

**L9100 MICROPROCESSOR COLUMN GAGE
LVDT and AIR Signal Conditioning**

OPERATING MANUAL

MANUAL REFERENCE

**L9100-M-001
Revision 09**

**For use with Columns
LVDT Ver. R26
AIR Ver. R25**

***LANCE INSTRUMENTS INC.,
WINDSOR, ONTARIO***

L9100 Series Column Gages
NEW FEATURES ADDED
July, 2004

Enhancements Common to L9100 Columns

Manual Revision 09, L9100 Air Rev. 25, L9100 LVDT Rev. 26

- *Programmable Display Colours: The L9100 Column now has a 3 colour programmable bar display available as an option. When ordered with this option, a menu item will allow the user to define various areas of the display in green (OK), amber (Hi and Lo Approach), and red (Hi and Lo Out-of-tolerance). Also available are 3 individual amber "markers" which can be moved to any area of the display. Part 1 and Part 2 can have individual colour setups. See Pg. 19 in the manual.*
- *New "Degree" Range: In addition to Inch and Metric ranges, a "Degree" range has been added for angular measurement. The range is from 0.1 degree full scale to 10 degrees full scale. See page 25.*
- *Serial 3 Communication Protocol: A third Serial output format has been added. This is identical to Serial 1 format except that a carriage return symbol (ASCII decimal 13) will be transmitted at the end of a reading transmission. This is useful for a group of columns which are daisy-chained together, so that the last column in the string can be programmed for serial 3 in order to identify the last transmission of data from the group. See page 30 in the manual.*
- *External I/O Enable-Disable: There are 3 column operation events which may be triggered via an external contact on the columns, either from the modular connectors or a DIN connector. These are (1) TIR Reset , (2) Read, and (3) Automaster. Each of these may now be enabled or disabled by the column programming. This is useful in situations where one or two of the above events are being triggered externally, and long cable runs from these inputs may be in close proximity to strong electromagnetic interference sources. In some cases, false triggering could occur in one of the above 3 items which are not being used. Turning the unused external input off from the menu will eliminate any possibility of this. See page 23 in the manual.*

TABLE OF CONTENTS

SECTION	PAGE
1.00 INTRODUCTION	
1.10 General	1
1.20 Specifications	2
1.30 Installation	3
2.00 MODEL L9100 PROGRAMMING AND OPERATION	
2.10 Description	7
2.20 Mechanical Setup	7
2.22 Front Panel Pushbutton and LED Functions	7
2.30 Powerup and Menu Structure	11
2.40 Column Program Mode	13
2.50 Manual Mastering and Calibration	25
2.60 Automastering	26
2.70 T.I.R. Operation	27
2.80 Data Readings	28
3.00 EXTERNAL CONNECTIONS	
3.10 Modular Connector Hookup	29
3.20 Serial Communications and Data Format	29
3.30 Connecting Analog Outputs to AUX-In Conn.	30
3.40 Additional Cables and Devices	30
4.00 ADDITIONAL NOTES	
4.10 Air Gage module air supplies	31

APPENDIX: Half-Bridge Transducers, Previous Revision History, Problem Resolution, Repairs & Warranty

List of Figures

1-1 Baseplate Mounting Details	4
1-2 Column and Signal Conditioning Module Pictorial Layouts	5
1-3 Signal Input/Output Wiring Connections	6
2-1a LVDT Column Flow Chart of Programming and Operation ...	8
2-1b AIR Column Flow Chart of Programming and Operation	9
2-2 Interconnection of Multiple Columns	10
2-3 Front Panel Pushbutton and LED Arrangement	11

OPERATING MANUAL

1.00 INTRODUCTION

1.10 GENERAL

The Model L-9100 Gaging column has been designed to provide a means of accurate dimensional gaging utilizing a variety of probe types, combined with the easy readability of a 10-inch LED bar display and an 8 digit alpha-numeric display. Depending on the application, the unit can be supplied for operation with either Linear Variable Differential Transformer (LVDT) probes, or back pressure air gage systems.

The LVDT model is dual-channel in that it will accept up to two gaging transducers at a time and display either one or any combination of the sum or difference of the two.

The Air Gage model is designed to work with standard air tooling and with a nominal centre scale pressure of 24 PSI. Front panel controls include both 'zero' and 'spread' air valves. An electronic gain control is provided to enable the instrument to cover a wide range of tooling requirements. Included in the unit is an internal pressure regulator which supplies a nominal 40 PSI regulated air pressure. Service air requirements are 80 -150 PSI.

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/Mean 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
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 combinations
Accuracy		1% of Full Scale
Digital Display		.2"H, 8 digit Alpha-numeric LED
Remote Status Output		
	- ON Status	+ 5 VDC
	- OFF Status	0 VDC
	- Maximum Load	20 MA
Analog Output		+5 to -5 VDC, 10 MA Max.
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 Board

Sensor Requirements:

Type		LVDT
Excitation Voltage		3 VAC
Excitation Frequency		5 Khz
Sensitivity		1.5 -6.5 MV / V / .001"
Maximum Burden		120 MA (Total all 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 inch (100 ranges)
	Metric	20 microns to 2000 microns (200 ranges)
	Degree	0.1 ° to 10 ° (100 ranges)

1.23 Air Signal Board

Supply Pressure	80 - 150 PSI
Outlet Pressure (max)	44 PSI
Pressure for centre scale	24 PSI
Signal Out (0 to full scale)	-5 to +5 volts Dc

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.

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. 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 24 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 and gently slide the unit out of its mating connector. Air modules have an additional nut which must be removed from the back inlet 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).

In addition to the standard scales available, scales for any of the selectable ranges can be provided which are printed on a heavy gage paper. A clear plastic insert is available for protection of the label. Alternatively, a disk or CD is available with all of the scales in a common word processing database, which the user can print out on a laserjet or inkjet printer. Please request any required scales at time of ordering.

2.00 MODEL L9100 PROGRAMMING AND OPERATION

2.10 Description

The L9100 signal conditioning modules, when combined with the L9100 display and power supply frame will allow direct bar graph readout from up to two LVDT signal probes for the LVDT version, or a single air input. Standard features include a +5 to -5 VDC analog output, an 8 character alpha-numeric display, serial output, total indicating readout, status output, and hardwire disabling of the primary security code. 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.

2.20 Mechanical Setup

The lower plug-in signal conditioning module is normally delivered installed. 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. For an air module, the air connector must be secured at the back of the case with a 7/16 - 20 nut. LVDT inputs are non-functional in an air column gage.

LVDT probes are connected to the rear of the cabinet to 5-pin DIN connectors marked LVDT-A and LVDT-B. 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 lockout of all setup programming, then the jumper pin on the printed circuit board must be in the correct position. Refer to Figure 1-3 for this setting.

2.22 Front Panel Pushbutton and LED Light Functions

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:

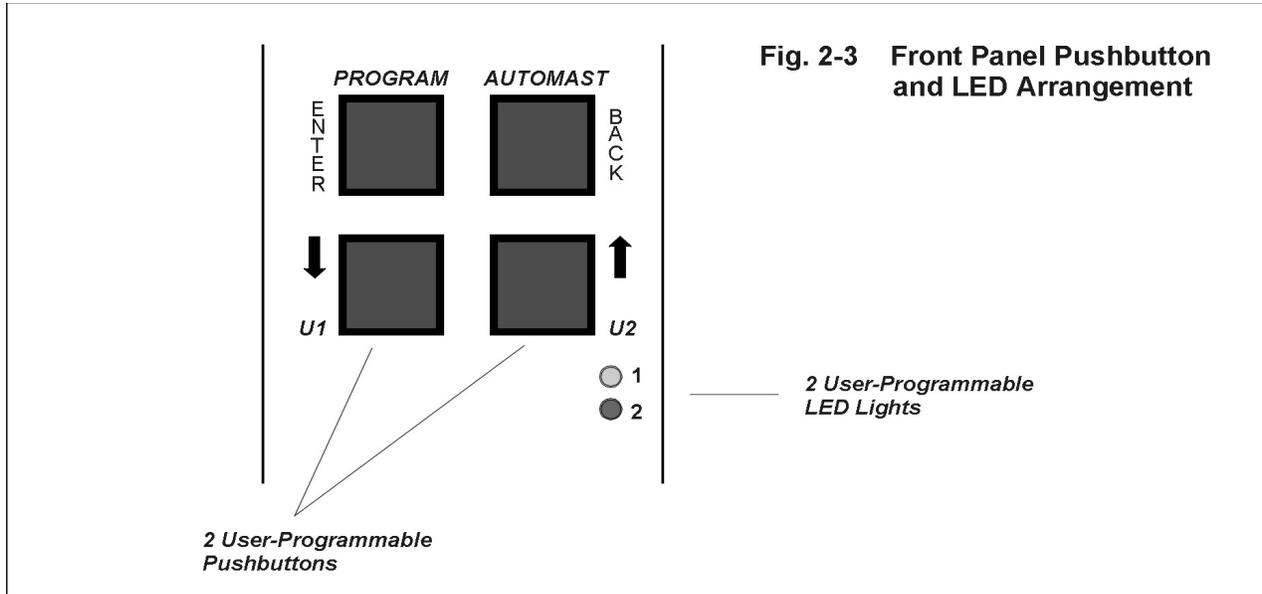
Pressing the upper left button will place the column in the Program Mode

Pressing the upper right button will place the column in the Automastering Mode

Pressing the lower left button will initiate a pre-programmed function for User 1, or U1

Pressing the lower right button will initiate a pre-programmed function for User 2, or U2

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.



When in the program mode (after the upper left key has been pressed once), 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 previously displayed selections.

Pressing the upper right button <Back> will allow the user to return to a previous menu option, or to back up by one digit in the case of entering a series of numbers.

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.

The user may return to the measurement mode either by scrolling to the Exit options of each menu level and pressing the <Enter> key, or by pressing the <Back> key to reverse through the menu layers.

There are also 2 LED's (Green for #1 and Amber for #2) on the front panel below and to the right of the pushbuttons, which are user-definable. The column menus allow the user to select from a list of conditions under which the LED's will light up.

2.30 POWERUP AND MENU STRUCTURE

Powerup

When the line cord is plugged into an AC outlet and power is applied, the digital display should immediately begin to read "L9100 Column Gage V:AXR24" (or LXR25) in a scrolling manner from right to left. If this display does not appear as described, then there is an operational problem and the column should not be used until it is resolved.

