# IS1001 PIT-PACK CONSTRUCTION MANUAL



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# **Objective:**

To provide procedures for the construction of a high-performance portable system to read PIT tags for the identification of individual aquatic organisms.

Reader Features:

# Specifications:

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Specification	Values			
Power	Removable rechargeable 25.2 Nickel-metal hydride battery			
Charger	Input: 100-240VAC, 50/60 Hz			
Tags decoded	Full-Duplex and/or Half-Duplex			
Dynamic antenna auto- tuning	YES			
Adjustable antenna output power	YES			
Tags detected	ISO-compliant FDX-B, HDX, and Fastag <sup>™</sup> FDX-B Half-Telegram PIT tags			
Data capacity	Non-volatile internal memory for up to 100,000 tag IDs and 1,000 status reports			
Set-up	Configurable and saved in non-volatile memory			
Internal Memory Battery	Super capacitor provides 2 week backup without power-up			
Diagnostics	Automatic system performance using a Virtual Test Tag			
Date/Time Stamp	YES			

## Construction Documents: (Included in .zip file)

- Top & Bottom Hole Pattern161205.pdf
- Top & Bottom Hole Pattern161205.dwg
- Battery Pack Cover.pdf
- IS1001 Interface Board SOP190730.pdf
- NiMH Battery Pack Construction and Operation for PIT Pack 201108.pdf

#### Tools:

- Tape measure, 6' minimum length
- Scissors
- Soldering iron with a conical tip
- 7" or larger compound miter Saw
- PVC Pipe Heater
- Insulating gloves
- Heat gun
- 22-<sup>3</sup>/<sub>8</sub>"x14-<sup>3</sup>/<sub>4</sub>" elliptical forming jig
- Wire cutter
- Wire stripper(s) for at least 16, 18, and 24 AWG
- Stationary belt sander
- Optional: Ratchet Crimp Tool for at least 18 AWG Wire Ferrules
- 7/16-20 National fine (NF) tap and tap handle
- Caulking gun for 10-oz cartridge
- 1" open end wrench
- <sup>3</sup>/<sub>4</sub>" open end wrench
- 11/16" open end wrench
- Channel-lock pliers that will open to  $1-\frac{3}{4}$ "
- #1 Phillips screwdriver
- Ratchet wrench
  - $\circ$  2" or longer extension
  - 11/32" socket
  - #0 Phillips screwdriver
- Screwdriver with a flat blade of 2mm or less
- LCR meter

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• Rubber mallet

# Parts Lists:

READER and WATER RESISTANT HOUSING				
PART	QTY	UNIT	SOURCE	
Pelican iM2306 storm case (empty)	1	ea	Bauer Cases	
IS1001 Antenna Control Node, 24V		ea	Biomark	
IS1001 Interface Board with beeper and			per IS1001 Interface Board	
over-temperature alarm		ea	SOP190403.docx	
NiMh battery pack 25.2V 3.3Ah	1	ea	per NiMH Battery Pack Construction and Operation for PIT Pack 170523.docx	
3'x2" Velstrap strap	2	ea	Home Depot, SKU 245578 (pack of 3)	
Seacon BH-3-FS Wet-con bulkhead				
connector	1	ea	Mecco	
7/16"-20 NF Jam Nut	1	ea	Mecco, or Fastenal SKU 75133	
#8-32x5/8 pan head Phillips SS screw	8	ea	Fastenal SKU 1172399 (pk 100)	
#8x.75 SS Fender Washer	8	ea	Fastenal SKU 1171207 (pk 100)	
#8-32 SS Nylon Insert Lock Nut	8	ea	Fastenal SKU 1170856 (pk 100)	
#4-40x1/4 pan head Phillips SS screw	4	ea	Fastenal SKU 72478	
#4-40x7/16 pan head Phillips SS screw		ea	Fastenal SKU 72484	
#4 SS flat washer	4	ea	Fastenal SKU 31161807 (pk 100)	
Smart Charger (4Amp) for 19.2 - 26.4 V			BatterySpace.com, PID# 3040, P# CU-	
NiMH / NiCd Battery Pack	1	ea	CH126	
Std Female Tamiya Connector w 8" #14 wire	1	ea	BatterySpace.com, PID# 536, P# CN- TMFM	
BEC male connector with 6" long,			BatterySpace.com, PID# 1417, P# CH-	
22 AWG leads	1	ea	BECSYP-Fx2 (min qty 10 sets of 2)	
Werma 10700075 audible alarm	1	ea	Newark, #19J2688	
			Newark, #83K3789, or Mouser, #538-	
USB A to mini B cable 30"-36" long	1	ea	88732-8510	
Bulgin PX0848/B Panel mount USB B	1	22	Newark, #02P6290, or Mouser, #172-	
Bulgin PX0840/B/2M00 USB IP 68	1	ea	PA0040/D Newark #07K8105 or Mouser #172	
cable	1	ea	PX0840/B/2M00	
			Newark, #28AH1340, or Mouser, #534-	
4-40x1/2 (12.7mm) F-F nylon spacer	1	ea	1902C	
			Newark, #84R1362, or Mouser #571-	
Optional: Single 18 AWG wire ferrule	6	ea	966067-5	

DISPLAY			
PART	QTY	UNIT	SOURCE
Tablet computer with Windows 10 or higher, 8			
inch display, 32 GB minimum, full size USB	1	ea	Gov Smart
READYACTION Sport 2-Large smartphone			
holder & chest harness	1	ea	ReadyAction
NuShield DayVue anti-glare tablet cover for			
the tablet computer	1	ea	NuShield

ANTENNA			
PART	QTY	UNIT	SOURCE
1" fiberglass conduit (shaft)	54	inch	Crescent Electric (10 ft)
CAT6 ethernet wire	65	ft	Blackbox EYN878A-PB-1000, GSA Advantage (1000 ft)
14/2 Coiled Cord, SKU# PCE142 10' extended	1	ea	CableScience Inc.
PVC Snap-On Saddle Tee, Sch 40, 1"x1" Socket	1	ea	Amazon
<sup>3</sup> / <sub>4</sub> x1- <sup>3</sup> / <sub>4</sub> SS hose clamp	2	ea	Home Depot, SKU602047 (pk 10)
Seacon IL-3-MP Wet-con in-line connector	1	ea	Мессо
Heyco M3251 liquid-tight strain relief	1	ea	Newark, #01AC6608, or Mouser, #836-M3251
1" Sch 40 PVC pipe (antenna hoop)	60	inch	Ferguson (20 ft)
1" Sch 40 PVC pipe (shaft extension)	15.5	inch	Ferguson (20 ft)
1" Sch 40 PVC pipe (handle)	6	inch	Ferguson (20 ft)
1" SxSxS sch 80 PVC Tee	1	ea	Ferguson
1" SxSxS sch 40 PVC Tee	1	ea	Ferguson
1"x1/2" sch 40 PVC spigot x FPT bushing	1	ea	Ferguson
1" sch 40 PVC cap	1	ea	Ferguson

