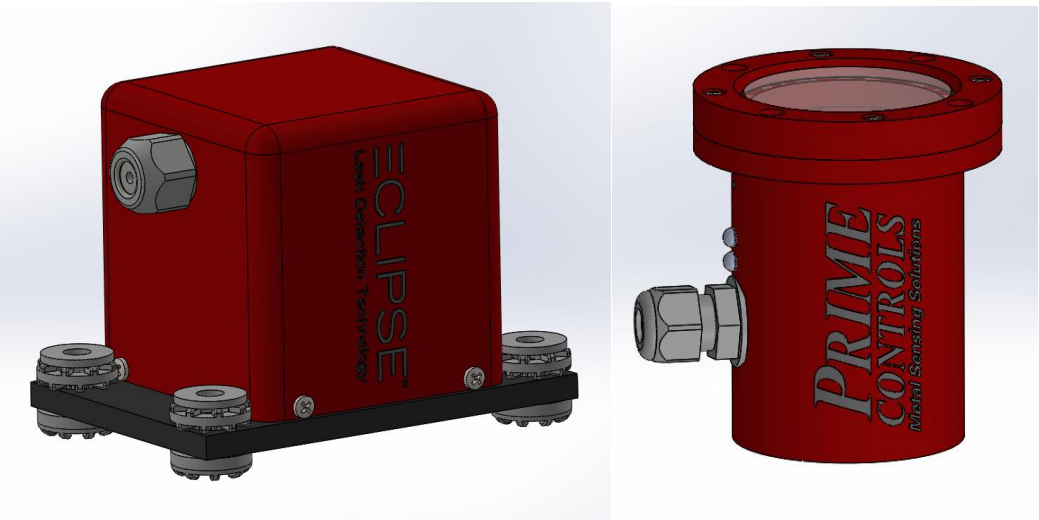
LH200H, SL100H End Leak Detection System

Operating Instructions

202867 Revision H

03/13/2023

Prime Controls, Inc.



DESCRIPTION

The LH200H, SL100H End Leak Detection System uses Prime Controls Eclipse Leak Detection Technology to provide state-of-the-art light-based end leak detection for conversion presses. The system can operate at up to 1000 ends per minute while detecting holes as small as 0.5µm.

Revision History

Revision	Date	Description	Author
A	2020-08-31	Initial Release	RMC
B	2020-09-10	Document clean up.	RMC
C	2020-12-16	Fixed missing references to drawings.	RMC
D	2021-05-26	Revised drawings 202798, 202866	RMC
E	2021-06-22	Revised with LH200H 2.4 firmware related changes	JDD
F	2021-11-02	Revised with LH200H-202 and LH200H-200	RMC
G	2022-08-10	Changed incorrect part number for CBL146-10	BP
H	2023-03-13	Added LH200H-2 Eight Wire Variant Revised with LH200H 2.5 firmware related changes	RMC, JDD

Table of Contents

1 INTRODUCTION

The LH200H, SL100H End Leak Detection System detects defects as small as 0.5µm in ends while operating at up to 1000 ends per minute. It utilizes all-solid-state illumination and detection components for maximum system reliability and lifetime. The system accepts a single trigger input and provides leak/no-leak, rejector control, and system ok outputs with programmable polarity and drive. Factory automation is supported via built-in RS-232 and Modbus communications. The system may be used with the SQ200 sequencer to automatically phase measurement timing to reduce inter-lane crosstalk between strobe units. The PS506 power supply and CAP001 power filter along with cables complete the system. A minimum installation requires only a signal trigger pulse from the PLC to initiate measurement during press dwell. A full system can take advantage of the system's measurement output, built-in rejector control, lane measurement phasing, system OK output, and optional Modbus.

For brevity, the LH200H, LH200H-202 and LH200H-300 shall be referenced as the LH200H in this manual. The units are functionally and electrically equivalent except for packaging and the absence of power and status LEDs on the LH200H-202 and LH200H-300. The term LH200H-opt shall be used to refer to the LH200H-202 or LH200H-300.

The LH200H-2 unit is designed as a drop-in replacement for the LH200 light detector. This unit features an 8 wire cable compatible with the LH200 eight wire cable. Due to the reduced number of wires to the unit, certain signals and functionalities are not available. Refer to other portions of this text for details.

2 SYSTEM COMPONENTS

The End Leak Detection System consists of five major components as described below:

2.1 LH200H or LH200H-opt Light Detector

The system uses a LH200H or LH200H-opt light detector based on Prime Control's proprietary Eclipse Leak Detection Technology. One detector is used per lane. These detectors are designed to work in the hostile industrial environment of a conversion press while detecting leaks down to 0.5µm. The LH200H, and LH200H-2 are packaged to mechanically match the Prime Controls LH200 light sensor, while the LH200H-opt is packaged to mechanically match a common mounting interface used in the industry.

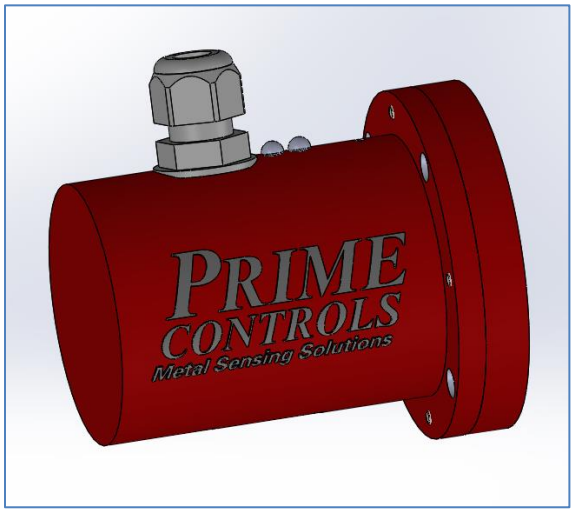


Figure 1 - LH200H, LH200H-2

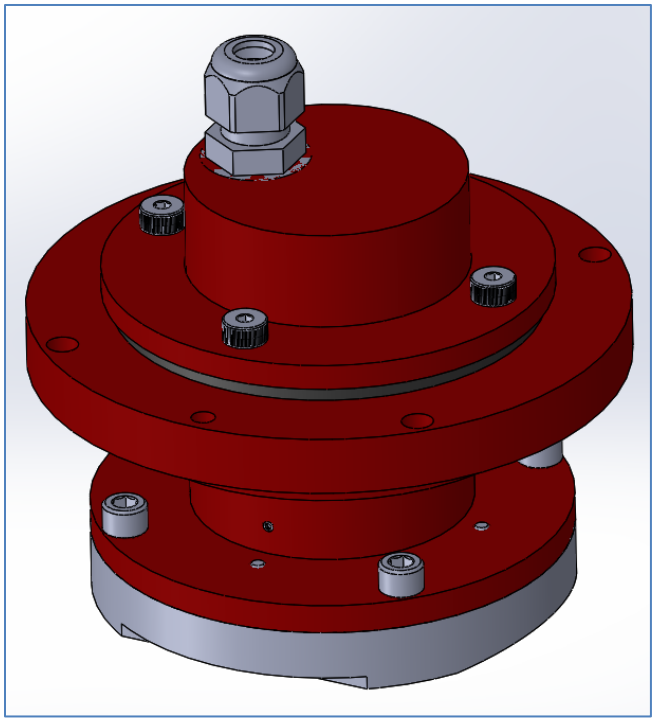


Figure 2 - LH200H-opt

2.2 SL100H LED Illuminator

The SL100H LED Illuminator is an all-solid-state LED-based illumination system designed specifically to work with the LH200H detector. It provides constant current drive to the LEDs for detection consistency and pulse confirmation to the LH200H ensuring correct leak detection operation.

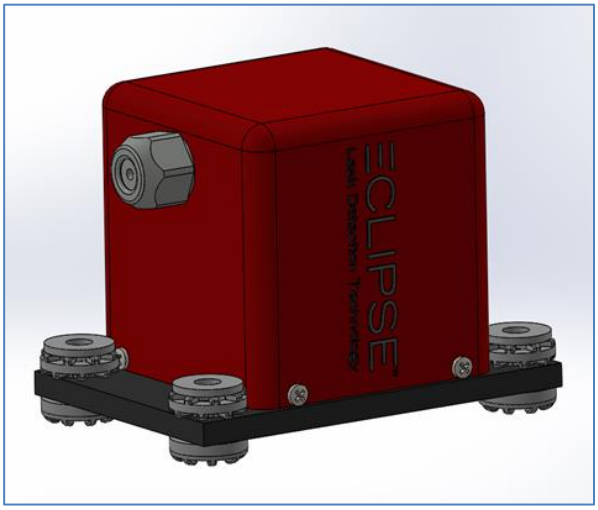


Figure 3 - SL100H

2.3 SQ200

The SQ200 sequencer automates the sequencing of measurements across multiple lanes to reduce inter-lane crosstalk due to adjacent SL100H illuminators turning on at the same time. It also automatically assigns Modbus addresses for up to six LH200H detectors.

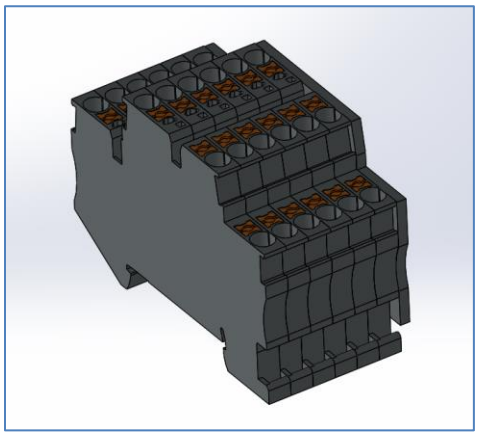


Figure 4 - SQ200

2.4 PS506 Power Supply

The PS506 power supply of the system is a high current, +27V power supply selected for its current handling capability and reliability. It can support up to four lanes. The supply is adjusted to produce 27VDC. It is DIN rail mounted for ease of service.

