ATTACHMENT #6
PART B

Standard Operating Procedure for RM4200 Visible Emissions Analyzer
LS710 Control Unit

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STANDARD OPERATING PROCEDURE
for
RM4200 VISIBLE EMISSIONS ANALYZER
LS710 CONTROL UNIT

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Appendix A - Configurations, Operating Information and Worksheets

1.0 OVERVIEW

This standard operating procedure (SOP) is written for the technician or plant personnel that will be responsible for the operation of the continuous opacity monitoring system (COMs). It provides an overview of the system description, function, theory, installation, operation, and maintenance of the monitoring system. This document is provided as a complete and *general* overview to assist the technician in the operational procedures of the COMs. This document is not intended to comprise the complete systems manual. Reference to the *RM4200 Instruction Manual and LS710 Control Unit Instruction Manual*, supplied by the manufacturer, is recommended for specific operational detail.

1.1 System Description

The RM4200 Visible Emissions (Opacity) Analyzer is a combined optical and electronic system that detects and measures opacity in stack emissions. By means of a path of light that protrudes through the stack wall into the stack exhaust stream, the RM4200 directly determines opacity without disturbing or modifying the effluent. The transceiver and retro-reflector include the optical and electrical system.

The RM4200 includes four basic components; probe, transceiver, J-box, and LS710 Control Unit. Signals flowing between the J-box and the LS710 are connected by the transceiver/J-box interconnect cable. The interconnect cable is a variable length communication link that transports signals between the J-box and the LS710.

The transceiver contains part of the optical system along with the electronics system located on the transceiver printed circuit board (PCB). Cooling fins are located on the PCB to minimize heat buildup and reduce lamp temperature thus extending the lamp life. Calibration access slot is provided on the transceiver to allow for ease of adjustment to the transceiver without removing the system cover during operation. The transceiver also has a desiccant cartridge chamber for maintaining proper instrument humidity. The chamber also provides a means for insertion of an external span cell for conducting functional response checks. Compressed air is provided to the transceiver housing to allow for the continuous purging of filtered air throughout the transceiver housing.

The J-box is a terminal interface unit located between the transceiver and the LS710. The J-box houses the serial data acquisition board, pressure gage and regulator, and lamp power supply board. External AC power is connected to the transceiver at the J-box.

The LS710 Control Unit is a microprocessor-based instrument that provides control, monitoring, calculation, and diagnostic functions for the RM4200 in-situ monitor. The LS710 is typically located in a control room some distance from the transceiver and J-box. It produces all system outputs that are displayed on the front panel on the unit. The LS710 also provides analog/digital output connection for recorder output and RS232 interface.

1.2 Specifications

• Transceiver Ambient Temperature	- 30.4° to + 60°C
• Process Gas Temperature	+ 51.7° to + 426.7°C
• Process Gas Pressure	25" H_2O (nominal)

1.2.1 System Accuracy (*)

• Calibration Error	+/- 5% of Calibration value
• Zero Drift (2-hour)	+/- 2% of Full Scale
• Zero Drift (24-hour)	+/- 2% of Full Scale
• Calibration Drift (2-hour)	+/- 2% of Full Scale
• Calibration Drift (24-hour)	+/- 2.5% of Full Scale
• Response Time	less than 4 minutes
• Operational Period	3 months typical
• Accuracy	within 10% RA (40CFR60 Appendix B, PS1)

(*) *The above specifications include the effects of (1) optical contamination over the defined operational period; (2) lamp degradation over operational period; (3) opacity and other process gaseous compounds in the process gas.*

1.2.2 Calibration

Automatic, on-stack zero and span calibration at selectable intervals to 24 hours, with manual activation at any time. Additional diagnostics include:

- Manual switch controls and LED indicators for Zero, Span, shutter, and dynamic calibration

1.2.3 Optical System

Light Source: Deuterium lamp, hollow cathode discharge

1.2.4 Physical Dimensions

Transceiver	15" L x 12" W x 10" H, 50 pounds
J-Box	12" W x 14" H x 6" D, 33 pounds
Probe Assembly	3.5" OD x 6' length, with 12" L x 7.5" W x 9" H adapter flange, 30 pounds, standard

2.0 LS710 : INTRODUCTION AND OPERATING CONFIGURATIONS

The LS710 Control Unit is a microprocessor-based instrument that provides control, monitoring, calculation, and diagnostic functions for the RM4200 in-situ monitor. The LS710 is typically located in a control room some distance from the transceiver and J-box. It produces all system outputs that are displayed on the front panel on the unit. The LS710 also provides analog/digital output connection for recorder output and RS232 interface.

Two twisted, shielded pairs of wires interconnected to the J-Box provide the serial communication link between the LS710 and the RM4200 instrument. The serial data acquisition circuit board (SDA) in the RM4200 provides an RS422 link that can be net-worked between additional CEMs or COMs. The communication network enables the LS710 to control calibration and monitor instrument status and measurements from the RM4200.

LS710 instrument configurations vary according to the type and number of instruments being monitored. In this application, each J-Box accepts one auxiliary input which is scaled and displayed or logged on the LS710. Any linear 4 to 20 mA signal is acceptable (including those from oxygen analyzers and velocity monitors).

The LS710 outputs include (1) a total of six contact closures for zero, span, high alarm, low alarm, process control, and fault; (2) eight 4-20 mA outputs that allows assignment of any measured or calculated parameter of the LS710, (3) and RS232 interface to transmit ASCII data, and (4) externally mounted current isolators (optional).

2.1 Configuration

The LS710 displays measurement/calculation data and status messages. The front panel controls allow the operator to access any data and to configure operating parameters, as required. These include automated calibration intervals, alarm limits, outputs, averaging periods, alarm reset conditions, etc.

The LS710 provides automatic and manual control zero/span calibration checks for the RM4200 . Automatic calibrations are performed at operator selected intervals from one to 24 hours. Manual calibrations can be initiated at any time, using the Check Cal button on the front panel. Automatic span checks are performed through span devices internal to the RM4200 instrument.

Calibrations performed on the RM4200 allow for span corrections by adjusting the gain of each instrument to agree with the value of the specified calibration source. If the gain correction exceeds a specified value, the SPAN ERR message is displayed on the LS710 front panel.

The LS710 provides instrument (RM4200) and self diagnostics to alert the user of "out-of-limit" conditions. Fault/Upset messages notify the user when LS710 or instrument malfunctions occur or when routine maintenance is required. Each circuit board includes an LED that illuminates to indicate a problem with a system board.

2.2 Specifications

Ambient Operating Temperature	+ 40° to 100°F
Analog Outputs	8 analog outputs with a common source
Digital Output	RS232 transmits ASCII data in data logger format
Computer Interface	Direct with Measurement Controls Computer System
Data Logger	RS232 output or LS710 calculation can be assigned
Contact Closure	6 dry contacts rated at 28 Vdc maximum at 2 amps
Z/S Correction	Opacity is corrected for zero and span
Calibration	Manual or automatic (operator selected intervals)
Configuration	Factory configured non-volatile memory
Installation	automatic processing of J-Box transmitted signals
Interface	Barrier terminal block
Power Requirements	25 watts typical, 90 to 130 VAC
Current Isolator	4-20 mA stand alone single channel isolator (optional)
Physical	19" rack mount, 3-1/2" high, 12" deep; 10 pounds

2.3 Operating Configurations

The LS710 is designed and configured to be operational after installation and power-up. Some minor changes in configuration may, however, be required. The front panel controls indicators provide information for maintenance and status messages about calibration settings. A minimum number of entries are required for access to all instrument parameters and selectable functions.

