

**USE OMEGA FRONT COVER**

**USE OMEGA INSIDE FRONT COVER**

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## 1.0 GENERAL DESCRIPTION

- 1.1 The OMEGA® LV750 Series Level Switch is used to detect the presence of a material at a given level in a tank, bin or other container. It can be used with a wide range of both liquid and solid materials which may be electrically conductive or non-conductive. In some cases, the LV750 can be used to detect the level of an interface between a lighter and a heavier substance such as that found in an oil and water separator.
- 1.2 The standard version of the LV750 is housed in a general-purpose enclosure with an integral 12 inch long probe. The standard probe is a solid 3/8 inch diameter stainless steel rod. A time delay circuit is included as standard on the LV750. It operates on rising level and may be set to times of 0, 5, 10, and 15 seconds. The standard version of the LV750 is powered from 120 VAC but a DC powered version is also offered.
- 1.3 There are four models available:
- LV751 General purpose, 3/8" diameter 316SS rod, acetal bushing, 1/2" NPT 316SS nipple
  - LV752 General purpose, 3/8" diameter 316SS rod, Teflon® bushing, 1/2" NPT 316SS nipple
  - LV753 Teflon® coated probe, 1/2" NPT 316SS nipple
  - LV754 Teflon® coated probe, 3/4" NPT Teflon® nipple
- The standard probe length is 12 inches, however, lengths of up to 72 inches are available.
- 1.4 In most applications, the installation and calibration of the LV750 are easily accomplished by a competent electrician. Mounting the unit requires three basic steps. First, provide an opening in the tank or other container. Second, fit this opening with a pipe coupling or other threaded entry. Third, install the LV750 securely into the coupling or other fitting. The wiring of the unit may consist of as few as three wires, depending upon the application. No test equipment is required for calibration since the necessary calibration indicators are built into the unit. Seasonal recalibration of the unit is unnecessary due to its exceptional stability.
- 1.5 Because of the patented detection technique used in the LV750, it can tolerate reasonable amounts of sticky material buildup on the probe. In addition, the rugged construction techniques used in building the probes allow them to support the weight of such a buildup. For conductive liquids and materials with a high dielectric constant (greater than 30) that additionally have a tendency to "bridge" between the probe and container wall, a Teflon® coated probe should be used. For chemical compatibility considerations, also request the 3/4" Teflon® nipple.

## 2.0 SPECIFICATIONS

### 2.1 ENVIRONMENTAL

Operating temperatures:

Electronics .....-40°C to +85°C (-40°F to +185°F)

Probes.....12 inches min length (standard) to  
72 inches(special)

Uncoated, acetal bushing.....-40°C to +85°C (-40°F to +185°F),  
1500 psig @ 25°C (77°F),  
0 psig @ 85°C (185°F)

Uncoated, Teflon® bushing..... -40°C to +230°C (-40°F to +450°F)  
1500 psig @ 25°C (77°F),  
0 psig @ 230°C (450°F)

Teflon® coated (except..... -40°C to +230°C (-40°F to +450°F)  
Teflon® nipple) 1500 psig @ 25°C (77°F),  
0 psig @ 230°C (450°F)

Teflon® coated, 3/4" .....-40°C to +85°C (-40°F to +185°F),  
Teflon® nipple 150 psig @ 25°C (77°F),  
0 psig @ 85°C (185°F)

Minimum dielectric constants

Liquid material sensing .....2.0 for standard uncoated probe

Solid material sensing.....8.0 for standard uncoated probe  
see Dielectric Chart, pages16 & 17

### 2.2 ELECTRICAL

Input Power.....95 to 130 VAC, 50 to 60 Hz, 2 watts (standard)  
or 9 to 35 VDC @ 100 mA max(optional)

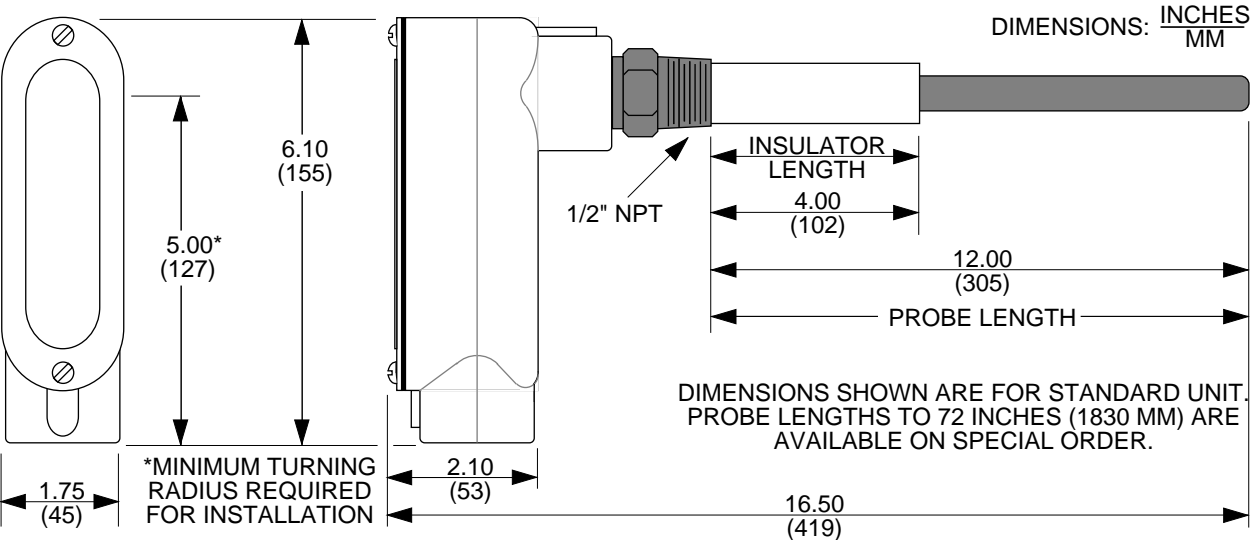
Relay DPDT (2 form C) dry contacts

Relay Contact Rating .....5 Amps Resistive @ 120 VAC or 28 VDC

Time delay .....0, 5, 10, 15 seconds, selectable

2.3 MECHANICAL

- Process Connection .....1/2" NPT (standard); 3/4" NPT (optional)
- Wetted parts ..... 316SS rod, 316SS nipple, acetal (Teflon® optional)
- Enclosure ..... Cast aluminum, (PVC optional)
- Overall Size ..... 16.5 X 6.1 X 1.8 inches(419 X 155 X 46 mm)
- Weight ..... 2 lb (4.4 kg)



**Figure 2.1: Overall Dimensions**

### 3.0 INSTALLATION AND CALIBRATION

- 3.1 After unpacking the unit, inspect it for any evidence of shipping damage. Any claims for damage due to shipping must be filed with the carrier who handled the package(s).
- 3.2 Select a mounting location for the LV750 unit and its attached sensing probe. See [Figure 3.1](#) for recommended mounting practices. [Figure 3.2](#) shows some mounting methods which have proven to be troublesome. Be sure that there is sufficient clearance around the mounting position to allow for the turning radius as the unit is screwed into place. Also, in the case of rigid probes, allow sufficient room to be able to insert the probe into the opening in the vessel. Cut a hole in the vessel that is at least large enough to allow the insulator portion of the probe to extend into the inside of the vessel and mount a threaded coupling to the vessel. The thread size of the coupling should be 1/2" NPT for standard probes. A 3/4" NPT fitting is required for some of the optional probes.

**CAUTION:** WHEN MAKING THE OPENING IN THE VESSEL, OBSERVE ALL SAFETY REQUIREMENTS OF THE AREA IN WHICH THE WORK IS BEING DONE. BE ESPECIALLY CAREFUL OF PRESSURIZED VESSELS.

**CAUTION:** SHOULD IT BE NECESSARY TO REMOVE THE PROBE ASSEMBLY FROM THE HOUSING FOLLOW THE DISASSEMBLY INSTRUCTIONS IN PARAGRAPHS 3.13 AND 3.14.

- 3.3 Screw the LV750 unit into the coupling and install conduit suitable to the environment in which the unit is to be used. See [Figure 3.1](#) for a suggested conduit arrangement.
- 3.4 Wire the LV750 unit in accordance with the typical wiring diagrams of [Figure 3.3](#), [3.4](#), or [3.5](#) or as may be required by the particular application in which the unit is to be used. Because of the extremely wide range of control and/or alarm applications in which the unit may be used, it is not possible to show all conceivable wiring diagrams. Consult OMEGA Engineering if assistance is desired.

**CAUTION:** BE SURE THAT ALL WIRING CONFORMS TO THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE AND ANY ENFORCING AUTHORITIES OR AGENCIES HAVING JURISDICTION OVER THE INSTALLATION.