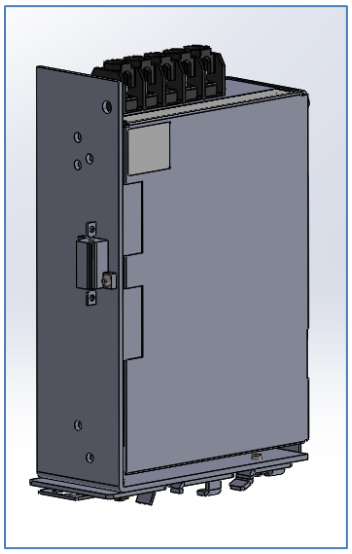


Figure 5 - PS506

2.5 CAP001 Power Filter

CAP001 provides current smoothing for the PS506 and up to four lanes of SL100H illuminators. It is DIN rail mounted for ease of service.

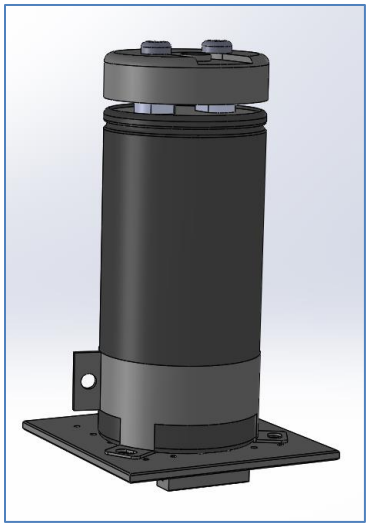


Figure 6 - CAP001

2.6 Cable Set

The following cables are used in the system:

Table 1 - Cable Set

Name	Part Number	Description	Note
CBL108-10	CBL108-10	Connector/Cable, 8 pole, F PUR, Shielded, 10M	to LH200H-2 only
CBL144-10	202807-10	Connector/Cable, 12 pole, F PUR, Shielded, 10M	to LH200H or LH200H-opt only
CBL146-10	202853-10	Connector/Cable, 6 pole, F PUR, Shielded, 10M	to SL100H

The customer is responsible for cables to the reject solenoids, PLC, and power source. Only one of CBL108-10 or CBL144-10 is required. Select the appropriate cable to match your LH200H version.

2.7 Sensors and Actuators

In addition to the LH200H or LH200H-opt and SL100H mounted on the machine, the customer may supply a relay, and reject solenoid (actuator) to reject failed can ends from the product flow by using a blast of air to remove the end from the outfeed conveyor.

3 INSTALLATION

Prior to installation of any component, verify that power is off to the unit and lock-outs are in place per workplace safety policies.

3.1 LH200H/LH200H-opt, LH200H-2 Mounting

The LH200H or LH200H-2 is mounted using four 6.75mm (0.266″) holes on a 69.85mm (2.75″) bolt circle. The unit should be shock-mounted to reduce the vibration of the unit. See section 12 for drawing 202690 for details.

The LH200H-opt is mounted using four 6.75mm (0.266″) holes on a 117.48mm (4.625″) bolt circle. Shim the unit to achieve proper contact with ends as they pass under the detector. See section 12 for drawing 202798 for details.

3.2 SL100H Mounting

The SL100H is mounted using four single ¼-20 or ¼-28 shoulder bolts. See section 12 for drawing 202720 for details.

3.3 SQ200 Mounting

The SQ200 terminal block array mounts onto a standard 35mm DIN rail. See section 12 for drawing 202740 for details.

3.4 PS506 Mounting

The PS506 power supply mounts onto a standard 35mm DIN rail. See section 12 for drawing 202822 for details.

3.5 CAP001 Mounting

The CAP001 power supply filter mounts onto a standard 35mm DIN rail. See section 12 for drawing 202850 for details.

3.6 Wiring and Cabling

3.6.1 Introduction

System wiring is described in the section. Refer to section 12 for wiring diagram 202866.

3.6.2 AC Power

The system uses 90-260 VAC, 47-63Hz power. The terminal blocks support wire gauges 26-12 AWG wire using Line1, Neutral (or Line 2), and Protective Earth (PE) ground. Select an appropriate wire gauge within the allowable range consistent with system safety requirements.

3.6.3 LH200H/LH200H-opt Connections

The light detector has a 12-wire male M12 connector. Pinout as indicated below:

Table 2 - LH200H/LH200H-opt Connection List

Pin	Signal	Color	Type
1	+27V Power	White	Power
2	Common	Brown	Power
3	Result	Green	Output
4	Serial Data In	Yellow	RS-232 Input
5	Serial Data Out	Gray	RS-232 Output
6	Strobe Trigger	Pink	Output
7	System OK	Blue	Output
8	Trigger	Red	Input
9	Rejector	Orange	Output
10	Strobe Good	Tan	Input
11	Modbus RS-485 B	Black	Bidirectional
12	Modbus RS-485 A	Violet	Bidirectional
Shield	Shield	Braid	Shield

Caution: Color codes vary for M12 12 pole cables. Verify the pin connections according to pin numbers shown.

3.6.4 LH200H-2 Connections

The light detector has an 8-wire male M12 connector. Pinout as indicated below:

Table 3 - LH200H/LH200H-opt Connection List

Pin	Signal	Color	Type
1	Result	White	Output
2	Power (+27V)	Brown	Power
3	Serial Data In	Green	RS-232 Input
4	Strobe Trigger	Yellow	Output
5	Test Cycle Enable	Gray	Input
6	Serial Data Out	Pink	RS-232 Output
7	Common	Blue	Power
8	Shield	Braid	Shield

The LH200H-2 light detector does not include System OK, Strobe Good, Rejector, and the ModBus communication pairs. These functions are not available on this unit.

Caution: Color codes vary for M12 8 pole cables. Verify the pin connections according to pin numbers shown.

3.6.5 SL100H Connections

The illuminator has a six-wire male M12 connector. Pinout as indicated below:

Table 4 - SL100H Connection List

Pin	Signal	Color/Label	Type
1	Common	Black 1	Power
2	Common	Black 2	Power
3	+27V Power	Black 3	Power
4	Strobe	Black 4	Input
5	Strobe Good	Black 5	Output
PE	Protective Earth	Green/Yellow	Safety
Braid	Shield	Braid	Braid

3.6.6 Input/Output Connections

Connections to the PLC are made individually to each LH200H. The Trigger input should be paralleled to all LH200H units. The LH200H Result and System Ok outputs may be used by the PLC to track rejects and individual lane status.

The logic outputs of the LH200H are programmable for PNP, NPN, and Push-Pull drive. The default is PNP. The polarity of the signals default to fail-safe values for PNP drive. This means that fault conditions are signaled by a low or ground signal, and non-fault signals are signaled by high or +24V (PNP driven signals).

Table 5 - Signal Drive Types

Drive Type	High Signal	Low Signal	Fail-Safe
Hi-Z	No Drive	No Drive	N/A
PNP	Pull Up	No Drive	Low
NPN	No Drive	Pull Down	High
Push-Pull	Pull Up	Pull Down	Low

3.6.6.1 Input Logic Signals

Each LH200H has a single input signal that triggers the measurement cycle. The detector can be programmed to trigger on the rising or falling edge of this signal. The timing of the measurement cycle is programmable. It is possible to have all lanes measure at once or to sequence them in several ways using the SQ200. The default is for odd lanes measure together and even lanes measure together 1mS later. Sequencing helps to reduce the possibility of light interacting between adjacent lanes.

3.6.6.2 Output Logic Signals

All versions of the LH200H and the LH200H-2 have a result output. The LH200H and LH200H-opt include System OK and Rejector outputs.

System OK signals the general health of the system and is used by the PLC to confirm each lane is fully functional with no faults detected. Result is the resulting output from the measurement cycle. The result output has three modes to assist the PLC in confirming that the result signal is properly connected and received by the PLC.

The Rejector output may be used to drive a relay to control a rejection mechanism to eject defective ends based on measurement results. This signal includes timing provisions to account for the time lag between the measurement and the arrival of an end at the rejector blow-off position along with the capability to reject ends before and after the suspect end to ensure successful rejection of the end regardless of minor speed and handling variations between the light detector and reject position.

4 Operation

4.1 Power-Up Sequence

Prior to powering on the unit, verify that all cables are properly connected to the LH200H or LH200H-2 and SL100H units. The system is designed to be continuously powered. It is not necessary to periodically cycle power other than as required for maintenance of the system.

4.2 Indicators

4.2.1 PS506

PS506 contains a single LED to indicate that it is powered and operating.

4.2.2 LH200H and LH200H-2

The LH200H and LH200H-3 have two LEDs. One dedicated to indicating power is applied, and the second, multiple color LED to indicate device status and measurement results.

Table 6 - Status LED Interpretation

Color	Meaning
Green	No Leak
Yellow	Measurement Fault Detected
Red	Leak Detected

4.2.3 SL100H

The SL100H has two LEDs. One dedicated to indicating power is applied, and the second, multiple color LED to indicate device status.

Table 7 - Status LED Interpretation

Color	Meaning
Green	Strobe Good
Yellow	Strobe Too Fast
Red	Strobe Error

4.3 Measurement Cycle

A measurement cycle is initiated by the Trigger input to the LH200H. Once triggered the LH200H delays for a period defined by the SQ200 or internal phase setting. Once the specified period has elapsed, the LH200H triggers the SL100H to produce a flash of light used to detect leaking ends. Data are captured during the flash and a determination is made if the end under test is a leaker. The Result line is set according to the leak status of the end and along with the rejector logic.

The timing of the strobe and Result output is controlled, in part, by the Phase setting of the LH200H. By adjusting the Phase setting between 1 and 10, it is possible to cause each lane to trigger its strobe and make its measurements at unique times. In the diagrams below, notice how the time from the edge of the trigger pulse to the strobe pulse increases as the Phase setting increases.

In each diagram, the top row is a representation of the trigger pulse assuming rising edge trigger, the second row represents the Strobe signal output. The third row represents the Result output if a no leak is detected Result (No-Leak), and the bottom row represents the Result output if a leak is detected Result (Leak). In the example, the Result output is set to High True. Setting the Result output to Low True inverts the signals from those shown.

