

# B|W Controls

## Fail-Safe Intrinsically Safe Modules

### 5510 IS MODULES

B/W Series 5510 Control Modules were developed especially to provide an intrinsically safe and economical means of detecting and controlling a wide range of processing variables in areas containing explosive atmospheric mixtures.

Tested and listed by UL for use in applications involving Class I, II, and III locations, these compact solid-state modules are designed to prevent an external probe or pilot control circuit from releasing sufficient electrical energy to ignite even the most flammable gases or vapors classified in Groups A, B, C, and D, and combustible dusts or fibers classified in Groups E, F, and G.

**Typical Applications** — Conditions covered by the above approvals include all the hazardous atmospheric mixtures encountered in refineries, chemical processing operations, manufacturing plants — mines, coal preparation and storage bins — hospitals, distilleries, grain elevators, feed and textile mills — industrial and municipal waste disposal systems — marine bilge and sewage treatment facilities — to mention just a few of the many areas for safe, practical installation.

**Installation Options** — When mounted in an approved explosion-proof enclosure, B/W Series 5510 Modules can be located within a hazardous area, providing the power wiring *to the module and from the load contacts* are installed in accordance with applicable codes for the location. The most economical method of installation, however, is to mount the module in a non-hazardous environment and run the external control circuit through an approved seal to a pilot device or level sensing electrodes in the hazardous area as shown on page 2.

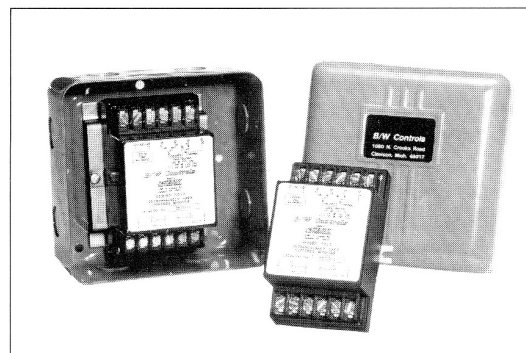
This permits use of low-cost general purpose enclosures for both the module and pilot device. Ordinary wires in conduit or an approved cable can be used for the intrinsically safe probe or pilot control circuit. Moreover, distance between the Series 5510 Module and the pilot device can be 1,000 feet or more, depending on resistance and capacitance of the wires used for the external control circuit. Refer to the chart on this page for maximum lead wire lengths.

**Module Types and Options** — B/W Series 5510 Module can be supplied for either 120 volt 50/60 Hz. incoming line voltage and can be supplied open chassis or in a NEMA 1, NEMA 4, NEMA 7 or NEMA 12 Enclosure.

**Failsafe Relay Contacts** — The 5510 Module uses two electro-mechanical relays K1 and K2 for its output contacts in order to provide the most reliable and versatile output functions.

One standard module can be used for pump up, pump down, high alarm, or low alarm functions. While providing the necessary control functions, the module can also provide the power failure release for pump or alarm circuits.

Load relay K1 is energized when power is first applied to the 5510 Module. Load relay K2 is energized when the sensing circuit is completed. This operation allows load circuits to open or close on power loss to the 5510 Module as needed (i.e. pump circuits open, alarm contacts open or close on loss of power).



**Module Sensitivity** — Operating sensitivity is important only in level control applications where the module is operated from electrodes and the liquid is used as a conductor to complete the external sensing circuit. Since liquid resistances vary, various operating sensitivities can be field installed. In such applications, the module must have a sensitivity greater than the specific resistance of the liquid being controlled. One or two sensitivity resistors of equal value should be selected from the package provided and installed according to the application drawings and chart. When operated from a B/W 7014 Unifloat® multi-level sensing system, 7010 Float Switch or other pilot switching device, a jumper wire(s) is recommended in place of the resistor(s).

Regardless of sensitivity ratings, all B/W Series 5510 Modules are designed to operate continuously with external probe or pilot circuit resistances as low as zero without damaging the module. This permits intrinsically safe operation at all times from electrodes or pilot switches.