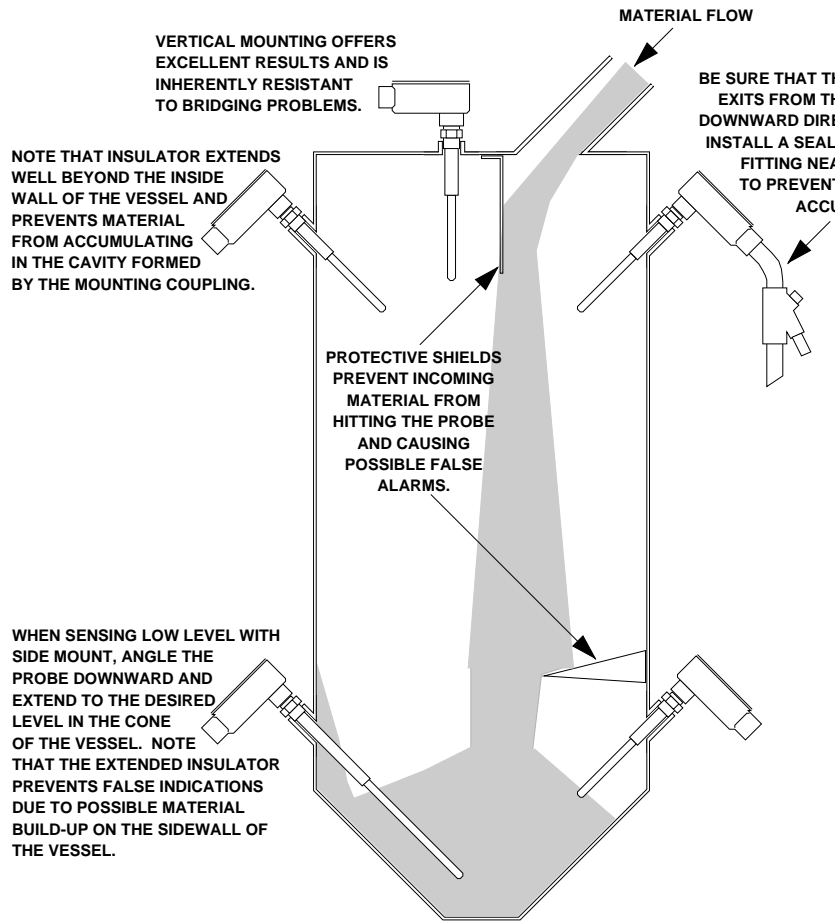


Figure 3.1: Suggested Mounting Arrangements

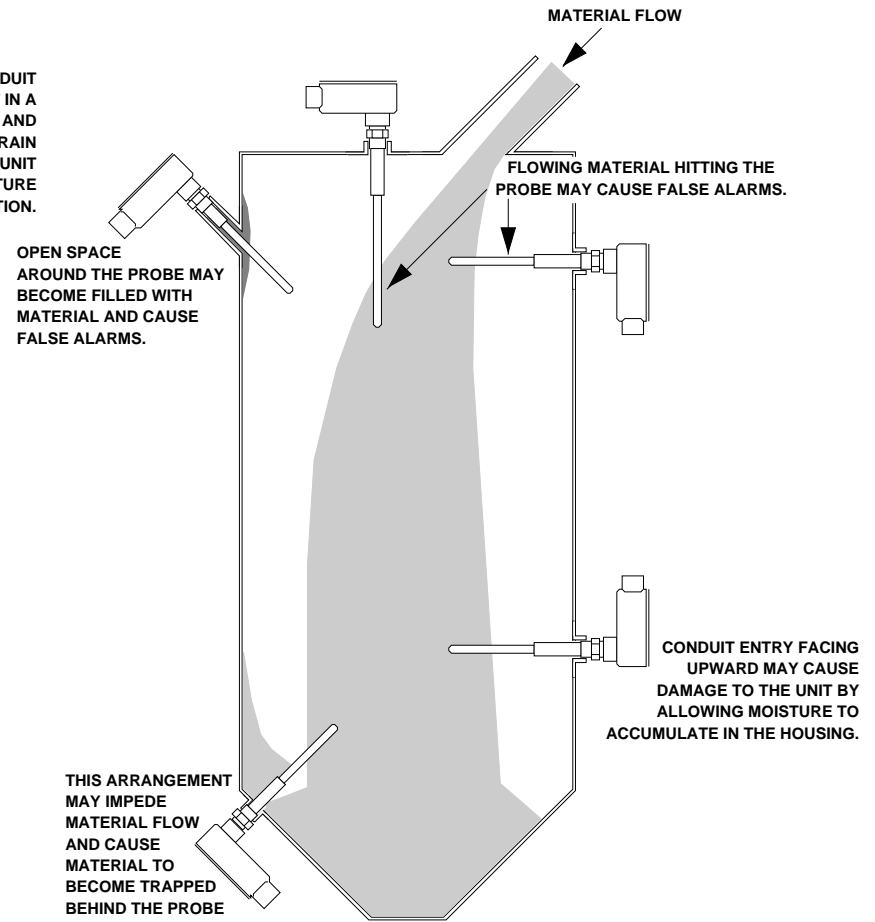
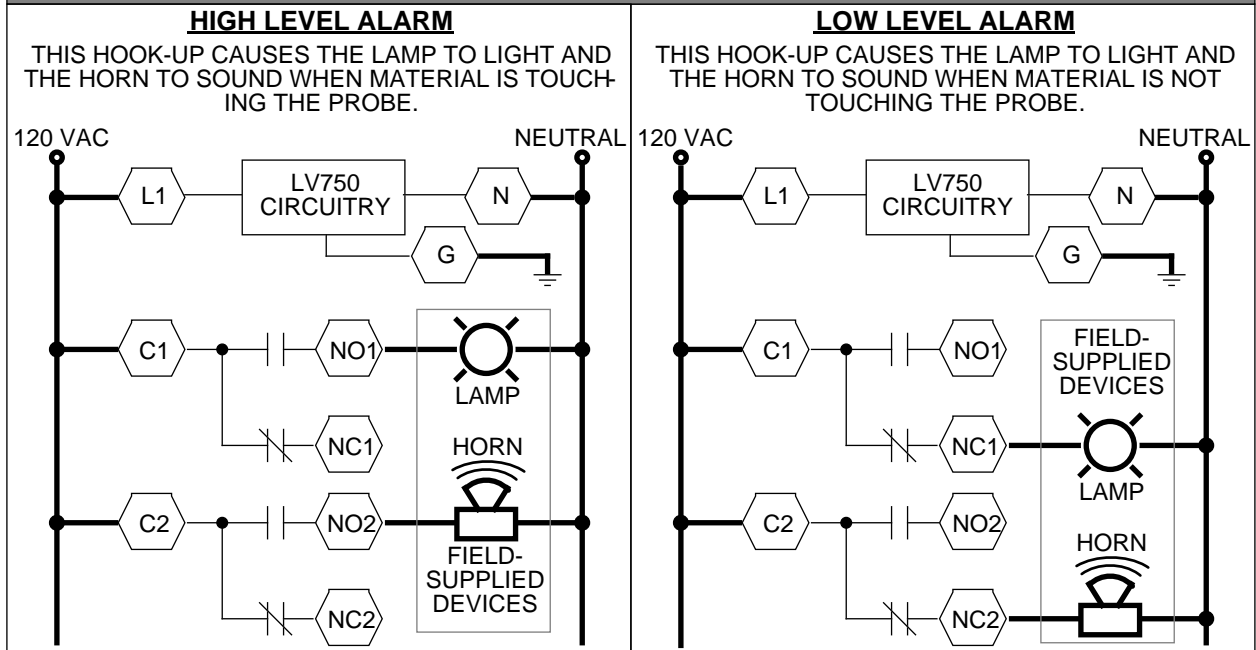