2.3.1 Front Panel Display

Multi-line alphanumeric readouts provide both measurement and status displays. During normal operation, both readout lines may be used to repeatedly cycle through all measurements available to the unit. If an anomaly is detected, the measurement values on the lower readout are moved to and sequenced with those on the upper readout to allow the lower readout to display the anomaly. Therefore, the alarm or fault indicators are displayed on the lower readout at a rate of about one second each.

2.3.2 Configuration Mode

The configuration mode allows the user to display and modify instrument parameters. Parameter changes can be made while in the transaction mode by pressing the SELECT button on the panel to enter the configuration mode. Parameters can be modified in the configuration mode by using the SELECT, UP or DOWN buttons. The unit automatically exits the configuration mode and returns to the display mode in about 5 minutes after the last panel button has been pressed or until the EXIT button is pressed.

2.3.3 Menu Selection

All parameter configurations are entered by accessing the configuration menu sub menu for the desired parameter. Press the SELECT button on the panel to display the configuration menu from the measurement display mode. Press an UP or DOWN button to scroll sequentially through a list of all sub menus in the configuration menu, one at a time. To select a sub menu, press the select button when the cursor is next to the desired entry.

2.3.4 Data Entry

Each sub menu is unique and contains parameter choice lists or numeric entries related to an instrument or control function. Each time you move to a new sub menu, the cursor begins at the top of the menu. Use the UP and DOWN buttons to select a parameter and use the SELECT key to move to the entry field for that parameter.

The UP button is used to change accessible limits, ranges, calibration factors, output assignments, parameters, etc. Numeric data can be entered into the system by incrementing from zero to nine in each of the four available integer digits, using the SELECT button to increment to the next digit. When the desired numerical value is displayed, press the ENTER button to enter the new value and move to the next entry field, if one exists. Pressing the EXIT or PG button from an entry field without first pressing the ENTER button will leave the field without changing the entry. Once all the fields for a parameter have been changed to the desired values, use the PG button to exit the field entry and place the cursor on the next parameter.

2.3.5 J-Box Controls

J-Box controls provide a means of monitoring the RM4200 analog output(s) and LS710 controls. Test points (TP) at the J-Box can be used to measure approximate transceiver zero and span values. LS710 controls can be overridden with the J-Box in the MANUAL position, in the manual mode, all channels can be verified for zero (with the ZERO switch moved toward the LED) and for Span (with the Span switch moved toward the LED). Cylinder gas instrument response can also be monitored from the J-Box by activating the GAS switch, and monitoring the TP response value. With the MANUAL switch in the auto mode, all controls are provided from the LS710.

2.3.6 E-O Calibration Sequence

The Electro-Optical (E-O) calibration is configured through the front panel of the LS710. Sequence setup includes calibration intervals (INTVL) and time reference until the following calibration sequence (NEXT). Each calibration sequence calculates a zero correction to cancel out any zero calibration drift that may have occurred since the last calibration. Manual calibration checks are initiated by pressing the START button from the CALIBRATION menu of the LS710. The entire sequence is completed in less than 10 minutes.

The calibration sequence follows the following steps:

CAL PURGE	Zero solenoids activated and system purge with compressed air initiated
ZERO CAL	System zero; average values over zero period are sent to RS232 output
SPAN CAL	Calculated span is process through normal routines for display and record

For a complete breakdown of the configuration descriptions and worksheets for the LS710, please refer to Appendix A of the document. A listing with setup examples for each configuration menu on the LS710 is provided.

2.4 GENERAL SETUP and OPERATING PROCEDURES

The following procedures must be initiated to set up the LS710 menu when the unit is powered up for the first time and whenever a change has been made in the process-mounted instruments. The operator must be familiar with the LS710 menu configurations, including menus and sub menus, increment buttons, calibration control, and upset and fault lights, before attempting the setup procedure.

2.4.1 Unlock the Front Panel

1 Be certain that the ACCESS entry is set to OPEN.

NOTE: Whenever power is reapplied to the LS710, ACCESS entry will be LOCKED. To change most parameters, the front panel must be opened, using the following procedure:

3. Verify that the panel is locked. If attempting to open the panel when is already open, the panel will become locked. Select the menu PANEL. If the ACCESS entry is OPEN, no further action is required.

4. If the ACCESS entry is LOCKED, reset to OPEN with the SELECT key..

2.4.2 LS710 Set Up

1. Use the HOURS sub menu to set the current hour of day (0-23). It must be entered when the power is applied to the system.

2 Use the MIN sub menu to set the current minute of the hour (0-59). It must be entered when power is applied to the system.

3. Use the MONTH sub menu to set the current month (1-12). It must be entered when power is applied to the system.

4. Use the DAY sub menu to set the current day of month (1-31). It must be entered when power is applied to the system.

5. Use the SITE sub menu to set the Site ID printed at top of each page, if RS232 output is selected.

6. Use the UNIT sub menu to set the Unit number printed on top of each page, if RS232 output is selected.

7. Other sub menus are available consisting of TEMP, RECORDER, AUX and AUX F8. Refer to Page 2-15 in Appendix A for instructions on the use of these sub menus.

2.4.3 Opacity Menu Set Up

1. In the **OPACITY Configuration MENU**, use the following sub menus to set up the LS710:

Z COMP - Displays the zero compensation for opacity.
OP S - Displays the E-O Span value for opacity (S Values.)
OP G - The opacity gain factor used to trim out variations from instrument to instrument.
OP DS - Defines the span drift error from the last calibration.
OP DZ - Defines the zero drift error from the last calibration.
OPLR - Sets the optical path length ratio for an opacity monitor.
SPAN OP - Sets the opacity span cell value.

2.4.4 Diagnostics Menu Set Up

The **DIAGNOSTICS** Menu allows the user to identify the software version of the LS710 (V/R sub menu). Additionally, the total number of hours that the LS710 has been in operation can be determined (**HOURS** sub menu).

2.4.5 Channel Names Menu

This Menu will allow the user to select the monitored, calculated and reported values by the LS710. The user can select from the following channel names in the **CHANNEL NAMES** Menu:

CO PPM -	CO measurement
CO_2 PERCENT-	CO_2 measurement
H_2O PERCENT-	H_2O measurement
O_2 PERCENT-	O_2 measurement
OPACITY % -	Opacity measurement
OPAC COMB % -	Combined opacity of all non-zero instruments
DENSITY -	Optical Density measurement
VELOCITY -	Velocity measurement through auxiliary input
NO PPM -	NO measurement
NO MASS -	NO #/MBTU (GCM) calculated using measurement and fuel factors
SO_2 PPM -	SO_2 measurement
SO_2 MASS -	SO_2 #/MBTU or GCM calculated using measurement and fuel factors
TEMP -	Temperature measurement
AUXILIARY -	Auxiliary measurement

Following each channel selected, the operator will select options in the following sub menus:

RESET -	Sets the alarm handling parameters. LATCH entry holds an alarm in the active status until YES is entered. YES acknowledges and clears the alarm. AUTO causes the alarm to reset automatically when the value falls below the limit. An alarm is activated any time a value exceeds the high or low limit.
ALARM -	Selects the processing for the alarm signal. OFF deactivates the alarm processor. 5-SEC uses the 5-second instantaneous values as the alarm variable. AVG uses the average values (averaged over the time period for a specific channel menu, AVG entry) as the alarm variable. Both 5-SEC and AVG activate the alarm processor.

