



HIT-NOT® Proximity Protection System for Powered Industrial Trucks

Model HN-2Z

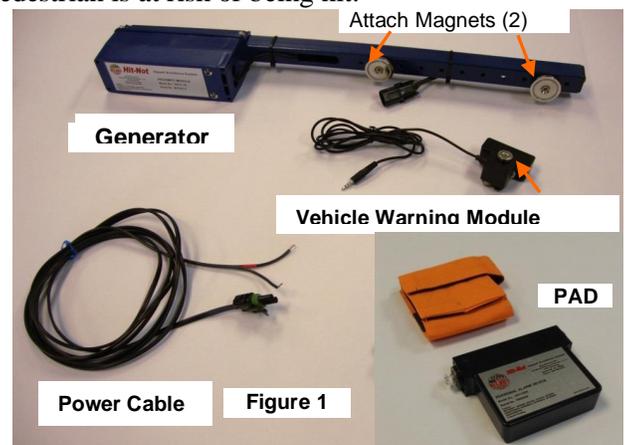
Installation and Operations Guide



INTRODUCTION

Frederick Energy Products developed the HIT-NOT® Proximity Protection System for Powered Industrial Trucks (PITs) to protect pedestrians from “Struck By” accidents. The HIT-NOT® system warns both the truck driver and the pedestrian when the pedestrian is at risk of being hit.

A HIT-NOT® Proximity Protection System includes: three components that mount to the PIT and one or more Personal Alarm Devices (PAD) worn by pedestrians. The three components on the PIT are a Magnetic Field Generator, Vehicle Warning Module, and an electrical power cable. (See Figure 1) The Generator creates a pulsing magnetic field that provides a marker field around the truck. The PAD, worn by the pedestrian, contains sensing elements that detect the magnetic field and initiates warnings for the pedestrian and truck operator.



The HIT-NOT® Proximity Protection System includes two optional add-on modules, which are not standard in the basic system. These are a Collision Avoidance Module (CAM) or a Collision Avoidance Module with Data and Tracking Capability (CADM). The CAM provides warnings to PITs when they are at risk of collision. Operation is similar to that of warnings for pedestrians, but a different LED/sounder pattern is used to denote a PIT in a magnetic field zone than that used for a pedestrian in a zone. The CADM is similar but also adds a capability to track the location of the PIT and report to a central computer. Although the CAM and CADM are not standard in the basic HIT-NOT® Proximity Protection System, electrical power and data interfaces are provided in the basic system to allow the addition of either the CAM or CADM as a “plug-in” module without modifying the basic system. Installation and operation of the CAM and CADM are not included herein, but the interface connections incorporated in the basic system are described in Appendix A.

The PAD is calibrated to differentiate the magnetic marker field into two zones: a Danger Zone closest to the truck and a Warning Zone further away. (see Figure 2) As shown in Figure 2, the magnetic fields (zones) are elliptical in shape with the major axis of the elliptical field (longest part of the field) aligned with the longest dimension of the Generator. The minor axis of the elliptical field is approximately 80% of the size of the major dimension.

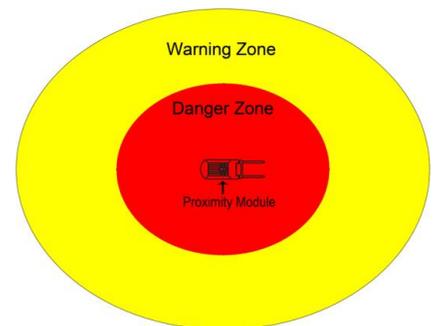


Figure 2

Both the Vehicle and the PAD Warning Modules provide audible warnings via a sounder and visual warnings via an LED light.

HARDWARE INSTALLATION

Hardware Installation on PIT

There are three pieces of hardware installed on a PIT: Magnetic Field Generator, Vehicle Warning Module, and Power Cable. Installation of these items is designed to be relatively simple and easy. In order to operate properly, the Generator housing must be kept at least four inches away from steel frame members and should NOT be installed inside the operator’s cage. This requirement is needed because steel structures near the Generator have an adverse effect on the size of the magnetic fields.