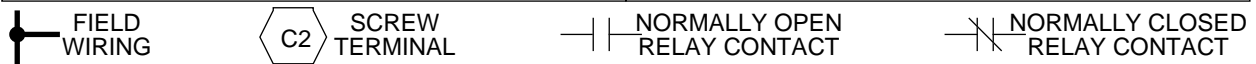
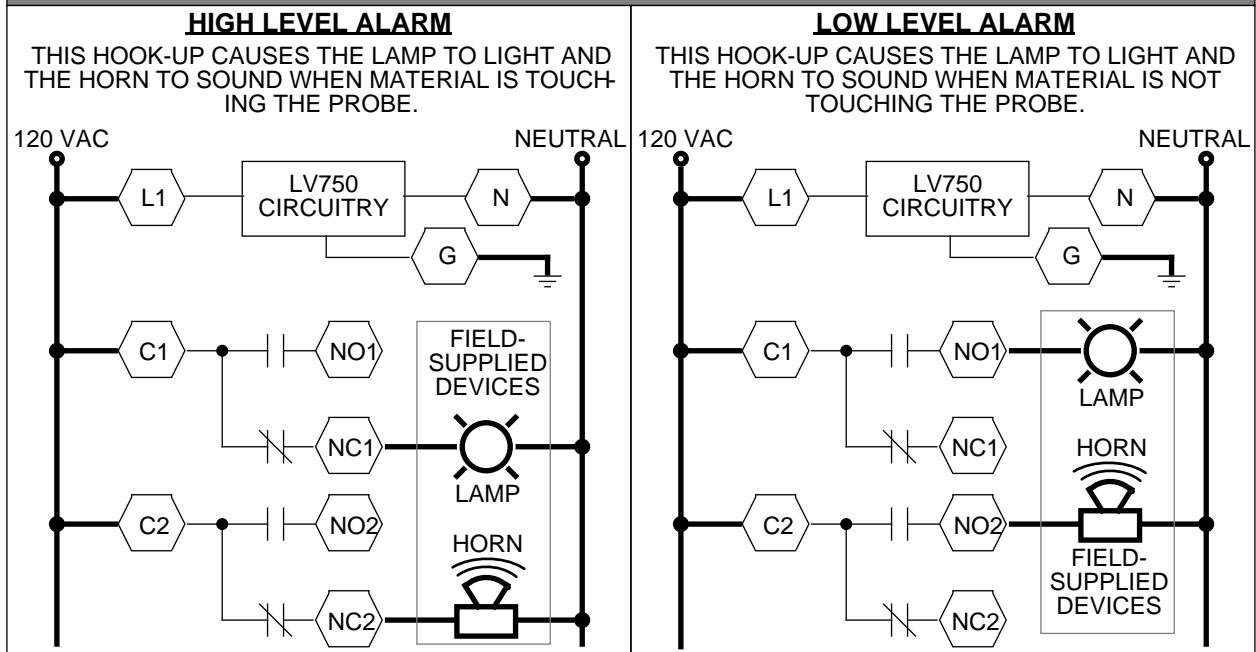
Figure 3.2: Doubtful Mounting Arrangements

# 120 VOLTS A. C. WIRING

## DIRECT ACTION ("FAIL-SAFE" LOW)



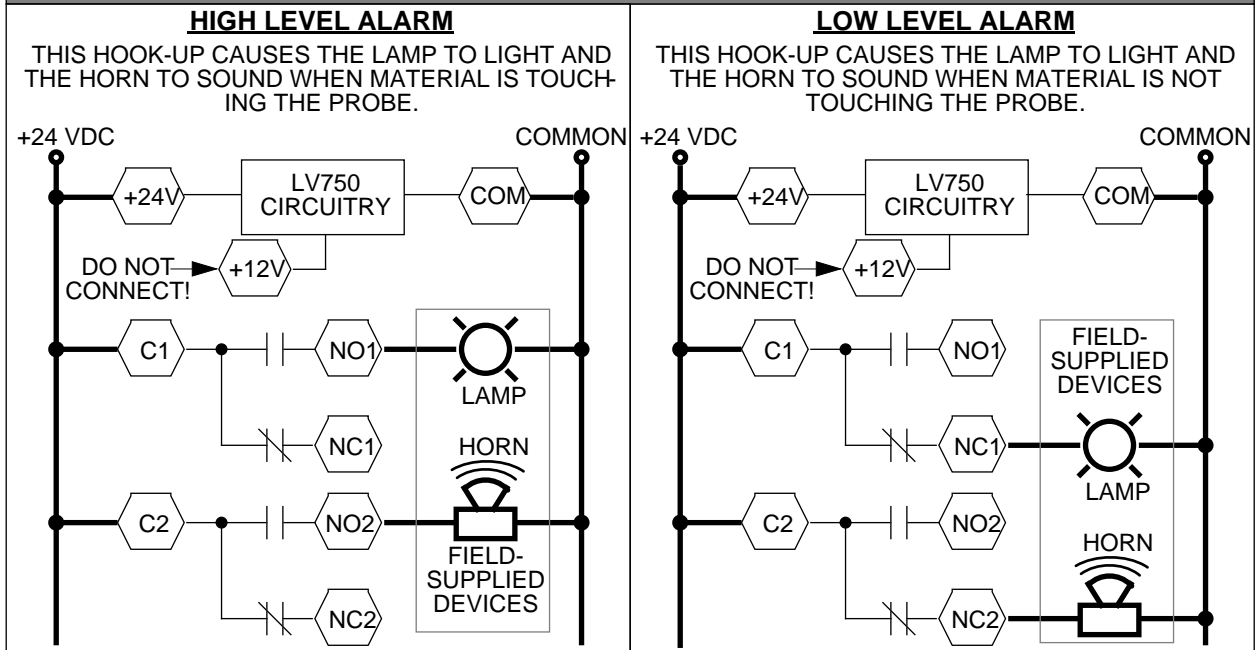
## REVERSE ACTION ("FAIL-SAFE" HIGH)



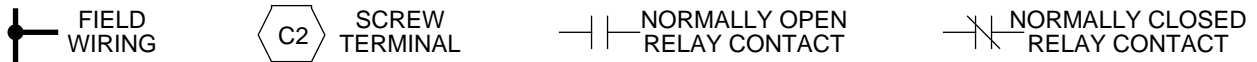
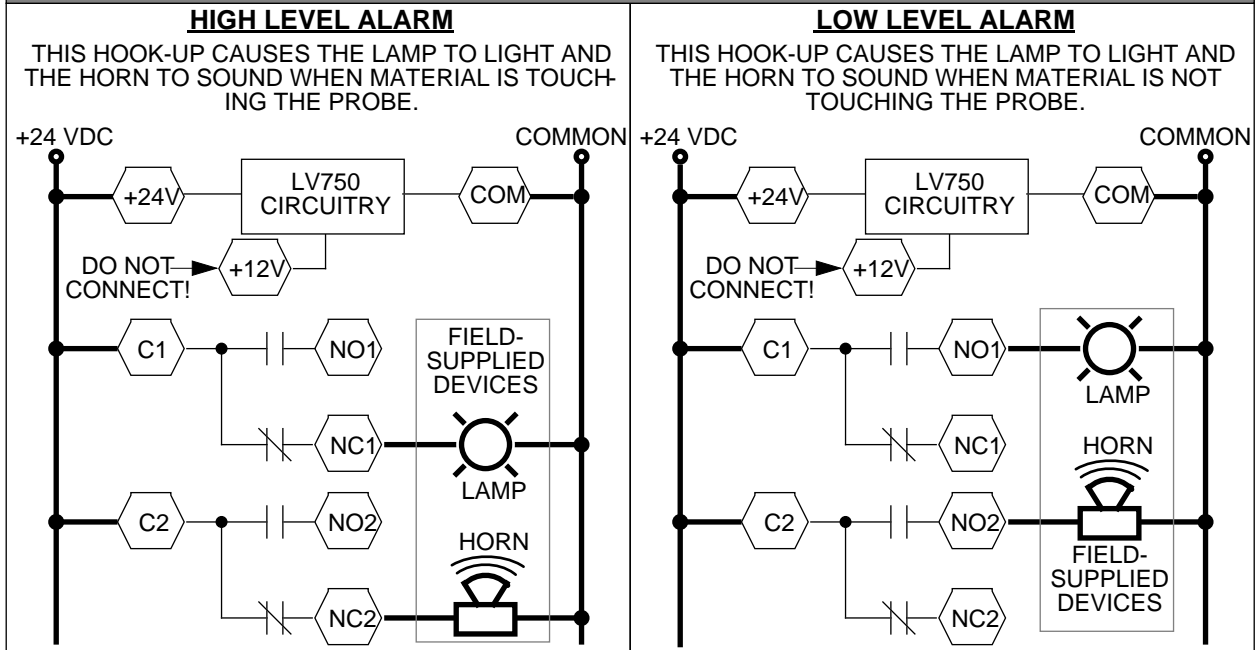
**Figure 3.3:** Typical Field Wiring Diagrams for 120 Volt A. C. Applications. These diagrams show typical hook-ups that may be useful in certain field situations. The lamp and horn represent visible and audible devices which may be controlled by the LV750. Many other hook-ups are possible. Consult OMEGA Engineering if you desire help.

