LSC Model 725

PROCESS REFRACTOMETER

Instruction Manual

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Preface

This instruction manual will help with the installation, calibration, and maintenance of the Liquid Solids Control "LSC" Model 725 Process Refractometer. It is intended for new users of the system, maintenance and engineering personnel responsible for the operation of the system, and others who are interested in the details of the system.
This manual is organized into the following sections for easy reference:

- Section 1, The features and benefits of the system are discussed, the main components are described, and the functions of the major sub-systems are explained.
- Section 2, Installation is discussed.
- Section 3, Describes initial start-up procedures and adjustments.
- Section 4, Calibration of the system.
- Section 5, Maintenance of the LSC Gate Adaptor is detailed.
- Section 6, Trouble - shooting guide.
- Section 7, Spare parts listing.
- Section 8, Address and phone numbers of your nearest LSC representative.

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1. INTRODUCTION

The Liquid Solids Control Model 725 is a "Critical Angle Refractometer." The Refractive Index of the process fluid being monitored is determined from the critical angle, and the concentration of dissolved solids is calculated based on refractive index. The dissolved solids is continuously shown on the digital display of the Model 725. This display is a direct, real - time indication of the current dissolved solids. The Model 725 Refractometer also provides standard analog control outputs, such as 4-20 mA and 0-10 VDC.

1.1Features and Benefits

LSC's implementation of the critical angle technology provides the following features and benefits:

- SOLID STATE CONSTRUCTION: The internal components of the sensing head are designed to encompass the full range of refractive indexes.

- INFRA-RED ENERGY SOURCE: The utilization of an infra-red LED(rather than an incandescent light source) provides a maintenance free sensing head. The heat, Filament failure, and adjustments inherent in incandescent light sources are completely eliminated by this design

- SAPPHIRE "PRISM:" LSC's unique hemisphere sapphire "prism" allows one sensing head to be used in all applications, and withstands years of service without deterioration.

- OUTPUT SIGNAL/DISPLAY: The LSC Model 725 provides an output signal that is truly linear versus dissolved solids/BRIX, even though the refractive index of the fluid may be non-linear.

1.2Refractometer Components

The major components of the Model 725 are described in the following paragraphs. This information will help familiarize the user with the components and the functions of each.

1.2.1 Sensing Heads

The sensing head is the portion of the refractometer that is mounted in contact with the product and performs the actual critical angle measurement. There are two types of sensing head: the in-line and the insertion probe style.

IN-LINE SENSING HEAD
The in-line sensing head is mounted in a process fluid pipe line. The 725 sensing head can be installed on the following:

- Pipe sections
- Flow thru blocks
- Valve bodies

Each of these options will be discussed in more detail in Section 1.2.4.

INSERTION PROBE SENSING HEAD
The insertion probe is used for installation in tanks and vessels where dissolved solids must be measured in the vessel rather than the pipeline. The probe style sensing head can also be installed in a large pipeline.

1.2.2 Sensing Head Components

The major sub-assemblies of the sensing head and their functions are described below, and illustrated schematically in *Figure 1.*

- SAPPHIRE SENSING WINDOW("PRISM"): The sapphire sensing window, commonly referred to as the "prism," is mounted in contact with the process fluid. The wetting of the prism face provides the physical properties necessary for the actual critical angle measurement to be performed. The focused light beam passes through the sensing window to the liquid interface, and is either reflected or refracted into the liquid, depending upon the refractive index of the liquid
- DETECTOR: The detector indirectly measures the critical angle, by measuring the amount of energy being refracted by the process fluid. The portion of the light beam which is reflected by depends on the refractive index of the fluid. The detector also incorporates a reference element, Which is used to compensate for any changes in the optical components over time.

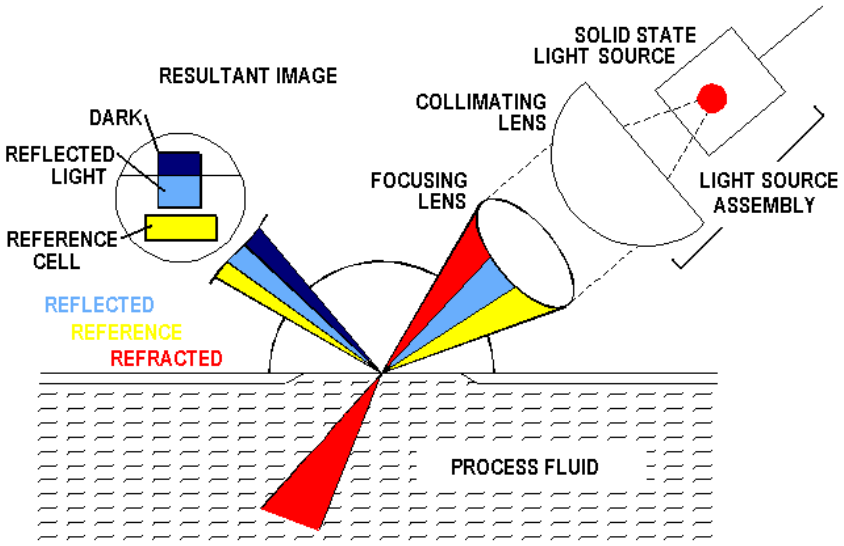


Figure 1. Sensing Head Components

- INFRA-RED ENERGY SOURCE: The infra-red LED generates a beam of invisible infra-red light, which is collimated, focused, and then projected through the sensing window to the interface of the process fluid. The portion of this light beam that hits the liquid interface at an angle greater than the "critical angle" is refracted into and absorbed by the process fluid, while the rest of the light beam is reflected by the interface, onto the detector. The portion of light energy that is reflected is measured by the detector.
- TEMPERATURE SENSOR: Changes in the refractive index due to the temperature variations are corrected using the signal from the temperature sensor. This is necessary because the refractive index in all liquids is affected by the temperature of the liquid.

1.2.3 **Prism Wash Assembly**:

An automatic prism wash system can be provided with all Model 725 systems. This subsystem periodically washes the fluid contact surface of the prism to remove any particles that have adhered to the prism surface, to assure accurate measurements. The prism wash assembly is mounted adjacent to the sensing head, as illustrated in *Figure 2.* A supply of an appropriate washing medium (often steam) must be provided for the prism wash to function, as described in Section 2.2.

The prism wash steam is controlled through a ball valve. Two different types of actuators are available to match the application, as follows:

- Air to open, spring to close
- Air to open, air to close

The actuator is controlled by air, through an electric solenoid.

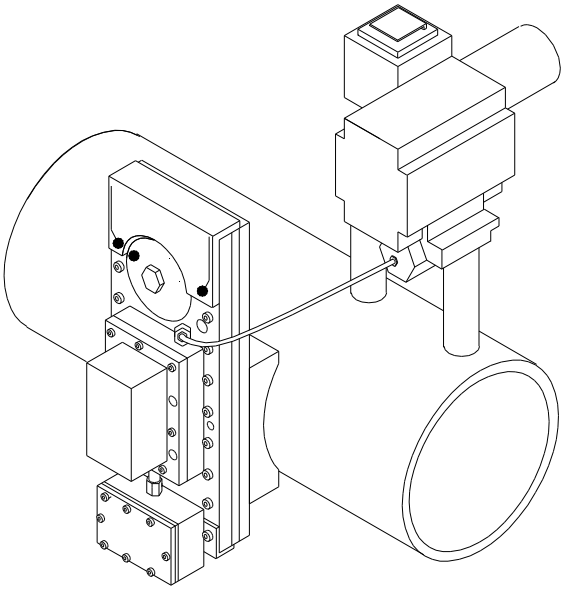


Figure 2. Installed Prism Wash

1.2.4 Sensing Head Mounting Systems

LSC offers several types of mounting hardware, to supply the most economical and practical system as possible in each specific application. The mounting hardware is shown in *Figures 3 - 6.*

➢ PIPE SECTION MOUNTING

The in-line Model 725 sensing head with pipe section is illustrated in *Figure 3.* This type of mounting is used in most pipe line applications, generally in pipe lines 3"-18" in diameter. Pipe sections can be ordered with bell reducers and mounting flanges when needed.

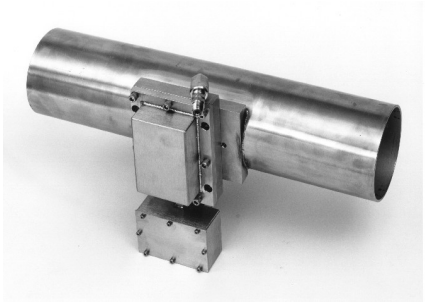


Figure 3. Pipe Section

➢ VALVE BODY MOUNTING

A sanitary valve body mounting with prism wash is illustrated in *Figure 4.* This type of mounting hardware is well suited to pipelines from 2"-3" in diameter, in sanitary and non-sanitary applications.

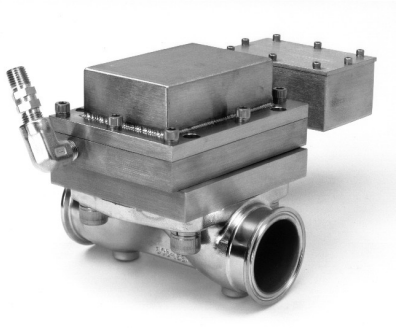


Figure 4. Valve Body

➢ FLOW THRU BLOCK

The Flow Thru Block mounting illustrated in *Figure 5* is often used in by-pass loops and other small pipe line applications, from ¼"-2" diameter. The Flow Thru Block mount is available with NPT threaded connections, industrial flanges, sanitary Tri-clover connections, and a variety of other connections to suit specialized applications.

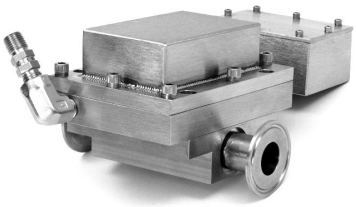


Figure 5. Flow Thru Block

➢ INSERTION PROBE

The insertion probe style sensing head, illustrated in *Figure 6,* is used in vessel walls, tanks, or large

pipe lines. It can be supplied with either sanitary prism wash or industrial prism wash.

Figure 6. Insertion Probe

1.2.4 Electronics

The standard LSC 725 processor system includes four sub-assemblies and one cable, as discussed below

Amplifier Board: PC-1

The PC-1 amplifier board supplies the 4-20 mA DC output and provides circuitry to compensate for all related process variables. The layout of the PC-1 amplifier board is shown in *Figure 7.*

Interconnecting Board: PC-2 and PC-3

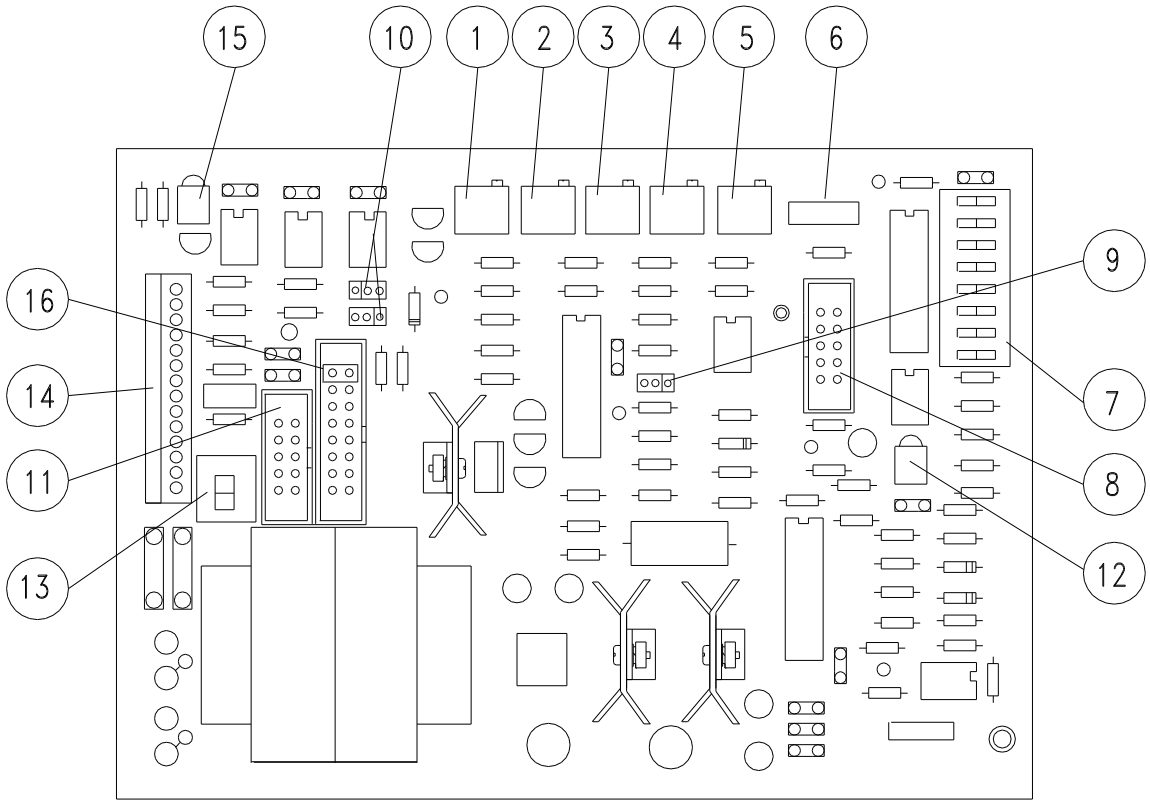
All wiring from the sensing head as well as the input power and the industry standard 4-20 mA output is provided through the PC-2/PC-3 interconnecting board, illustrated in *Figure 8.* The PC-2 interconnecting board is used for the rack and panel mount electronics enclosures, while the PC-3 is used with the NEMA and wallmount models.

Digital Display

The dissolved solids measurements and all diagnostic readings are shown on the digital display. The abbreviations and symbols used on the digital display are as defined in *Table 1,* in the following section. The digital display is capable of displaying 5 digits.

