CR™ 1212 GRAPHICS TABLET USER'S GUIDE

Chapter 1	**What is the CR 1212 and How Does It Work?**	**3**
	Section A: What is the CR 1212?	3
	Section B: How the CR 1212 Works	4
	Section C: Commands: Controlling the Tablet's Operation	6
	Section D: Alternative Configurations	6
Chapter 2	**Assembly and Installation**	**7**
Chapter 3	**Interfacing with the Host**	**10**
	Section A: Hardware Interfaces	10
	Section B: Baud Rate	11
	Section C: Communication Protocols	11
	Section D: Report Formats	12
Chapter 4	**Operating Characteristics and Functions**	**16**
	Section A: Controlling the Report Flow	16
	Point Mode	17
	Remote Request Mode	17
	Stream Mode	18
	Switch Stream Mode	18
	Report Rate	19
	Increment Mode	19
	Section B: Setting the Resolution	22
	Resolution, Predefined	23
	Resolution, Definable (Set X, Y Scale)	24
	Section C: Other Functions	27
	Bit Pad Configuration	27
	Origin	27
	Relative Coordinates (Delta Mode)	28
	Reset (to Default Operating Characteristics)	28
	Send Configuration	29

	Tablet Beep	30
	Transmission Control	31
	Section D: Reserved Commands	31
Chapter 5	**Guidelines for Writing a Device Driver**	**32**
Chapter 6	**Using the CR 1212**	**37**
Chapter 7	**Checking the Graphics Tablet**	**39**
	Section A: Tablet Calibration	39
	Section B: Power (and Proximity) Light	39
	Section C: A Quick Functional Check	39
	Section D: Diagnostic Functions	41
	Echo	41
	Self-Test	41
Chapter 8	**Operating Environment, Care and Service**	**43**
	Section A: Operating Environment	43
	Section B: Service	43
	Section C: Care and Cleaning	44
	Section D: Changing the Stylus Refill	45
Appendix A	**Specifications**	**46**
Appendix B	**ASCII Conversion Chart**	**47**

Chapter 1: What is the CR 1212 and How Does It Work?

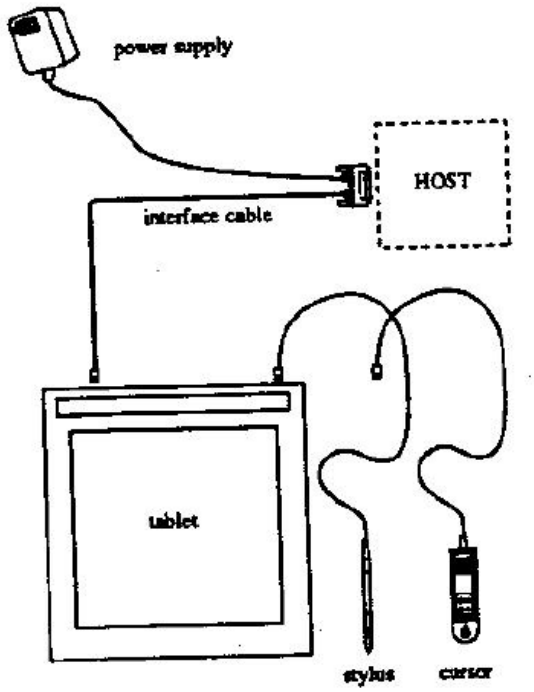
Section A: What is the CR 1212?

CR 1212 is a graphics tablet that acts as an input device. It allows for the translation of graphic information into digital, suitable for a digital device such as a computer.

- Steering a computer screen pointer
- Selecting locations on menus
- Drawing and tracing

The components required for a functional CR 1212 are:

- Tablet
- Stylus or cursor
- Interface cable
- Power source



The tablet is similar to a drawing board. The stylus and cursor are handheld devices that are used for pointing or drawing on the tablet. The interface cable connects the graphics tablet to the host (computer).

Section B: How the CR 1212 Works

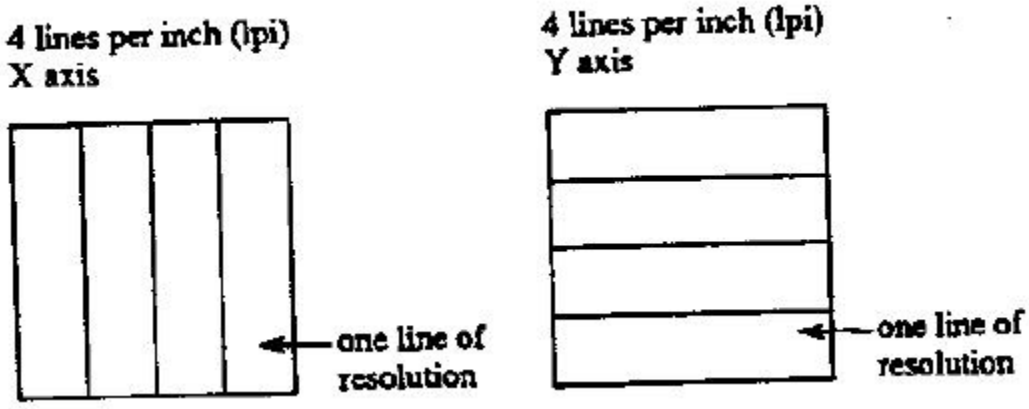
CR 1212 translates the stylus/cursor position on the tablet into digital information and communicates it to the host. The stylus/cursor position is expressed as an X, Y coordinate pair. One coordinate pair is a report.

Valid reports can only be collected when the stylus/cursor is in the tablet's active area and in proximity:

- Active area is a 12-inch square area inside the groove on the tablet surface.
- Proximity is the maximum distance above the active area that the stylus/cursor can be held and report a valid position. It's approximately ½ inches, which means the stylus/cursor and tablet do not need to be in direct contact with each other to issue reports. There still can be up to a ½ inch of material (drawings, photos, etc.) between the tablet and stylus/cursor, allowing it to issue reports.

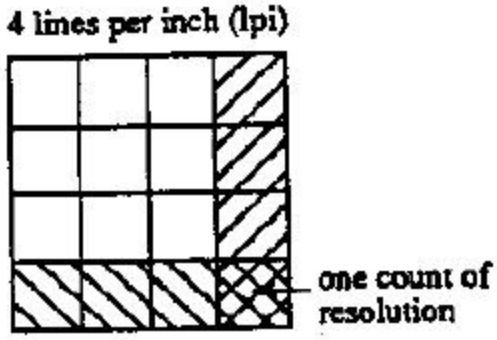
The active area and proximity, in effect, establish a three-dimensional volume within which the stylus/cursor can issue valid reports. Reports issued from outside of this volume are ***out-of-prox*** and, therefore, do not represent the current position of the stylus/cursor.

Reports are measured in counts of resolution. ***Resolution*** is the fineness of detail that the tablet can distinguish. It's expressed in lines per inch (lpi) or lines per millimeter (lpmm). This is slightly misleading, however. Resolution should be expressed in "bands per …" or "lanes per …" because these lines have perceivable width at lower resolution settings.

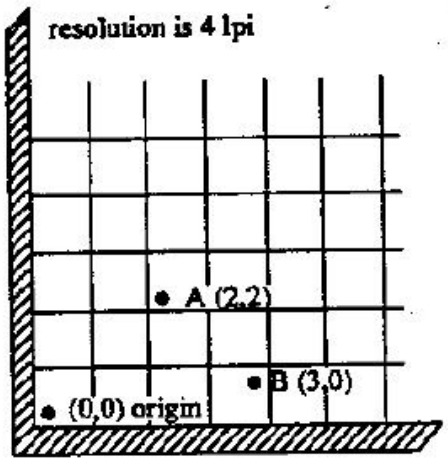


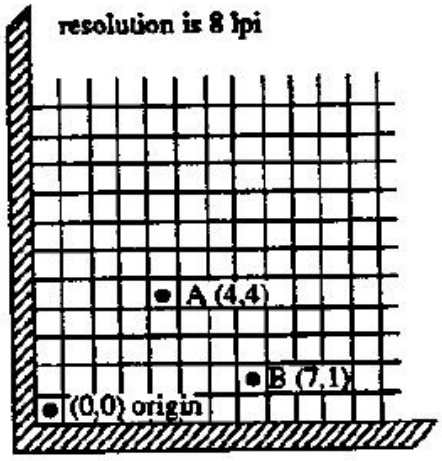
The higher the resolution, e.g. 100 lpi or 200 lpi, the narrower the bands of resolution become. Eventually, the bands become so narrow that they are easier to conceptualize as ***lines*** of no measurable width.

As previously stated, reports are measured in counts of resolution. As shown below, each square is one count of resolution. The tablet reports the same coordinates for any point within the square.



With different resolution settings, you can receive different reports for the same tablet location. In the illustration below, points A and B are the same physical locations on the tablet, but their coordinates are different because of the resolution setting.





points	absolute coordinates	relative coordinates
A	(2,2)	
B	(3,0)	(1,-2)

points	absolute coordinates	relative coordinates
A	(4,4)	
B	(7,1)	(3,-3)

Reports are in absolute or relative coordinates. ***Absolute coordinates*** are coordinates measured from the tablet's origin (0, 0). ***Relative coordinates*** are measured relative to the last report location. In the illustration above, point B is issued after point A. Therefore, in relative coordinates, point B is measured relative to point A.

The tablet defaults to absolute coordinates. However, you can change to relative coordinates with the Relative Coordinates command, described in Chapter 4.

Section C – Commands: Controlling the Tablet's Operation

Control the CR 1212's operating characteristics, functions and diagnostics with commands from the host. This book represents the commands in ASCII. For convenience, an ASCII conversion chart appears in ***Appendix B***.

The tablet accepts commands from the host at any rate, except as follows:

- After turning on the tablet, wait approximately 300 milliseconds before sending commands.

- Commands that require a tablet response: If you send a command to the tablet that requires a response, the tablet does so within two milliseconds. Wait until the host receives the entire response before issuing another command to the tablet.

- Definable Resolution (Set X, Y Scale): After issuing the Definable Resolution command, wait for at least 0.5 milliseconds before issuing another command to the tablet.