L 9 1 0 0 D i

Measurement Display

After powerup, the normal measurement display will appear, in either metric or inch formats as determined by previous programming.

0 0 . 0 0 0 0 0

Entering the Programming or Part Selection Modes

The upper left pushbutton on the front panel of the signal conditioning module is the <Enter> key for all programming. Pressing this key when the digital display is currently showing the part size will allow entry to either the program mode of the gage or a dual part selection routine (if engaged). A small pin jumper on the signal board allows the user to either engage or disengage a primary security ID

P R O G R A M

code requirement for entry to the program mode (See Fig. 2-1a or b). If disengaged, the next prompt seen in the program mode after pressing <Enter> is "Setup". If the ID code is engaged, (and set to a number other than "00000") then the user will be requested to enter a 5 digit number. If entered incorrectly, the display will flash "WRONG ID" for a few seconds and then return to the normal part measurement display. If correctly entered, the menu prompt "Setup" will appear. For Automastering or Dual Part selection from the menu, a secondary security code number is required to be entered if the (SI) code # is set to a number other than "00000".

W R O N G I D

Entering the ID #'s: The 1st digit of the 5 digit ID code will flash. Use the <Up> and <Down> arrow pushbuttons to increase or decrease the number to match the correct security code number (as previously set in the "Utility " or "Options" menus). Press <Enter> to advance to the 2nd digit. Repeat this procedure for all 5 digits. Pressing the <Backsp> button at any point will allow a re-entry of the previous ID code number.

I D # 0

When a new column gage is purchased, the default security code #'s are "00000". In this case, the user will not be prompted for an ID code entry. Any number other than "00000" will require operator ID entry.

Automastering

When the display is in the normal measurement mode, if the upper right "AUTOMAST" pushbutton is pressed, the column can begin an automated mastering procedure using Min and Max masters, or using a mean (nominal size) master.

Min/Max Mastering:

Pressing the <AUTOMAST> button once will cause the display to read "Min Mast". The Min master should be placed in the fixture at this point. When the <AUTOMAST> button is pressed again (a quick pulse press) , the electronic zero will be established in the column based on the Min master reading, and the user will then be prompted to place the Max master in the fixture. When the <AUTOMAST> button is again pressed, the electronic gain is configured within the column and the mastering sequence is complete. The display returns to normal measuring mode.

M i n M a s t

M a x M a s t

Mean Mastering (LVDT Only):

Pressing the <AUTOMAST> button once will cause the display to read "MeanMast". Once the nominal size master is placed in the fixture and the <AUTOMAST> button is pressed, the electronic zero of the column is adjusted to position the bar display to it's mid-point. The electronic gain is kept as previously established.

M e a n M a s t

See the section on "Automastering" in section 2.60 for a complete description of this procedure. An external connection on the column rear is also available for initiating the automastering sequence.

Dual Part Selection

The L9100 column has the capability of running 2 different parts by simply selecting from a menu PART 1 or PART2. If dual part capability is not engaged in the "Options" menu, then no selection menu item will appear in the column at this point. It is important to note that Part number selection may be accomplished in 2 ways:

1/ From the main menu (allows for a security ID entry)

2/ From the U1 or U2 pushbuttons if programmed for this function (no security ID entry).

The following parameters have separate values for Part 1 and Part 2 depending on the part number selected:

- Nominal part size
- Display range selection
- Part Polarity
- Min/Max or Mean Master setpoints
- Spec. Limit Hi/Lo setpoints
- Approach Limit Hi/Lo setpoints
- Mastering 'Zero' calibration setting
- Mastering 'Gain' calibration setting
- B balance
- Colour configuration of Bar display and Colour Markers

All other programmed parameters are common to both part setups.

Part #

On entering this mode from the menu, the user needs simply to press the up or down arrow keys to toggle between Part 1 or Part 2, and then press <Enter> to select.

If a user pushbutton (U1 or U2) have been programmed to select the Part number, then a single press of this button will toggle between Part 1 and Part 2, and the display will momentarily show which number is currently engaged.

Part 1

Part 2

All of the previously programmed values for the above parameters will be engaged for the column operation. When programming the setup for Part 1, select this part number and then follow the procedures as outlined in section 2.40. Then to program for Part 2, again select this part number, and follow the section 2.40 procedures again. Settings for both parts (from the above list) are maintained in memory, and will be maintained after powerdowns.

2.40 COLUMN PROGRAM MODE

Menu Flow Chart

Figure 2-1 shows the structure of the program menu for the L9100 column. If dual part operation is engaged (in "Options"), then the program parameters which follow will be associated with which part has been selected (see previous section). There are several main menu subsections which perform different tasks. These are:

1/ Setup - to establish function and polarity, range setting, nominal part size, and Min and Max mastering setpoints.

2/ Manual - this is used for manually adjusting the column electronic zero, the "B" channel gain (LVDT only), and the main electronic gain of the column.

3/ Mode - With LVDT columns, this allows the user to set the column up either for LVDT inputs, or in a special mode called AUX MODE, used primary when adding external Auxin inputs. For AIR columns, the gain range can be selected which is most appropriate for the air tooling used.

4/ Limits - The user can establish the positions of the Hi and Lo Specification limits, and Hi and Lo Approach limits, for control output. Also, the output can be configured for 1 of 3 basic control types.

5/ Display - Program the Bar display for the desired combination of Green, Amber, or Red Lights. Three Amber

coloured marker lights and be moved to anywhere on the bar display. (Note: Optional Feature)

6/ User - Two pushbuttons (U1 and U2) may be programmed by the user to perform any one of a list of functions. Also, 2 LED lights (Led 1 and 2) may be programmed to light from any one of a list of available conditions.

7/ Options - this is used to set up a secondary security number for both “Automastering” and “Part Number Selection “ (for dual part , menu mode only), and to engage or disengage the “dual part” capability.

8/ Utility - to establish the primary security ID code, station number, column number, TIR on/off, TIR Auto-reset delay time, Serial Output format, and Master format.

S e t u p

M a n u a l

M o d e

L i m i t s

D i s p l a y

Optional

U s e r

O p t i o n s

U t i l i t y

E x i t

Use the <Up> and <Down> arrow pushbuttons to scroll between these 6 main categories. The <Enter> key selects the currently displayed program category.

..Setup..

Pressing the <Enter> button while the display menu reads “Setup” will allow the user to modify current settings of function, range, nominal part size, and Min/Max master setpoints.

S e t u p

Parameter 1: POLARITY

The display to the right should appear first with the A channel polarity flashing.

The polarity of channel A may be changed from “+” to “-” by pressing the <Up> or <Down> keys, or may be turned off as a signal input by leaving the prompt displaying an underscore mark. Pressing the <Enter> key will advance the flashing cursor to the B channel (LVDT version only). Follow the same procedure here. For example, a positive value for A would produce an upward deflection on the display as the LVDT is pressed inward.

A : + B : -

Leaving the B channel at the underscore position would disengage the B channel from the column signal

processing. To subtract the Value of LVDT B from LVDT A, one would set A to "+" and B to "-". Air modules are set to either +A or -A. Press <Enter> to continue to the next item.

Parameter 2: UNITS

The display will now read either "Inches", "Metric", or "Degrees". Use the <Up> or <Down> keys again to scroll between these choices and press <Enter> to accept the selection.

I n c h e s

M e t r i c

D e g r e e s

Parameters 3 & 4: RANGE

This display should now flash the word "Range" for 3 seconds, and then display the current range setting. If "Inches" was selected for parameter 2, for example, then the display might read "10 Thou" (Thou--thousandths of an inch). If "Metric" had been selected, then the display might read "200 mic" (microns) for example. Use the <Up>/<Down> keys to scroll between the range selections and then press the <Enter> button to select the chosen units.

- Air Columns: Selecting a particular range changes the display range of the digital readout, and will not affect the electronic gain.
- LVDT columns: In "LVDT" mode, the range selection will determine both the digital display range and the appropriate electronic gain range. In "AUX" mode, the range selection will alter only the digital display range. The gain range to be used is determined by the user under a separate menu item (See "Mode" in 2.40). If the "Degree" scale is being used, then the column should typically be set up to run in "AUX" mode.

R A N G E

1 T h o u

Parameters 5 & 6: NOMINAL PART SIZE

The display will now flash "Nominal" for a few seconds, and then display 7 digits plus a decimal point. If you are working with tolerance readings only, then all of the digits can be left as zero's. If you wish to configure the column to display actual part size, however, then you may enter a value on this display which will represent the nominal part size, and this value will be added to the tolerance measurement. One of the user pushbuttons may be programmed to toggle the display between the actual part size and the tolerance if desired. The leftmost digit will display a flashing cursor first, and the digits may be incremented for decremented by using the <Up>/<Down> pushbuttons. To accept the 1st digit value, press the <Enter> button. The cursor will now move one digit to the right. Follow the same procedure until all digits have been entered. Pressing the <Enter> button on the last digit will advance the display to parameter 7. If you enter a digit incorrectly, you may return to the previous digit by pressing the <Back> key.

N O M I N A L

0 0 . 0 0 0 0 0

Parameters 7 and 8 : Max Master / Min Master

These bar positions are used to establish the reference points for the Max master and the Min master. In an LVDT column, these menu items will only appear if Min/Max mastering has been previously selected in the "Utility" menu.

Max Mast**Min Mast**

When the <Enter> button is pressed, the display will read "Max Mast". Use the <Up>/<Down> keys to raise or lower the height of the column bar LED segments to the desired position. There will be no change in the digital display during this procedure. When set, press the <Enter> button to set the "Min Master" bar height in a similar fashion. When the <Enter> button is again pressed, the column display will return to the SETUP prompt. The Min Master position can be anywhere from 0 lights on the bar up to 80 Lights, and the Max master position can range from 100 lights at the top down to 20 lights from the bottom of the display.

All changes made are programmed into the column at each step.

.. Manual ..**Parameter 1: ZERO BAR**

The first prompt presented to the user when the <Enter> button is pressed for manual programming is "Zero Bar". This refers to the electronic zeroing of the column and does not necessarily mean that an LVDT probe is centred or that an air module outlet pressure is at its zero reference.

Pressing the up or down arrow keys will deflect the bar lights up or down to allow the user to adjust the column zero reference. If an ERRZERO message is encountered when scrolling to the maximum or minimum travel, press the opposite arrow key to back the adjustment off slightly.