Display Driver and Output Signal Linearizer: PC-12

On most units shipped after June 1992, the electronics signal that drives the digital display is provided by the PC-12 board. The PC-12 board can also correct or "linearize" this signal, if necessary to compensate for a non-linear solution. The layout of the PC-12 board is illustrated in *Figure 9.*

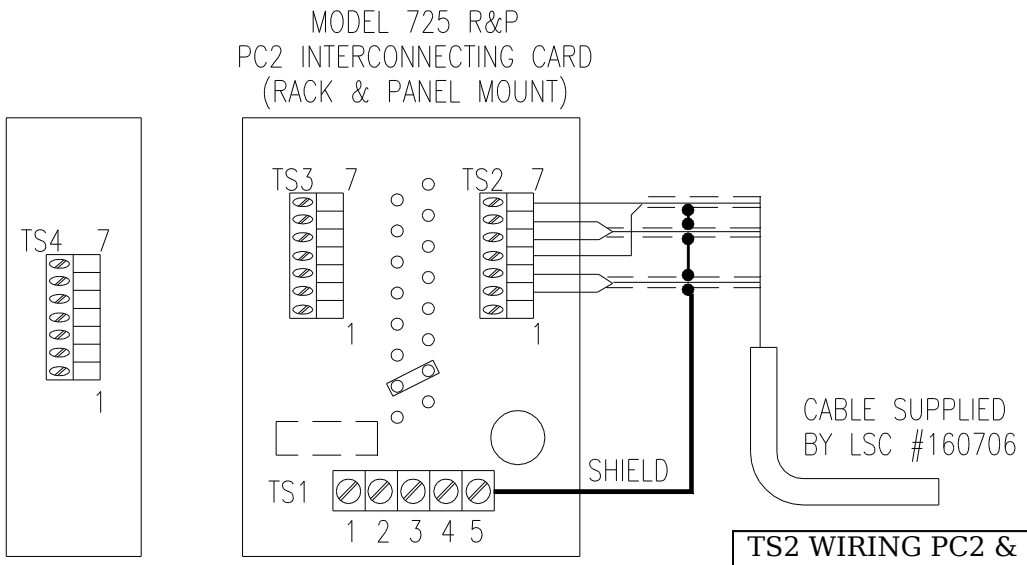


1 - COARSE ZERO (R1)
2 - TEMP ZERO READOUT (R2)
3 - CURRENT SPAN
4 - CURRENT ZERO (R4)
5 - T.C. ZERO (R5)
6 - DAMPING
7 - S2, PRISM WASH SWITCHES

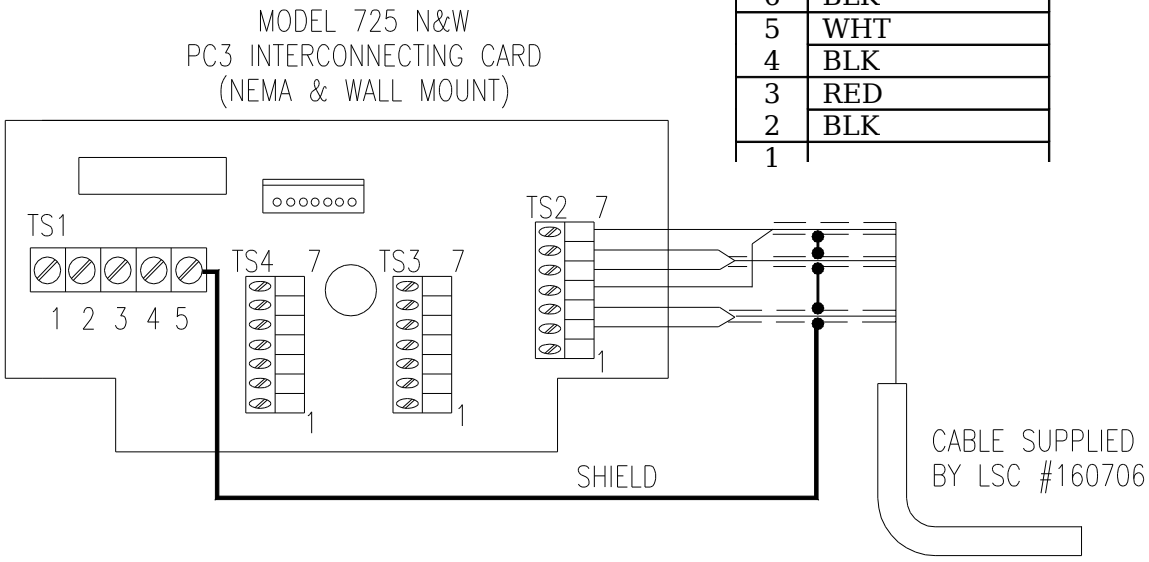
8 - INSTRUMENT PANEL CONNECTION

9 - T.C. GAIN JUMPER
10 - RI GAIN JUMPERS
11 - DISPLAY CONNECTOR
12 - PRISM WASH INDICATOR
13 - POWER SWITCH
14 - PC-2/PC-3 CONNECTOR
15 - LIGHT SOURCE FAULT INDICATOR
16 - JUMPER USED W/ PC7 DISPLAY BD.

Figure 7. Amplifier Board Layout



TS2 WIRING PC2 & PC3	
7	GRN
6	BLK
5	WHT
4	BLK
3	RED
2	BLK
1	



TS 1	
1	P/ W HOT
2	P/W NEUT
3	POWER HOT
4	POWER NEUT
5	CHASSIS GND

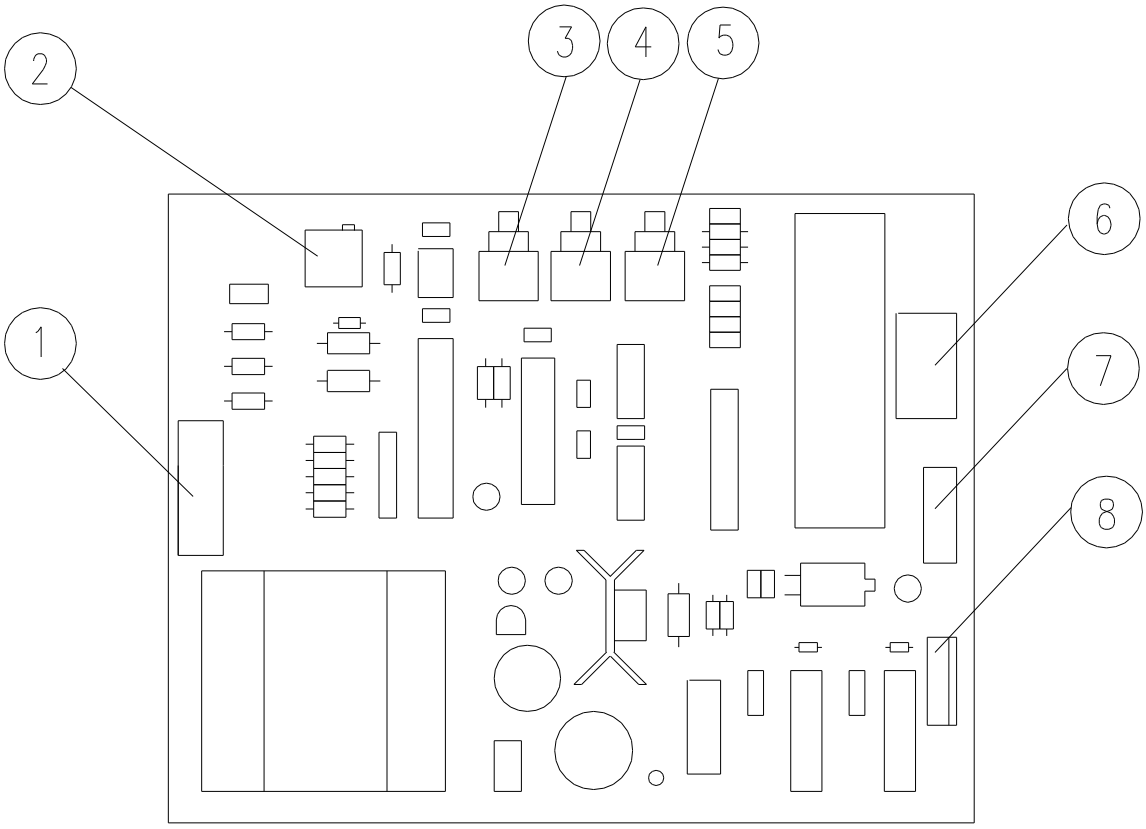
TS 2	
7	TEMP. PROBE
6	REF. DET.
5	MEASURE DET.
4	SIGNAL RETURN
3	LAMP VDC
2	GROUND
1	

TS 3	
7	EXT. TRIG. HOLD
6	GROUND
5	CURRENT OUT
4	GROUND
3	TEMP. OUT
2	0-10 VDC
1	GROUND

TS4		
7	N.O.	HIGHER
6	COM	
5	N.C.	
4		
3	N.O.	LOWER
2	COM	
1	N.C.	

N.O. DESIGNATES NORMALLY OPEN, N.C. DESIGNATES NORMALLY CLOSED
("NORMALLY" MEANS RELAY COIL NOT ENERGIZED)

Figure 8. PC2/PC3 Interconnecting Board Layout



1	PC-1, J2 CONNECTOR
2	FACTORY SET
3	SET DISPLAY AND ALARM LIMITS
4	SCROLL DISPLAY TO PREVIOUS POS.
5	SCROLL DISPLAY TO NEXT POS.
6	SERIAL TERMINAL CONNECTOR
7	DISPLAY CONNECTOR
8	ALARM CONNECTOR

Figure 9. PC-12 Linearizer Board

All calibration, alarm, diagnostic, and parameter settings are made using three switches on the PC-12 board. Each of the settings available through the PC-12 board are displayed on the digital display with a one digit identifying symbol, letter, or number as shown in Table 1.

Table 1. Digital Display Definitions

INDICATOR	READING
H	Higher Alarm Set-Point
L	Lower Alarm Set-Point
6	-15 VDC Read-out
5	+15 VDC Read-out
4	TC Offset Read-out
3	LED Supply Read-out
2	Sensing Head Temp. °C
-none-	BRIX, % solids, Refractive Index (as programmed)
t	Top (high) display Read-out
b	Bottom (low) display Read-out
l	0-10 VDC signal IN to the PC-12 board
o	Linearized signal OUT of the PC-12 board

Of the parameters above, only the Higher alarm, Lower alarm, Top, and Bottom (H,L,t.b) settings can be changed. The other positions display diagnostic information. The decimal can be changed, only in the main display position. Each time the SET button is Depressed the decimal moves one digit.

The functions of the PC-12 board are as follows:

- SET: When depressed, the SET switch "frees" one digit, allowing it to be changed by using the PREV/NEXT buttons.
- PREV: Scrolls the display to the previous position, or increments the flashing digit on integer lower.
- NEXT: Scrolls the display to the next position, or increments the flashing digit one integer higher.

To scroll through the display parameters, use the PREV and the NEXT buttons. To change one of the four user - changeable parameters, choose the position, press the SET switch once, and one of the digits displayed will blink, indicating that it is "free" to be changed. Press the SET button again, and the next digit will start blinking, indicating that it can be changed using the PREV and NEXT buttons. For further details on how to set parameters using the PC-12 switches, see Section 3.
The PC-12 Linearizer board incorporates two alarm outputs, for a variety of alarm conditions. The alarms can be operated as Hi-Hi, Hi-Lo, or Lo-Lo. The alarm outputs are provided through two dry contact relays, K1 and K2, located on the lower right of the PC-12 (see *Figure 9*). The PC-12 linearizer

board replaces the PC-6 display interface board and optional alarm interface board that were used in earlier LSC Model 725 systems.

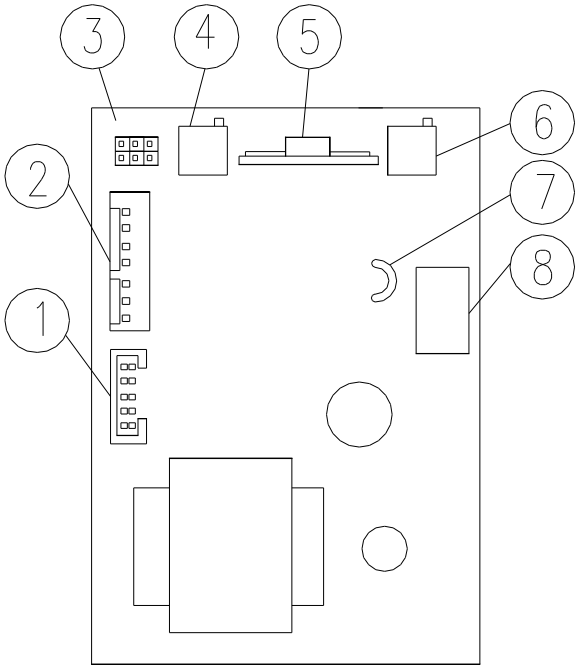
PC-6 DISPLAY INTERFACE BOARD
On units shipped before June 1992, the PC-6 board is used to drive the digital display and to provide a connection for the optional alarm board. The PC-6 board (illustrated in *Figure10*) incorporates several connectors, the 6 position switch, and two potentiometers. The 6 position rotary diagnostic switch and potentiometer are used in calibration and trouble-shooting of the system.

DIAGNOSTIC SWITCH:
The diagnostic switch is used to select from 6 available display modes, as defined in Table 2 below.

Table 2. Diagnostic Switch Functions

POSITION	DISPLAY
1.	Normal Operation (Main Display)
2.	Sensing Head Temperature, °C
3.	Light Source Voltage
4.	Temp. Comp. Offset Voltage
5.	+15 Volt Supply
6.	-15 Volt Supply

On units with the PC-6 board, the digital display is adjusted during system calibration using the two potentiometers, R1 (zero and R2 (span).



1 - MAIN AMPLIFIER CONNECTOR
2 - DISPLAY CONNECROR
3 - DECIMAL POINT JUMPER
4 - METER ZERO (DPM)
5 - DIAGNOSTIC SWITCH
SWITCH POSITION
1 - NORMAL OPERATION
2 - SENS. HEAD TEMP °C
3 - LIGHT SOURCE VOLTAGE
4 - T.C. OFFSET VOLTAGE
5 - +15V SUPPLY
6 - -15V SUPPLY
6 - METER SPAN (DPM)
7 - JUMPER (REMOVE WHEN USING ALARM CARD
8 - ALARM CARD CONNECTION

Interconnecting Cable
A three pair twisted/shielded cable is used to connect the sensing head to the PC-2/PC-3 inside the electronics enclosure. This cable is provided by LSC and is illustrated in *Figur4e 8*.

NOTE: OTHER TYPES OF CABLE MAY CAUSE IMPROPER OPERATION.

Electronic Enclosures
LSC provides several types of electronic enclosures, for different environments and available space, as described below.

- PANEL MOUNT ENCLOSURES: The Model 725-P panel mount enclosure illustrated in *Figure 11* is suitable for installation in an electronics panel. This enclosure should be used in clean, dry environments only.

Figure 11 Panel Mount

- WALL MOUNT ENCLOSURE: The single unit wall mount enclosure 725-W with ABS plastic body illustrated in *Figure 12* is water resistant, and can be used in areas with mild exposure to the environment.

Figure 12 Wall Mount

- NEMA 4 RATED STAINLESS STEEL ENCLOSURE: The single unit stainless steel, NEMA 4 rated 725-N wall mount enclosure illustrated in *Figure 13* is used in many outdoor applications where the enclosure must provide maximum protection from the environment.

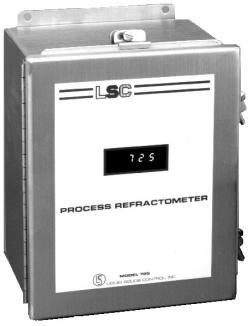


Figure 13 Nema 4

- RACK MOUNT ENCLOSURE: Single or multiple rack mount 725R units can be installed in one 19" rack unit. This type of enclosure should be used only in installations where it is well protected from the environment. It is well suited for use in an electronics room where several other types of equipment are mounted in the same rack.

