DOD Technologies, Inc.
Innovative Life Safety Systems & Services

ChemLogic® 1 & 2

Technical Service Manual

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Contents

IMPORTANT:

DOD Technologies, INC. reserves the right to make changes to the CL1 & CL2 due to our commitment for continuous improvement.

DOD Technologies, INC. shall not be liable for any damages, losses, costs or expenses, direct, indirect or incidental, consequential or special, arising out of, or related to the use of this material or the products described herein.

These instructions do not purport to cover all details or variations of the equipment and do not claim to provide for every possible contingency met in connection with installation, operation, or maintenance. Should further information be desired, or should particular problems arise which are not covered sufficiently for the operator's purpose, contact DOD Technologies, INC. for assistance.
Failure to follow instructions could lead to damage, serious injury, or death.

Before performing any work on the CL1 or CL2 monitor ensure proper safety precautions have been taken so no unnecessary disruption or harm occurs.

CAUTION:

	**Electrical Hazard.** The CL1 should only be serviced by trained personnel. Contact DOD Technologies for information on Training, Preventative Maintenance Programs, and application assistance.

IMPORTANT:

Read Appendix E before handling ChemLogic® Cassettes.

Chapter 1 – Introduction

WARNING:
Operation of the ChemLogic® 1 & 2 continuous gas detection system without a manual in the native language in its country of operation is illegal. A translated copy of the manual should be requested immediately from DOD Technologies and before installation of the device. Failure to do so may result in severe injury.

Contact:
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The ChemLogic® 1 & 2 continuous gas detection systems should be used exclusively for the quick detection of toxic, corrosive, and asphyxiant gases for process measurement and personnel safety purposes. Failure to comply with the intended purpose of the device may result in injury or death.

This manual has been construction to provide basic technical troubleshooting assistance on several components of the CL1 and 2.

The DOD Technologies ChemLogic® 1 & 2 continuously monitors a single or double location (called a point) for toxic and corrosive gas. It responds to gas that exceeds a programmed alarm level by:

- Triggering visual alarms on the display that warn of high or low concentrations
- Triggering relays or activating analog outputs to external devices
- Displaying the gas type and gas concentration
- Recording the alarm information and storing it to removable storage.

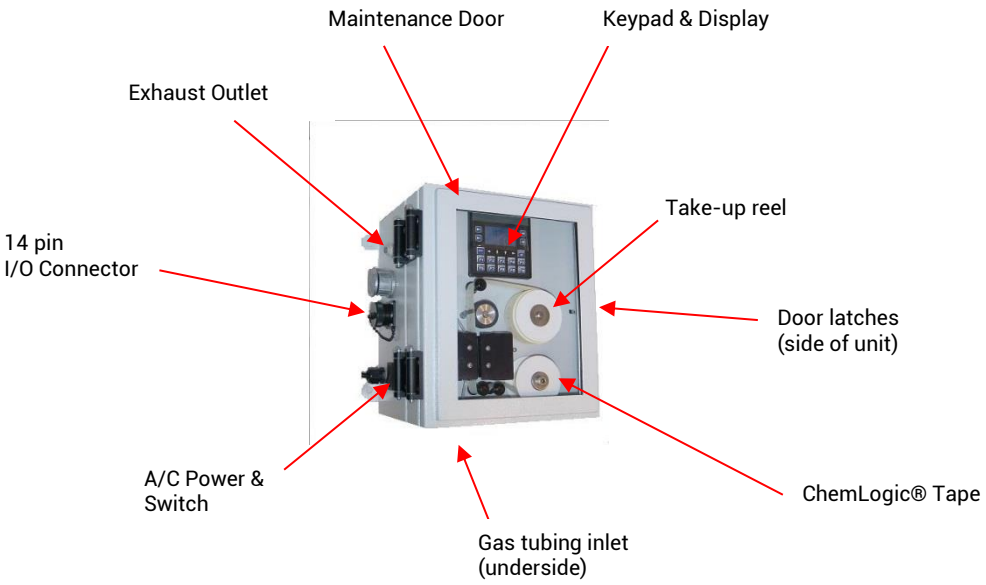
The CL1/CL2 triggers relays for two levels of gas concentrations. These programmable limits are factory-set at 1 TLV and 2 TLV for their respective gases.

The point may be up to 150 feet (45 m) from the CL1/CL2 location depending on the type of gas being monitored. This allows operators to monitor the gas concentration in an area removed from the location where gas may be leaking.

The CL1/CL2 provides a fast response to a wide range of gases. It was designed for maximum uptime, so routine maintenance and service can be performed quickly and easily.

The CL1/CL2 uses DOD Technologies ChemLogic® paper tape technology for fast and accurate gas detection.

Chapter 2 – System Overview



The system draws sample flow through the inlet on the bottom of the unit and across the ChemLogic tape then exhausted out on the left side of the CL1. Flow connections consist of "quick-connect" ports (2); one on the bottom (Inlet) and another on the left side for exhaust.

The unit is powered either with a standard AC Power cord or can be configured for hardwire connection. A single 14 pin connector on the left side of the CL1 provides electrical connections for the all the outputs and a remote reset input.

The sample flow is diverted across the ChemLogic Tape. The ChemLogic 1 (CL1) uses an advanced optical detection system to measure the light level reflected from the ChemLogic tape

As the target gas is detected, the color of the of the ChemLogic tape changes. This color change results in a loss of reflected light across the ChemLogic tape. This loss of reflected light is detected by the advanced optics system in the ChemLogic 1.

The ChemLogic 1 will then report an appropriate gas concentration reading and/or a gas alarm.
There are three major components that need to be working properly for the unit to detect toxic gas correctly.

These three major components are:

- Tape Advance System
- Optic System
- Flow System

We will learn how these systems work, how to check if the systems are working correctly and how to fix issues that may cause the system to fault. Refer to Section 7.0 for a full reference of faults and messages that can be found during operation of the CL1 gas detection system.

Chapter 3 – Tape Advance

The tape advance system has five components that must be operating correctly for the system to function properly. The components are listed below:

1. ChemLogic® Cassette
2. Gate Motor assembly
3. Tape advance assembly
4. Micro switch
5. HMI

First, the ChemLogic® Cassette is gas specific and must be purchased for the correct gas that the CL1 is to monitor for. It must also be within the expiration date as labeled on the cassette (and the box), and the tape must be installed correctly. If the tape is installed correctly the system will automatically advance during analysis or can be manually advanced via the HMI menu.

The following table describes a tape advance step by step:

The HMI verifies that the input from the micro switch is high (+12Vdc)	
The HMI then outputs a +12Vdc signal at Q12 port, and this turns the Gate motor on, and the gate begins to open.	
set screw that rest against the micro switch will begin to rotate and come off the switch which opens the micro switch contacts at which point the HMI sees the input go low (0Vdc).	
As the motor turns the capstan begins a 360-degree rotation and pulls the tape forward approximately 0.30 inches (7.6mm).	
Next, the HMI is now waiting for the input signal to go high again (+12Vdc) signaling the end of the tape advance. This occurs when the screw rotates all the way around and contacts the switch again (closing the contacts) and this must occur within a defined time period (or else a fault will be issued).	

Once the set screw successfully rotates around and closes the switch, the HMI turns off the motor output (+12Vdc) at Q12.
If any of these actions do not occur (within a specific time duration) the CL1 will issue a Gate Fault. Gate Faults include: • "Gate Open" fault • "Gate Close" fault.

NOTE:

A "Gate open" fault will occur when the HMI turns the motor on but the signal from the micro switch never changes from high to low.

A "Gate closed" fault will occur if the HMI sees the input change from high to low when the micro switch opens but then never sees the input change back from low to high to signal the end of the tape advance (and thus stop the gate motor).

More details on how to resolve gate faults can be found in the Fault Chart (Section 7.0) for these two conditions.

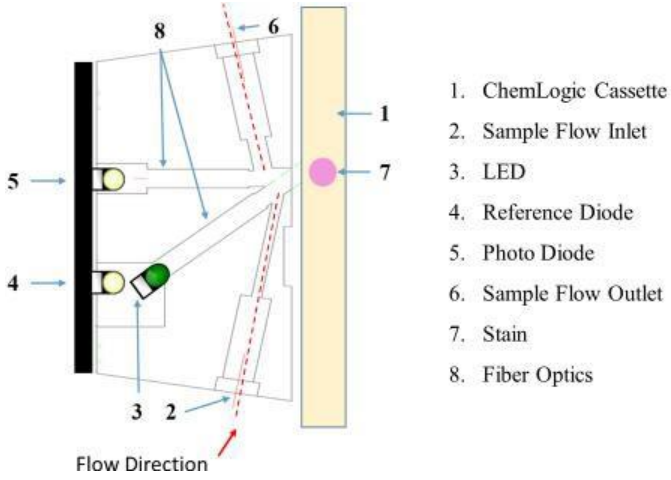
Chapter 4 – Optics System

The CL1's advancement provides a reference diode which is continually monitoring the optics for proper intensity.

If the optics needs adjustment the CL1 will automatically adjust the optics to ensure it is within the required range. If the system is unable to adjust the optics within the required range, the system will issue a fault.

The second major system in the CL1 is the optic system.

This system is very important because it analyzes the ChemLogic cassette during analysis and reacts appropriately to gas stains that develop



The optic system uses these 3 main components to monitor the ChemLogic cassette:

1. **LED** - provides a source of light.
2. **Photodiode** - monitors the light intensity.
3. **Fiber Optic Channel** - provides a path for the light to travel

The CL1 has a diagnostic screen that can be accessed by pressing F6 while the unit is in analysis.
The diagnostic screen can be used to verify the optic system is working correctly.
An image of this screen can be seen below (labeled Figure 1).

Please refer to this image for the following discussion about optic system diagnostic values.

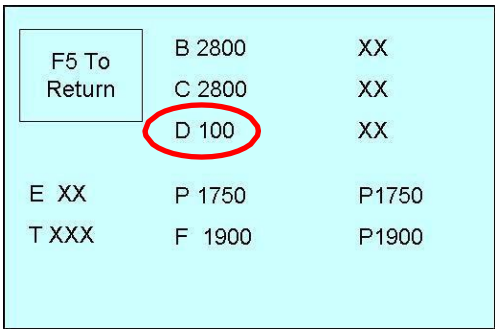


Figure 1

As previously stated, the LED provides a light source for the optic system and the intensity of the light is referred to as the DAC. This DAC value can be see following the capital letter D on the diagnostic screen (Figure 1).

A "clean" CL1 will have a DAC value between 70 and 120. The DAC value is directly associated with the transparency of the fiber optic lens. As the optic channel becomes dirty the DAC will automatically increase accordingly (via software auto calibrating the optics for proper LED intensity) until the DAC reaches the predefined upper limits. (See below for details)

4.1 Optic Faults

The CL1 has two predefined DAC limits that tell the system when to warn the user that the optic system is becoming too dirty to operate.

