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Specifications Subject to Change

Sampling Pump

SP 402

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1001 Oakdale Road, Oakdale, PA 15071-1500
(412) 788-4353 Toll Free 1-800-DETECTS
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INDUSTRIAL SCIENTIFIC

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Instruction Manual

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SP402

Sampling Pump

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1. INTRODUCTION

The SP402 Sampling Pump can be used in conjunction with Industrial Scientific's TMX410, TMX412 and LTX310 Multi-Gas Monitors or the LD322 Combustible Gas Monitor for remote sampling prior to entering an area where an atmospheric determination is required. The SP402 is also useful for testing otherwise inaccessible areas.

The SP402 Sampling Pump incorporates both an audible and visual alarm to warn the operator when the flow to the instrument drops below 1.0 Standard Cubic Foot Per Hour flow rate (1.0 Standard Cubic Foot Per Hour equals approximately .5 Liters per Minute). This Sampling Pump also offers a low battery warning indicator and a low battery failure circuit for whenever the battery does not have enough power left to operate the pump effectively. The SP402 is powered by a rechargeable nickel-cadmium battery pack that provides a minimum of 10 hours of continuous operation at 25°C with 10 feet of 1/8 inch I.D. sampling tubing. The battery pack is interchangeable with the battery packs of the TMX410, TMX412, LTX310 and LD322 instruments. Battery chargers are available to recharge the SP402's batteries. The battery pack can be charged either in or out of the Sampling Pump. An optional replaceable lithium battery pack is also available.

An easily replaced nylon filter (Industrial Scientific part number 1702-4597) is used on this Sampling Pump to protect internal pump parts.

2. WARNINGS AND CAUTIONARY STATEMENTS

Failure to observe certain procedures or conditions may impair the performance of the instrument. For maximum safety and performance while using the instrument, please read and understand the procedures and conditions outlined below.

⚠ Substitution of components may impair intrinsic safety of this design.

⚠ Battery charging and/or replacement should only be performed in a known non-hazardous location.

⚠ Before using the SP402, test the unit to ensure that it is operating properly. Failure of internal components may cause inaccurate instrument readings due to the inability of the pump to draw a proper gas sample. Return the SP402 to either Industrial Scientific or an authorized distributor for repair if a problem should occur. Refer to Testing the Pump (Section 4.1) for more information.

⚠ Do not use Tygon tubing when sampling for Chlorine (Cl_2), Nitrogen Dioxide (NO_2), Nitric Oxide (NO), Ammonia (NH_3), Hydrogen Cyanide (HCN), or aromatic Hydrocarbons (eg; Toluene, Styrene) because the inside surface of the tubing may absorb the gas being measured, providing an inaccurate instrument reading. Teflon sampling tubing is recommended in these applications. Refer to Accessories (Section 7) for Teflon sampling tubing accessories. If you are in doubt about the gas being sampled, contact Industrial Scientific.

⚠ Only use the SP402/LD322, SP402/LTX310. SP402/TMX410 or SP402/SP402 pump/instrument combination in Class I hazardous locations.

3. UNPACKING THE INSTRUMENT

The shipping carton should contain the following items. Account for each item before discarding the carton.

QUANTITY	PART NUMBER	DESCRIPTION
1	1810-2156	SP402 Sampling Pump UL
or 1	1810-2169	SP402 Sampling Pump CSA
1	1704-2946	Screwdriver
1	1700-7592	1/8" I.D. Tygon Tubing, 10 ft.
1	1702-7152	Dust Filter/Water Stop

After unpacking, if any listed item is missing, contact either your local distributor of Industrial Scientific products, or call Industrial Scientific Corporation at 1-800-DETECTS (338-3287) in the United States and Canada, or 412-788-4353.

4. SP402 Operation

Before proceeding to use the SP402, fully charge the battery pack.