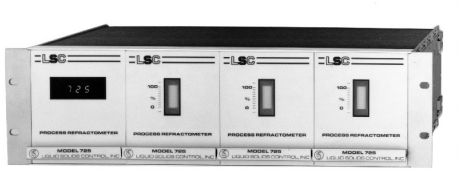


Figure 14 Rack Mount

- INTRINSIC SAFETY BARRIER AND EXPLOSION - PROOF ENCLOSURE: In applications where there is potential for explosion caused by spark., LSC offers an intrinsic safety barrier, or an explosion proof enclosure. The intrinsic safety barrier is installed in the interconnecting cable as illustrated below, and limits both the current and the voltage to the sensing head, such that it is impossible for the sensing head to generate a spark, making it "intrinsically safe." In intrinsic safety barrier installations the electronics are located in a remote, safe area, away from the process and protected from the risk of explosion. The explosion proof enclosure is used in applications where remote mounting of the electronics is not practical.

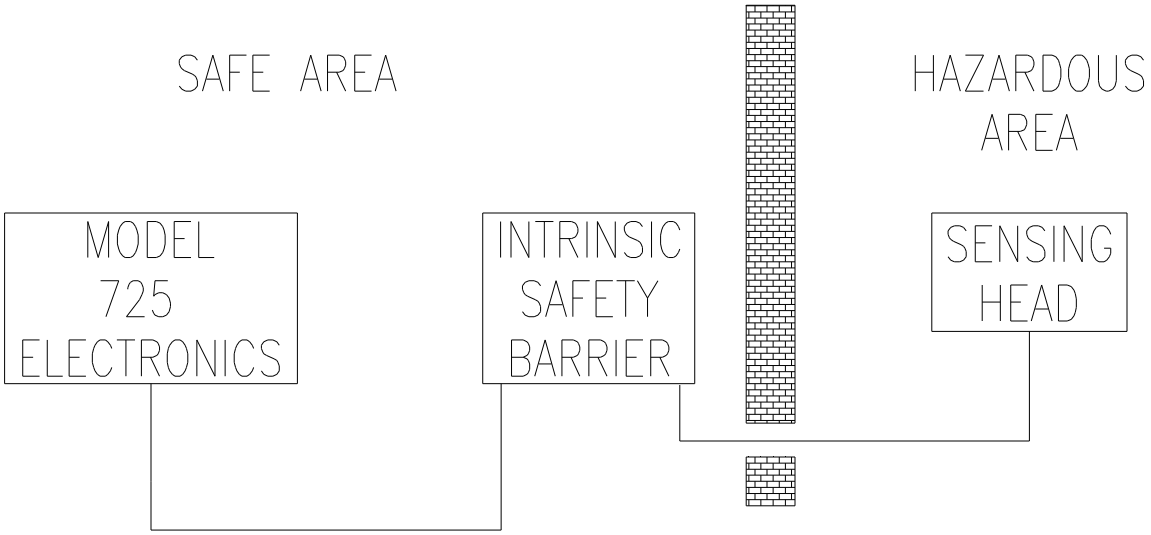


Figure 15. Intrinsic Safety Barrier Schematic

1.3Optional Programming Module

The Model 725 is programmed using the optional programming module. Although the system is fully preprogrammed and calibrated by LSC before being shipped to the customer, customers who wish to reprogram the unit can purchase the programming module. Reprogramming is generally required only when the application changes significantly, such as a change in the characteristics of the process liquid.

1.4Unit Specific Calibration

Each LSC refractometer is calibrated before it leaves the manufacturing facility. A data sheet listing all of the calibration constants and diagnostic information is shipped with each unit. Refer to the calibration sheet for specific parameters of the unit.

1.5Specifications

The LSC Model 725 specifications are listed in Table 3 below.

Table 3. Model 725 Technical Specifications.

Refractive Index Range % Solids or BRIX Range	100/115/230 vac, 50/60 HZ, <10 watts		
Span (calibration)		Minimum	Maximum
	RI	0.0015	0.2000
	BRIX	1	85
	SOLIDS*	1%	100%
	*May vary with some process materials or applications		
Accuracy	0.5% span (1 count on DPM read-out)		
Repeatability and Sensitivity	1 count on DPM read-out		
Stability	No measurable drift		
Speed of response	No damping: 25 milliseconds Max damping: Time constant 30 seconds		
Process Temperature Range	-25 to 150 C		
Temperature Compensation	Automatic - Electronic		
Process Temperature Output	0 - 150 C = 0 - 1500 MVDC		
Process Line Pressure	Up to 1000 PSIG (68 bar)		
Interconnecting cable length	1500 feet maximum (460 M)		
Analog Outputs	Standard and included: 1-5, 4-20, 10-50 MADC (20V compliance) 0-10 VDC		
Dual Alarm Set Points	LO-LO, LO-HI, HI-HI Relays normally energized or normally not energized Set points fully adjustable		

NOTES(1) 316 stainless steel is the standard wetted material. Many other materials are available for speciality options.(2) Due to ongoing Research and Development and product improvement, all specifications are subject to change.

INSTALLATION

Before beginning the installation, use the following check-list to verify that all components are available and for the correct type:

- Mounting Hardware
- Sensing Head / Prism Wash
- Electronics / Enclosure
- Interconnecting Cable
- Installation DWG's.

2.1 Installing the Pipe Section

Pipe section installations are used in applications where the flow is high and turbulent. The pipe section supplied by LSC is installed as a section of the process liquid pipeline. The pipeline may be oriented either vertically or horizontally. In vertical pipeline applications, the fluid flow must be upward and the sensing head can be installed in any orientation. In horizontal pipelines, the sensing head must be installed on the side of the pipelines. (as illustrated below)

Some of the installation options available are illustrated in *Figure 16*. There are three basic methods for pipe section installation.

- WELDED: A section of the process pipeline is cut out, and the pipe section provided by LSC is welded in its place, per specifications supplied by the customer.
- BOLTED FLANGE: When the ability to remove the LSC pipe section is desired, a bolted flange connection is used. LSC can provide the pipe section in the appropriate diameter, with the mounting flanges in place.
- REDUCING BELL FLANGES: When the flow rate in the pipeline is insufficient for good operation of the refractometer, reducing bell flanges are provided to yield a higher flow rate. The design of the bell flange is site - specific; see the LSC contract for further details.

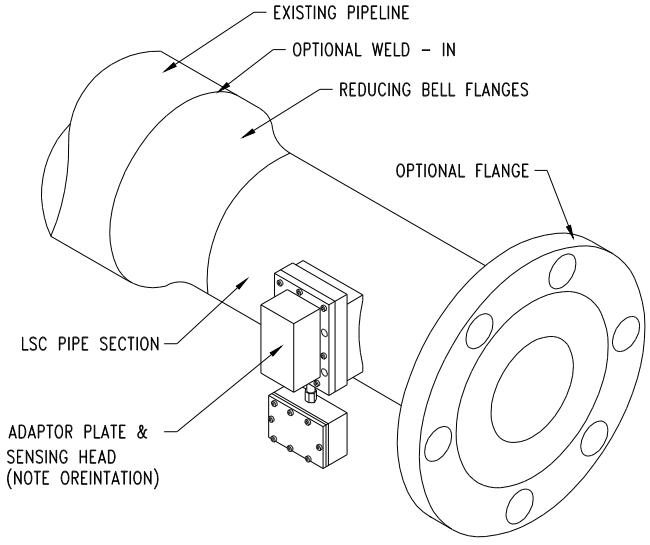


Figure 16, Pipe Section Installation

2.2 Installing Prism Wash

The prism wash system (illustrated in *Figure17*) is installed by connecting a supply of an appropriate wash medium with adequate pressure to the fitting provided, and connecting the prism wash AC power from TS-1 on PC-2/PC-3 to the solenoid.

The wash medium steam pressure must be sufficient to overcome the process line pressure and the check valve cracking pressure and the provide 30 psi for the actual prism wash. This total required pressure can be calculated as follows:

REQUIRED PRESSURE (psi)	=	PROCESS PRESSURE	+	CHECK VALVE CRACKING PRESSURE	+	30 psi

The wiring of the prism wash solenoid is as illustrated in *Figure 17.* Like all electrical installations, the prism wash solenoid wiring should be performed by a qualified industrial electrician.

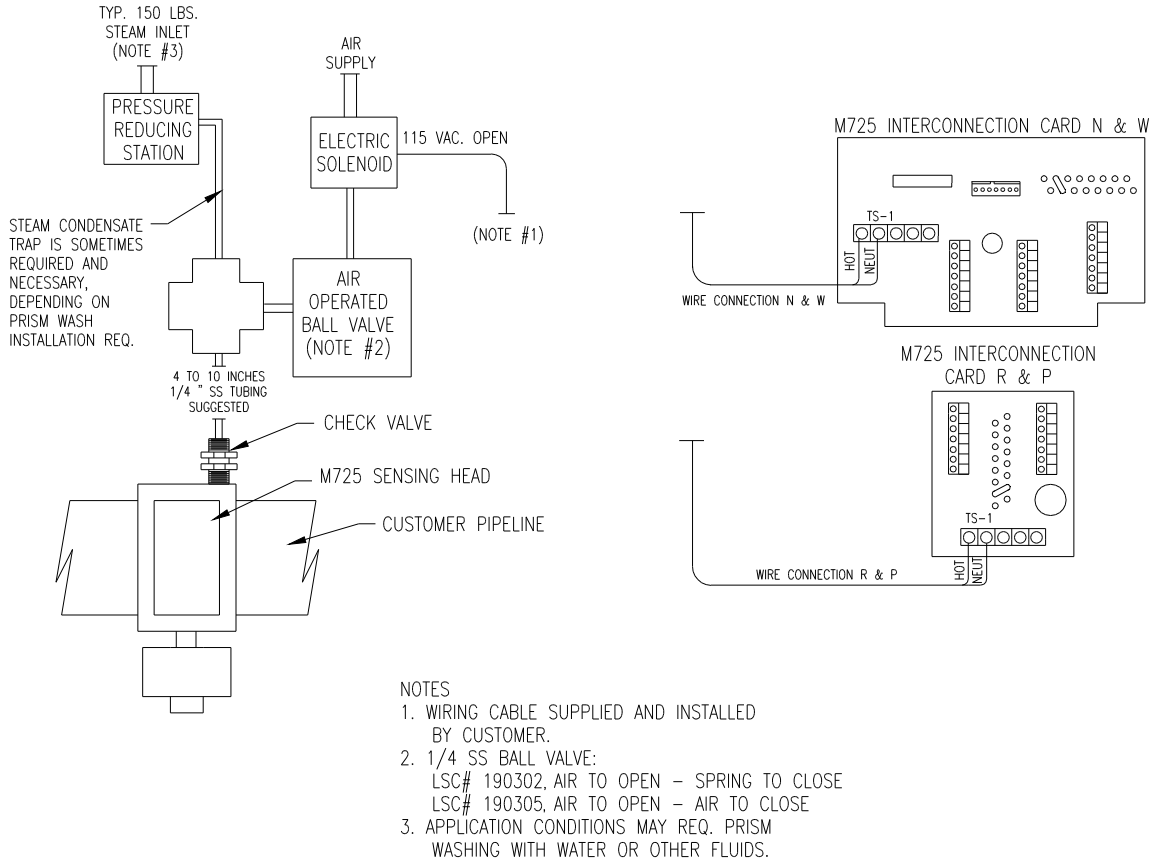
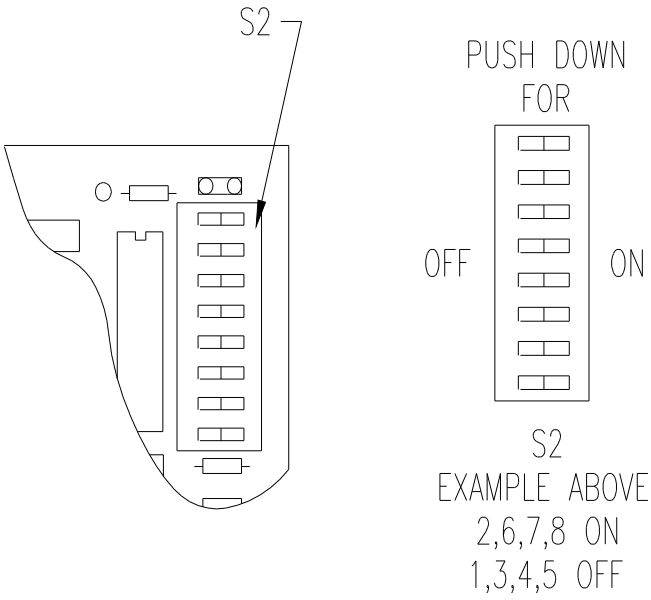


Figure 17. Prism Wash System Schematic and Wiring Diagram

The prism wash cycle is usually set at the factory to wash for 6-7 seconds once every 20 minutes. This wash schedule is adequate for most applications, but can be changed by using switch S2 on the PC-1 board, shown in *Figure 18*. There is a 40 second hold period after each prism wash, during which the digital display and outputs will remain unchanged (on "hold")

To verify proper operation of the prism wash circuitry, see section 3.5.



WASH FREQUENCY MINUTES	SWITCH POSITION ON	OFF
10	1	2,3,4, 5
20	2	1,3,4, 5
40	3	1,2,4, 5
80	4	1,2,3, 5
160	5	1,2,3, 4

WASH DURATION SECONDS	SWITCH POSITION ON	OFF
7	6,7,8	
10	6	7,8
15	7,8	6
20	7	6,8
45	8	5,7

Figure 18. Prism Wash Schedule Control Settings

2.3 Installing the Gate Adaptor

The Gate Adaptor is installed between the sensing head and the pipe section, as shown in *Figure 19.* For complete details on how to install the gate adaptor, see the drawings provided with your unit.

The Gate Adaptor is used primarily in the pulp & paper industry, for service of black liquor.

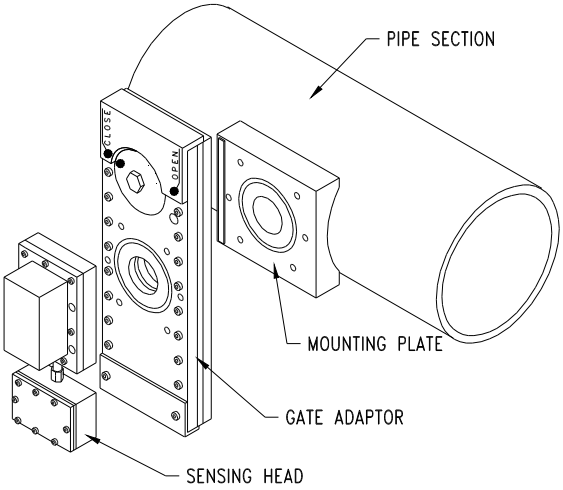


Figure 19. Installing the Gate Adaptor

2.4 Installing Sensing head

2.4.1 Standard Sensing Head
The sensing head is bolted directly to the in-line device and sealed with a teflon "o"-ring. Appropriate mounting hardware is provided. Connect the prism wash supply line to the fitting supplied, if applicable.