SENSITIVITY RESISTOR (OHMS)	OPERATING SENSITIVITY	MAXIMUM LEAD WIRE LENGTHS	APPLICATION RECOMMENDATIONS
0-Jumper in place of Resistor	--	2,500 Feet	7014 Unifloat, 7010 Float Switch, other dry contacts
270	1,400 ohms	2,500 Feet	Strong or weak electrolytes, plating solutions ammonium hydroxide, borax, acetic acid
1,000	2,400 ohms	2,500 Feet	Most food processing applications; beer, wine, fruit juices, milk, buttermilk
3,900	5,900 ohms	2,500 Feet	Most water; highly corrosive acid or caustic solutions where current must be minimized to extend electrode life: hydrochloric acid, sulfuric acid, etc.
10,000	13,000 ohms	1,000 feet	Water with medium to high mineral content, sewage, water soluble oil and starch solutions
22,000	26,400 ohms	450 Feet	Water with low mineral content; sugar syrup solutions
68,000	74,600 ohms	125 Feet	Deminerlized water (not distilled or deionized water - use 5200 H) steam condensate, corn syrup, strong alcohol solutions up to 50%

**Intrinsically safe control circuit listed by Underwriters Laboratories for Class I, II, III; Division 1; Groups A, B, C, D, E, F, G hazardous locations.**

## INTRINSICALLY SAFE MODULES

**Construction:** Designed to meet the most stringent intrinsic safety requirements, the 5110 Control Module has been encapsulated with an epoxy based thermoset. The key components inside the potted module are mounted on a circuit board consisting of a transformer, 2 output relays, a bipolar junction transistor, and a quad op-amp/comparator IC package.

**Application:** The 5510 Intrinsically Safe Control Module may be purchased in either 115 VAC models. The module is capable of performing control functions from a variety of NON-ENERGY emitting devices such as electrodes suspended in a well or tank, the BIW Unifloat level sensing system, float switches, or various pilot devices such as pressure, flow and limit switches, thermostats, push-buttons, etc.

In addition, units are unaffected by voltage and temperature variations within specifications. The control is furnished with replaceable fixed sensitivity resistors to permit adjustment of operation based on the resistance of the liquid to be controlled.

**Operation:** A customized current limiting transformer is used to convert the incoming line voltage into an 11.3 volt ac sensing circuit. The sensing circuit is comprised of a series of op-amp/comparators which compare the voltage created by the resistance of the liquid to the voltage created by an internal sensitivity resistor. Based on the comparison, the output of the op-amp/comparator either turns relay K2 on or off through a driving transistor. The AC sensing circuit will minimize electrolysis when used from electrodes for conductive liquid applications.

Multiple load relays are used in the design to allow control operations to open pump circuits, or open or close alarm circuits on power failure while maintaining proper functionality. This design feature provides better circuit design at lower cost.

A short time delay is designed into the module to eliminate nuisance tripping due to liquid wave action or other quickly cycling inputs.

\* Consult Factory for applications requiring wider temperature ranges.

## INTRINSICALLY SAFE SYSTEM INSTALLATION

As defined by the National Electrical Code, Factory Mutual and Underwriters Laboratories, an intrinsically safe control system consists of equipment and associated wiring that are inherently incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture at its most easily ignited concentration in air.

Abnormal conditions would include any two independent mechanical or electrical faults occurring simultaneously—such as accidental damage to any part of the equipment, wiring and installation, and any other failure of electrical components due to application of over-voltage, improper adjustment or maintenance, and other similar conditions.

When properly installed in accordance with the diagrams on page 36, BIW Series 5510 Modules meet the most stringent requirement of UL for intrinsically safe operation from pushbuttons, pressure or float switches, thermostats, humidistats or any other type of general purpose pilot control device. In addition, they may also be actuated by probes or electrodes in contact with any conductive liquid or moist bulk material to perform a wide variety of mixing, measuring, metering and flow or level control functions.

