

Aware Electronics USB-MSP V2.9A

Aware Electronics USB-MSP V2.9A is a new device from Aware Electronics which plugs into a USB port by-way-of the included cable. Its MOD jack accepts the cord from the radiation monitor or PMI-30. It includes extremely high performance and will accept maximum count rates of 12 million CPS (counts per second) and total counts per unit time above 4 billion counts. (Normal USB to serial port adapters are limited to ~500 CPS). Once per time unit it sends over the USB port to Aw-Radw, the tallied counts. Its crystal controlled clock controls timing information. It also allows the real-time Geiger "Click" without any loss of performance.

The USB-MSP includes automatic CRC verification of data sent to the PC and the ability to re-send its data packet if Aware's Windows program, Aw-Radw, detects any problem with the CRC check, framing error or other communication errors but the largest advantage is its ability to count even very high count rates with no lost counts.

Also included are two blue LEDs, two red LEDs and a yellow LED. One LED flashes with each data packet sent to the USB-MSP from the PC. Another LED flashes with each data packet sent from the USB-MSP to the PC. Another LED flashes with each radiation detection event. Another LED pulses on and off when the USB-MSP's internal running average exceeds the internal alarm set point. Another LED flashes when Aw-Radw's alarm is active. The USB-MSP also includes two sets of two alarm output pins that can be used to trigger external devices with alarm.

In addition to acting as a real time data source for Aware's Windows program Aw-Radw, the USB-MSP includes the ability to internally tally radiation counts and store them to its internal FLASH memory for later retrieval.

It also calculates radiation units from the count data by-way-of a calibration factor algorithm, dead time correction algorithm, and maintains a variable rate running average. It can output both stored and real time data to a user using any terminal program. It will compare the running average to a user defined alarm set point and blink its red alarm LED and apply voltage to its alarm output pins if the radiation level exceeds the alarm set point. Another yellow alarm LED and a second set of alarm output pins are activated when Aware's windows program, Aw-Radw, activates its alarm.

Another feature includes the ability to control the USB-MSP by-way-of any program capable of sending and receiving ASCII characters including programs running on an Apple, Linux or Windows PCs. Such control includes starting and stopping internal FLASH storage, downloading internally stored radiation data files, erasing internal radiation data files, setting the calibration factor, dead time correction and running average depth for both the alarm LED - alarm pin out algorithm and the ASCII out feature and controlling the action of the event LED. All user settable features of the USB-MSP are stored in internal FLASH such that even if power is removed from the unit, next time it is powered up, all the settings (and any stored radiation data files) are maintained.

DRIVER INSTALLATION

Aware Electronics new USB-MSP V2.9A performs all the functions of the previous version and one can follow the directions in the CD-README.TXT file for installing its FTDI USB driver and operating it in conjunction with Aw-Radw software. These directions include the following:

If you did not install the Aw-Radw program using the aware_setup_msp.exe program on the CD, which automatically installs the USB-MSP FTDI driver, install the USB-MSP FTDI driver as follows:

Run the install program CDM20830_Setup.exe found on the CD in the FTDI folder. The install program will prompt to re-boot. After Windows reloads, plug the USB-MSP adapter into the PC's USB port by way-of the USB extension cable. (Note: The latest FTDI USB chip drivers can be found here: <http://www.ftdichip.com/Drivers/VCP.htm>).

Now the PC should have a new COM port. Plug the RM or PMI-30 into the USB-MSP. Start Aw-Radw and click "Rad Options" "Find RM or Micro-Controller". Aw-Radw should print to its main window "Aware-MSP430 Detected on COM 3 (or some other COM number).

Next click "Rad Options" and check "Micro-Controller source switch".

Next click "Rad Options" - "Micro-Controller Options" then "Micro Controller COM port" then enter the COM port number found above.

Next click "Rad Options" - "Micro-Controller Options" - "COM Port Baud Rate and XON-XOFF" then check by clicking "9600 Baud" and also make sure XON-XOFF is not checked. (Note older USB-MSPs pre version V1.4 use 4800 baud)

Next click "Rad Options" - "Micro-Controller Options" and click to check "Use CRC Check".

