LAKEWOOD SYSTEMS LTD.
Remote Data Recording Products

IP-UDB
Rain-tight Input Plug
(Up- Down Buffer for incremental)

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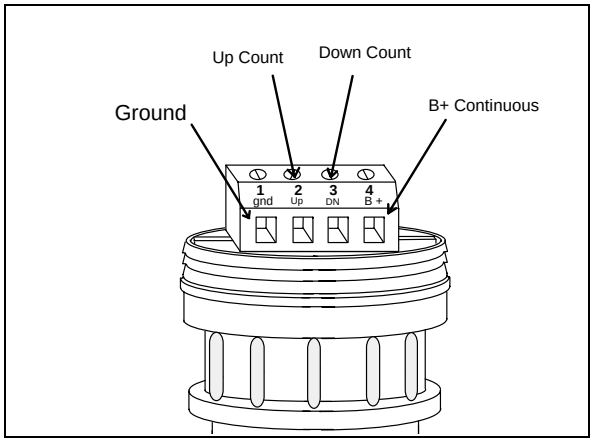
1 Introduction

The IP-UDB is a unique input plug with screw terminals to allow easy hookup to the Acro SA101 shaft encoder. 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 SA101 shaft encoder can be interfaced to Lakewood Systems dataloggers using the IP-UDB Up-Down buffer. The IP-UDB buffers the 1000uS pulse output of the SA101 encoder so that it can be recorded by the dataloggers strobe input. The SA101 is powered continuously and has a 1.4 mA current draw. The SA101 has a jumper selectable range of 50, 100, 150 and 300 counts per revolution. When used to measure water level using a Lakewood systems FS-FPK float-pulley kit the SA101 has a maximum range of 100 feet. This has been determined by the weight of the pulley and beaded cable on the encoder shaft. The IP-UDB offers low power consumption, wide operating temperature range and sensor excitation.

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 the UP count from the SA101 encoder. The next two screw terminals (3,4) offer excitation for the sensor. The third screw terminal (3) is a precision 2.500 volt excitation output. This output has minimal drive capability (5 milliamperes maximum). The power is pulsed on for a short duration then turned off. The length of the on time power pulse can be set when programming the Data Logger's header. The fourth screw terminal (4) is a B+ switched output. The voltage level of the B+ terminal depends on the battery system being used with the Data Logger. The on-time is the same as that for the 2.500V precision excitation output. Fig. 1 shows the position of the screw terminals.

Fig. 1 IP-UDB 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. 2 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.

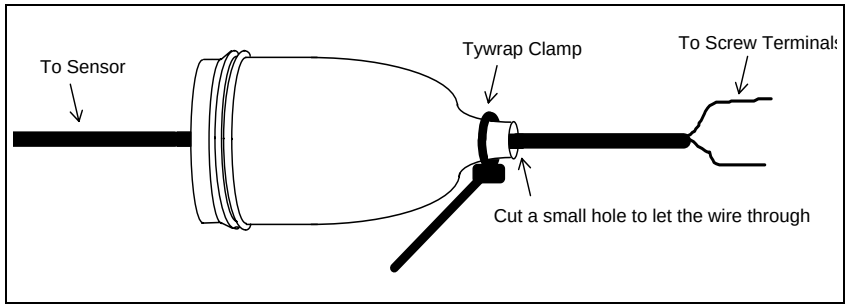


Fig. 2 Preparing the Rubber Boot Cover.

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. 3 below.

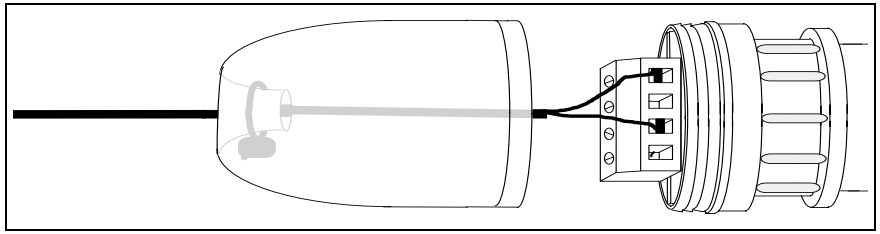


Fig. 3 Final Mounting of the Rubber Boot Cover.