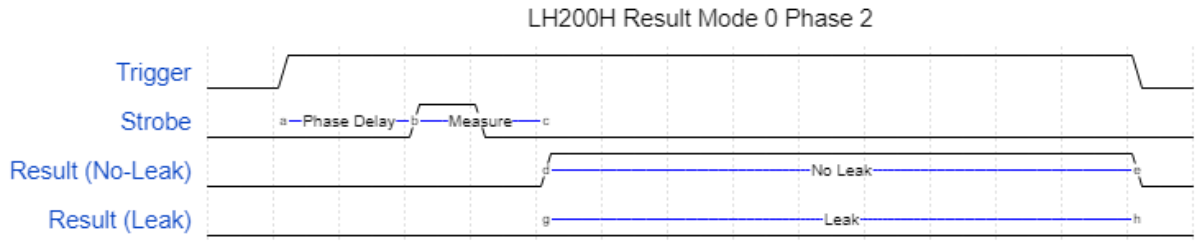


Figure 7 - Measurement Timing Phase 2

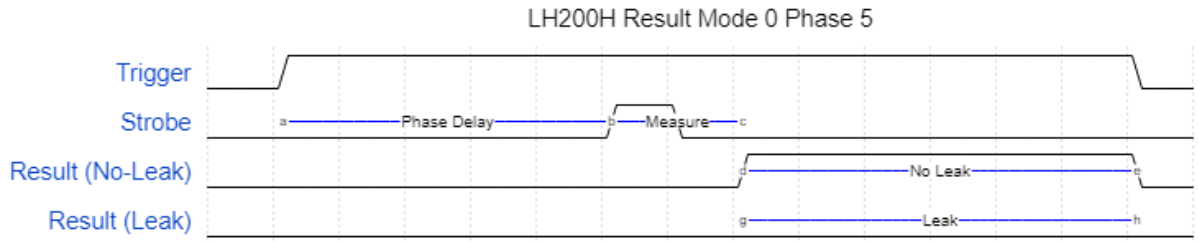


Figure 8 - Measurement Timing Phase 5

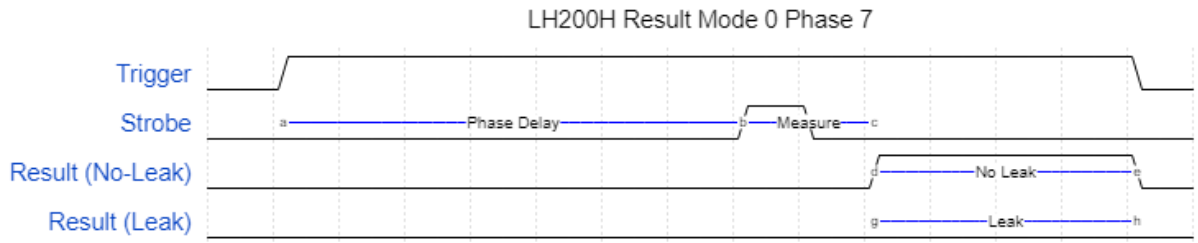


Figure 9 - Measurement Timing Phase 7

4.4 IO Configuration

The inputs and outputs of the LH200H are fully configurable. They can be enabled or disabled, they can be overridden and set to a fixed value. Each output's drive type can be set to one of four options.

4.4.1 Default Configuration

The LH200H is shipped with a default configuration that is designed to be ready to run without user adjustment. The default settings are as listed below. The Rejector and System OK signals are not available on the LH200H-2 unit.

Table 8 - Default IO Configuration

Signal	Enabled	Polarity	Override	Output Type
Trigger	Yes	Rising Edge	No	N/A
Result	Yes	Low - Leak	No	PNP
Rejector	Yes	High - Reject	No	PNP
System OK	Yes	High - OK	No	PNP

4.4.2 IO Enable/Disable Switch

Each input and output can be enabled or disabled using their respective IO Enable/Disable control. An output that is disabled asserts a state defined by its polarity control. The Trigger input when disabled will be treated by the software as if it is not changing (no trigger pulse).

Caution: Leaving any signal disabled may prevent the End Leak Detection System from properly testing any ends.

4.4.3 IO Polarity

The polarity of each input and output is set using their respective polarity settings. The Rejector and System OK signals are not available on the LH200H-2 unit.

Table 9 - Output Polarities

Signal	Setting “1”	Setting “0”
Trigger	Rising Edge Triggered	Falling Edge Trigger
Result	High for No Leak	Low for No Leak
Rejector	High to Reject	Low to Reject
System OK	High for System OK	Low for System OK

4.4.4 IO Override

The input or output state of a signal can be overridden and set to a fixed value by setting the Override setting to 1 and the Value setting to the desired 1 or 0 state. IO overrides are useful during installation to force signals into known states to verify the wiring.

Table 10 - IO Drive Overrides

Override	Value	Operation
0	Don’t Care	Input/Output operates as normal
1	0	Input/Output set to 0V.
1	1	Input/Output set to +24V.

Caution: Leaving any signal in the override state may prevent the End Leak Detection System from properly testing any ends.

4.4.5 IO Drive Type

The drive type of each output is controlled by selecting its output mode. Set each drive type according to your requirements as described below:

Table 11 - IO Drive Type

Mode	Operation
0	High Impedance Drive – The Driver is Disabled
1	PNP Drive – The Driver Pulls Up to +24V When the Signal is **On**
2	NPN Drive – The Driver Pulls Down to Common When the Signal is **Off**
3	Push-Pull Drive – The Driver Pulls Up to +24V When the Signal is On and Pulls Down to Common When the Signal is **Off**

4.5 Rejector Configuration

The rejector logic requires setting the press speed, distance (in ends) between the LH200H and the rejector, the number of ends before the leaker to reject, and the number of ends after the rejector to reject. These parameters are set as described in section 5.5.5.

4.5.1 Initial Set-Up

4.5.1.1 Parameters

Enter the press speed, estimated distance in ends between the LH200H and rejector, and the number of ends before and after the leaker to be rejected to 1.

4.5.1.2 Electrical Test

Use the rejector force commands RV1 {enter} to turn on forcing, and RO1 {enter} to turn on or RO0 {enter} to turn off the rejector output. Confirm that the rejector turns on and off in response to these commands. Turn off Rejector Override using RV0 {enter}.

4.5.2 Timing Adjustment

Start the press and run a known leaker through it while video recording the rejector location to capture when the rejector turns on. Verify that the rejector turns on indicating that the LH200H detected a leaker. Using the video recording, verify that one end before the leaker, the leaker, and one end after the leaker are rejected. If the rejection action is correct, proceed to final parameter adjustment. If not, determine the number of ends early or late that the rejector action occurred. Adjust the LH200H to Rejector distance parameter by this amount and repeat the test.

The rejection was early, add the amount to the original distance value. If the reject was late, subtract the amount from the original distance value.

4.5.3 Final Parameter Adjustment

Enter the desired number of ends before and after the leaker that are to be rejected using the RB and RA commands.

5 User Interface

A LH200H may be connected to a serial terminal or laptop to access configuration parameters. It may also be controlled via Modbus using an HMI such as the Prime Controls MI200, or a Modbus enabled PLC.

The Modbus interface is not available on the LH200H-2 unit. Settings related to the Rejector and System OK signals are inoperative in the LH200H-2 unit.

5.1 Console Serial Port Settings

The serial connection to the LH200H operates at 115,200 baud, 8 bit, no parity, 1 stop bit, no flow control.

5.2 Console Output

When no command has been entered, the console displays each measurement along with status information. Items are separated by commas.

Example measurement display:

```
 21, 2780, 1, +300, +350, +200, +310, +360, +195, +295, +340, +215, +320, +360, +210, +215,
L,N,N,N,N,N,N,N,N, 32.625
```

Table 12 - Console Output

Item #	Example Value	Definition
1	21	# of Strokes Since LH200H Power On
2	2780	Milliseconds Since LH200H Power On (added in firmware 2.5)
3	1	Automatic Adjustment Value
4	300	Sensor 1 Dark
5	350	Sensor 1 Light
6	200	Sensor 1 Signal
7	310	Sensor 2 Dark
8	360	Sensor 2 Light
9	195	Sensor 2 Signal
10	295	Sensor 3 Dark
11	340	Sensor 3 Light
12	215	Sensor 3 Signal
13	320	Sensor 4 Dark
14	360	Sensor 4 Light
15	210	Sensor 4 Signal
16	215	Combine Signal
17	L	L: Leak N: No Leak
18	N	S: Saturation N: No Saturation
19	N	O: Bad Offset N: Offset OK
20	N	B: Bad Strobe N: Strobe OK
21	N	D: Two Sensor Leak Detect N: Not Two Sensor
22	N	T: Three Sensor Leak Detect N: Not Three Sensor
23	N	Q: Four Sensor Leak Detect N: Not Four Sensor
24	N	T: Timing Error N: Timing OK
25	N	F: Forced Trigger N: Normal Trigger (added in firmware 2.5)
26	N	E: Temperature Measurement Error N: Temperature Measurement OK
27	32.625	LH200H Temperature in °C

5.3 Console Operation

The serial console organizes and presents many statuses and operational parameters of the system using a simple one- or two-character command interface. The most frequently used operator commands are accessed using a single character. Once a command is selected, the current value is displayed, and the operator has the option of entering a new value or pressing enter without entering a new value to retain the present value.

Invoking the console halts measurement display until the console mode is exited using the Q (Quit) command, or after 15 minutes of inactivity.

Sub-menu commands are accessed by pressing the character for the sub-menu and then the character of the sub-menu command. For example, the Lane Phase Automatic command is accessed by pressed P for the Phase Submenu and then A for Auto Lane Phase. Pressing a sub-menu command causes the available sub-menu commands to be printed assisting the user in navigating the menu structure.

Most commands prompt for a numeric entry. When prompted the user may type in a value or simply press {enter} to retain the original value. The backspace key may be used to edit values during typing.

5.4 Operator Commands

Operator commands are listed herein by their signal letter command and description. For example, the Bias command is listed as B: Bias indicating the user presses B to access the Bias command.

Entering a command causes the command name to be displayed along with the current value. Entering ‘B’ causes the following to display:

```
Bias 10:
```

Informing the user that the Bias command has been selected and the current bias value is 10. The user may now enter a new value, press enter to exit the bias command without changing the value, or press the Esc to abort which also leaves the current value unchanged.

Some commands are accessed by a sub-menu. In these cases, press the sub-menu command letter followed by the command letter. For example, to change the Automatic Lane Phase setting. Press P followed by A. When a sub-menu is selected, the commands for that sub-menu are displayed. To illustrate, when the user presses P in the example above the following is displayed:

```
Phase
  P - Lane Phase
  A - Automatically Set Lane Phase
```

The user may then proceed to press P or A as desired or enter to abort the sub-menu.

The system automatically saves all user adjustments after a period of ~30 seconds of inactivity. When the data are saved, the console prints:

```
Configuration saved.
```

When you are changing settings, do not power off the LH200H until you see the "Configuration Saved" message, or your changes may be lost.

