L9100 MICROPROCESSOR COLUMN GAGE
LVDT Signal Conditioning
OPERATING MANUAL

MANUAL REFERENCE

L9100-M-001L

For use with Columns

LVDT Ver. R00A

LANCE INSTRUMENTS INC.,
WINDSOR, ONTARIO

L9100 Series Column Gages
NEW FEATURES ADDED

Enhancements for L9100 LVDT Columns ... July 2017

- *New 240 x 320 Pixel (2.4" Diag.) full colour TFT Backlit Graphical LCD Display*
- *8 Part Setups: Program for up to 8 individual parts. The current part is easily selected, and part setups can be copied.*
- *Graphical Display in measurement mode always shows:*
  - *Measured part value in large characters*
  - *Currently selected part setup number*
  - *17 Character description of the current part*
  - *Column number and station number*
  - *Mini-bargraphs of current electronic "zero" and "gain" control positions for A and B channels*
  - *TIR mode if enabled*
  - *Error messages during automastering*
  - *3 LED light annunciators, user-selectable function and colours*
- *TIR includes new optional "FastTIR" mode, which enables the column to take a large number of readings quickly. These are user-programmable from a set of 6 ranges.*
- *TIR options now also include Min, Max, and ABS (absolute value)*
- *Expanded electronic Zero and Gain capacity and resolution*
- *External DIN connections (in addition to modular connector) for "Data Read" and "External Automaster" input trigger.*
- *Digital readings continue beyond the range of the bar display (twice the range)*
- *New Primary ID "Software Lock" eliminates the need of an on-board jumper.*
- *Limit positions and Master points now displayed digitally as well as graphically*
- *User configurable serial output protocol ... now includes part number (1 to 8)*
- *Optional relays for status out : Mechanical or Solid State*
- *Status Out signal can be software inverted*
- *Improved protection for external imputs from noise and transient voltages.*
- *Added the ability to disengage “Daisy Chain” mode to allow for individual column “Reads” when adjacent columns are interconnected with modular cable jumpers and only one serial connection to an external device is needed.*

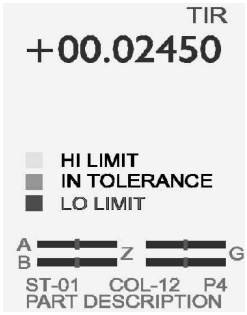
QUICK START

Power up (See also Section 1.32)

When the line cord is plugged into an AC outlet and power is applied, the digital display will immediately begin to read “L9100 Column Gage" and the software version number will also be displayed. After a few seconds the display will change to the measurement mode of normal operation.

Measurement Display (See also Fig. 1-4)

After power up, the normal measurement display will appear near the top of the LCD display, in either metric or inch formats as determined by programming. Below this may appear up to 3 annunciator lights, if they have been so programmed. Near the bottom of the screen are 4 horizontal bar displays, which indicate the current positions of the electronic "zero" and "gain" controls for both A and B channels. Underneath this is displayed the station number, the column number, the currently selected part setup #, and the currently selected part description. If TIR mode has been selected, then this will be indicated in the upper right corner of the display.



Front Panel Controls (See also Section 1.41)

There are 4 pushbuttons on the front panel of L9100 columns, arranged in a square format. Each pushbutton has 2 functions, depending on the mode the column is placed into.

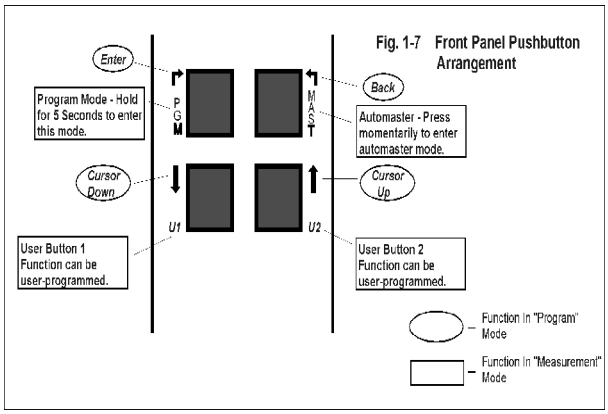
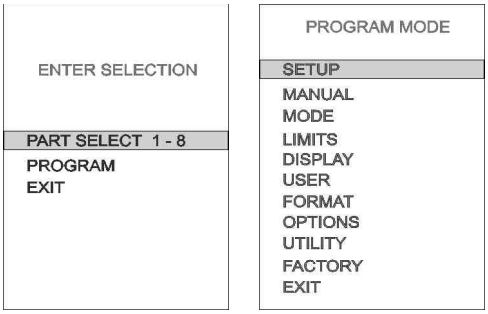


Fig. 1-7 Front Panel Pushbutton Arrangement

When in the normal operating mode (i.e. the measurement mode, where an input change will affect the display readout), the labeling in *Blue* applies to the buttons. Therefore:

- Pressing and holding the upper left button for 5 seconds will place the column in the Program Mode
- Pressing the upper right button momentarily will place the column in the Automastering Mode
- Pressing the lower left button will initiate a pre-programmed function for User 1, or U1 (if engaged)
- Pressing the lower right button will initiate a pre-programmed function for User 2, or U2 (if engaged)

Initial Programming

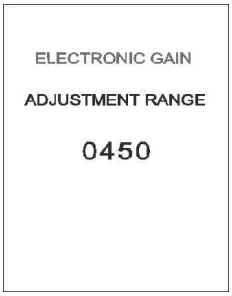


Sections 2 and 3 in the manual describe in detail the procedure for programming all the the parameters which are important for correct column operation. Initially, it is important to program all of the parameters in the "SETUP" menu, which is accessed from the main PROGRAM MODE menu. To enter PROGRAM mode, press in and hold the front panel <Enter> button for about 5 seconds, until the display changes. If multiple part operation has not been set up, then the menu which appears is entitled "PROGRAM MODE". This is the main menu from which all other program menus branch off. The important Setup menu items include Polarity, Unit(Metric/Inch/Degree), Range, Nominal part size, and Min and Max Master sizes. If multiple parts are enabled, then a preliminary menu appears first which allows either for part selection or entering the program mode.

Manual Zero and Gain Electronic Controls - Initial Settings (See also Sections 3.90 and 5.10)

The programming of these 2 controls is described more fully in section 3.90 . They are the electronic settings which are used during automastering in order to accomplish calibration. Each control ranges in value from -2000 to +2000. It is important, especially when first setting up a new part, to begin with these controls in a near central position (0 +/- 300 for example). This will give the automastering process the maximum amount of available

control movement without "maxing out" the control. When in normal measurement mode, the relative position of these 2 controls is always shown near the bottom of the LCD display by means of 2 horizontal bar graphs for each of the A and B channels. Avoid operating the column with either control at an extreme position.



Manual Mastering Using the Spread and Zero Controls (See also Section 5.10)

Ordinarily, the LVDT coloumns will be programmed in the Mode menu for LVDT operation, which automatically selects the best range, and therefore, there should be no need to perform a manual mastering prior to automastering, so long as the probe has been reasonably centered in the fixture and the electronic settings are not close to their maximum positions.
If the “Aux” mode has been selected (for special fixture requirements), the main gain range may need to be selected by trial and error, and manual electronic zero and gain may need to be adjusted.

Automastering (See also Section 5.20)

The "Automaster" function will perform a gage calibration by self-adjusting the electronic gain and zero.
To do this:

1) Ensure that the probe being used is consistant with the programmed column range, and that the polarity is correct for the operation. Also, the probe should be relatively “centred” in the fixture (display near zero when a part of nominal size is placed in the fixture, and electronic zero near the mid bar position.)

2) Press the <Mast> pushbutton on the front panel. The display will show an instruction to insert the Min master (if + polarity, or Max master for - polarity) in the fixture, which should be done now.

3) Press the <Enter> button. The display will now read "Working". When done, the message will either say to "Insert the (Max/Min) Master" or "Zero Error on Lo (or Hi)". If the message is zero error, then either the probe was not centered in the fixture, or the wrong master is in the fixture. A Zero Error on Hi would mean that the electronic zero can't position the bar high enough to match the input (out of its range). If the Min (Max for - polarity) mastering was successful, then insert the Max master (Min for - polarity) into the fixture.

4) Press the <Enter> button again. If successful, the display will return to the normal measurement mode with no automastering messages, and the column is ready for use. If the message reads "Gain Error on Hi", then it means that there is insufficient electronic gain range to successfully master. If the message reads "Gain Error on Lo", then it means that there is too much gain even at the minimum setting to master correctly. Check the range setting and the polarity.

IMPORTANT – After automastering, place the masters in the fixture again and verify the correct display positions before using.

2)

3)

3)

3)

4)

For more details on mastering and problem resolution, refer to sections 5.00 and 7.40

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OPERATING MANUAL

1.00 INTRODUCTION

1.10 GENERAL

The Model L-9100 LVDT Gaging column has been designed to provide a means of accurate dimensional gaging utilizing Linear Variable Differential Transducers (LVDT) , combined with the easy readability of a 10-inch LED bar display and a full colour TFT back lit LCD display. Depending on the application, the unit can also be supplied for operation using pneumatic back-pressure.

The LVDT model is designed to work with standard 5 wire LVDT probes, although other types can also be accommodated (see section 7.30). Electronic zero and gain controls are provided to enable the instrument to cover a wide range of tooling requirements. The column has 2 input channels, A and B, to allow for addition and subtraction of 2 probe signals.

Four hundred ranges are provided, 100 Imperial, 200 Metric, and 100 Degrees. These cover a full-scale deflection range of 100 thou inches down to one thou inch, in 1 thou steps; 2000 micrometers down to 20 micrometers in 10 micron steps; and 10 degrees down to 0.1 degree in .1 degree steps. Programmable setup controls consist of function and range settings, a gain control, digital offset, zero, Hi & Lo Limits, Approach Limits, Min/Max master settings, nominal values, and bar colours. Other setup parameters include ID security code #, TIR, and Station # and column # for serial transmission as well as a menu for automastering.

WARNING:

It is the responsibility of the user to ensure that column gages are connected to a properly grounded "U-ground" type AC receptacle only. Failure to do so may result in a shock hazard.

1.20 SPECIFICATIONS

1.21 General

AC Input Voltage		120 VAC, 50/60 Hz *220 VAC, 50/60 Hz for Export Versions Only*
Power Consumption		20 W
Fuse		Type AGC, 1A, 1-1/4" x 1/4"
Analog Display	- Type	LED Bar Type, 100 Segments
	- Height	10 inches
	- Segment Colours	Red ,Green or Amber, user-programmable
Accuracy		1% of Full Scale
Digital Display		240 x 320 pixel full colour back lit graphical LCD
Remote Status Output		
	- ON Status	+ 5 VDC
	- OFF Status	0 VDC
	- Maximum Load	20 MA
Analog Output		+5 (Top of bar display) to -5 VDC, 10 MA Max.
External Input Control		Dry contact ONLY (to simulate a manual pushbutton press) 100 msec to 800 msec closure time recommended. NO external voltage should be applied. Neither contact should be grounded externally.
Operating Temperature		50-100 degrees F; 10-38 degrees C
Dimensions		21"H x 2"W x 8.7"D (53.3 CM x 5.1 Cm x 22.1 CM)
Weight		9.3 LBS (4.2 KG)
Serial Output Baud Rate		9600 BAUD, Length 8, Parity (n) , 1StopBit

1.22 LVDT Signal Conditioning Module

Sensor Requirements:	
Type	LVDT (see section 7.3 for options)
Excitation Voltage	3 VAC
Excitation Frequency	5 Khz. Standard (see sect. 7.3)
Sensitivity	1.5 to 6.5 Mv/V/.001"
Maximum Burden	120 ma (total of both LVDT's)
Connector Type	5 Pin DIN
Functions:	A, B, -A, -B, A + B, A – B, B – A
Ranges:	
Imperial	1 thou to 100 thou (100 ranges)
Metric	20 microns to 2000 microns (200 ranges)
Degree	0.1" to 10" (100 ranges)

1.23 Options

<u>Dry-Contact Relays</u>	Types:	CGA-2-H-DC5 (5 VDC) or CGA-2-H-DC12 (12v)
	Max. Resistive Load	1 A @ 30 VDC
	Max. Inductive Load	0.5 A @ 30 VDC
	Note: Above ratings are absolute maximum. Applications should use more conservative loads for increased contact life.	
	Service Life:	Rated 100 million operations at 36,000 operations per hour.
	Characteristics:	Close Time - 5 msec. Max. Release Time - 3 msec. Max. Bounce Time - 0.5 msec. nominal
<u>Solid-State Relay</u>	Type:	Allen-Bradley 700-SKOC2Z25
	Continuous Load Current (Resistive) min. of 0.05 A., max. of 2.0 Amps	
	Voltage Rating	5 to 48 VDC
	Inductive Loads	A surge absorption component must be added

1.30 INSTALLATION

1.31 Mounting

Two custom, universal base mounting plates are available for mounting of the gaging column. These are designed to provide mounting support for the unit whether it is used as a single self-supporting column, or as part of a larger multiple column setup. Typical details for use of the mounting plate are shown in figure 1-1. It is recommended that columns be fastened to a bench or stand by means of bolts through the mounting feet in order to avoid tipping.