CONSUMABLES (A/R = As Required, some will be needed)					
PART	QTY	UNIT	SOURCE		
Pelican Case hole drawing: Top &					
Bottom Hole Pattern161205.dwg	1	ea	Included in .zip file		
3M 021200-20887, Scotch-Weld 3535					
Urethane Adhesive	A/R	tubes	Amazon (2 oz)		
Electrical tape	A/R	roll	Home Depot # 515192 (10 roll)		
GE-55 Silicone adhesive	A/R	ctg	Home Depot # 101241 (10 oz)		
			Newark, # 20M4934, or Mouser		
SN63 Flux core wire solder	A/R	lb	533-24-6337-8846 (1#)		
			Newark, #29AC9834, or Mouser,		
<sup>1</sup> / <sub>8</sub> " heat shrink tubing	A/R	foot	#538-19267-0123		
			Newark, #24M2728, or Mouser,		
<sup>1</sup> / <sub>4</sub> " heat shrink tubing	A/R	pc	562-Q53X14-48N25 (4 ft)		
1/2" 3:1 ratio adhesive lined heat shrink			Newark, #24M2731, or Mouser		
tubing	A/R	pc	#562-Q53X12-48N5 (4 ft)		
			Newark, #27M1432, or Mouser		
2 conductor 18 AWG unshielded cable	A/R	in	#602-1897C-100 (100 ft)		
			Newark, #84R1365, or Mouser		
Optional: Double 18 AWG wire ferrule	1	ea	#571-966144-4		
Oatey Purple Primer Cleaner for PVC	A/R	Pt.	Ferguson		
Oatey Rain-R-Shine PVC Cement	A/R	Pt.	Ferguson		
Thin bare copper or soft steel wire	~12"		e.g stripped CAT6 conductor scrap		
Aluminum foil	~6"x12"	roll			
Transparent tape	A/R	roll			
Tongue depressor or swab shaft	1	ea			

## Preparing the Pieces:

- 1. Housing
  - Pelican Case Modifications
    - A template for modifying the Pelican case has been developed. Take copies of Top & Bottom Hole Patterns161205.pdf (paper: printed actual size on tabloid size paper) and Top & Bottom Hole Pattern161205.dwg (the electronic AutoCAD file) with the Pelican iM2306 storm case to be modified to your local engraver who has laser cutting capability (e.g. Engraving Emporium Inc, Longview, WA), or a local machine shop for modification per the drawing. If the laser engraver has appropriate equipment, they will probably be less expensive than a machine shop since less fixturing will be required.
    - The 0.383"/0.375" diameter hole at the right end of the top of the case will need to be tapped using a 7/16-20 National fine (NF) tap and tap handle per Top & Bottom Hole Patterns161205.pdf and Top & Bottom Hole Pattern161205.dwg. A machine shop will have that capability, but a laser engraver will not, so you may need to thread the hole, taking care to keep the tap perpendicular to the top of the case.
  - Battery Straps
    - Using a tape measure and scissors, cut the straps to length as indicated in Figure 1 below.
    - Seal the cut edges and make the holes using a soldering iron with a conical tip as shown in **Figure 2**.

Velstrap dimensions and hole locations



Figure 1: Velstrap dimensions and hole locations





#### 2. Antenna Hoop

- Use a 7" or larger compound miter saw to cut a 60" piece, a 15.5" piece, and a 6" piece of 1" Schedule 40 PVC pipe.
- Mark the center of the 60" piece of schedule 40 PVC pipe with a fine-point permanent marker.
- Make a cap out of aluminum foil, shiny side out, to cover each end of the 60" piece of 1" schedule 40 PVC pipe and use scissors to trim the aluminum foil caps so that they cover about 1.5" of the ends as shown in **Figure 3**.

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Figure 3: Aluminum foil cap on the end of the pipe for the hoop.

Secure the aluminum foil caps to the pipe with thin bare copper or soft steel wire by wrapping it around the aluminum foil cap and twisting the ends together as shown in Figure 3. The aluminum foil caps will prevent the ends of the pipe from getting hot enough to distort while the pipe is being heated so that it can be bent to form the hoop.



Figure 4: Marked pipe with aluminum foil caps aligned on the elliptical form.

- Plug the PVC Pipe Heater into a 120 Volt 20 Amp circuit (with the ground terminal down, the left terminal of the outlet will accept a horizontal blade) and allow it a few minutes to preheat.
- A pair of hands on each end of the pipe may simplify the following: Using insulating gloves, place the 60" piece of 1" schedule 40 PVC pipe with the aluminum foil caps on its ends in the PVC Pipe Heater so that only one end sticks out of the PVC Pipe Heater. From the end of the 60" piece of schedule 40 PVC pipe sticking out of the PVC Pipe Heater, slowly rotate the 60" piece of schedule 40 PVC pipe a few turns about its axis so that it's heated evenly all around and rolls away from the heating element. Heat the end of the 60" PVC pipe of schedule 40 PVC pipe which sticks out of the PVC pipe heater with a heat gun, maintaining the nozzle of the heat gun 2" to 4" from the pipe so that you do not scorch the pipe. Shift the 60" piece of schedule 40 PVC Pipe Heater is inside the PVC Pipe heater and continue to rotate the 60" piece of schedule 40 PVC pipe about its axis, and heating

the end of the pipe that is out of the heater with a heat gun.

- Continue to shift the 60" piece of schedule 40 PVC pipe back and forth in the PVC pipe heater while rotating it about its axis until it is soft and flexible throughout its entire length except under the aluminum foil caps.
- Using insulated gloves, quickly remove the heated 60" piece of schedule 40 PVC pipe from the PVC Pipe Heater, align its center with the center mark on one of the long sides of the 22-3/8"x14-3/4" elliptical forming jig as shown in Figure 5, wrap the heated 60" piece of schedule 40 PVC pipe around the 22-3/8"x14-3/4" elliptical forming jig, and hold the 60" piece of schedule 40 PVC pipe around the 22-3/8"x14-3/4" elliptical forming jig as shown in until the 60" piece of schedule 40 PVC pipe around the 22-3/8"x14-3/4" elliptical forming jig as shown in until the 60" piece of schedule 40 PVC pipe has cooled enough that it is rigid.



Figure 5: Formed hoop on the elliptical forming jig.

#### 3. Antenna Wires

- Use a wire cutter to cut seven (7) 72" lengths and two (2) 138" (11' 6") lengths of CAT6 Ethernet cable.
- Use scissors to score the outer jacket 6" from both ends of each 72" length of CAT6 Ethernet cable and each 138" CAT6 Ethernet cable, bend them to break and remove 6" of the jacket from each end.
- Use scissors to trim the "rip cord" fibers and the X-section spacer.
- Using the wire stripper for 24 AWG, strip the insulation from wires about 3/8" of the ends of each of the CAT6 Ethernet cables.
- Twist all of the stripped ends of the wires together at each end of each of the seven 72" and two 138" lengths of CAT6 Ethernet cable.
- Using a soldering iron and SN63 flux core solder, tin the twisted wires at each end of each length of CAT6 Ethernet wire. Label the terminal ends of the first 138" CAT 6

Ethernet cable one (1) and two (2), and the ends of the other 138" CAT6 Ethernet cable seventeen (17) and eighteen (18) using transparent tape and a fine-point permanent marker. Label the terminal ends of the first 72" length of CAT 6 Ethernet cable should be labeled three (3) and four (4). The ends of the next length should be labeled five (5) and six (6). Continue labeling in this fashion. Label the last 72" length fifteen (15) and sixteen (16) as shown in **Figure 6**.



