and does not become part of your drawing program.

If you are using a black and white monitor, and you answered "no" to the color monitor configuration question at the beginning of the DELTA DRAWING program, you can use the Reverse Color command to change a white on black drawing to black on white, and vice versa.

DISPLAY COMMANDS

COMMAND	KEY	TEXT DISPLAY	COMMAND FUNCTION
Graphics	G	NONE	To view the graphics screen
Text	T	NONE	To view the text screen
Voice	V	NONE	To turn the DELTA cursor's voice on/off
Wrap	W	NONE	To select the wrap mode of returning the Delta cursor to an in-bounds position after it has touched the screen boundary line
Bounce	B	NONE	To select the bounce mode of returning the DELTA cursor to an in-bounds position after it has touched the screen boundary line
Center	X	NONE	To turn on/off the center screen marker
Hide	H	NONE	To hide or show the DELTA cursor on the graphics display
Reverse Color	CTRL C	NONE	To reverse the colors in a picture to their opposite colors in Apple's HI-RES color graphics



COLOR COMMANDS

COLOR

SELECT COLOR



FILL SHAPE



ADD BACKGROUND



If your computer system has a color monitor you can create drawings in color. Using color adds a lot to your drawings. With DELTA DRAWING you can produce colorful drawing programs that take advantage of the Apple's HI-RES color graphics. DELTA DRAWING's Color Commands let you draw in color, fill shapes with color, and add a background color to a picture. The programs you create can vary from the charmingly simple to the incredibly complex.

When you configure your computer system at the beginning of the DELTA DRAWING program you are asked whether you are using a color monitor. If you answer "yes," all of the Color Commands will be available to you; if you answer "no," your drawings will appear in black and white, and only the Fill Shape command will operate.

Select Color (C)

When you are drawing a picture, Select Color is the command you use to change the color of the line, the color of a shape, or the color of the background.

Pressing C presents a menu from which you can select a new drawing color at any time, provided that you answered "yes" to the color monitor question. Select Color requires an input—the number of your color selection. Nothing will happen until you press the appropriate number. You can press ESC to escape from the color menu's input routine.

In color mode you can select from among six different colors, each identified by a number.

0 black	3 green
1 white	4 blue
2 orange	5 violet

These six colors are used with D to draw a colored line, with CTRL F to fill a shape with color, or with SHIFT + to add background color to a picture.

Although 0 black does not appear on the menu as a possible choice, it is always available for use with the Draw command. However, 0 black is not an available color with the Add Background and Fill Shape commands. And, if you answered "yes" to the color monitor configuration question, 1 white will not



operate with the Fill Shape command.

The Apple's HI-RES graphics pairs the colors; some colors work well with others, some don't. The color pairs that work well together are shown below.

violet: :green

orange: :blue

black: :white

Either member of a pair will work well with the other, and black or white will work with any color.* For example, a violet line can be drawn on a green background, or vice versa. But an orange line on a green background produces a strange result. Sometimes, colors placed immediately next to one another on the screen cause strange color shifts. Again, this is due to the Apple's HI-RES graphics.

Sometimes a color is indicated on the color menu as a stripe, for example, 2 orange stripe. The line width is significantly increased in this case, and if you press 2 you'll get an orange stripe. A multi-color is occasionally indicated on the color menu. A multi-color is just that—a combination of several colors. It produces a somewhat "tweedy" line. If you draw a picture with a lot of different colors in it, and use the Reverse Color command (see Display Commands), you are likely to get some interesting results.

*However, a black line is invisible on a black background, and a white line is invisible on a white background.

The screen on your monitor is composed of a matrix of tiny dots, or picture elements, which are turned "on" or turned "off" by the computer. The color dots are "on" dots, black dots are "off" dots. Add Background and Fill Shape work by turning "off" dots "on" with the current drawing color. Thus, it is impossible to fill over another color because the dots are already "on." To try another color in an already filled area see Editing Color Commands in this section of the Guide.

Fill Shape (CTRL) (F)

CTRL F is used to fill a shape with color.* To do so, the DELTA cursor's blinking dot must be placed well inside the shape to be filled. If the DELTA cursor's blinking dot is touching a line it has just drawn or the boundary line of the shape, CTRL F will not operate. Therefore, you must place the DELTA cursor's blinking dot inside a shape to be filled with Move (or Half Move) commands.

*It can also be used to fill the screen with color.

Press C to select a new drawing color,** then press CTRL F to fill the shape with that color. CTRL F works only on a black background. It turns the black ("off") dots on with the color selected. CTRL F will halt when it hits the boundary of the shape since that boundary is comprised of "on" dots. A shape boundary may be any color or combination of colors, provided that it is continuous and uninterrupted.*** If the shape to be filled is not completely enclosed, the color will leak through the holes in the boundary and continue to fill other black areas of the screen until it hits a boundary.

