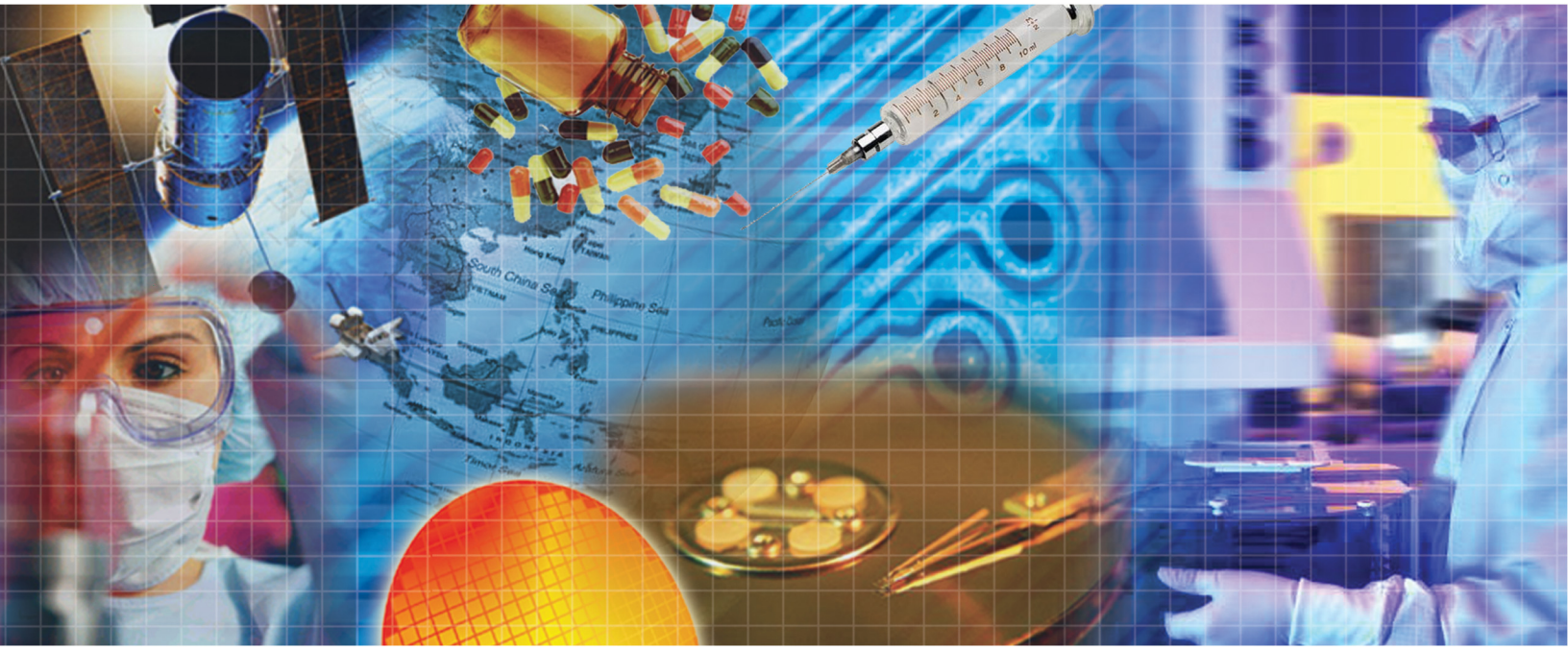


LIGHTHOUSE
WORLDWIDE SOLUTIONS

REMOTE

2012, 3012, 3102, 5012, 5102

Operating Manual

Lighthouse Worldwide Solutions

REMOTE 2012, 3012, 5012, 3102, 5102 Airborne Particle Counter

Operating Manual

LWS Part Number 248083201-1 Rev 6

LIGHTHOUSE
WORLDWIDE SOLUTIONS

EU DECLARATION OF CONFORMITY

Manufacturer's Name Lighthouse Worldwide Solutions, Inc.

Manufacturer's Address:

Lighthouse Worldwide Solutions, Inc.
1221 Disk Drive
Medford, OR 97501

Declares that the product:

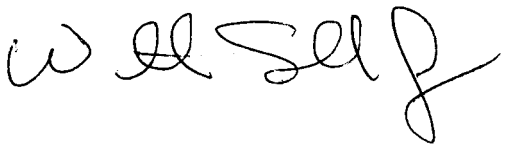
Product Name: Remote Airborne Particle Counter
Model Number(s): REMOTE 2012, 3012, 5012, 3102, 5102

Conforms to the following Product Specifications:

SAFETY	EN61010-1:2001	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part I: General Requirements IEC 61010-1:2000
	CAN/CSA C22.2 No. 1010.1-1992	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part1: General Requirements
LASER SAFETY	IEC 60825-1 Am. 2 IEC 60601-2-22 (Laser Notice 50)	Guidance on Laser Products: Conforms to FDA 21 CFR Chapter 1 Subchapter J
EMC	EN61326	Electrical Equipment for Measurement, Control and Laboratory Use EMC Requirements Part 1: General Requirements Includes Amendment A1:1998;IEC 61326:1997 + A1:1998

UL 61010A-1 – UL Standard for Safety Electrical Equipment for Laboratory Use; Part 1: General Requirements. Replaces UL 3101-1

Supplementary information: The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC amended by Directive 93/68/EEC and the EMC Directive 89/336/EEC amended by Directive 93/68/EEC, and carries the CE marking accordingly.



Fremont, CA, May 15, 2007

William L. Shade – V.P. Engineering

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Chapter 2 Introduction

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Chapter 4 Programming

Chapter 5 Technical Data

Chapter 6 Maintenance Procedures

Appendix A Limited Warranty

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About This Manual

This manual describes the detailed operation and use of the Lighthouse REMOTE 2 Series Airborne Particle Counters.

Text Conventions

The following typefaces have the following meanings:

Note: *A note appears in the sidebar to give extra information regarding a feature or suggestion*

WARNING: ***A warning appears in a paragraph like this and warns that doing something incorrectly could result in personal injury, damage to the instrument or loss and/or improper storage of data.***

italics	Represents information not to be typed or interpreted literally. For example, *file* represents a file name. Manual titles are also displayed in italics.
boldface	Introduces or emphasizes a term.
`Courier font`	Indicates command syntax or text displayed by the diagnostic terminal.
`Bold Courier`	Indicates commands and information that you type. You can use uppercase or lowercase letters; in this manual, commands are shown in uppercase.
Helvetica Italics	Indicates a comment on a command or text output.

Additional Help

For more information about Lighthouse REMOTE 2 Series Airborne Particle Counters, contact Lighthouse Worldwide Solutions.

(800) 945-5905 Sales & Support
(510) 438-0500 Outside of USA

www.golighthouse.com
techsupport@golighthouse.com

1 General Safety

Safety Considerations

Warnings and cautions are used throughout this manual. Familiarize yourself with the meaning of a warning before operating the particle counter. All warnings will appear in the left margin of the page next to the subject or step to which it applies. Take extreme care when doing any procedures preceded by or containing a warning.

There are several classifications of Warnings defined as follows:

- Laser - pertaining to exposure to visible or invisible laser radiation
- Electrostatic - pertaining to electrostatic discharge

Laser Safety Information

This product contains a laser-based sensor that is a Class 1 product (as defined by 21 CFR, Subchapter J of the Health and Safety Act of 1968) when used under normal operation and maintenance. Service procedures on the sensor can result in exposure to invisible radiation. Service should be performed only by factory-authorized personnel.

The particle counter has been evaluated and tested in accordance with EN 610109-1:1993, "Safety Requirements For Electrical Equipment for Measurement, Control, and Laboratory Use" and IEC 825-1:1993, "Safety of Laser Products".