Figure 6: The terminal ends of each length of CAT 6 Ethernet wire should be uniquely marked with transparent tape prior to being fed through the antenna hoop. Even and odd labeled wires are at the opposite ends of the cable bundle.

- Align the odd numbered ends of the 72" cables together with the #17 end of the second 138" cable. The #18 end of that 138" cable will extend past the even numbered ends of the 72" cables.
- Align the #2 end of the first 138" cable with the even numbered ends of the 72". The #18 end of that 138" cable will extend past the odd numbered ends of the 72" cables.
- Bundle the cables together with electrical tape so that they can be fed together through the antenna hoop. Tape the bundle together at several places to maintain orientation of the individual cables relative to each other and minimize the bulk of the bundle as shown in **Figure 7**.



Figure 7: Bundled and labeled CAT6 cables, ready to insert into the hoop.

# 4. Antenna Cable

• The Seacon IL-3-MP Wet-con in-line connector has its own pigtail already attached. Use scissors to strip 1<sup>1</sup>/<sub>2</sub>" of the outer jacket from this pigtail. Use wire cutters to trim <sup>1</sup>/<sub>2</sub>" off the white wire. Use the wire stripper for 18 AWG to strip <sup>1</sup>/<sub>4</sub>" of insulation off the end of the black wire and the white wire. Do not strip the end of the green wire. Use the soldering iron to tin the stripped ends with SN63 solder (**Figure 8**).



Figure 8: Trimmed and tinned ends of the IL-3-MP pigtail connector.

- $\circ~$  Use scissors to strip 1½" of the outer jacket from each end of the 10' 14/2 coiled cord.
- Cut <sup>1</sup>/<sub>2</sub>" off the black wire on one end of the 10' 14/2 coiled cord and <sup>1</sup>/<sub>2</sub>" off the white wire on the other end. Use the wire stripper for 14 AWG to strip <sup>3</sup>/<sub>8</sub>" of insulation off the end of the black wire and the white wire on each end.
- Tin the ends of the wires as shown in **Figure 9**.



# Figure 9: Ends of the 10' 14/2 coiled cord, left end is prepared to connect to the IL-3-MP pigtail.

Cut a 4" piece of ½" 3:1 ratio adhesive-lined heat shrink tubing and a 6" piece of ¾" 3:1 ratio adhesive-lined heat shrink tubing. Slip the 4" piece of ½" 3:1 ratio adhesive-lined heat shrink tubing over one end of the 10' 14/2 coiled cord that you prepared. Slip the 6" piece of ¾" 3:1 ratio adhesive-lined heat shrink tubing over the pigtail of the Seacon IL-3-MP Wet-con in-line connector as shown in Figure 10.



## Figure 10: Heat shrink tubing slipped over the coiled antenna cable and pigtail.

- Cut a <sup>3</sup>/<sub>4</sub>" piece of <sup>1</sup>/<sub>4</sub>" heat shrink tubing and slip it over the black wire of the pigtail from the Seacon IL-3-MP Wet-con in-line connector. Hold the tinned end of the black wire of the pigtail against the tinned end of the black wire on the end of the 10° 14/2 coiled cord with the <sup>1</sup>/<sub>2</sub>" heat shrink tubing, and touch the tip of the soldering iron with a drop of melted solder on it to both wires only until the solder melts and flows on both wires (Figure 11).
- Cut a <sup>3</sup>/<sub>4</sub>" piece of <sup>1</sup>/<sub>4</sub>" heat shrink tubing and slip it over the white wire of the 10' 14/2 coiled cord. Hold the tinned end of the white wire of the pigtail against the tinned end of the white wire on 10' 14/2 coiled cord, and touch the tip of the soldering iron with a drop of melted solder on it to both wires only until the solder melts and flows on both wires (**Figure 11**).
- Slide the pieces of <sup>1</sup>/<sub>4</sub>" heat shrink tubing to cover the solder joints and shrink them into place using a heat gun as shown in **Figure 11**



Figure 11: The white wire of the coiled cord soldered to the white wire of the IL-3-MP connector, and the black wire of the 10' 14/2 coiled cord soldered to the black wire of the IL-3-MP connector. Clear heat shrink tubing is in place over the joints after soldering is complete.

- Slide the 4" piece of ½" 3:1 ratio adhesive-lined heat shrink tubing so that it overlaps the 10' 14/2 coiled cord and the wire to the Seacon IL-3-MP Wet-con in-line connector equally, and shrink it using the heat gun starting at one end and moving to the other as shown in **Figure 12** and **Figure 13**.
- Slide the 6" piece of <sup>3</sup>/<sub>4</sub>" heat shrink tubing so that it is centered over the 4" piece, and shrink it using the heat gun starting at one end and moving to the other as shown in **Figure 14**.



Figure 12: Heatshrink the tubing from one end to prevent trapping air bubbles.



Figure 13: First layer of tubing shrunk.



*Figure 14: Both layers shrunk.* The finished antenna cable assembly is shown in **Figure 15**.

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Figure 15: Completed antenna cable assembly.

# 5. Antenna Shaft

Except for one end, the O.D. (Outside Diameter) of the 1" fiberglass conduit is too irregular to fit into 1" PVC fittings. Cut a 54" length using a compound miter saw. Its O.D. must be smoothed and reduced along its entire length using a stationary belt sander until it will fit through the arms of the Dura 463-010 1" schedule 40 PVC Snap Tee. Be sure that both ends will fit into a 1" PVC tee.

#### Assembling the PIT Pack:

## 1. Housing

- a. Install BH-3-FS Connector
  - i. Slide the labels on the leads of the BH-3-FS connector down close to the connector (so the leads can be identified after they've been cut to length) and cut the leads of the BH-3-FS connector to 10" to 10<sup>1</sup>/<sub>2</sub>". Strip the insulation from <sup>3</sup>/<sub>8</sub>" of the end of each lead and either tin the bare ends of the leads with SN63 rosin core solder and a soldering iron to keep the individual strands of wire together as shown in Figure 16, or alternatively, use a Ratchet Crimp Tool for at least 18 AWG Wire Ferrules to crimp a Single 18 AWG wire ferrule onto each wire for greater ease of assembly later.
  - ii. Place an O-ring (included with the connector) over the wires of a Seacon BH-3-FS connector and seat it in the groove at the base of the Seacon BH-3-FS connector as shown in **Figure 16**.



