



**IP-CO**  
**Rain-tight Input Plug**  
(Used to mark start and stop)

**Table of Contents**

1 Introduction..... 1

1.1 Terminal Assignments ..... 2

1.2 Using The Rubber Boot Cover ..... 3

1.3 Software Requirements ..... 4

1.4 Interfacing One Pump ..... 4

1.5 Interfacing Two Pumps and Level ..... 7

1.6 Entering the IP-CO into the Library ..... 14

1.7 R-XP External Plug Assembly and IP-CO ..... 15

1.8 Specifications ..... 16



## 1 Introduction

The IP-CO is a unique input plug with screw terminals to allow easy hookup of a contact closure to mark the start and stop times of an electrical device. The other end has a connector that will connect to an R-XP External Plug Assembly. This allows easy connection to many Lakewood Systems products such as the R-X Data Storage Unit, Auto Chart, Chart Pac, DR-X Depth Recorder, to name a few. The screw terminals are also protected from the environment by use of a Rubber Boot Cover. With the use of advanced electronics, the IP-CO converts and filters the contact closure. The IP-CO outputs a short pulse when the contact closes and when the contact opens. The two outputs on the IP-CO are meant to be connected to the parallels on the data logger. In exception mode, the data logger will mark the start and stop time when the parallels are taken to ground. This may be used for pump runtime and flow monitoring. The IP-CO features switch debouncing, low power consumption, wide operating temperature range and sensor excitation. This makes the IP-CO perfect for interfacing to relays and other dry contact devices.

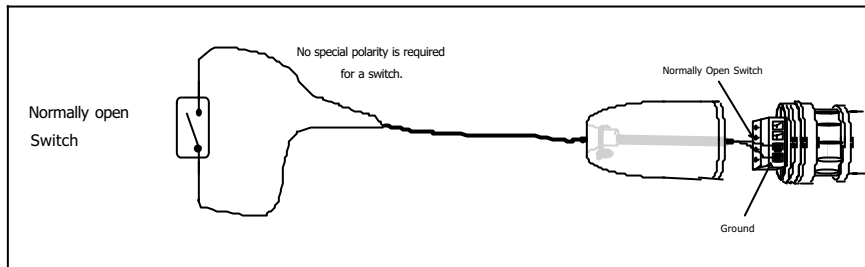


Fig. 1 Contact Closure Connections

## 1.1 Terminal Assignments

The four screw terminals are used to connect the sensor. If the sensor does not need excitation power, only two of the terminals are used. The first screw terminal (1) is common ground. The second screw terminal (2) is a switch contact input. The IP-CO is connected to a normally open switch contact and the RX-P is wired to two parallel inputs on the data logger. The third screw terminal (3) is not internally connected. The fourth screw terminal (4) is a B+ continuous output. The power is on continuously. The voltage level of the B+ terminal depends on the battery system being used with the data logger. Fig. 2 shows the position of the screw terminals.