WARNING: ***The use of controls, adjustments or performance of procedures other than those specified within this manual may result in exposure to invisible (infrared) radiation that can quickly cause blindness.***

Figure 1-1 Warning label on unit

For further technical assistance, contact our Technical Support Team at (800) 945-5905.

Electrostatic Safety Information

WARNING: ***Using a wrist-strap without an isolation resistor will increase the severity of an electrical shock.***

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all service or maintenance work should be done at a static-safe work station. A static-safe work station can be created by doing the following:

- Use a grounded conductive table mat and resistor-isolated wrist-strap combination
- Earth-ground all test instruments to prevent a buildup of static charge

2 *Introduction*

Overview

This operating manual introduces you to the Lighthouse REMOTE 2012, 3012, 5012, 3102, 5102 (REMOTE 2 Series) family of two-channel Airborne Particle Counters. Also included in this manual are instructions for inspecting, using, and maintaining the instrument. Any changes of instrument operation due to design changes are covered at the back of this manual.

Description

The 2012 instrument is manufactured to count particles at 0.2 and 0.3 micron, the 3012 counts particles at 0.3 and 0.5 micron and the 5012 model counts particles at 0.5 and 5.0 microns at 0.1 CFM. The 3102 model counts at 0.3 and 0.5 micron and the 5102 model counts particles at 0.5 and 5.0 microns at 1.0 CFM.

The instruments are effective in both ultra-clean areas (such as Class 1 or Class 10) and in more traditional cleanzones rated as Class 100 or higher. Refer to Specifications in this manual for additional instrument information.

Figure 2-1 REMOTE 3012 Airborne Particle Counter

The particle counter uses laser diode light source and collection optics for particle detection. The collection optics collect and focus light scattered by the particles onto a photo diode that converts the bursts of light into electrical pulses. The pulse height is a measure of particle size. Pulses are counted and their amplitude is measured for particle sizing.

The REMOTE 2 Series line of Airborne Particle counters was created for continuous operation 24 hours per day, 7 days per week.

Using an external vacuum source, the instrument provides versatile mounting options and can be installed where space is at a premium. The REMOTE 2 Series instrument integrates seamlessly with large facility monitoring/management systems and transfers 2 channels of simultaneous particle count data using 4-20mA output.

Accessories

You can order several accessories to tailor the instrument to your needs. These accessories are listed below.

- **Isokinetic Sampling Probe 0.1 or 1.0 CFM**
- **Sample Tubing**
- **Instrument to PC Cabling, RJ-45 to DB-9**
- **0.1μm Purge Filter Assembly 0.1 or 1.0 CFM Flow Rate with Tubing**
- **Vacuum tubing per foot**
- **Cable per foot**

REMOTE Specifications

Size Ranges, 2012	0.2 - 2.0
Size Ranges, 3012/3102	0.3 - 10.0µm
Size Ranges, 5012/5102	0.5 - 10.0µm
Channel Thresholds, 2012	0.2, 0.3µm
Ch. Thresholds, 3012/3102	0.3, 0.5µm
Ch. Thresholds, 5012/5102	0.5, 5.0µm
Flow Rate, 2012/3012/5012	0.1 CFM (2.83 LPM)
Flow Rate, 3102/5102	1.0 CFM (28.3 LPM)
Counting Efficiency	50% (per JIS)
Laser Source	Laser Diode
Zero Count Level	<1 count/5 minutes (per JIS)
Vacuum Requirements	External Vacuum >18" (45.7 cm) of Hg
Calibration	NIST Traceable
Communication Modes	4-20mA: Ch1, Ch2
Alarms	Ch1, Ch2 Count Overflow Alarm
Alerts	Service Alert
Enclosure	Stainless steel
Power	Instrument Power: +6V to +30VDC Loop Power: +15V to +30VDC
Dimensions	1.7" (L) x 4.2" (W) x 2.5" (H) [4.3 x 10.7 x. 6.3 cm]
Weight	12.5 oz (0.35 kg)
Operating Temp/RH	50° F to 104° F (10° C to 40° C) / 20% to 95% non-condensing
Storage Temp/RH	14° F to 122° F (-10° C to 50° C) / Up to 98% non-condensing

Table 2-1 Specifications

The manufacturer recommends that your Lighthouse instrument be calibrated annually by a Certified Lighthouse Service Provider to ensure that it continues to perform within specification.

3 Getting Started

Unpacking and Initial Inspection

The instrument is thoroughly inspected and tested at the factory and is ready for use upon receipt.

When received, inspect the shipping carton for damage. If the carton is damaged, notify the carrier and save the carton for carrier inspection. Inspect the unit for broken parts, scratches, dents, or other damage. Verify the contents of the package against the packing list.

If the carton is not damaged, keep it for reshipment when you return the instrument for the annual factory calibration.

Shipping Instructions

Should it become necessary to return the unit to the factory for any reason, be sure to contact Customer Service and obtain a Return Merchandise Authorization (RMA) number. Reference this number on all shipping documentation and purchase orders. After receipt of the return number, follow the shipping instructions provided below:

1. Use the original container or carton and packing materials whenever possible.

2. If the original container and packing materials are not available, wrap the unit in "bubble pack" plastic; surround with shock-absorbent material and place in a double-wall carton.

3. Seal container or carton securely. Mark "FRAGILE" and enter Return Merchandise Authorization (RMA) number in any unmarked corner.

4. Return to the address instructed by your Lighthouse representative.

Operation

Interpreting the Indicators

Both front-panel indicators have a specific meaning when illuminated. The figure below shows location of the indicators and gives a brief description of their meaning.

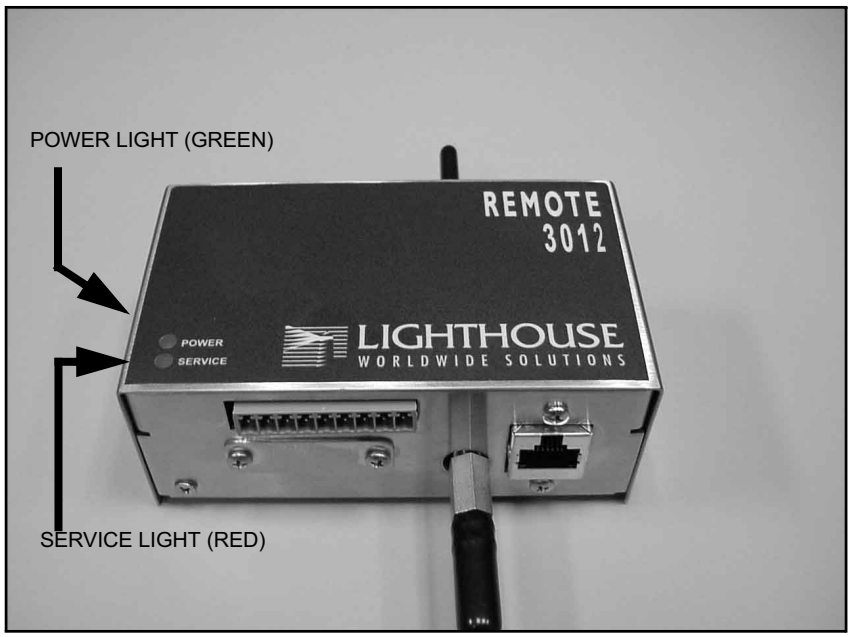

Figure 3-1 Front Panel LEDs

- The green POWER indicator lights when power is received through the DATA connector.
- The red SERVICE indicator blinks if either of the Channels overflows its programmed threshold.
- The red SERVICE indicator is ON if Laser power is low, sensor optics are dirty or the view volume contains foreign objects.

