

# Gage-Chek®

## User's Guide





# **Gage-Chek®**

# User's Guide

Metronics, Inc.  
Bedford, New Hampshire, USA



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# Conventions & Terms

System refers to the Gage-Chek and the measuring devices connected to it.

## Icons

This guide uses the following icons to highlight information:

### WARNING



The raised hand icon warns of a situation or condition that can lead to personal injury or death. Do not proceed until the warning is read and thoroughly understood. Warning messages are shown in bold type.

### CAUTION



The exclamation point icon indicates a situation or condition that can lead to equipment malfunction or damage. Do not proceed until the caution message is read and thoroughly understood. Caution messages are shown in bold type.

### NOTE



The note icon indicates additional or supplementary information about an activity or concept. Notes are shown in bold type.

## Safety & Maintenance Considerations

General safety precautions must be followed when operating the system. Failure to observe these precautions could result in damage to the equipment, or injury to personnel.

It is understood that safety rules within individual companies vary. If a conflict exists between the material contained in this guide and the rules of a company using this system, the more stringent rules should take precedence.

Additional safety information is included in [Chapter 2: Unpacking and Installation](#).

## Electrical



Do not allow the power cord to be located such that it can be walked on or create a tripping hazard.

### WARNINGS

**Unplug the Gage-Chek from the electrical outlet before cleaning.**

**The Gage-Chek is equipped with a 3-wire power plug that includes a separate ground connection. Always connect the power plug to a 3-wire grounded outlet. The use of 2-wire power plug adapters or any other connection accessories that remove the third grounded connection create a safety hazard and should not be permitted. If a 3-wire grounded outlet is not available, ask your electrician to provide one.**

## General Maintenance

Unplug the Gage-Chek from the wall outlet and seek the assistance of a qualified service technician if:

- The power cord is frayed or damaged or the power plug is damaged
- Liquid is spilled or splashed onto the enclosure
- The Gage-Chek has been dropped or the exterior has been damaged
- The Gage-Chek exhibits degraded performance or indicates a need for service some other way

## Cleaning

Use only a cloth dampened with water and a mild detergent for cleaning the exterior surfaces. Never use abrasive cleaners, and never use strong detergents or solvents. Only dampen the cloth, do not use a cleaning cloth that is dripping wet.

## Display Resolution in this guide

Display resolutions in this guide are examples only. User display resolutions are likely to vary according to the specific application.

## Accuracy & Precision

Measurement accuracy is determined by many factors, such as the resolution of the encoders or transducers connected to input channels. Generally, the display resolution of the Gage-Chek can exceed encoder or transducer resolutions. Setting the display resolution to exceed the encoder or transducer resolution does not increase measurement accuracy.

## System Configuration & Setup

All system setup and configuration must be performed by an experienced Metronics equipment user.

Any time the Gage-Chek is connected to a new encoder or transducer, it is necessary to perform configuration and setup again.



### **WARNING**

**Electrical shock risk: do not open the Gage-Chek enclosure. There are no user-serviceable components or assemblies inside.**

## **Guide Part Number**

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## **Guide Printing History**

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## **Software Version**

Software Version: 1.12

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# Overview



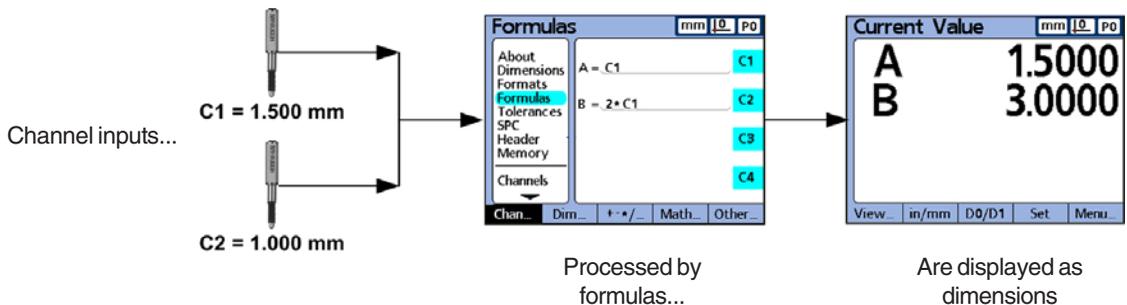
The Gage-Chek is an advanced digital readout system for performing single or multipoint measurements at very high levels of precision and accuracy. Dimensional inspection of components can be made using encoders or transducers as part of in-line production activities or final quality inspection.



Measurements can be conducted completely under operator control, or can be semi-automated and conducted in conjunction with a multipoint fixtured gage system.

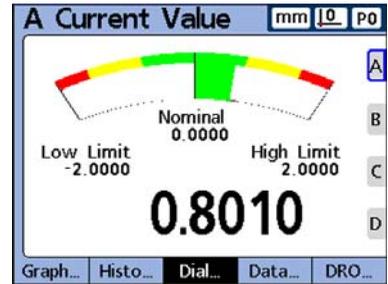
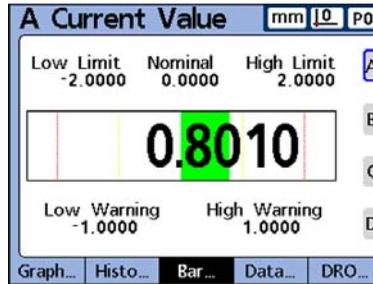


The Gage-Chek supports 1, 4 or 8 input channels that can be algebraically combined or processed by powerful math and control formulas to display dimensions such as flatness, volume and runout. Formulas are created as part of the Gage-Chek setup using straightforward screen control and math functions.

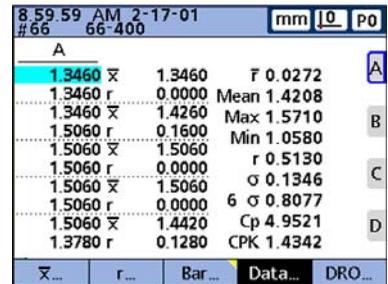
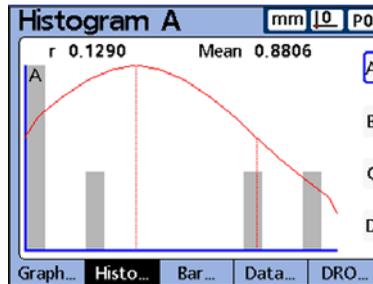
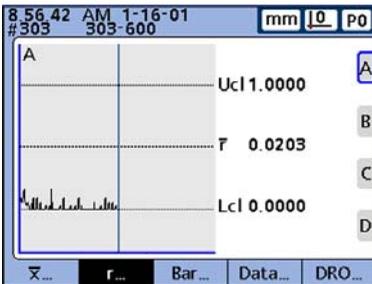


The intuitive user interface will be familiar to users of the QC200 and other Metronics products, and includes a large-character color LCD for fast and accurate measurement feedback.

User interface screens include bar and dial position indicators,



graphs and histograms of measurement statistics and tables of measurement and SPC data.

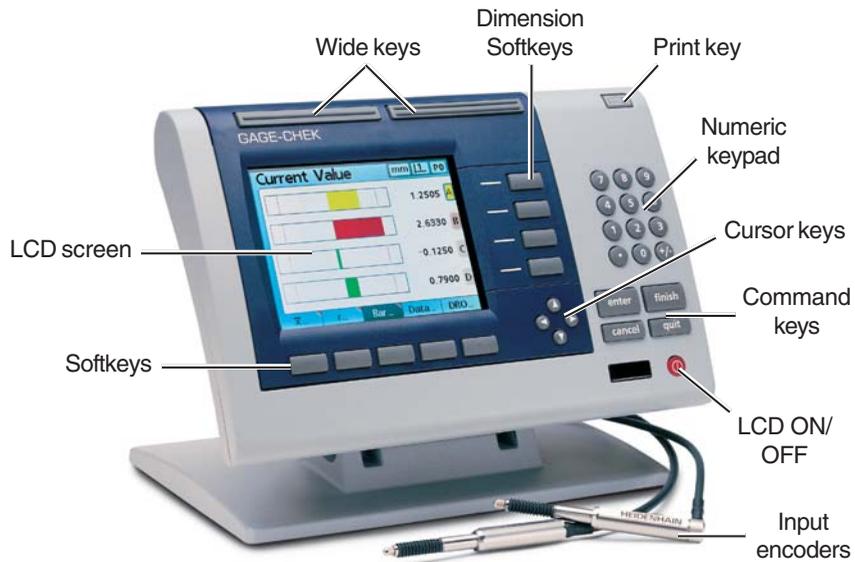


Panel keys are provided for selecting measurement functions, changing display screens, entering numeric data, zeroing or presetting datums, and sending data to a printer or a computer.

Softkeys control functions that change in support of screens selected by the user to control measurements or display measurement results.

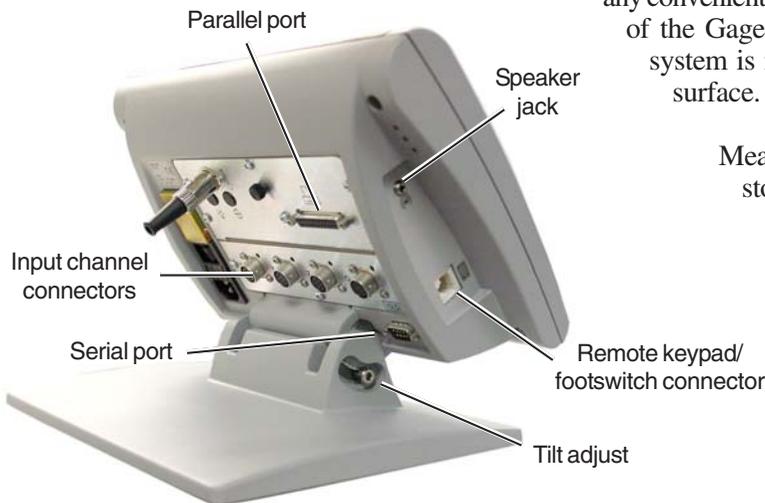
Wide keys located over the LCD can be programmed as hotkeys that initiate frequently used system functions and can quickly be pressed without looking at the front panel. In addition, most keys on the front panel can also be programmed as hotkeys that initiate commonly used functions.

All front panel keys provide tactile sensory feedback, and many key-press operations can be configured to generate an audible sound.



Speaker and external speaker jack outputs can be adjusted for quiet or noisy environments. Earphones can be plugged into the external speaker jack to facilitate silent operation in quiet environments.

The compact ergonomic design and adjustable-tilt front panel of the Gage-Chek allow users to locate and mount the instrument in a wide variety of environments to accommodate nearly any viewing requirement. The tilt front panel can be adjusted and secured in any convenient position. Rubber feet on the bottom of the Gage-Chek prevent slipping when the system is not permanently bolted to a work surface.



Measurements viewed on the LCD and stored data can be transmitted to a PC over the standard RS-232 serial port, or to a printer over parallel or serial ports.

A large selection of input channel connectors support a wide variety of input encoders and transducers.

An optional foot switch and remote keypad are available for control of Gage-Chek functions or data entry when the user is not close to the front panel.



The Gage-Chek is easy to install in a variety of basic and advanced measurement applications. This chapter describes how to unpack, install and test the basic connections to the Gage-Chek.

Repackaging instructions are also included for return shipments and for OEM customers that are configuring a Gage-Chek and shipping it to an end-user.

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## Unpacking the Gage-Chek

Carefully remove the contents of the Gage-Chek shipping carton.



### **NOTE**

**Save the carton and packaging materials for future re-shipment.**

Inspect the components listed below for shipping damage and other abnormalities. The contents of the carton include:

- Gage-Chek instrument
- Relay output connector (attached to the rear of the Gage-Chek)
- Power cord
- Mounting stand
- Mounting hardware (attached to the Gage-Chek)
- Warranty registration card

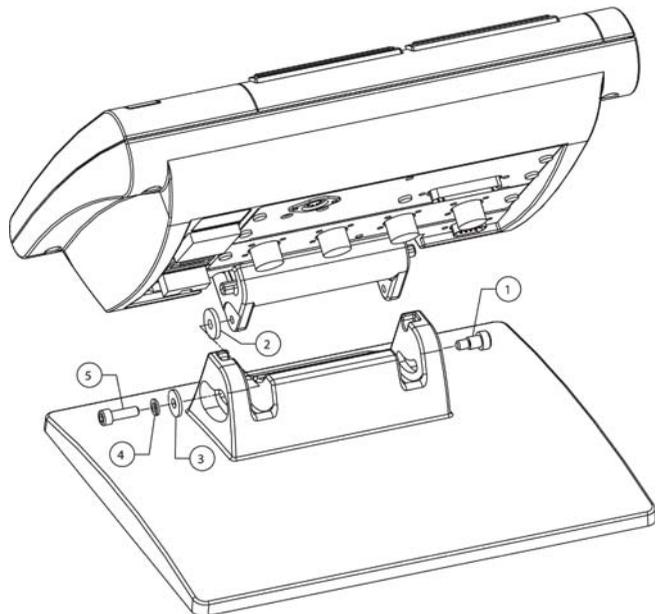
Shipments of optional equipment can include:

- Remote keypad
- RS232 serial cable
- Foot switch (separate carton)

If any components were damaged in shipment, save the packaging materials for inspection and contact your shipping agent for mediation. Contact your Metronics distributor for replacement parts.

## Assembling the mounting stand

The Gage-Chek is secured to the swivel slots of the mounting stand by a shoulder screw, a cap screw and associated washers as shown below.



Assemble the Gage-Chek to the mounting stand as shown. Tighten the shoulder screw (1), and then tighten the cap screw (5) and washers (3 & 4) so that the Gage-Chek can be adjusted to various tilt positions and will be secure in any position.

## Safety considerations

### Power cord and plug

Do not locate the power cord where it can be walked on or will create a tripping hazard. Connect the 3-wire power plug to a 3-wire grounded outlet only. Never connect 2-wire to 3-wire adapters to the power cord or remove the third ground wire to fit the plug to a 2-wire electrical outlet. Modifying or overriding the third-wire ground creates a safety hazard and should not be permitted.



### WARNING

**Always disconnect the power cord from the source of AC power before unplugging it from the Gage-Chek power connector. The AC voltage available at electrical outlets is extremely dangerous and can cause serious injury or death.**

### Electrical wiring and connections

Perform regular inspections of all connections to the Gage-Chek. Keep connections clean and tight. Locate cables away from moving objects. Do not create tripping hazards with power cords, input cables and other electrical wiring.

Use shielded cables to connect to the parallel and serial (RS-232) ports. Make certain that cables are properly terminated and firmly connected on both ends.

### Location and mounting

Mount the Gage-Chek on a stable surface.



### WARNING

**If the Gage-Chek falls from its mounting location, serious injury or damage to the equipment can result.**

### Power surge suppressor

Connect the Gage-Chek to power through a high-quality power surge suppressor. Surge suppressors limit the amplitude of potentially damaging power line transients caused by electrical machinery or lightning.

**CAUTION**

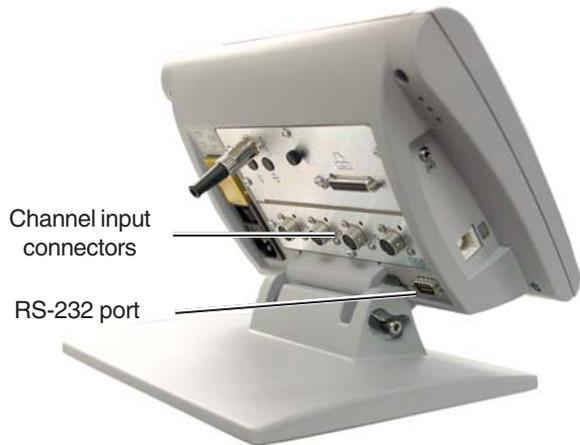
Industrial quality surge suppressors are recommended. Surge suppressors found in inexpensive power strips are insufficient to protect the Gage-Chek from damage.

**Liquids**

Do not spill or splash liquids on the Gage-Chek enclosure.

## Connecting channel input devices

Channel input devices are attached to connectors on the rear of the Gage-Chek. Many device interfaces are available to match the wide variety of encoder and transducer devices that can be used with the Gage-Chek. The number and type of channel input connectors will vary depending on the application. The connectors shown below are only examples.



Connect the channel input devices tightly to the desired connectors. A channel number is provided near each connector.

**NOTE**

A type D1311 thermocouple can be connected to the RS-232 port and designated as a channel input using the Channels setup screen discussed in [Chapter 3: Setup](#).

**Setting up channel input devices**

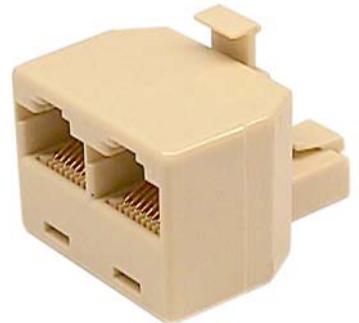
Channel input devices must be configured using the Channels setup screen. Please refer to [Chapter 3: Setup](#) for details regarding input channel setup.

**Connecting the optional foot switch and remote keypad**

The optional foot switch and remote keypad are connected to the RJ 45 connector on the left side of the Gage-Chek.



Typically, either the optional foot switch or remote keypad is used. However, both options can be connected simultaneously using a RJ 45 splitter as shown.



**NOTE**

RJ 45 splitters are readily available from most retail electronics stores.

**NOTE**

When the foot switch and remote keypad are connected using the RJ 45 splitter, all operating functions of each device are retained. However, the foot switch shares Hot Key mapping with the number keys 7 and 8 of the remote keypad. As a result, functions assigned to the two foot switch contacts will also be mapped to remote keypad numbers 7 and 8. The reverse is also true; functions mapped to the remote keypad numbers 7 and 8 will also be mapped to the two foot switch contacts.



Please refer to the Hot Keys portion of [Chapter 3: Setup](#) for details regarding the assignment of functions to the foot switch, remote keypad and Gage-Chek panel keys.

Connect the foot switch and/or remote keypad to the RJ 45 connector on the left side of the Gage-Chek body.

### Testing the foot switch and remote keypad connection

The factory default Gage-Chek settings generate a beep sound when any key or foot switch is pressed.

Apply power to the Gage-Chek and press a foot switch or remote keypad Key. Listen for a beep each time a switch or Key is pressed. This audible beep indicates that the foot switch or keypad is working and connected properly.

**NOTE**

No default functions are assigned to the foot switch. Hot Key assignments must be made for each foot switch contact later using the Hot Keys Setup screen. Refer to [Chapter 3: Setup](#). The remote keypad is always fully operational as a numeric keypad independent of Hot Key function assignments.

If a foot switch or remote keypad key is pressed and no audible beep is

generated, turn the Gage-Chek off, disconnect the foot switch or remote keypad and examine the cable connector and RJ 45 jack in the Gage-Chek. The connector housings and pins should be clean and undamaged.



If the connector and jack appear to be clean and undamaged, reconnect the device, re-apply power to the Gage-Chek and press the foot switch or keypad key again.

If pressing the foot switch or keypad key still doesn't generate an audible beep, consult your Metronics distributor for assistance.

## Connecting a printer

The Gage-Chek supports most HP printers using the HP PCL data format.



### NOTE

**The Gage-Chek provides a full complement of text and graphics outputs for parallel HP PCL format printers. However, the Gage-Chek RS 232 serial output can be connected to serial printers for text output. In special applications requiring serial printers, refer to the printer manufacturer's instructions for configuring the printer to work properly with standard RS 232 serial data.**

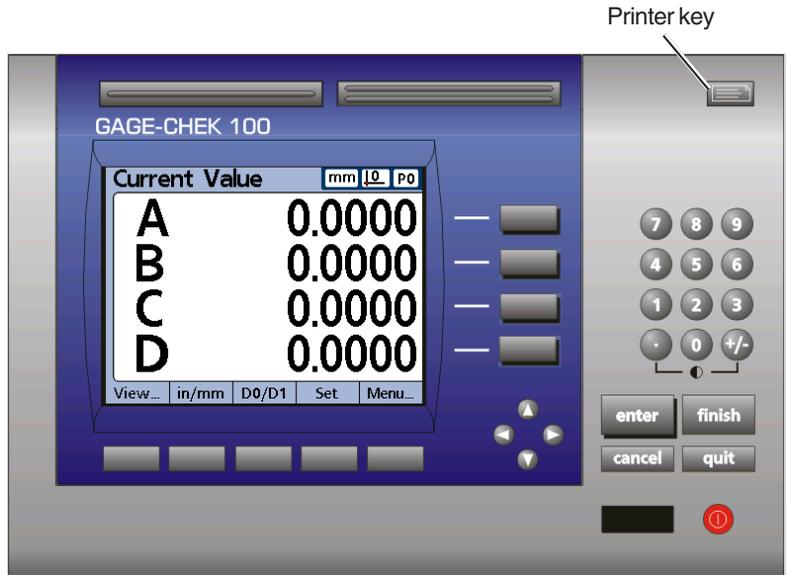
Verify that the Gage-Chek and printer power are off. Connect the printer to the parallel port connector on the rear panel of the Gage-Chek. Make sure the connections are tight, but be careful not to over-tighten the connector screws.



**Testing the printer connection**

Apply power to the Gage-Chek, and then to the printer.

When the Power of Quadra-Chek screen is displayed, press any key of the Gage-Chek to display the DRO screen, and then press the Printer key of the Gage-Chek.



A small report should be printed.

If the printer doesn't respond, turn the Gage-Chek and printer power off and disconnect the parallel cable from the Gage-Chek and the printer.

Examine the cable and cable connectors. The cable surface should be smooth and undamaged. The connectors should be clean and undamaged. The Gage-Chek and printer cable connectors should be clean and undamaged.

Reconnect the printer to the parallel port of the Gage-Chek. Make sure the connection is tight, but do not over-tighten the connector screws.

Apply power to the Gage-Chek, and then to the printer. Press any key of the Gage-Chek to display the DRO screen, and then press the Printer key of the Gage-Chek.

If the printer still doesn't generate a report, consult your Metronics distributor for assistance.

## Connecting a computer

Verify that the Gage-Chek and computer power are off. Connect a computer serial port to the Gage-Chek RS-232 port using a standard straight-through serial cable. Make sure the cable connectors are tight, but do not over-tighten the connector screws.



Apply power to the computer, and then the Gage-Chek.

The default Gage-Chek settings for communication over the RS 232 serial port are shown on this sample screen.

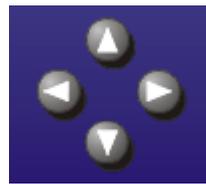
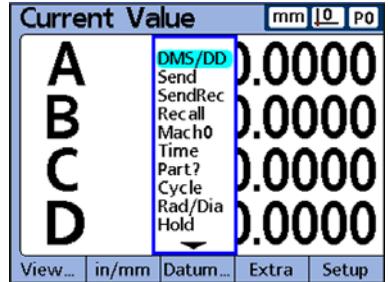
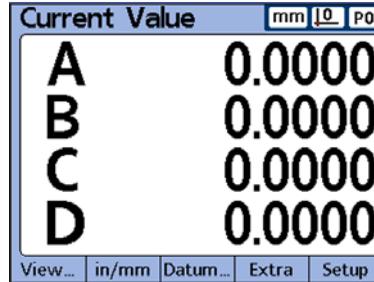
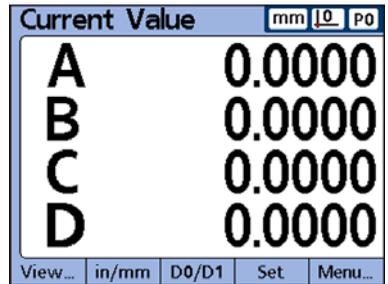
Launch the computer application that will be used to communicate with the Gage-Chek, and configure the communication properties of the serial port to match those of the Gage-Chek.

RS232		mm	10	P0
Channels	Baud			38400
Display	Word Len			8
Hot Keys	Stop Bits			1
Report	Parity			Odd
Rep Chars	Handshake			Hard.
Send	EOC Delay			330
Send Chars	EOL Delay			0
Parallel	Data			Send
RS232				

**Test 1: Communication from the Gage-Chek to computer**

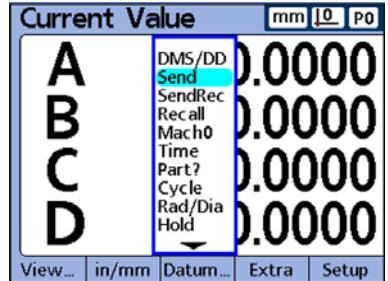
Press the Gage-Chek Enter key to display the DRO screen.

Press the Menu Softkey of the Gage-Chek, and then the Extra Softkey to display the Extra menu.



Press the down cursor key to highlight the Send function.

Press the Enter key to transmit data to the computer over the serial port. The computer should display a short dimension data file. If it does, proceed to Test 2.



If no data file is displayed, make sure the serial port settings match those of the Gage-Chek. If the problem persists, turn the Gage-Chek and computer power off and disconnect the serial cable from the Gage-Chek and from the computer.

Examine the cable and cable connectors. The cable service should be smooth and undamaged. The connectors should be clean and undamaged. The Gage-Chek and computer cable connectors should be clean and undamaged.

Reconnect the computer and Gage-Chek. Make sure the connections are tight, but do not over-tighten the connector screws.

Apply power to the computer, and then to the Gage-Chek. Press the Enter key of the Gage-Chek to display the DRO screen. Press the Menu Softkey, press the Extra Softkey and then scroll to highlight the Send function. Press the Enter key to transmit data.

If the computer still doesn't display a report, consult your Metronics distributor for assistance.

## **Test 2: Communication from computer to Gage-Chek and back**

When communication from the Gage-Chek to the computer has been verified, communication from the computer to the Gage-Chek should be verified as well.

Transmit the following command line from the computer to the Gage-Chek in uppercase characters exactly as shown below, followed by a carriage return:

`SEND ALL`

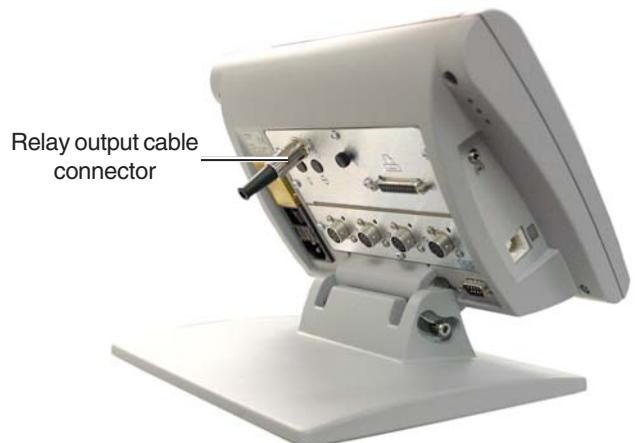
The Gage-Chek should transmit back a duplicate of the brief report received in Test 1. If the second report is not displayed, transmit the command line again:

`SEND ALL`

If the computer still does not display the report, consult your Metronics distributor for assistance.

## **Wiring the relay output connector**

Pull the relay output cable connector straight off the Gage-Chek rear panel.



Disassemble and wire the connector as shown below.

8 PIN DIN (Male)



8 Pin Conn.	Signal	
1	Relay 1 Input	
2	Relay 1 Normally Closed	
3	Relay 2 Normally Open	
4	Relay 1 Normally Open	
5	Relay 2 Normally Closed	
6	Relay 2 Input	
7	-	
8	-	

Select an overall cable diameter that matches the strain relief. The strain relief inside diameter is 0.219 inches.



**NOTE**

**Detailed specifications for the cable connector can be obtained from the Internet or directly from the manufacturer. The connector is a Switchcraft 15BL8M, male 8-pin DIN.**

Electrical characteristics of the relay contacts are contained in Chapter 8: Reference Material.

Relay operation is controlled by formulas created in the Formula setup screen. Testing the operation of the relay requires an understanding of formula creation in the Gage-Chek and is not discussed here.

## Warranty registration form

The warranty registration form included in the shipping carton should be completed and mailed as soon as possible. Also record the purchase and warranty information below so that it will be readily available later to support any necessary interactions with distributor or factory technical support personnel.

Metronics model number \_\_\_\_\_

Metronics serial number \_\_\_\_\_

Metronics dealer purchased from \_\_\_\_\_

Date received \_\_\_\_\_

Software version (From the front portion of this guide) \_\_\_\_\_

## Repackaging the Gage-Chek for shipment

Repackaging the Gage-Chek in the original packaging as received from the factory., or equivalent. It is not necessary to ship the base when shipping the Gage-Chek for repair.



### CAUTION

**The original packaging must be duplicated exactly to prevent damage to the Gage-Chek LCD screen.**

Pay special attention to the following instructions:

- 1) Connect any loose mounting hardware to the Gage-Chek instrument
- 2) Repackage the foam and cardboard carton inserts as originally shipped from the factory.
- 3) Place the Gage-Chek into shipping carton with the LCD facing up.



### CAUTION

**The LCD must be inserted face up to prevent damage to the LCD screen.**

- 4) Replace the warranty card and slip sheets found at the top of the carton. The “Before you begin” slip sheet should be inserted last.

## What's next?

Proceed to [Chapter 3: Setup](#) and then to [Chapter 4: Formulas](#) to configure your Gage-Chek for use.

The operating parameters of the Gage-Chek must be configured prior to using the system for the first time, and any time part measurement, reporting or communication requirements change. Day to day use of the Gage-Chek does not require re-configuration of system settings.



### CAUTION

**Parameter changes made in any of the setup screens affect the operation of the Gage-Chek. For this reason critical setup screen parameters can be password-protected. Only qualified supervisory personnel should be given password access to setup screens. The unlocking of password-protected setup functions is described later in this chapter.**

Gage-Chek operating parameters are entered into the system using a few screen navigation and menu selection keys located on the front panel. The configuration process is facilitated by a simple menu structure of setup functions that can be quickly navigated on the large LCD display.

## The Setup Menu

All setup functions of the Gage-Chek can be configured using screens accessed using the setup menu.

With the exception of the About screen, setup menu items above the horizontal dividing line on the left side of setup screens are used create and configure parts. Up to 10 parts can be configured and stored in the Gage-Chek.



Parameters configured in setup screens will be retained by the Gage-Chek until:

- The data-backup battery is changed
- The system data and settings are cleared by maintenance personnel
- Parameters are changed using the setup menu screens

Setup screens include:

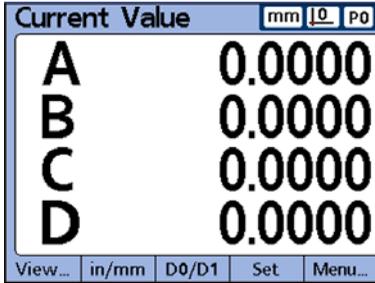
Screen	Setup Functions	Page
About	Select a language for LCD display and reports	3-10
Dimensions	Specify dimension labels	3-11
Formats	Specify measurement modes and display resolutions	3-13
Formulas	Specify dimension formulas	3-16
Tolerances	Specify dimension warnings and limits	3-17
SPC	Specify SPC subgroups and control limits and database parameters	3-24
Header	Specify text headers for reports; specify user prompts for text headers	3-29
Memory	Review Gage-Chek memory allocations	3-32
Channels	Configure encoders for channel inputs	3-33
Display	Specify various system display formats and colors	3-41
Hot Keys	Assign frequently used functions to keys	3-44
Report	Format contents and appearance of printed reports (also: compatible printers)	3-53
Rep Chars	Specify ASCII control characters for printers	3-56
Send	Format contents of data transmitted to computers and peripherals	3-57
Send Chars	Specify ASCII control characters in data transmissions	3-58
Parallel	Specify data transmitted on the parallel port	3-60
RS232	Specify data transmitted on the serial port	3-61
SLEC	Configure segmented linear error coefficients for encoder channels	3-64
Clock	Set the date and time; specify time display format	3-75
Screen	Specify LCD display and screen saver characteristics	3-77
Misc	Specify display and speaker characteristics; specify calibration type	3-79
Supervisor	Enter password to lock/unlock part settings and datum functions	3-83

## Printing Gage-Chek configuration settings

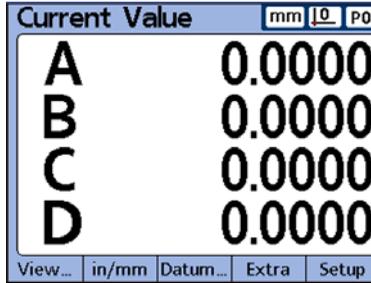
All of the Gage-Chek configuration settings and formulas can be printed by pressing the Print key while displaying any setup screen.

## Accessing the Setup Menu

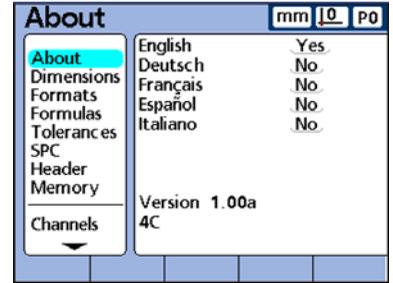
The Setup menu is accessed from the DRO screen by pressing the Menu softkey, then pressing the Setup softkey.



Press Menu softkey



Press Setup softkey

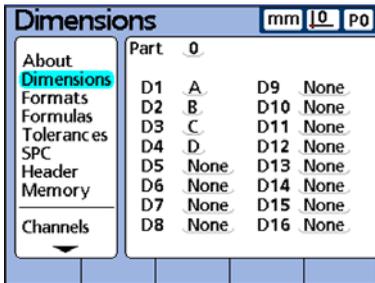


Setup menu displayed

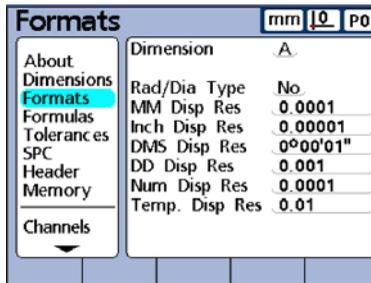
## Navigating the Setup Menu

### Cursor keys

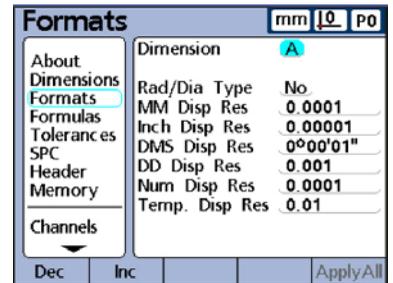
Scroll up and down through the setup menu using the up and down Cursor keys, then access setup screen functions using the right Cursor key.



Press down Cursor key



Press right Cursor key



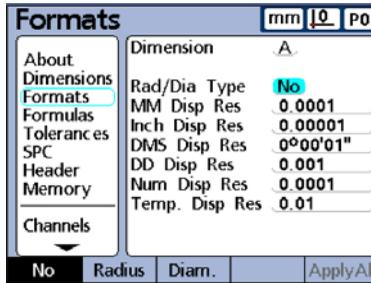
Setup screen functions available



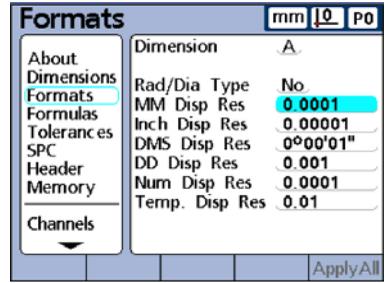
### NOTE

It might be necessary to enter the Supervisor password into the Supervisor setup screen to gain access to critical setup screen parameter fields. Refer to the Supervisor setup screen discussion later in this chapter.

Scroll up and down through setup screen functions using the up and down Cursor keys to highlight the desired field.



Press down Cursor key



New input field highlighted

**Dimension softkeys**

The dimension softkeys can be used to move to the top or bottom of the setup menu or to page up or down through the setup menu as shown below:



Top of menu

Page up

Page down

Bottom of menu

## Entering Numbers

Enter numbers into the highlighted setup screen fields using the numeric keypad.



Formats		mm	0	P0
About	Dimension	A		
Dimensions	Rad/Dia Type	No		
Formats	MM Disp Res	0.0001		
Formulas	Inch Disp Res	0.00001		
Tolerances	DMS Disp Res	0°00'01"		
SPC	DD Disp Res	0.001		
Header	Num Disp Res	0.0001		
Memory	Temp. Disp Res	0.01		
Channels				
				ApplyAll

Press 0.0001 numeric keys

Formats		mm	0	P0
About	Dimension	A		
Dimensions	Rad/Dia Type	No		
Formats	MM Disp Res	0.0001		
Formulas	Inch Disp Res	0.00001		
Tolerances	DMS Disp Res	0°00'01"		
SPC	DD Disp Res	0.001		
Header	Num Disp Res	0.0001		
Memory	Temp. Disp Res	0.01		
Channels				
				ApplyAll

Number entered in highlighted field

## Deleting Numbers and Alpha Entries

Press the Cancel key to erase the last (right most) digit in the selected number field.



SLEC		mm	0	P0
Channels	Channel	C1		
Display	Enabled	Off		
Hot Keys	Station	0		
Report	Standard			
Rep Chars	Observed			
Send	MZ Offset	0.24987		
Send Chars				
Parallel				
RS232				
SLEC				
Teach				

Press the Cancel key to erase the number 7

SLEC		mm	0	P0
Channels	Channel	C1		
Display	Enabled	Off		
Hot Keys	Station	0		
Report	Standard			
Rep Chars	Observed			
Send	MZ Offset	0.2498		
Send Chars				
Parallel				
RS232				
SLEC				
Teach				

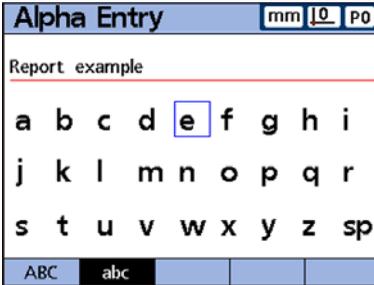
Press the Cancel key to erase the number 8

SLEC		mm	0	P0
Channels	Channel	C1		
Display	Enabled	Off		
Hot Keys	Station	0		
Report	Standard			
Rep Chars	Observed			
Send	MZ Offset	0.249		
Send Chars				
Parallel				
RS232				
SLEC				
Teach				

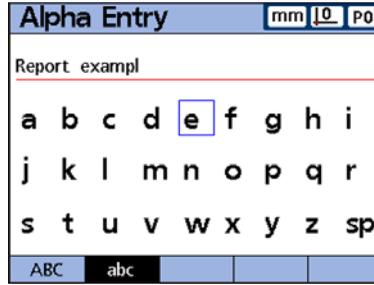
Two digits erased

The entire contents of the field can be replaced by entering a number immediately after highlighting the field.

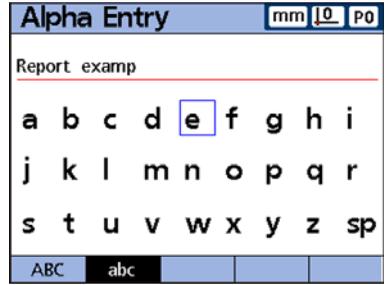
Press the Cancel key to erase alpha characters in the message line.



Press the Cancel key to erase the letter "e"



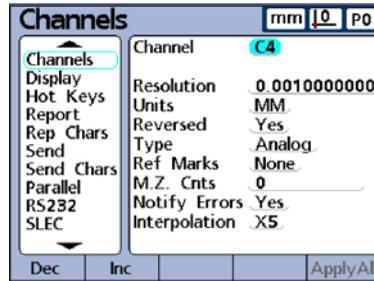
Press the Cancel key to erase the letter "l"



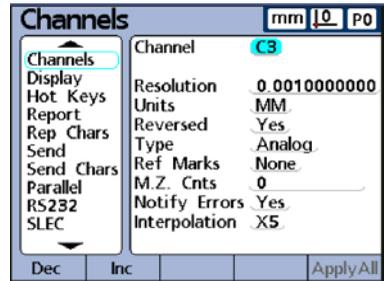
Two alpha characters erased

## Entering Softkey Choices

Press the desired softkey to perform the function or enter the parameter shown over the softkey under the LCD.



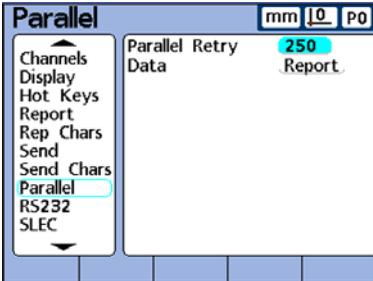
Press DEC to decrement the channel number



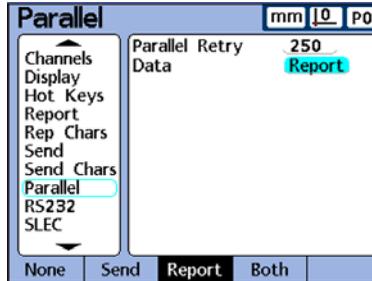
Channel number changed from C4 to C3

## Storing a Parameter

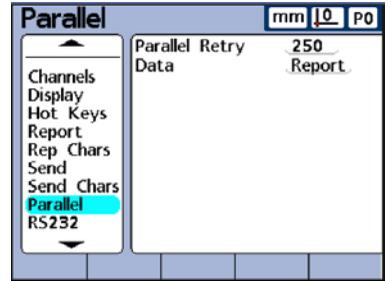
Press the Enter key to store the highlighted value and advance to the next setup field. Press the Finish key to store the value and return to the setup menu.



To store the highlighted value...



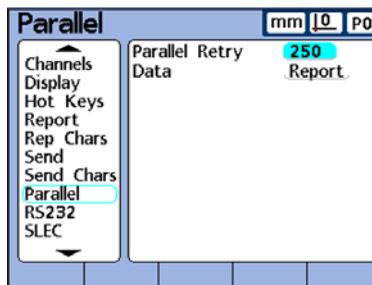
Press the Enter key to store and advance to the next field



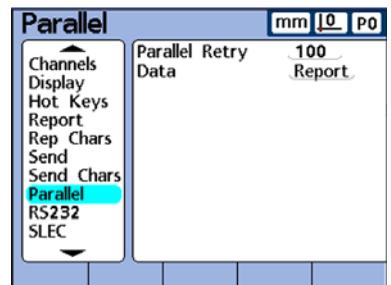
Press the Finish key to store and return to the setup menu

## Quitting without Storing Changes

Press the Quit key to return to the setup menu without saving changes.



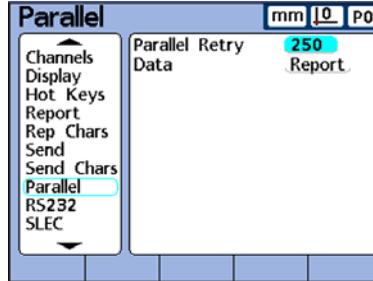
Enter new value then press the Quit key



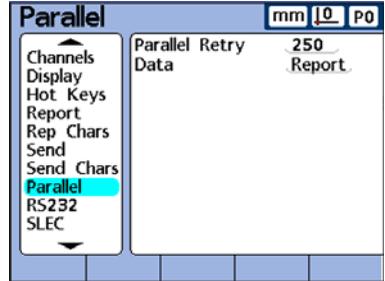
New value is disregarded, focus returns to setup menu

## Storing all Parameters and Returning to the DRO Screen

Press the Finish key to store all parameters on the screen and return to the setup menu.

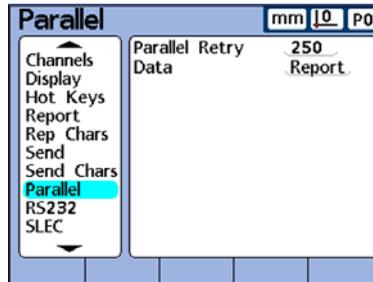


Press the Finish key to store a value

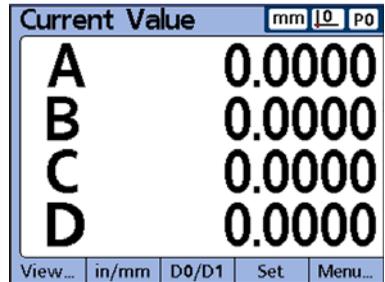


New value is stored and focus returns to setup menu

Press the Finish key to return to the DRO screen from the setup menu.



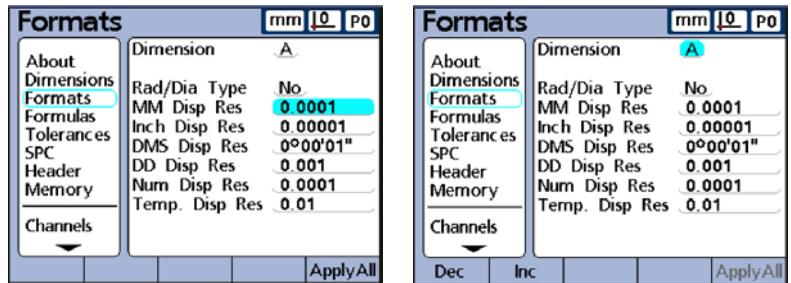
Press the Finish key to return to the DRO screen



## Applying a dimension's parameters to all dimensions

A single highlighted dimension parameter, or all parameters of the current dimension can be applied to all other dimensions by pressing the Apply All softkey.

To apply a single parameter of the current dimension to all dimensions, highlight the desired parameter and then press the Apply All softkey.



To apply all parameters of the current dimension to all dimensions, highlight the dimension at the top of the screen and then press the Apply All softkey.

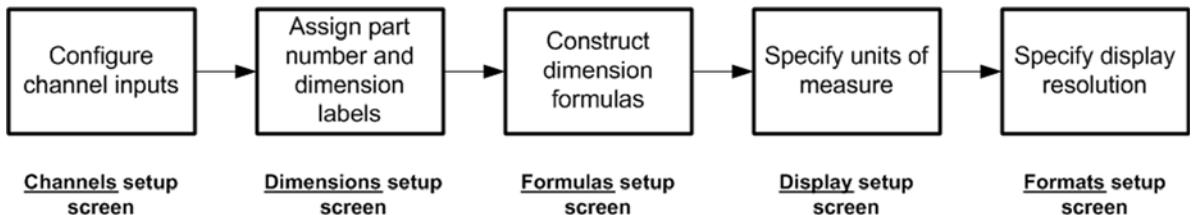
If all dimension parameters are already the same, the Apply All softkey will be grayed-out.

## Entering the Supervisor Password

When datum functions are locked, the supervisor password must be entered to allow access to setup fields or to permit datum changes. Please refer to the Supervisor Password screen instructions provided later in this chapter.

## Essential Setup Requirements

The essential, or minimum setup required to begin conducting measurements with the Gage-Chek are diagrammed below.



Additional setup will be required to utilize the full SPC, reporting, data communication and other capabilities of the Gage-Chek system.

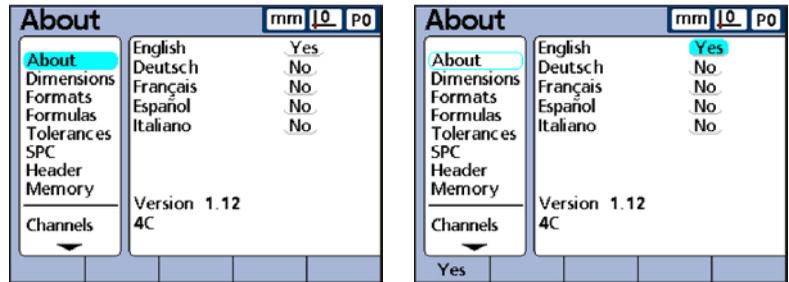
## Setup Screen Descriptions

The setup screen descriptions are presented in the order of their appearance in the setup menu. The first time the Gage-Chek is configured, the order of setup screen use should follow the essential setup requirements diagram on the previous page, and then continue in the order that best satisfies the application or the user's preferences. The subsequent use of setup screens will probably be infrequent and will address part requirement or hardware changes.