HI LIM -	Sets the upper alarm limit value. The HI-LIM range for OPACITY is 0-100% (or 20% if the technician wishes to be alerted of a potential exceedence).
LO LIM -	Sets the lower alarm limit value. The LO-LIM range for OPACITY is 0-100%
COLUMN -	Sets the RS232 column at which the channel value is to be printed. An entry of zero omits the measurements from printing. Columns 1 through 28 can be selected. Each column is 6 characters long.
DISPLAY -	Controls the measurements displayed on the front panel. When 0 is entered, the measurement for the channel is not displayed.
AVG -	Sets the time over which measurements for the channel are to be averaged. The time can be set for 1 to 60 minutes. AVG also sets the printing rate for a channel.
RANGE -	Sets the full-scale analog range for trend recording or process control for a channel.

Additionally, the user can select O_2 MAX and O_2 MIN if an oxygen analyzer is used.

3.0 RM4200 ; INTRODUCTION AND OPERATING CONFIGURATIONS

This section describes basic steps for operation, calibration, and maintenance of the RM4200. The operator must have an understanding of the basic operating procedures for the LS710, as described in *Section 2.0* of this standard operation procedure, before attempting to operate the RM4200.

The RM4200 has two control modes - manual and automatic. The manual mode, used during installation, maintenance calibration, and servicing, is controlled by the switches located on the Serial Data Acquisition board in the J-Box. These switches control the AUTO/MANUAL mode, zero cal solenoid, gas cal solenoid, internal span cell, and the SO_2 shutter position. The automatic mode is used for normal operation and data collection of the RM4200 and is controlled by the LS710.

3.1 OPERATING PROCEDURES

In general, the operator must be familiar with the following LS710 parameters/menu headings for proper operation. Basic RM4200 setup (results displayed on the LS710 front panel):

J-Box selection (1-4 corresponding to the SDA board jumpers)
INSTRUMENT Full Scale (can be 05-100%)
PANEL UNITS (%)
PANEL STATUS (YES)
E-O CALIB Z(ero) for OP

Calibration verification and diagnostics:

PANEL TYPE (OP for RM4200)
PANEL REF
E-O CALIB TYPE
E-O CALIB INTVL, NEXT

E-O CALIB CONT
E-O CALIB S(pen) for OP - results of last cal cycle
INSTRUMENT S(pen) for OP (reference value used in E/O cal)

Process monitoring and reporting:

LS710 SETUP - hours, minute, site, unit, and DAC
OP - Opacity Value of last average period.

3.1.1 System Parameter Setup

This section contains a setup of the parameters for system operation that do not effect or are not essential for calibration. Menu parameters pertinent to calibration are discussed in the calibration section of the RM4200 system manual.

1. Enter the calibration intervals and desired time of day for automatic calibrations. Access INTVL sub menu and increment to the desired calibration interval (e.g. 23 hours). Access the NEXT sub menu and enter the number of minutes from the present time to the desired time of day for the next automatic calibration.

2. Set up the measurement channels. Enter values for all appropriate sub menus (e.g. ALARM, HI LIM, LO LIM, etc.) for each measurement channel (e.g. OP CHAN, etc.). NOTE: To include a channel in the operator's (short) menu, the ALARM sub menu must be incremented to S-SEC or AVG.

   Verify that each channel has a different column number. If the LS710 uses the RS232 port for a printer or data acquisition system. No two channels can have the same column.

   Go to Step 6 if an oxygen analyzer is not used with the installation.

   If the LS710 is not connected to a printer, skip to Step 6.

4. Enter HOURS and MIN under the LS710 SETUP heading.

5. Enter the printer parameters in the PRINTER heading.

NOTES: If using a data acquisition system, set the MARGIN to zero and the WIDTH to 12; Set EXCESS to INCLD; The number of columns must match the number of measurement channels. Each COLUMN is equal to a measurement output; e.g. OP %, etc.

6. *Enter SITE and UNIT numbers under the LS710 SETUP heading, if desired to print the numbers with the printer output.*

3.2 MAINTENANCE

This section provides a guide to scheduled maintenance operations such as inspection, cleaning, and various adjustments. The calibration subsection includes procedures for the adjustment of parameters used to maintain system operation within desired specifications.

For diagnostic procedures and other non-routine maintenance activities beyond the scope of this SOP, refer to the manual.

3.2.1 Visual Inspection

1. Release the six latches that secure the transceiver to the probe assembly and swing the transceiver to the side on its hinges.

2. Look into the transceiver through the front lens to confirm that the transceiver optics are reasonably free of contamination.

3. Clean the outside surface of the transceiver lens with a clean, dry lens cloth.

4. Swing the transceiver back into position. Check that the transceiver is properly aligned on the alignment pins opposite the hinged side. Secure the six latches.

3.3 FIELD TEST PROCEDURES

The following procedures can be used for initial instrument start-up and for instrument verification at any time. For a detailed step by step procedure required for each of the listed field methods, reference to the *RM4200 Instruction Manual Section 4* is required. The individual detail required for each procedure, preclude the necessity of duplication in this general operating procedure,and use the manufacturers manual as the primary reference. The complexity and interactive nature of the following procedures require that an operator have RM4200 training and experience before proceeding.

These procedures must be confirmed during the initial setup:

- *Determining Zero Response*
- *Transceiver Test and Electronic Alignment*
- *Determining Span Response*
- *Neutral Density Filter Calibration*

3.4 CALIBRATION PROCEDURES

The following assumptions are made prior to performing gas calibrations; the transceiver test and electronic alignment have been completed and the optimum zero gas flow has been determined for the installed system. The operator must be familiar with the LS710 procedures and parameters before beginning this procedure.

3.4.1 Verification of Internal Span (Electronic/Optical)

1. Determine the internal span cell value on the RM4200 factory data sheet.
2. Initiate the E-O CALIB sequence on the LS710 and allow the sequence to complete.
3. Record the span value in the E-O heading (OP S sub menu).
4. Clear the SPAN ERR by entering ALL in the DIAGNOSTICS heading, CLEAR sub menu.
5. Repeat steps 2 through 4 an additional four times.
6. Enter the OP internal span value, averaged from step 5 in the INSTRUMENT heading, SPAN SD sub menu.
7. Repeat steps 2 through 4 to verify that there is no SPAN ERR message and that no faults occur.

REFERENCES

LS710 Control Unit, Instruction Manual, Lear Siegler Measurement Controls Corporation, 80250383, 1993.

RM4200 Visible Emissions Analyzer, Instruction Manual, Lear Siegler Measurement Controls Corporation, 1993.

APPENDIX A
Configurations, Operating Information and Worksheets

CHAPTER 2 - OPERATING INFORMATION AND CONFIGURATIONS

2.0 OPERATING CONFIGURATIONS

The LS710 is designed and configured to be operational after installation and power-up. However, some minor changes in configuration may be required. The front panel controls provides the means to make changes in the instrument configuration as needed for a site. These controls also provide information for maintenance and status messages about calibration settings. A minimum number of entries are required for access to all instrument parameters and selectable functions, making the LS710 easy to use. The controls provide a means of maintaining the process-mounted instruments.