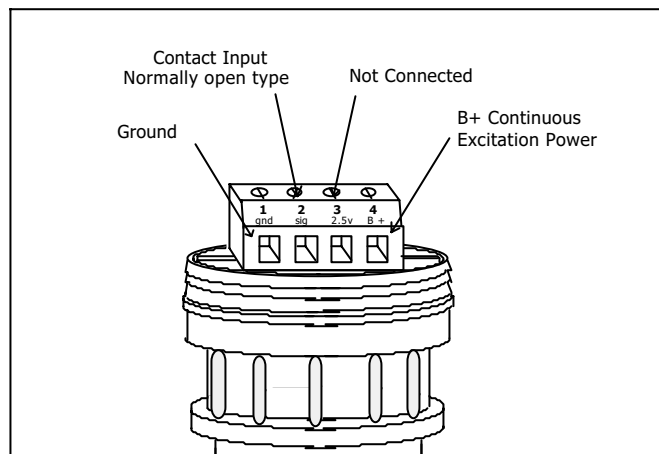


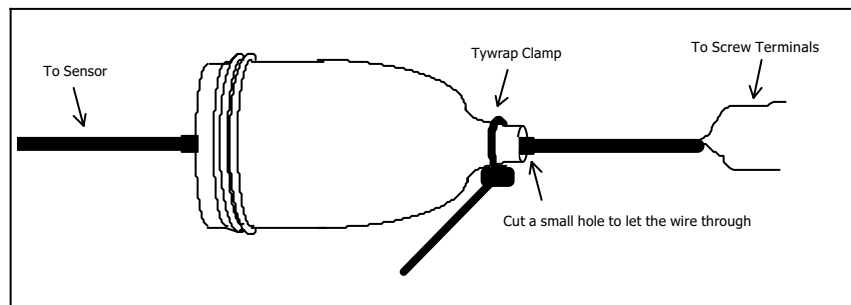
Fig. 2 IP-CO Terminal assignment.

Make sure the screw terminal is fully open before inserting the wire. A small tug on the wire after tightening can assure the wire is secure.

## 1.2 Using The Rubber Boot Cover

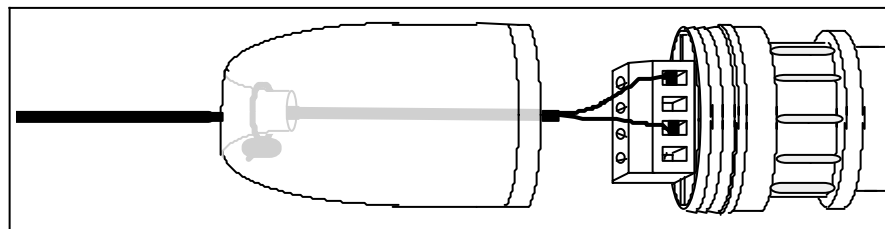
The rubber boot cover can be used to keep the screw terminals protected from the environment. To use the cover, turn it inside out as shown in Fig. 3 and make a small hole to let the wire through. By using a tywrap you can then clamp the wire at the position you desire.

Fig. 3 Preparing the Rubber Boot Cover.



Once you have screwed the wires down and returned the rubber boot cover from the inside out position you can slip it over the screw terminals as shown in Fig. 4 below.

Fig. 4 Final Mounting of the Rubber Boot Cover.



### **1.3 Software Requirements**

The IP-CO requires a special data logger's programming header. The header for the IP-CO has more than one exception source, thus it cannot be edited in the LE8200 or LS-4 software. To create the header you can use the DOS editor EDLIN (if DOS 5 or DOS 6 use EDIT).

## 1.4 Interfacing One Pump

An example header is shown in Fig. 5. Fig. 6 explains the settings that the header uses. The header has parallel one connected to the IP-CO plug's start pulse output (pin 2 on the RX-P connector). Parallel two is connected to the stop pulse output (pin 3 on the RX-P connector). This header will record the time within a second of when the contacts connected to the input closes and opens. The contacts are connected between the first screw terminal (1 - ground) and the second screw terminal (2 - Contact input). Just type in the lines as shown to create the header. There should be 49 lines of numbers in the header file. After entering the numbers using an editor, save the header as ONEPUMP.DAT to disk under the LE8200 or LS-4 DAT subdirectory.

This header can be modified to handle two pumps by increasing Line 7 to be 15 instead of 3.



*IP-CO RAIN-TIGHT INPUT PLUG*

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0 0
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Fig. 5 ONEPUMP.DAT Header