Fault #47 - Warning: Optics Dirty

The first limit, called the "Warning: Optics Dirty" occurs when the DAC reaches a value of 140.
At this point the CL1 will display a "Warning: Optics Dirty" message on the HMI screen.

NOTE: this is an "informational fault", it does not trigger the Fault Relay to "report" this warning has occurred.

This Fault message is however transmitted out on the two communications options available for the CL1 (i.e. Modbus/TCP and Ethernet)

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Fault #2 - DAC Calibration Required:

When the DAC reaches the second (or upper) predefined limit of 150 the CL1 will do the following:

- Stop analysis
- Trigger the Fault relay
- Display "DAC Calibration Required" on the HMI screen.

At this point the CL1 will not enter analysis until the optic system is cleaned and the DAC is brought down to under 150.

Please see the Optic Cleaning procedure in Appendix A for details on how to properly and thoroughly clean the CL1 optics and reduce the DAC value to an acceptable operating level (between 70 and 120).

NOTE: Filters are available to help reduce the amount of dirt/dust and particulate matter from entering the CL1 and causing frequent or premature dirty optics faults.

Filters are application specific and though they will add to routine maintenance (having to periodically change these filters) it should be less downtime versus having to clean the optics frequently on the CL1

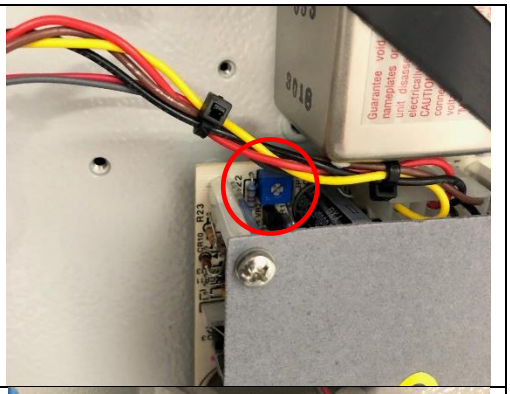
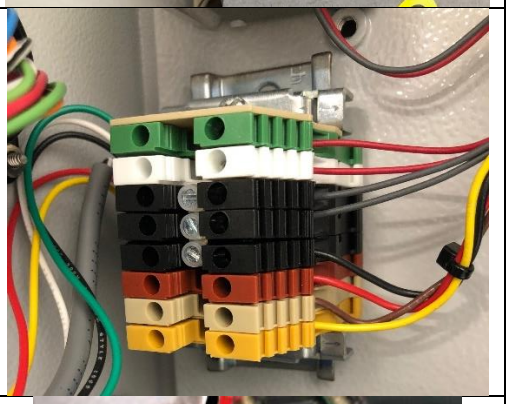
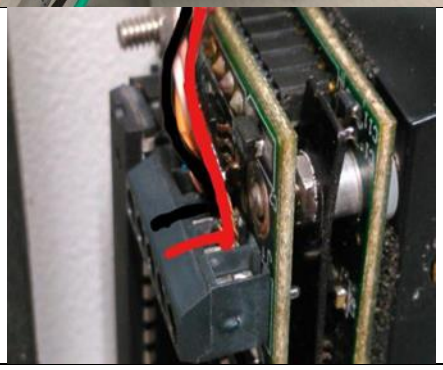
Gas	Description	Suggested Replacement	DOD Filter Part#
AsH_3	Arsine	6 Months	780248
B_2H_6	Diborane	6 Months	780248
GeH_4	Germane	6 Months	780248
H_2Se	Hydrogen Selenide	6 Months	780248
PH_3	Phosphine	6 Months	780248
SiH_4	Silane	6 Months	780248
TBA	Tertiary-Butyl-Arsine	6 Months	780248
H_2S	Hydrogen Sulfide	6 Months	780248
HCL	Hydrogen Chloride	1 Month (Membrane)	60009 (Housing) 60010 (Membrane)
HF	Hydrogen Fluoride	1 Month (Membrane)	60009 (Housing) 60010 (Membrane)
BF_3	Boron Trifluoride	1 Month (Membrane)	60009 (Housing) 60010 (Membrane)
HBR	Hydrogen Bromide	1 Month (Membrane)	60009 (Housing) 60010 (Membrane)
$COCL_2$	Phosgene	6 Months	780248
WARNING: Diisocyanate gases cannot use these filters. A special dust cone filter is available. Contact DOD Service for assistance.		PN: 780248 	PN: 60009 

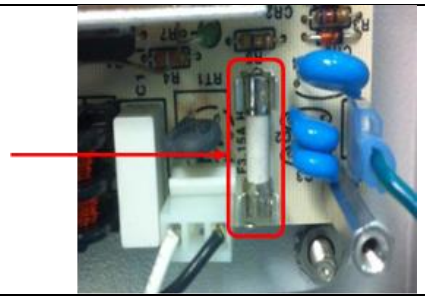
Fault #8 – Optic Comm Failure:

The Optic Comm fault indicates the CL1 HMI has requested information from the optic system and did not receive a response.

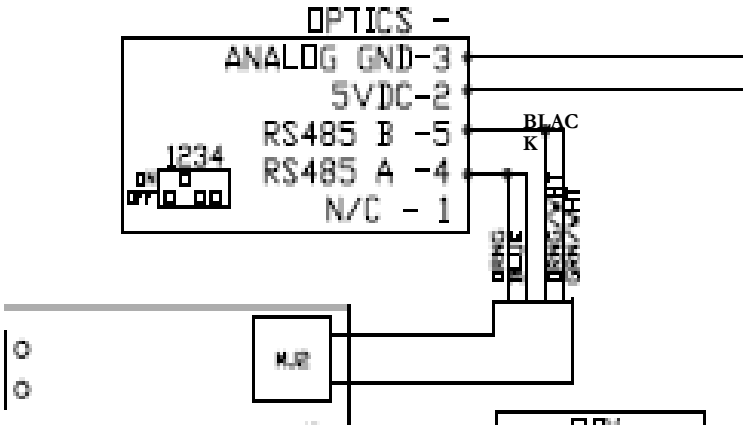
Three factors can be the root cause:

1. The 5Vdc supply that supplies power to the optics
2. A faulty HMI port (MJ2)
3. A faulty Optics Comm cable

Make sure 5VDC potentiometer is turned all the way CLOCKWISE	
Measure 5VDC here at Red and Black terminals – should be ≥5.40Vdc	
If 5Vdc was OK above check the level at the Black (-) and Red (+) wiring on the optics (will have to remove cover to access terminal) – should be ≥5.40Vdc	
If the 5Vdc levels are all OK then verify the optics are active by opening the gate and looking to see if the green LED's are flashing. If OK then the optic system has power and is active	
If there is no 5Vdc measured, verify the Power Supply fuse has not blown (ref. Fig 1 below)	
1. Remove the cover from the power supply to access the fuse	
2. The fuse is located in the lower corner on the right side of the Power supply	

3. The system power is fused with a 3.15A Slow Blow 5X20MM fuse	

The second possible cause is a break in the communication cable between the optic block and the HMI or a faulty HMI port (MJ2). Refer to image below for inspection of the optic communication wires.



If wiring looks OK the try removing and reinserting the optic cable from the HMI (MJ2) and checking to see if this fault re-occurs. If this does not fix the fault, suggest replacing the HMI. (HMI's will come pre-programmed from the factory, but you must provide what gas files are needed for the CL1)

NOTE: CL1's with a color HMI display has a modified communications cable. It is not the same as the standard CL1 cable.

Chapter 5 – Flow System

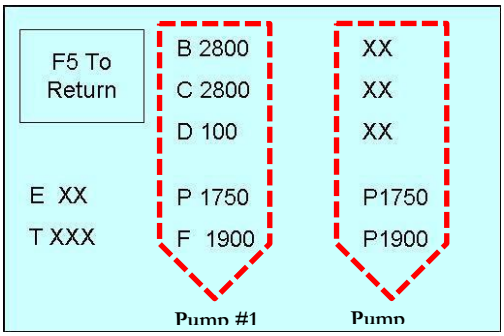
The Final component we will discuss is the flow system. The flow systems consist of:

1. Sample pumps (2)
2. An Upper filter/orifice assembly
3. A Pressure differential transducer
4. HMI

The CL1 continuously monitors the flow and adjusts as necessary. This ensures the CL1's flow is within the required range. If the system is unable to adjust the flow within the required range, the system will issue a fault.

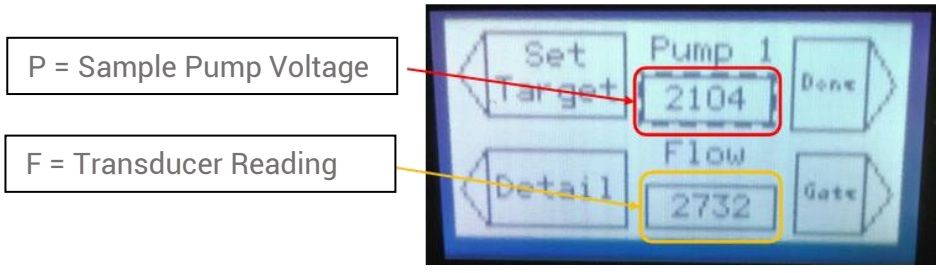
During normal operation each pump is on a 50% duty cycle, this allows an extension of the average MTBF. The pressure transducer provides a constant observation of the pressure in the flow path and the pump voltage is adjusted by the HMI to compensate for any fluctuations in flow. The Upper filter/orifice assembly provides a consistent load for the pumps and filters any particulate (dirt, dust, etc. . .) before reaching the pumps. If the integrity of the upper filter assembly is ever in question it is highly recommended to replace the entire assembly rather than just replacing individual parts. This will minimize the possibility of any leaks in the flow path.

Looking at the diagnostic screen (figure X below) there are letters that represent various system data:
P = Sample Pump voltage F = Transducer reading



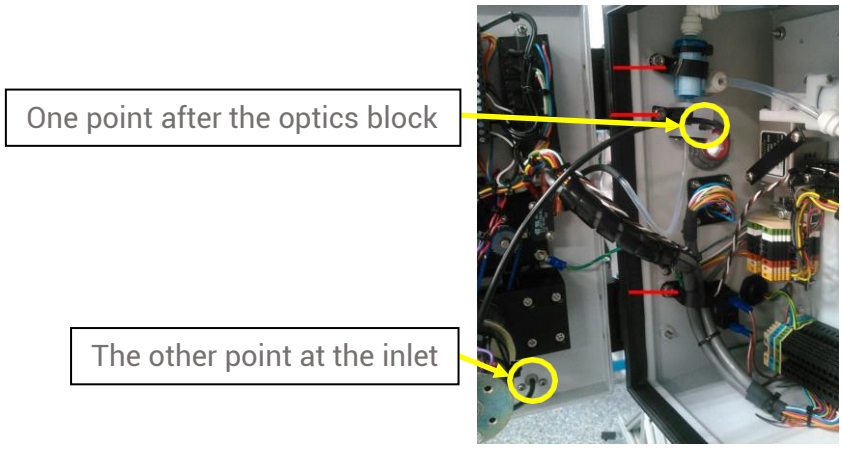
The diagnostic screen is formatted into 2 columns, the Left column is for when Sample pump 1 is operating and the right column is for when Sample pump 2 is operating.