# 24 VOLTS D. C. WIRING

## DIRECT ACTION ("FAIL-SAFE" LOW)



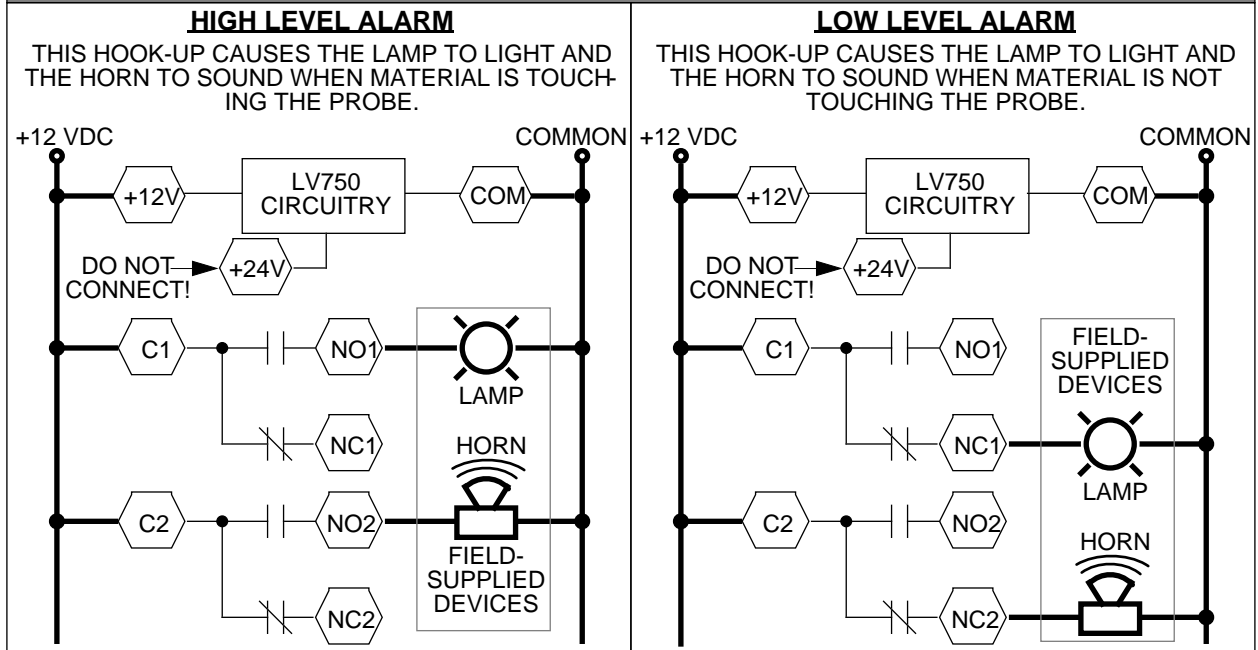
## REVERSE ACTION ("FAIL-SAFE" HIGH)



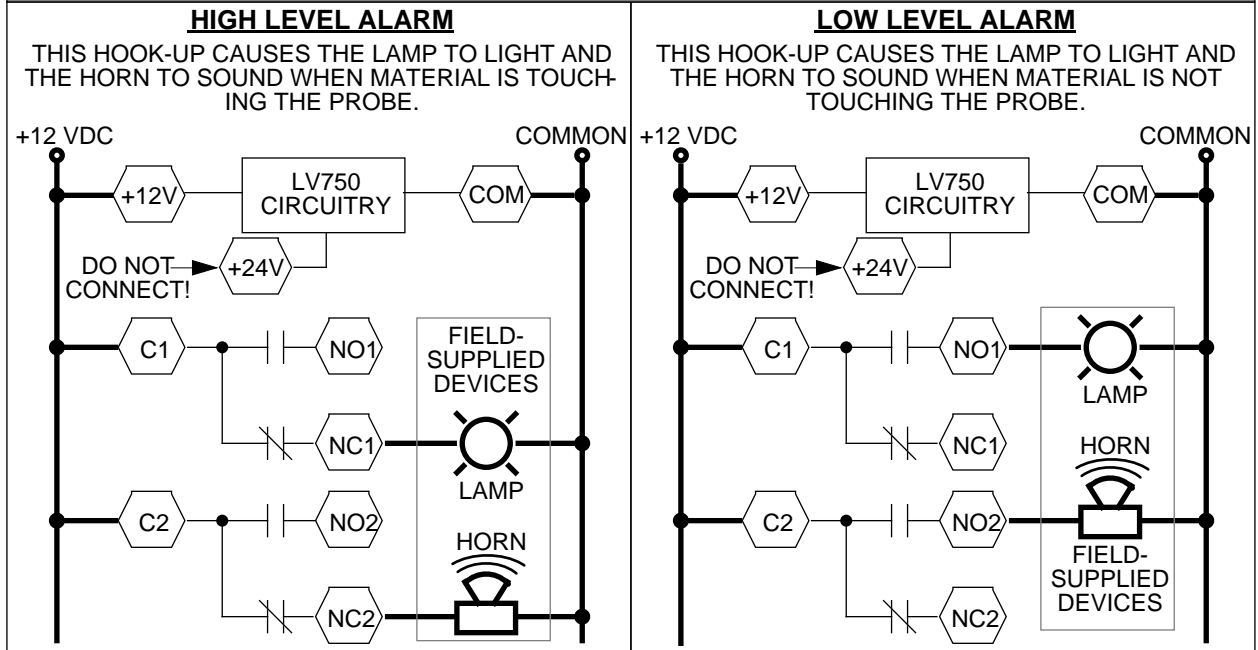
**Figure 3.4:** Typical Field Wiring Diagrams for 24 Volt D. C. Applications. These diagrams show typical hook-ups that may be useful in certain field situations. The lamp and horn represent visible and audible devices which may be controlled by the LV750. Many other hook-ups are possible. Consult OMEGA Engineering if you desire help.

# 12 VOLTS D. C. WIRING

## DIRECT ACTION ("FAIL-SAFE" LOW)

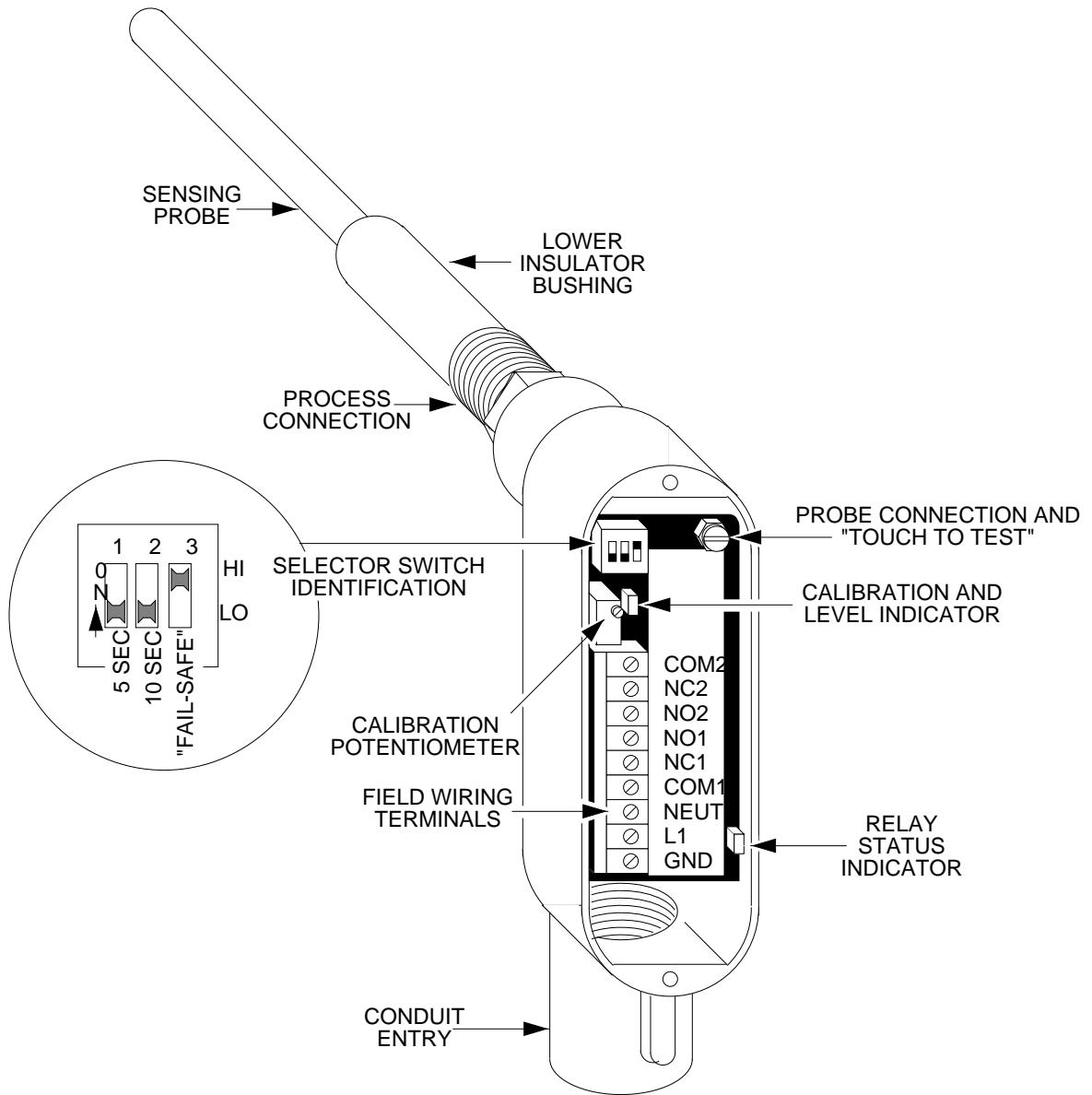


## REVERSE ACTION ("FAIL-SAFE" HIGH)



**Figure 3.5:** Typical Field Wiring Diagrams for 12 Volt D. C. Applications. These diagrams show typical hook-ups that may be useful in certain field situations. The lamp and horn represent visible and audible devices which may be controlled by the LV750. Many other hook-ups are possible. Consult OMEGA Engineering if you desire help.