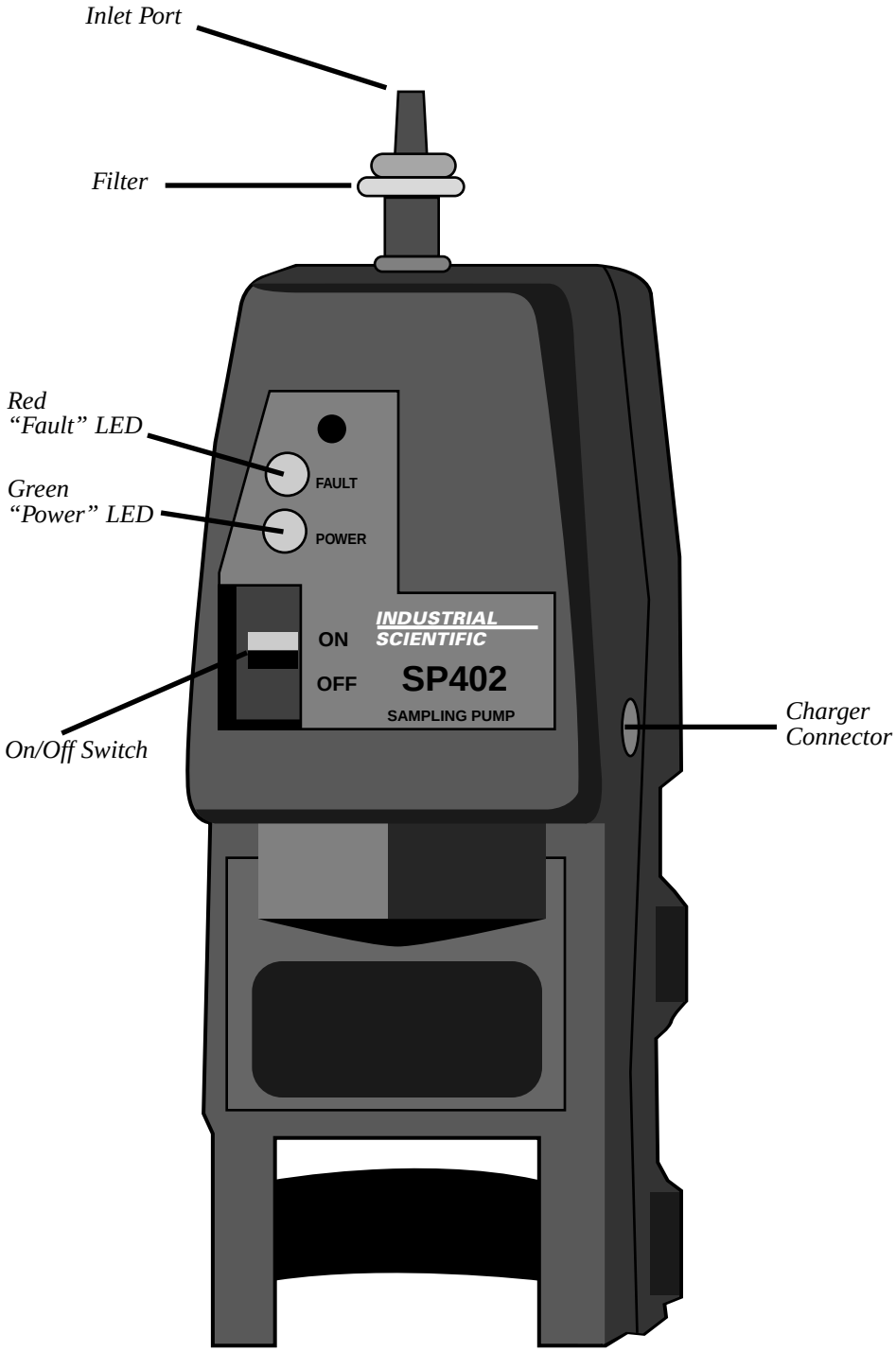
NOTE: *The power switch must be in the off position to charge the battery.*