Editing a drawing program may leave holes in the shape boundary lines. Consequently, the program should be closed and repeated before using CTRL F. This will prevent color leaks.

If you answered "no" to the color monitor question when you configured your computer system and are drawing with white on a black background, you can use CTRL F to fill a shape with white.

**Fill Shape only operates in the color mode with color numbers 2, 3, 4 and 5.

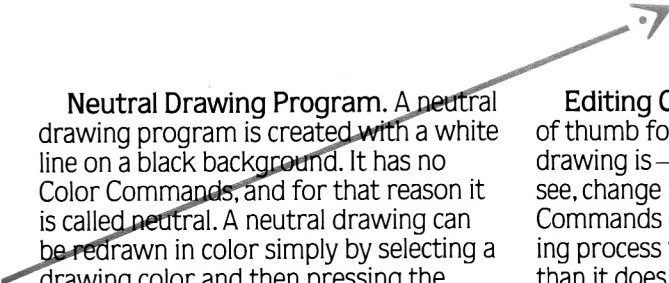
***A shape defined by an orange or green line may leak color if the screen boundary line is one of the boundaries of the shape.

Add Background (SHIFT) (+)

To add a background color to a picture you first select a drawing color (press C and the number of the drawing color) and then press SHIFT + . Beginning at the top of the screen, all black areas are filled with the selected drawing color. If you do not select a color before pressing SHIFT + , the black areas of the screen will be filled with the current drawing color when you execute the command. Add Background only operates on the black areas of the screen; i.e., it is not possible to add color over another color. It works by turning all the "off" dots (black dots) on with color. Using Add Background, because it fills all the black areas of the screen, prohibits the further use of CTRL F which is used to fill shapes.

As a matter of strategy, SHIFT + should be the last command used before closing a program. If a color change is made after using SHIFT + the color menu is limited – the color used to Add Background is not presented as an option. And, if you erase a line after using the Add Background command, the erasure is made in the background color.

Add Background will not operate if you answered "no" to the color monitor configuration question at the beginning of the DELTA DRAWING program.



Neutral Drawing Program. A neutral drawing program is created with a white line on a black background. It has no Color Commands, and for that reason it is called neutral. A neutral drawing can be redrawn in color simply by selecting a drawing color and then pressing the program number of that drawing.

Colored and neutral drawing programs are different. Colored drawing programs contain Color Commands. When color changes have been made in a current drawing and a colored drawing program is called, the color results may be surprising.

To prevent the DELTA cursor from drawing in the last color selected in a colored drawing program, it is a good strategy to end a colored drawing program by resetting the color to white.

If you intend to experiment by executing your drawing programs in several different colors, it is usually best to write a neutral drawing program and then make the color changes when that program is called.

Editing Color Commands. The rule of thumb for constructing any DELTA drawing is – if you don't like what you see, change it. DELTA DRAWING's Color Commands can be changed, but the editing process works somewhat differently than it does with other commands.

If the last command executed was a Color Command and you want to erase it, press E . By pressing E you erase the Color Command from the text display, and thus eliminate it from your open program. Color Commands can be edited while viewing either the text or graphics display.

If you have used the Select Color command to change the color of the line the DELTA cursor draws, you can press E to erase the Draw commands that produce the colored line. In this case, the line and its color will be erased from the graphics display. To continue drawing with a new color, you erase the Select Color command, then press C again to select the new color. The result of editing a Select Color command is that the DELTA cursor will draw in the previous color, if a color was selected. If no previous color was selected then lines drawn on the screen will once again be in white.

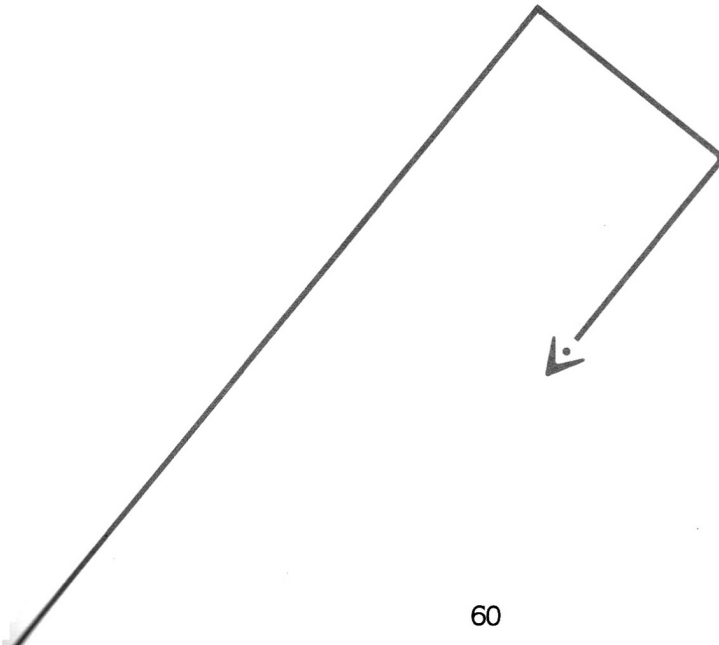
The Fill Shape and Add Background commands can be erased from the text display and eliminated from a program. But the colored areas produced in the graphics display by these commands cannot be erased by pressing E. Fill Shape and Add Background turn on color picture elements in the graphics display; these elements cannot be turned off without erasing the entire picture on the screen. Therefore, when you press E to erase these commands, the text and graphics displays will not correspond. The Color Command will be erased from the text display, but the color in the picture will remain on the graphics display.