2.1 FRONT PANEL DISPLAY

Multi-line alphanumeric readouts provides both measurement and status displays. During normal operation, the readout lines are used to display all measurements available to the unit. If an anomaly is detected the status line will display the anomaly. For example, if an alarm set point is exceeded, the alarm type is displayed on the status line. If, in addition to the alarm, a fault and/or warning occurs, the fault/warning type is also displayed on the status line. The alarm and fault messages are cycled on the status line at a rate of about one second each.

2.2 CONFIGURATION MODE

The configuration mode allows you to display and modify instrument parameters. Press the SELECT button on the panel to enter the configuration mode. Parameters can be changed while in the configuration mode, by using the SELECT, UP or DOWN buttons. The unit automatically exits the configuration mode and returns to the display mode about five minutes after the last panel button has been pressed or until the EXIT button is pressed while not in a field entry. The exit button returns to the panel to the display mode.

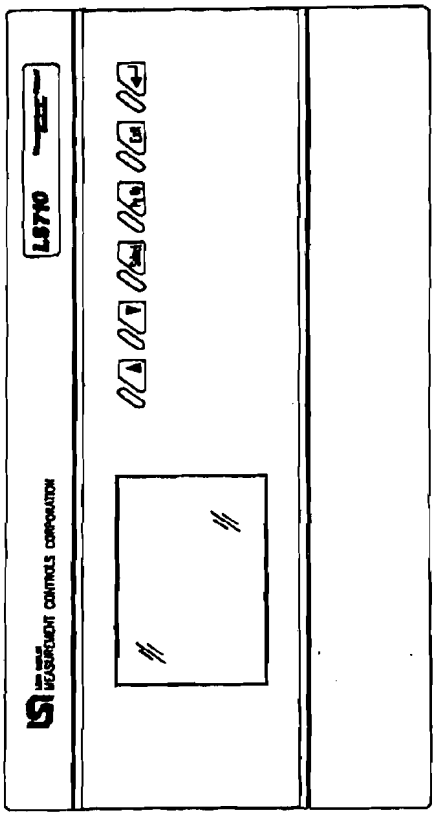

Figure 2-1

2.2.1 MENU SELECTION

All parameter configurations are entered by accessing the configuration menu and sub menu for the desired parameter. Press the SELECT button on the panel to display the configuration menu from the measurement display mode. Press an UP or DOWN button to scroll sequentially through a list of all sub menus in the configuration menu, one at a time. To select a sub menu, press the select button when the cursor is next to the desired entry.

2.2.2 MOVING TO ENTRY FIELDS

Each sub menu is unique and contains parameter choice lists or numeric entries related to an instrument or control function. Each time you move to a new sub menu, the cursor begins at the top of the menu. Use the UP and DOWN buttons to select a parameter and use the SELECT key to move to the entry fields for that parameter.

2.2.2 NUMERIC DATA ENTRY

The UP button is used to change accessible limits, ranges, calibration factors, output assignments, parameters, etc. Numeric data can be entered into the system by incrementing from zero to nine in each of the four available integer digits, using the SELECT button to increment to the next digit. When the desired numeric value is displayed, press the ENTER button to enter the new value and move to the next entry field if one exists. Pressing the EXIT or PG button from an entry field without first pressing the ENTER button will leave the field without changing the entry. Once all fields for a parameter have been changed to the desired values, use the PG button to exit field entry and place the cursor on the next parameter. Pressing EXIT from a menu selection(not a field entry) returns to the measurement display screen and pressing PG button from a menu selection returns to the configuration menu.

2.2.3 CHOICE SELECTION DATA ENTRY

Selecting an entry that is a list of choices is very similar to numeric entry. Once a choice field has been selected the UP button will select the next choice in the list. When the desired choice is displayed, press the ENTER button to finalize the choice. As with numeric entry, pressing the EXIT or PG button will leave the entry field with the original choice unchanged. Pressing EXIT from a menu selection(not a field entry) returns to the measurement display screen and pressing PG button from a menu selection returns to the configuration menu.

2.3 J BOX CONTROLS

The J box (junction box) controls allow monitoring process-mounted instrument analog outputs and the LS710 controls. Test points can be used to measure the approximate transceiver zero and span values. Controls from the LS710 can be overridden by placing the MANUAL switch on the SDA board in the J box, to the manual mode. Manual mode also enables the manual switches on the SDA board. In the manual mode, verification that all channels read zero can be made by moving the ZERO switch toward the LED and monitoring the measurement test points.

Similarly, move the SPAN and ZERO switches toward the LEDs, to verify span outputs. If a gas bottle is connected to the process-mounted instruments, instrument response can be verified at the SDA board or transceiver test points by activating the GAS switch. To do that, position both the SPAN and ZERO switches away from the LED. See Section 5 for more information about manual gas calibration. When the MANUAL switch is in auto mode, the LED next to each switch

indicates the command from the LS710. The switches have control of the LEDs and resulting command only when the J box is in the manual mode.

2.4 E-O CALIBRATION SEQUENCE

The E-O (Electro/Optical) calibration sequence is the same whether activated manually or automatically. The automatic calibration system is configured through the front panel under the CALIBRATION menu. Calibration intervals are configured under the INTVL entry. The NEXT entry sets the time until the next calibration, in minutes. NEXT also indicates when the next calibration will occur. Each calibration sequence calculates a zero correction to cancel out any zero drift that might have occurred since the last calibration. Manual calibration is initiated by selecting START from the CALIBRATION menu and entering YES.

The start of a calibration sequence is indicated by the message CAL PURGE, displayed on the status line. The process control contact closes, zero solenoids are activated and diagnostics are performed during CAL PURGE.

After one minute of purge, ZERO CAL appears on the status line and the zero contact closes. The current loops output the ZERO CAL results unless SH (sample and hold) has been activated. At the completion of ZERO CAL, both the values averaged over the zero period, and the % error of span, are sent to the RS232 output and all zero correction factors are updated.

ZERO ERR is displayed on the status line when any of the zero values fall outside their specified limits. The channel that is out of tolerance can be determined by reviewing the Z values under the individual instrument menu(i.e. EX4700A, SM8100A, OPACITY) for each instrument installed.

After two minutes of ZERO CAL, SPAN CAL appears on the status line, the zero contact opens, and the span contact closes. The current loops output the SPAN CAL results unless SH (sample and hold) has been activated. During the entire span cycle, the calculated span is processed through normal routines to be displayed and recorded. All measurement and calculated alarms not pertaining to calibration are disabled. All interference table gains are set to zero. The temperature is set to 75°F with 760 mm mercury barometer. At the completion of SPAN CAL, both the values averaged over the SPAN CAL period, and the % error of span, are sent to the RS232 output, followed by the current gain settings.

After the two minute SPAN CAL, TEMP CHECK appears on the status line and the span contact opens. During TEMP CHECK, the E-O calibration and zero solenoid commands are removed to allow the process-mounted instruments to return to process sample conditions and process temperature is placed on the strip chart recorder output. During this one minute period, the recorder pens reflect temperature readings based on temperature full scale. After one minute of TEMP CHECK, the calibration sequence is completed, the status line returns to normal operation, and the process control contact opens.

2.5 DYNAMIC GAS CALIBRATION SEQUENCE

The gas calibration sequence is similar to the E-O calibration sequence. The major differences is in the use of standard gases, stack pressure and stack temperature. The standard gas values are entered under the individual instrument menus(i.e. EX4700A, SM8100A). XX C entry (where XX denotes the gas concentration, CO, NO, etc.). Gas calibration can be selected instead of E-O calibration by selecting GAS under the E-O CALIB Configuration Menu, TYPE entry.