Generator Installation – A standard mounting kit, provided with the Generator, makes it easier to keep the Generator away from the steel structure. The standard mounting kit includes two magnets installed onto a square fiberglass tube. This facilitates an ideal mounting to the top of the PIT driver’s cage via the two magnets, allowing the Generator to extend rearward behind the operator’s cage. (see figure 3) Although the arrangement shown in the picture above is achievable for many PITs, the frame of some PITs may not readily accommodate the mounting described above. Frederick Energy Products should be contacted about other mounting arrangements.

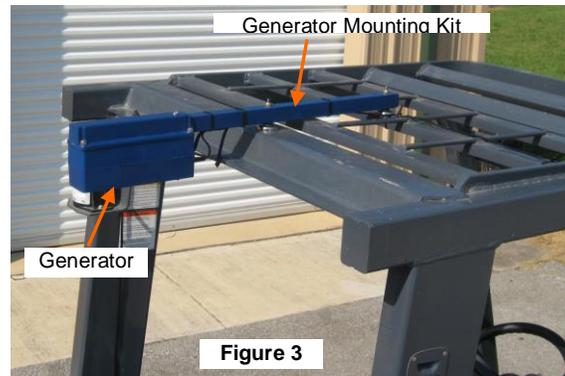


Figure 3

Vehicle Warning Module (VWM) – The VWM can be installed at any convenient location where its LED is visible to the operator and the sounder can be heard. The only constraint to mounting the VWM is that the six-foot cable from the VWM must be able to reach the Generator. A permanent magnet on the back of the VWM facilitates installation onto any steel member. Figure 4 shows a typical mounting location on the upper front cross-member of the PIT. This location also is favorable for another function of the VWM – generating a silent zone for the PIT operator. The silent zone allows the operator to wear an active PAD inside the operator’s cage without creating nuisance alarms to himself/herself and other PITs. However, when the operator leaves the PIT, the operator is protected just like any other pedestrian. With the VWM installed midway across the PIT, the silent zone normally just fills the operator’s cage.

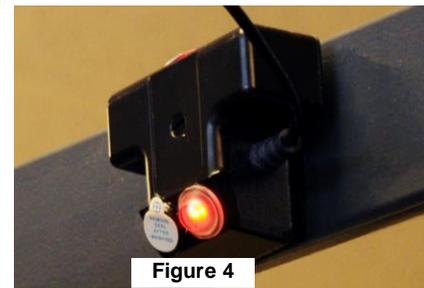


Figure 4

WARNING: THE VWM SHOULD BE INSTALLED AND ADJUSTED TO ONLY SILENCE A PAD INSIDE THE OPERATOR’S CAGE. IF THE SILENT ZONE EXTENDS OUTSIDE, A PERSON STANDING IN THE SILENT ZONE ADJACENT TO THE OPERATOR’S CAGE WILL NOT BE PROTECTED FROM OTHER PITs. THUS, THE TRUCK IGNITION SHOULD BE TURNED OFF IF SOMEONE ELSE APPROACHES THE TRUCK TO CONVERSE WITH THE TRUCK OPERATOR.

Note that the Generator includes a second LED in its bottom surface that mimics the LED in the Vehicle Warning Module (See Figure 5). Thus, an ideal location for mounting the Generator would one that would allow the operator to see the LED on the Generator when traveling in reverse.



Figure 5

Detail Installation Instructions

Generator Installation -

1. Using the Generator Magnetic Mounting Kit, attach the Generator to the truck so that the Generator Housing is at least four inches away from the truck steel structure. To satisfy this, one or both of the magnets on the fiberglass tube may have to be repositioned. A magnet can be repositioned by removing the nut from the magnet mounting screw, withdrawing the magnet and screw from fiberglass tube, reinserting the magnet and screw into another of the predrilled holes in the fiberglass tube, and reinstalling the nut onto the screw. (Note: predrilled holes are one inch

apart.) The magnetic marker field generated by the Generator is oval shaped with the major dimension in the direction of the long dimension of the Generator. Thus, the Generator should be installed with its longer-dimension oriented in the direction where the maximum warning is desired. Normally, the Generator is oriented with the long dimension parallel to the direction of travel for the truck. This orientation provides maximum warning and protection to the front and rear of the truck.