Manual**Zero Bar**

See the sections on mastering before adjusting the zero.

Press the <Enter> button to advance.

Parameter 2: "B" CHANNEL BALANCE

If 2 LVDT's are being used, an electronic gain control is available to adjust the balance between the 2 by controlling the gain of channel "B". Use the <Up> or <Down> keys to increase or decrease the gain to channel "B".

Once the sensitivity of channel B matches that of channel A then both channels may be calibrated simultaneously. If only one LVDT is being used, then ignore this adjustment. Press <Enter> to continue.

Bal "B" ch**Parameter 3: GAIN (GAIN ADJUSTMENT)**

The display will now read "GAIN" followed by a number. This function is the main signal gain adjustment for the column which is automatically altered during the automastering process. Press the Up or Down arrow buttons to manually increase or decrease the electronic column signal gain (respectively).

The number on the display right indicates the current gain setting, and ranges from 94 (min. gain) to 251 (max gain). For LVDT columns, this should be considered as a "fine tuning" gain adjustment, not to be confused with the more significant gain ranges as determined by the "Range" setting in Setup or the Aux Gain settings. Both A and B channel gains are affected uniformly by this adjustment. While adjusting this value, the bar height will move more rapidly when it is deflected to near the top or bottom of the display.

When the bar is at the zero position, no change will occur in the bar height at all as the gain is adjusted,

Gain 176**Zero Bar**

When mastering a part manually, it is usually necessary to go back and forth between the “Zero Bar” parameters and the “Gain” parameters several times, readjusting the column position each time until both the high limit positions and the low limit positions are correct. The <Back> button helps to simplify this process. LVDT setup involves an intricate balance between zero position and electronic gain, and highlights the advantages of using the automastering function.

.. **Mode** ..

LVDT COLUMNS

This menu item is designed to provide more flexibility for the user. Two choices are available, “LVDT MODE” and “AUX MODE”.

Parameter 1: LVDT MODE and AUX MODE

LVDT MODE: If this mode is selected, the column will be configured such that both digital display range and a matching column gain range will be established when the user selects a particular “Range” in the setup menu.

L v d t M o d e

AUX MODE: In this configuration, the digital display range will be adjusted when the user selects a “Range” in the setup menu, but the electronic gain range to be used can be selected separately by the user. The primary intent of this is to provide greater flexibility when the analog outputs of 2 or more columns are being summed through the AUX-IN inputs of a 3rd column. Being able to reduce (for example) the gain of the 3rd column while maintaining a particular display range can make this kind of setup simpler to configure. This mode should also be used for “Degree” measurements.

A u x M o d e

Additionally, this configuration may be useful when the column is used with non-standard LVDT’s or other devices which produce voltage outputs outside of the normally expected values for the column. Press the <Enter> button to select the mode. If you have selected AUX mode, then an additional gain setting menu will appear next.

Parameters 2 and 3: AUX GAIN RANGE ADJUSTMENT

If “AUX MODE” has been selected in the above step, then the display will momentarily flash with the message “AUX GAIN”, and then a currently selected AUX gain range will be shown. These range from a 1 times gain range (least signal amplification), to a 50 times range (most signal amplification) in 6 ranges. The designations are the inverse of the gains which are used for the RANGE selection in the “Setup “ menu. A comparison chart is shown below:

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.	5.0 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.	.5 X
1460-2000 uM.	.25 X

Scroll through these ranges using the up or down arrow buttons, and then press <Enter> to select.

1 0 x G a i n

AIR COLUMNS

When the <Enter> button is pressed when MODE is being displayed, the display will change to flash “Aux Gain” for a few seconds, and then will change to show the currently selected gain range. The ranges available are 1x

Aux Gain

8 x Gain

On previous column versions, only one gain range was available, which was equivalent to the 8x range. The ability to have greater variation in column electronic gain allows the user to work with a wider range of air fixture designs. During setup, it is best to start with the 8x range. If calibration cannot be achieved when the SPREAD control is all the way in, then a higher electronic gain range is required (12 x). If calibration cannot be achieved with the SPREAD control all the way out, then a lower electronic range (4x or 2x or 1x) is required.

.. Limits ..

Pressing the <Enter> button when the display reads "LIMITS" will allow the user to set the positions for both Hi and Lo specification points, and for Hi and Lo Approach limit points, as well as determine the output configurations. Upon special request, the "approach" areas on the bargraph display can be supplied with amber coloured LED's.

LIMITS

LIMIT OUTPUT CONFIGURATION

The display can be scrolled between 4 selections by pressing the up or down arrow keys:

1/ Spec Lim: Press <Enter> once to set the HI Limit bar position. Use the up/down arrow key to move the LED bar to the desired position. Press <Enter> again to set the Lo Limit position in a similar manner. Press <Enter> again to return to the SPEC LIM menu item. The allowable range for the Hi limit is from 10 LEDs from the bottom to 100 LEDs (top of scale). The range for the Lo Limit is from 1 LED (bottom of scale) to the Hi Limit position less 2 LED's.

Spec Lim

Hi Limit

Lo Limit

2/ AppLimit: Press <Enter> once to set the Hi Approach limit position. Use the up/down arrow keys to move the LED bar to the desired position. Press <Enter> again to set the Lo Approach position in a similar manual. If approach outputs are not needed, then the settings are irrelevant to the operation. Press <Enter> again to return to the AppLimit menu item. The allowable range for Hi Approach is from (Spec Lo + 2 Led's) to (Spec Hi -1 Led). The allowable range for Lo Approach is from (Spec.Lo +1 led) to (App. Hi -1). Note: If approach settings are moved beyond these points, they will default to:

App. Hi : Led # 60
App. Lo: Led # 40

AppLimit

AppHiLim

AppLoLim

3/ Output: Normal As-shipped units include a four-pin DIN connector with outputs as shown in the following

table. The output 'Type' selection provides reconfiguration of the three output lines to any of the following three types.

Press <Enter> to select between three output configurations:

Type	DIN Pin 1	DIN Pin 2	DIN Pin 3
1	Spec. Lo	OK	Spec. Hi
2	App. Lo	OK	App. Hi
3	App. Lo or Hi	OK	Spec. Hi or Lo

Output

Type 1

Type 2

Type 3

In addition to the above, on special order, all 3 spec. Limit outputs (Hi, Ok, Lo) plus the two approach limit outputs (App.Hi and App.Lo) can be wired out to a 6-Pin DIN receptacle. In this case, Type 1 must be selected.

4/ Exit: Press <Enter> to return to the LIMITS menu title.

Exit

.. Display ..

This menu item allows the user to configure the colours for various parts of the bar display. The 2 primary colours are RED and GREEN, and areas of the display appearing as AMBER are those where the RED and GREEN areas overlap. Also, 3 independent "Marker" lights may be programmed to appear anywhere on the display.

Display

1/ Colour: Pressing the <Enter> key when the display shows the menu item "Colour" will allow the user to program the bar display in colour segments which are usually associated with Hi and Lo limits, and optionally Hi and Lo "Approach" areas. Four programming steps are required as described below and in Figure 2-4.

Step 1: C1r1 -

20 C1r1

Use the up/down arrow keys to scroll the LED number from 0 to 90. The bar display (green) moves accordingly, with 0 representing the bottom of the display, and 90 representing the 10th LED from the top. This number represents the position of the lower transition point from green to red. If the final configuration is to include an "Approach" area in Amber, set the green bar position to include the amber area of the display. Press <Enter> to continue to step 2.

Step 2: C1r2 -

80 C1r2

Use the up/down arrow keys to scroll the LED number from the step 1 position up to 100. The bar display (green) moves accordingly, with 100 representing the top of the display. This number represents the position of the upper transition point from green to red. If the final configuration is to include an upper "Approach" area in Amber, set the green bar position to include the amber area of the display. Press <Enter> to continue to step 3.

Step 3: Clr3 -

30 Clr3

Use the up/down arrow keys to scroll the LED number from the lower red transition point (set in step 1) to the upper Red transition point (set in step 2) less 1 LED. This moves the lower red section of lights upward into the green area. Any area of overlap will produce an Amber colour, which usually represents an "Approach" area. If a lower Amber area is not desired, scroll to the minimum number allowed. Press <Enter> continue to step 4.

Step 3: Clr4 -

70 Clr4

Use the up/down arrow keys to scroll the LED number from the upper red transition point (set in step 2) to the position set in step 3 plus 1 LED. This moves the upper red section of lights downward into the green area. Any area of overlap will produce an Amber colour, which usually represents an "Approach" area. If an upper Amber is not desired, scroll to the maximum number allowed. Press <Enter> to return to the "Colour" menu item.

Special Colour Configurations

Creating an All Green Display:

- a/ Set Clr1 to 0 (bottom of bar)
- b/ Set Clr2 to 100 (top of bar)
- c/ Set Clr3 to 1 (minimum)
- d/ Set Clr4 to 100 (maximum)

Creating an All Red Display:

- a/ Set Clr1 to 50
- b/ Set Clr2 to 50
- c/ Set Clr3 to 51
- d/ Set Clr4 to 49

Creating an All Amber Display

- a/ Set Clr1 to 0
- b/ Set Clr2 to 100
- c/ Set Clr3 to 51
- d/ Set Clr4 to 50

Creating a TIR Type Display

- a/ Set Clr1 to 20
- b/ Set Clr2 to the Hi Limit Setpoint position desired (defines "OK" range)
- c/ Set Clr3 to 20
- d/ Set Clr4 to the same position as Clr2. If an "Approach" area in amber is desired, set Clr4 to a lower number than Clr2 as desired.

2 Part Configurations

It should be noted that 2 independent bar colour schemes can be used when the dual part feature is engaged, one for Part 1 and another for Part 2. This is useful for 2 separate parts, but it can also be used for a single part where 2 different colour patterns are desired. An example of this might be in TIR mode. A part could be set up for displaying TIR in part 1, and then Part 2 could be set up identically but in a non-TIR mode, with a different colour scheme.

2/ Marker : Use the up/down arrow keys to scroll to this menu item. Three independent light bar markers can be applied if desired, which could indicate centre "zero" position, master positions, approach areas, etc. All 3 can be moved anywhere on the display, or can be removed from the display.

The markers are always Amber in colour, so if they are positioned in an amber section of the display, they will not be visible. Press <Enter> to program these.