ZERO ERR is displayed after calibration whenever any zero is outside the specified tolerance. GAS ERR is displayed, after calibration, any time either measured concentration falls outside the named calibration gas concentration by more than a prescribed value.

If the gas calibration results are within the prescribed value, the gain under the GAS CALIB Configuration Menu, XX G entry is changed as required to re calibrate the measurement(s). The choices under the E-O CALIB Configuration Menu, TYPE are E-O and GAS. If GAS is selected, gas calibration is performed instead of E-O calibration, following the same sequence at the interval selected under the E-O CALIB Configuration Menu. To return to E-O calibration, E-O must be entered under the E-O CALIB Configuration Menu, TYPE entry.

The Configuration Descriptions and Worksheets list and describe all sub menus in the configuration menu. The configuration notes column provides a place for the operator to document site specific configuration. Where there is space for only one entry, the entry is not instrument specific and therefore applies to all instruments, except in systems including an EX4700A. The EX4700A must be on either J box 1 or 2, therefore, the information is instrument specific to the EX4700A.

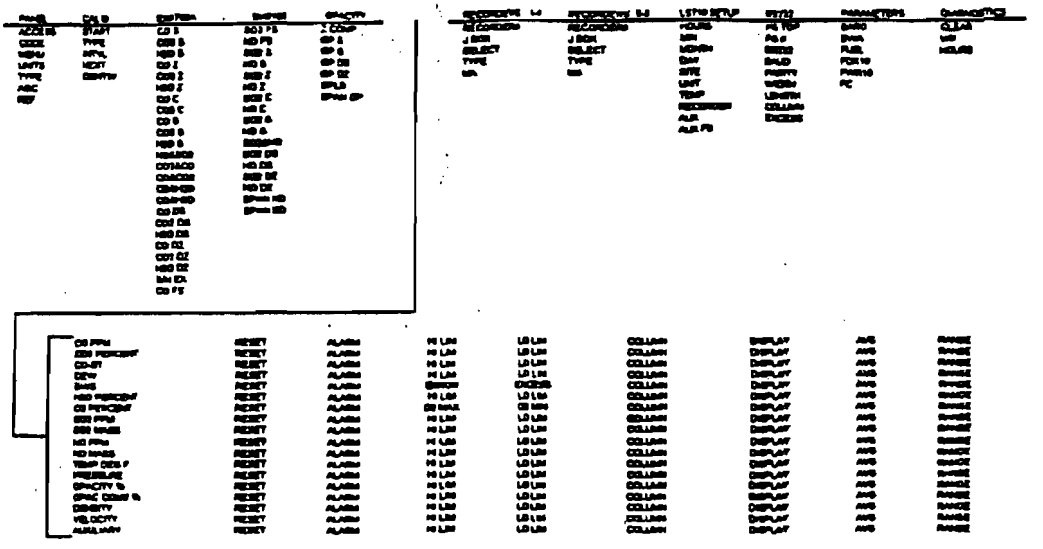

Figure 2-2

CONFIGURATION DESCRIPTIONS AND WORKSHEETS

CONFIGURATION MENU: PANEL

SUB MENU		INCREMENT	CONFIGURATION NOTES 1	2	3	4
ACCESS	(D.O.)	LOCK/OPEN				
CODE	(E.N.)	0-9999				
MENU	(S)	OPER/SETUP				
UNITS	(S)	ENG/ENGAVG/MA/CGS/CGS AVG				
TYPE	(D.O.)	EX/MC/SO2/NO				
AGC	(S)	1-30				
REF	(S)	1-30				

(D.O.) = DISPLAY ONLY (S) = SELECT (E.N.) = ENTER NUMBER
(CGS) = Centimeters/Grams/Seconds, indicates metric units

DESCRIPTION:

PANEL: Access to any entry under the PANEL menu can be made when the ACCESS entry is set to OPEN.

ACCESS Displays the current status of the front panel, OPEN or LOCK.

CODE A code is used to access certain parameters. Enter 3300 to change ACCESS to OPEN. Enter the code again to change ACCESS to LOCK.

MENU Controls the display of instrument menus. If OPER is selected, sub menus will not display or allow entry of any data for an instrument that is not connected and communicating. If SETUP is selected, all entry fields are available for data entry regardless of the instruments connected. Once the complete system is in place and operating, the most efficient setting is OPER. After five minutes of no activity on the keyboard the LS710 will automatically revert to the OPER setting.

UNITS Controls the display units. ENG displays 5-second English units; ENGAVG displays average English units, averaged over the period selected under each channel. MA displays process-mounted instrument output currents, where applicable. CGS(Centimeters/Grams/Seconds, indicates metric units) and CGSAV displays metric 5-sec and average data.

TYPE Indicates the instrument type for the selected J box (EX for EX4700A $CO/CO_2/H_2O$ Analyzers, MC for opacity monitors, and SO_2 or NO for SM8100A SO_2/NO Analyzers, depending on the position of the sequential shutter in the SM8100A transceiver). If an instrument was connected and communicating but has become unavailable, a NA will follow the type to indicate that instrument is Not Active.

AGC AGC is a reading of automatic gain control current used for EX4700A Analyzers only.

REF REF is an indicator of the electro-optical condition of a process- mounted instrument.

CONFIGURATION MENU: CALIBRATION

SUB MENU		INCREMENT	CONFIGURATION 1	2	3	4
START	(S)	YES/NO	_____			
TYPE	(S)	E-O/GAS	_____			
INTVL	(E.N.)	0-24 hours	_____			
NEXT	(E.N.)	1-1440 minutes	_____			
CONTIN	(S)	OFF/ZERO/SPAN/OUT	_____	_____	_____	_____

(D.O.) = DISPLAY ONLY (S) = SELECT (E.N.) = ENTER NUMBER

DESCRIPTION:

CALIBRATION: To change any item under this Menu, the PANEL menu, ACCESS entry must be set to OPEN. When CALIBRATION settings are completed, change the ACCESS entry to LOCK.

START When YES is selected a manual calibration sequence is initiated.

TYPE means any automatic interval or manual calibrations will use internal span devices. GAS means any automatic interval or manual calibrations will use externally connected gas bottles and may correct gain values.

NOTE Opacity monitors calibrate regardless of which type of calibration is selected(E-O or GAS) but will always use internal zero and span devices.

INTVL Allows selection of how often process-mounted instruments are put into automatic E-O calibration. Use the increment buttons, to select an interval from 0 to 24 hours. A zero entry eliminates automatic calibrations.

NEXT indicates the time until the next automatic calibration. Synchronize the start of the next calibration with the time of day by manually entering the appropriate time delay. (The intervals between automatic calibrations are determined by the INTVL entry.) The time entered can be from 1 to 1440 minutes (24 hours). This parameter cannot be changed during a calibration or when INTVL is set to zero.

For example, if you want calibrations to occur each day at 9:00 a.m., then enter the value, in minutes, from the current time until 9:00 a.m. in the NEXT entry.

CONTIN Selects a continuous ZERO or SPAN calibration. Once ZERO or SPAN is entered, the calibration continues until OFF is entered to end it. If TYPE in this menu is selected as E-O and CONTIN SPAN is selected then a continuous E-O span will result. If TYPE in this menu is selected as GAS and CONTIN SPAN is selected then a continuous GAS span will result. OUT is used to identify an out-of-service instrument. Calibration information does not print if the instrument is OUT of service.