- 3.5 Calibrate the LV750 unit using the following procedures. See [Figure 3.6](#) for location of adjustments and controls.
- 3.6 The "fail-safe" selection is used to determine the mode of operation of the relay. In the "fail-safe" **high** (reverse action) mode, the relay will be energized until the material in the vessel touches the sensing probe. At this time the relay will de-energize. In the "fail-safe" **low** (direct action) mode, the relay will be de-energized until the material in the vessel touches the sensing probe. At this time the relay will energize. The "fail-safe" mode selection may be altered in the field by setting the "fail-safe" switch to the desired position. Unless otherwise specified, all units are preset at the factory for operation in the reverse action or "FAIL-SAFE" HI mode.
- 3.7 There is a choice of four time delay settings of 0, 5, 10, and 15 seconds. The time delay in all units operates upon a rising level of material in the vessel. That is, as the level rises and material makes contact with the sensing probe, the time delay period will begin. At the end of the time delay period, the relay will change condition. The time delay selection may be altered in the field by setting the time delay switches to the desired positions as described in Paragraph 3.12, Step 6 below.
- 3.8 The calibration potentiometer is used to adjust the level switch for a particular installation in a specific vessel. Once it is adjusted, it should not require further adjustments unless the installation is changed or the unit is moved to a different vessel.
- 3.9 During calibration, the red indicator light shows the proper setting of the calibration potentiometer. Once the level switch is properly calibrated, the indicator light will show the presence or absence of material at the sensing probe: **ON** when material is present and **OFF** when material is absent.
- 3.10 The green indicator light shows the status of the relay in the detector module: **ON** when the relay is energized and **OFF** when the relay is de-energized.
- 3.11 Once the level switch is properly installed, use the following steps to calibrate the unit to the particular tank in which it is to be used. The only equipment required is a small screwdriver to adjust the calibration potentiometer.



**Figure 3.6:** Location of Adjustments and Controls

### 3.12 READ ALL STEPS BEFORE BEGINNING:

STEP 1. Select the desired mode of operation for the relay. See Paragraph 3.6 for complete details. For ease of calibration set both time delay switches to the OFF position until STEP 6 is reached.

STEP 2. Make sure that material is not touching the sensing probe.

STEP 3. Remove the cover of the enclosure and locate the adjustment potentiometer. See [Figure 3.6](#).

**NOTE:** There are 20 complete turns of the adjustment potentiometer from one end to the other. When one or the other end is reached, the adjustment screw will continue to turn and "free wheel" (without damage) until the direction of the rotation is reversed.

STEP 4. To make the preliminary setting of the adjustment potentiometer, observe the indicator light and proceed as follows:

If the light is **ON**:

Turn the potentiometer clockwise until the light goes OFF. Then slowly turn counter-clockwise until the light just comes back ON. Proceed to STEP 5.

If the light is **OFF**:

Turn the potentiometer counter-clockwise until the light just comes ON. Proceed to STEP 5.

STEP 5. Very carefully turn the potentiometer clockwise until the indicator light just barely goes OFF. Then turn the potentiometer one-fourth turn further clockwise.

STEP 6. Place your finger on the TOUCH TO TEST point. The red light should come on. Remove your finger and the red light should go back off. This verifies that the unit is functional.

STEP 7. Bring the material in the vessel into contact with the sensing probe. The red indicator light should turn ON. This verifies that the unit is properly calibrated for your application.

STEP 8. The time delay switch adjusts the length of the time delay. When switch 1 is in the ON position, 5 seconds will be added to the time delay. When switch 2 is in the ON position, 10 seconds will be added to the time delay. When both switches 1 and 2 are in the ON position, 15 seconds will be added to the time delay. When both switches 1 and 2 are in the OFF position, nothing will be added to the time delay and the

relay action will be nearly instantaneous. Set the desired time delay using switches 1 and 2.

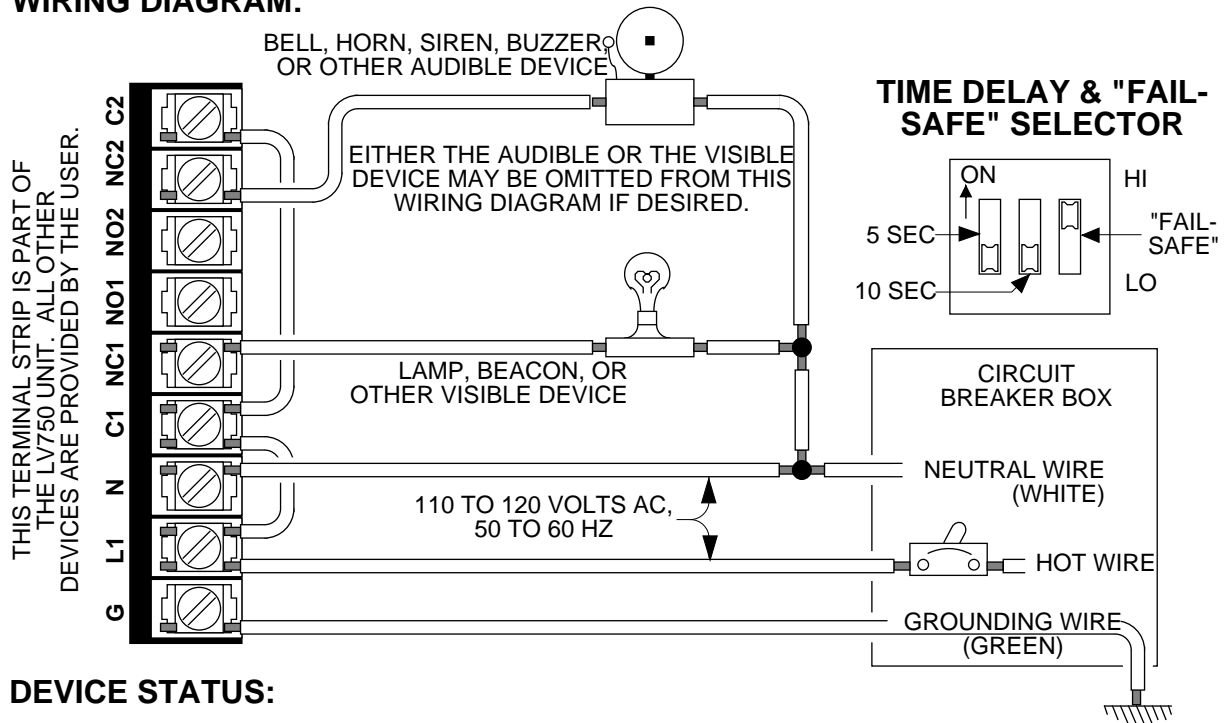
This completes the calibration of the level switch unit and it is now ready to operate.

- 3.13 Should it be necessary to remove the probe assembly from the enclosure while the probe assembly remains installed in the process, first, loosen the screw at the TOUCH TO TEST point. Slip the wire lug off of the loosened screw. Position the probe wire straight out from the enclosure so that it may rotate freely without twisting as the enclosure is unscrewed from the probe assembly. When the enclosure is free of the probe assembly carefully guide the probe connection wire through the space between the enclosure and the encapsulated electronics module. Removing the two screws on the bottom of the enclosure will allow the encapsulated electronics module to be removed from the enclosure.
- 3.14 Reverse the procedure in Paragraph 3.13 to restore the unit to operation. Repeat the calibration procedure after any changes.

#### **4.0 OPERATION**

- 4.1 No operator actions are required to use this unit. When material in the vessel comes into contact with the sensing probe, the relay in the unit will change state. If the unit is programmed for operation in the "fail-safe" high mode, the relay will de-energize upon contact of the sensing probe with the material. If the unit is programmed for operation in the "fail-safe" low mode, the relay will de-energize upon loss of contact of the sensing probe with the material. Since the relay contacts may be used in a number of different ways, the operator should know what to expect when a change of condition occurs and be prepared to take any action required by the system in which the LV750 is used.

**WIRING DIAGRAM:**



**DEVICE STATUS:**

VESSEL LEVEL	INDICATORS	RELAY	VISIBLE	AUDIBLE
<p><b>LOW</b></p>	<p>RED LED</p> <p>GREEN LED</p> <p><b>ON</b></p>	<p>NO1</p> <p>NC1</p> <p>NO2</p> <p>NC2</p> <p><b>ENERGIZED</b></p>	<p><b>OFF</b></p>	<p><b>SILENT</b></p>
<p><b>HIGH</b></p>	<p>RED LED</p> <p><b>ON</b></p> <p>GREEN LED</p> <p><b>OFF</b></p>	<p>C1</p> <p>NC1</p> <p>NO2</p> <p>NC2</p> <p><b>DE-ENERGIZED</b></p>	<p><b>ON</b></p>	<p><b>SOUNDING</b></p>

**Figure 3.7:** Typical Wiring Diagram and Device Status Chart. This diagram shows only one of many possible applications for the LV750 Level Switch. It provides a high level visible and audible alarm which helps the operator to avoid overfilling the vessel and possible spillage of material.

