



**SUBSURFACE  
INSTRUMENTS, INC.**

AML+™  
OPERATOR'S  
MANUAL



[www.ssilocators.com](http://www.ssilocators.com)



## AML SAFETY INFO



### READ & OBSERVE ALL INSTRUCTIONS

Save these instructions for future reference.

### INSPECTION OF THE AML+

DO NOT open the housing of this unit. Doing so will damage the transmission and receiving antennas. There are no user serviceable parts inside. Opening the sealed case will void the warranty.



If maintenance, tuning, or repair becomes necessary contact:

#### **SubSurface Instruments, Inc.**

email: [info@ssilocators.com](mailto:info@ssilocators.com)

Telephone: 920-347-1788 or

1-855-422-6346 (1-855-I can find it)

Or by mail:

SubSurface Instruments, Inc.

1230 Flightway Drive

De Pere, WI 54115 USA



Proudly Made in the USA

**READ & OBSERVE SAFETY WARNINGS**

Save these instructions for future reference.

Do not direct the laser beam at people or animals. Do not stare into the laser beam. The AML+ produces Laser Class II/2M laser radiation according to IEC 60825-1.




**DANGER**

**LASER LIGHT - AVOID  
DIRECT EYE EXPOSURE**

**DIODE LASER**  
POWER OUTPUT <5mW  
WAVELENGTH 835nm  
CLASS II LASER PRODUCTS

COMPLIES WITH 21 CFR 1040.10 AND 1040.11

Looking directly into the laser beam - especially with optical instruments such as binoculars or magnifiers - can permanently damage the eye. This is a professional tool, not a toy. It should not be used by children.



**LASER RADIATION – DO NOT  
STARE INTO THE BEAM OR VIEW  
DIRECTLY WITH OPTICAL INSTRUMENTS**

**CLASS 2M LASER PRODUCT**  
Max Output 51 mW @ 630 – 670 nm  
ACCORDING TO IEC/EN 60825-1: 2001

**OPERATION**

Only use this equipment for the purpose specified by the manufacturer. Any misuse may void the warranty.

# OPERATING INSTRUCTIONS



## How the AML+ Works

The unit contains an internal control circuit board, and an antenna board that controls the center transmitter and independent left and right signal receivers.

A powerful 2.45 GHz ground-penetrating, ultra-high frequency radio signal locates density differences by transmitting inverted conical shaped UHF signals into the ground.



The unit locates objects by analyzing differences in subsurface material densities. Man-made objects or geometries with a straight edge create a change in conductivity, density and/or permeability from surrounding materials. This causes a distortion in the return signal detected by the UHF receivers on the sides of the AML+, and is interpreted by the advanced microprocessor circuit board technology.

## User Reference - Scanning QR Codes

AML+ reference videos and instructions can be accessed from your smart phone using a standard QR code app. QR codes can be found and scanned from the blade side (or backside) of your AML+ unit. For more information on how to download and/or use a QR code app, visit the app store on your smart phone. Reference materials can also be accessed by visiting the SSI website at [ssilocators.com](http://ssilocators.com).

## FCC/IC/CE STATEMENTS



### FCC

This equipment was tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy.



