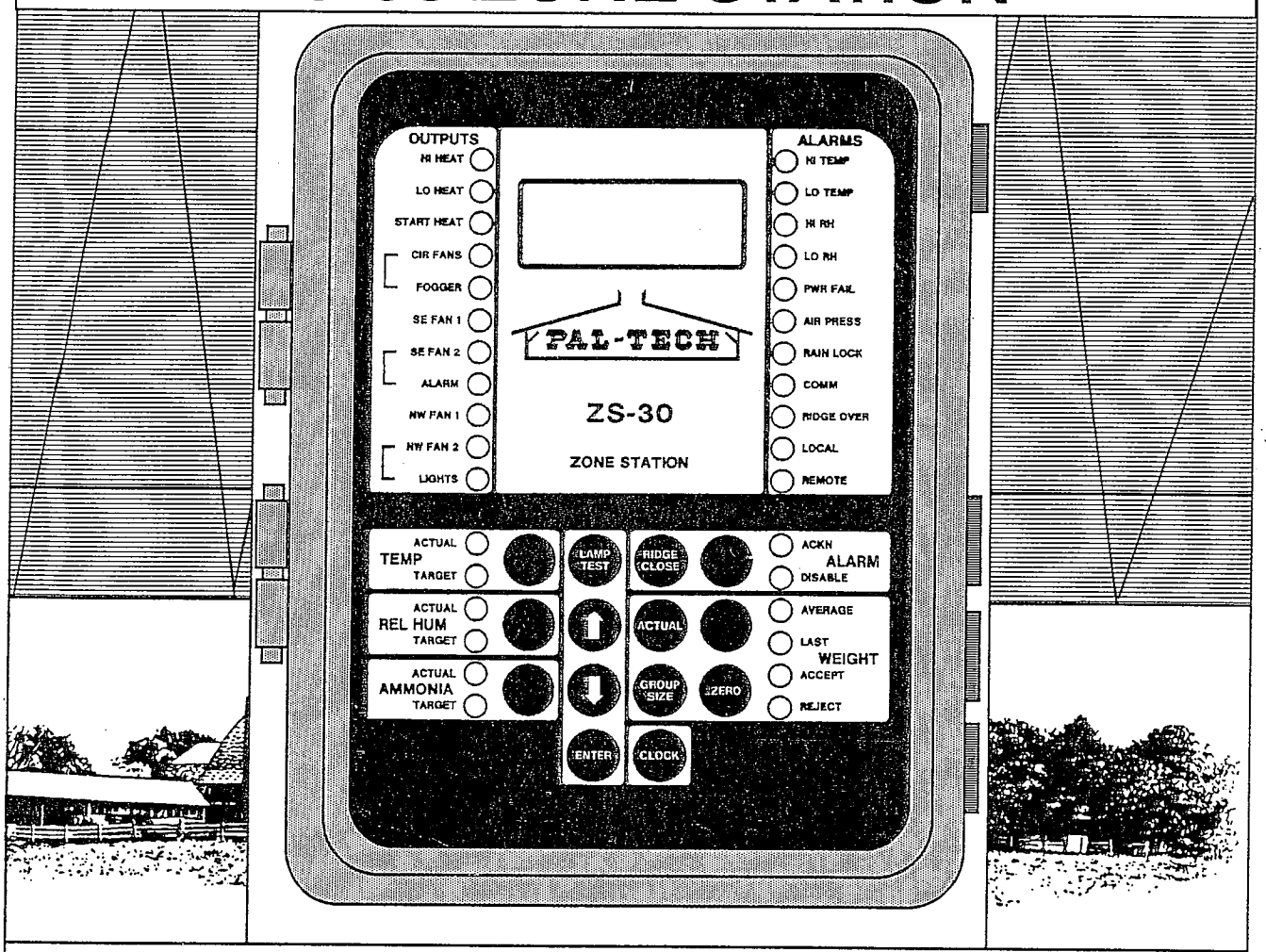
PAL-TECH

ZS-30 ZONE STATION



OPERATOR'S MANUAL

Another Fine Product From

"*The Profit Protectors*"

A Technology Department of PALS/Division of Willmar Poultry Company

YOUR ZS-30 ZONE STATION

PAL-TECH is proud to present you with one of our ZS-30 Zone Stations. We're confident that you'll find it a valuable environmental management tool that will provide you with years of trouble-free operation.

Your ZS-30 is a rugged, microcontroller that was designed for the poultry and livestock industries.

It combines the finest technology available today with simple easy-to-operate controls. Indeed, we think you'll find your ZS-30 as convenient to use as a telephone or pocket calculator.

When installed, your ZS-30 will automatically monitor temperature and humidity levels in your barn and operate ventilation equipment to make sure that your flock, or herd, has a healthy, stable environment in which to live. In addition, it will also gather barn management data.

Your ZS-30 can be used alone, with other PAL-TECH Zone Stations, or as part of a larger PAL-TECH system.

If used independently or in combination with other PAL-TECH Zone Stations, your ZS-30 automatically monitors temperature, humidity, and average weight levels as it controls ventilation equipment in its designated zone, or area, of your building.

If used as part of a larger PAL-TECH system, your ZS-30 will exchange data with a PAL-TECH Barn Management Center. You can then also collect and use management data such as feed, water, fuel, and electrical usage to help you run your operation more efficiently.

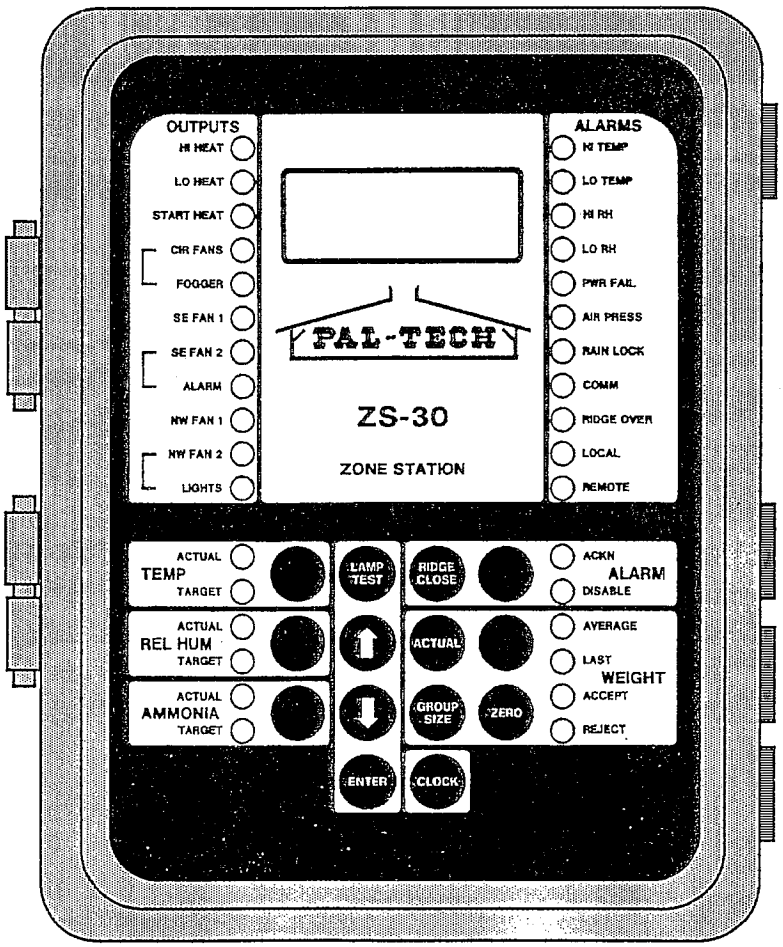


Figure 1.
TYPICAL ZS-30 ZONE STATION

USING YOUR ZS-30 IN A NATURAL VENTILATION SYSTEM

A natural ventilation system uses outside air to modify temperature, humidity, dust, and noxious gas levels in your building. In a PAL-TECH Natural Ventilation System, air flows in and out of your building as ridge and side vents open or close in sequence.

Years of testing in our own barns has shown us that "cross ventilation" ensures consistent natural air ventilation by drawing outside air in one end of a building and exhausting it at the other.

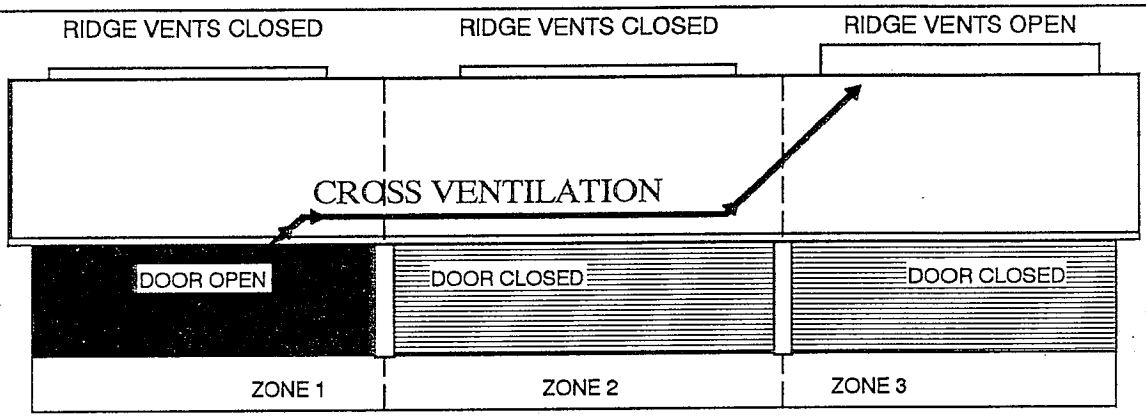


Figure 2. TYPICAL 3-ZONE NATURAL VENTILATION SYSTEM

The building shown in Figure 2 is a typical natural ventilation system set up for cross ventilation.

It uses three ZS-30 units to control three ridge vents and six side vents (three on the north or west side of the building and three on the south or east side of the building -- depending on how your barn sits).

These units monitor conditions in their particular building zone and, because of their communication links with each other, work together to ventilate the building as efficiently as possible. (The actions they normally perform and instruct their fellow units to perform are shown on the following table.)

3-ZONE NATURAL VENTILATION SYSTEM		
CONDITION DETECTED	ZS-30'S ACTION	ZS-30'S ACTION
TEMPERATURE RISING	ZONE 1 OR ZONE 3	ZONE 2
1° Over Target Temperature	Open Ridge in Other End of Bldg	Open Ridges in Ends of Building
2° Over Target Temperature	Open Own SE Vent	Open Own SE Vent
3° Over Target Temperature	Open Own NW Vent	Open Own NW Vent
4° Over Target Temperature	Open Own Ridge Vent	Open Own Ridge Vent
TEMPERATURE FALLING		
3° Over Target Temperature	Close Own Ridge	Close Own NW Vent
2° Over Target Temperature	Close Own NW Vent	Close Own SE Vent
1° Over Target Temperature	Close Own SE Vent	Close Own Ridge Vent
0° Over Target Temperature	Close Ridge in Other End of Bldg	Close Ridges in Ends of Building

There is only one exception to the actions described above.

Occasionally, just opening the ridge vents is enough to stabilize building temperature at 1° over the target temperature that you want maintained in your building. If this occurs, your ZS-30 waits 2.5 minutes and opens its own SE vent. It will then keep its SE vent open until building temperature equals target.

If you are setting up a smaller natural ventilation system than shown in Figure 2, simply leave out Zone 2 when you are setting up your system.

For even smaller systems, a single ZS-30 might be enough. If this is the case, refer to the following table to see how it will normally react when it detects various building conditions.

SINGLE ZONE NATURAL VENTILATION SYSTEM	
CONDITION DETECTED	ZS-30'S ACTION
TEMPERATURE RISING	ZONE 2
1° Over Target Temperature	Open Ridge Vent
2° Over Target Temperature	Open SE Vent
3° Over Target Temperature	Open NW Vent
TEMPERATURE FALLING	
2° Over Target Temperature	Close NW Vent
1° Over Target Temperature	Close SE Vent
0° Over Target Temperature	Close Ridge Vent

As with a 3-zone system, a single ZS-30 opens its SE vent if building temperature is 1° over target for 2.5 minutes and keeps its SE vent open until building temperature equals your selected target temperature.

Normally, your ZS-30 pulses its solenoid valves every 15 seconds. This keeps your building's curtains, doors, or ridge vents held tightly open or closed at appropriate times.

If pressure in your system's air lines falls below 60 PSI, your ZS-30 tries to put your building's doors, curtains, or ridge vents into their most frequently held positions while there is adequate air pressure in the lines.

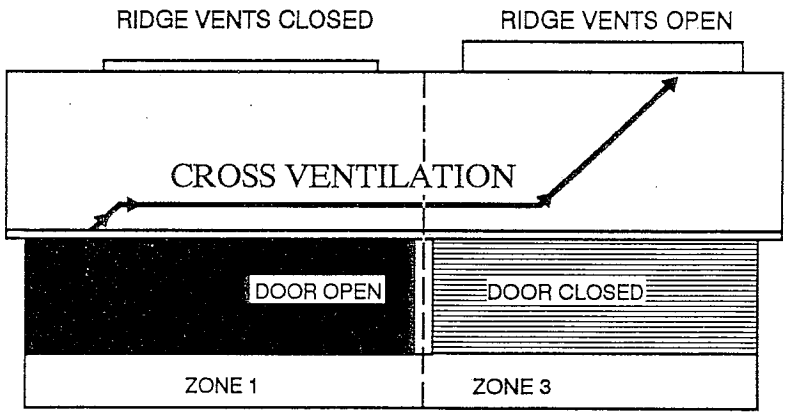


Figure 3. TYPICAL 2-ZONE NATURAL VENTILATION SYSTEM

Your ZS-30 will then send an alarm signal to the other pieces of PAL-TECH equipment that it can communicate with and they will indicate that a malfunction has occurred in your system. (For these situations, we reccommend that you take two precautions -- connect an external alarm to your PAL-TECH equipment and invest in an alarm system that can operate independently of your PAL-TECH equipment.)

Your unit will resume normal operations when pressure is restored to the air lines.

USING YOUR ZS-30 TO CONTROL HEATERS

You can connect heaters that operate on 24 VDC directly to your ZS-30's internal HEAT START, HI HEAT, and LO HEAT outputs. (If your unit is connected to a PAL-TECH Battery Back-Up Kit (P/N 697-500) these 24VDC heaters will still operate when AC power to your ZS-30 fails.) Heaters with 110 VAC control lines must be connected to your ZS-30 via a PAL-TECH Remote Output unit, P/N 697-780.)

Normally, one of two conditions cause your ZS-30 to turn on its heaters -- either building temperature has fallen at least 4° below the level you wanted your ZS-30 to maintain or relative humidity in your building is at least 4% higher than target. (In some operations, such as brooding, these levels will vary slightly.)

When one of these conditions occurs, the heaters connected to your ZS-30's heat control lines are turned on.

After 50 seconds, the HEAT START line is turned off.

If a low temperature caused your ZS-30 to turn on its heaters, it will turn off the equipment connected to its HIGH HEAT line when building temperature rises to 2° below the target temperature that it is trying to maintain in your building. The LO HEAT line will remain on until building temperature equals target.

If high humidity caused your ZS-30 to turn on its heaters, it will shut off the equipment tied to its HI HEAT line when building humidity falls to within 2% of the target level it is trying to maintain. The equipment connected to the LO HEAT line is kept on until building humidity equals your ZS-30's target humidity setting or until building temperature rises 4° above your ZS-30's target temperature setting.