Section D: Alternative Configurations

CR 1212 comes in three operational configurations: Bit Pad One, Bit Pad Two and CR. The standard configuration is Bit Pad One. The other configurations are special orders.

Chapter 2: Assembly and Installation

The CR 1212 package should include the following:

- Tablet
- Stylus or cursor
- Interface cable
- CR 1212 Graphics Tablet User's Guide

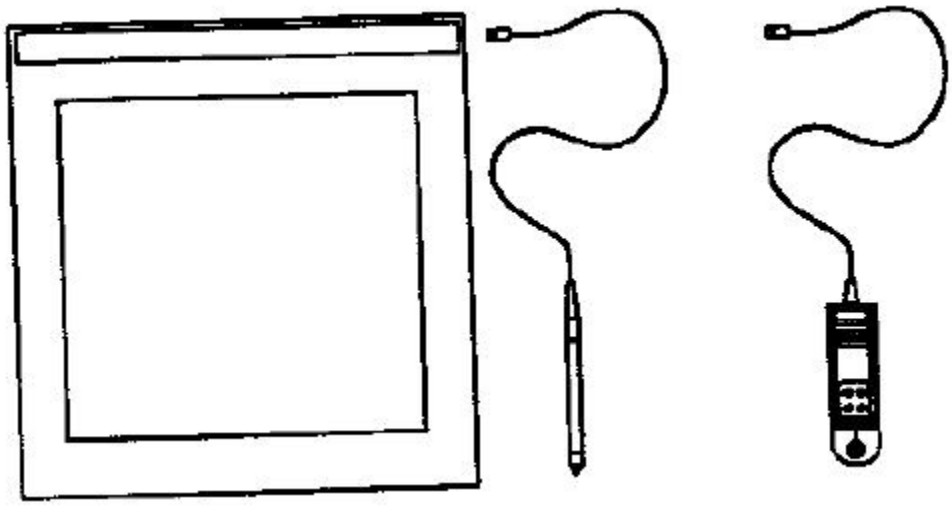
To assemble and install CR 1212:

1. Connect the stylus/cursor to the tablet.
2. Attach the tablet to the host and power source.
3. Turn on the tablet.

NOTE: Always have the computer and tablet power off when attaching or detaching any part of the CR 1212. If the power is on, nothing serious happens to the CR 1212, but it could have the potential to corrupt the file being worked on or cause the computer to malfunction.

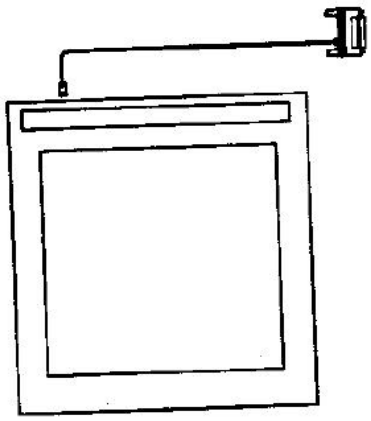
Installing CR 1212 Graphics Tablet

1. Plug the stylus/cursor into the phone socket on the right-hand edge of the tablet.

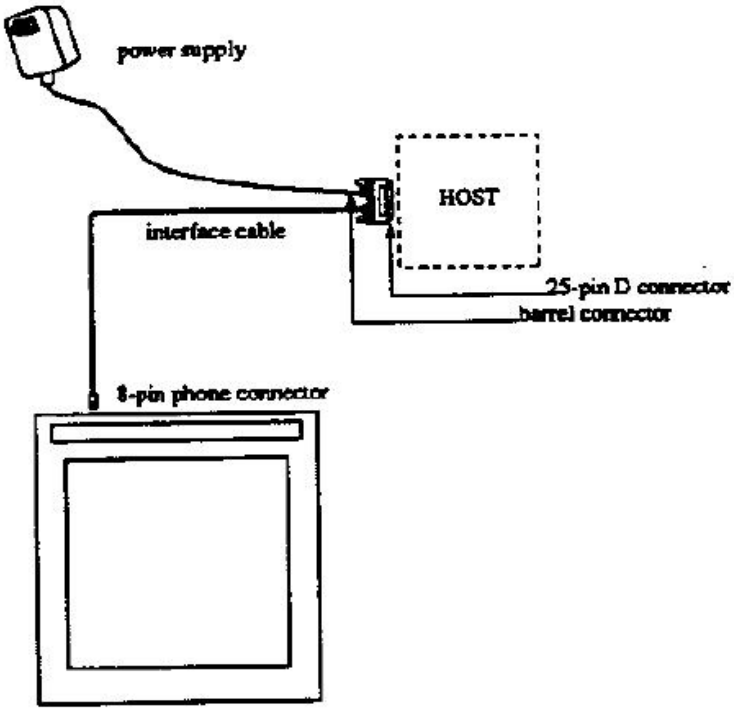


The cursor and stylus are interchangeable. However, before changing from one to the other, turn off the tablet. (This allows the tablet's internal software to re-initialize for each device.)

2. Plug the 8-pin phone connector on the interface cable into the tablet.



3. Connect the 25-pin D connector of the interface cable into the host communications port.

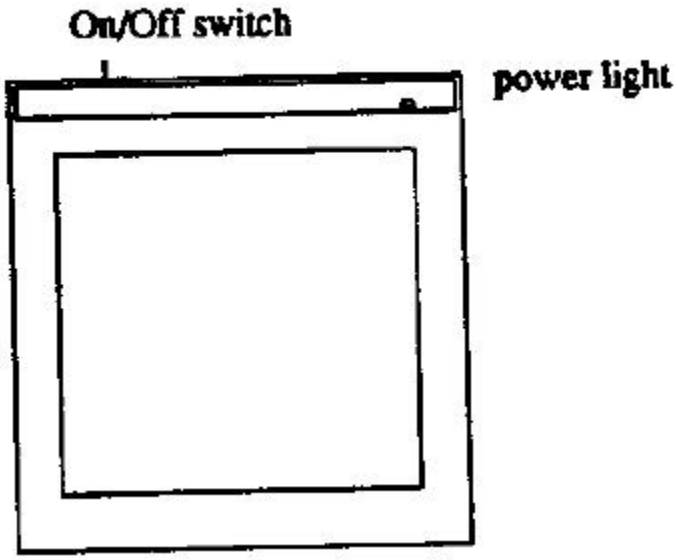


4. Plug the power supply barrel connector into the interface cable's D connector.

5. Plug the power supply into a grounded electrical outlet. Use only a CR 1212 power supply. Substituting a different power supply could permanently damage the graphics tablet.

6. Turn the tablet on.

Turn the power (ON/OFF) switch on. The tablet calibrates itself. This takes approximately three seconds and once the calibration is complete, the tablet beeps.



The power light is lit when the tablet is on. It's also a proximity indicator that remains lit when the stylus/cursor is in-prox. It blinks when the stylus/cursor is out-of-prox. If the light blinks when the stylus/cursor is in-prox, then the tablet is malfunctioning. Turn it off for 10 or 20 seconds, and then turn it on again. If it fails again, have it serviced.

Chapter 3: Interfacing with the Host

For successful communication between the CR 1212 and its host, they must have the same hardware interface, baud rate, communications protocol and report format.

Section A: Hardware Interface

The hardware interface for the CR 1212 is an RS-232C with a 25-pin D connector. The pin assignments are listed below.

RS-232C Interface: 25-Pin D Connector Pin Assignments

Pin	Wire Name	Description
1	shield	protective, frame ground
2	RXD	receives data from host
3	TXD	transmits data to host
4	RTS	Request To Send
5	CTS	Clear To Send
6	DSR	Data Set Ready
7	signal ground	return for data
20	DTR	Data Terminal Ready

The computer must have an RS-232C communications port terminated with a 25-pin male D connector that is configured as DTE (Data Terminal Equipment).

NOTE: If the computer has a different connector, contact your GTCO CalComp by Turning Technologies representative for information about adapter cables.

The CR 1212 complies with standard signal levels for data transmission:

RS-232C Signal Levels

RS-232-C Interface	Interchange Voltage -3V to -12V	+3V to +12V
Binary states	1	0
Signal condition	Mark	Space

NOTE: The source is the ***EIA Standard RS-232C: Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange***, by the Engineering Department of the Electronics Industries Association (Washington, D.C.: EIA, 1969).

Section B: Baud Rate

The CR 1212 is available with 9600 baud or Autobaud. The standard setting is 9600 baud, unless Autobaud is specifically ordered.

Autobaud automatically matches the tablet baud rate to the host baud rate. The tablet supports 9600, 4800, 2400 and 1200 baud. With Autobaud, you must send an ASCII space (SP) to the tablet just after starting it. The tablet uses this character to identify the host baud rate. The tablet then sets its baud rate and issues an ASCII acknowledge (ACK) to the host.

Section C: Communication Protocols

The CR 1212 communication protocols are:

	CR Configuration	Bit Pad One or Bit Pad Two Configuration
Number of parity bits	1, odd	1, even
Number of start bits	1	1
Number of data bits	8	7
Number of stop bits	1	2

Section D: Report Formats

The CR 1212 has one of the following report formats:

- Bit Pad One-compatible format (default)
- Bit Pad Two-compatible format
- CR format (similar to MM packed binary format)
- Bit Pad One- or Two-compatible format for Relative Coordinates (Delta Mode)
- CR format for Relative Coordinates (similar to MM packed binary format for Delta Mode)

The report formats are in (packed) binary. The reports are in counts of resolution, not in inches or millimeters.