### IC (Industrie Canada)

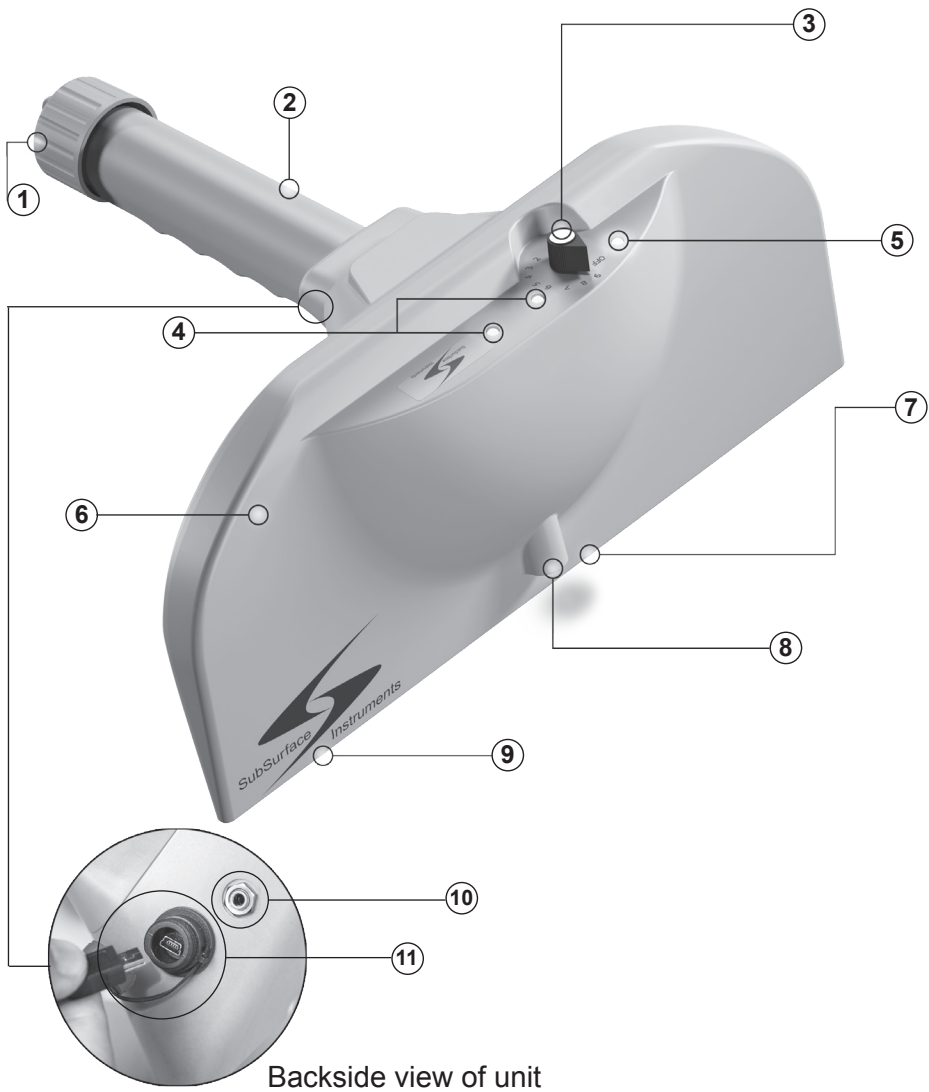
Canadian Compliance Statement: Complies with the Canadian ICES-003 Class B specifications. Cet appareil numérique de la Classe B est conforme à la norme NMB-003 du Canada.

This device complies with RSS 210 of Industry Canada. This Class B device meets all the requirements of the Canadian interference-causing equipment regulations. Cet appareil numérique de la Classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

### CE Approved (European Countries)

European Community Compliance Statement: The equipment complies with the RF Exposure Requirement 1999/519/EC, Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0–300 GHz). This wireless device complies with the R&TTE Directive.

# CONTROLS AND FUNCTIONS



### **1) EASY BATTERY ACCESS**

The AML+ is powered by either a convenient 9-volt battery system, or by a rechargeable Lithium battery pack.

### **2) ERGONOMIC HANDLE**

The ergonomically designed handle allows the operator to hold the AML+ for extended periods of time in all weather conditions.

### **3) POWER & 9-POSITION SENSITIVITY SWITCH**

The POWER & SENSITIVITY switch controls the unit's power supply and sensitivity adjustment. Turn the unit ON, and choose the appropriate sensitivity level depending on surface and/or soil type.

### **4) RIGHT SIDE & LEFT SIDE TARGET INDICATORS**

LED target indicators identify when an object has been located, and when the object is parallel with the AML+. Audio and laser target indicators work in unison with the right and left LEDs to alert the operator of an object's presence, and to place its location.

### **5) LED POWER INDICATOR**

The power indicator LED emits a bright green light when the unit is ON. This LED also serves as the battery life indicator and flashes green and red when battery power is low.

### **6) LIGHTWEIGHT, DURABLE CONSTRUCTION**

The electronic circuitry of this unit is housed in a tough, water-resistant, high-impact ABS enclosure. This enclosure protects the sensitive electronic components. It does not protect the unit from abuse or careless misuse. Treat this unit as a professional tool. Keep it stored in the foam-insulated case when not in use.

### **7) GROUND-PENETRATING, ULTRA-HIGH FREQUENCY (UHF) RADIO TRANSMITTER**

An UHF transmitter delivers the intensity of the UHF signal as it is aimed at its intended target.

## **8) LASER TARGET INDICATOR**

A red laser indicator identifies the target position on the ground when an object has been detected; and an audible signal is emitted.

## **9) ULTRA-HIGH RADIO FREQUENCY RECEIVERS**

The receiver captures the returning UHF reflection with antennas on both ends of the unit. Positioning the unit parallel to an object's edge will activate the receiver's antenna and illuminate both LED lights, the laser target indicator, and activate an audio signal.

## **10) HEAD PHONE JACK-PORT**

Insert headphone jack into the headphone port for operation in noisy environments if necessary.

## **11) USB PORT**

The USB Port has several functions such as connecting the auxiliary external lithium battery supply to the USB Port for extended power, and for uploading or downloading diagnostic information.

The lithium battery pack will provide a minimum of 20 hours of continuous usage before needing to be re-charged. There are several USB ports on the battery pack that can be used to power additional pieces of equipment such as a cellphone or any other device that requires a USB power supply. The battery pack can be placed in any suitable holder or simply carried in the operator's pocket to power the AML+ and recharge a cellphone or other USB powered device at the same time.