To erase a Fill Shape or Add Background command and remove the color from the graphics display (without using CTRL E to erase the current drawing on the screen) you can use the same procedure that is used when editing Random. Press E to erase the CTRL F or SHIFT + command. If you preceded the command with a Select Color command, you can erase it by pressing E again. Then, close the program by numbering it. Now you can use the Open Program command to open the program, press G to reproduce your drawing in graphics, and fill the shape or add a background with a new color.

COLOR COMMANDS

COMMAND	KEY(S)	TEXT DISPLAY	COMMAND FUNCTION
Select Color	C---	C:---	To select a color for drawing, filling, or adding a background. Requires a color number as an input.
Fill Shape*	CTRL F	^F	To fill an enclosed shape with the last color selected
Add Background	SHIFT +	+	To add the last color selected to all of the black areas of the screen

*Fill Shape works in a black and white mode only if you are drawing with a white line on a black background.



REPEAT COMMANDS

REPEAT

REPEAT

REPT

AUTOMATIC

A

SELECTED AUTOMATIC

CTRL

A

There are three Repeat Commands in DELTA DRAWING. With these three commands you can rapidly repeat a drawing, a program, or an erase command, or you can repeat a Program Command continuously.

Repeat (REPT) and the Command To Be Repeated

The Repeat command enables you to move, turn, or draw quickly with the DELTA cursor. This is done by pressing REPT first and holding it down while you press a Drawing Command key. By holding both keys down you repeat the Drawing Command. When you take your finger off either key the command will stop executing.

The Repeat command operates with all the Drawing Commands, but it is only useful with some of them. If you want to draw a long straight line use REPT D. To

move the DELTA cursor quickly across the screen use REPT M. Using the Repeat command in combination with the turn commands (R or L) takes a little practice, but it can be helpful at times.

The Repeat command can be used with E to erase a long sequence of commands without erasing an entire drawing. It works with the Erase command in the same way that it works with Drawing Commands—press REPT E, then release either key to stop erasing.

The Repeat command can also be used with Program Commands. To call a drawing program and re-draw its picture many times, press REPT and the number key that calls the program. When you release either key the DELTA cursor will stop drawing after all of the commands in the program have been executed.

Automatic (A)

The Automatic command will repeat the most recently closed drawing program continuously until you stop the repetition by pressing ESC. To use this command, press A. For example, if you are currently working on the third drawing program, the second drawing program is the most recently closed program. Press A and the second program will repeat over and over until you stop it by pressing ESC.* If you are in the text mode and press A, you are automatically switched to the graphics display.

*Pressing REPT 2 (to repeat the second drawing program) would have the same effect; however, you have to hold down both keys to continue repeating and the repetition is stopped by removing your finger from either key.



Selected Automatic (CTRL) (A)

The Selected Automatic command enables you to select a previously completed drawing program to be repeated continuously. You select the program to be repeated by pressing the number of that program after pressing CTRL A. That is, CTRL A requires an input—a program number—and the computer will wait to receive that input.

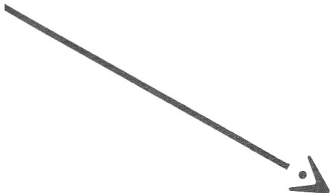
When CTRL A is pressed, the text screen is displayed and the closed programs from which you can choose are listed. You are prompted to supply the input. After the number of the program to be repeated is pressed, the graphics screen is displayed so you can watch the drawing program repeat.

A program that is being repeated using A or CTRL A can be stopped at any time by pressing ESC. The DELTA cursor will finish all commands in the drawing program and then halt. If, after pressing CTRL A, you decide not to repeat a program, pressing ESC enables you to escape from the CTRL A command input routine.

The automatic commands are useful for constructing complex figures, patterns, and designs with drawing programs that contain only a few commands. They demonstrate that interesting drawings can be made from simple elements.