In such installations, inexpensive general purpose enclosures may be used for both the control module and the pilot device. Wiring between the two may be of any type approved for non-hazardous locations without violating provisions of Article 500-517 of the National Electrical Code. It is essential, that:

- (1) an approved seal be used at the point where the intrinsically safe pilot control circuit enters the hazardous area, and
- (2) the pilot circuit wiring be isolated from other wiring.

## BASIC SPECIFICATIONS

**Voltage:** 115 VAC, +10% -20%, 50/60 Hz.

**Load Contacts:** Single pole, double throw.

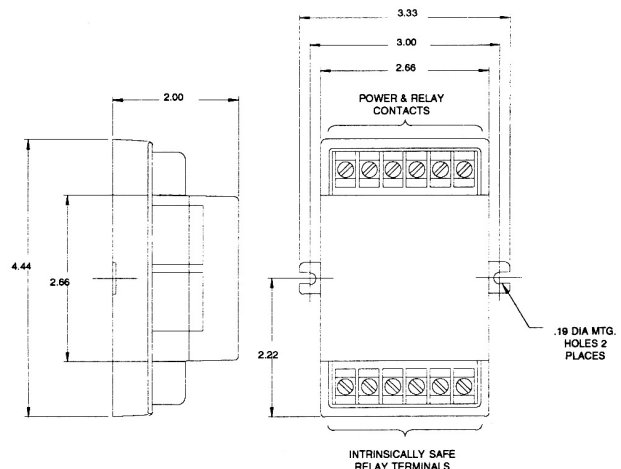
**Contact Ratings:** 10 amperes resistive load at 277 VAC or 30 VDC; 360va at 240 VAC - pilot duty; 1/3 Hp at 240 VAC, 1/4 Hp at 120 VAC.

**Power Required:** 2 volt - amp, 1.5 watts.

**Control Circuit Energy:** Inherently limited to less than 11.3 milliamperes at 11.3 volts ac to assure intrinsically safe operation under any abnormal fault condition.

**Operating Temperature:** -40°F to +180°F

## Open Chassis



**SERIES 5500 NON-INTRINSICALLY SAFE MODULE**

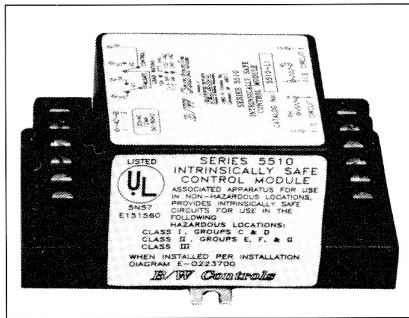
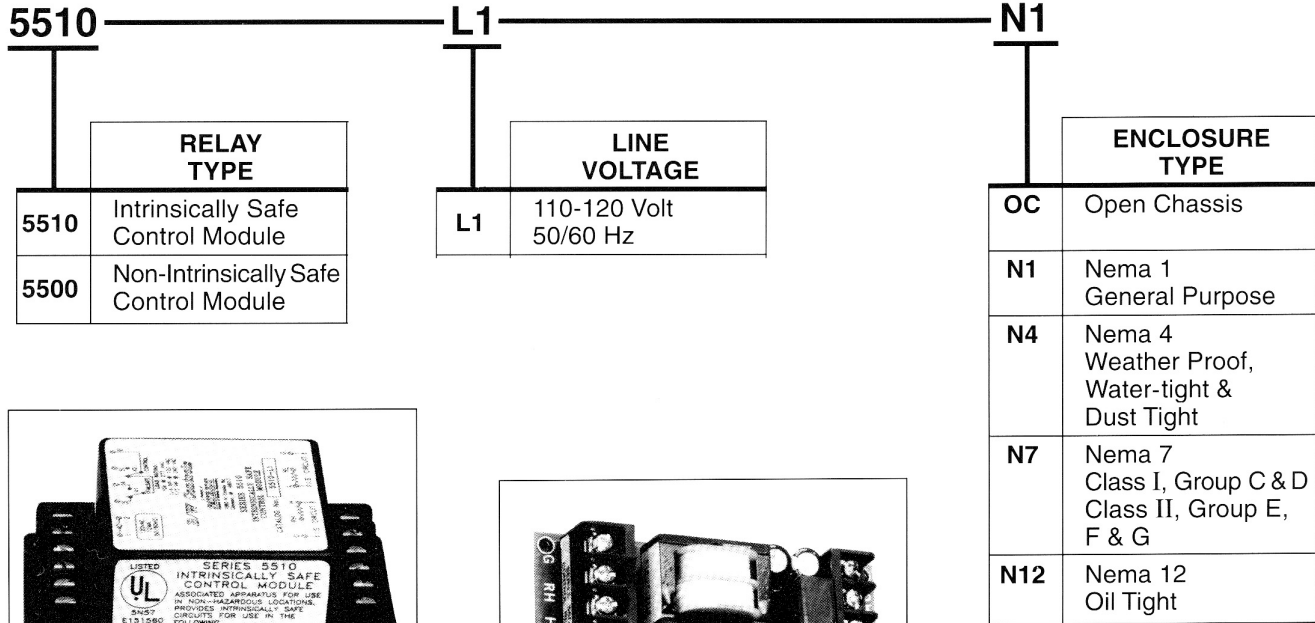
The B|W Series 5500 Control Module offers similar features and characteristics to the 5510 Intrinsically Safe Module but does not have the necessary approvals for use with sensors in hazardous locations. This module has only a general purpose approval by Underwriters Laboratory.