WARNING: ***Before using the SP402, test the unit to ensure that it is operating properly. Failure of internal components may cause inaccurate instrument readings due to the inability of the pump to draw a proper gas sample. Return the SP402 to either Industrial Scientific or an authorized distributor for repair if a problem should occur. Refer to the following section for information on testing the pump.***

4.1 Testing The Pump

To test the pump for proper operation:

- Attach the desired length of sampling tubing or sampling probe. Turn the Sampling Pump on. The green power LED will light and the pump motor will begin to run. The red fault LED and the audible alarm will turn on briefly and then turn off. If the pump does not turn on, or if the red fault LED only turns on, or if the red fault LED and audible alarm do not turn off after 5 seconds, the battery may need to be charged/changed or the filter may be obstructed and may require replacement. If the pump still does not function properly, the pump must be repaired before use.
- Block the inlet port of the SP402 by placing a finger over the inlet of the external filter. The red fault LED and the audible alarm will turn on. Immediately remove the obstruction from the inlet of the pump and verify that the red fault LED and the audible alarm shut off.
- Block the outlet port of the SP402 by placing a finger over the outlet in the sensor plenum. The red fault LED and the audible alarm will turn on. Remove the obstruction from the outlet of the pump and verify that the red fault LED and the audible alarm shut off.



NOTE: *Performing this test could cause the pump to go into Low Battery Fault. This is caused by temporarily drawing the battery voltage down below the minimum operating voltage due to the increased current draw of stalling the pump motor. If this occurs, turn the Sampling Pump off, then back on. For more information regarding the Low Battery Indicator and Low Battery Fault function, refer to Battery Charging.*

- If the pump fails any of these tests or fails to recover from alarm as a result of these tests, the pump must be repaired before use.

4.2 Operating the Pump

To use the pump:

- Insert the instrument into the SP402 first by placing the pump face down (the switch and status indicator area down). Disengage both hook and loop straps and loosen them enough to allow the instrument to fit into the instrument cavity freely. Insert the instrument into the cavity of the SP402, sensor end first, with the instrument sensors facing downward. Lower the instrument onto the sensor seal. Verify that the instrument is fully inserted into the instrument cavity and that it is seated on the senor seal. Secure the instrument in place by firmly pressing the straps nearest the center of the pump, then bring the end of the strap up and back onto itself. The other strap is then secured in the same manner. The straps do not require much tension to hold the instrument firmly in place.
- Attach the sampling tubing or the sampling probe to the fitting at the top of the SP402. If your are using the Extendible Sampling Probe (Industrial Scientific part number 1810-1386), the external filter and the black thread protector must first be remove from the fitting. Turn on the SP402. Allow 5 seconds for the Low Flow Alarm to reset. After the Low Flow Alarm resets, the pump motor should be running, and the green power LED should be lit. When taking a reading, allow 2 seconds per foot of hose length for the sampling line to be purged before reading the concentration. (Maximum sampling length for 1/8 inch I.D. sampling tubing is 100 feet).

WARNING: ***Do not use Tygon tubing when sampling for Chlorine (Cl_2), Nitrogen Dioxide (NO2), Nitric Oxide (NO), Ammonia (NH3), Hydrogen Cyanide (HCN), or aromatic Hydrocarbons (eg: Toluene, Styrene) because the inside surface of the tubing may absorb the gas being measured, providing an inaccurate instrument reading. Teflon tubing is recommended in these applications, refer to Accessories for Teflon sampling tubing accessories. If you are in doubt about the gas being sampled, contact Industrial Scientific.***

- If the pump motor runs slow or stalls and the Low Flow Alarm sounds during use, there may be a blockage in the sample draw line or sampling probe, or the external filter(s) may be clogged and in need of replacement. If there is a blockage in the sampling line or probe, withdraw the sampling device, clear the blockage and/or replace the filter(s) as necessary. Test the pump as described in Testing the Pump (Section 3.1) before resuming operation. See Testing the External Filter (Section 5.4) for the proper method to test the external filter.