1.3 Software Requirements

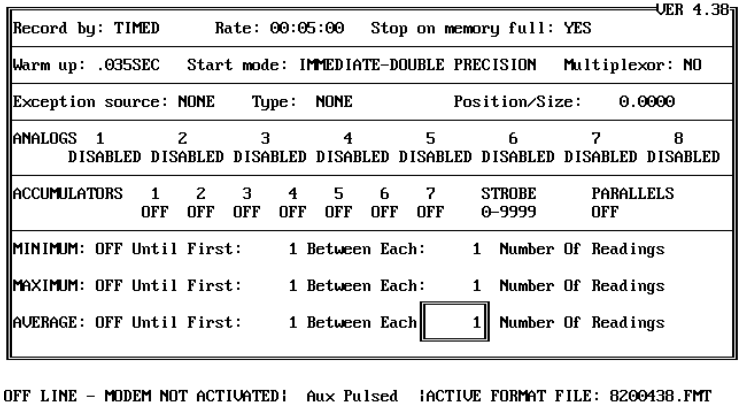
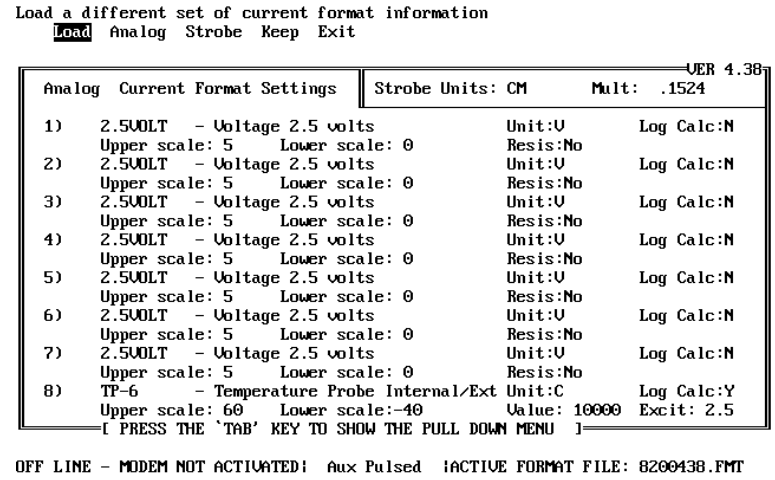


Fig. 4 Example Header Settings

When using the IP-UDB the strobe has to be enabled in the program modify screen. When using the SA101 shaft encoder the strobe should be set to 0 to 9999. The sample rate can then be adjusted to record the strobe at a specifed interval.

1.4 Strobe Preset

The strobe accumulator can be preset to a specified value in the datalogger software by selecting preset in the program menu. Preset can be used to change the strobe accumulator value into engineering units when used with a multiplier in the format file. The multiplier in the following example is 0.1524. This will convert the strobe readings from the SA101-300 encoder into CM when using the Lakewood Systems 45.72 cm diameter pulley. When the SA101 encoder is set to 300 counts per revolution the incremental change in water level per count is 300/45.72 = 0.1524.



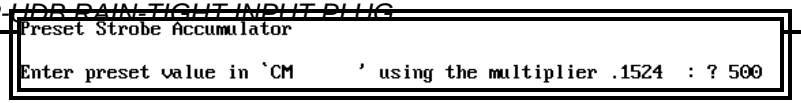
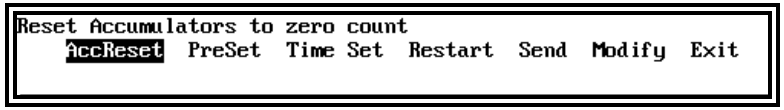


Fig. 5 Example Library Curve Fitting for an IP-UDB.



The IP-UDB's description and other parameters can also be entered as shown in Fig. 6.