## USING THE AML+

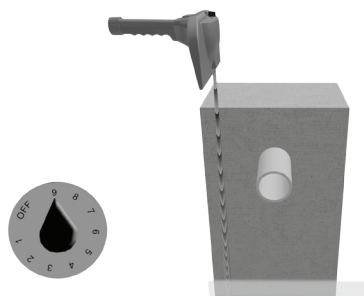


Operation of the AML+ is technique sensitive. We advise that you practice on a known buried object like a culvert pipe or other partially exposed objects. Once the principals of operation are understood, acquiring a technique is relatively simple with a little practice. Factory training is available and highly recommended.

The depth of the AML+ transmission signal varies with material substrates. The more dense the material, the further the signal travels. This unit can be used in various substrates such as water, snow, red-clay, and does not have the substrate restrictions of ground penetrating (GPR) radar.

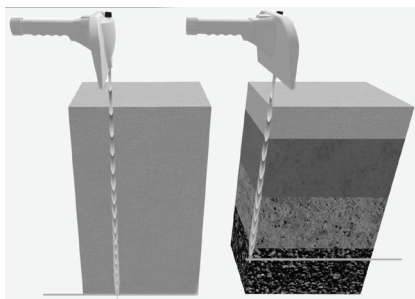
The AML+ has nine sensitivity settings, with setting 9 being the strongest (**see figure 9-1**). However, the density of the material will influence the depth of the transmitted signal. The transmission signal will penetrate deeper through highly reflective materials such as concrete, clay, asphalt, or highly compacted soil (**see figure 9-2**); and, less deep in sand, granular soil, or recently backfilled soil that tends to absorb some of the return signal strength (**see figure 9-3**).

**IMPORTANT:** The AML+ is water-resistant, not water-proof. Cover the unit with a clear plastic bag if operating in wet weather conditions.



**FIGURE 9-1**

Note: Level 9 provides the highest sensitivity setting, 0 the lowest sensitivity setting.



**Figure 9-2**

**Figure 9-3**

Note: Signals travel further in more dense and highly reflective materials.

### Locating an Object with the AML

Grip the AML+ by the handle with the fingers firmly placed along the finger knurls. Do not hold the unit above the knurls as it will produce false readings. Hold the handle parallel to the ground at waist level and 18 to 24 inches out in front of the body. The blade of the unit is designed with a 10° degree outward projection to help eliminate false readings from interference with the operator's feet (see Figure 10-1).

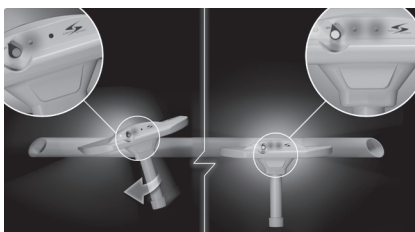
When an object is detected, the left and right LED target indicators will illuminate, an audio tone will sound and the laser indicator will activate marking your target. Lower the sensitivity level to the lowest setting that will still identify the object. This will prevent most irrelevant positives from being identified. Continue to scan the target using one of several methods:

- 1) Straight line scanning by following one edge of the pipe.
- 2) Holding the unit level and scanning the area with a slow and deliberate back and forth "W" motion.

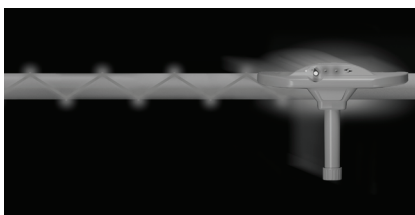
Note: See the back of the AML+ for QR Codes referencing additional user instructions and videos.



Scan to view  
training videos.



Once the left or right target indicator is activated, keep that side still and rotate the AML+ in parallel with the subsurface object. Both the left and right LED target indicators will light simultaneously and an audio sound will emit when the unit is in parallel and in alignment with the object.



With the AML+ in parallel with the pipe or underground object, you can now scan the entire length of the object's edge. As an alternative, utilize the "W" method of scanning by sweeping the area in a back-and-forth "W" motion, marking the object's location and direction as it is tracked.

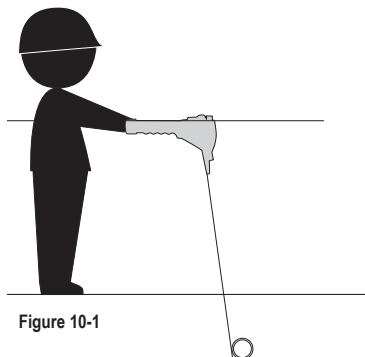


Figure 10-1

**Marking the Exact Location of an Object with the AML+**

Remember that the 10° forward projection of the blade will make the object appear closer than it actually is (see figure 11-1). Once the object is found, pivot the handle of the AML+ upward until the blade (or bottom of the AML+) is perpendicular to the ground and directly above the area of the signal (see figure 11-2). You can now scan the ground in parallel for the entire length of the object, identifying its diameter or width, location and run direction as you track the object.

