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Section 1
General description

1.1 Features

The GTC provides a complete operator interface in a compact, easy to integrate module.

The Module Integrates:

- Graphic display
- Transparent touch screen
- Interface electronics
- LCD controller/drivers
- Power supply voltage converters (only +5V power required) - option for 9-26 VDC input
- Serial communication circuit (RS-232C)
- Touch screen control electronics
- Flash memory backup for graphic screens (will store over 500 screens)
- Custom programmed microprocessors
- Software Features
- Powerful programmed microprocessor makes generating screens quick and easy
- Large command instruction set for text and graphics provided
- Complete touch button software for easy button control
- Exclusive software allows generation of graphic screens by PC paintbrush software
- (windows or DOS) in minutes
- Software adjustment of LCD contrast
- Software to program screens into on board flash memory
- Communication software allows painless interfacing to host computer

Features:

- Graphic display
- Transparent touch screen is highly durable and reliable (more than 1 million contacts)
- Compact size
- Back lighting utilizes a CFL lamp or LED for long life and exceptional bright and uniform lighting
- Single +5v power supply operation - option for 9-26 VDC input
- Communicates serially (RS-232C)
- Draw custom graphics screens easily
- Button generation, placement, and reporting done automatically
- Exclusive software allows creation of graphic screens by PC paintbrush software (Windows or DOS)
- On board flash memory stores over 500 screens
- Advanced software image compression for fast graphic screen draws
- Allows "piggyback" mounting and compatibility with PC-104 modules

The following is a brief description on the various types of operator panels we now offer:
We also offer the operator panels with or with out touch screen if no touch screen is used each unit has a 12 x 12 built in hardware/software matrix input which can be utilized for custom keypads.

Pixels	Overall Dimensions (W x H x L) Note: All dimensions in inches	Viewing Area (W x H)	Backlight	Features	Maximum number of touch screen buttons	Power requirements	Part number
128 x 64	3.66 x 2.76 x0 .75	2.83x1.57	LED	Transreflective, readable in direct sunlight	12	5 VDC 600 ma@5VDC	GTC100
256 x 128	7.63 x 3.75 x 2.25	5.02x2.68	CCFL cold cathode fluorescent	Transmissive, very bright, crisp	64	5 VDC 1200 ma@5VDC or 9-32 VDC	GTC200
320 x 240	6.60 x 4.30 x 1.75	4.76x3.58	CCFL cold cathode fluorescent	Transmissive, very bright, crisp	64	5 VDC 1200 ma@5VDC or 9-32 VDC	GTC300
320 x 240	6.40 x 4.70 x 2.00	4.06x3.11	LED	Transreflective, readable in direct sunlight	64	5 VDC 1200 ma@5VDC or 9-32 VDC	GTC301
640 x 200	10.20 x 4.00 x 1.75	8.58x2.91	CCFL cold cathode fluorescent	Transmissive, very bright, crisp	96	5 VDC 1200 ma@5VDC or 9-32 VDC	GTC600

Part numbering System

GTC100 128x64LED
GTC200 256x128CCF
GTC300 320x240CCF
GTC301 320x240LED
GTC600 640x200CCF
add **T** for Touch screen add **B** for bezel add **V** for additional 9-32VDC input (also does only 5 VDC input)

For example **GTC300TBV** This would specify a 320x240CCF Display with touch screen, bezel, and 9-32VDC (and 5 VDC) input

Additional 4 meg. Flash IC's are available for purchase

Development Kit (add **D**) available for every product
Includes: PC interface serial cable, software library, software demonstration program, and user manual.

Control board only option
We also offer a “off the shelf” graphic controller board which is capable of running any monochrome display up to 640 x 200 pixels and also has a 12 x 12 matrix input for custom keypads and comes with all our great firmware and software. This allows the user to immediately utilize any graphic display they choose. Controller board can be easily designed into custom products.
Graphic controller board Part number **GTCM1** (GTC motherboard, model 1)

We also do custom designs for display control boards along with LCD interfaces and control system software. Our extensive experience with various embedded controllers IC’s and LCD controller IC’s and immense hardware/software library allows a design project that could take years and cost well over a $100,000.00 plus reduced to a few weeks and a small design charge in many cases. We supply customers with geber and source code files and/or do the complete manufacturing of product.

1.2 Mechanical Description

Pixels	**Overall Dimensions (W x H x L)** Note: All dimensions in inches	**Viewing Area (W x H)**	**Maximum number of touch screen buttons**	**Part number**
128 x 64	3.66 x 2.76 x0 .75	2.83x1.57	12	GTC100
256 x 128	7.63 x 3.75 x 2.25	5.02x2.68	64	GTC200
320 x 240	6.60 x 4.30 x 1.75	4.76x3.58	64	GTC300
320 x 240	6.40 x 4.70 x 2.00	4.06x3.11	64	GTC301
640 x 200	10.20 x 4.00 x 1.75	8.58x2.91	96	GTC600

1.3 Specifications

Hardware

Display: Graphic LCD
Back light: Cold cathode tube, 20,000-30,000 hours use, LED 500,000 + hours
Resolution: Varies per size
Touch screen: Varies per size
Touch screen Durability: 1 million contacts or more
Touch screen Reliability:

Test item	Test condition	Evaluation standard
Storage at high humidity	65 C 90%RH 240 hours	R/Ro < 1.6
Storage at high temp.	80 C 240 hours	R/Ro <1.2
Storage at low temp.	-30 C 240 hours	R/Ro < 1.2
Heat shock	-30 C 1 hr <--> 80 C 1 hr (10 cycles)	R/Ro < 1.2
Anti-static electricity	Discharge the touch screen center and its surrounding 20 times	R/Ro < 1.2 Irregularity of appearance not present
Insulation resistance	DC100V and 100M ohm or more	Pass test with good results
Withstand voltage	DC125V for 1 min. or less	Pass test with good results
Wear resistance	Steel wool 10mm x 300mm 300g 10 times	No visual scratch
Touch screen chemical resistance	5% NaOH 5 hr immersion 28% NH4OH 12 hr immersion 35% HCL .5 hr immersion Toluene 24 hr immersion Acetone 24 hr immersion Methyl ethylketone 24 hr immersion Ethyl acetate 24 hr immersion Butyl acetate 24 hr immersion Ethanol 24 hr immersion	No degradation of touch screen appearance was present

Note: R=Resistance after test, Ro=Initial resistance

Electrical

Power supply voltage 5VDC or 9-32 VDC option +/- 10%
Power supply current 0.6 to 1.2 Amps (depending on model)

Software

Support software: Requires an IBM PC/AT or compatible computer with 1 FDD, 1 HDD, VGA monitor, 640 KRAM minimum

1.4 Host computer description

A wide range of host computers can be used to communicate with the GTC100.
Any device with a serial port for communication should be able to be utilized.
The following list of "computers" have been successfully used with the GTC100:
Desk top PC's with the following processors 8088, 80286, 8086, 80486, and P5.
Embedded computers with the following processors NEC V20, NEC V40, NEC V51,
Chips F8680, 8088, 80286, 80386, 80486, P5.
Programmable logic controllers (PLC's) have been successfully utilized (some need special serial port cards).
Microprocessor's with a serial port have also been successfully utilize such as Intel 8051, Motorola 6811, Z80, etc.

We recommend using a embedded standard (IEEE-P996) known as PC/104.
PC/104 is a industrial class compact (3.6" x 3.8") assortment of computers and expansion functions which have full architecture, hardware and software compatibility with standard DOS PC's (you can program in C or basic). The bus uses reliable pin and socket connectors in a unique self stacking card system. Expansion function cards can be easily added and secured to module. There are over a hundred companies manufacturing PC/104 cards and related products, the following is a very brief list of some of the PC/104 products: 8088 through 80486 CPU's, digital I/O, analog I/O, motor controllers, relay I/O, SSD memory, etc. For more information on PC/104 standard and products contact the PC/104 consortium at :

PC/104 Consortium
809 Cuesta Drive B-175
Mountain View, CA 94040
Phone (415) 903-8304
FAX (415) 967-0995

The GTC100 makes it very easy to use PC/104 cards, they can be easily "piggybacked" on back of control board. The control board has an expansion PC/104 bus connector and standoffs that secures and delivers power (+5VDC) and ground to the PC/104 bus stack card system. Communication is done through standard serial port.

1.5 GTC100 USERS

This manual is used for our complete line of displays, the only slight variation is for the GTC100.

Please note that their are only three software commands that are not used for the GTC100, dd, dl, and dt.

dd and dl are contrast adjustment commands which are not utilized on the GTC100 (the GTC100 has a pot on the motherboard for contrast adjustment).

And dt (display type does not have to be defined).

Section 2
Installation

2.1 Installation site

When possible keep the following factors into consideration when mounting

- Leave sufficient ventilation space
- Do not install directly above machinery that radiates a lot of heat (heaters, transformers, high capacity resistors, etc.)
- Leave at least 8" distance from electric power lines and even more from high voltage devices.
- When installing near devices with strong electrical or magnetic fields (such as solenoids), allow a least 3" distance, more if necessary.

The GTC100 has strong environmental resistance and high reliability, but you can maximize system reliability by observing and trying to avoid the following conditions existing at installation site:

- Abrupt temperature changes and condensation
- Ambient temperatures exceeding a range of 30 F to 115 F (-1 C to 46 C)
- Relative humidity exceeding a range of 40% to 85%
- Strong magnetism or high voltage
- Corrosive gasses
- Direct vibration or shock
- Excessive iron dust or salt
- Spray from harsh chemicals

2.2 Mounting position

The GTC employs a LCD display, so the angle of vision should be considered when mounting. Install the GTC at a height and direction that make it easy for the operator to see.

2.3 Mounting

There are two basic ways to install a GTC:
1- Machine an opening into your mounting panel (in accordance with recommended dimensions) and mount the GTC directly onto mounting panel.
2- Cut a hole in your panel (in accordance with recommended dimensions) and use our bezel face plate to mount the GTC.

2.4 Mounting assembly procedure
(Note: This is for typical generic assembly, exact size set screws, nuts, and standoffs will vary, please consult particles for your model).