REPEAT COMMANDS

COMMAND	KEY(S)	TEXT DISPLAY	COMMAND FUNCTION
Repeat	REPT and other command	Indicates the number of times a command is repeated	To repeat Drawing or Program Commands and the Erase command
Automatic	A	Indicates the number of times the program is repeated	To repeat the most recently closed drawing program continuously until stopping it by pressing ESC
Selected Automatic	CTRL A – –	Indicates the number of times the program is repeated	To select any closed drawing program and repeat it continuously until stopping it by pressing ESC. Requires a program number as input.



SYSTEM COMMANDS

SYSTEM

ESCAPE

ESC

DISK SYSTEM

CTRL

S

RESET

RESET

There are three System Commands which are used to stop or exit various routines, to save pictures and the text history on a disk, or to load pictures or text from a disk.

Disk System (CTRL) (S)

The Disk System command includes routines for saving and loading picture or text files. With DELTA DRAWING, either the picture or the text history can be saved on a disk for viewing or later revision. Alternatively, pictures or text can be loaded into your computer from a disk.* To use the Disk System command your disk controller card must be in slot #6.

You begin the Disk System routines by pressing CTRL S. From this point on, instructions appear on the monitor. **If at any time you wish to leave the Disk System routines, press (ESC).** After pressing ESC you are returned to the graphics display.

When you press CTRL S the bottom of the screen clears and several questions are presented. By answering the questions you are led step-by-step through the disk system routines. First, you'll be asked whether you wish to Save a file or Load a file. Press S to Save or L to Load. Depending on your answer to that question, you'll be asked whether you wish to save or load the Text display or the Graphics display. Press T for Text or G for Graphics. After answering these questions a message appears prompting you to insert a file disk into the disk drive.** After doing so, press RETURN.

The file disk you use must:

- be initialized by APPLE DOS 3.3
- have at least 16 sectors free in order to save a text file
- have at least 34 sectors free in order to save a graphics file

*You can use DELTA DRAWING to draw over or color pictures produced by all Apple computer programs which use the 34-sector binary file for picture storage.

**If you have more than one disk drive unit, use only disk drive #1.

Any combination of graphics or text files can be saved on a file disk. And you can name a file with any name permitted by Apple DOS 3.3 (see your Apple DOS Manual).

NOTE: Before inserting a file disk you must remove any disks still in the disk drive. It is a good practice to remove the DELTA DRAWING program disk immediately after loading and put it in a safe place.

Saving Text Files. Saving text files proceeds as described below.

Press (CTRL) (S) to begin Disk System routines

Press (S) to Save a file

Press (T) to Save a Text file

Insert file disk—disk must be initialized by APPLE DOS 3.3 and have at least 16 free sectors

Press (RETURN)—the names of all the text files stored on the disk are displayed and a message indicates how many more text files can be saved. If no more text files can be saved, press ESC, insert a new file disk, and start over again.

Type the name of your text file—names can be no more than 27 characters in length (including spaces). A name must begin with a letter and it cannot have any commas. To correct a typing error, press the Left Arrow key and retype your text file name.

Press (RETURN)—message indicates that your text file is being saved. Any open programs are automatically closed for you before the file is saved. When the computer finishes filing, the graphics display is shown and you can continue with DELTA DRAWING.

Saving Graphics Files. Saving graphics files proceeds as described below.

Press (CTRL) (S) to begin Disk System routines

Press (S) to Save a file

Press (G) to Save a Graphics file

Insert file disk—disk must be initialized by APPLE DOS 3.3 and have at least 34 free sectors

Press **(RETURN)**—the names of all of the graphics files stored on the disk are displayed and a message indicates how many more graphics files can be saved. If no more graphics files can be saved, press **ESC**, insert a new file disk, and start over again.

Type the name of your graphics file—names can be no more than **30** characters in length (including spaces). A name must begin with a letter and it cannot have any commas. To correct a typing error, press the Left Arrow key and retype your graphics file name.

Press **(RETURN)**—message indicates that your graphics file is being saved. When the computer finishes filing you are returned to your picture on the graphics display. You can continue with **DELTA DRAWING**.

Loading Text Files.* Loading text files proceeds as described below.

Press **(CTRL) (S)** to begin Disk System routines

Press **(L)** to Load a file

Press **(T)** to Load a Text file

Insert file disk must be initialized by **APPLE DOS 3.3**

Press **(RETURN)**—the names of the first 15 text files on the disk are listed. If there are no text files on the disk you will automatically exit from the Disk System routine and be returned to the graphics display. If the text file that you want to load is included in the first 15 text files, you are prompted to press **RETURN** to select a file. If the text file you want to load is not included in the first 15 text files, you are prompted to press spacebar to continue to the next 15 text files. Follow the prompts at the bottom of the screen until you identify the text file that you want to load.