2. (Optional) Wrap two plastic cable ties (or other suitable devices) around the fiberglass tube and truck frame to provide additional mounting support.
3. Mount the Vehicle Warning Module on a frame member of the overhead cage, forward of the operators head, so that the Warning Module LED is in the operator's peripheral vision. A magnet in the Vehicle Warning Module makes it easy to attach it to a steel frame member. **IF THERE IS A PAPER COVERING THE SOUNDER, REMOVE IT.**
4. Route the Vehicle Warning Module cable along any convenient path and plug into the receptacle on the Generator. Secure the cable, as needed, with cable ties.
5. Plug the Power Cable for the Generator into the "pig tail" connector and route along any convenient path to a 12 Vdc source on the truck, being careful to connect to the proper positive and negative sides of the 12 Vdc source. **THE CABLE POSITIVE LEAD IS MARKED WITH A RED BAND.** The 12 Vdc connection to the truck should be made at a point that is powered by the ignition switch to turn off the magnetic fields when the truck is parked. Secure the cable, as needed, with cable ties. (Note: early Generator hardware did not have a "pig-tail" connector.)

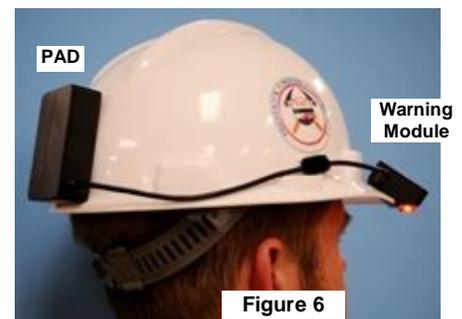
PAD Installation –

There are two PAD configurations available: (1) Two-piece PAD and (2) One-piece PAD. The two configurations are functionally identical in that both include a sensor that senses the magnetic fields from Generators, determine the threat level, send alert signals to the PAD Warning Module (PWM), and send alert signals back to the Generator. Two-piece PADs have a separate PAD Warning Module that contains the LED and sounder devices and contains a battery to power the PAD. A cable connects the PAD Warning Module to the main PAD unit. One-piece PADs contain all this in a single housing.

Two-Piece PAD - There are two main options for wearing the two-piece PAD. One is to wear it on a hardhat or cap. The second is to wear it on clothing. PADs are identical for the two options except for the length of the cable between the PAD and the PAD Warning Module. Canvas pouches are provided with PADs. The hardhat version has Velcro affixed to the case for use in attaching to the hat, whereas the clothing version has a belt loop for wearing the PAD on a belt.

a. Installing PAD to Hardhat:

1. Remove the backing from the adhesive of the Velcro preinstalled on a PAD canvas pouch, and attach the pouch to the rear of a hardhat. Install the pouch so that the flap is at the top. Insert the PAD into the case, oriented so that the cable extends toward the hardhat RH side. (See Figure 6)
2. Mount the PAD Warning Module to the top side of the hardhat brim (RH side) using the spring clip on the Warning Module. The sounder and LED should be facing downward. The Warning Module battery should be charged prior to performing Step 2.



3. Plug the PAD cable into the PAD Warning Module. The PAD is powered and ready for use.

Installation on a baseball-type cap is similar except one piece of the Velcro must be attached to the cap.

- b. **Wearing PAD on Clothing** - Under this option the PAD pouch attaches to the wearer's belt and the Warning Module is attached to clothing at chest level or higher. (See Figure 7)

1. Install PAD into a canvas pouch with belt loop. PAD should be inserted into the pouch with the PAD cable at top.
2. Install PAD/pouch onto wearer's belt.
3. Attach fully-charged PAD Warning Module to safety vest or article of clothing. The Warning Module must be worn high enough up on the body for the sounder to be easily heard in the ambient noise environment. **NOTE: FOR PROPER OPERATION, IT IS IMPORTANT THAT THE PAD AND THE PAD WARNING MODULE BE SEPARATED BY AT LEAST FOUR INCHES.**
4. Route cable from the PAD up to the Warning Module and insert plug into the Warning Module receptacle.