#### Figure 16: BH-3-FS connector with O-rink installed and ready to mount.

iii. Use a Caulking gun for 10-oz cartridge to apply a bead of GE-55 Silicone adhesive to the threads and around the base of the Seacon BH-3-FS connector. This will hold the Oring in place and help seal the connector. Feed the wires from the Seacon BH-3-FS connector through the hole in the lid of the modified Pelican case and screw the connector into the threaded hole. Use a <sup>3</sup>/<sub>4</sub>" open end wrench to tighten it firmly (Figure 17), but not tight enough to



Figure 17: BH3-FS bulkhead connector outside and inside, after affixing the nut.

strip the threads in the plastic of the Pelican case.

- iv. Use a Caulking gun for 10-oz cartridge to apply a bead of GE-55 Silicone adhesive around the threads of the Seacon BH-3-FS connector on the inside of the lid of the modified Pelican case.
- v. Slip a 7/16"-20 nut over the wires and screw it onto the threaded end of the connector on the inside of the modified Pelican case, and tighten it with a <sup>3</sup>/<sub>4</sub>" open end wrench on the outside and an 11/16" open end wrench on the inside to form a snug connection between the nut, Seacon BH-3-FS connector, and the case as shown in **Figure 17**.



#### *Figure 18: Bulgin connector (upper left), Werma alarm (upper right), BH-3-FS (bottom).* b. Install the Bulgin PX0848/B Panel mount USB B connector

- i. Unscrew the nut from the the Bulgin PX0848/B Panel mount USB B connector.
- ii. Use a caulking gun for 10-oz cartridge to apply a bead of GE-55 Silicone adhesive around the base of the threads of the Bulgin PX0848/B Panel mount USB B connector, and to both sides of the circular rubber gasket supplied with the Bulgin PX0848/B Panel mount USB B connector. Seat the circular gasket over the threads and against the flange on the connector. Insert the connector into the hole in the lid of the modified Pelican case.
- iii. Use a caulking gun for 10-oz cartridge to apply a bead of GE-55 Silicone adhesive around the base of the threads of the Bulgin PX0848/B Panel mount USB B connector on the outside of the modified Pelican case as shown in Figure 18. From inside the case, install the nut onto the Bulgin PX0848/B Panel mount USB B connector and tighten it with channel-lock pliers that will open to 1-3/4".
- c. Assemble the cable for the Werma 10700075 audible alarm.
  - i. Cut a 20" piece of 2 conductor 18 AWG unshielded cable.
  - ii. Use sharp scissors to score the jacket 1" back from each end, bend the cable to break the jacket where it was scored, and remove the piece of jacket from each end.
  - iii. Use 18 AWG wire stripper to strip the insulation from  $\frac{3}{8}$ " of the ends of the leads on each end of the 2 conductor 18 AWG unshielded cable.
  - iv. To use the same Werma alarm for both the battery over temperature and the tag alarm, all three pairs of the terminal blocks for the beeper, the temperature alarm, and the thermistor must be installed, and you must either:
    - Install a jumper on the back of the daughter board between (negative) Alarm and – (negative) Beeper per IS1001 Interface Board SOP190730.pdf. Refer to the Install the passive components section on page 8 of that document. Skip to step v.
    - 2. Build a cable for the Werma audible alarm which incorporates a jumper between (negative) Alarm and (negative) Beeper, and if all three

pairs of the terminal blocks for the beeper, the temperature alarm, and the thermistor are installed, then perform the following 4 steps. Otherwise skip to step v. (the Werma alarm will only be used for the Beeper function):

- a. Cut a 2" piece of 18 AWG insulated multistrand wire (a wire extracted from a piece of the 18 AWG unshielded cable would work).
- b. Use 18 AWG wire stripper to strip the insulation from <sup>3</sup>/<sub>8</sub>" of both ends of the 2" piece of 18 AWG multistrand wire.Either tin one bare end of the 2" piece of 18 AWG insulated multistrand wire with SN63 rosin core solder and a soldering iron to keep the individual strands of wire together, or use a Ratchet Crimp Tool for 18 AWG Wire Ferrules to crimp a Single 18 AWG wire ferrule onto the end.
- c. Untwist the other end of the 2" piece of 18 AWG insulated multistrand wire and one end of one of the black wires of the 20" piece of 2 conductor 18 AWG unshielded cable.
- d. With the 2" piece of 18 AWG multistrand wire and the untwisted end of the black wire of the 20" piece of 2 conductor 18 AWG unshielded cable side by side with the ends in the same direction, twist the ends of the wires together and either tin them with solder or:
  - i. Insert the twisted ends of the 2" piece of 18 AWG multistrand wire and the black wire of the 20" piece of 2 conductor 18 AWG unshielded cable into a Double 18 AWG wire ferrule.
  - ii. Use a Ratchet Crimp Tool for 18 AWG Wire Ferrules to crimp a Double 18 AWG wire ferrule onto the end of the two wires.
- v. Either tin the bare ends of the leads of the 20" piece of 2 conductor 18 AWG unshielded cable with SN63 rosin core solder and a soldering iron to keep the individual strands of wire, or use a Ratchet Crimp Tool for 18 AWG Wire Ferrules to crimp a Single 18 AWG wire ferrule onto each of the leads as shown in **Figure 19**.
- vi. Use a screwdriver with a flat blade of 2mm or less to loosen, but not remove, the screws on the connector to the Werma 10700075 audible alarm. Insert the end of the red wire of the 20" piece of 2 conductor 18 AWG unshielded cable into the X1 position of the connector and tighten its screw. Insert the end of the black



Figure 19: Finished cable for the Werma audible alarm, including the jumper to implement the battery over temperature alarm.

wire into the X2 position of the connector and tighten its screw as shown in **Figure 19**.

- d. Install the Werma 10700075 audible alarm.
  - i. Unscrew the nut from the Werma 10700075 audible alarm.
  - ii. Use a Caulking gun for 10-oz cartridge to apply a bead of GE-55 Silicone adhesive around the base of the threads of the Werma 10700075 audible alarm.
  - iii. Insert the Werma 10700075 audible alarm into the hole in the lid of the modified Pelican case from the outside as shown in Figure 18 and use a caulking gun for 10-oz cartridge to apply a bead of GE-55 Silicone adhesive around the base of the threads of the Werma 10700075 audible alarm.
  - iv. Screw the nut back onto the Werma 10700075 audible alarm and tighten it with channel-lock pliers.
- e. Install the battery straps. For each section of strap:
  - i. Use a Caulking gun for 10-oz cartridge to apply a bead of GE-55 Silicone adhesive on the outside of the top of the modified Pelican case around both mounting holes for the section of strap as shown in **Figure 20**.
  - ii. Insert a #8-32x5/8 pan head Phillips SS screw with a #8x.75 SS Fender Washer through each hole from the outside of the modified Pelican case.



# Figure 20: Preparation for mounting the screws to hold the Velstraps. View is exterior (outside) surface of Pelican case.