**IP-CO RAIN-TIGHT INPUT PLUG**

HEADER PROGRAMMING SHEET (For Datalogger Configuration)			
ONEPUMP.DAT header programming			
1.48..	FUNCTION:	TIMED RECORDING	[+ 0]
		ANALOGS	[+ 1]
		ACCUMULATORS	[+ 2]
		STROBE	[+ 4]
		STROBE ACCUMULATOR	[+ 8]
		<b>PARALLEL</b>	<b>[+ 16]</b>
		<b>EXCEPTION</b>	<b>[+ 32]</b>
		SNAPSHOT	[+ 64]
		STOP ON MEM/FULL	[+ 128]
2.0..	START MODE:	<b>IMMEDIATE</b>	<b>[+ 0]</b>
		DELAYED	[+ 1]
3.0..	HOURS SAMPLE RATE	[0-23]	
4.0..	MINUTES SAMPLE RATE	[0-59]	
5.0..	SECONDS SAMPLE RATE	[0-59]	
6.2..	EXCEPTION SOURCE	ANALOG	[+ 1]
		<b>PARALLEL</b>	<b>[+ 2]</b>
		STROBE	[+ 4]
		MINIMUM	[+ 8]
		MAXIMUM	[+ 16]
		AVERAGE	[+ 32]
7.3..	EXCEPTION CHANNELS (Analog or Parallels)		
		<b>CH1</b> [+ 1] <b>CH2</b> [+ 2]	
		CH3 [+ 4]      CH4 [+ 8]	
		CH5 [+ 16]      CH6 [+ 32]	
		CH7 [+ 64]      CH8 [+ 128]	
8.0..	ANALOG FORMAT	> MODE	[+ 0]
		< MODE	[+ 1]
		TRACKING WINDOW	[+ 2]
		FIXED WINDOW	[+ 3]
		(Choose only one of the above)	
	(Total delay equals sum plus default of 35ms)	25ms DELAY	[+ 8]
		50ms DELAY	[+ 16]
		100ms DELAY	[+ 32]
		200ms DELAY	[+ 64]
		400ms DELAY	[+ 4]
		DOUBLE PRECISION	[+ 128]
9.0..	ANALOG EXCEPT VALUE	POSITION OR CENTER OF WINDOW	[0- 127]
10.0..	ANALOG EXCEPT WINDOW SIZE		[0- 127]
11.0..	5 VOLT RANGE(Otherwise 2.5 VOLTS RANGE)		
	ANALOG1 [+ 1]	ANALOG2 [+ 2]	
	ANALOG3 [+ 4]	ANALOG4 [+ 8]	
	ANALOG5 [+ 16]	ANALOG6 [+ 32]	
	ANALOG7 [+ 64]	ANALOG8 [+ 128]	
12.0..	ANALOG CHANNELS ENABLED (ACTIVATED)		
	ANALOG1 [+ 1]	ANALOG2 [+ 2]	
	ANALOG3 [+ 4]	ANALOG4 [+ 8]	
	ANALOG5 [+ 16]	ANALOG6 [+ 32]	
	ANALOG7 [+ 64]	ANALOG8 [+ 128]	
13.0..	ACCUMULATORS ENABLED(ACTIVATED)		
	ACCUMULATOR1 [+ 1]	ACCUMULATOR2 [+ 2]	
	ACCUMULATOR3 [+ 4]	ACCUMULATOR4 [+ 8]	
	ACCUMULATOR5 [+ 16]	ACCUMULATOR6 [+ 32]	
	ACCUMULATOR7 [+ 64]	ACCUMULATOR8 [+ 128]	
14.0..	PARALLEL MODE:	<b>EXCEPTION INTERRUPT</b>	<b>[+ 0]</b>
		NO INTERRUPT SAMPLING	[+ 1]
		CONTINUOUS POWER FEED	[+ 2]
		OVERFLOW ENABLE	[+ 4]
		COMPLEMENT DATA	[+ 8]
15.0..	MULTIPLEXOR MODE:	<b>NO</b>	<b>[+ 0]</b>
		YES	[+ 32]
16.0..	RESERVED	-LEAVE AT ZERO-	
17.0..	<b>TO 48.0..</b>		

Fig. 6 ONEPUMP.DAT Header Programming Sheet

## **1.5 Interfacing Two Pumps and Level**

A example header is shown in Fig. 7. This header will record the time within a second of when the contacts connected to the two IP-COs close and open. Analog one is also enabled in a tracking window exception record mode. Analog one would be connected to a sonic level transmitter that outputs a 4-20 ma signal proportional to the level in the well. Just type in the lines as shown to create the header. There should be 49 lines of numbers in the header file. After entering the numbers using an editor, save the header as PUMPWELL.DAT to disk under the LE8200 or LS-4 DAT subdirectory. Fig. 8 explains the settings that the header uses.