*When you load a text file from a disk it **replaces** the current text history.

To select a file from among the group of files displayed:

Press the Right Arrow key to move the selection bar down to the file you wish to load

or

Press the Left Arrow key to move the selection bar up to the file you wish to load

Press(RETURN) when the selection bar is properly positioned over the text file you wish to load. When you press RETURN, a message indicates that your text file is being loaded. When loading is completed you are returned to the graphics display. Press T to view the text file you have loaded. The DELTA DRAWING text file that you have loaded can be revised (use CTRL O to open a program for editing).

Loading Graphic Files. Loading graphics files proceeds as described below.

Press (CTRL)(S) to begin Disk System routines

Press(L) to Load a file

Press(G) to Load a Graphics file

Insert file disk must be initialized by APPLE DOS 3.3

Press(RETURN)—the names of the graphic files on the disk are listed. If there are no graphic files on the disk you will automatically exit from the Disk System routine and be returned to the graphics display.

To select a file from among the group of files displayed:

Press the Right Arrow key to move the selection bar down to the graphics file you wish to load

or

Press the Left Arrow key to move the selection bar up to the graphics file you wish to load

Press(RETURN) when the selection bar is properly positioned over the graphics file you wish to load. When you press RETURN a message indicates your graphics file is being loaded. When loading is completed, the picture contained in the graphics file is shown on the graphics display.

Error Messages. The DELTA DRAWING program contains only one standard error message as follows:

PROGRAM STOPPED
CHECK DISK OR PRINTER
TO CONTINUE, PRESS SPACE BAR

The error message is restricted to errors involving either your Disk System or your printer. When you see the error message on the screen, review the correct procedures for using the Disk System or printer. When you believe you have corrected the problem, press the spacebar. You will be returned to the graphics display if the problem is corrected. You must begin the Disk System routines over again by pressing CTRL S after you have pressed the spacebar.

Common reasons for receiving an error message in the Disk System routines are listed below.

Your disk controller card is not in slot #6

DELTA DRAWING program disk in disk drive.

No file disk in disk drive.

Disk drive door is open.

File disk not initialized by APPLE DOS 3.3.

Not enough space remaining on file disk to save a file.

Attempting to save a file on a write-protected disk.

Attempting to save a file while using the name of a locked file.

Used Drive #2 instead of Drive #1

Escape (ESC)

ESC is an exit/stop command. Using ESC you can do the following:

- Stop the execution of the Automatic A or Selected Automatic CTRL A commands
- Exit from the Selected Automatic CTRL A input routine
- Exit from a Select Color C input routine
- Exit from an open program CTRL O input routine
- Exit from the Disk System routines.

Reset (RESET) (for use only with Apple computers that have Auto-Start ROMS)

The Reset command enables you to stop the execution of any command and return to the beginning of the program at any time. After pressing RESET you are shown the DELTA DRAWING title and publication data indicating the beginning of the DELTA DRAWING program. The Reset command can be used to recover from a bug* or it can be used when anything appears to go wrong with the operation of the program. Pressing RESET will erase both the text and graphics displays. If you have modified your keyboard, use CTRL RESET rather than RESET alone.

*The authors of the DELTA DRAWING program have made every effort to discover and fix all bugs. We know of none. If you discover one, please contact Spinnaker Software immediately.

SYSTEM COMMANDS

COMMAND	KEY(S)	TEXT DISPLAY	COMMAND FUNCTION
Disk System	CRTL S	NONE: Screen display first step in saving and loading routines	To save a picture or text history file on a disk and to load a picture or text file from a disk.
Escape	ESC	NONE	To stop the execution of the following commands: A, CTRL A; and to exit from the routines included in the following commands: C, CTRL O, CTRL A, CTRL S.
Reset*	RESET **	NONE: Screen displays the DELTA DRAWING program title and publication data.	To stop the execution of any command, erase both the text and graphics displays and return the user to the title at the beginning of the DELTA DRAWING program.

*Only for use with Apple computers with Auto-Start ROMS.

**A modified keyboard may require using CTRL RESET.

PRINTING COMMANDS

PRINTING

PRINT LARGE PICTURE PRINT



After you have loaded the DELTA DRAWING program the publication data are displayed. After you press the spacebar to continue, several configuration questions are presented. You are asked whether you are using a printer, and if so, whether you are using a CENTRONICS-parallel type printer card, THE GRAPPLER™ printer interface card, or another type of printer card. If you have THE GRAPPLER™ or a CENTRONICS-parallel type printer card, your printer card must be in slot #1. If you respond that you do not have a printer, or that you have another type of printer card, then the Printing Command keys are disabled.

