Installation, Operation and Maintenance Manual

MODEL L100DX

AC CURRENT / HP SENSOR

PEERLESS PUMP® LaBour Taber

Members of the Sterling Fluid Systems Group

MODEL L100DX AC CURRENT/HP SENSOR

The Model L100DX Sensor is designed to protect AC electrical powered equipment from possible damage due to equipment malfunction or abnormal operating conditions. The L100DX monitors input line current, or horsepower, to such equipment, and in the event the current or horsepower exceeds either upper or lower preset limits, indicating abnormal conditions, the L100DX will automatically shut down the protected equipment before possible damage can occur, providing such conditions continue beyond preset time limits. Protection can therefore be provided for process control type systems, AC motors and machinery, pumps, conveyor systems, etc. The detection of a dry-run condition for pumps is a common application.

AC current is monitored by a toroidal type sense transformer, a nonintrusive type sensor, not requiring the need to break or make contact (connections) with the power line. Consequently, power dissipation losses are negligible. Current is sensed by passing one leg of a power line, through the window of the sense transformer. AC horsepower is monitored by an optional interface device, the KP-1 AC Power Sensor. This device senses 3-phase real power.

Detection of both an upper and lower (preset) trip point is therefore provided. A 10 second start-up delay circuit is incorporated to prevent initial inrush start current from triggering the L100DX unit. The absence of line current, or cycling of equipment, will not result in triggering the L100DX.

An auxiliary input is provided for accommodating fixed-setpoint type sensors, such as a thermostat, pressure switch, level detector, etc., thereby providing additional protection. Four LED status indicators are located on the front panel, and when a fault occurs the appropriate indicator, or indicators, will flash, and will remain in their actuated state until the L100DX is manually reset. A digital LCD meter is provided for setting setpoint levels, and for monitoring the input current or power level.

A 4-20 ma (or 0-20 ma) current output is provided, proportional to AC current or HP, for remote monitoring, computer interface, etc.

The L100DX is housed in a 6.5 x 6.5 x 4.0” polycarbonate, NEMA-4X type enclosure, UL/CSA approved. The enclosure has a window through which the indicators and digital meter can be viewed. The cover is hinged, and the reset switch is mounted on the cover.

SPECIFICATIONS

Input Power	120/240 VAC, 50/60 Hz, 7 VAC AC
Current/HP Sense Range	1 to 20 and 10 to 200
Accuracy	2%
Undercurrent Trip Delay	Fixed at 2.0 seconds, or adjustable to 1, 2 or 3 minutes.
Overcurrent Trip Delay	Fixed at 1 seconds.
Start-Up Delay	Fixed at 10 seconds.
Type Current Sensor	Toroidal sense transformer.
Auxiliary Input	Requires NC dry switch contacts.
Auxiliary Delay	Fixed at 1 second.
Output Signal	4-20 ma current source (or 0-20 ma).
Relay Contacts	One NC for control, one SPST contact for alarm. 5 amps, 240 VAC resistive.
Operating Temperature Range	-25 to +55 degrees C.
Front Cover LCD Indicators	AC Line, Overcurrent, Undercurrent, Auxiliary.
Enclosure	NEMA-4X, polycarbonate, UL/CSA approved.
Line Transient Protection	MOV.
Weight	2 1/2 pounds.
Dimension	6.5 x 6.5 x 4.0". See drawing.

INSTALLATION PRECAUTION

Certain precautions must be taken during the installation of the L100DX, since voltages **DANGEROUS TO PERSONNEL** may be present. Before installation is started it must be made certain that there are no voltages present on the lines that are to be connected to the L100DX, or line current present in the sense transformer. Dangerous voltages can be generated across the sense transformer terminals if the transformer is unloaded, and line current preset. To run pump with sensor in line without connecting to L100DX, the terminals on the sensor must be shorted as a charge may build up in the sensor.

3-PHASE POWER SENSING

Sensing AC current is satisfactory in most applications since the relationship between current and load is relatively linear. There are conditions, however, when operating at the bottom of the motor curve, as an example, where the phase angle varies rapidly with load but with little change in load current. The actual AC power to the motor, however, varies linearly with motor load, since power is proportional, the product of voltage, current and phase angle. It is difficult sometimes to adjust setpoints when current changes are small. It is recommended that under these conditions that the LaBour KP-1 AC Power Sensor be used for converting the L100DX to power sensing.

ENCLOSURE MOUNTING

The L100DX is designed for panel mounting. The enclosure should be located at a convenient and protected location which provides easy access and visibility. The sense transformer, and the KP-1 Power Sensor (if used), are generally located in the motor starter enclosure, since both units are quite small, and power lines are accessible. The L100DX can be remotely located from the sense transformer and power sensor.