Bit Pad One-Compatible Report Format

MSB 6	5	4	3	2	1	LSB 0	Transmission Sequence
PH	Fd	Fc	Fb	Fa	0	0	1st byte
0	X5	X4	X3	X2	X1	X0	2nd byte
0	X11	X10	X9	X8	X7	X6	3rd byte
0	Y5	Y4	Y3	Y2	Y1	Y0	4th byte
0	Y11	Y10	Y9	Y8	Y7	Y6	5th byte

GTCO CalComp
by TURNING technologies

Bit Pad Two-Compatible Report Format

MSB 6	5	4	3	2	1	LSB 0	Transmission Sequence
PH	Fd	Fc	Fb	Fa	0	PR	1st byte
0	X5	X4	X3	X2	X1	X0	2nd byte
0	X11	X10	X9	X8	X7	X6	3rd byte
0	Y5	Y4	Y3	Y2	Y1	Y0	4th byte
0	Y11	Y10	Y9	Y8	Y7	Y6	5th byte

CR Report Format

MSB 7	6	5	4	3	2	1	LSB 0	Transmission Sequence
PH	PR	0	1	1	Fc	Fb	Fa	1st byte
0	X6	X5	X4	X3	X2	X1	X0	2nd byte
0	X13	X12	X11	X10	X9	X8	X7	3rd byte
0	Y6	Y5	Y4	Y3	Y2	Y1	Y0	4th byte
0	Y13	Y12	Y11	Y10	Y9	Y8	Y7	5th byte

Bit Pad One- or Two-compatible format for Relative Coordinates

MSB						LSB	Transmission
6	5	4	3	2	1	0	Sequence
PH	PR	Sx	Sy	Fc	Fb	Fa	1st byte
0	X5	X4	X3	X2	X1	X0	2nd byte
0	Y5	Y4	Y3	Y2	Y1	Y0	3rd byte

CR Format for Relative Coordinates

MSB							LSB	Transmission
7	6	5	4	3	2	1	0	Sequence
PH	PR	0	Sx	Sy	Fc	Fb	Fa	1st byte
0	X6	X5	X4	X3	X2	X1	X0	2nd byte
0	Y6	Y5	Y4	Y3	Y2	Y1	Y0	3rd byte

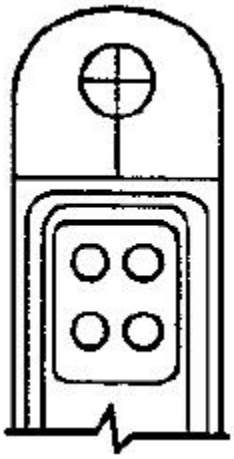
Key:

- LSB is the least significant bit. MSB is the most significant bit.
- Fa, Fb, Fc and Fd are the flag bits. They identify the status of the stylus tip and cursor buttons:

Stylus Tip	Cursor Buttons	Bit Pad/Absolute* Fd	Fc	Fb	Fa	Bit Pad/Relative** or CR Fc	Fb	Fa
unpressed	none pressed	0	0	0	0	0	0	0
pressed	1 pressed	0	0	0	1	0	0	1
	2 pressed	0	0	1	0	0	1	0
	3 pressed	0	1	0	0	0	1	1
	4 pressed	1	0	0	0	1	0	0

*Output for Bit Pad One or Two configurations using absolute coordinates.

**Output for Bit Pad One or Two configurations using relative coordinates.



- Sx and Sy are the X and Y coordinate signs. 1 is positive and 0 is negative.
- PR is the proximity bit. 0 is in-prox and 1 is out-of-prox.
- PH is the phasing bit, which is always 1.
- X0, X1, etc. and Y0, Y1, etc. are the X and Y coordinate bits.

Chapter 4: Operating Characteristics and Functions

The CR 1212 includes a variety of operating characteristics and functions that can be controlled with commands from the host. For example, define:

- Report flow
- Tablet resolution
- Tablet origin location

The tablet accepts commands from the host at any rate, except in a few situations. So that the CR 1212 is operable upon arrival at your facility, it is set to predefined default settings. The unit defaults to these settings each time you turn on the tablet or issue the Reset command. A summary of the defaults appear in the Reset command section and in ***Appendix B***.

Section A: Controlling the Report Flow

The primary functions that control the report flow are Point, Remote Request, Stream and Switch Stream modes. The secondary functions are Report Rate and Increment Mode.

- Bit Pad One configurations: Each time the tablet is turned on or issues the Reset command, it defaults to Stream Mode.

  CR and Bit Pad Two configurations: Each time the tablet is turned on or issues the Reset command, it defaults to Remote Request Mode.

- Bit Pad One reports have no proximity bit. CR and Bit Pad Two reports have a proximity bit.

- Each report has flag bits. These bits identify the stylus/cursor buttons that were activated when the report was issued.

- There is a distinction between ***scanned*** reports and ***issued*** reports. The tablet reads the stylus/cursor location 110 times each second. It stores the scanned reports in an internal buffer. Although the tablet scans continuously, it only issues reports to the host as dictated by the selected mode, such as Point Mode. The reports sent to the host are called ***issue reports***.

A report issued when the stylus/cursor is out-of-prox is always the last in-prox scanned report. Because the last scanned report may or may not be the last issued report, their values could be different. You may find this occurring when collecting reports at very slow rates.

Point Mode

ASCII command: B

In Point Mode, the graphics tablet issues one report when pressing a stylus/cursor button and another when releasing it. (The tip of the stylus is its "button".) If the stylus/cursor is moved between the time the button is pressed and time it's released, the reports will be different. If the stylus/cursor is out-of-prox, the tablet issues the last in-prox scanned report.

Remote Request Mode

ASCII mode command:	D
ASCII trigger command:	P

In Remote Request Mode, the tablet issues one report each time the host sends a trigger command. Issue the mode command once. Thereafter, send only a trigger command for each report. After initiating Remote Request Mode, the tablet issues the report resulting from the first trigger within two milliseconds. The tablet can issue subsequent reports up to 110 rps (reports per second).

When the stylus/cursor is out-of-prox, the tablet issues the last in-prox scanned report each time it receives a trigger.

Stream Mode

ASCII command:	@

In Stream Mode, the graphics tablet issues reports continuously, whether a stylus/cursor button is pressed or not. The Report Rate, described below, controls the number of reports issued per second.

When moving the stylus/cursor out-of-prox, the tablet issues the last in-prox scanned report three or four times before it stops transmitting.

Switch Stream Mode

ASCII command:	A

In Switch Stream Mode, the graphics tablet issues report continuously while pressing a stylus/cursor button. The Report Rate, described below, controls the number of reports issued per second. When releasing the button, the tablet issues an additional report. This report is the last scanned report, but its flag bit is 0 (zero).

If the stylus/cursor is out-of-prox when pressing a button, the last in-prox scanned report is issued continuously.

Report Rate

	ASCII command
Report Rate equal to:	
110 rps (reports per second)	Q
72 rps	R
36 rps	V
18 rps	S
9 rps	T

The Report Rate function is an adjunct to Stream and Switch Stream modes. Use Report Rate to define the number of reports the tablet issues each second. Each time the tablet is turned on or issues a Reset command, the report rate defaults to 110 or 72 rps, depending on the hardware configuration.

By their very nature, low baud rates limit the report rate. Therefore, follow these recommendations:

- No higher than 36 rps, when using 2400 baud
- No higher than 18 rps, when using 1200 baud

Increment Mode

Command Sequence: <mode command><increment value>

ASCII mode command	I
ASCII increment value	SP to z

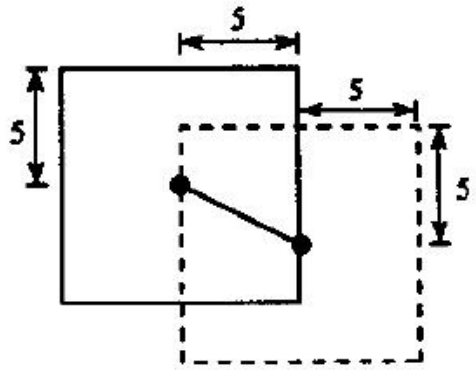
Increment mode is an adjunct to Point, Remote Request, Stream and Switch Stream modes. (It is particularly useful for reducing data output.) In Increment Mode, the unit sends a report only when the stylus/cursor has traveled a minimum distance in the X or Y direction. This minimum distance is the increment. It applies to both axes and is measured in counts (of resolution).

NOTE: When using ***Increment Mode***, it's recommended to use a resolution setting of 50 lpi or higher.

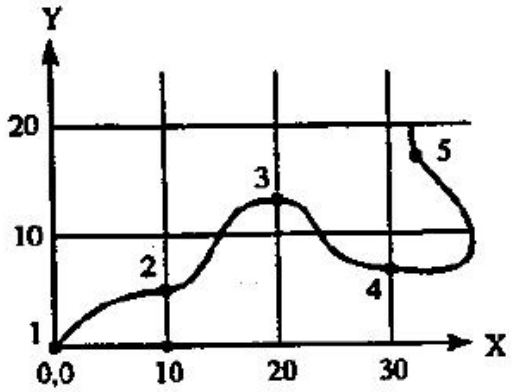
How Increment Mode Works

The last report issued becomes the center of an imaginary square. The square's sides measure twice the increment value. The stylus/cursor can move anywhere inside the imaginary square without the tablet issuing a report. When the stylus/cursor touches the square, the increment is met and the tablet transmits a report. This point becomes the center of a new imaginary square. The process repeats.

The following illustration shows the imaginary square created around a report point. The increment is five.



The following example shows the reports issued as the stylus/cursor travels across the tablet. The increment is ten. We have assumed that the first point collected is the origin (0, 0).



The points issued are:

Point	Report	Description
1	(0,0)	First point collected in Increment Mode.
2	(10,5)	The increment is met along the X axis. The tablet reports the actual Y location.
		No point is transmitted between points 2 and 3 because the stylus/cursor did not move ten counts in either the X or Y direction.
3	(20,13)	The increment is met along the X axis. The tablet reports the actual Y location.
4	(30,7)	The increment is met along the X axis. The tablet reports the actual Y location.
5	(32,17)	The increment is met along the Y axis. The tablet reports the actual X location.

How to Use Increment Mode

Send the mode command and then the increment value. The increment value is in counts (of resolution) and can be a decimal whole number from 0 to 90. (The default is zero.) Add 32 (decimal), a required offset, to the desired increment and then convert the sum into your preferred number base. For example, if the desired increment value is 10 (decimal),

desired increment	+32	= increment value in hexadecimal	= increment value in ASCII
10	+32	+ 2A hexadecimal	= ASCII

To disable Increment Mode, set the increment to zero with the ASCII space character (SP).