4.3 Operating Precautions

- The external dust filter will not stop mists, vapors, or steam.
- The SP402 will lift a vertical column of water in excess of 10 feet before the motor will stall. The pump will draw liquid over a much longer distance if the tubing is not vertical. If liquid is drawn into the pump, internal pump parts may be damaged. Take precautions to prevent this. Refer to Using the Water Stop (Section 4.4).
- Do not operate the SP402 without the external dust filter (Industrial Scientific part number 1702-4597). Pump damage may result, and the warranty will be voided. Refer to Accessories (Section 7) for additional filters.
- The screw-in external dust filter on the SP402 is designed to stop very small particles from damaging internal pump parts. In very dusty atmospheres, this filter may clog quickly. Use an additional in-line pre-filter (Industrial Scientific part number 1705-0908) to prevent most of the particles from reaching the screw-in external filter. Refer to Accessories (Section 7) for information on additional filters.

4.4 Using the Water Stop

- A Water Stop is included with each pump. If the pump will be used in areas where liquid can be drawn into the sampling tubing, the water stop should be inserted into the end of the tubing (tapered end into the hose) prior to sampling. This will prevent liquid from being drawn into the pump.
- If the water stop should become filled with liquid, it will restrict the the flow of gas and the pump will slow and/or stall, triggering the Low Flow Alarm. If this occurs, withdraw the tubing, turn off the sampling pump, disconnect the water stop from the tubing and tap or shake the water stop to remove the liquid. Reconnect the water stop to the tubing and test the unit as described in Testing the Pump (Section 4.1) before resuming operation.
- If the pump will not operate after attempting to remove the liquid from the water stop, remove it from the tubing. If the pump resumes normal operation (Non-alarm condition), the water stop is clogged and requires replacement.
- The water stop may be used as an auxiliary filter in very dusty atmospheres.

5. Maintenance

5.1 Regular Maintenance

The SP402 requires no regular maintenance except for recharging the battery, periodic replacement of filters and periodic inspection of the sensor seal contained within the sensor plenum.

The sensor seal should be kept free of dirt and debris that may prevent a proper seal around the instrument's sensor area. The exhaust port in the seal should also be kept open to prevent overpressurization of the sensors, which could cause erroneously higher readings on the instrument.

The faceplate of the SP402 is protected by a transparent film that may be peeled off if desired.

5.2 Battery Charging

The following chargers are available for charging the battery of the SP402:

1810-2251	Single unit compact charger
1810-1873	Single unit dual rate charger
1810-2558	Two unit dual rate charger
1810-2255	Four unit dual rate charger

The single unit compact charger (Industrial Scientific part number 1810-2251) provides a 10 hour recharge time. The dual rate chargers, (Industrial Scientific part numbers 1810-1873, 1810-2558, and 1810-2255) provide a 4.5 hour recharge time. The dual rate chargers are available in 12 and 230 volt supply configurations. Please contact Industrial Scientific or your local distributor of Industrial Scientific products for part number information.

These three chargers also provide a complete discharge feature that eliminates the memory condition that may result from repetitive use patterns. There is no danger of overcharging the battery when using any of the chargers listed above.

When charging the battery pack while it is in the pump, turn the pump power switch to the off position and place the pump on the battery charger. To charge the battery pack out the pump, remove the battery pack from the pump and place the battery pack onto the charger. Refer to Battery Replacement (Section 5.3) for information on removal of the battery.

When fully charged, the battery pack will power the SP402 for a minimum of 10 hours at 25°C with 10 feet 1/8 inch I.D. sample tubing. Near the end of the battery's charge, the low battery indicator circuit will warn the user that approximately 10 minutes of charge is left by sounding a short (1 second) tone each minute. At this point turn the SP402 off and recharge or replace the battery pack. Once the low battery indicator is activated, continued operation of the pump without recharging the battery pack is prevented by a low battery failure circuit. This circuit will turn off both the green power LED and the pump motor and illuminate the red fault LED. The audible indicator will not sound. This circuit prevents further operation of the pump when the battery does not have enough power left to run the pump effectively. Additional battery packs can be rotated into the SP402 to allow around the clock continuous monitoring.