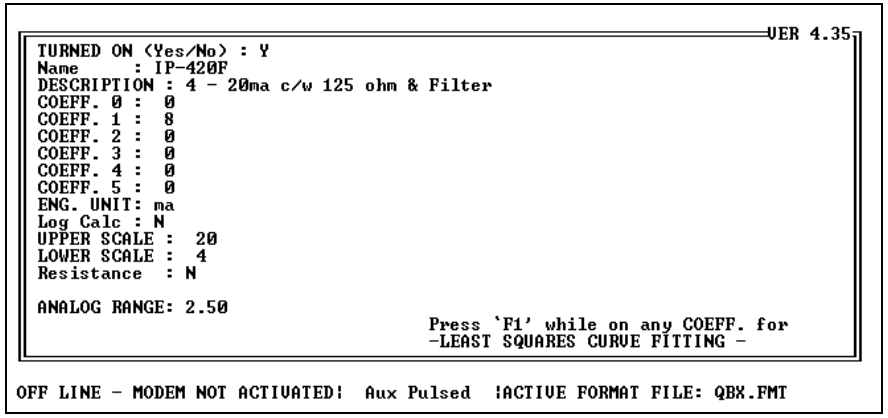


Fig. 6 Library Parameters for an IP-UDB.

1.5 Entering the IP-UDB with Eng. Units.

The IP-UDB converts the 4 to 20 mA sensor's output signal into 0.5 to 2.5 Volts. The 4 - 20 mA output the sensor generates is proportional to some type of engineering units. For example a 5 P.S.I. (pounds/inch$^{2)}$ probe can generate a 4 mA signal for 0 P.S.I. and 20 mA for a 5 P.S.I. signal. We may want to also further convert the pressure into depth of fluid (approximately 27.73 inches of water @20°C = 1 P.S.I.). The following table in Fig. 7 represents a fictitious sensor that we will use for the example library entries.

mA output	Voltage	P.S.I.	Inches H_2O
4.0	0.5	0.0	0.0
12.0	1.5	2.5	69.325
20.0	2.5	5.0	138.65

Fig. 7 Example sensor's output.

From the table we can see that the sensor ranges from 0" to 138.65" for a 4 to 20 mA output. This can be entered directly into the Library. By using many values that are actually measured over the sensor's range, it is possible to generate a more accurate curve fit. This can be done by connecting the sensor to the IP-UDB Input Plug that is connected to a datalogger. Program the analog channel connected to the IP-UDB to read in volts. Monitor the voltage in the Monitor screen while the sensor is at zero engineering units. Slowly increase the sensor's output and record the Monitor screen voltage value along with the sensor's current engineering unit (what the senor is measuring). These values should be evenly spaced from 0% to 100% of the sensors span. After you have recorded 2 to 60 points they can be entered into the library.

Our library entries would then be as shown in Fig. 8 for the example sensor.

```
 -LEAST SQUARES CURVE FITTING -

ENTER A DATA PAIR IN RESPONSE TO EACH QUESTION MARK.
EACH PAIR IS A DATALOGGER VALUE AND AN ENGINEERING UNIT
VALUE SEPARATED BY A COMMA. THIS WILL ALLOW YOU TO
ENTER THE EXPECTED OUTPUTS AT DIFFERENT VOLTAGES.

WHEN YOU HAVE ENTERED ENOUGH POINTS TYPE  999 , 999 TO END.
MAXIMUM OF 60 DATA PAIRS WILL BE ACCEPTED.

Voltage,Units? .5,0
Voltage,Units? 1.5,69.325
Voltage,Units? 2.5,138.65
Voltage,Units? 999,999

 3 DATA PAIRS ENTERED

DEGREE OF POLYNOMIAL TO BE FITTED ? 2


X POWER          COEFFICIENT
   0          -34.6624999999997
   1           69.3249999999995
   2           1.49380507963314D-13
Accuracy of Curve Fit = 100

CONTINUATION OPTIONS
  1 - DETERMINE SPECIFIC POINTS
  2 - FIT ANOTHER DEGREE TO THE SAME DATA
  3 - SAVE COEFFICIENTS TO DISK FOR LOTUS
  4 - SAVE DATA PAIRS TO DISK FOR LOTUS
  5 - LIST TABLE OF CALC. Y POINTS
  6 - EXIT AND USE THE COEFFICIENTS FOR THE PROBE BEING EDITED
  7 - EXIT AND DISCARD THE FITTED COEFFICIENTS
WHAT NEXT? 6
```

Fig. 8 Example Library Curve Fitting for a Sensor

The Sensor's description and other parameters can also be entered as shown in Fig. 9.