CIRCULATION FAN CONTROL

To make sure that air flows smoothly and evenly through your building, you may want to use circulation fans.

If so, you will need to wire them to a PAL-TECH Remote Output unit.

Normally, your ZS-30 will be set up to turn on/off circulation fans at the same time it turns on/off the heaters it controls.

It will also turn circulation fans on when temperatures rise 10° over target and run them until temperatures fall to 5° over target.

USING YOUR ZS-30 TO CONTROL EXHAUST FANS

If you have your ZS-30 connected to a PAL-TECH Remote Output unit, it can coordinate the actions of your building's exhaust fans with other heating and cooling equipment.

Normally, your ZS-30 will control exhaust fans as shown in the following table.

EXHAUST FANS	
CONDITION DETECTED	ZS-30'S ACTION
<u>TEMPERATURE RISING</u>	
2° Over Target Temperature	SE Fan #1 ON
3° Over Target Temperature	SE Fan #2 ON
4° Over Target Temperature	NW Fan #1 ON
5° Over Target Temperature	NW Fan #2 ON
<u>TEMPERATURE FALLING</u>	
3° Over Target Temperature	NW Fan #2 OFF
2° Over Target Temperature	NW Fan #1 OFF
1° Over Target Temperature	SE Fan #2 OFF
0° Over Target Temperature	SE Fan #1 OFF

INTERMITTENT LIGHTING (Optional)

If your ZS-30 has been fitted with our optional LIGHT CYCLE feature, it can turn your building's lights on and off up to 12 times per 24 hour time period.

Unless you specified otherwise when buying your ZS-30 or have used another PAL-TECH product such as a BMC-30 or FMC to modify your ZS-30's light cycle settings, it will be set to operate lights as shown in the following table.

TYPICAL LIGHT CYCLE INDEX & SETTINGS

CYCLE	INDEX	TIME SETTING	LIGHT STATUS
0	00 1	3:00	ON
0	00 0	4:00	OFF
1	01 1	7:00	ON
1	01 0	8:00	OFF
2	02 1	11:00	ON
2	02 0	12:00	OFF
3	03 1	15:00	ON
3	03 0	16:00	OFF
4	04 1	19:00	ON
4	04 0	20:00	OFF
5	05 1	23:00	ON
5	05 0	0	OFF
6	06 1	0	ON
6	06 0	0	OFF
7	07 1	0	ON
7	07 0	0	OFF
8	08 1	0	ON
8	08 0	0	OFF
9	09 1	0	ON
9	09 0	0	OFF
10	10 1	0	ON
10	10 0	0	OFF
11	11 1	0	ON
11	11 0	0	OFF

DUAL TEMPERATURE CONTROL (Optional)

When your ZS-30 is set up to control lights, it also gains the ability to vary building temperature slightly during periods of light and/or darkness.

Unless you requested otherwise or have used a PAL-TECH product such as a BMC-30 or FMC to modify these variation settings, your ZS-30 will be set up to lower building temperature by 5° whenever it turns building lights on.

PURGE (Optional)

An optional purge feature allows your ZS-30 to open all side and ridge vents so that hot, dusty, or ammonia-laden air inside your building can be replaced with cooler, cleaner outside air.

Unless you specify otherwise when buying your ZS-30 or use a PAL-TECH BMC-30 or FMC to change its purge settings, your ZS-30 will open all building vents 8 minutes after it turns off your building's lights and keep these vents open for 10 minutes or until building temperatures fall 10° below target.

FOGGER CONTROL (Optional)

You can also have PAL-TECH set up your ZS-30 to control a fogger. Your ZS-30 will then turn the fogger on when building temperatures rise 10° above target and run it until temperatures fall to 5° over target. Normally, PAL-TECH will also set your ZS-30 so it will not start the fogger if building humidity is over 80% and will automatically shut it off if building humidity rises to 85%. (Special fogger settings can be requested when buying your unit.)

LOCATING YOUR ZS-30

If your building runs north and south, locate your ZS-30 midway between the north/south boundries of its designated building zone and on the east side of your building 1/4 the distance between the east and west walls.

If your building runs east and west, locate your ZS-30 midway between the east/west boundries of its designated building zone and on the south side of your building about 1/4 the distance between the north and south walls.

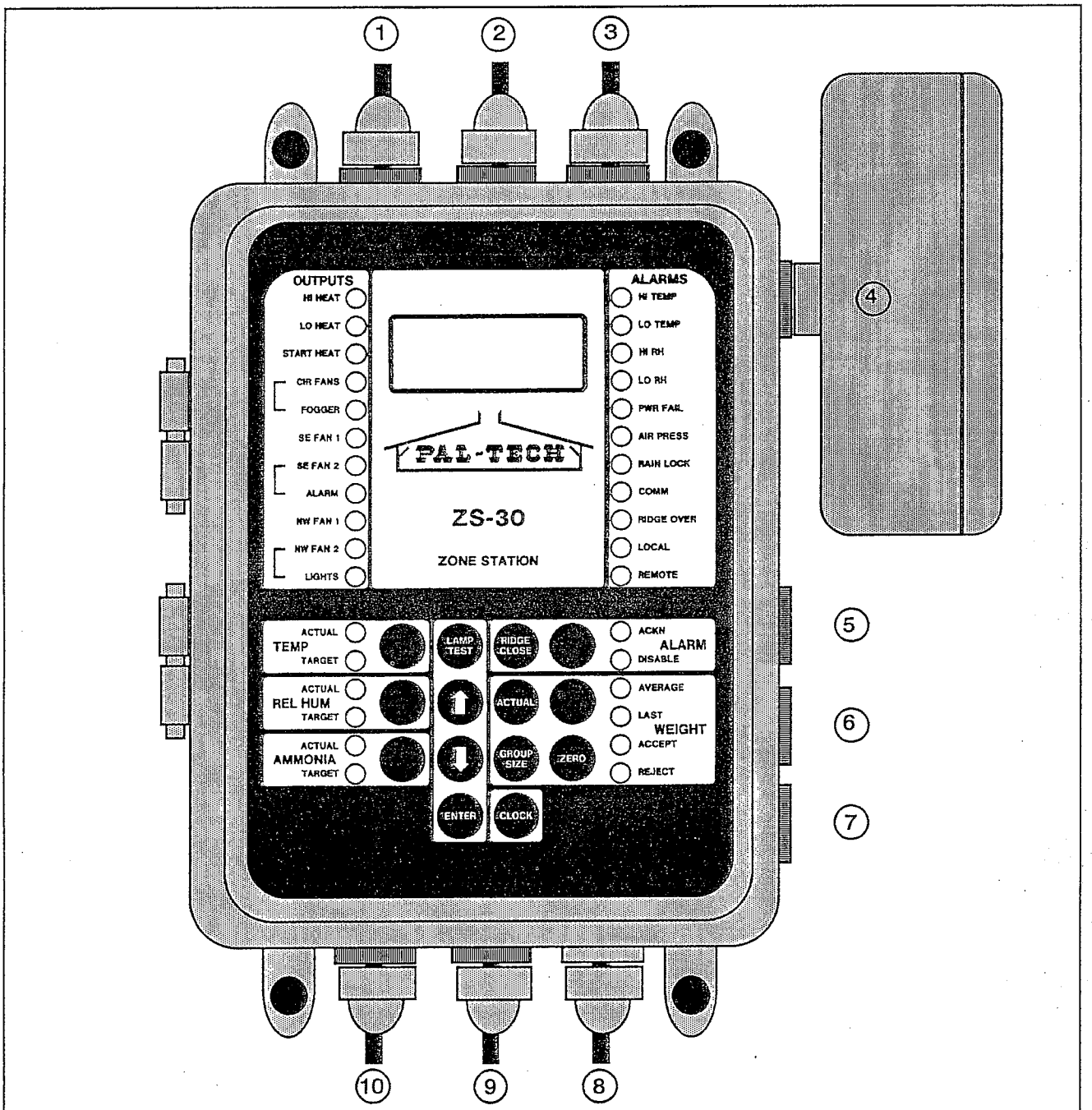


Figure 4: ZS-30 CABLE ROUTING DIAGRAM

1	Rain Sensor or 24 VDC Heating Equipment	6	Solenoids
2	Battery Back-Up	7	Scale
3	Communications	8	AC Power
4	Temperature/Humidity Sensor Package	9	Not Normally Used
5	Optional Sensor	10	Remote I/O Unit

PAL-TECH SENSOR PACKAGES

Depending on your particular needs, we can supply you with several different sensor packages.

Our normal sensor package (P/N 697-517) contains both a temperature and relative humidity sensor in a single, solid enclosure. It is designed to measure ambient air temperatures and relative humidity levels in growing situations. (In the future, an ammonia sensor may also be included in this package.)

For brooding operations, we also offer a remote temperature sensor package that can be placed near your brooder stove and used when creating "hot spots" for newly placed birds.

STANDARD SENSOR PACKAGE CONNECTIONS

Connecting a standard PAL-TECH sensor package to your equipment is a simple three-step process.

First locate the 9-pin sensor recepticle on your unit.

Second, align the 9-pin recepticle on your unit with the 9-pin connector on the back of your sensor package and plug them in. (The slots in the connector ensure that it can only be plugged in properly.)

Third, tighten the locking collar on the connector so that your sensor package is held firmly in place.

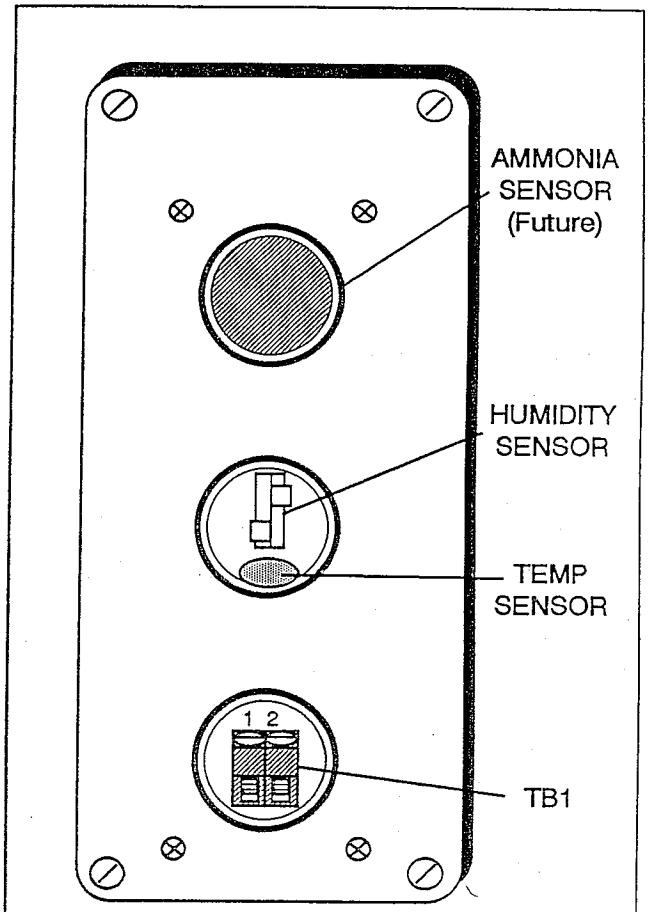


Figure 5.
TEMP/HUMIDITY SENSOR PACKAGE

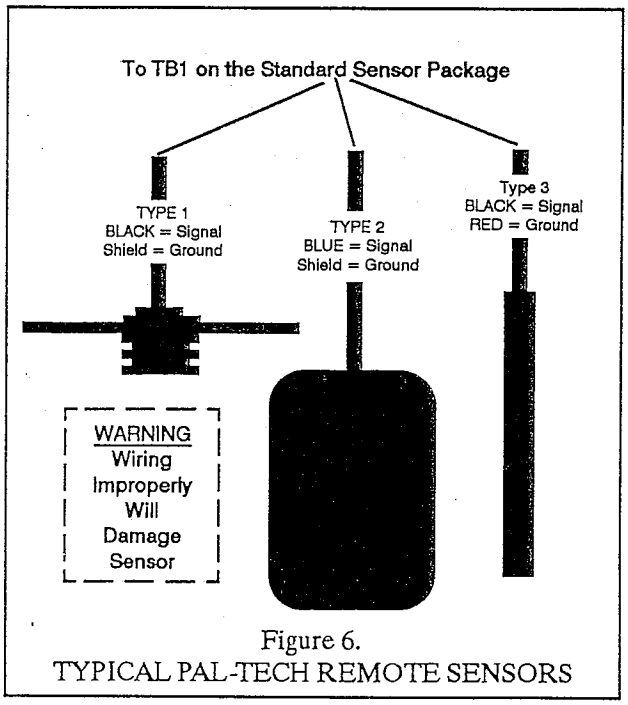


Figure 6.
TYPICAL PAL-TECH REMOTE SENSORS

REMOTE TEMPERATURE SENSOR CONNECTIONS

Connecting a PAL-TECH Remote Sensor to your unit is equally easy.

Begin by locating the sensor where you want it. (In brooding operations, this generally means near the brooders.)

Next route the cable from your remote sensor back to your unit's standard sensor package.

Wire the remote sensor to your standard sensor package as shown below and in Figure 6.

REMOTE SENSOR WIRING LOCATIONS	
TB1-1	Signal Line
TB1-2	GND (Shield)

WIRING YOUR ZS-30

Your ZS-30 is designed to work with a variety of different types of equipment. To connect these to your unit, refer to the following sections of this manual and locate the items which are appropriate for your installation. For your convenience, we have labeled all optional items as such.