2.4.2 Insertion Probe
The insertion - probe sensing head is installed by preparing a 4" diameter cut out in the tank or vessel, welding the mounting ferrule (provided by LSC) in place, and then mounting the probe to the ferrule, as illustrated in *Figure 20* below.

Note that the end face of the insertion probe is cut at an angle. After installing the insertion probe, but before fully securing the mounting clamp, rotate the insertion probe to a position that maximizes the product impingement on the sensing window "prism" face.

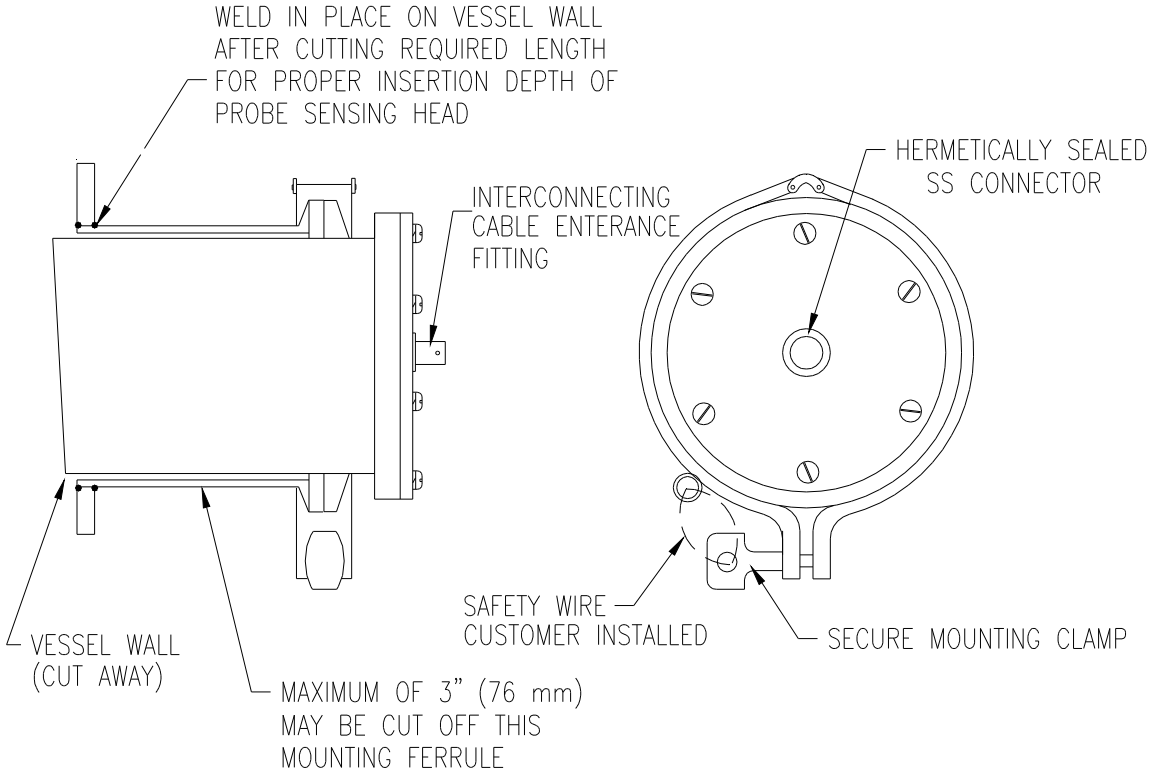


Figure 20. Insertion Probe Installation

2.5 Connecting the Electronics

Mount the electronics enclosure as described in this section. If possible, locate the electronics in a area where they will be protected from moisture, heat, and any corrosive gases. See *Figure 25* for wiring diagram.

2.5.1 Installing Enclosure

Mount the electronics enclosure in a suitable location. LSC recommends locating the electronics enclosure in a controlled environment, such as a control room.

- PANEL MOUNT: The panel mount electronics enclosure is mounted through a 4.25" x 4.68" (108 mm x 119 mm) cut out and secured with four 3/16" dia screws, as shown in *Figure 21.*
- NEMA: The NEMA enclosure is mounted to a suitable support using four 5/16" dia screws, as shown in *Figure 22.*
- WALL MOUNT: The wall mount enclosure is secured to suitable support (such as a wall) using four 7/32" dia screws, as shown in *Figure 23.*
- RACK MOUNT: The rack mount enclosure is installed in a standard 19" equipment rack and secured with four screws, as shown in *Figure 24*.

2.5.2 Connecting Sensing Head

Connect the sensing head to the electronics using the interconnecting cable, as illustrated in *Figure 25.* Note that, because there are three black wires in the cable bundle WHICH CARRY DIFFERENT SIGNAL AND PERFORM DIFFERENT FUNCTIONS, care must be exercised to make sure that the wires are connected properly. The black wires can be distinguished by the colored wires that they are paired with.

NOTE: OTHER TYPES OF CABLE MAY CAUSE IMPROPER OPERATION.

2.5.3 Intrinsic Safety Barrier Installation

The intrinsic safety barrier is installed between the electronics and the sensing head, as illustrated in *Figure 26.* (when applicable)

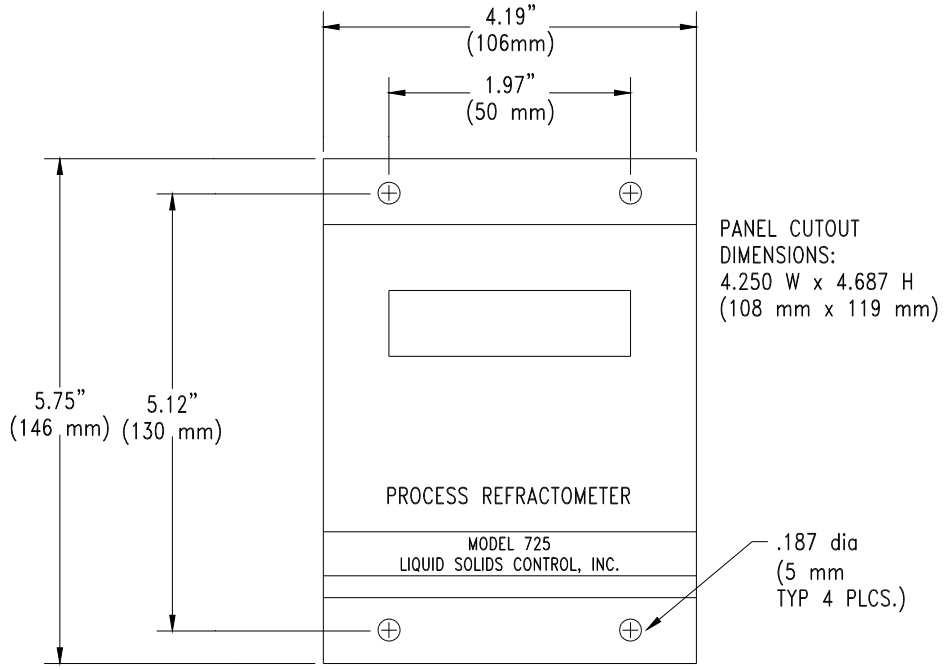


Figure 21. Panel Mount Dimensions

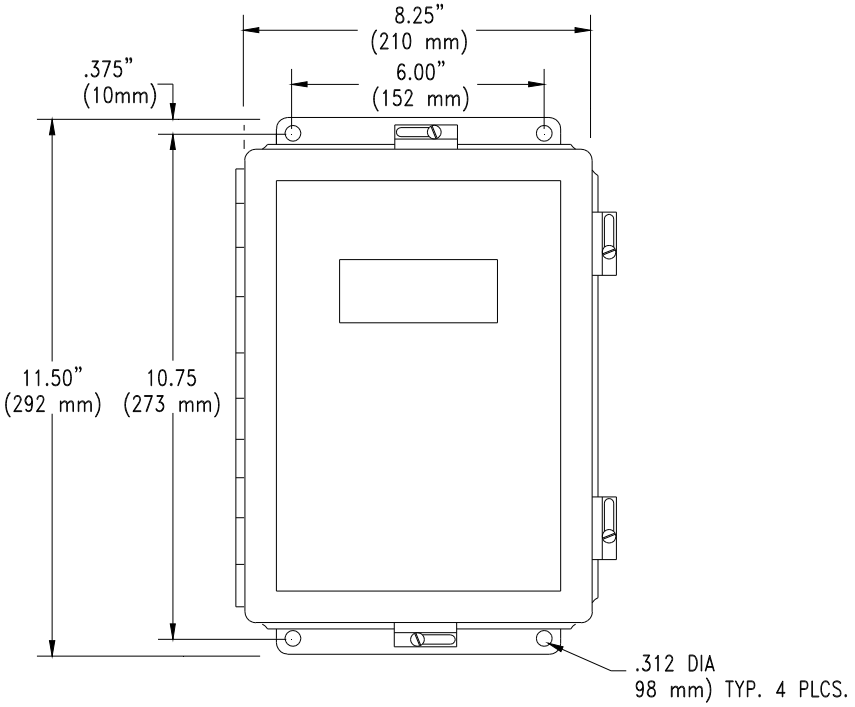


Figure 22. NEMA Enclosure Mounting Dimensions

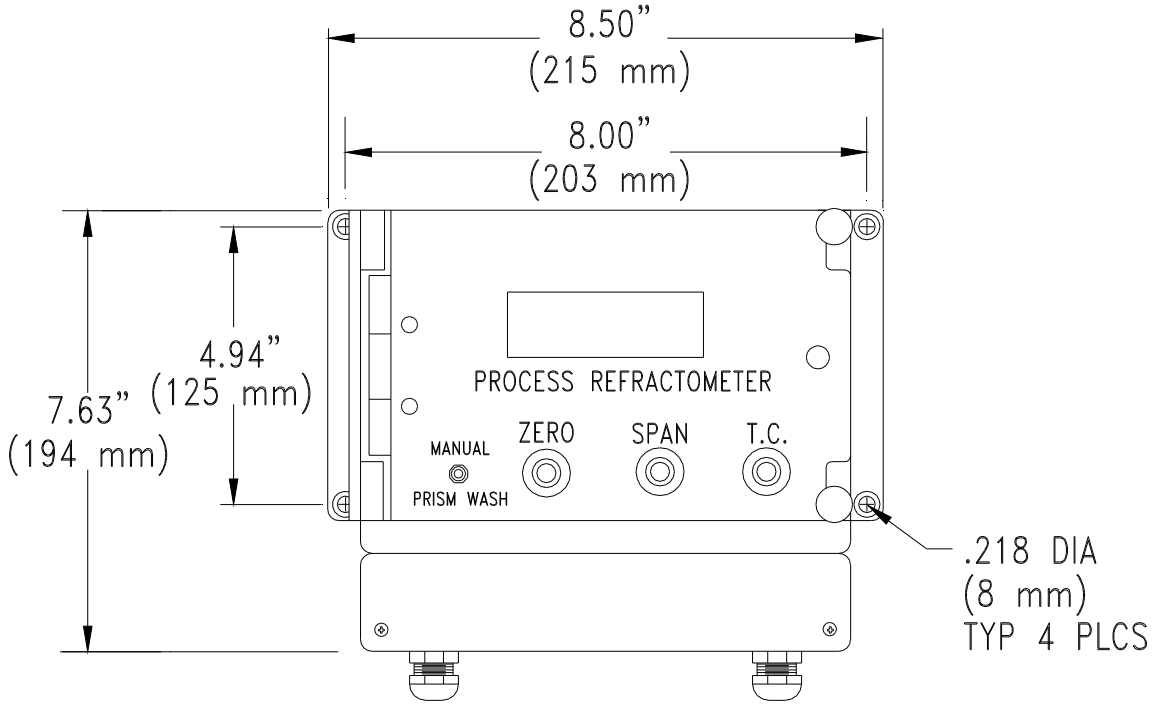


Figure 23. Wall Mount Dimensions

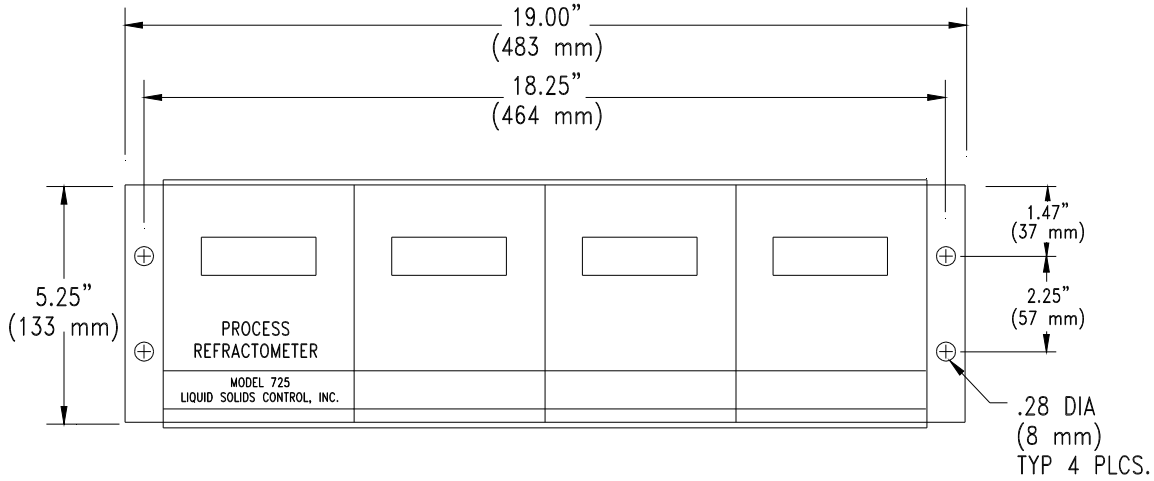
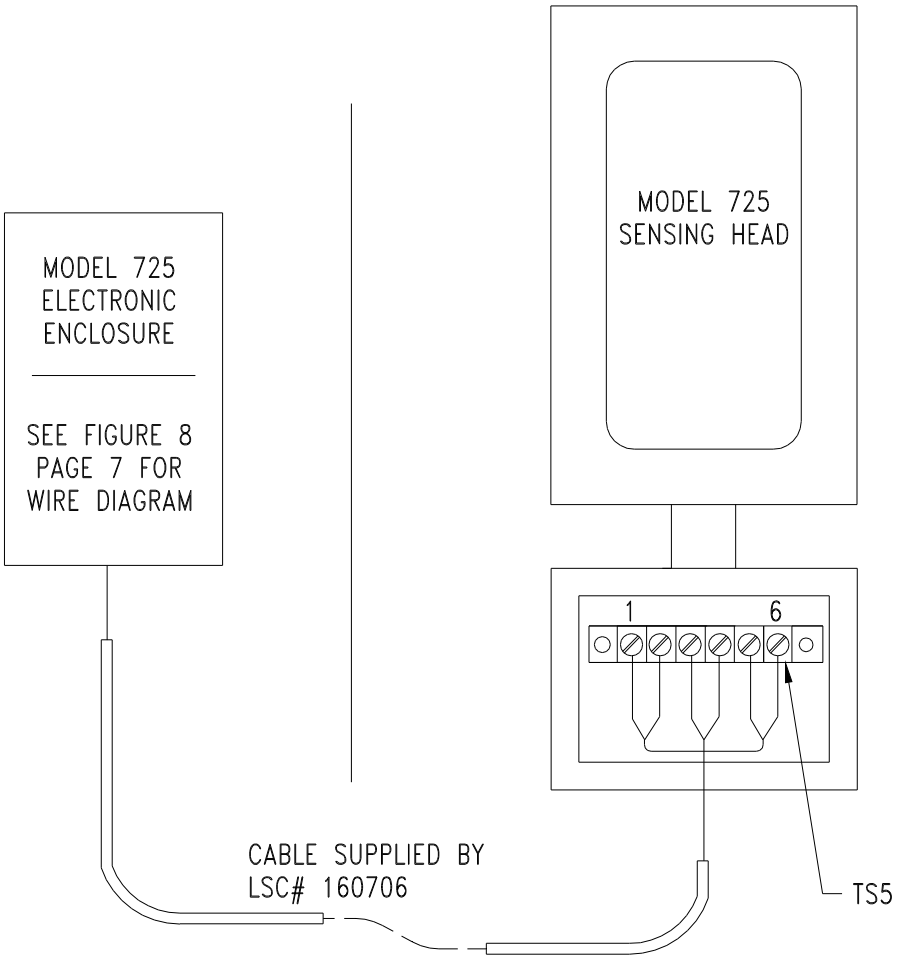