Connections

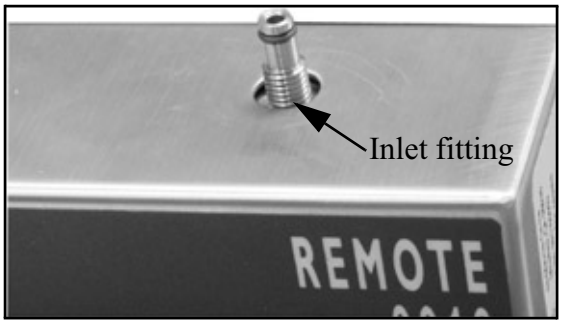

Figure 3-2 Connections on Top of Instrument

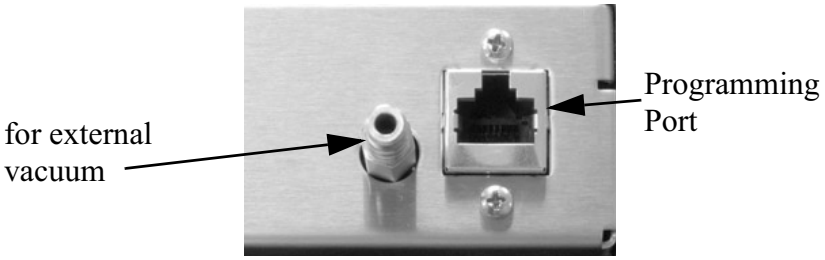

Figure 3-3 Connections on Bottom Right of Instrument

Figure 3-4 J10 Labeling (with Status feature on pin 5)

Figure 3-5 J10 Labeling (without Status feature on pin 5)

Installation

Your instrument(s) can be easily prepared for use by performing the steps below. Depending on the unit's output, each instrument can be located up to 1000 feet (330 meters) from the counting device.

1. Locate instrument(s) in areas to be sampled.
2. Attach barbed fitting to top inlet.

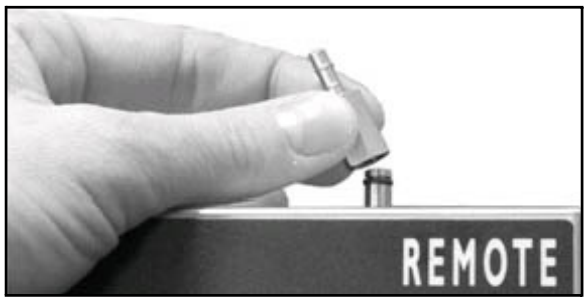

Figure 3-6 Attaching the Fitting

3. Attach sample tubing to barbed (top) fitting.

Figure 3-7 Attach sample tubing to inlet

4. Attach tubing from external vacuum source to the barbed fitting on the bottom of the unit.

Installing an Isokinetic Probe

An Isokinetic probe can be attached directly to the unit. Screw the probe directly onto the inlet.

Figure 3-8 Installing Probe Directly on Barb

Data Port

Connector J10 on the bottom of the instrument is used to communicate with your Facility Management System. Signals at this port include two 4-20mA data channels, an external alarm channel, power and ground.

Table 3-1 J10 with Status Data Connector Pinouts

Pin Number	Signal	Range
1	Chan 1	1) 4-20mA particle count levels 2) 2mA Service Alert level
2	Chan 2	1) 4-20mA particle count levels 2) 2mA Service Alert level
3 *	VLOOP	+15VDC to +30VDC
4	Ground	
5	Status (if signal is available - Figure 3-4)	1) 4mA: no Alarm, no Service Alert 2) 12mA: Channel overflow Alarm 3) 20mA: SERVICE Alert
6	Ground	
7 *	VPWR	+6VDC to +30VDC
8	External Alarm (-)	Continuity with Pin 9 if ALARM.
9	External Alarm (+)	+40VDC at 1A maximum

* If the application allows, VLOOP and VPWR may be connected to the same source. In that case, the VPWR is +15VDC to +30VDC.

Table 3-2 J10 without Status Data Connector Pinouts

Pin Number	Signal	Range
1	Chan 1	1) 4-20mA particle count levels 2) 2mA Service Alert level
2	Chan 2	1) 4-20mA particle count levels 2) 2mA Service Alert level
3 *	VLOOP	+15VDC to +30VDC
4	Ground	
5	N/A - (Figure 3-5)	
6	Ground	
7 *	VPWR	+6VDC to +30VDC
8	External Alarm (-)	Continuity with Pin 9 if ALARM.
9	External Alarm (+)	+40VDC at 1A maximum

* If the application allows, VLOOP and VPWR may be connected to the same source. In that case, the VPWR is +15VDC to +30VDC.

Included with the instrument is a plug to connect the J10 connector to your Facilities Monitoring System.

Figure 3-9 J10 Connector With Plug Attached

Applications

Figure 3-10 and Figure 3-11 illustrate how to wire J10 for a two-wire or a three-wire system.