**Note:** Read the Safety Notes section (pages 3-4) before operating your AML+.

**Searching Position:**

Objects are further than they appear when in the searching position.

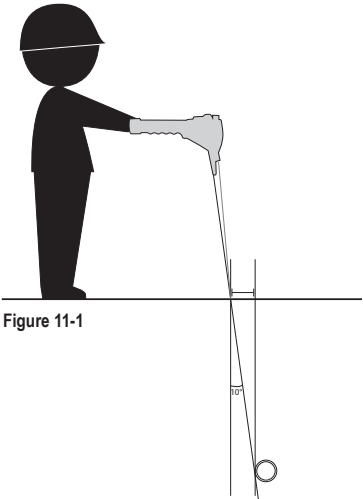


Figure 11-1

**Locating Position:**

Tilt the handle forward 10° when locating the exact edge of an object.

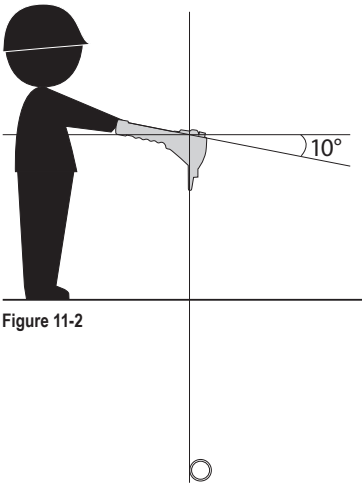
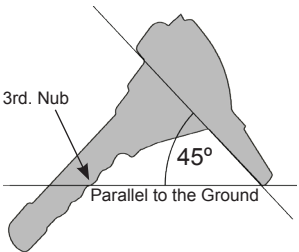


Figure 11-2

**Determining depth with the AML+**

Once you have located the PVC pipe or underground object, find its center and mark its position on the ground, tilt the handle of the unit downward until the blade is at 45°, (figure 12-1) and walk backwards until you find the top of the pipe. Make a mark where the laser indicator is located on the ground. Measure the distance between both of the marked points, this will be the depth at where the PVC pipe is located.



**Useful Tip:** if you tilt the handle downward until the 3rd nub from the battery cap is aligned to the blade tip and they are parallel to the ground the blade will be at 45°

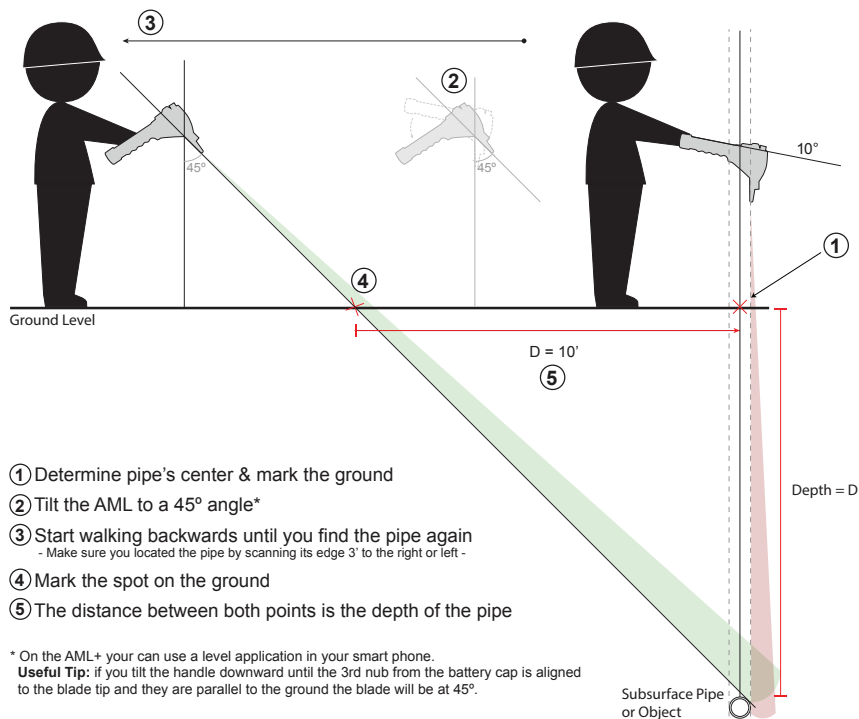
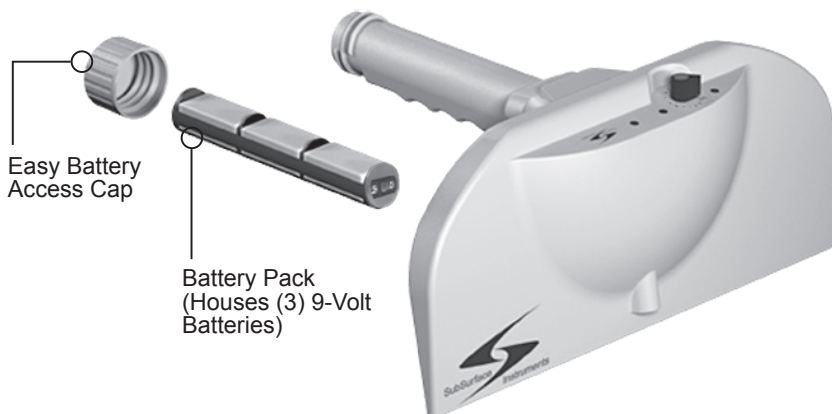