Direct panel mount:
1) Machine opening in control panel in accordance with recommended dimensions.
2) Screw four 6-32 set screws (about 1/2" long) onto control panel.
3) Attach supplied gasket by peeling off paper and applying adhesive side to control panel.
4) Fasten the four supplied hex spacers (6-32 male/female) with female spacer end being screwed on to set screws.
5) Carefully Attach LCD/control board by placing LCD "ears" onto the male hex spacer end attached to control panel and fastening the four hex spacers (6-32 female/female) above the "ears". Be careful not to tighten severely as damage to LCD could result. After making sure that the LCD and control board pins are correctly in place and touch screen membrane tail is in correct placement secure control board onto LCD by fastening four 6-32 screws.

Bezel panel mount:
1) Machine cut out in control panel in accordance with recommended dimensions.
2) Carefully "drop" in GTC100 with bezel and gasket attached.
3) Fasten unit with the supplied four 8-32 hex nuts.

Warning ! The GTC is composed of many IC's which are static sensitive. Use extra caution in handling units in high static areas!

2.5 Power requirements

Power requirement is 5 VDC or 9-26 VDC +/- 10%
Power supply current requirement is 0.6 to1.2 amps at 5VDC (depending on model)

We recommend for power supply a Cosel (model number K10AU-5-N) sold by Allied Electronics phone (800)433-5700 allied part number 800-5000 this is a 5VDC 2amp switcher and has been tested with GTC product line and approved by our engineering department.

Warning! Never apply voltages in excess of 5.75 VDC to the 5 VDC terminal block input as this will severely damage unit!
Warning! Be careful not to inverse the positive and negative terminals as this could severely damage unit!

2.6 Wiring guidelines

The following are some general guidelines when wiring the GTC:

- Use a power supply within the allowable voltage and current range.
- If you anticipate high noise levels, use noise prevention measures at power supply.
- Avoid running wiring to close proximity of high voltage/current or solenoids.
- If power lines are long, use appropriate wire size (16 gage) to avoid a drop in voltage.

Section 3
Memory devices hardware description

3.1 Flash memory usage

The GTC uses 512K x 8 (4M) flash memory for screen and script storage.
The location on the motherboard PCB is socket U3, U4, U5, and U6.
The standard unit is supplied with one flash memory device (should be enough to hold approximately 100 to 400 screens, depending on model). This flash memory device also includes our firmware and always resides in socket U6. If more memory is needed additional flash memory can be added as required. This can be done at customer's location and involves simply inserting a 32 pin dip into a socket. Three more additional flash memory devices can be used. The GTC software tool BMP2BIN (program that creates Digital.bin file from BMP and Scripts files) will tell user the size of Digital.bin (file to be down loaded into flash memory) and number of flash memory devices required along with their required socket location. This Digital.bin file then can be simply loaded into flash memory through the serial port by using the command MS (memory store) in the supplied terminal program (DTERM).

3.2 Memory devices and associated hardware part numbers and sources

Flash memory: Standard JEDEC 32 pin, Typical 512K x 8 (4M)
Part number AMD AM29F040B-120PC

Vendors Avnet, Arrow, FAI

3.3 Software updates

To improve our products we offer free software updates when a new version exists that incorporates new improvements and fixes. Please check on our tech department web site to find out the latest software version available. To update the GTC all you will need to do is exchange the flash memory in socket U6 with a new software version firmware programmed flash memory part. The fastest way to incorporate a software update is to download the new firmware file (by our web site) and program the new firmware software version into the 4M flash (AND AM29F040) which resides in socket U6. This can be easily accomplished by any number of EPROM/Flash programmers currently on the market.
To receive new software version firmware files/manual please check our web site at:
www.designtechengineering.com/tech.html
this will have the latest versions and is available for user download.
If you do not have a programmer or are unfamiliar with programming eproms/flash we will also program them at our facility. Please check with our tech department for details.

Section 4
Communication description

4.1 RS232 serial interface

Communication with the GTC is implemented through a RS232 interface with a simple program language we developed called DTGL (Designtech graphic language). Command and data are given as simple ASCII strings.
As an example to draw a single pixel command would be the ASCII string
GP "space" 50 "space" 100 "enter" (draws a single pixel at location 50,100).

4.2 Baud rate description

Baud rate can be selected by the system baud rate command from 600 to 57,600 the default is 9600. If you plan to download full screens on the "fly" (instead of loading them into the GTC100 memory) and set a higher baud rate then 9600 you will need to connect the CTS (handshaking) line.

Section 5
Software description

5.1 Instruction summary list

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Cursor Positioning
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Text erase
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Text on
Text off

5.2 Instruction and argument table

Instruction	Code	Argument
Button Control		
Buttons on	ba	
Buttons off	bb	
Button delete	bd	B
Button delete all	be	
Button jump to script	bj	Name C1 R1 [C2 R2]
Button place	bp	B C1 R1 [C2 R2]
Cursor Positioning		
Cursor set attributes	ca	A
Cursor down	cd	
Cursor go to saved position	cg	
Cursor left	cl	
Cursor right	cr	
Cursor set XY	cs	XC YC
Cursor up	cu	
Cursor save current position	cz	
Display Control		
Display back light on	da	
Display back light off	db	
Display color	dc	Ink backgrnd
Display contrast darker	dd	
Display contrast lighter	dl	
Display clear initialize	di	
Display reverse	dr	
Graphic Control		
Graphics on	ga	
Graphics off	gb	
Graphics erase	ge	
Draw filled rectangle	gf	X1 Y1 X2 Y2
Draw vector line	gl	X1 Y1 X2 Y2
Draw pixel	gp	X Y
Draw rectangle	gr	T X1 Y1 X2 Y2
Memory Control		
Memory store	ms	DIGITAL.BIN
Memory scripts display	md	Name
BMP File Control		
display image from memory BMP	pd	X Y Name
display serially image BMP	ps	X Y Name
Serial Interface Instructions		
Baud set rate	sb	Rate
System Instructions		
Display type	dt	Type
Help instruction list	he	[instruction]
System config	sc	Num! Num~ Num*
System delay	sd	Delay
System feed back	sf	
System no feed back (off)	sn	
Serial out	so	“Text string”
System software version number	sv	
Text Display		
Text on	ta	
Text off	tb	
Text display at cursor	tc	"Text string" [Font]
Text display at XY	td	XC YC "Text string" [Font]
Text erase	te	
Text erase line	tl	
Text erase to end of line	tz	

