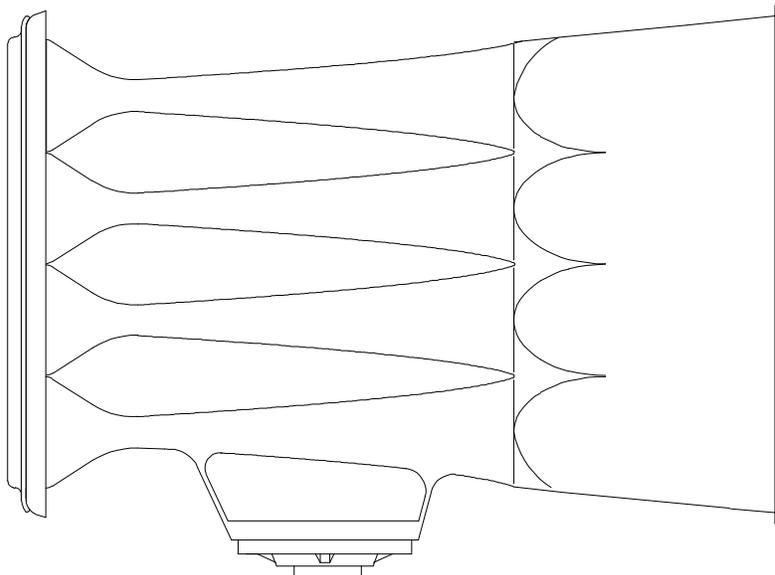


VORTEX™

OUTDOOR WARNING SIREN

Product Manual



PIONEERS IN WARNING SIGNALS
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The purpose of this manual is to provide the user with a general description of the theory, operation, installation, set-up and maintenance of a Vortex™ outdoor warning siren.

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Introduction

The Vortex™ is an outdoor, public warning siren, ideally suited for firehouse and community warning applications. A standard Vortex™ consists of a rugged speaker array, mounted on a maintenance free rotor assembly and a self contained electronics control cabinet.

The Vortex™ is designed for easy installation and easy operation. The speaker array is factory mounted on to the rotor. The speaker drivers and rotor motor are factory wired, with the cable exiting through a piece of flexible conduit.

The electronics cabinet contains all of the control electronics and an isolated battery compartment. This means that there is only one cabinet to install, which simplifies the installation.

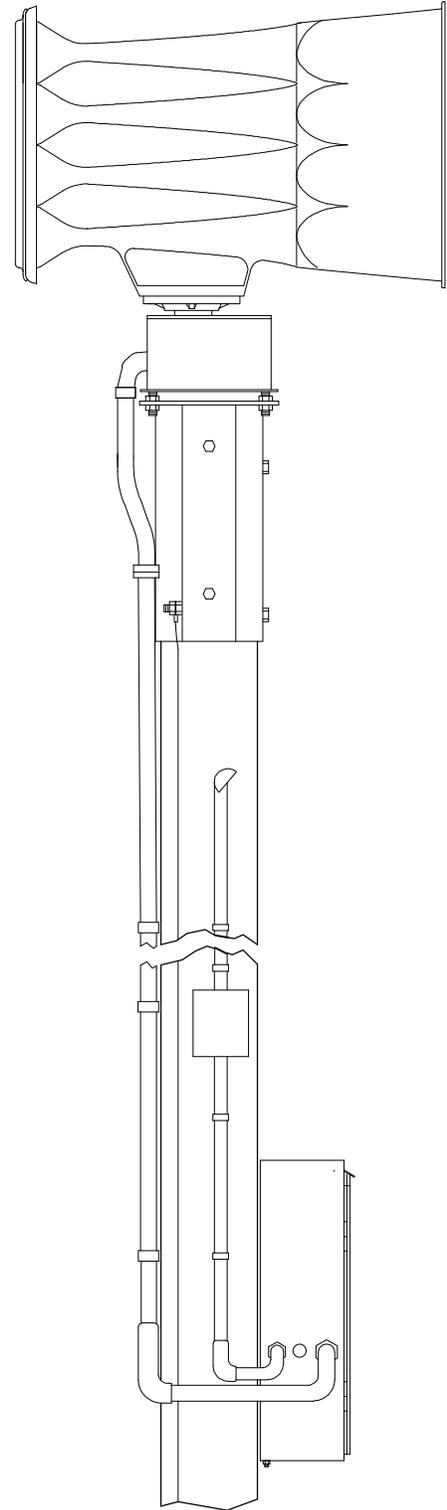
A simple contact closure is all that is needed to activate the Vortex™. Any one of six warning tones may be selected via a remote pair of wires or through a local control module.

Operation is further simplified by the presence of LED indicators on all of the key components of the Vortex™. In addition to the status LEDs the Vortex™ is equipped Whelen Engineering's patented SI-TEST® as a standard item.

As shown in the drawing, a typical siren installation consists of mounting the speaker and rotor assembly on top of a **utility pole**, with the cabinet closer to ground level. AC service is brought to the cabinet to power the Vortex's battery charger.

Complete details about installation, operation, and service will be covered in this manual. A complete review of the manual is recommended to ensure the best possible siren results.

Pay special attention to any **isolated bold type** paragraphs. These paragraphs highlight areas that are often confused and close attention at this time may save many hours at a later time.

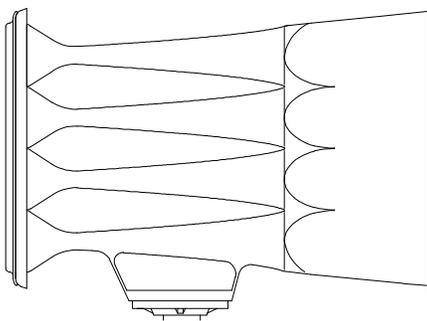


Section 1 - Preview

This section provides a general description of the Vortex™ components, as a preview to installing a Vortex™ public warning siren.

1.0 SPEAKER

The speaker is a fiberglass, horn flare design. It houses four (4) 400 watt drivers, that are accessible through a removable panel. A protective aluminum screen covers the flare opening.

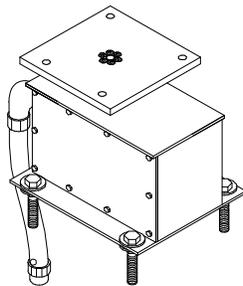


SPEAKER FLARE

1.1 ROTOR

The rotor is a maintenance free design, enclosed in an aluminum housing. The rotor oscillates the speaker through approximately 360° before pausing and reversing direction, at about 2 RPM.

Wiring to the rotor consists of a 50 foot, 14 conductor cable. The cable is factory wired to the speaker drivers and the rotor control switches.

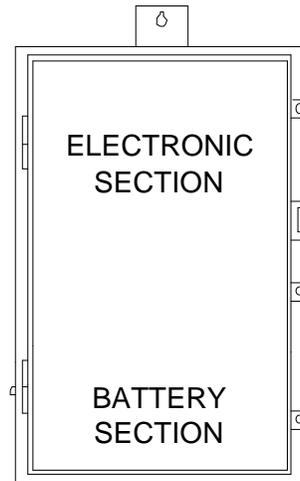


ROTOR

1.2 CABINET

Siren electronics are housed in an aluminum cabinet with a single door. Two clamps seal the door against a rubber gasket. Internally, the cabinet is divided into two sections.

The lower section of the cabinet houses two (2) 12 volt, deep discharge batteries. The lower section is separated from the upper section by a gas-tight seal and sealed cable clamps, which prevent any battery gases from entering into the electronics section. In addition, the battery compartment is vented to minimize the buildup of any battery gases.



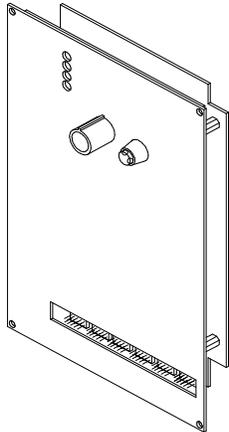
CABINET

The upper section of the cabinet houses the siren control electronics. This consists of a Local Control Module, four Power Amplifiers, a Battery Charger, an Oscillator Module, a fuse block and terminal strips for field wiring. See Section 8 for more information.