Figure 3 shows the outline drawing and mounting dimensions for the L100DX enclosures, and the sense transformer.

1. The first installation step is to remove the two printed circuit boards in the L100DX, and disconnect the two interconnecting cables.

2. The rear of the L100DX enclosure incorporates four 10-32 threaded inserts for mounting purposes. The L100DX can be panel mounted and attached from the rear of the panel with four 10-32 machines screws. Four mounting feet are also included, which can be attached to the back of the enclosure, making it possible to attach the L100DX from a front surface. See figure 4 for a drill template for either type mounting.

3. The conduit holes can be located on the bottom of the enclosure, for bottom cable entry, or to the rear of the enclosure for rear cable entry. The mounting feet would not be used for rear cable entry. The correct location of these holes is shown in figures 3 and 4. The installer will be required to punch the conduit holes in the L100DX enclosure.

4. After the enclosure is installed, and the cable wires pulled in, the bottom printed circuit board is re-installed, and conduit cable wires connected to the terminal block. See figure 1, interconnection wiring diagram for AC current sensing, or figure 2 for AC power sensing. Then the two cables from the upper board are reconnected, and the upper board reattached.

INTERCONNECTION WIRING

Refer to figure 1 for AC current sense wiring, or to figure 2 FOR AC power sense wiring. Note that the sense transformer lines must be connected to either the 20 or 200 amp range on the L100DX, or to the 20 or 200 HP range on the KP-1, depending on which configuration and range selected. Sense line polarity does not have to be observed for current sensing, **but must be observed for power sensing**. The METER switch located at the upper right hand corner of the front printed circuit board must be set to the correct range i.e. 20 or 200 (current or HP). The sense transformer lines should be shielded twisted pair type cable. The sense wires should not be routed with other cables which are carrying high current or high voltage. The cable shield must be

grounded at one end only, at the L100DX(AC Com terminal 14). If the AUX. input is not used it must be shorted with a jumper. If the KP-1 Power Sensor is used refer to figure 5, Model KP-1 Power Sensor Installation, for proper installation instructions. As with current sensing, the KP-1 wires should be shielded twisted pair with the shield wire grounded at Terminal 14 on the L100DX.

UNDERCURRENT DELAY ADJUSTMENT

The undercurrent delay period is fixed at 2 seconds at the factory. If delay times of one, two or three minutes are required, one or both jumpers, 1 M and 2M (M=minute), must be removed by means of a wire cutter. The two jumpers are located on the top printed circuit board, toward the upper left corner. The top panel must be removed first in order to gain access to these jumpers.

It must be cautioned that increasing the time delay can result in a loss of protection that the L100DX provides for the detection of a dry-run condition in a pump application. There are applications however, that require longer undercurrent delay periods.

4-20 MA OUTPUT

A 4 to 20 ma output current signal is available which is proportional to AC current or HP. The 20 ma output signal corresponds to 20A (or 200A), or to 20HP (or 200HP). The output can be converted to 0 to 20 ma by removing the 4-20 mA jumper on the lower printed circuit board.

ADJUSTMENT PROCEDURE

The front panel adjustments are, 1) LO-AC lower setpoint screwdriver adjustment, 2) HI-AC upper setpoint screwdriver adjustment, 3) meter select switch, and 4) RELAY ON/OFF switch. The relay switch is initially set to OFF. After the upper and lower setpoints are adjusted the RELAY switch is returned to **ON.**

The input signal level, AC current or HP, can be monitored by selecting AC on the METER selector switch.

If the upper setpoint level is not used it must be set to its maximum level, and if the lower setpoint level is not used it must be set to its minimum level.

INSTALLATION CHECKOUT PROCEDURE

Once the installation of the L100DX has been completed, and the setpoints adjusted, a functional verification test should be made. This can be done by referring to the "Preventative Maintenance Procedure" section.

PREVENTATIVE MAINTENANCE PROCEDURE

As a minimum requirement the various setpoint levels, and input level, should be read periodically and entered into a log, and any variations noted and investigated. A functional test can be made as follows;

1. A functional test requires that the protected equipment is operating under normal load conditions.

2. Set the METER switch to (LO-AC). Then increase the lower setpoint level until the LO-AC indicator starts to flash and the protected equipment shuts down. Note the LO-AC setpoint reading at the point where the equipment shuts down. This reading should equal the normal line current. Return the setpoint level to its previous setting, and then actuate the reset switch. Repeat this procedure by selecting the HI-AC on the meter, and reducing the upper threshold level until the HI-AC indicator starts to flash. Return the upper threshold to its previous setting, then actuate the Reset switch.

3. Momentarily disconnect the wire lead to the AUX input. This should result in a shut down of the protected equipment, and flashing of the AUX indicator. Reconnect the line, and then actuate the reset switch.