A single rear-panel tie bar is also available as part of the mounting kit to provide upper panel support between the columns of a multiple column setup.
Mounting feet and tie-bars need to be ordered separately when ordering columns.

1.32 Power

The first unit in a series should be plugged through a cord extension into a standard 120 VAC, 3-wire, 15 A circuit (or 220 VAC, 3 wire circuit for export units). At the rear of each column is a 3-wire AC receptacle to provide power for an adjacent gage in a multiple-gage installation. A maximum of 12 gages should be connected together in this manner.

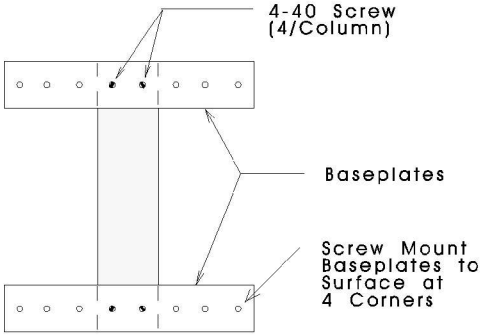
A warm-up period of approximately 10-minutes is recommended prior to calibration and/or use.

If a signal module must be removed from the case for any reason, disconnect all AC power to the unit first. Remove the screws at the top and bottom of the module face plate, remove the nut on the rear panel bottom which secures the air inlet connection, and gently slide the unit out of its mating connector.

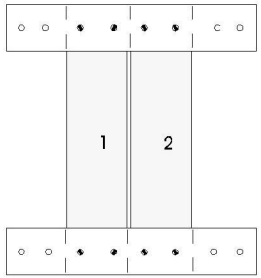
1.33 Scales

Centre-zero scales are provided with each unit to cover the more commonly used ranges available on the instrument. These are supported by the back U-channel running the length of the display. Scales are inserted from the bottom and lock into place as they approach the top of the display.

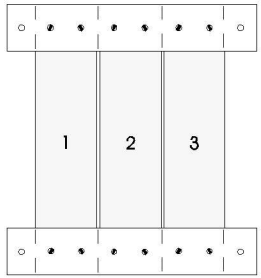
Scales are normally supplied in Yellow with Black lettering. Special scales can be provided for units which will be operated in TIR mode (request at time of ordering).



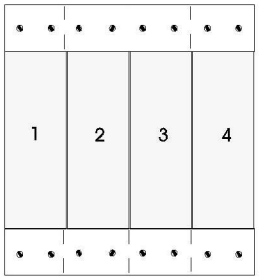
Single Column Baseplate Mounting (Bottom View)



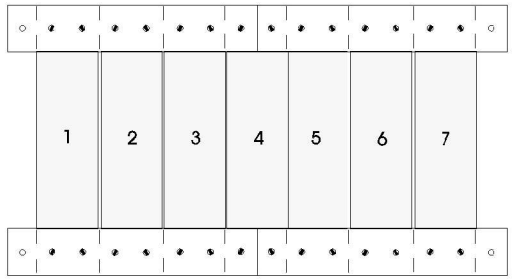
Two Column Baseplate Mounting (Bottom View)



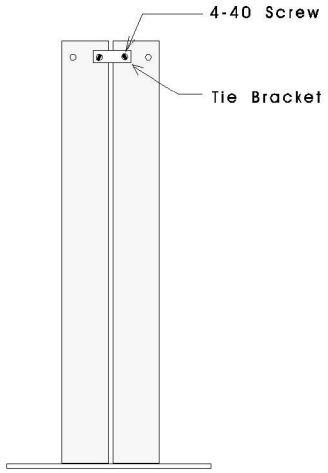
Three Column Baseplate Mounting (Bottom View)



Four Column Baseplate Mounting (Bottom View)

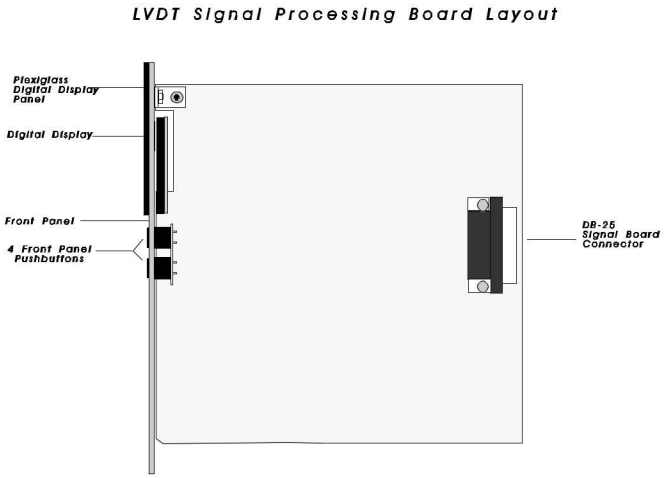


Multiple Column Baseplate Mounting (Bottom View)



Rear View of 2 Columns Showing Tie Bar Attachment at Top

Fig. 1-1 BASEPLATE MOUNTING DETAILS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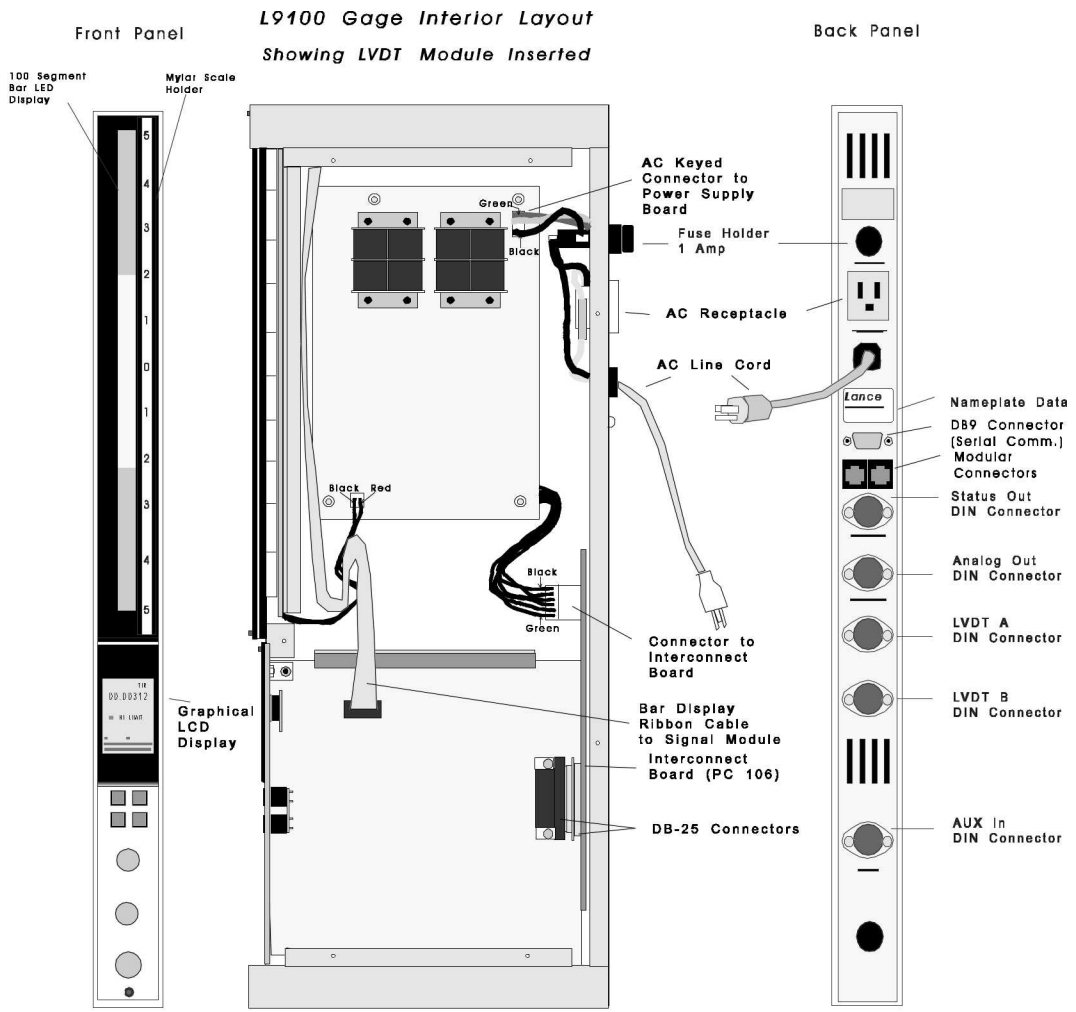
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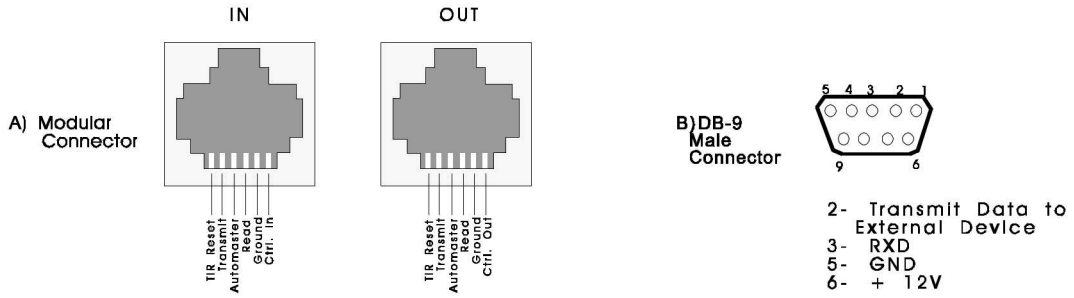
Analog Out DIN Connector
LVDT A DIN Connector
LVDT B DIN Connector
AUX In DIN Connector
Black Red
Black
Green
Connector to Interconnect Board
Bar Display Ribbon Cable to Signal Module
Interconnect Board (PC 106)
DB-25 Connectors

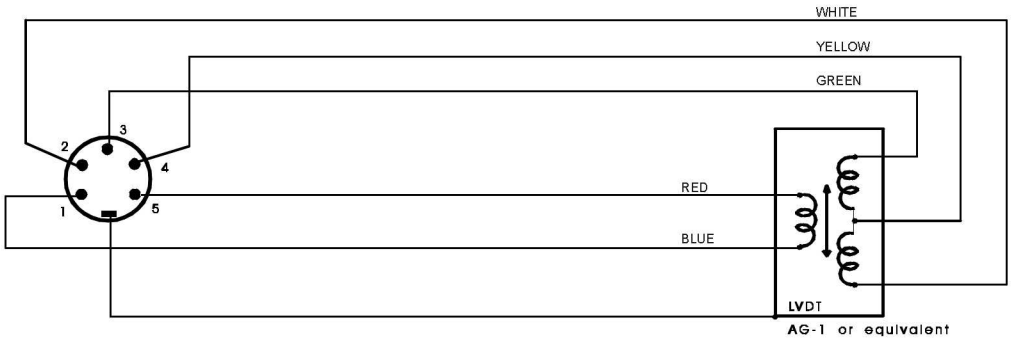
Figure 1 - 2

Fig. 1-3 SIGNAL INPUT/OUTPUT WIRING CONNECTIONS

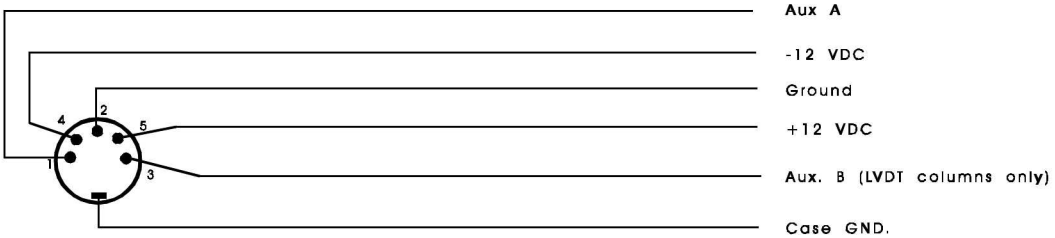
NOTE: ALL PLUGS SHOWN VIEWED FROM BACK OF GAGE CASE.



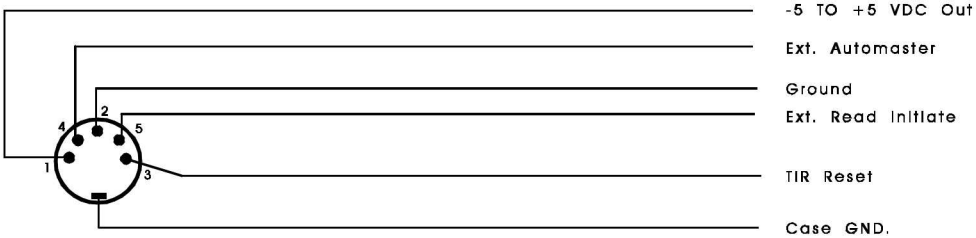
C) 5 Wire LVDT INPUT JACK (TYPICAL FOR "A" AND "B") [See Section 7 for alternative types]



D) AUXILIARY INPUT JACK

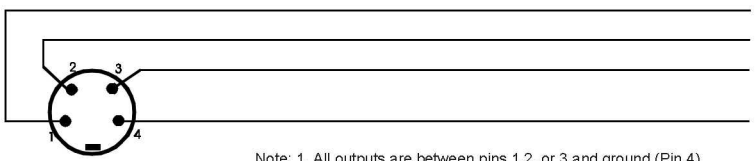


E) ANALOG OUTPUT JACK



Note: Connections to Pins 4 and 5 are identical to the "Automaster" and "Ctrl IN" pins of the modular connectors.