1.2.1 LOCAL CONTROL MODULE

The Local Control Module is the “brain” of the Vortex™. This module is comprised of a silk-screened front panel, a local control board and a tone generator board. The front panel is equipped with a tone selector switch, LED status indicators and programming jumpers for command timing.

The local control board monitors all external inputs and controls all siren activation and timing. The tone generator actually creates the siren tones and drives the power amplifiers.

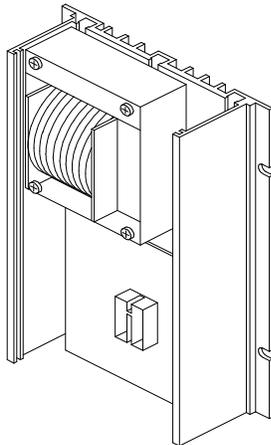


LOCAL CONTROL MODULE

1.2.2 POWER AMPLIFIER

A Vortex™ contains four highly efficient, 400 watt Power Amplifiers, each powering an individual speaker driver.

The Power Amplifier incorporates Whelen's patented SI-TEST® feature. An on board LED indicator provides a simple means of verifying amplifier activity.



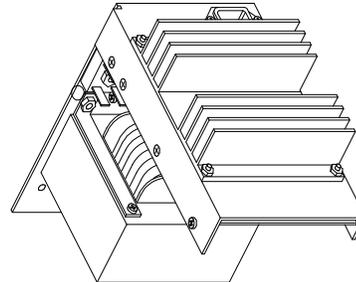
POWER AMPLIFIER

Each Power Amplifier is factory wired to a two position terminal block, to simplify field wiring.

1.2.3 BATTERY CHARGER

The Vortex™ is basically a 24 volt DC battery powered device. An internal Battery Charger

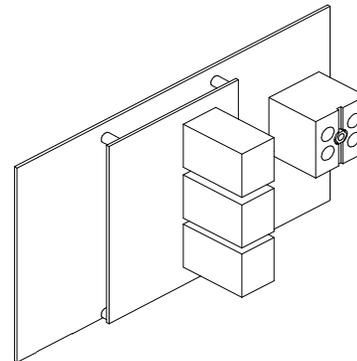
maintains the batteries at an optimum charge level. The charger incorporates a temperature compensation circuit, to insure proper charging regardless of outside temperatures.



BATTERY CHARGER

1.2.4 OSCILLATOR MODULE

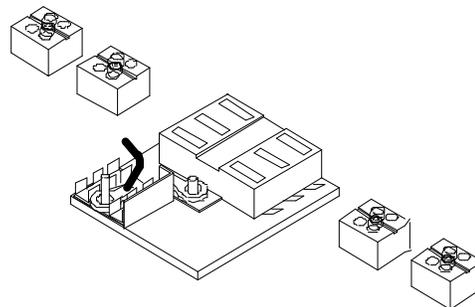
The Oscillator Module contains the oscillator board, for the rotor, and a terminal block for AC service wiring.



OSCILLATOR MODULE

1.2.5 TERMINAL STRIPS and FUSE BLOCK

The fuse block and speaker wire terminal strips are conveniently located for easy access, during installation and service. There are no special tools needed to perform the field wiring.



TERMINAL STRIPS and FUSE BLOCK

Section 2 - Getting Started

Check the contents for any damage or discrepancies. Contact the local Authorized Managing Sales Representative or the factory with any problems.

2.0 RECEIVING and UNPACKING

The Vortex™ is typically shipped with the following items on a single shipping pallet or skid:

- Speaker/Rotor Ass'y, with 50' of cable.
- Electronics Cabinet.
- Cabinet Pole Brackets.
- Batteries (optional).
- Pole Top Bracket (optional).

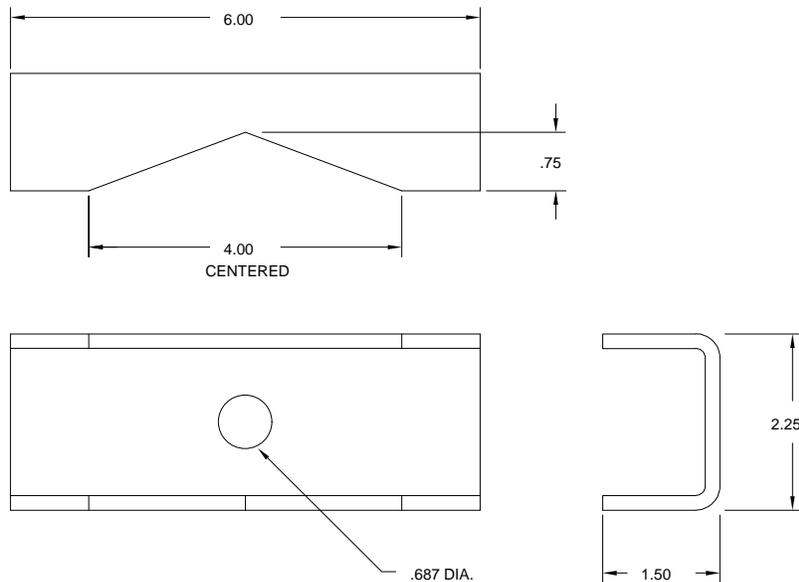
Carefully unpack the items from the pallet, checking for any damage.

The Speaker/Rotor Assembly is attached to the pallet with four 3/4"-16 nuts and washers. **Remove and save** the nuts and washers. They are needed for mounting the assembly.

The Speaker/Rotor Assembly weighs about 220 pounds. It may tip when the nuts are removed. Use caution to avoid injury or damage.

The Cabinet Pole Brackets are shipped in the battery compartment of the Electronics Cabinet. Use of the Cabinet Pole Bracket is at the discretion of the customer. It is recommended for a more secure fit to a round pole.

The Cabinet Pole Bracket dimensions are shown below.



CABINET POLE BRACKET

Section 3 - Installation

This section covers installation of a Vortex™. Any shortcuts taken in this area may adversely affect the operation of the siren.

The installation procedure assumes that the Vortex™ is mounted to a Class I or Class II utility pole. This procedure is a recommendation. Other factors or mounting issues may require slight deviations from this procedure. Contact the factory with any concerns or questions.

Typical installation involves mounting the siren components, conduit, ground wire, etc. to the pole, while the pole is laying on the ground. The pole is then raised and set in the hole.

Batteries and AC service are added after the pole is in place. Do not install the batteries until the pole and cabinet are secure.

Rooftop mounting is not recommended.

POLE PREPARATION

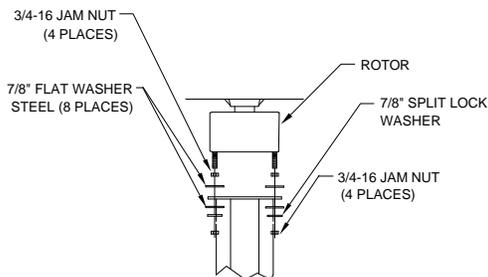
Sling or cradle the pole in a safe manner, with the top of the pole high enough off the ground to allow for clearance of the Speaker/Rotor assembly. The top of the pole must be squared off, with respect to the sides.

When using Whelen's optional Pole Top Bracket, the top 30 inches of the pole must be less than 10 inches in diameter. Pole top diameters of 9 to 9.5 inches are recommended.

3.1 POLE TOP BRACKET MOUNT

This procedure assumes that the optional Pole Top Bracket is being used.