4. It may not be possible to shut down an operating system for this test procedure. A somewhat less complete test would be to rely on the indicators functioning correctly, with the relay switch in the **OFF** position. It must be remembered to return the relay switch to the **ON** position when the test is completed.

KP-1 POWER SENSOR

1 .The KP-1 Power Sensor is designed to interface with the LaBOUR type L100DX and the current sensors, converting them into 3-phase power sensors. The KP-1 is small in size, comparable to the sense transformer itself, making it possible to locate both units in a motor start unit. Since the KP-1 output is a low level current signal the L100DX can be remotely located.

2. The KP-1 is encapsulated in a small plastic enclosure, providing environmental protection. The KP-1 interfaces with a 240/480 VAC, 50/60 Hz, 3-phase, 3-wire power line. No power is drawn from the line. The current sensing input to KP-1 is provided by the sense transformer normally supplied with the L100DX units. The sense range of the KP-1 is 1 to 20HP and 10 to 200HP. The FS scale output is a 4 ma DC current source. The supply voltage to the KP-1 is 15 VDC, 18 ma. The KP-1 measures real AC power, but is calibrated in horsepower.

3. The wiring diagram for the KP-1 is shown in figure 2. The L2 input to the KP-1 must be connected to the same 3-phase line that is routed through the sense transformer. The Ll and L3 inputs can be connected to either of the remaining lines.

4. Line polarity must be observed during power sensing (see figure 2).

5. The first time the L100DX is monitoring AC_ power the metering readings should be verified. If the output is zero the sense transformer sense leads to the KP-1 may be reversed. The meters should read HP in accordance to the following formula (assuming a balanced load):

$$HP = 1.73(\text{line voltage})(\text{line current})(\text{power factor})/746$$

KP-1 TROUBLE SHOOTING

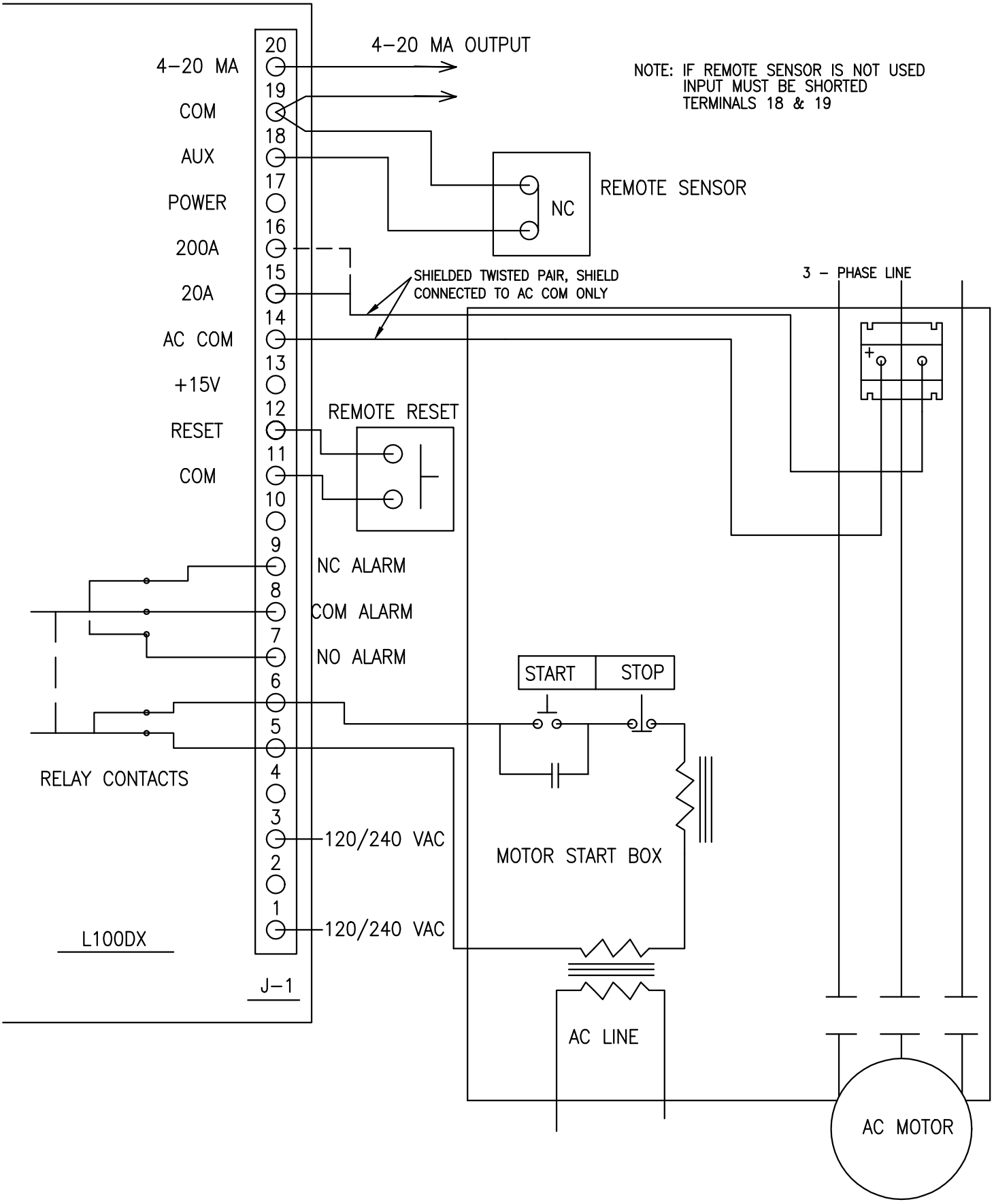
Sensors, in general, are low level devices, that is, they have low output signals, and are therefore very susceptible to interfering signals, due to radiation or ground loop conduction. Proper wire interconnection from the KP-1 sensor to the L100DX is critical. To determine whether or not interference is the problem the follow this procedure.