Print (P)

If you have no printer, then the Printing Command keys are disabled. If you have a printer and are using a CENTRONICS-parallel type printer card, then only the text history (the command lists recorded on the text display) can be printed.

With THE GRAPPLER™ printer interface card both the text history

and a picture can be printed. With THE GRAPPLER™ printer interface card, what you see is what you print. That is, if the graphics display is on the screen you will print the picture when you press P;* if the text display is on the screen you will print the text history.

Before printing, make sure the printer is on-line. Check the paper supply, and put the paper at the top of the form. You can print at any time, and after printing you can continue to work in DELTA DRAWING. Press P to print.

Print Large Picture (CTRL)(P)

If you have THE GRAPPLER™ printer card you can print a large-size picture, press CTRL P.** CTRL P prints the graphics display, regardless of which display is currently on the screen.

Error Message: You may press P or CTRL P and receive the following error message:

PROGRAM STOPPED
CHECK DISK OR PRINTER
TO CONTINUE, PRESS SPACE BAR
Common reasons for receiving an error message in using your printer are

*You can print 3 pictures per page with the Print command. **You can print 1 picture per page with the Print Large Picture command.

PRINTING COMMANDS

COMMAND	KEY(S)	TEXT DISPLAY*	COMMAND FUNCTION
*Print	P	NONE	To print a picture when the screen display is in the graphics mode and to print the text history when the screen display is in the text mode.
*Print Large Picture	CTRL P	NONE	To print a large-size picture of the current graphics display, regardless of whether text or graphics is currently displayed on the screen.

*DELTA DRAWING Printing Commands will operate only if you have indicated by your answer to the system configuration question at the beginning of the program that you are using a printer and your system includes a CENTRONICS-type parallel printer card or THE GRAPPLER™ printer interface card. With THE GRAPPLER,™ what you see is what you print. Both P and CTRL P can be used with THE GRAPPLER.™ With a CENTRONICS-parallel printer card only P can be used, and only the text history can be printed.

Note: You may also print a DELTA DRAWING picture if you first store the picture on a file disk. You can then print from this disk if you have a graphics printer and an appropriate graphics printing software package. See your Apple dealer for assistance.

listed below:

Your printer and computer are not securely connected

Your printer is not on-line

Your printer is not turned on

Your printer is out of paper

Your printer card is not in slot #1

Improper Dip Switch settings

(see your printer manual)

When you believe you have corrected the problem press the spacebar. You will be returned to the graphics display. Press P or CTRL P to print.

THE GRAPPLER™ printer interface card contains its own error message. If you are using this card and your printer

is not set up properly, you may receive the following message when you press P or CTRL P:

PRINTER NOT READY

PRESS <CR> TO CONTINUE

Check your printer. When you have corrected the problem press RETURN to continue.

Depending on your printer/printer card combination, you may not get an error message but the system may still jam. After you believe you have corrected the problem, press RETURN. If this does not work, press RESET or CTRL RESET. If this fails you should turn everything off and load DELTA DRAWING again.

3

GLOSSARY OF DELTA DRAWING TERMS

Auxiliary Command Key

The CTRL, REPT, and SHIFT keys are auxiliary command keys in DELTA DRAWING. Some DELTA DRAWING commands require that two keys be pressed. In these cases an auxiliary command key is pressed first and held down while another command key is pressed. CTRL E, REPT D, and SHIFT + are examples.

Background

The term "background" is used in a special sense in DELTA DRAWING. It refers to all black areas of the graphics display. The DELTA DRAWING program cannot discriminate between the foreground and background of a drawing. It simply treats all black areas of the screen as if they were "background." The Add Background command will add color to all of the black areas of the screen.

Boundary

This term is used in two different ways in DELTA DRAWING. The **screen boundary** always appears on the graphics display as a line drawn around the edge of the screen. When the DELTA cursor touches this boundary line it will either wrap or bounce, depending on which in-bounds procedure is in use. A **shape boundary** is the line that completely encloses an area of the screen. When an area inside a shape boundary is black it can be filled with color by using the Fill Shape command.

Bracket

On the text display you can see the beginning and end brackets that surround each closed program. The beginning bracket appears as ⟨, the end bracket appears as ⟩. The beginning bracket in each program is inserted automatically. You must insert the end bracket by pressing the appropriate number key to close the program. A program must begin and end with the same number.

Call

You "call" a drawing program by pressing the number key previously assigned to that program. When you call a program the picture it produces is re-drawn on the graphics display, and the Program Command is included as an entry on the text display. You can call closed drawing programs in any sequence and as often as you like.