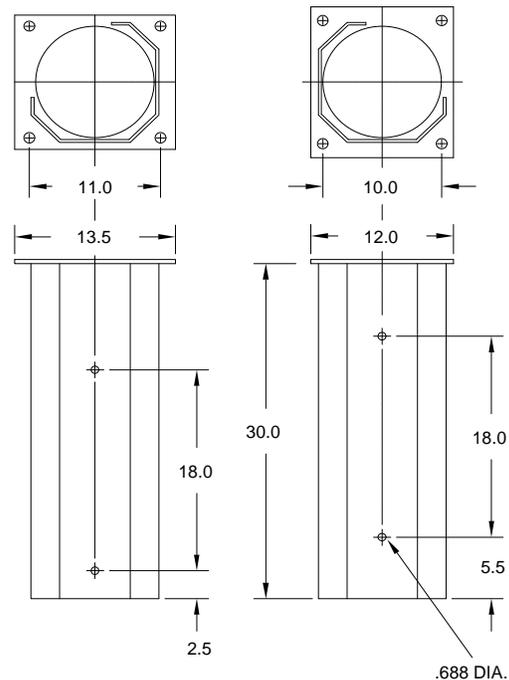
Position the bracket flush over the top of the pole to allow for easy access to the rigid conduit that



will be mounted to the pole.

Note: For installers familiar with Whelen's 4000 or 400 Series sirens, there is no North orientation requirement with a Vortex™ rotor.

Drill directly and straight through the pole, via the .688 (11/16) diameter holes, four places. Attach the bracket with four 5/8 through bolts (hex or square head) and appropriate flatwashers, lockwashers and nuts. **This hardware is supplied by the installer.**



POLE TOP BRACKET (optional)

Note: If a new pole is used, all mounting hardware should be checked for tightness within 6 to 12 months, to account for pole shrinkage.

3.2 SPEAKER/ROTOR MOUNT

Collect the hardware that was removed from the pallet. Attach the speaker/rotor assembly to the pole top bracket, using four flatwashers, lockwashers and nuts. **Be sure that a flatwasher and jam nut are in place on each speaker/rotor stud before mounting the assembly to the bracket.** Notice that the two nut arrangement provides a means of leveling the speaker/rotor assembly.

3.3 CABINET MOUNTING

This procedure assumes the use of the Cabinet Pole Brackets. Refer to page 4 for dimensions.

Remove the door from the cabinet, by lifting it off the black hinges. Notice that there is a mounting hole in the battery (lower) compartment.

Determine the direction that the cabinet will face, as well as, the mounting height on the pole. Remember that the bottom portion of the pole will be buried in the ground. Typical mounting height is 6 to 12 feet above the ground level. Local codes, security or service issues must be taken into account when selecting the height.

Note: The Speaker/Rotor Assembly is equipped with 50 feet of cable. Be sure that the cabinet is close enough to allow for internal wiring.

Mark the mounting holes (2) on the pole. The holes should be 25 inches apart. Check the actual dimension on the cabinet before drilling.

Drill two 11/16" holes straight through the pole. Place one Pole Bracket between the top flange and the pole, place the other Pole Bracket between the hole in the back of the battery compartment and the pole. The "V" goes against the pole. Attach the cabinet with two 5/8 through bolts (hex or square head) and appropriate flatwashers, lockwashers and nuts. **This hardware is supplied by the installer.**

Note: If a new pole is used, all mounting hardware should be checked for tightness within 6 to 12 months, to account for pole shrinkage.

3.4 GROUNDING

Proper grounding is essential for ensuring the reliability of a public warning siren. This section provides a recommended grounding procedure, however, **local codes prevail.**

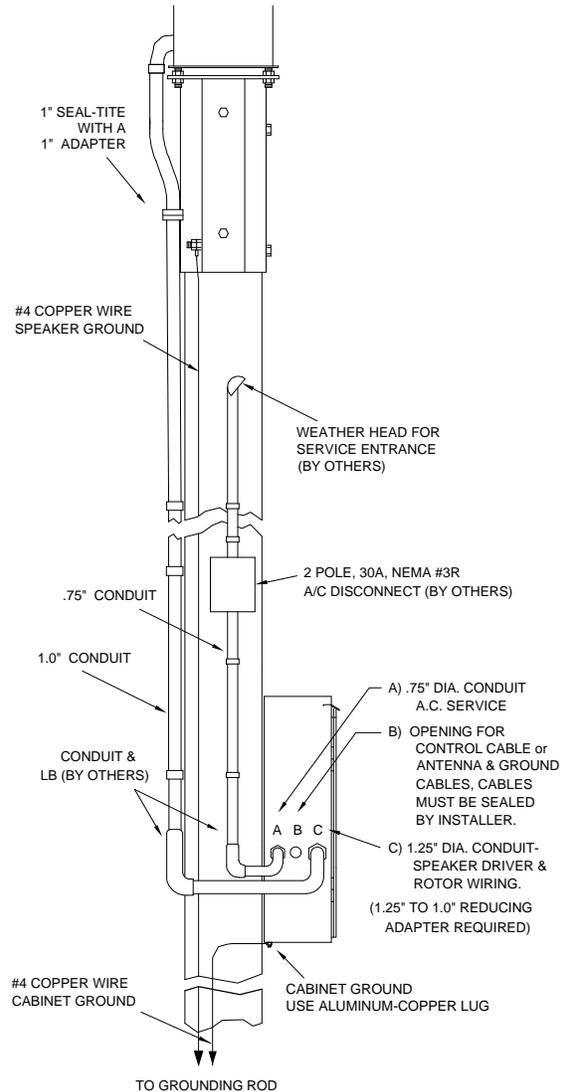
Use a nut and washer to attach a 4 AWG copper wire to the bolt on the Pole Top Bracket. Staple the wire the length of the pole.

Connect a second 4 AWG copper ground wire to the hole in the bottom of the cabinet, using a CU-AL (copper-aluminum) solderless lug. Staple this wire the length of the pole, to the approximate ground level.

Clamp both wires to an appropriate ground rod, installed per local code. A 10 foot ground rod is typical.

3.5 SPEAKER/ROTOR CONDUIT

Rigid steel conduit is required in a Vortex™ installation. The conduit is an integral part of the lightning and static charge protection of the siren.



Notice that the Speaker/Rotor Assembly is fitted with a 24" piece of metal-bonded "seal-tite", terminated with a 1" straight adapter. The recommended conduit for the speaker cable is 1" rigid steel. Metal bonded "seal-tite" may be used

between the LB and the cabinet, however, this section must not exceed 24" in length.

Run the 14 conductor speaker cable into the sections of conduit. Install the necessary couplings and clamps as the conduit is extended to the cabinet.

Notice the three holes in the side of the cabinet. The hole closest to the back of the cabinet is for 3/4" conduit for the AC service. The middle hole is for an optional radio antenna cable. The largest hole, near the front of the cabinet, is for the Speaker/Rotor conduit. **A 1.25" to 1" adapter is required.**

Use an LB to make the bend at the bottom of the conduit, as shown. A **drip loop must be provided** where the conduit enters the cabinet.

All connections must be water-tight.

Route the Speaker/Rotor cable through the cabinet entrance hole and leave it for Section 4.

3.6 AC SERVICE

The electrical service is always subject to local codes. An AC service with a traditionally acceptable type of weatherproof disconnect is recommended. Make sure that the **AC service is off** during this procedure.

Note: The Vortex™ requires AC power only for the purpose of maintaining charge on its battery supply. The battery charger requires a 3 Amp circuit, however, a 30 Amp circuit is recommended in the event that additional service is needed for service equipment.

Run the AC service cable through the 3/4" conduit. Use an LB to make the bend at the cabinet, as shown. Provide a **drip loop** prior to entering the cabinet.

Route the AC cable into the cabinet and leave it for Section 4.

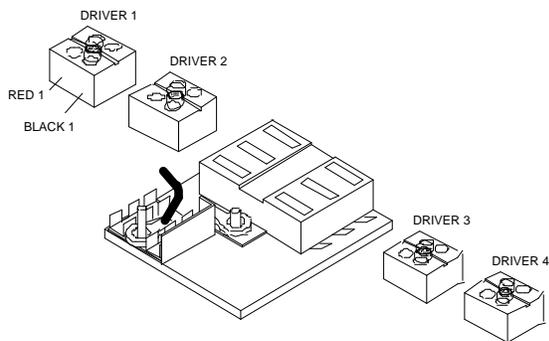
Section 4 - Installation Wiring

This section covers field wiring for the Speaker/Rotor Assembly and the AC service. Activation wiring is covered in Section 7.