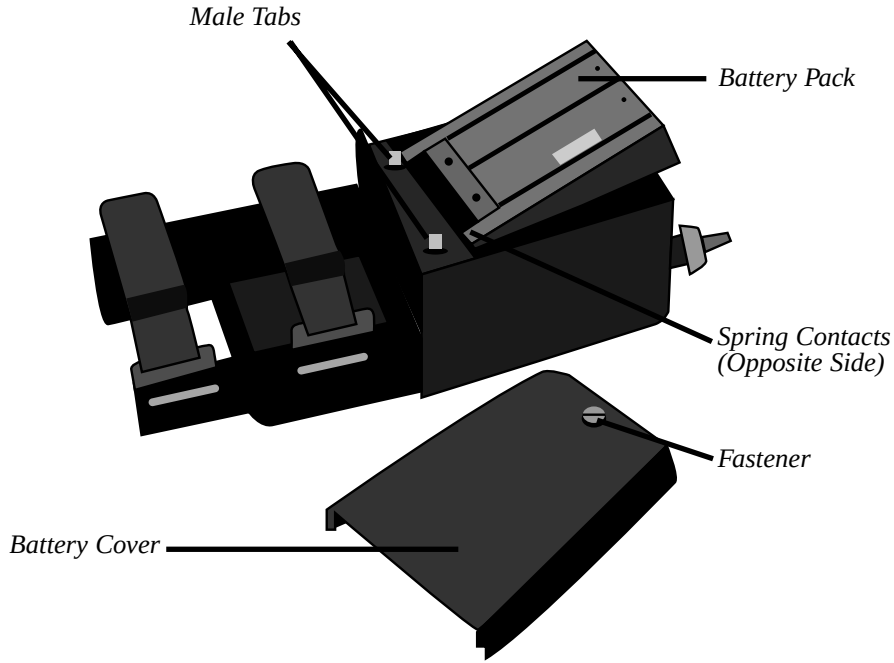
NOTE: *Operating the pump with clogged filters or excessive lengths of sampling tubing will cause increased loading of the pump and reduced run time. This excessive loading could cause the pump to go into low battery fault prematurely. This is caused by temporarily drawing the battery voltage down below the minimum operating voltage due to the current draw of the pump assembly. If this happens, turn off the pump, remove the cause of the load and restart the pump. If the pump restarts and then returns to low battery fault, the battery does not have enough charge left to operate the pump effectively with the load. Turn the SP402 off and refer to Battery Charging (Section 5.2) or Battery Replacement (Section 5.23) for information regarding the battery.*

5.3 Battery Replacement

To replace the battery pack, disengage the fastener mounted to the battery cover by turning it counterclockwise. Lift off the battery cover and pull the battery pack out of the battery compartment. Install a new battery with the male tabs protruding from the battery compartment of the pump. Push the battery pack fully into place. Insert the two plastic tabs of the battery cover into the two slots on the pump and close the cover over the battery compartment. Secure by turning the fastener clockwise.

NOTE: *When changing the lithium battery cells, replace the cells within the replaceable lithium battery pack in a non-hazardous location. Replace the lithium cells with three Duracell DL123A or three Panasonic CR123A or three Sanyo CR123A 3.0 volt lithium battery cells only. Use of another battery may present a risk of fire or explosion.*

WARNING: ***Battery cells may explode if mistreated. Do not recharge, disassemble or dispose of in fire. Also, do not charge the replaceable lithium battery pack while it is either installed or not installed within an instrument. The 1704-9889 replaceable lithium battery is not approved for use in applications or areas requiring MSHA approval.***



5.4 Testing the External Filter

If the filter is extremely dirty and lowers the gas sample flow through the pump below 1.0 SCFH (.5 LPM), the low flow alarm Indicator will indicate that a blockage has occurred and that the filter should be replaced. For maximum performance, the sampling pump should be operated with a clean filter. This assures the maximum run time from the battery and the maximum flow of a gas sample to the instrument. Also, the additional load that a clogged filter would represent could reduce the life of the pump assembly.