- iii. Use a Caulking gun for 10-oz cartridge to apply a bead of GE-55 Silicone adhesive on the inside of the modified Pelican case around both mounting holes for the section of strap.
- iv. Place the section of Velstrap over the screws with the loops and/or hooks facing away from the surface of the modified Pelican case.
- v. Place a #8x.75 SS Fender Washer over each of the screws and secure it with a #8-32 SS Nylon Insert Lock Nut.
- vi. Tighten the screws and locknuts using a #1 Phillips screwdriver and a ratchet wrench with an 11/32" socket on a 2" or longer extension.
- vii. Repeat until all four sections of Velstrap (Figure 1) are installed as shown in Figure 21.

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Figure 21: Velstraps installed.

#### 2. Mount the IS1001

- a. Remove the standoff and install a 4-40x1/2 Female-Female nylon spacer in its place at the corner of the IS1001 as shown in **Figure 22**
- b. Plug the 26-pin header of the IS1001 Interface Board with beeper and over-temperature alarm into the 26-pin socket at the end of the IS1001 opposite the orange connectors, and fasten it to the standoffs on the IS1001 with four (4) #4-40x1/4" Phillips head screws using a #0 Phillips screwdriver.
- c. Use a Caulking gun for 10-oz cartridge to apply a bead of GE-55 Silicone adhesive on the outside of the bottom of the modified Pelican case around the four mounting holes for the IS1001.
- d. Insert a #4-40x7/16 pan head Phillips SS screw with a #4 SS flat washer into each hole from the outside of the modified Pelican case.
- e. Use a Caulking gun for 10-oz cartridge to apply a bead of GE-55 Silicone adhesive on the inside of the modified Pelican case around each of the mounting holes.



Figure 22: Nylon spacer in place on IS1001 Antenna Control Node.

- f. Place one (1) #4 SS flat washer over each of the two screws toward the front (handle side) of the modified Pelican case, and four (4) #4 SS flat washers over each of the two screws toward the back (away from the handle side) of the modified Pelican case. The additional washers are necessary to space the IS1001 mounting standoffs up from the depression inside the bottom of the modified Pelican case. The GE-55 Silicone adhesive will help hold the screws and washers in place.
- g. Orient the modified Pelican case open and on its back (handle up), so you can access its bottom. Orient the IS1001 in the case with its connectors toward the end of the modified Pelican case where its connectors are mounted as shown in **Figure 23**. Carefully align the mounting standoffs of the IS1001 with the #4-40x7/16 pan head Phillips SS screws and

start them using a #0 Phillips screwdriver (it may be easier to start the screws at the back (hinge side, first).



Figure 23: IS1001 with Interface Board mounted in the modified Pelican case. Handle toward the bottom and hinge toward the top of the picture

h. Tighten the #4-40x7/16 pan head Phillips SS screws using a #0 Phillips screwdriver.

# 3. Assemble the Temperature Sensor Cable

- a. Cut a 13" piece of 2 conductor 18 AWG unshielded cable.
- b. Use sharp scissors to score the jacket 1<sup>1</sup>/<sub>4</sub>" back from each end, bend the cable to break the jacket where it was scored, and remove the piece of jacket from each end.
- c. Use 18 AWG wire stripper to strip the insulation from <sup>3</sup>/<sub>8</sub>" of the end of each lead on only one end and either tin the bare ends of the leads with SN63 rosin core solder and a soldering iron to keep the individual strands of wire, or use a Ratchet Crimp Tool for 18 AWG Wire Ferrules to crimp a Single 18 AWG wire ferrule onto each wire together as shown in **Figure 24** for greater ease of assembly later.
- d. Use an 18 AWG wire stripper to strip the insulation from <sup>1</sup>/<sub>4</sub>" of the end of each lead on the other end and tin the bare ends of the leads with SN63 rosin core solder and a soldering iron.
- e. Pull the wires from the BEC connector with 6" long, 22 AWG leads apart for 1" at the end. Use a 22 AWG wire stripper to strip the insulation from <sup>1</sup>/<sub>4</sub>" of the end of each lead and tin the bare ends of the leads with SN63 rosin core solder and a soldering iron.
- f. Slip a 2" piece of 3/8" 3:1 ratio adhesive lined heat shrink tubing over the 2 conductor 18 AWG unshielded cable.
- g. Slip a <sup>3</sup>/<sub>4</sub>" piece of <sup>1</sup>/<sub>8</sub>" heat shrink tubing over each of the wires at the end of the 2 conductor 18 AWG unshielded cable.
- h. Hold the black wire from the BEC connector alongside the black wire from the 2 conductor 18 AWG unshielded cable and solder them together by touching both wires with a soldering iron with a drop of SN63 solder on its tip.

- i. Hold the red wire from the BEC connector alongside the red wire from the 2 conductor 18 AWG unshielded cable and solder them together by touching both wires with a soldering iron with a drop of SN63 solder on its tip.
- j. Slide the <sup>3</sup>/<sub>4</sub>" pieces of <sup>1</sup>/<sub>8</sub>" heat shrink tubing to cover each of the solder joints and shrink them into place with a heat gun.
- k. Slide the 2" piece of 3/8" 3:1 ratio adhesive lined heat shrink tubing so that it covers the joints and the end of the jacket of the 2 conductor 18 AWG unshielded cable and shrink it into place with a heat gun as shown in Figure 24.



Figure 24: Completed temperature sensor cable.

## 4. Connect the wires to the IS1001

- a. Antenna Wires:
  - i. Facing the end of the IS1001 with the orange terminal blocks as shown in, use a screwdriver with a flat blade of 2mm or less inserted in the rectangular hole at the leftmost ("+") position (#1) of the rightmost orange terminal block to pry open the contact and insert lead #1 from the BH-3-FS Connector into the round hole at that position.
  - ii. Use a screwdriver with a flat blade of 2mm or less inserted in the rectangular hole at the second (ground) position from the left (#2) of the rightmost orange terminal block to pry open the contact and insert lead #3 from the BH-3-FS Connector into the round hole at that position as shown in Figure 25, remove the screwdriver, and pull on the wire to make sure it's securely connected. Wire numbers per Figure 16
  - iii. Use a screwdriver with a flat blade of 2mm or less inserted in the rectangular hole at the rightmost ("-") position (#4) of the rightmost orange terminal block to pry open the contact and insert lead #2 BH-3-FS Connector into the round hole at that position as shown in Figure 25, remove the screwdriver, and pull on the wire to make sure it's securely connected.



Figure 25: Antenna connector wires installed in the ANTENNA connector of the IS1001.

- b. Power wires:
  - i. Use a screwdriver with a flat blade of 2mm or less inserted in the rectangular hole at the leftmost ("+") position (#1) of the leftmost orange terminal block to pry open the contact and insert the red #14 wire lead of the Std Female Tamiya Connector wire into the round hole at that position as shown in **Figure 26**, remove the screwdriver, and pull on the wire to make sure it's securely connected.