*IP-CO RAIN-TIGHT INPUT PLUG*

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0 0
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Fig. 7 PUMPWELL.DAT Header

**IP-CO RAIN-TIGHT INPUT PLUG**

<b>HEADER PROGRAMMING SHEET</b> (For Datalogger Configuration)			
PUMPWELL.DAT header programming			
1.49..	FUNCTION:	TIMED RECORDING	[+ 0]
		<b>ANALOGS</b>	[+ 1]
		ACCUMULATORS	[+ 2]
		STROBE	[+ 4]
		STROBE ACCUMULATOR	[+ 8]
		<b>PARALLEL</b>	[+ 16]
		<b>EXCEPTION</b>	[+ 32]
		SNAPSHOT	[+ 64]
		STOP ON MEM/FULL	[+ 128]
2.0..	START MODE:	<b>IMMEDIATE</b>	[+ 0]
		DELAYED	[+ 1]
3.0..	HOURS SAMPLE RATE	[0-23]	
4.0..	MINUTES SAMPLE RATE	[0-59]	
5.30..	<b>SECONDS SAMPLE RATE</b>	[0-59]	
6.3..	EXCEPTION SOURCE	<b>ANALOG</b>	[+ 1]
		<b>PARALLEL</b>	[+ 2]
		STROBE	[+ 4]
		MINIMUM	[+ 8]
		MAXIMUM	[+ 16]
		AVERAGE	[+ 32]
7.15..	EXCEPTION CHANNELS (Analog or Parallels)		
		<b>CH1</b> [+ 1] <b>CH2</b> [+ 2]	
		<b>CH3</b> [+ 4] <b>CH4</b> [+ 8]	
		CH5 [+ 16]      CH6 [+ 32]	
		CH7 [+ 64]      CH8 [+ 128]	
8.130..	ANALOG FORMAT	> MODE	[+ 0]
		< MODE	[+ 1]
		<b>TRACKING WINDOW</b>	[+ 2]
		FIXED WINDOW	[+ 3]
		(Choose only one of the above)	
	(Total delay equals sum plus default of 35ms)	25ms DELAY	[+ 8]
		50ms DELAY	[+ 16]
		100ms DELAY	[+ 32]
		200ms DELAY	[+ 64]
		400ms DELAY	[+ 4]
		<b>DOUBLE PRECISION</b>	[+ 128]
9.0..	ANALOG EXCEPT VALUE	POSITION OR CENTER OF WINDOW	[0 - 127]
10.10..	<b>ANALOG EXCEPT WINDOW SIZE</b>	[0 - 127]	
11.0..	5 VOLT RANGE(Otherwise 2.5 VOLTS RANGE)		
	ANALOG1	[+ 1]	ANALOG2 [+ 2]
	ANALOG3	[+ 4]	ANALOG4 [+ 8]
	ANALOG5	[+ 16]	ANALOG6 [+ 32]
	ANALOG7	[+ 64]	ANALOG8 [+ 128]
12.1..	ANALOG CHANNELS ENABLED (ACTIVATED)		
	<b>ANALOG1</b>	[+ 1]	ANALOG2 [+ 2]
	ANALOG3	[+ 4]	ANALOG4 [+ 8]
	ANALOG5	[+ 16]	ANALOG6 [+ 32]
	ANALOG7	[+ 64]	ANALOG8 [+ 128]
13.0..	ACCUMULATORS ENABLED(ACTIVATED)		
	ACCUMULATOR1	[+ 1]	ACCUMULATOR2 [+ 2]
	ACCUMULATOR3	[+ 4]	ACCUMULATOR4 [+ 8]
	ACCUMULATOR5	[+ 16]	ACCUMULATOR6 [+ 32]
	ACCUMULATOR7	[+ 64]	ACCUMULATOR8 [+ 128]
14.0..	PARALLEL MODE:	<b>EXCEPTION INTERRUPT</b>	[+ 0]
		NO INTERRUPT SAMPLING	[+ 1]
		CONTINUOUS POWER FEED	[+ 2]
		OVERFLOW ENABLE	[+ 4]
		COMPLEMENT DATA	[+ 8]
15.0..	MULTIPLEXOR MODE:	<b>NO</b>	[+ 0]
		YES	[+ 32]
16.0..	RESERVED	-LEAVE AT ZERO-	
17.0..	<b>TO 48.0..</b>		