4.0 SPEAKER/ROTOR WIRING

The 14 conductor Speaker/Rotor cable has five red wires, five black wires, one gray, one violet, one white and a red wire with a white strip. Each of the red and black wires has a white ink identifier on it. The wires are grouped in red and black pairs, with labels 1, 2, 3, 4 and M. **The red and black wires are polarity sensitive.** Pair 1 is wired to speaker driver 1, which is the bottom driver of the speaker, pair 2 is wired to speaker driver 2, which is the next driver up the speaker and so on. Pair M is connected to the rotor motor. The other four wires are connected to limit switches in the rotor.

The speaker driver wires (red and black 1-4) connect to the 2 position terminal strips mounted along the shelf of the electronic section of the cabinet. Connect speaker driver pair 1 to the left-most terminal block. Match the colors with the wires exiting the other side of the block.



Connect speaker driver pairs 2, 3 and 4 from left to right, as shown. **The wire colors must match the wires that are factory wired into each terminal block.**

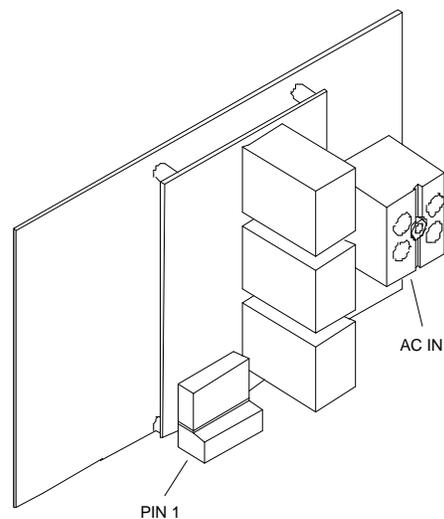
The remaining six wires connect to the six position connector on the Oscillator Module, located on the left side of the cabinet. Remove the plug from the printed circuit board, for easy access.

Follow the wire chart below. Pin 1 is closest to the front of the cabinet.

<u>Pin #</u>	<u>Color</u>
1	Red/White
2	White
3	Violet
4	Gray
5	Red M
6	Black M

4.1 AC WIRING

Connect the AC service to the large black, two position terminal block on the Oscillator Module. Match the factory wiring colors, in the terminal block, with respect to AC IN (black) and AC Return (white). Connect the Ground (green) to the #10-24 stud on the side wall of the cabinet.



Section 5 - Battery Installation

The Vortex™ is a nominal 24 volt DC unit. Its normal operating power comes from two (2) 12 volt, 60 amp-hour batteries, wired in series.

CAUTION

Extreme caution must be taken when working with batteries. Never allow the terminals or tools to make contact with the aluminum cabinet.

5.0 BATTERY TYPE

Recommended batteries are maintenance free, lead calcium, 12 V, 60 AH, deep cycle, side terminal type, such as a **Delco DC74 or equivalent**. Batteries are available as an option from Whelen Engineering Company, Inc. or any authorized Delco distributor.

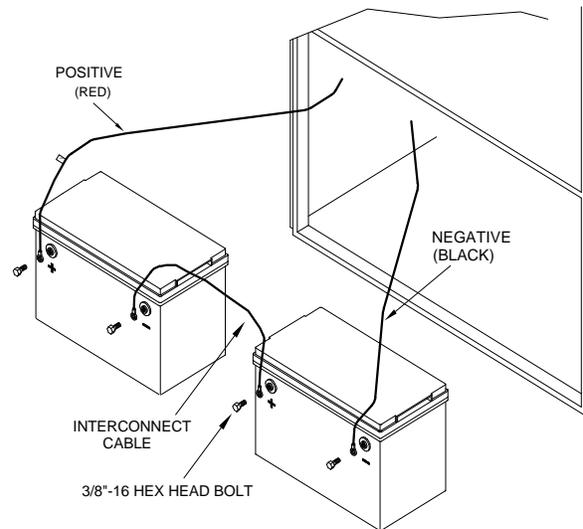
5.1 INSTALLATION

Remove and save the bag with the 3/8"-16 battery hardware, battery interconnect cable and Nyogel from the battery compartment.

Place the batteries into the battery compartment. Connect the **red** lead to the positive (+) terminal of the left-most battery. Connect the battery interconnect cable as shown. Connect the **black** lead to the negative (-) terminal of the right-most battery. **Note:** A small spark may occur when the

last connection is made. This is normal as the power amplifier capacitors charge up. The Vortex™ is now **powered up and operational**.

AC service should be turned on to avoid discharging the batteries. Remove the interconnect cable if AC service is not going to be available for more than a week.



Coat the battery terminals with the enclosed Nyogel. Failure to coat the terminals may lead to failure in the future.

Section 6 - Siren Functions

This section covers the basic siren functions, such as, the types of warning tones, the tone timing and control commands.

6.0 SIREN TONES

There are six standard warning tones in a Vortex™. In addition, there is a Noon Test tone, a SI TEST® function, and a Cancel function.

The tones are described by a frequency sweep range and a sweep rate, as listed below:

Tone	Frequency	Sweep Rate
Wail	410-675 Hz	1 second / 4 seconds
Attack	410-490 Hz	1 second / 1 second
Alert	465 Hz	Steady
Air Horn	465+650 Hz	Steady
Hi / Lo	465-650 Hz	.8 second / .8 second
Whoop	300-465 Hz	3 seconds
Noon Test	465 Hz	Steady

What this means is that the Attack tone rises up to 490 hertz in 1 second, then ramps down to 410 hertz in 1 second and so on.

The SI TEST® function is a patented Whelen circuit that allows for inaudible testing of the complete Vortex™ siren. The way SI TEST® works is that the Local Control Module generates a 20 KHz tone. Even though this is above the audible range of humans, it causes the power amplifiers to produce power to the speaker drivers, which cause the current sense LEDs to turn on.

The Cancel function terminates any active tone. It must be noted that **a siren tone does not shut off instantly**, however, it ramps down, then turns off.

Any closure, at the terminal strip, will **override** the active function, even if the previous closure is still present.

For example:

Assume the Attack tone is set for 3 minutes and the Wail tone is set for 90 seconds. Also, assume the Attack tone is 2 minutes into a 3 minute tone. Making a closure to ground at the Wail input will cause the tone to change to Wail, for a 90 second run time.

Note: If the closure is still active when the tone times out, it must be removed and reactivated to turn the tone on again.

6.1 TIMING

There are two basic ways of setting the timing for a Vortex™ siren tone. A fixed time out may be set, in which case, the tone will run for the length of the timer. In this mode, the activation signal does not have to be maintained for the duration of the tone. An alternate mode of timing is to use the Manual timing function. In this mode, the selected siren tone remains active for as long as the closure is maintained.

Tone timing may be set on an individual tone basis, by means of a jumper setting on the lower section of the Local Control Module. Note that each of the six siren tones has a set of jumpers positions associated with it. Each tone may be set to a fixed run time of 30 seconds, 60 seconds, 90 seconds or 3 minutes. As an alternative, the jumper may be set to the “MAN” (for manual) position. In the “manual” position, the selected tone remains active as long as the closure, at the terminal strip, is maintained, **up to a maximum of 5 minutes.**

Select the desired timing by moving the small black jumper to the appropriate position. Make sure that this is done for each tone that may be used.

Section 7 - Operation

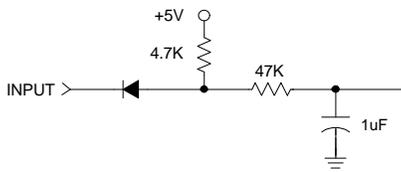
The Vortex™ is a relatively simple, one way public warning siren. It consists of six distinct warning tones, a noon test, a silent test feature and a cancel command. A number of internal LED indicators provide a quick and simple means of monitoring siren conditions.