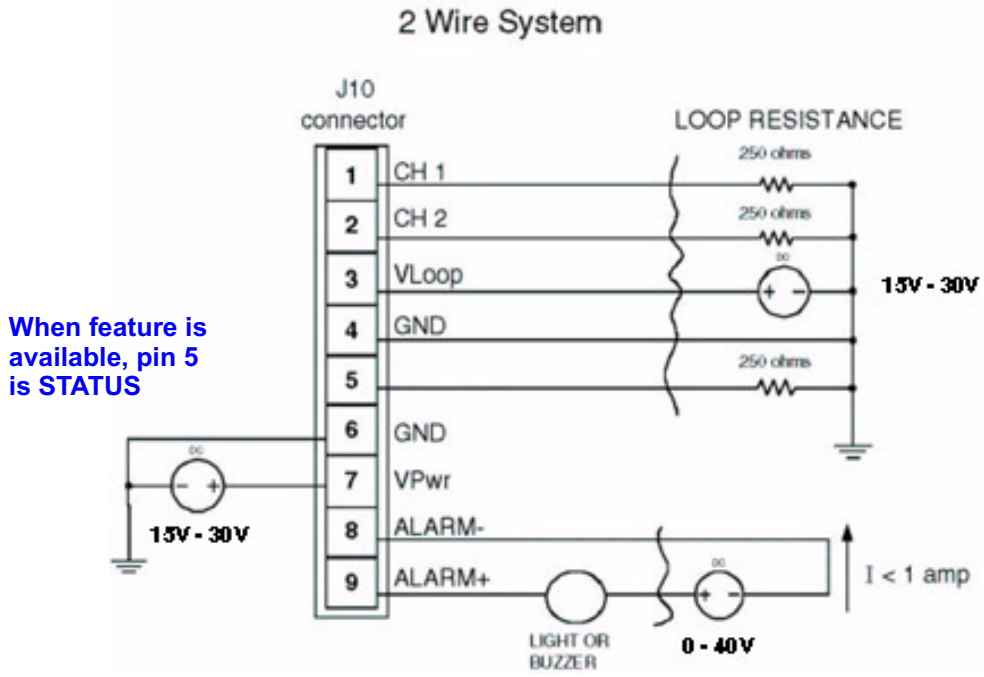

Figure 3-10 Application for a Two Wire System

When feature is available, pin 5 is STATUS

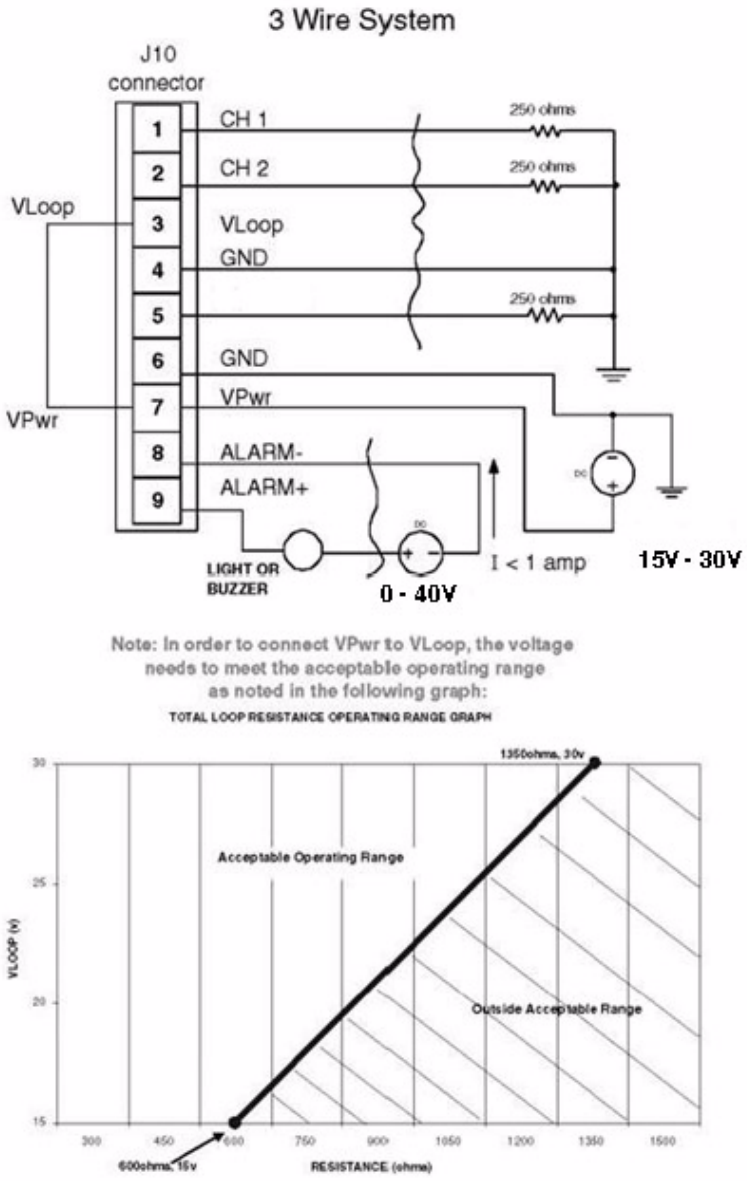

Figure 3-11 Application for a Three Wire System

4 *Programming*

General

The REMOTE 2 Series family of instruments can be programmed in either of two ways. The DIP switches can be used to set the Sampling Time and Range values. If an ASCII terminal is connected to the instrument, it can program the unit's Sample Time, Range, Service High, Service Low, Alarm Threshold and Suppress Alarm Count.

This chapter contains the information needed to program the instrument to meet your needs.

DIP Switches

The DIP switches are behind a panel under the Data connector J10.

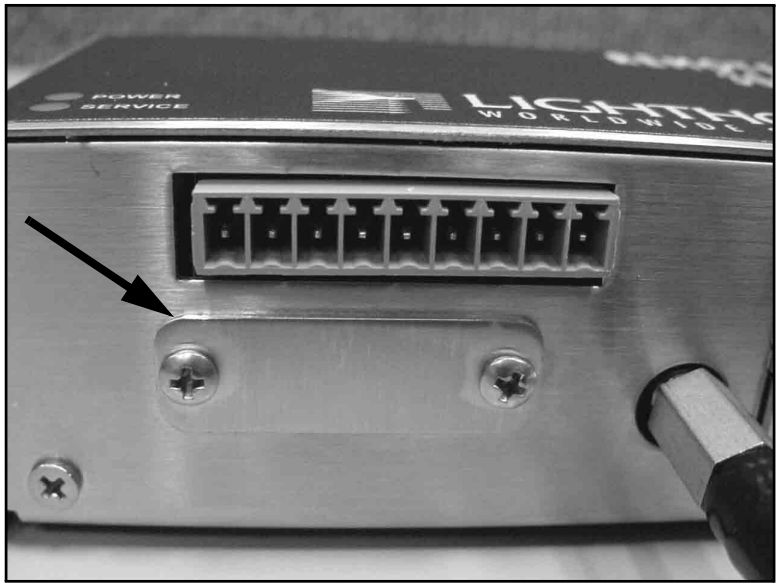

Figure 4-1 Panel Covering the DIP Switches

Remove the two Phillips head screws to expose the DIP switches.

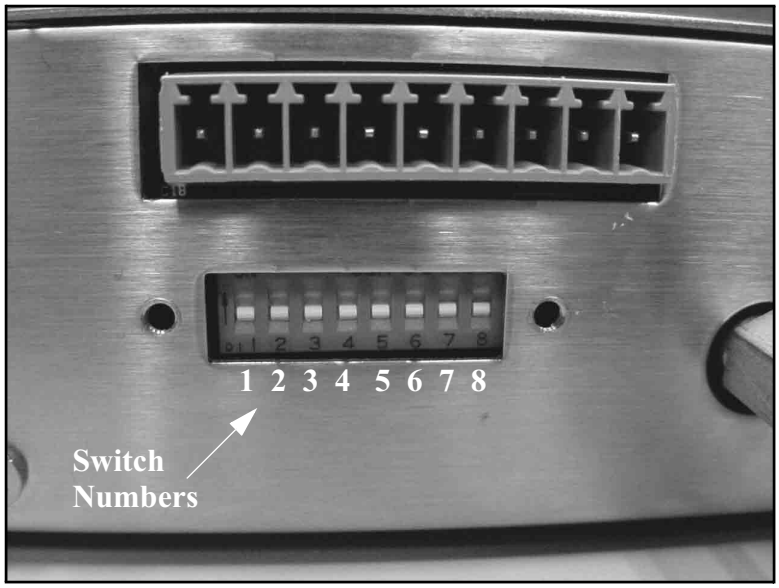

Figure 4-2 Panel Removed, Switches Exposed

DIP Switch Settings

GENERAL DEFINITIONS

OFF (DOWN) = 0, ON (UP) = 1

Switch Number1234 5678
Data 0000:0000

At Startup:

0000:0000==> Program Mode (ASCII terminal)

0000:0001==> Immediate Startup using last stored parameters

Anything Else==> DIP Switch Mode

Note: *The DIP Switches must be set before the unit is powered ON.*

Time:Range

When a DIP switch is set to any of the pre-programmed values listed below and power applied to the instrument, information is echoed back to the terminal, if connected.

These settings affect time and range only. All other parameters, such as Alarm Value and Suppress Alarms, are left at their previous settings.

Time is the sampling time in seconds. The Range setting is applied to both channels.

DIP Switch Settings and Meanings

1000:1000 ==> 6 seconds, 1000 counts

1000:0100 ==> 6 seconds, 10,000 counts

1000:0010 ==> 6 seconds, 100,000 counts

0100:1000 ==> 60 seconds, 1000 counts

0100:0100 ==> 60 seconds, 10,000 counts

0100:0010 ==> 60 seconds, 100,000 counts

0010:1000 ==> 600 seconds, 1000 counts

0010:0100 ==> 600 seconds, 10,000 counts

0010:0010 ==> 600 seconds, 100,000 counts

If the user chooses DIP switch combinations other than the ones specified above, the unit will default to a sample time of 300 seconds, Range1 and Range2 to 100,000 counts.

Procedure to Set DIP Switches

1. Remove power from the instrument.
2. Set the DIP Switches to the desired Time and Range, using the information above.
3. Apply power to the instrument.

Example Startup Echo, Reading DIP Switches:

```
Lighthouse Remote Instrument (4-20mA):
- reading dip switch:

Sample Time = 60 secs
Range1= 10000.
Range2= 1000.
Alarm Threshold = 750 counts
Suppress Alarms = 2
Service High = 3500 mV
Service Low = 125 mV
```

Connecting the Instrument to a Terminal

The RJ-45 connector on the instrument (marked "Programming Port" in Figure 4-3) is used to interconnect the unit with a COM port on a desktop or laptop PC. Once connected and set up as an ASCII terminal, the PC can be used to program and/or monitor the instrument settings.