Applications of this module include use as a liquid level control device when used with electrode equipment or as a general control device when used from a remote pilot device. Since the sensing circuit provides a low voltage and low current signal, usage with hard waters and corrosive chemicals will minimize build-up or erosion on the electrodes in liquid level applications. Use as an inexpensive control device from a distant pilot switch up to 2500 feet away is recommended as long as twisted shielded cable is used.

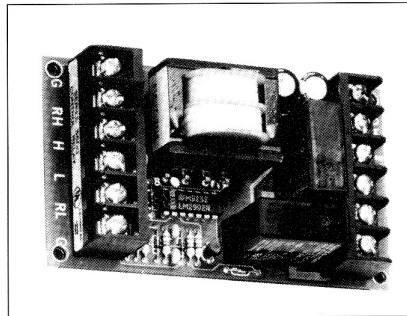
The 5500 Control Module has all the same basic specifications, fail-safe features, sensitivity/lead wire lengths, and wiring requirements, but is not Intrinsically Safe. The dimensions of the open chassis relay is shown below.

**Open Chassis**

## CATALOG NUMBERING SYSTEM



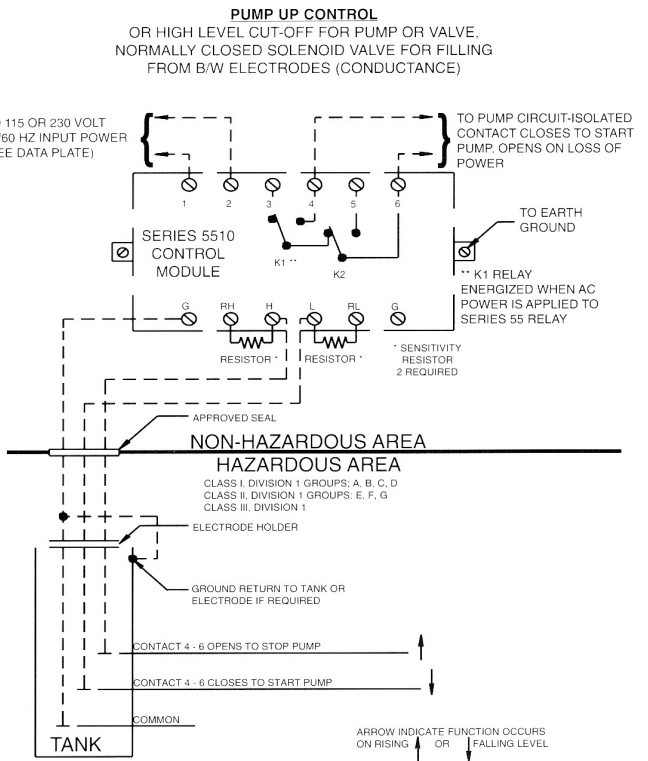
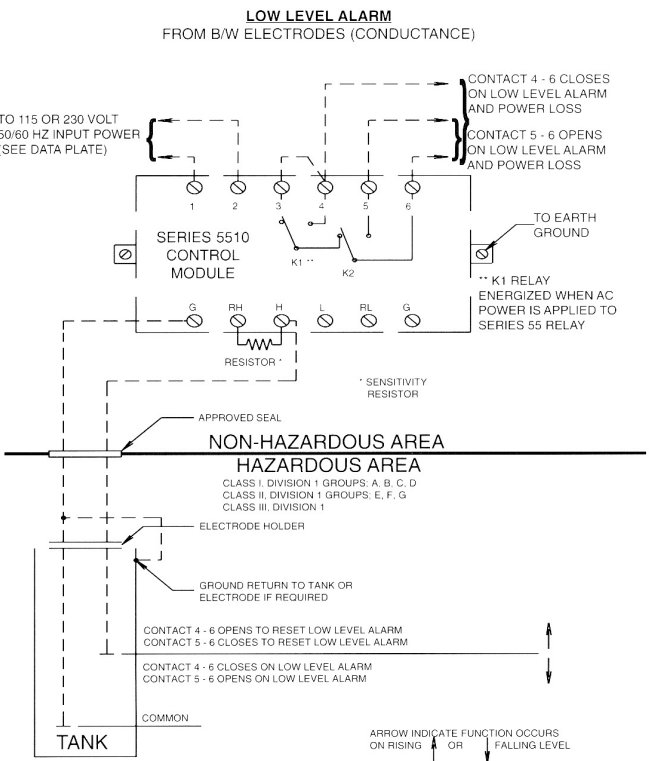
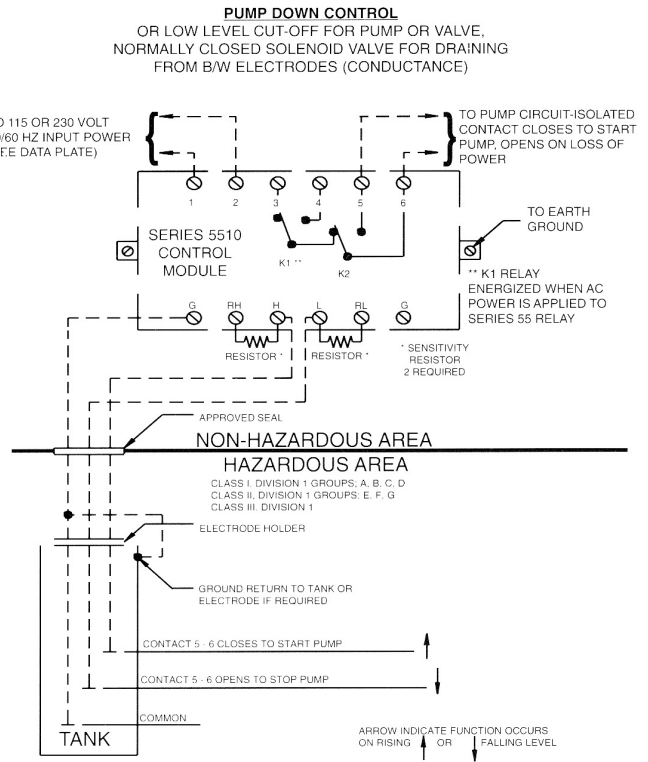
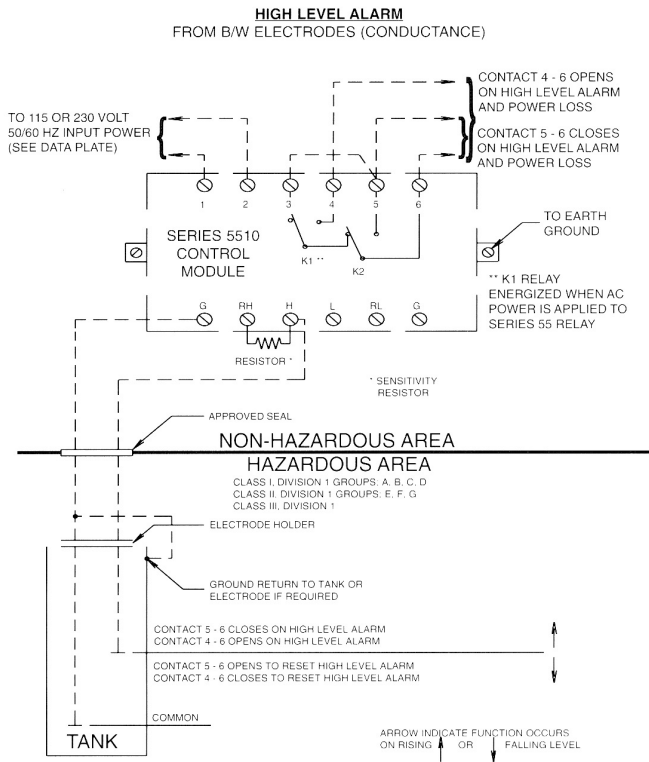
Catalog Number 5510-L1-OC  
 Intrinsically Safe Control Module