### About screen

The About screen contains selections for changing the language of text displayed on the LCD, included in transmitted data and printed on reports. Software version information and the number of input channels are displayed on the bottom of the screen.

Highlight the About menu item, and then use the right Cursor key to access items in the right portion of the screen.



### Language

Use the Cursor keys to highlight the desired language then press the Yes key to select the language.

### System information

The Gage-Chek software version and number of input channels are displayed at the bottom of the About setup screen.

Dimensions screen

The Dimensions screen contains fields for defining the part number and dimension labels displayed on the DRO, included in transmitted data and printed on reports for up to 10 individual parts.

The dimension definitions also determine data that will be stored in the Gage-Chek database.



**NOTE**

**Dimensions must be defined prior to other setup activities and conducting tests.**

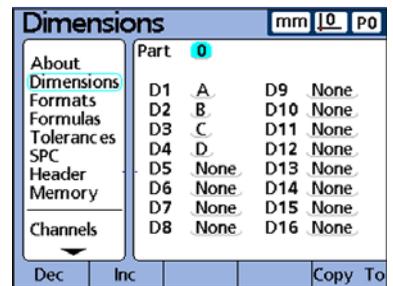
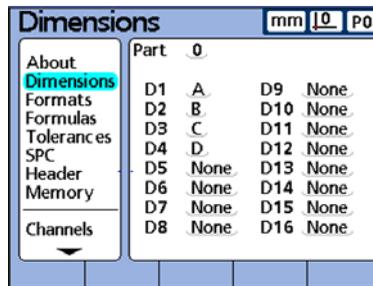


**CAUTION**

**Changing dimension labels will erase any data already associated with the dimension in the Gage-Chek database.**

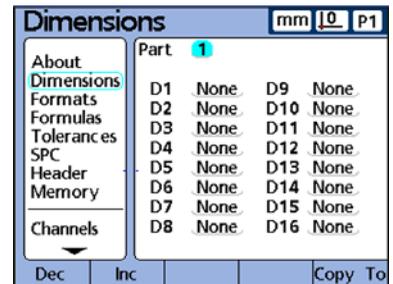
Dimension labels consist of a single alpha or numeric digit. Alpha labels can be in the range from A to Z and numeric labels can be from 0 to 9. The completed label specifications of one part can be copied and applied to another.

Highlight the Dimension menu item, and then use the right Cursor key to access items in the right portion of the screen.



**Part Number**

Use the Dec or Inc softkey to decrement or increment the part number to the desired value from 0 to 9.



## Labeling Dimensions

Use the Dec or Inc softkey to decrement or increment the dimension label to the desired alpha or numeric character.

Dimensions		mm	0	P1
About	Part	1		
Dimensions	D1	None	D9	None
Formats	D2	None	D10	None
Formulas	D3	None	D11	None
Tolerances	D4	None	D12	None
SPC	D5	None	D13	None
Header	D6	None	D14	None
Memory	D7	None	D15	None
Channels	D8	None	D16	None
Dec	Inc			

Dimensions		mm	0	P1
About	Part	1		
Dimensions	D1	L	D9	None
Formats	D2	H	D10	None
Formulas	D3	W	D11	None
Tolerances	D4	V	D12	None
SPC	D5	None	D13	None
Header	D6	None	D14	None
Memory	D7	None	D15	None
Channels	D8	None	D16	None
Dec	Inc			

The dimension labels specified in these examples were for the calculation of volume based on measurements of the length, height and width of a rectangular solid.



## NOTE

Dimension labels should reflect the measurement application.

## Copying Dimension Parameters

Dimension parameters assigned to one part can be copied to another to save setup time when similar or identical measurements are performed on different parts.

Highlight the Part field and press the Copy To softkey. The labels, formulas and all other parameters will be copied to the specified part. Database records will not be copied.

Use the Numeric Keypad to enter the part number that labels will be

Dimensions		mm	0	P1
About	Part	1		
Dimensions	D1	L	D9	None
Formats	D2	H	D10	None
Formulas	D3	W	D11	None
Tolerances	D4	V	D12	None
SPC	D5	None	D13	None
Header	D6	None	D14	None
Memory	D7	None	D15	None
Channels	D8	None	D16	None
Dec	Inc			Copy To

Dimensions		mm	0	P1
About	Part	1		
Dimensions	Enter the part number			
Formats	2			
Formulas	D6	None	D14	None
Tolerances	D7	None	D15	None
SPC	D8	None	D16	None
Header				
Memory				
Channels				
Cancel	OK			

Dimensions		mm	0	P1
About	Part	1		
Dimensions	Part setup information was successfully copied.			
Formats	D6	None	D14	None
Formulas	D7	None	D15	None
Tolerances	D8	None	D16	None
Header				
Memory				
Channels				
OK				

copied to. Press the OK softkey to copy the labels, then press OK again to return to the Dimension setup screen.



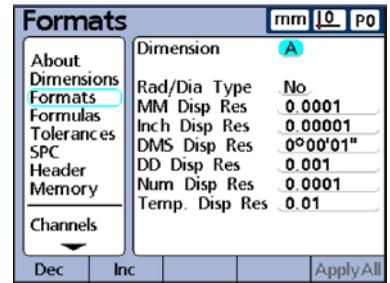
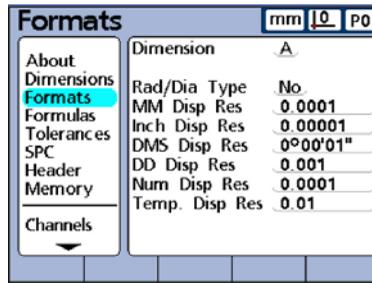
**Formats screen**

**CAUTION**

**Changing dimension labels for, or copying label to an existing part will erase all the data for that part.**

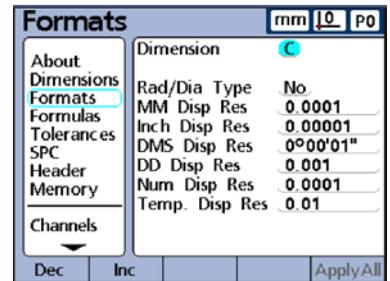
The Formats screen contains fields for specifying the display format and display resolution for each dimension of the currently selected part. Selections of radius and diameter measurement types are also provided.

Highlight the formats menu item, then use the right Cursor key to access items in the right portion of the screen.



**Specifying a Dimension**

Use the Dec or Inc softkey to specify the desired dimension.



**Specifying Radius or Diameter**

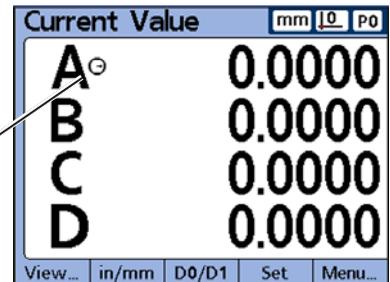
Radius or Diameter measurement types can be specified for cylindrical and spherical parts or parts with curved surfaces. When radius or diameter measurements are specified, the corresponding symbol will be displayed near the associated dimension on the DRO screen.



Radius Symbol



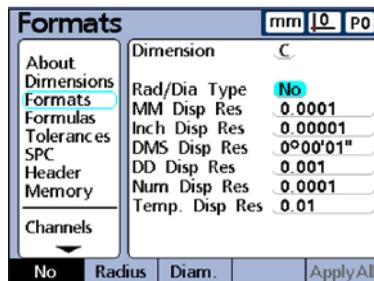
Diameter Symbol



**NOTE**

The dimension can be toggled between Radius and Diameter later from the DRO screen using the Extra menu. This feature can also be mapped to other keys using the Hot Keys setup screen.

Use the Radius or Diam softkeys to specify the radius or diameter measurement type. Press the No softkey to specify measurements that do not require radius or diameter, such as linear or angular measurements.

**CAUTION**

The Rad/Dia Type selected here must also be selected on the DRO screen while conducting measurements, or erroneous readings will result. For example, if Radius is selected here, and Diameter is selected on the DRO screen using the Extra menu, readings will display twice the actual channel value.

**Display resolution**

The display resolution fields are used to specify the resolution of measurements shown on the DRO screen. Displayed numbers will be rounded as the display resolution is decreased below that of the input channel. The table below illustrates how the display of a channel input is governed by the display resolution setting.

Channel input	Display resolution	Displayed value
1.567	0.0001	1.5670
1.567	0.001	1.567
1.567	0.01	1.57
1.567	0.1	1.6
1.567	1	2

### Specifying Linear Display Resolution

Highlight the MM Disp Res or Inch Disp Res field, and then enter the desired display resolution.

Formats		mm	10	P0
About	Dimension	C		
Dimensions	Rad/Dia Type	No.		
<b>Formats</b>	MM Disp Res	0.0001		
Formulas	Inch Disp Res	0.00001		
Tolerances	DMS Disp Res	0°00'01"		
SPC	DD Disp Res	0.001		
Header	Num Disp Res	0.0001		
Memory	Temp. Disp Res	0.01		
Channels		Apply All		

### Specifying Angular Display Resolution

Highlight the DMS Disp Res (degree, minute, second) or DD Disp Res (decimal degrees) field, and then enter the desired display resolution.

Formats		mm	10	P0
About	Dimension	C		
Dimensions	Rad/Dia Type	No.		
<b>Formats</b>	MM Disp Res	0.0001		
Formulas	Inch Disp Res	0.00001		
Tolerances	DMS Disp Res	0°00'01"		
SPC	DD Disp Res	0.001		
Header	Num Disp Res	0.0001		
Memory	Temp. Disp Res	0.01		
Channels		Apply All		

### Specifying Numeric Display Resolution

Highlight the Num Disp Res field and use the numeric keypad to enter the display resolution for dimensionless numeric values.

Formats		mm	10	P0
About	Dimension	C		
Dimensions	Rad/Dia Type	No.		
<b>Formats</b>	MM Disp Res	0.0001		
Formulas	Inch Disp Res	0.00001		
Tolerances	DMS Disp Res	0°00'01"		
SPC	DD Disp Res	0.001		
Header	Num Disp Res	0.0001		
Memory	Temp. Disp Res	0.01		
Channels		Apply All		

### Specifying temperature display resolution

Highlight the Temp Disp Res field and enter the desired display resolution.

Formats		mm	10	P0
About	Dimension	C		
Dimensions	Rad/Dia Type	No.		
<b>Formats</b>	MM Disp Res	0.0001		
Formulas	Inch Disp Res	0.00001		
Tolerances	DMS Disp Res	0°00'01"		
SPC	DD Disp Res	0.001		
Header	Num Disp Res	0.0001		
Memory	Temp. Disp Res	0.01		
Channels		Apply All		



### NOTE

Measurement resolution can never be better than the input channel resolution. Specifying display resolutions that are greater than the channel resolutions can lead to misleading displays of dimension calculation values.

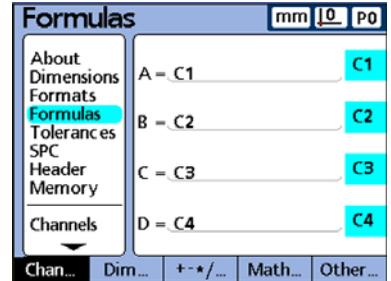
**Formula screen**

The Gage-Chek uses formulas to define and display dimensions based on channel inputs. These formulas can be constructed by the user to display:

- One dimension based on one channel (shown below)
- One dimension based on multiple channels
- Multiple dimensions based on one channel
- Multiple dimensions based on multiple channels

Formulas can be constructed that simply display a channel as a dimension, or that calculate a dimension from one or more channels using powerful math, logic or other functions.

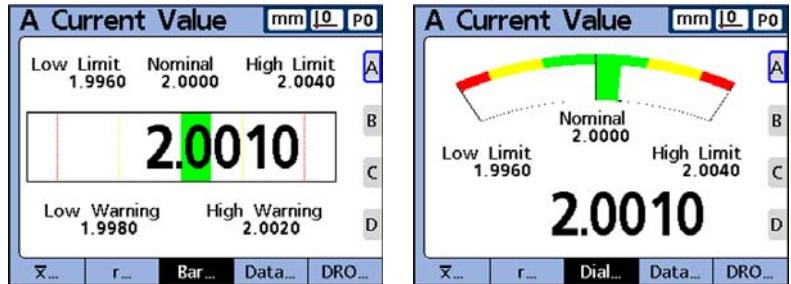
The number and richness of features provided by the Formula screen merit a separate chapter for adequate explanation. Please refer to [Chapter 4: Formulas](#) for detailed information.



## Tolerances screens

The tolerances screens contain fields for specifying nominal values, upper/lower warnings, upper/lower limits and minimum/maximum bar graph levels for each dimension. An audio alert can also be specified for warnings, limits, or both.

Tolerance ranges are indicated numerically and by bands of color on the Current Value bar and dial screens.



The default bar and dial displays show Pass values in green, Warning values in yellow, and Fail values in red.

These pass, warning and fail levels are shown clearly in the bar graph of current values above, and explained below:

- **Pass:** Above low warning and below high warning. Pass values fall within the specified range of acceptable values.
- **Warning:** Outside the range of pass values, but not at or beyond the specified acceptable limits. Warnings indicate the need to evaluate the process to prevent the generation of unacceptable, or failed parts.
- **Fail:** Outside the range of acceptable limits specified.
- **Max/Min:** Highest and lowest graph scale values. These values determine the range of values plotted on the graph. This range should be greater than the range limits of acceptable parts.



### NOTE

The colors used to indicate pass, warning and fail can be changed using the Display setup screen discussed later in this chapter.

Highlight the Tolerances menu item, and then use the right Cursor key to access items in the right portion of the screen.

Tolerances		mm	10	P0
About	Dimension	A		
Dimensions	Nom + Max	3.0000		
Formats	Nom + Limit	2.0000		
Formulas	Nom + Warn	1.0000		
<b>Tolerances</b>	Nominal	0.0000		
SPC	Nom - Warn	1.0000		
Header	Nom - Limit	2.0000		
Memory	Nom - Min	3.0000		
Channels	Audio Alert	None		

Tolerances		mm	10	P0
About	Dimension	A		
Dimensions	Nom + Max	3.0000		
Formats	Nom + Limit	2.0000		
Formulas	Nom + Warn	1.0000		
<b>Tolerances</b>	Nominal	0.0000		
SPC	Nom - Warn	1.0000		
Header	Nom - Limit	2.0000		
Memory	Nom - Min	3.0000		
Channels	Audio Alert	None		
Dec	Inc	Limits	+/-	ApplyAll

### Specifying a Dimension

Use the Dec or Inc softkey to specify the desired dimension.

### Specifying Nominal Values and Tolerances

Nominal values and tolerances can be specified as a nominal value with +/- tolerances, or as a nominal value with fixed limits.

#### *Nominal +/- with Tolerances*

Press the +/- softkey to specify a nominal value with +/- tolerances.

Highlight the desired fields, and then use the numeric keypad to enter values.

This example screen contains the nominal value and tolerances listed below:

Nominal = 2.0000 mm  
 Warning tolerance =  $\pm 0.0020$  mm  
 Limit tolerance =  $\pm 0.0040$  mm  
 Max tolerance =  $\pm 0.0050$  mm

Tolerances		mm	10	P0
About	Dimension	A		
Dimensions	Nom + Max	3.0000		
Formats	Nom + Limit	2.0000		
Formulas	Nom + Warn	1.0000		
<b>Tolerances</b>	Nominal	0.0000		
SPC	Nom - Warn	1.0000		
Header	Nom - Limit	2.0000		
Memory	Nom - Min	3.0000		
Channels	Audio Alert	None		
Dec	Inc	Limits	+/-	ApplyAll

Tolerances		mm	10	P0
About	Dimension	A		
Dimensions	Nom + Max	0.0050		
Formats	Nom + Limit	0.0040		
Formulas	Nom + Warn	0.0020		
<b>Tolerances</b>	Nominal	2.0000		
SPC	Nom - Warn	0.0020		
Header	Nom - Limit	0.0040		
Memory	Nom - Min	0.0050		
Channels	Audio Alert	None		
Dec	Inc	Limits	+/-	ApplyAll



### NOTE

Values specified using the +/- Tolerances screen will also be converted to fixed limits if the Limits softkey is pressed.

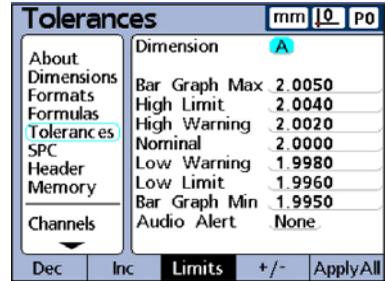
*Nominal with Fixed Limits*

Press the Limits softkey to specify a nominal value with fixed limits.

Highlight the desired fields, and then use the numeric keypad to enter values.

The example below of 2mm ± 0.005mm is used to show a nominal value with fixed limits.

- Nominal = 2.0000 mm
- High warning = 2.0020
- Low warning = 1.9980
- High limit = 2.0040
- Low limit = 1.9960
- Bar graph max = 2.0050
- Bar graph min = 1.9950

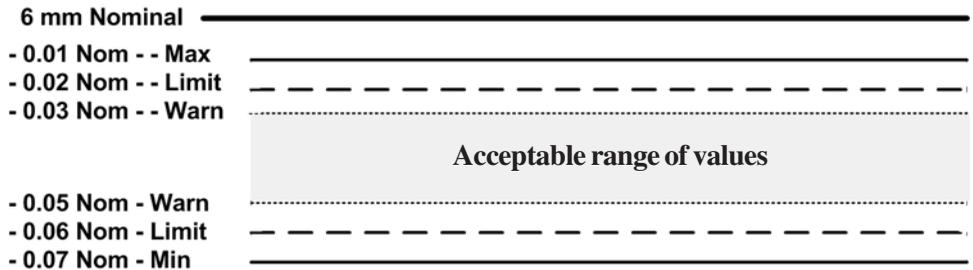


*Nominal with ++ - - Tolerances*

The +/- Tolerances screen can be used to enter tolerances on either side of a nominal value as discussed above, or to enter a range of acceptable tolerances entirely above or below a nominal value as shown below.



**++ Tolerance**



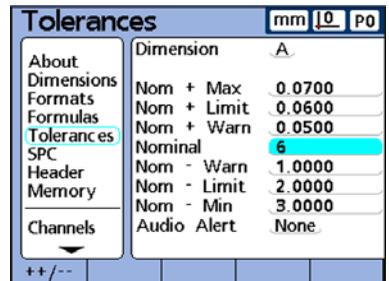
**-- Tolerance**

*Nominal with positive range of acceptable values*

To specify a range of acceptable tolerances *above* the nominal value such as shown above (++ Tolerance):

Step 1  
Enter the high end of the positive tolerance range into the + Max, + Limit and +Warn fields.

Step 2  
Enter the Nominal value.



Step 3

Enter the low end of the positive tolerance range into the - Warn, - Limit and - Min fields.

Tolerances		mm	0	P0
About	Dimension	A		
Dimensions	Nom + Max	0.0700		
Formats	Nom + Limit	0.0600		
Formulas	Nom + Warn	0.0500		
Tolerances	Nominal	6.0000		
SPC	Nom - Warn	0.0300		
Header	Nom - Limit	0.0200		
Memory	Nom - Min	0.0100		
Channels	Audio Alert	None		
++/--		ApplyAll		

Step 4

Highlight the - Warn field and press the ++ - - softkey to change the field to + Warn. Repeat this procedure for the - Limit and - Min fields. This establishes the lower end of the positive range of acceptable tolerances.

Tolerances		mm	0	P0
About	Dimension	A		
Dimensions	Nom + Max	0.0700		
Formats	Nom + Limit	0.0600		
Formulas	Nom + Warn	0.0500		
Tolerances	Nominal	6.0000		
SPC	Nom + Warn	0.0300		
Header	Nom + Limit	0.0200		
Memory	Nom + Min	0.0100		
Channels	Audio Alert	None		
++/--		ApplyAll		

The completed offset positive range of tolerances is shown below.

0.07 Nom + Max  
 0.06 Nom + Limit  
 0.05 Nom + Warn



0.03 Nom ++ Warn  
 0.02 Nom ++ Limit  
 0.01 Nom ++ Min  
 6 mm Nominal

**++ Tolerance**

*Nominal with negative range of acceptable values*

To specify a range of acceptable tolerances *below* the nominal value such as shown below (- - Tolerance):



**NOTE**

**Do not enter values with negative signs. The ++ - - Softkey will shift tolerance values below the nominal.**

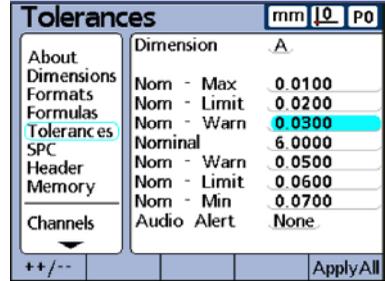
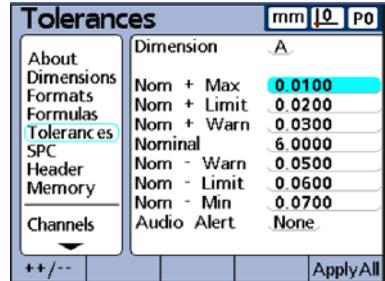
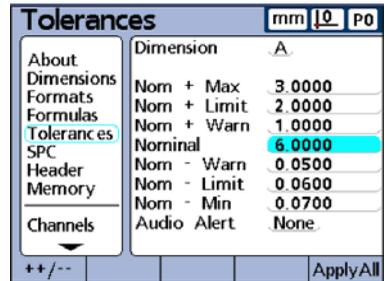
Step 1  
Enter the low end of the negative tolerance range into the - Max, - Limit and -Warn fields.

Step 2  
Enter the Nominal value.

Step 3  
Enter the high end of the negative tolerance range into the + Warn, + Limit and + Min fields.

Step 4  
Highlight the +Warn field and press the ++ - - softkey to change the field to - Warn. Repeat this procedure for the + Limit and + Max fields. This establishes the upper end of the negative range of acceptable tolerances.

The completed offset negative range of tolerances is shown below.



### Specifying Audio Alert

Audio alerts can be specified that sound when the specified dimension reaches warning and limit values.

The audio alert sounds when a warning or limit threshold is crossed, and will not sound again until the alert is reset by crossing the threshold again in the opposite direction.

Tolerances		mm	0.	P0
About	Dimension	A		
Dimensions	Nom + Max	0.0050		
Formats	Nom + Limit	0.0040		
Formulas	Nom + Warn	0.0020		
<b>Tolerances</b>	Nominal	2.0000		
SPC	Nom - Warn	0.0020		
Header	Nom - Limit	0.0040		
Memory	Nom - Min	0.0050		
Channels	Audio Alert	None		
		None	Warning	Limits
		Both		

Press the appropriate softkey to specify no audio alerts, or audio alerts for warnings, fails (limits) or both.

## SPC screen

The SPC screen contains fields for specifying statistical process control parameters including the Subgroup (sample) Size and Max (number of) Subgroups stored, upper and lower mean control limits, and upper and lower range control limits. Record ID numbers can also be viewed or changed.

Highlight the SPC Setup menu item, and then use the right Cursor key to access items in the right portion of the screen.

SPC		mm	10	PO
About	Subgroup Size	1		
Dimensions	Max Subgroups	200		
Formats	Graph Pts	50		
Formulas	Next Record Id	1		
Tolerances	Dimension	A		
<b>SPC</b>	UCL	2.0000		
Header	LCL	-2.0000		
Memory				
Channels	Warning Per.	66		

## Subgroup Size

Use the numeric keypad to specify the desired number of samples to be included in each subgroup. Each subgroup can contain from 1 to 10 samples.

SPC parameters in the lower half of the screen and graphs of data displayed on the screen are different for subgroup sizes of 1 and subgroup

SPC		mm	10	PO
About	Subgroup Size	1		
Dimensions	Max Subgroups	200		
Formats	Graph Pts	50		
Formulas	Next Record Id	1		
Tolerances	Dimension	A		
<b>SPC</b>	UCL	2.0000		
Header	LCL	-2.0000		
Memory				
Channels	Warning Per.	66		

sizes greater than 1.

These differences are described later in this SPC screen discussion.

### Max Subgroups

Use the numeric keypad to enter the maximum number of subgroups to be contained for the specified dimension. Each dimension can contain samples in from 2 to 200 subgroups.

The screenshot shows the SPC menu with the following settings: Subgroup Size: 1, Max Subgroups: 200, Graph Pts: 50, Next Record Id: 1, Dimension: A, UCL: 2.0000, LCL: -2.0000, and Warning Per.: 66. The 'Max Subgroups' field is highlighted in blue.

### Graph Pts

Use the numeric keypad to enter the maximum number of points that will be plotted on graphs of subgroups for the specified part.

The screenshot shows the SPC menu with the following settings: Subgroup Size: 1, Max Subgroups: 200, Graph Pts: 50, Next Record Id: 1, Dimension: A, UCL: 2.0000, LCL: -2.0000, and Warning Per.: 66. The 'Graph Pts' field is highlighted in blue.



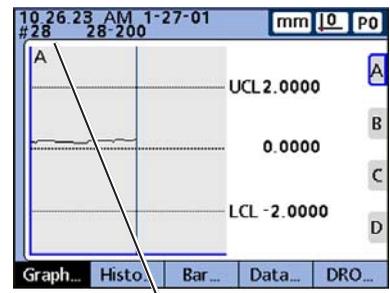
### NOTE

When there are fewer graph points specified than subgroups, the resulting dimension graphs might need to be scrolled to view all the subgroup data. Refer to [Chapter 5: Operation](#) for details regarding viewing and scrolling graphs.

### Next Record ID

Record ID numbers are displayed on graphs and can be included in printed reports and transmitted data.

The screenshot shows the SPC menu with the following settings: Subgroup Size: 1, Max Subgroups: 200, Graph Pts: 50, Next Record Id: 1, Dimension: A, UCL: 2.0000, LCL: -2.0000, and Warning Per.: 66. The 'Next Record Id' field is highlighted in blue.



Current record ID number

Normally, the Next Record ID field starts at 1 and is automatically incremented by the system each time a new record is stored. However, the Next Record ID field can be set to any value by the user to restart a new database at a specified record number, or for a variety of other

reasons. Use the numeric keypad to specify the Next Record ID.

### Specifying the Dimension for Control Limits

Use the Dec or Inc softkey to select the dimension to configure.

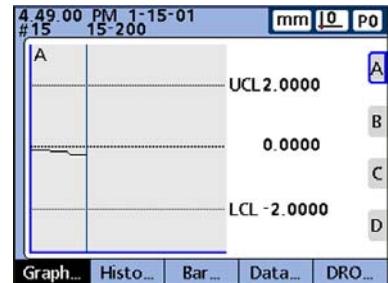
SPC		mm	10	P0
About	Subgroup Size	1		
Dimensions	Max Subgroups	200		
Formats	Graph Pts	50		
Formulas	Next Record Id	1		
Tolerances	Dimension	A		
SPC	UCL	2.0000		
Header	LCL	-2.0000		
Memory	Warning Per.	66		
Channels				
Dec	Inc			

### UCL and LCL

The UCL and LCL fields are displayed when the subgroup size is 1. Subgroup sizes greater than 1 change the lower half of the SPC screen to display mean and range control limits that are described later in this discussion.

SPC		mm	10	P0
About	Subgroup Size	1		
Dimensions	Max Subgroups	200		
Formats	Graph Pts	50		
Formulas	Next Record Id	1		
Tolerances	Dimension	A		
SPC	UCL	2.0000		
Header	LCL	-2.0000		
Memory	Warning Per.	66		
Channels				

By default, the UCL and LCL fields display the upper and lower (acceptance) limits specified earlier on the Tolerance setup screen. The limits are used by the Gage-Chek graphing software to scale the value axis of SPC graphs.



### CAUTION

The UCL and LCL values shown on the SPC setup screen should not be altered after initial setup. Change them only if you are certain that your application requires different values.

### $\bar{x}$ and $r$ Ucl and Lcl

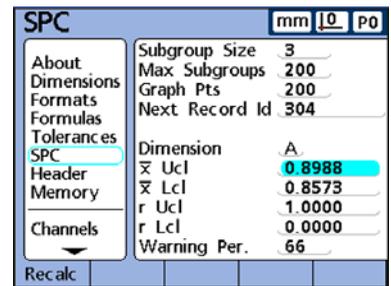
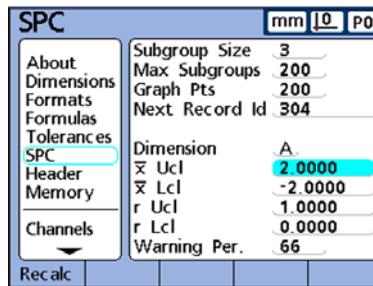
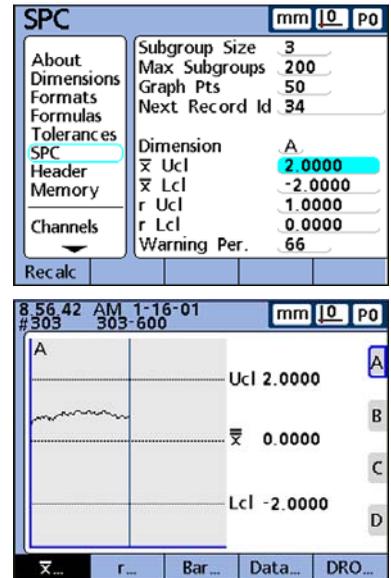
The  $\bar{x}$  and  $r$  Ucl and Lcl fields are displayed when the subgroup size is greater than 1.

### $\bar{x}$ Ucl and Lcl

The  $\bar{x}$  Ucl and  $\bar{x}$  Lcl are the likely limits of the values of  $\bar{x}$  in future subgroups. These limits are either entered manually or calculated (Recalc softkey) on the basis of existing subgroup data. The  $\bar{x}$  Ucl and  $\bar{x}$  Lcl values are displayed as horizontal lines on the  $\bar{x}$  chart and used to generate SPC limit alarms.

### Recalculating or Specifying $\bar{x}$ Ucl and Lcl

The  $\bar{x}$  chart above shows upper and lower control limits that were entered into the Tolerance setup screen as upper and lower acceptance limits prior to the collection of subgroup measurement data. Once subgroup data has been collected, the upper and lower control limits can be simultaneously recalculated by highlighting either of the  $\bar{x}$  control limit fields and pressing the Recalc softkey.



Alternatively, the  $\bar{x}$  upper and lower control limits can be entered directly into the  $\bar{x}$  Ucl and  $\bar{x}$  Lcl fields using the numeric keypad.

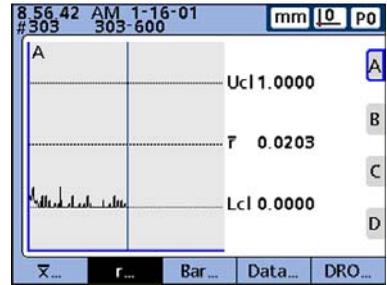


### NOTE

The  $\bar{x}$  upper and lower control limits must be recalculated to display a value for  $\bar{x}$  on the  $\bar{x}$  chart.

**r** Ucl and Lcl

The **r** Ucl and **r** Lcl are the likely limits of the values of the **r** of future subgroups calculated on the basis of existing subgroup data. These limits are either entered manually or calculated (Recalc softkey) on the basis of existing subgroup data. The **r** Ucl and **r** Lcl values are displayed as horizontal lines on the **r** chart and used to generate SPC limit alarms.



Recalculating or Specifying **r** Ucl and Lcl

The **r** chart shown above indicates upper and lower control limits that were included as upper and lower acceptance limits prior to the collection of subgroup measurement data. Once subgroup data has been collected, the upper and lower control limits can be simultaneously recalculated by highlighting either of the **r** control limit fields and pressing the Recalc softkey.

Alternatively, the **r** upper and lower control limits can be entered directly into the **r** Ucl and **r** Lcl fields using the numeric keypad.

SPC		mm	LO	PO
About	Subgroup Size	3		
Dimensions	Max Subgroups	200		
Formats	Graph Pts	200		
Formulas	Next Record Id	304		
Tolerances	Dimension	A		
SPC	$\bar{x}$ Ucl	0.8988		
Header	$\bar{x}$ Lcl	0.8573		
Memory	<b>r</b> Ucl	<b>1.0000</b>		
Channels	<b>r</b> Lcl	0.0000		
	Warning Per.	66		
Recalc				

SPC		mm	LO	PO
About	Subgroup Size	3		
Dimensions	Max Subgroups	200		
Formats	Graph Pts	200		
Formulas	Next Record Id	304		
Tolerances	Dimension	A		
SPC	$\bar{x}$ Ucl	0.8988		
Header	$\bar{x}$ Lcl	0.8573		
Memory	<b>r</b> Ucl	<b>0.0523</b>		
Channels	<b>r</b> Lcl	0.0000		
	Warning Per.	66		
Recalc				

### Warning Percent

The Warning Per field is used to specify the upper and lower warning limits on the  $\bar{x}$  and  $r$  SPC charts as a percentage of upper and lower control limits. For example:

When the Warning Per = 66

And:  $\bar{x}$  Ucl = 2.0000  
 $\bar{x}$  Lcl = -2.0000  
 $r$  Ucl = 1.0000  
 $r$  Lcl = 0.0000

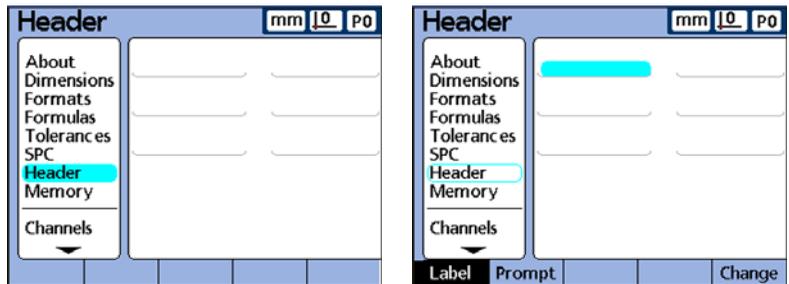
Then  $\bar{x}$  upper warning = 1.3200  
 $\bar{x}$  lower warning = -1.3200  
 $r$  upper warning = 0.6600  
 $r$  lower warning = 0.0000

Warnings and over-limits are indicated on  $\bar{x}$  and  $r$  SPC charts by color changes to yellow for warnings, and red for over-limits. These colors can be changed in the Display setup screen discussed later in this chapter.

### Header screen

The Header screen contains fields for creating header labels and user prompts for text that will be included on printed reports.

Highlight the Header menu item, and then use the right Cursor key to access items in the right portion of the screen.



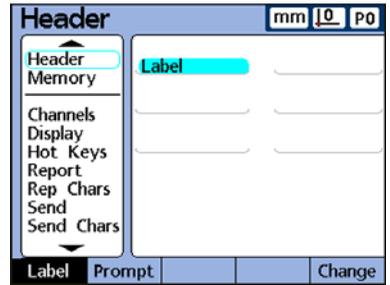
Header information will be printed in text fields at the top of all reports oriented as shown on the Header setup screen.

Each header text field can be defined as a Label or a Prompt. Labels are created in the header setup screen and printed on reports. Prompts are also created in the Header setup screen and printed on reports, but prompts elicit additional information from the user when the Print key is pressed.



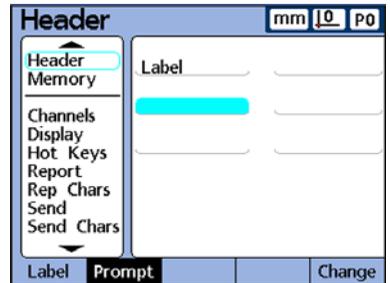
Use the SP character to include spaces.

Press the Finish key to return to the Header setup screen.



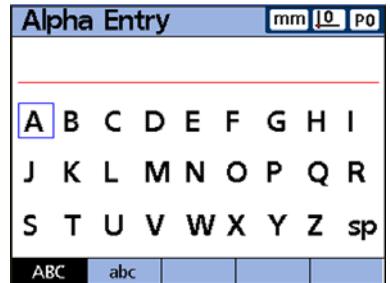
### Creating Header Prompts

Highlight the desired header field and press the Prompt softkey to define the field as a prompt.

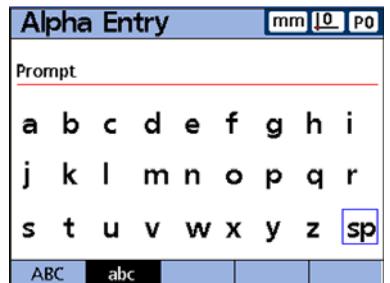
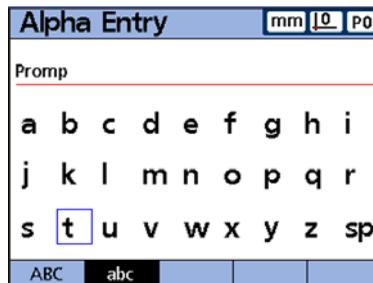
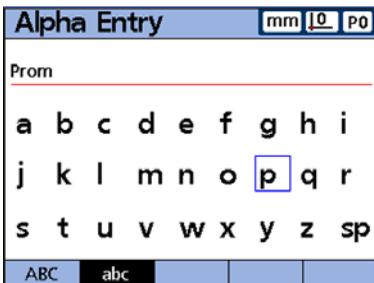


Press the Change softkey to display the Alpha Entry screen.

Alpha characters can be entered in upper or lower case. Press the ABC softkey for uppercase, or the abc softkey for lower case.



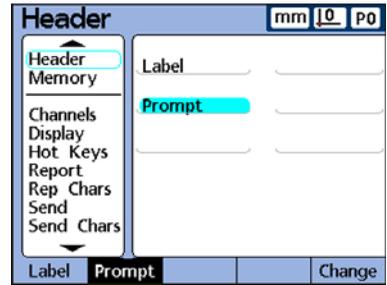
Use the Cursor keys to select the desired character, and then press the Enter key to append the selected character to the message line.



Use the SP character to include one space after the prompt, to separate the prompt message from the user's text response.

Press the Finish key to return to the Header setup screen.

The Alpha Entry screen will be displayed with the prompt when the user presses the Print key in the graph, histogram, data and detailed data views.

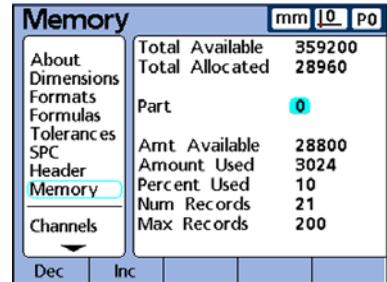
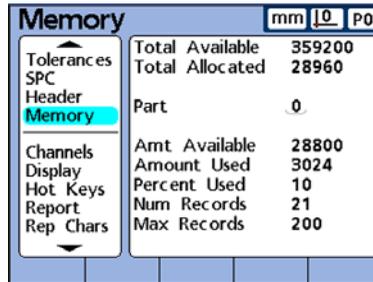


Press the Finish key to return to the Setup menu.

### Memory screen

The memory screen contains fields that describe memory allocations and use for each part, and the total system.

Highlight the Memory menu item, and then use the right arrow key to access the part number in the right portion of the screen.



Memory allocations are changed by defining new parts, changing the number of measurements performed on a part and reconfiguring parameters in the SPC setup screen.

Change the part number using the Dec or Inc softkey.



### NOTE

The memory screen is provided as a convenience to determine the memory usage in your system.

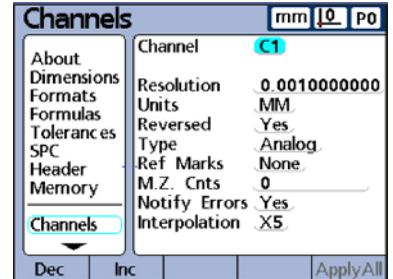
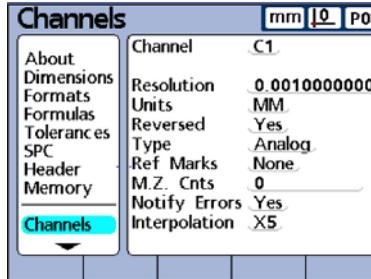
## Channels screen

The Channels screen contains fields for configuring channel input device parameters for each channel.

The Channels screen for encoders is slightly different than the Channels screen for transducers. The screens for both input devices are discussed below.

Channel screen for encoders and thermocouples

Highlight the Channel menu item, and then use the right Cursor key to access items in the right portion of the screen.

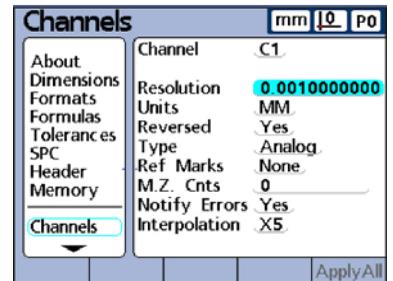


## Specifying the Channel

Use the Dec or Inc softkey to specify the desired input channel.

## Resolution

The resolution field specifies input resolution for analog and TTL encoders inputs, or specifies input scaling for thermocouple inputs as shown in the example below.



Dimension A = 25

When the temperature is equal to 25°  
and the resolution is equal to 1

Dimension A = 2.5

When the temperature is equal to 25°  
and the resolution is equal to 0.1

Use the numeric keypad to enter the desired encoder resolution or thermocouple scale factor for the specified channel.

### Units

The Units field is used to specify encoder displacement or angular units of measure, or thermocouple temperature units of measure.

Encoder units of measure can be inches, millimeters, angular or simply numeric. Thermocouple units of measure can be Celsius, Fahrenheit or numeric.

Press the List softkey to display a list of units of measure. Highlight the desired unit, and then press the Enter key to select the unit.

### Reversing Polarity

The Reversed field is used to reverse the direction all encoder counts, and will reverse the polarity of thermocouple temperatures.

Normally, encoder counts increase as the encoder or transducer is compressed, and temperature polarities reflect actual conditions.

Press the Yes softkey to reverse polarity.

### Type

Channel inputs can be provided by analog or TTL encoders connected to channel input connectors or by a D1311 thermocouple connected to the RS-232 serial port.

### NOTE

The channel input type can be specified by the user for channels 1 through 4. The input types of channels 5 and greater are specified by the customer prior to purchase, and fixed in hardware at the factory.

Channels		mm	10	P0
About	Channel	C1		
Dimensions	Resolution	0.0010000000		
Formats	Units	MM		
Formulas	Reversed	Yes		
Tolerances	Type	Analog		
SPC	Ref Marks	None		
Header	M.Z. Cnts	0		
Memory	Notify Errors	Yes		
	Interpolation	X5		
Channels				
List				ApplyAll

Channels		mm	10	P0
Channels	Channel	C1		
Display	Resolution	0.0010000000		
Hot Keys	Units	MM		
Report	Reversed	No		
Rep Chars	Type	Analog		
Send	Ref Marks	None		
Send Chars	M.Z. Cnts	0		
Parallel	Notify Errors	Yes		
RS232	Interpolation	X5		
SLEC				
List				ApplyAll

Channels		mm	10	P0
About	Channel	C1		
Dimensions	Resolution	0.0010000000		
Formats	Units	MM		
Formulas	Reversed	Yes		
Tolerances	Type	Analog		
SPC	Ref Marks	None		
Header	M.Z. Cnts	0		
Memory	Notify Errors	Yes		
	Interpolation	X5		
Channels				
No	Yes			ApplyAll



Channels		mm	10	P0
About	Channel	C1		
Dimensions	Resolution	0.0010000000		
Formats	Units	MM		
Formulas	Reversed	Yes		
Tolerances	Type	Analog		
SPC	Ref Marks	None		
Header	M.Z. Cnts	0		
Memory	Notify Errors	Yes		
	Interpolation	X5		
Channels				
List				ApplyAll

**NOTE**

When a thermocouple is connected to the RS-232 serial port, no other RS-232 functions, such as the Send function, are available.

The thermocouple input can be assigned to any channel using the Channel and Type fields. Once the thermocouple is assigned to an input channel, any encoders attached to that channel connector will be ignored.

Press the List softkey to display a list of input types available for the current channel. Highlight the desired input type, and then press the Enter key to select the type.

Channels		mm	0	P0
Channels	Channel	C1		
Display	Resolution	0.0010000000		
Hot Keys	Units	MM		
Report	Reversed	No		
Rep Chars	Type	Analog		
Send	Ref Marks	None		
Send Chars	M.Z. Cnts	0		
Parallel	Notify Errors	Yes		
RS232	Interpolation	X5		
SLEC				
List				ApplyAll

**Reference Marks**

Encoder reference marks are used to home the system when it is started. The Gage-Chek can be configured to prompt the user to cross reference marks or to perform a hard stop machine zero prior to measurements.

Channels		mm	0	P0
About	Channel	C1		
Dimensions	Resolution	0.0010000000		
Formats	Units	MM		
Formulas	Reversed	Yes		
Tolerances	Type	Analog		
SPC	Ref Marks	None		
Header	M.Z. Cnts	0		
Memory	Notify Errors	Yes		
Channels	Interpolation	X5		
	None	Manual	Ref	ApplyAll

**NOTE**

The Reference Marks setup parameter has no meaning when a thermocouple is specified as the channel input device.



When Manual is selected, the operator will be prompted when powering the system to move to the desired zero point and press the Enter key. When Ref is selected, the operator will be prompted to move the encoder to cross a reference mark.

Press the Manual or Ref softkey as required for the encoder on the specified channel.



### Machine Zero Count Offset

The M.Z.Cnts field is used to specify an offset count value for placing home at the desired position.

#### NOTE

The Machine Zero Count setup parameter has no meaning when a thermocouple is specified as the channel input device.

Channels		mm	10	P0
About	Channel	C1		
Dimensions	Resolution	0.0010000000		
Formats	Units	MM		
Formulas	Reversed	Yes		
Tolerances	Type	Analog		
SPC	Ref Marks	None		
Header	M.Z. Cnts	0		
Memory	Notify Errors	Yes		
	Interpolation	X5		
				Apply All

When Acu-Rite C-scale encoders are used, a repeatable machine zero is calculated after two encoder reference marks are crossed. There are reference marks every 10 mm along the encoder, so the reference marks are always nearby. However, the calculated zero can be up to 3000 mm away from the reference marks, and the DRO may read up to 3000 mm for that channel after the zeroing procedure. This inconvenience can be eliminated by entering an arbitrary C-scale offset value into the M.Z.Cnts field that forces the channel to read 0 at any desired position.

Zero the encoder connected to the specified channel by crossing reference marks. Move to the desired zero position and note the offset value displayed on the DRO.

Highlight the M.Z.Cnts field and use the number keypad to enter the offset value (in counts) into the M.Z.Cnts field to zero the channel.

### Notify Errors

The Notify Errors field is used to activate the reporting of scale errors for the specified channel on the DRO screen.



#### NOTE

The Notify Errors setup parameter has no meaning when a thermocouple is specified as the channel input device.

Channels		mm	10	P0
About	Channel	C1		
Dimensions	Resolution	0.0010000000		
Formats	Units	MM		
Formulas	Reversed	Yes		
Tolerances	Type	Analog		
SPC	Ref Marks	None		
Header	M.Z. Cnts	0		
Memory	Notify Errors	Yes		
	Interpolation	X5		
		No	Yes	Apply All

Use the Yes or No softkeys to activate or deactivate error reporting.

**CAUTION**

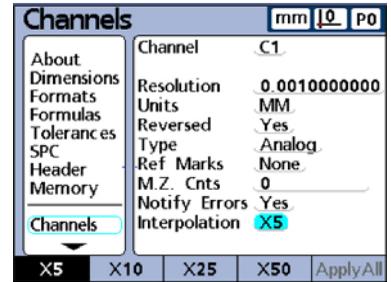
Error notification should be active for nearly all configurations.