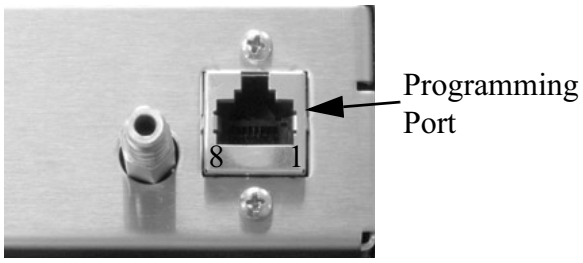

Figure 4-3 The Programming Port, Showing Pin Numbers

A modular adapter, RJ-45 to DB-9, is available from Lighthouse. The pinouts of the adapter are shown in the table below:

Table 4-1 RJ-45 to DB-9 Connections

RJ-45 Pin	Signal Name	DB-9 Pin
1	TX	2
2	RX	3
8	Ground	5

To connect the instrument to a computer:

1. Remove power from the instrument.
2. Connect the RJ-45 end of the adapter cable to the Programming Port on the instrument.
3. Connect the DB-9 end of the cable to a COM (Serial) Port on your computer.
4. Open Hyperterminal on your computer.
5. Configure the COM Port settings as follows. Any available COM Port may be used:

Figure 4-4 COM Port Properties

6. Configure the ASCII settings as follows:

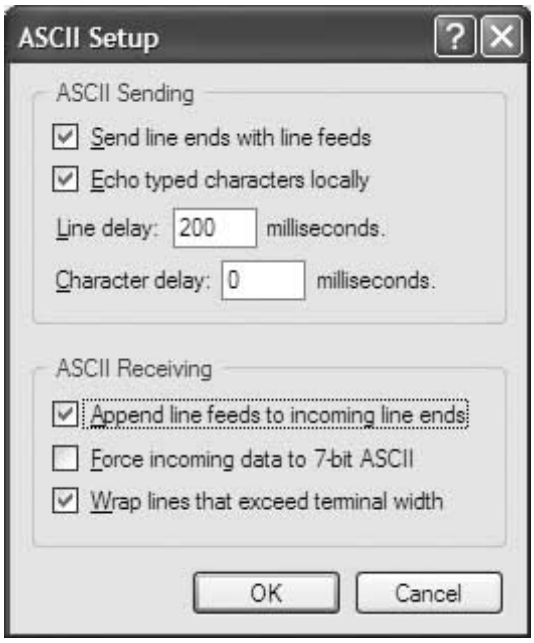

Figure 4-5 ASCII Settings

7. Ensure that all DIP Switches are set to 0 (OFF/DOWN).

Power Up

If DIP Switches all = 0 ==> Program Mode:

During the first 20 seconds after power is applied, the unit waits for programming commands. If no commands are received within that time, the instrument recalls its last stored parameters (or default settings) and continues to use them.

If a programming command is received within the first 20 seconds, the command is examined and, if valid, the parameters are set and stored in non-volatile memory, overwriting the previous parameters for that command.

The instrument waits another 20 seconds for the next command and the process repeats for each command that is sent. After the last command, the timer times out and the instrument is loaded with the commands that were issued. Old parameters are used if they were not modified during this session.

Once programmed, the instrument retains its settings until they are modified. The user can set DIP Switch 8 to ON (UP, 1) to eliminate the 20 second timer when the unit is next powered up.

Lighthouse recommends that, before powering up the instrument, you make a list of the commands and parameters you want to use, thus avoiding an unwanted timeout.

Session Example

The following steps should be performed whenever you want to program the instrument or check its settings using the ASCII terminal.

1. Set all DIP Switches to OFF (DOWN, 0) to program the instrument and connect it to the ASCII terminal.

2. Apply power to the instrument. The Hyperterminal programming prompt is sent from the unit.

Note: *Upper case V. The < and > characters are needed; they mark the beginning and end of the command.*

3. Type: **<V>** -- *this is Verbose mode. This must be the first command sent if you wish to see responses from the instrument*

4. Type: **<?>** -- *the unit's current settings are displayed.*

```
<?>
Flow Rate = 0.1 cfm
Sample Time = 5 secs
Range1= 10000.
```

```
Range2= 1000.
Service High = 3000 mV
Service Low = 145 mV
Alarm Channel = 1
Alarm Threshold = 1000 counts
Suppress Alarms = 2
Channel 1 =  0.3
Channel 2 =  0.5
```

5. Type: **<m1>** *-- the unit's menu is displayed to show commands to use to change parameters.*

```
<m1>
*** User Menu ***

<?> Display Parameters
<V> Verbose Mode
<sa> Start Counting
<sb> Stop Counting
<gv> Get Version Number
<ra#> Set Range 1 (counts)
<rb#> Set Range 2 (counts)
<ta#> Set Sample Seconds
<aa#> Set Alarm Channel #
<ab#> Set Alarm Threshold (# of counts)
<ae#> Set Alarm Suppression #
```

6. The instrument will wait 20 seconds after the last command is sent, then begin sampling

ASCII Programming Syntax

Using a simple ASCII protocol, the REMOTE 3012 family of instruments can be programmed from an ASCII terminal (i.e. Hyper Terminal). The protocol format is based on a start character, followed by a command, which is then followed by a terminating character. Any characters before the start character, or after the terminating character are ignored. White spaces between command character and command parameter are ignored.

Command Structure

The commands are defined as single case-sensitive ASCII characters. Format is defined as shown on page 8.

Note: *The < and > characters are part of the command and must be typed. The brackets [and] are field delimiters and are not typed.*

Note: *All command characters are lower case, except for the V (verbose).*

<x[yyyy]>

where:

< = Start Character

x = Command Character

yyyy = Optional Command Parameter

> = Terminating Character

Handshake

Upon execution of the command, and assuming you have typed **<V>** for Verbose, the REMOTE instrument will send a response based on the value of the counts, suppress alarms, and alarm status. Examples of responses are listed below:

<ERR> = Error in Command String.

-or-

```
Sample: ch1-2: 0, 0 Range1= 5000, Range2= 2500.
```

When the unit is powered up, it sets up the counters and timers, and starts reporting data. The data will be similar to this example:

```
Sample: ch1-2: 0, 0 Range1= 5000, Range2= 2500.
Sample: ch1-2: 0, 0 Range1= 5000, Range2= 2500.
```

Protocol

Protocol is defined through an RS-232 interface. The hardware protocol is defined as:

Baud Rate: 9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: None

Command Set

VERBOSE MODE

Note: *Upper case V*

<V>

Normally, VERBOSE MODE is off and the computer responds with <OK> after each command is received and correctly implemented.

Turning on VERBOSE MODE tells the computer to echo back the information to the screen.

VERBOSE MODE is required in order to program the device. It is not required to run the counter.

GET CURRENT SETTINGS

<?>

Shows current parameter settings.

Type:

<?>

Response:

```
<?>
Flow Rate = 0.1 cfm
Sample Time = 5 secs
Range1= 10000.
Range2= 1000.
Service High = 3000 mV
Service Low = 145 mV
Alarm Channel = 1
Alarm Threshold = 1000 counts
Suppress Alarms = 2
Channel 1 =  0.3
Channel 2 =  0.5
```

DISPLAY MENU OF COMMANDS

<m1>

Shows menu of commands.

Type:

<m1>

Response:

```
<m1>
*** User Menu ***

<?> Display Parameters
<V> Verbose Mode
<sa> Start Counting
<sb> Stop Counting
<gv> Get Version Number
<ra#> Set Range 1 (counts)
<rb#> Set Range 2 (counts)
<ta#> Set Sample Seconds
<aa#> Set Alarm Channel #
<ab#> Set Alarm Threshold (# of counts)
<ae#> Set Alarm Suppression #
```

START/STOP COUNTING MODE

START Counting

<sa>

This will start the device's counting mode. When implemented, the unit will wait until the sample time passes before displaying the sample data.