1. Set the meter switch on the L100DX to **INPUT**. The pump should be operating normally. Shut down the system and install a jumper wire between terminals 14 & 17 on the L100DX, which are the HP input terminals.

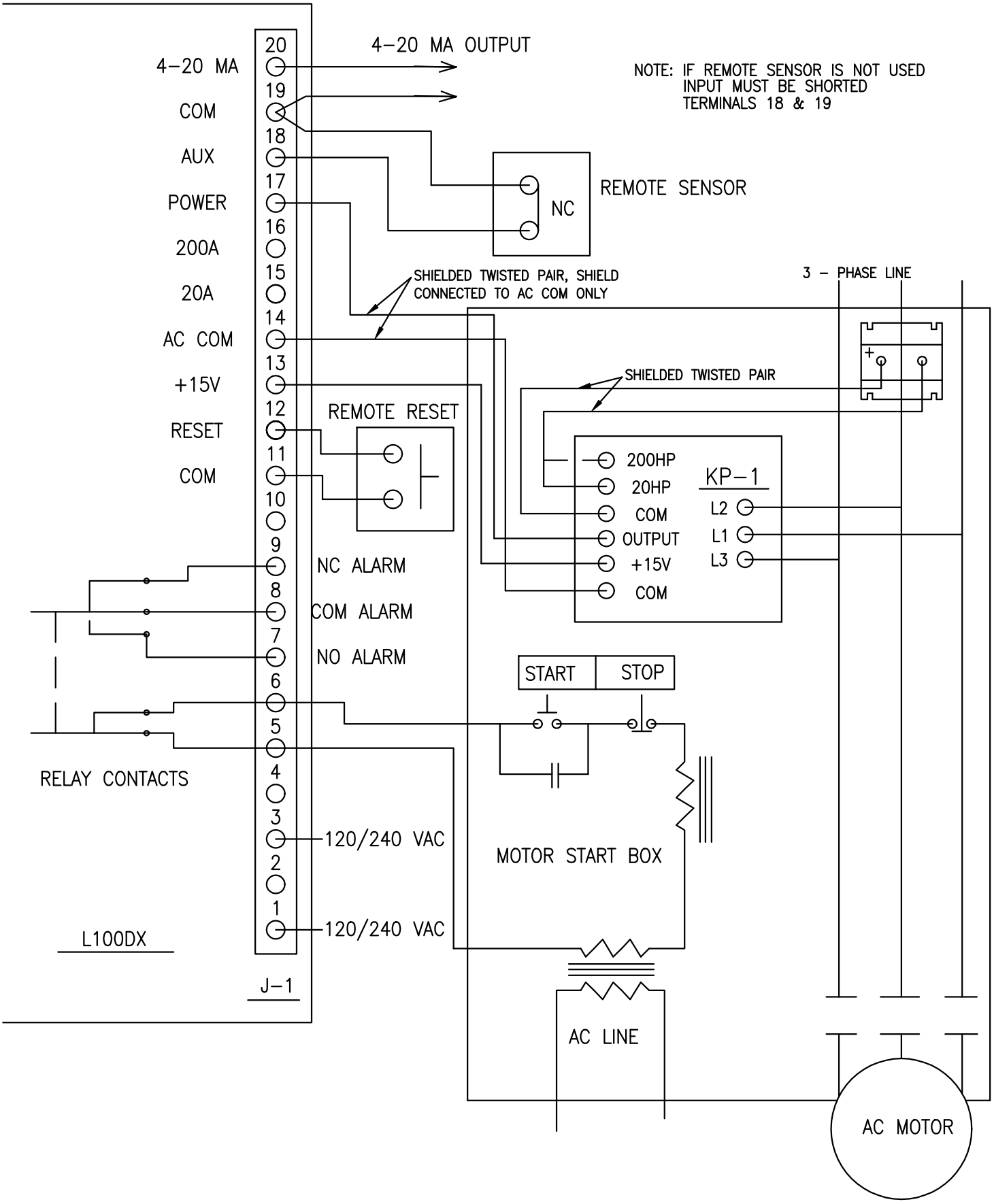
2. Restart the pump. The L100DX meter must then read zero, or very close to zero.