F) HI/LO LIMIT OUTPUT CONNECTIONS



Note: 1. All outputs are between pins 1,2, or 3 and ground (Pin 4).
2. Lamp ON status corresponds to + 5 VDC output. Lamp OFF corresponds to 0 VDC.
3. Optional output relays are available by special request. Configurations can be specified at time of ordering.

Fig. 1-4 Graphics Display Parameters in Measurement Mode

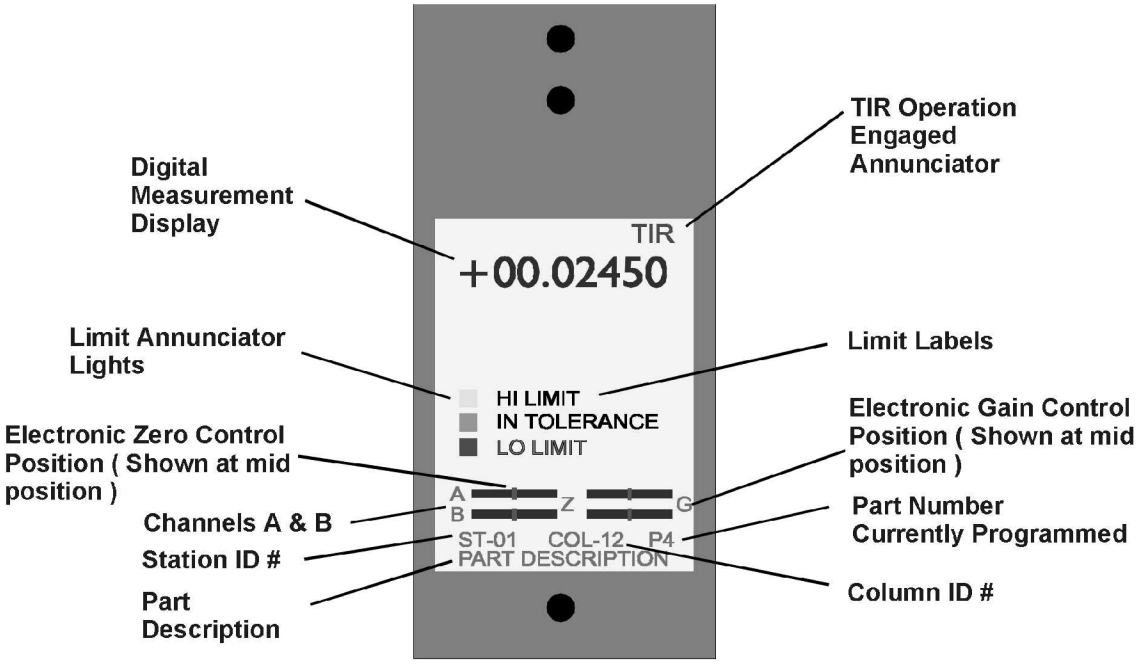


Fig. 1-5 Diagram Showing Interconnections of Multiple L9100 Column Gages

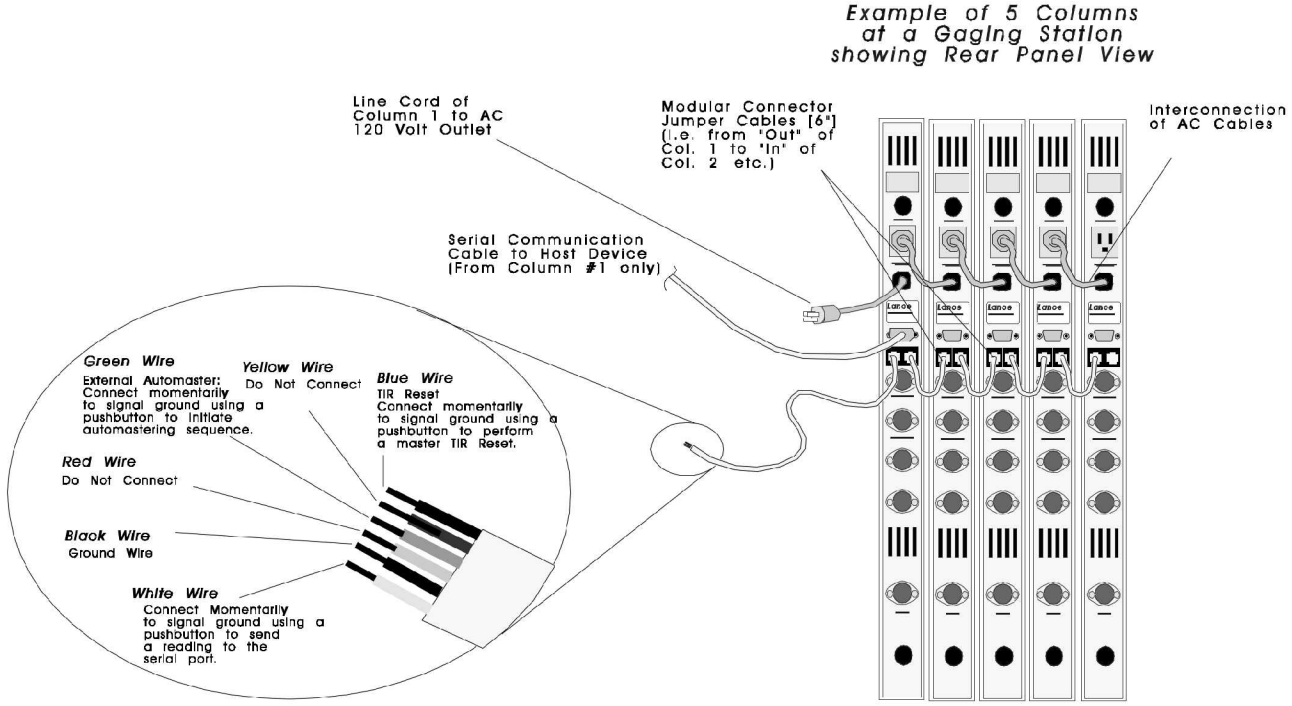
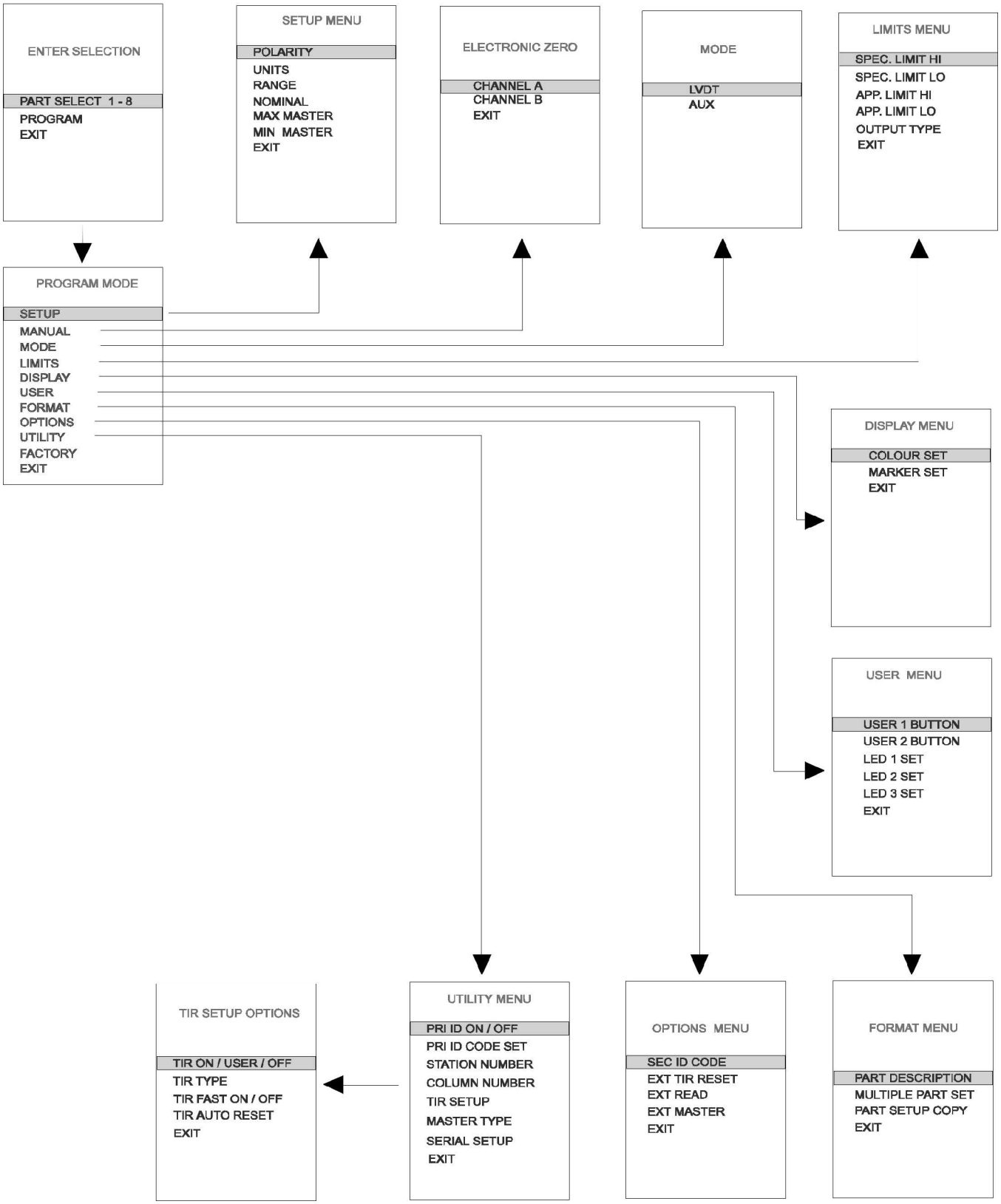


Fig. 1-6 PRIMARY PROGRAMMING MENUS



1.40 Mechanical Setup / Pushbutton Operation

The L9100 LVDT Column Gauge provides a dual channel LVDT circuit, and is designed to be used with gauging fixtures which utilize standard Min and Max masters, or a single Mean master. Standard features include a +5 to -5 VDC analog output, a graphical back-lit LCD display, a programmable colour LED bar display, serial output, total indicating readout, & status output. Programmable features include range, function, security code, gain and zero for manual mastering, automastering capability, digital offset, and station and column ID numbers as well as many others.

The lower plug-in signal conditioning module is normally delivered installed. If removed, re-insertion involves aligning the circuit board with the internal guides and sliding the module fully into position. Press the module in firmly to seat the connector at the back of the module and bring the front panel into direct contact with the mounts. Secure with two 6-32 x 3/8" socket head Cap screws at the top and bottom of the front panel.

Connections to the ANALOG OUT or STATUS OUT are made to their respective DIN connectors at the rear of the unit. Typical connections are shown in Figure 1-3. The modular connectors and DB-9 serial connector need not be connected unless the functions are to be used. If it is desired to engage a security code, 2 levels of software protection are provided.

1.41 Front Panel Pushbuttons

There are 4 pushbuttons on the front panel of L9100 columns, arranged in a square format. Each pushbutton has 2 functions, depending on the mode the column is placed into.

When in the normal operating mode (i.e. the measurement mode, where an input change will affect the display readout), the labeling in *Blue* applies to the buttons. Therefore:

- Pressing and holding the upper left button for 5 seconds will place the column in the Program Mode
- Pressing the upper right button momentarily will place the column in the Automastering Mode
- Pressing the lower left button will initiate a pre-programmed function for User 1, or U1 (if engaged)
- Pressing the lower right button will initiate a pre-programmed function for User 2, or U2 (if engaged)

The 2 lower buttons allow the user to define a variety of possible functions for these keys. Refer to section 2.40 under *User* for more details.