It is possible that a fault will occur before you can access the diagnostic screen, in this case you can access these values in Service Menu under the Flow sub-menu (ref. picture of that screen below).

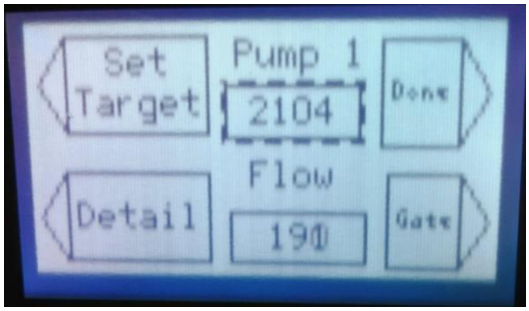


The Sample pump voltage (P) is represented on the HMI using a digital scale from 0 to 4000, 0Vdc = 0 and 12Vdc = 4000. If there are no problems with the Sample pumps or the shared flow path the P value should be between 1600 and 3200.

The pressure transducer reading (F) is also represented on the HMI as a value from 0 to 4000. The pressure transducer is monitoring the pressure differential between two points in the flow path. These two points can be found by locating the pressure transducer and following the two black tubes that are connected.



The difference in pressure that is monitored between these points is created by a small orifice at the inlet of the optic block. The pressure transducer reading (F) can be between 1600 and 2800 on a flow system that is performing correctly. If the (F) Value is < 1000 there is a leak in the system, or the pressure transducer has been damaged. If this value is above 3000 the optic block orifice is most likely clogged and needs to be cleaned. (see Appendix G for details)



5.1 Flow System Troubleshooting

By looking at the fault message we can determine a course of action to correct the fault.

Fault #50 – Flow Failure 1
Fault #51 – Flow Failure 2

These faults indicate that the pump (P1 or P2) voltage (P) has become too low and the flow (F) value is still too high above its setpoint.

Two conditions can cause this fault:

1. Clogged optic orifice
   The inlet and/or optics block orifice is becoming dirty and clogged, thus increasing the pressure drop and the (F) value.

   Clean per procedure in Appendix X.

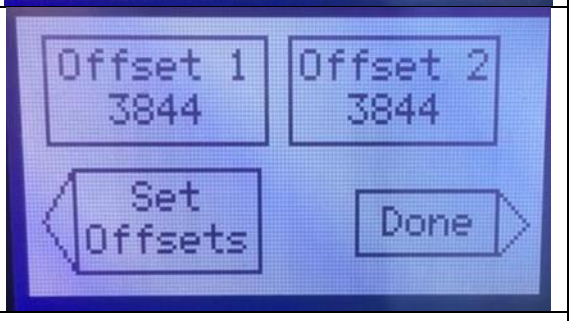
2. Transducer offset issue
   If cleaning the optics orifice does not remedy the issue you may have a faulty transducer.

NOTE: The transducer offset values are based on ambient atmospheric pressure.

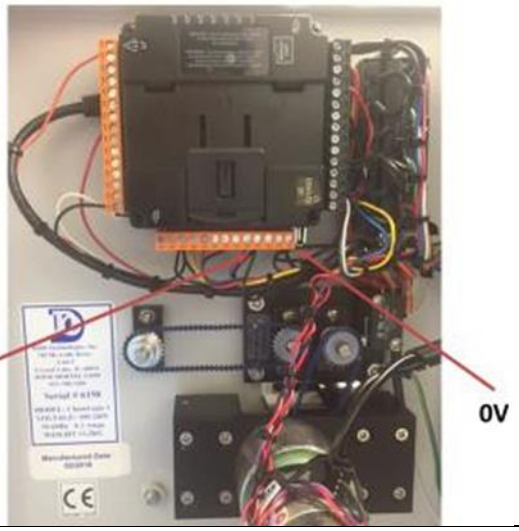
The offsets are set by the factory wen the CL1 was built but can become corrupted such as when positive pressure is used (compressed air) to blow out the optics to clear a blockage. In this case the offsets will show as ++++ instead of numbers and usually can be reset by cycling power to the CL1.

To cycle power:
1. Turn off the CL1
2. Wait for 3 minutes
3. Turn CL1 back on

Recheck offset values by following the steps below:

Go to the Service Menu and scroll down to Offsets	
Press Enter and verify both Offset values are around 4000 (+/- 200).	
If not, press arrow button next to “Set Offsets” on the display and recheck.	
If this does not correct the Offset values will need to check the transducer (See following steps to verify transducer).	

1. V1 is purple output wire from the transducer
2. 0V is DC ground on the HMI
3. With the pump not running the voltage should be between 1.1V – 1.3 V
4. With pump on the voltage should be greater than 1.3V
5. If the voltage reading is 5V the transducer has been damaged

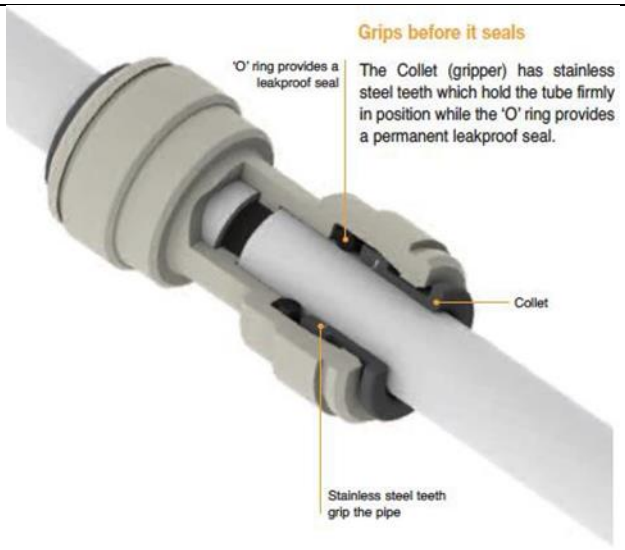


Fault #55 – Flow Failure 1H
Fault #56 – Flow Failure 2H

This fault indicates that the pump (P1 or P2) voltage (P) has reached maximum (4000) AND the flow (F) value is still too low (below its setpoint).

Three conditions can cause this fault:

1. Flow path Leak
    a. Check all the tubing connections at each point in the flow path where tubing inserts into a connection.
    b. Check ends of tubing for damage/burs.
    c. Make sure tubing is FULLY inserted.
    d. Push the tube into the fitting, to the tube stop.
    e. Pull on the tube to check it is secure.



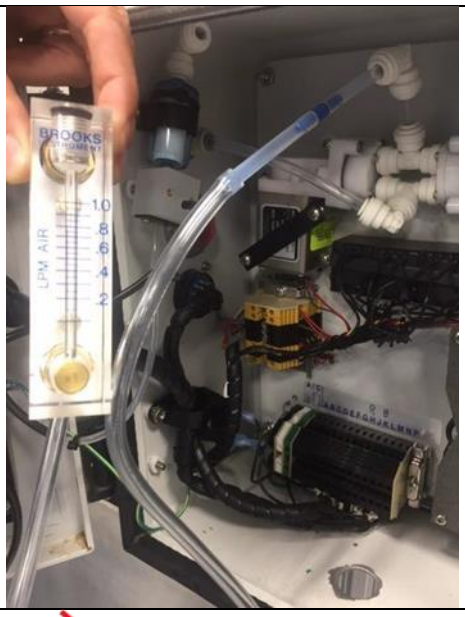
2. Clogged Filter
    a. The flow through the internal particulate filter is inside to outside of the filter's internal media
    b. Remove the filter from the assembly and view down into the narrower end of the filter to see if the filter needs replacing.
    c. The internal filter media will darken from white to blackish as it becomes dirty.

3. Weak or Worn Out Sample Pumps
    a. The typical life span of CL1 sample pumps is 3-5 years. To determine how old the pump is, look for the date stamp on the side of the pumps seen here.
    b. The last two digits are the year the pump was manufactured.

NOTE: when a sample pump is no longer operable the CL1 will shut (disable) that pump and analysis will continue with the other good pump. The lower left corner of the display will show which pump has been disabled (P1 or P2). There is NO FAULT ISSUED – only a 1 or 2 displayed in the lower left of the HMI depending on the disabled pump.

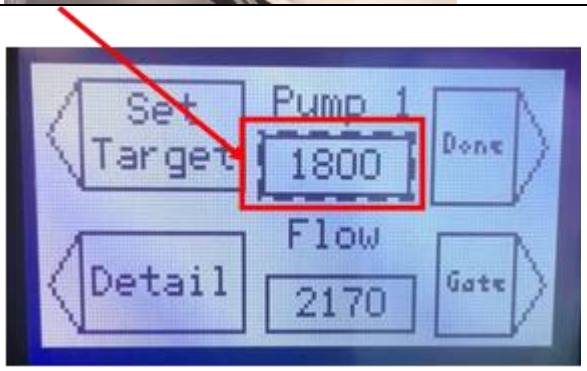
To test the sample pumps to determine if they are too weak or worn out, follow these steps:

1. Disconnect the tubing (with the internal orifice) from the top of the internal particulate filter as shown here.
2. Connect a flow meter (0-1.0LPM) to the end of this tubing as shown here.
3. Go to the "Service Menu" and scroll down to the "Flow Sub-Menu" and press enter.



**The first sample pump (Pump 1- right side pump) will be activated.

**The pump voltage (P) box should be outlined as shown here.



4. Using the numeric keypad, change the pump voltage value to 4000 then press enter.
5. The pump will be forced to maximum voltage and its flow should be above 1.0 LPM – if not, replace pump (See appendix C for steps on replacing sample pump)
6. Press arrow key next to "Done" and repeat test for sample pump 2.

NOTE: If a new sample pump(s) is installed we recommend that that inlet flow is checked and if necessary, a new Flow Target be set (see Appendix C for details).

See Appendix C for how to re-calibrate the flow system settings, check inlet flow, set pump (P) setting, and perform a Flow Target set.

Chapter 6 – Preventative Maintenance

DOD Technologies recommends having a DOD certified technician review the CL1 system for proper functioning at least once per year. However, this is not a requirement, the CL1 is designed to self-calibrate.

If self-calibration is not possible the CL1 will enter a fault state until the issue is resolved.

NOTE: the CL1 has components that will wear over time and use, by monitoring these components via a comprehensive Preventative Maintenance plan you can avoid any unplanned downtime, ensure peak operating efficiency, and increase overall life of the CL1.

To benefit from such a preventative approach, DOD recommends the following preventative maintenance steps be taken:

Optic system maintenance:

1. Check the health of the optic system monthly by observing the DAC value.

   Recommend cleaning the optics when the DAC value reaches 130 (see Appendix A for cleaning procedure).