3. Shut down the system and install jumper wire in **COM** and **OUTPUT** terminals on the KP-1. Restart the pump, the L100DX meter should now read as in step 2. Shut down the system and remove the jumper and reconnect wires per Figure 2.

Proper operation of the L100DX/KP-1 combination will not result unless the above test results are achieved. IF these results are not obtained a careful review of the interconnection is indicated.

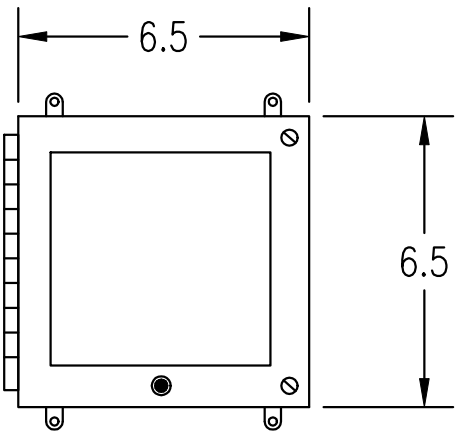


MODEL L100DX AC CURRENT/HP SENSOR WIRING DIAGRAM AC POWER CONFIGURATION	*LaBour Pumps*		
	DWG. No. L100DX IOM FIG. 1	DATE 11/11/96	REV. A

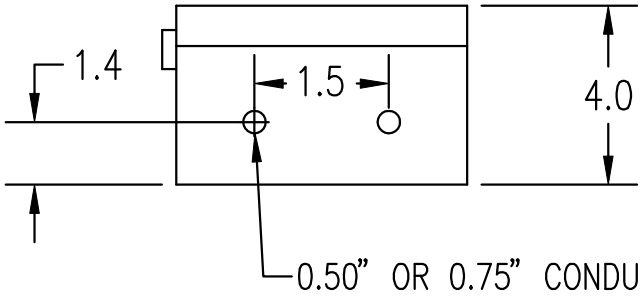


MODEL L100DX AC CURRENT/HP SENSOR WIRING DIAGRAM AC POWER CONFIGURATION	*LaBour Pumps*		
	DWG. No. L100DX IOM FIG. 2	DATE 11/11/96	REV. A