The length of a count can vary depending on the resolution and measurement system the tablet is using. Therefore, the increment length can vary:

Resolution	Measurement System	Increment Value (in Counts)	Length of One Count	Increment Length
50 lpi	U.S.	5	0.02 inches	0.1 inches
200 lpi	U.S.	5	0.005 inches	0.025 inches

Combining Increment Mode with Other Modes

- ***Point Mode*** and ***Increment Mode***: The stylus/cursor location, at the time Increment Mode is enabled, becomes the center of the initial imaginary square. The tablet issues one report when pressing a stylus/cursor button and another when releasing the button. However, reports are updated only when the increment is met.

- ***Remote Request Mode*** and ***Increment Mode***: When the tablet receives a (Remote Request) trigger from the host, it issues a report. If the increment has not been met when the tablet receives this trigger, the tablet reissues the last report. If the increment has been met when the tablet receives this trigger, the tablet advises an updated report.

- ***Stream Mode*** and ***Increment Mode***: The tablet issues a report only when the increment is met. It can issue reports up to the established Report Rate.

- ***Switch Stream Mode*** and ***Increment Mode***: If the increment has not been met, the tablet issues one report when a button is pressed and another when it is released. If the increment has been met and a button is pressed, the tablet can issue reports up to the established Report Rate.

Section B: Setting the Resolution

Resolution is the fineness of detail that the tablet can distinguish. Resolution is expressed in lines per inch (lpi) or lines per millimeter (lpmm). (A detailed definition of resolution appears in Chapter 1.) Two resolution functions are available, Predefined Resolution and Definable Resolution.

Each time the tablet is turned on or issues the Reset command, the tablet defaults to a resolution of 200 lpi.

Bit Pad One and Two Configurations: The tablet can have a resolution of up to 508 lpi (6096 counts over a 12-inch axis). Bit Pad configurations are restricted to a maximum of 4095 counts. This, in effect, restricts the resolution to 341 lpi (13 lpmm) over a 12-inch axis. (4095 lpi + 12 inches = 341 lpi) Higher resolutions can be used; however, the active area shrinks accordingly. For example:

Resolution Setting	Maximum Axis Length
400 lpi	10.24 inches
500 lpi	8.19 inches
508 lpi	8.06 inches

The axis is measured from the active area origin (0, 0). Reports issued from beyond the axis are clamped to a value of 4095.

Resolution, Predefined

	ASCII command
Resolution setting of:	
25 lpi	u
50 lpi	s
100 lpi	d
200 lpi	e
10 lpmm (254 lpi)	f
400 lpi	g
500 lpi	h
508 lpi	i

Use these commands to set the tablet to one of the predefined resolutions listed about. (Resolution is restricted in Bit Pad One and Two configurations. Refer to ***Section B: Setting the Resolution***.

Resolution, Definable (Set X, Y Scale)

Command Sequence: <command><X low byte><X high byte><Y low byte><Y high byte>

	ASCII	Hex
command	r	72
X axis resolution, low byte	—	00 to FF
X axis resolution, high byte	—	00 to 17
Y axis resolution, low byte	—	00 to FF
Y axis resolution, high byte	—	00 to 17

The purpose of the ***Definable Resolution*** function is to let you match the tablet resolution to the resolution of another two-dimensional device, e.g. a computer screen. With Definable Resolution:

- Define the resolution of each tablet axis, independent of one another.
- Specify the resolution to be any value from 10 lpi to 508 lpi. (Resolution is restricted in Bit Pad One and Two configurations. Refer to ***Section B: Setting the Resolution***.

After issuing the Definable Resolution command, wait at least 0.5 milliseconds before issuing another command to the tablet.

If Tablet is operating as a Bit Pad One or Bit Pad Two

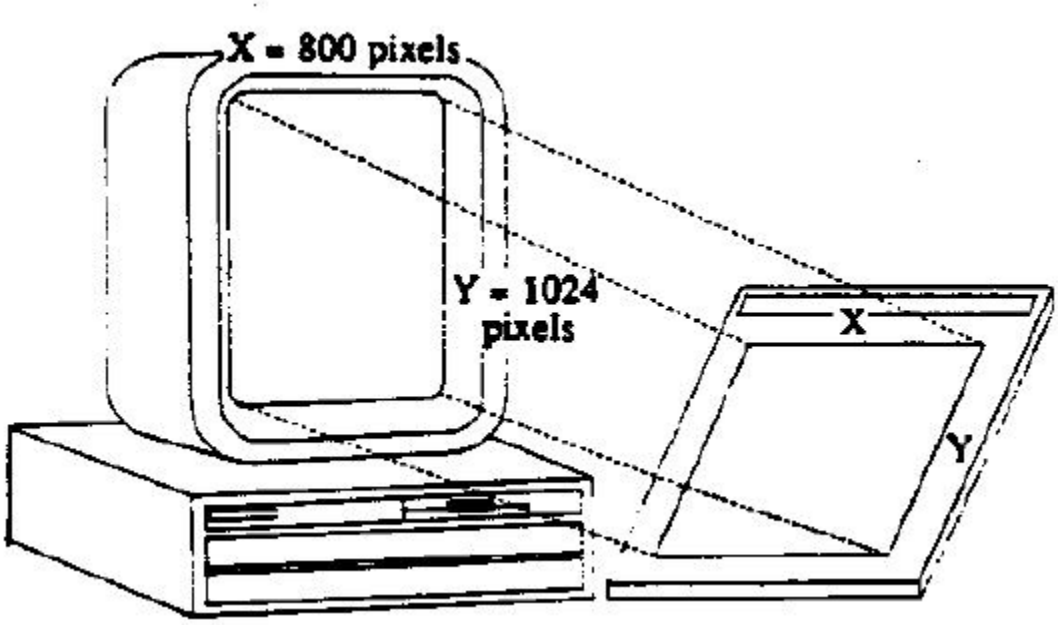
Here is how to use Definable Resolution:

1. Determine the resolution that's desired for the entire length of the (tablet) axis:

    - If the other device's resolution is expressed in "units per…", such as 37 lines per inch, multiply that number by the tablet axis length. Example: *other device's resolution x length of tablet axis = desired axis resolution*

37 lpi x 12 inches = 444 … is the desired axis resolution

- The other device may have a resolution expressed as the overall axis values, such as 800 by 1024 pixels.



In this case, ensure the length of the corresponding tablet axis divides evenly into the other device's resolution. If it does not, the tablet truncates the resolution value to a whole number.

Example: Matching the CR 1212 to a vertical (portrait) screen with a resolution of 800 (X) by 1024 (Y) pixels:

Other Device's Resolution / Tablet Axis Length

800 pixels / 12 inches = 66.66 … X axis

1024 pixels / 12 inches = 85.33 … Y axis

The tablet would truncate these values to 66 and 85. Therefore, round them high to 67 and 86. (This ensures that the entire screen is addressable from the tablet.) Multiply the rounded values by the tablet axis length to derive the desired resolution for the overall axis.

67 x 12 inches = 804 … is the desired X axis resolution

86 x 12 inches = 1032 … is the desired Y axis resolution

2. Convert the desired axis resolution to a hexadecimal number.
   Example: 804 decimal = 324 hexadecimal
   1032 decimal = 408 hexadecimal

   If the number is less from four digits, pack the left side with zeros. For example, 324 becomes 0324; 408 becomes 0408.

   Separate the hexadecimal number into two 2-digit parts, the most significant byte (high byte) and the least significant byte (low byte).

   Example:
   0324 = 03 high byte 24 low byte
   0408 = 04 high byte 08 low byte

3. You're now ready to send the Definable Resolution command sequence to the tablet. In the example of 800 by 1024 portrait screen, the command sequence is:

Command	***X Low Byte***	***X High Byte***	***Y Low Byte***	***Y High Byte***
72	24	03	08	04

NOTE: To change the resolution of only one axis, send zeros as the other axis's resolution.

4. To verify the new resolution settings, use the Send Configuration command.

Section C: Other Functions

Bit Pad Configuration

	ASCII command
Configuration:	
Bit Pad Two	O (uppercase letter, not zero)
Bit Pad One	o (lowercase letter)

If the unit's hardware configuration is Bit Pad, you can adjust between Bit Pad One and Bit Pad Two using the commands. (Changing to or from the CR configuration requires a hardware modification.) Once the configuration is revised; to return to the default, either send the appropriate command or repower the tablet. The Reset command does not control the configuration setting.

Origin

	ASCII command
Origin location:	
Upper Left	b
Lower Left	c

Use the Origin command to define the location of the tablet's origin (0, 0). It can be the lower or upper left corner of the active area. The default is the lower left.

When the origin is in the upper left corner, Y coordinates are positive, not negative. This departure from the standard Cartesian coordinate system is to aid in the compatibility between the CR 1212 and terminals with a screen origin in the upper left corner.

Relative Coordinates (Delta Mode)

ASCII command:	E

The tablet defaults to an absolute coordinate system. This command changes it to a relative coordinate system. Absolute coordinates are measured from the tablet's origin (0, 0). Relative coordinates are measured ***relative to*** the last report location. (Refer to Chapter 1 for details.)

In this operational mode, the active area origin is the lower left corner of the tablet. Stylus/cursor movement up and to the right is positive. Movement down and to the left is negative. (You can change the origin location to the upper left corner with the ***Origin*** command. Stylus/cursor movement down to the right is positive; up and to the left is negative.)

Reset (to Default Operating Characteristics)

ASCII command:	NUL

Use ***Reset*** to return the CR 1212 to the default operating characteristics:

- Coordinate system: absolute
- Increment: 0, Increment Mode off
- Origin: lower left corner
- Report Mode: In the Bit Pad One configuration, the mode is ***Stream***. In the Bit Pad Two or CR configuration, the mode is ***Remote Request***.
- Report Rate: 110 or 72 rps (reports per second) depending on hardware configuration
- Resolution: 200 lpi
- Tablet Beep: enabled

If the stylus/cursor is out-of-prox when the tablet receives the Reset command, and if it is still out-of-prox when the tablet issues a report, the X and Y coordinate values are zero.