**Interpolation**

The Interpolation field is used to enter the specified interpolation factor for the encoder attached to this channel.

**NOTE**

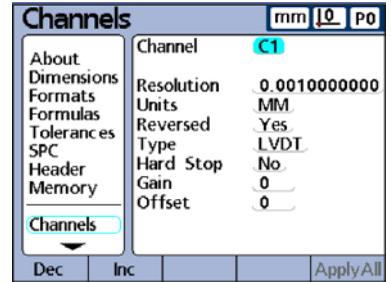
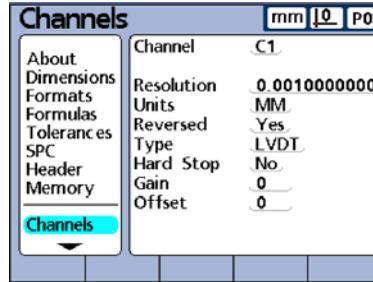
The Interpolation setup parameter has no meaning when a thermocouple is specified as the channel input device.



Use the X5, X10, X25, or X50 softkey to specify the desired interpolation multiplier.

Channel screen for transducers and thermocouples

Highlight the Channel menu item, and then use the right Cursor key to access items in the right portion of the screen.

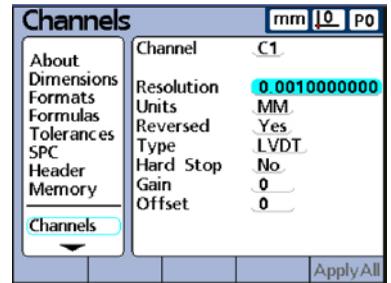


### Specifying the Channel

Use the Dec or Inc softkey to specify the desired input channel.

### Resolution

The resolution field specifies input resolution for LVDT transducer inputs, or specifies input scaling for thermocouple inputs as shown in the example below.



Dimension A = 25

When the temperature is equal to 25° and the resolution is equal to 1

Dimension A = 2.5

When the temperature is equal to 25° and the resolution is equal to 0.1

Use the numeric keypad to enter the desired encoder resolution or thermocouple scale factor for the specified channel.

### Units

The Units field is used to specify transducer displacement units of measure, or thermocouple temperature units of measure.

transducer units of measure can be inches, millimeters or simply numeric. Thermocouple units of measure can be Celsius, Fahrenheit or numeric.

Press the List softkey to display a list of units of measure. Highlight the desired unit, and then press the Enter key to select the unit.

The screenshot shows the 'Channels' menu with the 'Units' field highlighted in blue. The value 'MM' is selected. Other fields include Channel (C1), Resolution (0.0010000000), Reversed (Yes), Type (LVDT), Hard Stop (No), Gain (0), and Offset (0). The 'List' softkey is visible at the bottom left.

The screenshot shows the 'Channels' menu with a list of units displayed. The units listed are In, MM, Deg, Numeric, Celcius, and Farenh. The 'MM' unit is highlighted in blue. The 'List' softkey is visible at the bottom left.

### Reversing Polarity

The Reversed field is used to reverse the direction all transducer counts, and will reverse the polarity of thermocouple temperatures.

Normally, transducer counts increase as the transducer is compressed, and temperature polarities reflect actual conditions.

The screenshot shows the 'Channels' menu with the 'Reversed' field highlighted in blue. The value 'Yes' is selected. Other fields include Channel (C1), Resolution (0.0010000000), Units (MM), Type (LVDT), Hard Stop (No), Gain (0), and Offset (0). The 'Yes' softkey is visible at the bottom left.

Press The Yes softkey to reverse polarity.

### Type

Channel inputs can be provided by full-wave or half-wave LVDT transducers connected to channel input connectors or by a D1311 thermocouple connected to the RS-232 serial port.

The screenshot shows the 'Channels' menu with the 'Type' field highlighted in blue. The value 'LVDT' is selected. Other fields include Channel (C1), Resolution (0.0010000000), Units (MM), Reversed (Yes), Hard Stop (No), Gain (0), and Offset (0). The 'List' softkey is visible at the bottom left.

**NOTE**

When a thermocouple is connected to the RS-232 serial port, no other RS-232 functions, such as the Send function, are available.

The thermocouple input can be assigned to any channel using the Channel and Type fields. Once the thermocouple is assigned to an input channel, any transducers attached to that channel connector will be ignored.

Press the List softkey to display a list of input types available for the current channel. Highlight the desired input type, and then press the Enter key to select the type.

Channels		mm	LO	PO
About	Channel	C1		
Dimensions	Resolution	0.0010000000		
Formats	Units	MM		
Formulas	Reversed	Yes		
Tolerances	Type	LVDT		
SPC	Hard Stop	No		
Header	Gain	0		
Memory	Offset	0		
Channels				
List				Apply All

**Hard Stop**

The Hard Stop field is used to specify that a hard stop will be used at system startup to define a repeatable machine zero.

Press the Yes softkey to specify a hard stop at system startup.

Channels		mm	LO	PO
About	Channel	C1		
Dimensions	Resolution	0.0010000000		
Formats	Units	MM		
Formulas	Reversed	Yes		
Tolerances	Type	LVDT		
SPC	Hard Stop	No		
Header	Gain	0		
Memory	Offset	0		
Channels				
No	Yes			Apply All

**Gain and Offset**

The Gage-Chek includes hardware and software for automatically calibrating the system to accommodate variations in transducer output level and level offset.

Highlight the Gain or Offset field and follow instructions that appear on the Gage-Chek screen for calibrating the the system to accommodate the output level or offset of the transducer connected to this channel.

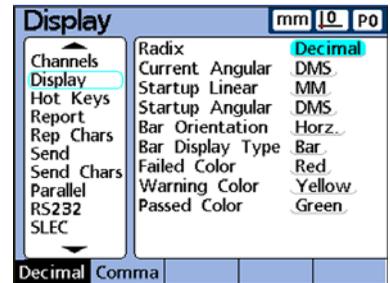
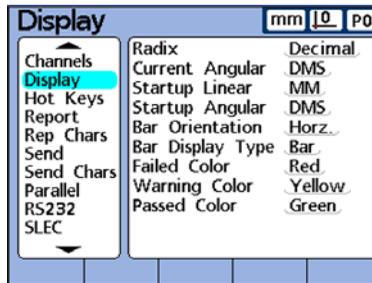
Channels		mm	LO	PO
About	Channel	C1		
Dimensions	Resolution	0.0010000000		
Formats	Units	MM		
Formulas	Reversed	Yes		
Tolerances	Type	LVDT		
SPC	Hard Stop	No		
Header	Gain	0		
Memory	Offset	0		
Channels				
Teach				Apply All

Channels		mm	LO	PO
About	Channel	C1		
Dimensions	Resolution	0.0010000000		
Formats	Units	MM		
Formulas	Reversed	Yes		
Tolerances	Type	LVDT		
SPC	Hard Stop	No		
Header	Gain	0		
Memory	Offset	0		
Channels				
Teach				Apply All

## Display screen

The Display screen contains fields for configuring display parameters.

Highlight the Display menu item, and then use the right Cursor key to access items in the right portion of the screen.



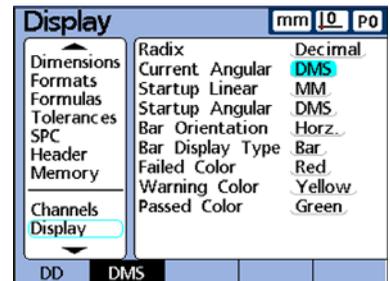
### Radix

The Radix field is used to specify the radix displayed in numeric fields. Use the Decimal (1.0) or Comma (1,0) softkey to enter the desired setting.

### Current Angular

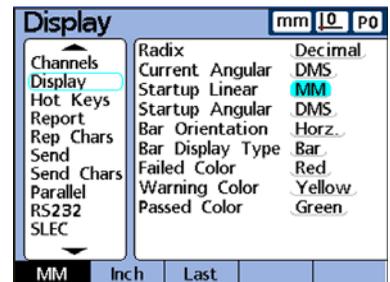
The Current Angular field is used to specify the display mode for angles until power to the system is turned off. When power is reapplied to the system, the startup angular setting will be used to define the display of angles. Current angular displays of measured angles can be set to decimal degrees or to degrees, minutes and seconds.

Use the DD or DMS softkey to enter the desired parameter. This can also be toggled between DD and DMS using the Extra menu from the DRO screen.



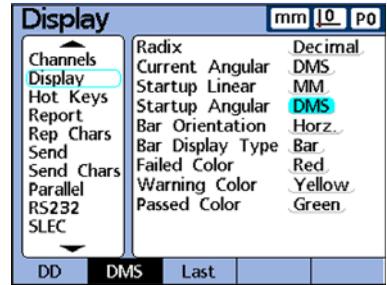
### Startup Angular/Linear

The Startup Angular and Startup Linear fields are used to specify the default display of angular and linear measurements when power is applied to the system. These display settings can be changed temporarily by pressing on the front panel for current data, but will revert to the startup defaults unless the Last setting is selected.



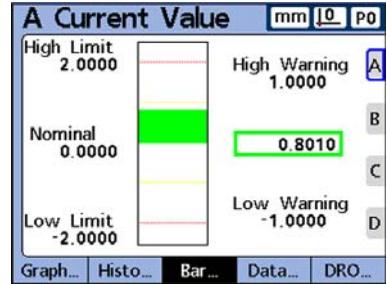
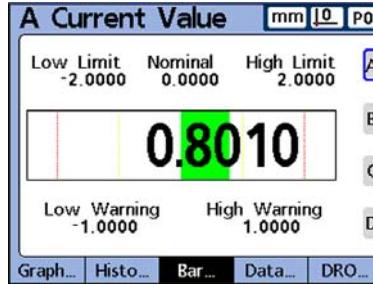
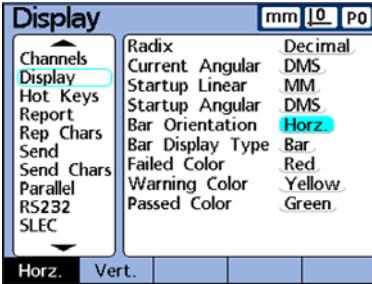
The Last setting can be selected to start the system using the last units that were active at shutdown.

Angular measurements can be displayed in degrees, minutes and seconds or in decimal degrees. Linear measurements can be displayed in English or metric units of measure. Enter the desired settings using the MM, Inch or Last softkey.



### Bar Orientation

The Bar Orientation field is used to specify the horizontal or vertical orientation of dimension bar graphs.

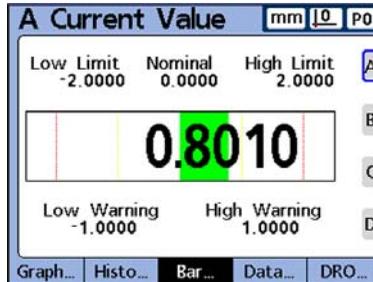
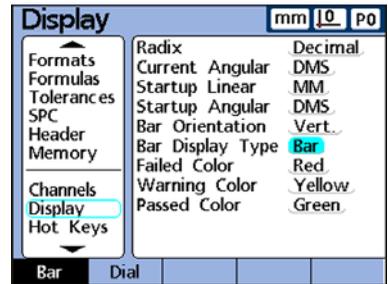


Use the Horz or Vert softkeys to specify the desired orientation.

### Bar Display Type

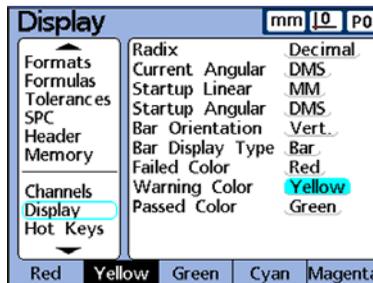
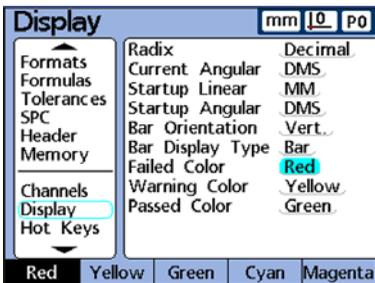
The Bar Display Type field is used to specify a bar graph or dial for dimension current value readings from a single channel.

Use the Bar or Dial softkey to specify the desired display type.



### Failed, Warning and Passed Colors

The Failed, Warning and Passed Color fields are used to specify colors used on DRO current value, graph, data and SPC screens to indicate measurement result status.

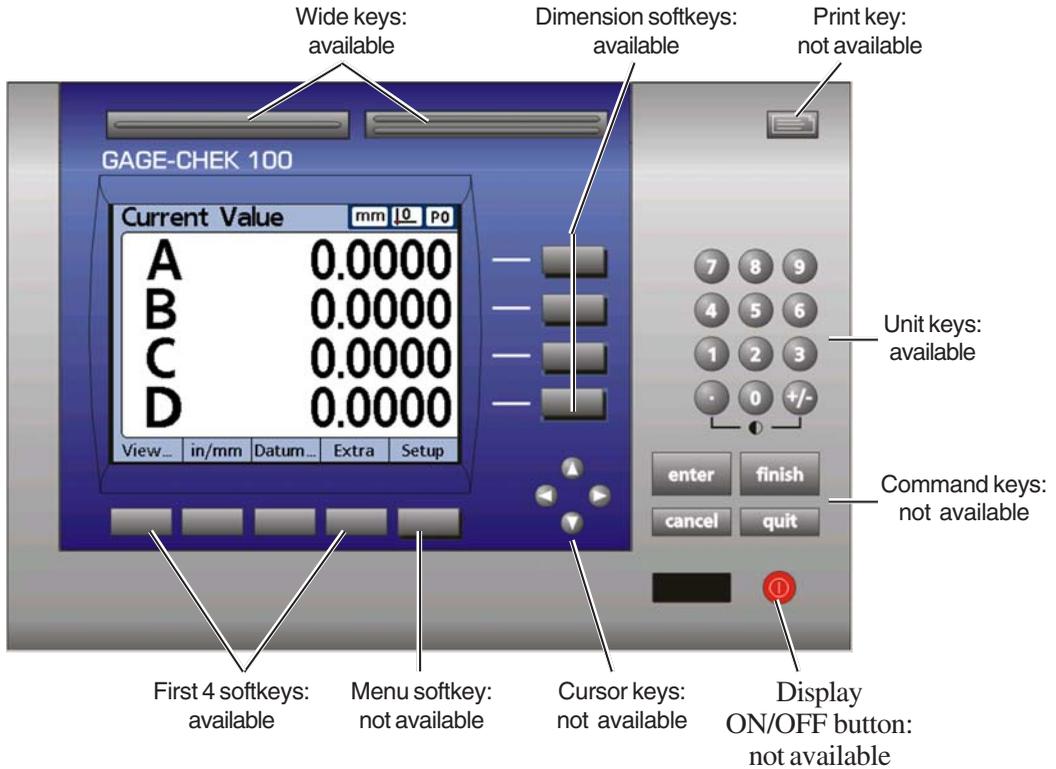


Use the softkeys under the LCD screen to specify colors. The default colors are shown above.

Hot Keys screen

The Hot Keys screen is used to map frequently used Gage-Chek functions to front panel keys, remote keypad keys, and foot switch keys. This feature can save time by eliminating the need to navigate through menus to invoke a function, or by making a function more physically accessible. For example, the Enter key function could be mapped to a footswitch, freeing the operator’s hands for gage loading and unloading operations and thereby accelerating a sequence of measurements.

Keys available for Hot Key mapping are shown and described below:



Softkeys

The first 4 softkeys under the LCD, and the 4 dimension softkeys at the right of the LCD are available for Hot Key mapping. The fifth softkey under the LCD is used to access menus and is unavailable for Hot Key mapping.

Functions assigned to softkeys can only be invoked when the DRO screen is displayed. At other times, softkey functions are permanently assigned by the system for menu, screen and function selection or dimension selection.

### Unit Keys

All unit keys except the decimal point and +/- keys are available for Hot Key mapping. Hot Key functions assigned to unit keys can be invoked at any time unless the system expects a numeric entry to complete a task.

### Remote Key Pad

All numeric remote keys are available for Hot Key mapping. Hot Key functions assigned to numeric remote keys can be invoked at any time unless the system expects a numeric entry to complete a task.

### Footswitch

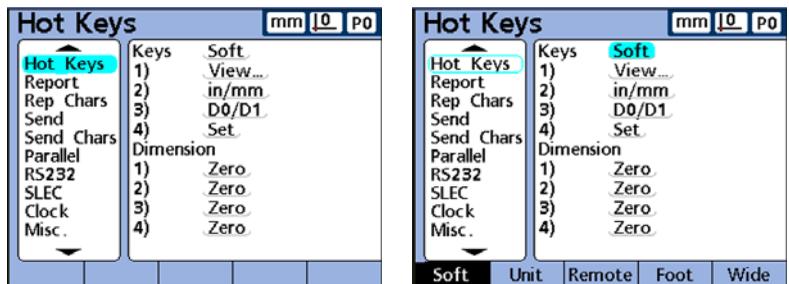
Both footswitch keys are available for Hot Key mapping. Hot Key functions assigned to footswitch keys can be invoked at any time.

### Wide Keys

Both wide keys are available for Hot Key mapping. Hot Key functions assigned to wide keys can be invoked at any time.

### Assigning Hot Keys

Highlight the Hot Keys Setup menu item, and then use the right Cursor key to access items in the right portion of the screen.

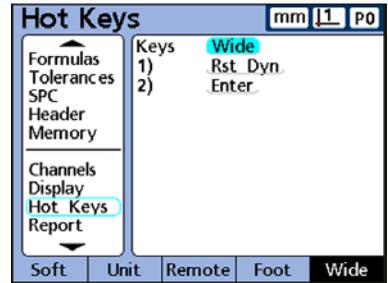


The method used to assign Hot Key functions is identical for all key types (soft, unit, remote, foot and wide). A key type is selected using a softkey under the LCD, and then assignments are made for individual keys in the right half of the Hot Keys Setup screen.



*Wide*

Wide (fast track) keys 1 or 2.

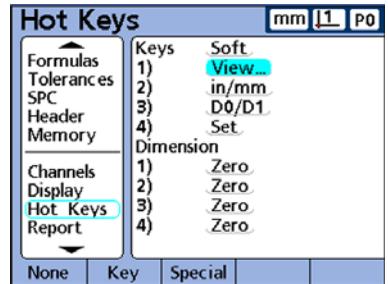


**Function types**

After a key is selected for Hot Key mapping, a function can be assigned (or reassigned) by pressing the None, Key or Special softkey.

*None*

No assignment will be made; this will not be a hot key.



*Key*

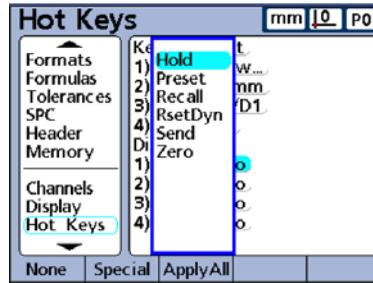
A key function will be assigned by pressing one of the front panel keys.

*Special*

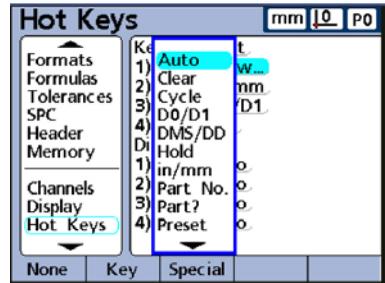
A Gage-Chek system function will be assigned by scrolling and selecting from a menu.

## Special Menu

The Special menu for dimension softkeys is different than the Special menu for the softkeys under the screen and for the unit, wide and footswitch keys. The difference is that while functions mapped to non-dimension softkeys can be quite broad in scope, the functions mapped to a dimension softkey apply only to the dimension associated (horizontally) with that specific key.



Special menu for dimension keys



Special menu for all other keys

The Special menus for the dimension keys and the Special menu for all other keys are discussed below.

### *Special menu for mapping to dimension keys*

Functions mapped to dimension softkeys apply only to the associated dimensions. For example, when the Send function is mapped to the Dimension A softkey, only the current value of Dimension A is transmitted over the RS-232 serial port when the Dimension A key is pressed.

Once a function is mapped to a dimension softkey, pressing the Apply All softkey extends the function type to all other dimension keys. Functions remain specific to individual keys as described in the previous paragraph.

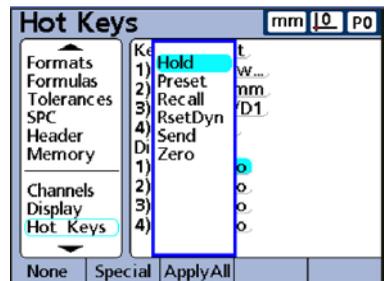
Functions in this special menu include:

#### *Hold*

Toggle function that holds (freezes) or releases the current value of the associated single dimension.

#### *Preset*

Presets the datums of all dimensions.



*Recall*

Applies the last used datum preset to all dimensions.

*RsetDyn*

Resets the minimum or maximum values accumulated during dynamic measurements. Resets the associated single dimension.

*Send*

The Send function transmits the current value of the associated single dimension.

The Send function transmits data to a printer or a computer or both depending on parameters configured in the Parallel or RS232 setup screens.

*Zero*

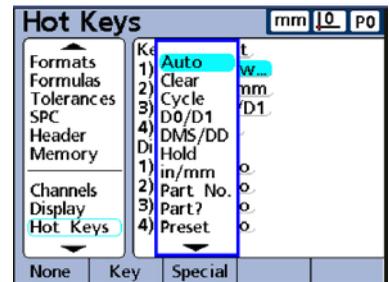
Zeros the current datum for the associated single dimension.

*Special menu for mapping to keys other than dimension keys*

Functions in this special menu include:

*Auto*

The Auto function toggles the Trip function ON and OFF. Please refer to the discussion of the Trip function in [Chapter 4: Formulas](#) for details.



**NOTE**

**The Auto function is only available for mapping to softkeys.**

*Clear*

Clears the incremental datums for all dimensions.

*Cycle*

Advances to the next part number. Part numbers are cycled in a continuous loop.

*D0/D1*

Toggles between the display of current values for the absolute datum (datum 0) and the incremental datum (datum 1).

*DMS/DD*

Toggles between the current presentation of degrees/minutes/seconds and decimal degrees for angular measurements.

*Hold*

Toggle function that holds (freezes) or releases the current value of all dimensions.

*In/Mm*

Toggles between the display of current dimension values between inches and mm.

*Part No.*

The part number, selected by the user during Hot Key setup, becomes the current part when the key is pressed.

*Part?*

Displays a pop-up screen that allows the user to specify a new part number.

*Preset*

Presets the datums of all dimensions.

*Rad/Dia*

Toggles between radius and diameter measurement types on the DRO screen if radius or diameter was specified in the Formats setup screen earlier.

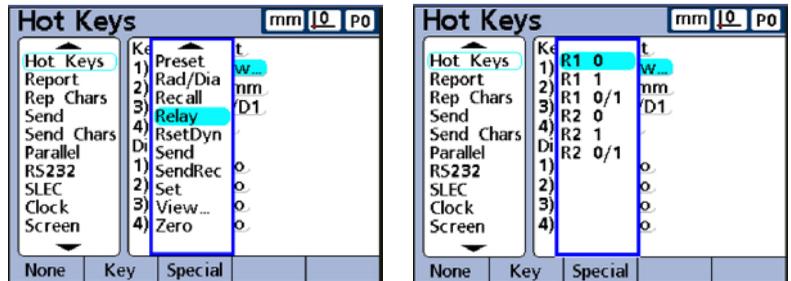
Toggles between radius and diameter on single dimensions when assigned to a dimension key, or on all dimensions when assigned to other keys.

*Recall*

Applies the last used datum preset to all dimensions.

### Relay

The output states of Relay 1 and Relay 2 can be assigned to hot keys. The output states of each relay are independent of the other, and can be the de-energized (0), or energized (1) or toggled as shown below.



Examples:

- R1 0: Relay 1 is de-energized (off, 0)
- R1 1: Relay 1 is energized (on, 1)

#### Relay output states

Conn pin	De-energized (0)	Energized (1)
1	Relay 1 Input	Relay 1 Input
2	Relay 1 Normally closed	Relay 1 Open
3	Relay 1 Normally open	Relay 1 Closed
4	Relay 2 Normally open	Relay 2 Closed
5	Relay 2 Normally closed	Relay 2 Open
6	Relay 2 Input	Relay 2 Input
7	-	-
8	-	-

8 PIN DIN (Male)



#### Selecting a relay output state

Step 1

Select a key for hot key assignment, and then press Special.

Step 2

Highlight Relay, and then press Enter.

Step 3

Highlight the desired relay and relay state, and then press Enter.

*RsetDyn*

Resets the minimum or maximum values accumulated during dynamic measurements. Resets all dimensions.

*Send*

The Send function transmits the current value of all dimensions.

The Send function transmits data to a printer or a computer or both depending on parameters configured in the Parallel or RS232 setup screens.

*Send Rec*

The Send Rec function transmits the last (most recent) record, a range of records, or all records.

The Send Rec function transmits data to a printer or a computer, or both depending on parameters configured in the Parallel or RS232 setup screens.

*Set*

Displays a pop-up screen that allows the user to set selected channels to specific values or ranges of values as determined by the Allow Full Calibration field of the Misc setup screen. Please refer to [Chapter 5: Operation](#) for more details regarding the use of the Set function.

*View*

Changes to the DRO and SPC data view for all dimensions.

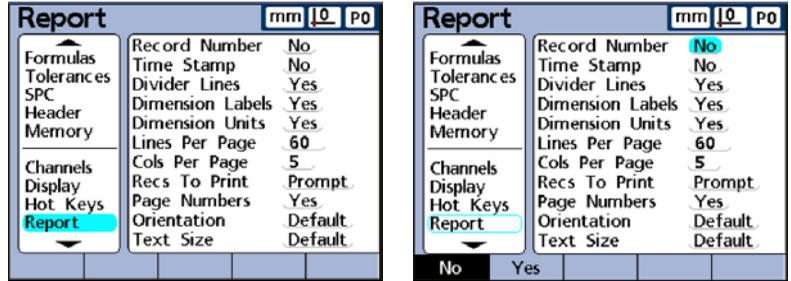
*Zero*

Zeros the current datum for all dimensions.

## Reports screen

The Reports screen contains fields for specifying the contents and formatting of printed reports.

Highlight the Reports menu item, and then use the right Cursor key to access items in the right portion of the screen.



## Report Formatting

Many fields provide the opportunity to turn report format parameters on or off with selections of Yes or No. Select Yes in these fields to enable:

- Record Number      Record index number in database
- Time Stamp          Date and time data was collected
- Divider Lines        Row and column lines
- Dimension Labels    Dimension labels at tops of columns
- Dimension Units     Units of measure printed with values
- Page Numbers        Report page numbers

Time Stamp	Rec No.	Time/Date	A	B	C	D	Dimension Labels
	9	8.07.19 AM 1-21-03	0.7090 mm	0.7390 mm	0.7660 mm	0.7840 mm	
	8	8.07.16 AM 1-21-03	0.7100 mm	0.7390 mm	0.7670 mm	0.7870 mm	
Record Number	7	8.07.14 AM 1-21-03	0.7080 mm	0.7380 mm	0.7650 mm	0.7840 mm	Dimension Units
	6	8.07.12 AM 1-21-03	0.7090 mm	0.7390 mm	0.7660 mm	0.7840 mm	
Divider Lines	5	8.07.10 AM 1-21-03	0.7130 mm	0.7420 mm	0.7700 mm	0.7890 mm	
	4	8.07.08 AM 1-21-03	0.7120 mm	0.7420 mm	0.7700 mm	0.7890 mm	
	3	8.07.06 AM 1-21-03	0.7090 mm	0.7390 mm	0.7670 mm	0.7860 mm	
	2	8.07.04 AM 1-21-03	0.7080 mm	0.7380 mm	0.7650 mm	0.7830 mm	
Page Numbers	1	8.07.00 AM 1-21-03	0.7110 mm	0.7400 mm	0.7680 mm	0.7870 mm	

Page 1

Other selections should be made to adjust the print format to meet the requirements of individual reports.

### Lines per page

Horizontal divider lines and lines of text are considered lines. Enter values into this field using the numeric keypad.

Report		mm	10	P0
Formulas	Record Number	No		
Tolerances	Time Stamp	No		
SPC	Divider Lines	Yes		
Header	Dimension Labels	Yes		
Memory	Dimension Units	Yes		
	Lines Per Page	60		
Channels	Cols Per Page	5		
Display	Recs To Print	Prompt		
Hot Keys	Page Numbers	Yes		
Report	Orientation	Default		
	Text Size	Default		

### Columns per page

Only vertical columns of text are considered columns. The example report shown earlier contains 6 columns of text. Enter values into this field using the numeric keypad.

Report		mm	10	P0
Formulas	Record Number	No		
Tolerances	Time Stamp	No		
SPC	Divider Lines	Yes		
Header	Dimension Labels	Yes		
Memory	Dimension Units	Yes		
	Lines Per Page	60		
Channels	Cols Per Page	5		
Display	Recs To Print	Prompt		
Hot Keys	Page Numbers	Yes		
Report	Orientation	Default		
	Text Size	Default		

### Orientation

The orientation can be specified as portrait or landscape. Select the desired orientation using softkeys under the LCD.

Report		mm	10	P0
Formulas	Record Number	No		
Tolerances	Time Stamp	No		
SPC	Divider Lines	Yes		
Header	Dimension Labels	Yes		
Memory	Dimension Units	Yes		
	Lines Per Page	60		
Channels	Cols Per Page	5		
Display	Recs To Print	Prompt		
Hot Keys	Page Numbers	Yes		
Report	Orientation	Default		
	Text Size	Default		
Default		Portrait	Landsc a.	

### Text Size

The text size can be specified as normal or small. Select the desired size using softkeys under the LCD.

Report		mm	10	P0
Formulas	Record Number	No		
Tolerances	Time Stamp	No		
SPC	Divider Lines	Yes		
Header	Dimension Labels	Yes		
Memory	Dimension Units	Yes		
	Lines Per Page	60		
Channels	Cols Per Page	5		
Display	Recs To Print	Prompt		
Hot Keys	Page Numbers	Yes		
Report	Orientation	Default		
	Text Size	Default		
Default		Normal	Small	

### Records printed

The records printed on a report can include a range specified by the user, records not yet printed (New), all records in the database or only the selected records.

Report		mm	10	P0
Formulas	Record Number	No		
Tolerances	Time Stamp	No		
SPC	Divider Lines	Yes		
Header	Dimension Labels	Yes		
Memory	Dimension Units	Yes		
	Lines Per Page	60		
Channels	Cols Per Page	5		
Display	Recs To Print	Prompt		
Hot Keys	Page Numbers	Yes		
Report	Orientation	Default		
	Text Size	Default		
	Range	New	All	Selected
				Prompt

#### *Range*

The user will be prompted to specify the number of records to print.

#### *New*

Only records that have not yet been printed will be printed.

#### *All*

All records in the database will be printed.

#### *Selected*

The highlighted record will be printed.

#### *Prompt*

The user will be prompted to select records to be printed. The user choices will include: range, new, all, and selected.



### NOTE

It might become necessary to increase the number of Parallel Retries found in the Parallel setup screen to print reports to certain parallel printers.

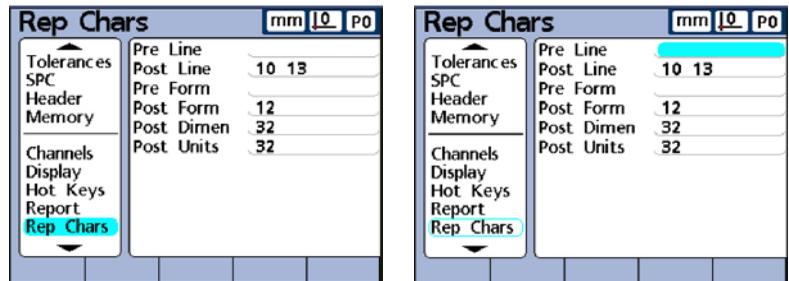
## Report characters screen

Reports can include ASCII codes for printer functions such as Carriage Return (ASCII code 13), Line Feed (ASCII code 10) and others to provide printer formatting based on the unique requirements of specific printers. Multiple ASCII codes can be included in a single field when separated by spaces.

**NOTE**

The Gage-Chek supports HP™ printers using the HP PCL data format.

Highlight the Rep Chars menu item, and then use the right Cursor key to access items in the right portion of the screen.



Enter the required ASCII codes into the formatting fields using the numeric keypad. Fields are available for inserting ASCII control or character codes:

- Before and after lines of text  
(Pre line and post line)
- Before and after the form  
(Pre form and post form)
- After each dimension value  
(Post dimem)
- After each unit of measure  
(Post unit)

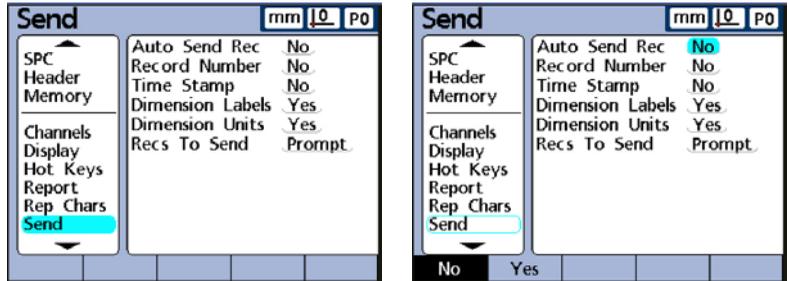
**NOTE:**

A complete list of ASCII codes is contained in Chapter 6: Communication.

## Send screen

The Send screen contains fields for specifying the contents of record data files transmitted to other computers. The Auto Send record feature can also be enabled in this screen.

Highlight the Send menu item, and then use the right Cursor key to access items in the right portion of the screen.

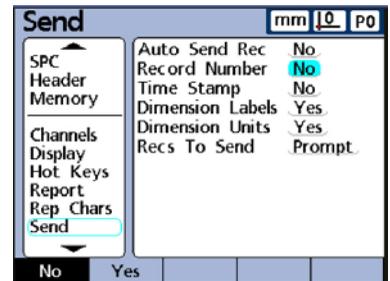


### Auto Send Record

Record data can be transmitted automatically as each record is entered into the database. Press the Yes softkey to enable, or the No softkey to disable this feature.

### Send Data Content

Four fields provide the opportunity to include or omit record data with selections of Yes or No. Select Yes in these fields to include data.



- Record Number      Record index number in database
- Time Stamp          Date and time data was collected
- Dimension Labels    Dimension labels at tops of column
- Dimension Units     Units of measure printed with values

**Records to Send**

The records transmitted can include a range specified by the user, records not yet transmitted (New), all records in the database or only the selected record.

*Range*

The user will be prompted to specify the number of records to transmit. The most recently acquired record will be transmitted.

*New*

Only records that have not yet been transmitted will be sent.

*All*

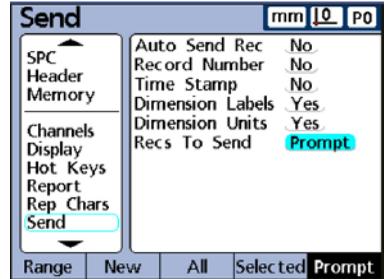
All records in the database will be transmitted.

*Selected*

The highlighted record will be transmitted.

*Prompt*

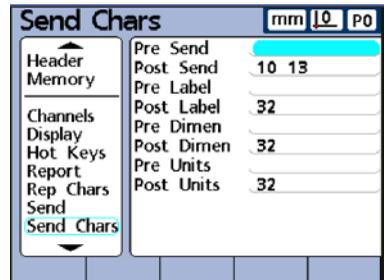
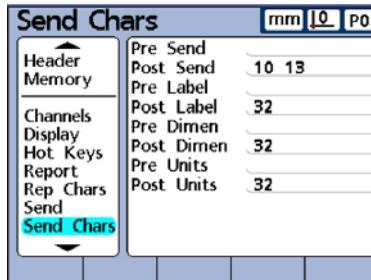
The user will be prompted to select records to be transmitted. The user choices will include: range, new, all, and selected.



**Send characters screen**

Transmitted data can include ASCII codes such as Carriage Return (ASCII code 10), Line Feed (ASCII code 13) and others to provide formatting based on the requirements of the receiving computer software. Multiple ASCII codes can be included in a single field when separated by spaces.

Highlight the Send Chars Setup menu item, and then use the right Cursor key to access items in the right portion of the screen.



Enter the required ASCII codes into the formatting fields using the numeric keypad.

Fields are available for inserting ASCII control or character codes:

- Before and after record data  
(Pre send and post send)
- Before and after the header label  
(Pre label and post label)
- Before and after each dimension value  
(Pre dimen and post dimem)
- Before and after each unit of measure  
(Pre unit and post unit)



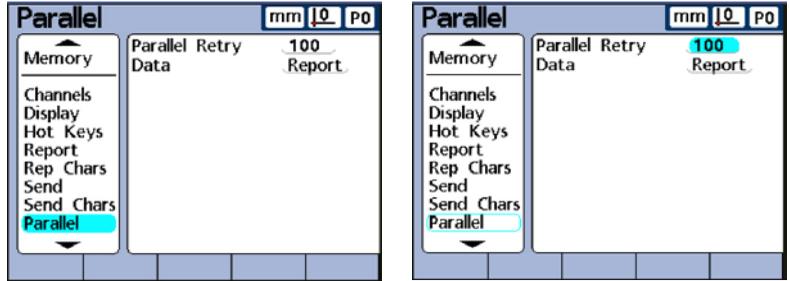
**NOTE**

**A complete list of ASCII codes is contained in Chapter 6: Communication.**

## Parallel screen

The Parallel screen contains fields for specifying the number of parallel communication attempts and the type of data sent to the parallel (printer) port.

Highlight the Parallel menu item, and then use the right Cursor key to access items in the right portion of the screen.



### Parallel Retry

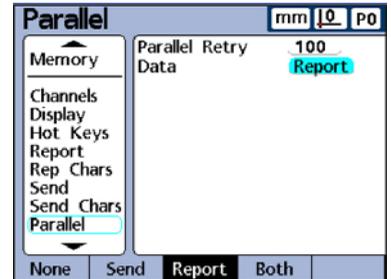
The Parallel Retry field is used to specify the number of unsuccessful parallel communication attempts allowed prior to notifying the user that parallel communication has failed. This number can be increased to accommodate large file transfers and slow parallel devices.

Use the numeric keypad to enter values into this field.

### Data

Data can be sent to the parallel port as a report formatted in the Report Setup screen, or as record data formatted in the Send Setup screen, or both.

The parallel port can also be disabled for data transmission by selecting the None softkey.



Select the desired data transmission state for the parallel port using the softkeys under the LCD.

## RS-232 screen

The RS-232 screen contains fields for specifying the RS-232 serial port settings for communication with a computer or serial printer.

Highlight the RS-232 menu item, and then use the right Cursor key to access items in the right portion of the screen.



## Baud Rate

The Baud field is used to specify the baud rate of serial data. Use the Dec or Inc softkey to decrease or increase the baud rate from 1200 to 115,200.

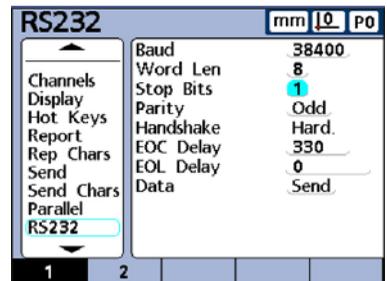
## Word Length

The Word Len field is used to specify the number of bits contained in each data word. Use the 7 or 8 softkey to specify the word length.



## Stop Bits

The Stop Bits field is used to specify the number of stop bits included after each data word. Use the 1 or 2 softkey to specify the number of stop bits.



### Parity

The Parity field is used to specify odd or even parity for error checking, or to omit parity error checking. Use the None, Odd or Even softkeys to specify parity error checking parameters.



### Handshaking

The Handshake field shows the type of synchronous signaling used by the system to prevent data collisions on the serial port. This is set to hardware and cannot be changed.

### End of Character Delay

The EOC delay field is used to specify the delay inserted after each character is transmitted. This delay can be increased or decreased to accommodate various serial devices. Use the numeric keypad to specify delays (in milliseconds) from 0 to 10 seconds between characters.



### End of Line Delay

The EOL delay field is used to specify the delay inserted after each line is transmitted. This delay can be increased or decreased to accommodate various serial devices. Use the numeric keypad to specify delays (in milliseconds) from 0 to 10 seconds between lines.



### Data

Data can be sent to the serial port as a report formatted in the Report Setup screen, or as record data formatted in the Send Setup screen, or as both.

The serial port can also be disabled for data transmission by selecting the None softkey.

The screenshot shows the RS232 configuration screen. The title bar reads 'RS232' and 'mm | 0 | P0'. The screen is divided into two main sections. The left section is a scrollable list of options: Channels, Display, Hot Keys, Report, Rep Chars, Send, Send Chars, Parallel, and RS232. The right section displays the current settings for each option: Baud (38400), Word Len (8), Stop Bits (1), Parity (Odd), Handshake (Hard), EOC Delay (330), EOL Delay (0), and Data (Send). At the bottom of the screen, there are four softkeys: None, Send, Report, and Both.

Option	Value
Baud	38400
Word Len	8
Stop Bits	1
Parity	Odd
Handshake	Hard
EOC Delay	330
EOL Delay	0
Data	Send

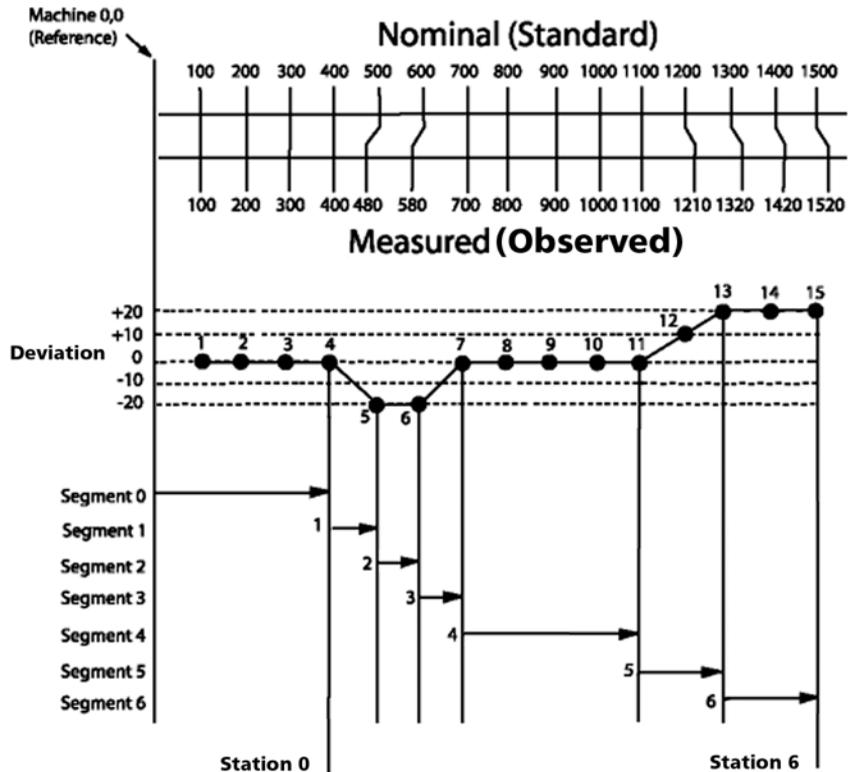
Press the Finish key to return to the Setup menu.

SLEC screen

The SLEC screen contains fields for enabling and configuring segmented linear error correction (SLEC) for each input channel.

Channel input devices might have slight non-linearities over their measurement range. The SLEC feature compensates for these non-linearities by applying correction coefficients to measurements conducted over nonlinear portions. These SLEC correction coefficients are created by the Gage-Chek system using data provided by the user in the SLEC Setup screen. The SLEC setup data provided by the user consists of nominal and measured values of a standard, or standards that cover the entire input range.

The measurements divide the input range into a number of segments. The following diagram shows nominal (standard) values compared to measured (observed) values. The deviation (difference between standard and observed) is shown as a graph. Segments are defined here as any straight line on the graph, beginning with segment zero.

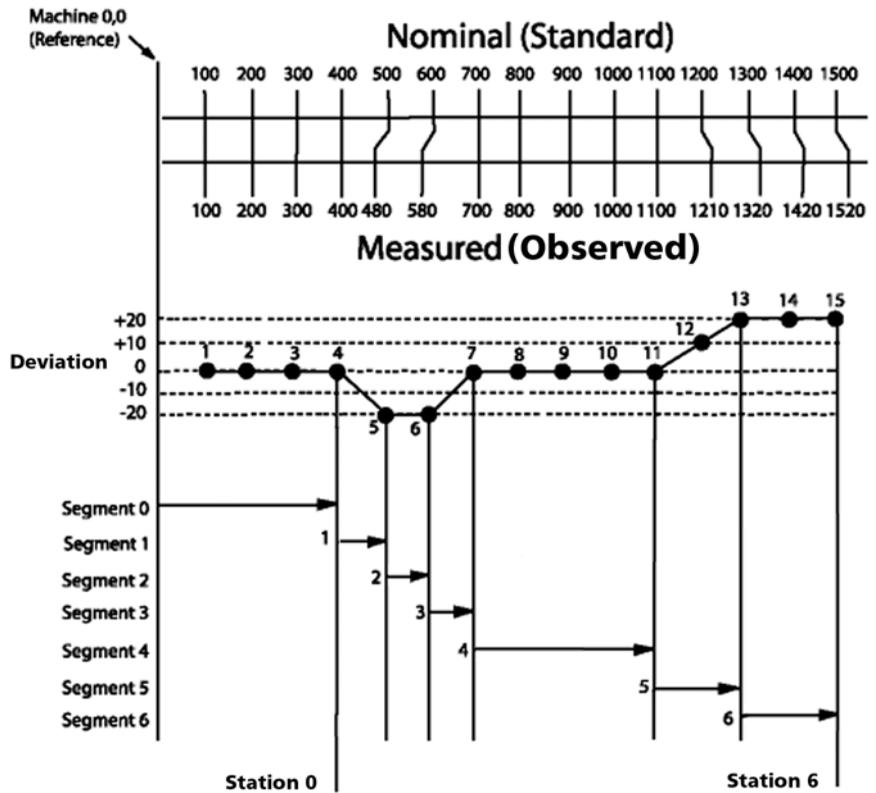


The standard and observed values at the end of each segment are entered as data for a station in the SLEC Setup screen. For example, the standard and observed values at the end of segment 0 on the diagram are 400 and 400, and are entered in this screen for station 0.

SLEC		mm	10	P0
Channels	Channel	C1		
Display	Enabled	Off		
Hot Keys	Station	0		
Report	Standard			
Rep Chars	Observed			
Send	MZ Offset	0.000000		
Send Chars				
Parallel				
RS232				
SLEC				

Station number  
Data

SLEC		mm	10	P0
Channels	Channel	C1		
Display	Enabled	Off		
Hot Keys	Station	0		
Report	Standard	400.00000		
Rep Chars	Observed	400.00000		
Send	MZ Offset	0.020000		
Send Chars				
Parallel				
RS232				
SLEC				
Teach				



When the procedure is complete and setup data are entered, correction coefficients will be calculated for the input based on the standard and observed values at the end of the segments.

SLEC setup procedure

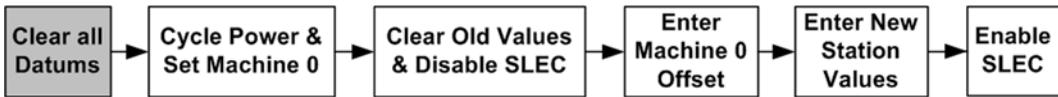
The procedure for configuring the SLEC error correction is diagrammed and explained below.