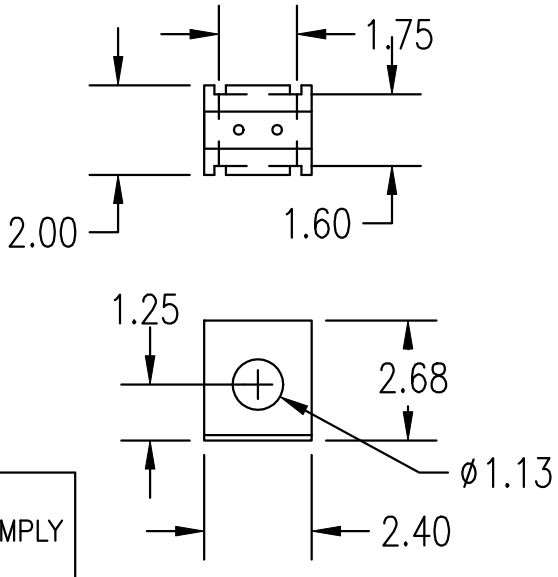
POLYCARBONATE ENCLOSURE



MTG FEET: 4 x 6.94"
REAR MTG: 4.00 x 4.12

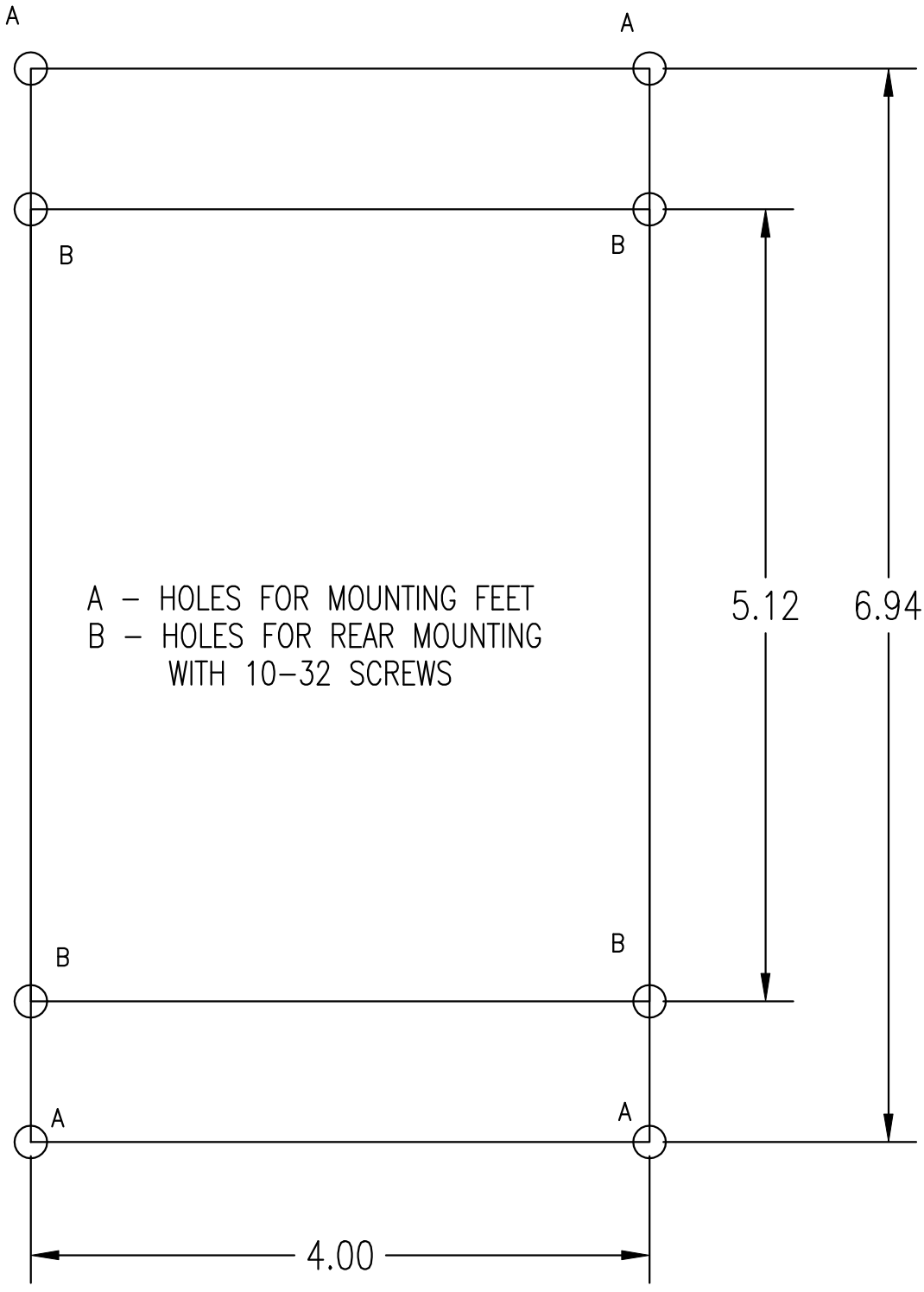


SENSE TRANSFORMER



NOTE: BOTH ENCLOSURES COMPLY WITH NEMA 4X/UL STANDARDS

L100DX & SENSE TRANSFORMER ENCLOSURES	*LaBour Pumps*		