Closed Program

A drawing program is closed when it has both a beginning bracket and an end bracket. You close an open program by numbering it. When you number a program an end bracket is inserted after the last command. Programs must be numbered and closed in sequence; for example, you cannot number a program 5 until the first four programs have been numbered.

Colored Drawing

A drawing program that contains Color Commands.

Command

An instruction in a programming language that directs the computer to perform a specific operation or set of operations.

Command Element

An entry in the text display that includes an abbreviation of a DELTA DRAWING command and the number of times the command was executed successively; also the program bracket recorded on the text display. The DELTA DRAWING program will record up to 858 command elements on the text display.

Command Key

One of the 36 keys on the Apple keyboard used to execute DELTA DRAWING commands. When a command key is pressed a command is immediately executed. When the DELTA cursor's voice is on and a command key is pressed, it will "beep" when it has completed the execution of a command. Some command keys are used in conjunction with an auxiliary command key. In these cases, both the auxiliary and the command key must be pressed to execute the command.

Command Line

A command line is comprised of command elements. At most, there are five command elements in a command line. The command line appears on the text display. The elements in it are read from left to right. The DELTA DRAWING program will record up to 171 command lines on the text display.

Command List

The list of commands in their sequence of occurrence in a drawing program. A drawing program is described by its command list.

Command Overload

The result of pressing too many command keys at the same time—the computer stops and must be restarted after command overload.

Configuration

An arrangement of computer system components. The DELTA DRAWING program is adapted to operate with the monitor and printer components of your computer system in accordance with your responses to the configuration questions asked when the program is loaded.

DELTA Cursor

A small pointer that appears on the graphics display when you start DELTA DRAWING. The DELTA cursor is your drawing instrument. It moves, turns and draws on the screen in response to the commands you give it. The DELTA cursor only appears on the graphics display. When the screen is in the text mode it does not appear.

Drawing Program

The sequence of commands used to produce a picture on the graphics display in DELTA DRAWING. A drawing program is described by a command list on the text display.

Edit

To change the contents of a drawing program. In DELTA DRAWING you can edit on either the text or graphics displays. When you are in graphics and erase and change a part of a picture you also change the contents of the open drawing program that is recorded on the text display.

Empty Program

An open drawing program that does not contain any commands. In DELTA DRAWING an empty program cannot be numbered and closed.

Error Message

A message on the screen informing you that a command cannot be executed. There is only one standard error message in DELTA DRAWING, and its use is limited to occasions when you are using the Disk System routines or your printer. Possible reasons for receiving the error message are listed in the System Commands and Printing Commands sections of this Guide.

File Disk

File disks are used either to save or load text or graphics files. A file disk must be initialized by APPLE DOS 3.3 and it must have at least 16 sectors free in order to save a text file or 34 sectors free to save a graphics file. The file disk should not be confused with the DELTA DRAWING program disk. The program disk must not be used as a file disk.

Graphics Display

DELTA DRAWING uses the screen in two ways – for text display and for graphics display. The graphics display shows the picture produced by the open drawing program.

Heading

The direction the DELTA cursor is pointing. The DELTA cursor is always pointing in some direction.

Input

A number that must be entered after a command if the command is to be executed. The CTRL A command requires an input – the number of the program you wish to repeat. When a command requires an input the computer will not accept other commands (except ESC or RESET) until it receives the input.

Menu

A list from which to choose. In DELTA DRAWING there are a few menus. The principal one is the color menu. By pressing C you see the list of colors from which you can choose; each is identified by a number.

Neutral Drawing

A drawing program that does not contain any Color Commands.

Number Key

In DELTA DRAWING the number keys on the computer keyboard are used in several ways. The first nine number keys are used as Program Command keys. You execute a Program Command by pressing a number key. The first time you execute a Program Command you "number" and close an open program. Subsequently, when you press the same number key you "call" that program. The Program number keys are also used as inputs for the CTRL O and CTRL A commands. The number keys are also used to select colors from the color menu.

Open Program

A program is "open" when it has a beginning bracket but does not have an end bracket. In DELTA DRAWING, the picture on the graphics display is produced by the open program and only one drawing program is open at any time. An open program cannot be called and re-drawn on the screen.

Picture Element

A picture element is the smallest unit of display on the monitor's screen. A picture element is one of the "dots" in the matrix of dots that make up the screen.

Position

The DELTA cursor's position is where it is located on the screen. The DELTA cursor is always located at some point on the screen.

Program Contents

The commands in the sequence in which they occur in a drawing program. Change a command, or the sequence of commands, and you change the contents of a drawing program.

Program Disk

The disk containing the DELTA DRAWING™ Computer Graphics program. It should not be confused with the file disk.

Program Instance

When you call a drawing program, the computer produces an "instance" of that program—it reproduces the drawing on the graphics display and records the Program Command as an entry on the text display. You can erase an instance of a drawing program without erasing its contents.