5.4.1 1: Trigger One Measurement

Pressing 1 will cause a single measurement to be made and displayed on the console.

5.4.2 B: Bias

The Bias value sets the baseline value for the Calibration and Auto Adjust functions. It can be adjusted between 1 and 100. The factory setting is 10. This value should not be adjusted without consulting Prime Controls. If adjusted, use Calibrate to adjust the system to the new Bias value.

5.4.3 A: Auto-Adjust

The Auto-Adjust function can be enabled 1 or disabled 0. The factory setting is 1. Auto-Adjust corrects for any long-term drift in the measurement system. Unless directed by the factory, leave the Auto-Adjust enabled.

5.4.4 C: Calibrate

The Calibrate function executes immediately upon invocation. Calibrate adjusts internal calibration settings according to the desired Bias setting. The LH200H must be in COMPLETE darkness prior to invoking calibrate. If calibration fails, it will restore the previous calibration values.

5.4.5 G: Signal Gain

The Signal Gain setting ranges from 1 to 100. The system is factory set to a Signal Gain of 30 which provides maximum sensitivity. Unless directed by Prime Controls, leave Signal Gain at its factory default.

5.4.6 L: Leak Limit

The Leak Limit setting sets the threshold value used to determine the Leak/No-Leak status of an end. The value used is a tradeoff between the desired sensitivity of the system and the ability of the press mechanics to provide a light-tight seal between the LH200H and the end. If set to too low a value, many ends may be falsely rejected due to minor light leaks due to improper sealing between the end and the LH200H. If set too high, true leakers may not be detected.

The factory default value of 250.0 provides a good balance between the sealing level and defect detection. The adjustable range is 0.0 to 5000.0.

5.4.7 F: Clear Fault

The Clear Fault function clears any internal faults which may have de-asserted the System OK output.

5.4.8 P: Phase

Accesses the Phase sub-menu.

The Phase sub-menu contains commands for adjusting the timing (or phasing) of the measurement process relative to the Trigger signal input. Phase may be automatically set using the SQ200 terminal blocks or manually set using the Phase commands below.

5.4.8.1 P: Lane Phase

The Lane Phase may be from 1 to 10. Each increment in value delays the measurement cycle by 1mS. Adjusting this value sets the manual lane phase. This value is used if Auto Lane Phase (below) if off (set to 0).

5.4.8.2 A: Auto Lane Phase

Selects between automatic and manual Lane Phase setting. A value of 1 results in an automatic Lane Phase setting based on the SQ200 terminal block used by this LH200H. A value of 0 results in a Lane Phase as set in the Lane Phase setting above.

5.4.9 V: Version

This command displays the software version loaded in the LH200H light detector.

5.4.10 I: Installer

This command is used to unlock installer commands. Set the value to 1 to unlock the commands and to 0 to relock.

5.4.11 Q: Quit

This command quits the console command mode and returns to displaying measurement values on the console.

5.4.12 ?: Menu

This command displays the currently enabled commands available to the user.

```
Menu
1   - Trigger one measurement
B   - Target value for signal offset
A   - Continuously adjust signal offset
C   - One time adjust signal offset
G   - Set detector gain
L   - Set leak limit threshold
P   - Phase Submenu
V   - Display software version
I   - Unlock installer commands
Q   - Quit command mode
?   - Display command menu
```

5.5 Installer Commands

Installer commands are enabled using the command I1 {enter}.

5.5.1 M: Modbus

Accesses the Modbus sub-menu.

5.5.1.1 A: Address

Displays the current Modbus address in use. Adjusting this parameter will change the Manual Address as described below.

5.5.1.2 E: Enumerated Address

Displays the Modbus address as determined by the SQ200 terminal block attached to the LH200H Strobe Good signal.

Table 13 - Enumerated Addresses

SQ200 Lane	Enumerated Address
1	21
2	22
3	23
4	24
5	25
6	26

5.5.1.3 M: Manual Address

Allows the user to set the Manual Modbus Address to any valid Modbus address value (1-250).

5.5.1.4 X: Use Enumerated

Selects between the Enumerated Modbus address determined by the lane's SQ200 terminal block - 1 and the user entered Manual Modbus Address - 0.

5.5.1.5 R: Enumeration ADC

Displays the Enumeration ADC raw value. This value is determined by the SQ200 terminal block and is used to determine the Enumerated Address. It will be a value between 0 and 4095. This parameter is read-only.

5.5.2 T: Trigger

Accesses the Trigger sub-menu.

5.5.2.1 E: Enable

Enables 1 or disables 0 the Trigger input. This setting should be 1 so the light head will trigger and make measurements. This setting is useful for diagnostics purposes. It can be used to disable measurements and prevent the SL100H from flashing when working in proximity of the equipment and leak measurements are not required.

The system will not operate with the Trigger input disabled.

5.5.2.2 P: Polarity

Sets which edge of the Trigger input is used to initiate measurements. 1 – Rising Edge (0 to +24V transition) or 0 – Falling Edge (+24V to 0V transition).

5.5.3 W: Strobe

Accesses the Strobe sub-menu.

5.5.3.1 S: Start

Sets the time in µS from the start of acquisition to the start of the strobe. The default setting is 1000. Do not change without consulting Prime Controls.

5.5.3.2 W: Width

Sets the width of the strobe pulse in µS. The default setting is 1000. Do not change without consulting Prime Controls.

5.5.3.3 P: Polarity

Sets the polarity of the strobe pulse. 1 – Pulse is +24V or 0 – Pulse is 0V. The default setting is 1. Do not change without consulting Prime Controls.

5.5.3.4 E: Enable

Enable 1 or disable 0 the strobe pulse. The default setting is 1. Do not change without consulting Prime Controls.

5.5.3.5 O: Override

Override 1 or don't override 0 the Strobe output. Used with Value (below) to control the Strobe output during diagnostic testing. The default setting is 0.

5.5.3.6 V: Value

Used with the Override command. When the Override (above) is 1, the Strobe output is controlled by this value. 1 – output is +24V, 0 – output is 0V. The default setting is 0.

5.5.4 H: Strobe Good

Accesses the Strobe Good sub-menu.

5.5.4.1 P: Polarity

Sets the polarity of the Strobe Good input. 1 – high good or 0 – low good. The default setting is 1. Do not change without consulting Prime Controls.

5.5.4.2 E: Enable

Enable 1 or disable 0 the Strobe Good input. The default setting is 1. In rare circumstances where the Strobe Good signal from the SL100H is not connected to the LH200H and is monitored by another device such as the PLC, the Strobe Good input can be disabled by setting this value to 0 and the LH200H will operate as if the Strobe Good signal is present and indicating a good strobe for each measurement cycle.

It is imperative that the Strobe Good signal is monitored either by the LH200H or the PLC. If left unmonitored, a failure of the SL100H may go undetected possibly resulting in missed detection of leakers.

5.5.4.3 O: Override

Override 1 or don't override 0 the Strobe Good input. Used with Value (below) to control the Strobe Good input during diagnostic testing. The default setting is 0. Note, overriding the Strobe Good input will cause a Strobe Fault during the next measurement cycle because the Strobe Good signal is required to go low and high during the measurement. When forced continuously low or high by the Overriding the input this signal cadence is not observed and a fault generated.

5.5.4.4 V: Value

Used with Override. When Override (above) is 1, the Strobe Good input is controlled by this value. 1 – the software reads a high input, 0 – the software reads a low input. The default setting is 0.

5.5.5 R: Rejector

Accesses the Rejector sub-menu.

5.5.5.1 P: Polarity

Sets the polarity of the rejector pulse. 1 – Pulse is +24V or 0 – Pulse is 0V. The default setting is 1. Set according to the requirements of the rejector electronics.

Caution: Software Versions 2.2 and below incorrectly state the Rejector Polarity as 1 – Low Leak, 0 – High Leak which is incorrect.

5.5.5.2 E: Enable

Enable 1 or disable 0 the Rejector output. The default setting is 1. Used for diagnostics. Must be set to 1 if the LH200H is to reject ends. Disabling the rejector prevents the LH200H from rejecting leakers.

5.5.5.3 R: Rate

Sets the stroke rate of the press. Used to calculate the timing to reject ends.

5.5.5.4 L: Location

Sets the location of the rejector relative to the LH200H in the number of ends.

5.5.5.5 B: Before

The number of ends before the leaking end to reject.

5.5.5.6 A: After

The number of ends after the leaking end to reject.

5.5.5.7 O: Override

Override 1 or don't override 0 the Rejector output. Used with Value (below) to control the Rejector output during diagnostic testing. The default setting is 0.

5.5.5.8 V: Override Value

Used with Override. When Override (above) is 1, the Rejector output is controlled by this value. 1 – output is +24V, 0 – output is 0V. The default setting is 0.

5.5.5.9 T: Type

Sets the output drive type of the Rejector output.

Type Setting	Output Function
0	High Impedance – Output is Completely Disabled
1	PNP – Output Sources Current (Pulls High) When the Signal is High
2	NPN – Output Sinks Current (Pulls Low) When the Signal is Low
3	Push-Pull – Output Sources Current (Pulls High) When the Signal is High and Sinks Current (Pulls Low) When the Signal is Low

5.5.6 O: Result

Accesses the Result sub-menu.

5.5.6.1 M: Result Mode

The Result output can operate in one of three modes depending upon the needs of the PLC. Enter a value of 0, 1, or 2 to select the desired mode of operation. The details of each mode are described below. In each diagram, the top row is a representation of the trigger pulse assuming rising edge trigger, the second row represents the Result output if a no leak is detected, Result (No-Leak), and the bottom row represents the Result output if a leak is detected, Result (Leak). In the example, the Result output is set to High True. Setting the Result output to Low True inverts the signals from those shown.