	DWG. No. L100DX IOM FIG. 3	DATE 11/21/96	REV. B



L100DX DRILL TEMPLATE MOUNTING FEET	*LaBour Pumps*		
	DWG. No. L100DX IOM FIG. 4	DATE 11/11/96	REV. A

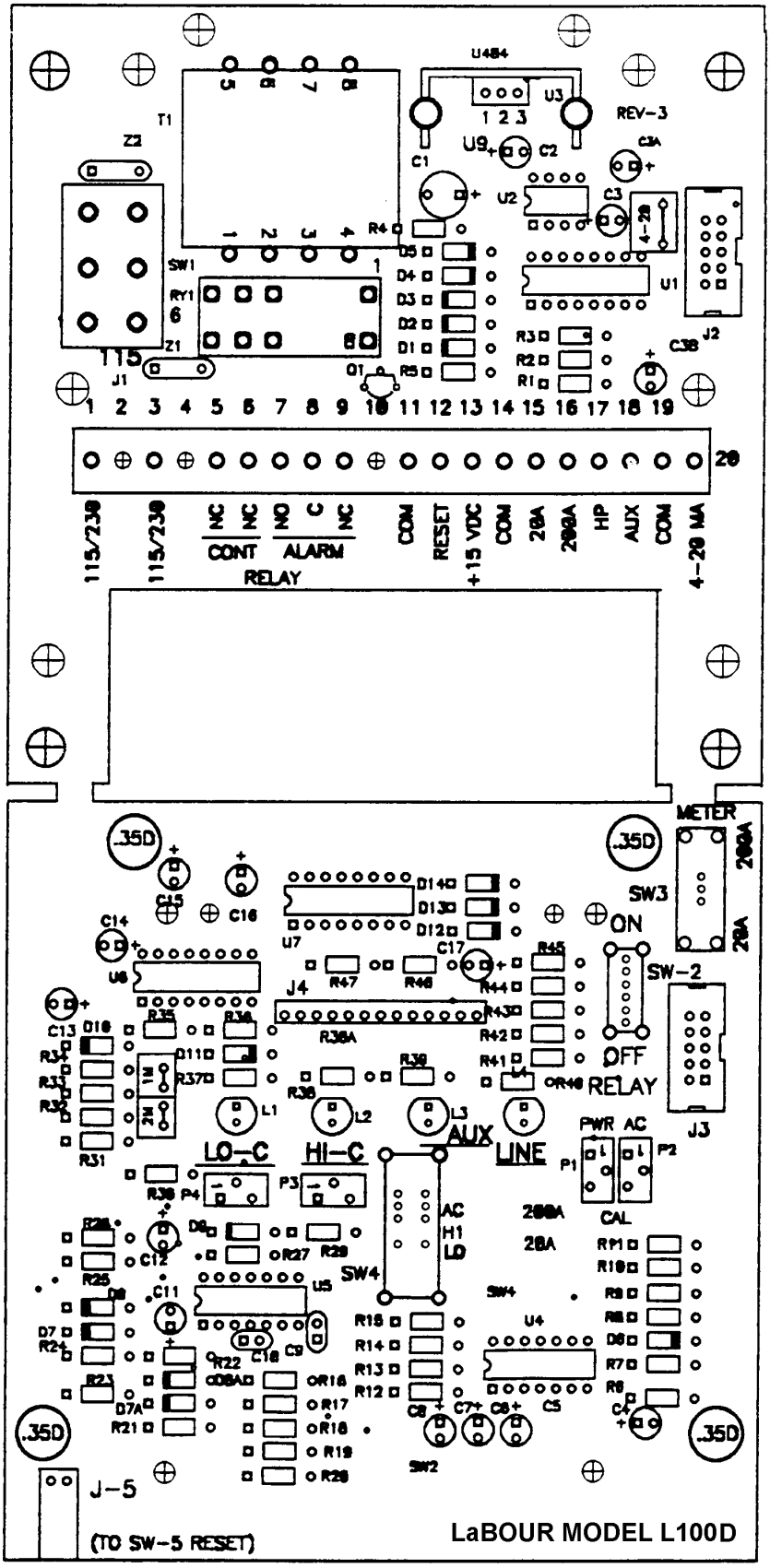
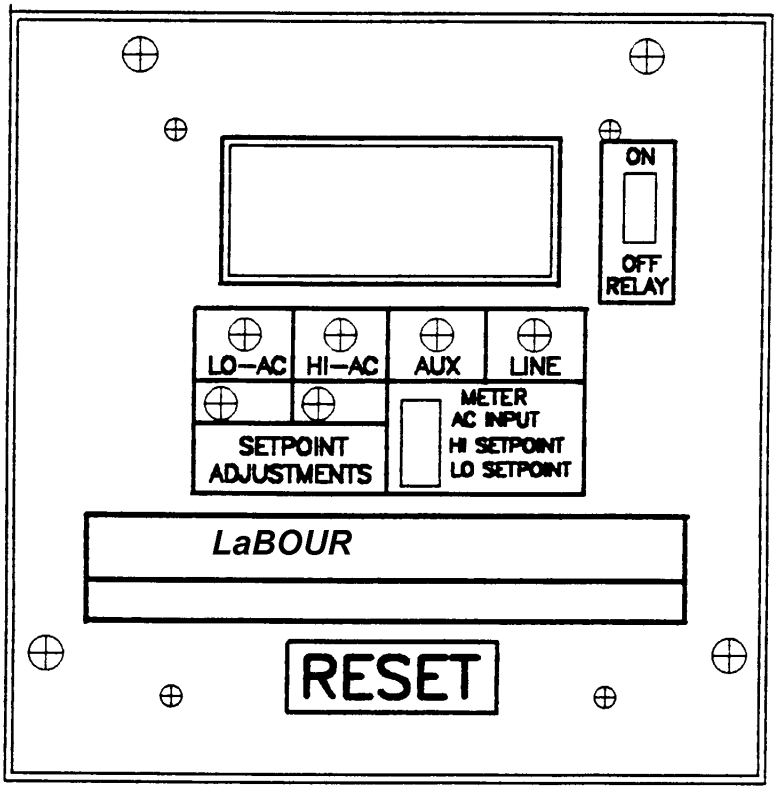