Note: [ ] = argument is optional

5.3 Argument definition table

Argument	Value	Definition
A		Cursor attribute
“ “	on	Cursor on
" "	off	Cursor off
" "	block	Cursor block on
" "	line	Cursor underline on
B	0 to Z	Button number
CR	CR	Carriage return
Delay	0 to 9999	Delay by 0.1 seconds
DIGITAL.BIN		DIGITAL.BIN
Ink	0 or 15	Ink color: 0 = black or 15 = white
Backgnd	0 or 15	Background color: 0 = black or 15 = white
FONT		
" "		6x8 regular font
" "	6x8	6x8 condensed pixel font
" "	12x16	12x16 pixel large font
" "	24x32	24x32 pixel large font
" "	46x64	48x64 pixel large font
Font.set	Font.set	Font set to be uploaded
Name	Name	Name of SCP file
Rate		Baud rate
" "	600	600 baud
" "	1200	1200 baud
" "	2400	2400 baud
" "	4800	4800 baud
" "	9600	9600 baud
" "	14400	14400 baud
" "	19200	19200 baud
" "	57600	57600 baud
T	0 to 99	Thickness in pixels
Type	LCD type	
" "	256128cst	256x128 CCF display
" "	320240cst	320x240 CCF display
" "	320240lst	320x240 LED display
" "	640200cst	640x200 CCF display
Num!	0 to 255	ASCII equivalent button release return
Num~	0 to 255	ASCII equivalent system feedback return
Num*	0 to 255	ASCII equivalent invalid command return
"Text string"		Text string
X	0 to 639	X coordinate position
Y	0 to 199	Y coordinate position
X1	0 to 639	X1 coordinate position
Y1	0 to 199	Y1 coordinate position
X2	0 to 639	X2 coordinate position
Y2	0 to 199	Y2 coordinate position
XC	1 to 80	X character coordinate
YC	1 to 25	Y character coordinate

5.4 Instruction definitions

Button Control

Buttons on
Code: ba
Description: This instruction turns on the button instructions

Buttons off
Code: bb
Description: This instruction turns off the button instructions, when touch screen is pressed after button off instruction it will read touch screen as a simple 12 X 12, X Y matrix.

Button delete
Code: bd B
Description: This instruction deletes a specified button number B activated on current screen.

Button delete all
Code: be
Description: This instruction deletes all buttons activated on current screen.

Button jump to script
Code: bj Name C1 R1 [C2 R2]
Description: This instruction executes all the software instructions in the corresponding numbered script file [NAME] which has been specifed in the bj command at the specified location C1 R1 [C2 R2] (column and row) when touched. Button place instruction will calculate the activation area of button from specified coordinates if C2 and R2 are specified.

Button place
Code: bp B C1 R1 [C2 R2]
Description: This instructions places a button at specified number B at the specified location. C1 R1 [C2 R2] (column and row). Button place instruction will calculate the activation area of button from specified coordinates if C2 and R2 are specified. B can be any number or letter (upper and lowercase) for example 3 , <, Z, and b are valid button numbers.

Cursor Positioning

Cursor set attributes
Code: ca A
Description: This instruction selects the cursor attributes (off, block on, block flash on, under line on, under line flash on).

Cursor down
Code: cd
Description: This instruction moves the cursor down by one character value.

Cursor go to saved position
Code: cg
Description: This instruction moves the cursor to the previous cursor saved position.

Cursor left
Code: cl
Description: This instruction moves the cursor left by one character value.

Cursor right
Code: cr
Description: This instruction moves the cursor right by one character value.

Cursor set XY
Code: cs XC YC
Description: This instruction sets the position of the cursor at specified position XC YC, the coordinate system is character spaces, up to 80 horizontally and 25 vertically depending on display and font size. 0 0 is specified as the top left corner of the display.

Cursor up
Code: cu
Description: This instruction moves the cursor up by one character value.

Cursor save current position
Code: cz
Description: This instruction saves the current cursor position.

Display Control

Display back light on
Code: da
Description: This instruction turns on the back light on the LCD display.

Display back light off
Code: db
Description: This instruction turns off the back light on the LCD display.

Display color
Code: dc Ink Backgnd
Description: This instruction sets the color for the graphic and text display commands.
0 = black and 15 = white.
For example DC 15 0 would draw white ink on a black background.

Display contrast darker
Code: dd
Description: This instruction darkens the contrast of the LCD display by a small amount.