Figure 12-1

# BATTERY REPLACEMENT



## To Replace Batteries in Your AML+ Unit:

1. Unscrew the battery access cap and remove the battery sleeve.
2. Individually, lift each battery out of the sleeve, turn it 180 degrees and remove used battery.
3. Install new battery in the battery sleeve and reposition by turning 180 degrees into the sleeve. Use caution when handling the wiring harness.
4. Reinsert the battery sleeve into the handle, silver lead end first.
5. Replace battery access cap.

**Note:** One battery sleeve is included with each unit. Each battery sleeve uses three (3) 9-volt industrial grade alkaline batteries. For best results and longer battery life use only industrial grade 9-volt batteries. Additional or replacement battery sleeves are available by emailing [info@ssilocators.com](mailto:info@ssilocators.com)

# TECHNICAL SPECIFICATIONS



## PRODUCT INFORMATION

### Physical Dimensions

- Height ..... 11" ..... 27.9cm
- Length ..... 14" ..... 35.6cm
- Width ..... 6" ..... 15.2cm
- Weight ..... 2 lbs ..... 0.90kg

### Typical Operating Range

- Temperature: 0°F to 120°F (-17°C to 48°C)

### Power Specifications

Estimated Battery Life:

- (3) 9-Volt Industrial Strength Alkaline  
Provides up to 7 hours of continuous operation at full power,  
or 40 hours at average industry usage.
- Lithium Rechargeable Battery Pack  
Provides over 20 hours of continuous usage and cellphone  
recharging, or over 150 hours of use at average industry usage.

### Shipping Dimensions

- Cube ..... 20"l x 17"w x 8"h ..... 50.8cm x 43.18cm x 20.32cm
- Weight ..... 17 lbs ..... 7.7kg

### Includes

- (1) AML+ Unit
- (1) Battery Pack (Housing [3] 9-Volt Batteries)
- (1) Lithium Rechargeable Battery Pack with Battery Charger  
and Cables
- (1) Headphones
- (1) Waterproof Foam-Insulated Hard Case
- (1) Operator's Manual
- (1) Training Video Disc & Operator's Manual File

# APPENDIX (FIRMWARE UPDATE)



## AML+ Tiny BootLoader

This utility is used to install AML+ firmware updates.

## INSTALL SOFTWARE TO YOUR COMPUTER

### Download Tiny BootLoader File

1. Download SSI Tiny BootLoader Utility from the SSI web site at <http://www.ssilocators.com/specialty-products/all-materials-locator-plus-series/>, found on the Downloads tab on the SSI website. Save the file to the Downloads folder in your computer.
2. Go to the Downloads folder and extract the file from the compressed file. If your Operating System doesn't have compress software, you can go to <http://www.winzip.com/win/en/downwz.html> to download a free version.
3. Move the tinybldWinBeta.exe file to the desktop, for easy access.
4. This is a very simple application, once you have the file on your desktop, it is ready for use.

**Note:** After completing the firmware update process, your unit will need to be recalibrated, use the AML+ Customer Utility to calibrate the AML+ and to run diagnostics requested by the manufacturer.

### Updating the Firmware on the AML+

1. Connect the AML+ to your computer with the supplied USB mini cable. Turn on the AML+; if this is the first time you connect your unit to the computer, an automatic notifications will display: "New hardware has been detected" and "Installing new device driver". When your operating system completes its automatic driver installation, you will be ready to proceed to the transfer process.

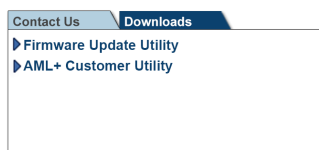


Figure 15-1



Figure 15-2



Figure 15-3

# APPENDIX



**Note:** the computer will recognize this unit when connecting in future uses.

You can obtain the latest firmware updates by contacting Subsurface Instruments at [info@ssillocators.com](mailto:info@ssillocators.com); create a folder in a convenient location, you will use this folder to store the “\*.HEX” (firmware update) file you receive from SSI.