This section of the manual covers the different ways of activating the Vortex™, as well as, the meaning of the LED indicators.

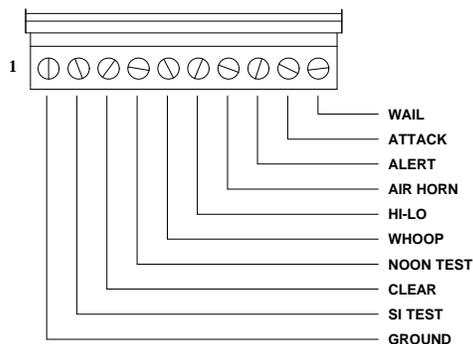
7.0 ACTIVATION

Any warning tone, or SI TEST®, may be activated by either supplying a “closure” at the connector on the Local Control Module or by selecting a command with the Local Control Module rotary switch and pressing the Start button.

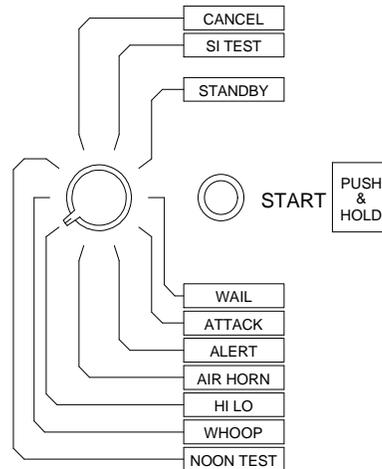
For external controls, the “closure” must be at least **1/2 a second** in duration. The “closure” must be made **to ground**. A ground contact is supplied at the terminal strip for this reason. The typical input circuit is shown below.



The 10 position connector strip is located at the lower left of the Local Control Module. All tones and functions are available at the 10 position connector, as shown. Any contact closure between a terminal and the ground terminal will activate the Vortex™. The ground terminal may have more than one connection, if multiple tones are being used.



The Vortex™ is also equipped with local controls. With the cabinet open, the user can select a function and activate that function.



As shown, all six tones, the Cancel function, Noon Test and SI TEST® may be selected. After selecting a function, the Start button must be pressed. **Hold the Start button for about 1/2 a second** to activate the function.

To avoid accidental activation, the selector switch should be left in the **Standby** position.

7.1 LOCAL CONTROL LEDS

There are four green LED indicators on the Local Control Module. The LED definitions are:

Power Up - The LED is on when the Local Control Module has received a command and “powered up” the Tone Generator and the Power Amplifiers.

Command Timing - This LED is on when a tone is actually being processed. It basically follows the same pattern as the Power Up LED. It goes off when a tone is ramping down.

DC On - The green LED is on when the battery voltage is above 20 volts. If the battery voltage drops below approximately 19 volts, the Tone Generator and Power Amplifiers are turned off in order to protect the batteries from damage.

AC On - This LED is on as long as the AC line voltage is above 90 volts AC, for a nominal 115 VAC service.

Section 8 - Preliminary Test

A relatively simple preliminary test is described in this section. This test should be performed following the connection of the Batteries, AC service and Speaker/Rotor cable.

Refer to Section 11 for troubleshooting help.

8.0 INITIAL TESTING

With a voltmeter, check the voltage at the fuse block. The voltage should read about 26 volts DC, at the red wire. The black wire is ground.

Check the Green LED on the Battery Charger, it should be on. Check that the green DC On and AC On LEDs are active on the Local Control Module front panel.

Caution: Selecting anything other than SI TEST® will generate a full power warning tone. This may not be desirable in your community.

Select the SI TEST® position on the Local Control Module front panel. **Press and Hold** the Start button. Hold the button for at least 1/2 a second.

Observe the red LED on each of the Power Amplifiers. It should be active for the duration of the silent test, about 5 seconds. Also observe the Power Up LED on the front panel. It should be active during the silent test. Observe that the Command Timing LED goes active and remains active for about 30 seconds. Repeat this test if

necessary, to observe all of the LED activity. The Speaker should also start rotating during the silent test period.

8.1 SIREN TONE TESTING

If everything checked out during silent testing consider activating a “live” tone to further test the installation.

Note: Starting anything other than SI TEST® will generate a full power warning tone. This may not be desirable in your community.

Hearing Protection is Recommended

Select a warning tone and press the Start button. The tone should be active. Observe the red LED on each of the Power Amplifiers. It should be active for the duration of the tone. Also observe the Power Up LED on the front panel. It should be active during the tone. Observe that the Command Timing LED goes active and remains active for the timer value.

If external controls are being used, to select tones, it is recommended that they be activated at this time.

Select Cancel and press the Start button, at any time, to silence the Vortex™.

Section 9 Electronic Modules

All of the standard Vortex™ electronic modules are described in this section. The description will cover the general purpose of each module and how it relates to the other modules. A wiring diagram is also included in this section.

9.0 LOCAL CONTROL BOARD

The Local Control Board is “sandwiched” between the Local Control front panel and the Tone Generator Board. The Local Control Board monitors all inputs, such as the external closures at the 10 position connector, the rotary selector switch and the Start push button, on the Front Panel, and the AC and DC voltage sense lines.

In a typical scenario, the Local Control Board receives an input and processes the input by determining which tone or function has been selected. It then updates the LED indicators and sends a command to the Tone Generator Board. A command timer is also started, based on the jumper settings. At the end of the timer period, the Local Control Board sends a command to the Tone Generator to stop.

The Local Control Board monitors the DC sense signal from the Battery Charger. If the sense line drops off, the Local Control Board shuts down the Tone Generator, which shuts down the Power Amplifiers and the Oscillator Board. This protects the batteries from irreversible damage.

9.1 TONE GENERATOR

The Tone Generator is located behind the Local Control Board. Its primary function is to generate one of the six warning tones, or the Noon Test tone depending on the command from the Local Control Board. The output of the Tone Generator has an audio output driver circuit that goes to the Power Amplifiers. The Tone Generator also controls the Bias line. The Bias signal enables the Power Amplifiers and activates the Rotor oscillator circuit.

9.2 POWER AMPLIFIERS

There are four Power Amplifiers in a Vortex™. Each 400 watt Power Amplifier drives an individual 400 watt speaker driver. A Power Amplifier receives a low level, square wave signal from the Tone Generator and amplifies it

to 400 watt, 70 volt RMS level. The **red LED, in the left-center of the Power Amplifier**, is on whenever the Power Amplifier is producing full power.

This Power Amplifier is designed specifically for the Vortex™. **It is meant to operate with the Vortex™ Tone Generator only.**

9.3 OSCILLATOR BOARD

The Oscillator Board is located on the Oscillator Module. The Oscillator Board performs two functions. When the Bias signal goes active, on the Tone Generator, the Oscillator Board responds by supplying 24 volt DC power to the Rotor motor. The Oscillator Board then monitors the limit switch inputs, from the Rotor. When a limit switch is activated the Oscillator Board removes power from the Rotor motor, reverses polarity to the motor and re-applies power to reverse the direction of the Rotor.

Note: The term “oscillator” is used to define a rotation through approximately 360° that stops and reverses back through 360°, in the opposite direction. The Vortex™ does not rotate continuously in the same direction.

9.4 BATTERY CHARGER

The Battery Charger maintains an optimum charge level on the Vortex™ batteries. An on-board temperature sensing circuit automatically adjusts the charge voltage, with respect to temperature. A green LED provides a visual indicator that the batteries are charging. The Battery Charger also supplies 12 volts DC to the Local Control and Oscillator Module. The Battery Charger includes a 7 Amp, SLO-BLO type 3AG fuse on the AC in. and a 7 Amp, type 3AG fuse on the battery charging voltage.

9.5 FUSE BLOCK

A six position fuse block is located on the shelf in the Vortex™ cabinet. An insulating cover protects the block from potential short circuits. Industry standard “automotive” type fuses are used for the Power Amplifiers and the Oscillator Board. Each Power Amplifier uses a **30 amp fuse** and the Oscillator Board uses a **20 amp fuse**.