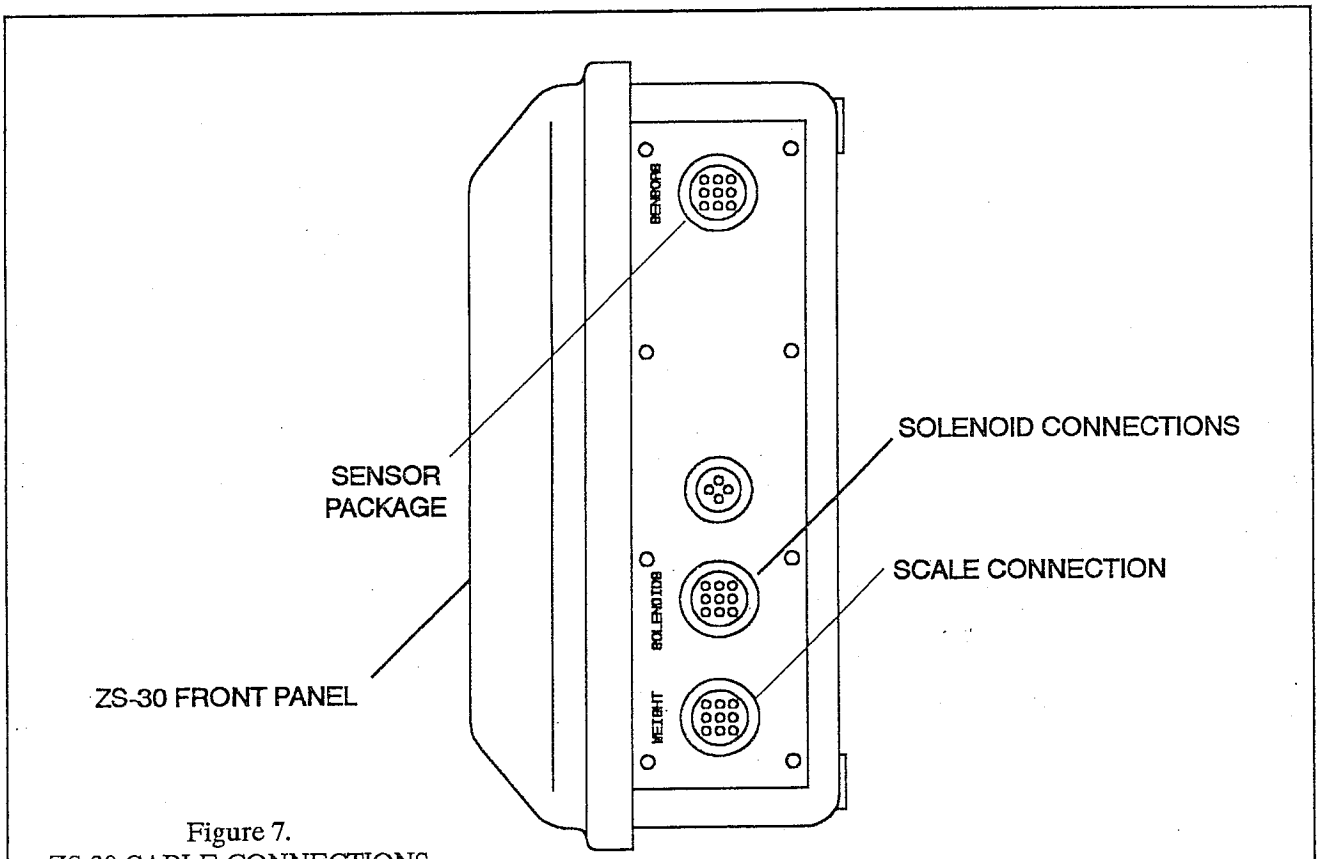
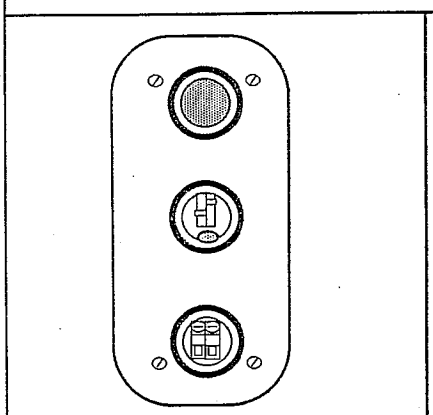
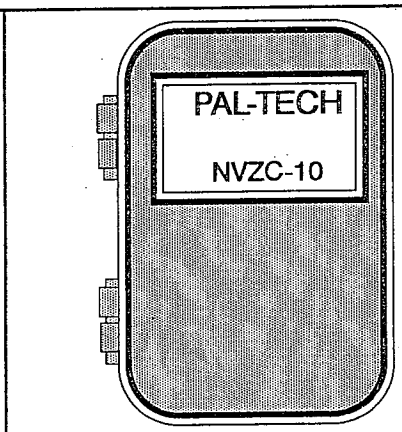
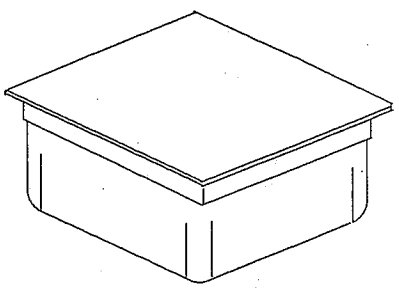


Figure 7.
ZS-30 CABLE CONNECTIONS


SENSOR PACKAGE




SCALE

SOLENOID CONNECTIONS (Optional)

Remove the dust cap from the 9-pin receptacle labeled, "SOLENIOD" on the right-hand side of your ZS-30 and plug in the interface cable from a PAL-TECH NVZC-10 Natural Ventilation Zone Control (P/N 697-057).

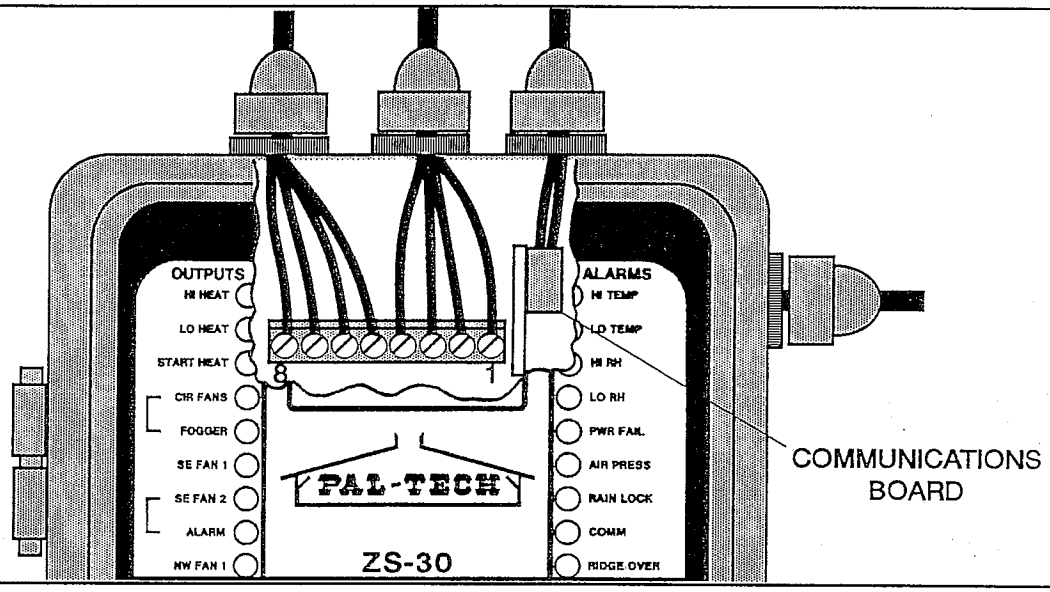
SCALE CONNECTIONS (Optional)

Remove the dust cap from the 9-pin receptacle labeled, "WEIGHT" on the bottom of the black panel that is located on the right-hand side of your ZS-30. Then plug in the interface cable from your PAL-TECH Scale.

INTERNAL WIRING

Wiring connections for PAL-TECH Battery Back-Up kits, Rain Sensor kits, 24 VDC Heaters, and communication lines are located inside your ZS-30. For further details about these connections, refer to Figure 8 and the following sections of this manual.

Figure 8.



WIRING CONNECTIONS FOR TB1 ON THE ZS-30 POWER SUPPLY BOARD		
TB1-1	BLACK	RAIN SENSOR
TB1-2	BLACK	RAIN SENSOR
TB1-3	WHITE	GROUND
TB1-4	BLACK	BATTERY BACK-UP
TB1-5	GREEN	GROUND
TB1-6	RED	HEATER START
TB1-7	BROWN	LOW HEAT
TB1-8	BLACK	HIGH HEAT

Wiring codes apply to PAL-TECH equipment only.

BATTERY BACK-UP (Optional)

If you want to make sure that your ZS-30 continues to monitor and control all DC-powered equipment during a power failure, you must wire a PAL-TECH Battery Back-Up Kit (P/N 697-500) to your unit. To do this, connect the back-up kit's black (+24 vdc) wire to TB1-4 and the white (24 vdc RETURN) wire to TB1-3 on your ZS-30's power supply board. (See Figure 8 for the location of TB1.)

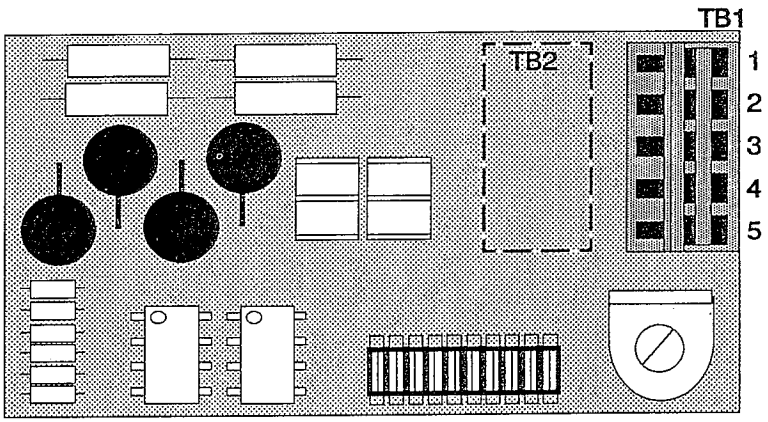
RAIN SENSOR CONNECTIONS (Optional)

If you want to give your ZS-30 the capability of shutting its ridge vents when it is raining, refer to the following table and connect a PAL-TECH Rain Sensor kit (P/N 697-523) to TB1 on your unit's power supply board. (Refer to Figure 8 for the location of TB1.)

24 VDC HEATING EQUIPMENT (Optional)

If your heating equipment requires 24 vdc control signals, you must wire your equipment to TB1 as shown in Figure 8.

Make sure that the total load on TB1-6, TB1-7, and TB1-8 doesn't exceed 1 amp unless you have a PAL-TECH Battery Back-Up Kit installed in your ZS-30. (If this is the case, limit your total load to 2.0 amps for the heater lines.)



WIRING CONNECTIONS FOR TB1 ON THE ZS-30 COMMUNICATIONS BOARD		
TB1-1	RED	COMMUNICATIONS LINE #1
TB1-2	BLACK	COMMUNICATONS LINE #2
TB1-3	---	NOT USED
TB1-4	RED	CURTAIN SENTRY
TB1-5	BLACK	CURTAIN SENTRY
Wiring codes apply to PAL-TECH equipment only.		

COMMUNICATION WIRING (Optional)

There are two sets of communications terminals on your ZS-30's communications board. Exactly how these terminals are wired depends on the amount and types of PAL-TECH equipment in your system.

Your ZS-30 uses the first set of terminals (TB1-1 and TB1-2) to exchange data with either another PAL-TECH Zone Station or a PAL-TECH Barn Management Center. (Refer to Figure 9 for wiring codes.)

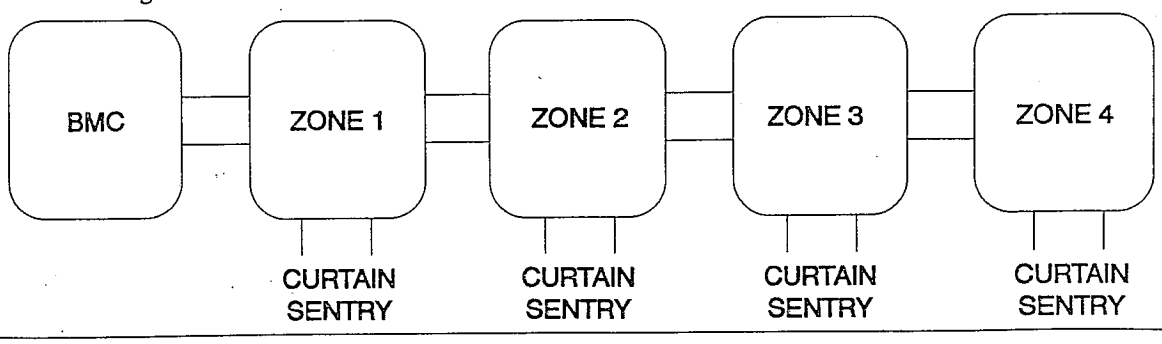
It uses the second set of terminals (TB1-4 and TB1-5) to transmit data to the PAL-TECH Curtain Sentry units that it controls. (Again, refer to Figure 9 for wiring codes.)

Shown below is an example of how a typical PAL-TECH system is wired for communications.

Each unit is "daisy chained" to the next unit in sequence. (By "daisy chaining," we mean that the communications line from the preceding unit and the communications line that is routed to the next unit are connected to the same terminal in each unit.) Refer to Figure 10.

We have arranged these units in sequence for illustration purposes. In normal installations, they may be daisy chained together in any order.

Figure 10. TYPICAL COMMUNICATIONS WIRING CONFIGURATION



AC EQUIPMENT, ALARMS, & LIGHTS (Optional)

To operate 120 VAC or 220 VAC heaters, alarms, and purge lights you must connect your ZS-30 to a PAL-TECH Remote Output unit (P/N 697-780).

To do this, connect the interface cable from the Remote Output unit to the 12-pin CON3 connector on the lower left corner of your ZS-30's power supply board. (Refer to Figure 11 for the location of CON3.)

Because control lines for each piece of equipment are rated for 3 amps, it is normally necessary to use an auxiliary relay to turn AC equipment on or off.

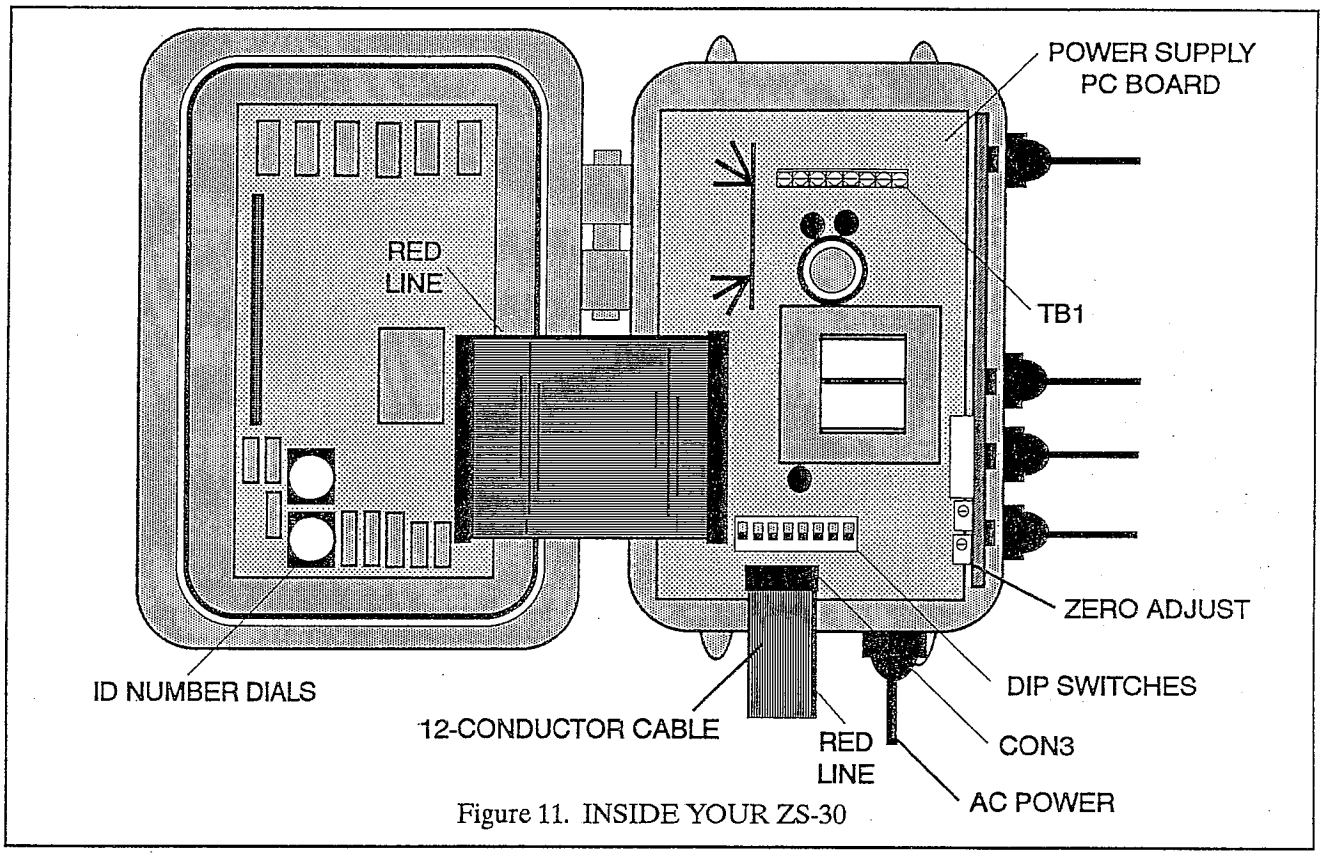


Figure 11. INSIDE YOUR ZS-30

SETTING YOUR ZS-30'S ID NUMBER

Each ZS-30 in your operation must have its own identification number so it can function properly in its designated building zone. (To designate zones, see pages 2 and 3.) In a normal system, there can be up to four zone designations. Zones 1 - 3 are for cross ventilation operations. Zone 4 operates independently, but still communicates with a PAL-TECH BMC-30 Barn Management Center. (Normally, each zone must have a different designation.)