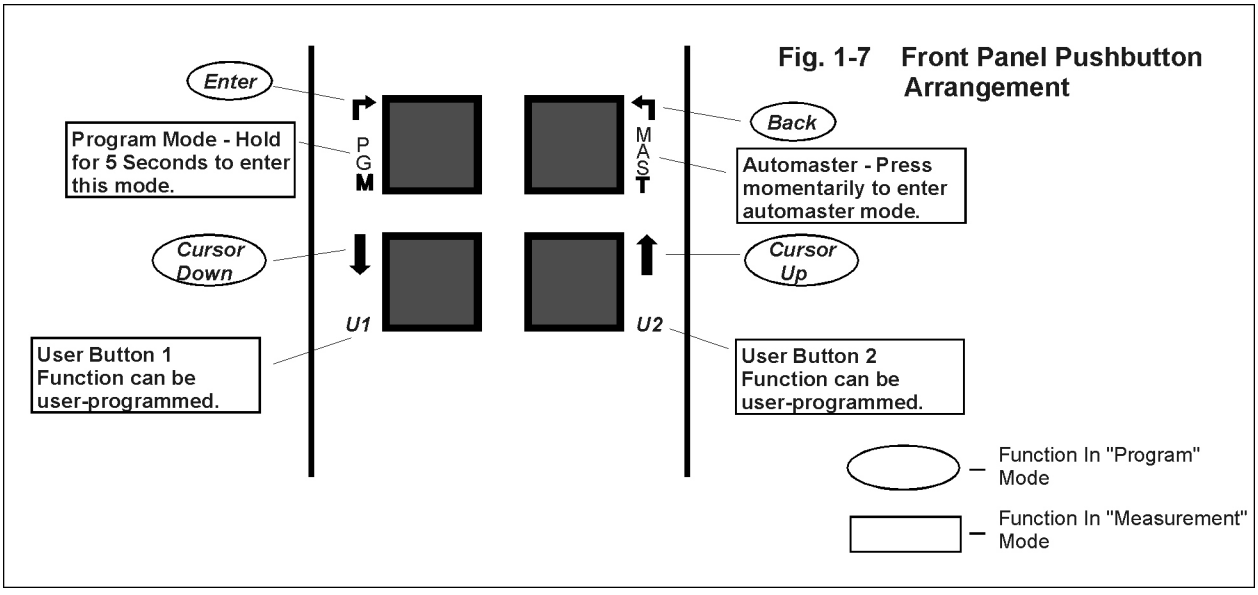


Fig. 1-7 Front Panel Pushbutton Arrangement

When in the program mode (after the upper left key has been pressed and held), the labeling in *Black* applies to the 4 pushbuttons, and their functions change as follows:

- Pressing the upper left button acts as a keyboard <Enter> key, allowing the user to proceed through the displayed menu options, and accepting the currently highlighted menu selection.
- Pressing the upper right button <Back> will vary depending on the menu item. In some cases, it will allow the user to return to a previous menu option. When a series of alpha-numeric values are being entered, the button will shift the digit position by one to the left. There are some menus where the <Back> key will have no function.
- Pressing the lower left button allows the user to scroll upward through menu options, or to increment a digit.
- Pressing the lower right button allows the user to scroll downward through menu options, or decrement a digit.

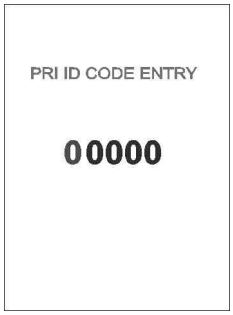
In Automaster Mode, the <Enter> key performs Min and Max Mastering funtions.
The user may return to the measurement mode either by scrolling to the Exit option on a screen menu and pressing the <Enter> key, or by completing an entry by pressing the <Enter> key, or in some cases by pressing the <Back>.

2.00 MODEL L9100 PROGRAMMING COMMON PARAMETERS

With the availability of 8 part configurations, some program parameters are specific to each part, while others are common to all 8 parts. This section includes detailed instructions on programming all of the parameters which are the same, regardless of the part configuration selected.

2.10 SECURITY CODES

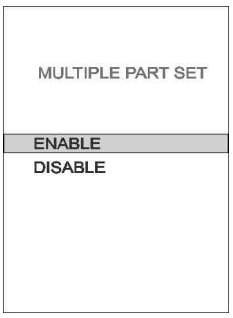
The L9100 column has 2 levels of security, defined by Primary and Secondary 5 digit security code numbers.



- PRIMARY CODE: The primary code is engaged or disengaged from the <Utility> menu from the item "PRI ID ON/OFF". The code number itself is entered from the <Utility> menu, from the item "PRI ID CODE SET". The primary ID, when engaged, will prevent unauthorized persons from gaining access to any of the column program menus. One digit will be hi-lighted at a time in red, and the numeric value can be incremented or decremented by pushing the up or down arrow buttons. The <Enter> key will advance to the right character, while the <Back> key will move to the left. To accept the security code number, press the <Enter> key while at the right-most digit. When the Primary ID is engaged, the user must enter this number in order to enter the program mode.

- SECONDARY CODE: The secondary code is engaged if any number other than 00000 is entered as the code. The code number is entered from the <OPTIONS> menu , from the item "SEC ID CODE". When a code number is entered, the secondary security number will need to be entered in order to change the currently selected part number, or to automaster. The code number entry description is similar to the primary code above.

2.20 MULTIPLE PART SETUPS



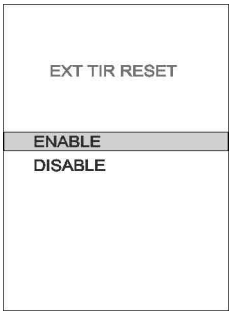
The L9100 can be configured for up to 8 individual parts. This is useful when a number of similar parts are to be measured using one column. The multiple part capability must be engaged from the <FORMAT> menu, from menu item "Multiple Part Set". Use the up or down buttons to select Enable or Disable, and press <Enter> to accept. Once engaged, the user will be allowed to select a part when the column is placed in Program mode.

2.30 EXTERNAL INPUTS

In the <Options> menu, there are 3 external inputs available which allow the user to trigger certain events from an external device. The 3 events are TIR Reset, Read (Send Data), and External Automaster. The pin numbers for these inputs are defined in Fig. 1-3. For the external inputs to function, they must be engaged in the software. All external inputs require a momentary contact closure to the ground pin (Pin 2 of the Analog Output) DIN connector in order to initiate the event. Contact closures should simulate the momentary closure of a pushbutton, and range from .1 second to .8 second max. Under no circumstances should any external voltage be applied to the external inputs. They must be dry-contact closures (pushbutton or external relay “dry” contacts).

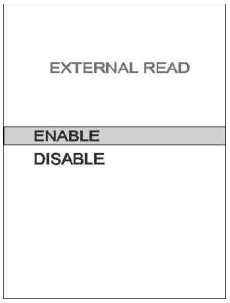
This *Disable* feature can be helpful in cases where a long cable is used to trigger one or two of the 3 events, if the cable runs near other devices or wires which may generate strong electromagnetic spikes into the adjacent cable wires, and therefore causing false triggering of an unwanted feature.

2.31 External TIR Reset



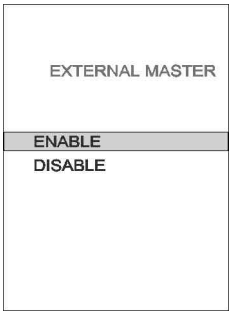
If the column has been programmed to operate in TIR mode (Total Indicating Readout), the display can be reset externally using Pin 3 of the Analog Output DIN Connector. Select "EXT TIR RESET" from the Options menu, and then use the up/down arrow keys to scroll between Enable or Disable, and press <Enter> to accept. TIR functions are defined in the <Utility> menu under the item "TIR SETUP". This is useful for resetting a bank of columns simultaneously if they are interconnected via the modular connectors.

2.32 External Reading



Data readings to an external device can be initiated either from a pre-programmed front panel "User" button press (See section 4.10) or from an external connector contact closure. The L9100 column provides 2 external contact pins which can be used for this purpose, one on the modular IN connector, and the other on Pin 5 of the analog output DIN connector. To program, select "EXT READ" from the Options menu, and then use the up/down arrow keys to scroll between Enable or Disable, and press <Enter> to accept. Section 5.40 defines how data readings are sent from the rear panel DB-9 connector to an external device.

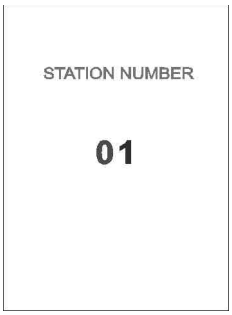
2.33 External Master

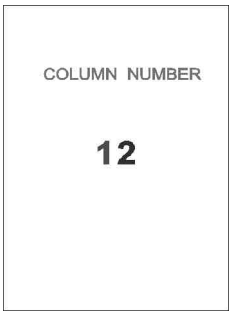


External Auto-mastering can be performed in an automated process by momentarily closing Pin 4 on the Analog Output connector to ground. This option is not generally recommended, since an error condition during the process will only be visible on the column display, but if needed, it can be implemented. Three external momentary contact closures are needed to complete the mastering process. The first closure will place the column in an auto-mastering mode. The 2nd closure will perform a MIN mastering, and the 3rd closure will perform a MAX mastering. The External Mastering is enabled from the Options menu. Select "EXT MASTER" and then use the up/down arrow keys to scroll between Enable or Disable, and press <Enter> to accept. The front panel "Automast" pushbutton will still function in its normal manner.

2.40 STATION AND COLUMN NUMBERS

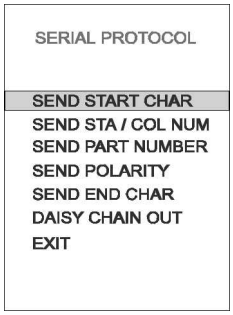
A 2 digit station identification number, and a 2 digit column number can be programmed into the column. These 2 numbers will be displayed on the main panel display at all times, Also, if data readings are to be sent to an external device, the user can program the data to also include the station and column numbers. Both are selected from the UTILITY menu. The digit currently active on the menu is hi-lited in red. Use the up/down arrow keys to scroll the digits, and press <Enter> to move to the right digit. Pressing <Enter> when at the right digit will accept the entry and return to the previous menu.



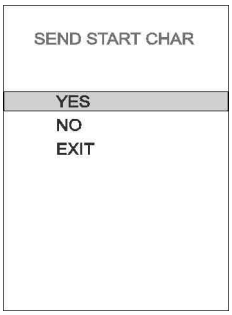


2.50 SERIAL PROTOCOL

The L9100 column can be configured to send data readings to an external device via RS-232 communications from the DB-9 connector on the column rear (See Fig. 1-3). Readings must be initiated either by a front panel User button press (if so configured), or by a contact closure occuring at the correct pins on either the Modular connector (IN) or the Analog Out DIN connector. The data format is standard ASCII, but the protocol (sequence of information transmitted) can be customized by the user according to requirements of the receiving device (i.e. PLC, external computer, etc.). The measured reading value is always part of this data stream, and appears in the same manner as displayed on the digital readout on the column front. Other parameters can be added to this data transmission as needed:



1) Start Character - A small case "a" (Hex 61, Dec.97) can be sent at the beginning of any reading, so that the receiving device can know when a new reading is beginning.
2) Send STA / COL Number. The 2 digit station and 2 digit column numbers can be sent as the next part of the data stream if desired.
3) Part Number (Currently selected). A single digit number from 1 to 8
4) Polity - A "+" or "-" sign can be sent just before the measurement reading if desired.
The next item in the data will be the measurement reading (including decimal point).
5) End Char. - A carriage return (ASCII 13) (HEX 0D) symbol can be included after the measured value if desired. This tells the receiving device that the transmission is completed.



For example, a typical data stream with all parameters selected and in metric would look like this

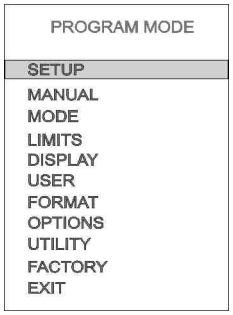
a01042+001.4680 followed by a carriage return, where Station number is 01, the column number is 04, selected part # is 2, and the measured metric reading is +001.4680.

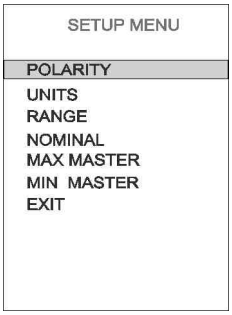
(Note: To simulate serial output Type 1 of previous L9100 column versions, engage all paramters except Part Number, and End Char.)

A new feature allows “Daisy Chain” to be disengaged. When turned off, a series of columns when interconnected with modular cables at the rear, will allow any one of the columns in the chain to send it's reading only to the external device. Each column must either have a user button programmed to intiate a data read, or must have an external pushbutton or trigger device connected. The serial out to the external device may come from any of the columns which are so interconnected.

3.00 PROGRAMMING PARAMETERS FOR INDIVIDUAL SETUPS

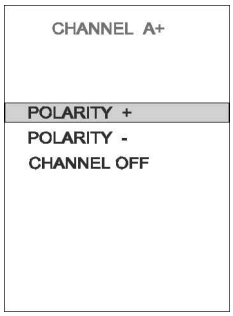
This section describes how to program the parameters which are specific to individual setups or parts (8 Part configurations available). The currently selected part number is always displayed on the main LCD front panel display when in measurement mode. It is shown on the lower right of the display, to the right of the column number, and is designated by a "P" followed by a number (1 thru 8). Any of the parameters programmed in this section will apply only to the currently selected part. Most of the parameters which fit into this category are programmed from the "Setup" selection of the Program Mode menu.

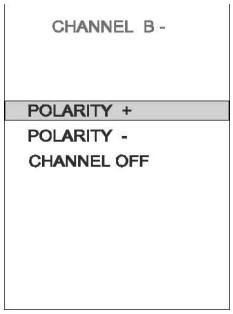




3.10 POLARITY

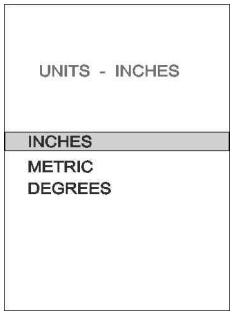
Polarity for an input can be set to either positive (+) or negative (-) operation. Changing the polarity will cause the bar display to move in the opposite direction as the input signal changes, and will change the order of inserting masters (+ pol. is Min followed by Max, usually used for measuring inside dimensions ... - pol. is Max followed by Min, for outside dimensions*). It is configured from the Setup Menu, and is the first parameter shown. There are separate polarities for input A and input B. The current polarity is shown in the menu title. The menu for Channel A will appear first. Use the up/down arrow key to scroll the selections and press <Enter> to accept. This will advance to the B channel menu. After scrolling to the desired option, press <Enter> to accept, and the system will return to the Setup menu. If only one input channel is being used, either A or B inputs can be turned Off, although the bar graphs indications on the LCD screen will still appear.