*IP-CO RAIN-TIGHT INPUT PLUG*

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Fig. 8 PUMPWELL.DAT Header Programming Sheet

The header assumes that there are two IP-CO plugs connected to the parallels. The interfacing of the IP-CO plugs is illustrated in Fig. 9. The IP-CO and the pump controller aux. relay contacts are connected as well. The aux. relay contacts are connected between the first screw terminal (1 - ground) and the second screw terminal (2 - Contact input). These contacts on the aux. relay should be isolated (not connected to any other device) and closed when the pump is running.

Parallel	IP-CO Plug	R-XP External Plug Pin	Wire Color	Function
One	First	Pin 2	Green	Pump 1 Start Pulse
Two	First	Pin 3	White	Pump 1 Stop Pulse
Three	Second	Pin 2	Green	Pump 2 Start Pulse
Four	Second	Pin 3	White	Pump 2 Stop Pulse

Fig. 9 Hook-Up of IP-CO

An IP-420F would be used to interface the 420ma level signal to Analog one. Fig. 10 is the same front panel with the IP-420F connections shown. Notice that Analog one must be connected to Analog two, Analog three and Analog four.

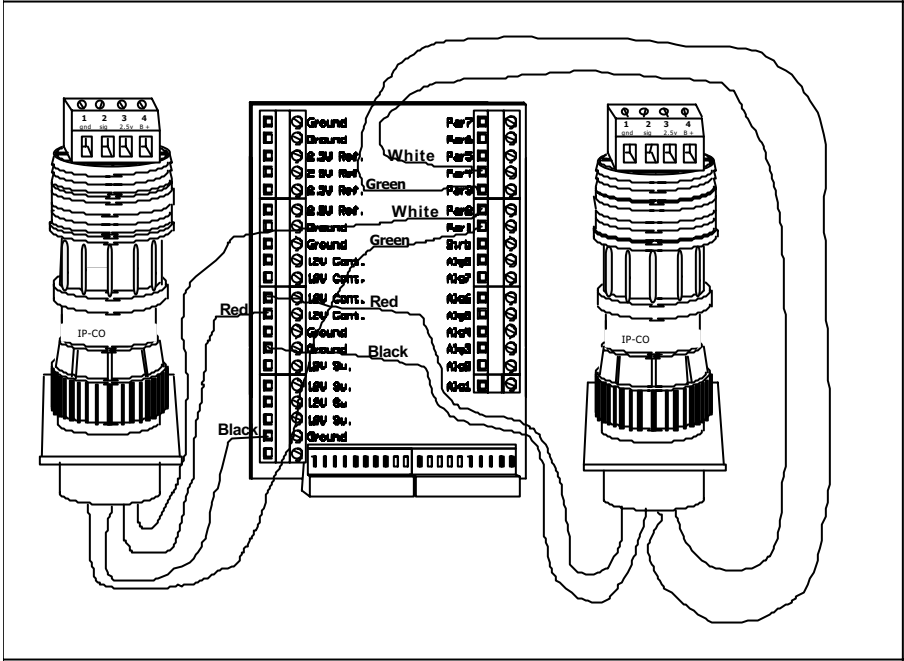




Fig. 10 Hook-Up of IP-420F

There is only one location where we can select which channels can cause an exception. This location is shared between the parallels and analogs. Since we need channel one, channel two, channel three and channel four for the parallels, the analogs are affected equally. With tracking window enabled the analogs are compared to a window position value plus or minus half of the window size value. If they are higher or lower than the Window position value +/- half the window size value a reading is stored into memory. There is only one window position value and only one window size value. If Analog two, Analog three, Analog four were not the same as Analog one the window could be moved and a recording taken every time it was checked. By tying Analog one to Analog two, Analog three and Analog four the window is only compared to the value of Analog one multiple times.