To test the filter for proper operation:

- Switch on the pump.
- Verify that the Low Flow Alarm turns off after 5 seconds.
- Listen to the pump speed.
- Unscrew and remove the filter.
- If the pump speed increases noticeably, replace the filter.

5.5 Alternate Filter Test Method

A visual inspection of the filter can be used to provide a quick check of the condition of the filter. To visually check the filter:

- Unscrew and remove the filter.
- Take the old filter and hold it up to a light source.
- Look through the inlet of the old filter and examine the condition of the filter element. A clean filter will not have any dirt or particulate in it. A filter that has a large amount of dirt and particulate trapped in its filter element should be discarded and replaced.

6. Specifications

Dimensions: 234 x 88 x 75mm (9.20 x 3.45 x 2.95 inches)

Weight: 510 grams (18 oz.) (with battery pack)

Pumping Capability: Minimum of one standard cubic foot per hour (1 SCFH = one half liter per minute (LPM) through 100' of .125" I.D. hose.)

Power Source: Rechargeable, replaceable nickel-cadmium battery pack, or replaceable cell lithium battery pack

Battery Life: Minimum of 10 hours continuous operation with battery pack (P/N 1704-1872) at 25°C with 10 ft. Tygon Tubing.

Battery Voltage: 7.2 volts (nominal)

7. Accessories

Part Number	Description (Qty)
1702-4597	External Nylon Filter, 1 each
1702-4191	Nylon filter, package of 5
1705-0908	In-line Pre-filter
1810-1428	Polycarbonate Probe
1810-1386	Extendible Sampling Probe (6 ft.)
1810-2111	Folding Probe, 4.5 Ft.
1810-2246	3 Ft. Extendible Probe (Teflon)
1700-7592	Tygon Sampling Hose
1705-0605	Teflon-lined Tygon Tubing, By the Foot
1702-7152	Dust Filter/Water Stop
1704-6590	Teflon-lined Tygon Tubing, 10 Ft. w/Fitting
1704-6608	Teflon-lined Tygon Tubing, 20 Ft. w/Fitting
1704-7077	Teflon-lined Tygon Tubing, 50 Ft. w/Fitting
1810-2161	Leather Case
1810-2177	Leather Handle (for Leather Case, 1810-2161)
1704-9889	Replaceable Lithium Battery Pack (includes 3 Lithium Batteries)
1704-7747	Replaceable Lithium Battery
1706-7174	9 V Alkaline Battery Pack
1703-3648	9 V Alkaline Battery