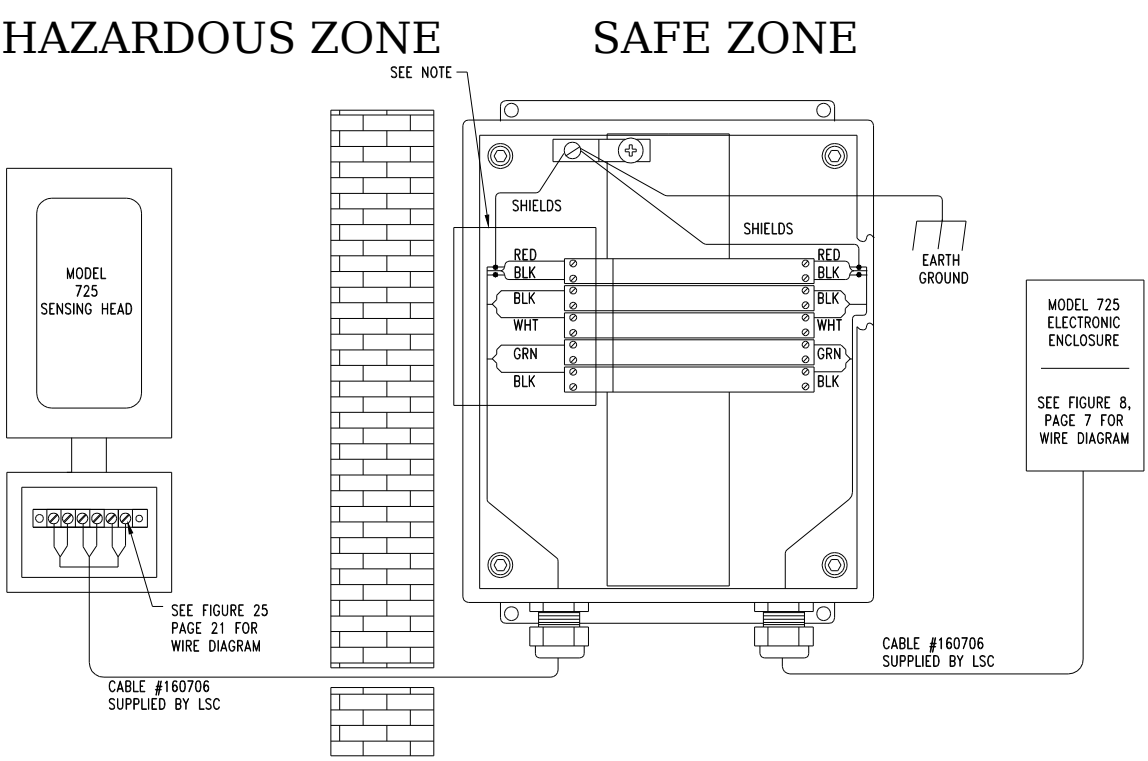
Figure 24 Rack Mount Dimensions



TS5

1	RED	LED SUPPLY
2	BLK	LED GROUND
3	BLK	REF. DET.
4	WHT	MEAS. DET.
5	GRN	TEMP. PROBE
6	BLK	SIG GROUND

Figure 25. Sensing Head Wiring



NOTE - SENSING HEAD CONNECTIONS TO BE MADE ON THE BLUE SIDE OF BARRIER.

Figure 26. Intrinsic Safety Barrier Wiring Diagram

2.5.4 Connecting Main Power

NOTE: PLEASE CHECK WITH LOCAL ELECTRICAL CODES BEFORE INSTALLING. A CIRCUIT BREAKER ON THE POWER SUPPLY IS HIGHLY RECOMMENDED FOR ALL INSTALLATIONS.

See the data sheet provided with the unit for specification of the proper power supply. (Model 725 units are set-up at the factory for either 115 VAC or 230 VAC operation, as specified by the customer.) A wire routing hole is provided at the bottom of all LSC electronics enclosures, which should be used for the power and interconnecting cable.

Before connecting the main power supply, make sure that the power supply circuit breaker is OFF and that the power on/off switch located on the PC-1 board is turned OFF. (see *Figure 27*.) Connect the main POWER HOT supply wire to terminal TS1-3, POWER NEUTRAL to TS4 and GROUND to terminal TS1-5 on the PC-2 or PC-3 board, as illustrated in *Figure 8* and detailed in the drawing provided with each system.

3. START - UP

Before turning the power circuit breaker or the refractometer power switch on, recheck all wiring per diagrams in this manual and the detail drawings supplied with the refractometer.

3.1 Turning the Power ON
The refractometer power switch is located on the PC-1 board inside the electronics enclosure, as shown in *Figure 27.* Turn the power supply circuit breaker on, and then switch the refractometer on. The digital display should illuminate immediately, indicating that the unit is functioning.

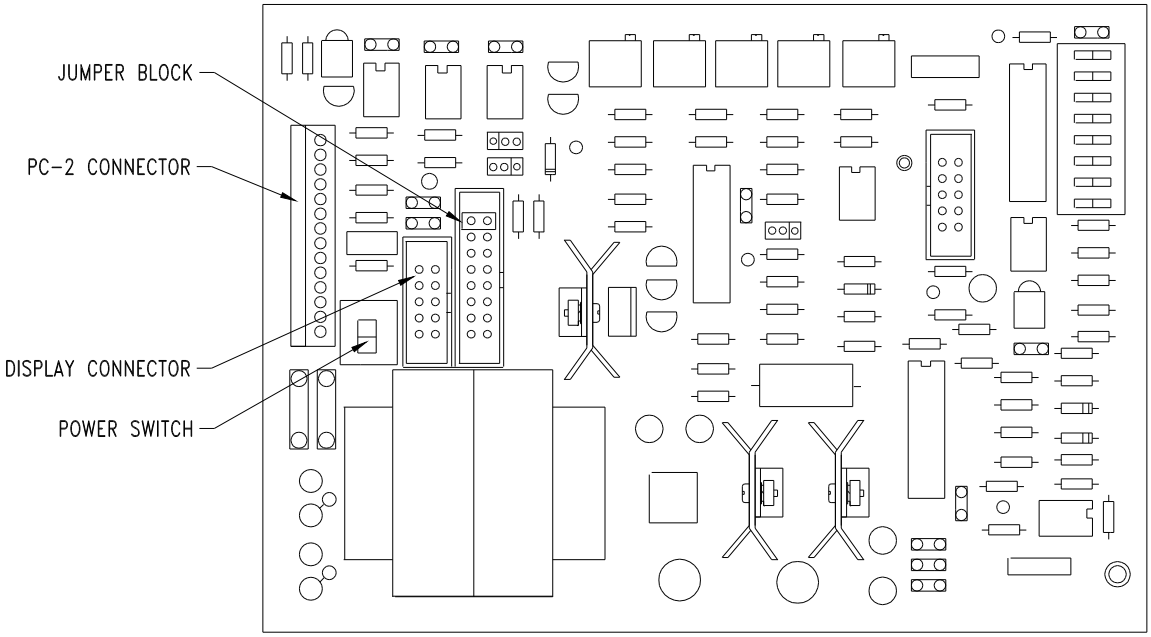


Figure 27. Refractometer Power Switch Location

On initial power up, the display will show the model number (725) and then the software version number. After 3 seconds, the display will return to the mode that it was in when it was shut off, usually the dissolved solids main display. If there is no liquid in contact with the sensing window the display will appear -1, indicating that the dissolved solids range is below range.

3.2 Verification of System Settings
All LSC refractometer systems are calibrated and preconfigured for the user's application before they leave the factory. However, all system settings should be checked and verified on initial system start up.

3.2.1 Systems with PC-12 Linearizer Board
To verify the system settings, scroll through the list of parameters by repeatedly pressing the NEXT or PREV button located on the PC-1`2 board inside the electronics enclosure. All of the parameters (with the exception of the main display) are identified with the numbers or symbols, as shown in Table 1 (repeated below for convenience.) If any of the values appear to be incorrect, contact your LSC technical support representative.

Table 1. Digital Display Definitions

INDICATOR	READING
H	Higher Alarm Set-Point
L	Lower Alarm Set-Point
6	-15 VDC Read-out
5	+15 VDC Read-out
4	TC Offset Read-out
3	LED Supply Read-out
2	Sensing Head Temp. °C
-none-	BRIX, % solids, Refractive Index (as programmed)
t	Top (high) display Read-out
b	Bottom (low) display Read-out
l	0-10 VDC signal IN to the PC-12 board
o	Linearized signal OUT of the PC-12 board

3.2.2 Systems with PC-6 Display Interface Board
The 6 position diagnostic switch located on the PC-6 board is used to check the system operating parameters. The PC-6 diagnostic positions should check out as follows:

- POSITION 1: NORMAL OPERATION: With the switch in position 1 the digital display will indicate the process measurement (in the units chosen by the customer). If a process liquid is in contact with the sensing window and the window is clean, the normal measurement reading should be indicated. If there is no liquid in contact with the sensing window, the display will show -1 indicating below range. A reading of +1 indicates that the sensing window is dirty or coated, or that the ZERO is well above range.
- POSITION 2: SENSING HEAD TEMPERATURE: Should display the current temperature of the sensing head, in degrees c. This reading can be checked against a reading taken with a suitable temperature probe.

- POSITION 3: LIGHT SOURCE VOLTAGE: Should read between 5 and 10 volts, 5 when the sensing head is cold and higher when the sensing head is hot. A reading over 10 volts indicates a problem.

- POSITION 4: TC OFFSET VOLTAGE: Should read around 0 volts when the sensing head is at normal operating temperature. The normal range of this reading is -10 to +10 volts, with large negative values indicating that the unit is below the temperature that it was calibrated for.

- POSITION 5 & 6: +15 and -15: Position 5 should read +15 1 volts, position 6 should read
  -15 1 volts.

3.3 Light Source Fault Check
Check the light source fault check located on the PC-1 board inside the electronics enclosure (see *Figure 28).* If it is illuminated, contact your LSC representative or refer to section 6.

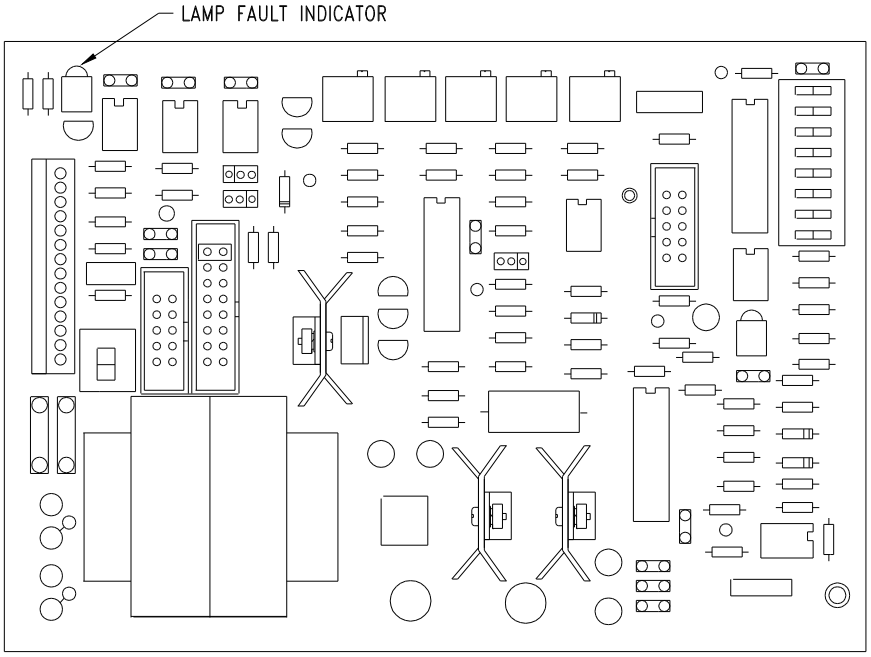
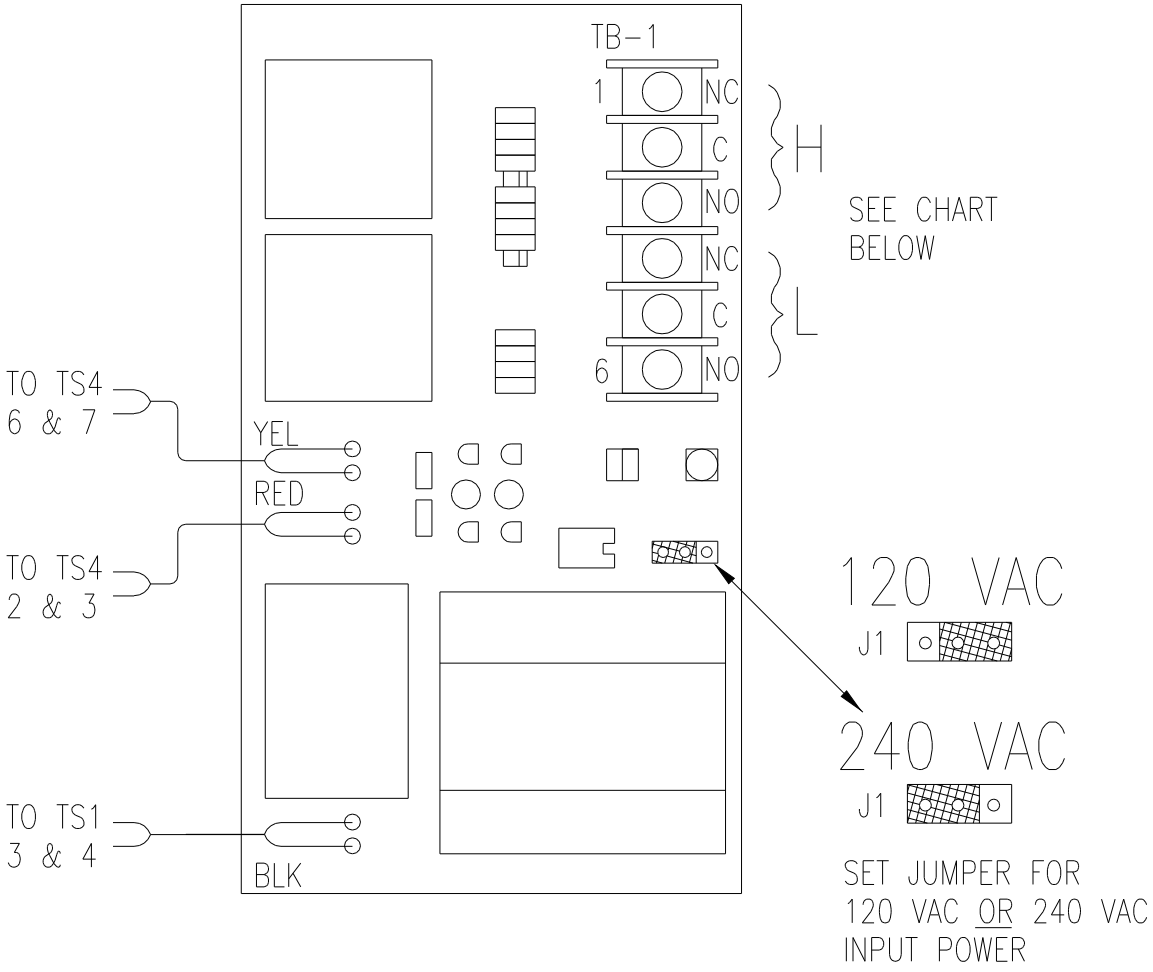