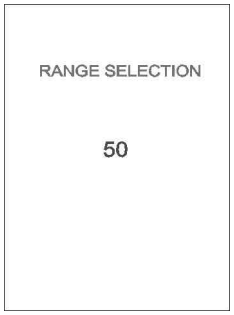


3.20 UNITS

The units for operation can be either Inches, Metric (millimeters), or Degrees. When inches are selected, the digital value will have 2 digits to the left of the decimal and 5 digits to the right. Metric has 3 digits to the left of the decimal and 4 digits to the right. When degrees are selected, there are 4 digits to the left of the decimal and 3 digits to the right.
The currently selected units are shown in the menu title. Use the up/down arrow keys to scroll to the desired selection and press <Enter> to accept.

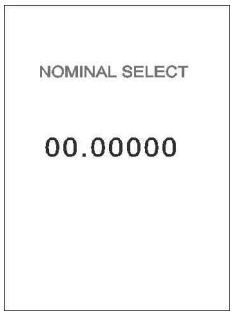


3.30 RANGE



The available range selection will vary depending upon the Units which have been selected.
INCHES: Range is from 1 to 100 thou in 1 thou increments. (1 thou=.001 inch)
METRIC: Range is from 20 to 2000 microns in 10 micron increments (1 micron= .001 mm.)
DEGREES: Range is from 0.1 to 10 degrees in 0.1 degree increments
When the range menu is selected, a single number on the screen is incremented with the up arrow key and decremented with the down arrow key. Press <Enter> to accept. For example, if the units are inches, and the range selected is 50 thou, this means that there will be a 50 thou spread from the top of the bar display to the bottom.
Note: If the “LVDT” option is selected in the MODE menu (most often the case), then the range chosen here will automatically apply an appropriate Gain Range to the column. However, if the “AUX” option is selected in the MODE menu, then the Range selected will only apply to the display parameters, and the user must independantly chose a gain range to be applied, and that menu option follows the AUX selection in the MODE menu.

3.40 NOMINAL



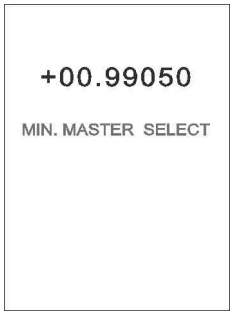
The nominal part size is the ideal design size of a part, around which actual part measurements will vary. The Nominal Select menu is accessed from the "Setup Menu", and will appear as 7 digits on the screen. Each digit is incremented (up key) or decremented (down key) one digit at a time, starting from the left. The active digit will be red in colour. If the <Back> key is pressed at the 1st digit, the column will return to the previous menu without making any changes. The <Enter> key advances the digit to the right, and at the last digit pressing <Enter> accepts the entry and returns to the Setup menu.
The nominal part size is added to the actual measured tolerance readings on the digital readout, unless the display is programmed for “tolerance” mode.

3.50 MASTER POSITIONS

The MIN and MAX master positions are defined based on the actual sizes of the Min and Max masters being used for calibration. Before programming these parameters, the nominal part size should be entered as described in section 3.40. Both menu items are accessed from the Setup Menu.

3.51 Max Master

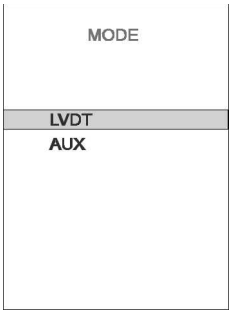
Use the up/down arrow keys to increment or decrement the programmed size of the Max master. This will move both the bar display and the digital readout, so either display method can be used to establish the correct position. The movement resolution is determined by the Range selection. The programmed position will be used for the automastering process. Press <Enter> to accept.
The Max master is always the largest diameter one, regardless if the inside diameter or the outside diameter of the part is being measured.



3.53 Min Master
Use the up/down arrow keys to increment or decrement the programmed size of the Min master, and is similar to the Max master description above.

If Mean mastering is employed, the Min and Max master positions are ignored.

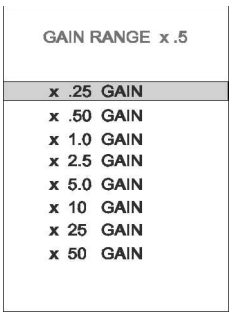
3.60 MODE



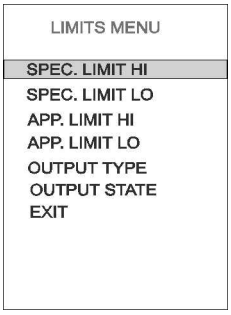
The method of determining the gain range to be used for the part is selected from the MODE option in the main Program Mode menu.
There are 2 options:

LVDT – with this selection, which is most commonly used, the gain range is automatically programmed into the column based on the RANGE selection made in the Setup menu.

AUX - with this selection, the user is presented with a menu of 8 amplification or gain ranges. This ability to define the gain range independantly from the display range allows for special fixture designs, where, for example, a mechanical lever is moving the LVDT probe, giving a mechanical advantage.
This gain range defines the amount of signal amplification to be used for the part, and the available gain ranges are: 0.25, 0.5, 1.0, 2.5, 5.0, 10, 25, and 50 times, all referenced to the 1 x range. (See appendix for an equivalence chart) In other words, the 0.25 x range has the least signal gain, and the 50 x range has the greatest (50 x that of the 1 x range). These ranges should accommodate all requirements for standard fixture designs. The selection usually involves a trial and error process to determine which gain range works best for your application. A good idea is to set the gain range for a new part to 1 x, and then test whether the column gain is adequate, or if it needs to be increased or decreased. The correct setting will depend on the fixture design and the master sizes.

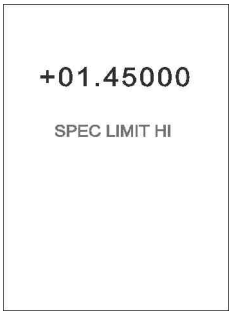


3.70 SPECIFICATION AND APPROACH LIMITS



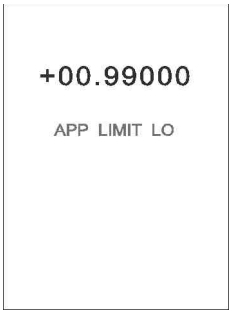
Specification limits define the maximum (Hi Limit) and minimum (Lo Limit) sizes to be allowed for a part to be considered as acceptable. Any sizes outside of these limits are generally considered to be rejected parts. Approach limits (Hi and Lo) define a region of part size which, while considered acceptable, are close to being rejected, and therefore alerts the operator to a potential problem if increasing numbers of measured parts are in this range. Limit output signals can be defined in order to control external equipment if measured parts exceed these limits. The Output Type menu selection allows the user to configure these status signal arrangements. The bar display colours are usually defined based on these limit positions. The Limits menu is accessed from the main Program Mode menu.

3.71 Hi and Lo Specification Limit Setpoints:



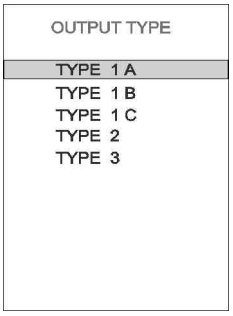
These are set in the Limits Menu. Use the up or down arrow keys to raise or lower the bar display to the desired positions representing the upper and lower spec limits. The digital display will change accordingly indicating the numeric values of the limit positions. Press <Enter> to accept and return to the Limits Menu.

3.72 Hi and Lo Approach Limit Setpoints:



These are set in the Limits Menu. Use the up or down arrow keys to raise or lower the bar display to the desired positions representing the upper and lower approach limits. The digital display will change accordingly indicating the numeric values of the limit positions. Generally, the colours of the bar display are programmed to match the limit settings. Press <Enter> to accept and return to the Limits Menu.

3.73 Output Type

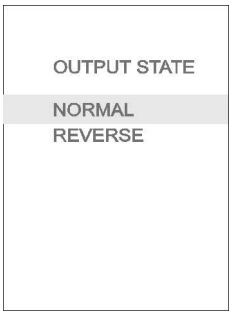


There are 5 configurations available for changing the status output signal of the columns (Fig. 1-3 F). On this connector, there are 3 limit outputs which can be configured. When in the specified range, an output voltage will rise to +5 VDC (nominal), for controlling external devices (Note: By special order, a relay output can be provided). The 5 configurations are:

Output Menu	Pin 1	Pin 2	Pin 3
Type 1A	Spec.Lo	OK	Spec. Hi
Type 1B	(NA)	Spec. Hi	(NA)
Type 1C	(NA)	Spec. Lo	(NA)
Type 2	App. Lo	OK	App. Hi
Type 3	App. Lo or Hi	OK	Spec. Hi or Lo

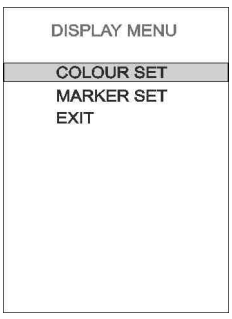
For example, if set for Type 1A, when the display is less than the Lo Spec. position, Pin 1 will rise from 0 (approx) to + 5 VDC (other 2 pins at 0 volts). When in the OK area between the 2 Spec Limits, Pin 2 will rise to + 5 volts, and pin 1 again drops to 0 volts. When the display rises above the Spec Hi point, pin 3 will rise to + 5volts.
Use the up / down arrow keys to scroll between the output selection types, and press <Enter> to accept.
Note: When a relay output is requested, only pin 2 of the above applies. Relay output is usually a contact closure on Pin 2 when the display is in the OK region.

3.74 Output State



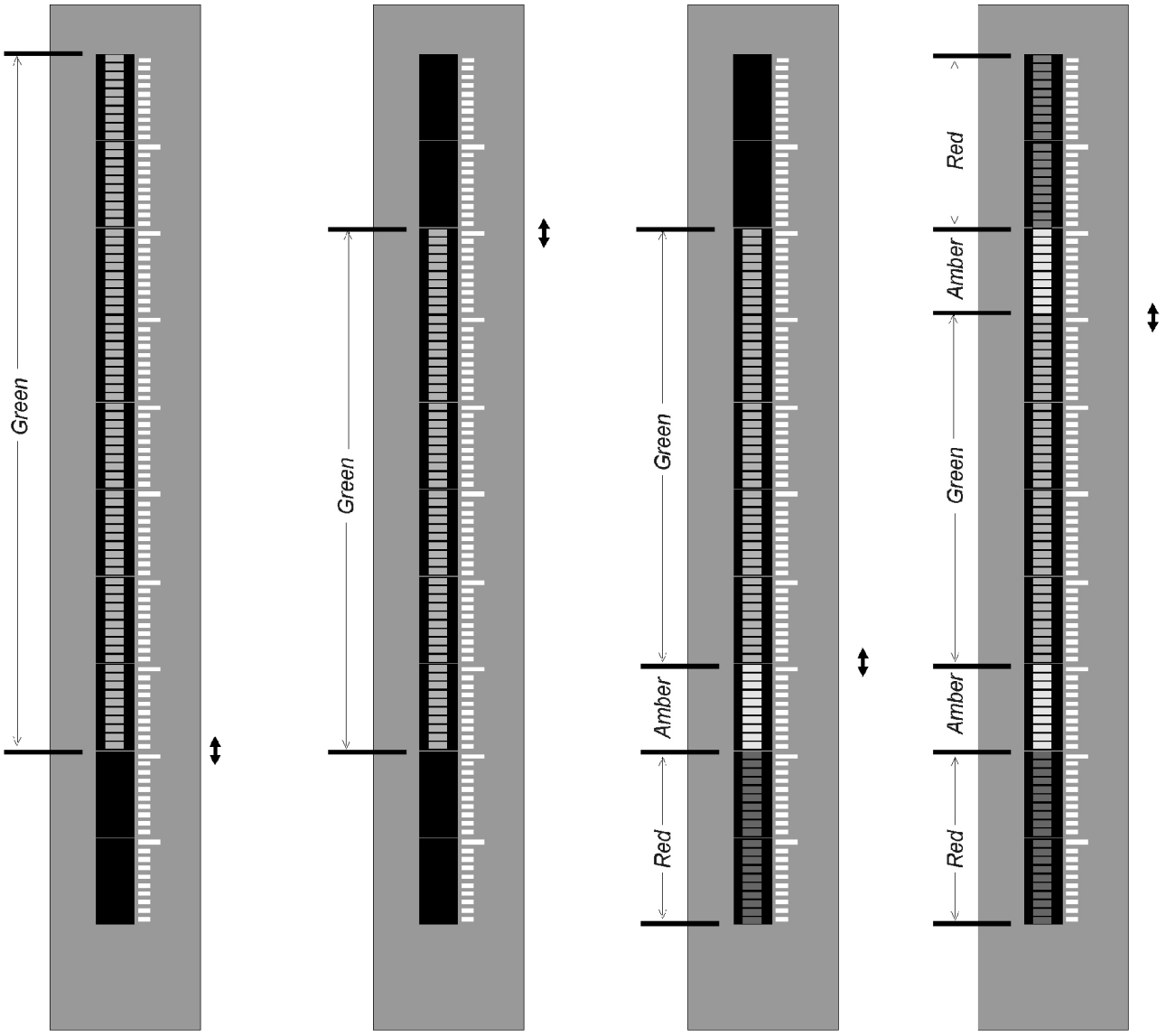
The configurations shown in 3.73 are for the NORMAL output state. This can be reversed if needed, so that "high" outputs will become "low", and vice-versa. For relay outputs, "Closed" contacts will become "Open" and vice-versa. This allows configurations to be reversed without major hard wiring changes to the relay output.