Result Mode 0 (Default)

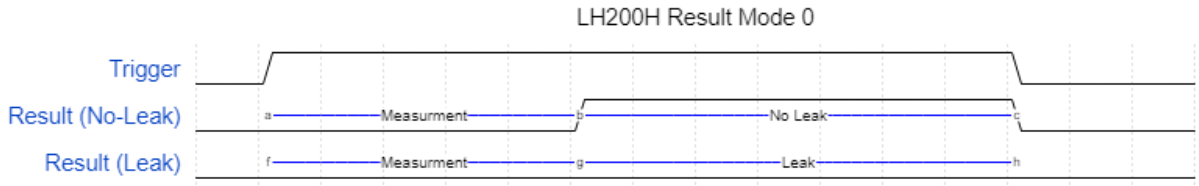


Figure 10 - Result Mode 0

The Result output operating in Result Mode 0, always asserts the leak state other than after the completion of the measurement and prior to the de-assertion of the Trigger signal provided the minimum result assertion time has elapsed as set by the Result Finish value (below) when the measurement result is no-leak. This mode is useful as the PLC may sample the Result output prior to triggering a measurement to assure the Result output can indicate the leak state. The PLC must sample the result output prior to de-asserting the Trigger input to capture the Leak/No Leak condition of the end.

Result Mode 1

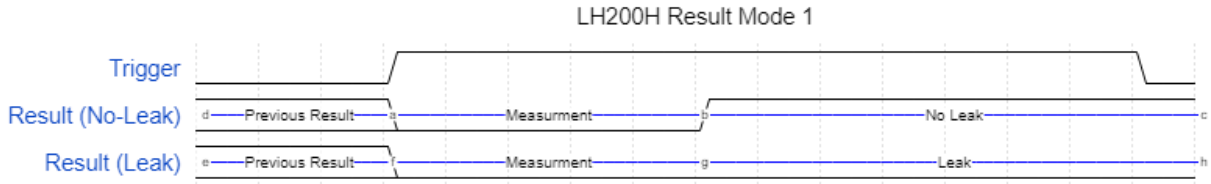


Figure 11 - Result Mode 1

The Result output operating in Result Mode 1 asserts the leak state when triggered and once the measurement is completed, asserts leak or no leak as appropriate. This mode is useful as the PLC may sample the Result output immediately after triggering a measurement to assure the Result output can indicate the Leak state. The PLC can then sample the Result output at any time prior to the next trigger to capture the Leak/No Leak condition of the end.

Result Mode 2

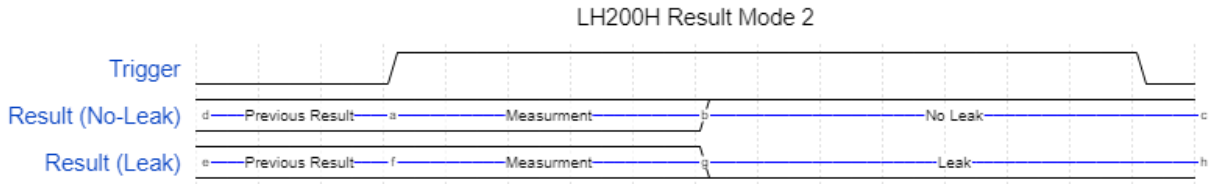


Figure 12 - Result Mode 2

The Result output operating in Result Mode 2 maintains the leak/no leak state from the prior measurement until the next measurement completes. Once the next measurement is completed, it asserts leak or no leak as appropriate. This mode is useful as the PLC may sample the Result output at any time to capture the Leak/No Leak condition of the

end. A disadvantage of this mode is that the PLC cannot verify that the Result signal is functional and is not stuck in the no-leak state due to a wiring error or cable damage.

5.5.6.2 P: Polarity

Sets the polarity of the Result output. 1 – No Leak is +24V, or 0 – No Leak is 0V. The default setting is 1. Set according to the requirements of the PLC.

5.5.6.3 S: Start

Sets the time in µS from the end of the strobe pulse to the setting of the result output. The default setting is 2500 µS. Do not change without consulting Prime Controls.

5.5.6.4 F: Finish

Sets the time in µS from the assertion of the Result output to the assertion of the leak state when operating in Mode 0. The default setting is 8000uS. Do not change without consulting Prime Controls.

5.5.6.5 E: Enable

Enable 1 or disable 0 the Result output. The default setting is 1. Used for diagnostics. Must be set to 1 if the LH200H is to assert a Leak condition.

5.5.6.6 O: Override

Override 1 or don't override 0 the Result output. Used with Value (below) to control the Result output during diagnostic testing. The default setting is 0.

5.5.6.7 V: Override Value

Used with Override. When Override (above) is 1, the Result output is controlled by this value. 1 – output is +24V, 0 – output is 0V. The default setting is 0.

5.5.6.8 T: Type

Sets the output drive type of the Result output.

Type Setting	Output Function
0	High Impedance – Output is Completely Disabled
1	PNP – Output Sources Current (Pulls High) When the Signal is High
2	NPN – Output Sinks Current (Pulls Low) When the Signal is Low
3	Push-Pull – Output Sources Current (Pulls High) When the Signal is High and Sinks Current (Pulls Low) When the Signal is Low

5.5.7 K: System OK

Accesses the System OK sub-menu.

5.5.7.1 P: Polarity

Sets the polarity of the System OK output. 1 – System OK is +24V when the system is not faulted. or 0 – System OK is 0V when the system is not faulted. The default setting is 1. Set according to the requirements of the PLC.

5.5.7.2 E: Enable

Enable 1 or disable 0 the System OK output. The default setting is 1. Used for diagnostics. Must be set to 1 if the LH200H is to assert a fault condition.

5.5.7.3 O: Override

Override 1 or don't override 0 the System OK. Used with Value (below) to control the System OK output during diagnostic testing. The default setting is 0.

5.5.7.4 V: Override Value

Used with Override. When Override (above) is 1, the System OK output is controlled by this value. 1 – output is +24V, 0 – output is 0V. The default setting is 0.

5.5.7.5 T: Type

Sets the output drive type of the System OK output.

Type Setting	Output Function
0	High Impedance – Output is Completely Disabled
1	PNP – Output Sources Current (Pulls High) When the Signal is High
2	NPN – Output Sinks Current (Pulls Low) When the Signal is Low
3	Push-Pull – Output Sources Current (Pulls High) When the Signal is High and Sinks Current (Pulls Low) When the Signal is Low

5.5.8 U: Utility

Accesses the Utility sub-menu

5.5.8.1 D: Default Settings

Set to 1 to reload default system settings. Use with caution as all user settings are lost if this value is set to 1.

5.5.8.2 F: Freerun

Set to 1 to cause the LH200H to generate its own trigger pulse at a 600 ends per minute rate. Set to 0 to disable. Used for diagnostic testing.

5.5.9 D: Display

Accesses the Display sub-menu.

5.5.9.1 1: Samples Ch 1

Displays internal values from sensor channel 1 following a measurement. This command disables the Trigger Input. To restore use TE1, {enter}.

5.5.9.2 2: Samples Ch 2

Displays internal values from sensor channel 2 following a measurement. This command disables the Trigger Input. To restore use TE1, then {enter}.

5.5.9.3 3: Samples Ch 3

Displays internal values from sensor channel 3 following a measurement. This command disables the Trigger Input. To restore use TE1, then {enter}.

5.5.9.4 4: Samples Ch 4

Displays internal values from sensor channel 4 following a measurement. This command disables the Trigger Input. To restore use TE1, then {enter}.

5.5.9.5 P: Plot Signals

Terminal plots the sensor signals.

5.5.9.6 M: Settings

Displays all system settings. Useful for documenting the system configuration. The table below lists all the settings displayed, their default values, and the appropriate console command to set each value.

Table 14 - System Settings and Commands

Setting	Default Value	Console Command
Bias	10	B
Auto-Adjust	1	A
Signal Gain	30	G
Leak Limit	250	L
Trigger Enable	1	TE
Trigger Polarity	1	TP
Lane Phase Automatic Enabled	1	MX
Lane Phase Auto	5	ME
Lane Phase Manual	5	MM
Rejector Enable	1	RE
Rejector Polarity	1	RP

Setting	Default Value	Console Command
Rejector Output Type	1	RT
Rejector Rate	650	RR
Rejector Location (x10)	100	RL – Note this value is 10x
Rejector Before	1	RB
Rejector After	1	RA
Rejector Override	0	RO
Rejector Override Value	0	RV
Strobe Good Enable	1	HE
Strobe Good Polarity	1	HP
Strobe Good Override	0	HO
Strobe Good Override Value	0	HV
Result Enable	1	OE
Result Polarity	1	OP
Result Output Type	1	OT
Result Mode	0	OM
Result Override	0	OO
Result Override Value	0	OV
Strobe Enable	1	WE
Strobe Polarity	1	WP
Strobe Output Type	3	Not User Adjustable
Strobe Override	0	WO
Strobe Override Value	0	WV
System OK Enable	1	KE
System OK Polarity	1	KP
System OK Output Type	1	KT
System OK Override	0	KO
System OK Override Value	0	KV

Setting	Default Value	Console Command
Modbus Auto Address Enabled	1	MX
Modbus Address Auto	21	ME – Read Only
Modbus Address Manual	21	MM
Acquisition Start Ticks	4250	Read Only
Acquisition Strobe Start Ticks	1000	SS
Acquisition Strobe Stop Ticks	1000	SW
Acquisition Result Driver Start	2500	OS
Acquisition Result Driver Stop	8000	RF

5.5.10 S: Statistics

Accesses the Statistics sub-menu. This function should only be used under the direction of Prime Controls.

5.5.10.1 F: Statistics

The Statistics command provides the installer with the ability to detect noise in the measurement system. An assessment can only be initiated when the machine is stopped. A calibrated leaker or no-leak end should be used during noise measurement.

This function initiates immediately. The measurement takes 20-30 seconds and outputs a series of numbers upon completion. The values displayed, in order are:

Gain, Voffset DAC,

Strobe White Ave 1, Strobe Black Ave 1, Strobe Ave Signal 1, Strobe Std Dev 1,

Dark White Ave 1, Dark Black Ave 1, Dark Average Signal 1, Dark Std Dev 1, SNR 1,

Strobe White Ave 2, Strobe Black Ave 2, Strobe Ave Signal 2, Strobe Std Dev 2,

Dark White Ave 2, Dark Black Ave 2, Dark Average Signal 2, Dark Std Dev 2, SNR 2,

Strobe White Ave 3, Strobe Black Ave 3, Strobe Ave Signal 3, Strobe Std Dev 3,

Dark White Ave 3, Dark Black Ave 3, Dark Average Signal 3, Dark Std Dev 3, SNR 3,

Strobe White Ave 4, Strobe Black Ave 4, Strobe Ave Signal 4, Strobe Std Dev 4,

Dark White Ave 4, Dark Black Ave 4, Dark Average Signal 4, Dark Std Dev 4, SNR 4,

Strobe White Ave A, Strobe Black Ave A, Strobe Ave Signal A, Strobe Std Dev A,

Dark White Ave A, Dark Black Ave A, Dark Average Signal A, Dark Std Dev A, and SNR A.