Always set the top (MSD) yellow identification number dial to zero.

Then set the bottom (LSD) identification number dial to correspond to your ZS-30's designated building zone.

If your ZS-30 is to be independent, set the MSD dial to "F". (Unlike settings 1 - 4, several units can be set to "F".)

TESTING EQUIPMENT CONNECTED TO THE REMOTE OUTPUT UNIT

Use the DIP switches located in the lower left corner of your ZS-30's power supply board to test the equipment connected to your PAL-TECH Remote Output unit.

During normal operations you should leave these switches in the OFF position. Only turn them ON when you want to manually activate a piece of equipment connected to your Remote Output unit.

YOUR ZS-30'S OUTPUT INDICATORS

If you look at the upper left half of the ZS-30 in Figure 1, you will notice that it contains the ZS-30's output lights, or indicators.

During normal operations, these indicators light to tell you which pieces of equipment your ZS-30 has turned on.

The following sections of this manual explain the function of each indicator. Refer to them if you need to quickly refresh your memory concerning your ZS-30's operations.

To test these indicators, you can use the LAMP TEST key on your ZS-30's front panel. When pressed, this key causes all of your ZS-30's indicators, digits, and decimal points to light, but does not affect the operation of your unit in any other way.

HI HEAT

The HI HEAT indicator lights during normal operations to indicate that your ZS-30 has turned on the heating equipment connected to its 24 VDC or Remote Output unit's HI HEAT lines.

LO HEAT

This indicator lights to announce that your unit has turned on the heating equipment connected to the 24 VDC and Remote Output unit's LO HEAT lines.

HEAT START

During normal operations, this indicator lights whenever your ZS-30 activates the equipment connected to its 24 VDC or Remote Output unit's HEAT START control line.

CIR FANS

This indicator lights to tell you that your ZS-30 has turned on the circulation fans connected to its Remote Ouput unit.

FOGGER

If your ZS-30 is set up to run a fogger instead of circulation fans, this indicator lights when your fogger turns on.

SE FAN 1

This indicator lights to tell you that your ZS-30 has turned on the ventilation fan #1 on either the south or east (depending on how your building sits) side of your building.

SE FAN 2

This indicator lights when your ZS-30 turns on the south or east fan #2 connected to its Remote Output unit.

ALARM

If you have a remote alarm connected to your system via a PAL-TECH Remote Output unit, this indicator will light whenever an alarm is on.

NW FAN 1

This indicator lights when your ZS-30 turns on the north or west fan #1 connected to its Remote Output unit.

NW FAN 2

This indicator lights to tell you that fan # 2 on either the north or west side of your building is on.

LIGHTS

If lights are connected to your ZS-30's Remote Output unit, this indicator will tell you when they are on.

YOUR ZS-30'S ALARM INDICATORS

If you look at the upper right half of the ZS-30 in Figure 1, you will notice that it contains the ZS-30's alarm lights, or indicators.

Whenever your ZS-30 detects a new condition that it considers serious enough to tell you about, it will light the appropriate alarm indicator on its front panel.

In addition it will activate any external alarm connected to your system. (This accounts for your system's tendency to sometimes turn on the external alarm when you thought that you'd deactivated it.)

HI TEMP

During normal operations, this indicator will light to announce that building temperature exceeds target by more than an acceptable margin.

LO TEMP

This indicator lights when the temperature in your building falls too far below target.

HI RH

This alarm indicator lights to inform you that the relative humidity level in your building has risen above your target humidity level by more than the specified margin.

LO RH

This indicator lights when the relative humidity level in your building falls below target by more than an acceptable range.

PWR FAIL

If your ZS-30 is connected to a PAL-TECH Battery Back-Up kit, this indicator will light to inform you that AC power to your ZS-30 has failed.

AIR PRESS

This indicator lights to tell you that pressure in the air lines monitored by your ZS-30 has fallen below 60 PSI, and that your ZS-30 has placed the curtains, doors, or ridge vents that it controls in the most frequent position (open or closed) that it has been keeping them lately.

RAIN LOCK

This indicator lights when either you or your ZS-30's rain sensor locks your building's ridge vent closed.

COMM

If this indicator is lit, your ZS-30 can't communicate with the PAL-TECH equipment in your building.

RIDGE OVER

This indicator lights when high building temperatures cause your ZS-30 to override its ridge vent lock feature and open your ridge vents.

LOCAL

This indicator lights to inform you that the alarm condition is occurring in the barn where this unit is located.

REMOTE

This indicator indicates that the alarm condition is in another building in your operation. (This indicator is active only when your ZS-30 is in communication with a PAL-TECH Barn Management Center.)

YOUR ZS-30'S CONTROLS

If you look at the lower half of the ZS-30 front panel in Figure 1, you will notice that it contains your ZS-30's operating controls.

These operating controls allow you to do a variety of things with your ZS-30.

They allow you to view present temperature, humidity, and ammonia levels in your building.

They let you view and set target temperature, humidity, and ammonia levels for your ZS-30 to maintain in its designated building zone.

You can also use these operating controls to set the margins that temperature, humidity, and ammonia levels can vary from target settings before activating an alarm.

You can use them to monitor average weights and perform self tests.

You can even set and view the current time.

TEMP

Normally your ZS-30 will be displaying the temperature in its designated zone when you look at it.

To see your ZS-30's target temperature setting, press the black key in the TEMP box on your ZS-30's front panel.

You can also use this key to view your temperature sensor's calibration setting or to observe the margin that your ZS-30 will allow temperatures in its designated building zone to vary from target before considering building temperatures "out of control" and activating its HI TEMP or LO TEMP alarm.

REL HUM

To display the humidity level in your building , press the black key in the REL HUM box on your unit's front panel.

Press it again to display the current target humidity setting.

You can also use this key to see your humidity sensor's calibration setting or to view the margin that your ZS-30 will allow humidity levels in its zone to vary from target before activating its HI RH or LO RH alarm.

AMMONIA (Future)

As with the TEMP and REL HUM controls, pressing the black key in the AMMONIA box will display the current ammonia level in your ZS-30's building zone.

Pressing the key again displays your current target ammonia level setting.

LAMP TEST

Use the LAMP TEST key to systematically light all of your ZS-30's indicators, digits, and decimal points. (This key has no other effect on your ZS-30's operations.)

THE ARROW KEYS

Use the arrow keys in conjunction with the ENTER key to change a displayed numeric value.

Pressing an arrow key will either increment or decrement a displayed numeric value.

ENTER

To "load" a new setting into your ZS-30's memory, press this key. (Otherwise, your unit will ignore the new setting.)

ALARM

When the proper software is installed in your ZS-30, the SE FAN 1 control line in your PAL-TECH Remote Output unit is redesignated as an ALARM output. (The brackets joining the two indicator labels on your ZS-30's front panel indicate that your unit has either one or the other of these outputs.)

This software allows your ZS-30 to activate a remote alarm (buzzer, horn or light) each time any piece of PAL-TECH equipment informs your unit that conditions in your operation are extremely different than those you instructed it to maintain.

When your external alarm is activated, press the black key in the ALARM box on the front panel of the ZS-30 connected to that alarm. This deactivates the alarm caused by that particular condition for 15 minutes. (The alarm condition, of course, still exists and your ZS-30 will be working to correct it as quickly as possible.) If the alarm condition still exists after 15 minutes, your unit will reactivate the external alarm.

You can also press the black ALARM box key twice to disable your ZS-30's external alarm for 2 hours. If you do so, however, remember that your ZS-30 won't tell you if the alarm condition gets worse and it is unable to correct the situation. (If a new alarm condition arises, however, your external alarm will still activate.)

RIDGE CLOSE

Press the RIDGE CLOSE key to lock the ridge vent controlled by your ZS-30 closed.

Press the RIDGE CLOSE key a second time to unlock the ridge vents.

WEIGHT

Press the black key inside the WEIGHT box on your ZS-30's front panel once and your ZS-30 will Display its current average weight setting. (This can be modified using the arrow and ENTER keys.)

Press the black key a second time to display the last accepted weight.

Press it a third time to see the number of accepted weights since your scale was last zeroed.

Press it a fourth time to see the number of rejected weights since the scale was last zeroed.

Finally, press the black key in the WEIGHT box to again display your scale's average weight setting.

GROUP SIZE

The GROUP SIZE key is used to set the number of weights that your ZS-30 uses in average weight calculations. During normal operations, the newest accepted weight is added to this group and the oldest removed each time your ZS-30 does an average weight calculation. (You can use the arrow and ENTER keys to modify this setting.)

ACTUAL

Press the ACTUAL key to see the amount of weight presently on the scale.

This key also starts the calibration procedure when you are using test weights to calibrate your PAL-TECH scale.

ZERO

Press the ZERO key to view the tare value for your scale. (Tare is the weight of scale components on the load cells.)

Hold the ZERO key down to establish a new tare value for your scale. (Tare should always be between .2 & 1 lb.)

CLOCK

Press this key to display the current military time.

SETTING UP YOUR ZS-30

Before you start using your ZS-30, you will have to make sure that it is set up properly.

To do this, refer to the following sections of this manual and use the keys on your unit's front panel to perform the operations described in each.

You should perform these procedures every time you put a new set of birds or animals in your building.

SETTING UP THE TEMPERATURE SENSOR

Before you start using your ZS-30, you will have to set up the temperature sensor. To do this, find yourself an accurate thermometer and use the following step-by-step procedure. (It works for both standard and remote temperature sensors.)

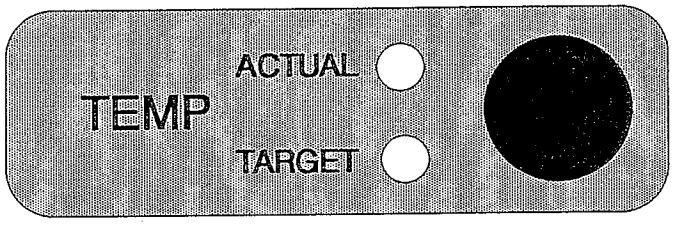


Figure 12.
TEMPERATURE SET UP CONTROLS

* If necessary, power up your ZS-30.	There is no ON/OFF switch on your unit, just plug it in to turn it on.
* Put an accurate thermometer near your temperature sensor and allow your ZS-30 about one hour to read the temperature in your building. (If you have a remote temperature sensor connected to your unit, your ZS-30 will ignore readings from the temperature sensor in its standard sensor package.	When you do this, make sure that temperatures in your building are stable. In other words, heating and cooling equipment should be off while you are setting up your ZS-30's temperature sensor.
* If the ACTUAL indicator in the TEMP box is not lit, press the black key in the TEMP box.	As you press this key, the ACTUAL indicator in the TEMP box on your ZS-30's front panel will light. (If this is not the case, press the black key again.)
* If the ACTUAL indicator in the TEMP box is lit, hold the black key in the TEMP box down for about 5 seconds.	Hold the key down until both the ACTUAL and the TARGET indicators in the TEMP box light.
* When both the ACTUAL and TARGET indicators in the TEMP box light, release the black key.	A temperature reading should be on your unit's digital display.
* Use the "up" or "down" arrow keys on your ZS-30's front panel to change the temperature shown on your unit's display until it matches that of your thermometer.	If you need to raise the displayed value, use the "up" arrow key. If you need to decrease the setting, use the "down" arrow key. (If you need to modify the displayed setting by more than 20 degrees, call your PAL-TECH service technician. He'll tell you what to do.)
* While the correct temperature is still on the display, press the ENTER key to load the new temperature into your unit's memory.	As you press the ENTER key, your ZS-30 will resume normal operations, matching its new temperature reading with the output signal from your temperature sensor.

SETTING UP THE RELATIVE HUMIDITY SENSOR

Before using your ZS-30, you must set up the relative humidity sensor using the following step-by-step procedure. (For this operation, you will need an accurate psychrometer.)

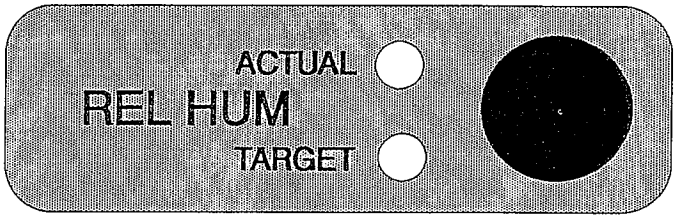


Figure 13.
HUMIDITY SET UP CONTROLS

* Use your psychrometer to get an accurate relative humidity reading in your building.	Refer to the operating instructions that were included with your psychrometer to obtain a good reading from your psychrometer.
* If necessary, power up your ZS-30.	There is no ON/OFF switch on your unit, just plug it in to turn it on.
* Press the black key in the REL HUM box on your ZS-30's front panel.	As you press this key, the ACTUAL indicator in the REL HUM box on your ZS-30's front panel will light. (If this is not the case press the black key again.)
* If the ACTUAL indicator in the REL HUM box is lit, hold the black key in the REL HUM box down for about 5 seconds.	Hold the key down until both the ACTUAL and the TARGET indicators in the REL HUM box light.
* When both the ACTUAL and TARGET indicators in the REL HUM box light, release the black key.	A relative humidity reading should be on your unit's digital display.
* Use the up or down arrow keys on your ZS-30's front panel to change the relative humidity shown on your unit's display until it matches the humidity level detected by your psychrometer.	If you need to raise the displayed value, use the "up" arrow key. If you need to decrease the setting, use the "down" arrow key. (If you need to modify the displayed setting by more than 20 increments, call your PAL-TECH service technician. He'll tell you what to do.)
* While the correct relative humidity is still on the display, press the ENTER key to load the new relative humidity setting into your ZS-30's memory.	As you press the ENTER key, your ZS-30 will resume normal operations, matching its new relative humidity reading with the output signal from your relative humidity sensor.

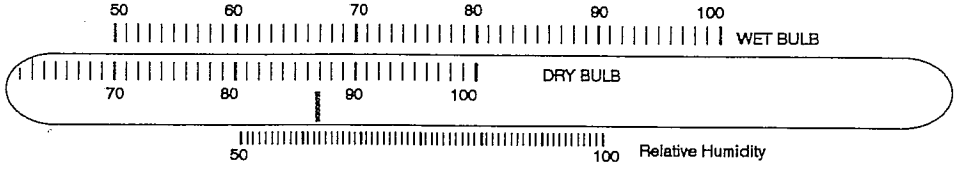


Figure 14. TYPICAL PSYCHROMETER DISPLAY

SETTING UP THE AMMONIA SENSOR (Future)

If you have a PAL-TECH Ammonia Sensor in the future, use the following step-by-step procedure to set it up prior to putting your ZS-30 into operation. (For this procedure, you will need an accurate gas analyzer.)