## 5.0 MAINTENANCE AND TROUBLESHOOTING

- 5.1 No routine maintenance is required other than keeping the interior of the unit clean and free of dirt, dust, and other contaminants.
- 5.2 The LV750 consists of two main sub-assemblies. These are the enclosure with the encapsulated detector module and the sensing probe assembly. The following troubleshooting guide will assist in determining how to correct most of the problems that may be encountered. Review the Installation and Calibration procedures in [Section 3.0](#) prior to using this guide.

	<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>SOLUTION</b>
5.3	LED cannot be adjusted to turn ON.	Sensing probe assembly not installed.	Install sensing probe assembly into enclosure.
		No power to unit.	Check for correct power to unit.
		Detector module non-functional.	Replace detector module.
5.4	LED remains on at all times.	Sensing probe is shorted to case or ground.	Remove module from sensing probe. Turn calibration potentiometer 20 turns clockwise. LED should go out. If so, repair, replace, or clean sensing probe.
		Detector module non-functional.	Replace detector module.
5.5	Unit triggers when material touches sensing probe, but will not reset when material recedes from probe or unit gives false alarms.	Improper mounting of sensing probe.	Revise mounting. See <a href="#">Figures 3.1</a> and <a href="#">3.2</a> .
		Improper calibration procedure.	See <a href="#">Paragraph 3.12</a> .
		Excessive material buildup on probe.	Perform a "dirty probe calibration": Recalibrate with built up material on probe.
		Probe is mounted in flow of material.	Revise mounting. See <a href="#">Figures 3.1</a> and <a href="#">3.2</a> .
5.6	Unit will not detect material.	Improper calibration.	See <a href="#">Paragraph 3.12</a> .
		Unit was calibrated with material touching probe.	Be sure material is not touching probe, then recalibrate.

	<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>SOLUTION</b>
5.7	Unit will not stay in calibration.	Poor grounding of case to vessel.	Provide secure ground connection.
5.8	Relay operates properly, but no contact closure at wiring terminals.	Burned or broken lands in detector module.	Replace detector module.

**DIELECTRIC CONSTANTS**

ABS RESIN	2.4	BENZYLAMINE	4.6	CHOLESTERIN	2.86	FLOUR	2.5 - 3.0
ACENAPHTHENE	3	BENZYLETHYLAMINE	4.3	CHROME, ORE	7.7 - 8.0	FLY ASH	1.5 - 2.6
ACETAL	3.6	BENZYL METHYLAMINE	4.4	CHROMYL CHLORIDE	2.6	FORMALIN	23
ACETAL BROMIDE	16.5	BERYL	6	CINNAMALDEHYDE	16.9	FORMAMIDE	84
ACETAL DOXIME	3.4	BIPHENYL	20	CIS-3-HEXENE	2.1	FORMIC ACID	58
ACETALDEHYDE	21.8	BLEACHING POWDER	4.5	CLAY	1.8 - 2.8	FORSTERITE	6.2
ACETAMIDE	41	BONE BLACK	5.0 - 6.0	CM-CHLOROANALINE	13.4	FREON 12	2.4
ACETANILIDE	2.9	BORNYL ACETATE	4.6	COAL TAR	2.0 - 3.0	FULLER'S EARTH	1.8 - 2.2
ACETIC ACID	6.2	BORON BROMIDE	2.6	COAL, POWDER, FINE	2.0 - 4.0	FURAN	3
ACETONE	20.7	BROMAL	7.6	COCAINE	3.1	FURFURAL	42
ACETONITRILE	37.5	BROMINE	3.1	COKE	1.1 - 2.2	FURFURALDEHYDE	41
ACETOPHENONE	17.3	BROMOANISOLE	7.1	COMPOUND	3.6	[ G ]	
ACETOXIME	3	BROMOBENZENE	5.4	COPPER CATALYST	6.0 - 6.2	GASOLINE	2
ACETYL ACETONE	23.1	BROMOBUTYLENE	5.8	COPPER OLEATE	2.8	GLASS, BEAD	3.1
ACETYL BROMIDE	16.5	BROMOBUTYRIC ACID	7.2	COPPER OXIDE	18.1	GLASS, RAW MATERIAL	2.0 - 2.5
ACETYL CHLORIDE	15.8	BROMOCTADECANE	3.53	CORDERITE	2.5 - 5.4	GLYCERIN, LIQUID	47 - 68
ACRYLIC RESIN	2.7 - 4.5	BROMODODECANE	4.1	CORN	5.0 - 10	GLYCOL	37
ACTEAL	3.6	BROMOFORM	4.4	COTTON	1.3 - 1.4	GLYCOLIC NITRILE	27
AIR	1	BROMOHEPTANE	5.3	COTTON SEED OIL	3.1	GRAIN	3.0 - 8.0
ALCOHOL, INDUSTRIAL	16 - 31	BROMOHEXADECANE	3.7	CREOSOL	10.6	GRAPHITE	12.0-15.0
ALKYD RESIN	3.5 - 5.0	BROMOHEXANE	5.8	CREOSOL, LIQUID	9.0-11.0	GYP SUM	2.5 - 6.0
ALLYL ALCOHOL	22	BROMOMETHANE	9.8	CROTONIC NITRICE	28	[ H ]	
ALLYL BROMIDE	7	BROMONAPHTHALENE	5.1	CRYSTALE	3.5 - 4.7	HAGEMANNIE ESTER	10.6
ALLYL CHLORIDE	8.2	BROMOOCTADECANE	3.5	CUMALDEHYDE	11	HALOWAX	4.5
ALLYL IODIDE	6.1	BROMOPENTADECANE	3.9	CUMENE	2.4	HEAVY OIL	3