Figure 28. Lamp Fault Indicator

3.4 ALARM SETTINGS
3.4.1.Systems with PC-12 Linearizer Boards
The high and low solids alarm are set at the factory, but can be changed through the PC-12 board. If necessary, set the high and low alarm levels as follows:

1. Scroll through the parameters list by repeatedly pressing the NEXT or PREV button until H (high solids alarm set point) or L (low alarm set point) is displayed.

2. Press the SET button. The first digit of the set point will start flashing
3. Use the NEXT or PREV button to change the flashing digit to the desired value
4. Repeat steps 2 and 3 above for all digits. The digit stops blinking after 3 seconds, indicating that the digit is locked.

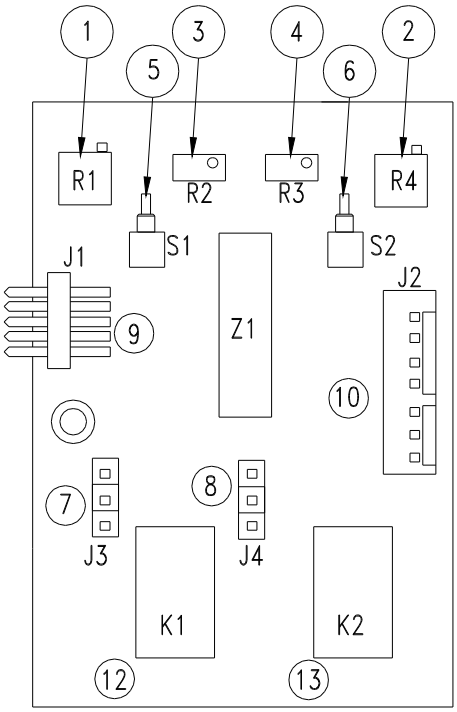


TB1

1	N.C.	} HIGHER
2	COM	
3	N.O.	
4	N.C.	} LOWER
5	COM	
6	N.O.	

3.4.2 Systems with PC-6 Display Board

The alarms are set through the optional alarm board on systems that have the PC-6 display interface. See alarm Board diagrams, *Figures 29* and *Figure 30,* below.



J3 JUMPER POSITION			J4 JUMPER POSITION		
TRIP POINT	KI LOWER ALARM RELAY (NO ALARM CONDITION) NOT ENER ENER		TRIP POINT	KI LOWER ALARM RELAY (NO ALARM CONDITION) NOT ENER ENER	
ABOVE NORMAL OPERATION	B	A	ABOVE NORMAL OPERATION	B	A
BELOW NORMAL OPERATION	A	B	BELOW NORMAL OPERATION	A	B

ITEM	
1.	SET - LOWER ALARM
2.	SET - HIGHER ALARM
3.	CALIBRATION OF LOWER SET POINT
4.	CALIBRATION OF HIGHER SET POINT
5.	DISPLAY SET POINT LOWER ALARM
6.	DISPLAY SET POINT HIGHER ALARM
7.	SELECT MODE OF OPERATION LOWER ALARM
8.	SELECT MODE OF OPERATION HIGHER ALARM
9.	CONNECTOR INPUT POWER
10	CONNECTOR OUTPUT ALARM CONTACTS
11	QUAD OP - AMP
11	RELAY - LOWER ALARM CONTACT
12	RELAY - HIGHER ALARM CONTACT
13	

Figure 29. Alarm Settings for Systems with PC-6

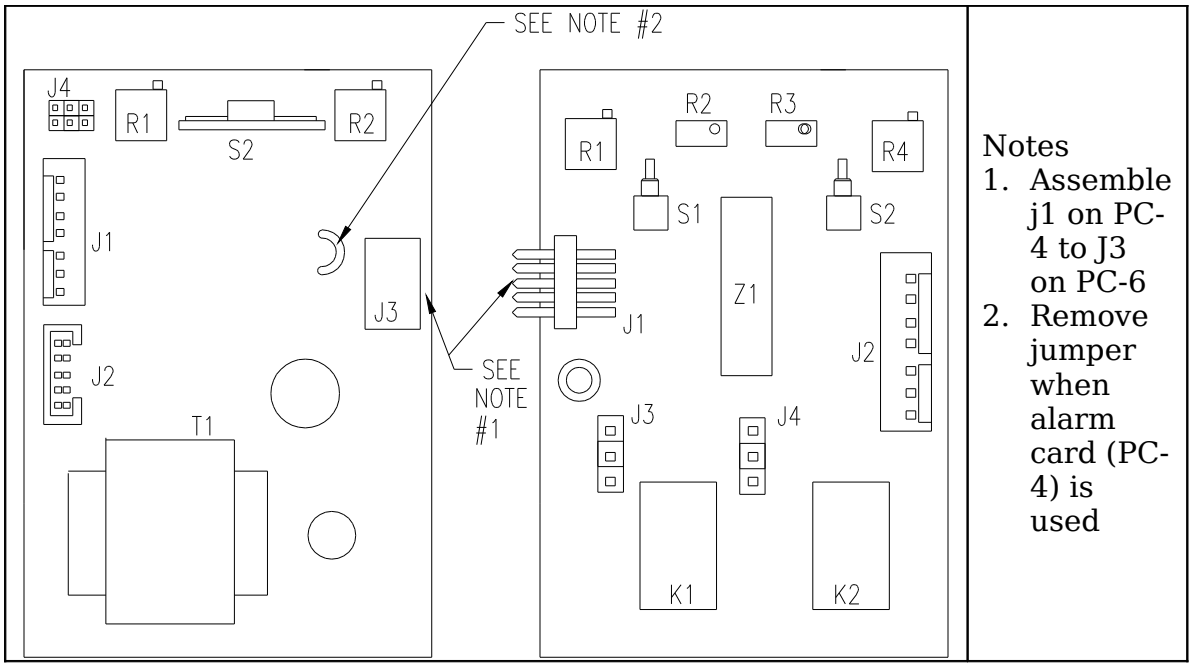
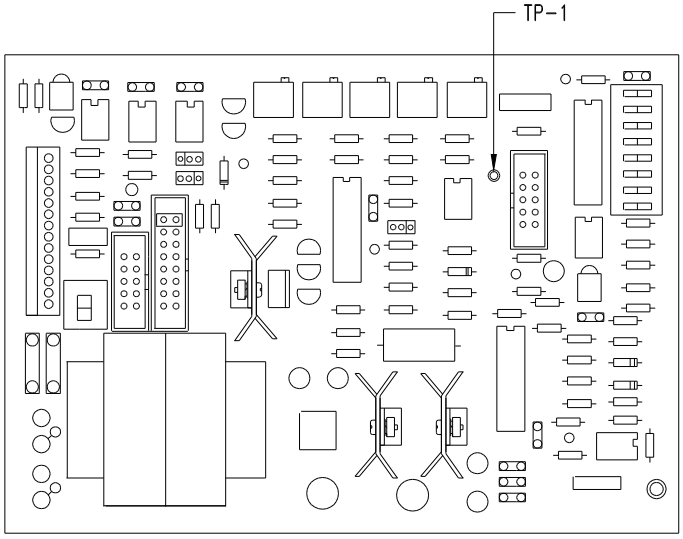


Figure 30. Alarm Card Installation

3.5 Prism Wash Verification

The signal from the sensing head during a prism wash should be checked periodically to verify that the prism wash is working properly. In most installations, the signal from the sensing head will drop below range during prism wash (because there are no dissolved solids in the prism wash medium). To avoid undesirable process fluctuations during a prism wash, a prism wash hold circuit is used to maintain the reading shown on the digital display, and the analog control output signal, at the same value that was measured immediately before the prism wash. Test Point (TP-1) on the PC-1 amplifier board is used for checking the 0-10 volt signal before the prism wash hold circuitry. Check the prism wash using the following procedure:

1. Connect the positive lead of a DC volt meter capable of measuring 0 - 10 VDC to TP -1 (see *Figure 31*) and the negative lead to the circuit ground on the terminal strip TS-3 ground, located on the PC-2/PC-3 interconnecting board (see *Figure 8*)
2. Press the manual prism wash button. The 0 - 10 VDC signal should read below 0 VDC.



If the signal from TP-1 does not read 0 or less than 0 VDC after the manual prism wash button is pressed, see section 6.

3.6 Temperature Compensation Zero Adjustment

3.6.1. Units incorporating PC-12

The temperature compensation circuitry must be zeroed when the process and the LSC sensing head reach normal operating temperature.

Zero the temperature compensation circuitry as follows:

1. Scroll through the system parameters using the NEXT/PREV buttons until parameter 4 (temperature compensation) is displayed.

2. Adjust R-5 on the PC-1 board (see *Figure 7*) until the digital display reads 0 volts. If unable to achieve this reading, see section 6.

3.6.2 Units Incorporating PC-6

The temperature compensation circuitry must be zeroed when the process and the LSC sensing head reach normal operating temperature.

Zero the temperature compensation circuitry as follows:

1. Set the diagnostic switch to position 4 (TC offset Voltage - see *Figure 10*)

2. Adjust R-5 on the PC-1 board (see *Figure 7*) until the digital display reads around 0 volts. If unable to achieve this reading see section 6.

3.7 Dissolved Solids Measurement Adjustment

The LSC refractometer is pre-calibrated at the factory to the customers specifications. Due to site specific process conditions, the LSC refractometer must be adjusted to match that particular process. Adjust the refractometer using the dials located on the PC-1 board inside the electronics enclosure (see *Figure 32*), as follows:

1. Take a sample of the process steam as close to the LSC sensing head as possible. Record the reading on the Model 725 display at the time that the sample is taken.

2. Determine the actual dissolved solids in the sample using your standard in house method.

3. Adjust the ZERO dial to match the main display to the test results. If the reading has changed since the sample was taken, adjust the ZERO dial to compensate for the difference between the test results and the 725 reading at the same time that the sample was taken.

If unable to achieve the correct dissolved reading, see section 4 and 5.

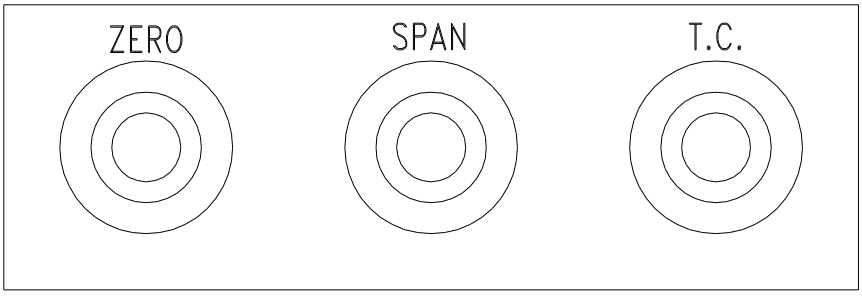


Figure 32. Adjustment Dials

4. CALIBRATION

The calibration procedure described in this section should be performed periodically to assure proper equipment operation and accuracy. Generally, calibration is only required when there is a discrepancy between the Model 725 readings and other dissolved solids indicators. It should also be performed if there is a change in the process liquid that requires a different range of dissolved solids measurements. All LSC refractometers are precalibrated before they leave the factory, so it is not necessary to calibrate the system on initial installation.

NOTE: If calibrating to a different range, it may be necessary to change the gain, see section 4.3 for instructions on how to change the gain.

4.1 Tools Required

The following tools are needed to perform the calibration procedure:

- Multi - meter capable of measuring 0 - 30 milliamps and 0 - 10 volts DC
- 3/16" allen wrench
- Two calibration samples - one for the low end ("zero"), and one for the high end ("span"), of the desired dissolved solids measurement range. The RI of the calibration samples at the ambient temperature must match the RI of the process liquid at the process temperature, but do not have to be the actual process liquid. When the actual process liquid is unstable or volatile, it is recommended that a stable, safe solution with the correct refractive index be used instead. Consult your LSC representative for suggestions on suitable calibration samples.
- Small screwdriver

4.2 Calibration Procedure

It is recommended that the new user read through this entire procedure before starting.

1. If a prism wash is installed, turn off the prism wash steam supply.

2. Remove the sensing head form the process pipeline or vessel. If a gate adaptor is installed, this can be accomplished by shutting the gate; otherwise, the process must be shut down and the liquid drained for the line before removing the sensing head.

3. Remove the prism wash nozzle (if installed) by removing the two mounting screws, to facilitate the cleaning of the sensing window.

4. Make note of the TC (temperature compensation) dial position (located inside the electronics enclosure), then turn the TC vernier dial to 0.00

5. Make note of the "damping" setting, then turn it off by turning R6 on the PC-1 amplifier board counter clockwise.

6. Wipe the prism clean, then apply 6 - 7 drops of the low "zero" calibration sample and cover prism with and opaque cover, so no external light hits the sensor.