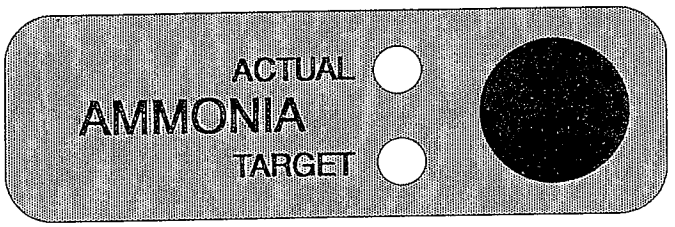


Figure 15.
AMMONIA SET UP CONTROLS

* Use your analyzer to get an accurate ammonia level reading for your building.

Refer to the operating instructions that were included with your gas analyzer to obtain a good reading from your analyzer.

* If necessary, power up your ZS-30.

There is no ON/OFF switch on your unit, just plug it in to turn it on.

* Press the black key in the AMMONIA box on your ZS-30's front panel.

As you press this key, the ACTUAL indicator in the AMMONIA box on your ZS-30's front panel will light. (If this is not the case press the black key again.)

* If the ACTUAL indicator in the AMMONIA box is lit, hold the black key in the AMMONIA box down for about 5 seconds.

Hold the key down until both the ACTUAL and the TARGET indicators in the AMMONIA box light.

* When both the ACTUAL and TARGET indicators in the AMMONIA box light, release the black key.

An ammonia level reading should be on your unit's digital display.

* Use the up or down arrow keys on your ZS-30's front panel to change the ammonia level shown on your unit's display until it matches that of your gas analyzer.

If you need to raise the displayed value, use the "up" arrow key. If you need to decrease the setting, use the "down" arrow key.

* While the correct ammonia level is still on the display, press the ENTER key to load the new ammonia setting into your ZS-30's memory.

As you press the ENTER key, your ZS-30 will resume normal operations, matching its new ammonia level reading with the output signal from your ammonia sensor.

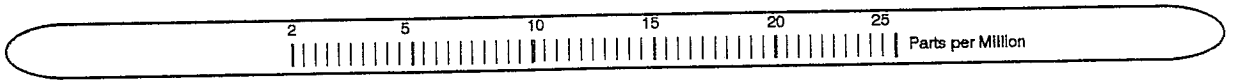


Figure 16.
TYPICAL PULL-TYPE GAS ANALYZER TUBE

CALIBRATING THE SCALE

There are two procedures that can be used to calibrate your scale. We recommend that you use method B. It gives you slightly better results for your application.

ZEROING YOUR SCALE

If necessary, use the following procedure to "zero" dead weight off your scale.

* Place the scale in the desired location and power up your ZS-30.	Make sure that your scale is free of all dirt and debris that could interfere with proper scale operations.
* Press and release the ZERO key on the front of your ZS-30.	As you press this key, a numerical value should appear on your ZS-30's display.
* If the number on your ZS-30's display is not between ".2" and ".9", turn the ZERO ADJUST screw until it is.	Refer to Figure 11 for the position of the ZERO ADJUST potentiometer.
* Press the ZERO key in the WEIGHT box on your ZS-30's front panel for about three seconds.	Pressing the ZERO key causes your ZS-30 to "zero" the remaining weight off it's display.

METHOD A: THE QUICK CALIBRATION PROCEDURE

Every PAL-TECH scale is calibrated at the factory and given a calibration number which defines its working capacity. This number is inscribed on your scale over its interface cable connector and can be used to quickly calibrate your scale as described below.

* If necessary, use the procedure described above to zero out any dead weight that may be on the scale.	Otherwise, this is automatically done whenever you zero your ZS-30's accepted or rejected weight totals.
* Press the GROUP SIZE key in the WEIGHT box on your ZS-30's front panel for about three seconds.	After you release the GROUP SIZE key, a numerical value will appear on your ZS-30's display.
* Use the arrow keys to change the value on the display to match the value inscribed above your scale's interface cable connector.	Pressing the "down" arrow key decreases the displayed value and pressing the "up" arrow key increases the displayed value.
* Press the ENTER key.	Pressing the ENTER key causes your ZS-30 to calibrate itself to the signal it is receiving from your scale's load cell.

METHOD B: USING TEST WEIGHTS

If you have some known test weights, you will want to try another method of calibrating your scale.

This method is a bit more time-consuming than the method discussed above, but allows you to calibrate your scale more accurately.

* If necessary, use the procedure described above to zero out any dead weight that may be on the scale.	You should only need to zero dead weight off your scale when your unit is reset or when a new scale is attached to your ZS-30.
* Place your test weights on the scale.	We recommend tha you use at least 6 lbs of test weights for this procedure.
* Press the ACTUAL key on your ZS-30's front panel for about three seconds.	After you release the ACUTAL key, both the AVERAGE and LAST indicators will light.
* Use the arrow keys to set the value on the display equal to your test weights.	The arrow keys will allow you to either increase or decrease the value on the display.
* Press ENTER.	Pressing the ENTER key causes your unit to recalibrate itself to the signal presently being returned from the load cell in your scale.

SETTING UP THE SCALE

Before you put any birds or livestock in the area of your building where your ZS-30's scale is located, you should use the following procedure to set up your scale.

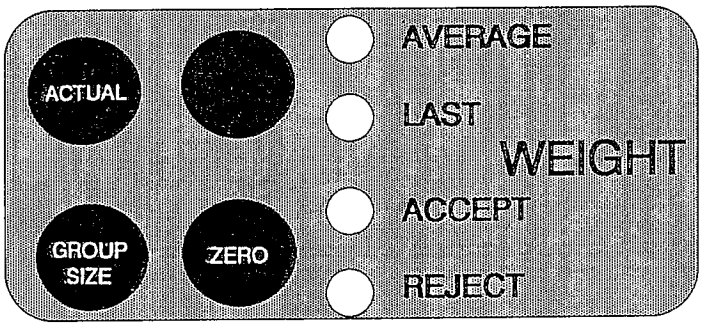


Figure 17.
SCALE CONTROLS

* Place the scale in the desired location and power up your ZS-30.	Make sure that your scale is free of all dirt and debris that could interfere with proper scale operations.
* Press and release the ZERO key on the front of your ZS-30.	As you press this key, a numerical value should appear on your ZS-30's display.
* If the number on your ZS-30's display is not between ".2" and ".9", open the front of your ZS-30 and turn the ZERO ADJUST screw until it is.	Refer to Figure 11 for the position of the ZERO ADJUST potentiometer.
* Press the ZERO key in the WEIGHT box on your ZS-30's front panel for about three seconds.	Pressing the ZERO key causes your ZS-30 to "zero" the remaining weight off it's display. (To see the amount of weight removed from the display, press the ZERO key.)
* Press the black key in the WEIGHT box on your ZS-30's front panel until the AVERAGE indicator in the WEIGHT box on your ZS-30's front panel lights.	When the AVERAGE indicator lights, release the key.
* Use the arrow keys to change the number on your ZS-30's display to a setting that equals the average weight of the birds or animals that are about to be put in with the scale.	The "up" arrow key increases the displayed number. The "down" arrow key decreases the displayed number.
* Press the ENTER key.	As the ENTER key is pressed, your ZS-30 stores the displayed value for use in validating future weighments and average weight calculations.
* Press the GROUP SIZE key in the WEIGHT box on your ZS-30's front panel.	As this key is pressed, your ZS-30 will display the number of valid weight readings it uses to calculate average weights.
* If you want to change this setting, use the arrow keys.	Again, the "up" arrow increases the displayed value and the "down" arrow key decreases the displayed value.
* Press the ENTER key.	Pressing the ENTER key stores the displayed value in your ZS-30's memory for use in future average weight calculations.

SELECTING A TARGET TEMPERATURE

To select the target, or desired, temperature that your ZS-30 will try to maintain in your building, use the following step-by-step procedure.

* If you are not currently viewing the temperature in your building, press the black key in your ZS-30's TEMP box.	As the black key is pressed, the ACTUAL annunciator in your ZS-30's TEMP box will light and the actual temperature presently in your building will appear on your unit's display.
* Press the black key in the TEMP box again.	As the black key is pressed a second time, the TARGET annunciator in your ZS-30's TEMP box will light and the current target temperature selection will appear on your unit's display.
* Use the arrow keys to select the temperature you want to maintain in your building.	Pressing the "down" arrow key will decrease the value on the display. Pressing the "up" arrow key will increase the value on the display.
* Press the ENTER key	As the ENTER key is pressed, your ZS-30 will store the value currently on its display in its memory as its new target temperature selection.

SELECTING A TARGET RELATIVE HUMIDITY SETTING

To select the target, or desired, relative humidity that your ZS-30 will try to maintain in your building, use the following step by step procedure.

* Press the black key in your ZS-30's REL HUM box.	As the black key is pressed, the ACTUAL annunciator in your ZS-30's REL HUM box will light and the actual relative humidity level presently in your building will appear on your unit's display.
* Press the black key in the REL HUM box again.	As the black key is pressed a second time, the TARGET annunciator in your ZS-30's REL HUM box will light and the current target temperature selection will appear on your unit's display.
* Use the arrow keys to select the relative humidity level you want to maintain in your building.	Pressing the "down" arrow key will decrease the value on the display. Pressing the "up" arrow key will increase the value on the display.
* Press the ENTER key	As the ENTER key is pressed, your ZS-30 will store the value currently on its display in its memory as its new target relative humidity level selection.

SELECTING A TARGET AMMONIA LEVEL SETTING (Future)

To select the target, or desired, ammonia level that your ZS-30 will try to maintain in your building, use the same procedure as used for temperature and relative humidity.

* Press the black key in your ZS-30's AMMONIA box twice.	When this is done, the TARGET annunciator in the AMMONIA box will light and your unit will display the current ammonia level in your building.
* Use the arrow keys to select the relative humidity level you want to maintain in your building.	Pressing the "down" arrow key will decrease the value on the display. Pressing the "up" arrow key will increase the value on the display.
* Press the ENTER key	As the ENTER key is pressed, your ZS-30 will store the value currently on its display in its memory.

SETTING ALARMS

Once you have determined the temperature, humidity, and ammonia levels that you want your ZS-30 to maintain in your building, you can set your unit's internal alarms to warn you if any particular condition is getting out of hand. To do this, refer to the following step-by-step procedure.

* Locate the controls for the alarm that you want to set.

  You can use this procedure to set the temperature, humidity, and ammonia alarms. The control boxes you are looking for are in the lower left-hand corner of your ZS-30's front panel.

* Press the black key in the appropriate control box so that the ACTUAL indicator is lit.

  If you are already viewing the actual reading for the alarm that you want to set, skip this step.

* When the ACTUAL indicator is lit, hold down the black key for about 5 seconds.

  When you release the key, both the ACTUAL and TARGET indicators in the control box should be lit and a sensor setting should appear on your ZS-30's display.

* Press the black key one more time.

  The ACTUAL and TARGET indicators should begin flashing together and an alarm setting should appear on your ZS-30's display.

* Use the arrow keys to modify the value on the display.

  The value on the display is the variation from your target setting that your ZS-30 will allow in actual building conditions before it activates its alarm for that condition. (For temperature this variation is measured in degrees. For humidity it is expressed in percentage points. For ammonia, it is displayed in parts per million.)

* Press the ENTER key.

  When you press the ENTER key, your ZS-30 stores the new alarm setting in its memory for future use.

CLOSING YOUR RIDGE VENTS

Normally, your ZS-30 will open and close your ridge vents automatically. However, there may be times when you want to lock your ridge vents closed. To do so, refer to the following procedure.

* To lock your ridge vent closed, Press the RIDGE CLOSE key on your ZS-30's front panel.

  Remember that your ZS-30 may still override this locking feature if temperatures inside your building vary far too far from target settings.

* To unlock your ridge vent, press the RIDGE CLOSE key a second time.

  When you press the RIDGE CLOSE key a second time, the RAIN LOCK indicator will go out and your ZS-30 will resume automatic control of the ridge vents connected to it.

TIME SETTINGS

To find out what time it is, press the CLOCK key on your ZS-30's front panel. The current time (in military format) will appear on your unit's display. (To change the time setting, use the arrow and ENTER keys.)

CHECKING THE DISPLAY

To systematically light all of your ZS-30's indicators, display segments, and decimal points, press the LAMP TEST KEY on your unit's front panel.

ENABLING & DISABLING YOUR ZS-30'S ALARM

If a ZS-30 is fitted with the proper software, it will be able to control (via a PAL-TECH Remote Output unit) an external alarm such as a horn, buzzer, or light.

This external alarm is activated (sounded or lit) whenever any piece of PAL-TECH equipment in your system informs the ZS-30 with the alarm software that a condition in your operation is significantly different than you instructed your PAL-TECH equipment to maintain.

The external alarm will then stay activated until you either acknowledge (temporarily shut off for 15 minutes) or disable (shut off for 2 hours) it. (It is also possible that your system will eventually correct the condition that caused the alarm by itself and deactivate your external alarm.)

To enable or disable an external alarm, go to the ZS-30 that controls that alarm and use the following procedure.

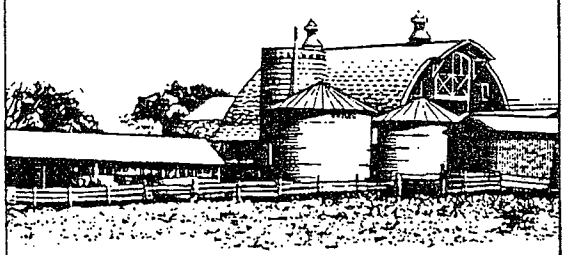
* To disable the active alarm for 15 minutes, press the black key in the ALARM box on the ZS-30 that is connected to the external alarm.	When you press this key, the ACKNowledge indicator in the ALARM box will light to remind you that the alarm will be activated again in 15 minutes.
* To shut off the alarm for two hours, press the black key in the ALARM box twice.	When this is done, the DISABLE indicator in the alarm box lights to remind you that you have shut your alarm off for 2 hours.
* To reactivate the alarm, press the black key in the ALARM box again.	When this is done, your ZS-30 again activates the alarm when it detects an alarm condition.

REMEMBER!!!

Turning the external alarm off does not correct the condition which caused it to activate. The alarm is merely designed to call your attention to the fact that your ZS-30 is having trouble maintaining the conditions you specified or your building. IT IS UP TO YOU TO DETERMINE THE CAUSE OF THE PROBLEM AND TAKE STEPS TO HELP YOUR ZS-30 CORRECT IT.

PAL-TECH

REMOTE OUTPUT UNIT



INSTALLATION GUIDE

Another Fine Product From

"*The Profit Protectors*"

A Technology Department of PALS/Division of Willmar Poultry Company

INSTALLING A REMOTE OUTPUT UNIT

This document contains instructions for connecting equipment to a PAL-TECH Remote Output unit (P/N 697-780).

If you have any questions about the instructions, or if you can not find instructions for your particular type of equipment, don't hesitate to ask our technicians for help.

