IP-24VBMA
Rain-tight Input Plug
(4-20 mA Input range with filter and 24 Volt Excitation Boost)

Table of Contents

1 Introduction

The IP-24VBMA is a unique input plug with screw terminals to allow easy hookup of 4-20 mA transmitters and sensors. The voltage boost section of the IP-24VBMA converts the excitation voltage upto 24 Volts. This allows a 12 volt battery to supply 24Volts to the sensor/transmitter. 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-24VBMA converts and filters a 4-20 mA input into a 0.5 to 2.5 volt output. The IP-24VBMA features a quick response time (<410 milliseconds), low power consumption, wide operating temperature range and 24 volt sensor excitation. This makes the IP-24VBMA perfect for interfacing to 4-20 mA sensors and other 4-20 mA transmitters.

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 an analog input that has a useful input range of 0 to 20 milliamperes. It has a 125W ±0.1% input impedance to eliminate loop voltage loss. 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 24 volt switched output. The voltage level of the 24 volt terminal does not depend on the battery system being used with the Data Logger. The 24 volts is generated even if the battery system may only be supplying 6 volts. The on-time is the same as that for the 2.500V precision excitation output. Fig. 1 shows the position of the screw terminals.

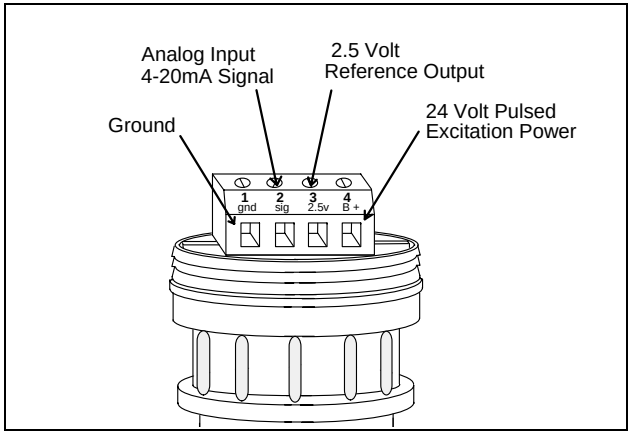


Fig. 1 IP-24VBMA Terminal assignment.

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.

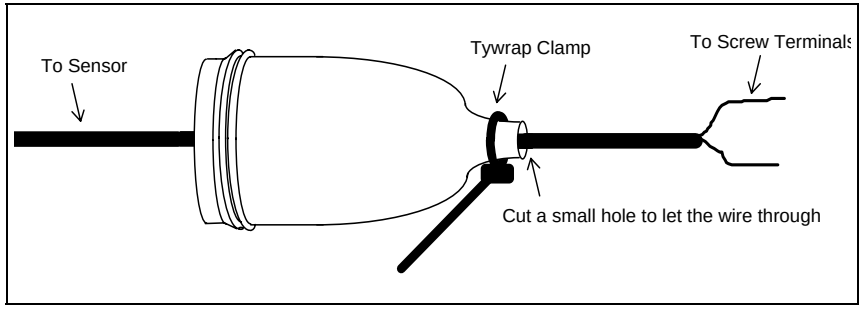


Fig. 2 Preparing the Rubber Boot Cover.

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.

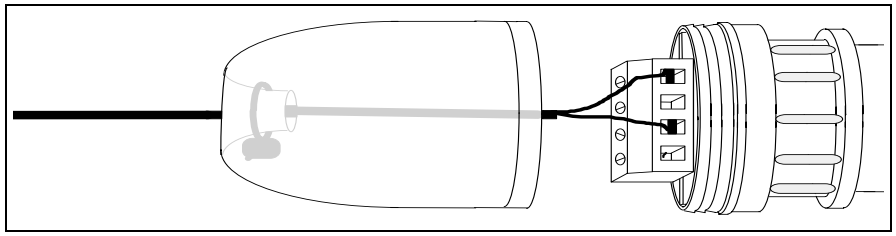
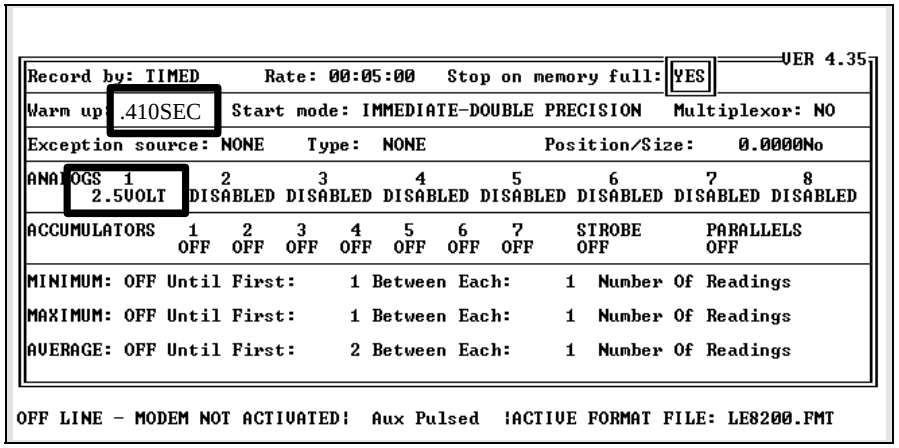