Flow system maintenance:

1. Check the Sample pump voltages (P) and the flow values (F) via the Service menu >> Flow.

   If these values out outside the ranges discussed earlier, follow the recommended corrective actions in this manual (section 5.0

2. Periodically replace Upper Filter assembly.

NOTE: this interval will depend on the amount of airborne particles present in the sampling area.
If environment is heavily polluted with airborne particles Sample Line filters are available - contact DOD for application assistance.

Tape Advance system maintenance:

1. Lubricate the motor cam with grease every 6 months to reduce wear between components.
   Apply a small amount of #2 type petroleum (or synthetic) grease to the rounded portion of the cam.

   Access cam from either the top between drive belt as shown in Fig.1), or from underneath the Gate Motor as shown in Fig. 2.

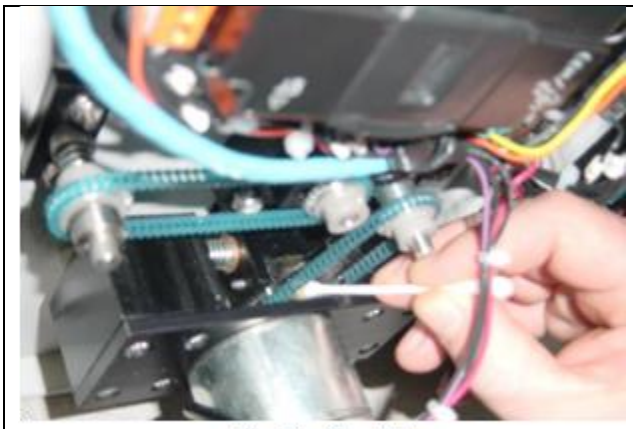


Fig.1 - Top View

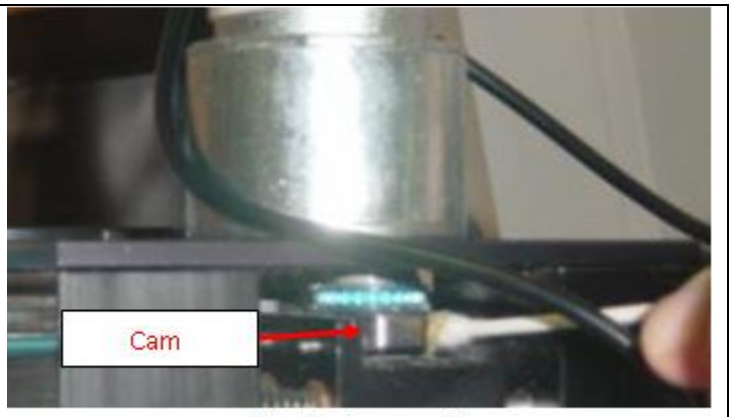


Fig. 2 - Bottom View

Try not to get grease on the drive belt or gear. Do not use excessive amount, only a small dab is needed.

Chapter 7 – Faults & Gas Alarms

Color Coding

RED	Alarm	Gas Alarm
ORANGE	Fault	Service Fault
YELLOW	Fault	Minor Fault
BLUE	Event	Information Message
GREEN	Event	Status Update

NOTE: The System Fault relay is ENERGIZED at all times except when a fault is detected. The Alarm and Fault relay(s) can be configured for either ENERGIZED or DE-ENERGIZED operation in the Setup Menu.

CL1 Msg Code	Message	Possible Cause	Corrective Action
1	No Gas Data Loaded	System Restored	Reload gas files – reference Software Update procedure in Appendix B.
2	DAC Calibration Required	Optics Dirty	See Appendix A for cleaning instructions.
4	No Gas Selected	No Gas Selected	Select gas via Setup menu Go to select gas entry
5	Gate Open Fault	Gate Motor did not leave home position	Make sure that all wires coming from the motor to the HMI are fully inserted: [Red (or grey) @ Q12 and black @ 0V]. Verify drive belt is not broke and is connected onto both gears properly.

CL1 Msg Code	Message	Possible Cause	Corrective Action
6	Gate Close Fault	Motor did not return to the Home (closed) position.	Reference section 3.0 in this manual for troubleshooting tips. If the gate opens and does not stop, there is a problem with micro switch. Make sure both wires are connected (I8 and V+). Using a multimeter, verify switch opens and close when rotation occurs. Try slightly bending the switch arm toward the motor collar to ensure the set screw is closing the switch.
7	High Background Fault	No Tape Loaded OR Tape has become too discolored.	Load new tape if none installed. Verify fresh tape (i.e. not dis-colored) is inserted in optics and gate is closed. Manually advance tape, if necessary, to get to a “clean” section of tape. Go to Service menu and perform Optics Calibration.
		Optics Dirty	See manual Appendix A for cleaning instructions.
8	Optic Comm Failure	Electrical problem	Verify +5Vdc level OK (≥5.4). Check cable and connection to HMI (MJ2). Check wiring at optics block.
9	All Pumps Disabled	Flow Blocked and/or Unstable Inlet/Exhaust	See Appendix G for cleaning instructions and if applicable add a filter to inlet. When blockage is fixed, go to Setup Menu and re-enable pumps.

CL1 Msg Code	Message	Possible Cause	Corrective Action
10	Flow Fluctuation Fault	Flow Blocked and/or Unstable Inlet/Exhaust	See Appendix G for cleaning instructions.
11	Idle Timeout	Out of Analysis Beyond Timer	If Fault caused, must remedy Fault first, then Re-enter Analysis. NOTE: the Timeout duration is adjustable from 0 to 45 minutes
12	Low Background Fault	Wrong tape or optic problem	Verify correct Chemlogic cassette for gas selected is installed. If tape is correct, go to Service menu and perform an Optics Calibration.
13	Purge Option Fault	Sample line Tubing Blocked	Clear blockage in sample line or End of Line filter maybe clogged.
14	Optic Auto Cal Failure	Optics Dirty	See Appendix A for cleaning instructions Verify fresh tape (i.e. not dis-colored) is inserted in optics and gate is closed. Manually advance tape if necessary to get to a “clean” section of tape. Perform Optics Cal (Service Menu).
33	SD Card Fault	No SD Card or Card Full	If a SD card is installed, power off unit and remove and re-insert SD card then re-start CL1.
34	Analyzing	Analysis mode started	N/A
35	Chemlogic Tape Low	Cassette nearing end	Replace tape
36 37	Pump 1 Disabled Pump 2 Disabled	Flow Blocked and/or Unstable Inlet/Exhaust	Perform Flow system test (Section 5.0) to verify Sample pump(s) and Flow system condition. Once root cause has been corrected Go to Setup Menu and Re-enable pump(s).

NOTE: When one of the Sample Pumps are disabled a P1 or P2 (depending on which pump is disabled) will appear in the lower left side of the CL1 display.

CL1 Msg Code	Message	Possible Cause	Corrective Action
38	Large Flow Fluctuation	Flow Blocked and/or Unstable Inlet/Exhaust	See manual Appendix G for cleaning instructions. Re-enable pumps in Set Up menu. Check for presence of excessive pressure (+/- 1.5”H2O) at Sampling point.
39	High Flow Fault	Optics Orifice Dirty	See manual Appendix G for cleaning instructions. Check for presence of excessive pressure (+/- 1.5”H2O) at Sampling point.
40	Alarm Level 1	Gas Detected	After gas leak is found and corrected reset alarms
41	Alarm Level 2		
42	Remote Reset		Message indicating a Remote Reset was performed
43	Power On		Message of event occurring.
44	Optic Calibration	Operator initiated	Message of event occurring.
45	Pump 1 high voltage	Pump drawing too high of current Or Bad Pump	Leak somewhere between the optics and Sample pumps. Check ALL flow path connections are fully inserted. Troubleshoot Flow System as described in Section 5.0
46	Pump 2 high voltage		

Chapter 8 – Spare Parts

For pricing and availability please contact DOD Technologies, INC. Service Department.
Phone (815) 788-5200
Fax (815) 788-5300

Part Number	Spare Parts for CL1/CL2 Description	Price
102531	Fuse 3.15A Slow Blow 5X20MM	$4.00
104213	Power Supply 5V, 12V, -12V	$89.00
60009	Assy Filter Housing for Corrosive Gases	$105.00
60010	Teflon Membranes for 60009 - 100Pk - 47mm	$275.00
780248	Particulate Filter	$11.00
2-800-013	End of Line Filter for Use with Corrosive Gases	$29.00
870328	Pump CL1/SPM Standard	$295.00
1-400-001	Tubing 5/32 x 3.31 Black PVC (Transducer Tubing)	$1/ft.
2-100-040	CL1 Sample Manifold	$70.00
2-100-061	CL1 Service Door Lock	$45.00
2-100-A12	CL1 & CL8 Gate Open Assy with Cam	$596.00
2-100-A13	CL1 & CL8 Tape Advance Assy	$250.00
2-100-A18	CL1 Optics Back Plate with Sealing Foam	$83.00
2-100-A24	Assy CL1 Light w/Pole for Light Option w/6 Pin Connector	$675.00
2-100-A25	CL1 (ONLY) Optic Block Assembly	$820.00
2-100-A26	Assy Micro Switch Field Upgrade	$55.00
2-100-A27	Transducer Assembly w/ Wires	$50.00
2-100-A34	Assembly Tee Fitting with Double O-rings and with 2 Collets Removed	$12.00
2-100-A35	Assy CL1 Exhaust Fitting	$9.00
2-100-A36	Assembly - CL1 Upper Fittings & Filter Assy	$125.00
2-100-A64	Assy CL1 - Inlet Manifold - Rev B per ECR 46	$70.00
2-100-A69	CL1 Optic Block - Self Cleaning Option	$865.00
2-200-024	Replacement CL1 HMI Controller for Units with Damaged Standard Screen	$864.00
2-200-028	Switch Rocker SPST 15A Sealed	$35.00
2-200-030	Relay Form C 12VDC Coil	$14.00
2-200-201	Replacement CL1 HMI Color Controller for Units with Damaged Color Screen	$1,350.00
2-300-004	Gear 24 Teeth Take-Up	$45.00
2-300-008	Drive Belt 84 Links CL1	$35.00
2-300-009	Drive Belt 73 Links CL1	$35.00
2-400-006	FEP Tubing 2 mm ID x 4 mm OD (Tubing between optics out and upper fitting manifold)	$6/ft.
2-600-202	Memory Card SD Micro 2G	$70.00
2-600-204	Option 14 Pin Mating Connector w/Strain	$75.00
2-600-207	Filter Media Disc for Dusty Diisocyanate Applications (10/pack)	$65.00
2-600-209	Option CL1 Modbus TCP Interface	$425.00