7. On units with the PC-12 board, scroll through the digital display parameters using the NEXT/PREV buttons until the 0-10 VDC signal IN, indicated by "1", is displayed. On units shipped prior to June 1992, attach the positive multi-meter lead to terminal 2 and the negative lead to terminal 1 on TS-3, located on the PC-2/PC-3 board (see *Figure 8*), and set the multi-meter for 0-10 VDC.

8. Set the Fine Zero dial to 5.0 (mid-range) then adjust the coarse zero screw (R-1) on the PC-1 board to achieve a reading on the digital display or volt meter of 0.00.

NOTE: if its necessary to change the display reading to a new range, refer to section 4.3 and 4.4.

9. To adjust the 4-20 mA output attach the multi-meter leads to terminal TS3-5 and TS3-6 on PC-2/PC-3 (see *Figure 8* and drawings provided with the system) and set the multi-meter to milliamps. Verify that the digital voltage display still indicate 0 volts, then adjust R-4 on PC-1 to achieve 4 milliamps on the multi-meter.

10. Remove the low limit sample from the prism and wipe it clean. Make sure that the prism is perfectly clean to avoid contamination of the neat sample. Apply 6 - 7 drops of the high/span calibration sample and cover the prism.

11. Measure the 0 - 10 VDC output (see step 5 above) and adjust the span dial to achieve 10.0 VDC output. (position 1 should indicate correct upper limit reading - see section 1.2.5).

12. To adjust the high end 4 - 20 mA output, set the multi-meter for milliamps and connect it to the 4 - 20 mA terminals (TS-3 terminals 5 & 6 on PC_2, see *Figure 8*, DWG. 725600). Verify that the signal indicates 10 VDC, and adjust R-3 on PC-1 (see *Figure 7,* drawing 725626 to achieve 20 milliamps.

13. Reapply the low and high dissolved solids samples and recheck/readjust the zero and span dials as described above. Repeat until the low and high readings are correct without adjustment.

14. Reinstall the sensing head and prism wash assemblies, and refill the pipe or vessel with the process liquid.

15. Set the TC dial to the original setting, as recorded at the beginning of this procedure (step 4).

16. Set the Damping back to the original setting recorded in step 5 (infused).

17. Allow the sensing head to reach operating temperature, then check the TC ZERO by scrolling through the display parameters until number 4 is displayed. If necessary, adjust R-5 on PC-1 to achieve a reading around 0 volts.

4.3 Gain Adjustment

To achieve maximum sensitivity, the gain setting of the amplifier may need to be changed. The gain is set through the jumpers J4A and J4B on the PC-1 board, illustrated in figure 33. The gain should be adjusted so the span dial falls between 5.00 and 7.00 after the calibration procedure is completed. If the span does not fall into (or close to) this range, change the jumpers as indicated below and recalibrate the system.

SPAN SETTING	GAIN ADJUSTMENT
Above 7.00	Move jumper to higher gain position
Below 5.00	Move jumper to lower gain position

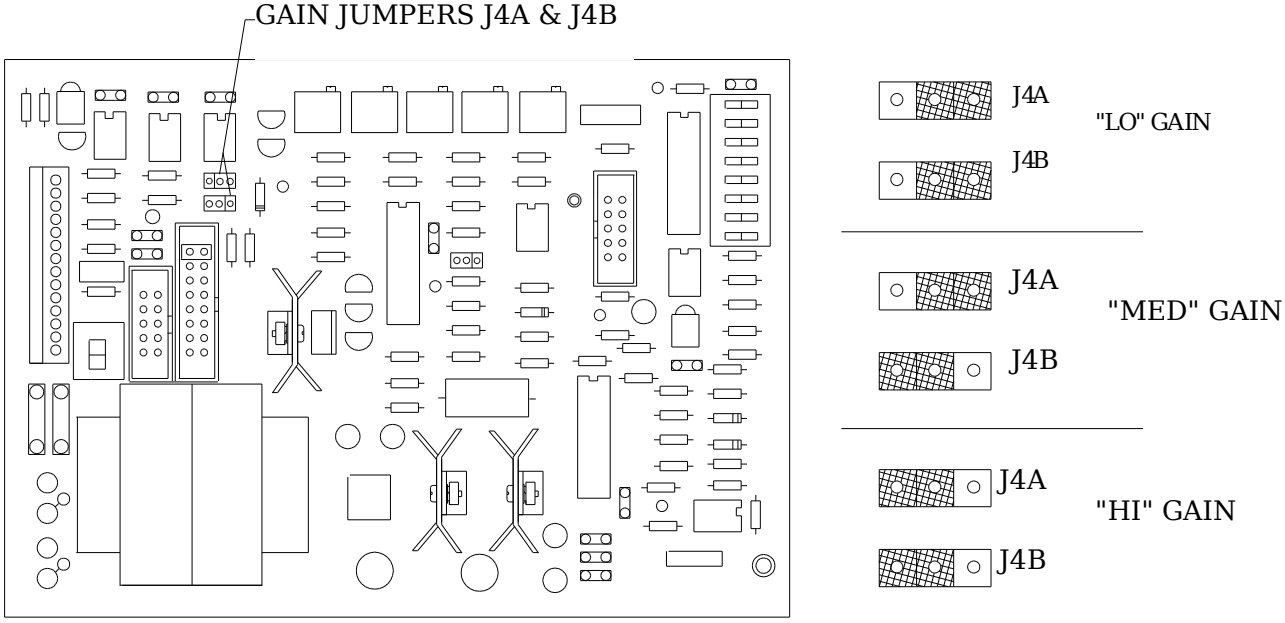


Figure 33. Gain Adjustment Jumpers

4.4 Temperature Compensation

The LSC Model 725 incorporates Temperature Compensation (TC) circuitry to produce accurate refractive index measurements over a wide range of process liquid temperatures. This is necessary because the refractive index of all liquids changes with temperature, while dissolved solids remain the unchanged. The amount of change in refractive index per degree C is known as the temperature coefficient. All liquids have a negative temperature coefficient, generally from - 0.0001/C to -0.0005/C.
The TC vervier dial located inside the 725 electronics enclosue must be set to the correct position to accurately compensate for the temperature coefficient. Although all LSC systems are preset before being shipped to the customer, it may be necessary to reset the TC dial due to a change in the process liquids, gain orsome other change in the system.

The TC dial can be calculated using the simple equation below:

$$\text{DIAL SETTING} = \frac{\text{CONSTANT X TEMP. COEFFIECIENT}}{\text{REFRACTIVE INDEX (RI) SPAN}}$$

WHERE:

CONSTANT =	20,000 with TC Gain Jumper (J5 on PC-1) in HIGH position 100,000 with TC Gain Jumper in LOW position
TEMP	The correct value for the process liquid.
COEFFICIENT=	See the data sheet provided with your unit, or contact your LSC representative if the process liquid has changed
RI SPAN=	The value listed on the data sheet provided with the unit. If the unit has been recalibrated to a new span, use the value obtained by subtracting the low RI from the high RI used in the calibration procedure. (SPAN=HIGH RI - LOW RI)

In most cases, 100,000 is the appropriate constant. Calculate the TC dial setting using 100,000 as the constant, and if the result is less than 1,000, recalculate the setting using 20,000 as the constant. When the correct constant has been determined, check the TC gain jumper (J5 on PC-1, illustrated below) to make sure it is in the correct position (LOW if 100,000 was used above; HIGH if 20,000 was necessary to yield a result below 1,000)

Set the vernier dial to the result calculated above divided by 100. For example, if the result from the equation is 645, set the TC dial to 6.45.

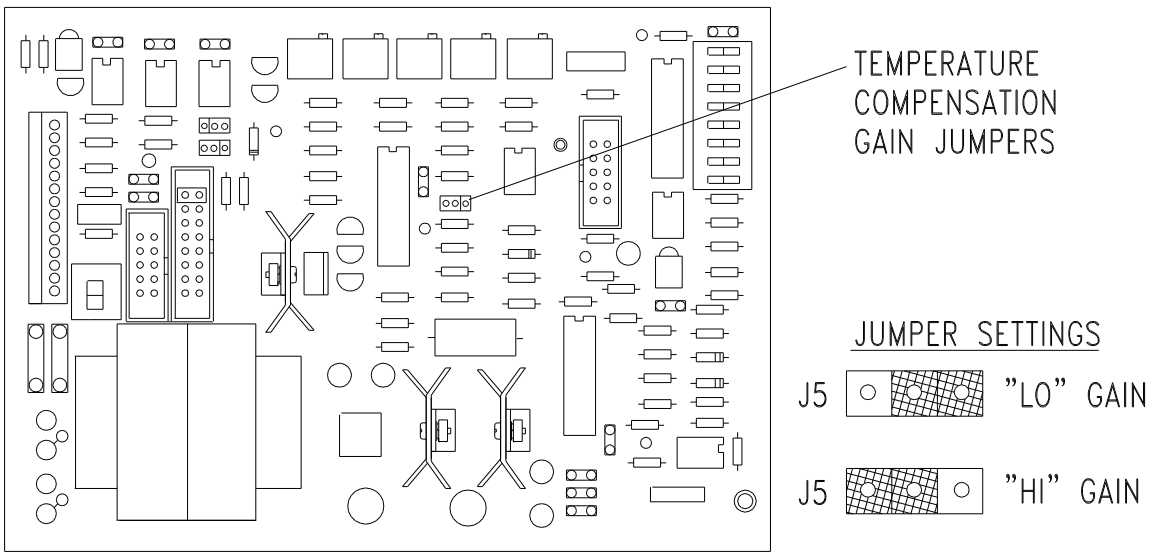


Figure 34. Temperature Compensation Gain Settings

4.5 Linearization

The LSC hand held programming terminal (P/N 480200) is used to modify the Linearization table, which may be necessary when a significant change is made in the process. The keys on the programming module simulate the action of the three push switches located on the pc-12 board as well as some additional commands, as listed in Table 4 below.

Table 4. Programming Terminal Key Functions

KEY	FUNCTION
P	Scrolls to the Previous display
N	Scrolls to the Next display
S	Allows the Settable parameters to be changed. Numbers may be entered directly from the numerical keypad.
M	Displays the Menu. Select "L" to enter the Linearization table or "C" to toggle the local access. To lock local access means to disable the functions of the three onboard push switches. Once locked, only the hand held terminal can make changes to the settable parameters or unlock local access.
L	Enter the Linearization
A	Add an entry to the LIN table
D	Delete any entry from the LIN table.
l	Reset the LIN table to two entries: 01 in=0000 out=0000 02 in=1000 out=1000
P	Scrolls to the Previous entry.
N	Scrolls to the next entry
X	Exit back to main menu
Ctrl/B	Adjust Brightness: press the (control) and (b) key simultaneously to step through the 16 levels of LED brightness. The brightness is set at level 8 from the factory.
Ctrl/Y	Reset Board: press (control) and (Y) simultaneously to reset the board
Ctrl/K	Install Factory Defaults: press (control) and (k) simultaneously while the board is being initialized following a reset or while powering up to revert back to the factory default settings: Bottom Scale=0, Top Scale = 100, no LIN Table

There are 20 memory locations for programming the point by point corrections needed to generate a linear output curve from a non-linear liquid refractive index versus dissolved solids curve. For most applications only 4 - 5 correction points are used.

To determine the correct values to be entered, a refractive index curve for a particular span must be plotted, as illustrated in *Figure 35* below. The correction values are then entered using the programming module. All necessary functions of the programming are read on its display

.

5. GATE ADAPTOR MAINTENANCE

The components of the Gate Adaptor assembly are illustrated in *Figure 36.*

5.1 Gate Adaptor Operation

Description of the LSC Gate Adaptor
The LSC gate adaptor provides a means for simple and quick removal of a LSC In-line Refractometer Sensing head from an active process pipeline. The Gate adaptor employs a completely captivated slide plate, mechanically sure, operated by an eccentric cam. Operation of the Gate adaptor is accomplished by turning a 25mm hex cam just under ½ turn. Double teflon seals are provided against both sides of the slide plate. The Gate adaptor provides for an external lock “fully open” or “fully closed” with positive visual and physical indication of “fully open” or “fully closed”

Operation of the LSC Gate Adaptor

REMOVAL OF THE LSC SENSING HEAD:
Turn off the steam and air supply to the Prism Wash Valve.
Rotate the 25mm hex cam counter clockwise to align the closed indication with the cam reference point. Insert the LSC lock (PN # 670350) through the ¼ hole located next to the open indication. (See picture) If our lock is not available a 2” * .250” dia. pin may be used. **NOTE:** Closing the Gate adaptor will trap material between the sensing head and the closed slide plate. This area is 3/8” * 2” diameter. Care should be taken not to allow a prism wash or any other means to pressurize this area through the prism wash nozzle.
Loosen the four mounting bolts (¼*20) sequentially. Never remove one bolt completely at a time. Loosen the two top bolts first, followed by the two lower bolts. Remember there is a small amount of pressurized material behind the sensing head. By loosening the mounting bolts in this manner we expect the material to burp and ooze from the bottom of the sensing head.
Once the pressure has been relieved, the steam line can be removed. Finish removing the four mounting bolts. The sensing head is now free to service or recalibrate.
Clean the face of the gate adaptor and inspect the o-ring. Replace if necessary (PN# 640040)

NOTE - As always, common sense must prevail when working around HOT Black Liquor under pressure.

5.2 Removal and Annual Rebuild of Gate Adaptors

1. Once the sensing head has been removed and all liquids drained from the process line, gate adaptor removal may begin.

2. Remove the four threaded inserts form the sensing head mounting holes, allowing access to four of the gate adaptor mounting bolts.

3. Unscrew the six mounting bolts that hold the gate onto the pipe section. Note that the four corner bolts are captive and must be unscrewed in successive increments to avoid jamming.

4. Dismantle the gate adaptor by removing twenty-two socket head cap screws.

5. Remove "o"-rings and clean all liquor from all "o"-ring grooves.

6. Inspect all parts for physical damage and replace or repair as necessary.

5.3 Gate Reassembly

7. Apply a thin layer of High - Temperature Teflon Grease, LSC part # 660600, to all four internal sliding surfaces and "o"-ring grooves. (see *Figure 36*) This lubricant protects the "o"-ring and moving parts during operation. Use of other lubricants could lead to leaking or eventual seizing.

8. For ease of assembly, set the bottom plate on a pair of riser blocks at lest 1.2" thick.

9. Place the four ¾" captive gate mounting bolts, with their high collar lock washers into the counterbored holes in the bottom plates.

10. Press the "o"-rings (LSC #'s 640065 & 640023) into the appropriate grooves of the top and bottom plates and smooth any excess lubricant.

11. Position the slide gate on the bottom plate aligning the oval hole over the C-shaped cutout in the bottom plate.

12. Place the greased cam actuator assembly onto the slide gate with the small bearing in the oval hole.

13. Position the side rails on the bottom plate.

14. Situate the top plate onto the previously arranged assembly, guiding the cam actuator to seat it in the opening of the top plate.