Fig. 3 Final Mounting of the Rubber Boot Cover.

1.3 Software Requirements

The IP-24VBMA has two settings in the Data Logger's programming header that must be correct. The first is warm-up time and the second is a 0 to 2.5 volt range setting. The following example in Fig. 4 would be used if the IP-24VBMA was connected to analog channel one and if the probe connected to the IP-24VBMA did not require a longer excitation warm-up time than 410 milliseconds. If the excitation warm-up time is too short, the probe's output will differ between AUX PULSED readings and AUX CONTINUOUS readings. AUX PULSED readings are monitor screen values taken when Aux power is being pulsed. AUX CONTINUOUS readings are monitor screen values taken when Aux power is turned on continuously. Keep increasing the warm-up time until the AUX PULSED readings and the AUX CONTINUOUS readings match.

Fig. 4 Example Header Settings



1.4 Entering the IP-24VBMA into the Library

The IP-24VBMA converts the 4 to 20 mA sensor's output signal into 0.5 to 2.5 Volts. The IP-24VBMA can be simply entered in the library as a milliamperes device or as a device whose engineering units that are proportional to the current that the sensor generates. The first example shows how you would enter the IP-24VBMA into the library as a milliamperes device. The IP-24VBMA converts 4 milliamperes into .5 Volts and 20 milliamperes into 2.5 Volts. Our library entries would be as shown below.

```
 -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? .5,4
Voltage,Units? 2.5,20
Voltage,Units? 999,999

 2 DATA PAIRS ENTERED

DEGREE OF POLYNOMIAL TO BE FITTED ? 1

X POWER          COEFFICIENT
   0           0
   1           8

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?
```

The IP-24VBMA's description and other parameters can also be entered as shown in Fig. 6.

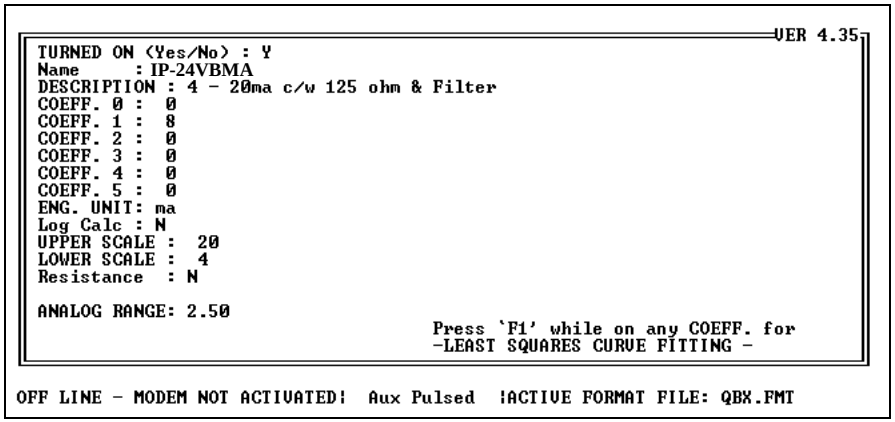


Fig. 6 Library Parameters for an IP-24VBMA.

1.5 Entering the IP-24VBMA with Eng. Units.

The IP-24VBMA 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 also want to 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-24VBMA Input Plug that is connected to a datalogger. Program the analog channel connected to the IP-24VBMA 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.