ALLYL RESIN (CAST)	3.6 - 4.5	BROMOPROPIONIC ACID	11	CUMICALDEHYDE	10.7	HEPTANE	1.9
ALUMINA CHINA	3.1 - 3.9	BROMOTOLUENE	5.1	CUPRIC OLEATE	2.8	HYDRAZINE	52
ALUMINA	4.5 - 11.5	BROMOTRIDEKANE	4.2	CUPRIC OXIDE	18.1	HYDROCHLORIC ACID	4.0 - 12.0
ALUMINUM FLUORIDE	2.2	BROMYL CHLORIDE	5.21	CYANOACETIC ACID	33	HYDROCYANIC ACID	2.3
ALUMINUM HYDROXIDE	2.2	BUTANOL (1)	17.8	CYANOETHYL ACETATE	17.8	HYDROGEN IODIDE	2.9
ALUMINUM OLEATE	2.4	BUTANONE	18.5	CYANOGEN	2.6	HYDROGEN BROMIDE	3.8
ALUMINUM PHOSPHATE	6	BUTYRIC ANHYDRIDE	12	CYCLOHEXANE	2	HYDROGEN CHLORIDE	4.6
ALUMINUM POWDER	1.6 - 1.8	BUTYL CHLORAL	10	CYCLOHEXANE, LIQUID	18.5	HYDROGEN CYANIDE	95.4
AMBER	2.8 - 2.9	BUTYL CHLORIDE	9.6	CYCLOHEXANOL	15	HYDROGEN FLUORIDE	11.0-17.0
AMINOALKYD RESIN	3.9 - 4.2	BUTYL OLEATE	4	CYCLOHEXANONE	18.2	HYDROGEN PEROXIDE	84.2
AMMONIA	16.5	BUTYL STEARATE	3.1	CYCLOHEXENE	18.3	HYDROGEN SULFIDE	5.8
AMMONIUM BROMIDE	7.2	BUTYLACETATE	5.1	CYCLOPENTANE	2	HYDROZINE	52.9
AMMONIUM CHLORIDE	7	BUTYLAMINE	5.4	CYCLOC NITRILE	27	[ I ]	
AMYL ACETATE	5	BUTYRALDEHYDE	13.4	CYMENE	2.3	ILMENITE	6.0 - 7.0
AMYL ALCOHOL	15.8	BUTYRIC ACID	3	[ D ]		INDONAL	7.8
AMYL BENZOATE	5.1	BUTYRONITRILE	20.7	D-COCAINE	3.1	IODINE	11
AMYL BROMIDE	6.3	[ C ]		DECANAL	8.1	IRON OXIDE	14.2
AMYL CHLORIDE	6.6	CALCITE	8	DECANE	2	ISO-BUTYL ALCOHOL	18.7
AMYL ETHER	3.1	CALCIUM	3	DECANOL	8.1	ISO-PROPYL ALCOHOL	18.3
AMYL FORMATE	5.7	CALCIUM CARBONATE	9.1	DECYLENE	2.7	ISO-PROPYL BENZENE	2.4
AMYL IODIDE	6.9	CALCIUM FLUORIDE	7.4	DECYNE	2.2	[ J ]	
AMYL NITRATE	9.1	CALCIUM FLUORIDE	7.4	DEUTERIUM OXIDE	78.3	JET FUEL (JP4)	1.7
AMYL THIOCYANATE	17.4	CALCIUM OXIDE	11.8	DEXTRIN	2.2 - 2.4	[ K ]	
AMYLAMINE	4.6	CALCIUM SULFATE	5.6	DIACETOXYBUTANE	6.6	KENT WAX	6.5 - 7.5
AMYLENE	2	CAMPHERE	2.7	DIALLYL SULFIDE	4.9	KEROSENE	1.8
AMYLENE BROMIDE	5.6	CAMPHER, CRYSTAL	10.0 - 11.0	DIAMOND	10	KYNAR	2
AMYL MERCAPTAN	4.7	CAMPHORPINACONE	3.6	DIBENZYL SEBACATE	4.6	[ L ]	
ANILINE	7.3	CAPRYLIC ACID	3.2	DIBENZYLAMINE	3.6	LACTIC ACID	22
ANISOLE	4.3	CARBIDE	5.8 - 7.0	DIBUTYL PHTHALATE	6.4	LACTRONITRILE	38.4
APATITE	7.4	CARBON BLACK	2.5 - 3.0	DIBUTYL SEBACATE	4.5	LEAD OXIDE	25.9
ARSENIC TRIBROMIDE	9	CARBON DISULPHIDE	2.6	DIEBENZYLAMINE	3.6	LEAD SULFATE	14.3
ARSENIC TRICHLORIDE	12.4	CARBON TETRACHLORIDE	2.2	DINITROGEN OXIDE	1.6	LIME	2.2 - 2.5
ASBESTOS	4.8	CARNAUBA WAX	2.9	DIOCTYL PHTHALATE	5.1	LIMONENE	2.3
ASPHALT	2.6	CARVENONE	18.4	DIOXANE (1,4)	2.2	LINOLEIC ACID	2.9
[ B ]		CARVOL	11.2	DIPENTENE	2.3	LINSEED OIL	3.2 - 3.5
BAKELITE	3.5 - 5.0	CASEIN	6.1 - 6.8	DIPHENTY METHANE	2.6	[ M ]	
BARIUM CHLORIDE	11	CASTOR OIL	2.6	DIPHENYL	2.53	MAGNESIUM OXIDE	9.7
BARIUM NITRATE	5.8	CEDRENE	3.2	DIPHENYL ETHER	3.9	MAGNESIUM SULFATE	8.2
BARIUM SULFATE	11.4	CELLOPHANE	3.2 - 6.4	DIPHENYLAMINE	3.3	MALACHITE	7.2
BARLEY FLOUR	3.0 - 4.0	CELLULOID	3.3 - 11	DIPROPYL KETONE	12.6	MALONIC NITRILE	47
BEESWAX	2.7 - 3.0	CELLULOSE	3.2 - 7.5	DIPROPYLAMINE	2.9	MANDELONITRILE	17
BENZAL CHLORIDE	6.9	CELLULOSE NITRATE	6.4	DOLOMITE	6.8 - 8.0	MANGANESE DIOXIDE	5.0 - 5.2
BENZALDEHYDE	17.8	CEMENT	1.5 - 2.1	DOWTHERM	3.4	MANNITOL	3
BENZALDOXIME	3.8	CHARCOAL	1.2 - 1.81	[ E ]		MARGARINE, LIQUID	2.8 - 3.2
BENZENE	2.3	CHLORINE	2	EBONITE	2.5 - 2.9	MELAMINE RESIN	4.7 - 10.9
BENZONITRILE	26	CHLOROACETIC ACID	21	EMERY SAND	16.5	MERCURY CHLORIDE	7.0-14.0
BENZOPHENONE	13	CHLOROACETONE	29.8	EPICHLORHYDRIN	22.9	MERCURY DIETHYL	2.3
BENZOTRICHLORIDE	7.4	CHLORO BENZENE	5.6	EPOXY RESIN (CAST)	3.6	MESITYL OXIDE	15.4
BENZOYL CHLORIDE	19	CHLOROCYCLOHEXANE	7.6	ETHYL ACETATE	6	MESITYLENE	2.4
BENZOYLACETONE	3.8	CHLOROFORM	4.8	EUGENOL	6.1	MESITYLENE	3.4
BENZYL ACETATE	5	CHLOROHEPTANE	5.5	[ F ]		METHANOL	32.6
BENZYL ALCOHOL	13	CHLOROHYDRATE	3.3	FERRIC OLEATE	2.6	METHOXYBENZENE	4.3
BENZYL BENZOATE	4.8	CHLORONAPHTHALENE	5	FERROCHROMIUM	1.5 - 1.8	METHOXYPHENOL	11
BENZYL CHLORIDE	6.4	CHLORO OCTANE	5.1	FERROMANGANESE	5.0 - 5.2	METHOXYTOLUENE	3.5
BENZYL CYANIDE	18.3	CHLOROPHETANE	5.4	FERROUS OXIDE	14.2	2-METHYL-1-PROPANOL	17.7
BENZYL SALICYLATE	4.1	CHLOROTOLUENE	4.7	FERROUS SULFATE	14.2	METHYL ACETATE	6.7