5.5.10.2 G: Gain

The function performs the Statistics measurement as described in command FS above for multiple Signal Gain values.

5.5.10.3 M: Gain M

The function performs the Statistics measurement as described in command FS above for multiple Signal Gain values.

6 MODBUS COMMUNICATION

6.1 Serial Interface

The Modbus serial protocol is a Master-Slave protocol where each LH200H or LH200H-opt operates as a Modbus slave that responds to a master when a request is received. The LH200H operates in RTU transmission mode with its electrical interface in accordance with the EIA/TIA-485 standard in a two-wire (half-duplex) configuration at 38400 bps. The LH200H-2 unit does not support Modbus.

Multiple LH200H Modbus connections may be paralleled to form a multiple drop network. Use proper termination techniques to assure reliable communication.

Table 15 – LH200H Modbus Connections

Pin	Function	Wire Color	Comment
2	Common	Brown	Modbus Return
12	D0	Violet	RS-485 A/A’
11	D1	Black	RS-485 B/B’

Caution: Color codes vary for M12 12 pole cables. Verify the pin connections according to pin numbers shown.

6.2 Commands

Table 16 - Modbus Command Codes

Command Code	Message Type	Meaning
1	Read Coils	Bit Reads From Addresses 0000nn
2	Read Discrete Inputs	Bit Reads From Addresses 1000nn
3	Read Holding Registers	Register Reads From Addresses 4000nn
4	Read Input Registers	Register Reads From Addresses 3000nn
5	Write Single Coil	Bit Writes to Addresses 0000nn
6	Write Single Register	Register Writes to Addresses 4000nn
15	Write Multiple Coils	Bit Writes to Addresses 0000nn
16	Write Multiple Registers	Register Writes to Addresses 4000nn

6.2.1 Discrete Coil Outputs (000001)

Do not write to undefined Coil or Holding register addresses.

Table 17 - Modbus Discrete Coils

Coil Address	Name	Meaning
1	Trigger_Int_Enable	1-Enables
2	Trigger_Polarity	1-High True
3	Strobe_Enable	1-Enables
4	Strobe_Polarity	1-High True
5	Strobe_Override	1-Overrides
6	Strobe_OverrideValue	Override Value
7	Rejector_Polarity	1-Low Leak, 0-High Leak
8	Rejector_Enable	1-Enables
9	Rejector_Override	1-Overrides
10	Rejector_OverrideValue	Override Value
11	StrobeGood_Polarity	1-High True
12	StrobeGood_Enable	1-Enables
13	StrobeGood_Override	1-Overrides
14	StrobeGood_OverrideValue	Override Value
15	SystemOK_Polarity	1-High True
16	SystemOK_Enable	1-Enables
17	SystemOK_Override	1-Overrides
18	SystemOK_OverrideValue	Override Value
19	Result_Polarity	1-High True
20	Result_Enable	1-Enables
21	Result_Override	1-Overrides
22	Result_OverrideValue	Override Value
23	Auto_Adjust	1-Enables
24	VDiodePS_enable	1-To Enable
26	DoSoftTriggerTrue	Triggered Event - Bit Clears When Function Completes

Coil Address	Name	Meaning
27	DoCalibrate	Triggered Event - Bit Clears When Function Completes
28	GetLoadDefault	Triggered Event - Bit Clears When Function Completes
30	Freerun	Initiate Freerun
34	DoStatistics	Triggered Event - Bit Clears When Function Completes
38	System_Ok_Clear	Reset System OK if it Latches to Fault
39	LanePhaseAutoEnabled	Select Between Auto and Manual Value
40	ModbusAddressUseEnnum	Flag to Select Manual or Automatic Address
43	ModbusCtClr	Modbus Counter Clear

6.2.2 Discrete Inputs (100001)

Table 18 - Modbus Discrete Inputs

Coil Address	Name	Meaning
100001	Trigger_Value	Trigger IO Pin State
100002	Strobe_Value	Strobe IO Pin State
100003	Rejector_Value	Rejector IO Pin State
100004	StrobeGood_Value	Strobe Good IO Pin State
100005	SystemOK_Value	System OK IO Pin State
100006	Result_Value	Result IO Pin State
100007	Calibrate_Status	Calibrate Busy Status
100010	StoreXREF_Status	Store XREF Busy Status
100011	RecallXREF_Status	Recall XREF Busy Status
100012	Machine_Running	Machine Running
100013	System_Ok_Error	System OK Error

6.2.3 Register Inputs (300001)

Table 19 - Modbus Register Inputs

Register Address	Name	Size	Meaning
300001	VersionInt	16 Bit	Software Version Major
300002	VersionFrac	16 Bit	Software Version Minor
300051	GreatestSignal	16 Bit	Leak Value
300052	Result Bits	16 Bit	
300053	Temperature	16 Bit	Temperature °C x 100
300054	StatusLED	16 Bit	Status LED Value
300055	PowerLED	16 Bit	Power LED Value
300056	LanePhase	16 Bit	Lane Phase in Use
300057	LanePhaseAutomatic	16 Bit	Automatic Lane Phase Value
300058	ModbusAddress	16 Bit	Modbus Address in Use
300059	ModbusAddressAutomatic	16 Bit	Automatic Modbus Address
300060	ModbusEnnumerationADC	16 Bit	Internal Value for Modbus Enumeration
300061	StrokeCount	32 Bit	Running Stroke Count
300075	ModbusMsgCt	16 Bit	Total Message Count
300076	ModbusHandledMsgCt	16 Bit	Handled Msg Count
300077	ModbusCRCErrCt	16 Bit	CRC Error Count
300078	ModbusExceptionCt	16 Bit	Exception Count
300079	ModbusNoRespCt	16 Bit	No Response Count
300080	ModbusNakCt	16 Bit	Incoming Bad Msg Count

6.2.4 Holding Registers (400001)

Do not write to undefined Coil or Holding register addresses.

Table 20 - Modbus Holding Registers

Register Address	Name	Size	Meaning
400003	Strobe_OutputType	16 Bit	Strobe Output Type (0-Hi-Z, 1-PNP, 2-NPN, 3-Push-Pull)
400004	Rejector_Rate	16 Bit	Press Rate in Strokes Per Minute
400005	Rejector_Location	16 Bit	Rejector Location Relative to Detector
400006	Rejector_Before	16 Bit	# Ends to Reject Before Suspect End
400007	Rejector_After	16 Bit	# Ends to Reject After Suspect End
400008	Rejector_OutputType	16 Bit	Rejector Output Type (0-Hi-Z, 1-PNP, 2-NPN, 3-Push-Pull)
400010	SystemOK_OutputType	16 Bit	System OK Output Type (0-Hi-Z, 1-PNP, 2-NPN, 3-Push-Pull)
400011	Result_Mode	16 Bit	Result Output Mode (0-Hi-Z, 1-PNP, 2-NPN, 3-Push-Pull)
400014	Result_OutputType	16 Bit	Result Output Type (0-2)
400016	Bias		Bias Value (1-100)
400019	Signal_Threshold	16 Bit	Leak Threshold (1-5000)
400020	Signal_Gain	16 Bit	Gain (1-100)
400021	LanePhaseManual	16 Bit	Manual Lane Phase Value
400022	ModbusAddressManual	16 Bit	Manual Modbus Address Value

7 MAINTENANCE

With each preventative maintenance cycle, the LH200H, LH200H-2 or LH200H-opt and SL100H should be inspected for damage or wear. For the LH200H-opt the following kits are available for replacement of items subject to long-term wear:

Prime Controls #	Description	Frequency
202741A	Light Head Gasket and Bushing Kit	Replace Each PM Cycle
202674C	Light Head Skid Plate (-202)	Inspect Each PM Cycle
202988A	Light Head Skid Plate (-300)	Inspect Each PM Cycle

8 TROUBLESHOOTING

8.1 Basic Guide

Should an issue develop, proceed as follows:

1. Verify the integrity of all electrical connections to and from each unit.
2. Check AC point input power to the system.
3. Check PS506 for incoming AC, and +27VDC on its output.
4. Check the SL100H status LED. Red indicates a strobe misfire. Check power and cabling to the unit. If the problem persists, replace the unit.
5. Check the LH200H or LH200H-2 status LED. If the LED is yellow a fault has been detected. Cycle power and repeat. If the fault persists, check the system settings using a serial terminal. If the problem persists, replace the unit.

8.2 Status Messages

The console measurement output is useful in diagnosing system faults. Examining the alphabetic characters in positions 17-26 according to the table below:

Table 21 - Console Measurement Flags

Item #	Values	Description
17	L, N	L: Leak N: No Leak
18	N, S	S: Saturation N: No Saturation
19	N, O	O: Bad Offset N: Offset OK
20	N, B	B: Bad Strobe N: Strobe OK
21	N, D	D: Two Sensor Leak Detect N: Not Two Sensor
22	N, T	T: Three Sensor Leak Detect N: Not Three Sensor
23	N, Q	Q: Four Sensor Leak Detect N: Not Four Sensor
24	N, T	T: Timing Error N: Timing OK
25	N, F	F: User manually forced a measurement N: Normal measurement
26	N, E	E: Temperature Measurement Error N: Temperature Measurement OK

Table 22 – Flag Interpretation

Item #	Value	Cause
17	L	Leaker End Detected
18	S	Excessive light. If this occurs when measuring a good end: 1) Poor Seal to the End 2) Incorrect Bias 3) Calibration Needed
19	O	1) Poor Seal to the End 2) Incorrect Bias 3) Calibration Needed
20	B	Strobe System Problem
21	D	Leaker End Detected
22	T	Leaker End Detected
23	Q	Leaker End Detected
24	T	1) Phasing Error 2) Incorrect Timing Parameters
25	F	If unexpected, forced measurements are observed, limit access to Console and Modbus
26	E	Internal Hardware Fault

8.3 Detailed Instructions

8.3.1 Strobe NOK

The Strobe NOK message indicates that the LH200H is not receiving a proper Strobe Good signal from the SL100H illuminator. Receiving a proper Strobe Good signal is the culmination of many requirements:

1. The Strobe signal from the LH200H unit is properly connected to the SL100H illuminator.
2. The SL100H is powered and functional.
3. The Strobe Good signal from the SL100H is properly connected to the LH200H.