Now Aw-Radw is ready to start collecting radiation data. See Aw-Radw's help for more info.

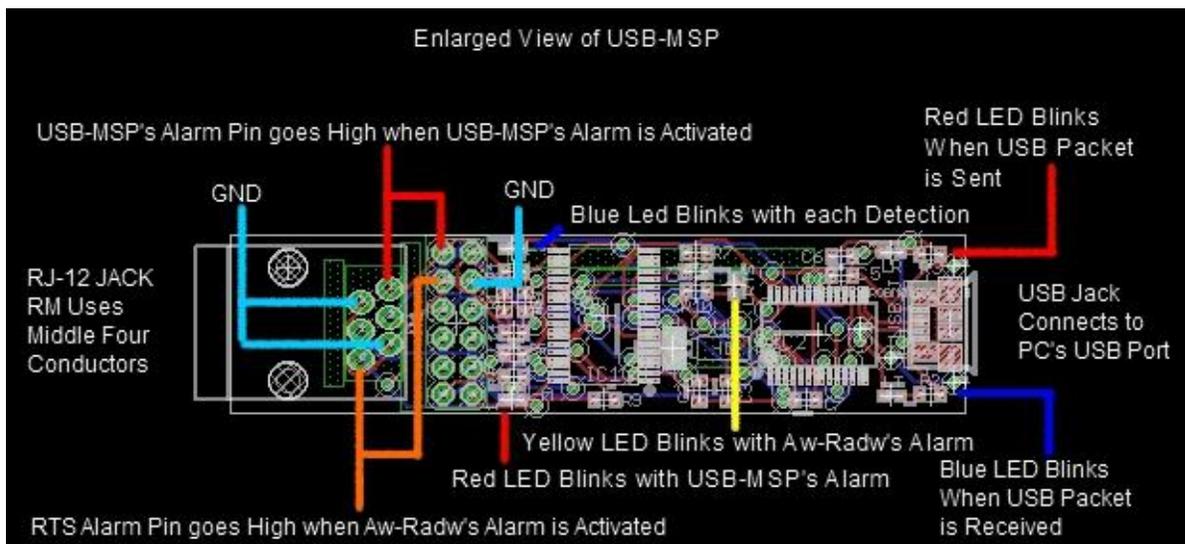
If you update the drivers from the FTDI website and find a problem, run FTDI's program CDMuninstallerGUI.exe found in the CDMUninstaller_v1.4.zip. After CDMuninstallerGUI.exe starts, click "ADD" then click "REMOVE DEVICES". After CDMuninstallerGUI.exe is done, run CDM20830_Setup.exe and then plug the devices back in. FTDI's drive website is <http://www.ftdichip.com/Drivers/VCP.htm>

Please note sometimes when FTDI driver installs itself on a PC that already has a COM port, it might use the same COM number. You can check this as follows: Start Windows Device Manager by clicking "Start" - "Control Panel" - "Performance and Maintenance" - "System" - "Hardware" - "Device Manager" then expand the "Port (COM & LPT) and check to see if the "USB Serial Port (COM #) conflicts with another COM #. If it does then right-click the "USB Serial Port (COM #)" then "Properties" then "Port Settings" then "Advanced" then change the "COM Port Number" to an unused COM #, then "OK" - "OK" then unplug and then plug in the USB-MSP. One might need to reboot the PC to have these changes take effect.

Also please note if a large external electromagnetic noise pulse causes the FTDI driver and chip to stop responding, you might have to unplug the USB cable from the USB port then plug it back in to force the FTDI driver and chip to respond again.