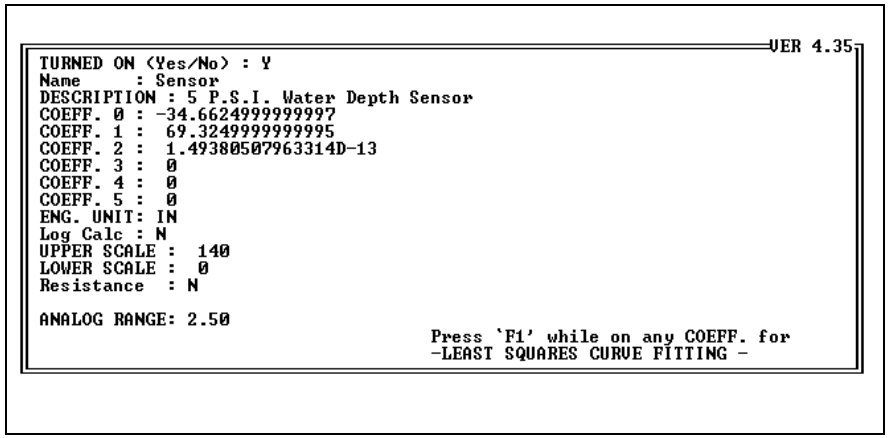
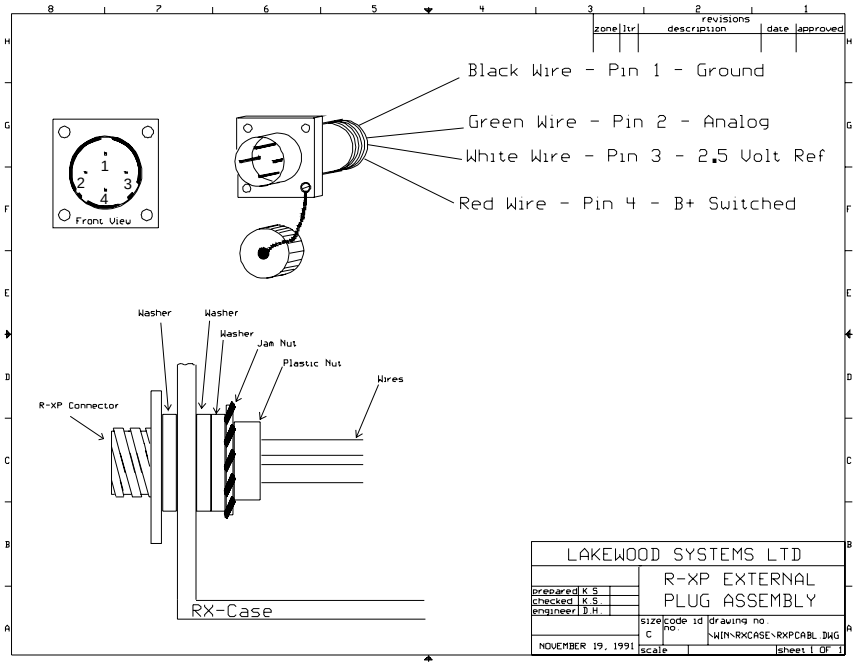


Fig. 9 Library Parameters for an Example Sensor.

1.6 R-XP External Plug Assembly and IP-UDB

The IP-UDB 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. 10 .

Fig. 10 R-XP Wiring and Mounting Information



1.7 Wiring an IP-UDB to an Pressure Sensor.

The IP-UDB can be wired to a large assortment of sensors. The wiring to a typical water depth sensor is shown in Fig. 11.