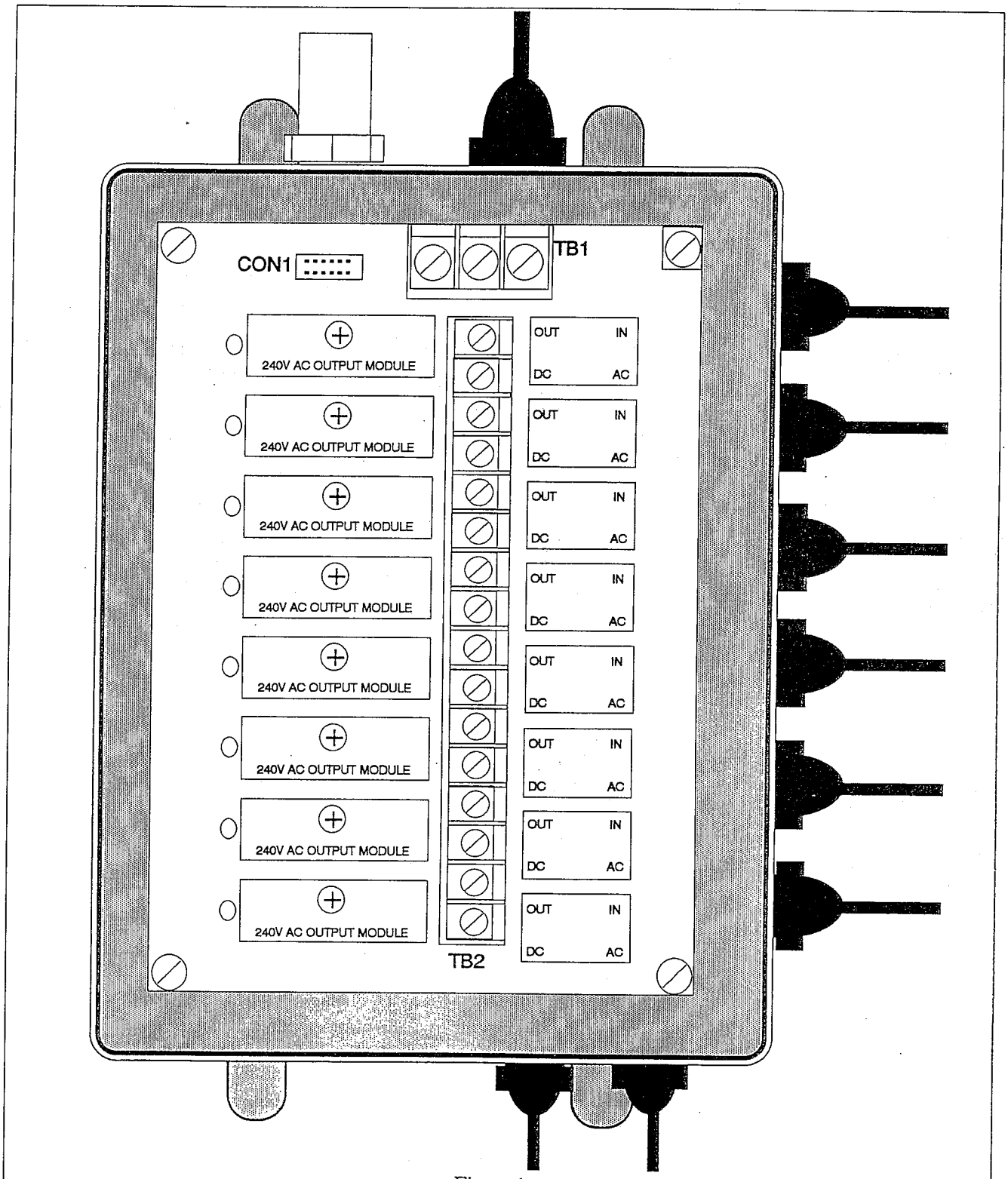


Figure 1.
TYPICAL REMOTE I/O UNIT

LOCATING YOUR UNIT

To make it easy to route AC lines and the 12-conductor cable to both units, we recommend mounting your Remote Output unit 6" below your Zone Station. (Refer to Figure 2 for details.)

Be sure to route the 12-conductor cable through conduit. It can be subject to interference if you do not.

Use the holes in the mounting feet of both units to screw or bolt them to a secure mounting surface.

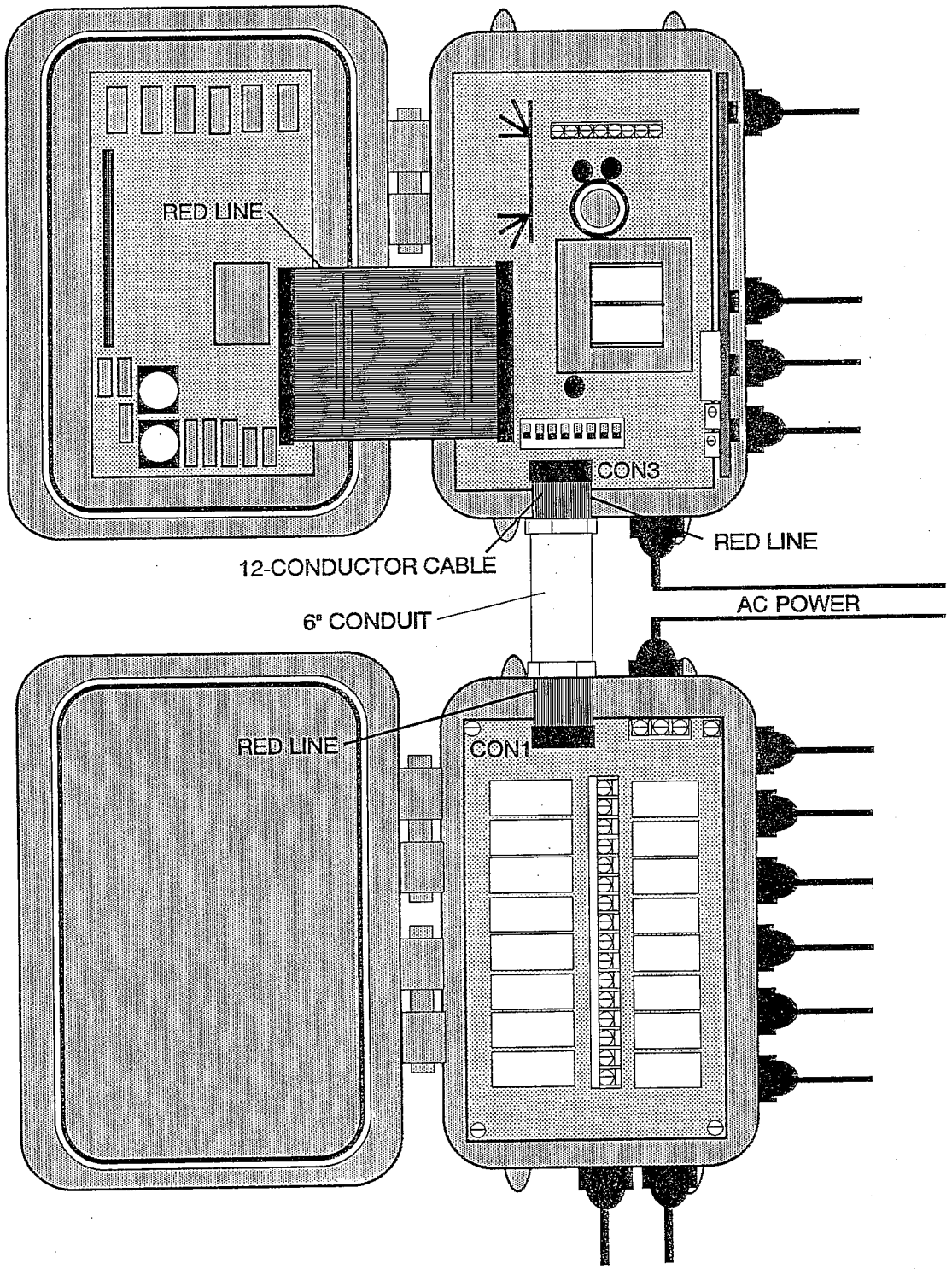


Figure 2. MOUNTING DIAGRAM

OUTPUTS & CABLE ROUTES

The table at the bottom of this page shows the function of each of your Remote Output unit's TB2 terminals.

Figure 3 shows cable routings from those terminals.

When connecting these terminals to equipment, make sure that the load on the output module is less than 1 amp.

If this is not the case, include an auxiliary relay in your circuit. (PAL-TECH does not generally supply these.)

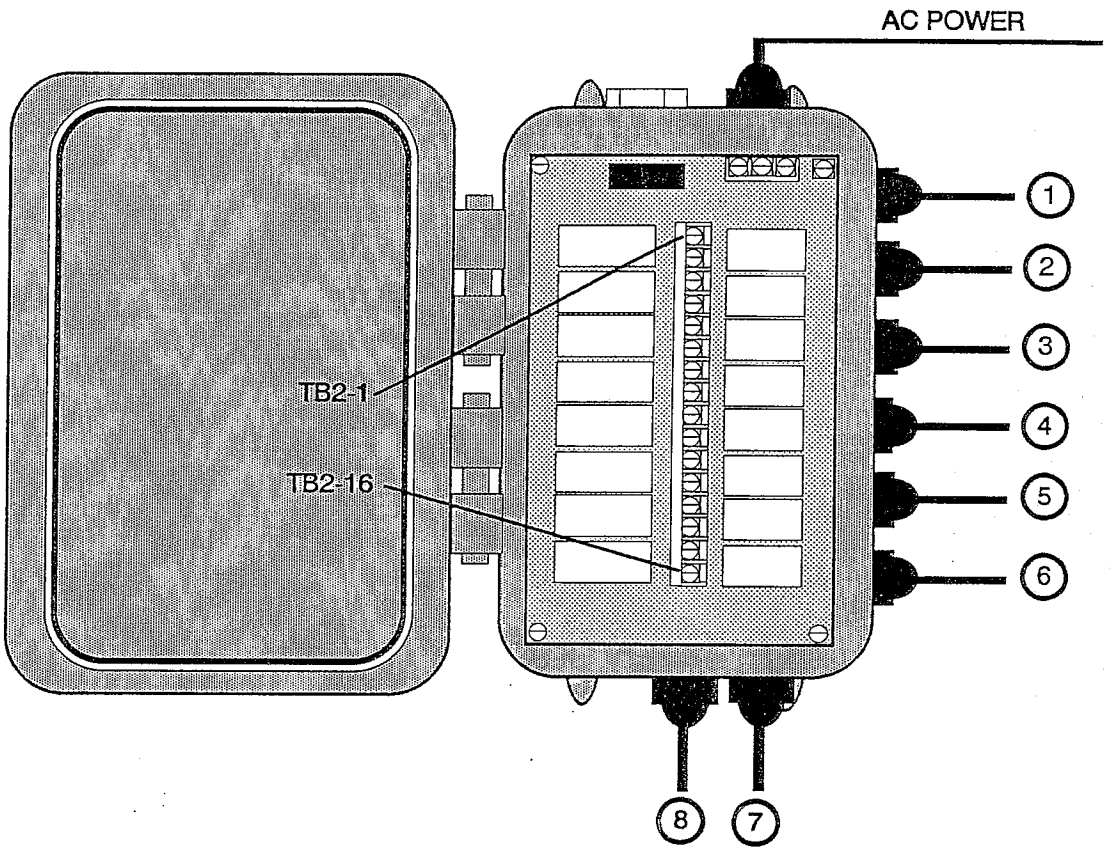


Figure 3. CABLE ROUTING DIAGRAM

TERMINAL	LINE ROUTING LOCATION	DESCRIPTION
TB2-1	1	COMMON
TB2-2	1	HI HEAT*
TB2-3	2	COMMON
TB2-4	2	LO HEAT*
TB2-5	3	COMMON
TB2-6	3	HEAT START*
TB2-7	4	COMMON
TB2-8	4	CIR FAN/FOGGER*
TB2-9	5	COMMON
TB2-10	5	SE FAN #1*
TB2-11	6	COMMON
TB2-12	6	SE FAN #2/ALARM*
TB2-13	7	COMMON
TB2-14	7	NW FAN #1*
TB2-15	8	COMMON
TB2-16	8	NW FAN #2/LIGHTS*
* 110 VAC SWITCHED LINES		

LB WHITE HEATER CONNECTIONS

Use the diagram below to help you wire your LB White heater to your unit's LO HEAT terminals.

TB2-3 is COMMON. TB2-4 is 110 VAC SWITCHED.

For this installation, you will have to supply your own relay. (Its size will vary depending on the number of heaters in your circuit.)

Try to install your relays in an enclosure that will keep them clean and dry

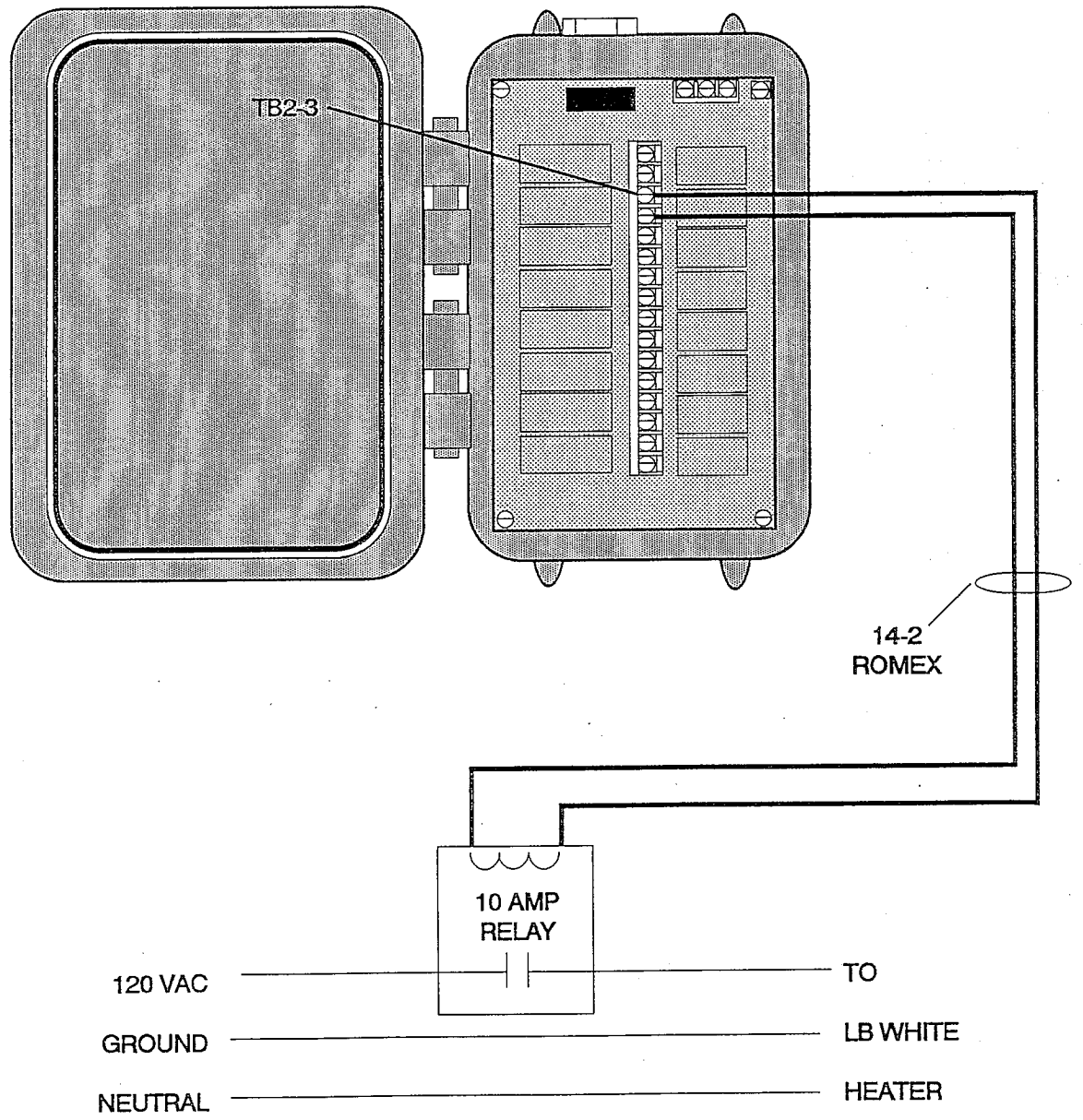


Figure 4. LB WHITE WIRING

HEATERS & ELECTRONIC IGNITION

Use the following diagram to wire your Remote Output unit to SBM-type heaters with electronic ignition.