USB-MSP V2.9A SPECIFICATIONS

- **OPERATING TEMPERATURE RANGE:** -40 C to +85 C.
- **MAXIMUM COUNT RATE:** 12 million CPS (counts per second).
- **MAXIMUM COUNT SIZE per TBU (Time Base Unit):** Over 4 billion.
- **DATA STORAGE:** ~21K (Up to 21,000 data points with time code using Aware Electronics's no loss data compression).
- **TBU (Time Base Unit) FOR DATA STORAGE:** Anywhere between once per second to once per 65,535 seconds (i.e. up to once per 1092 minutes) in increments of one second.
- **NUMBER OF DATA FILES:** Unlimited up to limit of flash.
- **FLASH RETENTION:** Greater than 100 years at 25C.
- **RADIATION UNITS:** mR/hr, μ R/hr, μ SV/hr, CPM, CPS, Total Counts, in floating point format.
- **ALARM LED:** Between one and 10 million radiation units in increments of one radiation unit. Alarm condition optionally flashes Alarm LED twice per second.
- **ALARM OUTPUT PINS:** Two sets of Alarm output pins for triggering external devices with Alarm. One set derived from USB-MSP's internal alarm set point and another set activated by Aw-Radw's alarm algorithm.
- **RUNNING AVERAGE FOR ALARM and ASCII OUTPUT:** 1 to 120 seconds.
- **COMMUNICATIONS:** MICRO-B jack to PC's USB jack. USB Virtual COM port 9600 BAUD with 8 bits, one or two stop bits, and no parity. Uses no loss data compression, variable size packets, 16 bit CRC (cyclic redundancy check) error detection and correction during FLASH and real-time data download and will resend packets with a NAK command (Negative Acknowledgement) from the PC. During FLASH data download will respond to XON-XOFF.



ALARM FEATURES

The USB-MSP includes three types of alarms. One is activated by the USB-MSP's internal alarm function. Another is activated by Aware's windows program Aw-Radw's alarm feature when Aw-Radw's menu item "Alarm Options" - "Alarm COM Pin On/Off" - "Activate Alarm Pin with High Alarm" is checked. A third type of alarm is activated when Aw-Radw's menu item "Alarm Options" - "Send LCD-90 or USB-MSP Alarm Signal On-Off" has one of its sub-menu items checked.

USB-MSP's INTERNAL ALARM

The USB-MSP's internal alarm function compares its internal running average to a user defined alarm set point and blinks its red alarm LED and applies voltage to the two USB-MSP's alarm pins if the radiation level exceeds the alarm set point. These can be used to trigger an external device such as strobes, sirens, etc.

The USB-MSP's alarm function will continue to operate even with no connection to the PC, as long as power is supplied to the USB-MSP by-way-of, for example, a USB power outlet. For example one can program all the USB-MSP functions that affect the USB-MSP alarm, using Aw-Radw (or ASCII characters sent to the USB-MSP by any program), including USB-MSP's calibration factor, detector Dead Time, USB-MSP's running average, USB-MSP's alarm set point and USB-MSP's radiation units, and then unplug the USB-MSP from the PC's USB port, and then plug the USB-MSP's USB cable into a USB power outlet, found in many cars or available from many sources, for a few dollars. All the above mentioned parameters are automatically saved to the USB-MSP's internal Flash memory such that even with no power, the settings are maintained.

USB-MSP's ALARM DERIVED FROM AW-RADW

The USB-MSP includes a second alarm feature (RTS pin alarm) which is activated by Aware's windows program Aw-Radw's alarm feature when Aw-Radw's menu item **"Alarm Options" - "Alarm COM Pin On/Off" - "Activate Alarm Pin with High Alarm"** is checked. This allows all of the features of Aw-Radw's alarm functions to be utilized, including Auto Alarm, etc. (See Aw-Radw's Help File about Alarm). When Aw-Radw's alarm is triggered, it will assert the RTS pin. The USB-MSP will detect this and will begin blinking its yellow alarm LED and apply voltage to its two RTS Alarm output pins. Either of the two pins can be used to trigger an external device such as strobes, sirens, etc. For very critical situations, the USB-MSP's internal alarm can be used as a back-up alarm, which will continue to operate even if the PC crashes, as-long-as the USB-MSP has power. (PC's USB ports normally continue to supply power even if the PC crashes).