NOTE: BE CAREFUL TO PROPERLY ALIGN THE PLUG AND RECEPTACLE WHILE INSERTING PLUG. Misalignment while inserting the plug can result in a bent or broken plug.

One-Piece PAD - An ideal location for wearing the One-Piece PAD is in a pouch attached to a safety vest. (See Figure at right.) A pouch, provided with the One-Piece PAD, has two Velcro tabs. One secures the PAD in the pouch and the second opens a tab at the bottom to allow battery charging without removing the PAD from the pouch. Thus, the safety vest with PAD could be placed on a hangar and charged when the vest is not being worn. **NOTE THAT THE ONE-PIECE PAD IS POWERED AT ALL TIMES EXCEPT WHEN ITS BATTERY IS BEING CHARGED.** (The two-piece PAD is powered only when its cable is plugged into the PAD Warning Module.) One feature of the One-Piece PAD is that the LED blinks every 15 seconds as an indicator that the PAD is powered and operating.



CHARGING PAD BATTERIES

PADS are powered by a rechargeable lithium ion battery. The battery is contained inside the PAD Warning Module for Two-Piece PADs. Two battery options are available for Two-Piece PAD Warning Modules: 500 mAh and 1400 mAh. For One-Piece PADs, the battery is a 750 mAh battery. The charging port receptacle in the One-Piece PAD accepts the standard plug that is supplied with battery chargers. (a 5.5 mm DC power plug). The charging port receptacle in the PAD Warning Module for the Two-Piece PAD is a 3.5 mm stereo plug. When Two-Piece PADs are ordered, an adapter cable is provided that plugs into the standard plug supplied with the batteries on one end and provides a 3.5 mm stereo plug on the other end. With this arrangement any of the batteries can be charged.

Charging Two-Piece PAD batteries:

1. Unplug the PAD cable from the PAD Warning Module,
2. Connect a charger adapter cable to the charger output cable, and plug the 3.5 mm stereo plug of the adapter cable into the PAD Warning Module receptacle.

Under normal usage the 500 mAh battery should be charged daily, whereas the 1400 mAh battery should be charged approximately every 3 days.

Charging One-Piece PAD batteries:

1. Loosen the Velcro flap from over the charging port,
2. Connect the 5.5 mm plug from a charger output cable into the PAD charging receptacle.

Under normal usage the One-Piece PAD battery should be charged approximately every 2 days.

When a PAD battery voltage drops to approximately 3.5 VDC or below while connected to a PAD, the PAD will signal a low battery condition. This alert is two rapid beeps of the sounder every 1.6 seconds. When the PAD determines the battery to have low voltage, the PAD will cease to give zone warnings and will give only a low battery alert. **CAUTION: WHEN A LOW BATTERY IS SIGNALLED, THAT PAD SHOULD NOT BE USED UNTIL ITS BATTERY IS RECHARGED.**

Battery chargers are designed to operate with input voltage from 100 to 240 VAC, 50/60 Hz. They provide an output current of 0.5 A at a voltage of 4.2 VDC. Chargers are smart-chargers designed to safely charge lithium-ion batteries and will power OFF when the battery voltage reaches 4.2 V. When a discharged battery is connected to the charger, the indicator light will change from green to red and remain red until the battery is fully charged, at which time it will change to green. The charger indicator light will be green when batteries are not connected.

WARNING – DO NOT CHARGE LITHIUM-ION BATTERIES WITH ANY CHARGER THAT IS NOT DESIGNED SPECIFICALLY FOR USE WITH LITHIUM-ION BATTERIES.