**CAUTION**

Make sure that all encoder channel resolutions and machine zero references are properly configured, and that any required channel Set operations have been completed prior to configuring the SLEC feature. Refer to the description of Channel setup earlier in this chapter, and to the description of the Set function in Chapter 5: Operation.

The overall SLEC setup process is diagrammed below.

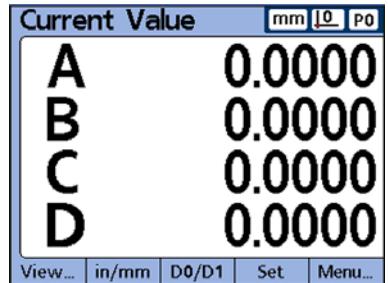


**Clear All Datums**

Steps 1 through 3 clear incremental datums in preparation for SLEC standard measurements.

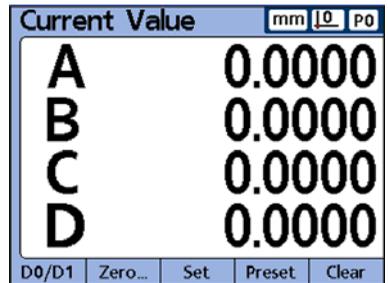
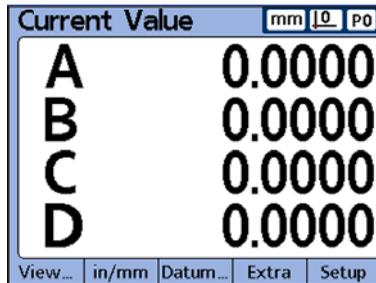
Step 1

From the DRO screen, press the Menu softkey.



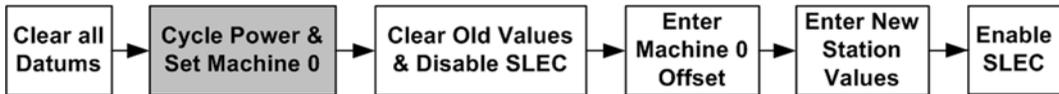
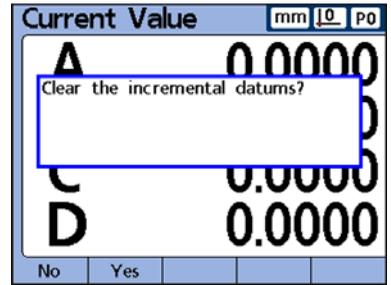
Step 2

Press the Datum softkey, and then press the Clear softkey.



You will be asked to confirm your Clear datums request.

Step 3  
Press the Yes softkey to clear datums.



### Cycle Power & Set Machine Zero

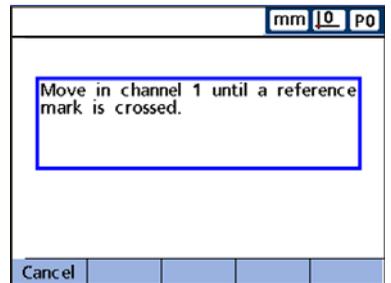
Steps 4 and 5 cycle power to reestablish fresh machine zeros for all input channels.

Step 4  
Turn the Gage-Chek power switch off, wait for approximately 3 seconds and turn the power switch on again.

Step 5  
Press any key to initiate the Gage-Chek display.

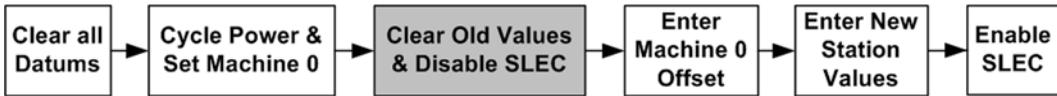
You will be prompted to cross reference marks or perform hard stop zeroing on all input channels.

Perform machine zero operations on all channels.



### NOTE

If a hard stop zero is performed, the same stop will be required each time the Gage-Chek is started.

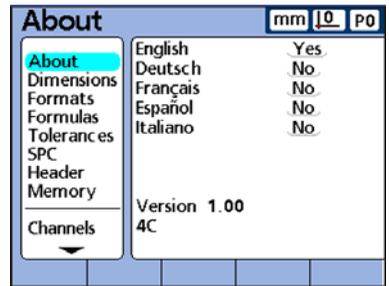
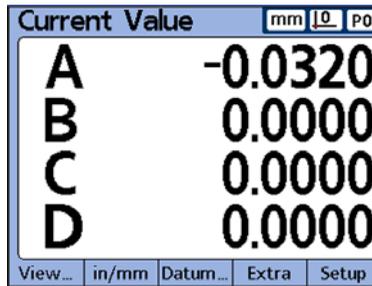
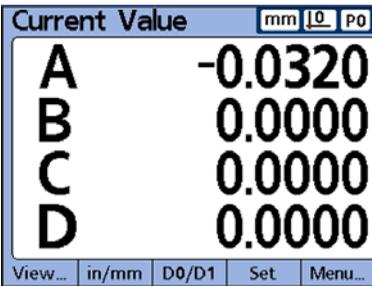


### Clear Old Values & Disable SLEC

Steps 6 through 13 disable the SLEC feature to isolate the SLEC data fields during the data entry process, and clear old SLEC values.

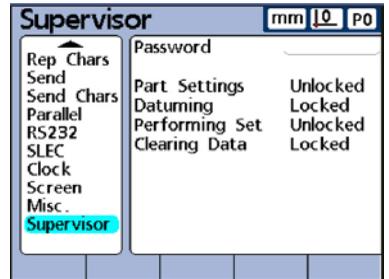
Step 6

Press the Menu softkey, then the Setup softkey to reenter the setup menu.



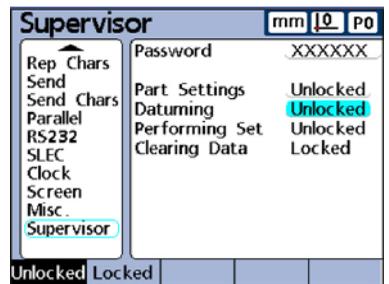
Step 7

Highlight the Supervisor menu item, and then press the right Cursor key to highlight the Password field.

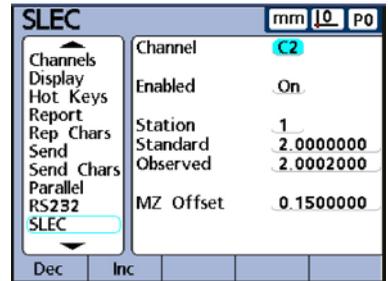


Enter the supervisor password and unlock the Part Settings and Datuming if necessary.

Press the Finish key to return to the Setup menu.



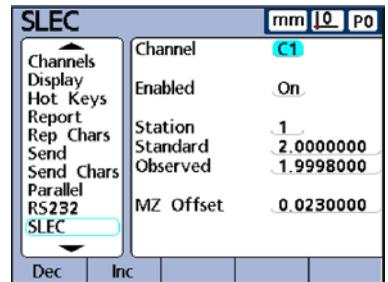
Step 8  
 Highlight the SLEC Setup menu item and use the right Cursor key to highlight the Channel field.



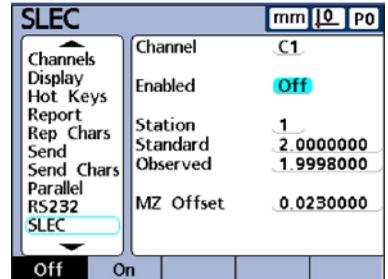
If this is the first time that SLEC compensation is being configured, or if new SLEC values are being created for all encoders, then SLEC for all channels must be disabled. Any existing SLEC values must also be cleared.

However, if only a fraction of channels require new SLEC values, only those channels must be disabled and cleared of old values.

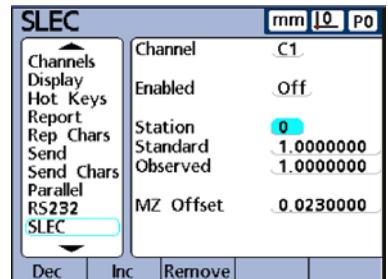
Step 9  
 Use the Dec or Inc softkey to select a channel that will be configured.



Step 10  
 Highlight the Enabled field and press the Off key to disable SLEC for the selected channel.



Step 11  
 Highlight the Station field and use the Dec or Inc key if necessary to display Station 0.

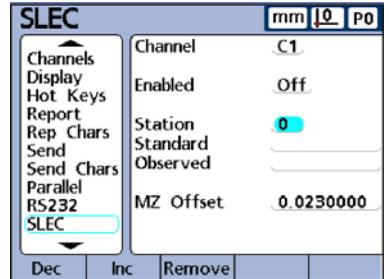
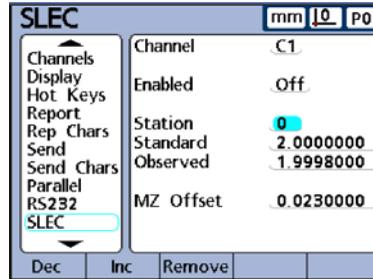


Step 12

If the Standard and Observed fields contain data, press the remove softkey to clear the data.

The old station 0 data will be replaced by data from station 1.

Continue pressing the remove key until the Standard and Observed fields are empty.

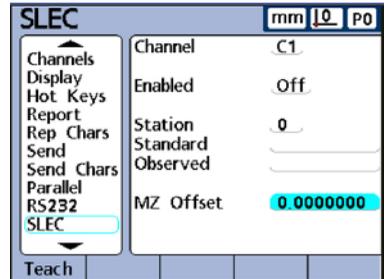


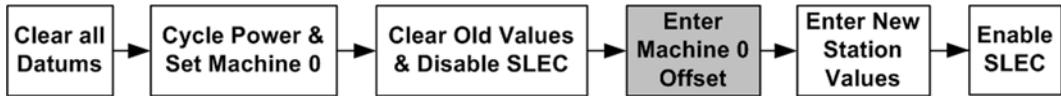
Step 13

Highlight the MZ Offset field and use the numeric keypad to enter 0.

Step 14

Repeat steps 9 through 13 for each encoder channel to be configured for SLEC.





### Enter Machine 0 Offset

Steps 15 through 17 enter the offset count value from machine zero to the standard's zero.

#### Step 15

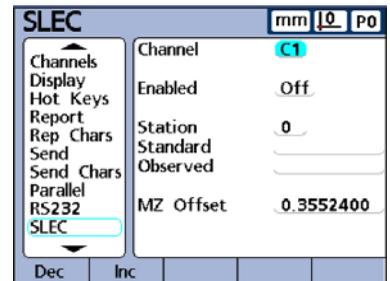
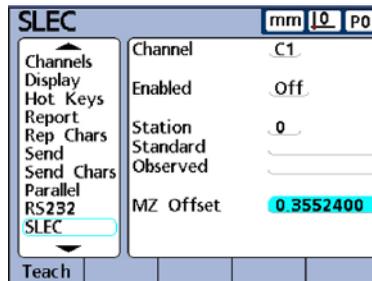
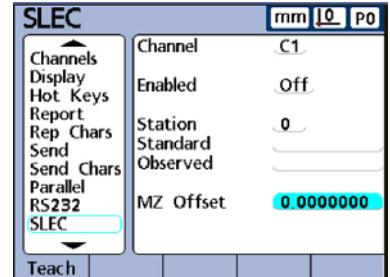
Highlight the MZ Offset field of the channel being configured.

#### Step 16

Position the Channel's probe against the standard's zero surface.

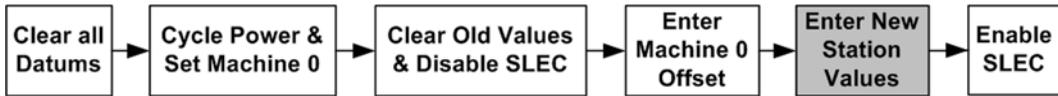
#### Step 17

Press the Teach softkey, then press the Enter key to enter the machine zero offset.



### NOTE

Machine zero offset will not be entered again for this channel.



### Enter New Station Values

Steps 18 through 25 enter standard and observed values across the entire range of measurement.

The station 0 data is used as the reference for all subsequent SLEC segment measurements and is derived from the standard's zero surface. Station 0 Standard and Observed field data must be identical or entered as zeros to initiate the standard's reference position.

#### Step 18

Highlight the Standard field and enter 0 using the numeric keypad, then press the Enter key.

SLEC		mm	0	P0
Channels	Channel	C1		
Display	Enabled	Off		
Hot Keys	Station	0		
Report	Standard	0.0000000		
Rep Chars	Observed	0.0000000		
Send	MZ Offset	0.3552400		
Send Chars				
Parallel				
RS232				
SLEC				
Teach				

#### Step 19

Highlight the observed field and enter 0 using the numeric keypad, then press the Enter key.

SLEC		mm	0	P0
Channels	Channel	C1		
Display	Enabled	Off		
Hot Keys	Station	0		
Report	Standard	0.0000000		
Rep Chars	Observed	0.0000000		
Send	MZ Offset	0.3552400		
Send Chars				
Parallel				
RS232				
SLEC				
Teach				

Now that the Station 0 reference data is entered into Standard and Observed fields, subsequent observed values can be measured. The observed data could have been entered using the Teach softkey with the same result.

#### Step 20

Highlight the Station field and use the Inc softkey to enter the next station number.

SLEC		mm	0	P0
Channels	Channel	C1		
Display	Enabled	Off		
Hot Keys	Station	1		
Report	Standard			
Rep Chars	Observed			
Send	MZ Offset	0.3552400		
Send Chars				
Parallel				
RS232				
SLEC				
Dec	Inc	Remove		

## Step 21

Highlight the Standard field and use the numeric keypad to enter the value marked on the standard part. Press the Enter key to enter the value and highlight the Observed field.

SLEC		mm	10	P0
Channels	Channel	C1		
Display	Enabled	Off		
Hot Keys	Station	1		
Report	Standard	1.0000000		
Rep Chars	Observed	1.0000000		
Send	MZ Offset	0.3552400		
Send Chars				
Parallel				
RS232				
SLEC				
Teach				

## Step 22

Position the probe against the surface of the standard and press the Teach softkey. The appropriate measured value will be displayed in the Observed field. Press the Enter key to enter the value.

SLEC		mm	10	P0
Channels	Channel	C1		
Display	Enabled	Off		
Hot Keys	Station	1		
Report	Standard	1.0000000		
Rep Chars	Observed	1.0007500		
Send	MZ Offset	0.3552400		
Send Chars				
Parallel				
RS232				
SLEC				
Teach				

## LEC

## Step 23

Repeat steps 20 through 22 to enter Standard and Observed values across the encoder range.



## LEC NOTE

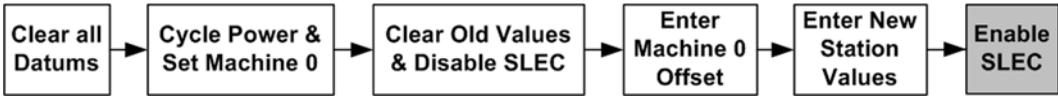
The SLEC feature can be used to perform linear error correction (LEC) if steps 20 through 22 are performed only once, resulting in only 2 stations of values. The first is the zero station (steps 18 and 19), the second is as described in steps 20 through 22 but utilizes a standard equivalent to the maximum range of the input device.

## Step 24

Highlight the channel field and use the Inc softkey to enter the number of the next channel to be configured.

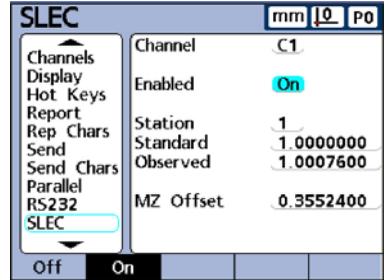
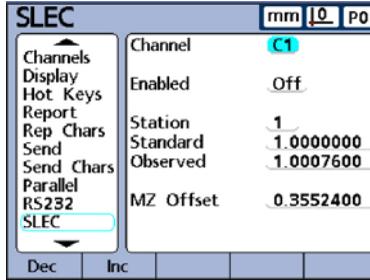
## Step 25

Repeat steps 15 through 24 for each channel until SLEC data is entered for all channels.



### Enable SLEC/LEC

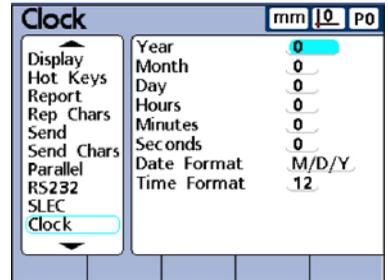
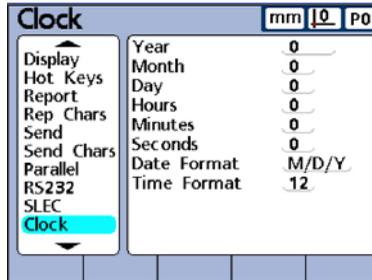
Highlight the Enabled field for any channel and use the On softkey to enable SLEC or LEC for that channel.



**Clock screen**

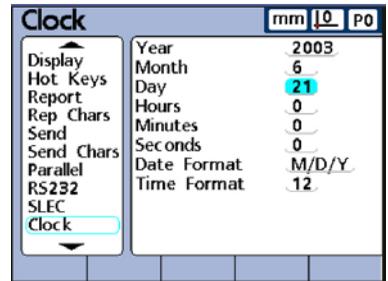
The Clock screen contains fields for setting and formatting displays of date and time shown on the LCD and printed on reports.

Highlight the Clock menu item, and then use the right Cursor key to access items in the right portion of the screen.

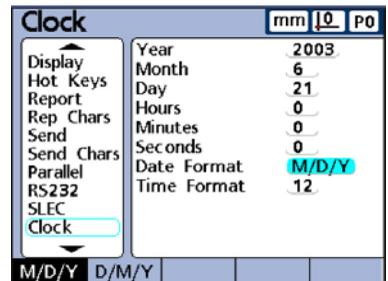


**Setting the Date**

Use the numeric keypad to enter data into the Year, Month and Day fields.



Highlight the Date Format field and use softkeys under the LCD to specify the format for displaying the date on the LCD and printed reports.



### Setting the Time

The time must be entered into the Hours field in the 24 hour format, but can be displayed in either the 12 hour or 24 hour format.

For example, 7:00 pm must be entered into the Hours field as 19, but can be displayed as 19 or 7 pm depending on the selection of the 12 or 24 hour display format.

Use the numeric keypad to enter data into the Hours, Minutes and Seconds fields.

Clock		mm	10	P0
Display	Year		2003	
Hot Keys	Month		6	
Report	Day		21	
Rep Chars	Hours		19	
Send	Minutes		35	
Send Chars	Seconds		20	
Parallel	Date Format		M/D/Y	
RS232	Time Format		12	
SLEC				
Clock				

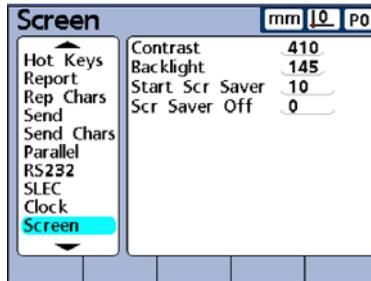
Highlight the Time format field and use softkeys under the LCD to specify the 24 hour or 12 hour format for displaying time on the LCD and printed reports.

Clock		mm	10	P0
Display	Year		2003	
Hot Keys	Month		6	
Report	Day		21	
Rep Chars	Hours		19	
Send	Minutes		35	
Send Chars	Seconds		20	
Parallel	Date Format		M/D/Y	
RS232	Time Format		12	
SLEC				
Clock				
		12	24	

## Screen

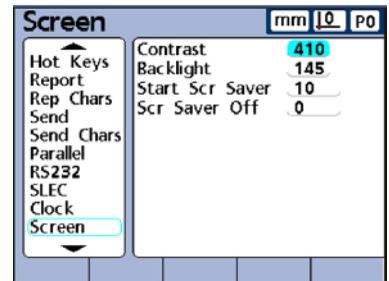
The Screen configuration screen contains fields for specifying LCD display and screensaver parameters.

Highlight the Screen menu item, and then use the right Cursor key to access items in the right portion of the screen.



## Contrast

The Contrast field is used to adjust the default LCD display contrast used when power is applied to the system. The factory default contrast value is 410. This provides sharp contrast and excellent readability in most lighting situations.



Increased values of Contrast increase the contrast of displayed text and images. The acceptable range of values extends from 395 to 425. Highlight the Contrast field and use the numeric keypad to enter the desired value.

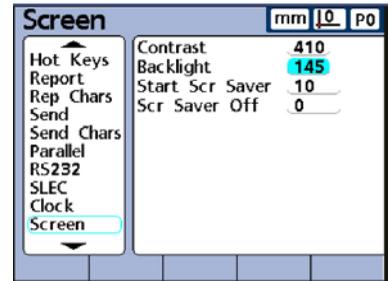


## NOTE

LCD screen contrast can be adjusted temporarily when displaying screens other than setup menu screens by pressing the numeric keypad decimal point or +/- keys. These temporary adjustments will be retained until the Gage-Chek power is cycled off and on again.

### Backlight

The Backlight field is used to adjust the default LCD backlighting used when power is applied to the system. The factory default LCD backlighting value is 145. This provides adequate backlighting for most lighting situations.

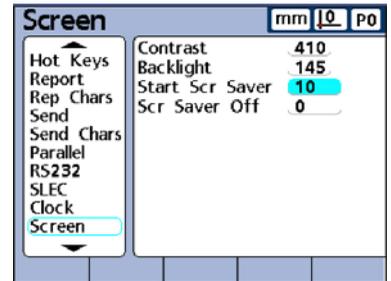


Increased values of Backlight decrease the backlighting of the LCD. The acceptable range of values extends from 0 to 700.

### Start Screen Saver

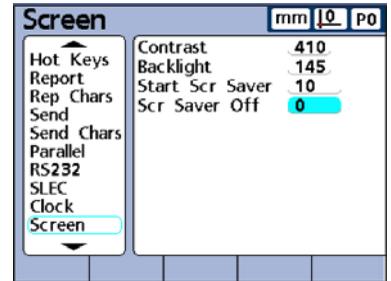
The Start Scr Saver field is used to specify the minutes of Gage-Chek inactivity before the LCD screen saver is displayed.

Highlight the Start Scr Saver field and use the numeric keypad to enter the desired value.



### Screensaver off

The Screen Saver Off field is used to specify the range of motion required on any channel to automatically turn the screensaver off. When the Screen Saver Off field is zero, only pressing a front panel key will turn the screensaver off.



Highlight the Screen Saver Off field, and then use the numeric keypad to enter the desired range of motion.

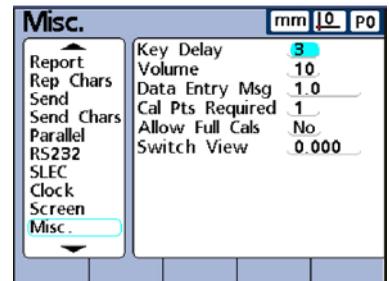
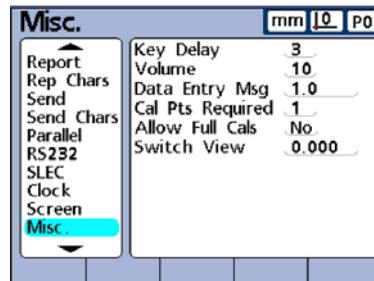
## Misc screen

The Misc screen contains fields for specifying keypad, LCD display, audio and set calibration parameters.

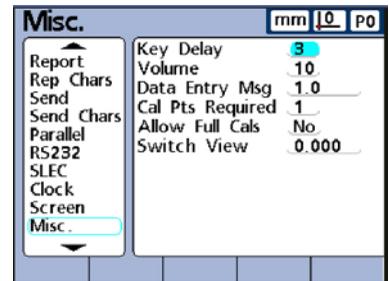
**NOTE**

The Misc screen for encoders is slightly different than the Misc screen for transducers. The Misc screen for LVDT transducers includes an additional LVDT Average Count field at the bottom of the screen. The LVDT Average Count field is discussed at the end of this section.

Highlight the Misc menu item, and then use the right Cursor key to access items in the right portion of the screen.

**Key Delay**

The Key Delay field is used to adjust the rate at which front panel key presses will be accepted, and characters will be repeated when a front panel key pressed and held down. As the delay value is increased, the rate of key entry and auto-repeat decreases.



The default value of 3 provides crisp keypad response and rapid auto-repeat rates. Values less than 3 increase the likelihood of accidental double-entries and are not recommended. Values greater than 3 slow data entry activities.

Highlight the Key Delay field and use the numeric keypad to specify the delay.

### Volume

The Volume field is used to adjust the audible volume of Gage-Chek speaker tones that signal key presses and alerts.

Volume settings range from 0 to 10. A volume setting of 0 disables the audible alert.

The screenshot shows the 'Misc.' menu with the following settings:

Field	Value
Report	3
Rep Chars	10
Send	1.0
Send Chars	1
Parallel	No.
RS232	0.000
SLEC	
Clock	
Screen	
Misc.	

Highlight the Volume field and use the numeric keypad to enter the desired value.

### Data Entry Message

The Data Entry Msg field is used to specify the duration of the display of the data entry confirmation message each time a value is entered.

For example, when this value is 2, the message:

The screenshot shows the 'Misc.' menu with the following settings:

Field	Value
Report	3
Rep Chars	10
Send	1.0
Send Chars	1
Parallel	No.
RS232	0.000
SLEC	
Clock	
Screen	
Misc.	

“Data has been added to the database”

will be displayed for approximately 2 seconds.

The factory default value is 1. Durations range from 0 to 9999. When the value is 0, no message is displayed. When the value is very large, the message will be displayed until the user presses the Quit key, or the duration is allowed to complete.

Highlight the Data Entry Msg field and use the numeric keypad to enter the desired value.

### Calibration Points Required

The Cal Pts Required field is used to specify the number of sampled values that will be averaged to determine the value of channel groups when using the Set function.



Misc.		mm	10	P0
Report	Key Delay	3		
Rep Chars	Volume	10		
Send	Data Entry Msg	1.0		
Send Chars	Cal Pts Required	1		
Parallel	Allow Full Cals	No		
RS232	Switch View	0.000		
SLEC				
Clock				
Screen				
Misc.				

### NOTE

Refer to the Set function description in [Chapter 5: Operation](#).

The factory default value is 1 and should be used in most applications. The number of samples allowed ranges from 1 to 10. Higher numbers of samples should be used in applications involving less than ideal reference surfaces, or to integrate out slight imperfections in gage repeatability.

Highlight the Cal Pts Required field and use the numeric keypad to enter the desired value.

### Allow Full Calibrations

The Allow Full Cals field is used to enable full calibrations of input channels using the Set function.



Misc.		mm	10	P0
Report	Key Delay	3		
Rep Chars	Volume	10		
Send	Data Entry Msg	1.0		
Send Chars	Cal Pts Required	1		
Parallel	Allow Full Cals	No		
RS232	Switch View	0.000		
SLEC				
Clock				
Screen				
Misc.				
		No	Yes	

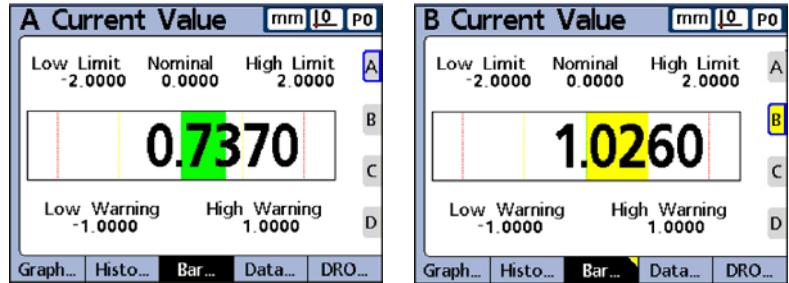
### NOTE

Refer to the Set function description in [Chapter 5: Operation](#).

Highlight the Allow Full Cals field and select Yes to perform full encoder calibrations using the Set function. Use softkeys under the LCD to select Yes or No.

### Switch view

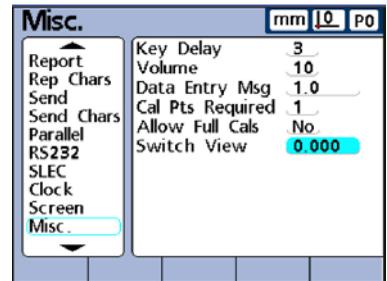
Normally, the user presses softkeys to select the screens displayed on the LCD. However, the Gage-Chek can be programmed to automatically change the DRO, bar or dial views to display a dimension in response to activity on the channel included in its formula. In the example below, the LCD switches from the display of dimension A, to dimension B in response to a movement on dimension B's input channel.



Movement on dimension B's input channel causes the current view to change to Dimension B

The Switch View field is used to specify the range of motion required on any channel input to switch DRO, bar or dial views to the associated dimension. When the Switch View field is zero, no switching occurs.

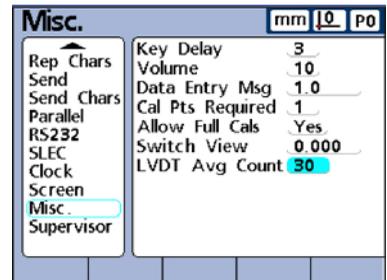
Highlight the Switch View field and use the numeric keypad to enter the desired range of motion.



### LVDT Average Count

The input counts from the LVDT channel are accumulated and then averaged prior to presenting a value on the LCD. The averaging of input counts smooths the visual display of values by presenting updated values at rates determined by the number of counts averaged.

Greater numbers of averaged counts result in slower update rates.

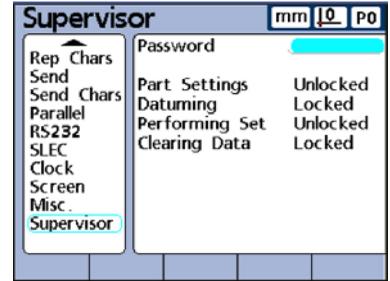
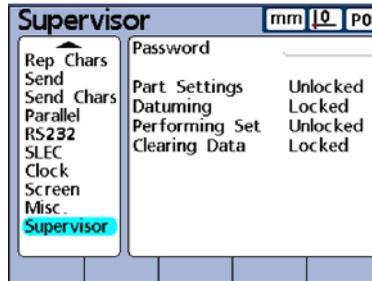


Highlight the LVDT Average Count field and use the numeric keypad to enter the desired number of counts to be averaged.

## Supervisor screen

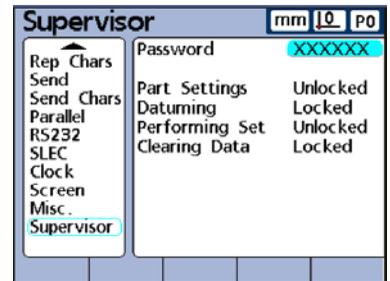
The Supervisor screen contains fields for locking or unlocking access to part setup fields contained on other setup menu screens, datuming and set functions invoked by front panel controls, and data clearing functions.

Highlight the Supervisor menu item, and then use the right Cursor key to access the right portion of the screen.



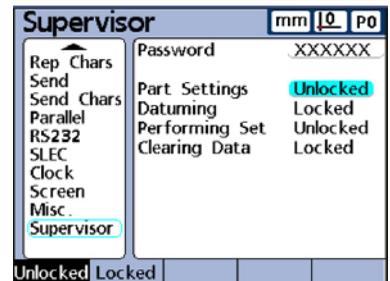
### Password

Enter the Supervisor Password into the Password field using the numeric keypad.



### Part Settings

Unlock or lock the Part Settings fields of all setup screens using the Unlock or Lock softkey under the LCD. Part settings are found in above the horizontal dividing line on the left side of the Setup menu screens.



### Datuming

Unlock or lock the datuming features of the Gage-Chek, including incremental datums, set and preset datums using the Unlock or Lock softkey under the LCD, and clear datums.

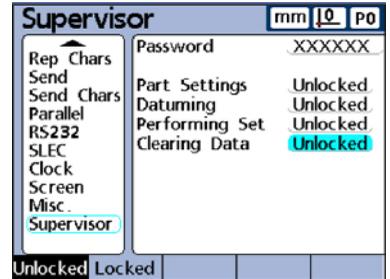
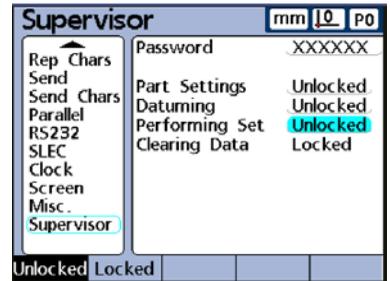


### Performing Set

Unlock or lock the Set function using the Unlock or Lock softkey under the LCD. Refer to [Chapter 5: Operation](#) for details regarding the Set function.

### Clearing data

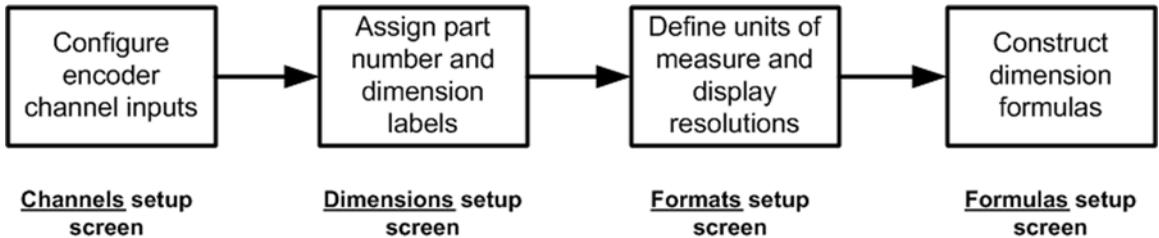
Unlock or lock the Clear Part and Clear All functions accessed from the red LCD ON/OFF button using the Unlock or Lock softkey under the LCD. Refer to [Chapter 5: Operation](#) for details regarding clearing datums.



The Gage-Chek uses formulas to define and display dimensions based on channel inputs. These formulas can be constructed by the user to display:

- One dimension based on one channel
- One dimension based on multiple channels
- Multiple dimensions based on one channel
- Multiple dimensions based on multiple channels

Formulas must be constructed as the last step of the essential, or minimum setup required to begin conducting measurements the first time the Gage-Chek is used. Most of this initial setup is performed using the setup screens described in [Chapter 3: Setup](#) as diagrammed below.



**NOTE**

The essential setup steps indicated above must be completed prior to constructing formulas.



**NOTE**

Formulas can be disabled temporarily for editing or troubleshooting by pressing the top dimension key on system startup. Formulas will be re-enabled upon exiting setup.

Formulas can be constructed that simply display channels as dimensions, or that calculate dimensions from one or more channels using powerful math, logic or other functions.

In this chapter, you'll learn to construct formulas that use math, logic and data evaluation functions to calculate dimensions, and to use advanced functions to control or automate measurements. Here is what you'll find in the remainder of this chapter:

<b>Topic</b>	<b>Page</b>
Anatomy of a formula	4-3
Constructing formulas	4-4
Printing formulas	4-14
Formula functions	4-15
Variable types	4-16
Units of measure	4-17
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Dimension references	4-18
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Order of operation	4-20
Parentheses	4-20
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Semicolons	4-21
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Absolute value function	4-24
Modulo value function	4-25
Integer function	4-25
Logical operations and comparisons	4-26
Minimum and maximum functions	4-29
Data lookup function	4-31
Sequential measurement control	4-32
Dynamic measurement	4-35
Dynamic reset	4-37
Measurement automation (Trip function)	4-38
Relay output functions	4-43
Fail	4-45
Send	4-46
Send record	4-47
Send a message	4-48
Report	4-50
User prompting (Ask function)	4-51

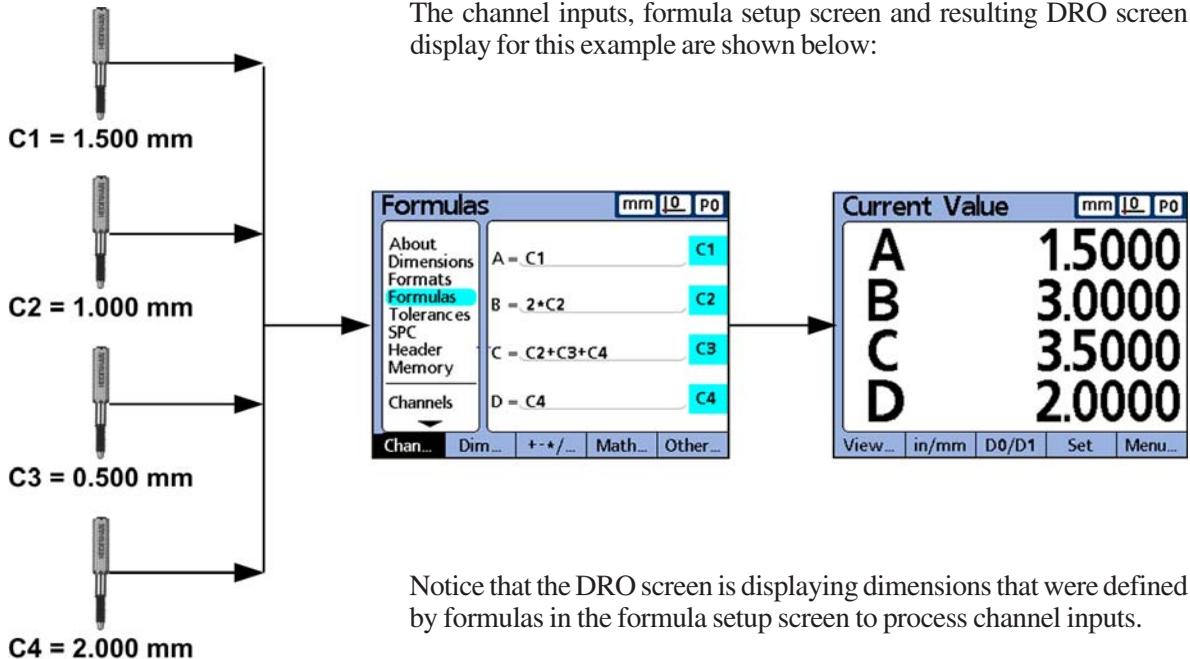
## Anatomy of a formula

Formulas define dimensions displayed on the screen. Formulas contain a dimension label on the left side of an equal sign, and arrange the defining channel references, constants, and math, logic or control functions on the right. The formula syntax (or format) is typical of algebraic equations generally, and is similar to the syntax used to define cell values in spreadsheet applications such as Microsoft™ Excel™.

The example shown below defines dimensions A, B, C and D.

$$\begin{aligned} A &= C1 \\ B &= 2 * C1 \\ C &= C2 + C3 + C4 \\ D &= C4 \end{aligned}$$

The channel inputs, formula setup screen and resulting DRO screen display for this example are shown below:



Notice that the DRO screen is displaying dimensions that were defined by formulas in the formula setup screen to process channel inputs.

The basic formula concepts illustrated by this example apply to all formulas, no matter how complex.

The remainder of this chapter describes the techniques required for formula construction and the use of formula functions. Examples are included that illustrate each new concept.

## Constructing formulas

Formulas are constructed in the Formula Setup screen. Navigate to the Formula Setup screen from the DRO screen by pressing the Menu

Current Value		mm	10	P0
A	-0.0320			
B	0.0000			
C	0.0000			
D	0.0000			
View...	in/mm	D0/D1	Set	Menu...

Current Value		mm	10	P0
A	-0.0320			
B	0.0000			
C	0.0000			
D	0.0000			
View...	in/mm	Datum...	Extra	Setup

softkey, the Setup softkey, then repeatedly pressing the down Cursor key until Formula is highlighted in the left portion of the screen.



### Formula setup screen

The default screen is shown here prior to the construction of any formulas. Dimensions are labeled A through D and are defined to display channels 1 through 4 respectively.

Formulas		mm	10	P0
About	A - C1			
Dimensions	B - C2			
Formats	C - C3			
Formulas	D - C4			
Tolerances				
SPC				
Header				
Memory				
Channels				

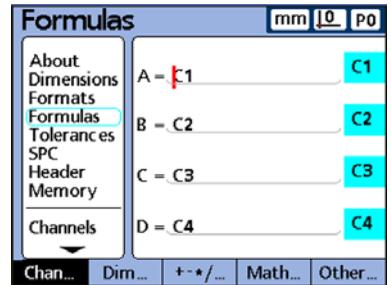


### NOTE

Your system might be configured with fewer or more channels than the 4 of this example.

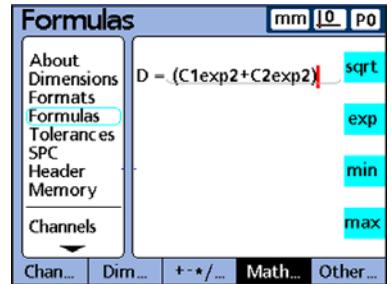
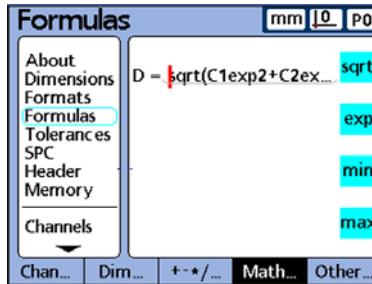
Press the Right Cursor key to enter the Formula Setup screen.

A red cursor will appear to the immediate right of the equal sign in the top formula. This cursor indicates the insertion point for any new channel reference or formula function. Move the cursor to the desired insertion point by pressing Cursor keys.



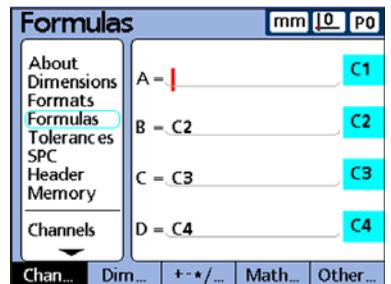
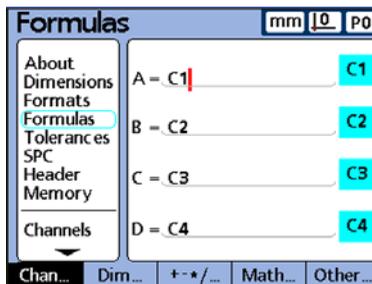
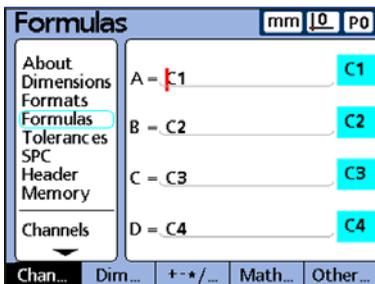
### Scrolling long formulas

Complex formulas can be entered that are wider than the formula setup screen. Use the Cursor keys to scroll right and left to display the entire contents of long formulas.



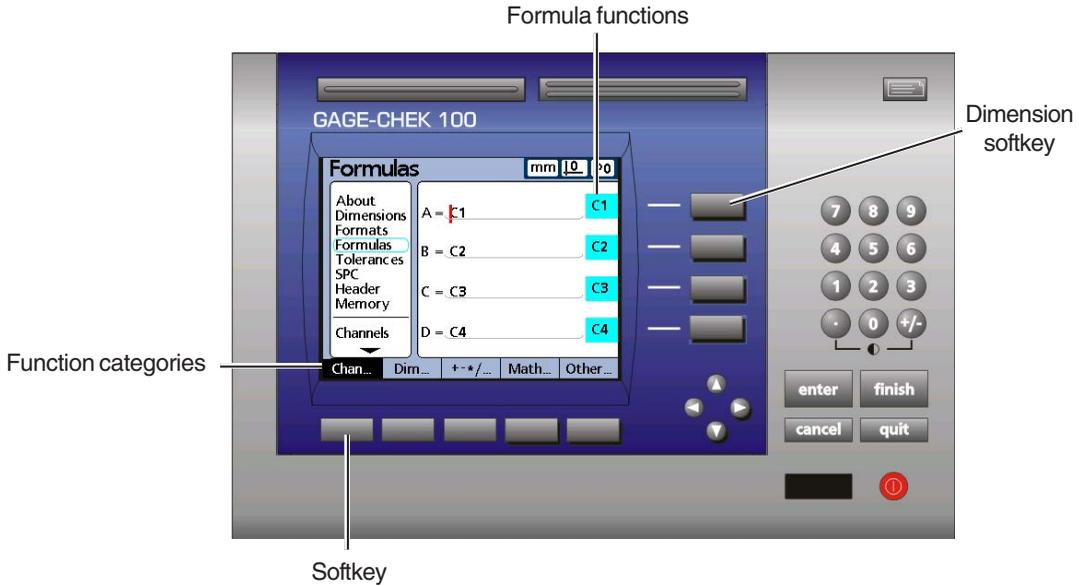
### Deleting formula elements

Pressing the Cancel key deletes the element to the immediate left of the cursor. For example, the channel reference C1 was removed from this formula for dimension A by moving the cursor to position C1 at its left, and then pressing the Cancel key.

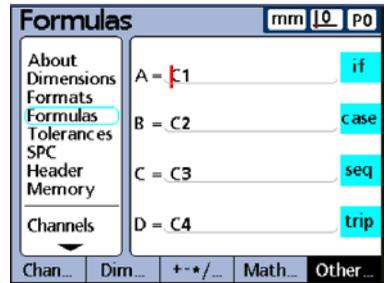
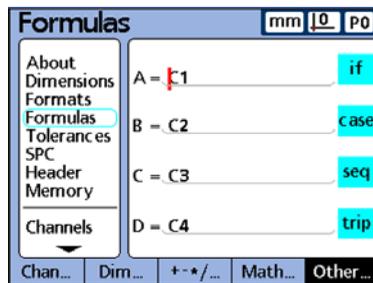


Displaying and inserting formula functions

Softkeys under the screen control the display of channel references and other functions required to construct formulas. Once displayed, references and functions are selected using the dimension softkeys at the right of the screen.



Repeatedly pressing any bottom softkey displays multiple sets of available functions for that softkey. For example, repeatedly pressing the Other softkey displays two sets of available functions near softkeys at the right of the screen.



The complete collection of formula functions is shown in the formula function table shown below.

Chan...	Dim...	+*/...	Math...	Other...
C1	A	+	sqrt	if
C2	B	-	exp	cls
C3	C	*	min	seq
C4	D	/	max	trip
-	-	(	sin	dmin
-	-	)	asin	dmax
-	-	,	cos	fail
-	-	;	acos	xtra
-	-	>	tan	
-	-	>= (≥)	atan	
-	-	<	pi	
-	-	<= (≤)		
-	-	== (=)	abs	
-	-	!= (≠)	mod	
-	-	&& (and)	int	
-	-	(or)		

**Channel** selection will be depend on the number of inputs (1, 4, 8 or 16)

**Dimension** selection will depend on the number assigned to a part in setup.

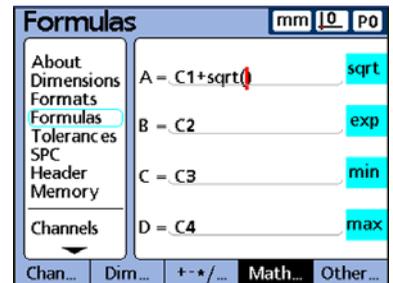
**xtra**: for Ask, Relay, Report, RsetDyn, Send, SendMsg, SendRec



**NOTE**

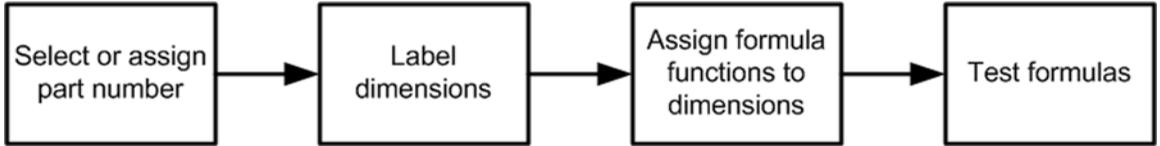
The table above includes 4 channels and 4 dimensions. Your system might be configured to include fewer or more channels or dimensions.