The window size sets the amount the level can change before triggering an exception. The formula for calculating the window size value is shown below:

$$((\text{window size}/127) * \text{input range})/2 = \text{level change}$$

If 4.0 mA from our sonic unit equals zero meters of level and 20 mA equals three meters of level our input range would be three meters. If we use the example value of ten, our window size in level would be:

$$((10/127) * 3)/2 = .24/2 \text{ or } +0.12 \text{ meters or } -0.12 \text{ meters}$$

### *IP-CO RAIN-TIGHT INPUT PLUG*

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If the level changed more than +/- 0.12 meters in 30 seconds an exception would be generated and a recording would be taken. After the recording is stored the window is recentered around the new value.

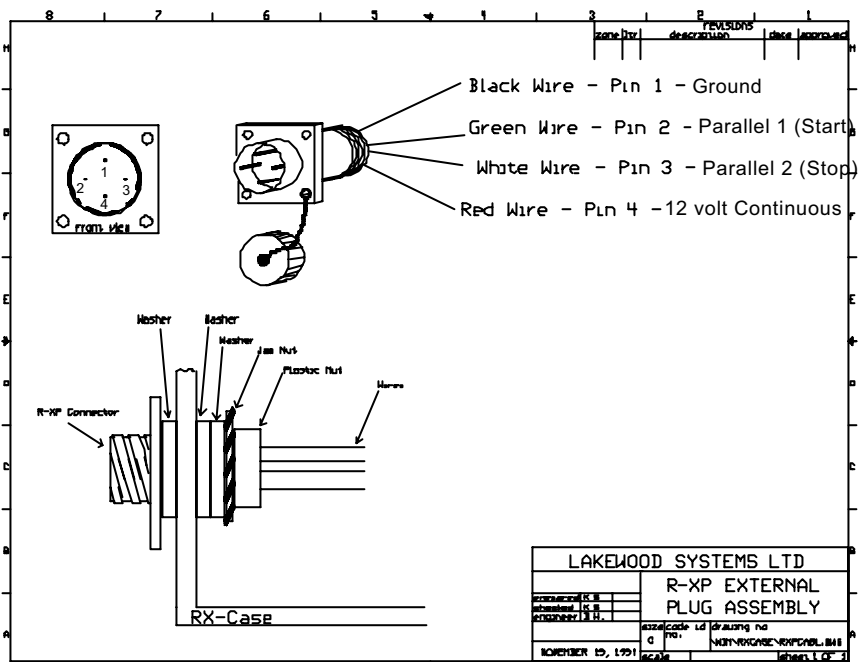
The example header compares Analog one every 30 seconds. This rate could be changed for your specific needs. Running the logger at 30 seconds requires an external power source or adapter.