2. Click on the icon to run the application.
  3. The tiny bootloader screen will display, (Figure 16-1).
  4. The computer will automatically recognize the Comm Port the AML+ is connected. The port # ① will appear in the left panel of the screen.
  5. Select your file source by clicking on “Browse” ② button, select latest firmware file and click “OK”
  6. Go over the configuration settings in all tabs, compare the values with the values in page 17, make sure they match.
  7. On the left panel, click “Write Flash”. This will start the transfer process
  8. Upon completion, the screen will display a string of values and commands (Figure 17-4).
  9. Your AML+ is now updated with the latest firmware and needs to be recalibrated.
- Exit software.

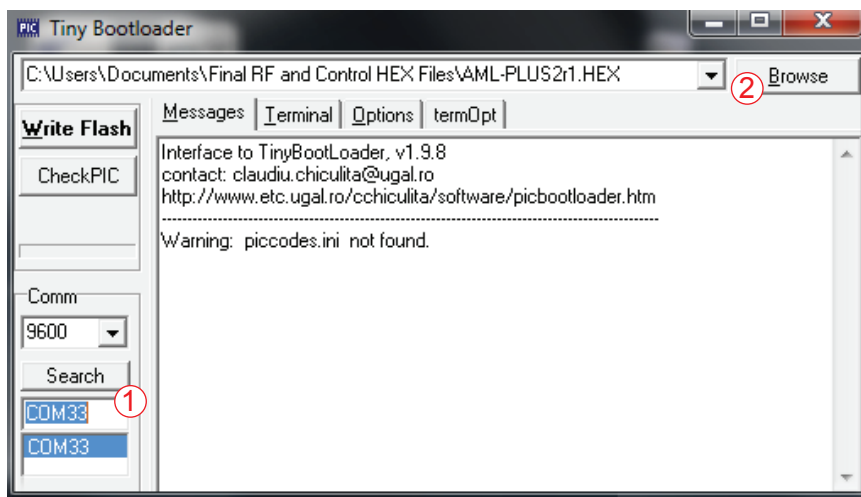


Figure 16-1



# APPENDIX



## Terminal

Comm Port Speed: 9600  
Tx/Transmitter: Char\  
Rx/Receiver: Char - dump.bin

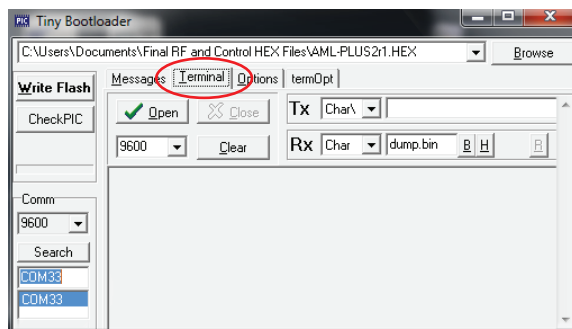


Figure 17-1

## Options

ID code: C1h - Normal  
Reset: "Active" RTS, DTR ON  
Codes to send first: 24h 49h  
Search Delay: 7  
Timeout(ms): 300  
Search for COMs: "Active"

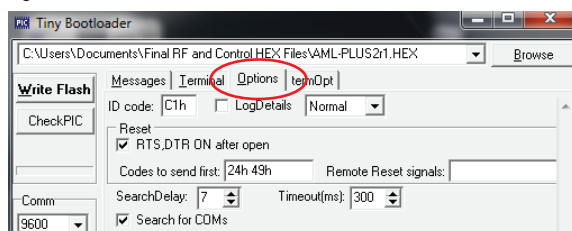


Figure 17-2

## TermOpt

Graphic 2 reference: 128  
Xaxis compression: 1

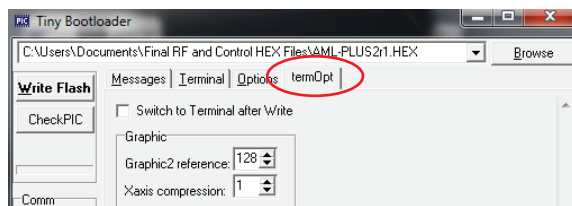


Figure 17-3

Click "Write Flash" to start  
Upon completion a message  
"WRITE OK" will display.

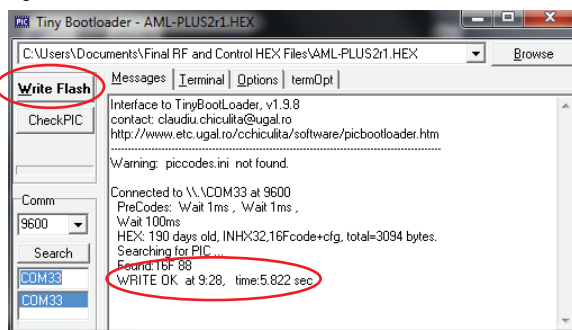


Figure 17-4

# APPENDIX (AML+ UTILITY APP)



## AML+ CUSTOMER UTILITY

The AML+ Customer Utility is used to calibrate and run diagnostics on your AML+ unit.