Marker 1:

5 0 M k r 1

Use the up/down arrow keys to scroll the position of Mkr1. Moving it to "0" will remove it from the display. Press <Enter>

Marker 2:

1 5 M k r 2

Use the up/down arrow keys to scroll the position of Mkr2. Moving it to "0" will remove it from the display. Press <Enter>

Marker 3:

9 0 M k r 3

Use the up/down arrow keys to scroll the position of Mkr3. Moving it to "0" will remove it from the display. Press <Enter> to return to the "Marker" menu item.

3/ Exit: Press <Enter> to return to the previous menu item.

Note: There are 3 independent markers for both Part 1 and Part 2.

.. User ..

The User menu allows the 2 lower pushbuttons and the 2 front panel LED's to be programmed for user-determined functions.

U s e r

1/ User1PB (U1) and User 2PB (U2): Pressing the <Enter> pushbutton from either of these 2 menu items will allow for the selection of a function for the pushbutton when in measurement mode. The function list includes the following:

- PB Off : Pressing the button will have no effect
- PB Tir<=>: Pressing the button will toggle the column mode from normal to TIR and back. Note that "TirUsePb" must be selected in the Utility menu.
- PB TirRes: Pressing the button will perform a TIR reset if the column is in TIR mode.
- PBPart12: Pressing the button will toggle between Part 1 and Part 2 selection if the column is set up for this operation in the "Options" menu. The display will momentarily show which part number will be programmed.
- PBRead: Pressing the button will initiate a measurement reading transmission to the serial port. The display will momentarily display "TRANSMIT".
- 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).

Press the up or down pushbuttons to scroll through the list, and press <Enter> to accept the desired function. The column menu will return to the User1PB or User2PB menu prompt.

U s e r 1 P B

P b O f f

P b T i r < = >

P B T i r R e s

21

P B P a r t 1 2

P b R e a d

P b A c t T o l

2/ Led1Set (1) and Led2Set(2) :

L e d 1 S e t

The user may program the 2 front panel LED lights to indicate a variety of operation functions when the column is in the display mode, as selected from a scrollable list. Press the <Enter> button from either of these 2 menu items to see the following list:

- Led Off : Don't have the LED come on at all
- LedTirOn: The LED will light when the column is in TIR mode.
- LedOnPt1: The LED will be lit when the column is in Part 1 mode. Part 1 / 2 must be enabled in the Options menu.
- LedOnPt2: The LED will be lit in Part 2 mode.
- LedInTol: The LED will be lit whenever the display is in tolerance, as established by the Hi/Lo Limit setpoints.
- LedOutTI: The LED will be lit whenever the display is out of tolerance.
- LedAppro: 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.

L e d O f f

L e d T i r O n

L e d O n P t 1

L e d O n P t 2

L e d I n T o l

L e d O u t T I

L e d A p p r o

Use the up or down pushbuttons to scroll between these selections, and then press <Enter> to select one. The menu will return to Led1Set or Led2Set.

..Options..

Parameter 1: SECONDARY SECURITY CODE #

The user may choose to establish a secondary security number (SI) in this menu. If set to "00000", then no SI # entry will be required for either automastering or menu prompted part number selection . (Part number selection from a programmed user button never requires an SI number entry.) Programming any number other than "00000" will require the user entry of the SI number for either automastering or for menu-driven part number

selection.

S I 0 0 0 0 0

Use the up or down arrow keys to scroll the numbers for each digit and the <Enter> key to advance.

Parameter 2: PART SELECTION ENABLING

The column may be set up to operate either for a single part, or for 2 parts of different sizes with the ability to select the programmed setup for each part. To engage the dual part activity, use the up/down arrow keys to toggle the display till it reads "Enable", and press <Enter> to accept.

This will cause the "PART#" display to appear in the Main menu. If 'Disabled', the PART# display will not be included in the main menu list of menu options. A list of those parameters stored individually for the 2 parts can be found in section 2.30.

P a r t

Parameter 3: EXTERIOR I/O ENABLING

There are 3 external contact controls which can be enabled if desired:

- 1- External TIR Reset
- 2- External READ
- 3- External Automaster

The above events (when enabled) will occur if the respective external contact is momentarily shorted to the connector ground pin (See Fig. 1-3) by either a pushbutton or a relay contact. The external TIR Reset can be triggered either from the analog output DIN connector or the modular IN or OUT connectors on the panel rear. The other 2 can be triggered only from the modular connectors. NOTE: Use the connector electrical ground pins only, and not a case ground.

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.

Ext I/O

A flashing message "Ext I/O" will appear for a few seconds after selecting the Part 1 / 2 Enable-Disable, and then the menu will read "ExtTirRes". Pressing the <Enter> button will allow the user either to Enable or Disable the external contact for TIR Reset. Use the Up or Down arrow keys to toggle between "Disable" or "Enable". The current status is always shown initially. Press <Enter> again to select and the menu will return to "ExtTirRes".

Use the Up/Down arrow keys to scroll to "ExtRead" (External Read for serial transmission), or "ExtMast" (For external Automaster triggering), or to "Exit" (to return to the "Options" menu title).

ExtTirRes

Ext Read

Ext Mast

Exit

.. Utility ..

Parameter 1: SECURITY CODE I.D. NUMBER

Utility

The first parameter displayed in the utility is the security code number. To change the current number, begin at the left digit (flashing) and use the Up/Down buttons to increment or decrement the digit. Press <Enter> to move to the 2nd digit. Repeat this procedure until all 5 digits are entered. Leaving all numbers as zeroes (or setting the onboard jumper - see Sect. 2.2) will remove the need to enter a security code number for programming.

ID 0000

23

Parameter 2: STATION NUMBER

The station number is presented next. This is simply a 2 digit number which can be encoded in the gage to identify which gage fixture the column is being used with. If readings are taken and transferred to another device, this number always precedes the data value in transmission. See section 2.50 for a detailed description of the serial communication protocol.

St# 01

Parameter 3: COLUMN NUMBER

Like the station number above, the column number is a 2 digit number to identify the column at a particular gaging station, and is likewise transmitted during serial communications.

Col# 01

Parameter 4: TIR

Use the Up/Down arrow buttons to select between an “On” state for the Total Indicating Readout (TIR - dynamic readings), an “Off” state, or a “TirUsePb” state, which allows one of the user-programmable pushbuttons to turn TIR on or off. TIR provides a measurement of the difference between the Maximum and Minimum values encountered before a reset occurs. If a circular part is being measured, then during one revolution the column will detect the minimum and maximum readings, and display the difference.

A remote master reset connection is available at the back of the gage.

Tir Off

Tir On

TirUsePb

Parameter 5 [TIR Autoreset]

If TIR has been turned “On” in the previous step, or if a user-programmable pushbutton has been programmed for TIR, then the user is presented with the option of engaging an “Autoreset” function if desired. When the part is removed from the fixture (therefore causing the bar display to move to a max or min position), the autoreset function will begin a timer countdown when a new part is inserted (therefore bringing the display back into range). After this delay time has expired, the column will automatically reset. The user can select a time delay of either 1 second, 2, 3, 4, 5, 7, or 10 seconds, or disengage the autoreset entirely if desired.

Reset Off

Reset 10

:

Reset 2s

Reset 1s

These values may be scrolled by pressing the Up or Down arrow keys. Press the <Enter> key to select. The trip point for reset is the top and bottom of the display in a non-TIR mode. If the fixture is designed such that part

removal will not exceed these trip points, then the autoreset function will not be operational.

Parameter 6 [Master Type Select - LVDT only]

The menu at this point will allow the user to select the type of mastering to be used for LVDT inputs. Use the up and down arrow keys to toggle between <MeanMast> (for mean mastering) or <MiMxMast> (for Min/Max mastering). Press the <Enter> key to return to the <Utility> submenu.

24

M e a n M a s t

M i M x M a s t

Parameter 7 [Serial Output Type]

Use the Up or Down arrow keys to select between SERIAL 1 ,SERIAL 2, pr SERIAL 3. Serial 1 is the normal format for digital data output from the column, and Serial 2 is a new protocol which is designed to interface to Rockwell Automation “DataMyte” collectors, and used with Quantum SPC software. See section 3.20.

Serial 3 is similar to Serial 1, except that an additional ACSCII carriage return is sent at the end of the transmission (Decimal "13", Hex "ØD"). Use this for the last column is a daisy-chained group.

S e r i a l 1

.. *Exit* ..

The column will return to normal measurement mode when the <Enter> button is pressed.

2.50 MANUAL MASTERING AND CALIBRATION

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 HI and LOW masters (or a MEAN master for LVDT) into the gaging fixture and press a single button for each. The gage will perform the necessary calculations and adjustments to calibrate itself.

However, it is often a good policy to manually master a column during initial programming and setup for the following reasons:

1/ If the column is an AIR unit, the electronic zero and gain adjustments should be set up to approximate mid span positions before pneumatic adjustments of “Spread” and “Zero” are made. 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.

2/ If the column is an LVDT unit, the electronic zero should be adjusted before the LVDT is plugged in to ensure that the bar display deflects to the midpoint (zero position) . This enables the user to “bodyset” the probe in its fixture initially to a mechanical zero position (the bar should deflect approximately to the midpoint when the LVDT is plugged in and a part with approximate nominal size is placed in the fixture).

Ensure that all Setup programming has been done before attempting to master.

Steps for Manual Min/Max Mastering of LVDT Columns:

[A] Follow initial instructions as described above.

[B] Place column in the “Zero Bar” mode of the *Manual* Menu . Place the MIN master in the gaging fixture and adjust the electronic zero (up/down arrow buttons) until the display is at the Lo limit position.

[C] Press the <Enter> key twice so that the display reads “Calibra.” Place the MAX master in the fixture and adjust column electronic gain by pressing the up or down arrow buttons until the display is at the Hi limit position. Press the <Backup> key twice so that the display again reads “Zero”, and with the MIN master in the fixture, check to see if the display is still at the Lo Lim position. If not, then repeat steps [B] and [C]. It is sometimes necessary to repeat these steps several times before the unit is calibrated. This highlights the advantages of using the automastering function. When done, press <Enter> to return to the MANUAL display and then Exit to return to normal measurement mode. If you have trouble achieving a calibration, it may be that the LVDT probe is not sufficiently well centred in the fixture (Bodyset).

Steps for Manual Mean Mastering of LVDT Columns:

[A] Bodyset the LVDT as described above in point 2.