Notice that your unit must be fitted with a PAL-TECH TRIAC kit (P/N 697-781)and wired for 220 VAC.

To install the TRIAC kit, use the following procedure.

Connect the TRIAC's MT1 wire to L1 (120 VAC) at TB1-1. Connect the TRIAC's GATE line to TB2-6. Use the TRIAC's MT2 wire as the 120 VAC SWITCHED HEAT START line of your 240 VAC installation.

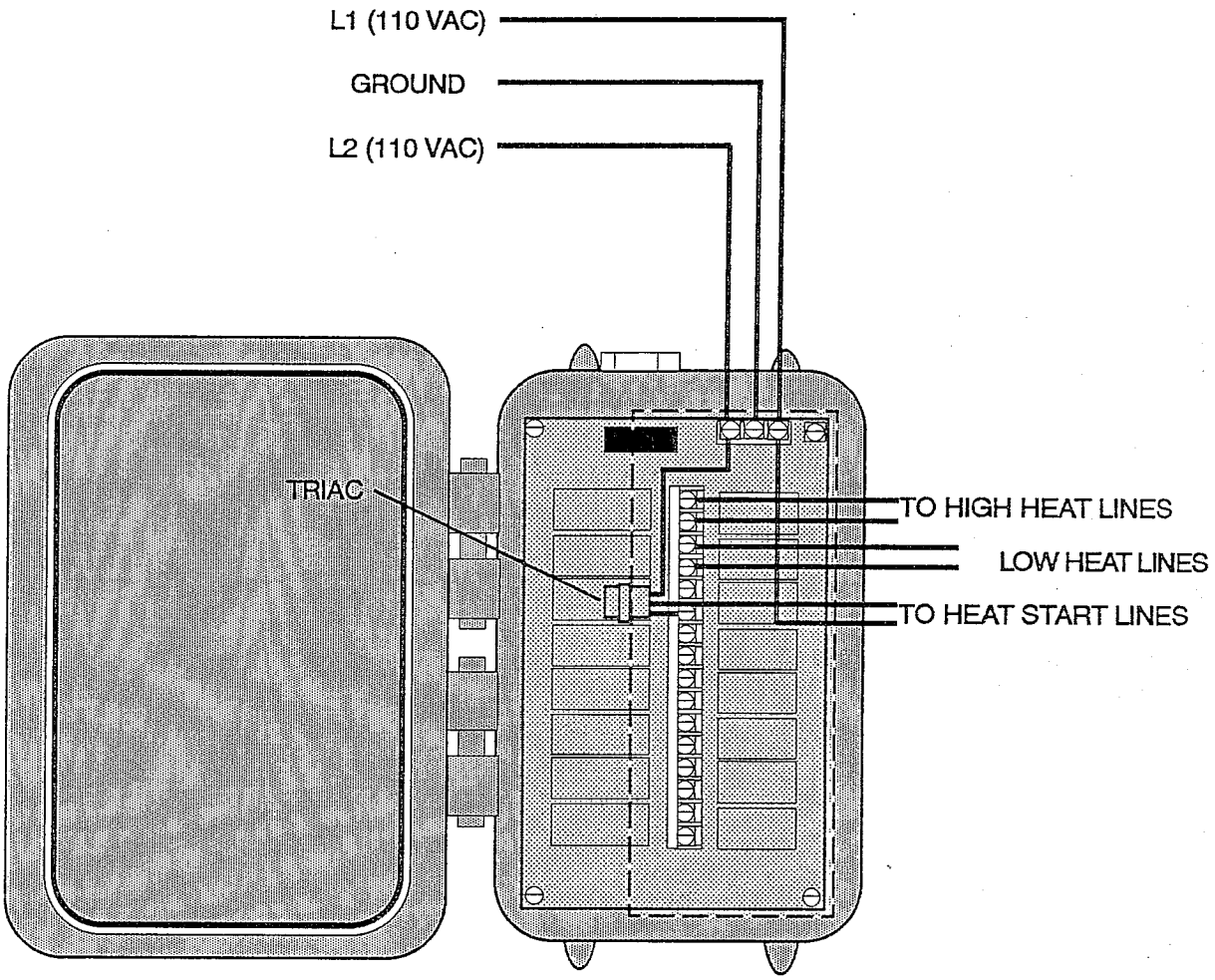


Figure 5. SBM HEATER WIRING

WIRING CIRCULATION FANS

Use the diagram below to help you wire circulation fans to your Remote Output unit's TB2 terminals.

TB2-7 is COMMON. TB2-8 is 110 VAC SWITCHED.

For this installation, you may have to supply your own relays. (Sizes will vary depending on the number of items in your circuit.)

Try to install your relays in an enclosure that will keep them clean and dry

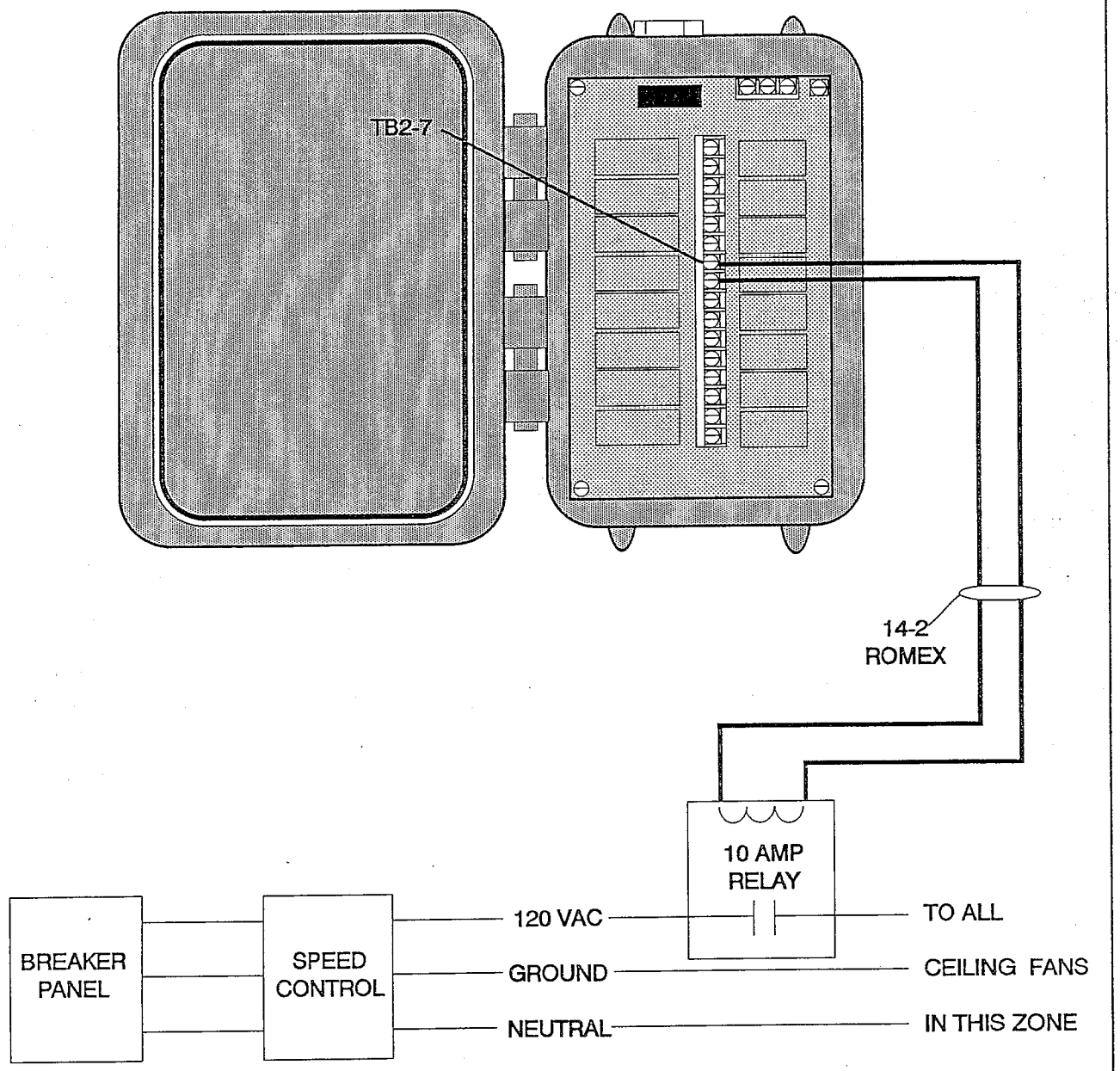


Figure 6. CIRCULATION FAN WIRING

FOGGER CONNECTIONS

If your ZS-30 has been fitted with a software package that redesignates your Remote Output unit's CIR FANS output, you can wire a fogger to your unit as shown in the following diagram.

Remember that the maximum load on this circuit can only be 1amp. If you have fogger equipment that draws more current than that, you will need to use an auxiliary relay to actually turn your foggers ON or OFF.

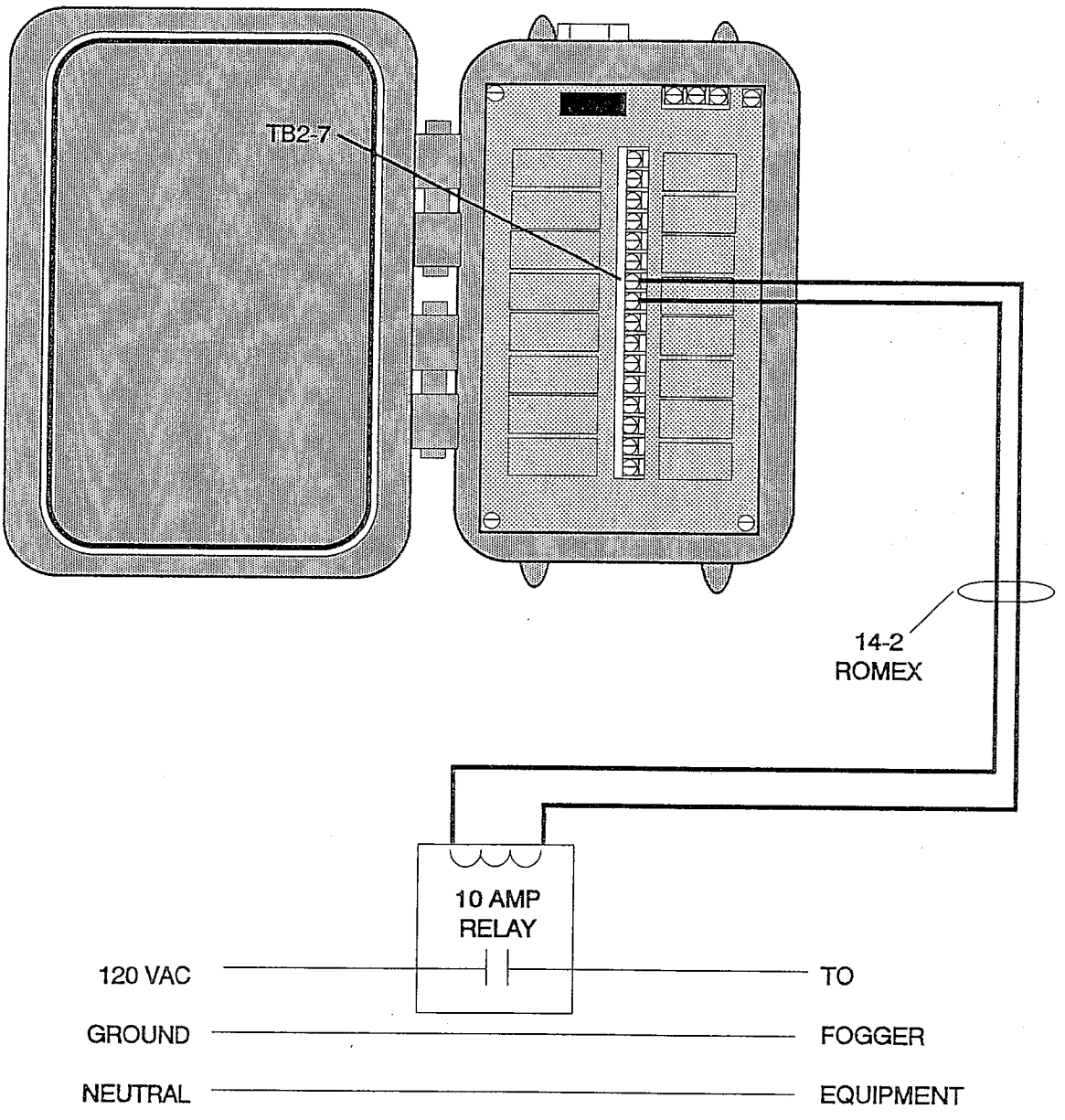


Figure 7. FOGGER CONNECTIONS

WIRING VENTILATION FANS

Use the diagram below to help you wire ventilation fans to your Remote Output unit's TB2 terminals.

Terminals 9, 11, 13, & 15 are COMMON. Terminals 10, 12, 14, and 16 are 110 VAC SWITCHED.

For this installation, you may have to supply your own relays. (Sizes will vary depending on the number of items in your circuit.)

Try to install your relays in an enclosure that will keep them clean and dry.