2-600-214	Outdoor Rain Resistant End of Line Cone	$55.00
2-600-217	CL1 Option Dust Cone for Diisocyanate Applications	$55.00
2-600-219	CL1 YZ PURGE OPTION WITH ATEX nP CERTIFIED for Zone 2 Group IIB+H2	$4,200.00
2-600-223	CL1 Upgrade to Color Touchscreen for Existing Units	$1,350.00
2-600-225	CL1 Upgrade to Color Touchscreen for New Units	$900.00
2-600-226	CL1 Remote Light Tower with Pole Mount	$925.00
2-100-039	Cam Wear Plate	$15.00
2-100-074	CL1 Optics Communication Cable	$22.00
2-100-A78	Tubing Assy CL1 Optics Exhaust	$10.00
2-100-A30	Assy CL1 CL8 Drive Roller w/Shaft	$72.00
2-400-003	Tubing FEP 5/32 X 3/32 Natural	$2.50/ft.
2-600-021	CL1 Performance Upgrade Package with New Pumps and Extended Warranty	$2,700.00
2-600-022	CL1 Performance Upgrade Package	$1,731.00

When requesting replacement parts please provide Serial No. and specify if the CL1 is configured with any special options that may alter the replacement part required

Appendix A – Optics Cleaning Procedure

1. Enter the CL1 Main Menu	
2. Enter the Service Menu (Password: 1234)	
3. Enter “Optic Calib.”	
4. Press “Open/Close”	
5. Remove the ChemLogic® cassette tape from the gate	
6. After the gate is open, remove the (2) Phillips screws that hold the back-plane block cover.	
7. Remove the (2) Phillips screws holding the back-plane block. The face of the optic block should be exposed once completed.	
8. You should see (4) circular holes with a green light flashing in one channel at a time. Each one of these holes represents a channel. The CL1 only uses channel 2 for gas detection	

9. To clean the fiber optic lenses, you will need a Small cotton swab(Q-tip) and Industrial alcohol.

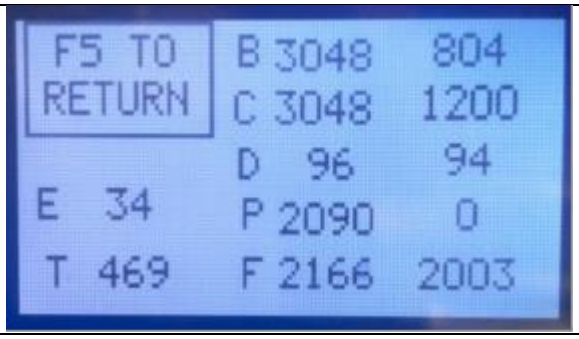
10. Dip the cotton swab into the alcohol and insert it in channel 2. It is very important to clean both lenses. Make sure to put the swab straight in to clean the first lens and angled downward to clean the second lens.

11. After the cleaning is complete re-insert the tape and put the back-plane block on. Press "Open/Close" and the gate will close.

12. Press start to initiate the calibration process. The current DAC value will become 0. Then the new DAC value will populate. This new value should between 60-130 which is the manufacturers range. DAC value cannot be improved from the value it is shipped at. Call DOD Technologies to check your starting DAC value.

13. When done, the main menu should be on the display and press start analysis.

14. Once in analysis press F6 in order to see the technician screen.

15. In the technician screen you will see the letter D. In front of the D is a number that represents how bright your optic LED is. When this number reaches 140 you will be prompted to clean with a fault. When this value reaches 150 your CL1 will not go in to analysis until the optic block is cleaned.	
16. Repeat the cleaning process until this value is back to the manufacturer's DAC value range below 130.	
17. Once the value is below 130 re-install the optic block covers.	

A.1 Optic Orifice Cleaning

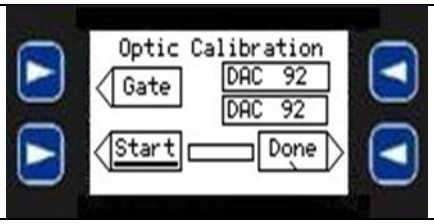
This procedure describes the cleaning of the CL1 / Cl2 optic orifice to prevent the buildup of debris around the orifice that could cause increased pressure readings and decreased pump voltages.

1. Press F1 to exit analysis
2. Make sure the gate is closed
3. POWER OFF the CL1 / CL2 unit
4. Carefully remove the optic exhaust tube without pulling the optic wires loose
5. Spray compressed air into the optic exhaust channel down towards the inlet of the CL1 (You should feel air coming out of the inlet)
6. Reinstall the optic exhaust tube
7. POWER ON the CL1 / CL2 unit

You can now perform a quick check to see how much the DAC has come down due to the cleaning.

1. Take a section of the tape and press it against the optics block covering Channel 2 opening.

2. Press the arrow key (on the left side of display) to Start an Optics Calibration.



3. Keep pressing the tape against the block and covering Channel 2 opening. When the calibration is finished it will display a new DAC number

4. If this new DAC number is NOT lower than 120 then repeat the 2nd part of the cleaning procedure using the flat wooden end of the swab.

5. Make sure you press FIRMLY while doing the spinning of the swab. The idea is to “rub” off the film that stuck to the surface of the lens.

6. Perform another Optic Calibration with a piece of tape (as described above) and If the DAC returns under 120 then no further cleaning is needed.

Before re-assembling backplate this would be an opportunity to perform an Inlet cleaning just as a preventative measure. See Appendix G for details.

Otherwise you can re-assemble backplate and re-load tape:

1. Re-install the backplate taken off earlier.
2. Install tape back into unit.
3. Re-install backplate cover.
4. Close the gate by pressing the arrow key on the left of the display.
5. Redo the Optics Calibration just to verify DAC still calibrates less than 120.

Appendix B – Software Updating / Loading Procedure

The CL1 software is installed and configured using the Micro SD drive on the top of the display unit. Refer to the CL1 User's manual Chapter 6 for information on installing and removing SD cards from the CL1. The Micro SD card should slide easily in and out of the slot.

Use CAUTION when inserting the SD card. Forcing the card into the slot may damage the unit.
Installing a new version of software in the CL1 involves the following steps. Details of each step are provided below:

1. Create the Micro SD cards from the email attachment (if necessary)
2. Install the new software from the Micro SD card
3. Run the first-time use "Auto-Configuration" of the CL1

Section 1 – Creating Micro SD boot disk from email attachment

This section is only necessary if the software was received via email. If the software was received on a Micro SD card you may proceed to section 2. In order to create the Micro SD card, you will need a MS Windows based computer with a Micro SD drive installed. You should have received an attachment in compressed ZIP format which contains the installation software and the configuration data.

NOTE: All files & folders contained in the ZIP file need to be extracted to the root of the Micro SD card. After the extraction is complete there should be a program file (S****.PGM) located in the root of the Micro SD card along with 1 or more folders. If you extract the program file (S****.PGM) file to a folder on the Micro SD card the software will not install correctly.

You may remove and use the Micro SD card previously installed in the CL1 for this procedure. Below is a procedure to extract the files to the Micro SD card on a windows XP system. If you have another unzip utility you may use it as long as the files are extracted to the root folder on the Micro SD card.

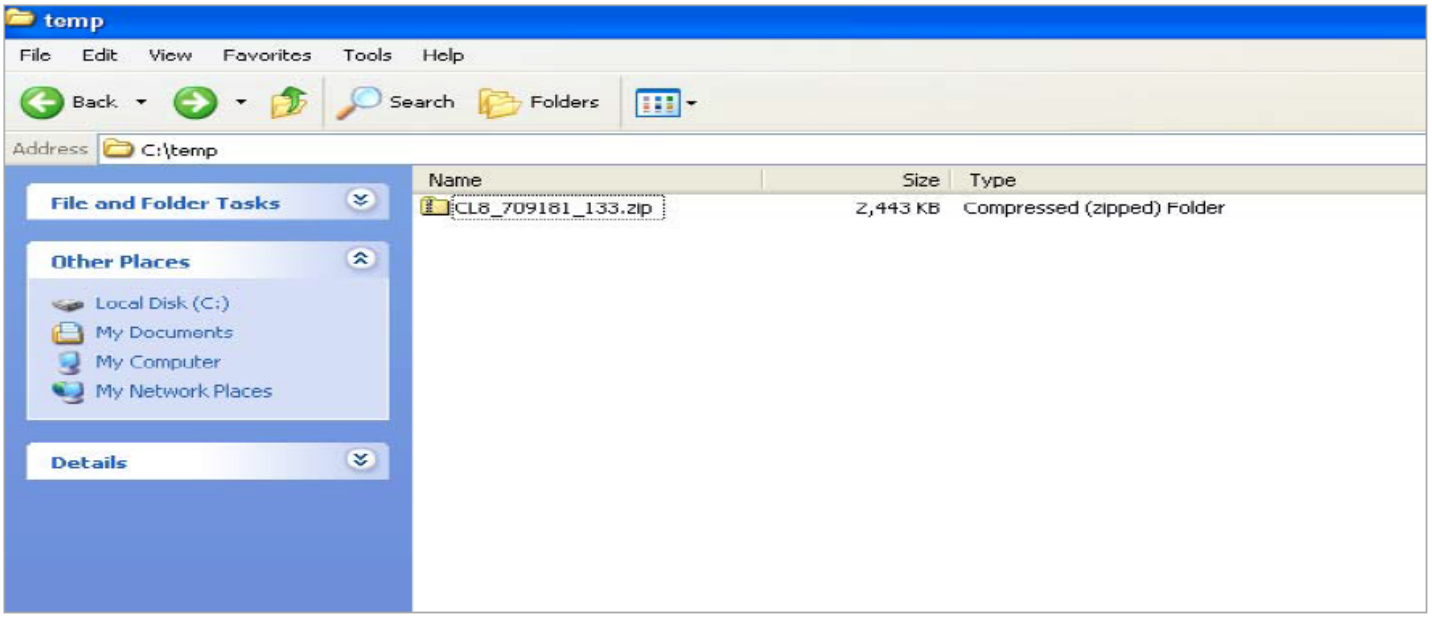


Figure 1.1

Save the .zip attachment to a folder on the computer.

Right click the .zip file in the folder where it was stored and select 'Extract All' as shown below. This will start the extraction wizard shown in figure 1.3.