3.80 BAR DISPLAY COLOURS AND MARKERS



The L9100 Column can be configured for custom colour arrangements on the Bar display. The OK region is usually configured in green, the approach areas in amber, and the out-of-limits areas in red, but the colour settings do not necessarily have to match the limit positions as set in section 3.70. The menu called "DISPLAY MENU" is accessed from the main Program Mode menu. It has 2 sub-menus, called "Colour Set" and "Marker Set".

Fig. 2-4 ***Setting the Bar Display Colour Configuration (Display Menu)***



20 Clr1

Step 1

Press up/down arrow keys to move the green bar up or down. This sets the position of the lower transition point from green to red. This will typically be the Lo Limit Spec. position. If the final configuration will include an AMBER approach area, set the green bar position to include the amber area of the display. Press <Enter>.

80 Clr2

Step 2

Press up/down arrow keys to move the top of the green bar up or down. This sets the position of the upper transition point from green to red. This will typically be the Hi Limit Spec. position. If the final configuration will include an AMBER approach area, set the green bar position to include the amber area of the display. Press <Enter>.

30 Clr3

Step 3

Press up the Up/Down arrow keys to move the position of the lower red colour bar into the green section. As this moves into the green area, the overlap of red and green creates an AMBER "Approach" area. Press <Enter>.

70 Clr4

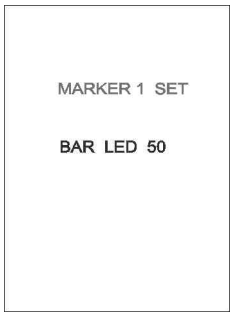
Step 4

Press up the Up/Down arrow keys to move the position of the upper red colour bar into the green section. As this moves into the green area, the overlap of red and green creates an AMBER "Approach" area. Press <Enter>.

3.81 Colour Set

There are 4 steps in colour configuration of the bar display. See Fig. 2-4. Press <Enter> on the "Colour Set" menu selection. The screen will say "Colour 1 Set". Use the arrow keys to move the lower edge of the green LED lights to the desired position (usually the Lo Limit point). The graphics display will indicate the LED position referenced to the bottom of the bar display. Press <Enter> to continue to "Colour Set 2". Use the arrow keys to move the upper edge of the green LED lights to the desired position (usually the Hi Limit point) and press <Enter> to change to the "Colour Set 3" menu. The bar display area below the Lo Limit will now appear in Red. Use the arrow keys to move the lower edge of the green LED lights to the desired Lo Approach position. The area between this and the Lo spec. position will be an amber colour. The amber colour is produced by an overlap of green and red. If no approach area is desired, then move the green lights all the way down to the red. Press <Enter> again to move to the "Colour Set 4" menu. The area above the Hi Spec Point will now also be red in colour. Use the arrow keys to move the upper edge of the green to the Hi Approach area. Press <Enter> to return to the "Display Menu".

3.82 Marker Set



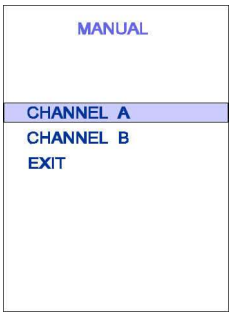
The bar display can be configured to display 1, 2, or 3 amber markers at positions of the user's choosing. These could be used to represent the display mid-point, Hi or Lo spec positions, master positions, etc. From the "Display Menu", select Marker Set, and the next menu screen which appears will be Marker Set 1. Use the up or down arrow keys to move the amber marker to the desired position. The graphics display will indicate the relative bar segment position. Note that the marker will not be visible in the "Amber" segments of the bar display as defined in Section 3.32. Press <Enter> to proceed in like manner to markers 2 and 3. If markers are not desired, move them to the very bottom of the bar display (Bar LED 0). Press <Enter> to return to the Display Menu.

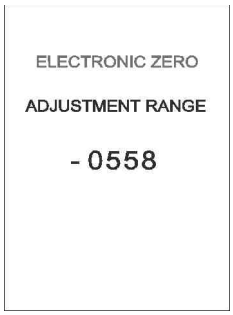
3.90 MANUAL CALIBRATION ELECTRONIC CONTROLS

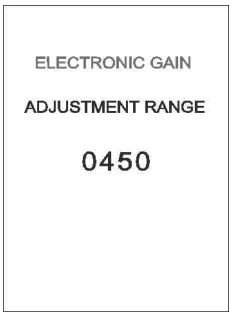
This menu item is discussed here in the "PROGRAM MODE" main menu, but it is addressed also in Sections 5.10 and 5.20 under the topic of manual column calibration and automastering.

There are two electronic signal controls which are used for calibration of the column:

1) Electronic Zero and 2) Electronic Gain. There are independent adjustments for A and B channels.





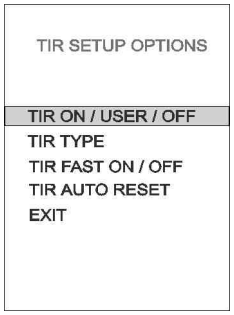


Electronic zero is an adjustment which is used to calibrate for the zero position of a part in a fixture. It is addressed in the "Manual" menu item, and has a range of from - 2000 to + 2000. Generally speaking, after initial setup, the programmer or operator will not have to adjust this, as the automastering will automatically find the correct value during the mastering sequence. The value can be changed manually, however, by scrolling the number using the up or down arrow keys. When "pulsing" the button, the value will increment or decrement by "1". When holding the button down continuously, it will do this by "1" for the 1st 3 seconds, and then begin changing by "10's". Pressing the <Enter> key will advance the menu to the "Electronic Gain" control.

Electronic gain is an adjustment which is used to calibrate the overall electronic signal amplification which is required to master a part. It also has a range from - 2000 to + 2000. This should not be confused with the "Gain Mode" or range setting of section 3.60, which allows the user to select a coarse gain range suitable to the part or fixture. Again, this parameter is automatically changed during automastering, and also when the Gain Range (Sect 3.60) is changed. Press <Enter> again to return to the main menu.

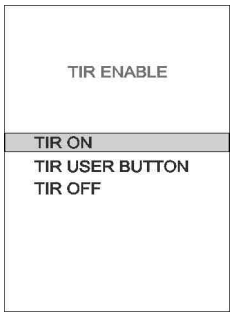
3.A TIR SETUP

The term TIR (Dynamic) stands for Total Indicating Readout (or Runout) , and normally defines a reading which is a maximum, minimum, or a subtraction of these two encountered during a rotation of a part. Runout can be caused by angular misalignment of a projecting piece, or by a radial offset. TIR can easily be engaged or disengaged by programming one of the User front panel buttons to perform this function, and since TIR readings are held until reset, a second user button can also be programmed to perform a TIR reset. Under the menu option of "TIR SETUP", accessed from the Utility menu, we have also included an Absolute Value reading option, which is not strictly a TIR function. When pressing the <Enter> button from the "TIR SETUP" selection, another menu appears which is entitled "TIR SETUP OPTIONS".



3.A1 TIR Enable

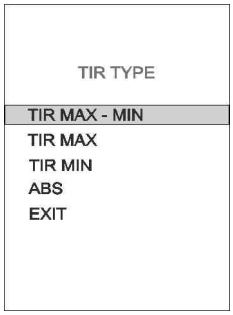
The 1st menu item is "TIR ON/USER/OFF". When this is selected, the user is presented with another menu, where there are 3 selections. TIR ON means that the column will operate in continuous TIR mode. TIR USER BUTTON means that a user button can be programmed to turn the TIR function on or off. TIR OFF will disengage any TIR mode of operation in the column. Selecting any one of these will return to the Setup Options menu.



3.A2 TIR Type

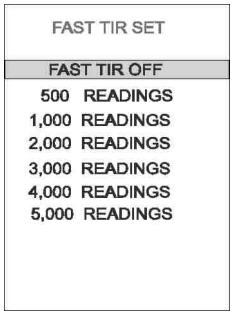
When TIR Type is selected from the TIR SETUP OPTIONS menu, another menu is presented entitled "TIR TYPE". The options available here are:

1) TIR MAX-MIN - After a part is placed in a fixture, do a TIR reset. The bar display will drop to a point 20 LED's from the bottom (in order to give greater display usage). As a part is rotated, the display will continuously update to indicate the greatest value detected during the rotation, and is "latched" at that position. In this case, the column will display whichever of the Maximum or the Minimum values reached during the rotation has been the greatest.
2) TIR MAX - As above, but only the Maximum value is displayed and held. Resets to mid-point of bar display, and display will only move upwards from the mid-point.
3) TIR MIN - As above, but only the Minimum value is displayed and held. Resets to mid-point of bar display, and display will only move downwards from the mid-point.
4) ABS - The column will display the absolute value of the input. This resets to the mid-point of the bar display, and the display will only move in the top half , since negative signals are changed to positive. Bar display is not latched.



3.A3 TIR Fast On / Off Set

This is a unique function of the L9100 column which allows for extremely rapid detection of values during a part sweep. A TIR type must be selected, and if TIR Fast is also set ON, then the column will take a specified number of reading samples at a rate of approximately 3200 samples per second. The start of this sampling process begins with a TIR reset button press. The rate of sampling is significantly higher than in normal TIR mode, but the display is not updated until the sampling is complete. This mode of operation is useful when a part is being turned at a fairly high speed (say during an automated measuring process), and the normal TIR mode would miss imperfections due to a slower sampling rate. The user can select from 6 ranges of readings, up to 5,000 readings (do not confuse the term "readings" with the readings which are sent to the serial port output). For example, if a part's rotation time is 1.7 seconds, then you would want to select "2,000 READINGS" to accommodate this process.

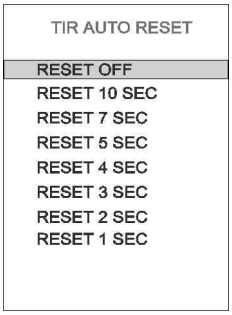


Approximate times for readings are:

500	0.35 seconds	3,000	2.1 seconds
1,000	0.7 seconds	4,000	2.8 seconds
2,000	1.4 seconds	5,000	3.5 seconds

3.A4 TIR Auto Reset

In normal TIR mode (not Fast TIR), one can set the column to perform an auto-reset after a specified time period,. The timer begins when the part which has just been measured is removed from the fixture. This allows for part changing without requiring a manual reset once the new part is in place. The time range is from 1 to 10 seconds.



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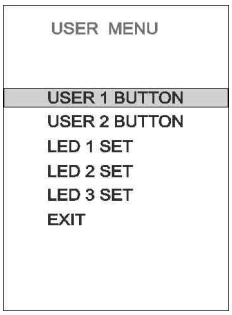
4.00 MODEL L9100 PROGRAMMING SECONDARY PARAMETERS

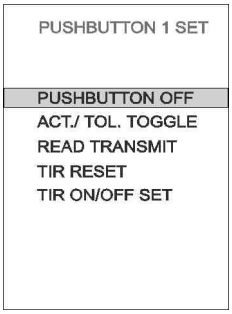
Secondary parameters are the programming parameters for each of the 8 available part setups which are not essential to the operation of the column, but are still specific to each part setup. The L9100 has 2 front panel pushbuttons available in measurement mode which can be programmed by the user to perform a variety of functions, and 3 programmable light annunciators.



4.10 USER BUTTONS AND LIGHT ANNUNCIATORS

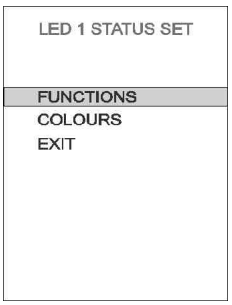
The functions available for selection are:

- PB Off : Pressing the button will have no effect
- PBActTol: If a nominal part size has been entered in the SETUP menu, then pressing the button will toggle the display to show tolerance values only, or actual part size (Tolerance + nominal size).
-PBRead: Pressing the button will initiate a measurement reading transmission to the serial port.
The display will momentarily display “TRANSMIT”.
- PB Tir<=>: Pressing the button will toggle the column mode from normal to TIR and back. Note that “TirUsePb” must be selected in the TIR Setup Options menu.
- PBTirRes: Pressing the button will perform a TIR reset if the column is in TIR mode.

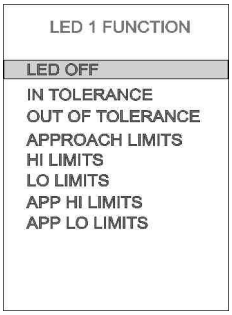


Use the arrow keys to scroll to a selection and press <Enter> to accept.