15. Position the end plates and install the twenty-two socket head cap screws (complete with lock washers and anti seize compound)

16. Tighten the bolts in succession, starting in the center and alternately progressing to the ends.

17. Slowly cycle the actuator (using 1" box wrench) to seat "o"-rings and evenly distribute the excess grease.

18. Before mounting the gate adaptor to the pipeline, make sure the pipe mounting plate surface and "o"-ring groove are clean.

19. Install new "o"-ring (LSC# 640040) into the pipe mounting plate "o"-ring groove.

20. Position the gate adaptor on the pipe and fasten with the four captive bolts (be sure to use an anti-seize compound on the threads), then install the remaining two 7/16" bolts with lock washers.

21. Screw the threaded inserts into four captive bolt holes. MAKE SURE EACH INSERT IS SCREWED BELOW THE TOP PLATE SURFACE, BOTTOMED AND TIGHT!!

22. Seat a new teflon "o"-ring (P/N 640040) into the groove on the gate and re-attach the sensing head, steam fittings, and the gate adaptor limit switch (if removed).

23. The gate should be cycled open.

24. Re-establish the steam and air supply to the prism wash system.

NOTE: DUE TO CLOSE TOLERENCES IN ALL LOCATIONS WHERE SOCKET HEAD CAP SCREWS ARE USED, HIGH COLLAR LOCK WASHERS MUST BE USED.

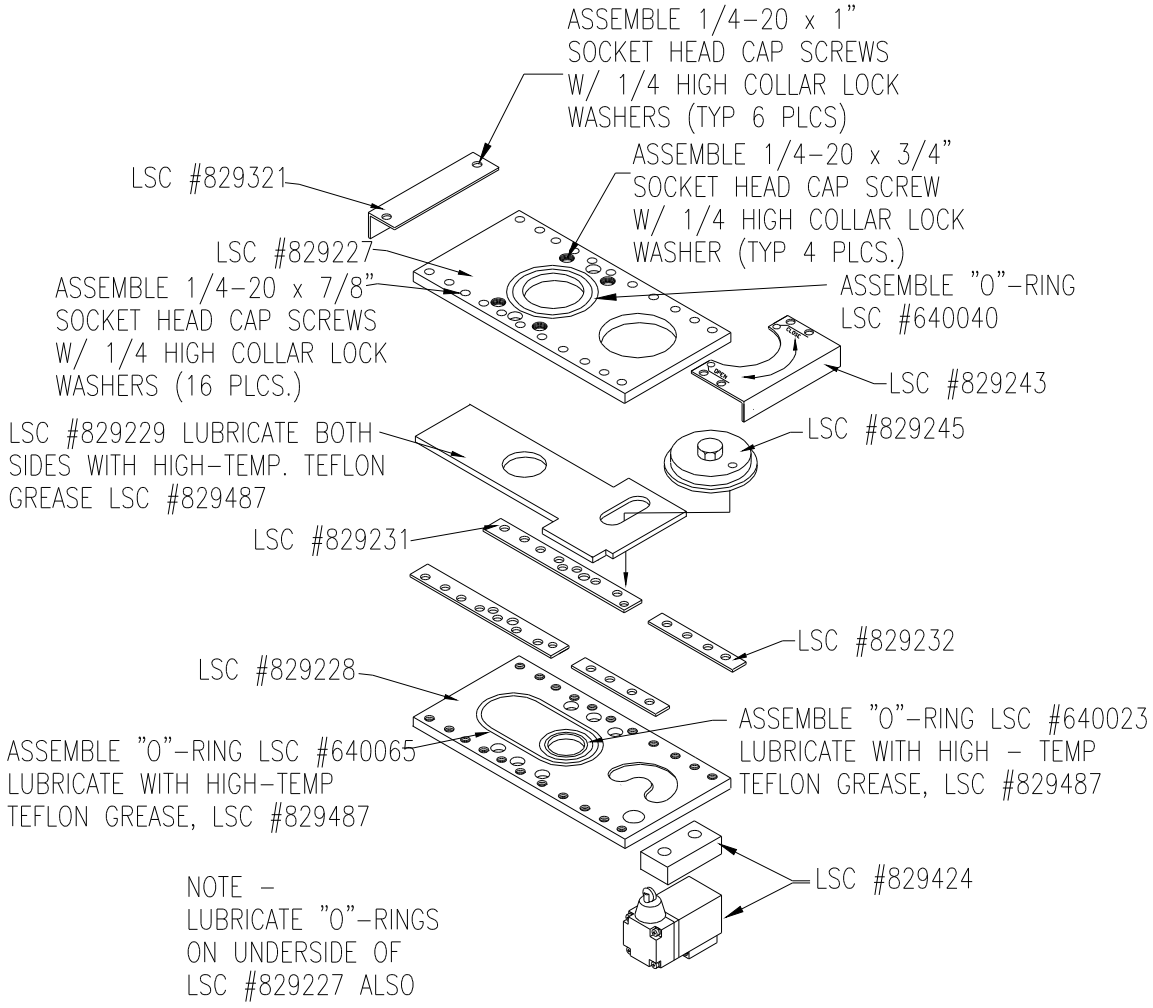


Figure 36. Gate Adaptor Reassembly

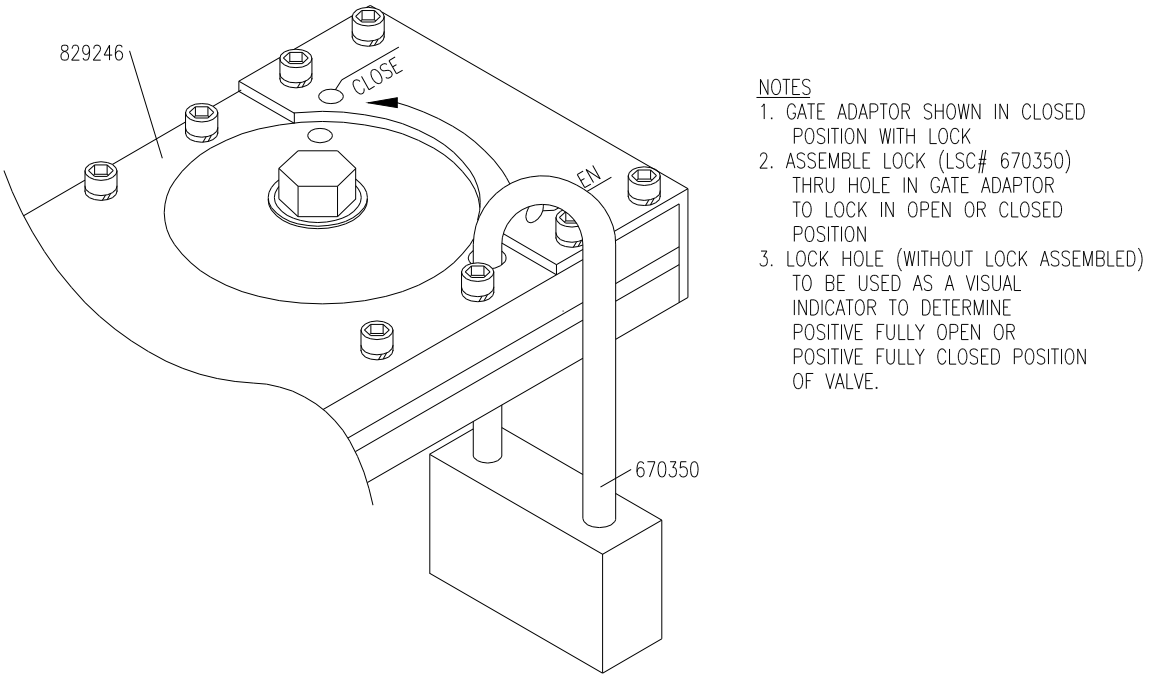


Figure 37. Gate Adaptor Lock Assembly

6. TROUBLE-SHOOTING

Consult the table below as an aid in solving systems problems. If this table does not answer your questions or solve the problem, do not hesitate to call your LSC representative.

TABLE 5. TROUBLE-SHOOTING

Symptom	Checks and Adjustments
⩾ No Power	⩾ Check circuit breaker ⩾ Check fuse in 725 enclosure
⩾ No Display	⩾ Check on/off switch on PC-1, should be in ON position ⩾ Check ribbon cable connection between display and PC-6 or PC-12 board. ⩾ Try different display
⩾ Display off scale; won't respond	⩾ Make sure sensing window is clean and in contact with the solution being measured. ⩾ Check other parameters on the display, using the PC-12 switches or the PC-6 diagnostic switch. If unable to get a display of any parameter, try a different display or PC-12/PC-6 board.
⩾ Lamp fault indicator ON	⩾ Check wiring, especially if new installation or after replacement of refractometer component. ⩾ Check lamp voltage, parameter number 3. If over 11.5 VDC, change LED in sensing head. IF new LED makes no difference, replace PC-1.
⩾ Prism wash failure, sensing window coated	⩾ Measure the 0-10 VDC signal at TP-1 on PC-1 (see section 3.5) during a prism wash. If the signal does not drop to 0 VDC or lower, check the following: ⩾ Steam or water pressure - should be as calculated in section 2.2. ⩾ Steam or water line - should be free from clogs ⩾ Prism wash timer - should be cycling at the preset interval, as set on PC-1 (see section 2.2.) If, not replace PC-1.
⩾ Unable to achieve desired calibration	⩾ Check to see if coarse zero pot on PC-1 was used (see section 4.2) ⩾ Check the gain jumper for proper position (see section 4.3) ⩾ Check parameter 1 (see section 3.2) ⩾ Replace PC-1

7. SPARE PARTS

725903 - SENSING HEAD SPARE PART KIT		
QTY.	PART #	DESCRIPTION
4	102006	SCREW, PH #2-56 x 3/8 LONG
4	102820	WASHER, LOCK #2
3	106206	SCREW, PH #6-32 x 3/8 LONG
2	106830	WASHER LOCK # 6 HC
7	125214	SCREW, ¼-20 x 7/8 LONG
7	125830	WASHRE, LOCK ¼ HC
1	610100	PRISM, SAPPHIRE
1	640040	"O"-RING , 3 5/8" OD x 3 3/8 ID
1	640066	"O"-RING, 4 7/16 x 4 ¼ " ID
1	725010	GASKET, T-BOX
1	725079	DESICCANT BAG, KIT OF 3
1	725307	DETECTOR HOLDER ASSY
1	725308	LIGHT SOURCE ASSY.
1	829098	GASKET, PRISM SEAL
1	829114	TEMPERATURE SENSOR ASSY.

725912 - SENSING HEAD MOUNTING HARDWARE KIT		
QTY.	PART #	DESCRIPTION
4	125214	SCREW, SH/CS ¼-20 x 7/8 LONG
4	125830	WASHER, LOCK ¼ HC
1	640040	"O"-RING, 3 5/8" OD x 3 3/8" ID

725904 - AMPLIFIER SPARE PARTS KIT		
QTY.	PART #	DESCRIPTION
1	725400	AMP. PCB ASSY., PC-1
1	725402	LED INTERFACE PCB ASSY. PC-6
1	725403	LED DISPLAY PCB ASSY., PC-7
1	725408	INTERCONNECT PCB., PC-3

725945 - AMPLIFIER SPARE PARTS KIT - LIN		
QTY.	PART #	DESCRIPTION
1	725400-L	PC-1 LIN ASSY
1	725408	INTERCONNECT BRD.
1	725430	ASSY., PC-11 LIN
1	725431	ASSY., PC-12 LIN

725921 - AMPLIFIER EXPLOSION PROOF SPARE PARTS KIT - LIN		
QTY.	PART #	DESCRIPTION
1	725400	PC-1 ASSY
1	725401	INTERCONNECT PCB ASSY PC-2
1	725402	LED INTERFACE PCB ASSY. PC-6
1	725403	LED DISPLAY PCB ASSY. PC-7

725915 - PROBE SPARE PARTS KIT		
QTY.	PART #	DESCRIPTION
4	102006	SCREW, PH #2-56 x 3/8 LONG
4	102820	WASHER, LOCK #2
1	106006	SCREW, PH #6-32 x 3/8 LONG
2	106010	SCREW, PH #6-32 x 5/8 LONG
2	106820	WASHER, LOCK #6
6	108008	SCREW, PH #8-32 x ½" LONG
6	108820	WASHER, LOCK #8
1	610105	PRISM, SAPPHIRE - PROBE
1	640068	"O"-RING, 3 11/16 OD x 3 ½ ID
1	640105	GASKET, TRI-CLAMP 4"
1	725079	DESICCANT BAG, KIT OF 3
1	725108	GASKET, PRISM, INS PROBE
1	725307	DETECTOR HOLDER ASSY
1	725308	LIGHT SOURCE ASSY.
1	829098	GASKET, PRISM SEAL
1	829114	TEMPERATURE SENSOR ASSY.

725930 - CONVERSION KIT, 829 TO 725		
QTY.	PART #	DESCRIPTION
30'	160706	CABLE 6 COND. # 22 AWG, SHIELDED
1	725306	SENSING HEAD ASSY. W/ PRISM WASH
1	725422	POWER SUPPLY 829 TO 725 CONVERSION
1	725912	SENSING HEAD MOUNTING HARDWARE KIT
1	725995	MANUAL, 829 TO 725 CONVERSION

829254 - GATE ADAPTOR SPARE PARTS KIT		
QTY.	PART #	DESCRIPTION
2	640023	"O"-RING, 2 3/8" OD x 2 1/8" ID
1	640040	"O"-RING, 3 5/5" OD x 3 3/8" ID
2	640065	"O"-RING, 4 1/8" OD x 3 7/8" ID
4	829233	INSERT, THREADED
1	829245	CAM ASSEMBLY
1	829487	LUBRICANT

829424 - LIMIT SWITCH TO GATE ASSY.		
QTY.	PART #	DESCRIPTION
2	110208	SCREW, SH/CS #10-32 x ½" LONG
2	110220	SCREW, SH/CS # 10-32 x ¼" LONG
4	110820	WASHER LOCK # 10
1	440250	SWITCH, LIMIT
1	829276	SPACER, G/A SWITCH

8. TECHNICAL SUPPORT

If your questions are not answered by the information contained in this manual, contact one of our LSC locations listed below:

LIQUID SOLIDS CONTROL, INC.
P.O. Box 259
Upton, MA 01568 U.S.A.

Phone: (508)-529-3377
Fax: (508)-5296591
E-mail: usa@liquidsolidscontrol.com

LIQUID SOLIDS CONTROL *DIVISION OF LIQUID SOLIDS CONTROL, INC*
P.O. Box 7201
Victoria, BC, Canada V9B 2Z3

Phone: (250)-474-2243
Fax: (250)-474-3339
Email: canada@liquidsolidscontrol.com

Pensacola, FL.
Phone: (850)-478-6400
Fax: (850)-478-4406
Email: usasouth@liquidsolidscontrol.com