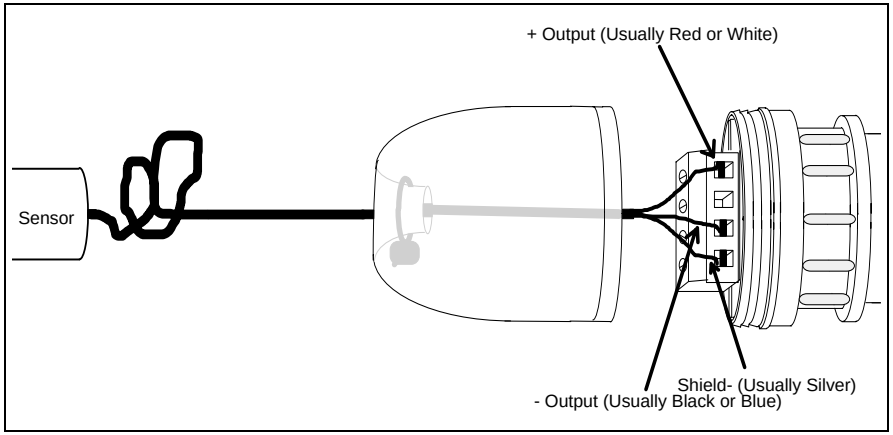


Fig. 11 Water Depth Probe Connections.

1.8 Wiring an IP-UDB to an Transmitter.

The IP-UDB can be wired to a large assortment of Transmitters. The wiring to a typical pH Transmiter is shown in Fig. 12.

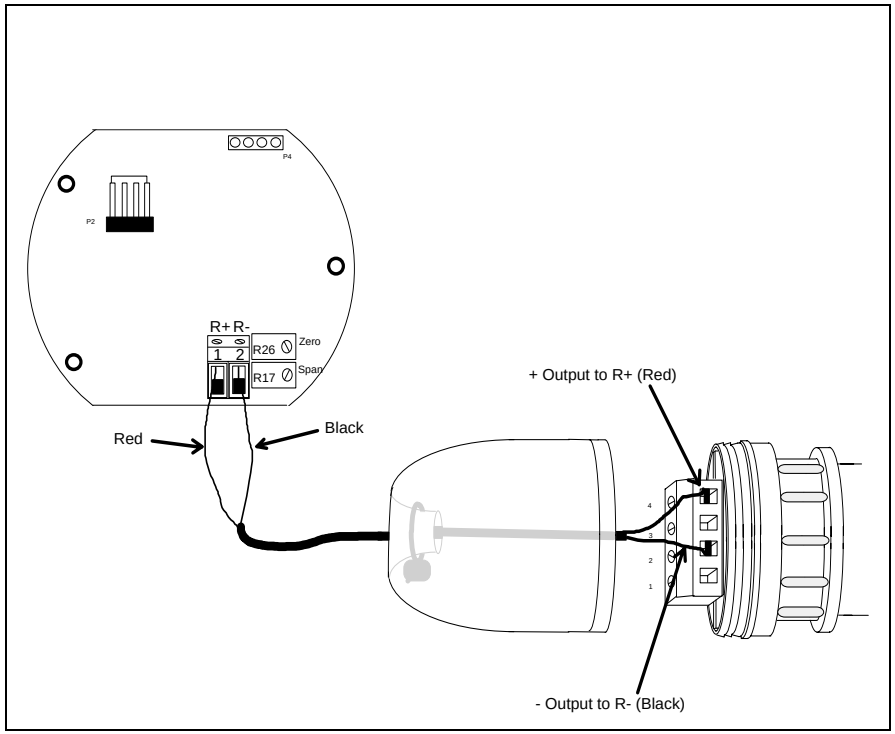


Fig. 12 SIGNET Transmitter connections.

1.9 Specifications

Parameter	Min.	Typical	Max.	Units
Input Range	0.0	4.0	20.0	mA
Output Voltage	0.0	0.5	2.5	Volts
Input Resistance	124.875	125	125.125	Ohms
Operating Temperature	-40	25	65	°C
Turn On Delay	330	410	∞	ms

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