- ii. Use a screwdriver with a flat blade of 2mm or less inserted in the rectangular hole at the second (ground) position from the left (#2) of the leftmost orange terminal block to pry open the contact and insert the black #14 wire lead of the Std Female Tamiya Connector into the round hole at that position as shown in Figure 26, remove the screwdriver, and pull on the wire to make sure it's securely connected.
- c. USB Cable:
  - i. Plug the USB A plug of the TE Connectivity/AMP 1496476-1 USB A to mini B cable into the USB A socket on the inside of the Bulgin PX0848/B Panel mount USB B connector on the modified Pelican case.



Figure 26: Standard Tamiya connector wires installed in the Power connector of the IS1001.

- ii. Plug the USB mini B plug of the TE Connectivity/AMP 1496476-1 USB A to mini B cable into the USB mini B socket on the IS1001 Antenna Control Node next to the IS1001 Interface Board. You may coil and stuff the excess cable under the IS1001
- d. Wermer alarm:
  - i. Route the end of the cable for the Werma 10700075 audible alarm without the connector (the end at the upper right in **Figure 19**) under the IS1001 and behind the middle standoff of the IS1001 (as shown in **Figure 23**, to keep it out of the way).
  - ii. Press down the lever at position 5 from the left, BEEPER + as shown in Figure 27 (or from the right as shown in IS1001 Interface Board SOP 190730.pdf) of the X2 terminal block on the IS1001 Interface Board. Bear in mind that not all ten positions of X2 may be installed,



Figure 27 Interface Board wiring. From left to right: #5 Beeper+ RED, #6 Beeper- BLACK & WHITE, #8 Beeper Jumper WHITE, #9 & #10 Thermistor Wires either order.

so you may need to count empty hole positions. Insert the end of the red wire of the cable for the Werma audible alarm at position 5 of X2, release the lever, and pull on the wire to make sure it's securely connected.

iii. Press down the lever at position 6 from the left, BEEPER -, as shown in of the X2 terminal block on the IS1001 Interface Board in Figure 27, insert the end of the black wire of the cable for the Werma audible alarm at position 6 of X2, release the lever, and pull on the wire to make sure it's securely connected.

- iv. If the cable for the Werma audible alarm has a jumper wire attached to the black wire, press down the lever at position 8 from the left, BEEPER JUMPER, as shown in **Figure 27** of the X2 terminal block on the IS1001 Interface Board. Insert the end of the jumper wire of the cable for the Werma audible alarm at position 8 of X2, release the lever, and pull on the wire to make sure it's securely connected. Otherwise, skip to section iv.
- v. Plug the connector on the other end of of the cable for the Werma audible alarm in to the back of the Werma alarm on the inside of the lid of the modified Pelican case.
- e. Temperature Sensor:
  - i. Route the end of the two-wire end of the temperature sensor cable from the right to the left under the IS1001 and behind the middle standoff of the IS1001 (as shown in **Figure 23**, to keep it out of the way).
  - ii. Push down the lever on the rightmost position of the terminal strip on the IS1001 Interface Board, one of the Thermistor Wires positions, in **Figure 27**, insert either of the wires into that position on the terminal strip, release the lever, and pull on the wire to make sure it's securely connected.
  - iii. Push down the lever on the second from the right position of the terminal strip on the IS1001 Interface Board, insert the other wire into that position on the terminal strip, release the lever, and pull on the wire to make sure it's securely connected.

# 5. Install JP1

a. Verify that JP1 is installed next to the Antenna connector of the IS1001. It is behind, but hidden by, the connector in, and visible, as the red component to the left of the Antenna connector at the upper right corner of the IS1001 in **Figure 23**. Install it if it's not installed. It must be installed for use with the antenna described herein, but must not be installed if the reader is used with a different antenna which has an inductance above about 157  $\mu$ H. If JP1 is not installed, it should be secured inside the modified Pelican case with clear tape.

## 6. Antenna Hoop

- a. Remove the aluminum foil caps from the ends of the antenna hoop.
- b. Prime the outside of the ends of the hoop and the inside of the ends of the "arms" only (do not apply it to the "leg") of a 1" PVC schedule 80 tee with Oatey Purple Primer Cleaner for PVC, as shown in Figure 28.
- c. Push the bundled odd numbered ends of the CAT 6 Ethernet wires through the antenna hoop without twisting or crossing the cables.
- d. Pull the odd numbered ends of the CAT 6 Ethernet wires through one "arm" of the primed1" schedule 80 PVC tee and out the "leg" of the tee. Pull the even numbered ends of the CAT 6 Ethernet wires through the other "arm" of the 1" schedule 80 PVC tee and out the "leg" of the tee, as shown in **Figure 28**.



*Figure 28: Antenna hoop with PVC tee, and bundled wires.* 

- e. Each of the nine CAT6 Ethernet wire lengths make one turn of the antenna. Slip a 1" length of ¼" heat shrink tubing over each of the even numbered cable ends, except number 18. Hold end #2 alongside #3 and solder them together by touching both pairs with a soldering iron with a drop of SN63 solder on its tip. Use an LCR meter on its frequency setting nearest 134,200 HZ to measure and record the inductance between end #1 and end #4. Continue to connect and insulate the connections in the wires in the following sequence. The inductance of the connected turns should increase with each added turn.
  - i. End 1 (Connection 1 to the antenna cable)
  - ii. End 2 connects to End 3
  - iii. End 4 connects to End 5
  - iv. End 6 connects to End 7
  - v. End 8 connects to End 9
  - vi. End 10 connects to End 11
  - vii. End 12 connects to End 13
  - viii. End 14 connects to End 15
  - ix. End 16 connects to End 17
  - x. End 18 (Connection 2 to the antenna cable)
- f. Slide the pieces of heat shrink tubing to cover the solder joints as shown in **Figure 30**, and shrink them into place with a heat gun.
- g. Apply Oatey Rain-R-Shine PVC Cement to the ends of the antenna hoop and the inside of the "arms" of the 1" schedule 80 PVC tee
- h. Orient the 1" schedule 80 PVC tee at 70° relative to the plane of the hoop, and quickly and firmly force both ends of the antenna hoop into the "arms" of the 1" schedule 80 PVC tee. Hold it in place for a minute until the glue sets.

#### 7. Antenna Shaft

- a. Prime the following with Oatey Purple Primer Cleaner for PVC:
  - i. The inside of one "arm" (do not prime both "arms") and the leg of an unmodified 1" schedule 40 PVC tee.
  - ii. The inside of a 1" schedule 40 PVC cap
  - iii. The outside of the unthreaded (smooth inside) end of a 1"x1/2" schedule 40 PVC spigot x FPT bushing.
  - iv. The outside of both ends of the shaft extension, a 15.5" length of 1" Sch 40 PVC pipe.
  - v. The outside of one end ONLY of the handle, a 6" length of 1" Sch 40 PVC pipe.
  - vi. The inside of the leg of the 1" schedule 40 PVC snap tee for the handle.