OPERATIONAL DESCRIPTION

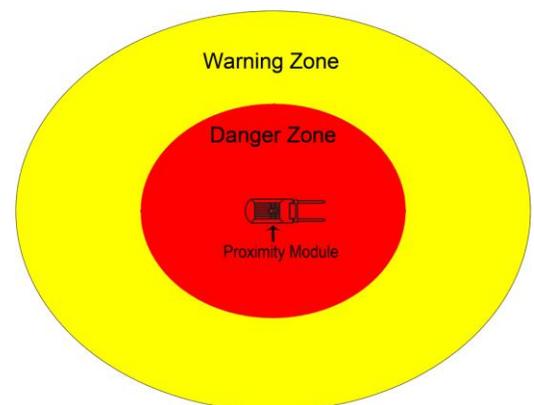
The HIT-NOT® Proximity Protection System is operational when a Generator is installed on a truck and pedestrians are wearing a Personal Alarm Device (PAD) with Warning Module.

Operation of the system is described below. Zone sizes cited for the Warning and Danger Zones are based on factory settings for the hardware. Zone sizes can be readjusted but should only be accomplished by authorized personnel. Readjustment to other zone sizes is described herein in a later section.

1. Warning Zone

When a pedestrian is within approximately 43 feet (13 meters) of a Generator, the pedestrian and the truck operator are alerted to possible danger for the pedestrian. This alert is indicated by a series of three short LED flashes simultaneous with three beeps of the sounder, which are repeated every three seconds while the pedestrian is in the Warning Zone. The alert is given on both the Vehicle Warning Module and PAD Warning Module.

When a Warning Zone alert is given, the truck operator should look for the pedestrian(s) in danger and prepare for



an evasive maneuver to prevent a Struck-By accident. Likewise, the pedestrian should look for the truck and move to a safe area, if needed.

2. Danger Zone

When the pedestrian is within approximately 30 feet (9 meters) of the Generator, pedestrian and driver are alerted that the pedestrian may be in imminent danger. This alert is indicated by continuous lighting of the LED and activation of the sounder, on both the Vehicle Warning Module and PAD Warning Module. The danger alert continues until the pedestrian is out the Danger Zone and returns to the Warning Zone or beyond.

A HIT-NOT® Generator can process multiple pedestrians (i.e. PADs) in its Warning and Danger Zones. Likewise, PADs can handle and process being in the zones of multiple truck Generators. These capabilities are discussed in further detail below. The ability to process multiple pedestrians among multiple trucks is a unique feature of the HIT-NOT® Proximity Protection System.

Multiple pedestrians in the Zones of a Single Truck

When multiple pedestrians are in the Warning Zone of a truck, the truck operator will receive a Warning Zone alert when the first pedestrian enters its Warning Zone, but will not receive a new alert for additional pedestrians. The additional pedestrians, however, will individually receive alerts when they enter a Warning Zone.

Similarly, when multiple pedestrians are in the Danger Zone of a truck, the truck operator will receive a Danger Zone alert when the first pedestrian enters its Danger Zone, but will not receive a new alert for additional pedestrians. The additional pedestrians, however, will individually receive alerts when they enter a Danger Zone.

Pedestrians in a zone of a single truck are always individually alerted to the particular zone that he/she is in. However, truck operators are alerted only to the highest level zone that any pedestrian is in (the Danger Zone is a higher level than the Warning Zone).

Single pedestrian in the Zones of Multiple Trucks

If a pedestrian is in the Warning Zone of a truck and other trucks approach and put the pedestrian in the Warning Zone of their truck, the pedestrian will be alerted for the first truck, but will not receive an additional alert for other trucks. Operators of the other trucks, however, will be alerted to presence of the pedestrian. Also, the pedestrian will receive a Danger Zone alert if the Danger Zone of any of the trucks is entered. Other truck operators will receive an alert that is appropriate to the zone of their trucks that the pedestrian enters.

Protection of Truck Operator

The HIT-NOT® Proximity Protection System includes a Silent Zone feature that allows the truck operator to wear an active Personal Alarm Device (PAD) while in the operator's cage without triggering any alerts while the operator is inside the operator's cage. However, when the operator dismounts from the truck, the operator's PAD is activated and the operator is protected the same as any other pedestrian.