Display contrast lighter
Code: dl
Description: This instruction lightens the contrast of the LCD display by a small amount.

Display initialize clear
Code: di
Description: This instruction clears the entire display of text and graphics.

Display reverse
Code: dr
Description: This instruction reverses color on the entire display of text and graphics

Graphic Control

Graphics on
Code: ga
Description: This instruction turns on the screen to show graphics.

Graphics off
Code: gb
Description: This instruction turns off the screen to show graphics.

Graphics erase
Code: ge
Description: This instruction erases all graphics drawn on screen.

Draw filled rectangle
Code: gf X1 Y1 X2 Y2
Description: This instruction draws a filled rectangle from specified coordinates X1 Y1 X2 Y2

Draw vector line
Code: gl X1 Y1 X2 Y2
Description: This instruction draws a vector line at the specified coordinates X1 Y1 to specified coordinates X2 Y2.

Draw pixel
Code: gp X Y
Description: This instruction draws a single pixel at the specified coordinates X Y.

Draw rectangle
Code: gr T X1 Y1 X2 Y2
Description: This instruction draws a rectangle from specified coordinates X1 Y1 X2 Y2 and T pixels thick. The thickness extends inside the box coordinate.

Memory Control

Memory store
Code: ms
Description: This instruction allows the binary file (DIGITAL.BIN) created from BMP2BIN.EXE to be downloaded to a flash memory on board the GTC (in socket U3-U6 (depending on size). The procedure to down load is to connect the GTC to a com port on your PC , use a terminal program (we supply DTERM for this) to establish communication between your PC and the GTC then type MS carriage return from your terminal, then up-load Digital.bin (follow instructions in DTERM)

Memory scripts display
Code: md NAME
Description: This instruction executes all the software instructions in the corresponding numbered script file [NAME] which has been loaded into memory on board the GTC.

BMP File Control

Display image from memory BMP
Code: pd X Y Name
Description: This instruction draws the corresponding named BMP file at the specified coordinates X Y which has been loaded into memory on board the GTC100. Note that coordinates X Y is the top left corner of where the image is to be displayed. For example the command md 0 0 1(enter) will display 1.bmp starting at pixel location 0,0.

Display serially transmitted image BMP
Code: ps X Y Name
Description: This instruction serially transmits and draws a BMP file at the specified coordinates X Y. Note that coordinates X Y is the top left corner of where the image is to be displayed. For example to use this command type ps 0 0(enter), then hit upload in serial program dterm, then type 1.bmp(enter), (this then should start uploading image and will take from 2 to 10 seconds to upload image), when uploading is done it will display 1.bmp starting at pixel location 0,0.

Serial Interface Instructions

Baud rate set
Code: sb Rate
Description: This instruction sets the baud rate at specified rate , the default is 9600 baud. Note that when transmitting full screen BMP files serially and a garbled image results a higher baud rate is recommended and CTS must be connected.

System Instructions

Display type
Code: dt Type
Description: This instruction sets the GTC for specific LCD size and manufacturer types. This command needs to always be the first command the GTC executes for correct operation. We always recommend placing this command in a O.SCP file in the GTC. The following is a brief description of displays supported, check with our tech support department for additional ones if needed.

Types

256128cst → 256x128 CCF display
320240cst → 320x240 CCF display
320240lst → 320x240 LED display
640200cst → 640x200 CCF display

Help
Code: he [instruction]
Description: This instruction pulls up a list of all the supported instructions and arguments. For a more specific instruction type in he instruction for example he gp (will give gp instruction).

System configuration
Code: sc num num num
Description: This instruction allows the user to define the three items which get returned to your host computer or terminal. The three items are button return, system feedback, invalid command. Currently the unit defaults up to ! for a button return, ~ for system feedback, * for a invalid command. To change insert a ASCII control code number (0 to 255) in place of num, For example sc 13 65 66 would give a carriage return for button return, A for system feedback, B for invalid command.

System delay
Code: sd Delay
Description: This instruction causes a delay of specified amount delay between the execution of instructions where this instruction is placed, this instruction is useful in prolonging a drawn graphics routine on screen. Delays by the amount of 0.1 seconds.

System Feedback
Code: sf
Description: This instruction causes the GTC to send out a “~” when ever the on board processors receive an incoming instruction and are finished implementing such. It can be useful in situations where the CTS (hardware handshaking) is not being used. For example if you have the GTC draw a full screen image from memory then immediately start sending it more instructions the processors could still be busy (drawing the screen image), and because there is no hardware handshaking (CTS) it would have no way of knowing that more instructions have been sent and would ignore or receive an incomplete next instruction. To avoid this you could use this feedback command and have your host computer look for an incoming “~” before it sends the next instruction to the GTC. You could also use a small time delay instead, or could avoid this all together by utilizing the CTS hardware handshaking.

System no feedback
Code: sn
Description: This instruction turns off the system feedback instructions.

Serial out
Code: so “text”
Description: This instruction causes text to be out put through the serial port.
You can also output any ASCII contol code such as carriage return, line feed, null, beep, etc.
To output a ASCII control code use “\control code number (0 to 255) space “
For example to output a carriage return use backslash 13 space within the quotes.
The following GTC command so “123\13 “ would output a 123 carriage return

System software version
Code: sv
Description: This instruction displays the current software version number.

Text Display

Text on
Code: ta
Description: This instruction allows text to be displayed on screen.