Catalog Number 5500-L1-OC  
 Non-Intrinsically Safe Control Module

**See page 12 for enclosure dimensions.**

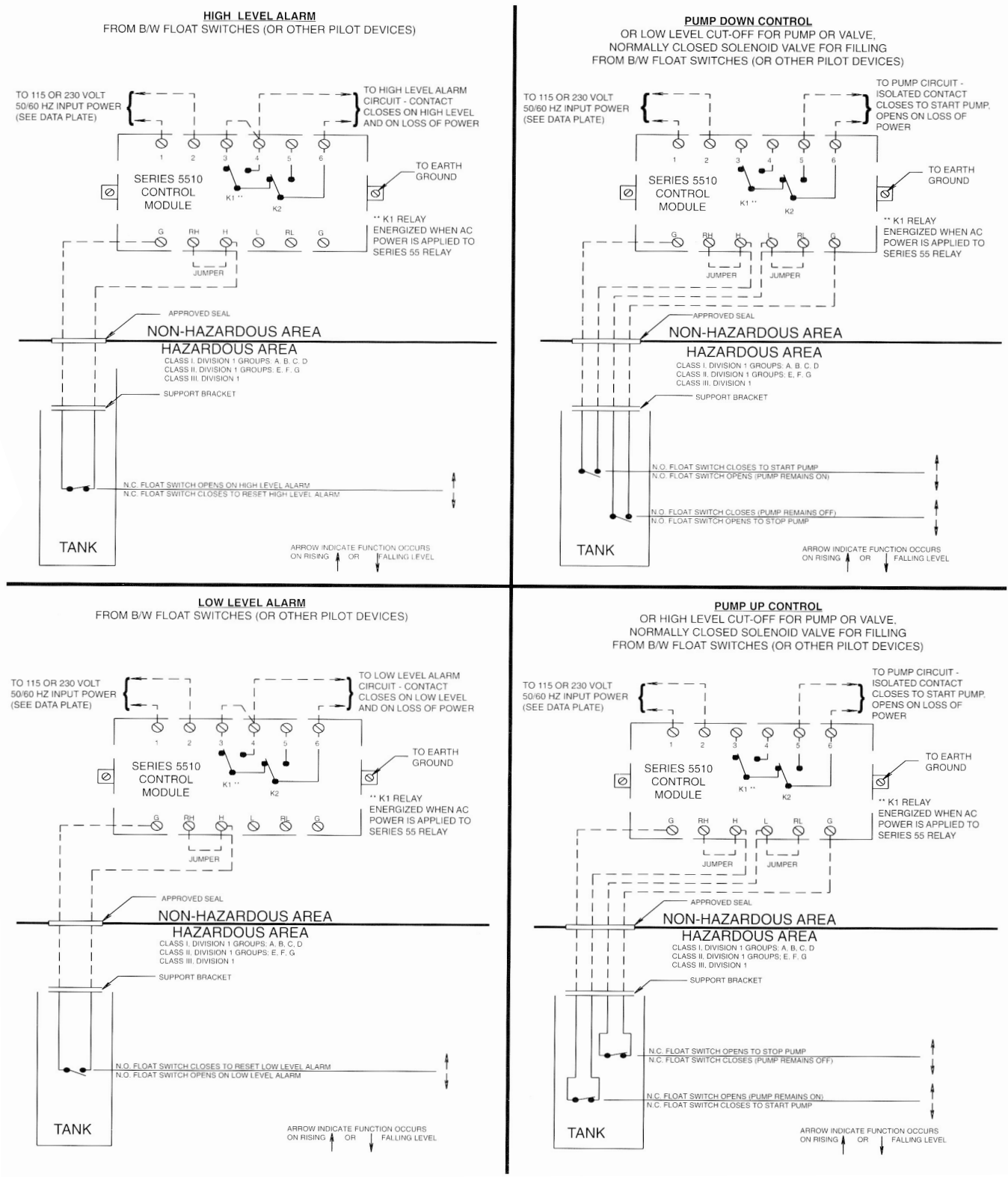
## APPLICATIONS USING SWITCHING DEVICE



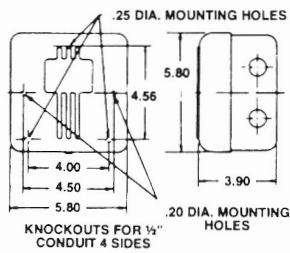
# B|W Controls

## Fail-Safe Intrinsically Safe Modules

### APPLICATIONS USING LIQUID LEVEL ELECTRODES

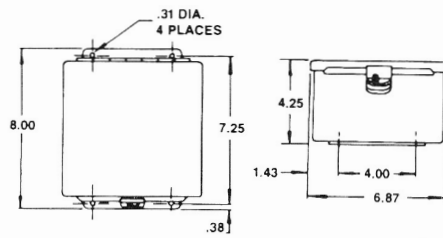


## NEMA Type 1



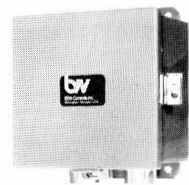
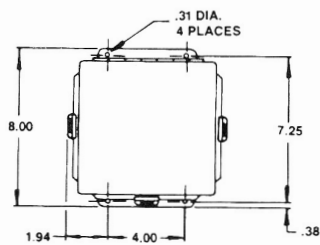
Part #11028300  
Approx. shipping weight:  
5 pounds with relay

## NEMA Type 12

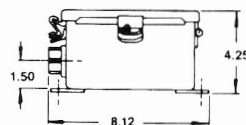
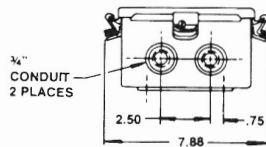