GTCO CalComp
by TURNING technologies

Send Configuration

ASCII command: a

Send Configuration issues a report to the host that identifies the resolution of each axis. The report format is one of the following:

Bit Pad One or Bit Pad Two Configuration – Report Format

MSB 6	5	4	3	2	1	LSB 0	Transmission Sequence
1	0	0	0	0	0	0	Flag byte
0	b5	b4	b3	b2	b1	b0	X low byte
0	b11	b10	b9	b8	b7	b6	X high byte
0	b5	b4	b3	b2	b1	b0	Y low byte
0	b11	b10	b9	b8	b7	b6	Y high byte

CR Configuration – Report Format

MSB 7	6	5	4	3	2	1	LSB 0	Transmission Sequence
1	0	0	1	1	0	0	0	Flag byte
0	b6	b5	b4	b3	b2	b1	b0	X low byte
0	b13	b12	b11	b10	b9	b8	b7	X high byte
0	b6	b5	b4	b3	b2	b1	b0	Y low byte
0	b13	b12	b11	b10	b9	b8	b7	Y high byte

Key:

LSB	Least significant bit
MSB	Most significant bit
b0	Maximum X or Y value at set resolution

The configuration report does not express the resolution in lines per inch or lines per millimeter. Rather, the resolution is indicated as the total number of counts over the length of the axis.

Example: The tablet is the CR configuration. The resolution setting is 200 lpi. The X and Y axis are 12 inches long. Therefore, the resolution is 2400 for each axis. The Send Configuration report is:

MSB 7	6	5	4	3	2	1	LSB 0	Transmission Sequence
1	0	0	1	1	0	0	0	Flag byte
0	1	1	0	0	0	0	0	X low byte
0	0	0	1	0	0	1	0	X high byte
0	1	1	0	0	0	0	0	Y low byte
0	0	0	1	0	0	1	0	Y high byte

Tablet Beep

ASCII command:	y

Use this command if you want to disable the tablet beep. To enable it again, issue the Reset command or repower the tablet.

Transmission Control

	ASCII command
Stop Transmission (XOFF)	DC3
Resume Transmission (XON)	DC1

The ***Stop Transmission*** and ***Resume Transmission*** commands act as software gates, controlling data transmission from the CR 1212 to the host. These commands control the data flow, regardless of the report collection mode (stream, Point, etc.).

Stop Transmission and Resume Transmission are equivalents of the transmission protocols XOFF and XON.

Stop Transmission places the graphics tablet on standby. It is useful for systems that do not constantly use the graphics tablet. End the standby state by sending the Resume Transmission command.

NOTE: The Reset command does not cancel the Stop Transmission command.

While the tablet is on standby, it does not buffer reports for subsequent transmission. However, if you issue Stop Transmission while data is being transmitted, no data is lost. The CR 1212 severs the data transmission at the end of the report. When you issue the Resume Transmission command, the tablet continues operation.

While the CR 1212 is on standby, it accepts and executes commands from the host. During this state, however:

- Tablet does not execute the Echo command.
- Recommended to limit the number of status commands to one. ***Status commands*** are commands that issue a reply to the host, e.g. Send Configuration. The tablet issues the reply after it receives XON.

Section D: Reserved Commands

NOTE: Do not use the ASCII commands z, l, n or p or their equivalents. They're reserved for factory use. If a reserved command is issued by mistake, clear it by repowering the tablet or by assigning the Reset command.

Chapter 5: Guidelines for Writing a Device Driver

For the computer to make use of the data being sent to it from the tablet, the software (system or application) must contain a tablet device driver. The driver needs to be written for your specific CR 1212 configuration (Bit Pad One, Bit Pad Two or CR). The device driver is a program that collects and decodes the tablet data.

The driver usually sits between the application and serial interface. The driver should be able to:

- Receive reports and status information from the tablet via the serial interface
- Transmit data to the application
- Present high level commands from the application that control the tablet

A typical driver consists of four major parts:

- ***Configure Host and Tablet***
  - Structure the host communications port (port address, baud rate, etc.)
  - Shape the tablet (resolution, report mode, etc.)

- ***Report Collection – Interrupt Routines***
  - Assemble the report: collect the report's data bytes into an array
  - Check for errors

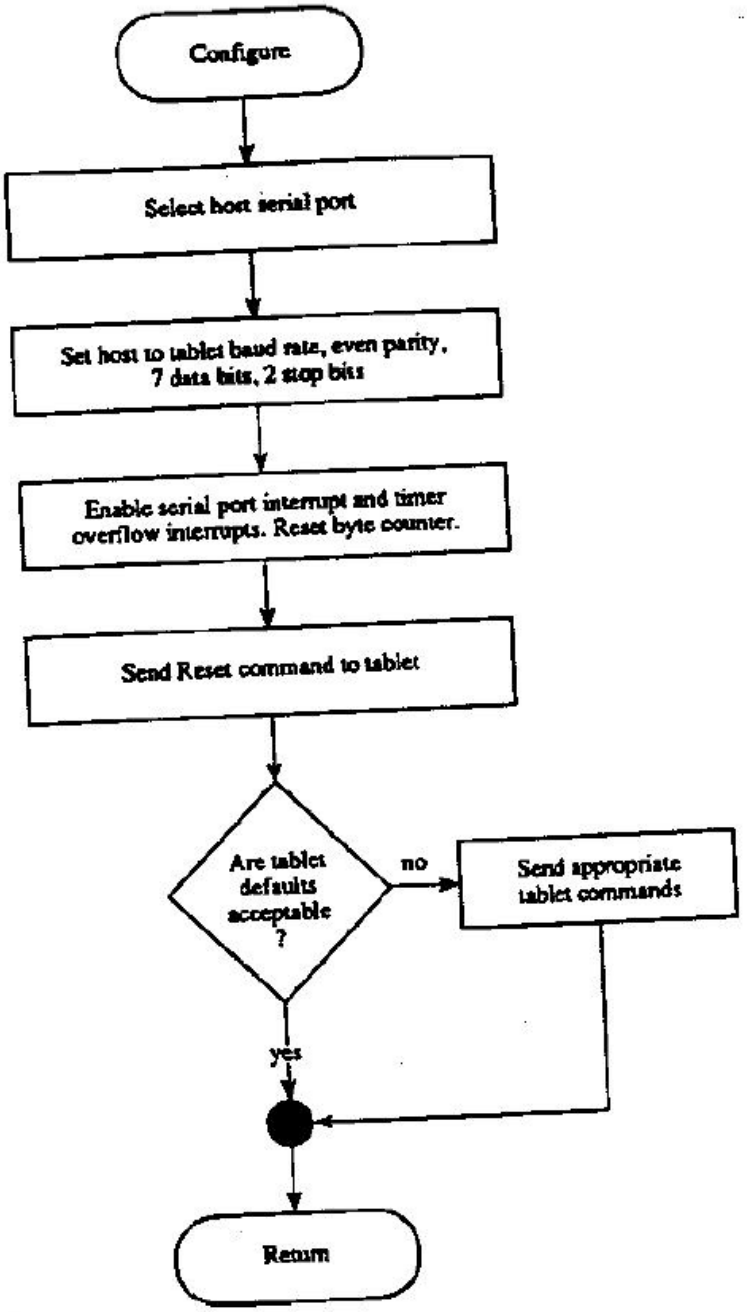
- ***Process Reports from the Tablet***
  - Decode the report
  - Filter reports, if required by the application
  - Notify the application, if applicable, that a report is ready to be issued to the application

- ***Process Errors***
  - Parity errors
  - Short report errors after time-out
  - Long report errors
  - Missing report errors after time-out
  - Host buffer full errors (automatic XON/XOFF support)

The following flowcharts are for a CR 1212 in the Bit Pad One configuration.

Configure Host and Tablet

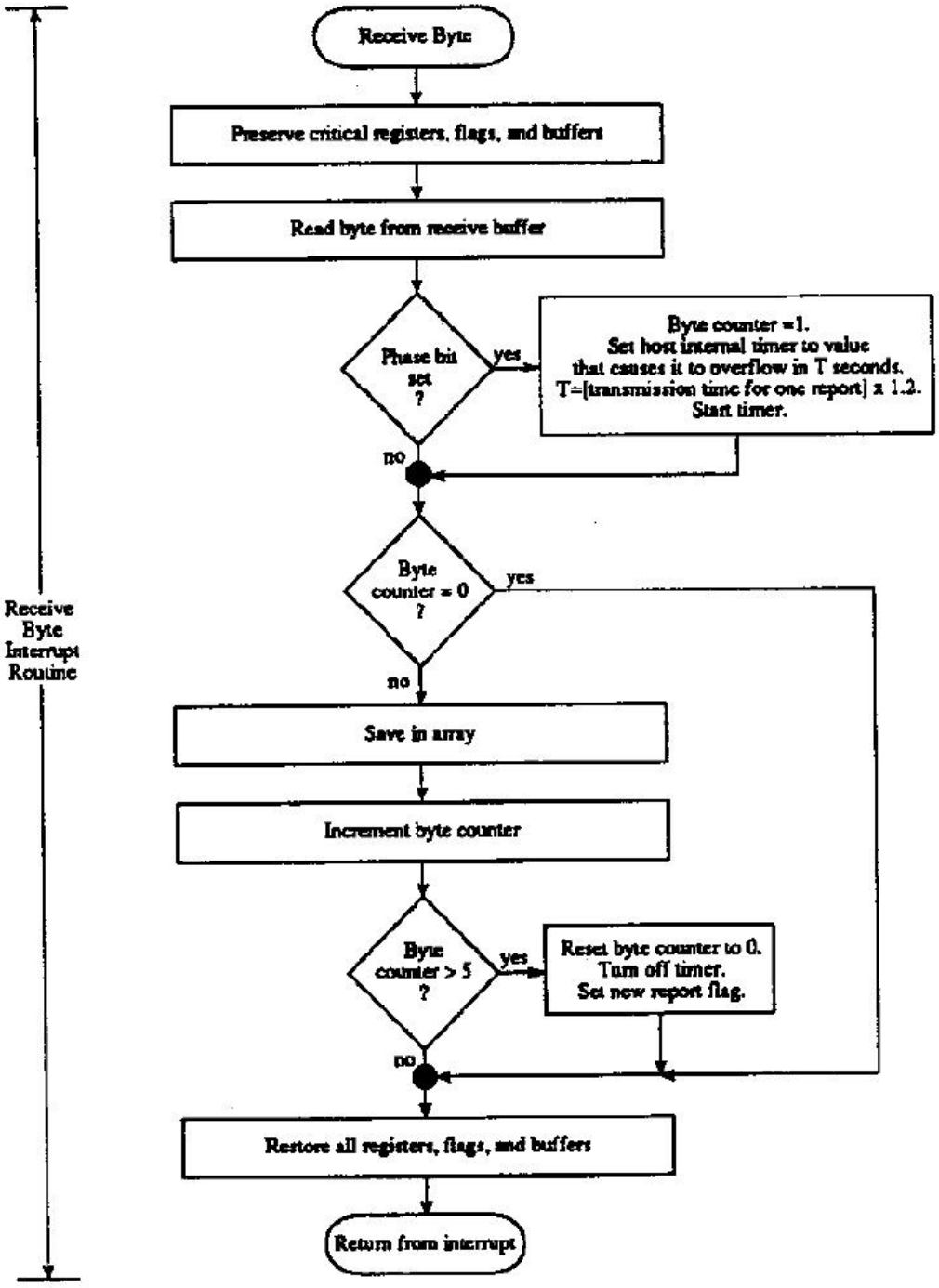
- Structure the host communications port (port address, baud rate, etc.)
- Shape the tablet (resolution, report mode, etc.)