Text off
Code: tb
Description: This instruction inhibits text from being displayed on screen.

Text display at cursor
Code: tc “text” [Font]
Description: This instruction displays text specified by "Text String" at the current position of the cursor. Font specifies the font size, such as 6x8, 12x16, 24x32, 48x64 for example 24x32 refers to a 24 pixel by 32 pixel character. When a font size other then 8x8 is specified this uses a special font which was created by graphics and resides in the GTC firmware, when this is used graphic commands such as ge (graphic erase), ga (graphic on), and gb (graphics off) will work with these special fonts. Note if no Font is specified this defaults to a 8x8 pixel text size standard character font which uses the standard text commands such as te (text erase), ta (text on), and tb (text off).

Text display at XY
Code: td XC YC “Text” [Font]
Description: This instruction displays text specified by "Text String" at specified position XC YC , the coordinate system is character spaces, up to 80 horizontally and 25 vertically depending on display and font size. 0 0 is specified as the top left corner of the display.
Font specifies the font size, such as 6x8, 12x16, 24x32, 48x64 for example 24x32 refers to a 24 pixel by 32 pixel character. When a font size other then 8x8 is specified this uses a special font which was created by graphics and resides in the GTC firmware, when this is used graphic commands such as ge (graphic erase), ga (graphic on), and gb (graphics off) will work with these special fonts. Note if no Font is specified this defaults to a 8x8 pixel text size standard character font which uses the standard text commands such as te (text erase), ta (text on), and tb (text off).

Text erase
Code: te
Description: This instruction erases all text on the current screen.

Text erase line
Code: tl
Description: This instruction erases all text on the current line.

Text erase to end of line
Code: tz
Description: This instruction erases text to end of line.

5.5 Displaying graphics and text on screens

There are several ways to display graphics on the GTC. Graphics can be either stored into on board flash memory or down loaded on the "fly" or a combination of booth. Most users will want to store as many screens and graphic routines as possible into on board memory and only down load graphics that can not be stored a head of time such as real time graphs or randomly generated messages (remember you can load 1000's of "canned" messages through script files in on board memory). Storing as many screens and graphic routines as possible into on board memory will give the fastest screen draw rates plus it frees up you host computer.

5.6 Memory devices software description

The following section defines various files utilized in converting and storing in the memory device, two file formats are utilized to place into memory device BMP files and SCP (script) files.

5.6.1 Script file definition

Script files are a collection of various instructions and data that can be loaded into memory on board the GTC and executed by a single instruction. These make it very easy to draw "canned" routines in graphics and text. An unlimited number of scripts can be used your only limitation is the amount of available memory. The script files can be created on any standard word processor program (we prefer PC Write, comes with windows) as they are just standard text files with "white space" between every instruction and argument. For obtaining the number of expected arguments for each instruction, see the instruction and argument table. All instructions can be used in script files.
The saved file format is NAME.SCP.

5.6.2 Script file example

The following is an example. This example draws a BMP file 3.BMP at location 0,0 draws Hello World! at location 0,0, and draws a filled rectangle at location 50,50,200,100.
Example: 1.SCP

```
pd 0 0 3
td 0 0 "Hello World!"
gf 50 50 200 100
```

If you wanted your program to execute all the above instructions all you would have to send to the GTC is md 1 (memory display 1.SCP).

5.6.3 BMP file definition

BMP files are graphic images which can be stored into memory and displayed on the GTC. You can create screen images with any graphic software on any PC (we prefer PC Paintbrush, comes with windows) as long as you can save the file as a BMP file. The BMP images can be any size up to the resolution of LCD screen display.
The saved file format is NAME.BMP. For example you might have your first screen located in file 1.BMP and second screen located in file 2.BMP.

5.6.4 Boot up files

The file 0.SCP have special meaning in that these files serve as the boot-up script for the GTC. That is once power is turned on the file 0.SCP starts immediately excecuting.
0.SCP at the very least should contain a DT Type instruction as this sets the software for the correct LCD and manufacturer type. It can also contain display contrast instructions for example if you wanted to bring up the display in a slightly lighter or darker state other then what is stated is firm wear default. And of course a company logo or even a first control panel screen can be utilized.

5.6.5 Converting and storing BMP files and Script files into memory device

A program called "BMP2BIN.EXE", supplied with a GTC development kit, is a special program which converts a series of BMP files and Script files into one binary file, DIGITAL.BIN, that can be downloaded into the flash memory device on the GTC.

A file should be created containing all the NAME.BMP files and NAME.SCP files the user wishes to load into memory, the file should also contain the program BMP2BIN.EXE.
The program should be run in a DOS environment. Note to window users BMP2BIN should be run in a DOS shell (Start>programs>MS DOS Prompt)is OK, just “double clicking” on BMP2BIN from windows will lead to a corrupt file.

To use program type **BMP2BIN.**
The program will search through the working directory and convert each BMP file and Script file that contains the following format:
NAME.BMP and **NAME.SCP** where **NAME** is any description such as 5.BMP, STOP.SCP, JOHN.SCP or 14.SCP.

After the program has successfully converted all of the BMP files and SCP files into the binary file (DIGITAL.BIN), the program will display the size of memory needed in the flash memory device along with amount and location of flash memory devices to be used.