There are also 3 LED lights which can be programmed to appear on the front panel. Select the "Functions" option and the following list of conditions will appear:

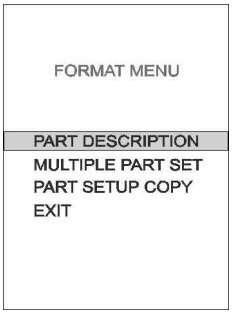


- Led Off : Don’t have the LED come on at all
- Out of Tolerance: The LED will be lit whenever the display is not in tolerance, as established by the Hi/Lo Limit setpoints.
- Approach Limits: The LED will be lit whenever the display is in the “approach” area of the display (Hi or Lo) as established by the Approach setpoints in the LIMITS menu.
- Hi Limits : The LED will be lit whenever the display exceeds the Hi Lim point.
- Lo Limits: The LED will be lit whenever the display exceeds the Lo Lim point.
- App Hi Limits: The LED will light when the display is in the High Approach region (if region is programmed)
- App Lo Limits: The LED will light when the display is in the Low Approach region (if region is programmed)



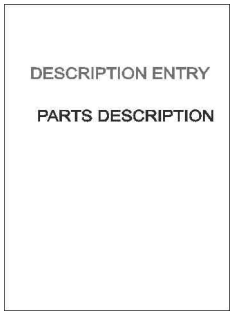
Use the arrow keys to scroll to the desired condition and press <Enter> to accept. In the "Colours" menu option, the user may select to have the light appear as Red, Yellow, Green, or Blue.

4.20 PART DESCRIPTIONS AND COPYING



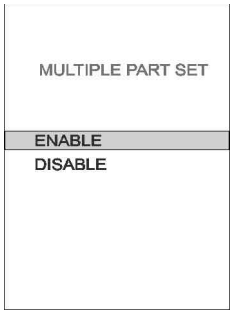
The menu options described in this section are found in the "FORMAT MENU", which is accessed from the main "PROGRAM MODE" menu. The Format menu has 3 options, all dealing with the 8 available Part setups.
"Part Description" allows the user to type in a 17 character description of the Part currently selected, and this appear at the bottom of the front panel LCD display.
"Multiple Part Set" allows the user to enable or disable the multiple part option. When disabled, the user will not have the ability to select a part setup, as there will be only one part programmed.
"Part Setup Copy" allows one part setup configuration to be copied to another. This saves a lot of programming time when there are only minor differences between part dimensions.

4.21 Part Description



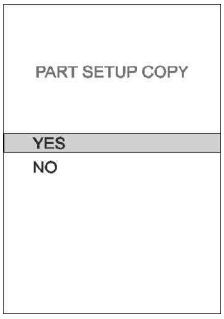
On entering this menu option, the left-most character is hi-lited in red. Use the up or down arrow keys to scroll to the character desired. There are the full alphabet characters, followed by the numbers 0 through 9, followed by the special characters + , - , * , / , = , . , Blank Space.
Press <Enter> to advance to the next digit. Pressing the <Back> key moves one character to the left. This procedure is takes some time, but only needs to be done once.

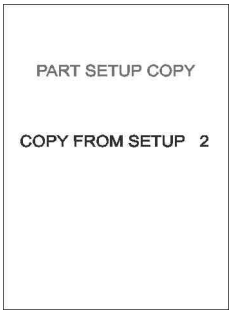
4.22 Multiple Part Set

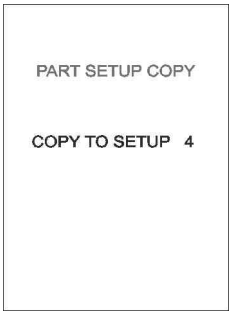


Use the arrow keys to select between "Enable" and "Disable" and press <Enter> to accept. When enabled, the user will be presented with a menu option to select the desired Part setup configuration each time the column Program mode is entered.

4.23 Part Setup Copy







In order to copy the setup parameters of one part to another, select "Yes" in the Part Setup Copy Menu. Then scroll the number of the part setup to be copied using the arrow keys. After pressing <Enter>, scroll the number of the Part setup you wish to copy the parameters to, and then press <Enter> to accept. Care should be taken with this action, as any pre-existing programming in the setup number being copied to will be overwritten and is not recoverable. Once a part configuration is copied to another part number, then the user can select that part number and make any editing changes as needed to the programming for that part.

5.00 COLUMN OPERATION

5.10 MANUAL ELECTRONIC AND GAIN SETTINGS

The quickest and easiest way to calibrate the L9100 column during production is to use the “Automastering” feature described later The user needs simply to insert MIN and MAX masters into the gaging fixture and press a single button for each. The gage will perform the necessary calculations and adjustments to calibrate itself.
However, one should first ensure that the electronic zero and gain, who's positions are shown in the LCD display bar graphs during normal operation, are not at extreme left or right positions before automastering. Especially when initially programming a column for a new operation, one should set the electronic zero and gain adjustments to near mid-postions, to allow for maximum adjustment capability during mastering. This helps to ensure that the calibration is not performed near the maximum or minimum settings of the electronic controls, thereby preventing these settings from reaching their maximums or minimums during future automastering sequences.
Ensure that all Setup programming has been done before attempting to master.
NOTE: The descriptions following are for a + polarity operation. On - polarity, the MAX master is inserted before the MIN master.

5.20 AUTOMASTERING PROCEDURE

Once the column has been initially programmed, and the necessary Manual adjustments have been performed as described above, then the column Automastering function can be used for rapid mastering on a regular basis using Min and Max masters, or a nominal size Mean master.

Steps For Min / Max Automastering (+ Polarity assumed) :

[1] From the Measurement Display mode, press the <Mast> button once(with a pulse action). The display should now read “Insert Min Master” for + polarity, or "Insert Max Master" for - polarity.

[2] Place the Min Master (Max for - pol.) in the fixture. Press the <Enter> button to begin the min mastering process. The bar display will not be visible during the mastering process. The display will change to "WORKING" while the mastering is occurring. When completed successfully, the display will change to "Insert Max Master" (or Insert Min Master if - polarity) . Go to step 3. If the process takes much longer than usual, and a "Zero Error" message occurs, then most likely the initial manual calibration has not been performed correctly, or the wrong master is being used. If the message reads "Zero Error on HI", then the column has not been able to raise the display high enough to reach the master position. If it reads "Zero Error on Lo", then it has not been able to lower the zero sufficiently to reach the master position. Press <Enter> to abort and return to the measurement mode of operation. The electronic zero control will return to it's previous position.

[3] The display should now read “Insert Max Master” (or Min Master for - polarity). Place the master in the fixture and press the <Mast> button. If successful, the bar display should now appear again and be at the Max master position, and the digital display should return to the measurement mode. Calibration is complete.
If an error message appears, then the display will read "Gain Error on Hi (or Lo)". If "Hi", then the column had insufficient gain to be able to reach the master position. If "Lo", then there was too much gain to be able to master. Some of the reasons that mastering can fail are:

1) LVDT probe has not been mounted in an operable range of movement.
2) The electronic zero or gain controls are too close to their limits on either end (look at bar displays which can be seen at the bottom of the graphics display when in measurement mode).
3) The size of the masters does not match the programmed values in the column.
4) The nominal part size is incorrectly entered in the programming.
5) The min and max masters have been inserted in reverse order.
6) There is a basic fixture design problem.
7) The Mode (Gain range) setting is not correct for the setup if “AUX” has been selected in the MODE menu item.
8) There is too much variation in the fixture when the same master is re-inserted.

Once a column has been successfully automastered, re-insert the Min and Max masters in order to verify the calibration before placing the column back in active service. The frequency of re-mastering is, of course, up to the user, but a column should always be re-mastered after having been turned off.

Steps For Mean Mastering:

The commonly used term “Mean Mastering” is actually a misnomer, as there is no real mastering done during this process, aside from resetting the display to a zero position. This process relies on the LVDT probe manufacturer's declaration of linearity, and upon the stability of probe operation over time.
Generally, a probe is placed in a fixture, and using an external mesurement device, the column electronic gain is set to the required value in order to achieve a specified display value, based on the external gage's reading. Once set, the gain is not adjusted in the future. Only the display zero position is reset during the “mastering” process, if a nominally sized part is available.

Notes:
1/ Automastering will only work effectively if the fixture being used is repeatable. Over time, fixtures may lose their ability to give repeatable readings when the same master is removed and then re-inserted into the fixture. If this happens, the column electronic gain or zero may not be able to compensate for a wide measurement variation and may produce error messages during automastering.
2/ When a column is programmed for continuous TIR operation, the operation automatically reverts to Non-TIR mode during automastering. This means that TIR does not have to be manually turned off in order to automaster. However, if the operator wishes to visually verify that the automastering has been successful, then it will be necessary to manually turn the TIR off, as it automatically reverts to the “On” mode after automastering.
3/ While the software has been designed to provide an indication of the most common mastering errors, ***it is important for the user to confirm that the column has actually been correctly mastered. Following a mastering procedure, the Min and Max masters should be re-inserted to guarantee the correct positions on the display.***

5.30 T.I.R. OPERATION

T.I.R. (Total Indicating Readout) is often referred to as *dynamic reading,* because it involves rapid part measurement during a period of part movement within a fixture. Most often this involves rotation of a circular part within the fixture, and detecting maximum and minimum runouts. The L9100 column has a special measurement mode which allows it to detect part measurements very rapidly during part rotation.

The column may be placed in T.I.R. mode by following the steps of section 3.A1 under the “Utility” menu. When placed in "Max-Min" T.I.R. mode, the effective display “zero” is dropped from the normal 50% point of the display to the 20% point, allowing for greater usage of available display space. Resets will return the display to this position.

TIR Reset:
An external pushbutton (or relay contact) may be connected to the TIR reset connection terminals at the back of the column (see Fig. 2-2) if it is desired to manually set the display to the zero point when beginning a new part measurement sequence. It should be noted that, unlike previous versions of the L9100 column, a reset does not move the "electronic zero" control of the column, in the same way that automastering does. TIR reset is performed by means of software calculations rather than by changing the electronic control. If a relay contact is used to reset TIR, it must simulate the timing of a pushbutton press, and no external voltage should be applied to the connections (See section 2.31). Alternatively, one of the programmable pushbuttons (U1 or U2) may be set up to perform a reset, or to turn TIR on or off. A special automatic timer mode of operation is also available (See section 3.A4).

Max-Min, Max, and Min TIR

In the normal TIR operating mode, sample readings are made, and the display is updated at a moderate speed in a continuous mode. The peak readings are "latched" by the display, and so the the display will not change until the next sample which exceeds the previous peak is encountered. Because the display is being continuously updated, the sample rate, while adequate for most needs, may be too slow for some automated fixtures which require turning a part in a fixture rapidly, without missing peak points. For these situations, a special "Fast TIR" mode is available as described below.

Fast TIR

Section 3.A3 in the manual describes the programming for the "Fast TIR" mode. This allows for very rapid part sampling over a specified period of time, and is useful especially for automated part processing. To operate in this mode, the user still needs to program the TIR "Type" being used (Min-Max, Max, or Min). The fast TIR works by eliminating the continuous updating of displays while processing a part measurement. The user defines a time period for operation, and the part is turned during this period, while the column is sampling readings. Once the Fast TIR operation times out, the peak value encountered during the time period is displayed and held. At this point, the part may be removed and replaced with the next one. A TIR reset to the column will reset the display to off and initiates the next sampling time period.

5.40 DATA READINGS

The L9100 Column Gages are equipped with 2 modes of transferring data to an external device or computer.

A) Analog Signal Out

A connector is available on the rear of the column which provides a varying D.C. voltage output as the bar display changes. The voltage will vary from -5.00 volts at the bottom of the display, to + 5.00 volts at the top (+/- 0.1 volt). Each LED movement will cause the voltage to vary in 0.1 volt increments. This output is continuous and is not controlled by a “reading” pushbutton. It is suitable for interfacing to PLC analog cards or to any analog-to-digital converter for computer data uploading. See Fig. 1-3 (E) for connection information.

B) Digital Signal Out

A digital reading output is also available from the 9 Pin “DB” connector on the rear of the column. See Fig. 1-3 (B) for connection information. This is a standard computer serial connector, which allows for direct connection to the serial port of a personal computer without requiring a “null modem” adapter (i.e. use a "straight-thru" cable). A reading initiation “pushbutton” may be connected to the modular connector (as per Fig. 1-5), or to the analog out DIN connector, on the rear of the column. When the contacts are closed, the digital display will momentarily read “TRANSMIT”, and the currently measured value, as well as other programmed information (See Section 2.50) will be transmitted to the serial port. Alternatively, for automated systems, relay contacts may be used in place of a pushbutton to take the data readings. The user must configure the programming of the receiving device to accept the incoming data, to sort it, and store or use as needed. The column has no memory provisions for storing data. Some distributors may have special software/hardware packages available for this purpose.

Also, the cable carrying the data to the external device should not be extremely long, and may need to be shielded in order to avoid industrial electromagnetic interference.
NOTE: Columns with the new LCD graphics display cannot be mixed with previous generations of columns for modular connector data transmit interconnection (i.e. a bank of columns having both generations of columns).