The USB-MSP includes a third alarm feature which is activated by Aware's windows program Aw-Radw's alarm feature when Aw-Radw's menu item **"Alarm Options" - "Send LCD-90 or USB-MSP Alarm Signal On-Off" - "Send LCD-90 or USB-MSP Alarm Signal with Aw-Radw's High Alarm"** and/or **"Send LCD-90 or USB-MSP Alarm Signal with Aw-Radw's High Alarm"** is checked. When active, this mode overrides the RTS alarm pin feature mentioned above. (See Aw-Radw's help manual for more information)

GAINING ACCESS TO THE ALARM OUTPUT PINS

The alarm outputs can be used to trigger external transistor switches, power SCRs, TRIACs, etc. which in turn could activate relays, blowers, sirens, Radon mitigation equipment, etc. One needs access to one or the other alarm output pins as-well-as one of the ground pins.

One can gain access to the two outer RJ-12 pins and one of the ground pins by, for example, using a six-conductor telcom RJ-12 cable to connect the USB-MSP to the RM or PMI-30 and strip wires to gain access.

Another option: Plug a six-conductor telcom RJ-12 cable into the USB-MSP. Plug the other end of the cable into one of the jacks of a telcom RJ-12 Duplex Surface Jack with screw terminals and plug the RM or PMI-30's telcom RJ-11 or RJ-12 cable into the other jack of the Duplex Surface Jack. The screw terminals allow access to the two outer wires and one of the ground wires. These telcom products can be purchased from www.mcmaster.com for a few dollars.

Another option includes punching a small hole through the plastic enclosure above one or more of the appropriate pins in the twelve pin header and pushing on a standard single line header jack. (See above diagram).

One could place the USB-MSP with the alarm output wiring, TRIAC or SCR or transistor switch, relay, etc. in a small instrument box and mount the box on a wall, etc.

When an alarm pin is activated, the USB-MSP applies 3.3 VDC to it by-way-of a 1K ohm resistor. See above diagram for location of USB-MSP's alarm pins.

SETTING USB-MSP PARAMETERS USING AWARE'S WINDOWS PROGRAM AW-RADW

Since the USB-MSP uses a microcontroller from the same family as that used in the LCD-90, we were able to include software code from the LCD-90, within the USB-MSP. Some of the features thus provided might or might not prove of value to the user. These additional software features are controlled by-way-of Aw-Radw menu items that are directed towards the control of the LCD-90 and are included in the following descriptions:

Aw-Radw 'Micro-Controller Options' menu items are described:

“COM Port Baud Rate & XON-XOFF” Choose 9600 to match USB-MSP's baud rate (Default is 9600 baud). If “Use X-ON X-Off” is checked by clicking it, Aw-Radw will direct the PC's COM port to use one way X-On X-Off flow control (software flow control). During flash data file downloads, if the USB-MSP receives an X-Off it will stop sending the data until an X-ON is received. Note some Windows COM port drivers don't work well with one way X-ON X-OFF so this item defaults unchecked.

“Use CRC Check” Click to check or uncheck. If this item is checked, Aw-Radw and USB-MSP will use 16 bit CRC error detection and correction (default).

"Download Stored Data" Downloads all stored data files from the USB-MSP and optionally saves the data to an Aware binary file and an ASCII file. The data files within the USB-MSP are always in the form of counts per unit time. When displaying the downloaded data and writing the data to an ASCII file, Aw-Radw applies the current "RM Calibration Factor" to each

downloaded data point. (See description of RM Calibration Factor in Aw-Radw's help file). Since an Aware binary file is always in the form of counts per unit time, as is the stored data in the USB-MSP, the calibration factor has no effect on the data stored to an Aware binary file.

When downloading the stored data, first Aw-Radw asks "Enter Detector Dead Time". Accept the default or change or enter 0 for no dead time correction.

Next if there are any files to download, Aw-Radw first asks for an 'Aware Binary Data File' name. Enter a file name or hit 'Cancel' to skip creating the binary file.

Next Aw-Radw asks for an ASCII file name. Enter name or cancel as above. If you choose to create an ASCII file, the format of the file is determined by all of Aw-Radw's 'Output Options' - 'ASCII Text File Options'. See Aw-Radw's help for more information about ASCII Text File Options.

Aw-Radw then downloads the data to the file(s). If there is more than one data file in the USB-MSP, Aw-Radw repeats the file name prompts for each file, in turn. One can download stored data even while the USB-MSP is storing data.