**DIELECTRIC CONSTANTS**

METHYL ALCOHOL	33.1	PHENYLHYDRAZINE	7.2	RUBY	11.3	THIOPHENE	2.8
METHYL ETHYL KETONE	18.4	PHOSGENE	4.7	RUTILE	6.6 - 8.6	THORIUM OXIDE	10.6
METHYL P-TOLUATE	4.3	PHOSPHORUS	4.1			THUJONE	10
METHYL PROPIONATE	5.4	PHOSPHORUS, RED	4.1	[ S ]		TIN TETRACHLORIDE	2.9
METHYL SALICYLATE	9	PHOSPHORUS, YELLOW	3.6	SAFROL	3.1	TITANIUM DIOXIDE	110
METHYL THIOCYANATE	35.9	PHTHALIC ACID	5.1-6.3	SALICYLALDEHYDE	13.9	TITANIUM OXIDE	40.0 - 50.0
METHYL VALERATE	4.3	PINACOLIN	12.8	SALT	3.0 - 15.0	TOBACCO	1.6 - 1.7
METHYLAMINE	10.5	PINACONE	7.4	SAND	3.0 - 5.0	TOLUENE	2.4
METHYLANILINE	6	PINE TREE RESIN	1.5-1.8	SAND (DRY)	5	TOLUIDINE	6
METHYLBENZYLAMINE	4.4	PINENE	2.7	SANTOWAX	2.3	TOLUNITRILE	18.8
METHYLCYCLOPENTANE	2	PIPERIDINE	5.9	SELENIUM	6.6 - 11.0	TOLYL METHYL ETHER	3.5
METHYLENE IODIDE	5.1	PLASTER	2.5 - 6.0	SESAME	1.8 - 2.0	TOURMALINE	6.3
METHYLETHER, LIQUID	5	PLASTIC GRAIN	65-75	SHELLAC	2.0 - 3.8	TRANS-3-HEXENE	2
METHYLHEXANE	1.9	PLASTIC PELLETS	1.1-3.2	SILICA ALUMINATE	2	TRANSMISSION OIL	2.2
METHYLISOCYANATE	29.4	PLATINUM CATALYST	6.5 - 7.5	SILICA SAND	2.5 - 3.5	TRIBROMOPROPANE	6.4
METHYLOCTANE	30	POLYACETAL	3.6-3.7	SILICON	11.0 - 12.0	TRIBUTYLPHOSPHATE	8
METHYLPYRIDINE (2)	9.8	POLYACETOL RESIN	2.6-3.7	SILICONE OIL	2.2 - 2.9	TRICHLOROETHYLENE	3.4
MICA	2.6 - 3.2	POLYACRYLIC ESTER	3.5	SILICONE RESIN, LIQUID	3.5 - 5.0	TRICHLOROETHANE	7.5
MICANITE	1.8 - 2.6	POLYAMIDE	2.5-2.6	SILICONE RUBBER	3.2 - 9.8	TRICHLOROETHYLENE	3.4
MINERAL OIL	2.1	POLYBUTYLENE	2.2-2.3	SILICONE VARNISH	2.8 - 3.3	TRICHLOROPROPANE	2.4
MORPHOLINE	7.3	POLYCAPROLACTAM	2.0 - 2.5	SILK	2.5 - 3.5	TRICHLOROTOLUENE	6.9
[ N ]		POLYCARBONATE	2.9-3.0	SILVER BROMIDE	12.2	TRICHLOROTOLUENE	6.9
NAPHTHY ETHYL ETHER	3.2	POLYCARBONATE RESIN	2.9 - 3.0	SILVER CHLORIDE	11.2	TRIETHYL ACONITATE	6.4
NAPHTHALENE	2.5	POLYESTER RESIN	2.8 - 4.5	SILVER CYANIDE	11.2	TRIETHYL ALUMINUM	2.9
NAPHTHONITRILE	6.4	POLYETHER CHLORIDE	2.9	SLAKED LIME, POWDER	2.0 - 5.6	TRIETHYLAMINE	2.4
NEOPRENE	6.0 - 9.0	POLYETHER RESIN	2.8-8.1	SLATE	6.0 - 7.5	TRIETHYLAMINE	3.2
NITROANISOLE	24	POLYETHYLENE	2.2-2.4	SMITHSONITE	9.3	TRIFLUOROACETIC ACID	39
NITROBENZENE	35.7	POLYIMIDE	2.8	SOAP POWDERS	1.2 - 1.7	TRIFLUOROTOLUENE	9.2
NITROCELLULOSE	6.2 - 7.5	POLYPROPYLENE	1.5	SODIUM CARBONATE	8.4	TRIMETHYL BORATE	8.2
NITROETHANE	19.7	POLYSTYRENE RESIN	2.4 - 2.6	SODIUM CARBONATE	8.4	TRIMETHYL-3-HEPTENE	2.2
NITROGLYCERIN	19	POLYSTYROL	2.0-2.6	SODIUM CYANIDE	7.55	TRIMETHYLAMINE	2.5
NITROMETHANE	39.4	POLYSULPHONIC ACID	2.8	SODIUM DICHROMATE	2.9	TRIMETHYLBENZENE	2.3
NITROTOLUENE	25	POLYVINYL ALCOHOL	1.9-2.0	SODIUM NITRATE	5.2	TRIMETHYLBUTANE	1.9
NITROUS OXIDE	1.6	POLYVINYL CHLORIDE	3.4	SODIUM OLEATE	2.7	TRIMETHYLPENTANE	2.9
NONANE	2	PORCELAIN	5.0 - 7.0	SODIUM PERCHLORATE	5.4	TRINITROBENZENE	2.2
NYLON	4.0 - 5.0	POTASSIUM CHLORIDE	5.1	SODIUM PHOSPHATE	1.6 - 1.9	TRINITROTOLUENE	22
NYLON RESIN	3.0 - 5.0	POTASSIUM CHLORIDE	4.6	SODIUM SULFIDE	5	TRIOLEIN	3.2
[ O ]		POTASSIUM IODIDE	5.6	SOY BEANS	2.8	TURPENTINE (WOOD)	2.2
OIL, ALMOND	2.8	POTASSIUM NITRATE	5	STANNIC CHLORIDE	3.2	TWO-DICHLOROETHANE	10.7
OIL, COTTON SEED	3.1	POTASSIUM NITRATE	5	STARCH	3.0 - 5.0	[ U ]	
OIL, GRAPESEED	2.9	POTASSIUM SULFATE	5.9	STARCH, PASTE	1.7 - 1.8	UNDECANE	2
OIL, LEMON	2.3	PROPANE	1.6	STEARINE	2.3	UNDECANONE	8.4
OIL, LINSEED	3.4	PROPANEDIOL	32	STEATITE	5.5 - 7.5	UREA	3.5
OIL, OLIVE	3.1	PROPANOL (1)	20.1	STYRENE	2.4	UREA FORMALDEHYDE	6.4 - 6.9
OIL, PARAFFIN	2.2 - 4.7	PROPENE	1.9	STYRENE (MODIFIED)	2.4 - 3.8	UREA RESIN	6.2 - 9.5
OIL, PEANUT	3	PROPIONALDEHYDE	18.9	STYRENE RESIN	2.3 - 3.4	URETHANE	3.2
OIL, PETROLEUM	2.1	PROPIONIC ACID	3.3	SUCCINAMIDE	2.9	URETHANE RESIN	6.5 - 7.1
OIL, PYRANOL	5.3	PROPIONIC ANHYDRIDE	18	SUCCINIC ACID	2.4	[ V ]	
OIL, SESAME	3	PROPIONITRILE	27.7	SUCROSE	3.3	VALERALDEHYDE	11.8
OIL, SPERM	3.2	PROPYL ACETATE	6.3	SUCROSE (MEAN)	3.3	VALERIC ACID	2.6
OIL, TERPENTINE	2.2	PROPYL ALCOHOL	21.8	SUGAR	3	VALERONITRILE	17.7
OIL, TRANSFORMER	2.2	PROPYL BENZENE	2.4	SUGAR, GRANULATED	1.5 - 2.2	VANADIUM SULFIDE	3.1
OLEIC ACID	2.5	PROPYL BROMIDE	7.2	SULFUR	1.6 - 1.7	VASELINE	2.2 - 2.9
OPAL WAX	3.1	PROPYL BUTYRATE	4.3	SULFUR DIOXIDE	15	VERATRIN	4.5
[ P ]		PROPYL ETHER	3.4	SULFUR TRIOXIDE	3.1	VINYL ALCOHOL RESIN	2.6 - 3.5
PAINT	5.0 - 8.0	PROPYL FORMATE	7.9	SULFUR, LIQUID	3.5	VINYL BUTYRAL	3.3 - 3.9
PAPER (DRY)	2	PROPYL NITRATE	14.2	SULFUR, POWDER	3.6	VINYL CHLORIDE RESIN	2.8 - 4.0
PARAFFIN	1.9 - 2.5	PROPYL PROPIONATE	4.7	SULFURIC ACID	84	VINYL ETHER	3.9
PARAFFIN OIL	4.6 - 4.8	PROPYL VALERATE	4	SULFURYL CHLORIDE	10	VINYLDENE CHLORIDE	3.0 - 4.0
PARALDEHYDE	13.9	PROPYLENE LIQUID	11.9	SULPHUR	4	VYCOR GLASS	3.8
PARAWAX	2.3	PSUEDOCUMENE	2.4	SYRUP	50 - 80	[ W ]	
PARRAFIN CHLORIDE	2.0 - 2.3	PULEGONE	9.5	SYRUP WAX	2.5 - 2.9	WATER	80.4
PENTACHLOROETHANE	3.7	PULEZONE	9.7	[ T ]		WATER	88
PERLITE	1.3 - 1.4	PVC, POWDER	1.4	TANTALUM OXIDE	11.6	WAX	2.4 - 6.5
PETROLEUM	2.0-2.2	PYREX	4.8	TARTARIC ACID	6	WHEAT FLOUR	3.0 - 5.0
PHENATHIENE	2.8	PYREX GLASS	4.3 - 5.0	TARTARIC ACID	35.9	WHITE MICA	4.5 - 9.6
PHENETOLE	4.5	PYRIDINE	12.5	TEFLON	2	WOOD, DRY	2.0 - 6.0
PHENOL ETHER	9.8	PYROCERAM	3.5-4.5	TEFLON (4F)	2	WOOD, WET	10.0 - 30.0
PHENOL RESIN	4.9	PYRROLE	7.5	TEFLON, FEP	2.1	[ X ]	
PHENOXYACETYLENE	4.8	[ Q ]		TEFLON, PCTFE	2.3 - 2.8	XYLENE	2.4
PHENTIDINE	7.3	QUARTZ	4.2	TEFLON, PTFE	2	XYLENOL	3.9
PHENYL ACETATE	6.9	QUINOLINE	9	TEPINEOL	2.8	XYLIDINE	5
PHENYL ETHER	3.7	[ R ]		TERPINENE	2.7	[ Z ]	
PHENYL ISOCYANATE	8.9	REBURNED LIME	2.2	TERPINEOL	2.8	ZINC OXIDE	1.7 - 2.5
PHENYL-1-PROPANE	1.7	REFRACTORY (CAST)	6.7	TETRABROMOETHANE	7	ZINC SULFIDE	8.2
PHENYLACETALDEHYDE	4.8	REFRACTORY	1.8 - 2.1	TETRAETHYL SILICATE	4.1	ZIRCON	12
PHENYLACETIC	3	RESORCINOL	3.2	TETRANITROMETHANE	2.2	ZIRCONIUM OXIDE	12.5
PHENYLACETONITRILE	18	RICE	3.0 - 8.0	THALLIUM CHLORIDE	46.9	ZIRCONIUM SILICATE	5
PHENYLETHANOL	13	RICE BRAN	1.4 - 2.0	THINNER	3.7		
PHENYLETHYL ACETATE	4.5	ROUGE	1.5	THIOACETIC ACID	13		
PHENYLETHYLENE	2.4	ROUGE (JEWELERS)	1.5 - 1.6	THIONYL BROMIDE	9.1		
		RUBBER	3	THIONYL CHLORIDE	9.3		

# OMEGA INSIDE BACK COVER

# OMEGA BACK COVER