The generated file **DIGITAL.BIN** can then be down loaded by a terminal program (such as our DTERM terminal program, comes with development kit) into the flash memory device(s) on board the GTC motherboard.

5.7 Touch screen report description

5.7.1 Button report

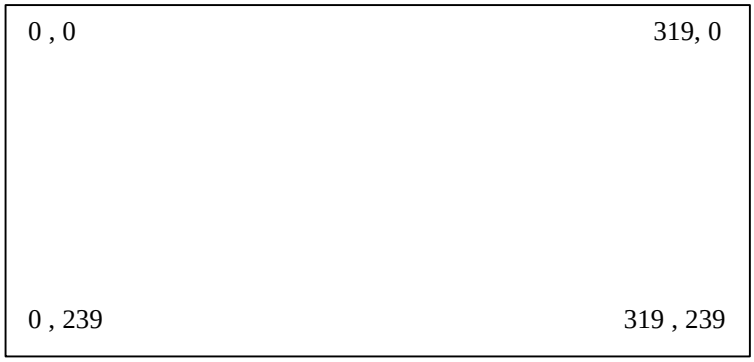
The following is the format for the serial command report after a defined button is placed and touched.
The GTC returns the button name that was used to create a button with the BP instruction. When a defined button is pressed the button name is reported (sent through the serial port), when released the ASCII "!" is reported.
The following is an example:
A button place command has been defined on a current screen with a button defined as "5". When pressed, 5 is reported, when released ! is reported.

5.7.2 X Y Matrix report

The touch screen can also report a touch in the form of a simple matrix. This is the power up default or can be placed in this mode by sending a button off instruction. When in this mode the touch screen sends touch report information in the form of a matrix coordinate report., one character is reported which defines the column and row which was touched. It will send a ! when released. For example if we have a 8 x 8 matrix touch screen and a "37" is reported this means that a location of column 3 row 7 was touched.

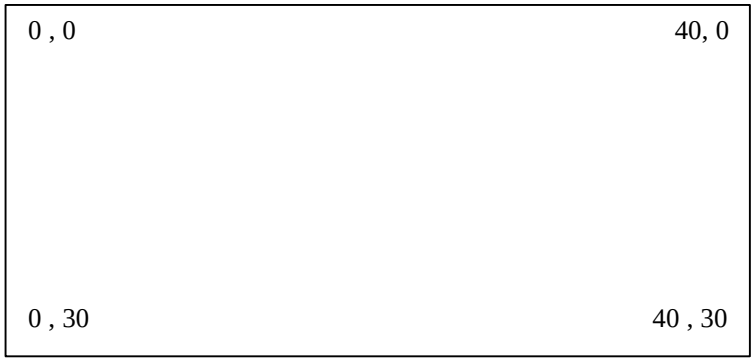
5.8 Coordinate system layout description

Graphic coordinates:



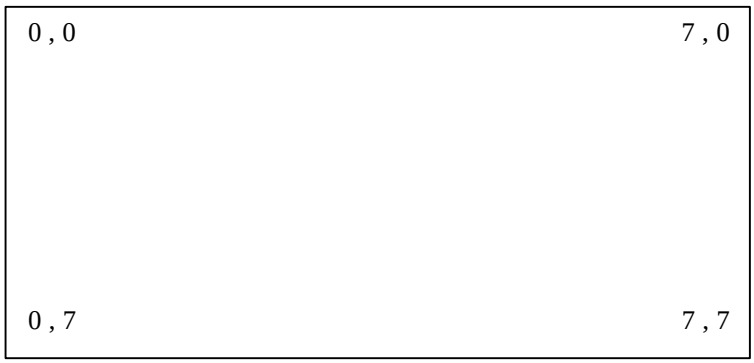
Note: above example is for a 320 X 240 pixel display

Text coordinates:



Note: above example is for a 320 X 240 pixel display utilizing a 8 x 8 font.

Button coordinates



Note: above example is for a 320 x 240 pixel display utilizing a 8 x 8 touch screen matrix

5.9 Serially downloading BMP files

BMP files can be downloaded and displayed serially. The instruction is ps X Y then upload Name.BMP. This is a good method of displaying screens for quick testing, for example at a terminal to see what the actual screen displayed on the LCD looks like. You can also utilize this instruction for downloading and displaying screens from your host computer in a real time application, but the screen draw rate (especially on full screen images) could be to slow to be practical. The optimum screen draw rates will be accomplished by placing BMP images on the control board in a memory device (explained elsewhere in this manual). If you have to down load BMP images on the "fly" in your application the following is recommended to obtain the fastest screen draws possible.

- Set baud rate as high as possible
- Remember to connect CTS line

Section 6
Setups and use of PC Paintbrush and terminal programs

6.1 Using PC Paintbrush (Windows)

Setting up PC Paintbrush (Windows) to create GTC screens:
From Windows (Program Manager),
open Accessories by double clicking on the accessories icon,
open Paintbrush by double clicking on the Paintbrush icon,
from the options menu, click Image Attributes,
set units to pels (pixels), enter size (width and length) of PCX image you wish to create remember maximum image size is LCD display resolution width = 320 and length = 240 (for 320x240 LCD display),
colors should be black and white, click OK.
From the view menu, click Cursor Position, this shows the position of the cursor in pixel location near the top of the right corner. This is very handy especially when you need exact coordinate points such as the two corners when placing a touch screen button.
Use the Paintbrush tools to create your image.
Save file in NAME.BMP format.