"Erase Store Memory" Click this item and Aw-Radw sends a command to USB-MSP instructing it to erase all the stored radiation data files in its flash memory, freeing up the space for new files.

"Set Storing TBU" sets the default USB-MSP's storing TBU (Time Base Unit) anywhere between once per second to once per 65,535 seconds (i.e. up to once per 1092 minutes).

"Start Store Command" tells USB-MSP to start storing the radiation data to a FLASH memory file.

"Stop Store Command" tells USB-MSP to stop storing data.

"LCD Display's Calibration" sets USB-MSP's calibration factor for the alarm LED, USB-MSP's alarm output pin and ASCII data output. One can also set the radiation units to mR/hr, μ R/hr, μ SV/hr, CPM, CPS, or Total Counts.

"LCD Display's Calibration" - "Detector Dead Time" Enter the Detector Dead Time in μ secs (microseconds). Allowed range is zero to 2000 μ secs. The detector dead time is the time after the detection of an event during which the detector can't detect another event. This might range from 20 to 150 μ secs. For example given a detector with a dead time of 100 μ secs and a count rate of 1000 CPS, the detector will not be able to detect events during 10,000 μ secs for each second (1% of the time) i.e. the count rate is really 1000 counts per 0.99 seconds. In such a case, with an entered "Detector Dead Time" of 100 μ secs., the program will add an additional 111 counts and therefore the reported count rate will be 1111 CPS instead of 1000 CPS. With 2000 CPS and dead time of 100 μ secs the program adds 500 counts, at 3000 CPS it adds 1286 counts, at 100 CPS it adds 1 count, etc. The exact addition is calculated each TBU (Time Base Unit.) according to the count, the TBU and the entered dead time. With a entered dead time of zero, no addition to the count rate is calculated.

"Display's Running Average" sets USB-MSP's running average depth for the alarm LED, USB-MSP's alarm output pin and ASCII data output, anywhere between one and 120 TBUs (Time Base Units). While the USB-MSP is displaying the radiation level, it maintains a running average of the radiation data. This running average is updated once per second. The depth of the running average is set by the "Display's Running Average" menu item. For example, an Average

Depth of one will cause the USB-MSP's alarm set point to be compared to the radiation data with no averaging and a value of 120 will cause the USB-MSP's alarm set point to be compared to the radiation data with a running average of the last 120 seconds updated once per second.

"**Display's Decimal Precision**" sets USB-MSP's Decimal Precision for ASCII out i.e. the number of digits to the right of the decimal point.

"**Display's Alarm Level**" sets USB-MSP's internal alarm set point. Enter zero for no USB-MSP derived alarm.

"**Alarm's Action Settings**" opens a pop-up menu with three options which control how the USB-MSP will react with alarm condition. The options are "Alarm LED" (turn on alarm LED and applies voltage to USB-MSP's alarm output pin with alarm), "Alarm Buzzer" (No effect) and "Alarm Vibrator" (No effect). First check or uncheck the desired alarm actions by clicking on them in-turn. Next click "**Send Above Settings to Micro-Controller**" to send the desired alarm actions. When first activated, the "Alarm's Action Settings" pop-up menu defaults to Alarm LED and Alarm Buzzer.

"**Send LCD-90 or USB-MSP Alarm Signal On-Off**" allows Aw-Radw's sophisticated alarm algorithm to activate the USB-MSP's alarm, overriding its internal RTS pin alarm. The menu option opens a pop-up menu with two options, namely "**Send LCD-90 or USB-MSP Alarm Signal with Aw-Radw's High Alarm**" and "**Send LCD-90 or USB-MSP Alarm Signal with Aw-Radw's Low Alarm**" They can be checked or un-checked by clicking on them. If either is checked, then, when Aw-Radw is using the USB-MSP as a real time data source, it will send a command to the USB-MSP telling it not to use its RTS pin alarm system to activate its RTS alarm, but rather, activate its alarm only when Aw-Radw sends it an alarm command i.e. when Aw-Radw enters an alarm state.

When both menu options are un-checked, or when Aw-Radw is not using the USB-MSP as real time data source, then the USB-MSP will default back to using its RTS pin alarm system.