Section 10 - Radio Control (option)

This section covers the Radio Control option. A one way (receive only) radio control option may be added to a Vortex™. Typically, this is a factory installed option. The option includes a radio and a decoder. The decoder may be for either DTMF protocols or two-tone sequential decoding.

Radio frequencies are available as follows:

VHF Low Band 30-50 MHz.
VHF High Band 150-170 MHz.
UHF Band 450-470 MHz.

In addition, the option includes the appropriate antenna, antenna mounting bracket and 35 feet of coax cable.

The option mounts to the left side wall of the cabinet. The antenna cable should be routed through the center hole on the side of the cabinet, as shown on page 6. **Seal the hole** after the antenna cable installation is complete.

10.0 MULTIFORMAT DECODER

The Multiformat Decoder can be used to decode Whelen Engineering Company's standard 10 digit DTMF protocol, as well as, a number of other DTMF formats used in the public warning industry. A series of field programmable rotary switches allow the user to select the DTMF data

string length and digit timing. The switches are defined in detail in Appendix C.

In the Vortex™, only the functions shown on the front panel are available through the Multiformat Decoder, that is:

Wail
Attack
Alert
Air Horn
Hi/Lo
Whoop
Noon Test
Cancel
SI TEST®

Note: Any new command, via the RF path or the local control, will override an active function.

10.1 TWO TONE DECODER

The Two Tone Decoder may be equipped with **up to six** decode modules, for Motorola Quick-Call frequencies.

The appropriate decode module is factory wired to the appropriate Vortex™ command, provided the information is supplied to the factory.

Two Tone formats and ordering information are supplied in Appendix D.

Section 11 - Troubleshooting

This section assumes that a trained electronic technician is servicing the Vortex™. The

discussion on repair is limited to replacement of modules or printed circuit boards.

Always disconnect the AC service and remove the battery interconnect cable before removing any modules or circuit boards.

11.0 TROUBLESHOOTING MATRIX

FAULT

With AC service off, no DC voltage at the fuse block.

With AC service off, less than 24 VDC at the fuse block.

With AC service on, no LED on battery charger.

With AC service on, Charger LED on, but no charger output.

With AC service on and battery voltage above 22 VDC, no **AC On** or **DC On** LEDs on the front panel.

No **Power Up** or **Command Timing** LEDs, when a function is activated.

Function started, Front Panel LEDs are active, but no Power Amplifier LEDs.

Function running, No LED on one of the Power Amplifiers. Follow the procedure for the Amplifier in question.

Tone activates, but then shuts off. **DC On** LED goes off.

PROCEDURE

Check the wiring, polarity and connections at the batteries and the interconnect cable.

Measure the voltage across each battery, right at the battery terminals. If either battery is less than 12 volts, charge it. If a battery fails to take a charge, replace it.

Measure AC voltage. Check 7 Amp fuse on AC in to Battery Charger board. Replace fuse, if needed, or replace Charger.

Check charger output voltage 7 Amp fuse. Replace if necessary.

Check connections to the Local Control Module and the Battery Charger. Replace the Local Control Module.

If the activation is from the Terminal strip, check the external wiring. If the selection is from the Front Panel, replace the Local Control Module.

Check harness to Power Amplifiers. Check wiring to Speakers at Terminal Strips. Most likely a Tone Generator problem. Replace the Local Control Module, which includes the Tone Generator.

Check the Terminal Strip wiring. Check the fuse. Swap the driver wires, at the Terminal Strip, to a working Amplifier. If the problem follows the Amplifier, change the Power Amplifier. If the problem stays in the same position, check the Driver. Remove the Driver wires, at the Terminal Strip. Measure the resistance of the Driver. If it is not from 2.5 to 4 ohms, the Driver must be replaced. See Section 11.3 on Speaker **Driver Replacement**.

Batteries are not fully charged. Check AC service. Check Battery Charger LED. Charge batteries or replace faulty batteries.

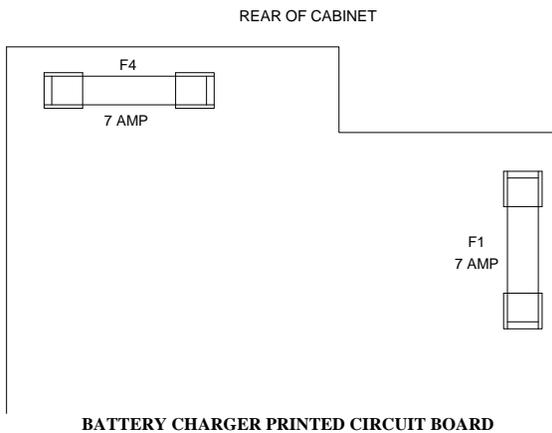
11.1 SPEAKER DRIVER TEST

As mentioned in the Matrix, troubleshooting and replacing a Speaker Driver requires an additional test to isolate a problem.

To test a driver, remove the black and red Speaker Driver wires from the Terminal Strip. Next, use an ohmmeter, on a low resistance scale, to measure the resistance of the driver coil. Do not touch the bare driver wires or the meter probe tips during the measurement. The resistance of your body might change the reading. A typical measurement is **2.5 to 4 ohms**. Drivers outside of this range should be replaced.

11.2 BATTERY CHARGER FUSES

There are two serviceable fuses on the Battery Charger. The AC fuse is a 7 Amp, SLO-BLO, 3AG type, located at the back of the printed circuit board. The fuse for battery charge voltage is a 7 Amp, 3AG type, located along the right rear of the printed circuit board, as shown below.



11.3 DRIVER REPLACEMENT

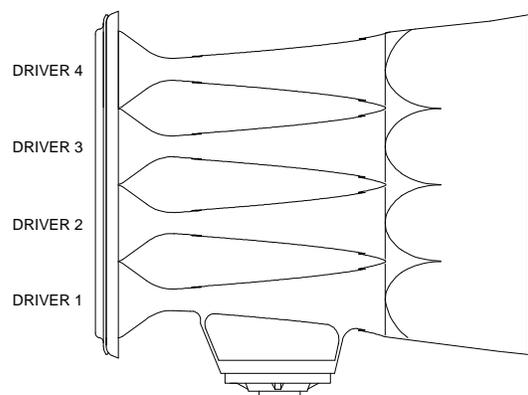
Replacing a driver requires a bucket truck to reach the Speaker.

DISCONNECT AC SERVICE & BATTERIES BEFORE SERVICING DRIVERS

Caution: A speaker driver weighs about 40 pounds. Be careful handling it.