Type:

<sa>

Response:

```
<sa>START
Sample: ch1-2: 0, 0 Range1= 10000, Range2= 5000.
Sample: ch1-2: 0, 0 Range1= 10000, Range2= 5000.
```

STOP Counting

<sb>

This will stop the device's counting mode.

Type:

<sb>

Response:

```
<sb>STOP
```

GET CURRENT VERSION NUMBER

<gv>

Shows current version number of the device firmware.

Type:

<gv>

Response:

```
<gv>  Version: 010
```

SET CHANNEL RANGES

Note: *Range 1 should always be greater than or equal to Range 2; Range 2 should never be greater than Range 1.*

When using the DIP switch programming, both channels are set to the same range value.

<ra#> *-- sets upper range of channel 1 where # is the range value*

<rb#> *-- sets upper range of channel 2 where # is the range value*

Sets upper limit to counting range. The upper limit will be equal to 20mA, and the lower range will always be 0 counts = 4 mA. If the counts exceed range limit, the counts will be set to the range limit. The maximum range is 10,000,000.

Type:

<ra10000>

Response:

```
<ra10000>Range1= 10000.
```

Type:

<rb7500>

Response:

```
<rb7500>Range2= 7500.
```

SET SAMPLE TIME (seconds)

Note: *Sample times ≤5 seconds are not recommended.*

<ta#>

Sets sample time in # seconds, where # ≥1 and nnnn ≤ 3600.

Type:

<ta30>

Response:

```
<ta30>Sample Time = 30 secs
```

SET ALARM CHANNEL

<aa#>

Sets the alarm channel to channel 1 or 2.

Type:

<aa1>

Response:

```
<aa1>Alarm Channel= 1
```

SET ALARM THRESHOLD

<ab#>

Sets Alarm High count threshold for the configured alarm channel. Value # must be less than range in order to set the threshold. Set the value to 0 (zero) to disable alarm.

If the count for the configured alarm channel exceeds the threshold then:

- The red SERVICE indicator on the instrument blinks.
- The EXTERNAL ALARM relay, described below, is set.
- The alarm alert will be seen on the ASCII terminal as illustrated next:

Type:

<ab1000>

Response:

```
<ab1000>Alarm Threshold= 1000 counts
```

Hyperterminal Alarm Alert without Alarm Suppression:

Note: *The field bk= 429 in this example is the "backlight" function which is a measurement of scattered light in the instrument. See SET_SERVICE_HIGH and SET_SERVICE_LOW*

In this example, the Alarm Suppress is disabled (0).

```
secs=1: ch1-2: 285, 48 , bk= 429
secs=2: ch1-2: 487, 89 , bk= 429
secs=3: ch1-2: 1699, 1033 , bk= 1049
secs=4: ch1-2: 2572, 1320 , bk= 434
secs=5: ch1-2: 3337, 1575 , bk= 429

Sample: ch1-2: 3337, 1575 Range1= 10000, Range2= 5000.
Alarms: Threshold= 1000, Channel= 1, # in a row=1

secs=1: ch1-2: 615, 228 , bk= 434, alarm alert.
secs=2: ch1-2: 1115, 382 , bk= 429, alarm alert.
secs=3: ch1-2: 1595, 502 , bk= 429, alarm alert.
secs=4: ch1-2: 2029, 637 , bk= 429, alarm alert.
secs=5: ch1-2: 2381, 738 , bk= 429, alarm alert.

Sample: ch1-2: 2381, 738 Range1= 10000, Range2= 5000.
Alarms: Threshold= 1000, Channel= 1, # in a row=2
```

SET ALARM SUPPRESSION

<ae#>

Sets the alarm suppression for the configured alarm channel. The number of alarm conditions have to be greater than # in order to turn on the Alarm Relay.

For example, if Alarm Suppress is set to 2, then the device won't report an alarm condition via the external alarm output or the flashing service light until the 3rd consecutive alarm condition.

Type:

<ae2>

Response:

```
<ae2>Suppress Alarms = 2
```

Hyperterminal Alarm Alert with Alarm Suppression:

In this example, the Alarm Suppress is set to 2.

```
<ae2>Suppress Alarms = 2

secs=1: ch1-2: 0, 0 , bk= 429
secs=2: ch1-2: 681, 430 , bk= 2558
secs=3: ch1-2: 1629, 886 , bk= 444

Sample: ch1-2: 1629, 886 Range1= 10000, Range2= 5000.
Alarms: Threshold= 1000, Channel= 1, # in a row=1

secs=1: ch1-2: 828, 517 , bk= 1640
secs=2: ch1-2: 1861, 1230 , bk= 434
secs=3: ch1-2: 3149, 2177 , bk= 449

Sample: ch1-2: 3149, 2177 Range1= 10000, Range2= 5000.
Alarms: Threshold= 1000, Channel= 1, # in a row=2

secs=1: ch1-2: 450, 126 , bk= 434
secs=2: ch1-2: 1279, 530 , bk= 444
secs=3: ch1-2: 1875, 678 , bk= 439

Sample: ch1-2: 1875, 678 Range1= 10000, Range2= 5000.
Alarms: Threshold= 1000, Channel= 1, # in a row=3

secs=1: ch1-2: 697, 131 , bk= 439, alarm alert.
secs=2: ch1-2: 1215, 227 , bk= 434, alarm alert.
secs=3: ch1-2: 1505, 302 , bk= 439, alarm alert.

Sample: ch1-2: 1505, 302 Range1= 10000, Range2= 5000.
Alarms: Threshold= 1000, Channel= 1, # in a row=4
```

Note: *The first line starting with "Alarms" (in boldface) shows what the current alarm threshold is, which channel is set for alarming and how many alarm conditions in a row have occurred.*

Note: *The "alarm alert" (in boldface) doesn't display until after the 3rd consecutive alarm condition; the external alarm light goes on at this point as well.*

Service High and Service Low

Service High and Service Low are the voltage levels at which the Service Light will go on. Those levels are compared to the "Backlight" measurement (seen as the bk= 1455 field) in every sample period. If the Backlight measurement is greater than Service High or less than Service Low, then:

Note: *The "normal" levels seen in these "bk" fields are examples only and are not necessarily what you will see with your instrument.*

- the service alert appears as seen in the following Hyperterminal Service Alert example:
- J10 pins 1 and 2 (Chans 1 and 2) = 2mA
- the Service Light is turned on

The default Service High threshold is 3500.

Hyperterminal Service Alert Example:

```
secs=1: ch1-2: 667, 214 , bk= 463
secs=2: ch1-2: 2262, 1395 , bk= 449
secs=3: ch1-2: 2890, 1608 , bk= 434
secs=4: ch1-2: 4719, 2983 , bk= 4995, service alert.
```

```
secs=5: ch1-2: 4719, 2983 , bk= 4995, service alert.

Sample: ch1-2: 4719, 2983 Range1= 10000, Range2= 5000.
Alarms: Threshold= 1000, Channel= 1, # in a row=1
```

Service Menu

The Service Menu is available by typing **<ms>**.

Type:

<ms>

Response:

```
<ms>
*** Service Menu ***
<ia> Don't show 1 sec data
<ib> Show 1 sec data
<gb> Get Bkgnd
```

DON'T SHOW 1 SEC DATA

<ia>

Turns OFF 1 second data display.

Type:

<ia>

Response:

```
<ia>Don't show 1 sec data.
```

After starting the counter with <sa>, the device will wait until the sample time interval passes before displaying the first sample.

SHOW 1 SEC DATA

<ib>

Turns ON 1 second data display.