[B] Place the column in the "Gain" mode of the Manual menu. Adjust the digital gain to the known position for

25

the LVDT probe being used (See chart in Appendix). NOTE: It is the user's responsibility to ensure calibration. We recommend that all calibrations be verified by the use of an external device when the gain setting is to be established.

[C] Press the <Backup> key twice till the display reads "Zero". With the mean master placed in the fixture, use the up or down arrow keys to bring the bar display to its mid point. (Note: Although a position other than mid-point may be selected manually, the automastering routine will always master to the mid-point.) Press the <Enter> key 3 times to return to the "Manual" menu item.

"B" Channel Balance Procedure for LVDT Columns:

[A] A Dial Gage which moves the plunger of an LVDT probe is generally required for this procedure.

[B] Turn both inputs on to +A +B

[C] Plug LVDT A into its input connector and move the dial gage a pre-determined distance (eg. On a 10 Thou range, move 4 thou which should move the display approximately 40 LED's if calibrated). Make note of the actual bar display position.

[D] Unplug LVDT A and plug it into the LVDT B input connector. Enter the "B Bal." menu (under MANUAL in the flow chart of programming). Move the dial gage the same distance or "spread" as was done previously. Press the up/down arrow keys to increase or decrease the B channel gain until the bar display is at the same position as was noted in step [C].

Steps for Manual Mastering of Air Columns:

[A] Follow initial instructions as described in point 1/ above.

[B] Place the MIN master in the gaging fixture, with the column in normal measurement mode. Adjust the *SPREAD* and *ZERO* pneumatic controls on the front panel so that the display is at the Lo limit point.

NOTE: Turning the Spread control clockwise has the effect of increasing the signal gain and therefore the overall spread between Lo and Hi limit positions. As it is adjusted, the display zero will also move. The zero control moves the bar position up or down. Air calibration involves an intricate balancing of these controls, which often takes several attempts, alternating back and forth between zero and spread adjustments.

[C] Place the MAX master in the gaging fixture. Adjust the *SPREAD* and *ZERO* controls again alternately until the bar display is at the Hi Lim position. Now place the Min master in the fixture and check to see if the bar display is at the Lo Lim position. If not, then repeat steps B and C until calibration for both masters is complete. If calibration cannot be achieved, then it may require an adjustment to the electronic gain - proceed to step D.

[D] If after attempting to do an air calibration, if the *SPREAD* control must be turned clockwise and can go no further then this is an indication that the electronic gain must be INCREASED. If the *SPREAD* control is too far out (Counterclockwise turns more than 15), then the electronic gain should be DECREASED. Manually Adjusting Electronic Gain: Enter the "Gain" submenu under the MANUAL menu category. Press the UP arrow button to increase signal gain, or the DOWN arrow button to decrease. The display will slowly move as gain is changed (unless it is near the display mid-point). Never leave electronic gain at maximum (251) or minimum (94) positions as there will be no room for the electronic gain in the column to move when you automaster. Ideally, you should try to keep it within the mid 60% of its total range.

2.60 AUTOMASTERING

Once the column has been initially programmed, and the necessary Manual mastering functions have been performed as described above, then the column Automastering function can be used for rapid mastering using Min and Max masters.

Steps For Automastering (Min/Max):

[1] From the Measurement Display mode, press the <AutoMast> button once (with a pulse action). The display should now read "Min Mast".

[2] Place the Min Master in the fixture. Press the <AutoMast> button. The display will move to the Min position.

Note - ERRZERO message:

If an ERRZERO message appears with LVDT columns, it means that the LVDT probe position is currently not within the range of the column's electronic zero adjustment (usually meaning that the probe has not been properly "bodysset" or that an incorrect master is being used). With Air columns, most likely the initial manual calibration has not been performed correctly, or the wrong master is being used. Press

26

the <Enter> button to clear this message and correct the problem before trying again. The display will return to the normal measurement mode when the error message is cleared, and to the original calibration spec's.

[3] The display should now read "Max Mast". Place the Max master in the fixture and press the <AutoMast> button.

The bar display should now be at the Max master position.

Note- ERRGAIN message:

If this message appears, then the master is requiring the column electronic gain to move beyond its range of adjustment. The Max master may be incorrectly sized, or the Max Mast position in the setup may be incorrect, or the scale (or gain scale) being used may be incorrect, or there may be a problem with the fixture. For air columns, the initial manual calibration may have been done with the electronic gain too close to maximum or minimum positions. Press the <Enter> button to clear the error message. The display will return to the normal measurement mode, and the original gain and zero calibration values will be maintained.

[4] Upon successful automastering, the display will return to the normal measurement mode. Check to verify the correct display position with the MAX master in place, and then re-insert the MIN master and verify the correct display position.

Steps for Automastering (Mean - LVDT Only):

This procedure is similar to the above, except that the "Min Mast" display item will read "Mean Mast", and the mean master of nominal part size should be inserted at this point into the fixture. Pressing the <AutoMast> button will electronically zero the column, and the current gain setting as established in the "Utility" menu will be maintained.

If the ERRZERO message does not appear (See above) then the column has been correctly zeroed and the display will return to normal measurement mode.

Notes:

1/ Once an air column has been mastered, the pneumatic "SPREAD" and "ZERO" controls should not be moved if the automastering function is to be used. The column electronic gain should be sufficient to calibrate and correct any daily changes or fluctuations in air pressure. If the pneumatic controls are moved periodically, then sooner or later a condition may be reached where the electronic Gain or Zero is at maximum or minimum positions.

2/ 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 ERRZERO or ERRGAIN error messages during automastering.

3/ When a column is programmed for 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.

2.70 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 measurement resolution which allows it to detect new part measurements very rapidly during part rotation.

The column may be placed in T.I.R. mode by following the steps of section 2.40 under the "Utility" menu. When placed in T.I.R. mode, the effective display "zero" is dropped from the 50% point of the display to the 20% point. Since T.I.R. readings can never be negative, this allows for greater usage of the display. 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.

27

Alternatively, one of the programmable pushbuttons (U1 or U2) may be set up to perform a reset, or to turn TIR on or off.

The procedure is usually to place the part to be measured in the fixture, press the reset button, and then rotate the part once in the fixture. As the part is rotated, the column will detect variation in size, and continuously calculate the difference between the maximum measurement encountered and the minimum measurement encountered during the cycle. This difference will be displayed and held at the greatest value encountered during a revolution.

If the auto-reset function has been engaged (See "Utility" menu programming), then the reset timeout will commence once a new part has been placed into the fixture. At the end of the delay time, the column will perform it's electronic zero reset.

If an ERRZERO message is encountered during a TIR reset, it means that the reset has been activated either without the part in the fixture or that the gage needs to be recalibrated. The electronic zeroing of the column has not been able to compensate for the problem. Press the <Enter> key once to clear the message and correct the gaging fixture problem before resetting. It should be noted that if a programmable pushbutton is being used to turn TIR on or off, a part or a master should be kept in the fixture when the TIR mode is turned "on" again, as a reset is automatically performed. If no part is in the fixture at this point, the ERRZERO message may appear.

2.80 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 convertor 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. A reading "pushbutton" may be connected to the modular connector (as per Fig. 2-2) 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 the assigned station number and column number 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 "protocol", or data format used, is defined in section 3.20.

3.00 EXTERNAL CONNECTIONS

3.10 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 2-2. 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. 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 disabled in the programming (See pg.23)

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

Data Read: When this connection is shorted to ground by a pushbutton or a relay type device, the column will send the current measurement reading, as well as the station number and column number to the serial port for transmission to another device. The display on the front panel will read "Transmit" for a second while the reading is being transmitted.

Automaster: Closing this contact to 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, and the display will read "Hi Lim", as it waits for the Max master to be inserted. The next contact closure will cause the column to perform a gain adjustment to complete the calibration, and the column will return to the normal measurement mode. If errors are encountered during the mastering process, then the normal ERRZERO or ERRGAIN messages will be displayed, and the contact closures will clear these messages. 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). See Fig. 2-2. 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) Daisy Chain Serial Communication: 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 bus, and the "read" button of the 1st column initiates the "reads" for all other columns in the chain in rapid succession.

3) Simultaneous Automastering

3.20 SERIAL COMMUNICATIONS HOOKUP AND DATA FORMAT

The L9100 column gage has been designed to connect directly to the serial port on most common PC's without the need of a null modem. The data is transmitted on pin 2 of the DB-9 connector, which, in most cases will allow for a direct connection to the DB-9 serial port on the computer, which receives on pin 2. Communication speed is 9600 BAUD.

The protocol of the transmitted data for all L9100 columns takes the following format:

29

SERIAL TYPE 1

ABCDEFxGHIJKL For imperial measurements (inches)
ABCDEFxGHIJKL For metric measurements (mm.)

SERIAL TYPE 2

xFGHIJKL For imperial measurements (inches)
xFGHIJKL For metric measurements (mm.)

SERIAL TYPE 3

xFGHIJKLy For imperial measurements (inches)
xFGHIJKLy For metric measurements (mm.)

where A is the ascii character "a" signaling that a new data reading is being transmitted.(Hex 61, Dec. 97)
BC = 2 digits representing the station number (for example "01" for station 1)
DE = 2 digits representing the column number (for example "05" for column 2 of that station)
x = a "+" or a "-" sign indicating reading polarity
Next 7 digits (F,G,H,I,J,K,L) + decimal = measured value.
y = ASCII character 13 (Hex. 0D) for last column signalling

This protocol is applicable to all columns with serial numbers of 980075 or greater. Serial numbers of columns produced before this had a slightly different protocol. A change was necessary because the early versions did not transmit polarity and contained no character to indicate a new measurement was commencing. If you have L9100 columns with serial numbers less than 980075 and the change of protocol for new columns poses a problem for your use, please contact the factory. Serial Type 2 became available only on columns with serial numbers of 001133 or greater. This setting is required when interfacing to Rockwell Automation "Datamyte" series of data collectors. Serial 3 became available as of Aug.1 /2004 for serial numbers 041072 or greater.