## **1.6 Entering the IP-CO into the Library**

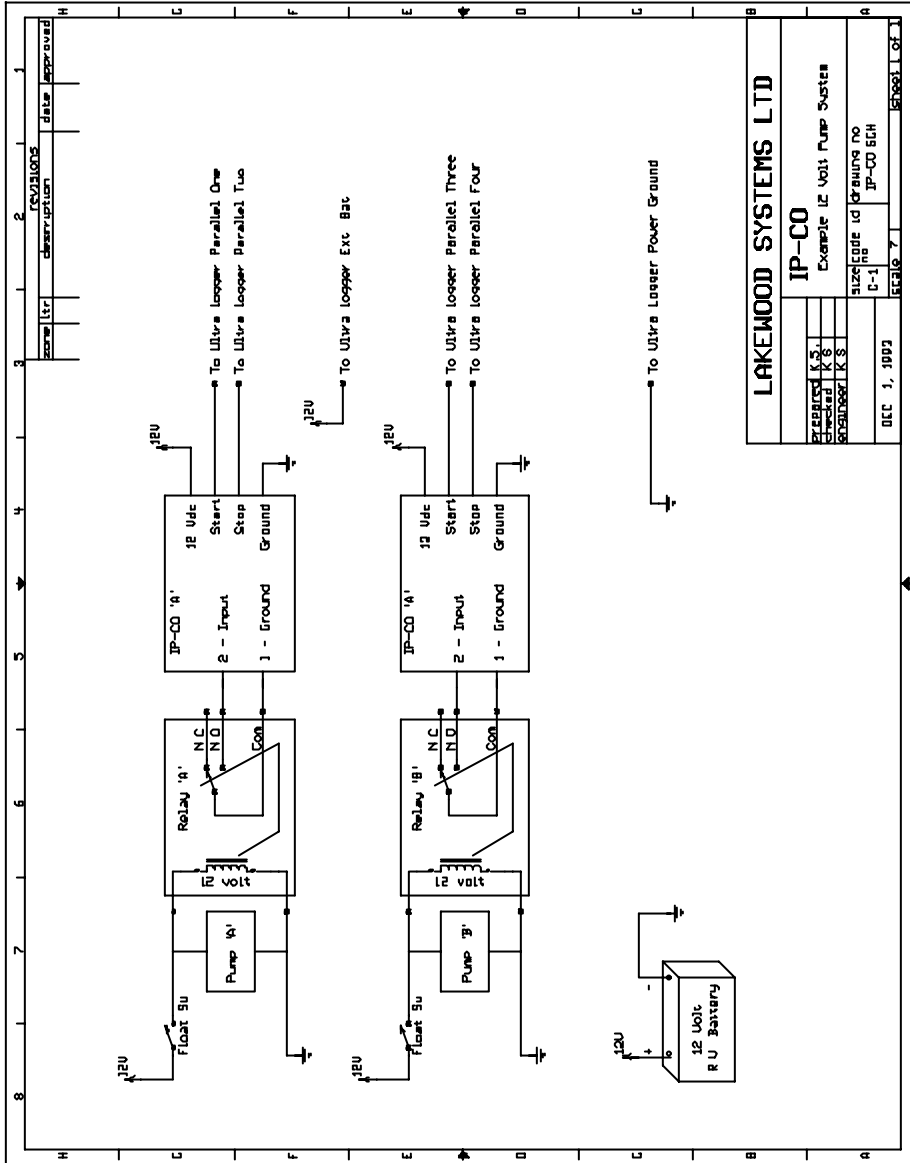
The IP-CO is usually connected to the data logger's parallels and does not use the library. Any analog sensors that are connected to activated analog channels may be added to library. These activated analog channels on the data logger will be recorded when the contact closes and opens. An analog exception can also be added to the header to record the analogs when the parallels are inactive (Example: Record the analogs every five minutes or when they have changed more that a predetermined amount).

### 1.7 R-XP External Plug Assembly and IP-CO

The IP-CO can be wired to an *Ultra-Logger* directly through the UL16-TB Terminal Board by using an R-XP External Plug Assembly. The wiring and mounting information is shown in Fig. 11.



1.8 Example 12 Volt System



## **1.9 Specifications**

Parameter	Min.	Typical	Max.	Units
Debounce Delay	.80	1.4	1.5	Seconds
Input Range	0.0	contact	5	Volts
Output Voltage	0.0		5	Volts
Pin 4 Continuous power	9	12	18	Volts
Operating Temperature	-40	25	65	°C
Current Consumption(Input-open)	35	55	70	μA
Current Consumption(Input-ground)	1.4	1.5	1.6	mA