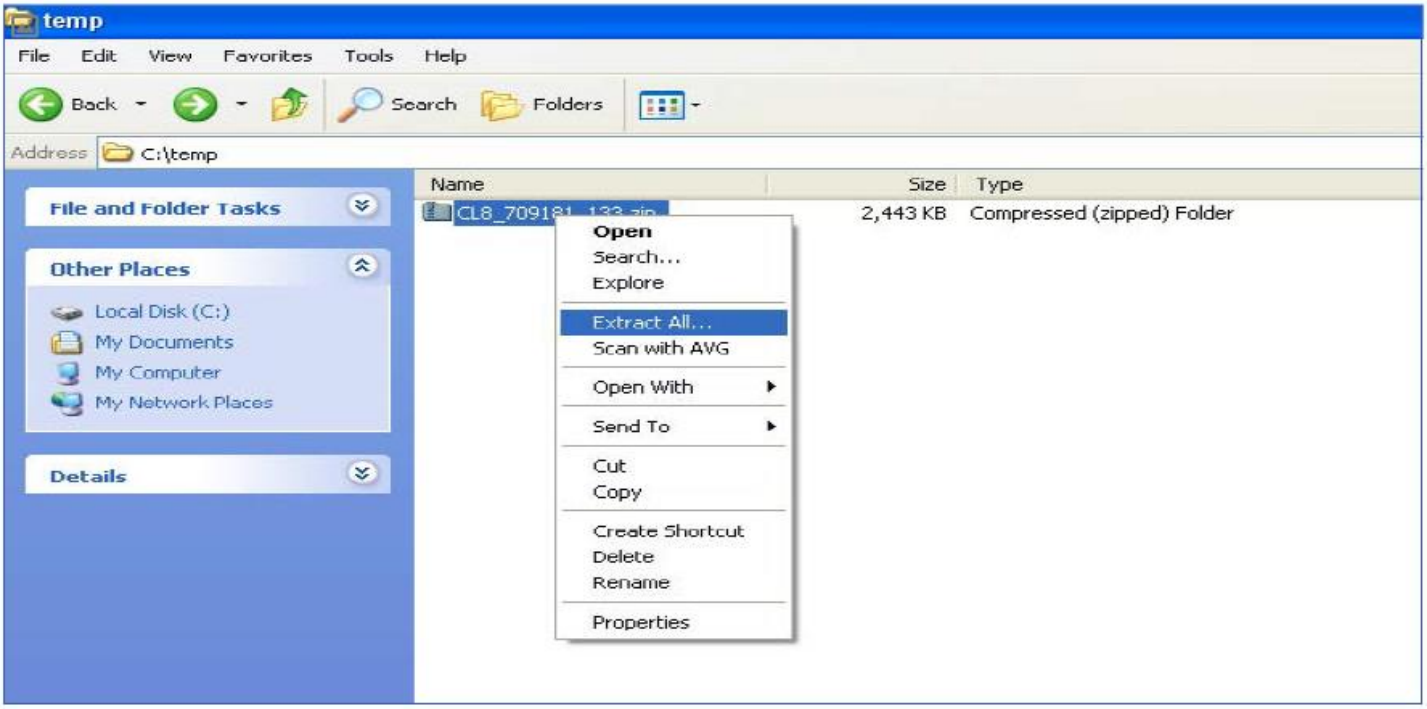


Figure 1.2

If you do not see an option for 'Extract All' try double clicking the ZIP file which should start the wizard.

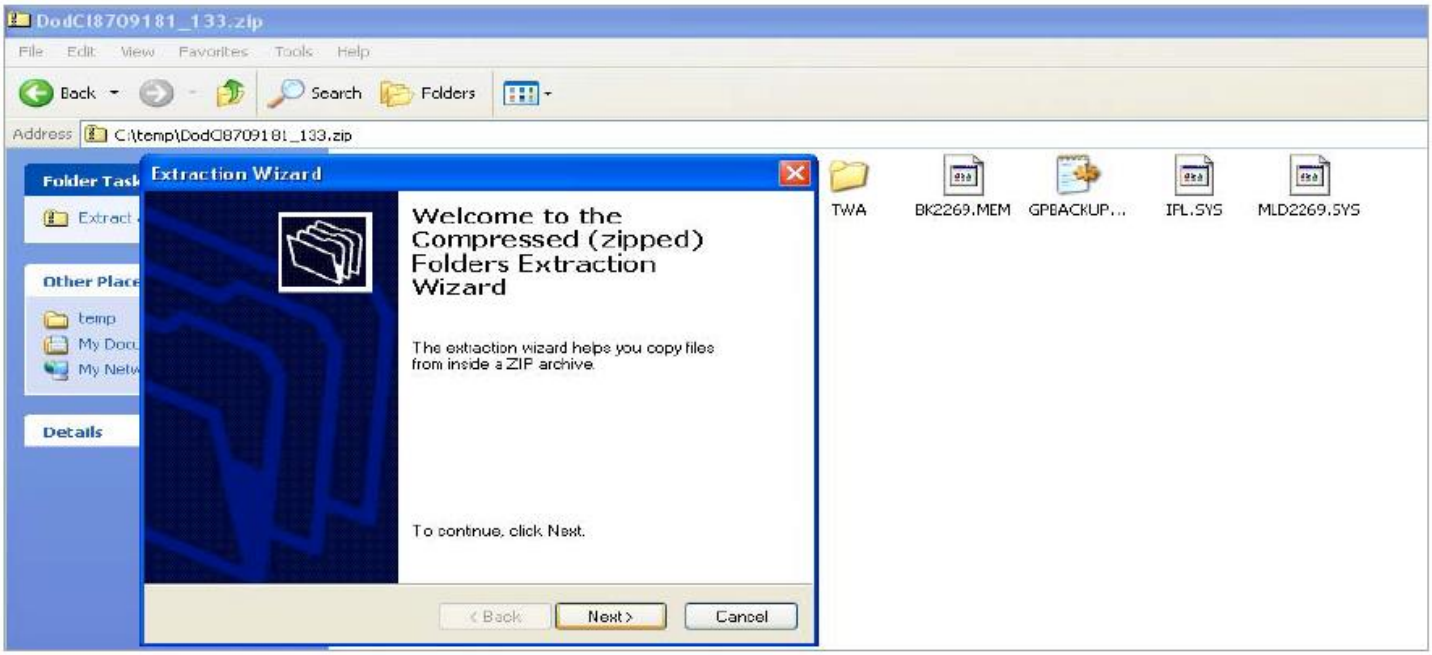


Figure 1.3

Click 'NEXT' to select the destination as shown in figure 1.4

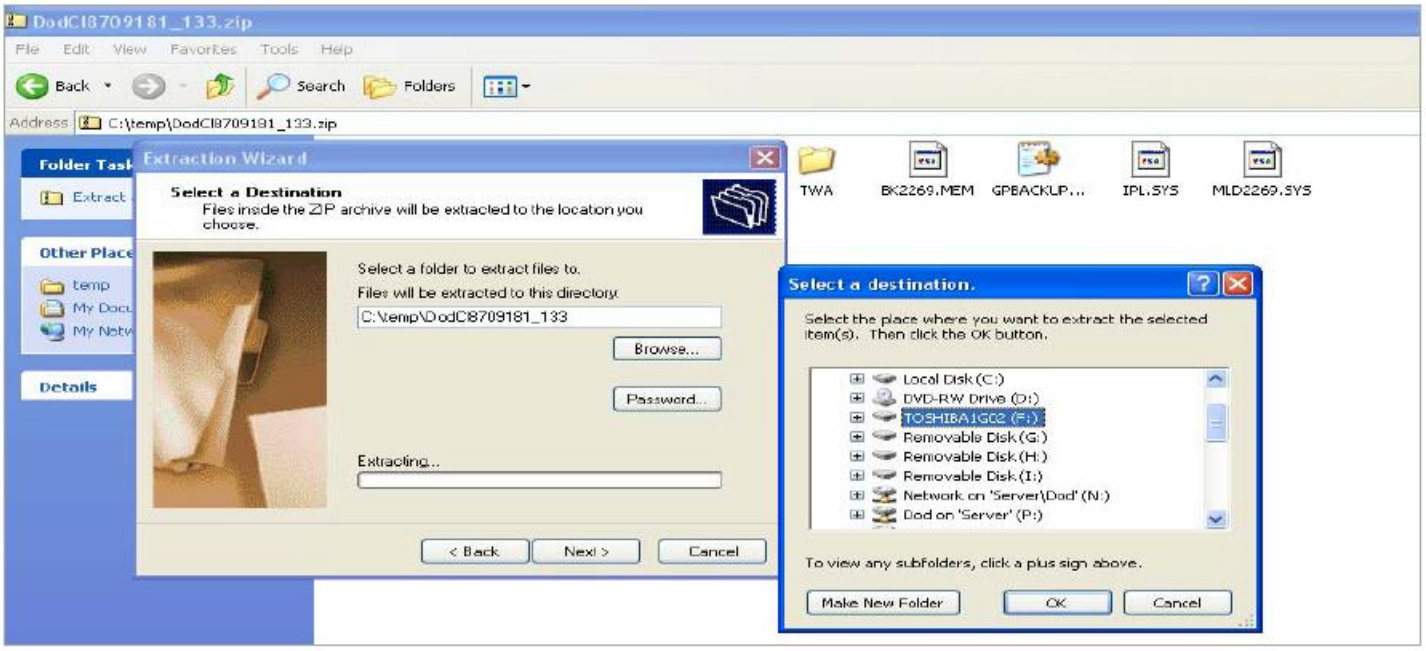


Figure 1.4

Click on 'Browse' and select the letter of the Micro SD (Micro SD) drive as the destination Be sure the Micro SD card is inserted in the drive. After selecting the drive click 'OK' then 'NEXT' to complete the file extraction.

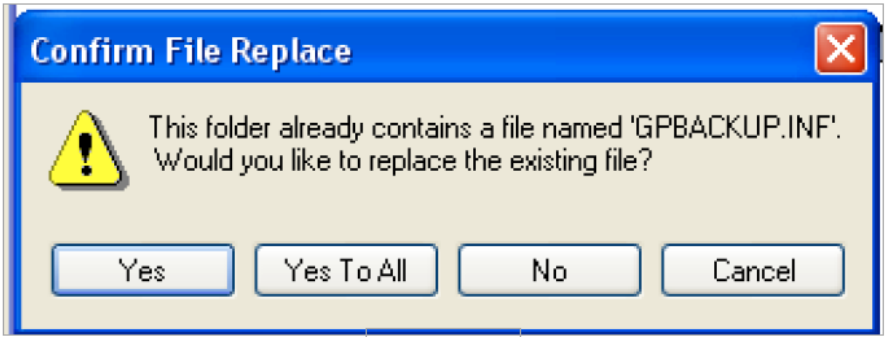


Figure 1.5

If you receive a warning message similar to figure 1.5 clicks on 'Yes to All" to ensure the current files are loaded on the Micro SD card.