"**Get Micro-Controller Info.**" Aw-Radw queries the USB-MSP for info. and prints the info. to Aw-Radw's main window.

"**Edit Micro-Controller ID**" Aw-Radw queries the USB-MSP for its current ID string and then presents it as default in an edit box, allowing user to change the ID string, then Aw-Radw sends the new string back to the USB-MSP. The ID string can be used to help identify which USB-MSP is connected to which COM port. The ID string can be up to 80 characters long.

"**Sync Time with PC's Time**" Aw-Radw sets USB-MSP's real time clock to the same value as the PC's Date-Time. (Note USB-MSP uses UNIX time code i.e. the number of seconds since Jan. 1st 1970).

"**LED Event and Clicker Settings**" opens a pop-up menu with options allowing control of how the USB-MSP flashes the Event LED, with each detection event. First select the desired options by clicking on them and then click "**Send Above Settings to Micro-Controller**" to send the desired options

"**Adjust MSP430 Clock Rate**" The USB-MSP includes an accurate quartz crystal real time clock which generates the timing pulses for the microcontroller. This menu item allows making very slight adjustments to the rate of the clock in increments of 1 part per 32,768 seconds (0.003%). A

value of 10 equals no clock adjustment. A value of 1 to 9 speeds up the clock with 1 equal to the fastest clock rate. A value of 11 to 20 slows down the clock with 20 equal to the slowest clock rate. For example if the USB-MSP clock is running slightly slow, try using a value of 9 instead of 10 tick adjustments.

When the Aw-Radw menu item "**Adjust MSP430 Clock Rate**" is clicked, Aw-Radw queries USB-MSP for its current TICK ADJUST number. Next Aw-Radw presents the TICK ADJUST number as default in an edit box, allowing user to change the number after-which Aw-Radw sends the new TICK ADJUST number to the USB-MSP. One can also make very small adjustments to the clock rate by directing the USB-MSP to use various crystal load capacitances. 14pf is the default. 18pf slightly slows down the clock rate and 10pf slightly speeds up the clock rate. Please note some very high efficient crystals generate very small signals with a small load capacitance and the MSP430 might not be able to detect the timing pulses from the crystal reliably. Therefore it is suggested to leave the crystal load capacitance at 14pf or 18pf and use the above menu item "TICK ADJUST" to speed up or slow down the clock.

USING USB-MSP WITH RADIATION MONITOR AS A REAL-TIME RADIATION DATA SOURCE FOR AW-RADW

When starting real-time rad collection using USB-MSP and radiation monitor as source, first Aw-Radw syncs the USB-MSP 's real time clock with the PC's clock. Next it sends to the USB-MSP the desired TBU (i.e. the TBU entered in Aw-Radw's menu item 'Rad Options' - 'TBU'). Next, every TBU the USB-MSP sends a time code, the counts from the latest TBU (up to a maximum of 4 Billion Counts per TBU) and a 16 bit CRC error detection.

Aw-Radw receives this information, checks that the time code is in the correct order, checks for correct CRC and then uses the count to calculate all the parameters as it normally would when connected directly to a radiation monitor i.e. Aw-Radw applies the calibration factor to the count, the dead time, calculates the auto-alarm data and activates any of the alarm options, and stores the data to the file(s).

If Aw-Radw detects an error in the time code, CRC or Windows communication error, it sends a NAK to the USB-MSP which causes the USB-MSP to repeat the packet. If this fails Aw-Radw stops the real-time radiation data collection.

Note that when using the USB-MSP as a real-time radiation data source, the USB-MSP 's crystal controlled real time clock is used to determine each TBU, not the PC's clock.

While the USB-MSP is being used as a real-time data source by Aw-Radw, all the other features of the USB-MSP are available i.e. it can be storing radiation data to its FLASH memory using the flash storage TBU, calculating the alarm pin and LED's value using its current calibration factor, dead time and running average depth.