WARNING: FOR THE TRUCK OPERATOR TO BE PROTECTED WHEN OFF OF THE TRUCK, THE TRUCK'S IGNITION MUST BE OFF. IF NOT, THE OPERATOR'S PAD WILL GIVE A DANGER ZONE ALERT FROM HIS OWN TRUCK AND THE OPERATOR WOULD POSSIBLY BE UNAWARE OF DANGER FROM ANOTHER TRUCK.

HARDWARE MAINTENANCE

The HIT-NOT® Proximity Protection System is robust and normally does not require maintenance unless damaged by impact from objects. Magnetic Field Generators are designed to automatically adjust and maintain the original zone setting size. If the truck supply voltage changes or other changes occur resulting in a reduction of zone sizes, the system will automatically adjust as much as 5% to ensure that the zones remain where they were initially set. If the zone size of a generator reduces to less than 10% of the set size, and the system is unable to adjust for the loss, then a special alarm will be given to the Operator.

Factory settings of PADs are expected to be stable and change very little with time. Because of this, adjustment capability is not available for field use.

The PAD is powered by a Lithium Ion Battery. Lithium Ion batteries have a finite life and eventually will need replacement. Battery life is based on the number of times recharged. There are no published data about the exact number of charges that the battery can undergo before its life is over, but literature suggests that it's at least 300 charges and maybe 500 or more charges. Batteries in the HIT-NOT® PADs are not designed to be replaceable by the user and should be returned to Frederick Energy Products for replacement.

A daily check to verify that the systems are functioning is advised. Any PAD or a Generator system can be shown to be working properly by approaching a truck with a PAD and verifying that a warning is given at the expected distance. The Vehicle and PAD warning modules should both provide the proper visual and audible alert previously described. There are also other features built in to the HIT-NOT® Proximity Protection System to provide a positive indication that the system is functioning.

1. The Generator has two positive indicators. (1) A blue LED at the bottom of the Generator provides a positive indication that the field generator is operating properly. (2) A very short blink of the LED and beep of the sounder in the Vehicle Warning Module occurs when the Generator is functioning.
2. When a two-piece PAD is plugged into its Warning Module or a one-piece PAD is removed from a charger, the sounder and LED will activate for a second or two. Since the sounder and LED are activated only from the main PAD box by the processor chip, this brief alarm indicates that the PAD is powered and the processor is functioning. It does not verify that the magnetic field detection by the PAD is functioning. This can only be done by exposing the PAD to a proper magnetic field.

Adjustment of Magnetic Field Size

As previously mentioned, Generators are nominally set at the factory to have a Danger Zone field size of 30 feet (9 meters) from the Generator. The Warning Zone field size is approximately 1.4 times the Danger Zone field size or 43 feet (13 meters). If the factory setting for Danger Zone/Warning Zone is not the desired distance, the size of the Danger Zone magnetic field can be reset. A change in the Danger Zone field automatically results in a Warning Zone field size that is approximately 1.4 times the Danger Zone. The Danger Zone range that can be set is approximately 16 feet to 35 feet (5 meters to 11 meters). The corresponding range for the Warning Zone is 23 feet to 50 feet (7 meters to 15 meters).

The procedure for readjusting the Danger Zone field size is:

1. Using a 3/16 inch Allen-type hex wrench, remove the four screws attaching the module housing to the 1 in. x 1 in. fiberglass tube. (see figure 9)
2. Lower the module housing from the upper support bracket and remove the thin plastic spacer.
3. Remove the blue rubber seal from the hole labeled “Field Adj.” (center hole) in the module housing. (See Figure 10)
4. Insert small slot screwdriver into “Field Adj.” hole (center hole). Screwdriver must be small with a shaft of at least 4 inches. Screw driver will extend down to an adjustable potentiometer located directly below the hole.
5. Gently turn screwdriver until the slot in the potentiometer is engaged.
6. Gently turn the potentiometer until the desired Danger Zone size is achieved. A Personal Alarm Device (PAD) can be used as the measuring device by having someone hold the PAD at the desired Danger Zone location and adjusting the potentiometer until the PAD just goes into the Danger Zone at the desired distance. Turning the potentiometer clockwise increases the zone size and turning counterclockwise decreases the field size.