Type:

<ib>

Response:

```
<ib>Show 1 sec data.
```

After starting the counter with <sa>, the device will show the samples collecting every second.

```
secs=1: ch1-2: 0, 0. , bk= 424
secs=2: ch1-2: 0, 0. , bk= 424
secs=3: ch1-2: 0, 0. , bk= 424
secs=4: ch1-2: 0, 0. , bk= 424
secs=5: ch1-2: 1, 0. , bk= 424
```

This mode can be used to view the data on a second-by-second basis for troubleshooting.

GET BACKGROUND LIGHT VALUE

<gb>

Displays the current background value in milli-volts (mV).

5 Technical Data

Introduction

This chapter describes the operation and programming of the instrument.

Control Design

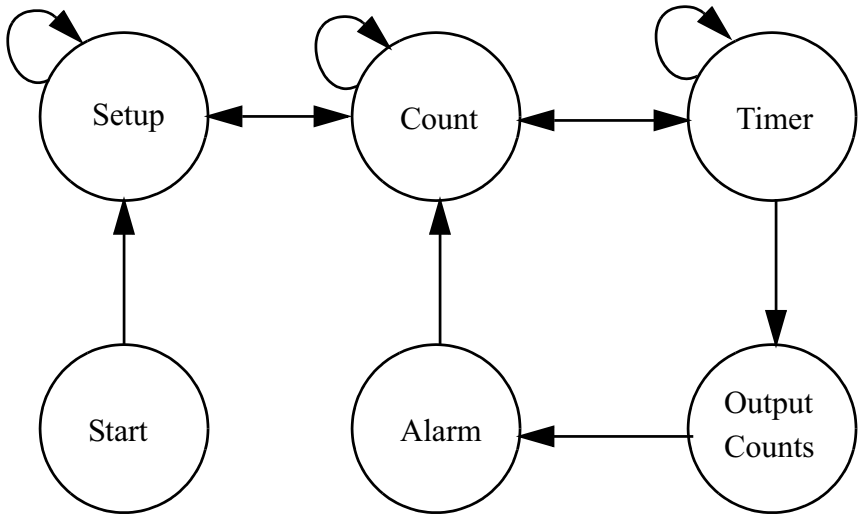

Figure 5-1 States for the 3012, 5012, 3102, 5102 Particle Counter

START

- Starts microprocessor, and initializes hardware.

SETUP

- If DIP Switches all = 0 ==> Program Mode:

  During the first 20 seconds, the unit waits for programming commands. If any programming commands are received within the first 20 seconds, those commands will be examined and executed. If the commands are valid, the parameters will be set. If no

commands are received (all DIP switches = 0) or if an invalid command is received, the instrument will recall its last stored parameters (or default settings) and continue to use them.

- If DIP Switches = 0000 0001 ==> Use last stored parameters

  With the DIP switches set with this value, the instrument will start up immediately using the last stored parameters.

Startup Example:

```
Lighthouse Remote Instrument (4-20mA):
- reading dip switch:

Sample Time = 60 secs
Range1= 10000.
Range2= 1000.
Alarm Threshold = 750 counts
Suppress Alarms = 2
Service High = 3500 mV
Service Low = 125 mV
```

- DIP Switches = Anything other than (0000 0000 or 0000 0001)

  The DIP switch settings will be read and interpreted. If the combination is valid, those parameters will be chosen. Otherwise, sample time of 300 seconds and 100,000 counts will be used.

COUNT

The instrument uses setup parameters to run, collect data, and output count and alarm data. 0 counts will be represented by 4mA, and counts equal to upper range will equal 20mA. The current output will have a direct linear relationship to the range.

- Iout= 16mA(counts/ range) + 4mA
- Vout= Iout(R-load)
- If a Service Alert occurs, both channels are set to 2mA.

TIMER

Keeps track of time relative to sample seconds, and outputs sample data every SampleSecs.

OUTPUT

- Counts are output on CH1 and CH2 lines in 4-20 mA current.
- If STATUS feature is available and counts become greater than the alarm threshold, after a "suppress" of # of consecutive alarm conditions, STATUS (pin 5) is set to 12mA and the ALARM relay is turned ON.
- If STATUS feature is not available and counts become greater than the alarm threshold, after a "suppress" # of consecutive alarm conditions, the ALARM relay is turned ON.
- If STATUS feature is available and Background Light laser voltage exceeds the ServiceHigh or ServiceLow limit or when the laser optics are dirty, STATUS (pin 5) is set to 20mA.

ALARM

If the CH1 or CH2 count exceeds the programmed ALARM threshold,

- The red SERVICE indicator on the instrument blinks.
- The EXTERNAL ALARM relay, described below, is set.
- If STATUS feature is available, STATUS (pin 5) is set to 12mA.

SERVICE ALERT

If the service/background light voltage is greater than the Service High, or less than Service Low limits, then:

- CH1 and CH2 outputs are set to 2mA.
- The red SERVICE indicator on the instrument is turned on steady.
- If STATUS feature is available and pin 5 = 4 mA ==> No Alarms and No Service Alerts.

EXTERNAL ALARM

An ALARM condition, as described above, also closes a relay inside the instrument. Contacts of that relay are connected to the DATA connector, pins 8 (-) and 9 (+). The user may use an external power supply and a buzzer or light stick to provide local indication of an alarm condition. The contacts are rated at 40VDC, 1A maximum.

6 *Maintenance Procedures*

Introduction

This chapter provides instructions for routine maintenance that may be required for your REMOTE 2012, 3012, 5012, 3102 or 5102 instrument.

The maintenance procedures described in this chapter are not required on regular or prescribed intervals and should be performed only if you have reason to question the data you are receiving from the instrument.

Safety

Before performing any of the maintenance tasks described in this chapter, read Chapter 1 of this manual and become familiar with the warnings and caution labels.

Calibration

To maintain optimum performance of this instrument, it should be re-calibrated annually by a Lighthouse Authorized Service Provider.

Purge Count Test

This section will provide you with the procedure to check the counter for zero counts. A purge filter must be attached to the instrument and six (6) five (5) minute samples must be taken. There should be no more than 1 count on average per five-minute sample.

1. Disconnect power from the instrument.
2. Connect the Purge filter to the sample inlet.
3. Apply power to the instrument.
4. Configure the unit to run one 30-minute sample.
5. Run the 30-minute sample. This time allows the unit to warm up and purge any residual particles that might be inside the instrument.
6. Stop sampling.

7. Program the unit for 5-minute sample time and 10-second hold.

8. Run six 5-minute samples.

9. If an average of more than one count per five-minute period is reported, run another 30-minute sample to purge it and repeat Step 8.

10. If the instrument has met the requirement of the Purge Count test, return the instrument to its normal location and operating status.

Fault Isolation

If the instrument does not pass the Purge Count test, please perform the following procedure:

1. Check the data over the last 6 five-minute sample times.

2. If sporadic counts over all channels are occurring, the unit may still have particles inside it. Allow the unit to sample overnight with the purge filter attached before retesting it. If the counts are still high after the overnight purge, call Lighthouse Technical Support for assistance.

3. If the data shows consistent counts in the smallest channel only, the instrument may have electrical problems. Call your Lighthouse Service Representative for assistance.