Prompt

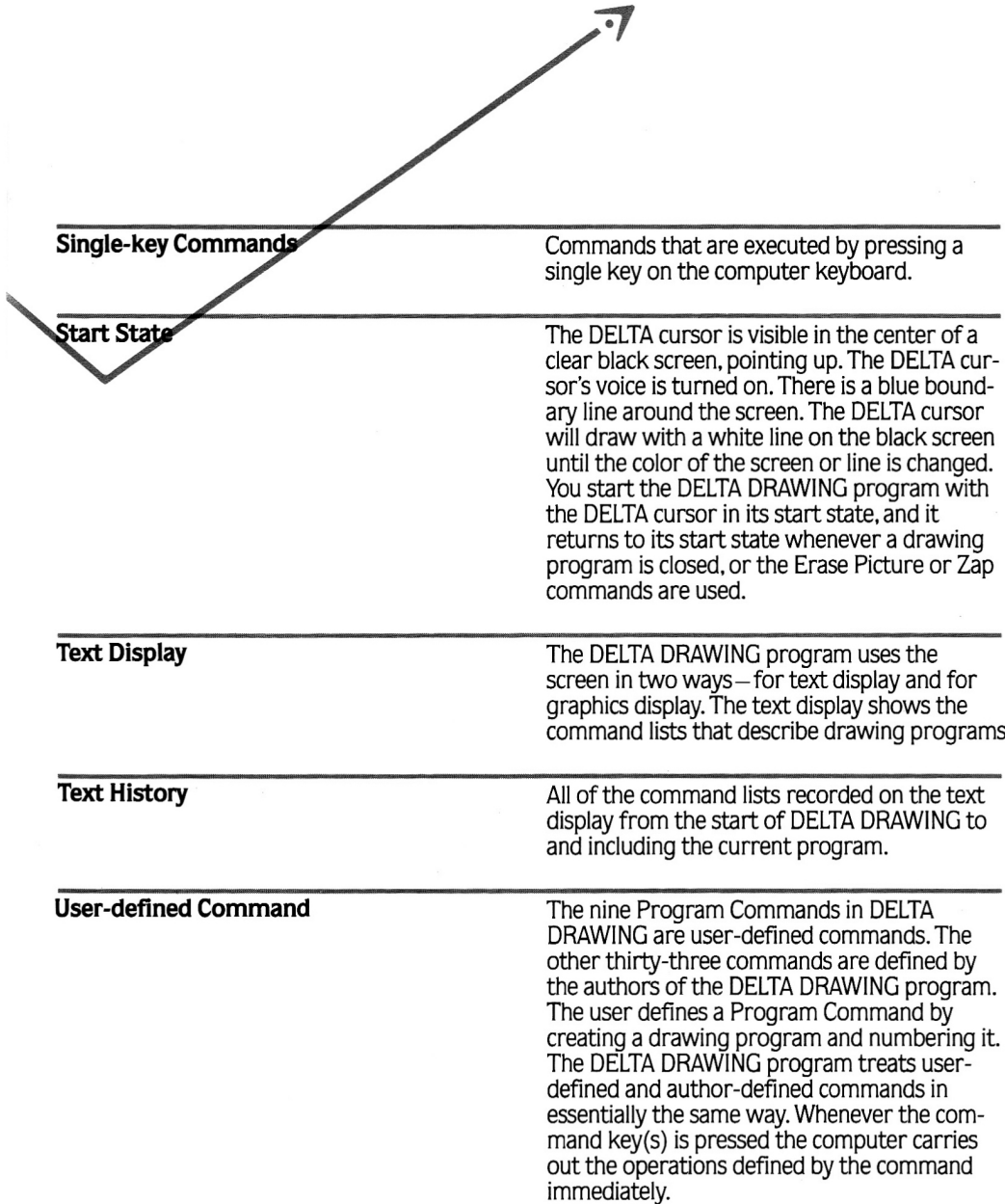
A message on the screen telling you to do something, such as "Press Spacebar to Continue."

Routine

A fixed set of procedures for supplying commands or inputs to the computer. For example, the Select Color command has an input routine requiring that you press a number key to complete the execution of the command.

Scroll

To roll off the screen. The command lines on the text display scroll up and off the top of the screen one by one as new lines are added. The DELTA DRAWING program will record up to 24 command lines before scrolling begins.



Computer-Access Corporation, creators of DELTA DRAWING™ Computer Graphics, specializes in developing software which makes the power of the computer accessible to people of all ages.

DELTA DRAWING, Originated by Jock Gill, was authored by the principals of Computer-Access Corporation.

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Programmer: Dennis W. Purcell

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Computer-Access welcomes comments from users.

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