CONTROLLING AND GATHERING DATA FROM THE USB-MSP IN ASCII FORMAT USING OTHER PROGRAMS OR ASCII DEVICES

To connect USB-MSP to LABVIEW and/or ASCII devices:

- [Connect LCD-90 Pro and USB-MSP to LABVIEW and/or ASCII devices](#)

For detailed info. about Sending and Receiving ASCII Data With Aware Electronics LCD-90 Pro and USB-MSP:

- [Sending and Receiving ASCII Data with LCD-90 Pro and USB-MSP](#)

To connect the USB-MSP to Android Smart-Phones and other Android Devices:

- [Using Aware Electronics Radiation Monitors with Android Smart-Phones and other Android Devices](#)

The USB-MSP will respond to any program that can send and receive characters over the USB's virtual COM port. The USB-MSP will respond with standard ASCII characters. Set the program's COM port to the USB-MSP's USB virtual COM port, and set 9600 Baud, 8 Data Bits, No Parity, 1 Stop Bit, No Flow Control.

If using the USB-MSP with operating systems other than Microsoft Windows, for example, on an Apple, Linux or Windows CE, first one must install the USB driver for the other operating system. See <http://www.ftdichip.com/Drivers/VCP.htm> for a list of drivers.

When sending command characters to the USB-MSP, it expects two characters, first a CTRL-G and then the command letter. The CTRL-G is included to help avoid noise etc. from triggering a command. The CTRL-G character can be typed on a PC's keyboard by holding down the CTRL key then tapping the G key then releasing the CTRL key. CTRL-G is known as the Bell Character. In C programming language, the CTRL-G Bell Character escape sequence is \a. i.e. to insert the Bell Character in a C string one includes \a. To copy a CTRL-G into a text file, open a command prompt or use the Run command and type "copy con mytext.txt (enter key) Ctrl-G Ctrl-Z".

When the USB-MSP receives one of the commands from the first set of the following command letters (the ones that need a follow-up string or number from the PC such that the new command is accepted by the USB-MSP), it first sends back a short description of the command followed by a string or number indicating its current condition. One responds to this with the new string or number.

The following descriptions of command letters the USB-MSP responds to should each be prefixed with a **CTRL-G**, for example **CTRL-G \$**

\$ sets the USB-MSP's ID string. USB-MSP first sends its current ID string. Send it the new ID string (followed by enter i.e. carriage return) and USB-MSP stores it in flash memory and then sends back the new ID string.

T sets USB-MSP's time. USB-MSP sends back current time (UNIX time code). Send it the new time code (enter), and USB-MSP sets and sends back the new time. One could copy and paste a UNIX time code from the internet. One could also set the USB-MSP time to UNIX time zero by setting a time code of zero.

C sets USB-MSP alarm and real-time ASCII data output calibration factor. USB-MSP sends back current CALB. Send new calb (enter) and USB-MSP sets, stores in flash and sends back new CALB.

Likewise follow the same procedure for the following:

E sets dead time in $1/1000^{\text{th}}$ of a microseconds for USB-MSP's alarm and real-time ASCII output.

V sets radiation units for alarm. 0=cps 1=cpm 2=microR 3=microSV 4=milliR 5=Total.

A sets alarm level.

L sets USB-MSP's alarm action with alarm condition and how the USB-MSP will flash the Event LED with each detection. A four byte number in ASCII format. (Note the following includes actions that only the LCD-90 will respond to. The USB-MSP will ignore these additional actions).

The bottom byte: 0 = No Alarm LED or Alarm output pin activation; 1 = Alarm LED and Alarm Output pin; 2 = Alarm Buzzer; 3 = Alarm LED, Alarm Output pin and Buzzer.

The second from bottom byte: 0 = No Alarm Vibrator; 1 = Alarm Vibrator.

The third from bottom byte: 0 = No Click; 1 = Short Click; 2 = Medium Click; 3 = Medium-Long Click; 4 = Long Click.

The top byte: 0 = No Event LED; 1 = Short Event LED; 2 = Long Event LED.

For example, for short event LED, medium-long click, no alarm vibrator, alarm LED and alarm buzzer, the ASCII number is 16,973,827 (hex 01030003).

. (the period character) sets LCD-90's decimal precision i.e. the number of digits to the right of the decimal point.