Part #11073900  
Approx. shipping weight:  
7 pounds with relay

## NEMA Type 4

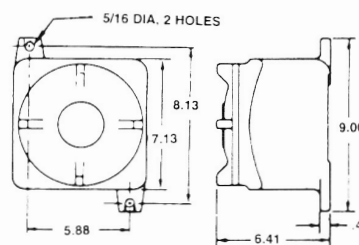


Part #11073800



Approx. shipping weight:  
9 pounds with relay

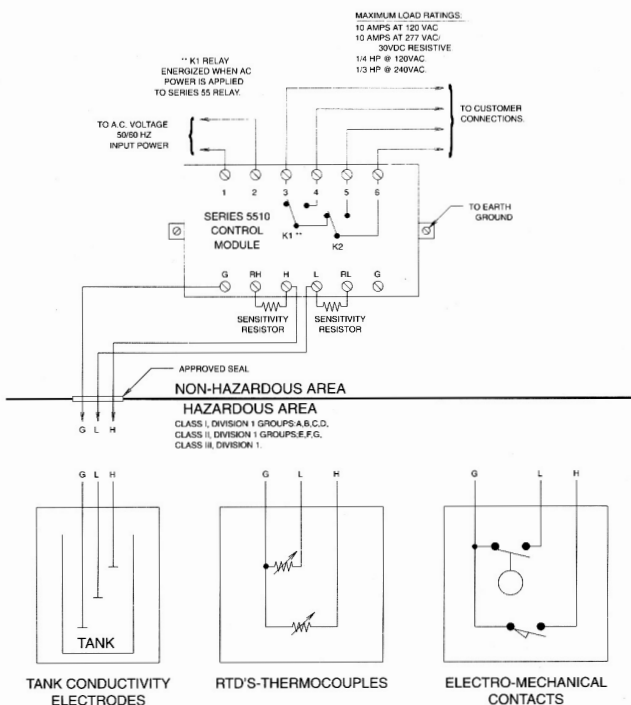
## NEMA Type 7



UL & CSA Rating  
Class I, Group D  
Class II, Group E, F & G

Part #11073100  
Approx. shipping weight:  
12 pounds with relay

## INTRINSICALLY SAFE UNIT INSTALLATION DRAWING



### NOTES:

- BEFORE PROCEEDING TO INSTALL AND WIRE THE CONTROL MODULE, READ AND THOROUGHLY UNDERSTAND THESE INSTRUCTIONS. FOR ADDITIONAL GUIDANCE ON INTRINSICALLY SAFE SYSTEMS, REFER TO NATIONAL ELECTRIC CODE (ANSI/NFPA70) ARTICLE 504.
- THE CONTROL MODULE MUST BE EITHER SITUATED IN A NON-HAZARDOUS AREA OR MOUNTED INSIDE A SUITABLE APPROVED EXPLOSION PROOF ENCLOSURE.
- INTRINSICALLY SAFE WIRING MUST BE KEPT SEPARATE FROM NON-INTRINSICALLY SAFE WIRING.
- THE CIRCUIT WIRING IN THE HAZARDOUS AREA SHOULD NOT EXCEED 3000 FEET. THIS DISTANCE LIMITATION IS BASED ON A CABLE WITH A SPECIFIC CAPACITANCE OF 60 pF/FT AND A SPECIFIC INDUCTANCE OF 0.2 uH/FT.
- AN APPROVED SEAL SHOULD BE USED AT THE POINT WHERE THE INTRINSICALLY SAFE CONTROL CIRCUIT WIRING ENTERS THE HAZARDOUS AREA.
- ONLY ONE 'G' WIRE IS REQUIRED IN THE HAZARDOUS AREA (INTRINSICALLY SAFE 'G' TERMINALS ARE ELECTRONICALLY CONNECTED TOGETHER IN THE CONTROL MODULE)
- INTRINSICALLY SAFE CONNECTIONS MUST ONLY BE MADE TO NON-ENERGY GENERATING OR STORING DEVICES SUCH AS SWITCH CONTACTS, NON-INDUCTIVE RESISTANCE TEMPERATURE DEVICES (RTD'S) AND THERMOCOUPLES, OR ANY TANK CONDUCTIVITY ELECTRODE.
- THE RESISTANCE BETWEEN THE GROUNDING TAB ON THE CONTROL MODULE AND EARTH GROUND MUST BE LESS THAN ONE (1.0) OHM.
- ELECTRICAL EQUIPMENT CONNECTED TO THE ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 Vrms WITH RESPECT TO EARTH GROUND.
- SELECT SENSITIVITY RESISTORS TO SET OPERATING POINT OF RESISTIVE INPUTS (SEE CHART IN SERVICE BULLETIN). SET TO ZERO OHMS (JUMPER) FOR SWITCH CONTACT SENSING.