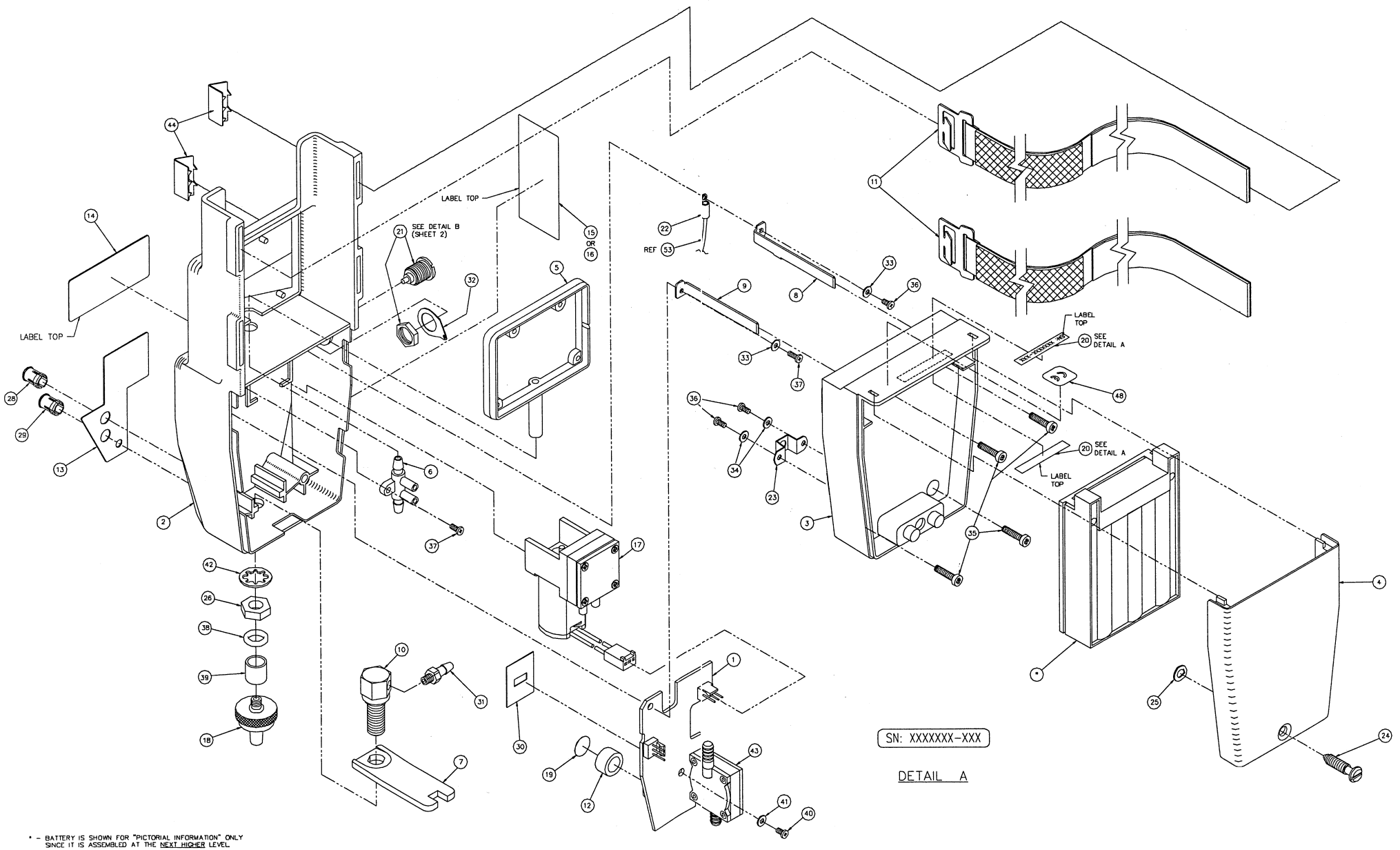
8. Replacement Parts

The following items numbers refer to the exploded view drawing on pages 16 and 17.

Item	Part Number	Description (Qty)
1	1705-0331	Printed Circuit Board - Low Flow
2	1704-9793	Housing, Top Half
3	1704-9796	Housing, Bottom Half
4	1704-9798	Battery Cover
5	1704-9799	Sensor Cavity Gasket
6	1704-9800	Pump Manifold
7	1704-9811	Housing Support
8	1704-9821	Male Contact (+)
9	1704-9822	Male Contact (-)
10	1704-9823	Bulkhead Fitting
11	1704-9874	Strap with Clip
12	1704-9878	Buzzer Seal
13	1704-9935	SP402 Faceplate
16	1704-1872	Battery Pack
17	1705-0447	Pump Motor Unit Assy. - CSA
or	1705-0383	Pump Motor Unit Assy. - UL
18	1702-4597	Filter
19	1705-0245	Buzzer Water Barrier
20	NA	Serial No. Label
20	NA	Serial No. Label
21	1704-2151	Charging Jack
22	1704-2367	Crimp Ring Terminal
23	1704-3753	Fastener Receptacle
24	1704-3761	Fastener Stud
25	1704-3779	Fastener Retainer
26	1704-9942	M8 Nut
28	1704-9947	Green LED Lens
29	1704-4793	Red LED Lens
30	1705-0452	Switch Seal
31	1702-6154	1/8" Fitting Nylon
32	1701-1990	Solder Lug
33	1700-5943	#2 Locking Washer
34	1703-4174	#2 Flat Washer
35	1703-5080	4-40 x .50" Screw
36	1703-4034	2-56 x .18" Screw
37	1703-0883	2-56 x .25" Screw
38	1702-2211	O-Ring
39	1704-4009	Thread Cover
40	1703-3689	4-40 x. 25" Screw
41	1700-4300	#4 Locking Washer
42	1701-2600	.312" Locking Washer (5/16")
43	1704-9944	Pressure Switch
44	1707-7017	End Clip
57	1705-0407	Pre-formed Tube, 1.93" Assy.
58	1705-0408	Pre-formed Tube, 3.08" Assy.
59	1705-0379	Pre-formed Tube, 3.25" Assy.
60	1705-0405	Pre-formed Tube, 5.13" Assy.