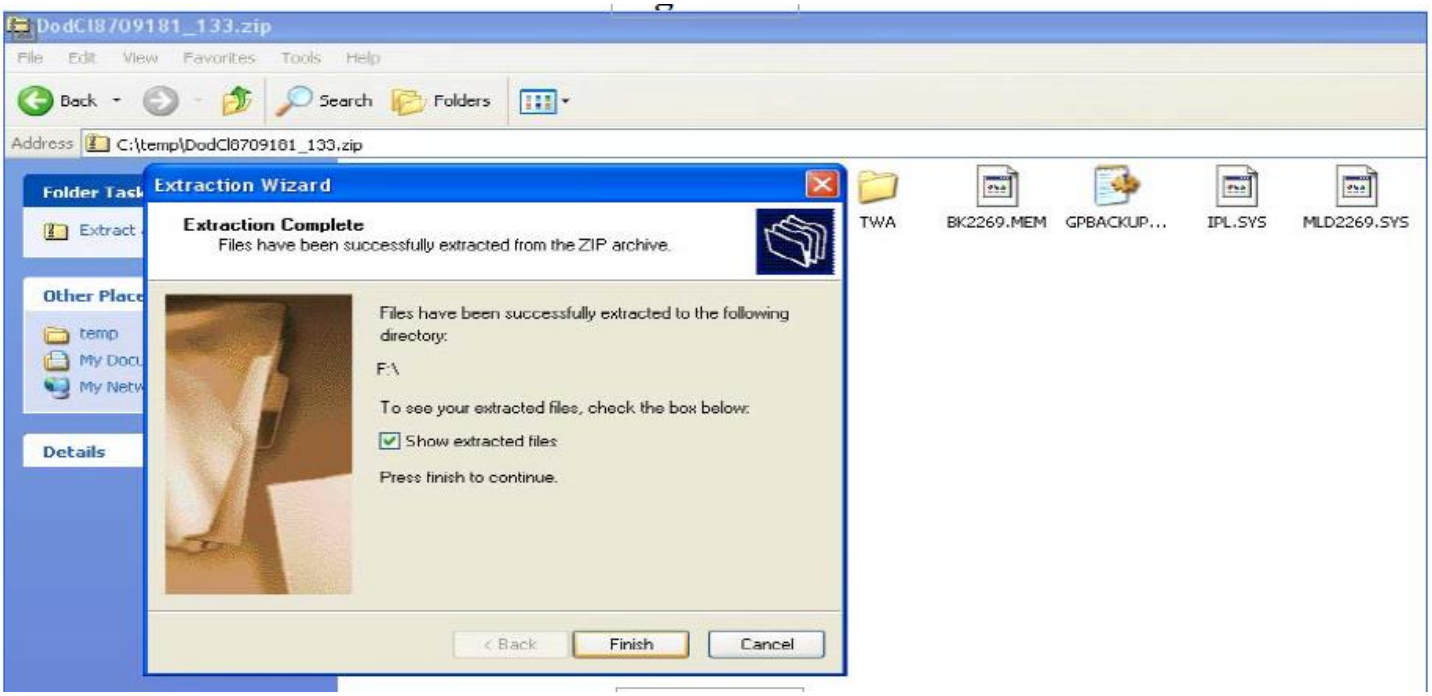


Figure 1.6

The Micro SD card should now be ready for use.

Appendix B.1 – Installing the Software

Power off the CL1 Insert the Micro SD card containing the software upgrade into the slot. Power on the CL1 and return to the main menu. Hold in both the "UP" arrow and 'DOWN' arrow at the same time which should bring up the screen in figure 2.2.	 Figure 2.1
Use the down arrow key to scroll down to the menu item "Removable Media" shown in figure 2.3	 Figure 2.2
Use the <ENTER> key to display the contents of the Micro SD card as shown in figure 2.4	 Figure 2.3
Use the down arrow key to scroll down to the program which will have a name ending in ".PGM" as shown in figure 2.4. Use the <ENTER> key to start loading the program as shown in Figure 2.5	 Figure 2.4
Use the<ENTER> key to begin loading the application. A clock will appear during the program load which will take less than 30 seconds. When the load completes a screen similar to figure 2.6 will appear.	 Figure 2.5
IMPORTANT: Use the<ENTER> key again to place the CL1 in Run Mode. The system will start and you're now ready to configure the system in Section 3.	 Figure 2.6

Appendix B.2 – Configuring the CL1

Figure 3.1

IMPORTANT: The Micro SD card that was used to load the software must remain in the CL1 during this procedure.

- The screen in figure 3.1 will appear when the software boots for the first time after installation or if you have followed the procedure to restore the default configuration
- Wait 10 seconds for the Micro SD Drive to initialize on the CL1.
- Touch the <Configure> soft key to begin the configuration as shown in figure 3.2

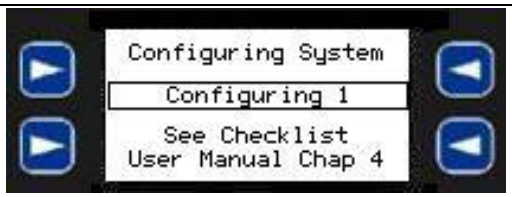


Figure 3.2

- The system will begin auto-configuration with several messages scrolling through the center status box. See Figure 3.3

Figure 3.2

IMPORTANT : If you receive the following screen at any time during installation, power cycle the CL1 and retry the installation. If you continue to get to this screen contact DOD Service.

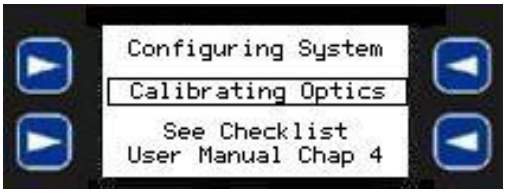


Figure 3.3

- When the configuration has been completed the screen in figure 3.4 will appear.

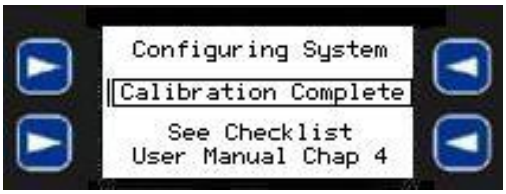


Figure 3.4

IMPORTANT: If you do not receive the "Calibration Complete" status within 5 minutes contact DOD Technologies for further assistance.

At this point the calibration has been completed. Refer to the User Manual Chapter 4 for a checklist of options that should be configured manually.

Power cycle the CL1 off and on and touch the <MENU> soft key to return to the main menu to finish the configuration from the checklist.

If this is an upgrade from a version older than 10.0304 you may need to configure the power supply monitoring feature. Please contact DOD Support for help on this issue.

Appendix C – Flow System Testing and Setup

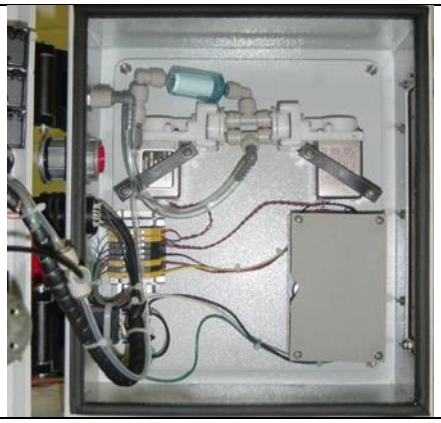
Testing of the Sample pumps is described in Section 5.0 of this manual.

In the event a pump(s) must be replaced, we recommend re-calibrating the Flow settings to ensure proper inlet flow and thus accurate machine response.

The sample pumps are arranged in the system as follows:

Right side = Pump 1 (P1)

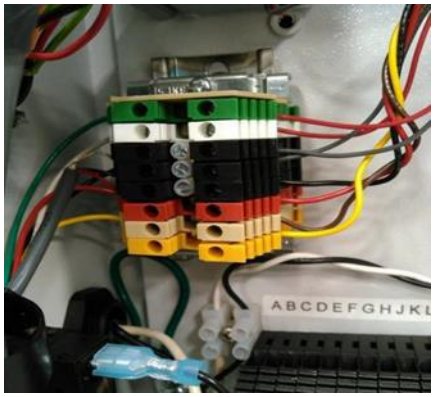
Left side = Pump 2 (P2)



The pump(s) are wired into the terminal blocks just below Pump 1 and are connected as follows:

Pump 1 positive wire (Red) to Green (or 1st top) terminal.

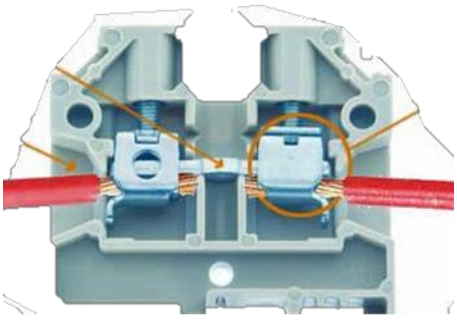
Pump 2 positive wire (Red) to White (or 2nd) terminal.



Trim length of each wire for pumps and strip 9mm off of wire and fully insert into terminal block.

Tighten down screw and test by pulling on wire to make sure it does not come out.

Make sure to dress and secure wiring out of the way of the Gate Motor so it does not get snagged when Service door is opened.



IMPORTANT: Once new pump(s) are installed and secured make sure ALL the tubing connections are fully inserted so there are no leaks.

Perform the following steps to re-calibrate the Sample Inlet flow and reset the system Flow Target setting.

1. Go to Service Menu then to Flow press Enter and Pump 1 should turn on.

2. Connect your flowmeter (same flowmeter used to check the pumps in section 5.0) to the CL1 Inlet (PT1).

3. If the inlet flow is within 800 – 1100cc's then no adjustment is necessary.

   Note the Flow number and press the arrow key next to Set Target on display.
   If the flow is not between 800 – 1100cc's adjust the Pump setting as follows:

4. Press Enter key – the Pump setting box should become highlighted on display.

5. Using the numeric keypad enter a new pump setting number to achieve proper inlet flow rate (800-1100cc's).

6. For more flow enter a higher number – for less flow enter a lower number.

7. Once proper flowrate is achieved Note the Flow number and press the arrow key next to Set Target on display.

8. Next, press the Enter key and now Pump 2 should turn on

9. Repeat the steps above to achieve proper inlet flowrate EXCEPT DO NOT PRESS SET TARGET BUTTON if Pump 2's Flow (F) number is lower than Pump 1's.

10. You want to Set Target on the higher of the two (F) values to favor a higher flow rather than a lower one.

Appendix D – CL1 Specifications

Height	12.5" (31.75 cm)
Width	10.25" (26.04 cm)
Depth	9"(22.86 cm)
Weight	30lbs. (13.5 kg)
Operating Temperature	40° – 140° F (5°-40° C)
Sample Tubing	FEP ¼" OD x 1/8" ID (150 ft. MAX) NOTE: Isocyanates (6" MAX FEP ¼" OD)
Exhaust Tubing	¼" OD x 3/16" ID Polypropylene (25ft. MAX)
Pumps	2 Pumps (P1 & P2) – 50% duty cycle – Long Life)
Power	Less than 1 Amp Max @ 120 VAC (60 Hz)
Output Relays	24VDC 6 Amp Max – 240 VAC 6 Amp MAX
4-20ma Output	500 Ohm Load Max
External Reset	Contact Closure (Normally Open)
Maximum Branch-Circuit Rating	20 Amperes
Removeable Media	Micro SD up to 2 GB formatted (FAT16 File System)
Noise Level	< 15dB

NOTE: Temperature and humidity levels must be stable

CL1 Sample Pressure Specifications: (Positive pressure can cause leaks at the optics head)

Sample In	Minimum	Normal	Maximum
Pressure	-1.5" H2O	Ambient	+1.5" H2O
Flow Rate @	750cc/min	900cc/min	1050cc/min

Options are available to handle positive pressure applications and special sample conditions. Please contact DOD or your local representative for more information.

Appendix E – CL1 ChemLogic® Cassette Handling and Storage

E.1 – Cassette Handling

ChemLogic cassettes do not release or result in exposure to hazardous chemicals under normal use. ChemLogic cassettes are non-toxic and require no special precautions for protection. Material Safety Data Sheets (MSDS) are not required.