CONFIGURATION MENU: EX4700A

SUB MENU		INCREMENT	CONFIGURATION NOTES 1	2	3	4
CO S	(D.O.)					
CO_2 S	(D.O.)					
H20 S	(D.O.)					
CO Z	(E.N.)	0-24.00				
CO_2 Z	(E.N.)	0-24.00				
H_2O Z	(E.N.)	0-24.00				
CO C	(E.N.)	100-5000				
CO_2 C	(E.N.)	1.0-20.0				
CO G	(E.N.)	0-2.00				
CO_2 G	(E.N.)	0-2.00				
H_2O G	(E.N.)	0-2.00				
CO_2 & CO	(E.N.)	0-2.00				
CO & CO_2	(E.N.)	0-2.00				
CO & H_2O	(E.N.)	0-2.00				
CO & H_2O	(E.N.)	0-2.00				
CO DS	(D.O.)					
CO_2 DS	(D.O.)					
H_2O DS	(D.O.)					
CO DZ	(D.O.)					
CO_2 DZ	(D.O.)					
H_2O DZ	(D.O.)					
S/N EX	(D.O)	0-999				
CO FS	(E.N.)	50-5000				

(E.N.) = ENTER NUMBER (S) = SELECT (D.O.) = DISPLAY ONLY (CO) = CO_2

DESCRIPTION:

EX4700A: To change items under this menu, the PANEL menu, ACCESS entry must be set to OPEN. Set the ACCESS entry to LOCK entry after the settings are completed.

XX S — Displays the last E-O span value for measurement XX, which can be (S values) CO, CO_2, etc.

XX Z — Displays the zero offset value for measurement XX, which can be (Z values) CO, etc.

XX C — Sets the concentration of NBS traceable standard gas (taken from (C values) the from supplier's cylinder tag) for gas XX, which can be CO, CO_2, etc.

CONFIGURATION MENU: EX4700A (continued)

DESCRIPTION:

XX G	Defines the gain factors used to trim out variations from instrument to instrument. The factors can be manipulated manually or are automatically adjusted during gas calibrations.
XX & YY	Defines the gain factor for interference between XX and YY (e.g., CO_2 & CO, etc.).
XX DS	Define the span drift error from the last calibration.
XX DZ	Define the zero drift error from the last calibration.
S/N EX	A display of the EX4700A calibration curve serial number. If there are no tables entered into the firmware for a particular J-box the display will be -1.
CO FS	Sets the CO full scale value in ppm.

CONFIGURATION MENU: SM8100A

SUB MENU		INCREMENT	CONFIGURATION NOTES 1	2	3	4
SO_2 FS	(E.N.)	20-7500				
NO FS	(E.N.)	75-7500				
SO_2 S	(D.O.)					
NO S	(D.O.)					
SO_2 Z	(E.N.)	0-89.99				
NO Z	(E.N.)	0-89.99				
SO_2 C	(E.N.)	0-7500				
NO C	(E.N.)	0-7500				
SO_2 G	(E.N.)	0-2.00				
NO G	(E.N.)	0-2.00				
NO & SO_2	(E.N.)	0-2.00				
SO_2 DS	(D.O.)					
NO DS	(D.O.)					
O_2 DS	(D.O.)					
SO_2 DZ	(D.O.)					
NO DZ	(D.O.)					
O_2 DZ	(D.O.)					
SPAN NO	(E.N.)	0-7500				
SPAN SO	(E.N.)	0-7500				

(NOTE SO = SO_2) (E.N.) = ENTER NUMBER (S) = SELECT (D.O.) = DISPLAY ONLY

DESCRIPTION: SM8100A

The SM8100A menu is used to set parameters specific to the SM8100A SO2/NO analyzer. To change items under this Menu, the PANEL menu, ACCESS entry must be set to OPEN. Set the ACCESS entry to LOCK entry after the settings have been completed.

XX S — Displays the last E-O span value for measurement XX, which can be NO, SO_2.(S values)

XX Z — Displays the zero offset value for measurement XX, which can be NO, SO_2.(Z values)

XX C — Sets the concentration of NBS traceable standard gas (taken from the from supplier's cylinder tag) for gas XX, which can be NO, SO_2. (C values)

XX G — Defines the gain factors used to trim out variations from instrument to instrument. The factors can be manipulated manually or are automatically adjusted during gas calibrations.

NO&SO2 — Defines the gain factor for interference between NO and SO2, SO2 & NO

DS & DZ — Defines the span and zero drift error from the last calibration.

SO_2 FS — Sets the SO_2 full scale value in ppm.

CONFIGURATION MENU: SH8100A (continued)

DESCRIPTION:

NO FS Sets the NO full scale value in ppm.

SPAN NO Sets the NO span cell value.

SPAN SD Sets the SO_2 span cell value.

CONFIGURATION MENU: OPACITY

SUB MENU		INCREMENT	CONFIGURATION NOTES 1	2	3	4
Z COMP	(D.O.)					
OP S	(D.O.)					
OP G	(E.N.)	0 - 2.00				
OP DS	(D.O.)					
OP DZ	(D.O.)					
OPLR	(E.N.)	0.20 - 2.00				
SPAN OP	(E.N.)	0 -99.9				

(E.N.) = ENTER NUMBER (S) = SELECT (D.O.) = DISPLAY ONLY

DESCRIPTION:

OPACITY: This menu is used to set parameters specific to the Opacity monitor. To change items under this Menu, the PANEL menu, ACCESS entry must be set to OPEN. Set the ACCESS entry to LOCK entry after the settings have been completed.

Z COMP Displays the zero compensation value for opacity.

OP S Displays the last E-O span value for opacity. (S values)

OP G The opacity gain factor used to trim out variations from instrument to instrument.

OP DS Define the span drift error from the last calibration.

OP DZ Define the zero drift error from the last calibration.

OPLR Sets the optical path length ratio for an opacity monitor.

SPAN OP Sets the opacity span cell value.

CONFIGURATION MENU: RECORDER OUTPUT

SUB MENU		INCREMENT	CONFIGURATION NOTES 1	2	3	4
RECORDERS	(D.O.)		1 / 5	2 / 6	3 / 7	4 / 8
J BOX	(E.N.)	1-4	/	/	/	/
SELECT	(S)	Any channel name (see below)	/	/	/	/
TYPE	(S)	5-SEC/AVG/5S-SH/AV-SH	/	/	/	/
MA	(S)	4-20/0-20	/4-20	/4-20	/4-20	/4-20

(E.N.) = ENTER NUMBER (S) = SELECT

DESCRIPTION:

RECORDERS 1-4: To change items under this menu, the PANEL menu, ACCESS entry must be set to OPEN. Set the ACCESS entry to LOCK entry after the settings have been completed. To enable this menu for display, the RECORDER entry under LS710 SETUP must be set to 4 or 8 with a 4 or an 8 analog channel board installed.

RECORDERS 5-8: To change items under this menu, the PANEL menu, ACCESS entry must be set to OPEN. Set the ACCESS entry to LOCK entry after the settings have been completed. To enable this Menu for display, the RECORDER entry under LS710 SETUP must be set to 8 with an 8 channel analog board installed.

J BOX — Specifies the J box or instrument that the above RECORDER # will be connected to.