If any of these requirements are not met, the Strobe Good error will appear. To troubleshoot this issue check:

1. Are all cables between the LH200H and SL100H in place, undamaged, and secure?
2. Is the SL100H powered as indicated by the power LED located on the unit? The green power LED is continuously on.
3. Cycle the press or use the 1 command (see 5.4.1) to force measurement.
    a. If the SL100H status LED did not flash, then it is not receiving the Strobe signal from the LH200H. Verify the wiring and cables between the LH200H and SL100H. Verify that the trigger input is enabled (see 5.5.2). Verify that the strobe signals settings have not been overridden (see 5.5.3.5). Verify that the strobe signals settings have not been changed (see 5.5.3 all settings).
    b. If the SL100H status LED flashed but remained red, then one or more of the LEDs in the SL100H did not illuminate correctly. Recheck all connections and cables to the SL100H. Check PS506 for correct voltage levels. Attach a spare

SL100H (or swap cables between a known good SL100H) to the CBL146-10 cable and retest. If the problem is resolved, replace the SL100H.

c. If the SL100H status LED flashed green and then went dark, then the LED flash was correct and there is a problem with the Strobe Good signal between the SL100H and LH200H. Check the wiring and cable between the SL100H and LH200H. Check the setting of the Strobe Good signal (see 5.5.4 all settings).
d. Check the wiring to the SQ200 terminal block on this lane. Bypass the terminal block by directly connecting the SL100H Strobe Good output to the LH200H Strobe good input. If this resolves the problem, replace the SQ200 terminal block.
e. Swap the LH200H with another unit. If the problem follows the LH200H replace it.

8.4 Factory Assistance

For further information on service assistance, contact Prime Controls, Inc., 4528 Gateway Circle, Dayton, Ohio, 45440 USA. Phone +1 (937) 435-8659. Please have the model number and serial number of the unit available to expedite service.

9 OPERATING SPECIFICATIONS

9.1 LH200H, LH200H-opt

Speed:	Up to 1000 Strokes Per Minute
Detection:	Down to 0.5µm Leaks
Rejection Logic:	Up to 99.9 Ends Between Detector and Rejector Up to 10 Ends Before the Leaker Up to 10 Ends After the Leaker
Signals:	Trigger Input Result Output Rejector Output System OK Output
Interfaces:	2-Wire RS-485 Modbus Link RS-232 Serial Link

9.2 LH200H-2

Speed:	Up to 1000 Strokes Per Minute
Detection:	Down to 0.5µm Leaks
Signals:	Trigger Input Result Output
Interfaces:	RS-232 Serial Link

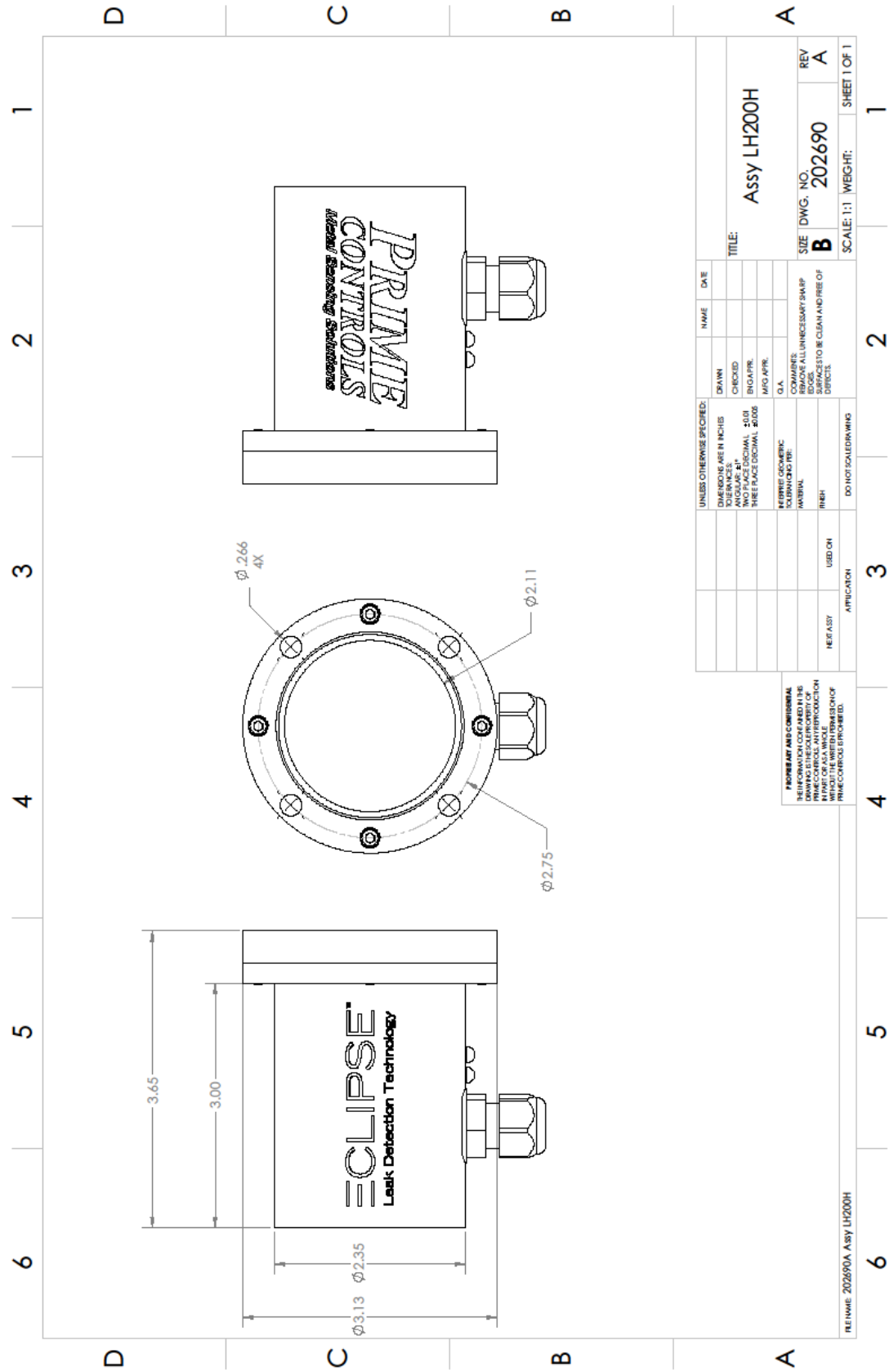
10 ELECTRICAL SPECIFICATIONS

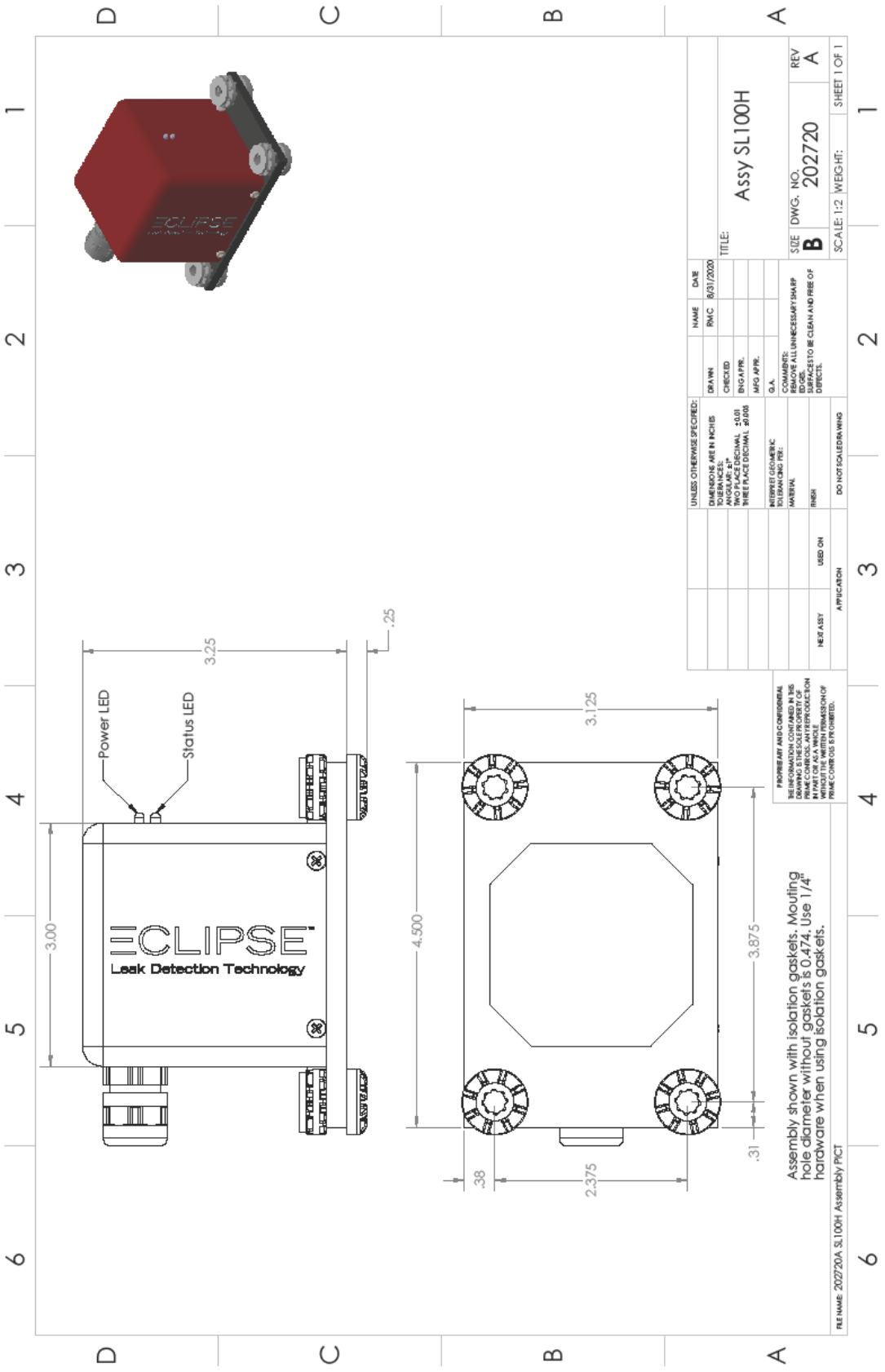
Supply Voltage:	90-260 V AC, 47-63Hz
Supply Current:	< 4 A
Input Max Input Voltage:	-1V, 30V DC
Input Impedance:	30K ohms On voltage: > 18V Off voltage: < 7V
Outputs:	Drive Mode: High Impedance, PNP, NPN, or Push-Pull On voltage: 24-27 V DC Off voltage: 0 Volts Impedance: 15 Ohms Max current: 50 mA
Output Overload Protection:	50 mA Self-Resetting Thermal Fuse
Transient Protection:	30 Volt Transient Absorber
LH200H Cable Length:	10m Maximum
LH200H-opt Cable Length:	10m Maximum
LH200H-2 Cable Length:	10m Maximum
SL100H Cable Length:	10m Maximum