FIG. 5

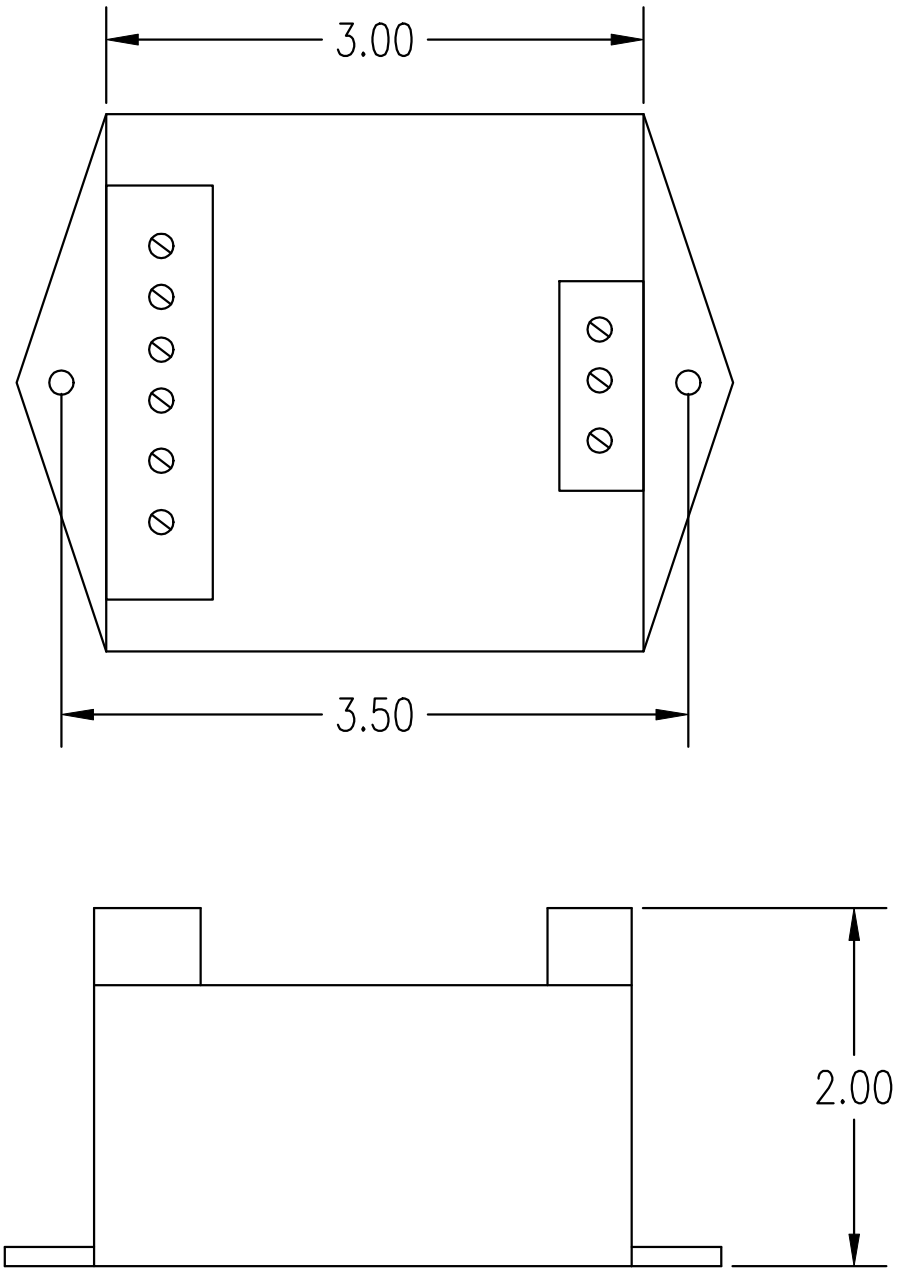
L100DX BOARD	*LaBour Pumps*		
	DWG. No.	DATE	REV.
	L100DX IOM FIG. 5	07/10/95	--



FRONT PANEL

FIG. 6

L100DX FRONT PANEL	*LaBour Pumps*		
	DWG. No.	DATE	REV.
	L100DX IOM FIG. 6	07/10/95	--



KP-1 POWER SENSOR

LaBour Pumps

DWG. No.	DATE	REV.
L100DX IOM FIG. 7	11/11/96	--