SELECT — Assigns a measurement channel designation to a particular RECORDER # channel. Enter the desired channel name: CO/CO_2/CO-ST/H_2O/DEW/BWS/O_2/SO_2/SO_2 M/NO/NO M/TEMP/MMHG/OPAC/CB-OP(OPAC COMB%)/DENS/VEL/AUX/ZERO/ZERO/FS. ZERO and FS(Full Scale) can be entered here for recorder calibration (see Section 5).

TYPE — Determines how output data is processed. 5-SEC uses a fundamental 5-second measurement. AVG uses the calculated average measurement. 5S-SH (sample/hold) means the last 5-SEC output is sampled and held through all calibration cycles or any time the instrument is placed in the manual mode. AV-SH means the last averaged output is sampled and held through calibration cycles or any time the instrument is placed in the manual mode.

MA — Sets the current loop output to 0-20 mA or 4-20 mA. (Reminder: the eight recorder configuration allows only 4-20 mA output.)

CONFIGURATION MENU: RS232 (continued)

DESCRIPTION:

EXCESS The selection ONLY prints only those measurements/calculations that exceed the specified high alarm level. The selection INCLD prints all measurements/calculations that are configured in the LS710.

CONFIGURATION MENU: PARAMETERS

SUB MENU		INCREMENT	CONFIGURATION NOTES 1	2	3	4
BARO F.S.	(E.N.)	500 - 800 mm mercury				
BWA	(E.N.)	0.01 - 0.05				
FUEL	(S)	ANTH/BITUM/LIQU/OTHER	_____			
FDX10	(*)	700 - 2000	_____			
FWX10	(*)	700 - 2000	_____			
FC	(*)	500 - 4000	_____			

(S) = SELECT (D.O.) = DISPLAY ONLY (*) = ENTRY MADE ONLY IF FUEL IS OTHER

DESCRIPTION:

PARAMETERS: To change items under this menu, the PANEL menu, ACCESS entry must be set to OPEN . Set the ACCESS entry to LOCK after changes are completed.

BARO — Sets the full scale value for the pressure input sensor .

BWA — Sets the ambient moisture in percent H_2O (site average moisture level).

FUEL — Causes calculations to use the fuel factors appropriate for the selected fuel; ANTH = anthracite, BITUM = bituminous, LIQU = liquid, and OTHER = uses fuel factors entered below for any other fuel type.

FDX10 — FUEL FACTOR (DRY). When entered, the numerical factor displayed, times ten, should equal fuel FD. FDX10 is entered only if FUEL is selected as OTHER.

FWX10 — FUEL FACTOR (WET). When entered, the numerical value displayed, times ten, should equal fuel FW. FWX10 is entered only if FUEL is selected as OTHER.

FC — FUEL FACTOR (CO_2). When entered, the numerical value displayed should equal fuel F_c. FC is entered only if FUEL is selected as OTHER.

CONFIGURATION MENU: DIAGNOSTICS

SUB MENU		INCREMENT	CONFIGURATION NOTES 1	2	3	4
CLEAR	(S)	YES/NO				
V/R	(D.O.)	5.11				
HOURS	(D.O.)					

(S) = SELECT (D.O.) = DISPLAY ONLY

DESCRIPTION:

DIAGNOSTICS: The CLEAR entry can be accessed when the PANEL menu, ACCESS entry is set to LOCK or OPEN.

CLEAR Sets the diagnostics that are to be cleared. NONE saves faults when the front panel steps to the FAULTS entry. ALL clears all LS710 faults.

V/R Displays the firmware version and revision number of your LS710.

HOURS Displays the total number of hours that the LS710 has been in operation.

CONFIGURATION MENU: Channel Names

CO PPM -	CO measurement
CO_2 PERCENT -	CO_2 measurement
H_2O PERCENT -	H_2O measurement
O_2 PERCENT -	O_2 measurement
OPACITY % -	Opacity measurement
OPAC COMB % -	Combined opacity of all non zero velocity instruments
DENSITY -	Optical density measurement
VELOCITY -	Velocity measurement through auxiliary input
NO PPM -	NO measurement.
NO MASS -	NO #/MBTU (GCM) calculated using measurement and Fuel factors.
SO_2 PPM -	SO_2 measurement.
SO_2 MASS -	SO_2 #/MBTU or GCM calculated using measurement and Fuel factors.
TEMP -	Temperature measurement
AUXILIARY -	Auxiliary measurement

These channels are used as appropriate to the site instruments. Each channel will use entries as described on the worksheets that follow the description.

SUB MENU		INCREMENT
RESET	(S)	LATCH/YES/AUTO
ALARM	(S)	OFF/5-SEC/AVG/
HI LIM	(E.N.)	#.#
LO LIM	(E.N.)	#.#
O_2 MAX	(E.N.)	##.# (Note)
O_2 MIN	(E.N.)	##.# (Note)
COLUMN	(E.N.)	0-28
DISPLAY	(S)	0-30
AVG	(E.N.)	1-61 minutes
RANGE	(E.N.)	####

(E.N.) = ENTER NUMBER (S) = SELECT (D.O.) = DISPLAY ONLY

NOTE This entry only appears with the O2 PERCENT menu. All other channel menus use HI LIM and LO LIM.

CHANNEL: With the exception of RESET, the PANEL menu, ACCESS entry must be set to OPEN for channel entries to be changed. Set the ACCESS entry to LOCK entry after the changes are completed.

DESCRIPTION:

RESET Sets alarm handling parameters. LATCH holds an alarm in the active state until YES is entered. YES acknowledges and clears the alarm. AUTO causes the alarm to reset automatically when the value falls below the limit. An alarm is activated any time a value exceeds the high or low limit. In the case of O_2, an alarm is activated when the O_2 value falls below the O_2 minimum.

CONFIGURATION MENU: Channel Names (continued)

DESCRIPTION:

ALARM Selects processing for the alarm signal. OFF deactivates the alarm processor. 5-SEC uses 5-second instantaneous values as the alarm variable. AVG uses the average values (averaged over the time period entered for the specific channel menu, AVG entry) as the alarm variable. Both 5-SEC and AVG activate the alarm processor.

HI LIM Sets the upper alarm limit value. The HI LIM range is 0 to 100% of full scale.

LO LIM Sets the lower alarm limit value. The LO LIM range is 0 to 100% of full scale.

O_2 MAX Sets the O_2 high alarm limit value. The O_2 MAX range is 0-30%.

O_2 MIN Sets the O_2 low alarm limit value. The O_2 MIN range is 0-30%.

COLUMN Sets the RS232 column at which a channel value is to be printed. An entry of zero omits the measurement from printing. Columns from 1 to 28 can be selected. Each column is six-characters long.

DISPLAY Controls the measurements displayed on the front panel. When 0 is entered, the measurement for the channel is not displayed. The entered number indicates the display position. The positions are numbered in two columns starting in the upper left hand corner of the display. Numbers 1-13 are the first column and number 18 starts the second column in the upper middle of the display. The bottom line is reserved as a status line.

AVG Sets the time over which measurements for a channel are to be averaged. The time can be set for 1 to 60 minutes. AVG also sets the printing rate for a channel. For example, an entry of six averages measurements for a channel over a six minute time period and prints the average measurement every six minutes.

RANGE Sets the full scale analog range for trend recording or process control for a channel.