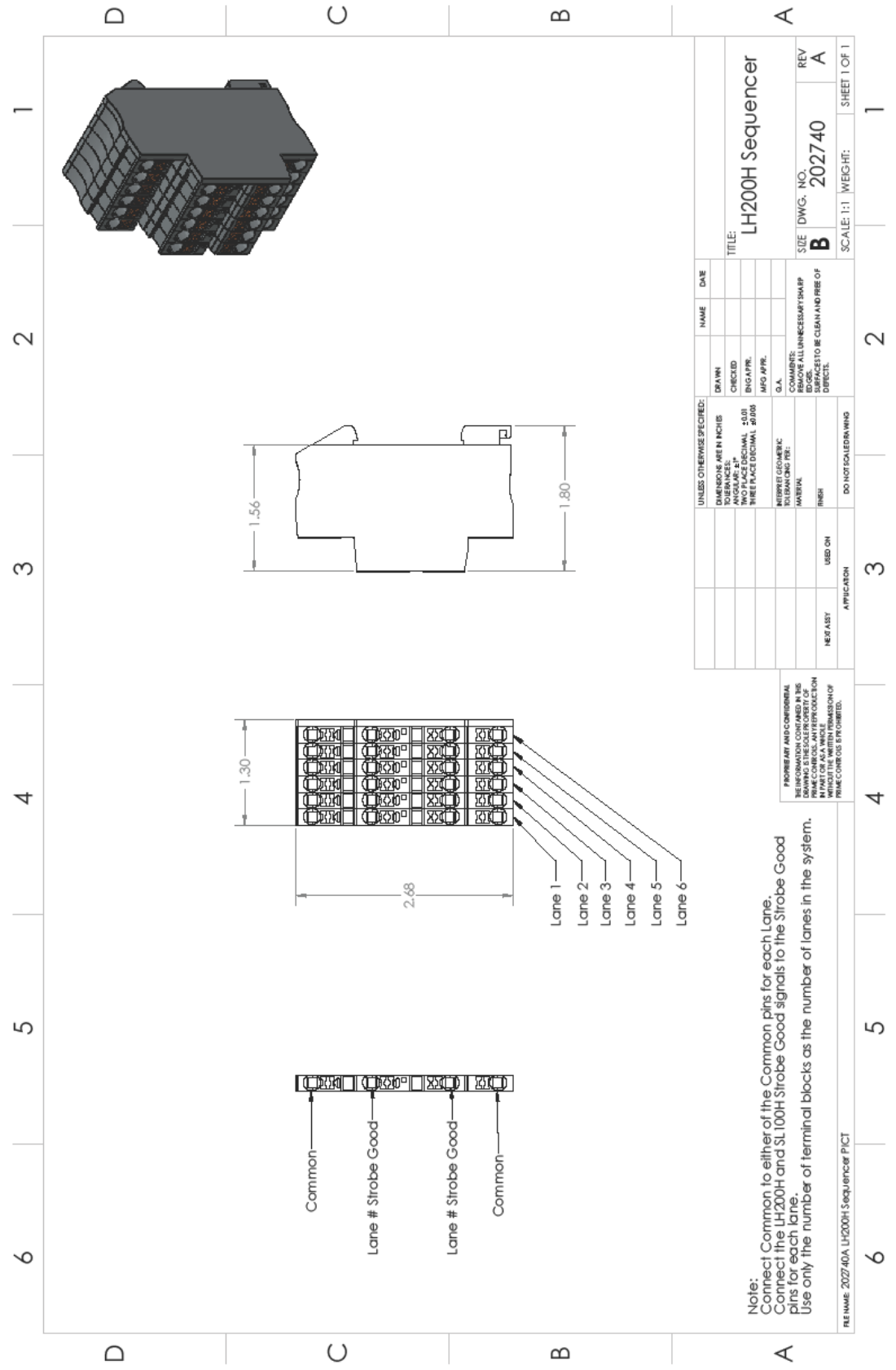
11 LIMITATIONS AND EXCLUSION OF WARRANTIES

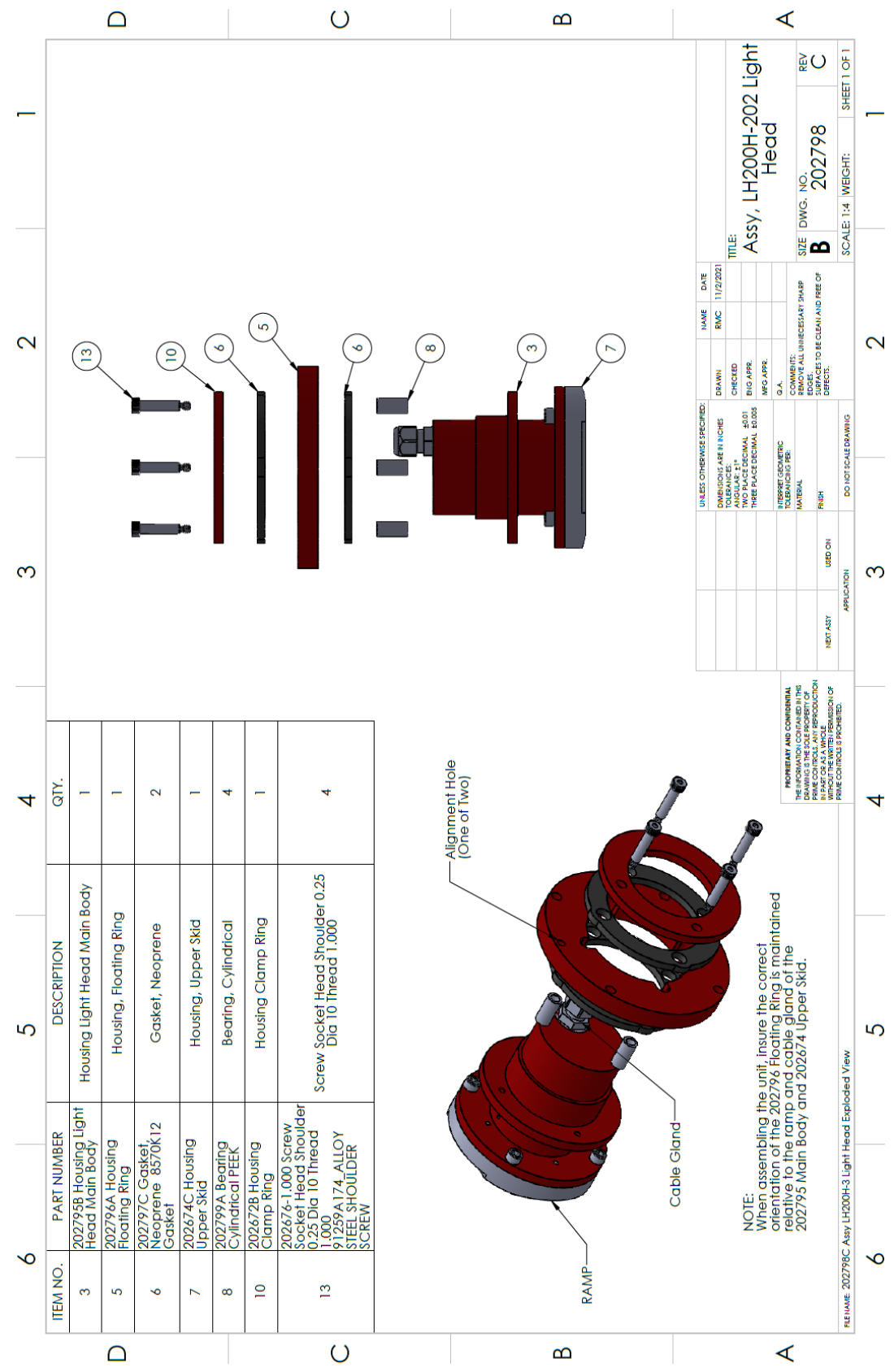
All goods purchased form PRIME CONTROLS, INC. shall be free from defects in materials, design and workmanship under normal conditions of use for one year from the date of shipment. THIS WARRANTY IS THE SOLE WARRANTY AND IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED, WARRANTY OF MERCHANTABILITY OF FITNESS FOR A PARTICULAR PURPOSE. THE LIABILITY OF PRIME CONTROLS TO ANY PURCHASER SHALL BE LIMITED EXCLUSIVELY TO THE COST OF REPLACEMENT OR REPAIR OF DEFECTIVE PARTS, AND SHALL NOT INCLUDE LIABILITY FOR ANY DIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES WHATSOEVER, WHETHER FORESEEN OR UNFORESEEN, INCLUDING BUT NOT LIMITED TO LOST PROFITS, LOST SALES, OR INJURY TO PERSONS OR PROPERTY.

12 Drawings









ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
3	202795B Housing Light Head Main Body	Housing Light Head Main Body	1
5	202796A Housing Floating Ring	Housing, Floating Ring	1
6	202797C Gasket, Neoprene 8570K12 Gasket	Gasket, Neoprene	2
7	202674C Housing Upper Skid	Housing, Upper Skid	1
8	202799A Bearing Cylindrical PEEK	Bearing, Cylindrical	4
10	202672B Housing Clamp Ring	Housing Clamp Ring	1
13	202676-1.000 Screw, Socket Head Shoulder 0.25 Dia 10 Thread 1.000 91259A174 ALLOY STEEL SHOULDER SCREW	Screw Socket Head Shoulder 0.25 Dia 10 Thread 1.000	4