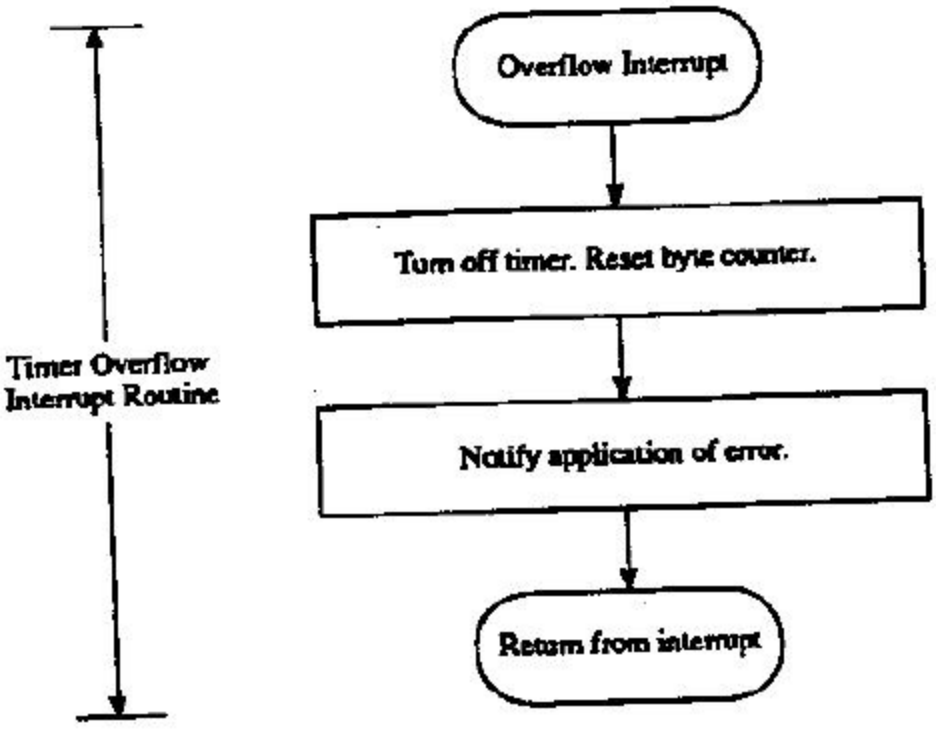
by TURNING technologies

Report Collection – Interrupt Routines

- Assemble the report: collect the report's data bytes into an array
- Check for errors

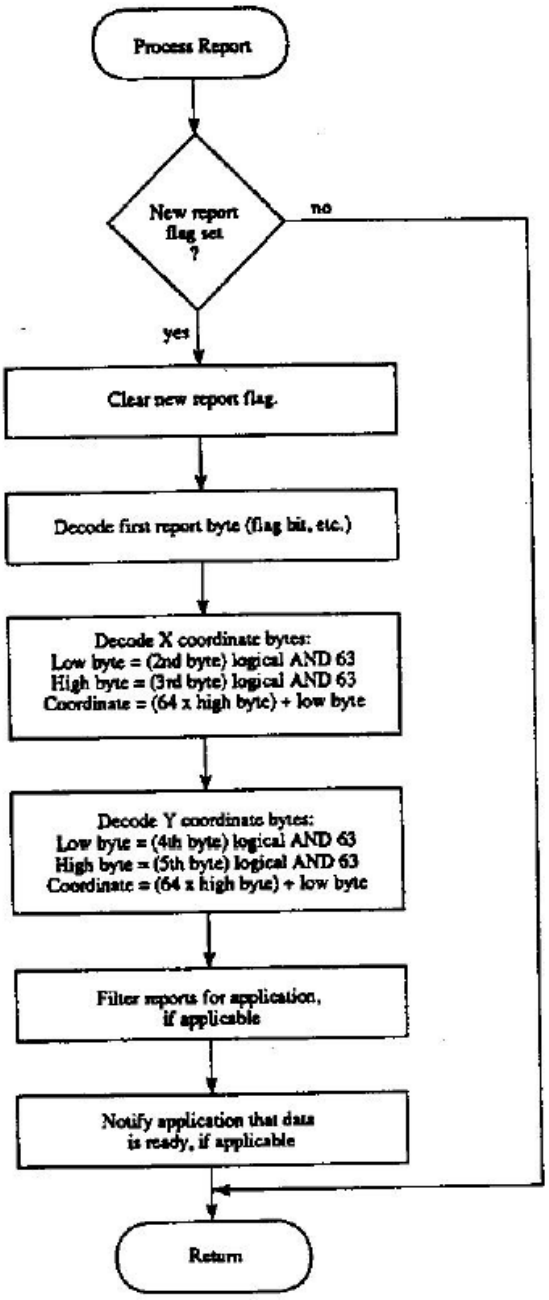


Cont.


Timer Overflow Interrupt Routine
Overflow Interrupt
Turn off timer. Reset byte counter.
Notify application of error.
Return from interrupt

Process Reports from the Tablet

- Decode the report
- Filter reports, if required by the application
- Notify the application, if applicable, that a report is ready to be issued to the application



Chapter 6: Using the CR 1212

Follow these guidelines to maximize usage of the CR 1212.

- You can tape things down to the tablet, including pictures and drawings. Tape does not affect the tablet. You can even stack materials up to ½ inch high between the tablet and stylus/cursor.

- After turning on the tablet, wait until it stops calibrating before starting an application that uses it.

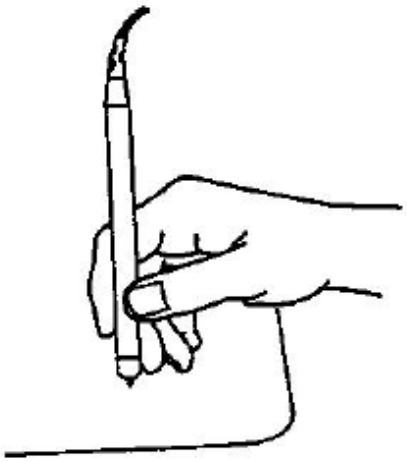
- Keep the stylus/cursor in the active area of the tablet and in proximity. Please note when the stylus/cursor is in proximity, the tablet power light is on. When the stylus/cursor is out-of-prox, the power light blinks.

- Stylus or cursor - which to use? For freehand drawing, the stylus tends to feel more natural. For tracing, the cursor provides the user with more control and precise sighting. Also, the cursor has multiple buttons, to which can assign specific functions in your device driver.

- The cursor and stylus are interchangeable. However, before changing from one to the other, turn off the tablet. (This allows the tablet's internal software to re-initialize for each device.)

- Stylus: The stylus has a switch inside the barrel. To activate the switch, press the stylus tip or button.

- Hold the stylus above the nose piece, away from the tip. The angle at which you hold the stylus affects the location reading, so it helps to hold the stylus at the same angle consistently. The stylus is most accurate when it is perpendicular to the tablet. However, it functions satisfactorily within 45 degrees of the perpendicular.



- Cursor is most accurate when held parallel with the tablet surface. To activate a cursor button, press it.
- The tablet beeps each time the stylus/cursor button is pressed.
- Remember to release the pressure on the stylus/cursor button when you're done performing a function.
- When you turn off the computer, turn off the tablet.
- The unit is affected by conductive materials. Do not trace through metal or metallized paper. Do not use metal objects, such as rulers, on the tablet. However, with the cursor, you can trace through some conductive materials, such as X-rays or drawings in pencil or conductive ink.

14557 N. 82nd St.
Scottsdale, AZ 85260

www.gtcocalcomp.com

866.746.3015 toll free
480.998.1751 fax

Chapter 7: Checking the Graphics Tablet

Section A: Tablet Calibration

The tablet calibrates each time it's turned on. The calibration takes less than three seconds and beeps once completed.

Section B: Power (and Proximity) Light

The power light on the tablet serves two purposes. First, it notifies when the tablet is on and receiving power. Second, it is a proximity indicator. The light remains lit when the stylus/cursor is in-prox. It blinks when the stylus/cursor is out-of-prox. If the light blinks when the stylus/cursor is in-prox, then the tablet is malfunctioning. Turn it off for an estimated 10-20 seconds and then turn it back on.

Section C: A Quick Functional Check

Here is a quick functional check that you can perform. Its purpose is to ensure that the interface is working and that all parts of the tablet active area are being read by the stylus/cursor.