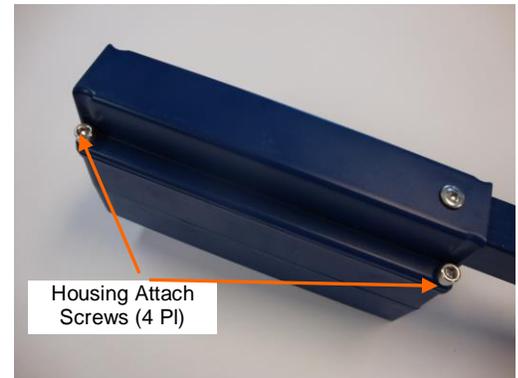


Figure 9

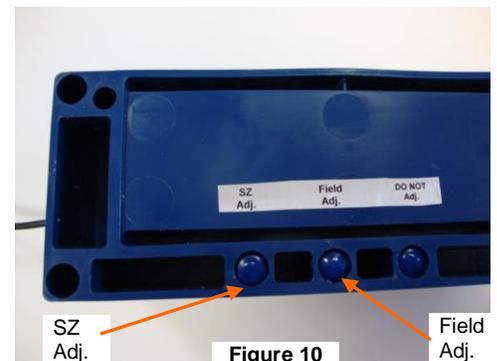


Figure 10

CAUTION: TURN POTENTIOMETER GENTLY AND CEASE TURNING EFFORT WHEN STOPS AT EITHER LIMIT OF TRAVEL ARE FELT. EXCESSIVE FORCE ON THE LIMIT STOPS WILL DAMAGE POTENTIOMETER.

7. Reinsert the blue rubber seal. Apply a small amount of silicone sealer over the top of the seal.
8. Reposition the thin plastic spacer and reinstall the housing to the upper support bracket using the four screws removed in Step 1.

Adjustment of Silent Zone Size

The silent zone inside the operator’s cage can be adjusted if the zone size is too large. (Factory setting for Silent Zone size is at the maximum setting.) Adjustment is the same as described above for the Adjustment of the Magnetic Field Size except for Steps 3 and 4. Modified Steps 3 and 4 are:

1. Remove the blue rubber seal from the hole labeled “SZ Adj.” (left hole) in the module housing. (See Figure 10)
2. Insert small slot screwdriver into “SZ Adj.” adjustment hole (left hole). Screwdriver must be small with a shaft of at least 4 inches. Screw driver will extend down to an adjustable potentiometer located directly below the hole

WARRANTY

The HIT-NOT® Proximity Protection System is warranted for a period of one year from the date of delivery. The warranty does not cover damage to the hardware (accidental or otherwise), misuse, or careless handling. **Opening of the hardware and attempting to repair by the purchaser will void the warranty.**

TECHNICAL SPECIFICATIONS

Personal Alarm Device (PAD)

Input Voltage: 3.7 VDC

Magnetic Field: none

Transmitter Frequency: 916 MHz

Transmitter Power: 0.001 W (typical)

PAD Battery: 3.7 VDC Lithium Ion

PAD Battery Capacity: Two-Piece PAD: Option 1 – 500 mAh; Option 2 – 1400 mAh; One-Piece PAD: 750 mAh

Generator

Input Voltage: 12 VDC

Magnetic Field Frequency: 73 kHz pulsing AC field. Magnetic field pulses occur approximately 3 % of the time.

Magnetic Field Strength: Tests have determined the magnetic field strengths to be negligible.

Maximum current draw. Less than 5 A. This is not a constant draw since magnetic field pulses occur approximately 3 % of the time. Current draw between pulses is very low and the overall current draw is low.

POTENTIAL HEALTH EFFECTS

The Generator generates a pulsing magnetic field and the PAD transmits a 916 MHz signal, both of which are in the radio frequency (RF) spectrum. There are two potential health effects from the RF electromagnetic fields: (1) electromagnetic effects on the human body, and (2) electromagnetic effects on implantable devices.