Pressing a softkey at the right of the screen inserts the displayed formula function associated with the key into a formula at the insertion point indicated by the red cursor.



### Constructing and modifying formulas

The exact steps required to construct or modify a formula are unique to each formula, and more generally to the measurements required for each part. Therefore, it would be impossible to present a single set of instructions that adequately covered the topic. Instead, what follows is a generic guide in the form of an example that describes and illustrates the *activities* required to construct or modify formulas. More specific instructions and examples regarding the use of formula constants, references and functions are provided later in this chapter. The activities required to construct a formula are diagrammed below:



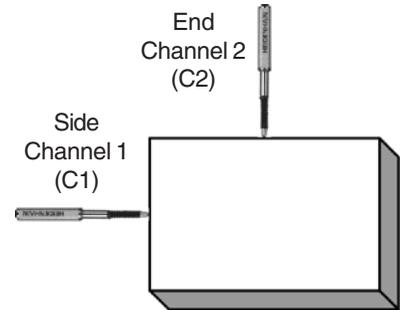
The following example will use the default Formula Setup screen to construct a formula that derives the perimeter of a rectangular block from the measurement of two sides.

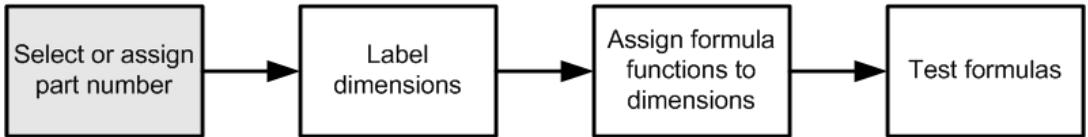
A general form of the formula necessary to derive the perimeter of a rectangular block is:

$$\text{Perimeter} = 2 (\text{side} + \text{end})$$

The specific formula that will be constructed in the Formula Setup screen is:

$$P = 2 * (C1+C2)$$





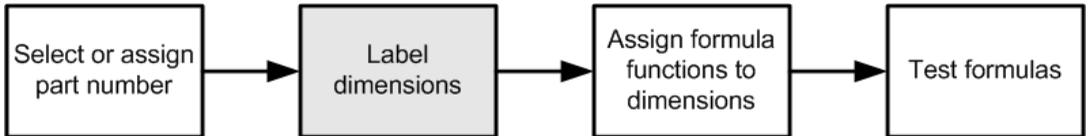
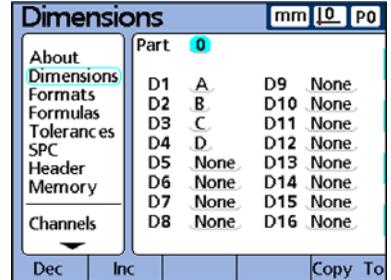
**Select or assign part number**

Since separate dimension formulas can be created for each of up to 10 parts, begin by selecting the correct part.

Navigate to the Part Setup screen from the DRO screen by pressing the Menu softkey, the Setup softkey, then the down Cursor key.

Press the right Cursor key to highlight the Part field.

Press the DEC or INC softkey to display the desired part number in the Part field.

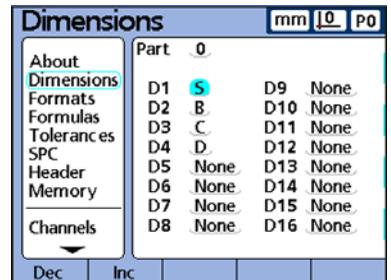


**Label dimensions**

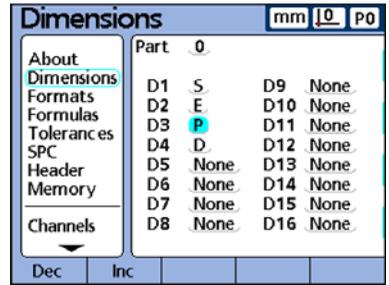
Each dimension label should reflect the purpose of its formula. Re-label each dimension. In this example:

- S=side
- E=end
- P=Perimeter

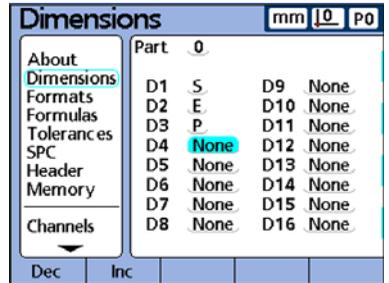
While in the Part Setup screen, press the down Cursor key to highlight the D1 (dimension 1) field. Press the Inc softkey repeatedly until S is displayed in the D1 field.



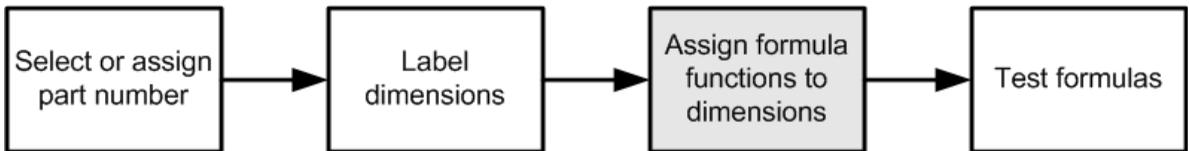
Repeat the process described above to display E in the D2 field and P in the D3 field.



Since only three dimensions are used in this example, delete the fourth dimension. Press the down Cursor key to highlight the D4 field and repeatedly press the DEC softkey to display None.



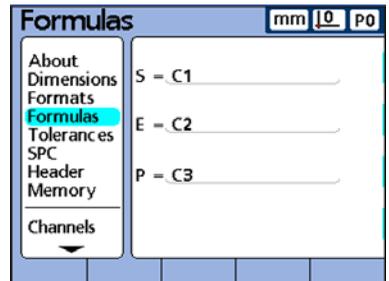
Press the Finish key.



**Assign formula functions to dimensions**

Now that the correct part is selected, and the dimensions are labeled to reflect the measurement application, the dimension formulas must be constructed.

Press the down Cursor key to highlight the Formula setup menu item.



Press the right Cursor key to enter the Formula Setup screen. Softkey designations and the red cursor will appear on the screen.

The first formula simply defines the dimension S to be equal to the value of channel 1 (C1). This formula already meets the requirement of our measurement application by displaying the side measurement as dimension S, so it will remain unchanged. The second formula also meets the application requirement by defining dimension E as equal to the value of channel 2 (C2). It will also remain unchanged.

The third formula will be changed to derive the perimeter measurement.

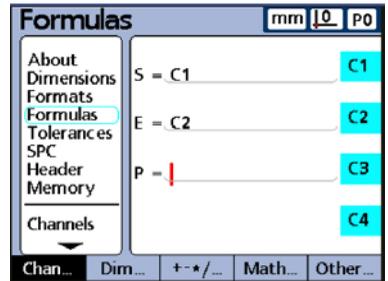
$$P = 2 * (C1 + C2)$$

Press the down Cursor key to position the cursor in the third formula line.

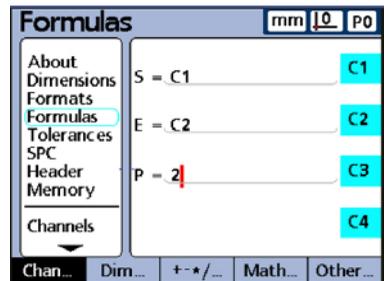
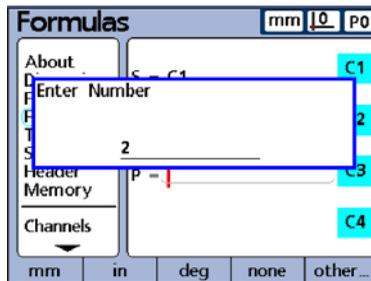
Press the right Cursor key to position the cursor on the right side of the C3 channel reference.

Press the Cancel key to delete the C3 channel reference.

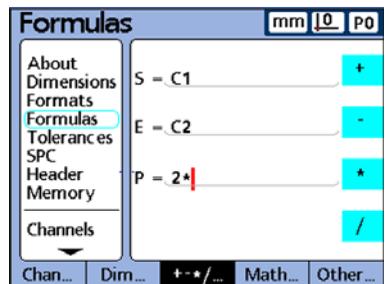
Now that the formula line for C is empty, the new formula will be entered.



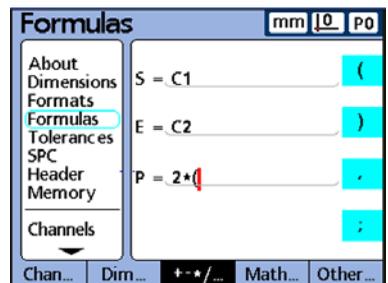
Press the 2 numeric keypad key, then press the None softkey to insert the dimensionless constant 2 into the formula.



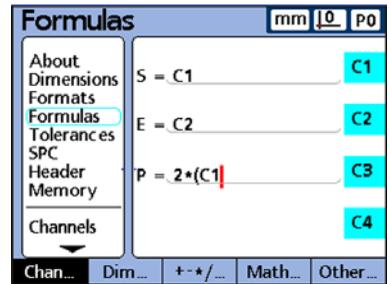
Press the +\*/ softkey to display arithmetic functions and then press the \* softkey to insert the multiplication operator into the formula.



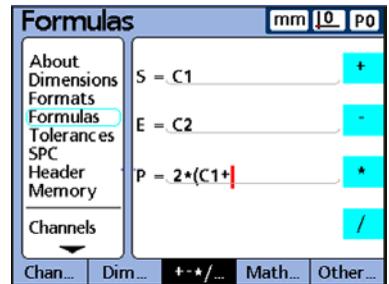
Press the +\*/ softkey again to display parentheses, and then press the ( softkey to insert the open parenthesis into the formula.



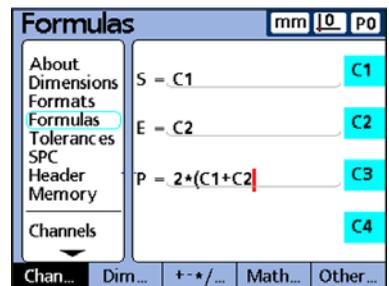
Press the Chan softkey to display channel references, and press the C1 softkey to insert the channel 1 reference.



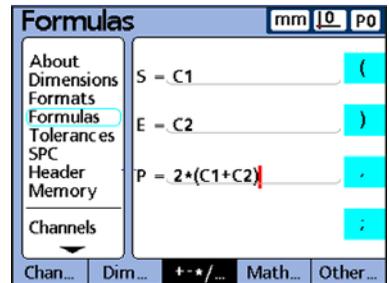
Press the +\*/ softkey repeatedly to display arithmetic functions, and press the + softkey to insert the plus sign.



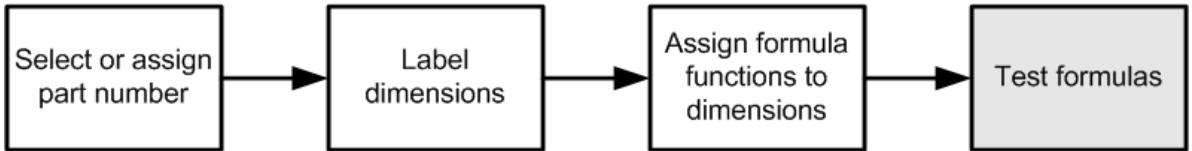
Press the Chan softkey to display channel references, and press the C2 softkey to insert the channel 2 reference.



Press the +\*/ softkey repeatedly to display parentheses, and press the ) softkey to insert the closed parenthesis.



The formulas are now ready to test.



### Test formulas

Always test formulas thoroughly to confirm their correct operation before using them for inspection.

Press the Finish key again to display the DRO screen.

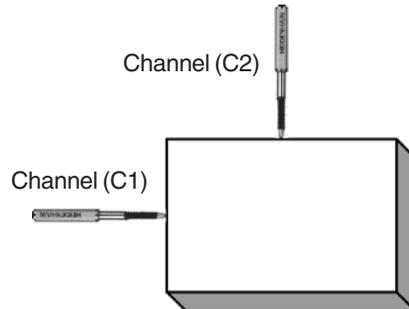
In this example, the Gage-Chek encoders are positioned against the side and end of a rectangular block. The DRO screen displays a side dimension of 20.019 mm and an end dimension of 10.017 mm. The resulting perimeter is calculated to be 60.072 mm, which is correct and confirms that the formulas are ready to use.

Current Value		mm	10	PO
S	0.0000			
E	0.0000			
P	0.0000			

View... in/mm D0/D1 Set Menu...

Current Value		mm	10	PO
S	20.0190			
E	10.0170			
P	60.0720			

View... in/mm D0/D1 Set Menu...



### Printing formulas

Formulas and settings can be printed by pressing the Print key while displaying any setup screen.

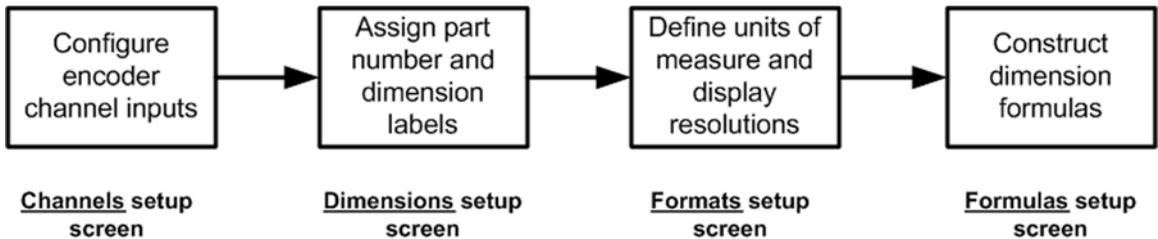
## Formula functions

The remainder of this chapter describes formula functions in detail. Each description is accompanied by at least one example of use in a typical Gage-Chek formula. Study these examples prior to constructing your formulas.



### NOTE

Complete the essential setup steps discussed earlier and shown below prior to constructing formulas.



Formula functions are displayed and selected in the Formula setup screen by pressing combinations of softkeys located above and below the screen, and are shown in the table below.

Chan...	Dim...	+*/...	Math...	Other...
C1	A	+	sqrt	if
C2	B	-	exp	cls
C3	C	*	min	seq
C4	D	/	max	trip
-	-	(	sin	dmin
-	-	)	asin	dmax
-	-	,	cos	fail
-	-	;	acos	xtra
-	-	>	tan	
-	-	>= (≥)	atan	
-	-	<	pi	
-	-	<= (≤)		
-	-	== (=)	abs	
-	-	!= (≠)	mod	
-	-	&& (and)	int	
-	-	(or)		

Channel selection will be depend on the number of inputs (1, 4, 8 or 16)

Dimension selection will depend on the number assigned to a part in setup.

xtra: for Ask, Relay, Report, RsetDyn, Send, SendMsg, SendRec

**Variable types**

Formula variables include channel references and dimension references.

**Channel references**

Channel reference values are determined by the positions of measurement devices attached to channel inputs on the rear panel of the Gage-Chek. These values can be offset, scaled or calibrated using the Set or SLEC/LEC error correction functions.

The Set function is available to operators using the front panel Set softKey and is used to offset or calibrate channel inputs. Error correction is only available to supervisors using the SLEC set up menu screen, and is used to compensate for scale or encoder nonlinearities.

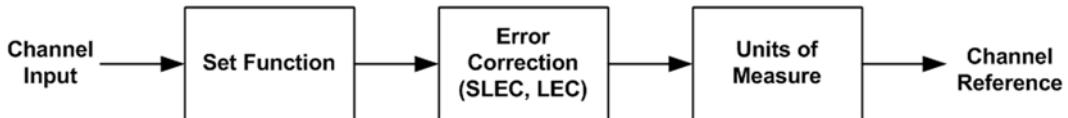
Channel references can be assigned units of measure for linear or angular values or can be numeric (no unit of measure). Units of measure can only be assigned by supervisors using the Channels setup screen.

Final channel references used as variables in the formula setup screen can be:

- Direct from the channel inputs
- Level-adjusted by the Set function or error correction

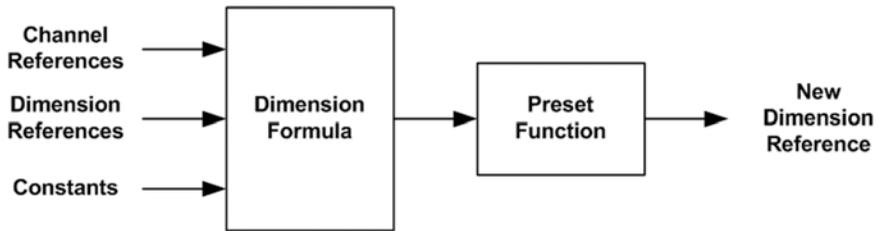
Channel reference units of measure can be:

- Linear or angular
- Numeric

**Dimension references**

Dimension reference values are determined by formulas acting on channel variables, constant and other dimension variables. The dimension reference values can be offset using the Preset function.

Formulas can only be created by supervisors using the Formulas setup screen. The Preset function is available to operators using the front panel Preset softKey, and is used to offset dimension values.



## Units of measure

Dimensions acquire the units of measure from channel references, dimension references and constants used in their defining formulas. For example, formulas containing numeric channel references and numeric constants will produce dimensions without units of measure.

The tables below show the basic results of combining and mixing units of measure in addition, subtraction, multiplication and division formulas. In the tables, two variable types are used in an arithmetic operation and produce a dimension variable type or a mismatch error.

Dim References, Channel References and Constants	Dimension
Linear + Linear	Linear
Angular + Angular	Angular
Linear ± Angular	Mismatch Error
Angular ± Linear	Mismatch Error

### Adding and subtracting different variable types

Dim References, Channel References and Constants	Dimension
Linear <sup>A</sup> * Linear <sup>B</sup>	Linear <sup>A+B</sup>
Linear <sup>A</sup> / Linear <sup>B</sup>	Linear <sup>A-B</sup>
Angular <sup>A</sup> * Angular <sup>B</sup>	Angular <sup>A+B</sup>
Angular <sup>A</sup> / Angular <sup>B</sup>	Angular <sup>A-B</sup>
Angular <sup>A</sup> / Linear <sup>B</sup>	Angular <sup>A</sup> / Linear <sup>B</sup>
Linear <sup>A</sup> / Angular <sup>B</sup>	Linear <sup>A</sup> / Angular <sup>B</sup>
Angular <sup>A</sup> * Linear <sup>B</sup>	Angular <sup>A</sup> * Linear <sup>B</sup>
Linear <sup>B</sup> * Angular <sup>A</sup>	Linear <sup>B</sup> * Angular <sup>A</sup>

### Multiplying and dividing different variable types

The descriptions of formula functions later in this chapter include discussions of expected units of measure for each function.



### Channel references

#### NOTE

The Gage-Chek software recognizes most formula syntax errors and displays helpful error messages that prevent most formula construction mistakes.

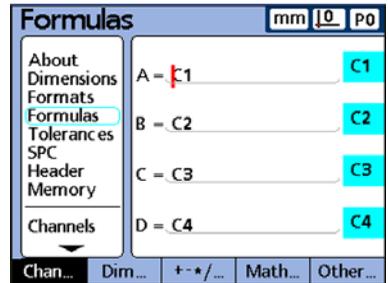
Insert channel references into formulas to include channel position values in dimensions. Press the Chan softkey to display channel references.

Channel values can simply be displayed directly by making a dimension equal to a channel reference as shown below.

$$B = C1$$

Channel values can also be the basis of calculated dimensions as in this area example that uses a channel reference as the diameter of a circle, based on the equation:  $\text{Area} = \pi d^2 / 4$

$$A = (\text{Pi} * (\text{C1 exp2}))/4$$

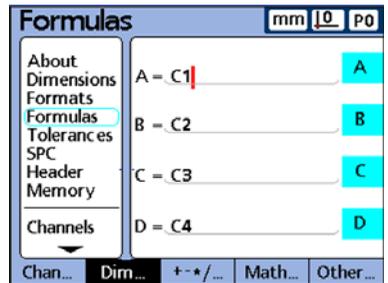


### Dimension references

Insert dimension references into formulas to include values of existing dimensions in new dimensions. Press the Dim softkey to display dimension references.

#### NOTE

**Recursion is not allowed. A dimension reference cannot be included in its own formula.**



This example illustrates the use of rectangle length and width dimension references to construct an area dimension based on the equation:

$$\text{Area} = \text{Length} * \text{Width}$$

$$L = C1$$

Length is a channel reference

$$W = C2$$

Width is a channel reference

$$A = L * W$$

Area is calculated from dimension references

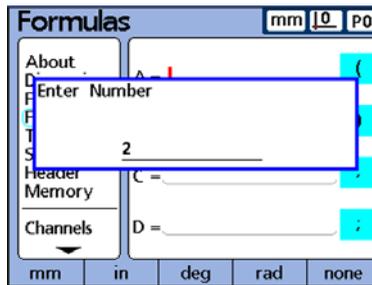
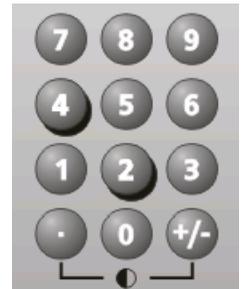
Notice that the same area dimension could also have been calculated from channel references as shown below.

$$\begin{aligned} L &= C1 \\ W &= C2 \\ A &= C1 * C2 \end{aligned}$$

## Constants

Insert constants into formulas to add, subtract, multiply, divide or raise a value to a power. Numeric constants are also used as arguments in logical, data evaluation and measurement control functions described later in this chapter.

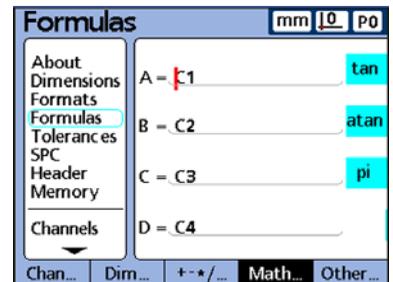
Press numeric keypad keys to display numbers. The number will be displayed in a separate Enter Number pop-up screen. Insert the number by pressing the softkey for the desired unit of measure or the None softkey for dimensionless constants. Press the Math softkey to display  $\pi$ (pi).



The earlier example that illustrated the use of channel references also demonstrates the use of constants in a formula that calculates the area of a circle using the equation:

$$\text{Area} = \pi d^2 / 4$$

$$A = (\text{Pi} * (C1 \text{ exp } 2)) / 4$$

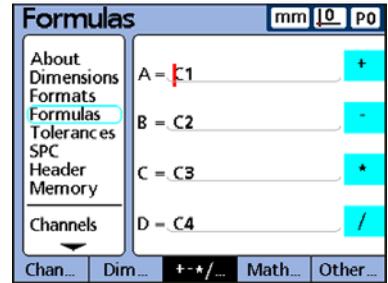


The formula uses the constant  $\pi$  as a factor, the constant 2 to raise C1 to the second power, and the constant 4 to divide.

Constants can be inserted as dimensionless numeric quantities, or can be assigned units of measure. All the constants shown above are dimensionless.

## Arithmetic operators

Insert arithmetic operators into formulas as required by the application. The use of arithmetic operators in Gage-Chek formulas is consistent with the use of arithmetic operators generally. Press the +\*/ softkey to display arithmetic operators.



A = C1 + C2	Addition
B = 10 - C1	Subtraction
C = C1 / 1.5	Division
D = 2 * Pi * C1	Multiplication

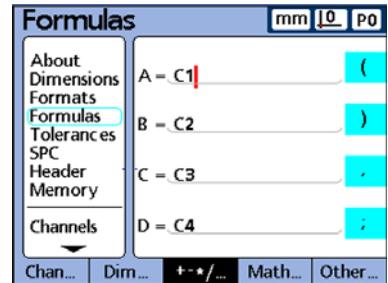
## Order of arithmetic evaluation

The order of arithmetic evaluation of a collection of terms follows generally accepted practice, as shown below:

First evaluation:	Exponentiation
Second evaluation:	Multiplication and division
Third evaluation:	Addition and subtraction

## Parentheses

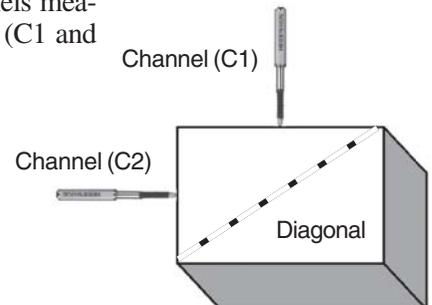
Insert Parentheses to group terms within a formula. Grouped terms can then be operated on by other functions as a single term. Parentheses allow you to control the order of evaluation and make complex formulas easier to construct and read. Press the +\*/ softkey repeatedly to display parentheses.



The example shown here illustrates the use of parentheses to group terms in a formula that calculates the diagonal across the surface of a rectangular block from 2 channels measuring the short and long sides (C1 and C2) using the equation:

$$D = \sqrt{(A^2 + B^2)}$$

$$D = \text{sqrt}(C1 \text{ exp } 2 + C2 \text{ exp } 2)$$

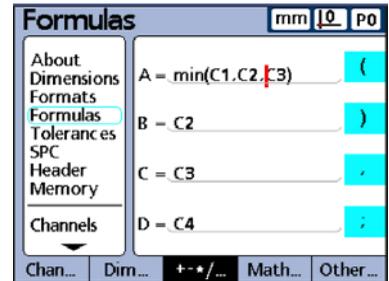


## Commas

Insert commas to separate terms within a formula. For example, the min function returns the minimum value from a list of variables:

$$A = \min (C1,C2,C3)$$

List elements C1, C2 and C3 are separated by commas.



### NOTE

The min function is discussed later in this chapter.

Commas are used to separate all formula terms, regardless of form or complexity, as shown in the Case function example below.

$$A = \text{Case} (C1 \leq 1, 0, (C1 > 1 \text{ and } C1 \leq 2), 1, C1 > 2, 2)$$

In spite of the apparent complexity of the expression  $(C1 > 1 \text{ and } C1 \leq 2)$ , it is treated as a term in the formula shown above and separated from other terms by commas.



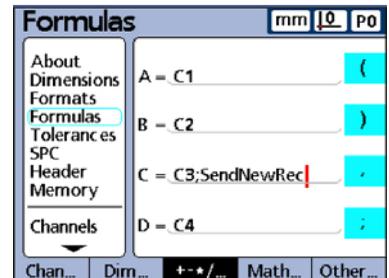
### NOTE

The Case function is discussed later in this chapter

## Semicolons

Insert semicolons to separate multiple functions on a single dimension formula line. In the example below, a record containing new values of dimensions A, B and C is sent to a computer by appending the Sendrec function to the last formula line.

$$\begin{aligned} A &= C1 \\ B &= C2 \\ C &= C3;\text{SendNewRec} \\ D &= C4 \end{aligned}$$



### NOTE

The SendRec function is discussed later in this chapter.

## Exponents

Insert the exponent function (exp) to raise a term within the formula to a power. Press the Math softkey to display the exponent function.

Exponents can be any dimensionless value. This example calculates the volume of a cube by raising the channel value measuring a side of the cube to the third power.

$$A = C1 \text{ exp } 3$$

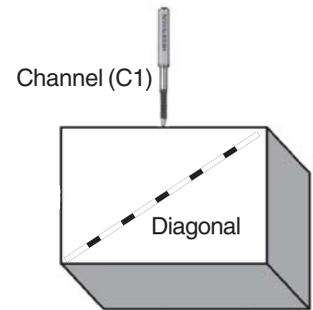
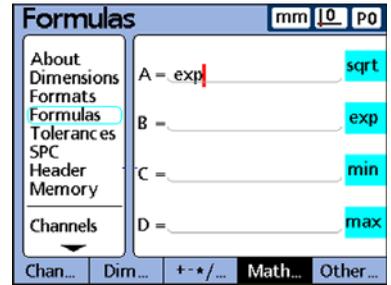
The exp function must be followed by a dimensionless value. Channel references can be used as an exponent as shown below if the channel units are defined as dimensionless in the Channels Setup screen.

$$N = 6 \text{ exp } C1$$

Dimension references can also be used with exponent functions if the value resulting from the calculation of the dimension's formula is dimensionless.

$$A = C1 + C2$$

$$B = 5 \text{ exp } A$$



## Square roots

Insert the square root function (sqrt) to calculate the square root of a term within the formula. Press the Math softkey to display the square root function.

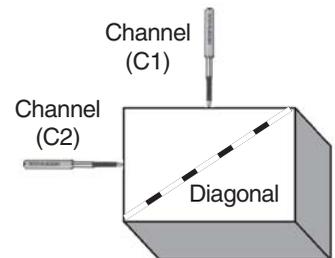
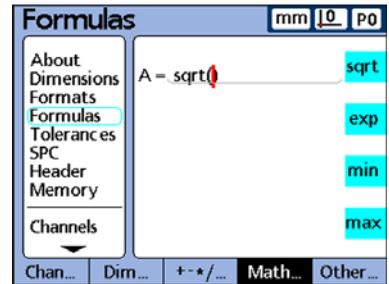
Square roots can be calculated for any dimensionless values, or any values having square units of measure such as square inches.

Square roots can be calculated for collected terms and for channel references as illustrated in by the earlier example that calculated the diagonal across the surface of a rectangular block, using the equation:

$$D = \sqrt{(A2 + B2)}$$

$$D = \text{sqrt}(C1 \text{ exp } 2 + C2 \text{ exp } 2)$$

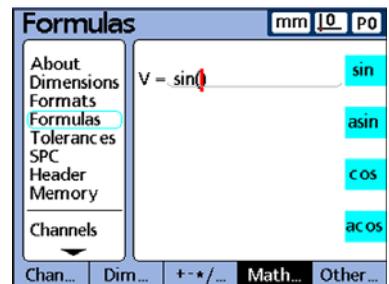
Parentheses are automatically inserted after the square root function with the red insertion cursor positioned between them. Enter terms into the square root function at this point.



## Trig functions

Insert trig functions to calculate the sine, cosine or tangent of a term within a formula. Press the Math softkey to display trig functions.

Trig functions can be applied to any angular or numeric value or collection of terms. Trig functions return dimensionless numbers.



For example, the formula below finds the sine of the value of channel 1.

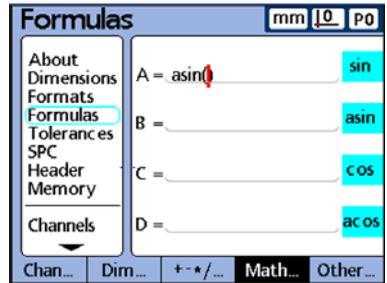
$$V = \text{sin}(C1)$$

Parentheses are automatically inserted after the trig function with the red insertion cursor positioned between them. Enter terms into the trig function at this point.

## Inverse trig functions

Insert inverse trig functions to calculate the arcsine, arccosine, or arctangent of a term within a formula. Press the Math softkey to display inverse trig functions.

Inverse trig functions can be applied to any dimensionless value or collection of terms. Inverse trig functions return angular values.



For example, the formula below finds the arcsine of the position value of channel 1.

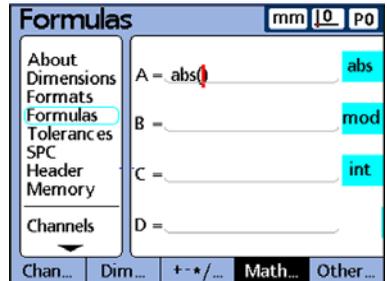
$$V = \text{asin}(C1)$$

Parentheses are automatically inserted after the inverse trig function with the red insertion cursor positioned between them. Enter terms into the inverse trig function at this point.

## Absolute values

Insert the Absolute value function (abs) to include the absolute value of a channel input, dimension or collection of terms in the formula. Press the Math softkey to display the absolute value function.

Absolute values can be calculated for any term or collection of terms.



In the example below:

$$\text{Dimension } A = 2.0 \text{ when } C1 = -2.0$$

$$A = \text{abs}(C1)$$

Parentheses are automatically inserted after the absolute value function with the red insertion cursor positioned between them. Enter terms into the absolute value function at this point.

**Modulo**

Insert the Modulo (mod) function to calculate the remainder of a division operation. Press the Math softkey to display the Modulo function.

The syntax of the Mod function is:

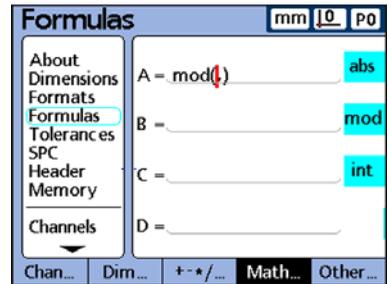
$$A = \mathbf{mod}(\text{value}, \text{divisor})$$

In the example below:

$$\begin{aligned} \text{Dimension A} &= 25.0039 \text{ degrees when } C1 = 385.0039 \text{ degrees} \\ A &= \mathbf{mod}(C1, 90) \end{aligned}$$

Modulo values can be calculated for any term or collection of terms.

Parentheses are automatically inserted after the Modulo function with the red insertion cursor positioned between them. Enter terms into the Modulo function at this point.

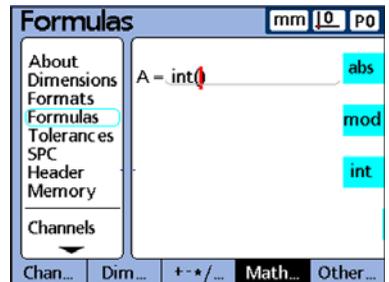
**Integer**

Insert the Integer function (int) to include the integer value of a channel input, dimension or collection of terms in the formula. Press the math softkey to display the Integer function.

In the example below:

$$\begin{aligned} \text{Dimension A} &= 2 \text{ when } C1 = 2.9732 \\ A &= \mathbf{int}(C1) \end{aligned}$$

Parentheses are automatically inserted after the integer function with the red insertion cursor positioned between them. Enter terms into the Integer function at this point.



**Logical operations and comparisons**

Insert logical functions to conduct conditional tests on terms within a formula. Logical functions are divided into:

Comparison Tests:

**If** Returns a single value based on a test or tests of one or multiple terms

**Case:** Sorts single term into multiple classes based on tests

Comparison Test Criteria:

- > Greater Than
- >= Greater Than or Equal to
- < Less Than
- <= Less Than or Equal to
- = = Equal to
- ! = Not Equal to

Comparison Test Conditions

**&&:** **and** - both of 2 terms must meet criteria

**||:** **or** - one, or the other, or both of 2 terms can meet criteria

Press the +/-\*/ softkey to display:

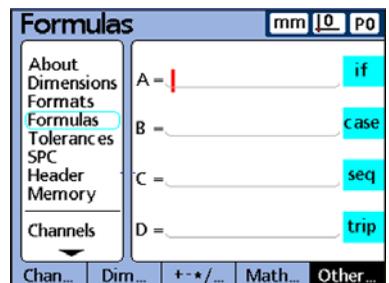
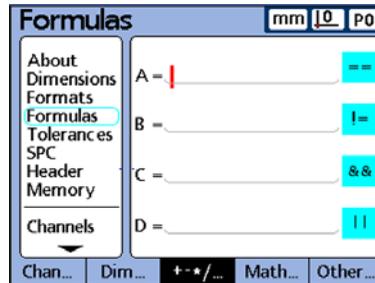
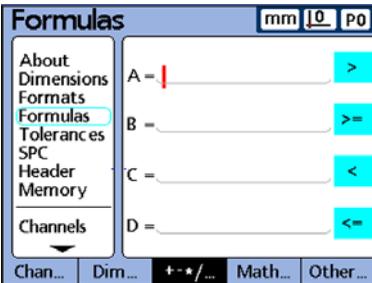
- >
- > =
- <
- < =

Press the +/-\*/ softkey to display:

- = =
- ! =
- &&** (and)
- ||** (or)

Press the Other softkey to display:

- If**
- Case**

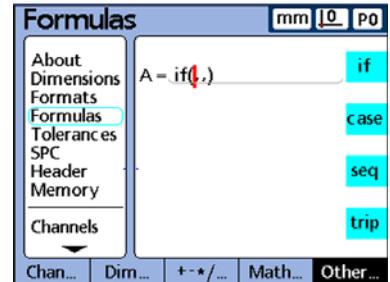


Logical functions can be applied to any value or collection of values. Logic functions will accept mixed units of measure of the same type. For instance, length in inches can be compared to length in mm, but not to angles. Length values or angle values can be compared to dimensionless constants.

### If Function

Insert the if function to return a single value based on one or more comparison tests. Press the Math softkey to display the if function.

The syntax of the If function is:



$A = \mathbf{If}$  (Comparison test, true value, false value)

In the following example:

Dimension A = 2.0 when  $C1 > 0.5$

Dimension A = 3.0 when  $C1 < 0.5$

$A = \mathbf{If}$  ( $C1 >= 0.5$ , 2.0, 3.0)

Multiple terms can be tested as a single expression by grouping terms for the comparison test in parentheses as shown in the following example:

Dimension A = 0 when  $(C1 * C2) < 1.2$

Dimension A = 1 when  $(C1 * C2) >= 1.2$

$A = \mathbf{If}((C1 * C2) < 1.2, 0, 1)$

Parentheses including commas are automatically inserted after the if function with the red insertion cursor positioned for entry of the comparison test terms and criteria.

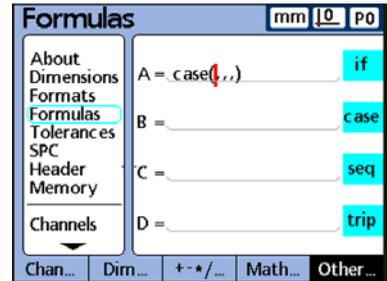
Enter the comparison test terms and criteria. Then position the insertion cursor for entry of the value to be returned if the result of the test is true. Enter the true value. Then position the insertion cursor for entry of the value to be returned if the result of the test is false. Enter the false value.

The If function is now ready to test.

### Case function

Insert the Case function to sort a channel or dimension reference into multiple classes based on comparison tests. Press the Other softkey to display the Case function.

The Case function returns a single value based on a series of comparison tests that sorts a channel or dimension value into one of several categories.



The syntax of the case function is:

$$A = \mathbf{Case}(\text{Test1}, \text{Value1}, \text{Test2}, \text{Value2}, \dots, \text{Test } n, \text{Value } n)$$

As shown above, case function arguments are entered in test pairs. Each test pair consists of a test and the value that will be assigned to the dimension if the test requirement is satisfied.

In the following example:

$$A = 0 \text{ when } C1 \leq 1$$

$$A = 1 \text{ when } (C1 > 1 \text{ and } C1 \leq 2)$$

$$A = 2 \text{ when } C1 > 2$$

$$A = \mathbf{Case}(C1 \leq 1, 0, (C1 > 1 \text{ and } C1 \leq 2), 1, C1 > 2, 2)$$

The possibility of generating undefined test results can be avoided by adding an empty test and special case value after the last test pair.

$$A = \mathbf{Case}(\text{Test1}, \text{Value1}, \text{Test2}, \text{Value2}, \text{,Special case value})$$

In the following example:

A = 0 when C1 <= 1  
 A = 1 when (C1 > 1 and C1 <= 2)  
 A = 999 when none of the tests shown above are satisfied,  
 for instance, when C1 > 2

A = **Case**(C1 <=1, 0, (C1 > 1 and C1 <= 2), 1, , 999)

Case function tests are terminated and the dimension assigned the corresponding value as soon as the first test condition is satisfied. In the following example, dimension A is assigned the value from the first test pair, even though the channel value being evaluated would have satisfied subsequent tests.

A = 0 when C1=1.0  
 A = **Case**(C1<2,0,C1<3,1,C1<4,2)

Parentheses are automatically inserted after the case function with the red insertion cursor positioned for entry of the first test parameters.

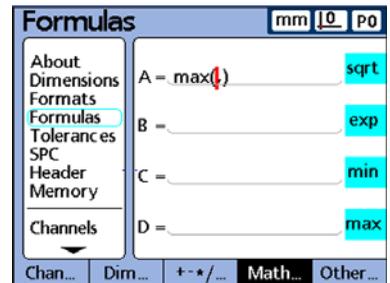
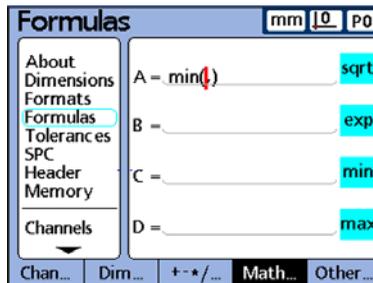
Enter the first test pair consisting of a test and a value, separated by a coma. Press the +/-\*/ softkey to display a comma.

Enter the remaining test pairs, followed by an empty test and a special case value to avoid undefined test results if necessary.

The case function is now ready to test.

## Min and Max functions

Insert the Min and Max functions to return the minimum and maximum values from a specified list of values or references. Press the Math softkey to display the Min and Max functions.



The syntax of the min and max functions is:

$A = \mathbf{min}(\text{value1, value2, ...value n})$  returns minimum value

$A = \mathbf{max}(\text{value1, value2, ...value n})$  returns maximum value

In the following max function example:

Dimension A = 6 when C1 = 6, C2 = 3, C3 = 2

$A = \mathbf{max}(C1, C2, C3)$

Multiple terms can be grouped by parentheses and treated as a single value as shown in the following example:

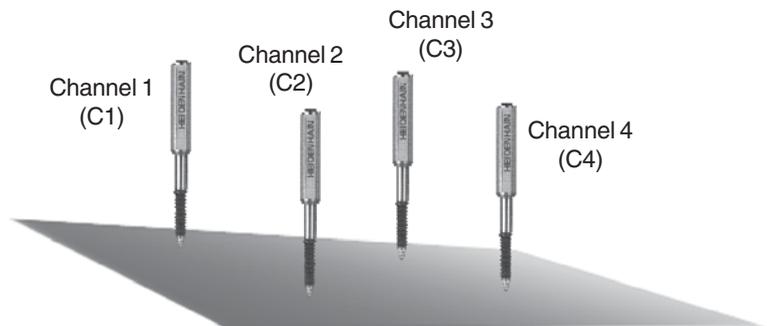
Dimension A = 3 when C1 = 1, C2 = 2, C3 = 4

$A = \mathbf{min}((C1 + C2), C3)$

Min and max functions can be used to conduct many simultaneous measurements that produce a single result.

A flatness measurement is used in the example below to illustrate this (many channels to one dimension) capability.

In this example, multiple channel inputs are distributed across a surface, and then flatness is determined by calculating the difference between the highest and lowest points on the surface.



$F = \mathbf{max}(C1, C2, C3, ..Cn) - \mathbf{min}(C1, C2, C3, ..Cn)$

Min and max functions will not accept mixed units of measure. All lengths must be in inches or mm, all angles must be in decimal degrees or degrees, minutes and seconds. Numeric constants used in addition or subtraction must match the data types of the channel or dimension references.

Parentheses are automatically inserted after the min or max function with the red cursor positioned for entry of the first value of the list. Enter the desired series of values separated by commas.

### Data lookup function

Insert the data lookup function to include a specified element from a list of stored dimension values. The data lookup function is constructed of a dimension label and parentheses containing a list index as shown below:

$$B = A(2)$$

A is the dimension label and 2 is the dimension list index.

In this example, the dimension B is assigned the value of the *third* element of the list of stored values for dimension A.

List elements are numbered starting with element 0 at the top of the list. The most recently stored value is at the top. So value A(2) is the *third* element from the top of dimension a list as shown below:

List indexes must be positive integers. An index that exceeds the range of a specified list results in an error message.

Dimension  
A list

	A	B	C	D
A(0)	1.6670	1.5710	1.6670	1.7310
	1.6670	1.6350	1.6670	1.7310
A(2) = 2.97	1.6990	1.5710	1.6990	1.6990
	1.6030	1.6030	1.7310	1.7310
	1.6030	1.6350	1.7950	1.7630
	1.5710	1.6030	1.7630	1.7630
	1.6670	1.5380	1.8270	1.8910
	1.6350	1.5060	1.8270	1.8270
	1.5380	1.6340	1.7950	1.7630
	1.6350	1.6350	1.8270	1.8590

Data lookup functions can be used in formulas in the same manner as other dimension values, but must be constructed by the user.

For example, to assign the third value of the A dimension list to dimension B:

Insert the dimension reference:  $B = \underline{A}$

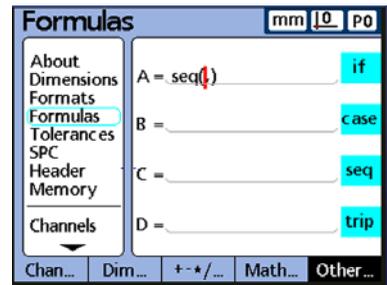
and then insert the A list index between parentheses.

$B = \underline{A(1)}$        $B = \underline{A(2)}$        $B = \underline{A(2)}$

## Sequential measurements

Insert the Sequence function (seq) to control the order of measurement steps. Press the Other softkey to display the sequence function.

Normally all dimension formulas are calculated simultaneously when the Enter key is pressed. So in the example below, the Gage-Chek would assign the same channel 1 value (C1) to each of the three dimensions: H, W and L when the Enter key is pressed.



H = C1  
W = C1  
L = C1

The sequence function allows dimension assignments to be made one at a time in a user-defined sequence. This is accomplished by assigning only the dimension of the next sequence step number when the Enter key is pressed. The syntax of the sequence function is:

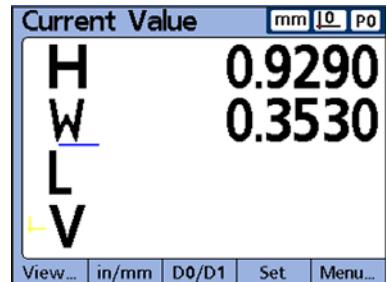
$A = \text{seq}(\text{sequence step number, value})$



### NOTE

Data is not stored in the Gage-Chek database until the last step of the sequence is completed by pressing the Enter key.

Dimensions are calculated in sequence after each Enter key-press. During operation, a blue line appears under the dimension label of the current dimension assignment



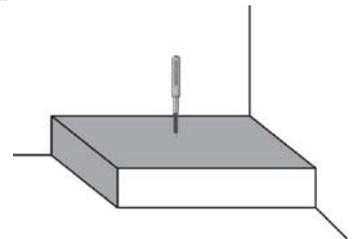
on the screen to indicate the dimension assignment in the sequence.

The following example shows the volume of a rectangular solid calculated from a sequence of 3 measurements using a single channel based on the equation:  $\text{Volume} = \text{Height} * \text{Width} * \text{Length}$

$$\begin{aligned} H &= \text{seq}(1, C1) \\ W &= \text{seq}(2, C1) \\ L &= \text{seq}(3, C1) \\ V &= H*W*L \end{aligned}$$

To accomplish this sequence of measurements using only one channel the operator performs the following steps:

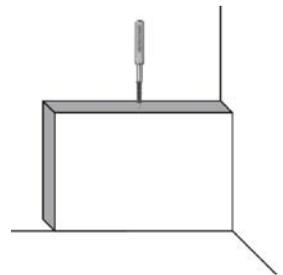
The operator positions the block and channel to measure height, and then presses the Enter key to store the channel position.



$$H = \text{seq}(1, C1)$$

The Gage-Chek advances to the next step in the sequence and waits for the operator to press the Enter key again.

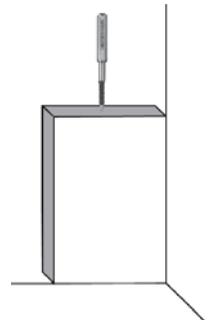
After entering the previous value, the operator positions the block and channel to measure width, and presses the Enter key to store the new channel position.



$$W = \text{seq}(2, C1)$$

The Gage-Chek advances to the next step in the sequence and waits for the operator to press the Enter key again.