Figure 29: Antenna turns connected and heat shrink tubing in place.



b. Apply Oatey Rain-R-Shine PVC Cement to the inside of the "leg" of the 1" schedule 40 PVC tee, and the outside of the unthreaded end of the 1"x1/2" schedule 40 PVC spigot x FPT bushing. Promptly use a rubber mallet to firmly seat the 1"x1/2" schedule 40 PVC spigot x FPT bushing in the "leg" of the 1" schedule 40 PVC tee (Figure 30).



Figure 30: PVC tee, Heyco cord grip, PVC shaft extension, and PVC cap assembled.

- c. Apply Oatey Rain-R-Shine PVC Cement to the inside of the 1" schedule 40 PVC cap, and one end of the shaft extension (15.5" of 1" schedule 40 PVC pipe. Promptly use a rubber mallet to firmly seat the 1" schedule 40 PVC cap to the end of the shaft extension to which Oatey Rain-R-Shine PVC Cement was applied (**Figure 30**).
- d. Apply Oatey Rain-R-Shine PVC Cement to the primed inside of the "arm" of the 1" schedule 40 PVC tee, and the outside of the end of the shaft extension without the cap. Promptly use a rubber mallet to firmly seat the shaft extension in the "arm" of the 1" schedule 40 PVC tee which has the 1"x1/2" schedule 40 PVC spigot x FPT bushing in the "leg" (Figure 30).
- e. Apply Oatey Rain-R-Shine PVC Cement to the primed inside of the "leg" of the 1" schedule 40 PVC snap tee, and the primed end of the 6" length of 1" PVC for the handle. Promptly use a rubber mallet to firmly seat the handle in the "leg" of the 1" schedule 40 PVC snap tee (*Figure 31*).
- f. Slide the ends of the cables (1 and 18) from the antenna through the 56" length of 1" fiberglass conduit (shaft).
- g. Thread the stripped and tinned ends of cables 1 and 18 from the antenna through the unprimed arm of the 1" schedule 40 PVC tee and out through the threaded end of the 1"x1/2" schedule 40 PVC spigot x FPT bushing in the "leg" of the 1" schedule 40 PVC tee on the end of the handle extension. Pull the ends of the cables through the fittings as shown in **Figure 31**.



Figure 31: Handle on the shaft.

h. Put a  $\frac{3}{4}x1-\frac{3}{4}$  SS hose clamp around each end of the "arms" of the 1" schedule 40 snap tee, and slide it over the 56" length of 1" fiberglass conduit (shaft) and tighten the hose clamps to hold it in place as shown in *Figure 31*.



Figure 32: Shaft extension with the antenna cable.

Squeeze the bundle of wires from the antenna hoop as pictured in Figure 29 and fit them into the end of the 56" length of 1" fiberglass conduit (shaft). Run the two long lengths (ends #1 and #18, if they are still labeled) of CAT6 cable into the arm of the 1" schedule 40 tee on the end of the shaft extension, and out the leg of the 1" schedule 40 tee as

shown in *Figure 32*. Pull the two cables from the antenna that are coming out of the leg of the 1" schedule 40 PVC tee on the end of the handle extension until both ends of the 56" length of 1" fiberglass conduit (shaft) are close to the PVC fittings (on the antenna hoop and on the shaft extension).

- j. Lay 3" long beads of parts A and B of 3M 021200-20887, Scotch-Weld 3535 Urethane Adhesive next to each other on a clean disposable surface (such as aluminum foil). Mix the two beads of adhesive together quickly, but thoroughly with a tongue depressor or swab shaft.
- k. With the tongue depressor or swab shaft, apply a layer of the mixed adhesive to the inside of the tee from the antenna hoop and about 1" of the outside of the end of the fiberglass antenna shaft closest to the antenna hoop. Push the antenna shaft into the tee from the antenna hoop and smooth the bead of adhesive at the joint.
- 1. With the tongue depressor or swab shaft, apply a layer of the mixed adhesive to the inside of the tee from the shaft extension and about 1" of the outside of the end of the antenna shaft nearest the shaft extension. Align the tee of the shaft extension so that it points directly opposite the antenna hoop and push the tee of the shaft extension onto the

antenna shaft and smooth the bead of adhesive at the joint.

- m. Pull the cables (1 and 18) from the antenna as far as they will come through of the leg of the 1" schedule 40 PVC tee on the end of the handle extension. Use scissors to split the end of the jacket on each cable about 1". Fold the jacket back to find the rip cord. Use the rip cord to split the jacket back to the 1" schedule 40 PVC tee on the handle. As shown in Figure 32.
- n. Use scissors to trim the jacket, spacer, and rip

cords back to the fitting *Figure 33: Cable jackets split back to the fitting.* 

as shown in **Figure 33** (note: Take care not to cut, or damage the insulation of, the individual wires).

o. Cut the wires from one of the CAT6 cables to 2 <sup>1</sup>/<sub>2</sub>" from the fitting. Using the wire stripper for 24 AWG, strip the insulation from wires about <sup>3</sup>/<sub>8</sub>" of the ends of each of the wires of the cable. Twist all 8 of the stripped ends of the wires together. Using a



soldering iron and SN63 flux core solder, tin the twisted wires at the end of the cable as shown in **Figure 34**.

p. Slip the two pieces of the Heyco M3251 liquid-tight strain relief over free the end of the 14/2 Coiled Cord of the antenna cable, being sure that the jacket of the cable is completely through the connector, as shown in Figure 35.



Figure 34: The strain relief on the antenna cable.

- q. Cut two ¾" pieces of ¼" heat shrink tubing and slip one over each of the two unconnected CAT6 cables from the tee in the antenna shaft (ends numbers 1 and 18, if they are still labeled). Hold end number 1 overlapping alongside one of the stripped ends of the two wires protruding from the shaft extension from the opposite direction and solder them together by touching both pairs with a soldering iron with a drop of solder on its tip. Hold end number 18 so that it overlaps the other stripped end of the two wires protruding from the shaft extension in the same fashion and solder them together by touching both pairs with a drop of solder on its tip.
- r. Slide the pieces of heat shrink tubing to cover the solder joints, and shrink them into place with a heat gun as shown in **Figure 36**



Figure 35: Wires soldered and heatshrink tubing shrunk into place.

s. Push the wires into the 1"x1/2" sch 40 PVC spigot x FPT bushing of the handle far enough that the jacketed portion of the 10' 14/2 coiled cord protrudes into the bushing. Slide the waterproof fitting portion of the Heyco M3251 liquid-tight strain relief into the 1"x1/2" sch 40 PVC spigot x FPT bushing and use a 25mm open end wrench to tighten it into place. Slide



Figure 36: Heyco M3251 liquid tight strain relief and antenna cable assembled to the handle.

the strain relief portion of the Heyco M3251 onto the waterproof fitting portion, and use a 25mm open end wrench to tighten it into place, making sure that it clamps on the jacketed portion of the 10' 14/2 coiled cord as shown in **Figure 37**. The finished antenna should look as shown in **Figure 38**.