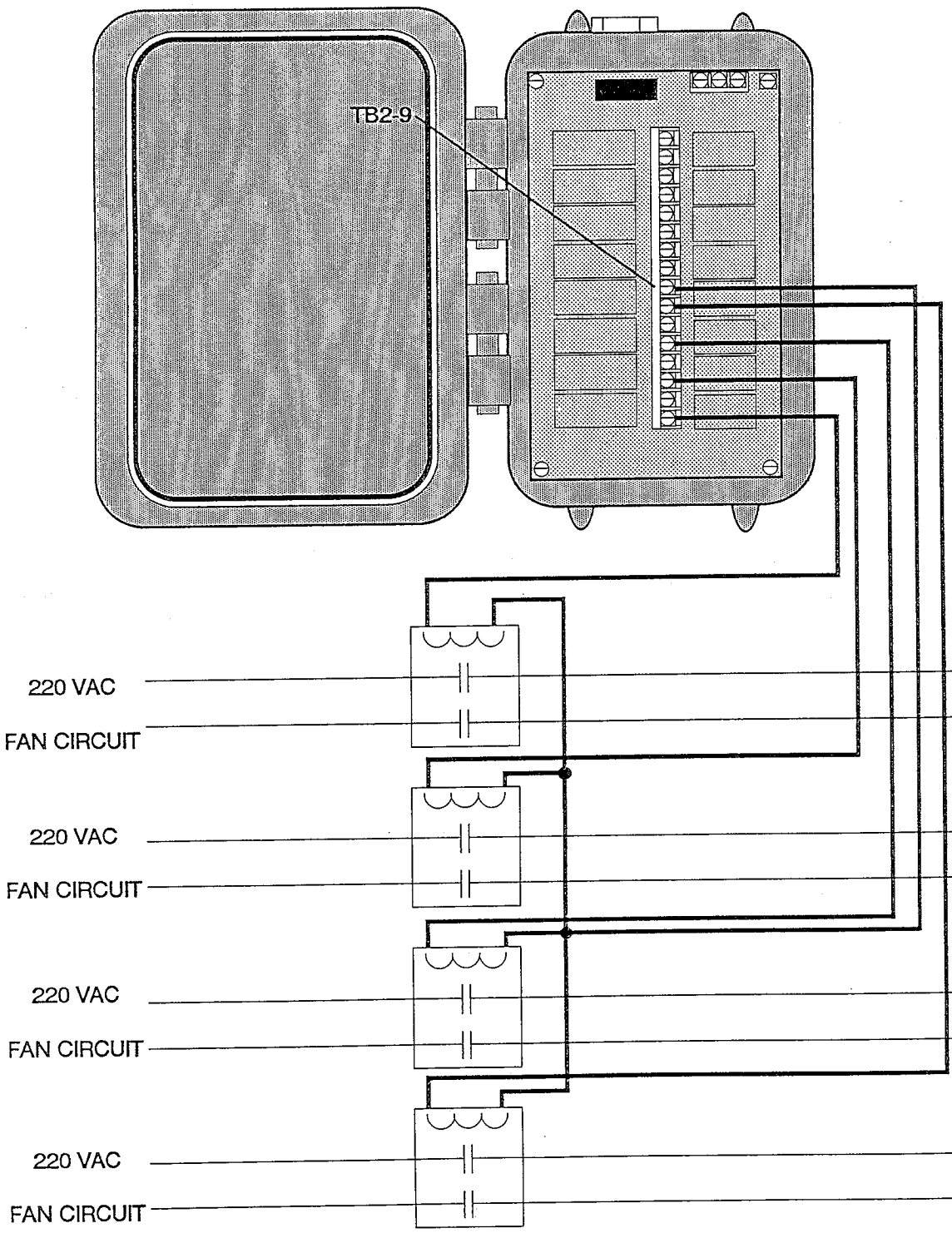


Figure 8. FAN WIRING

WIRING AN ALARM TO YOUR UNIT

If you have the proper software, your unit's SE FAN #2 terminals are redesignated as an ALARM output.

TB2-11 is COMMON. TB2-12 is switched 120 VAC.

Unless your alarm device (buzzer, horn, or light) draws more than three amps, you can use the output module in your unit to drive it.

Otherwise, you will have to provide a relay to power your alarm device.

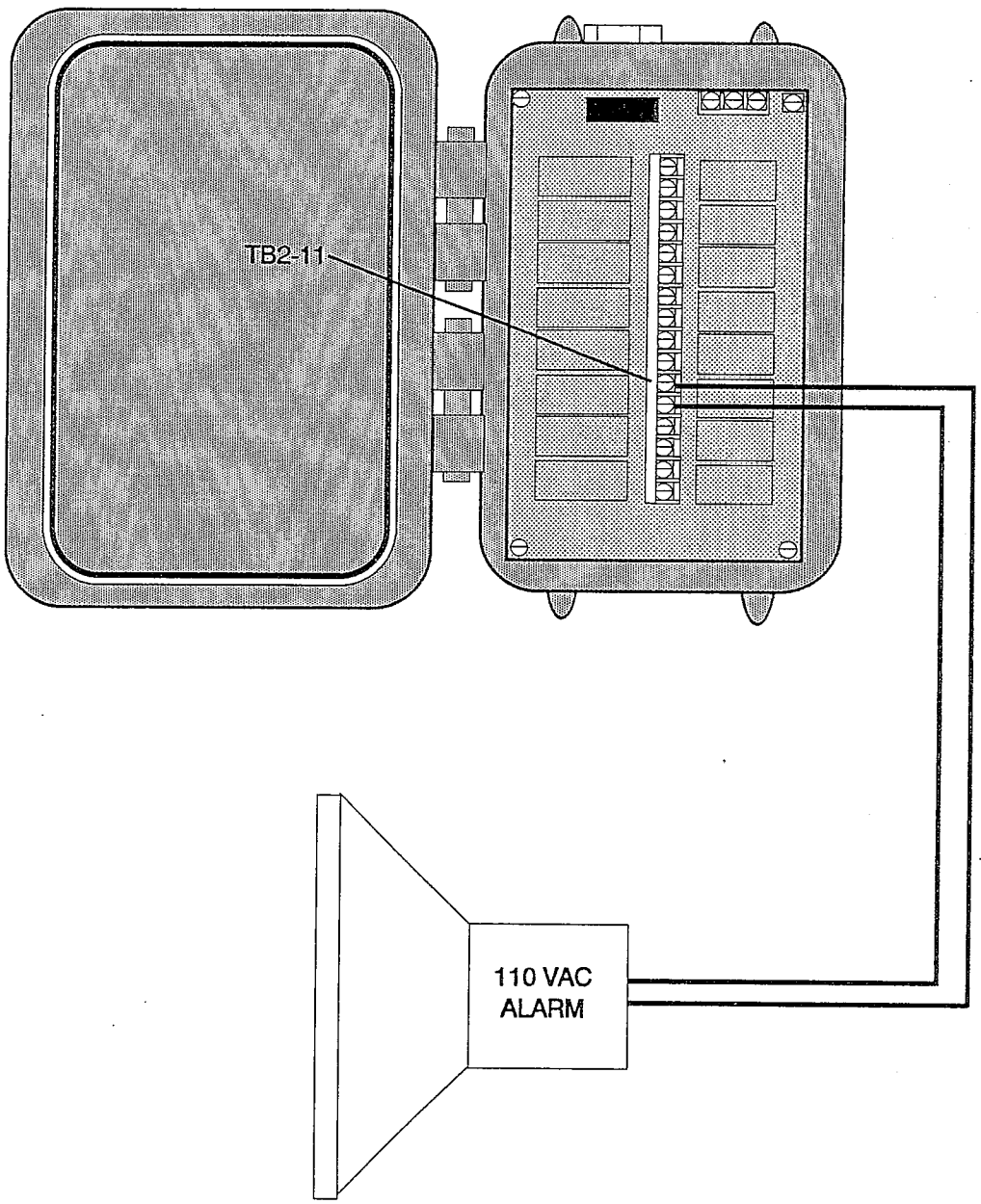


Figure 9. TYPICAL ALARM WIRING

WIRING LIGHTS TO YOUR UNIT

If you have the proper software, your unit's NW FAN #2 output is redesignated LIGHTS.

TB2-15 is COMMON and TB2-16 is switched 120 VAC.

For this installation, you will have to supply your own relay. (Its size will vary depending on the number of items in your circuit.)

Try to install your relays in an enclosure that will keep them clean and dry.

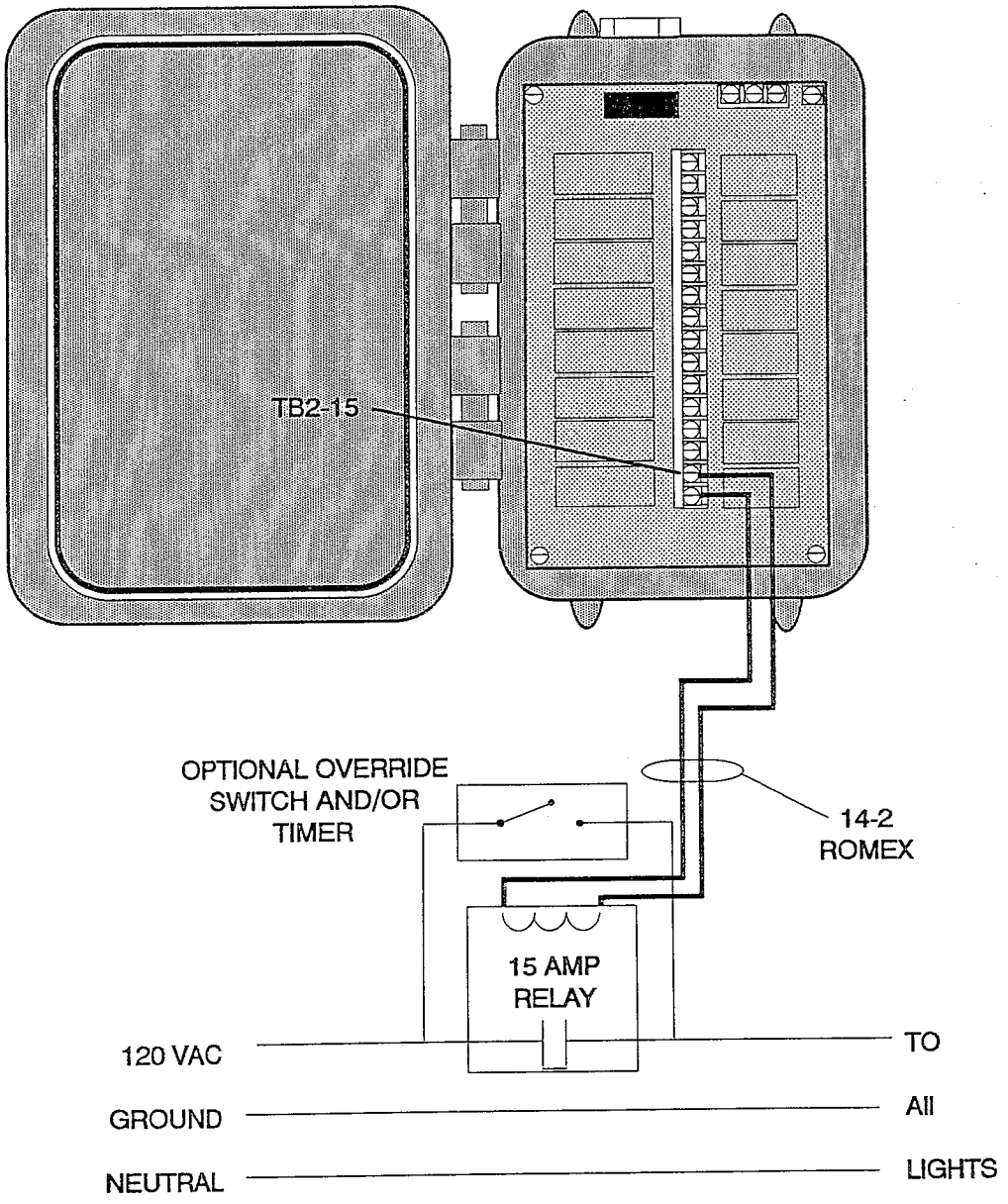


Figure 10. TYPICAL LIGHTS WIRING

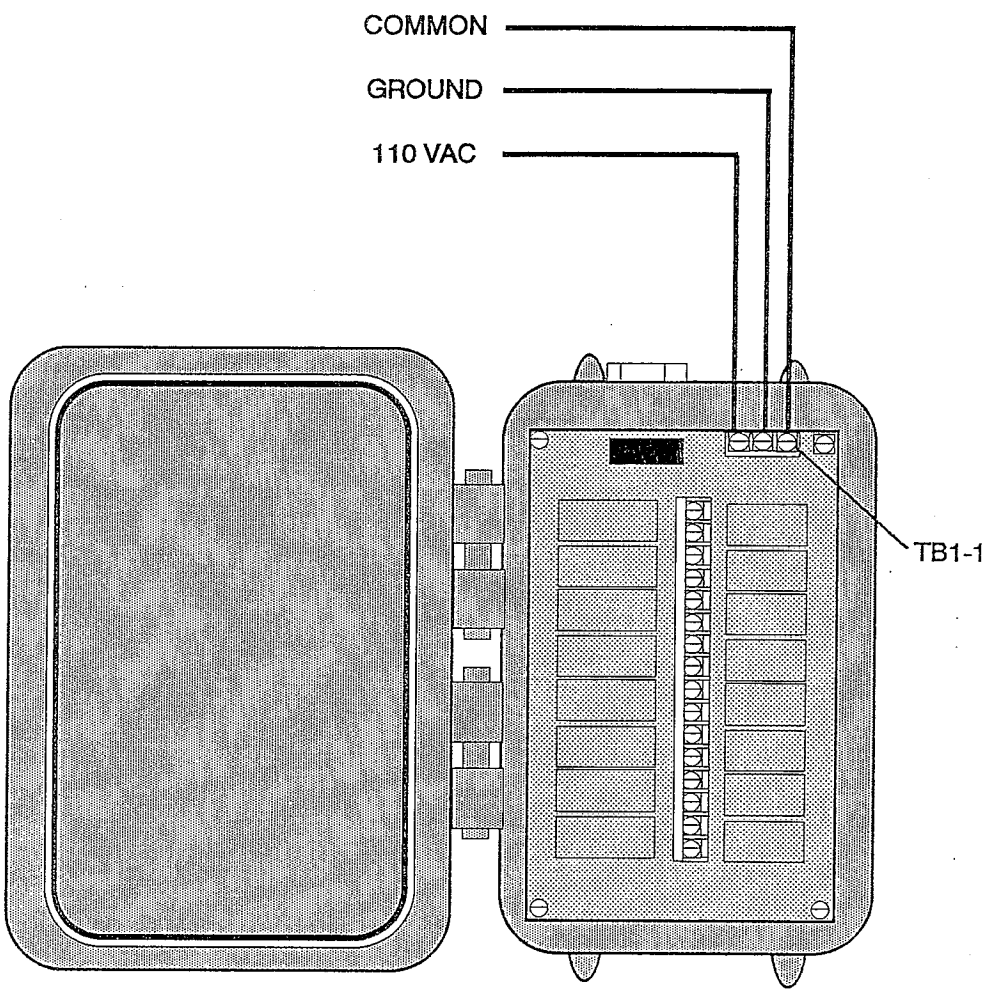
POWER SUPPLY CONNECTIONS

After you have finished wiring the rest of your equipment to your Remote Output unit, refer to the following diagram and connect your unit to a 110 VAC power source as shown.

TB1-1 is COMMON.

TB1-2 is GROUND.

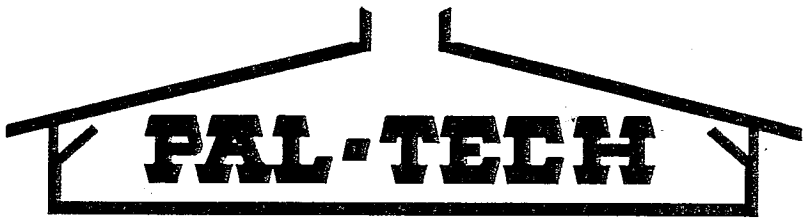
TB1-3 is 110 VAC (HOT).



WARNING:

MAKE SURE THAT YOU HAVE SHUT OFF POWER TO THE AC LINES BEFORE STARTING THIS PROCEDURE. FAILURE TO DO SO CAN RESULT IN SERIOUS INJURY, OR DEATH, DUE TO ELECTRICAL SHOCK. NEVER WORK WITH LIVE WIRES.

Figure 11. AC WIRING CONNECTIONS



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