After entering the previous value, the operator positions the block and channel to measure length and presses the Enter key to store the final channel position.



$$L = \text{seq}(3, C1)$$

This last step in the sequence also initiates the calculation of volume based on the 3 stored values of H, W and L.

$$V = H * W * L$$

Upon completion of the last step, the calculation of the volume dimension V is stored, and the Gage-Chek returns to the first step in the sequence to begin a new series of measurements.

The example of volume measurement above illustrates that many dimensions can be calculated from a single channel.

### **Sequence data storage and RS-232 transmission**

In most cases it is desirable to store dimension data in the Gage-Chek database when a sequence is complete. However, some applications might only require data to be transmitted to a computer, and storage of the data would be unnecessary. In still other applications, it is desirable to do both; store and send dimension data.

### **Storing Dimension data without data transmission**

Use the Seq function as described earlier in this section to conduct sequence measurements and store the resulting dimension data in the Gage-Chek database.

### **Transmitting Dimension data with and without storage**

A slightly different form of the Sequence syntax is used to transmit dimension data over the RS-232 port upon completion of a series of sequence steps. This new syntax is appended to the last sequence step when data transmission is desired, as shown on the next page. The data transmission syntax is shown below:

$$A = \text{Seq} (\text{Sequence step number}, \text{Send function})$$

Appending the data transmission syntax to the last step of a series of sequence steps always causes dimension data to be sent over the RS-232 port. Additionally, assigning specific values to the sequence step number determines if data is transmitted and stored, or only transmitted. The table and examples that follow illustrate the use of the data transmission syntax.

<b>Seq step number</b>	<b>Resulting action</b>
Same as last step	Data sent, nothing stored
Last step + 1	Data sent and stored

Example: Data sent, nothing stored

A = Seq (1, C1)

B = Seq (2, C2)

C = Seq (3, C3); Seq (3, Send)

Step number is the  
same as last step

Example: Data sent and stored

A = Seq (1, C1)

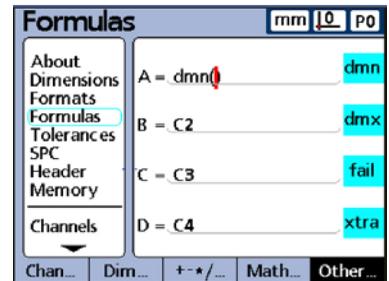
B = Seq (2, C2)

C = Seq (3, C3); Seq (4, Send)

Step number is 1  
more than last step

## Dynamic measurements

Insert the dynamic minimum (dmin) or dynamic maximum (dmax) function to include the minimum or maximum value of a dynamically sampled channel into a formula. Press the Other softkey to display the dynamic minimum and dynamic maximum functions.



Dynamic sampling of channel inputs is performed by the Gage-Chek at hundreds of samples per second and is continuously processed by the system to retain the minimum and maximum values encountered from all samples. Pressing the Enter button ends the sampling and stores the minimum and maximum values. Minimum and maximum values are being sampled simultaneously from a single channel input.

Dynamic functions can return the minimum and maximum of the sampled channel, or can include a second parameter that returns a value from a different channel or dimension.

The syntax of the dmin and dmax function when returning values from the sampled channel is:

A = dmin (sampled channel) for dynamic min and

A = dmax (sampled channel) for dynamic max

In the following example, the runout of a shaft is determined by spinning the shaft, dynamically measuring the shaft's minimum and maximum diameters and then subtracting the minimum diameter from the maximum diameter.



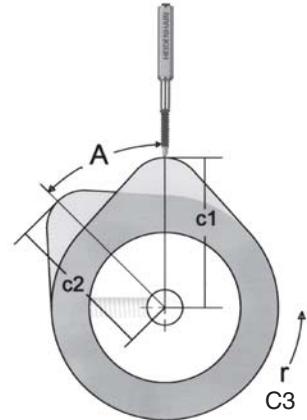
$$R = \mathbf{dmax}(C1) - \mathbf{dmin}(C1)$$

The syntax of the  $\mathbf{dmin}$  and  $\mathbf{dmax}$  functions when returning values defined by the second parameter is:

$A = \mathbf{dmin}$  (sampled channel, returned value) for dynamic min and  
 $A = \mathbf{dmax}$  (sampled channel, returned value) for dynamic max

In the following example, the angle between 2 cam lobes is determined by spinning the cam shaft, dynamically measuring the rotational angle at each cam maximum, and subtracting the smaller angle from the larger angle.

In this example, the encoder on channel 1 (C1) measures lobe 1, the encoder on channel 2 (C2) measures lobe 2, and the rotary encoder on channel 3 (C3) measures the rotational angle of the cam shaft as the shaft spins.



$$A = \mathbf{dmax}(C2,C3) - \mathbf{dmax}(C1,C3)$$

Dynamic minimum and maximum values can be calculated for any term or collection of terms.

Parentheses are automatically inserted after the  $\mathbf{dmin}$  and  $\mathbf{dmax}$  functions with the red insertion cursor positioned between them. Enter terms into the  $\mathbf{dmin}$  and  $\mathbf{dmax}$  functions at this point.

**CAUTION**

The Reset Dynamic function (RsetDyn) must be initiated prior to the use of the dmin and dmax functions to clear previous min and max values. The left wide hotkey above the screen is assigned the dynamic reset as a default function. Simply pressing this hotkey prior to a dynamic measurement will clear previous min and max values.

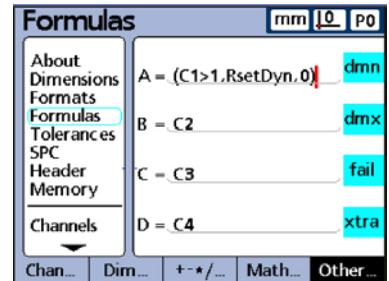
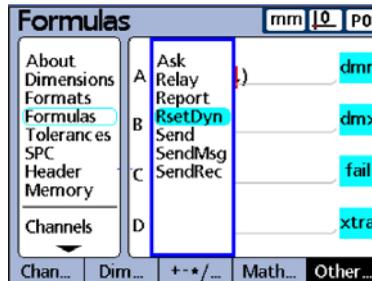
**NOTE**

The Reset Dynamic function is also available in the xtra menu for inclusion in formulas. The xtra menu is discussed later in this chapter.

**Dynamic reset**

Include the Reset Dynamic function (RsetDyn) to clear minimum and maximum values from previous dynamic measurements based on the results of a conditional test. The Reset Dynamic function can also be appended to a formula using the semicolon.

Press the Other softkey, and then the Xtra dimension softkey to display the RsetDyn function.

**NOTE**

The Reset Dynamic function can also be initiated from the front panel at any time. This function is mapped to the left wide key as a factory default.

The RsetDyn function is included in if statements or case statements as the logical result of either passing or failing a conditional test. The syntax for using the RsetDyn function in if statements is:

A = if(comparison test, **RsetDyn**, false value)

For reset dynamic on pass, or

A = if (comparison test, true value, **RsetDyn**)

For reset dynamic on fail

The syntax for using the RsetDyn function in case statements is:

A = case (test 1, value 1, test 2, **RsetDyn**, test n, value n)

Where the reset dynamic function will be executed as a result of satisfying test 2, in this example.



#### NOTE

**The Reset Dynamic function can be used in any test/value pair of a case statement.**

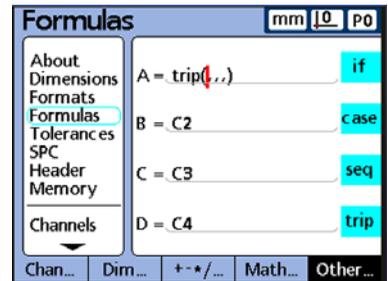
#### Measurement automation (Trip function)

Insert the Trip function to increase the speed of a series of identical measurements by automating the data entry process. Press the Other softKey to display the trip function.

Normally, channel values are used in dimension formula calculations only when the Enter key is pressed.

The trip function eliminates the need to press the Enter key by initiating formula calculations based on channel input level conditions.

By automatically initiating formula calculations, the trip function allows the operator to conduct a series of identical measurements by simply loading and unloading parts into and out of a mechanical gage.

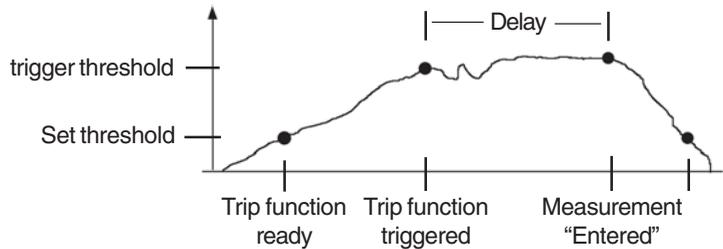


#### NOTE

**Measurement automation (the Trip function) can be toggled on and off from the front panel using the hot key Auto function. Refer to the Hot Keys section of Chapter 3: Setup for details regarding hot keys.**

The trip function is set and triggered by channel values passing through predefined threshold levels. A delay can be included in the trip function to eliminate erroneous measurements caused by hardware settling times.

The trip function thresholds and delay are diagrammed below for a positive-going channel input.



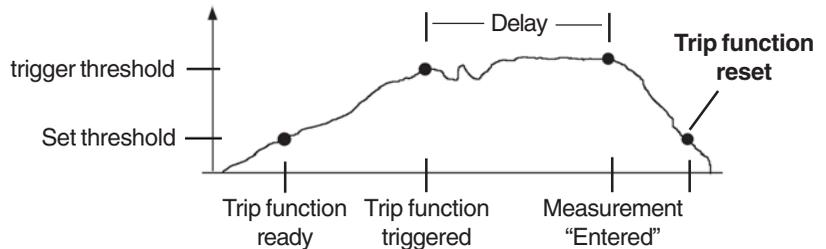
Trip functions can be specified to accommodate positive-going and negative-going inputs. Negative-going and positive-going inputs are conceptually identical except for direction and polarity of the input wave-shape.



**NOTE**

**The trip function delay can be set to 0 if hardware settling is not a problem.**

The trip function must be reset before it can be used for another measurement. The trip function is reset when the channel input reverses direction and passes back through the set threshold as shown below.



The trip function can be used by itself, or added at the end of a formula, separated from the formula by a semicolon. The syntax for the trip function is:

A = **trip** (channel or dimension reference, set, trigger, delay)

or

A = formula; **trip** (channel or dimension reference, set, trigger, delay)

In the following example, the flatness of a sheet is calculated automatically one second after the sheet is loaded into a mechanical gage using the formula below.

$$F = \max(C1,C2,C3,C4) - \min(C1,C2,C3,C4); \text{trip}((C1,0.1,0.5,1.0))$$

The gage is lifted away from the sheet. Channel levels = 0



The gage begins pressing channel inputs against the sheet. Channel levels pass through 0.1; the trip function is ready.



The gage is fully pressing channel inputs against the sheet. Channel levels pass through 0.5; the trip function is triggered and a one second delay begins.



The one-second delay is complete. The measurement is “entered” and the flatness dimension formula is calculated.

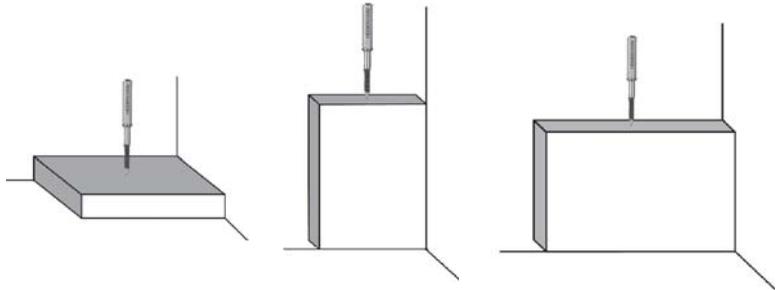
The gage is lifted away from the sheet. The channel levels pass back through 0; the trip function is reset for the next use.



The example above demonstrates the use of multiple channels to calculate a single dimension. The trip function can also be used to automate single-channel measurements that produce multiple dimensions.

The example below shows the formulas required to calculate the volume of a block from a sequence of three measurements of height, width, and length. The formulas use a single channel to perform measurements that are automated using the trip function. A one second delay is included in each sequence step.

$$\begin{aligned} H &= \text{seq}(1,C1); \text{trip}(C1,0.1,0.5,1.0) \\ L &= \text{seq}(2,C1); \text{trip}(C1,0.1,1.0,1.0) \\ W &= \text{seq}(3,C1); \text{trip}(C1,0.1,1.5,1.0) \\ V &= H*L*W \end{aligned}$$



Notice that while the set threshold is identical for all trip formulas, the trigger threshold of each is different to accommodate the differences in gage position for each measurement.



#### NOTE

The examples shown above used channel references. However, dimension references could as easily have been used in the same syntax.

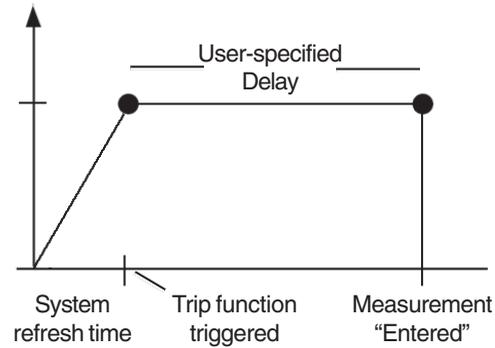
#### Continuous cycling of the Trip function

Typical applications using the Trip function include the use of Set and Trigger thresholds as discussed above. However, some applications are configured with the input channel devices in constant contact with the surface(s) to be measured, and require continuous input sampling.

Continuous input sampling can be achieved by omitting the Set and Trigger thresholds from the standard Trip function syntax, as shown below.

$$A = \text{Trip}(\text{channel or dimension reference}, , , \text{Delay})$$

The rate of continuous sampling is determined by the Delay parameter and the system refresh time as shown below.



System refresh time typically varies between 0.007 and 0.10 seconds depending on the number and type of channels used and the complexity of formulas. The resulting sample rate becomes:

$$\text{Sample rate} = 1/(\text{System refresh time} + \text{Delay time})$$

Assuming the maximum system refresh time, and no sample Delay, the maximum sample rate is approximately:

$$\text{Max sample rate} = 1/(0.10 + 0) = 10 \text{ samples/second}$$

Generally applications that require continuous sampling employ slower rates, with seconds, minutes or even more time between samples. For these applications the sample rate can simply be expressed as the inverse of Delay as shown below.

$$\text{Sample rate} \sim 1/\text{Delay}$$

### Choosing a Delay parameter

Application developers generally know the sample rate requirement and need to find the Delay parameter to enter into the Trip function. Since sample rate and Delay are inversely related, for sample rates less than 10 per second, delay can be expressed as:

$$\text{Delay} \sim 1/\text{sample rate}$$

For example, a sample rate of 1 sample per minute requires a Delay of

60 seconds, resulting in the formula parameters shown below.

$$A = \text{Trip} (C1, , , 60)$$

### Sending continuous samples to a computer

Continuous samples can be accumulated in the Gage-Chek database, or can be transmitted over the RS-232 port to an external computer by appending the Send function as shown below.

$$A = \text{Trip} (C1, , , 60); \text{Send}$$

The Send function is discussed later in this chapter.

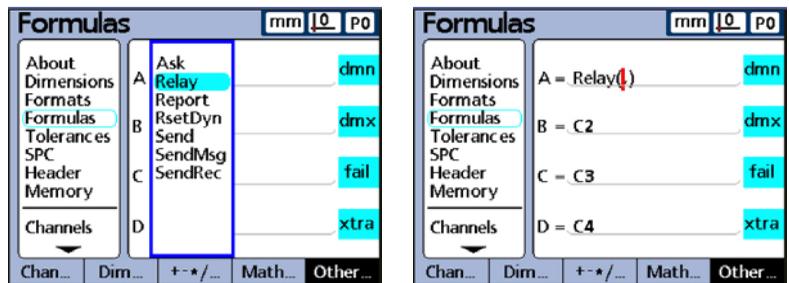
### Turning continuous sampling on and off

The Auto hot key function toggles the Trip function on and off. Assign the Auto function to the desired front panel key prior to configuring the Trip function for continuous sampling. Refer to the Hot Keys section of [Chapter 3: Setup](#) for details.

Parentheses are automatically inserted after the trip function with the red insertion cursor positioned between them. Enter arguments into the trip function at this point.

## Relay output function

Include the Relay function (relay) to provide electrical relay contact operation in response to conditional tests of channels, dimensions or other terms within a formula. The Relay function can also be appended to a formula using the semicolon. Press the Other softKey, and then the xtra dimension softkey to display the relay function.



The contacts of two single-pole, double-throw dry-contact relays are accessible on the rear of the Gage-Chek for special applications requiring electrical switching. The normally open and normally closed contacts of both relays are available for use in low-current, low-voltage applications.

**NOTE**

The electrical characteristics and wiring diagram of the relay and relay output jack are contained in Chapter 8: Reference.

The relay function is included in If statements or Case statements as the logical result of either passing or failing a conditional test. The syntax for the relay function is:

**relay**(output line, state)

where:

output line = 1 or 2

state = 0 (off/low/de-energized) or 1 (on/high/energized)

The syntax for using the relay function in If statements is:

A = If (comparison test, **relay**, false value)

For relay function on pass, or

A = If (comparison test, true value, **relay**)

For relay function on fail

The syntax for using the Relay function in Case statements is:

A = Case (test 1, value 1, test 2, **relay**, test n, value n)

Where the relay function will be executed as a result of satisfying test 2, in this example.

In the example below,

A = 1 when C1 <= 5 and

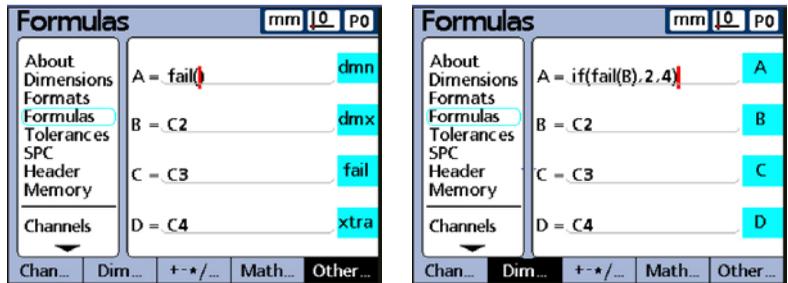
Relay line 1 = 0(off/de-energized) when C1 > 5

A = if(C1>5,relay(1,0),1)

Parentheses are automatically inserted after the relay function with the red cursor positioned between them. Enter terms into the relay function at this point.

## Fail function

Insert the Fail function to return user-specified values indicating a passed or failed dimension tolerance test. The Fail function can be used by itself, or is more commonly used as the conditional test in an IF function.



The syntax of the Fail function when used by itself is:

$$A = \text{Fail} (\text{Dimension})$$

In the following example:

Dimension A = 1 when dimension B fails a tolerance test

Dimension A = 0 when dimension B passes a tolerance test

$$A = \text{Fail} (B)$$

The syntax of the Fail function when used as the conditional test in an IF function is:

$$A = \text{IF} (\text{Fail} (\text{Dimension}), \text{Fail value}, \text{Pass value})$$

In the following example:

Dimension A = 2 when dimension B fails a tolerance test

Dimension A = 4 when dimension B passes a tolerance test

$$A = \text{IF} (\text{Fail} (B), 2, 4)$$

Parentheses are automatically inserted after the Fail function with the red cursor positioned for entry of the dimension for tolerance tests.



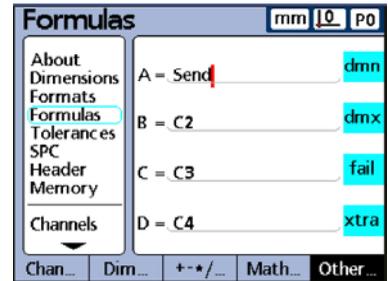
### NOTE

The Fail function will be executed if *any* dimension fails a tolerance test when the parentheses are empty as shown below.

$$A = \text{If}(\text{Fail}(), 2, 4)$$

## Send function

Include the Send function to transmit the value of the current dimension over the RS-232 port in response to conditional tests of channels, dimensions or other terms within a formula. The Send function can also be appended to a formula using the semicolon.

**NOTE**

The **Send** function can also be initiated from the front panel at any time.

The Send function is included in IF or Case statements as the logical result of either passing or failing conditional tests. The syntax for using the Send function in IF statements is:

A = IF (comparison test, **Send**, false value)

For sending the value of dimension A on pass

A = IF (comparison test, pass value, **Send**)

For sending the value of dimension A on fail

The syntax for using the Send function in the Case statement is:

A = Case (test 1, value 1, test 2, **Send**, test n, value n)

For sending the value of dimension A has a result of satisfying test 2, in this example

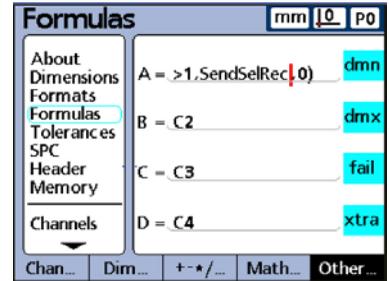
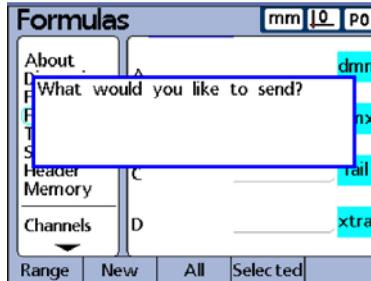
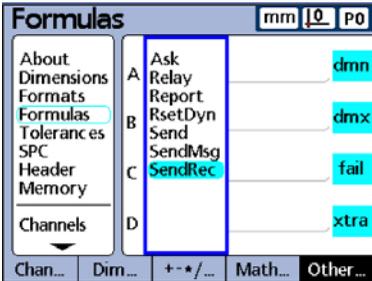
**NOTE**

The **Send** function can be used in any test/value pair of a case statement.

## Send record function

Include the Send Record function (SendRec) to send records to a computer on the RS232 (serial) port based on the results of a conditional test. The Send Record function can also be appended to a formula using the semicolon.

Press the Other softkey, and then the xtra dimension softkey to display the SendRec function.



### NOTE

The Send Record function can also be initiated from the front panel at any time.

A user-specified range of records, the last (most recent) record, all records or only the selected record can be chosen to send.

The SendRec function is included in if statements or case statements as the logical result of either passing or failing a conditional test.

The syntax for using the SendRec function in if statements is:

A = if(comparison test, **SendRec**, false value)

For send record on pass, or

A = if (comparison test, true value, **SendRec**)

For send record on fail

The syntax for using the SendRec function in case statements is:

A = case (test 1, value 1, test 2, **SendRec**, test n, value n)

Where the Send Record function will be executed as a result of satisfying test 2, in this example.



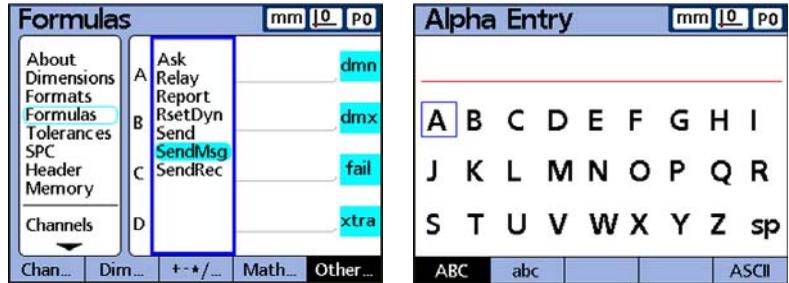
### NOTE

The SendRec function can be used in any test/value pair of a case statement.

## Sending a message

Include the Send Msg function to transmit text or ASCII codes over the RS-232 port in response to conditional tests of channels, dimensions or other terms within a formula. The SendMsg function can also be appended to a formula using the semicolon.

Press the Other softkey, the xtra dimension softkey, highlight Send Msg and press the Enter key to display the Alpha Entry screen.



Text messages and ASCII codes are entered into the Alpha Entry screen.

**Text characters**

Press a softkey to select the desired upper or lower case, use the cursor keys to highlight the desired text character, and then press the Enter key to include the character in the message.

**ASCII codes**

ASCII codes can precede or follow text characters or text strings. Press the ASCII softkey prior to entering the ASCII code from the numeric keypad. The < symbol will appear on the message line.

**NOTE**

**No separation is required between an ASCII code and text.**

The syntax for using the Send Msg function in the IF statement is:

A = IF (comparison test, **SendMsg** “ message”, fail value)

For a message on pass, or

A = IF (comparison test, true value, **SendMsg** “ message”)

For a message on fail

The syntax for using the SendMsg function in the Case statement is:

A = Case (test 1, value 1, test 2, **SendMsg**, test n, value n)

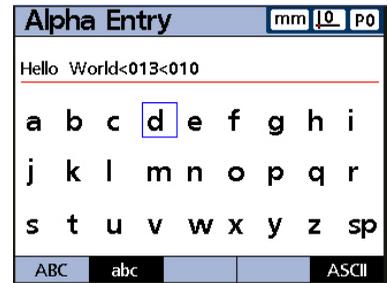
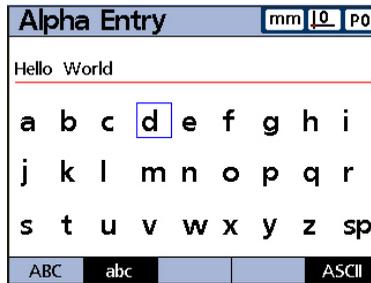
Where a message will be sent over the RS-232 port as the result of satisfying test 2, in this example

In the following example, the message

Hello world

is created in the Alpha Entry screen, and ASCII codes are appended to perform carriage return and line feed.

First, the text messages entered using cursor keys and softkeys. Then ASCII codes for character return (013) and line feed (010) are entered so that the next “Hello world” message will appear on the next line.



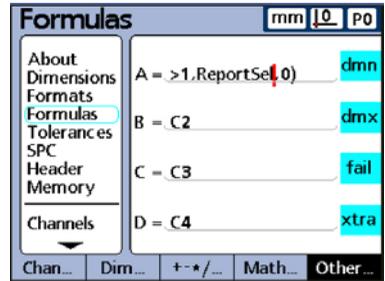
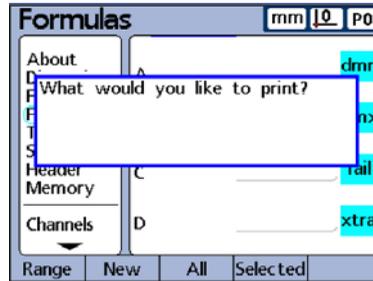
## Report function

Include the Report function to print reports on the parallel port based on the results of a conditional test. The Report function can also be appended to a formula using the semicolon.

**NOTE**

Refer to [Chapter 3: Setup](#) for details regarding the Report function.

Press the Other softkey, and then the Xtra dimension softkey to display the Report function.

**NOTE**

The Report function can also be initiated from the front panel at any time.

The Report function is included in if statements or case statements as the logical result of either passing or failing a conditional test.

The syntax for using the Report function in if statements is:

A = if(comparison test, **Report**, false value)

For Report on pass, or

A = if (comparison test, true value, **Report**)

For Report on fail

The syntax for using the Report function in case statements is:

A = case (test 1, value 1, test 2, **Report**, test n, value n)

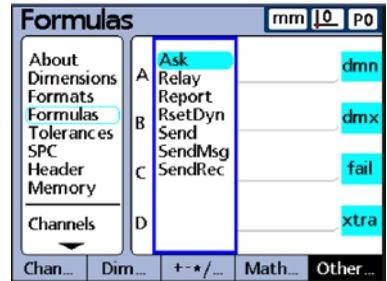
Where the Report function will be executed as a result of satisfying test 2, in this example.

**NOTE**

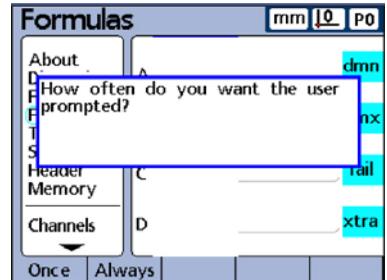
The Report function can be used in any test/value pair of a case statement.

**User prompting (Ask function)**

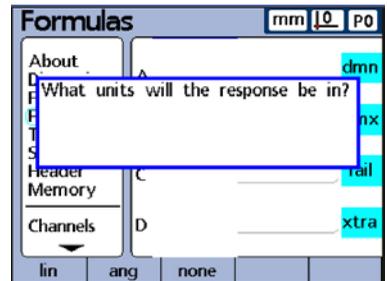
Insert the ask function to display messages that prompt the user to input information as part of measurement activities. Press the xtra softkey to display the ask function, and then press the Enter key.



Messages can contain up to 80 upper or lower case alpha characters and can be displayed once at the beginning of a measurement session, or repeatedly each time the Enter key is pressed.



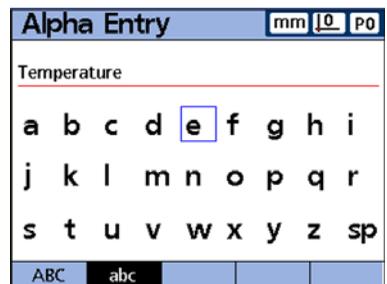
Numeric data entered by the user in response to a prompt can be interpreted as linear, angular or dimensionless.



The prompt message is displayed to the user in a pop-up box that provides a space for entering the requested data.

Data is entered into the pop-up box from the numeric keypad, and stored by the system by pressing the Enter key.

The user prompt messages are constructed on the Alpha Entry screen. Press the desired softkey to choose upper or lower case at the bottom of the screen. Press the cursor keys to highlight the desired alpha character. Press the Enter key to include the highlighted character in the prompt message.

**NOTE**

More detailed information regarding the use of the Alpha Entry screen is provided in Header screen section of [Chapter 3: Setup](#).



The Gage-Chek can be operated as a digital readout for manual measurements conducted completely under operator control, or as a semi-automated multipoint measurement system in conjunction with a fixtured gage. In either case, operation of the Gage-Chek is very straightforward, requiring only a basic understanding of the available panel controls and LCD screens.

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## Front Panel Keys and LCD Screens

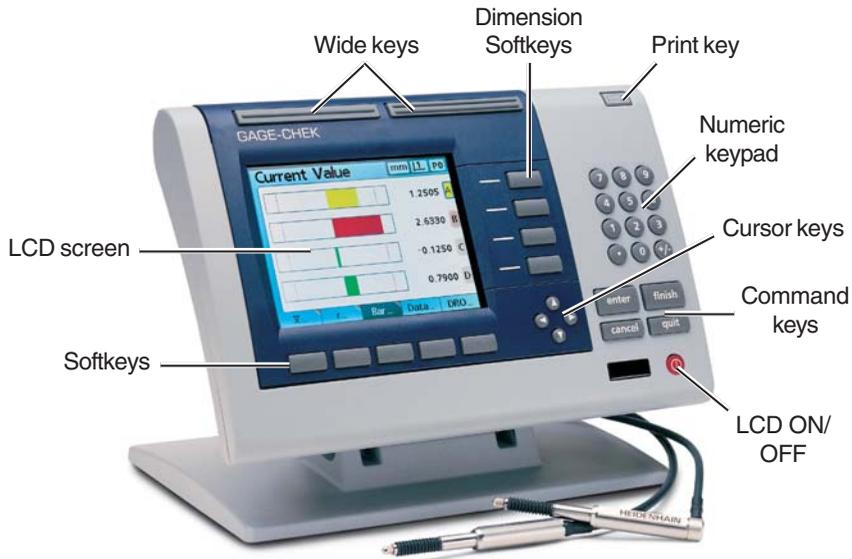
The Gage-Chek combines front panel keys and color LCD screens to provide a simple, intuitive operator interface for setting up and conducting measurements, and for reviewing measurement data and SPC information.

The Gage-Chek front panel keys and LCD screens are explained in the following pages. Please read this portion of the guide carefully as subsequent operating instructions depend on a familiarity with the key function, screen content and screen hierarchy descriptions.

### Front panel keys

Front panel keys include:

- Command keys
- Cursor keys
- Numeric keypad
- LCD ON/OFF
- Print key
- Wide keys
- Softkeys
- Dimension softkeys



---

Command keys	<p>The command keys are used to enter individual data points, finish a data entry session, cancel (or delete) the last data entry, or quit the current activity and return to the DRO screen.</p> <p><b>Enter</b> Enters data for a measurement. Information on the LCD is stored as measurement or configuration data. This information includes current dimension values or alphanumeric data for a configuration or user-prompt data field.</p> <p><b>Finish</b> Completes the data entry process for a measurement. The Finish key may also be used to return from the display of measurement or SPC data to the current DRO screen.</p> <p><b>Cancel</b> Erases the last data value entered into the system from the numeric keypad. The Cancel key can also be used to delete any highlighted alphanumeric characters from data fields shown on the screen.</p> <p><b>Quit</b> Aborts the current task and returns to the previous screen. The Quit key can also be used to exit the current menu.</p>
Cursor keys	<p>The 4 cursor keys are used to scroll lists such as the extra menu and to navigate through the hierarchy of screens.</p>
Numeric keypad	<p>The keypad is used for numeric data entry.</p> <p>The decimal point key and +/- key can also be used to reduce or increase the LCD screen contrast if a decimal point or +/- input are not expected by the system as part of a data entry process. The screen contrast setting will be saved when the system is powered down and used as the default contrast setting the next time the system is turned on.</p>
LCD On/Off key	<p>Toggles the LCD display on and off without removing power from the instrument. The LCD on/off key can also be used to clear channel calibrations, delete data stored for a single part or delete data stored for all parts.</p>

Print key

Pressing the Print key transmits data corresponding to the screen contents to the parallel printer port.

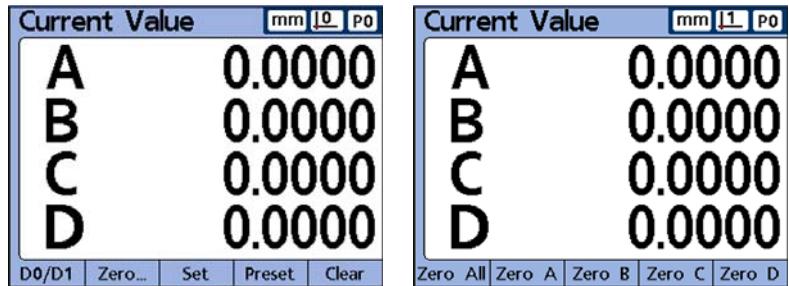
Screen	Data Transmitted
DRO Screen	Currently displayed dimension values
Data View	Stored dimension data as specified by the user in response to a prompt message.
Graph Views	Currently displayed graph, including: <ul style="list-style-type: none"> <li>• Dimension values or histogram for subgroups of 1 or</li> <li>• <math>\bar{x}</math> and <math>r</math> for subgroups greater than 1.</li> </ul>
Setup Menu	A list of all Gage-Chek setup parameters.

Wide keys

The wide keys can be configured as hot keys to initiate frequently used functions in the Hot Keys setup screen. Refer to [Chapter 3: Setup](#) for details regarding Hot Key setup.

Softkeys

The softkeys initiate functions that are labeled above the keys at the bottom of the LCD screen. As different system functions are selected, the softkey labels change in support.



In the example above, pressing the Zero softkey of the left screen changes softkey labels to those at the bottom of the right screen.

Softkey selections presented at the bottom of LCD screens provide alternative viewing, measurement and configuration functions that are unique to specific screens. The left 4 softkeys can be configured by supervisors to provide a variety of commonly used functions when viewing the DRO screen.

Dimension softkeys

Dimension softkeys support functions selected by the softkeys under the LCD.

Screen	Dimension Softkey
DRO screen	Zero the incremental datum of the (Horizontally) associated dimension.
Graph screens	Display a single graph for the associated dimension
Bar/Dial screens	Display a single bar or dial showing current values for the associated dimension.
Data screens	Display a single data table of stored values for the associated dimension.
Extra Menu	Dimension keys page up or down through the extra menu items.



LCD Screens and menus

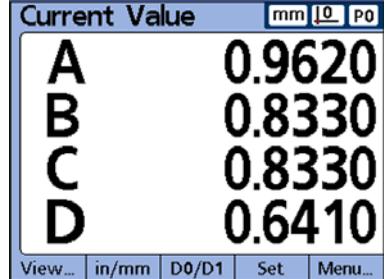
The large-character color LCD presents a variety of screens and menus selected by the user to display current dimension values, pass/fail test results, dimension value graphs, statistical process control graphs and data tables, and setup and part configuration options.

Screen Navigation

As suggested by the diagrams shown on subsequent pages, navigation from one screen to another is very straightforward. For example, to display a bar graph of current values from the DRO screen, press the View softkey and then the Bar softkey.

DRO screen

The DRO screen is the “Home Screen” displayed upon startup. The DRO screen provides numeric displays of the current values of up to 4 dimensions. The Unit of measure, current datum and current part number are displayed in the upper right corner of the screen.



Use the cursor keys to scroll dimensions when more than 4 dimensions are active.

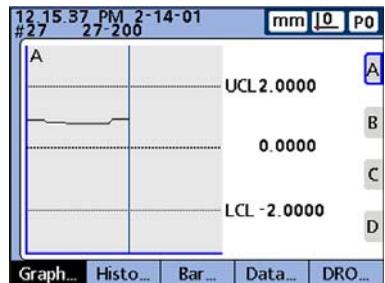
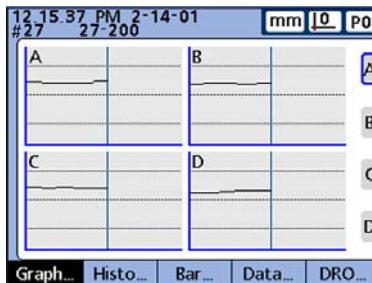
View screens

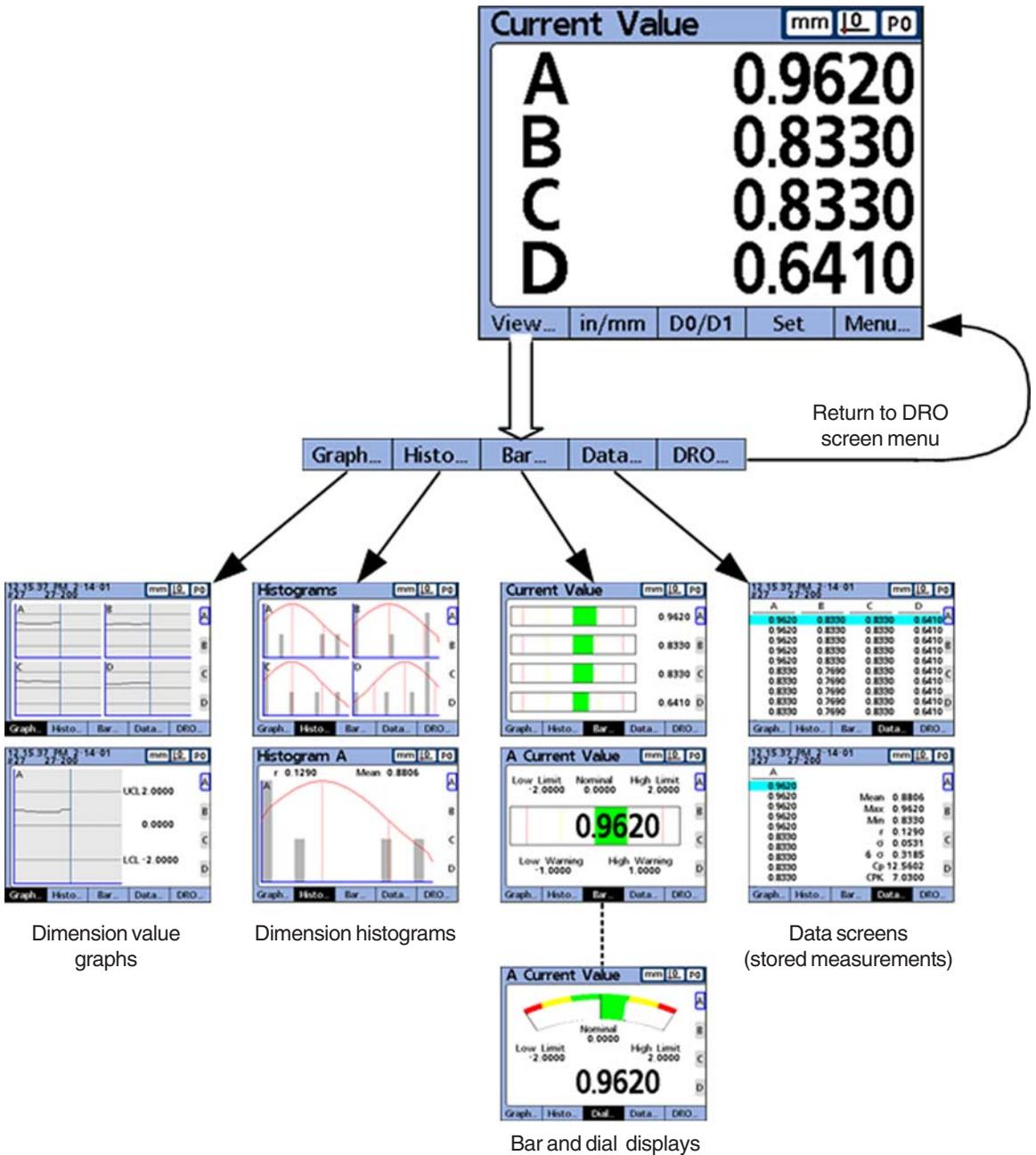
The screens accessed by pressing the View softkey are shown on the next page.

Dimension Value Graph Screen (SPC subgroups of 1)

The dimension value graph screen is displayed for SPC subgroups of 1 and displays graphs for up to 16 dimensions.

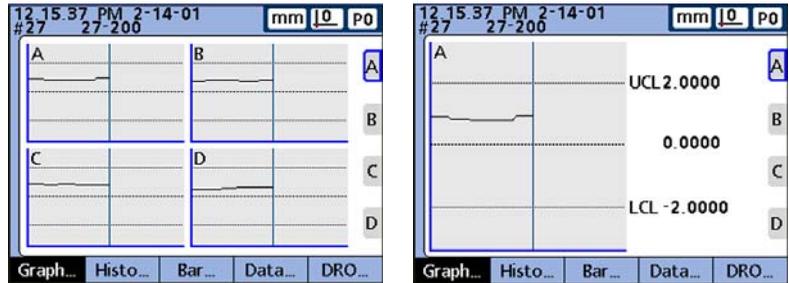
Press the Graph softkey to change the number of graphs presented on the screen. Press a dimension softkey to display a graph of the dimension and the minimum additional dimensions. Use the cursor keys to scroll the graphs when more data is stored than will fit on the screen.





View screens displayed for SPC subgroups of 1

Individual samples are selected by a vertical line on the graph. Move the vertical line left and right through the stored data using the cursor keys. The time and date that the selected sample was stored are shown in the upper left corner of the screen. The ID number of the sample and total number of samples stored for the dimension are also shown in the upper left corner.

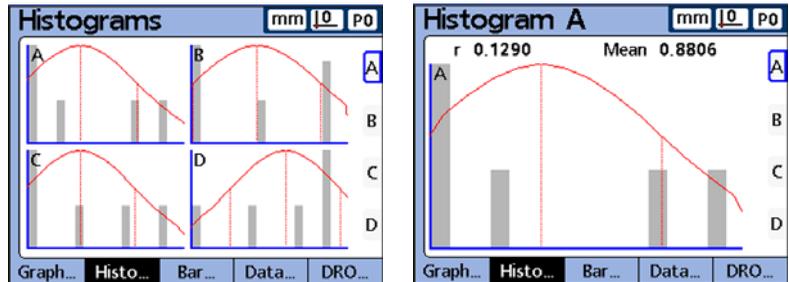


Displays of a single dimension also show the nominal and control limit values.

Dimension histogram screen  
(SPC subgroups of 1)

The dimension histogram screen displays histograms of values for up to 16 dimensions. This screen is displayed for SPC subgroups of 1.

Press the Histo softkey to change the number of histograms presented on the screen. Press a dimension softkey to display the histogram of a single dimension.



The display of a single dimension also shows the total range and mean of the values.

## Bar and dial screens

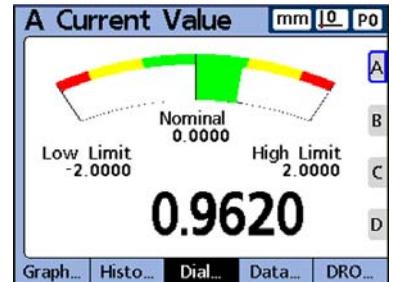
The bar and dial screens provide graphic displays of the current values of up to 16 dimensions. The default bar screen can be configured to display current value bars in horizontal or vertical orientation using the Display setup screen.

Bar displays of multiple dimensions show current values. Bar displays of single dimensions include the current value, nominal value, and high and low warning and limit values.



Press the Bar softkey to change the number of bars presented on the screen. Press a dimension softkey to display a bar for a single dimension.

The display can be configured in the Display setup screen to include a dial in addition to the bars. When the dial display is also available, press the Bar softkey to toggle between the bars and the dial.

**NOTE**

The display of a single dimension can be configured to be a bar or a dial, and cannot be toggled between a single bar and a dial.

Dimension data screens  
(SPC subgroups of 1)

Dimension data screens contain measurement data stored for up to 4 dimensions.

Press the Data softkey to toggle between views of data for all dimensions and data for a single dimension that includes SPC statistics.

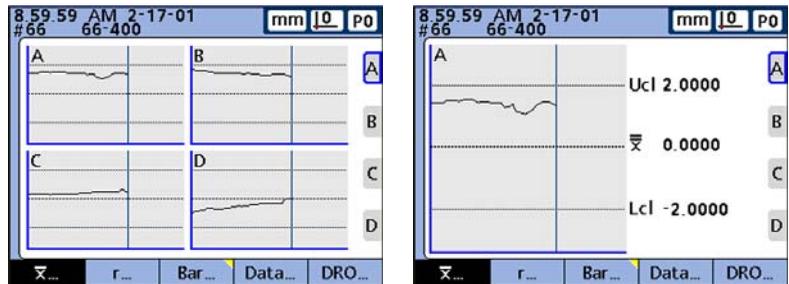


Press a dimension softkey to display data for a single dimension. Use the cursor keys to scroll the tables when more data is stored than will fit on the screen.