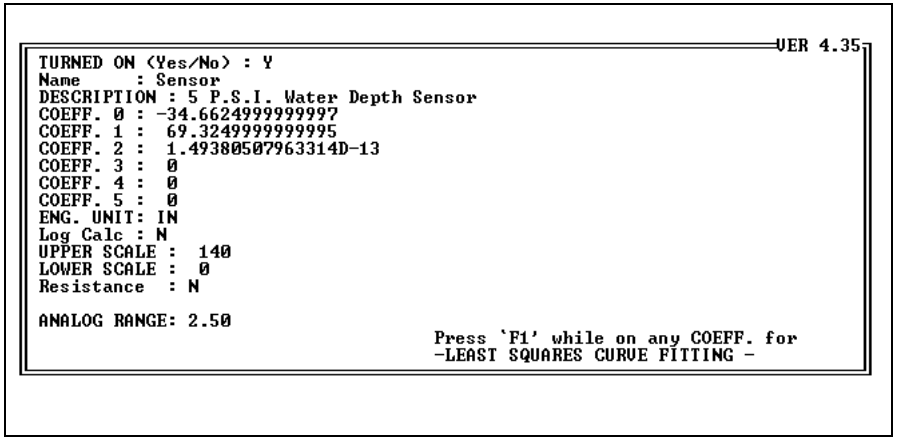


Fig. 9 Library Parameters for an Example Sensor.

1.6 R-XP External Plug Assembly and IP-24VBMA

The IP-24VBMA 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 .

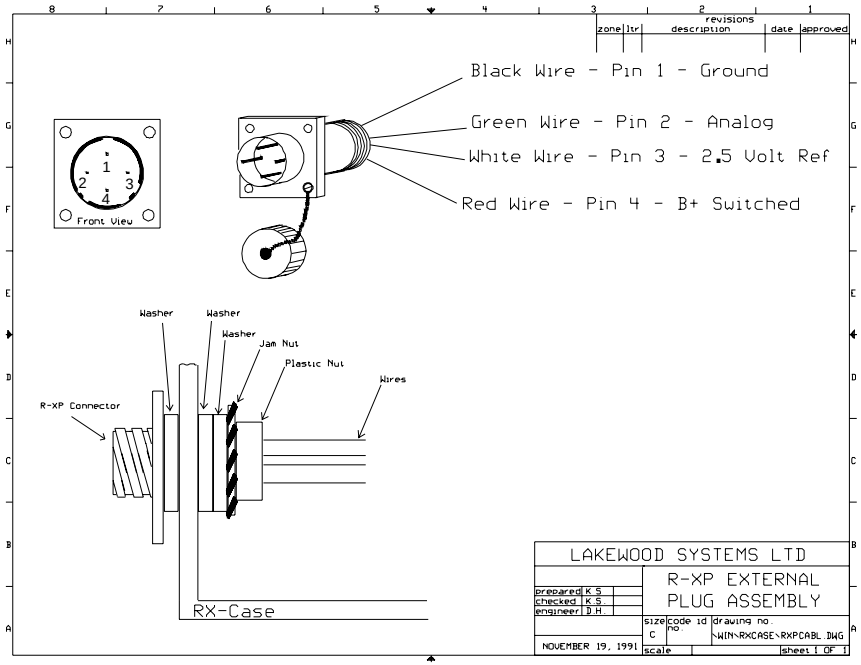


Fig. 10 R-XP Wiring and Mounting Information

1.7 Wiring an IP-24VBMA to a Pressure Sensor.

The IP-24VBMA can be wired to a large assortment of sensors. The wiring to a typical water depth sensor is shown in Fig. 11.

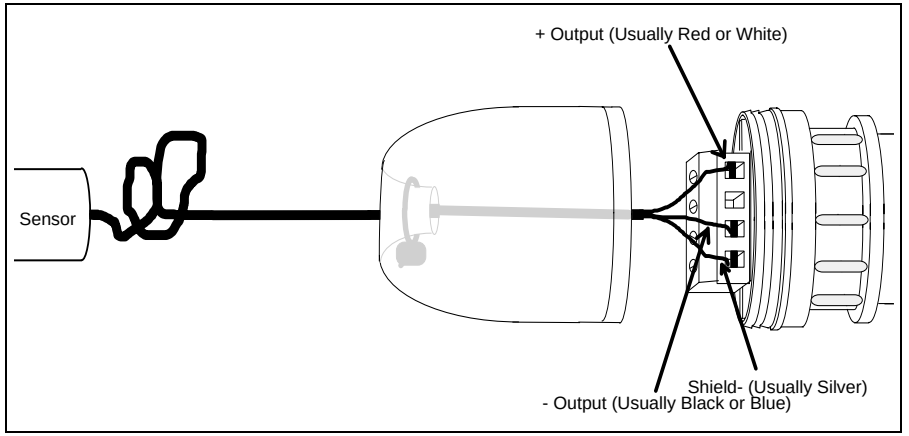


Fig. 11 Water Depth Probe Connections.

1.8 Wiring an IP-24VBMA to an Transmitter.

The IP-24VBMA can be wired to a large assortment of Transmitters. The wiring to a typical pH Transmiter is shown in Fig. 12.