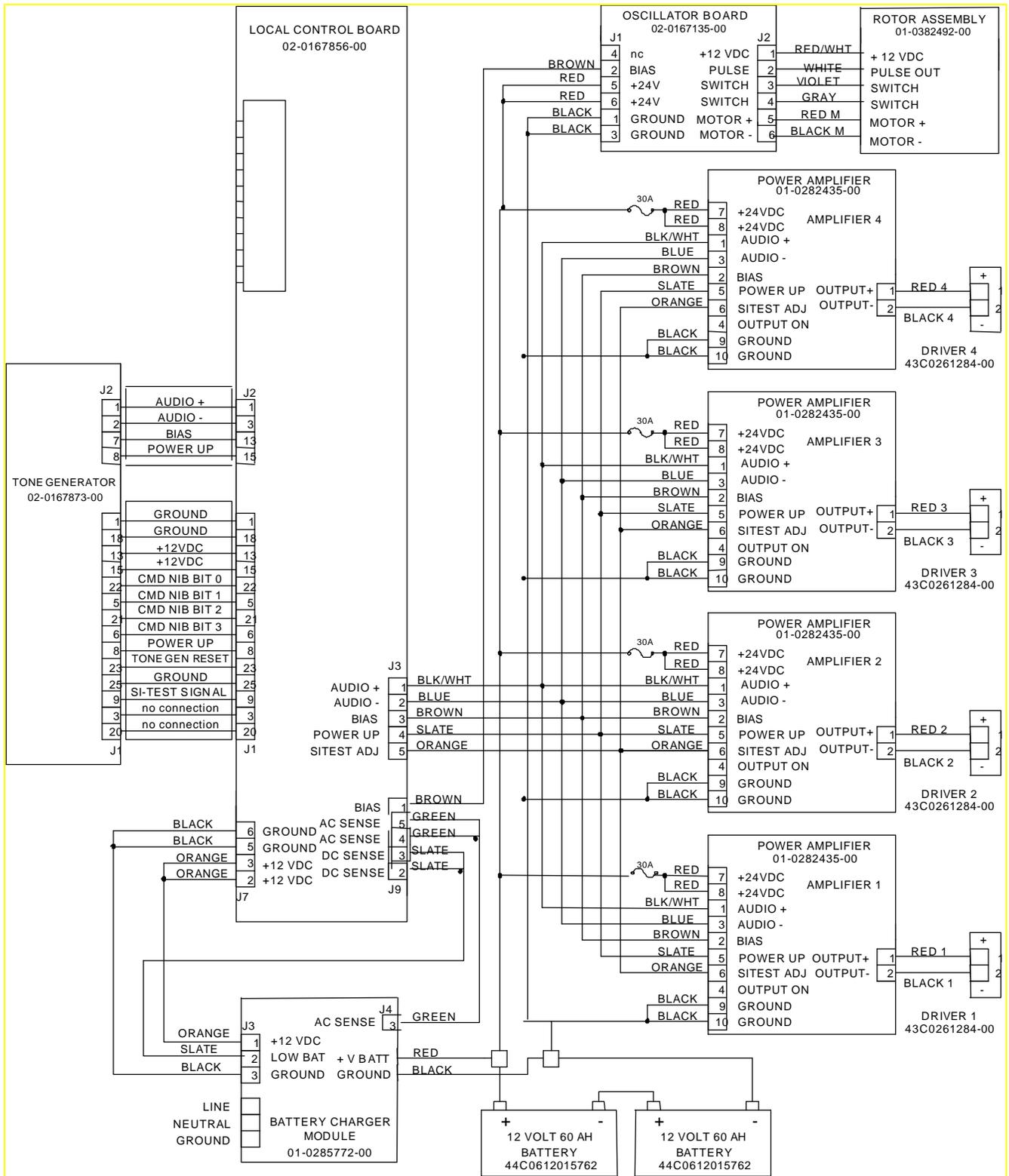
Driver 1, which is connected to Power Amplifier 1, is the bottom driver. Driver 4 is the top driver.

Remove the back cover from speaker flare. Disconnect the red and black speaker wires, from the faulty driver. Remove the driver bracket, with the driver, from the speaker flare. Remove the bracket from the driver.



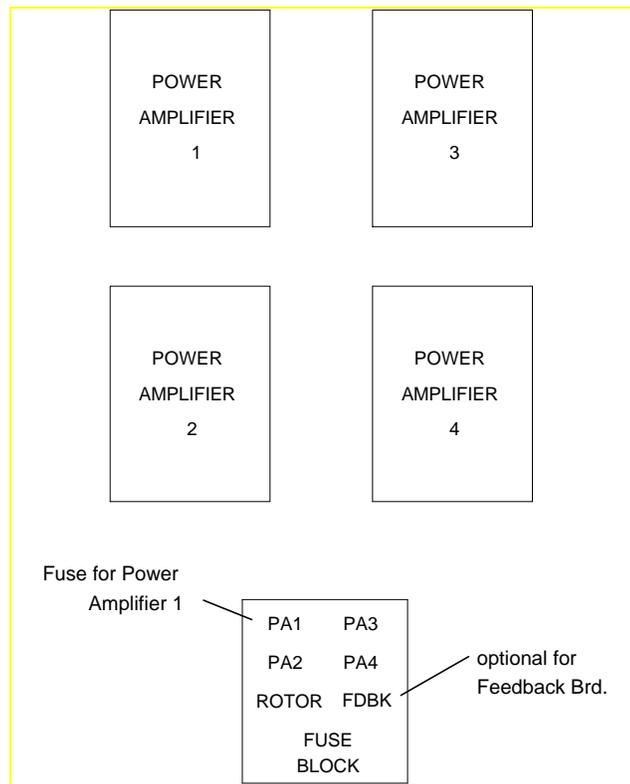
Reverse the procedure to install a new driver. Lightly coat the terminals with a silicone based (Nyogel) material, to minimize corrosion.

Power up the Vortex™ and test the new driver.

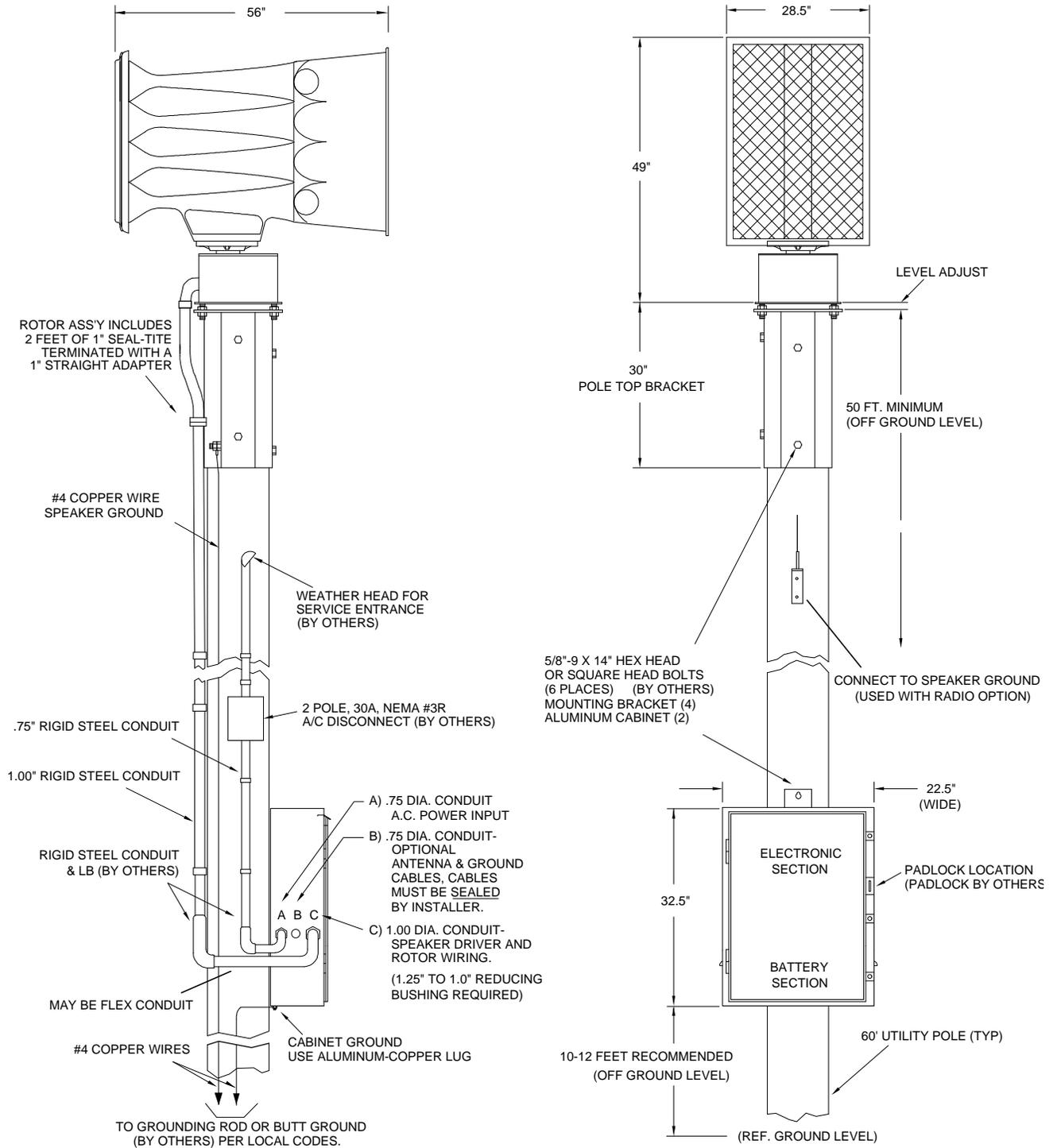


VORTEX™ WIRING DIAGRAM

This drawing shows the relative position of the Power Amplifiers and the fuses.