Dimension Xbar charts  
(SPC subgroups > 1)

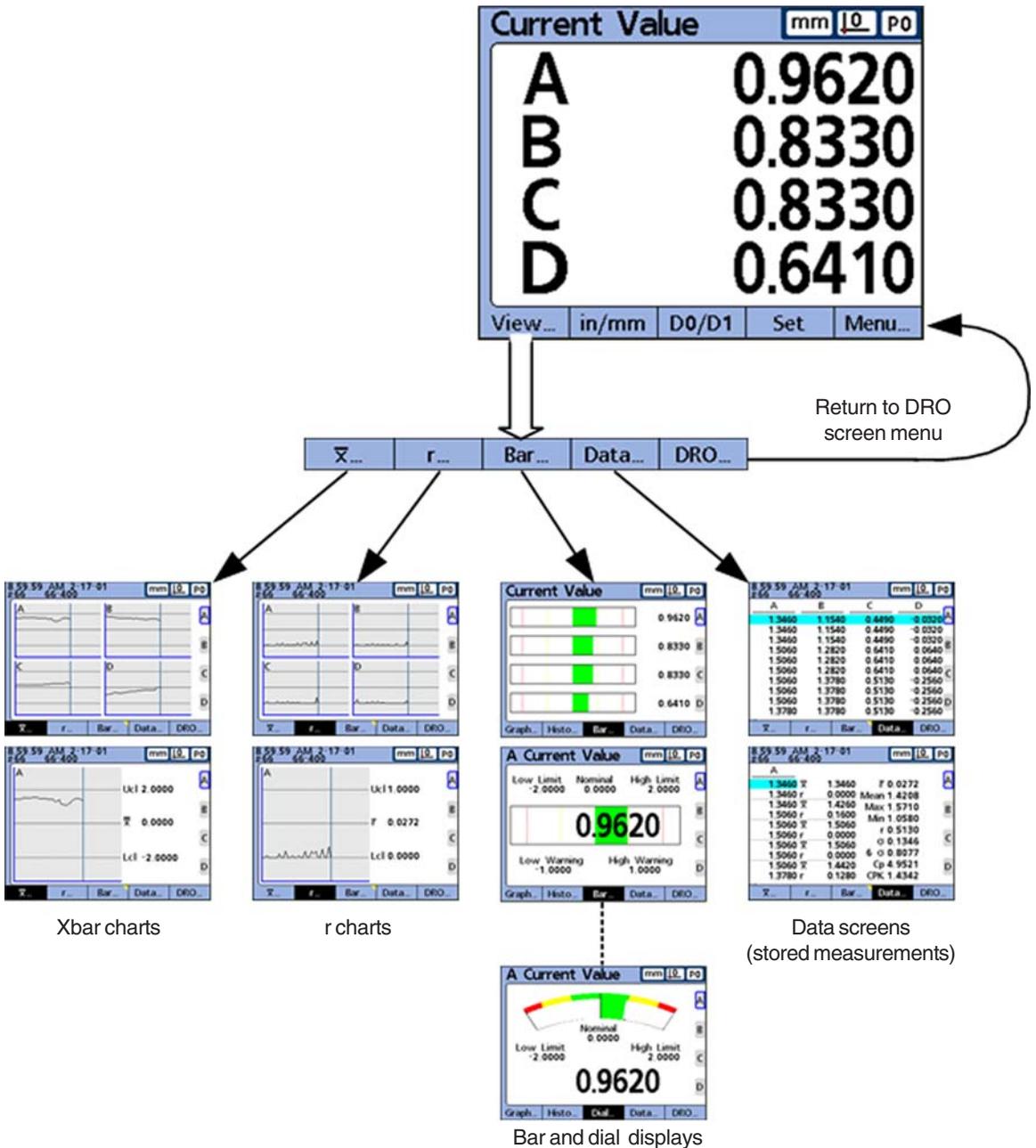
The Dimension Xbar screen is displayed in place of the Value Graph screen discussed earlier for SPC subgroups greater than 1, as shown on the next page. The Dimension Xbar screen graphs the mean ( $\bar{X}$ ) of each subgroup for up to 16 dimensions.

Press the  $\bar{X}$  softkey to change the number of graphs presented on the screen. Press a dimension softkey to display a graph of a single dimension.



Use the cursor keys to scroll the graphs when more data is stored than will fit on the screen.

Individual subgroups are selected by a vertical line on the graph. Move the vertical line left and right through the stored data using the cursor keys. The time and date that the selected subgroup data was stored are



View screens displayed for SPC subgroups > 1

shown in the upper left corner of the screen. The ID number of the subgroup and total number of subgroups stored for the dimension are also shown in the upper left corner.

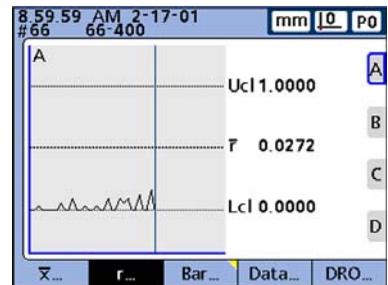
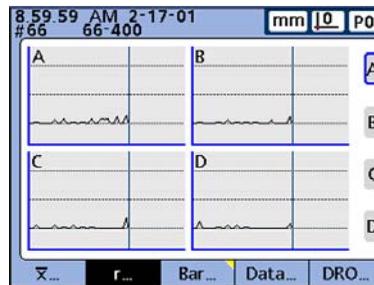


Displays of single dimensions also show the mean of all subgroup samples ( $\bar{x}$ ) and the control limits. The mean is not recalculated for each measurement. Refer to the SPC information contained in [Chapter 8: Reference material](#) for details.

Dimension r charts  
(SPC subgroups > 1)

The dimension r screen is displayed in place of the Histogram screen discussed earlier for SPC subgroups greater than 1, as shown on the previous page. The dimension r screen graphs the range ( $r$ ) of each subgroup for up to 16 dimensions. The range is not recalculated for each measurement. Refer to the SPC information contained in [Chapter 8: Reference material](#) for details.

Press the  $r$  softkey to change the number of graphs presented on the screen. Press a dimension softkey to display a graph of a single dimension.



Use the cursor keys to scroll the graphs when more data is stored than will fit on the screen.

Individual subgroups are selected by a vertical line on the graph. Move the vertical line left and right through the stored data using the cursor keys. The time and date that the selected subgroup data was stored are shown in the upper left corner of the screen. The ID number of the subgroup and total number of subgroups stored for the dimension are also shown in the upper left corner.

Displays of single dimensions also show the mean of all subgroup ranges ( $\bar{r}$ ) and the range control limits.

Dimension data screens  
(SPC subgroups>1)

Dimension data screens display measurement data for up to 4 dimensions. The Data screen for a single dimension is slightly different for SPC subgroups > 1 than those for SPC subgroups of 1. Individual subgroups are indicated by a horizontal line in tables for single dimensions. The data table for multiple dimensions remains unchanged for SPC subgroups > 1.

Press the Data softkey to toggle between views of data for all dimensions and data for a single dimension that includes SPC statistics. Press a dimension softkey to display data for a single dimension. Use the cursor

8:59:59 AM 2-17-01				
#66 66-400				
A	B	C	D	
1.3460	1.1540	0.4490	-0.0320	A
1.3460	1.1540	0.4490	-0.0320	
1.3460	1.1540	0.4490	-0.0320	B
1.5060	1.2820	0.6410	0.0640	
1.5060	1.2820	0.6410	0.0640	C
1.5060	1.3780	0.5130	-0.2560	
1.5060	1.3780	0.5130	-0.2560	D
1.5060	1.3780	0.5130	-0.2560	
1.3780	1.3780	0.5130	-0.2560	
Σ...	r...	Bar...	Data...	DRO...

8:59:59 AM 2-17-01				
#66 66-400				
A				
1.3460	1.3460	0.0272		A
1.3460	0.0000	Mean 1.4208		
1.3460	1.4260	Max 1.5710		B
1.5060	0.1600	Min 1.0580		
1.5060	1.5060	r 0.5130		C
1.5060	0.0000	σ 0.1346		
1.5060	1.5060	6 σ 0.8077		D
1.5060	0.0000	Cp 4.9521		
1.5060	1.4420	CPK 1.4342		
1.3780	0.1280			
Σ...	r...	Bar...	Data...	DRO...

keys to scroll the tables when more data is stored than will fit on the screen.

The time and date that the highlighted subgroup data was stored are shown in the upper left corner of the screen. The ID number of the subgroup and total number of subgroups stored for the dimension are also shown in the upper left corner.

**in/mm menu item**

Pressing the in/mm menu softkey toggles the display of distance between inch and millimeter units of measure. This does not alter the channel configurations in the Channel setup screen. The Gage-Chek simply calculates the conversion of one unit of measure to another as a convenience to the user.

Current Value		mm	in	P0
A	0.9620			
B	0.8330			
C	0.8330			
D	0.6410			
View...	in/mm	D0/D1	Set	Menu...

Converts units of measure for display purposes only

**D0/D1 menu item**

Pressing the D0/D1 softkey toggles the display between the absolute (D0) and incremental (D1) datum.

Current Value		mm	in	P0
A	0.9620			
B	0.8330			
C	0.8330			
D	0.6410			
View...	in/mm	D0/D1	Set	Menu...

Toggles between the display of the absolute datum and incremental datum

## Channel set screens



Channel Set screens are used to set the absolute datums (D0) or calibrate input channels. The channel set is configured to either set D0 or calibrate the entire channel range in the Misc setup screen.

**NOTE**

**Prior to applying, and after clearing a channel Set Value, the Gage-Chek machine zero is used as the absolute datum.**

**Set absolute datum (D0) screen**

When the Misc setup screen is configured to set datums (no full cal), the absolute datum (D0) of any channel can be specified or changed at any time using the Channel Set screen. Up to 3 groups of datum Set values can be stored for all Gage-Chek input channels. Any of these groups can be quickly recalled and applied later.

Current Value		mm	0	P0
A	0.9620			
B	0.8330			
C	0.8330			
D	0.6410			
View...	in/mm	D0/D1	Set	Menu...

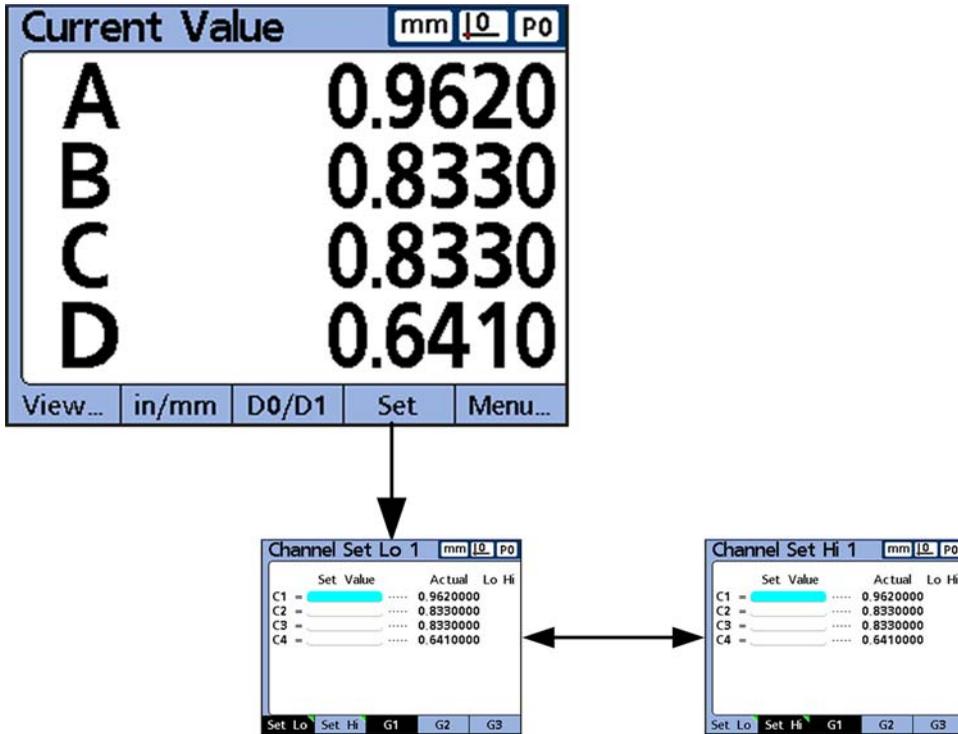
Channel Set 1		mm	0	P0
Set Value	Actual			
C1 =	0.9620000			
C2 =	0.8330000			
C3 =	0.8330000			
C4 =	0.6410000			
		G1	G2	G3

**NOTE**

**Instructions for setting the absolute datum to a specific value are provided later in this chapter.**

### Calibrate channels screens

When the Misc setup screen is configured to perform full calibrations of input channels (full cal), the full range calibration of any channel can be specified or changed at any time using the Channel Set Lo and Channel Set Hi screens. Up to 3 groups of low-range and high-range calibration values can be stored for all Gage-Chek input channels. Any of these groups can be quickly recalled and applied later.

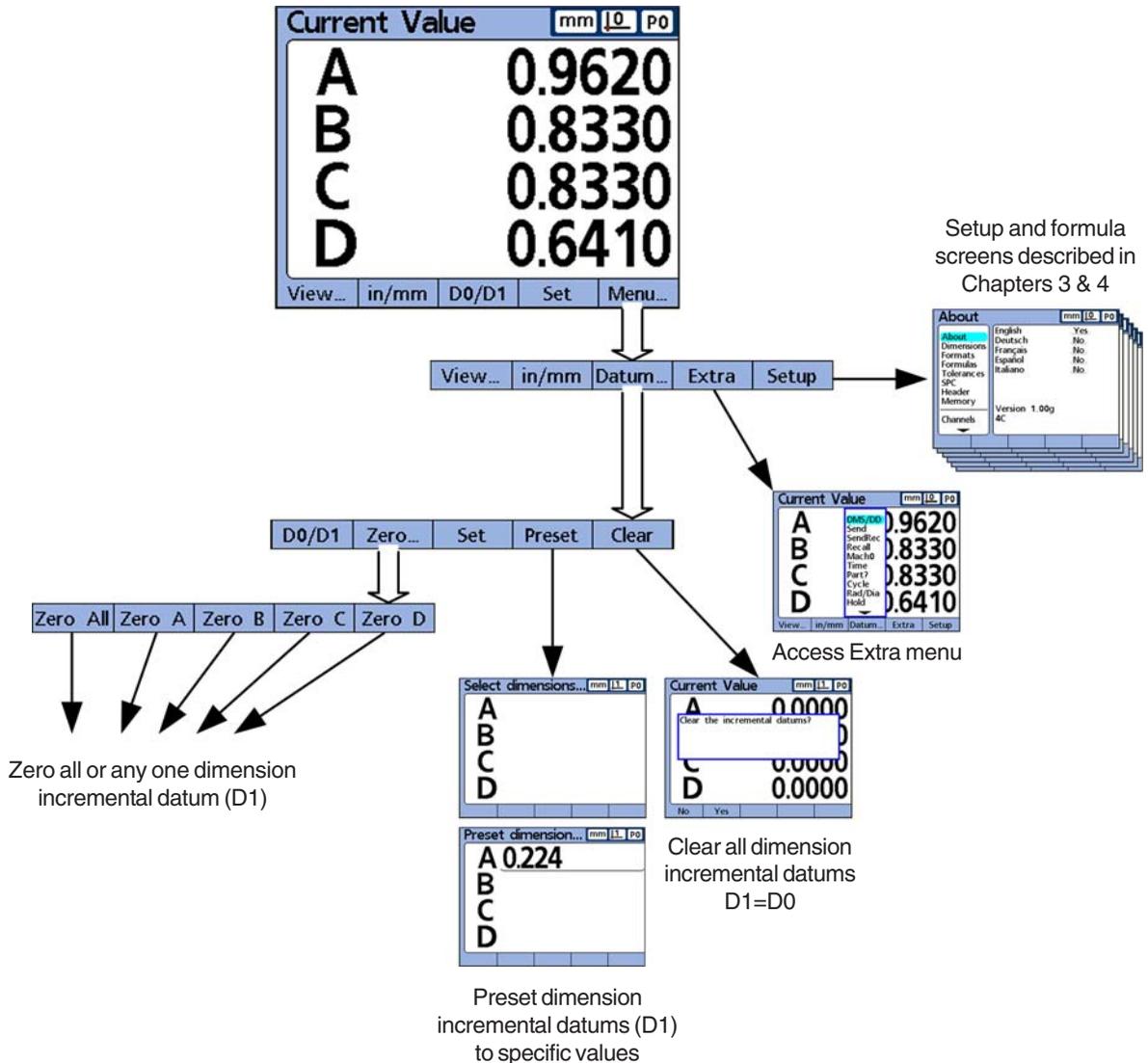


### NOTE

Instructions for calibrating input channels to specific low-range and high-range values are provided later in this chapter.

Menu screens

The screens accessed by pressing the Menu softkey are shown below.



Menu screens

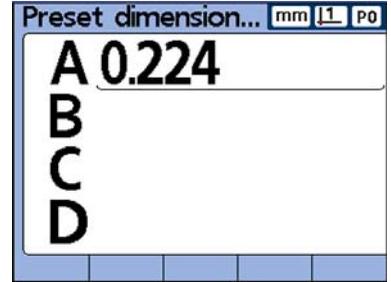
**Zero menu function**

The Zero menu function can be used at any time to simultaneously zero all incremental datums, or to zero any specific incremental datum.

**Preset screen**

The Dimension Preset screen is used to preset incremental datums.

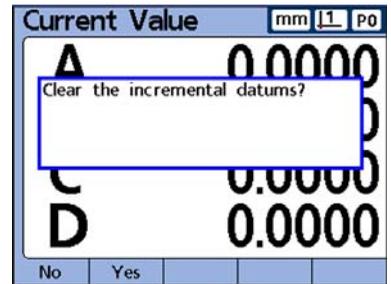
The incremental datum of a dimension can be preset to a specific value at any time by pressing the Preset softkey, pressing a dimension softkey and entering the desired value.

**NOTE**

**Instructions for presetting dimensions are provided later in this chapter.**

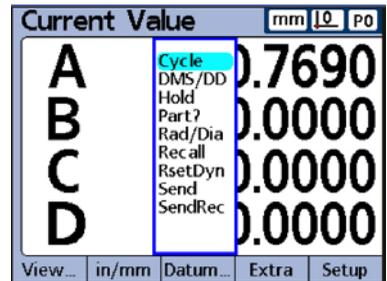
**Clear menu function**

The Clear menu function can be used at any time to simultaneously clear all incremental datums. Cleared incremental datums are equal to absolute datums.



## Extra menu

The extra menu provides quick access to a variety of display and other system functions. To use any Extra menu function, use the cursor keys to highlight the desired function, and then press the Enter key.



### Cycle

Advances to the next defined part.

Part numbers are cycled in a continuous loop.

### DMS/DD

Toggles the display of angles between Degrees, Minutes, Seconds (DMS) and Decimal Degrees (DD).

### Hold

Toggle function that holds (freezes) or releases the current value of a single dimension when a dimension softkey is pressed, or of all dimensions when the All softkey is pressed.

### Part?

Displays a pop-up screen that allows the user to specify a new part number.

### Rad/Dia

Toggles between the radius and diameter measurement types on the DRO screen, if radius or diameter was specified earlier in the Formats setup screen.

### Recall

Applies the last-used incremental datum preset.

### RsetDyn

Resets the minimum and maximum values accumulated during dynamic measurements. This function must be initiated prior to new dynamic measurements.

### Send

Sends the specified current dimension values, or all current dimension values to the RS-232 serial port for transmission to a computer. The user is prompted to send one or all.

**SendRec**

Sends stored records to the RS-232 serial port for transmission to a computer.

**Setup screens**

Refer to Chapter 3: Setup for details regarding the setup screens.

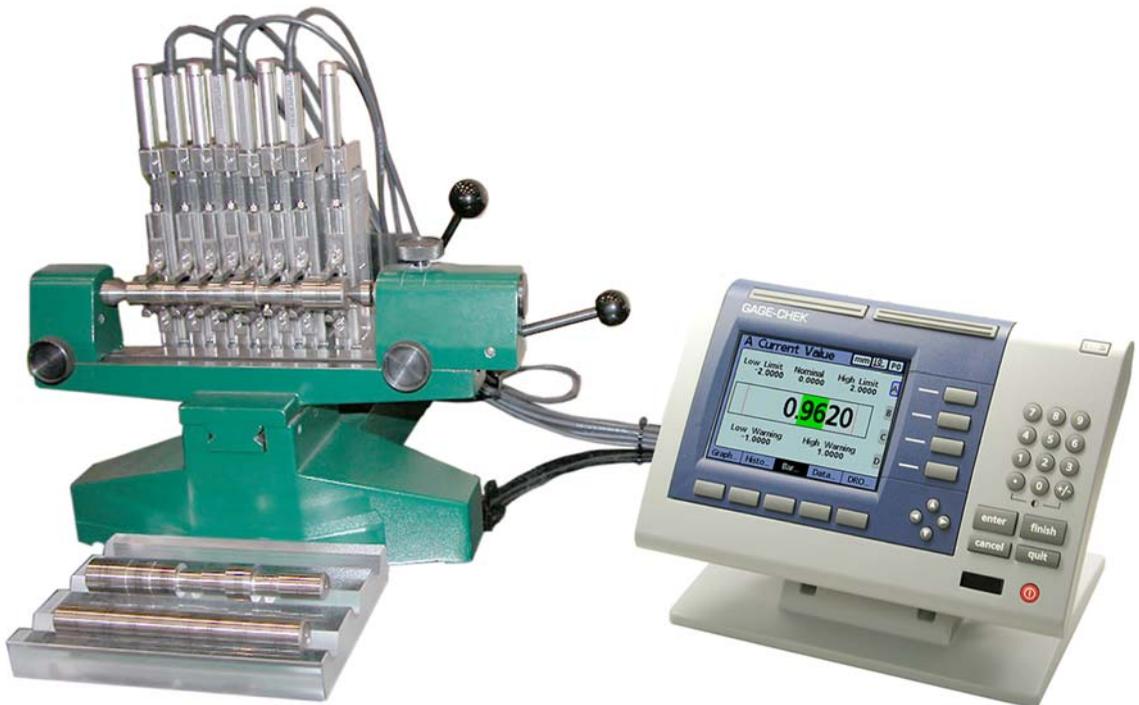
## Operating Instructions

Basic operation of the Gage-Chek is extremely simple, as shown by the typical process steps shown below.

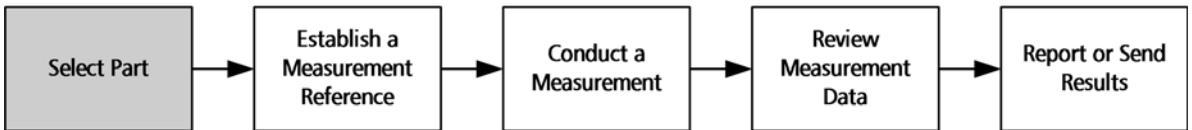
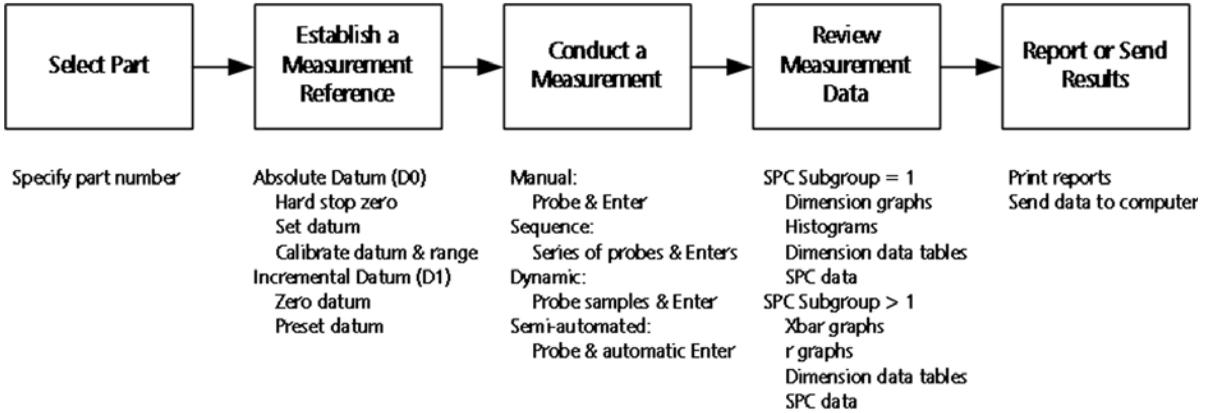


Measurement steps and the resulting data collected depend entirely on setup parameters and dimension formulas defined earlier to satisfy a specific application.

Often the measurement process simply consists of selecting a part number, establishing a measurement reference, manually probing the part and pressing the Enter key to store the data. At other times, the Gage-Chek is used in conjunction with a fixtured gage to conduct sequential, dynamic or semi-automated measurements. In all cases, the fundamental operating steps are the same.

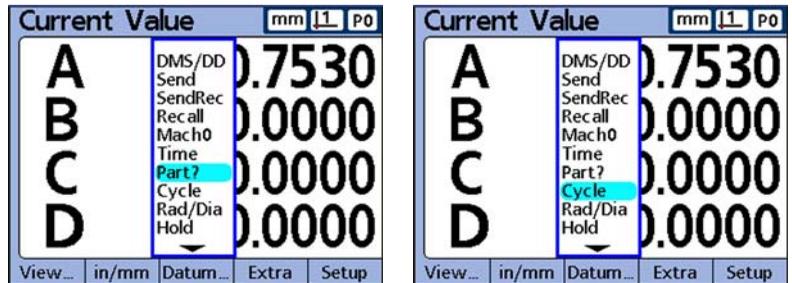


The previous diagram of operating steps is expanded below to indicate specific alternatives for each step. These alternatives are explained in subsequent pages.



Selecting a part

The correct part (number) must be selected prior to conducting measurements. Ten part configurations can be stored in the Gage-Chek. Each part configuration includes all the Gage-Chek settings and dimension formulas required to conduct measurements and report results for the part.



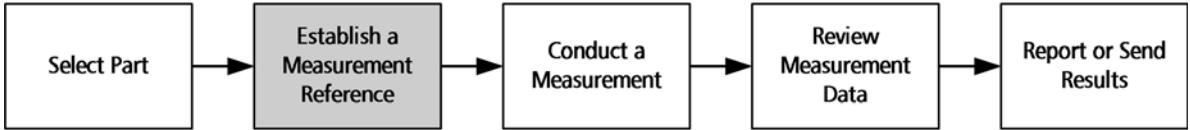
Step 1

Press the Extra softkey and use the cursor keys to highlight Part? Or Cycle.

Step 2

Press Enter. If Part? was highlighted, you will be prompted for a part number. Use the Numeric Keypad to specify the part and press the Enter key.

If Cycle was highlighted, the part number will be incremented. Continue incrementing to select the desired part number.



**Establishing a measurement reference**

A measurement reference must be established prior to conducting a measurement. Measurement references can be established, and measurements conducted using the absolute or incremental datum.

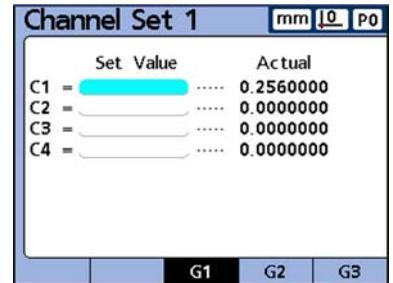
**Establishing a reference with the absolute datum (D0)**

Absolute references (or channel calibrations) are applied to the channels of all parts. For example, a channel Set or calibration performed for channel 1 and part number 0 will also apply to channel 1 measurements for all parts.

Setting the absolute datum (D0) to zero or an offset

Step 1

Press the Set softkey. Use the cursor keys to select the desired channel if necessary.

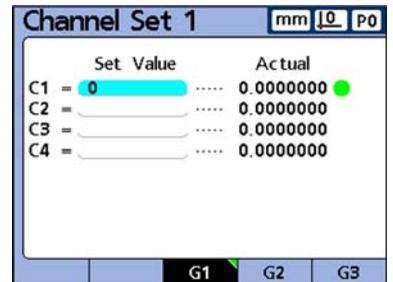
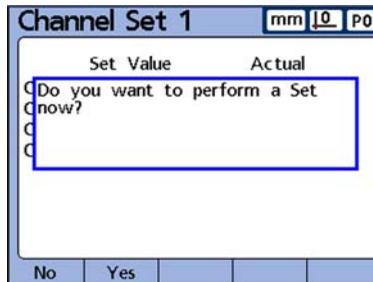
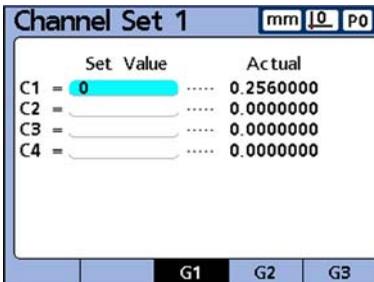


Step 2

Position the probe against the reference surface.

Step 3

Use the Numeric Keypad to enter the reference value (zero or the desired offset) into the Set Value data field. Press the Enter key, then press the Yes softkey to zero (or offset) the absolute datum (D0).

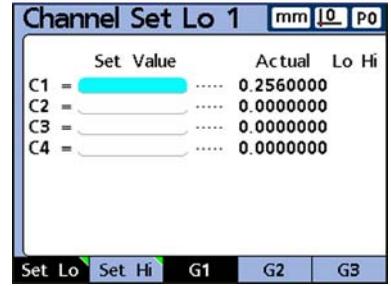
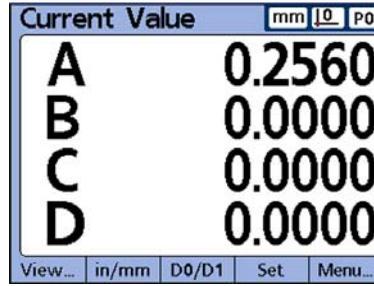


Calibrating a channel

The Allow Full Cals field of the Misc setup screen must be set to Yes to perform a calibration. Refer to [Chapter 3: Setup](#) for details.

Step 1

Press the Set softkey. Press the Set Lo softkey if necessary to display the Channel Set Lo screen.



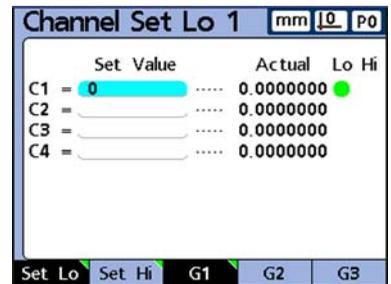
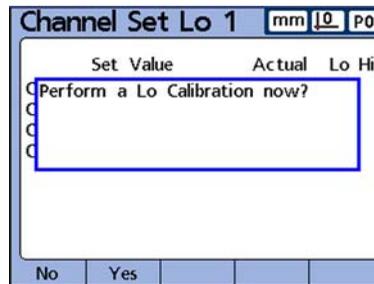
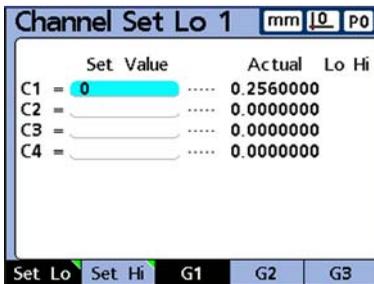
Use the cursor keys to select the desired channel if necessary, then press the G1, G2 or G3 softkey to select a group to store the calibration data in.

Step 2

Position the channel's probe against the reference surface.

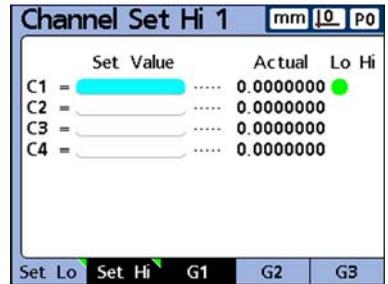
Step 3

Use the Numeric Keypad to enter the reference value (zero or the desired offset) into the Set Value data field for the channel. Press the Enter key, then press the Yes softkey to zero or offset the absolute datum (D0) for the channel. This calibrates the low end of the channel range. Completed calibration is indicated by a green circle.



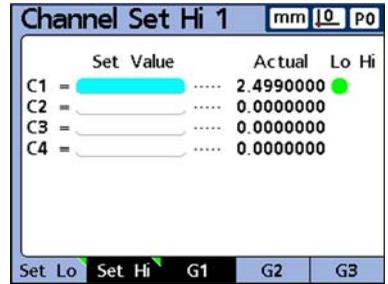
Step 4

Press the Set Hi softkey and use the cursor keys to select the same channel as in step 1 if necessary.



Step 5

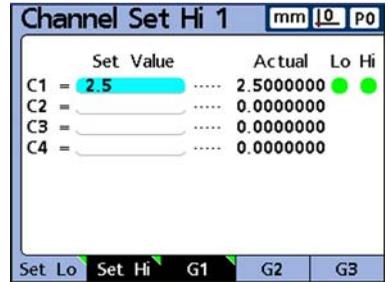
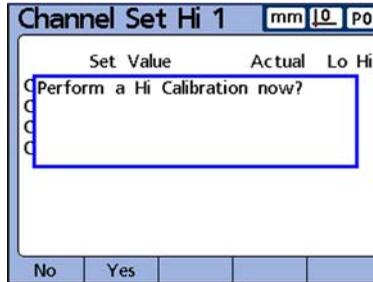
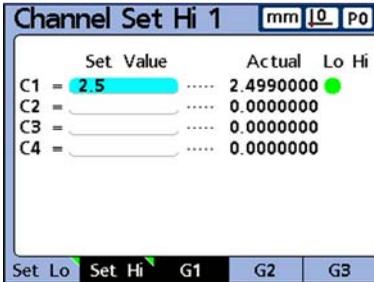
Position the channel's probe against the reference surface for the high end of the channel calibration range.

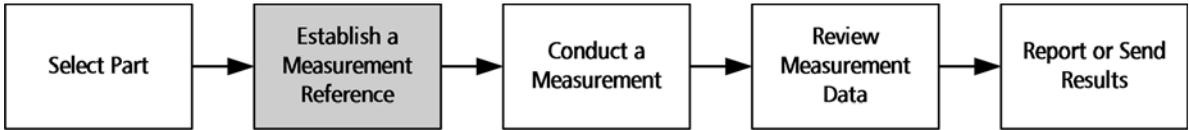


Step 6

Use the numeric keypad to enter the value corresponding to the high end of the channel calibration range, and then press the Enter key.

Press the Yes softkey to calibrate the high end of the channel range. Calibration is indicated by a green circle.





**Establishing a reference with the incremental datum (D1).**

The incremental datum (D1) can be used independent of the absolute datum (D0) to perform measurements based on temporary references.

While the absolute datums of input channels are shared by all parts, the values of incremental datums are unique to each part.

Zeroing the incremental datum

Step 1

Press the D0/D1 softkey to display the incremental datum (D1) in the top right corner of the DRO screen if necessary.

Step 2

Press the desired dimension softkey to zero the incremental datum.

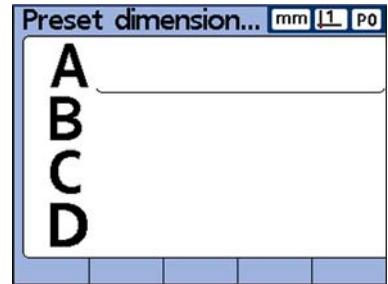
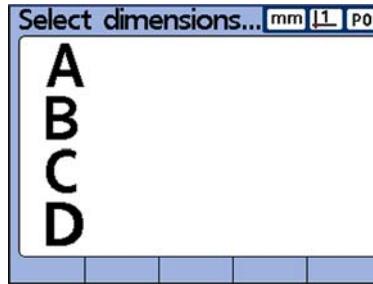
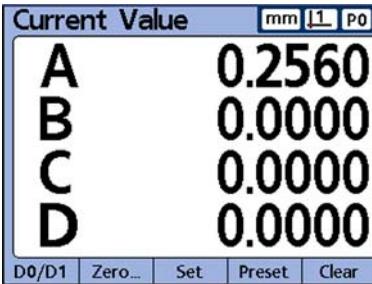
Presetting the incremental datum

Step 1

Press the D0/D1 softkey to display the incremental datum (D1) in the top right corner of the DRO screen if necessary.

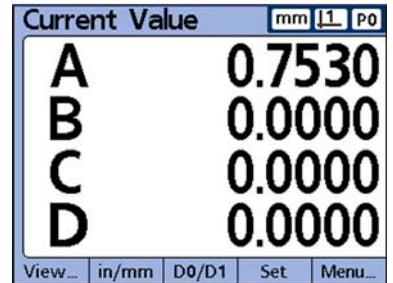
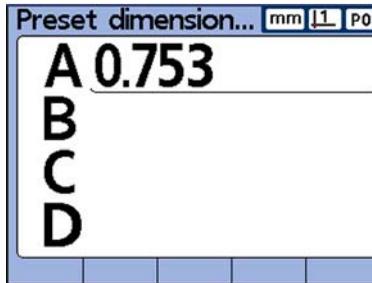
Step 2

Press the Menu softkey, the Datum softkey, and the Preset softkey. Then press the Dimension softkey of the dimension you wish to preset.



Step 3

Use the Numeric Keypad to enter the reference value (preset) of the incremental datum (D1).

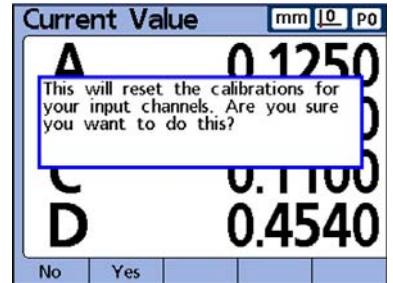
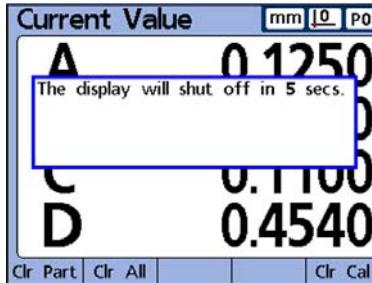


**Clearing channel sets and calibrations**

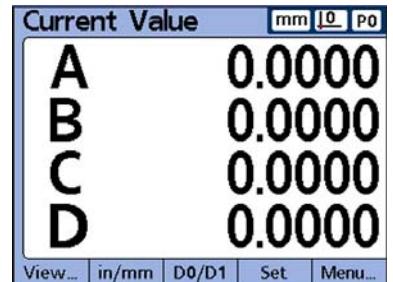
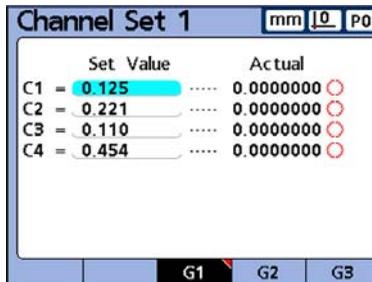
The set values and full calibrations of all channels can be cleared using the LCD ON/OFF key.

Step 1

Press the LCD ON/OFF key, then press the Clr Cal softkey. You will be asked to confirm your intention. Press the Yes softkey to clear channel sets and full calibrations.



Channel sets and full calibrations will be cleared, as indicated by the empty circles at the right of the screen. However, the values will be retained in the value data fields, and can be reactivated at any time by pressing the Enter key.

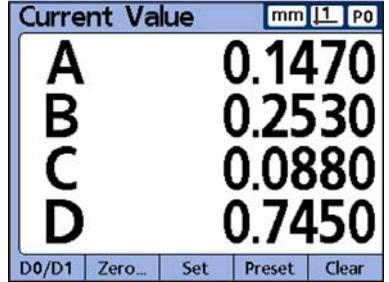
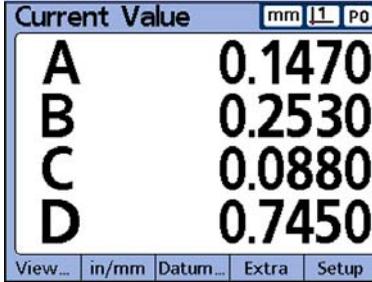
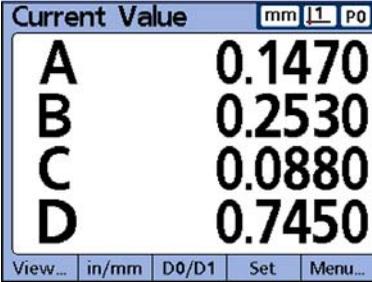


Clearing incremental datums

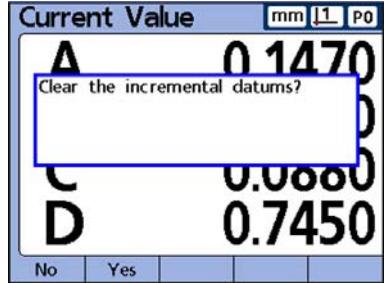
Incremental datum presets can be cleared, thereby making incremental datum values equal to absolute datums, using the Datum menu.

Step 1

Press the Menu softkey, press the Datum softkey and then press Clear.

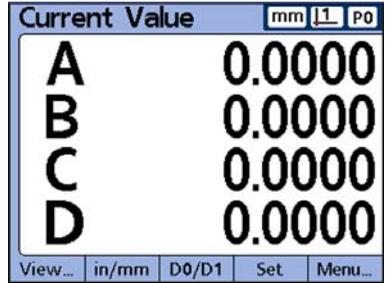


You will be asked to confirm your intention.



Step 2

Press the Yes softkey to clear incremental datums.





**Conducting a measurement**

When a part number is selected and a reference is established, measurements can be conducted. Measurements can be conducted manually, follow a sequence of steps shown on the screen, be based on dynamic sampling or be semi-automated.

Manual measurements

Probe a single point with one channel, or multiple points simultaneously with multiple channels and press the Enter key to store the data.

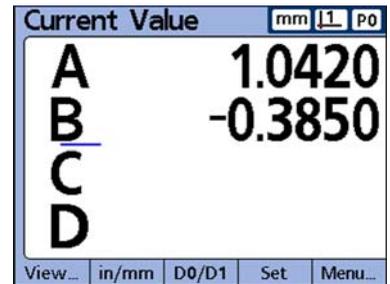
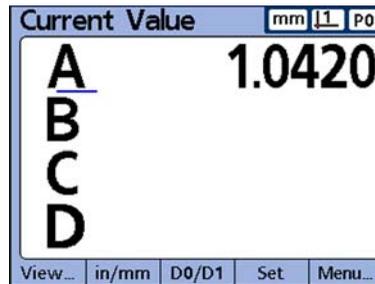
Sequential measurements

The Gage-Chek can be configured in the Formula setup screen to direct the user through a sequence of pre-defined measurements.

Typically a setup person will provide instructions describing how to conduct the measurements. However, the Gage-Chek operation is fundamentally the same for all sequential measurements.

Step 1

Probe the dimension underlined on the DRO screen and press the Enter key to store the data. The underline will advance to highlight the next dimension in the measurement sequence.



Step 2

Continue probing the underlined dimensions and pressing the Enter key as described above.

When measurements specified for the part are complete, the Gage-Chek will return to underline the first dimension in the series to indicate the beginning of a new sequence.

## Dynamic measurements

The Gage-Chek can be configured in the Formula setup screen to sample input channels and retain the minimum and maximum values of all samples.



In the example above, a shaft is measured for runout. The minimum and maximum values are sampled as the shaft is turned. Typically a setup person specifies dynamic measurements to evaluate rotational or curved surfaces and will provide instructions describing how to conduct the measurements. The Gage-Chek operation is essentially the same for all dynamic measurements.

**Step 1**

Perform a dynamic reset by pressing the left Wide key (factory default), or by highlighting RsetDyn in the Extra menu, and pressing the Enter key. This clears old dynamic measurement data prior to a new measurement.

**Step 2**

Position the probe(s) against the surface to be measured and repeatedly rotate or move the surface slowly while observing the resulting dimension value(s).

**CAUTION**

**The part must be rotated or moved slowly to ensure that all points on the surface are sampled.**

**Step 3**

Repeat the rotation or movement until the dimension values that reflect minimum or maximum values no longer change.

**Step 4**

Press the Enter key to store the measurement data.

Semi-automated measurements

Normally, measurements shown on the DRO screen are not stored in the Gage-Chek database until the user presses the Enter key. However, the Gage-Chek can be configured in the Formula setup screen to store measurements automatically when the gage is loaded with a new part.



Load part; channels ready

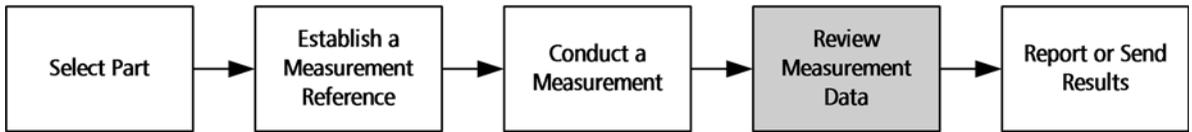


Gage down; channels measure



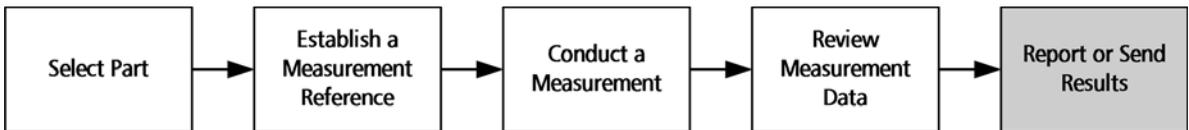
Unload part; channels reset

In the example above, a sheet is measured to verify flatness. The measurement is made and entered into the database when the gage is lowered to position the channel probes against the sheet surface. The channels are reset for a new measurement when the gage is lifted. Typically, a setup person will provide instructions describing how to load and unload the gage, and to confirm that the measurement was conducted and the resulting data stored.



**Reviewing the measurement results**

Measurement results can be displayed in graphs or in data tables using the screens described earlier in this chapter. Please refer to these descriptions of graph and data table screens for details.



### Printing reports

Measurements results can be printed or transmitted to a computer. The data printed or transmitted is specified and formatted in the setup screens described in [Chapter 3: Setup](#).

Reports of current dimension values, stored measurement results or Gage-Chek setup parameters can be printed by displaying the desired screen and pressing the Print key. In some cases, the user will be prompted to provide additional information.



#### NOTE

**The Gage-Chek supports most HP printers that utilize the HP PCL data format.**

Report types, screens and user actions required for printing are listed in the table shown below.

Report type	Screen	User actions
Current dimensions (Numeric display)	DRO	Press Print key
Graphs of dimension values (SPC subgroups = 1)	Graph...	Press Print key
Histograms of dimension values (SPC subgroups = 1)	Histo...	Press Print key
xbar chart of subgroup mean values (SPC subgroups > 1)	xbar chart	Press Print key
r chart of subgroup range values (SPC subgroups > 1)	r chart	Press Print key
Current dimension values (Bar display)	Bar...	Press Print key
Current dimension values (Dial display)	Dial...	Press Print key
Data table multiple-dimensions	Data...	Press Print key, respond to prompt
Data table single-dimensions	Data...	Press dimension softkey, press Print key, respond to prompt



#### NOTE

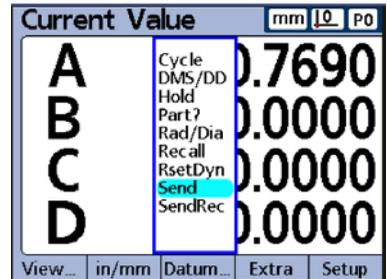
**If printing large files, or printing on a slow printer generates printer errors, increase the Parallel Retry number in the Parallel setup screen. Refer to [Chapter 3: Setup](#) for details.**

## Sending data to computers

Current dimension values, or a collection of stored dimension measurement results can be transmitted to a computer using the Send and SendRec functions in the Extra menu. Please refer to the Extra menu descriptions provided earlier in this chapter for more details regarding the Extra menu.

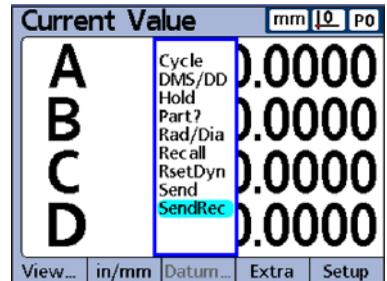
### Sending current dimension values

Press the Extra softkey, use the cursor keys to highlight Send and press the Enter key to send the current dimension values to a computer.



### Sending stored measurement results

Press the Extra softkey, use the cursor keys to highlight SendRec and press the Enter key to send a file of stored measurement results



### Clearing stored measurement results



Stored measurement result data can be cleared for a single part, or for all parts by pressing the LCD ON/OFF key.