For more information on connecting Lance L9100 columns to Rockwell Automation equipment contact:

In Canada:
Rockwell Automation Canada Inc.
12 Raglin Place
Cambridge, Ontario N1R 7J2
Phone(519) 740-5509 FAX (519) 740-5542

In USA:
Rockwell Automation Headquarters
1201 South Second Street
Milwaukee, WI 53204-2496

3.30 CONNECTING ANALOG OUTPUT OF 1 COLUMN TO THE AUX-IN OF ANOTHER

L9100 Columns are designed to allow the user to send the signal output (-5VDC to + 5VDC) to an external input of a second column. Most often, the second column is an LVDT type, which has 2 inputs and therefore can be used for signal mixing. This allows for configurations where signal additions or subtractions are necessary to be displayed. The cable connects from the ANALOG OUT of the first column(s) to the AUX-IN connector of the summing column. Cables or mixer boxes are available for this purpose:

Order # LC0703 Single Column Analog Out to 2nd Column Aux-In
Order # LC0708 2 or 3 Column Analog Out Mixer Box to LVDT Column Aux-In

There are often cases where a specific range is required for display purposes on the summing column, but the signal gain normally associated with that range would not be compatible with the analog output signal from the sending column. To remedy this condition, the column can be placed in AUX MODE (See section 2.40 "Mode"). In this operation mode, the RANGE selection of the Setup menu merely defines the digital display range used, and the column gain range to be used may be selected independently. It may take some experimentation to find which gain range is best suited for the particular application.

30

3.40 ADDITIONAL CABLES AND DEVICES

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

4.00 ADDITIONAL NOTES

4.10 AIR GAGE MODULE AIR SUPPLIES

Air gage tooling should be connected to the front panel air fitting and a clean, dry air supply at 80 to 150 psi connected to the rear panel inlet fitting. The filter used in the air line should be capable of filtering liquid particles as well as oil vapour. (*Example: Norgren Models F08-200-AIDA and F40-200-AOPA together or an equivalent*) .

APPENDIX

1/ LVDT GAIN SETTINGS

The following represent the approximate electronic gain settings for LVDT probes used with the L9100 columns.

Solartron AG1 or AX/1.0	Rated Sensitivity 210 mV./V/mm.	Column Gain Setting 146
Solartron AGZ0-5	Rated Sensitivity 281 mV./V/mm.	Column Gain Setting 115

CAUTION:

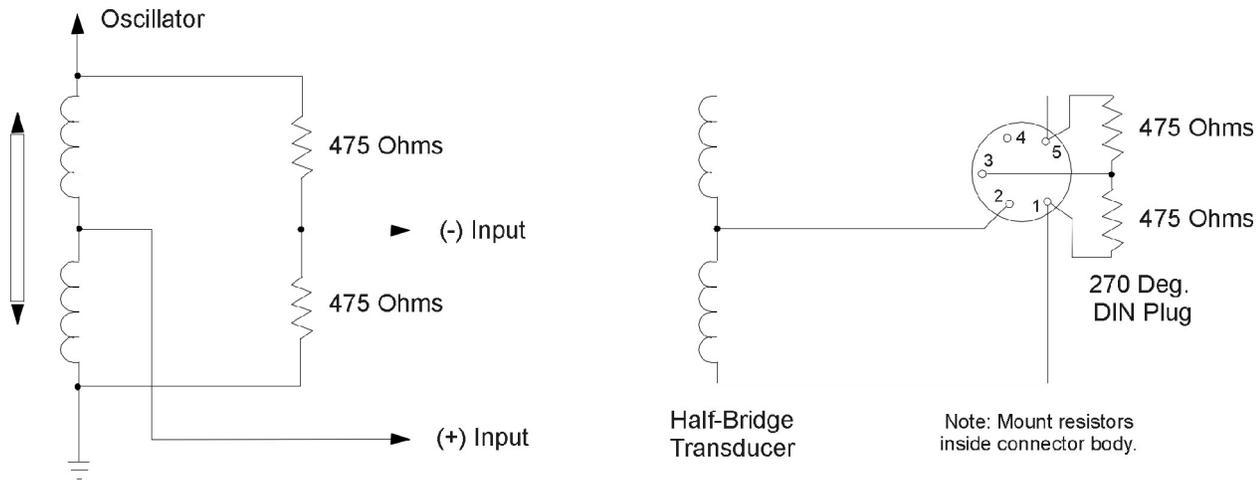
The above values are listed as a guide for initial setups of LVDT probes. Precise settings may vary depending upon the particular probe, environmental considerations, and column calibration. Since the user is responsible to ensure correct calibration, we recommend that a barrel micrometer be used to confirm the accuracy of any gain setting when mean mastering is employed.

2/ HALF-BRIDGE TRANSDUCERS

Half-Bridge transducers may be used with the L9100 columns when wired in the configuration shown below. We recommend that the user verify the operation and correct calibration of any column used in conjunction with a transducer wired for half-bridge operation before being placed in service.

Schematic

Transducer Cable Wiring



3/ PREVIOUS REVISION HISTORY

AIR COLUMNS

Revision #

Changes

Revision #	Changes
2.0	<ul style="list-style-type: none"> - Added Automastering capability - Added TIR capability - Added serial output capability - Changed menu format
2.1	<ul style="list-style-type: none"> - Changed opening menu to show version number - Changed menu structure so that automastering does not require ID entry - Added external automaster initiation from back connector - Added calibration error messages (ERRZERO, ERRGAIN) - Changed "Zero" menu label to say "Nominal" - Added hysteresis to Hi/Ok/Lo outputs to avoid relay "chatter"
2.2	<ul style="list-style-type: none"> - Added TIR Auto-reset with time delay selections - Added digital readout to manual electronic gain adjustment - Changed existing Hi/Lo limit labels to read Max Mast and Min Mast - Added separate Hi/Lo limit bar positioning in a new menu category
2.3	<ul style="list-style-type: none"> - Added approach limit capability - Added 2 mm. and 2 Thou ranges - Added Serial output type selection (Ser.1/Ser. 2) - Added 5 user-selected gain ranges
2.3a	<ul style="list-style-type: none"> - Added Dual Part Capability - Added Secondary Security codes for Dual Part and Automastering
2.3b	<ul style="list-style-type: none"> - Changed range selection from 14 ranges to 200 ranges
2.4	<ul style="list-style-type: none"> - Changed to square, 4 pushbutton panel layout with programmable buttons - Added 2 Front panel user-programmable LEDs - Added enhanced digital filtering to reduce flicker on sensitive ranges .
2.5	<ul style="list-style-type: none"> - Increased range of MIN and MAX master positions (Full 80 LED movement) - Added optional programmable colour bar display. - Added "Degree" Range

- Added Serial 3 Communication Protocol
- Added Menu item to Enable/Disable External Controls

LVDT COLUMNS

Revision #	Changes
1.5	- Modified software to maintain "B" channel gain setting after powerdown
1.6	- Changed TIR zero position from 50% of full scale to 20% of full scale
	- Changed Hi & Lo adjust cotrols to allow either to go to bar zero point
2.0	- Added front panel TIR reset and on/off option.
2.1	- Enhanced automastering range to cover full bar display scale
	- Modified software for storing gain after powerdown when automastering did not move the electronic gain
	- Changed serial output protocol to include "+/-" polarity and new reading character flag "A".
2.2	- Changed opening menu to show revision number
	- Changed menu structure so that automastering does not require ID entry
	- Added external automaster initiation from back connector
	- Added calibration error messages (ERRZERO, ERRGAIN)
	- Added "Mode" menu item which allowed for independent gain scale selection when adding signals.
	- Changed "Zero" menu label to say "Nominal"
	- Added hysteresis to Hi/Ok/Lo outputs to avoid relay "chatter"
2.3	- Added TIR Auto-reset with time delay selections
	- Added digital readout to manual electronic gain adjustment
	- Changed Hi/Lo limit labels to read Max Mast and Min Mast
	- Added separate Hi/Lo limit bar positioning in a new menu category
	- Added Mean mastering capability
2.4	- Added approach limit capability
	- Added 2 mm. and 2 Thou ranges
	- Added Serial output type selection (Ser.1/Ser. 2)
2.4a	- Added Dual Part Capability
	- Added Secondary Security Code for Dual Part and Automastering
2.4b	- Changed range selection from 14 ranges to 200 ranges
2.5	- Changed to square, 4 pushbutton panel layout with programmable buttons
	- Added 2 Front panel user-programmable LEDs
	- Added enhanced digital filtering to reduce flicker on sensitive ranges
	- Increased range of MIN and MAX master positions (Full 80 LED movement)
2.6	- Added optional programmable colour bar display.
	- Added "Degree" Range
	- Added Serial 3 Communication Protocol
	- Added Menu item to Enable/Disable External Controls

4/ PROBLEM RESOLUTION

[1] - NOTHING HAPPENS WHEN POWER IS APPLIED

- Check to ensure column is receiving 120 VAC at plug
- With unit unplugged, check fuse at back of column. Replace with fuse rated 250v/ 1 amp if needed.

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

If the column is a non-programmable colour type then:

- Remove lexan front panel and examine lights. If a series of 10 are not lighting, then the bar display unit may have been inserted backwards (check for a small chamfered area on one corner and compare polarity with other light segments.)
- Check to see if the bar display has been properly inserted into the socket (i.e. leads are not bent outward at socket base).
- Ensure that LED display is firmly inserted into socket and that pins are not bent.

If the column is a programmable colour type:

Check the programming for colours according to the manual (pg. 19 of R09)

[3] - DIGITAL DISPLAY IS SCRAMBLED ON POWERUP

- Microprocessors sometimes will go into an abnormal mode if power is not applied in a normal manner. For example, if the column is plugged in such that 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 digital characters are still not-normal, re-program the "Setup" parameters, and particularly the NOMINAL part size.
- If using Part 2 for the 1st time, scroll through the SETUP menu to initialize the NOMINAL part size.