6.00 EXTERNAL CONNECTIONS

6.10 Modular Connector Hookup

Two 6 pin modular connectors are provided at the rear of the column for purposes of external control and column interconnection. Refer to Fig. 1-3 and 1-5. The left connector (viewed from the back of the column) is the input and the right connector is the output. A special cable (Order # LC0706) is available for the user control functions, which include external TIR reset and Data Reading transmission (Duplicate connections for these 2 functions are also available on the "analog out" DIN connector). One end has a modular connector to plug into the column, and at the other end the wires are left bare for the customer to connect to external pushbuttons. External controls may be enabled and disabled in the programming .
The modular connector control functions are:

TIR Reset: With this connection shorted to the connector ground momentarily by a pushbutton, the TIR display will reset.

Data Read: When the "Ctrl. In" pin of the IN modular connector is shorted to the connector ground by a pushbutton or a relay type device, the column will send the current measurement reading, as well as other programmed information. The display on the front panel will read “Transmit” for a second while the reading is being transmitted.

Automaster: Closing this contact to the connector ground momentarily will cause the column to enter the “automaster” mode, and the column will be placed in the condition of waiting for the Min master to be inserted into a fixture. The next contact closure will force an electronic zero within the column (Min mastering if + pol.) . The next contact closure will cause the column to perform a gain adjustment to complete the calibration (Max mastering if + pol.) , and the column will return to the normal measurement mode. The primary purpose of this external automastering system (rather than the front panel buttons) is to allow a series of columns which are interconnected in a bank to be simultaneously mastered.

If more than one column is used at a gaging station, they may be interconnected by means of a series of short (6" long) modular jumper cables (Order # LC0707). The OUT connector of a slave column should go to the IN connector of the master column. See Fig. 1-5. This has 3 purposes:

1) TIR Master Reset: An external button connected to the 1st column in a string will cause all other columns which are interconnected to simultaneously reset when pressed.

2) Serial Communication:
   a) “Daisy Chain On” : If the first column in the series is connected to another data receiving device by means of the DB9 connector on the back of the column, it will transmit its data when the external pushbutton is pressed. Once sent, it will signal the 2nd column in the chain to transmit its data back through the first column and again to the serial port. This will continue in a “daisy chain” fashion until all of the interconnected columns have sent their data. Because of this system, only one column at a gaging station needs to be connected to the external data reading device, and the “read” button of the 1st column initiates the “reads” for all other columns in the chain in rapid succession. NOTE: Newer columns with the LCD graphical display cannot be interconnected for serial transmission with the older style red digital display columns.
   b) “Daisy Chain Off” : If the Daisy Chain function is disengaged (see sect. 2.50), then any one column in the chain will send only its reading to the extenal device. In this case, each column must be triggered individually for data readings.

3) Simultaneous Automastering: All columns in the string will Min master simultaneously, and then Max master simultaneously.

6.20 DB-9 SERIAL OUT CONNECTOR

The serial output connector is a standard DB-9 connector, but only two pin connections are used. Pin 2 is used to send the data readings to an exterior device, and pin 5 is the ground connection. The connector is wired so that a "straight-thru" serial cable can be used to connect to the receiving device (Not "Crossed"). Screw anchors are available on the connector for locking a cable connector to the column.

6.30 ANALOG OUT CONNECTOR

The Analog out DIN connector provides a varying DC signal voltage out as described in section 5.40. The voltage out is available on pin 1 of the connector with reference to the ground pin 2 (See Fig. 1-3). Pin 4 allows for external automastering control when momentarily shorted to Pin 2 (See Sect. 6.1). Pin 5 will initiate a data read from an external device when momentarily shorted to Pin 2 (See Sect. 6.1). Pin 3 will likewise perform a TIR reset. The user has the option of using the DIN connector or the modular connector for these control functions. The connector is a 5 Pin 180 degree DIN.

6.40 AUX IN CONNECTOR

This connector is used primarily in LVDT versions of the L9100 column, although it also provides a + and - 12 VDC out for special applications. The connector is 5 Pin, 180 degree DIN. See section 7.20 for usage of the AUX IN.

6.50 LVDT A and LVDT B CONNECTORS

These are 5 Pin , 240 degree DIN connectors. Wiring configuration is specified in Fig. 1-3 c, and in Section 7.

6.60 ADDITIONAL CABLES AND DEVICES

A number of other special products are available from Lance Instruments, including special cables, LVDT splitters, Air-to-Electronic converters, output relay options, etc. Consult the factory or your distributor for your needs. We can also provide custom equipment and software.

7.00 ADDITIONAL NOTES

7.10 AUX MODE EQUIVALENCY CHART

The column can be operated in an AUX mode (rather than normal LVDT). This mode is useful if mechanical leverage is being used for LVDT operation, or if the analog outputs of additional columns are being summed through the AUX-IN connector, or if Degree measurements are being made. There are 8 gain ranges available. The chart below shows which gain range the column automatically assigns if placed in LVDT mode.

SETUP MENU RANGE	EQUIVALENT AUX MODE GAIN RANGE
1 Thou	50 x
2-3 Thou or 20-30 uM.	25 x
4-7 Thou or 40-70 uM.	10 x
8-14 Thou or 80-140 uM.	5 x
15-32 Thou or 150-320 uM.	2.5 x
33-74 Thou or 330-740 uM.	1.0 x
75-100 Thou or 750-1450 uM.	0.5 x
1460-200 uM.	0.25 x

7.20 CONNECTING ANALOG OUTPUT OF ONE COLUMN TO THE AUX-IN OF ANOTHER

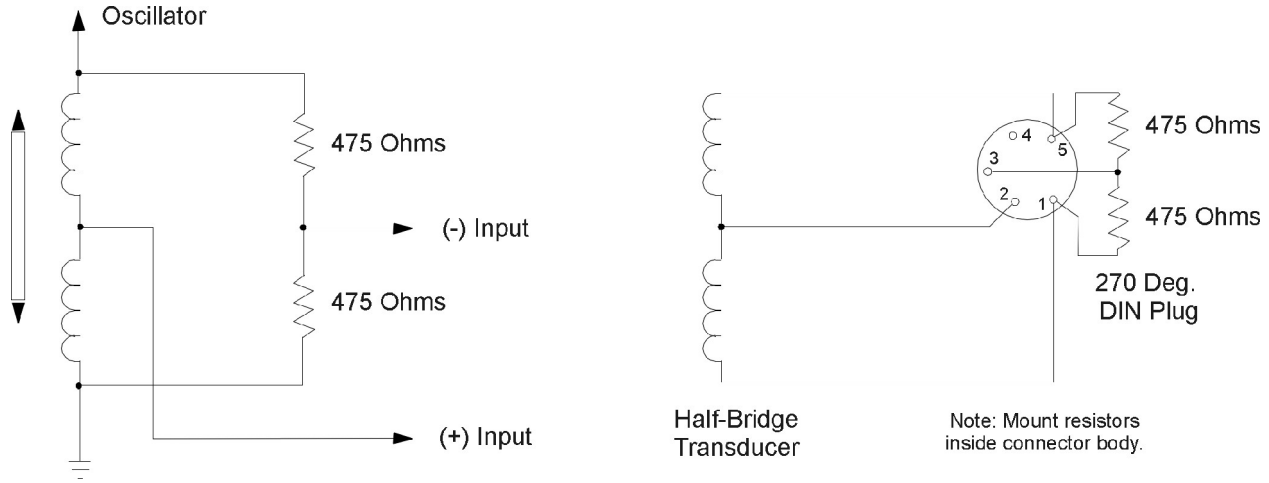
L9100 Columns are designed to allow the user to send the signal output (-5 VDC to + 5 VDC) to an external input of a 2nd column. Most often, the second column is an LVDT type, which has 2 inputs and therefore can be used for signal mixing. This allows the configurations where signal additions or subtractions are necessary to be displayed. The cable connects from the ANALOG OUT of the first column to the AUX-IN connector of the summing column. Cables are available fo this purpose. Order # LC0703 Single column analog out to 2nd column AUX-IN.
It is sometimes advantageous to place the column in AUX mode (rather than LVDT mode) in order to select a suitable gain range.

7.30 USE OF VARIOUS PROBE TYPES

a) Standard 5 Wire LVDT : This is the most commonly used transducer for the L9100 column. Wiring configuration is shown in Fig. 1-3

b) 4 Wire LVDT transducer: This is similar to the above 5 wire, except that the secondary winding centre tap is not brought out to the connector. When these types of probes are to be used, it must be specified when ordering the L9100 column, as the input circuity and configuration is different from the 5 wire unit.

c) 3 Wire Half-Bridge Transducer: These may be used with the standard 5 wire L9100 column, but the probe connector must be wired as shown in the diagram below, including 2 resistors in the connector.



d) 3 Wire Miniature High Frequency Transducer: Some miniature transducers use an oscillator frequency of approximately 50 Khz instead of the standard 5 Khz as produced by the L9100 column circuitry. When these types of probes are to be used, it must be specified when ordering the L9100 column.

7.40 PROBLEM RESOLUTION

[1] - NOTHING HAPPENS WHEN POWER IS APPLIED

- Check to ensure column is receiving 120 VAC (220 VAC Foreign units) at plug. This test should be done by a qualified person.
- With unit unplugged, check fuse at back of column. Replace with fuse rated 250v/ 1 amp if needed. To remove a fuse, the fuse housing must be pressed in and then turned counterclockwise.

[2] - SOME OF THE BAR DISPLAY SEGMENTS DO NOT LIGHT

- Check the programming for colours according to the manual

[3] - LCD GRAPHICS DISPLAY IS ABNORMAL ON POWERUP

- Microprocessors sometimes will go into an abnormal mode if power is not applied in a smooth manner. For example, if the column is plugged in such that the it connects and disconnects rapidly a few times, or if a power outage has the same affect, then the processor may go into an abnormal mode. Try unplugging the column, wait 10 seconds, and then re-apply power with a quick, firm motion. If the measurement digits are scrambled,re-program the "Setup" parameters, and particularly the NOMINAL part size.

[4] - COLUMN WILL NOT MASTER CORRECTLY

- See Section 5.20 for information regarding mastering problems.

[5] - TIR "User-programmable" BUTTON NOT TURNING TIR ON AND OFF

- Check to see if TIR is set to programmable operation in the "Utility" menu

[6] - MULTIPLE PART SELECTION OPTION NOT AVAILABLE

- Ensure that the Multiple Parts Option is engaged in the "Format" menu.

[7] - DISPLAY READS TOLERANCE *ONLY* EVEN THOUGH NOMINAL SIZE IS ENTERED

- If, at any point, a User-Programmable Button had been programmed to toggle the display between "Actual Value" and "Tolerance", the column may have been left in the "Tolerance" mode, even if no User button is currently programmed for this function. Program one of the 2 user buttons for this function, and check to see if the column is in "Tolerance" mode. If so, then set it to the "Actual Value" mode, and then the user-button may be returned to its original program setting if desired.

[8] - EXTERNAL CONNECTIONS FOR "Read", "TirReset", or "Automaster" NOT WORKING

- Check the wiring connections to the connector as per Fig. 1-3 . For example, for TIR Reset from the Analog Output DIN connector, Pin 3 must be shorted momentarily to Pin 2 in order to initiate a TIR reset. For TIR Reset, or Automaster on the Modular Connectors (IN), these pins must be momentarily connected to the ground pin of the modular connector. To initiate a "Read" from an external switch, the "Ctrl.In" Pin of on the "IN" Modular connector must be momentarily connected to the modular connector ground. NOTE: Do not use the case ground when wiring for a remote trigger.
- As a default condition, external triggers are usually turned "Off" in the column programming. In order to engage any one or more of the above external connection functions, the user must enable the external input in programming. See Ext. I/O under the "Options" menu category
- Check the insides of the modular connectors on the column rear to make sure that the pins are not being shorted out with metallic debree.

<u>NOTE:</u> Before connecting to the external control inputs, ensure that the connected equipment is not supplying any voltage to the column inputs. The connectors are dry-contact only, such as a manual pushbutton switch or the dry contacts of a mechanical relay. Solid-state relays should not be used for this purpose.

[9] - NO DATA OUTPUT FROM DB-9 CONNECTOR

- Data readings must be "initiated" from either a programmed front panel user button or an external source
- If an external input is being used to initiate a reading, it must be enabled in the software (Sect. 2.30)
- If the front panel display reads "TRANSMIT" when a reading is initiated, then check the serial cable being used. Cable must be a "straight-thru" type, where the receive and transmit lines are not crossed.
- If data is received, but information is missing, check the programmed protocol.

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REPAIRS

Instruments requiring repair should be returned to the **distributor where they were purchased**.
Equipment returned directly to Lance Instruments without prior authorization may not be accepted. Warranty repairs are made subject to the conditions outlined below.

WARRANTY

This product is warranted to be free from defects in materials and workmanship for a period of one year from the original date of shipping. The manufacturer will repair or replace, at its option, any part or parts that upon its inspection prove to have such defects arising under conditions of normal use and service as defined in this manual. Significant amounts of oil or liquid in pneumatic lines, or of metallic or other foreign debree inside the instrument may also void the warranty.

The manufacturer will not be liable for the loss of the product, or any other incidental or consequential costs, expenses, or damages incurred by the purchaser. This warranty does not cover damage resulting from unreasonable use, neglect, improper service or other causes not arising out of defects in material or workmanship.

Lance Instruments
1370 Matthew Brady Blvd.
Windsor, Ontario
Canada, N8S 4R6

Phone (519) - 945-3571 FAX (519) 945- 5268
Email lanceinstruments@gmail.com