### INSTALL SOFTWARE TO YOUR COMPUTER

#### Download AML+ Customer Utility

1. Download AML+ Customer Utility from the SSI web site at <http://www.ssilocators.com/specialty-products/all-materials-locator-plus-series/>, found under the Downloads Tab.

Save the file to your Downloads folder in your computer.

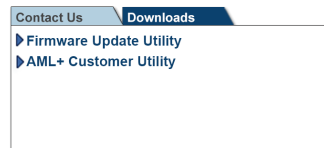


Figure 18-1

2. Go to your downloads folder and extract the file from the compressed file to access SETUP-AML-PLUS-CAL-V1r3.exe If your Operating System doesn't have a compress software, you can go to <http://www.winzip.com/win/en/downwz.html> to download a free version.
3. Double click the SETUP-AML-PLUS-CAL-V1r3.exe and follow the instructions on the screen.
4. The Installation will create a shortcut on your computer's desktop for quick access to the calibration process in the future.

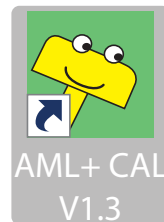


Figure 18-2

**Note:** The calibration process must be performed outdoors, with the AML+ plugged into the computer and pointing to an unobstructed sky. We suggest performing this process with a portable computer or have a USB extender cord.

### RUNNING THE AUTOCALIBRATION

1. Click on the AML+ Cal V1.3 Icon
2. The utility will run a diagnostic of the AML+ and display it on the screen,

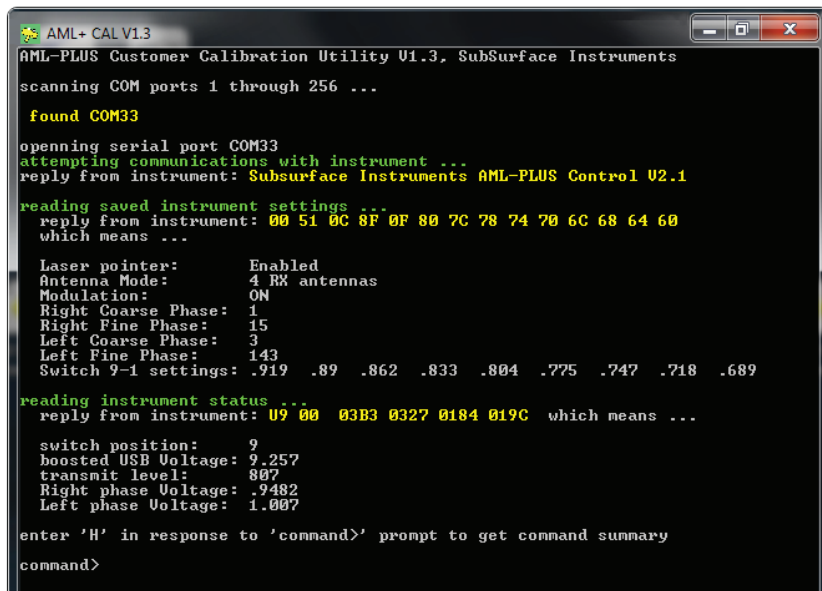


Figure 18-3

## APPENDIX



3. There will be a command prompt line at the bottom of all diagnostic data from the AML+ unit, (figure 19-1)



```
AML+ CAL V1.3
AML-PLUS Customer Calibration Utility V1.3, SubSurface Instruments
scanning COM ports 1 through 256 ...

found COM33

opening serial port COM33
attempting communications with instrument ...
reply from instrument: Subsurface Instruments AML-PLUS Control V2.1

reading saved instrument settings ...
reply from instrument: 00 51 0C 8F 0F 80 7C 78 74 70 6C 68 64 60
which means ...

Laser pointer:      Enabled
Antenna Mode:      4 RX antennas
Modulation:        ON
Right Coarse Phase: 1
Right Fine Phase:  15
Left Coarse Phase: 3
Left Fine Phase:   143
Switch 9-1 settings: .919 .89 .862 .833 .804 .775 .747 .718 .689

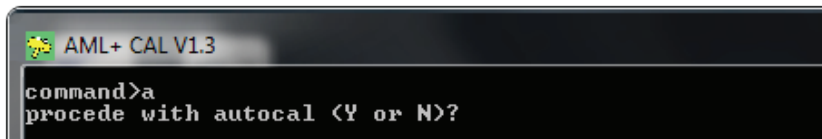
reading instrument status ...
reply from instrument: 09 00 03B3 0327 0184 019C which means ...

switch position:      9
boosted USB Voltage:  9.257
transmit level:       807
Right phase Voltage:  .9482
Left phase Voltage:   1.007

enter 'H' in response to 'command>' prompt to get command summary
command>
```