The following items can be purchased as an assembly:

Item	Part Number	Description (Qty)
43,59, 60	1705-0378	Pressure Switch w/Tubing & Filters


LABEL TOP
SEE DETAIL B (SHEET 2)
LABEL TOP
OR
REF
LABEL TOP
SEE DETAIL A
SEE DETAIL A
LABEL TOP
SN: XXXXXXX-XXX
DETAIL A
* - BATTERY IS SHOWN FOR "PICTORIAL INFORMATION" ONLY SINCE IT IS ASSEMBLED AT THE NEXT HIGHER LEVEL

9. WARRANTY

Industrial Scientific portable gas monitoring instruments are warranted to be free from defects in material and workmanship for as long as the instrument is in service.

The above warranty does not include sensors, battery packs, internal pumps or filters, all of which are warranted to be free from defects in material and workmanship for eighteen months from the date of shipment, or one year from the date of first use, whichever occurs first, except where otherwise stated in writing in Industrial Scientific literature accompanying the product.

All other Industrial Scientific products are warranted to be free from defects in material and workmanship for a period of eighteen (18) months from the date of shipment, or one (1) year from the date of first use, whichever occurs first, except where otherwise stated in writing in Industrial Scientific literature accompanying the product.

LIMITATION OF LIABILITY

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SHOULD THE PRODUCT FAIL TO CONFORM TO THE ABOVE WARRANTY, BUYER'S ONLY REMEDY AND INDUSTRIAL SCIENTIFIC'S ONLY OBLIGATION SHALL BE, AT INDUSTRIAL SCIENTIFIC'S SOLE OPTION, REPLACEMENT OR REPAIR OF SUCH NON-CONFORMING GOODS OR REFUND OF THE ORIGINAL PURCHASE PRICE OF THE NON-CONFORMING GOODS. IN NO EVENT WILL INDUSTRIAL SCIENTIFIC BE LIABLE FOR ANY OTHER SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOSS OF PROFIT OR LOSS OF USE, ARISING OUT OF THE SALE, MANUFACTURE OR USE OF ANY PRODUCTS SOLD HEREUNDER WHETHER SUCH CLAIM IS PLEADED IN CONTRACT OR IN TORT, INCLUDING STRICT LIABILITY IN TORT.

It shall be an express condition to Industrial Scientific's warranty that all products be carefully inspected for damage by Buyer upon receipt, be properly calibrated for Buyer's particular use, and be used, repaired, and maintained in strict accordance with the instructions set forth in Industrial Scientific's product literature. Repair or maintenance by non-qualified personnel will invalidate the warranty, as will the use of non-approved consumables or spare parts. As with any other sophisticated product, it is essential and a condition of Industrial Scientific's warranty that all personnel using the products be fully acquainted with their use, capabilities and limitations as set forth in the applicable product literature.

Buyer acknowledges that it alone has determined the intended purpose and suitability of the goods purchased. It is expressly agreed by the parties that any technical or other advice given by Industrial Scientific with respect to the use of the goods or services is given without charge and at Buyer's risk; therefore, Industrial Scientific assumes no obligations or liability for the advice given or results obtained.