1. Connect the tablet to a "dumb" terminal. The terminal must be set up to communicate in full duplex at 9600 baud. If the unit is a Bit Pad One or Two configurations, the terminal's data protocol must be an 8-bit frame: even parity and seven data bits. If the unit is a CR configuration, the terminal's data protocol must be a 9-bit frame: odd parity and eight data bits.

2. On the terminal, enter the command string: ***zA@.*** The tablet is now in ***Stream Mode*** sending reports in an ASCII format.

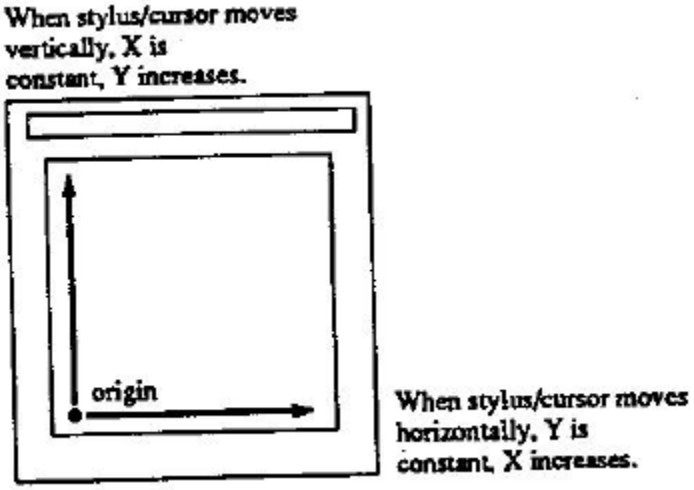
3. Starting at the lower left corner of the tablet, run the stylus/cursor across the tablet's active area. You should see reports on the terminal in the following ASCII format: ***F,XXXX,YYYY,P***

where,
F = stylus/cursor flag:

Stylus Tip	Cursor Button	F
not pressed	none pressed	0
pressed	1 pressed	1
	2 pressed	2
	3 pressed	3
	4 pressed	4

XXXX.YYYY = X,Y coordinates
P = proximity flag. 0 is in-prox. 1 is out-of-prox.

The X and Y coordinates should increase as you slide the stylus/cursor up and right, as shown below.



Section D: Diagnostic Functions

Echo

ASCII command: k

Use Echo to ensure that the interface between the tablet and host is operating correctly. The tablet echoes (retransmits) characters back to the host that were sent from the host. The tablet echoes the characters, one by one, as it receives them. If the interface is working properly, the sent character matches the echoed character.

Note that character sequences are passed through, not acted upon by the tablet. Therefore, remote commands issued while Echo is in effect are ignored by the tablet. To abort the Echo function, issue the Reset command or repower the tablet.

Self-Test

ASCII command: w

The Self-Test function tests certain parts of the unit and transmits the results to the host. The results are transmitted as one byte in one of the following formats:

Bit Pad One and Two Configurations: Self-Test Report

MSB						LSB
6	5	4	3	2	1	0
0	0	CA	PR	D	1	A

CR Configuration: Self-Test Report

MSB							LSB
7	6	5	4	3	2	1	0
T	0	0	CA	PR	D	1	A

A Analog circuitry test; pass = 1, fail = 0

D Digital circuitry test; pass = 1, fail = 0

PR Stylus/cursor proximity; stylus/cursor in-prox = 1, stylus/cursor out-of-prox = 0

CA Tablet calibration; pass = 1, fail = 0

T Total test result (based on A, D and CA); pass = 1, fail = 0

Bit Pad One and Two configurations: If the test result is a Hex 17 or 1F, or equivalent, the tablet passed the tests. Any other result means that the tablet failed.

CR configuration: If the test result is a Hex 9F or 97, or equivalent, the tablet passed the tests. Any other result means that the tablet failed.

Chapter 8: Operating Environment, Care and Service

Section A: Operating Environment

Operate the CR 1212 within these temperature and humidity ranges:

+45 degrees to +110 degrees Fahrenheit
+7 degrees to +43 degrees Celsius
8% to 80% relative humidity, non-condensing

Acceptable non-operating conditions are:

-45 degrees to +145 degrees Fahrenheit
-43 degrees to +63 degrees Celsius
8% to 80% relative humidity, non-condensing

Extremes in environment can cause degradation of operation. Be careful as extreme temperatures can occur in some rather surprising places – atop a TV set, in direct sunlight or in a car on a hot or cold day.

Section B: Service

You should have no problems with the CR 1212. However, if a problem arises, try one or more of the following:

- Check the hardware connections.
- Ensure that the computer is working.
- If possible, perform the tests described in Chapter 7.
- If applicable, check that the device driver is installed in your system or application software.
- Turn off the computer and tablet. Then turn them on again.

If the tablet continues to malfunction, contact our Customer Service Department at:

GTCO CalComp by Turning Technologies
14557 N. 82nd Street
Scottsdale, AZ 85260

Toll-Free Number: 1.866.746.3015

When contacting Customer Service, please have ready the unit serial number. The serial number is located on the bottom of the tablet. If it is necessary to return the unit, Customer Service will give you a Return Authorization Number. Write this number on the outside of the package and on all accompanying paperwork.

NOTE: Please do not ship equipment to GTCO CalComp by Turning Technologies without obtaining instructions and a Return Authorization Number from the Customer Service Department.

Section C: Care and Cleaning

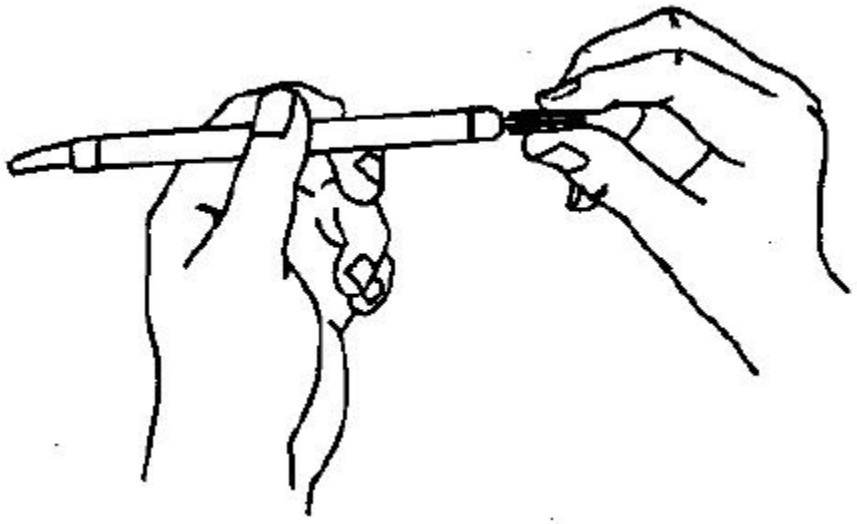
The CR 1212 requires minimal care and cleaning. However, the following guidelines are important:

- Disconnect the unit from its power source before cleaning.
- Using a soft, damp (not wet), lint-free cloth, wipe the case clean with a mild detergent solution.
- Never disassemble any part of the CR 1212, except to change the stylus refill.
- Never immerse in liquid.
- Never bang it around or drop it.
- Never scratch or mar the tablet.
- Cursor: The transparent part of the cursor that encases the cross hair is called the paddle. The top surface of the paddle is covered by a special film. It is important to protect the paddle and film. Do not scratch, mar or separate. To clean the paddle, wipe with a lint-free cloth dampened with water. Do not use spray cleaner or any other type of cleaner or solvent.

NOTE: Do not plug CR 1212 connectors into foreign objects. Do not plug foreign objects into the CR 1212. Doing so would product unpredictable results and could destroy the tablet.

Section D: Changing the Stylus Refill

To change the stylus refill, grasp the refill by the tip and pull straight out. Since the tip is small and slippery, you will probably not be able to pull it out with your bare fingers. We recommend using needle nose pliers or two coins.



Insert the new refill until it is firmly seated.

14557 N. 82nd St.
Scottsdale, AZ 85260

www.gtcocalcomp.com

866.746.3015 toll free
480.998.1751 fax

Appendix A Specifications

Physical Description
Approximate physical dimensions:

Width	16 inches (406 mm)
Length	17 inches (432 mm)
Maximum Height	1.3 inches (33 mm)
Weight	7 lbs. (3.2 kg) maximum

Power Supply Specifications
The CR 1212 power supply for the RS-232C configuration is specified as:

- Input: 120 VAC +7%, -13%, 58 to 62 Hz
- Output: 5 VDC at 225 mA, less than 50 mV ripple, +/-5% regulation, rise time less than 100 milliseconds

Operating Specifications

Standard Accuracy: +/-0.050 inches (1.27 mm) or better
Accuracy is how closely a point's actual location is determined.

Active Area: 12 inches by 12 inches (305 mm by 305 mm) approximately
The area of the tablet that senses the stylus/cursor location and where valid reports are obtained.

Jitter: Stylus or cursor: +/-1 count of resolution
Jitter is the different in values collected by the graphics tablet for the same point (for example, 200, 201 and 202). Jitter can be caused by electrical noise from environmental sources or from the tablet's analog-to-digital conversion circuitry. Noise affects the signal that identifies a point. Jitter is measured as one unit of the resolution.

Proximity: 0.5 inches (12.7 mm) approximately
Proximity is the maximum distance the stylus/cursor can be held above the active area and report a valid position.

