AN153
Cold Weather Operation of AEA Technology Instruments

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Abstract:
This application note discusses best methods and practices for maintaining the operation of AEA Technology's instruments in extreme cold weather.

General:
The two most temperature sensitive components in AEA Technology's instruments, or most instruments regardless of manufacturer, are the LCD and the batteries. The LCD's contrast is sensitive to temperature change over a wide range. As the LCD becomes warmer the background will develop a dark haze. In direct sunlight it can go completely black. As the temperature drops the dark characters fade. This can be corrected over the instrument's specified operating range by using the contrast adjustment in the instrument's F–Key setting. However, in extreme cold weather the key word in LCD to remember is "Liquid." At temperatures approaching and below freezing (32°F or 0°C) the LCD will slow, eventually stop operating and/or fade to unreadable. The batteries, whether alkaline, NiMH or NiCd, produce power via chemical interaction with the metal anode and cathode. That chemical process will also slow in extreme cold reducing their power output until they can no longer support the instrument's operation.

Counteracting the Cold Weather Effects:
The following are user actions that can result in producing satisfactory instrument operation in extreme cold weather. Depending on the temperature and wind chill factors the instrument will operate continuously or at least for a short period of time until the cold effects overpower the warming effects listed below:

A. Keep the instrument in a warm location until actually needed. The best locations are in a heated building or vehicle. However, if that is not possible place the instrument inside your jacket to take advantage of body heat.

B. Turn the instrument on at least 5-10 minutes before taking it into the cold. This will generate internal heat from the circuits and it will cause the batteries to warm as they produce power to support the operation.

C. Set the LCD backlight to "ON Continuous," and raise the brightness to the maximum. The backlight generates a small amount of heat that will keep the LCD warmer longer. It also draws more current from the batteries increasing their warmth.

D. Set the LCD contrast to the highest setting. This will help keep the characters visible even as the LCD cools and slows in operation. If the background becomes too dark at first, adjust it for readability and re-adjust it higher again as the LCD cools.

E. Set the "Battery Saver" mode to OFF. Keeping the instrument on during cold weather will preserve the heat sources. This sacrifices from 10 – 25% of battery life as a trade off to keep operating longer in the cold temperature.

F. Protect the instrument from wind chill as much as possible. Definitely use the belt case all of the time and if instrument use is intermittent, close the case cover with the instrument left ON to keep it warm. Again, keep it inside a jacket when not in use or place it in its soft or hard carrying case and only take it out when actually required to make measurements.

Cold Instrument Recovery Procedures:
If the instrument has been in the cold and the LCD has completely faded to unreadable there are three possible recovery methods:

A. If the highest contrast setting has not been selected, it can be selected by adjusting the contrast "in the blind." See the Contrast Adjustment Table below or consult the Operating Manual for the specific instrument to ID the Keys used to adjust the contrast. In most cases it is the F2 key and the contrast is the third setting down in the vertical menu.
Step 1 - Turn the instrument ON and wait about thirty seconds for boot up. On some equipment relays can be heard clicking as it goes through a self-calibration cycle even though nothing appears on the LCD.
Step 2 - Press the applicable F–key per Contrast Control Table or Operator Manual.
Step 3 - Press the up-arrow that controls the menu cursor "n" times to ensure it is at the top of the menu.
Step 4 - Press the down-arrow to move the cursor to the "Contrast" feature (normally two presses).

Step 5 - Press the right-arrow key repeatedly to increase the contrast setting. If the LCD is not readable in 15 presses this method will not recover the LCD. Try methods B or C.

Contrast Control Table

Instrument	F- Key	Vertical menu control	Contrast Control
VIA Echo (all models)	F2	Scale key arrows - up 8 & down 2	Width or Freq keys – right higher & left lower
20/20 TDR (all models)	F2	Scale key arrows – up 8 & down 2	Any right/left arrows – right higher & left lower
VIA Bravo	F2	Width key – up 4 & down 1 & ENTER	Width or Freq keys – right higher & left lower
VIA Analyzer	F1	Width key – up 8 & down 2	Freq key – up higher & down is lower
140-525 Analyzer		Internal Adjustment	R10
Cellmate EX		Internal Adjustment	R1

B. Another cause of LCD fade can be the batteries either too weak or too cold to produce sufficient power. Connect the instrument to it's AC wall adapter or use a DC vehicle adapter. If this corrects the faded LCD the cause was battery power or the lack there of.

C. Lastly, move the instrument into a warm building or vehicle. Remove the belt case to speed the warming of the instrument. About 15 minutes at 70°F (22°C) should be sufficient time to recover the LCD or battery power. Now use the cold weather counteracting measures to keep the LCD and batteries operational.

Conclusion:

AEA Technology, Inc. designs and constructs our instruments to work over a wide temperature range. The operating temperature limits for our instruments are published in the instrument's Operating Manuals. In many cases you can operate in temperatures colder than those cited in the manual by employing the practices in this application note. The amount of operating time in extreme cold will vary depend on the temperature, wind chill factor, batteries' condition and charge, and instrument's settings. The University of Wisconsin's Project Icecube engineering team operates our 20/20 TDR's at the South Pole where the normal summer temperatures are about -15°F (-26°C). See our web page at www.aeatechnology.com for more information about Project Icecube.