6.2 Using DTERM (supplied in development kit)

Setting up Terminal to communicate with the GTC :
DTerm is a simple serial communication program we supply to communicate with the GTC.
Place dterm.exe in a dos file.
From dos window type dterm
This should run the dterm program
Dterm will default to a baud rate of 9600 and serial port com1
Following the instructions from dterm will allow change of serial baud rate and serial com port.
There are also instructions for uploading to the GTC simply follow the directions on the monitor screen. To check communication with the GTC type in a he [carriage return] if you are successfully communicating with the GTC a list of software instructions should appear on your monitor.

7.1 Quick Demo

Be careful on hooking up the 5VDC to the correct input on terminal block as there is also a input for 9 to 26 VDC.
If 9 to 26VDC is connected to the 5VDC input you will damage the motherboard.

We have put a digital.bin file already in memory so all you need to do is give the unit 5VDC and it should immediately boot up with a image.

If you want to talk to the unit hook up a serial line to you computer and run our program DTERM, after this comes up type in HE (enter) this should pull up a list of instructions. Remember that you have to put spaces between every variable in each command. For example if you wanted to pull up a script you would type MD (hit the space bar) 2 (enter key) this should pull up script 2. We also have all software items returning in ASCII characters so you can read this from your terminal.

Quick Demo

1) Connect GTC to any PC Compatible computer (use serial cable provided connect PC computer COM1 to GTC100 - CTS, RXD, TXD, GND).
2) Connect 5 VDC to GTC100 (use a 2 Amp power source).
3) From floppy provided run DTERM.EXE on PC computer.

8.1 Booting up with a bad script/memory

It is possible to corrupt the section of flash which contains the digital.bin file which would not allow the GTC to boot up in a correct state.
Some examples are as follows:
1) Putting a bunch of bad commands or typo errors in 0.SCP file
2) Leaving blank lines at the beginning of x.SCP files
3) Losing power when uploading a digital.bin file with the ms command.
To correct this problem disconnect power to GTC (unit needs to be powered down for a minimal of five seconds) hold your finger to any location on touch screen (if you do not have a touch screen short any two pins on touch screen input connector (be careful this is not located on motherboard .. the board with the 386EX chip on board, it is located on carrier board which is the PCB directly mounted to back of LCD). While keeping your finger pressed on touch screen, power GTC back up again. When the GTC detects a closure on any of the touch screen input pins at power up it will immediately boot up into a “safe mode” and by pass 0.SCP or any corrupted memory locations. At this point you can load a corrected digital.bin back into memory by using the ms (memory store) command.
If all else fails...
Although rare if this fails to correct the problem it is possible that the entire flash memory device (the same part which holds the firmware) could be corrupted. If this is the situation the only remedy would be to re-program the flash memory device (location in socket U6 on motherboard) with a known good file. Any eprom programmer should be able to program the flash device. A good policy is to make and save a copy of the firmware shipped with unit (by reading the flash device). We can also email a copy of latest firmware when requested to do so.

9.1 Warranty information and policy

Warranty

Designtech Engineering warrants the purchaser for a unlimited time period and no question asked policy of free replacement (technician time) of damage parts for a small parts charge (a parts only charge at below our cost). Designtech's obligation under this warranty is limited to replacing or repairing our products, does not include customers productivity loss.

Warranty policy

We have had production quantities of GTC's in multitude of industrial applications for many years with little to no problems and are very confident about our products.
Every GTC goes through a 25 quality checkpoint procedure.
Each GTC is completely burned in for a minimum of 24 hours.
Each GTC has a final check by running a computer program which runs through every function.
We also test all touch area points on the touch screen by hand for every unit.

Being an electronic product with many IC's their are unfortunately some ways in which the user can circumvent all our protection devices designed to avoid a malfunction.
A few examples are as follows: Connecting with 48VDC instead of 5VDC, static shock from improper handling, putting flash memory Eprom IC in backwards, using a out of tolerance power supply, vandalism, blasting unit with +150 deg. C temperatures, excessive vibration and rough handling, etc.

We have found the best solution to a GTC that becomes nonfunctional is to offer a unlimited time period and no question asked policy of free replacement (technician time) of damage parts for a small parts charge (a parts only charge at below our cost). This helps streamline the repair process and gives the customer the confidence of knowing that no matter what happened to the unit (even if it was due to gross abuse) or how long after it was purchased (say 5 years) that they will be able to have it repaired/replaced at a very fair small parts charge.

The GTC breaks down into two major sub assemblies, The front LCD with touch screen (for example our part number GTC300F) and the main control board (for example our part number GTC300M). It is easy and fast to replace either one of these sections. A worst case repair would consist of replacing the main control board with a new one (approx. cost $100). We have not had to replace the front LCD section on many repair units (less then 1 out of a 1,000 of returned nonfunctional units). We do have some protection designed in so the main control board gets zapped before any damage occurs to the LCD front assembly (which is good because this is the more expensive part) but if needed this can also be replaced quickly. We can replace them at our facility at no charge, or could supply the customer with these sub assemblies so a repair can be made immediately or even on site. We do require that a damage assembly is exchanged (returned to our facility) to qualify for special repair pricing cost.