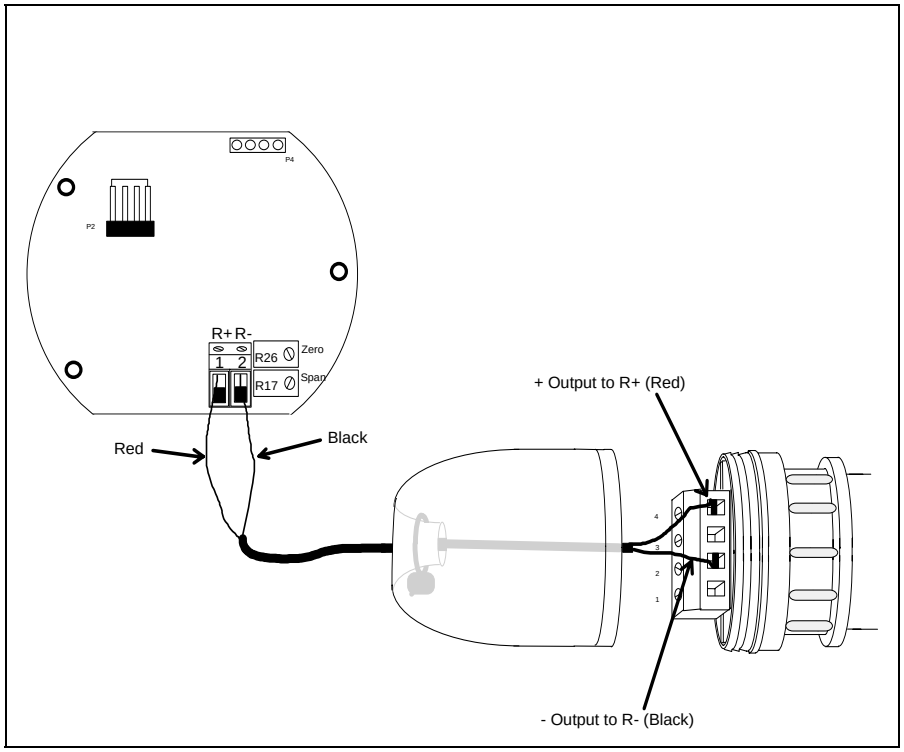
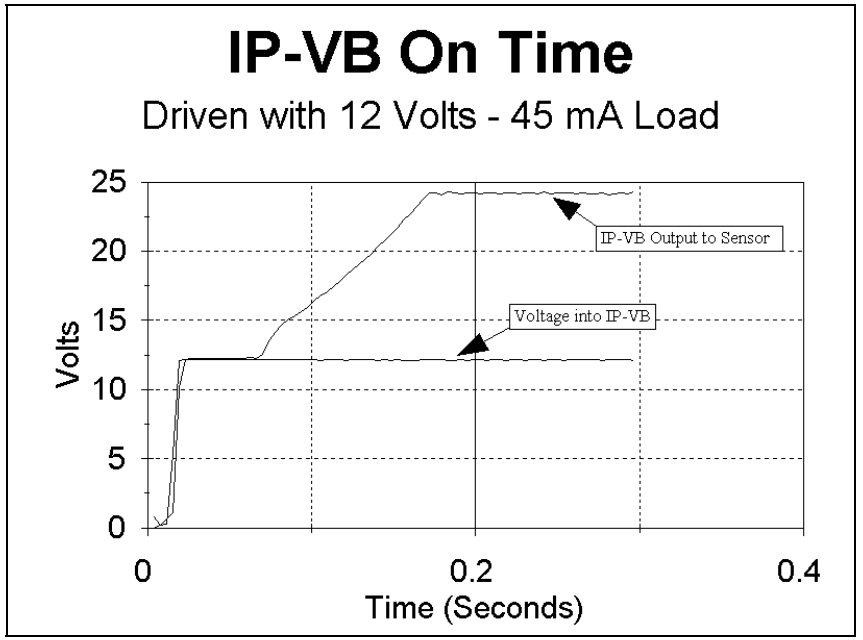


Fig. 12 SIGNET Transmitter connections.

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
Battery (Switched voltage)	7	12	24	V
Turn On Delay	330	410	∞	ms
24 volt Stabilization Time		200		ms



☐ U.S. CORPORATE HEADQUARTERS 9477 Greenback Lane, #527, Folsom, CA, USA 95630
☑ CANADIAN CORPORATE HEADQUARTERS 8709 - 50 Avenue, Edmonton, Alberta, Canada T6E 5H4