Effects of 916 MHz PAD Transmission

The FCC's exposure guidelines specify limits for human exposure to RF emissions from hand-held RF devices in terms of Specific Absorption Rate (SAR). The SAR limit is an absorption threshold of 1.6 watts/kg, as measured over any one gram of body tissue. The output power of the HIT-NOT® PAD is 0.001 watts and is well below any limits.

Effects of 73 kHz Generator Magnetic Field

Effects on the human body – The frequency range for limits adopted by the FCC does not cover the HIT-NOT® 73 kHz magnetic field. There is, however, an IEEE standard that appears to be the most relevant for conformance purposes (“IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, IEEE Std C95.1) The standard cites a maximum permissible exposure to magnetic fields as 163 A/m. Following the procedure in the standard, using time averaged numbers from the duty cycles, the maximum permissible exposure is as follows.

Magnetic Field Strength – 9055 A/m

Effects on Implantable Devices – Two types of implantable devices are considered: (1) Insulin Pump, and (2) Heart Pace Makers. Note that there is not a consensus agreement in available literature for limits of these two items at the 73 kHz frequency.

1. Insulin Pumps - Discussion of insulin pumps in available literature cites that strong magnetic fields should be avoided. The limit for insulin pumps is 600 gauss.

2. Heart Pacemakers – A few different limits for heart pacemakers can be found in the literature. A limit offered by Medtronic USA, Inc seems most reasonable for the 73 kHz magnetic field. It is also more severe than others. The Medtronic recommended limit is 1 A/m (or 12.5 milligauss)

Tests have reportedly shown the measured fields to be negligible. Therefore based on the measured data, the HIT-NOT® Generator offers no ill effects to the human body or to implantable devices.

CAUTION: Although testing has shown the electromagnetic fields created by a Generator to be small, it is prudent for persons wearing heart pacemakers to follow general guidelines offered for safe use of electrical equipment. The appropriate suggestion is to maintain a distance of at least 6 inches between the heart device and the Generator.

APPENDIX A. CAM AND CADM INTERFACES

There are two optional add-on modules for the HIT-NOT® Proximity Protection System, which are not standard in the basic system. These are a Collision Avoidance Module (CAM) or a Collision Avoidance Module with Data and Tracking Capability (CADM). The CAM provides warnings to PITs when they are at risk of collision. Operation is similar to that of warnings for pedestrians, but a different LED/sounder pattern is used to denote a PIT in a magnetic field zone than that used for a pedestrian in a zone. The CADM is similar but also adds a capability to track the location of the PIT and report to a central computer. Although the CAM and CADM are not standard in the basic HIT-NOT® Proximity Module Assembly, electrical power and data interfaces are provided in the basic system to allow the addition of either the CAM or CADM as a “plug-in” module without modifying the basic system. Installation and operation of the CAM and CADM are not included here, but power and data interface connections incorporated in the basic system are described below.

The basic HIT-NOT® Proximity Protection System is delivered ready to accommodate a CAM or CADM. This is accomplished via (1) the software incorporated into the Generator, (2) a power receptacle on the Generator Mounting Tube for the CAM or CADM (see Figure A-1), and (3) a signal receptacle in the Vehicle Warning Module. (see Figure A-2)

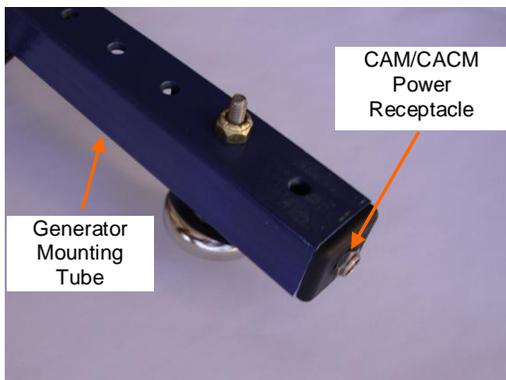


Figure A-1



Figure A-2