Resolution: Up to 508 lpi (lines per inch)
Resolution is the "fineness" of detail that the tablet can distinguish. Resolution is expressed in lines per inch (lpi) or lines per millimeter (lpmm).

by TURNING technologies

Appendix B ASCII Conversion Chart

Decimal	Binary 7 6 5 4 3 2 1 0	Octal	Hex	ASCII Character	Control Function or Character Description
0	0 0 0 0 0 0 0 0	000	00	NUL	Null
1	0 0 0 0 0 0 0 1	001	01	SOH	Start of Heading
2	0 0 0 0 0 0 1 0	002	02	STX	Start of Text
3	0 0 0 0 0 0 1 1	003	03	ETX	End of Text
4	0 0 0 0 0 1 0 0	004	04	EOT	End of Transmission
5	0 0 0 0 0 1 0 1	005	05	ENQ	Enquiry
6	0 0 0 0 0 1 1 0	006	06	ACK	Acknowledge
7	0 0 0 0 0 1 1 1	007	07	BEL	Bell
8	0 0 0 0 1 0 0 0	010	08	BS	Backspace
9	0 0 0 0 1 0 0 1	011	09	HT	Horizontal Tab
10	0 0 0 0 1 0 1 0	012	0A	LF or NL	Line Feed or New Line
11	0 0 0 0 1 0 1 1	013	0B	VT	Vertical Tab
12	0 0 0 0 1 1 0 0	014	0C	FF	Form Feed
13	0 0 0 0 1 1 0 1	015	0D	CR or RT	Carriage Return
14	0 0 0 0 1 1 1 0	016	0E	SO	Shift Out
15	0 0 0 0 1 1 1 1	017	0F	SI	Shift In
16	0 0 0 1 0 0 0 0	020	10	DLE	Data Link Escape
17	0 0 0 1 0 0 0 1	021	11	DC1	Device Control 1
18	0 0 0 1 0 0 1 0	022	12	DC2	Device Control 2
19	0 0 0 1 0 0 1 1	023	13	DC3	Device Control 3
20	0 0 0 1 0 1 0 0	024	14	DC4	Device Control 4
21	0 0 0 1 0 1 0 1	025	15	NAK	Negative Acknowledge
22	0 0 0 1 0 1 1 0	026	16	SYN	Synchronous Idle
23	0 0 0 1 0 1 1 1	027	17	ETB	End Transmission Block
24	0 0 0 1 1 0 0 0	030	18	CAN	Cancel
25	0 0 0 1 1 0 0 1	031	19	EM	End of Medium
26	0 0 0 1 1 0 1 0	032	1A	SUB	Substitute
27	0 0 0 1 1 0 1 1	033	1B	ESC	Escape
28	0 0 0 1 1 1 0 0	034	1C	FS	File Separator
29	0 0 0 1 1 1 0 1	035	1D	GS	Group Separator
30	0 0 0 1 1 1 1 0	036	1E	RS	Record Separator
31	0 0 0 1 1 1 1 1	037	1F	US	Unit Separator
32	0 0 1 0 0 0 0 0	040	20	SP	Space
33	0 0 1 0 0 0 0 1	041	21	!	Exclamation Point
34	0 0 1 0 0 0 1 0	042	22	"	Double Quote
35	0 0 1 0 0 0 1 1	043	23	#	Number or Pound
36	0 0 1 0 0 1 0 0	044	24	$	Dollar
37	0 0 1 0 0 1 0 1	045	25	%	Percent
38	0 0 1 0 0 1 1 0	046	26	&	Ampersand
39	0 0 1 0 0 1 1 1	047	27	'	Apostrophe
40	0 0 1 0 1 0 0 0	050	28	(	Left Parenthesis
41	0 0 1 0 1 0 0 1	051	29	)	Right Parenthesis
42	0 0 1 0 1 0 1 0	052	2A	*	Asterisk
43	0 0 1 0 1 0 1 1	053	2B	+	Plus or Addition

GTCO CalComp
by TURNING technologies

Decimal	Binary 7 6 5 4 3 2 1 0	Octal	Hex	ASCII Character	Control Function or Character Description
44	0 0 1 0 1 1 0 0	054	2C	,	Comma
45	0 0 1 0 1 1 0 1	055	2D	-	Hyphen
46	0 0 1 0 1 1 1 0	056	2E	.	Period
47	0 0 1 0 1 1 1 1	057	2F	/	Slash
48	0 0 1 1 0 0 0 0	060	30	0	
49	0 0 1 1 0 0 0 1	061	31	1	
50	0 0 1 1 0 0 1 0	062	32	2	
51	0 0 1 1 0 0 1 1	063	33	3	
52	0 0 1 1 0 1 0 0	064	34	4	
53	0 0 1 1 0 1 0 1	065	35	5	
54	0 0 1 1 0 1 1 0	066	36	6	
55	0 0 1 1 0 1 1 1	067	37	7	
56	0 0 1 1 1 0 0 0	070	38	8	
57	0 0 1 1 1 0 0 1	071	39	9	
58	0 0 1 1 1 0 1 0	072	3A	:	Colon
59	0 0 1 1 1 0 1 1	073	3B	;	Semicolon
60	0 0 1 1 1 1 0 0	074	3C	<	Less Than
61	0 0 1 1 1 1 0 1	075	3D	=	Equals
62	0 0 1 1 1 1 1 0	076	3E	>	Greater Than
63	0 0 1 1 1 1 1 1	077	3F	?	Question Mark
64	0 1 0 0 0 0 0 0	100	40	@	Commercial At
65	0 1 0 0 0 0 0 1	101	41	A	
66	0 1 0 0 0 0 1 0	102	42	B	
67	0 1 0 0 0 0 1 1	103	43	C	
68	0 1 0 0 0 1 0 0	104	44	D	
69	0 1 0 0 0 1 0 1	105	45	E	
70	0 1 0 0 0 1 1 0	106	46	F	
71	0 1 0 0 0 1 1 1	107	47	G	
72	0 1 0 0 1 0 0 0	110	48	H	
73	0 1 0 0 1 0 0 1	111	49	I	
74	0 1 0 0 1 0 1 0	112	4A	J	
75	0 1 0 0 1 0 1 1	113	4B	K	
76	0 1 0 0 1 1 0 0	114	4C	L	
77	0 1 0 0 1 1 0 1	115	4D	M	
78	0 1 0 0 1 1 1 0	116	4E	N	
79	0 1 0 0 1 1 1 1	117	4F	O	
80	0 1 0 1 0 0 0 0	120	50	P	
81	0 1 0 1 0 0 0 1	121	51	Q	
82	0 1 0 1 0 0 1 0	122	52	R	
83	0 1 0 1 0 0 1 1	123	53	S	
84	0 1 0 1 0 1 0 0	124	54	T	
85	0 1 0 1 0 1 0 1	125	55	U	
86	0 1 0 1 0 1 1 0	126	56	V	
87	0 1 0 1 0 1 1 1	127	57	W	
88	0 1 0 1 1 0 0 0	130	58	X	
89	0 1 0 1 1 0 0 1	131	59	Y	

Decimal	Binary 7 6 5 4 3 2 1 0	Octal	Hex	ASCII Character	Control Function or Character Description
90	0 1 0 1 1 0 1 0	132	5A	Z	
91	0 1 0 1 1 0 1 1	133	5B	[	Left Square Bracket
92	0 1 0 1 1 1 0 0	134	5C	\	Back Slash
93	0 1 0 1 1 1 0 1	135	5D	]	Right Square Bracket
94	0 1 0 1 1 1 1 0	136	5E	^	Circumflex
95	0 1 0 1 1 1 1 1	137	5F	_	Underscore
96	0 1 1 0 0 0 0 0	140	60	`	Left Single Quote
97	0 1 1 0 0 0 0 1	141	61	a	
98	0 1 1 0 0 0 1 0	142	62	b	
99	0 1 1 0 0 0 1 1	143	63	c	
100	0 1 1 0 0 1 0 0	144	64	d	
101	0 1 1 0 0 1 0 1	145	65	e	
102	0 1 1 0 0 1 1 0	146	66	f	
103	0 1 1 0 0 1 1 1	147	67	g	
104	0 1 1 0 1 0 0 0	150	68	h	
105	0 1 1 0 1 0 0 1	151	69	i	
106	0 1 1 0 1 0 1 0	152	6A	j	
107	0 1 1 0 1 0 1 1	153	6B	k	
108	0 1 1 0 1 1 0 0	154	6C	l	
109	0 1 1 0 1 1 0 1	155	6D	m	
110	0 1 1 0 1 1 1 0	156	6E	n	
111	0 1 1 0 1 1 1 1	157	6F	o	
112	0 1 1 1 0 0 0 0	160	70	p	
113	0 1 1 1 0 0 0 1	161	71	q	
114	0 1 1 1 0 0 1 0	162	72	r	
115	0 1 1 1 0 0 1 1	163	73	s	
116	0 1 1 1 0 1 0 0	164	74	t	
117	0 1 1 1 0 1 0 1	165	75	u	
118	0 1 1 1 0 1 1 0	166	76	v	
119	0 1 1 1 0 1 1 1	167	77	w	
120	0 1 1 1 1 0 0 0	170	78	x	
121	0 1 1 1 1 0 0 1	171	79	y	
122	0 1 1 1 1 0 1 0	172	7A	z	
123	0 1 1 1 1 0 1 1	173	7B	{	Left Curved Bracket
124	0 1 1 1 1 1 0 0	174	7C	|	Vertical Line
125	0 1 1 1 1 1 0 1	175	7D	}	Right Curved Bracket
126	0 1 1 1 1 1 1 0	176	7E	~	Tilde
127	0 1 1 1 1 1 1 1	177	7F	DEL	Delete (rubout)

Corporate Headquarters
14557 N. 82nd Street
Scottsdale, Arizona 85260
Tel: 1-866-746-3015
Support: 1-866-746-3015
Fax: 480-998-1751

www.gtcocalcomp.com

Support: 1.866.746.3015

CR™ 1212

Copyright© 2015 GTCO CalComp by Turning Technologies, Inc.
CR 1212 is a trademark of GTCO CalComp by Turning Technologies, Inc.
All other products and company names are the trademarks or registered trademarks of their respective owners.

The information contained in this document is subject to change without notice. GTCO CalComp by Turning Technologies assumes no responsibility for technical, or editorial errors, or omissions that may appear in this document, or for the use of this material. Nor does GTCO CalComp by Turning Technologies make any commitment to update the information contained in this document. This document contains proprietary information which is protected by copyright. All rights reserved. No part of this document can be photocopied or reproduced in any form without the prior, written consent of GTCO CalComp by Turning Technologies, Inc.