Contact with skin may cause the cassette to react, change color, and no longer be useful in your gas monitoring system.

We therefore recommend that rubber gloves be worn while handling the cassette during removal and installation.

As an added precaution, we recommend washing hands after handling ChemLogic cassettes.

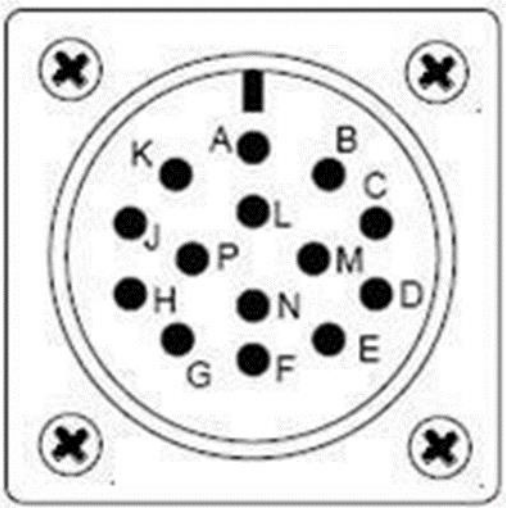
E.2 Cassette Storage

ChemLogic cassettes should always be stored per the factory requirements labeled on each cassette. Once loaded into the CL1 unit, tapes are designed with specific durations (i.e. 30 days, 60 days, etc. . .) that vary depending on the gas being monitored for. This duration length is also on the label of each cassette. With proper storage (to maximize life span), cassettes have different Months to Expire depending on type of gas the cassette is manufactured to detect for (see chart for specific details):

Tape Part #	Description	*Exp Months	Storage Temp
1-200-020	Phosgene ChemLogic 60 Day Tape	12	Less than 25C (77F)
1-200-340	LANXESS Velcorin ChemLogic 60 Day Tape	12	Less than 25C (77F)
1-300-020	Hydride-LL/H2S ChemLogic 60 Day Tape	12	From 4-10C (40-50F)
1-300-022	Carbonyl Sulfide ChemLogic 60 Day Tape	12	From 4-10C (40-50F)
1-400-020	Mineral Acid ChemLogic 60 Day Tape	12	Less than 25C (77F)
1-490-020	Acetic Acid ChemLogic 60 Day Tape	12	Less than 25C (77F)
1-500-020	Chlorine ChemLogic 60 Day Tape	6	Less than 25C (77F)
1-500-024	Ultra-Low-Level Chlorine ChemLogic Tape 30 Day	6	From 4-25 (40-77F)
1-600-020	Diisocyanate ChemLogic 60 Day Tape	6	Less than 0C (32F)
1-600-022	Diisocyanate ChemLogic 60 Day Tape (High Humidity)	6	Less than 0C (32F)
1-600-040	Methyl Isocyanate ChemLogic 60 Day Tape	6	Less than 0C (32F)
1-700-020	Ammonia ChemLogic 60 Day Tape	12	Less than 0C (32F)
1-700-040	TDA ChemLogic 60 Day Tape - 2 to 3-week lead time	6	Less than 0C (32F)
1-800-020	Hydrogen Cyanide ChemLogic 30 Day Tape	6	Less than 0C (32F)
1-810-020	Sulfur Dioxide ChemLogic 30 Day Tape	6	Less than 0C (32F)
1-D11-020	Hydrazine ChemLogic 60 Day Tape	9	Less than 25C (77F)
1-E15-020	TDI & MDI SPXNO2 ChemLogic 60 Day Cassette	6	Less than 0C (32F)

Appendix F – CL1 Wiring Diagrams

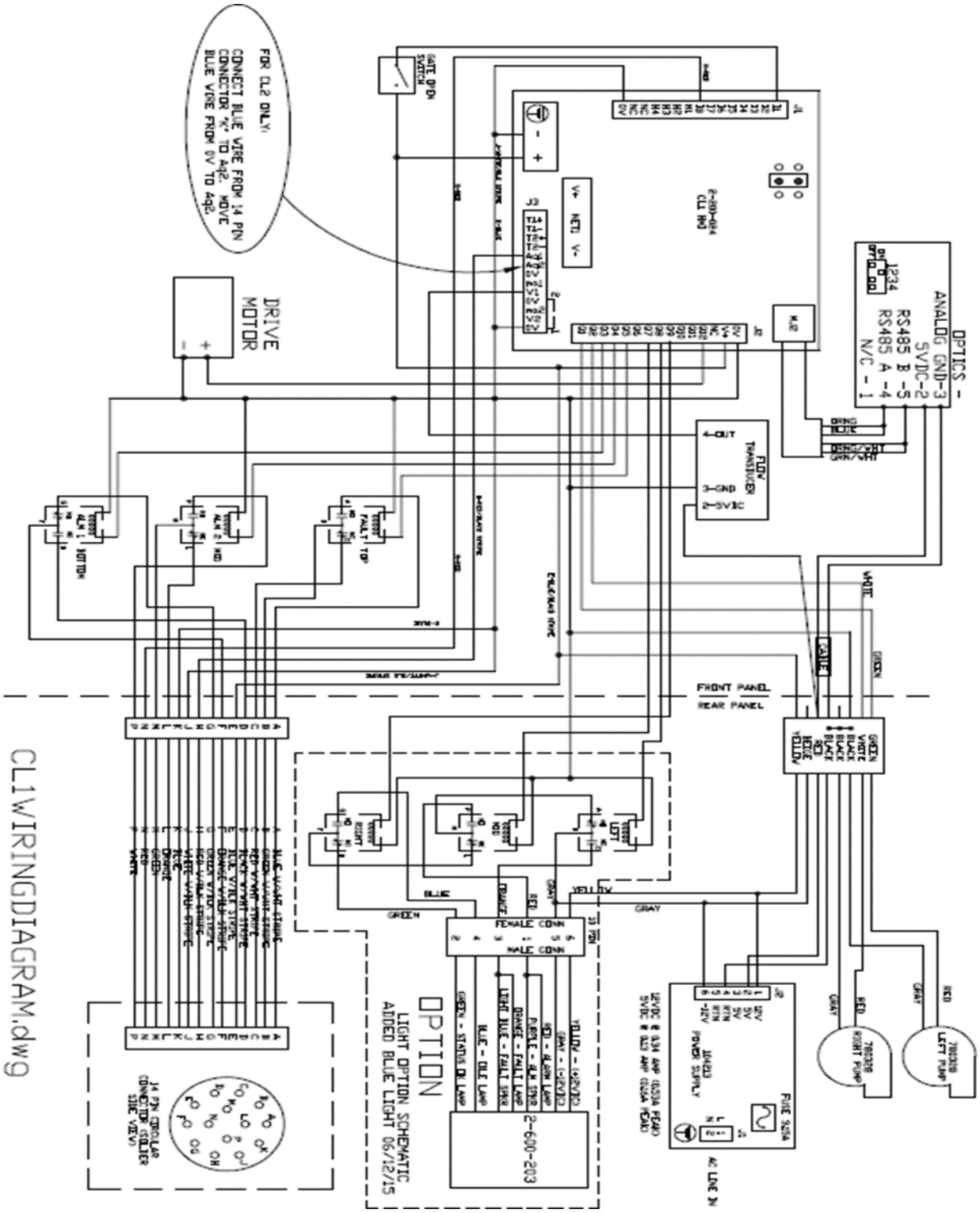
14-pin CL1 I/O Connector



Pin	Description	Usage
A	System Fault*	Normally Open
B	System Fault*	Common
C	System Fault*	Normally Closed
D	Gas - Alarm Level 1	Normally Closed
E	External Fault & Alarm Reset	Momentarily connect to pin N for reset
F	Gas - Alarm Level 1	Common
G	Gas - Alarm Level 1	Normally Open
H	4-20 ma	Positive (500-ohm max impedance)
J	Ground	
K	4-20 ma	Negative (500-ohm max impedance)
L	Gas - Alarm Level 2	Normally Closed
M	Gas - Alarm Level 2	Common
N	External Fault & Alarm Reset	Momentarily connect to pin E for reset
P	Gas - Alarm Level 2	Normally Open

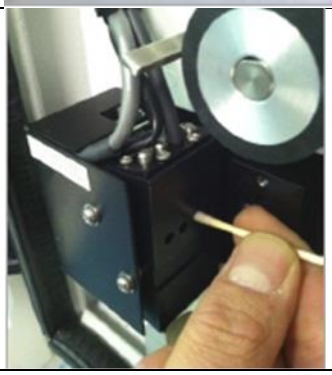
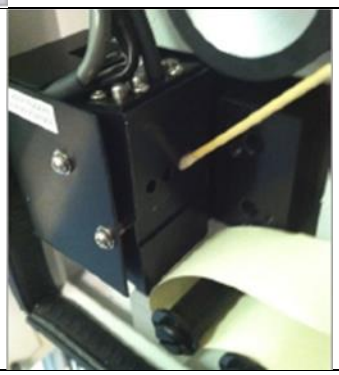
*NOTE: The System Fault relay is energized at all times except when a fault is detected. The alarm fault relays are configured for energized or de-energized on the Setup Menu.

**NOTE: If "Positive Pressure Sample Option" is installed, pins L, M, and P can be used to control a valve that will activate whenever the pump is not powered.


CL1WIRINGDIAGRAM.dwg
06/16/15 REV C
DRIVE MOTOR
FRONT PANEL
REAR PANEL
OPTION
LIGHT OPTION SCHEMATIC
ADDED BLUE LIGHT 06/12/15
2-600-203
FEMALE CONN
MALE CONN
25 PIN
ANALOG GND-3
5VDC-2
RS485 B -5
RS485 A -4
N/C - 1
FLOW TRANSDUCER
4-OUT
3-GND
2-5VDC
FUSE 5X20
AC LINE IN

Appendix G – CL1 Inlet Manifold Cleaning Procedure

1. Press F1 to exit analysis	
2. Scroll to “Gate and Tape” and press enter	
3. Press “Open Gate”	
4. Power the CL1 Off	
5. Remove the 2 optic block cover screws	
6. Remove the 2 optic block screws under the recently removed optic block cover plate	
7. Remove the black tygon tube from the barbed fitting on the back side of the manifold	
8. Unscrew the barbed fitting	
9. Unscrew the 2 manifold mounting screws	
10. You should now be able to remove the manifold and optic block carefully a. The optic block is held in using alignment pins that will take some maneuvering to get out. b. The optic block has small wires connected, be careful not to strain these connections.	
11. There is an O-ring in place below the manifold that should be put back in place after the cleaning is complete	

12. The manifold should now be cleaned from all angels using alcohol and cotton swabs	
13. Also clean the optics block with a cotton swab and alcohol	 
14. After the cleaning is complete, replace the optics block and manifold back into the CL1 and secure it using the screws removed in previous steps.	
15. Power the unit on	