CONFIGURATION MENU: Channel Names (continued)
CONFIGURATION NOTES:

			INSTRUMENT # 1	2	3	4
CO PPM						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/5-SEC/AVG	*			
HI LIM	(E.N.)	0-5000	*			
LO LIM	(E.N.)	0-5000	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-61 minutes				
RANGE	(E.N.)	200-5000				
CO_2 PERCENT						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/5-SEC/AVG	*			
HI LIM	(E.N.)	0-20.0	*			
LO LIM	(E.N.)	0-20.0	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-61 minutes				
RANGE	(E.N.)	0-30.0				
H_2O PERCENT						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/5-SEC/AVG	*			
HI LIM	(E.N.)	0-60.0	*			
LO LIM	(E.N.)	0-60.0	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-61 minutes				
RANGE	(E.N.)	10.0-50.0				

*ENTRY EFFECTS ALL INSTRUMENTS
(S) = SELECT (E.N.) = ENTER NUMBER

CONFIGURATION MENU: Channel Names (continued)
CONFIGURATION NOTES:

				INSTRUMENT # 1	2	3	4
CO-ST CALC							
	RESET	(S)	LATCH/YES/AUTO	*			
	ALARM	(S)	OFF/5-SEC/AVG	*			
	HI LIM	(E.N.)	0-9000	*			
	LO LIM	(E.N.)	0-9000	*			
	COLUMN	(E.N.)	0-28				
	DISPLAY	(S)	0-30				
	AVG	(E.N.)	1-61 minutes				
	RANGE	(E.N.)	500-9000				
DEW CALC							
	RESET	(S)	LATCH/YES/AUTO	*			
	ALARM	(S)	OFF/5-SEC/AVG	*			
	HI LIM	(E.N.)	0 - 180	*			
	LO LIM	(E.N.)	0 - 180	*			
	COLUMN	(E.N.)	0-28				
	DISPLAY	(S)	0-30				
	AVG	(E.N.)	1-61 minutes				
	RANGE	(E.N.)	10 - 180				
BWS CALC							
	RESET	(S)	LATCH/YES/AUTO	*			
	ALARM	(S)	OFF/5-SEC/AVG	*			
	EXCESS	(E.N.)	0-30	*			
	ERROR	(E.N.)	0-30	*			
	COLUMN	(E.N.)	0-28				
	DISPLAY	(S)	0-30				
	AVG	(E.N.)	1-61 minutes				
	RANGE	(E.N.)	15.00 - 30.00				

*ENTRY EFFECTS ALL INSTRUMENTS
(S) = SELECT (E.N.) = ENTER NUMBER

CONFIGURATION MENU: Channel Names (continued)
CONFIGURATION NOTES:

			INSTRUMENT # 1	2	3	4
O_2 PERCENT						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/S-SEC/AVG	*			
O2 MAX	(E.N.)	0-30.0	*			
O2 MIN	(E.N.)	0-30.0	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-61 minutes				
RANGE	(E.N.)	1.0-25.0				
SO_2 PPM						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/S-SEC/AVG	*			
HI LIM	(E.N.)	0-7500	*			
LO LIM	(E.N.)	0-7500	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-61 minutes				
RANGE	(E.N.)	0-7500				
SO_2 MASS						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/S-SEC/AVG	*			
HI LIM	(E.N.)	0-10.00	*			
LO LIM	(E.N.)	0-10.00	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-61 minutes				
RANGE	(E.N.)	0-10.00				

NOTE Mass calculations are based upon O2 measurement. If O2 measurement is not available for the specified J-box then a calculation based upon CO2 is used. J-box 1 CO2 is used unless the mass measurement is on J-box 1. In this case J-box 2 CO2 is used. When GCS units are selected GCM is calculated. Refer to section 4 for calculations.

*ENTRY EFFECTS ALL INSTRUMENTS
(S) = SELECT (E.N.) = ENTER NUMBER

CONFIGURATION MENU: Channel Names (continued)
CONFIGURATION NOTES:

				INSTRUMENT # 1	2	3	4
NO PPM							
	RESET	(S)	LATCH/YES/AUTO	*			
	ALARM	(S)	OFF/5-SEC/AVG	*			
	HI LIM	(E.N.)	0-7500	*			
	LO LIM	(E.N.)	0-7500	*			
	COLUMN	(E.N.)	0-28				
	DISPLAY	(S)	0-30				
	AVG	(E.N.)	1-61 minutes				
	RANGE	(E.N.)	0-7500				
NO MASS							
	RESET	(S)	LATCH/YES/AUTO	*			
	ALARM	(S)	OFF/5-SEC/AVG	*			
	HI LIM	(E.N.)	0-10.00	*			
	LO LIM	(E.N.)	0-10.00	*			
	COLUMN	(E.N.)	0-28				
	DISPLAY	(S)	0-30				
	AVG	(E.N.)	1-61 minutes				
	RANGE	(E.N.)	0-10.00				
TEMP							
	RESET	(S)	LATCH/YES/AUTO	*			
	ALARM	(S)	OFF/5-SEC/AVG	*			
	HI LIM	(E.N.)	0-800	*			
	LO LIM	(E.N.)	0-800	*			
	COLUMN	(E.N.)	0-28				
	DISPLAY	(S)	0-30				
	AVG	(E.N.)	1-61 minutes				
	RANGE	(E.N.)	500-800				

NOTE Mass calculations are based upon O2 measurement. If O2 measurement is not available for the specified J-box then a calculation based upon CO2 is used. J-box 1 CO2 is used unless the mass measurement is on J-box 1. In this case J-box 2 CO2 is used. When CGS(Centimeters/Grams/Seconds) units are selected GCM(Grams per Cubic Meter) is calculated. Refer to section 4 for calculations.

*ENTRY EFFECTS ALL INSTRUMENTS
(S) = SELECT (E.N.) = ENTER NUMBER

CONFIGURATION MENU: Channel Names (continued)
CONFIGURATION NOTES:

			INSTRUMENT # 1	2	3	4
OPACITY						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/5-SEC/AVG	*			
HI LIM	(E.N.)	0-100.0	*			
LO LIM	(E.N.)	0-100.0	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-60 minutes				
RANGE	(E.N.)	0-100.0				
OPACITY COMB						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/5-SEC/AVG	*			
HI LIM	(E.N.)	0-100.0	*			
LO LIM	(E.N.)	0-100.0	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-60 minutes				
RANGE	(E.N.)	0-100.0				
DENSITY						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/5-SEC/AVG	*			
HI LIM	(E.N.)	0-2.0	*			
LO LIM	(E.N.)	0-2.0	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-60 minutes				
RANGE	(E.N.)	0.09-1.80				

*ENTRY EFFECTS ALL INSTRUMENTS
(S) = SELECT (E.N.) = ENTER NUMBER

LS710 CONTROLLER — SECTION 2

CONFIGURATION HERE: Channel Name (maximum)
CONFIGURATION NOTES:

			INSTRUMENT # 1	2	3	4
VELOCITY						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/5-SEC/AVG	*			
HI LIM	(E.N.)	0-80.0	*			
LO LIM	(E.N.)	0-80.0	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-60 minutes				
RANGE	(E.N.)	0-80.0				
AUXILIARY						
RESET	(S)	LATCH/YES/AUTO	*			
ALARM	(S)	OFF/5-SEC/AVG	*			
HI LIM	(E.N.)	0-999.9	*			
LO LIM	(E.N.)	0-999.9	*			
COLUMN	(E.N.)	0-28				
DISPLAY	(S)	0-30				
AVG	(E.N.)	1-60 minutes				
RANGE	(E.N.)	0-999.9				

*ENTRY EFFECTS ALL INSTRUMENTS
(S) = SELECT (E.N.) = ENTER NUMBER

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