Figure 19-1

4. Type “a” to start the calibration process and press enter, a confirmation prompt will display, type “y” to confirm and press enter to start the process, (remember to have the AML+ pointing to an unobstructed sky at this point).



```
AML+ CAL V1.3

command>a
proceed with autocal <Y or N>?
```

Figure 19-2

# APPENDIX



5. The calibration process will take a few seconds and you will be able to see progress in your screen, which displays 0-9 and then A-F. All values are displayed after the calibration is complete. This information will be helpful when troubleshooting with a SSI Technician. For end user calibration needs, the process is finished and the AML+ is ready to be used.
6. Test your AML unit on the field for proper operation. If you have any questions or concerns contact SSI at [info@ssilocators.com](mailto:info@ssilocators.com).

```
AML+ CAL V1.3
scanning COM ports 1 through 256 ...

found COM33

opening serial port COM33
attempting communications with instrument ...
reply from instrument: Subsurface Instruments AML-PLUS Control V2.1

reading saved instrument settings ...
reply from instrument: 00 51 0C 8F 0F 80 7C 78 74 70 6C 68 64 60
which means ...

Laser pointer:      Enabled
Antenna Mode:      4 RK antennas
Modulation:        ON
Right Coarse Phase: 1
Right Fine Phase:  15
Left Coarse Phase: 3
Left Fine Phase:   143
Switch 9-1 settings: .919 .89 .862 .833 .804 .775 .747 .718 .689

reading instrument status ...
reply from instrument: 09 00 03B3 0327 0184 019C which means ...

switch position:      9
boosted USB Voltage:  9.257
transmit level:       807
Right phase Voltage:  .9482
Left phase Voltage:   1.007

enter 'H' in response to 'command?' prompt to get command summary

command>y
unrecognized command (ASCII character -1 )

command>a
proceed with autocal (Y or N)? y
autocal running (complete on step 'F') 0123456789ABCDEF
0      .5381231      .2766373
1      .3523749      5.425221E-2
2      8.662148E-2    4.349947E-2
3      4.398823E-3    4.349947E-2
4      4.398823E-3    4.349947E-2
5      4.398823E-3    4.349947E-2
6      4.398823E-3    4.349947E-2
7      4.398823E-3    4.349947E-2
8      4.398823E-3    4.349947E-2
9      4.398823E-3    4.349947E-2
10     4.398823E-3    4.349947E-2
11     4.398823E-3    4.349947E-2
12     4.398823E-3    4.349947E-2
13     4.398823E-3    4.349947E-2
14     4.398823E-3    4.349947E-2
15     4.398823E-3    4.349947E-2

best LEFT coarse/fine values: 3 143 (error= 4.398823E-3 )
best RIGHT coarse/fine values: 2 255 (error= 4.349947E-2 )
autocal session saved to AMLautoCAL.LOG
calibration data now saved in AML non-volatile memory
command>
```

Figure 20-1

# DISCLAIMER



SubSurface Instruments Inc., its owners, employees, dealers, distributors, and/or assigns, shall not be liable for any action, inaction, injury, or property damage, sustained or expenses incurred, whether consequential or inconsequential; from the use/non-use, misuse, improper or proper use of this or any product designed, manufactured, and/or distributed by SubSurface Instruments Inc. Locating accuracy and safety, all encompassed, are the sole responsibility of the “Operator-user” of the product.

SubSurface Instruments, Inc. is not responsible for errors and/or omissions in this manual.

Information in this manual is subject to change without notice.

# WARRANTY STATEMENT



**Warranty Period:** 36 months or (3) years from original user's purchase date. The All Materials Locator Plus (AML+) is specifically guaranteed to be free of defects in both material and workmanship to the original purchaser. Save your invoice and shipping documents for reference.

Physical abuse, battery acid and water damage as determined by the sole discretion of SubSurface Instruments Inc., are explicitly and entirely excluded from this warranty. Additionally, this is a scientific instrument and cannot be protected by the manufacturer from damage if dropped or if placed in an environment which will cause physical or chemical harm to the unit; therefore this shall be considered abuse also.

SubSurface Instruments' Liability under this warranty is absolutely limited to repair, service, or replacement of the product, at the sole discretion of SubSurface Instruments Inc. No other warranty is expressed or implied.

**Failure to register your AML+ within 30 days of receipt, will void the warranty.**

Any unit suspected of being in need of repair must be returned to SubSurface Instruments Inc., freight prepaid to:

SubSurface Instruments, Inc.  
1230 Flightway Drive  
De Pere, WI 54115 USA  
920.347.1788 phone  
920.347.1791 fax  
info@ssilocators.com  
www.ssilocators.com



## Warranty Registration



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