Figure 37: Finished antenna.

#### **Battery:**

1. Battery Safety.

#### IMPORTANT SAFETY INSTRUCTIONS AND WARNINGS

You must read these safety instructions and warnings before using or charging your batteries!

- a. Only use the Ni-MH&Ni-Cd Battery Pack Charger Model: H02640040-XX-D7 supplied for this battery: BatterySpace.com, PID# 3040, Connector CU-CH126 (Mini Female Tamiya plug).
- b. The charger is for indoor use only.
- c. The charger must be placed on a horizontal surface when it is in use.
- d. Do not cover the charger when it is in use. Air must circulate freely around it for cooling.
- e. Do not use the charger if the ambient temperature exceeds  $104^{\circ}F$  ( $40^{\circ}C$ ).
- f. Avoid storing or operating the charger in highly humid place or any place with inflammable materials
- g. Do not disassemble the charger any time.
- 2. Charging the Battery
  - a. The battery must be charged before first use
  - b. Remove the battery from the PIT pack.
  - c. Let battery cool down to ambient temperature before charging.
  - d. Do not charge the battery in an area with flammable vapors.
  - e. Plug the power and temperature sensor connectors of the battery pack into the charger's connectors first as shown in **Figure 39**.



Figure 38: Battery connected to the charger.

f. Plug the charger in to AC power. The charger's LEDs will flash RED then GREEN twice while it does a self-check and senses the battery's voltage. The RED LED (**Figure 40**) will stay lit while the battery is charging.

g. Charge the battery until the RED LED goes OFF and the GREEN LED lights as shown in **Figure 41**. A fully discharged battery will take 3.2 hours to charge.







Figure 39: GREEN LED

- 3. Storage & Transportation
  - a. Store the battery at room temperature between  $40^{\circ}$ F and  $80^{\circ}$ F.
  - b. Do not expose battery pack to direct sunlight (or heat) for extended periods of time.
  - c. When transporting or temporarily storing the battery in a vehicle, the temperature range should be greater than 20°F but no more than 150°F.
- 4. Caring for Battery
  - a. Do not discharge the battery to a level below 21 Volts under load. The IS1001 should provide a "Low Voltage" alarm well above that level (at about 23.9 Volts). Deep discharge will reduce the battery capacity and life.
- 5. Charging Temperature: 32°F to 113°F. Let battery cool down to ambient temperature before charging.
- 6. Operating Temperature: 32°F to 140°F. During discharge and handling of the battery, do not exceed 160°F.
- 7. Battery Life: When the fully-charged battery capacity falls below 5 Amp-hours, it must be removed from service and disposed of properly. Discharge the battery to 21V, make sure the output wires are insulated, and then wrap the battery for disposal.
- 8. Install the Battery
  - a. Orient the battery in the lid of the Pelican case with the battery lead toward the right end (the end with the connectors) as shown in.
  - b. Wrap the Velstraps over the top of the battery, thread them through the buckles on the other side of the battery, pull them tight, and press the ends down against the Velcro as shown in **Figure 40**.
  - c. DO NOT PLUG THE BATTERY LEAD INTO THE POWER LEAD FROM THE IS1001 UNTIL YOU ARE READY TO TURN THE PIT PACK ON. There is no other ON/OFF switch, and that would drain the battery before you need to use it.



Figure 41: Battery installed in the lid of the Pelican case.

# PIT Pack Operation:

1. Orient the Bulgin PX0840/B/2M00 USB IP 68 cable to mate with the Bulgin PX0848/B Panel Mount USB B connector and screw the cover down as shown in **Figure 43**.



Figure 42: Bulgin USB cable installed on the Bulgin connector.

- 2. Plug the antenna into the 3-pin female waterproof connector as shown in **Figure 44**
- 3. Turn ON the IS1001 reader
  - a. Plug the two small red connectors for the temperature sensor together as shown in Figure 45. They do not have to be disconnected when the power connectors are unplugged, and may be left connected until the battery pack needs to be recharged.
  - b. There is no power switch. The IS1001 is turned on by plugging the white plastic Tamiya connectors on pigtails of a red wire and a black wire together as shown in **Figure 45**.
  - c. When you plug them together, you may see an arc flash in the connector. That's normal. The battery pack has a built in temperature sensor that will cause the beeper to sound continuously (as opposed to intermittently as it does when PIT tags are read) to provide notification if the battery pack overheats during use. The IS1001 must be powered by the battery pack, and the temperature sensor connected for this feature to function. The power



Figure 43: Bulgin USB connector and the antenna connector plugged in.

indicator lights on the IS1001 should light as shown in Figure 44.



Figure 44: Battery (white) and temperature sensor (red) connectors joined.

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Figure 45: IS1001 power indicators lit.

#### Configure the Field Computer and connect to the IS1001 reader

- 1. Install the driver software on the tablet or computer that will interface with the IS1001 reader.
  - a. Obtain a copy of the <u>Silicon Labs CP210x USB Drivers</u> at <u>https://www.biomark.com/software-drivers</u>
  - b. The driver software can either be downloaded directly to the field tablet or laptop if it is connected to the internet, or downloaded to another laptop or desktop computer and transferred to the field computer using a USB thumb drive.
  - c. Once the driver software has been copied onto the field computer, install it.
- 2. Install software to communicate with and configure the IS1001 reader.
  - a. Following the same process as for the driver software, obtain a copy of the latest version of Bioterm (or Biostat) at: <u>https://www.biomark.com/software-drivers</u> and install it on the field computer to be used with the PIT pack.
- 3. Power up the PIT pack (see above directions) and connect it to the field computer or tablet using Bulgin USB cable connector.
- 4. Start the BioTerm or BioStat program.
- 5. In the Serial Port box, select COM[x] Silicon Labs CP210x USB to UART Bridge, where [x] is the port number assigned to the computer's USB port.

- 6. In the **Baud Rate** box, match the IS1001 port speed setting, which is generally **115200**.
- 7. Click the **Open** button to establish a connection to the IS1001 reader.
- 8. In the **Traffic** window, type ? and press Enter. If the connection was successful, a list of the available commands will be returned.
- 9. You can now configure the reader and antenna for operation. Please refer to the latest version of the IS1001 standalone manual for details about the individual commands. As of this writing, it could be downloaded at: <u>https://www.biomark.com/is1001-reader-board</u> under the Resources tab

# Literature Cited

AA Portable Power Corp. IMPORTANT SAFETY INSTRUCTIONS AND WARNINGS For NIMH BATTERIES (<u>http://www.batteryspace.com/warningsforusingbatteries.aspx</u>)

AA Portable Power Corp. CH-UN400 Charger Data sheet (3040.pdf available at <u>www.batteryspace.com</u>).

Biomark, IS1001\_Reader\_Standalone\_Operation\_User\_Manual\_Rev\_11.pdf (or later version) available at

IS1001 Interface Board SOP 190730.pdf available from Abernathy Fish Technology Center