COMPONENT ORIENTATION DIAGRAM



VORTEX™ STATION DRAWING

Appendix A

PRODUCT SPECIFICATIONS

Electrical :

Input Power..... 120 VAC, 2 Amps, 50-60 Hz

Dimensions :

Cabinet..... Height, 32.5" (82.6 cm)
Width, 22.5" (57.2 cm)
Depth, 10.5" (26.7 cm)
Weight, 70 lbs *. (31.8 kg)

Speaker/Rotor Height, 49" (124.5 cm)
Width, 28.5" (72.4cm)
Depth, 56" (142.2 cm)
Weight, 220 lbs. (100 kg)

Operating Characteristics :

Voltage 24 volts DC (nominal)
Standby Current..... 40 mA
Operating Current 88 Amps, 24 VDC
Charger Output Current 5 Amps

Environmental :

Operating Temperature..... -35° to +60° F
Storage Temperature..... -65° to +125° F
Humidity 0 to 95% (non-condensing)

* not including batteries, add 90 lbs for Delco DC74 or equivalent.

Appendix B

Replacement Level Part Numbers

<u>Item Part Number</u>	<u>Item Description</u>	<u>Quantity per Vortex™</u>
01-0285767-00C	Local Control Module	1
01-0282435-00C	Power Amplifier	4
02-0167135-00C	Oscillator Board	1
01-0285772-00C	Battery Charger Module	1
43C0261284-00C	Speaker Driver	4
01-0382492-00C	Rotor Assembly	1
44C0612015762C	60 AH Battery	2

Appendix C

PROGRAMMING THE MULTIFORMAT DECODER

Twelve rotary switches are used to program the Multiformat Decoder as follows:

Switch #	Function
DS 1-7	These switches set up the address of the decoder board. For configuration 0, the switches are set from 0 to 9. Address digits 4-7 will always respond to wild cards (# signs). For configuration 1, the switches are set up to respond to a hex keypad (0-D, * #). If a "*" is to be decoded, set the switch to an "E". If a "#" is to be decode, set the switch to an "F". If a pound sign (#) is received for any digit, it will be treated as a wild card.
DS 8,9	The number of digits per second being used. This is calculated by adding the tone "on" time and the "off" time for each digit, and dividing this number into one second. The 8th switch sets the tens, the 9th switch sets the ones.
DS 10	The number of digits to decode. This number is derived by adding the address digits and the command digit. For configuration 0, only 8 or 10 (a 10 is programmed as an "A") digits can be programmed. For configuration 1, from 3 to 8 digits can be programmed.
DS 11	Applies only to configuration "1". Set at "0", unless the "0" command is being used, then set at some unused command.
DS 12	The configuration switch. If this switch is set to a "0", the outputs will correspond to Whelen DTMF. When set to a "1", the outputs turn on from a 0 to an F. The "0" command corresponds to the output at J5 position 1 (Whelen's WAIL command), through the "F" command which corresponds to the output at J4-8.

Appendix D

TWO TONE SEQUENTIAL TIMING & TONE FORMATS

The following tables list the timing sequences and tones that are supported by the two tone decoder for a Vortex™ siren. Up to six modules may be used on one decoder board.

Any one timing sequence may be used for each module, with the first and second tones always being from the same tone table.

Timing Sequences

FORMAT	CALL SEQUENCE	1ST TONE	GAP	2ND TONE
MOTOROLA QUICK CALL 2	INDIVIDUAL CALL TONE & VOICE	1 SECOND	0	3 SECONDS
	GROUP CALL	8 SECONDS	0	0

Motorola Tone Tables 1,2,3 Frequencies - Whelen Model "2TTMA"							
288.5Hz	330.5Hz	410.8Hz	510.5Hz	624.5Hz	788.5Hz	953.7Hz	1063.2Hz
296.5Hz	349.0Hz	433.7Hz	539.0Hz	669.9Hz	832.5Hz	979.9Hz	1092.4Hz
304.7Hz	368.5Hz	457.9Hz	569.1Hz	707.3Hz	879.0Hz	1006.9Hz	
313.0Hz	389.0Hz	483.5Hz	600.9Hz	746.8Hz	928.1Hz	1034.7Hz	

Motorola Tone Tables 4,5,6 Frequencies - Whelen Model "2TTMB"							
321.7Hz	399.8Hz	496.8Hz	584.8Hz	726.8Hz	903.2Hz	1185.2Hz	1321.2Hz
339.6Hz	422.1Hz	524.6Hz	617.4Hz	767.4Hz	979.9Hz	1217.8Hz	1357.6Hz
358.6Hz	445.7Hz	553.9Hz	651.9Hz	810.2Hz	1122.5Hz	1251.4Hz	1395.0Hz
378.6Hz	470.5Hz	569.1Hz	688.3Hz	855.5Hz	1153.4Hz	1285.8Hz	1433.4Hz

Motorola Tone Tables A,B,Z Frequencies - Whelen Model "2TTMC"							
346.7Hz	398.1Hz	457.1Hz	524.8Hz	582.1Hz	668.3Hz	767.4Hz	881.0Hz
358.9Hz	412.1Hz	473.2Hz	543.3Hz	602.6Hz	691.8Hz	794.3Hz	912.0Hz
371.5Hz	426.6Hz	489.8Hz	562.3Hz	623.7Hz	716.1Hz	822.2Hz	944.1Hz
384.6Hz	441.6Hz	507.0Hz	569.1Hz	645.7Hz	741.3Hz	851.1Hz	979.9Hz

GE Tone Tables A,B,C Frequencies - Whelen Model "2TTMD"							
517.5Hz	577.5Hz	637.5Hz	697.5Hz	757.7Hz	817.5Hz	877.5Hz	937.5Hz
532.5Hz	592.5Hz	652.5Hz	712.5Hz	772.5Hz	832.5Hz	892.5Hz	952.5Hz
547.5Hz	607.5Hz	667.5Hz	727.5Hz	787.5Hz	847.5Hz	907.5Hz	967.5Hz
562.5Hz	622.5Hz	682.5Hz	742.5Hz	802.5Hz	862.5Hz	922.5Hz	

Appendix E

TWO WAY FEEDBACK OPTION

GENERAL-

Whelen's Vortex™ Siren may be equipped with an optional Two-Way communications module. This feedback module can receive and decode Whelen's standard **10 digit DTMF** command string and it can transmit back a standard **14 digit DTMF** status response string.

A three digit Area Code and a four digit Address may be set by seven rotary switches. The output of the module is an active low, open collector, 1/2 second pulse corresponding to the decoded command.

Siren status data consists of:

- Full
- Partial
- Battery
- Rotor
- AC On
- Intrusion (option)

Definitions are as follows:

- Full - All Power Amplifiers and Speaker Drivers functioned properly.
- Partial - At least one Amplifier/Driver functioned properly.
- Battery - Actual battery voltage value.
- Rotor - The Rotor oscillated properly to both limit switches.

AC On - 115 VAC service is present.

Intrusion - The cabinet door is open.

Note: A low battery condition, below 21.8 volts DC, will automatically report back, as INSTANT STATUS, to the base station. Also, Intrusion will report automatically, as INSTANT STATUS.

Siren status is available through the STATUS REQUEST Command (1F) only.

PROGRAMMING AREA CODE & ADDRESS

Seven rotary switches are used to program the Feedback Decoder as follows:

Switch #	Function
DS 1-7	These switches set up the area code and address of the decoder board. Switches 1-3 define the Area Code. Switches 4-7 define the Address. Address digits 4-7 will always respond to wild cards (# signs).