A Limited Warranty

Limitation Of Warranties:

A. Lighthouse Worldwide Solutions (LWS) warrants that all equipment shall be free from defects in material and workmanship under normal use for a period of two years from date of shipment to Buyer except that LWS does not warrant that operation of the software will be completely uninterrupted or error free or that all program errors will be corrected. Buyer shall be responsible for determining that the equipment is suitable for Buyer's use and that such use complies with any applicable local, state, or federal law. Provided that Buyer notifies LWS in writing of any claimed defect in the equipment immediately upon discovery and any such equipment is returned to the original shipping point, transportation charges prepaid, within two years from date of shipment to Buyer and upon examination LWS determines to its satisfaction that such equipment is defective in material or workmanship, i.e. contains a defect arising out of the manufacture of the equipment and not a defect caused by other circumstances, including, but not limited to accident, misuse, unforeseeable use, neglect, alteration, improper installation, improper adjustment, improper repair, or improper testing, LWS shall, at its option, repair or replace the equipment, shipment to Buyer prepaid. LWS shall have reasonable time to make such repairs or to replace such equipment. Any repair or replacement of equipment shall not extend the period of warranty. If the Instrument is modified or in any way altered without the explicit written consent of LWS then the warranty is null and void. This warranty is limited to a period of two years, except as noted below, without regard to whether any claimed defects were discoverable or latent on the date of shipment. The length of warranty for pumps in hand held particle counters is one (1) year. Batteries and accessories with all products are warranted for one (1) year. Fuses and purge filters carry no warranty. If a third party battery is used in the product, the product warranty is null and void. If the battery is charged by a third party battery charger the battery warranty is null and void.

B. If Buyer shall fail to pay when due any portion of the purchase price or any other payment required from Buyer to LWS under this contract or otherwise, all warranties and remedies granted under this Section may, at LWS's option, be terminated.

C. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER REPRESENTATIONS, WARRANTIES AND COVENANTS, EXPRESS OR IMPLIED WITH RESPECT TO THE EQUIPMENT AND ANY DEFECTS THEREIN OF ANY NATURE WHATEVER, INCLUDING AND WITHOUT LIMITATION WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. LWS SHALL NOT BE LIABLE FOR, AND BUYER ASSUMES ALL RISK OF, ANY ADVICE OR FAILURE TO PROVIDE ADVICE BY LWS TO BUYER REGARDING THE EQUIPMENT OR BUYERS USE OF THE SAME. UNDER NO CIRCUMSTANCES SHALL LWS BE LIABLE TO BUYER UNDER ANY TORT, NEGLIGENCE, STRICT LIABILITY, OR PRODUCT LIABILITY CLAIM AND BUYER AGREES TO WAIVE SUCH CLAIMS. LWS's SOLE AND EXCLUSIVE LIABILITY AND BUYERS SOLE AND EXCLUSIVE REMEDY, FOR ANY NONCONFORMITY OR DEFECT IN THE PRODUCTS OR ANYTHING DONE IN CONNECTION WITH THIS CONTRACT, IN TORT, (INCLUDING NEGLIGENCE), CONTRACT, OR OTHERWISE, SHALL BE AS SET FORTH IN THE SUBSECTION A HEREOF AS LIMITED BY SUBSECTION B HEREOF. THIS EXCLUSIVE REMEDY SHALL NOT HAVE FAILED OF ITS ESSENTIAL PURPOSE (AS THAT TERM IS USED IN THE UNIFORM COMMERCIAL CODE) PROVIDED THAT THE SELLER REMAINS WILLING TO REPAIR OR REPLACE DEFECTIVE EQUIPMENT (AS DEFINED IN SUBSECTION A) WITH A COMMERCIALLY REASONABLE TIME AFTER RECEIVING SUCH EQUIPMENT. BUYER SPECIFICALLY ACKNOWLEDGES THAT SELLER'S PRICE FOR THE EQUIPMENT IS BASED UPON THE LIMITATIONS OF LWS'S LIABILITY AS SET FORTH IN THIS CONTRACT.

Warranty Of Repairs After Initial Two (2) Year Warranty:

A. Upon expiration of the initial two-year warranty, all parts and repairs completed by an authorized Lighthouse repair technician are subject to a six (6) month warranty.

B. Other than the above, LWS makes no warranty of any kind, expressed or implied, except that the products manufactured and sold by LWS shall be free from defects in materials and workmanship and shall conform to LWS's specifications; Buyer assumes all risk and liability resulting from use of the products whether used singly or in combination with other products. If instrument is modified or in any way altered without the explicit written consent of LWS, then the warranty is null and void.

C. WARRANTY REPAIRS SHALL BE COMPLETED AT THE FACTORY, BY AN AUTHORIZED SERVICE LOCATION, BY AN AUTHORIZED SERVICE TECHNICIAN, OR ON SITE AT BUYER'S FACILITY BY A LIGHTHOUSE AUTHORIZED EMPLOYEE. BUYER PAYS FREIGHT TO FACTORY; SELLER WILL PAY STANDARD RETURN FREIGHT DURING THE WARRANTY PERIOD. BUYER MAY SELECT A FASTER METHOD OF SHIPMENT AT ITS OWN EXPENSE.

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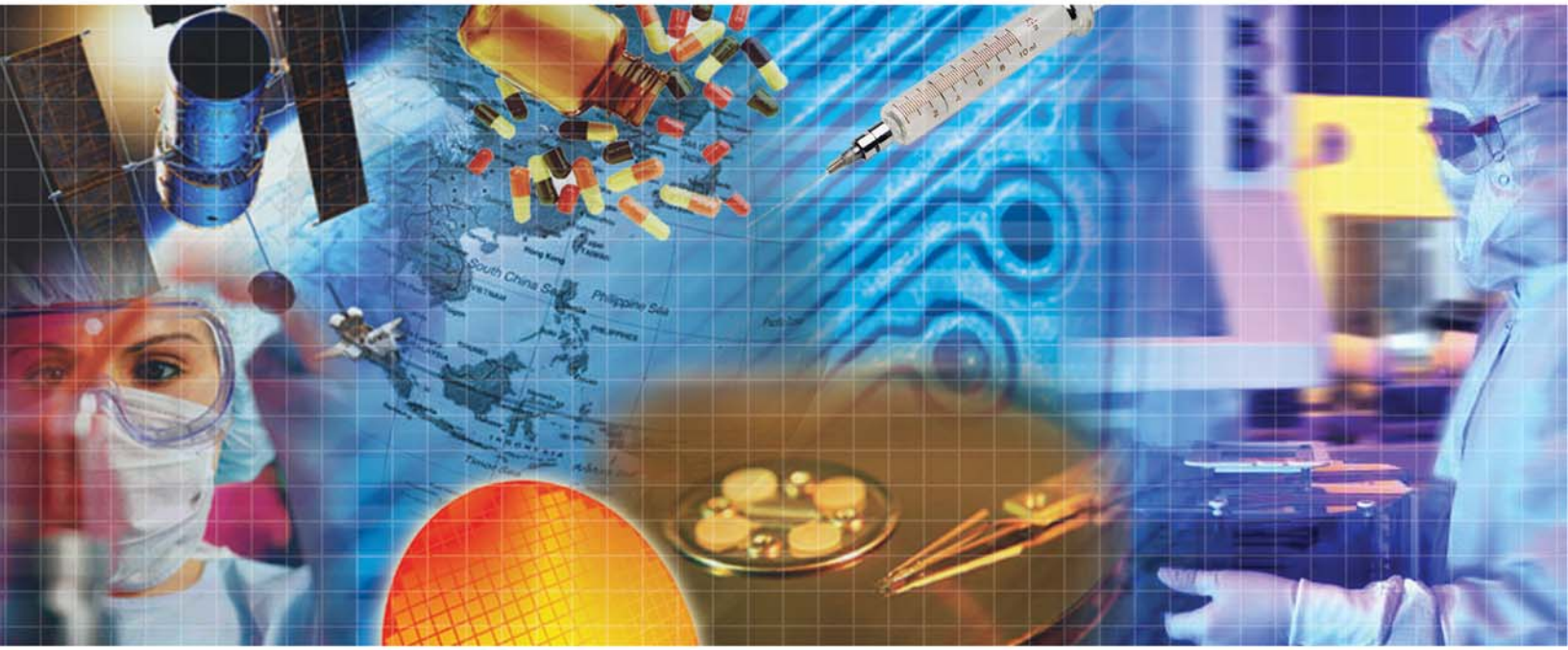

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