[4] - COLUMN WILL NOT MASTER CORRECTLY

- Air columns require a proper balance between electronic gain and zero settings and the pneumatic Spread and Zero control settings. If the pneumatic controls are too far out of range for the fixture, then the electronic adjustments may not have sufficient range to compensate. Make sure that the Gain Range is appropriate for calibration. See the manual sections 2.50 and 2.60 .
- Ensure that the inlet air pressure is at least 80 psi. for air columns.
- Air columns may not calibrate properly if the internal pneumatic lines are filled with oil (due to improperly filtered incoming air supply to column). Unplug column, remove module, and visually inspect for this.
- In LVDT columns, if signal mixing is not being performed, make sure that the MODE menu item is programmed for "Lvdv Mode", and not "Aux Mode".
- For LVDT columns, check that the LVDT probe is properly "bodysset" for null position (See 2.50 / 2)
- Ensure that the gage fixture is not damaged and that the masters used are the right ones.
- Check your Min Mast and Max Mast positions in setup to verify correctness, as well as other setup parameters.
- If a 2nd column unit is available, see if it will master correctly under the same setup settings.
- Make sure that TIR is off (columns can automaster with TIR on, but the display position may make it appear that the mastering has not been successful).
- ERRZERO message indicates that the MIN Master is not in the column's operating range
- ERRGAIN message indicates that the MIN Master and the MAX master are showing either too great of a difference between them, or too little difference. Check for bar height consistency as the part is rotated in a fixture, and as the master is inserted and re-inserted several times.
- Check to see if you are trying to master (for example) a "Part 1" using "Part 2" masters.

[5] - AIR COLUMN DISPLAY MOVES AS A CYLINDRICAL PART IS ROTATED IN A FIXTURE

- In some cases, with air tooling, a part inserted in a gaging fixture may not appear balanced. In other words, a spindle being rotated within a cylindrical fixture may vary the display reading even if the part is perfectly cylindrical. In this case, stoning the jets of the air tooling may be required. This involves making a very slight countersink in the jet orifice to allow escaping air to "fan out" more uniformly in all directions. Consult the gage manufacturer on this. The recommended total jet clearance referenced to the Min Master is 0.0025" (0.0635 mm.). For example, if 4 jets are used in the spindle design, and the total jet clearance is chosen to be 0.0016", then the clearance per jet with the Min Master in place should be $.0016 / 4 = 0.0004$.

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

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

[7] - Part1/Part2 "User-programmable" BUTTON NOT WORKING

- Ensure that Part1/Part2 option is engaged in the "Options" menu.

[8] - 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. (See pg. 21 in manual)

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

- Check the wiring connections to the connector as per Fig. 1-3 . 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 (Pg. 23 in manual)

NOTE: 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 relay.

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 debris inside the instrument may also void the warranty.

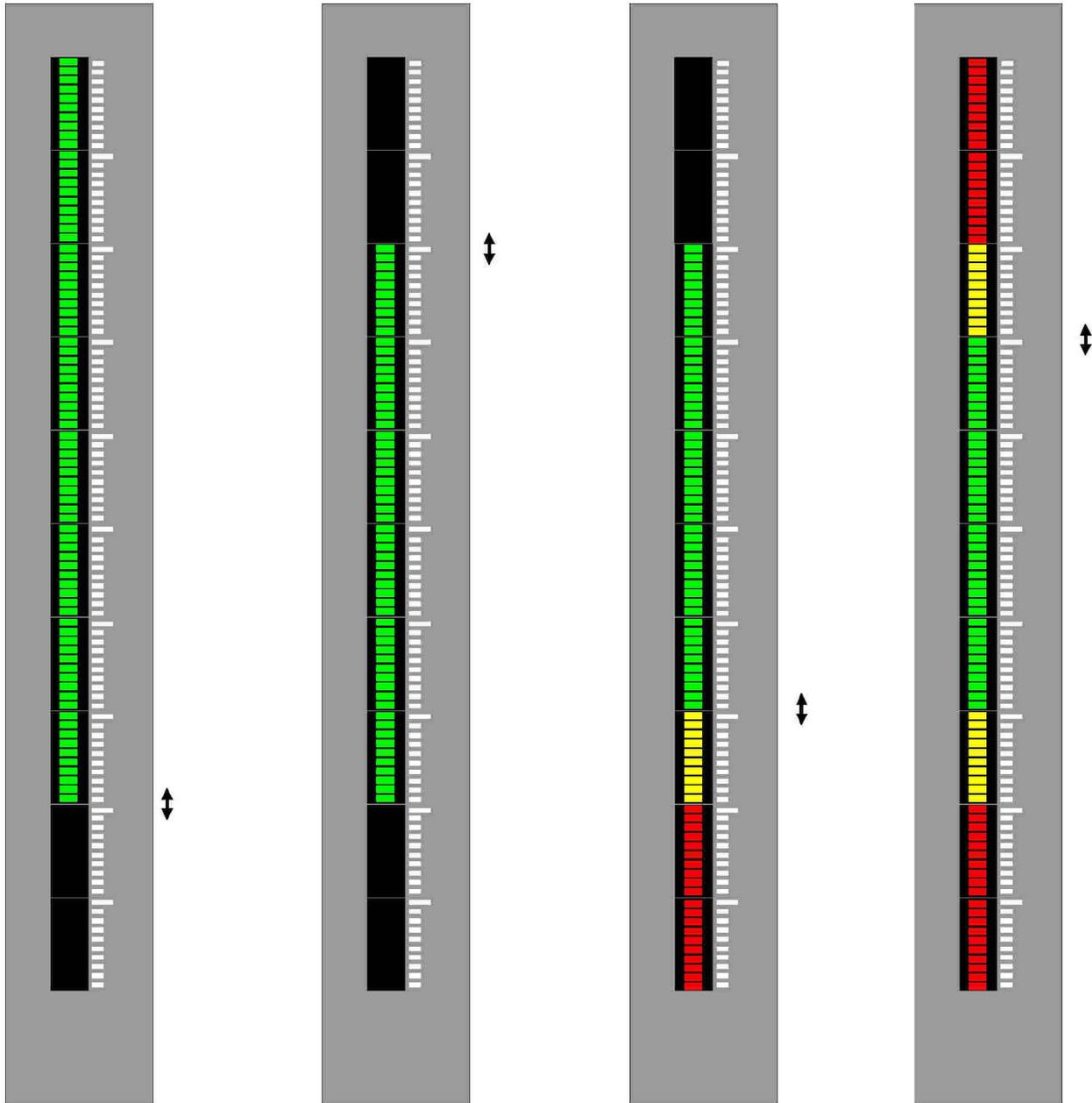
The manufacturer will not be liable for the loss of the product, or any other incidental or consequential costs, expenses, or damages incurred by the purchaser. This warranty does not cover damage resulting from unreasonable use, neglect, improper service or other causes not arising out of defects in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

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

Phone (519) - 945-3571 FAX (519) 945- 5268

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>.