#### CAUTION

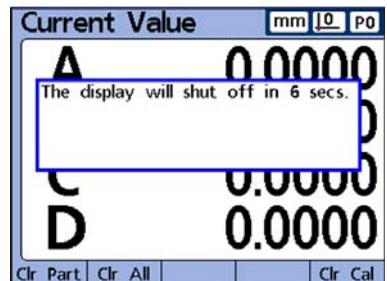
**Erased data cannot be restored.**

#### Clearing data stored for a single part

Select the desired part, press the LCD ON/OFF key and press the Clr Prt softkey to erase stored data for the part.

#### Clearing data stored for all parts

Press the LCD ON/OFF key and press the Clr All softkey to erase stored data for all parts.





This chapter explains how to send data to a computer running the WinWedge® or SPC-IV® programs. A table of ASCII character codes is also provided.

## Using WinWedge®

The Gage-Chek Rep Chars and Send Chars setup screens provide fields for formatting data for transmission to computer programs such as Microsoft® Excel®. ASCII control characters can be inserted into these fields to satisfy most data transfer requirements. However, WinWedge® can be used for data transfers as well.



### NOTE

**ASCII characters are shown in a table at the end of this chapter.**

Communication with a computer running the WinWedge® program relies on a serial RS-232 connection using a standard straight-through cable. Instructions for connecting and testing a computer are provided in [Chapter 2: Installation](#).

WinWedge® sends data to a user defined application. In the following example, WinWedge® is used to send data to Microsoft® Excel®.

### Connecting to a computer with WinWedge®

#### Step 1

Double-click on the WinWedge® icon to launch the WinWedge application.



### NOTE

**Use the Windows® Start menu to open WinWedge® if there is no shortcut icon on the desktop.**

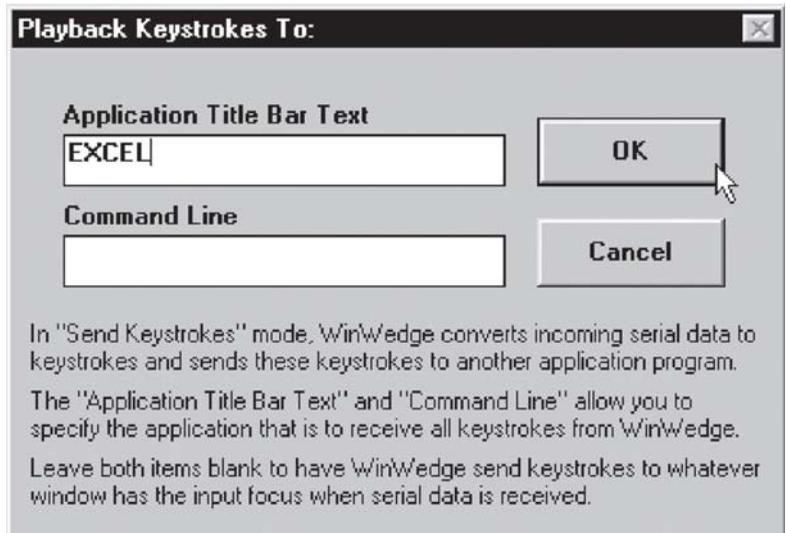
Step 2

Click on the Mode menu and choose Send Keystrokes To.



Step 3

Type EXCEL in the application title bar text box.



#### NOTE

Type the name of the application that will receive the Gage-Chek data. This example uses a Microsoft® Excel® spreadsheet. Type the application name in all upper case characters as shown.



#### NOTE

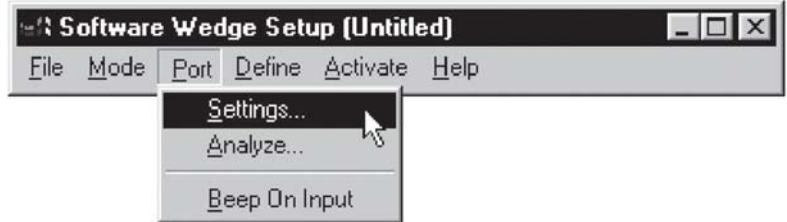
Leave the Command Line box blank.

Step 4

Click OK.

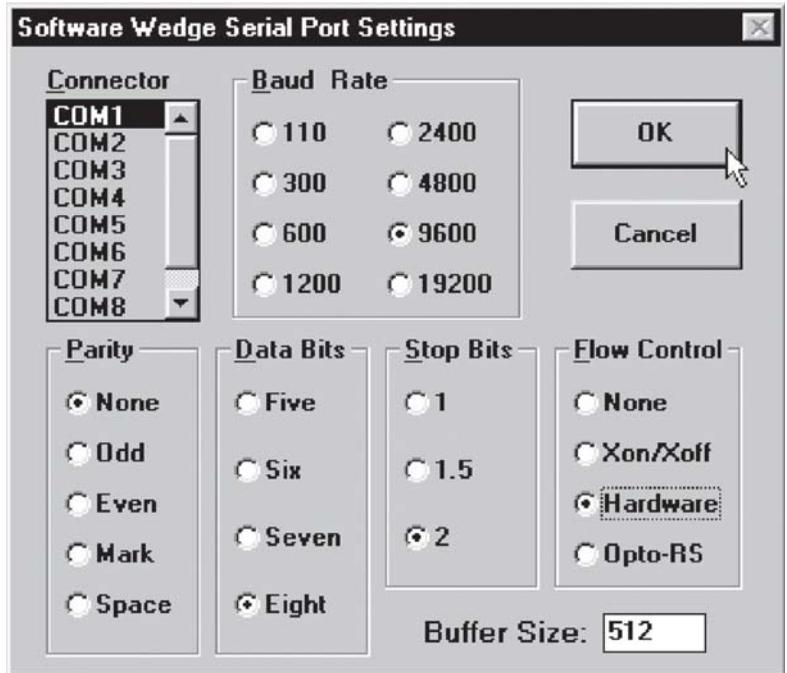
Step 5

Click on the Port menu and choose Settings.



Step 6

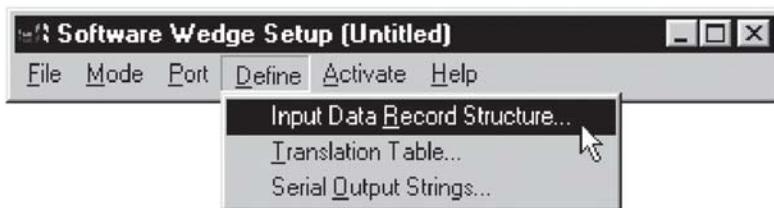
Enter the following settings:



- Connector: COM 1 or COM2 (as connected)
- Baud rate: 9600
- Parity: None
- Data bits: 8
- Stop bits: 2
- Flow control: Hardware
- Buffer size: 512

Step 7  
Click OK.

Step 8  
Click on the Define menu and choose Input Data Record Structure.

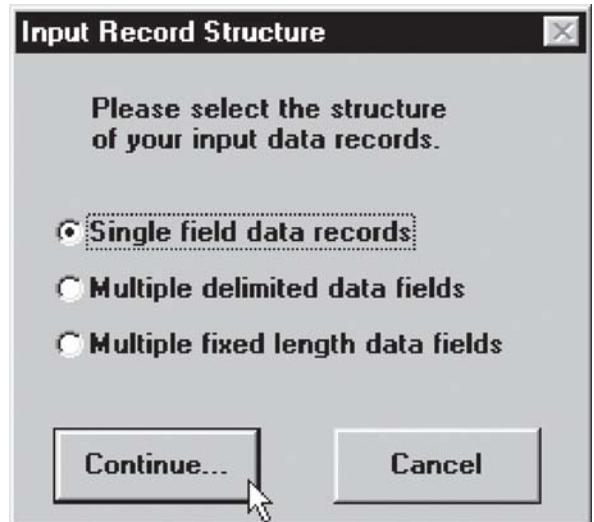


Step 9  
Select Carriage Return or Cr Lf Received



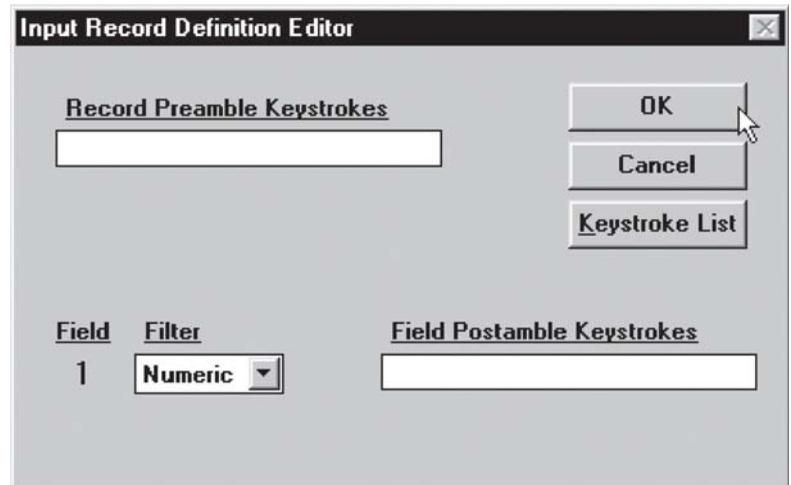
Step 10  
Click on Continue.

Step 11  
Select Single field data records.



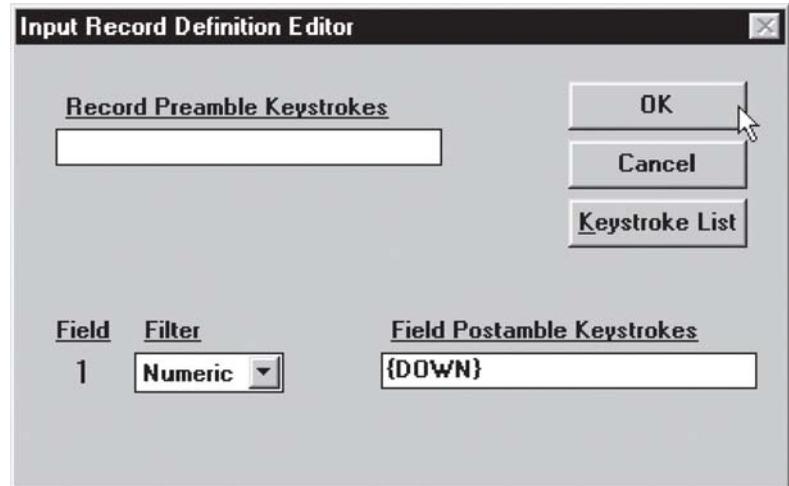
Step 12  
Click on continue.

Step 13  
Select numeric from the filter list.



Step 14

Type {DOWN} in the Field Postamble Keystrokes textbox.



#### NOTE

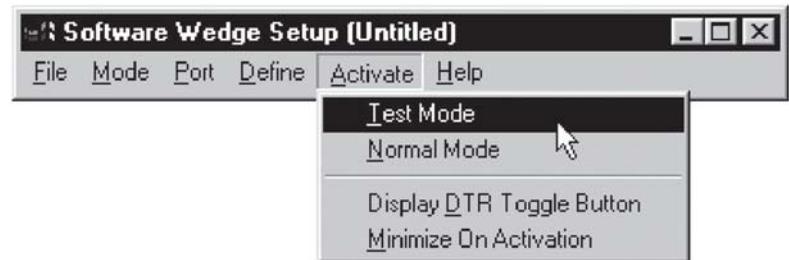
Leave the Record Preamble Keystrokes field blank.

Step 15

Click OK.

Step 16

Click on the Activate menu and choose Test Mode.

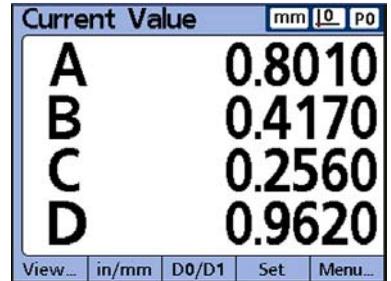


The WinWedge® connection window appears.

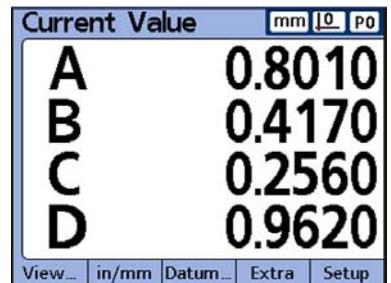
Preparing to send data to WinWedge®

Steps 16 through 20 describe how to set up the Gage-Chek to send data to WinWedge®.

Step 16  
Press the Menu softkey.



Step 17  
Press the Setup softkey.



Step 18  
Highlight RS-232.



Step 19  
Enter the following RS-232 port settings.

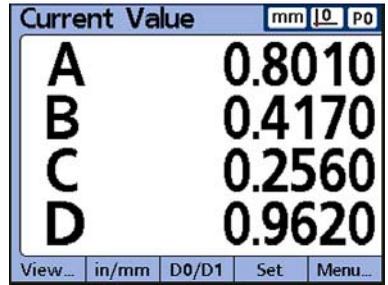
Baud: 9600  
Word length: 8  
Stop bits: 2  
Parity: None  
Data: Send.



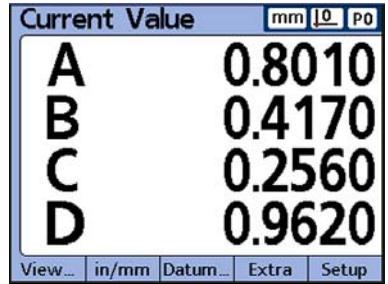
Step 20  
Press the finish key twice.  
The Gage-Chek is now set up to send data to the WinWedge® application.

Sending data to WinWedge®

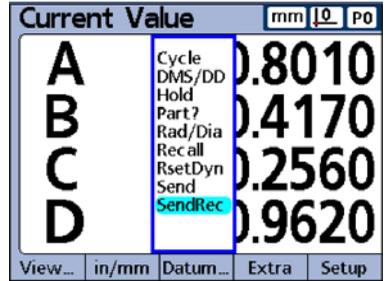
Step 1  
Press the Menu softkey.



Step 2  
Press the Extra softkey.



Step 3  
Highlight SendRec and press the Enter softkey. Respond to the screen prompt to specify which records you wish to send.



**NOTE**

If no data appears in WinWedge®, verify that the RS-232 cable is connected to the correct port (COM1 or COM2) of the computer. Check that the port settings in the Gage-Chek match those of the WinWedge® application.

## Using SPC-IV®

The Gage-Chek can be configured to send data to a computer running the SPC-IV® program.

Communication with a computer running the SPC-IV® program relies on a serial RS-232 connection using a standard straight-through cable. Instructions for connecting and testing a computer are provided in [Chapter 2: Installation](#).



### Connecting to a computer using SPC-IV®

#### NOTE

**SPC-IV® must have the gage control module installed to receive data from the Gage-Chek.**

Steps 1 through 14 describe how to set up SPC-IV® to receive data from the Gage-Chek.

#### Step 1

Double-click on the SPC-IV® icon.



#### NOTE

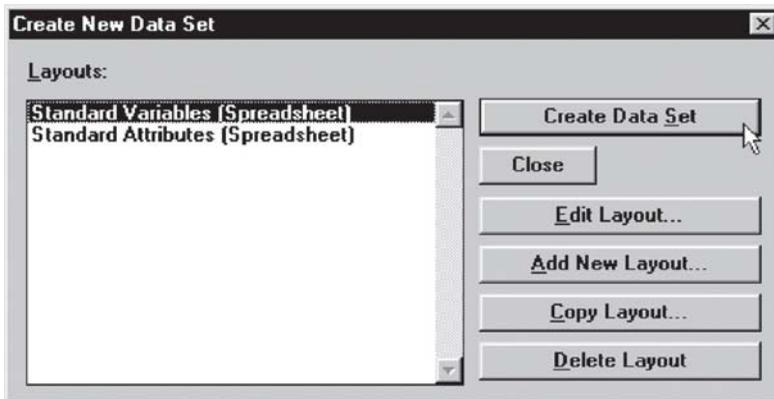
**Use the Windows Start menu to open SPC -IV® if there is no shortcut icon on the desktop.**

#### Step 2

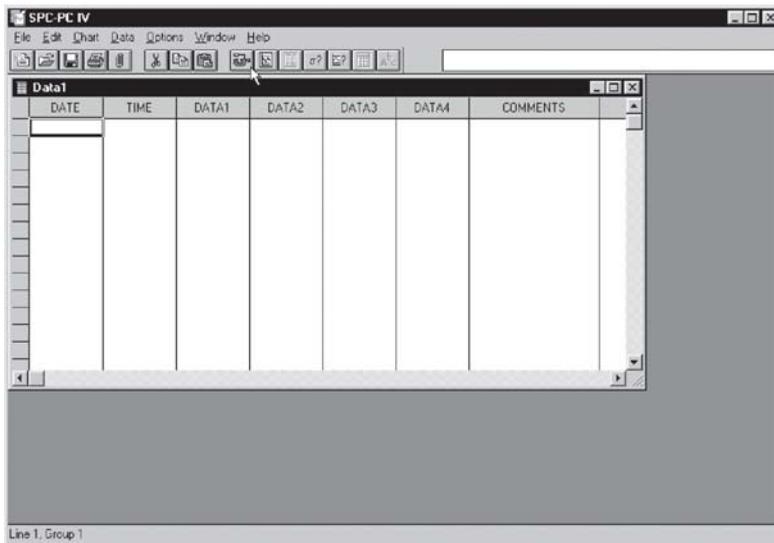
Click on the File menu and select New.



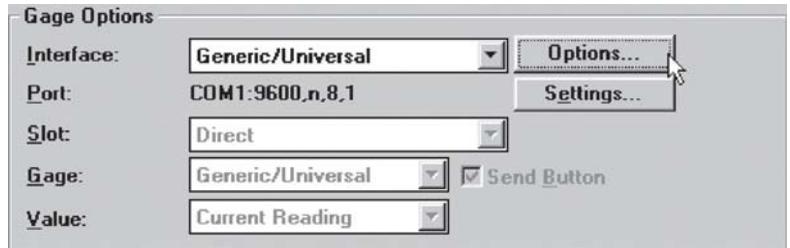
Step 3  
Click on Create Data Set.



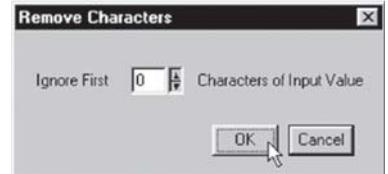
Step 4  
Click on the gage cursor icon.



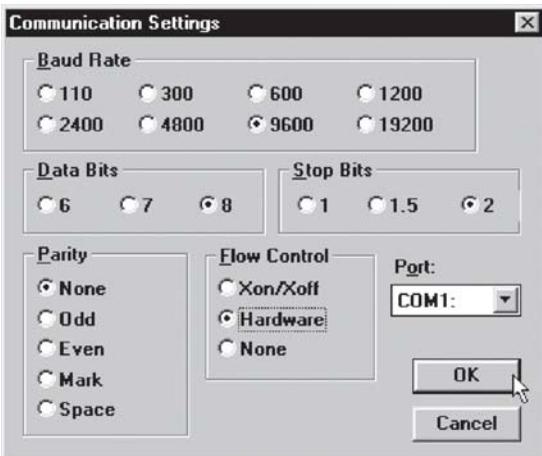
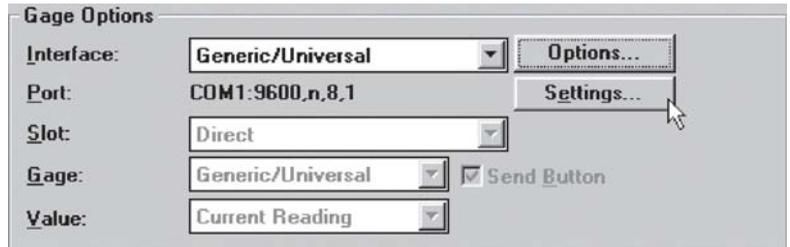
Step 5  
Click Options.



Step 6  
Enter 0 in the Ignore First text box and click OK.



Step 7  
Click on Settings.

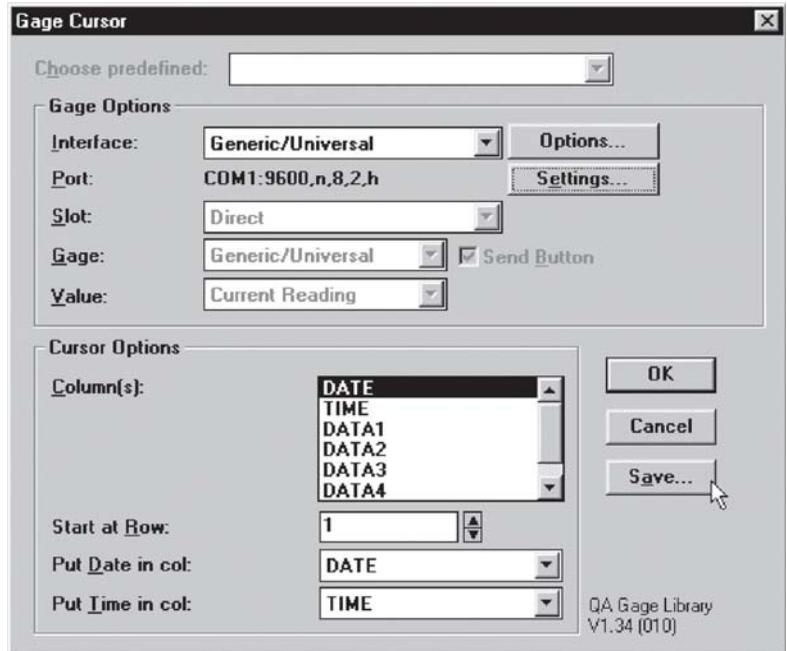


Match the communications settings shown below:

- Baud rate: 9600
- Data bits: 8
- Stop bits: 2
- Parity: None
- Flow Control: Hardware
- Port: COM 1 or COM 2 (as connected)

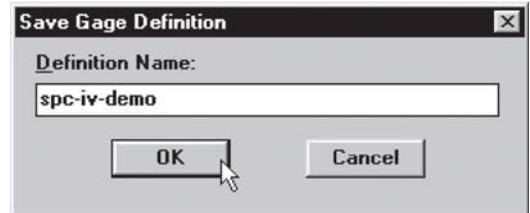
Step 8  
Click OK.

Step 9  
Click Save.



Step 10  
Enter the desired name..

Step 11  
Click OK.



## Step 12

Set the following Cursor Options:

- Select Data 1 in the columns list
- Enter 3 in the Start at Row text box

The screenshot shows the 'Cursor Options' dialog box. It has a title bar with the text 'Cursor Options'. Inside, there are four main sections:

- Column(s):** A list box containing 'DATE', 'TIME', 'DATA1', 'DATA2', 'DATA3', and 'DATA4'. 'DATA1' is selected and highlighted.
- Start at Row:** A text box containing the number '3'.
- Put Date in col:** A dropdown menu with 'DATE' selected.
- Put Time in col:** A dropdown menu with 'TIME' selected.

## Step 13

Click OK.

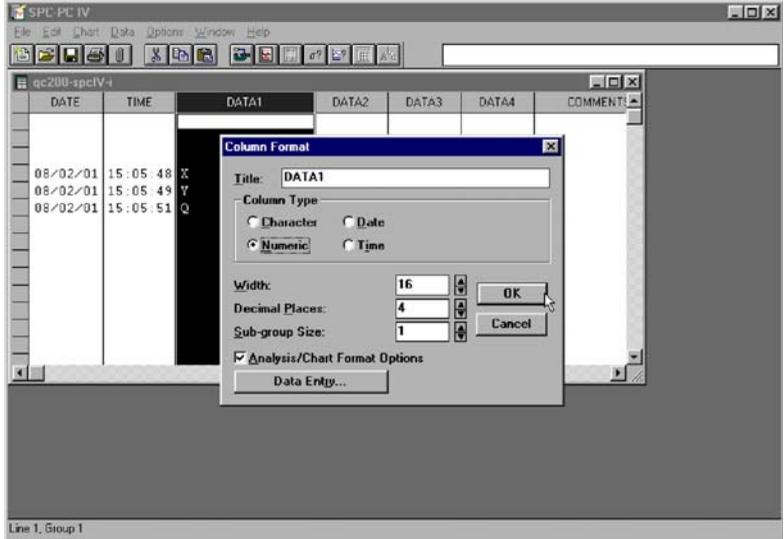
The screenshot shows the 'Gage Cursor' dialog box. It has a title bar with the text 'Gage Cursor' and a close button (X). The dialog is divided into several sections:

- Choose predefined:** A dropdown menu with 'spc-iv-demo' selected.
- Gage Options:** A section containing several fields and buttons:
  - Interface:** 'Generic/Universal' (dropdown) and 'Options...' button.
  - Port:** 'COM1:9600,n,8,2,h' (text) and 'Settings...' button.
  - Slot:** 'Direct' (dropdown).
  - Gage:** 'Generic/Universal' (dropdown) and a checked checkbox for 'Send Button'.
  - Value:** 'Current Reading' (dropdown).
- Cursor Options:** A section containing:
  - Column(s):** A list box with 'DATE', 'TIME', 'DATA1', 'DATA2', 'DATA3', and 'DATA4'. 'DATA1' is selected.
  - Start at Row:** '3' (text).
  - Put Date in col:** 'DATE' (dropdown).
  - Put Time in col:** 'TIME' (dropdown).
- Buttons:** 'OK', 'Cancel', and 'Save...' buttons are located on the right side.
- Footer:** 'QA Gage Library V1.34 (010)' is printed in the bottom right corner.

Step 14

Adjust the Data column width if necessary to view the data.

- Highlight the desired data column (for example, data 1)
- Click on the Edit menu, and select column format.
- Select Numeric in the column type section.
- Enter 16 (or other desired character width) in the width text box.
- Click OK.

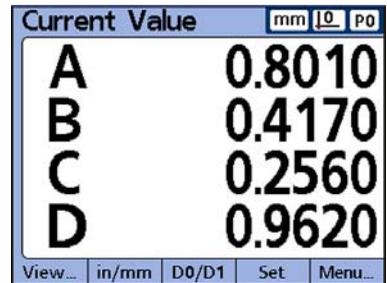


Preparing to send data to SPC-IV®

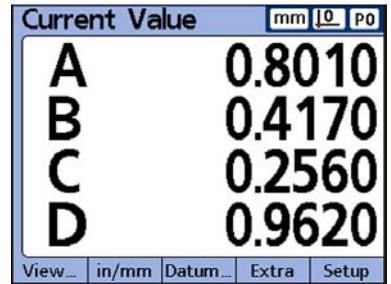
Steps 15 through 19 describe how to set up the Gage-Chek to send data to SPC-IV®.

Step 15

Press the Menu key.



Step 16  
Press the Setup soft key.



Step 17  
Highlight RS-232.



Step 18  
Enter the following RS-232 port settings.

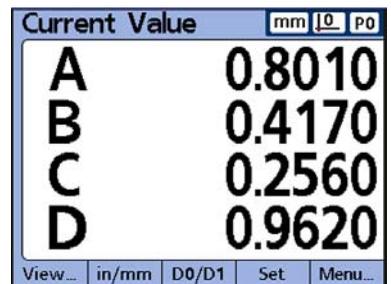
Baud: 9600  
Word length: 8  
Stop bits: 2  
Parity: None  
Data: Send



Step 19  
Press the Finish key twice. The Gage-Chek is now set up to send data to the SPC-IV® application.

**Sending data from the Gage-Chek to SPC-IV®**

Step 1  
Press the Menu softkey.



Step 2  
Press the Extra softkey.

Current Value		mm	0	P0
A	0.8010			
B	0.4170			
C	0.2560			
D	0.9620			
View...	in/mm	Datum...	Extra	Setup

Step 3  
Highlight SendRec and press the Enter softkey. Respond to the screen prompt to specify which records you wish to send.

Current Value		mm	0	P0
A	0.8010			
B	0.4170			
C	0.2560			
D	0.9620			
View...	in/mm	Datum...	Extra	Setup



#### NOTE

If no data appears in SPC-IV®, verify that the RS-232 cable is connected to the correct port (COM1 or COM2) of the computer. Check that the port settings on the Gage-Chek match those of the SPC-IV® application.

## Printing reports

Instructions for connecting and testing a printer are provided in [Chapter 2: Installation](#).

Instructions for formatting reports are included in [Chapter 3: Setup](#).

Instructions for printing reports are included in [Chapter 5: Operation](#).

## ASCII codes

The table shown on the next page lists ASCII codes that can be used to format data for printed reports and data transmissions to a computer.

Insert the desired ASCII character codes in the Rep Chars or Send Chars setup screen. For example, use ASCII character codes to insert a line feed and carriage return command as shown here.

Rep Chars		mm	10	P0
Channels	Pre Line			
Display	Post Line		10 13	
Hot Keys	Pre Form			
Report	Post Form		12	
Rep Chars	Post Dimen		32	
Send	Post Units		32	
Send Chars				
Parallel				
RS232				

Send Chars		mm	10	P0
Channels	Pre Send			
Display	Post Send		10 13	
Hot Keys	Pre Label			
Report	Post Label		32	
Rep Chars	Pre Dimen			
Send	Post Dimen		32	
Send Chars	Pre Units			
Parallel	Post Units		32	
RS232				

In the example Rep Chars screen shown above, ASCII character codes 10 (line feed) and 13 (carriage return) are included in the post line field. This instructs a printer to perform a line feed and carriage return after each line of print.

Use the decimal key on the numeric keypad to space ascii character codes in the fields. The Gage-Chek does not recognize multiple unspaced ASCII codes.

## ASCII Codes

8	backspace	46	.	84	T
9	horizontal tab	47	/	85	U
10	line feed	48	0	86	V
11	vertical tab	49	1	87	W
12	form feed	50	2	88	X
13	carriage return	51	3	89	Y
14	so	52	4	90	Z
15	si	53	5	91	[
16	dle	54	6	92	\
17	dcl	55	7	93	]
18	dc2	56	8	94	^
19	dc3	57	9	95	~
20	dc4	58	:	96	·
21	nak	59	;	97	a
22	syn	60	<	98	b
23	etb	61	=	99	c
24	can	62	>	100	d
25	em	63	?	101	e
26	sub	64	@	102	f
27	esc	65	A	103	g
28	fs	66	B	104	h
29	gs	67	C	105	i
30	rs	68	D	106	j
31	us	69	E	107	k
32	space	70	F	108	l
33	!	71	G	109	m
34	"	72	H	110	n
35	#	73	I	111	o
36	\$	74	J	112	p
37	%	75	K	113	q
38	&	76	L	114	r
39	'	77	M	115	s
40	(	78	N	116	t
41	)	79	O	117	u
42	*	80	P	118	v
43	+	81	Q	119	w
44	comma (,)	82	R	120	x
45	-	83	S	121	y
				122	z

## Controlling the Gage-Chek using ASCII command codes

Nearly all Gage-Chek functions can be controlled over an RS-232 connection using the ASCII command codes shown in the table below.

Command code	Gage-Chek function
@E	Enter
@F	Finish
@C	Cancel
@Q	Quit
@U	Up Arrow
@D	Down Arrow
@L	Left Arrow
@R	Right Arrow
@P	Print
@W1	The left most "wide" key
@W2	The right most "wide" key
@S1	Soft key #1
@S2	Soft key #2
@S3	Soft key #3
@S4	Soft key #4
@S5	Soft key #5
@D1	Dimension key #1
@D2	Dimension key #2
@D3	Dimension key #3
@D4	Dimension key #4
@0 to @9, @-, @+, @.	Numeric keys
zero all	Zeros all incremental datums

Commands can be transmitted from a file, or keyed in manually using Windows Hyperterminal or equivalent communications software. The use of Hyperterminal is explained later in this section.

Use a carriage return or line feed to separate commands included in command strings.

## Using Hyperterminal

Hyperterminal can easily be configured to transfer data between the Gage-Chek and your Windows computer using the RS-232 serial port.

Communication with a computer running Hyperterminal relies on a serial RS-232 connection between the Gage-Chek and your computer using a standard straight-through cable. Instructions for connecting and testing a computer are provided in [Chapter 2: Installation](#).

### Connecting to a computer using Hyperterminal

#### Step 1

Launch the Hyperterminal application by double-clicking the Hyperterminal icon or by clicking the following sequence:

- Start button
- Programs
- Accessories
- Communications
- Hyperterminal

#### Step 2

Enter the desired connection name into the Connection Description dialog box and click OK.



#### Step 3

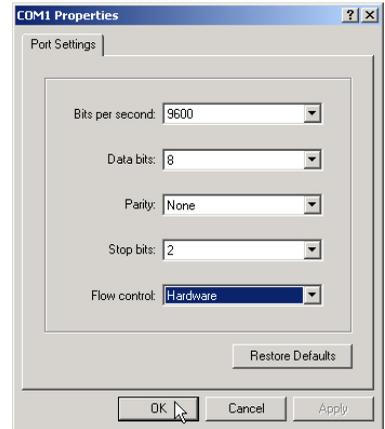
Select the desired serial port and click OK.



Step 4

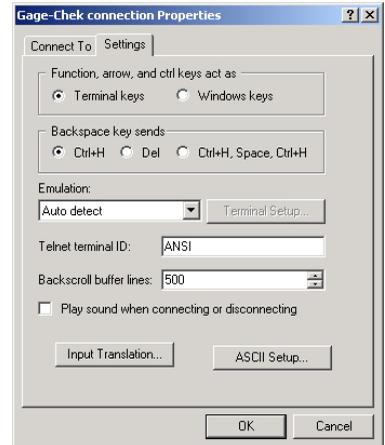
Enter the port settings shown below and click OK.

Bits/second: 9600  
 Data bits: 8  
 Parity: None  
 Stop bits: 2  
 Flow control: Hardware



Step 5

Click on the File menu and then click Properties to display the Properties dialog box. Click on the Settings tab and configure the settings as shown below.



Function, arrow and cut keys act as:  
 Backspace key sends:  
 Emulation:  
 Telnet terminal ID:  
 Backscroll buffer lines:

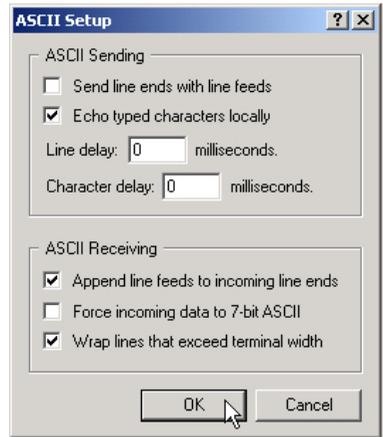
Terminal  
 Ctrl + H  
 Auto detect  
 ANSI  
 500

## Step 6

Click on the ASCII button and configure the ASCII setup as shown below and click OK.

Check only the following boxes:

- Echo typed characters locally
- Upend line feeds to incoming line ends
- Wrap lines that exceed terminal width



## Step 7

Click OK in the Properties dialog box to return to the main Hyperterminal screen.

## Step 8

Click the File menu and then click Save. The Hyperterminal program is now ready to exchange data with the Gage-Chek.

### Preparing the Gage-Chek to exchange serial data

## Step 9

Press the Menu softkey.

Current Value		mm	10	P0
A	0.8010			
B	0.4170			
C	0.2560			
D	0.9620			
View...	in/mm	D0/D1	Set	Menu...

## Step 10

Press the Setup softkey.

Current Value		mm	10	P0
A	0.8010			
B	0.4170			
C	0.2560			
D	0.9620			
View...	in/mm	Datum...	Extra	Setup

Step 11  
 Highlight the RS-232 menu item.



Step 12  
 Enter the following RS-232 port settings.

Baud: 9600  
 Word length: 8  
 Stop bits: 2  
 Parity: None  
 Data: Send

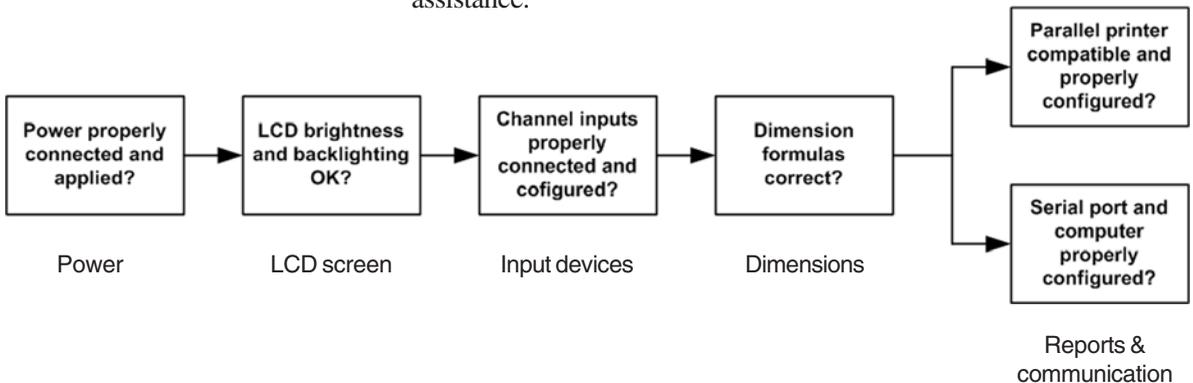


Step 20  
 Press the Finish key twice. The Gage-Chek is now setup to send data to and receive data from the Hyperterminal application.



The Gage-Chek is based on a hardware platform common to the Metronics QC100 and QC200 products. Years of continuous improvement of this hardware have resulted in extremely reliable operation and few, if any hardware problems. Problems experienced with the operation of the Gage-Chek are likely to be the result of printer or cable incompatibilities, configuration or setup errors or encoder/transducer incompatibilities or malfunctions.

The steps recommended for initial troubleshooting are shown below. These are typically the same initial steps that would be taken by a distributor or factory product support technician. Since most problems experienced in the field will have simple causes, and equally simple solutions, substantial time and expense can be saved by performing some straightforward troubleshooting of configuration settings and hardware connections prior to calling the distributor or factory for assistance.



As you're troubleshooting, list the steps that you use to identify and solve your problem. Should problems persist in spite of your efforts, gather the necessary product information listed at the end of this chapter, and your list of troubleshooting steps, and contact your distributor for assistance.

## Symptoms with probable causes and solutions

Some common problem symptoms are listed in the following pages with probable causes and solutions.

### LCD screen image is not visible

Power is not applied to the Gage-Chek

- 1) Activate the main power source
- 2) Connect the power cord or turn the power ON
- 3) Replace the fuse

LCD ON/OFF toggle switch is in the OFF mode

- 1) Press the LCD ON/OFF switch to toggle the LCD ON

LCD contrast or backlighting is out of adjustment

- 1) Perform the LCD parameter reset
  - Turn the power OFF
  - Press and hold the 0 numeric keypad key and
  - Turn the power back ON while continuing to hold the numeric 0 key down until a beep is heard
  - Release the 0 numeric keypad key
  - Press the left-most softkey

The LCD contrast and backlighting parameters will be reset to factory defaults.

### Dashes are shown across the LCD screen

The wrong encoder or transducer is connected

- 1) Connect the input device specified in the Channels setup screen

The Channels setup screen specifies the wrong input device

- 1) Change the Channels setup screen parameters to reflect the correct input device.

The channel encoder or transducer is not connected or is malfunctioning

- 1) Connect the input device cable firmly to the Gage-Chek
- 2) Replace the input device

### Dimension values shown on the LCD are incorrect

The Channels setup screen specifies the wrong input device resolution

- 1) Specify the correct resolution

The wrong input device interpolation is specified in the Channels setup screen

- 1) Specify the correct interpolation

The wrong input device count polarity is specified in the Channels setup screen

- 1) Specify the correct count polarity

The wrong encoder or transducer is connected

- 1) Connect the input device specified in the Channels setup screen

The wrong in/mm units of measure is specified

- 1) Specify the correct units of measure

The wrong Rad/Diam measurement type is specified

- 1) Specify the correct Rad/Diam measurement type

The dimension formula specifies the wrong calculation

- 1) Correct the dimension formula in the Formula setup screen

**Reports are not printed or are not completed**

The printer is not supported by the Gage-Chek

- 1) The supported printer is:

- HP printer using the HP PCL data format

The printer is slow

- 1) Increase the Parallel Retries field of the Parallel setup screen

The parallel printer cable is not firmly connected or is damaged

- 1) Connect or replace the parallel printer cable

The parallel port configuration is incorrect

- 1) Correct the parallel port configuration in the Parallel setup screen

**Reports are printed incorrectly**

The wrong report configurations are specified in the Report setup screen

- 1) Correct the report configurations

The wrong control character configurations are specified in the Rep Chars setup screen

- 1) Correct the control character configurations

**Data cannot be transmitted to a computer**

The wrong serial cable (or no cable) is connected between the computer and the Gage-Chek

- 1) Connect the computer to the Gage-Chek using a standard straight-through RS-232 serial cable

The wrong computer serial port is used

- 1) Connect the serial cable to the serial port specified by the computer port settings

The wrong RS-232 port configurations are specified in the Send setup screen

- 1) Correct the RS-232 port configurations to reflect the computer's serial port configuration settings

The wrong control character configurations are specified in the Send Chars setup screen

- 1) Correct the control character configurations to reflect the requirements of the receiving software

### **Corrupted database or configuration files**

Power transients can corrupt the contents of the Gage-Chek memory

- 1) Install an industrial-quality power line filter. Also verify that other equipment connected to the Gage-Chek such as printers and computers are connected to power line filters as well.

## **Getting help from your distributor**

Performing the simple troubleshooting listed on the previous pages solves most problems experienced with the Gage-Chek. If, after performing this troubleshooting, a problem persists, follow the steps listed below and contact your distributor for assistance.

- 1) Be prepared to discuss your list of troubleshooting steps
- 2) Gather the following Gage-Chek information:
  - Model number
  - Serial number
  - Approximate purchase date
  - Software version number from front of User's Guide
- 3) List the input device type and input device characteristics such as resolution and interpolation value.
- 4) Printout of the Gage-Chek configuration settings
  - Navigate to the Setup menu
  - Press the Print key

This chapter contains technical information regarding:

- Output relay contact specifications
- SPC formulas used by the Gage-Chek
- Gage-Chek product specifications

## Output relay contact specifications

The table shown below lists the electrical specifications of the output relay contacts that are controlled by formulas created in the Formula set up screen.

<b>CONTACT RATINGS</b>			
Switching Voltage	Max DC/Peak AC Resist.	Volts	100
Switching Current	Max DC/Peak AC Resist.	Amps	0.25
Carry Current	Max DC/Peak AC Resist.	Amps	0.5
Contact Rating	Max DC/Peak AC Resist.	Watts	3
Life Expectancy-Typical <sup>1</sup>	Signal Level 1.0V,10mA	x 10 <sup>6</sup> Ops.	100
Static Contact Resistance (max. init.)	50mV, 10mA	Ω	0.200
Dynamic Contact Resistance (max. init.)	0.5V, 50mA at 100 Hz, 1.5 msec	Ω	N/A
<b>RELAY SPECIFICATIONS</b>			
Insulation Resistance (minimum)	Between all Isolated Pins at 100V, 25°C, 40% RH	Ω	10 <sup>9</sup>
Dielectric Strength (minimum)	Between Contacts	VDC/peak AC	250
	Contacts to Shield	VDC/peak AC	1500
	Contacts/Shield to Coil	VDC/peak AC	1500
Operate Time - including bounce - Typical	At Nominal Coil Voltage, 30 Hz Square Wave	msec.	1.0
Release Time - Typical	No Suppression	msec.	1.0
	Diode Suppression	msec.	1.5

## SPC formulas used in the Gage-Chek

### Xbar ( $\bar{x}$ )

Xbar is the mean (average) of the samples that makes up each subgroup. The Xbar chart is a graph of the Xbars of all complete subgroups.

### Xdoublebar ( $\bar{\bar{x}}$ )

Xdoublebar is the mean of all the Xbars and is equal to the mean of all the samples (except those of an incomplete subgroup). It is only updated when the recalc function is used in the SPC setup page to recalculate xbar UCL and LCL.

### r

r is the range of a subgroup (max of subgroup minus min of subgroup). The r chart is a graph of the ranges of all complete subgroups.

### UCL and LCL

The Upper Control Limit (UCL) and Lower Control Limit (LCL) are horizontal lines in the Xbar chart, representing the likely limits of the values of the Xbar of future subgroups. The values of these limits may be entered by the user, or if there is sufficient data, the system can calculate values for UCL and LCL:

The value of the UCL of the Xbar chart is:

$$\text{Xdoublebar} + A2 \text{ times Rbar}$$

The value of the LCL of the Xbar chart is:

$$\text{Xdoublebar} - A2 \text{ times Rbar}$$

A2 is a factor that depends on the size of the subgroup. Refer to the factor table at the end of this discussion.

The Upper Control Limit (UCL) and Lower Control Limit (LCL) are horizontal lines also found in the R chart, representing the likely limits of the values of the R. These may be entered by the user or calculated by the system:

The value of the UCL of the R chart is:

$$D4 \text{ times Rbar}$$

The value of the LCL of the R chart is:

$$D3 \text{ times Rbar}$$

D3 and D4 are factors that depend on the size of the subgroup. Refer to the factor table at the end of this discussion.

The statistics display (in the View display when only one dimension is shown) shows a list of values on the right. These values are statistics that are derived from all the samples taken so far. These are calculated as follows:

**rbar (  $\bar{r}$  )**

rbar is the average of the ranges of all the completed subgroups

**Mean**

Mean is the average of all the samples. It is the same as  $\bar{X}$  except that it includes the samples of any incomplete subgroup.

**Max**

Max is the Maximum value of all the samples taken so far.

**Min**

Min is the Minimum value of all the samples taken so far.

**Range**

Range is the overall range (Max – Min) of all the samples taken so far.

 **$\sigma$** 

Sigma ( $\sigma$ ) is the standard deviation of all the samples taken so far. The formula for sigma is:

$$\sigma = \sqrt{\frac{\sum(X_i - \text{mean})^2}{n - 1}}$$

6 Sigma is 6 times the standard deviation

**Cp**

Cp is a capability index. The formula for Cp is:

$$Cp = (USL - LSL) / 6 \text{ sigma}$$

**USL and LSL**

USL and LSL are the max and min tolerance values. They stand for Upper and Lower Specification limits. In this system, the sigma in the denominator is not an estimate based on  $\bar{\sigma}$  (the average sigma). This system does not calculate sigma for each subgroup. The sigma for all samples is used instead.

**CpK**

CpK is another capability index. The formula for CpK is:

$$\text{CpK} = \text{Minimum of } (\text{USL} - \bar{\bar{X}}, \bar{\bar{X}} - \text{LSL}) / 3 \text{ sigma}$$

**Factor table**

Subgroup size	2	3	4	5	6	7	8	9	10
A2	1.88	1.02	0.73	0.58	0.48	0.42	0.37	0.34	0.31
D3	0	0	0	0	0	0.08	0.14	0.18	0.22
D4	3.27	2.57	2.28	2.11	2.00	1.92	1.86	1.82	1.78

## Gage-Chek product specifications

### Electrical

Input Voltage Range: 85 VAC to 264 VAC. 1.0 Amp maximum  
(Auto switchable)  
Fuse: 1.6 Amp 250V Slow Blow 5X20mm  
Input Frequency: 43Hz to 63Hz



### CAUTION

**For continued protection against fire, use replacement fuse with the specified voltage and current ratings only.**

### Environmental Conditions

Temperature: 0°C to 45°C (32°F TO 113°F)  
non-condensing  
Humidity: 90%rh  
Altitude: 2000 meters  
Installation: Category: II

### Dimensions

Enclosure (WxHxD): 11.5" X 7.5" X 2.75"  
Base (WxHxD): 10" X 2" X 7.8"  
Enclosure weight: 3.5 lbs.  
Base weight: 7 lbs.

### LCD

Size/color: 5.7 inch Color  
Display digit size: 0.5 inch  
Resolution: 0.000004 inch or 0.0001 mm



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