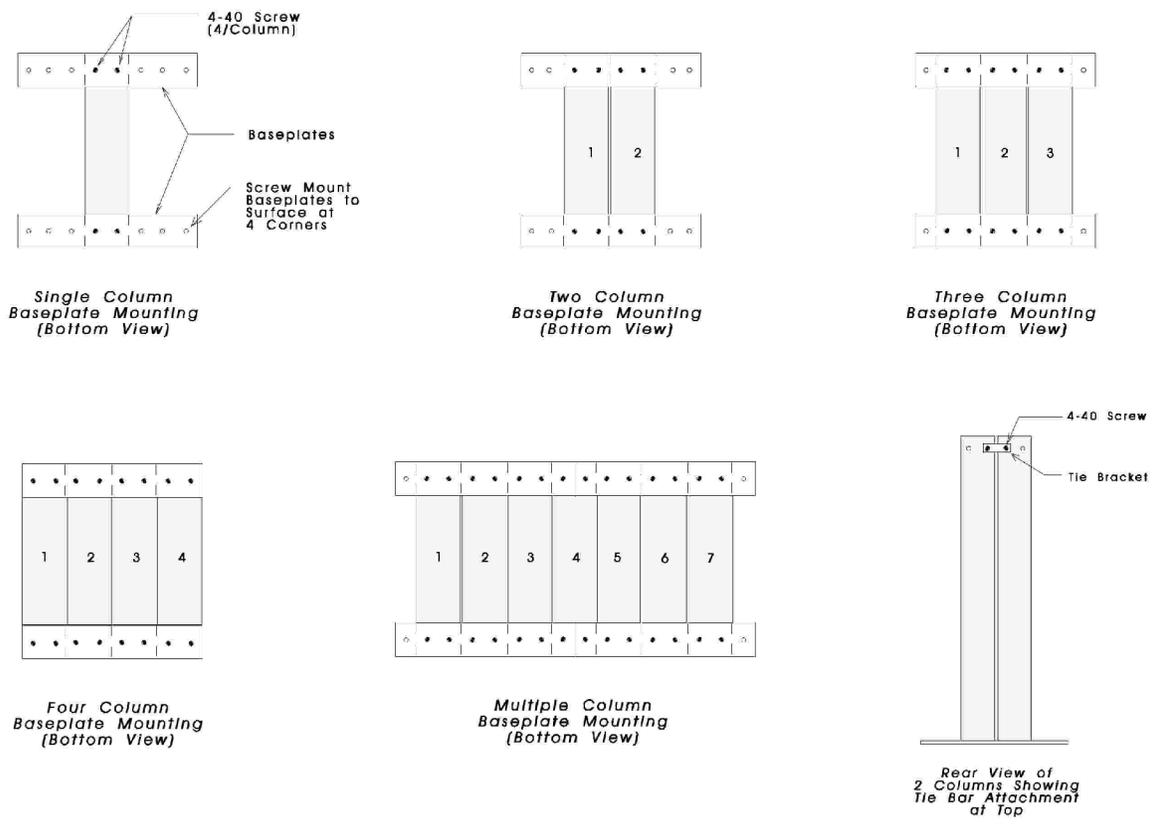


Fig. 1-1 BASEPLATE MOUNTING DETAILS

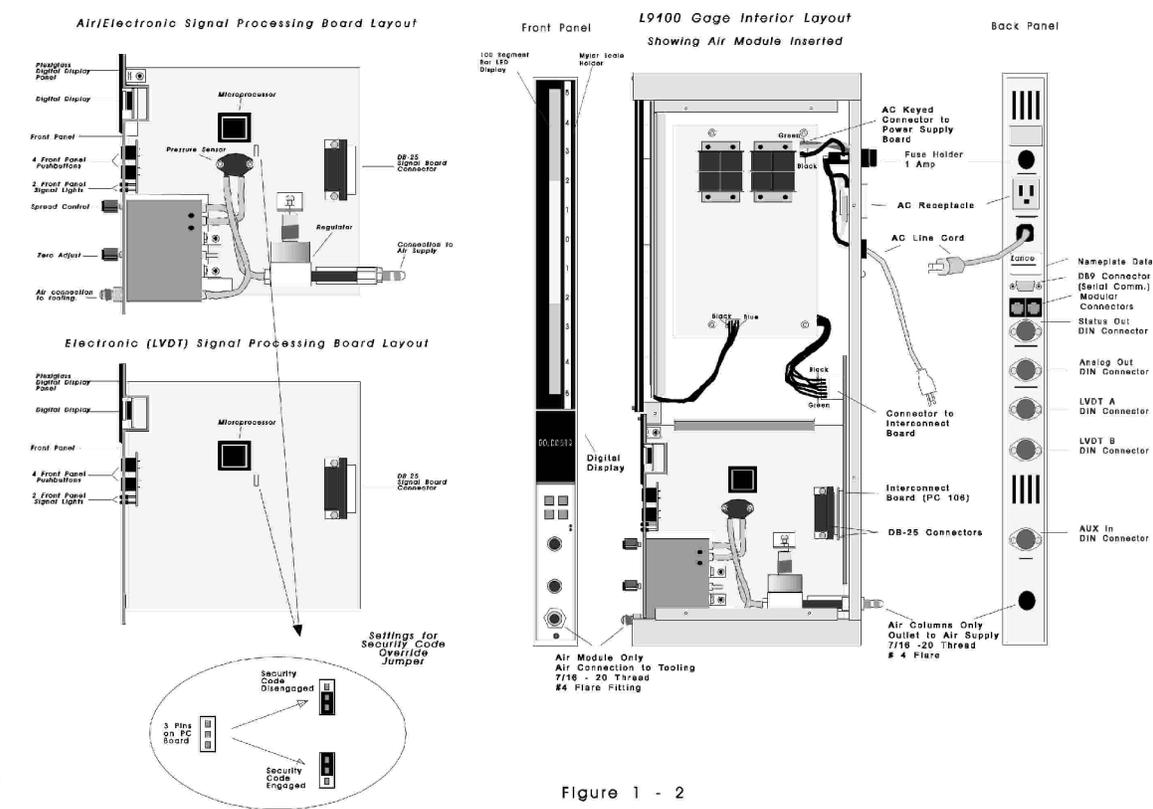
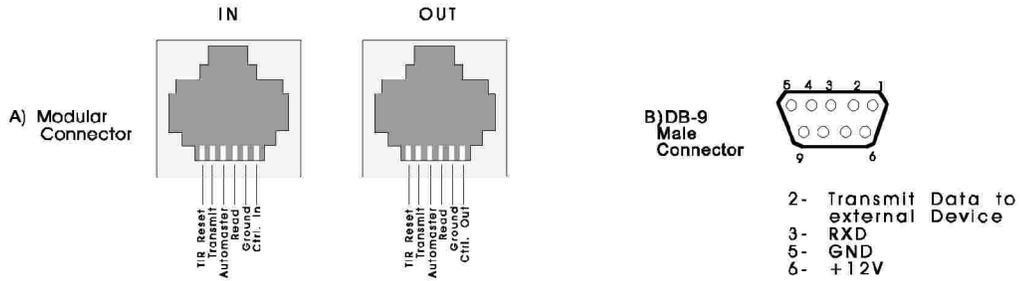


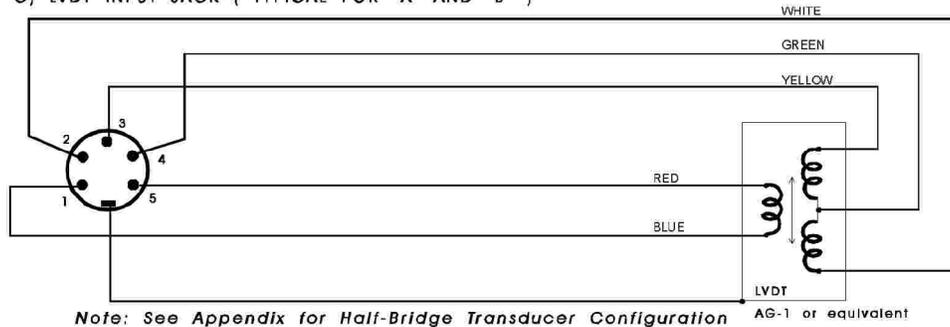
Figure 1 - 2

Fig. 1-3 SIGNAL INPUT/OUTPUT WIRING CONNECTIONS

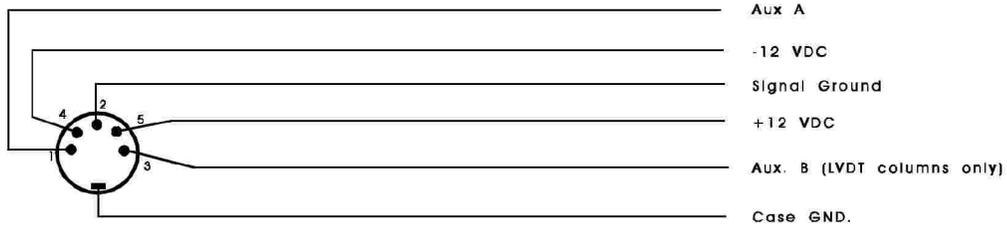
NOTE: ALL PLUGS SHOWN VIEWED FROM BACK OF GAGE CASE.



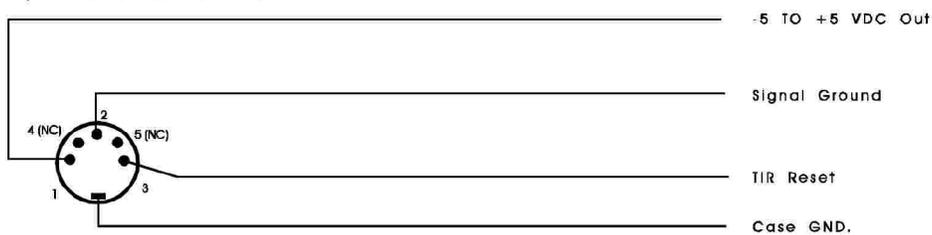
C) LVDT INPUT JACK (TYPICAL FOR "A" AND "B")



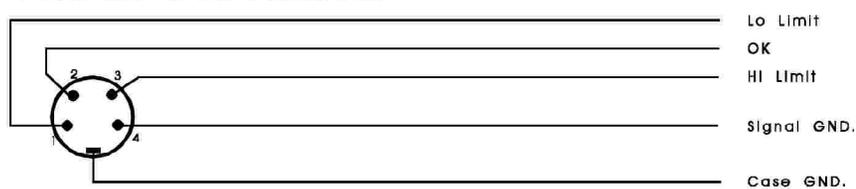
D) AUXILIARY INPUT JACK



E) ANALOG OUTPUT JACK

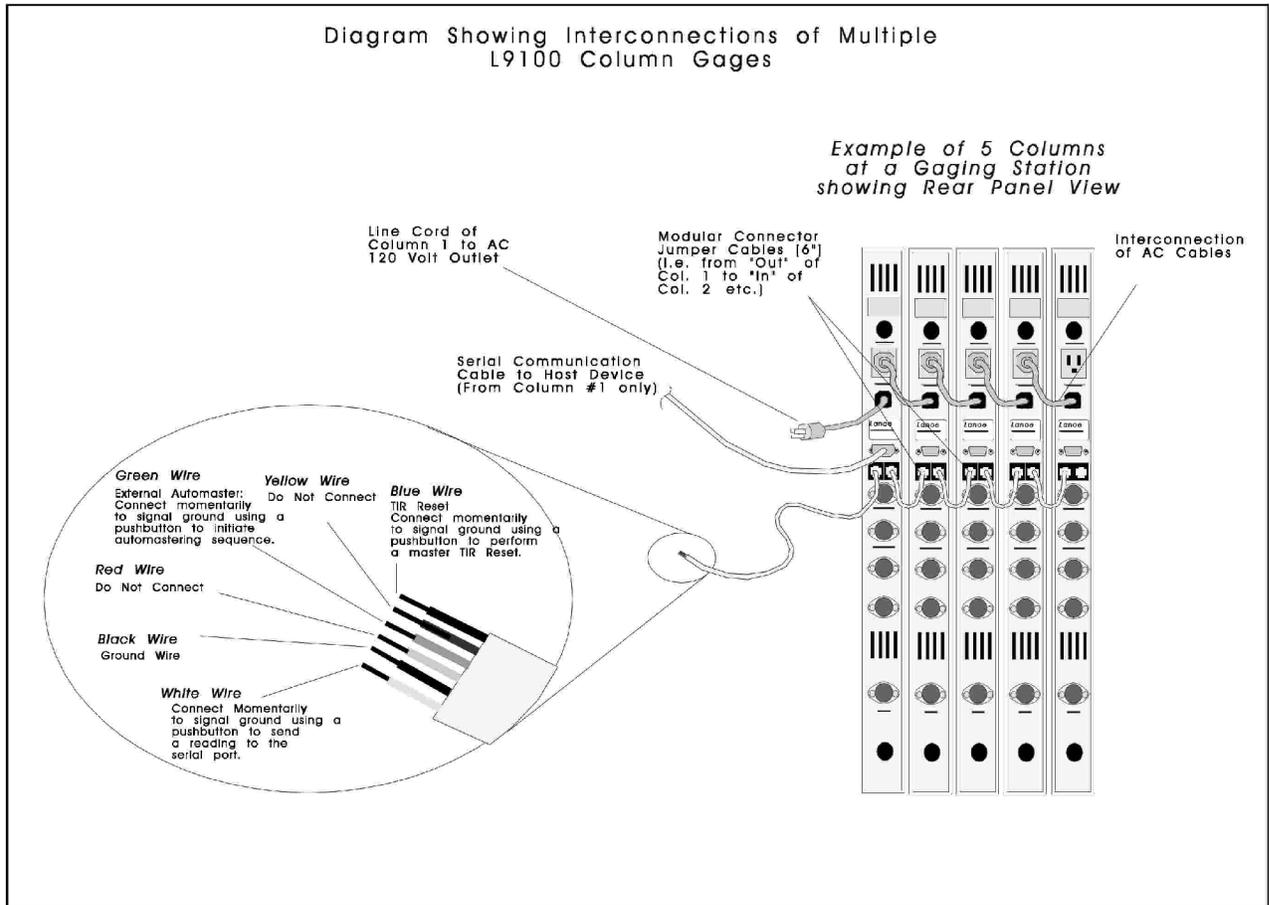


F) HI/LO LIMIT OUTPUT CONNECTIONS



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. 2-2



10