I sets running average depth in seconds for USB-MSP alarm and real-time ASCII output.

U sets real-time data UART output TBU (for binary data only)

K adjusts clock rate ticks. A two byte number in ASCII format.

The bottom byte: 0 to 20. 0 = the fastest, 10 (hex A) = no adjust and 20 (hex 14) = the slowest.

The top byte: 16 (hex 10) = 10pf; 32 (hex 20) = 14pf; 48 (hex 30) = 18pf crystal load.

For example, for no adjustment to clock rate and a crystal load of 18pf, the ASCII number is 12298 (hex number 300A).

F sets radiation data file Flash storage TBU.

The following do not need a follow-up number or character string and do not need a carriage return (Enter key) i.e. they act immediately:

[tells USB-MSP not to use its RTS pin alarm system to activate its alarm, but rather, only activate its RTS alarm when signaled to do so by the command letter '!' (see below). Note: This mode is automatically canceled when the USB-MSP exits ASCII real-time mode.

] cancels the above **[** i.e. tells USB-MSP to use its RTS pin alarm instead.

! character tells USB-MSP to activate its alarm.

, (comma character) tells USB-MSP to deactivate its alarm.

? USB-MSP returns information about its current condition.

+ Geiger click On and RI line in RS-232 is pulsed with each click.

- Geiger click off and RI line in RS-232 is not pulsed with each click.

ID string is returned

S starts radiation data file Flash store

X stops radiation data file Flash store

R erases radiation data file Flash memory

M to receive radiation data stored in flash with USB-MSP's calibration factor and deadtime correction applied and expressed in units with desired decimal precision, USB-MSP sends (assuming a ten second TBU for Flash Storage):

```
Start File 1
Units: MICROSV
Calb: 105.000
Dead Time: 121.000
Secs. Per pt.: 10
File Start Time: 1379559160      (Note time codes are UNIX type time)
1.086  MICROSV 1379559170      (Value TAB units TAB time code)
1.429  MICROSV 1379559180
0.914  MICROSV 1379559190
1.543  MICROSV 1379559200
1.200  MICROSV 1379559210
0.571  MICROSV 1379559220
Total Points: 6
End File 1
```

```
Start File 2
Units: MICROSV
Calb: 105.000
Dead Time: 121.000
Secs. Per pt.: 10
File Start Time: 1379559228
0.629  MICROSV 1379559238
1.143  MICROSV 1379559248
0.686  MICROSV 1379559258
0.457  MICROSV 1379559268
1.086  MICROSV 1379559278
0.914  MICROSV 1379559288
Total Points: 6
End File 2
```

A blank line separates each file and the download ends with CRLF.

D to receive radiation data stored in flash in the form of raw counts. USB-MSP sends (assuming 10 second TBU for Flash Storage):

```
Start File 1
Raw Count Mode
Secs. Per pt.: 10
File Start Time: 1207516030
4 1207516040
3 1207516050
```

```
6 1207516060
Total Points: 3
End File 1
```

A blank line separates each file and the download ends with CRLF.

The USB-MSP will send the above for each data file stored in flash. If there are no files it returns NO FILES.

Q toggles on-off the descriptions of the files i.e. the USB-MSP sends just the value-TAB-units-TAB-time code without the descriptions at the top and bottom of the file values. For use with the **M** or **D** as above, or **P** as below.

```
0.629  MICROSV 1379559238
1.143  MICROSV 1379559248
```

Z toggles on-off the units character string following the value.

J toggles on-off the time codes.

```
0.629  MICROSV
1.143  MICROSV
```

ESCAPE (Esc key) aborts download, real-time mode, and returns the **Q**, **Z** and **J** back to the default on.

P causes USB-MSP to immediately send the same floating point number that is being calculated for USB-MSP alarm followed by TAB units TAB time code, followed by carriage-return line-feed. The above **Z** and **J** apply. 1.143 MICROSV 1379559248

N causes USB-MSP to send the same floating point number that is being calculated for USB-MSP alarm, sent periodically according to the USB-MSP running average depth (real-time ASCII output). The above **Z** and **J** apply. 0.629 MICROSV 1379559238

For example to receive the USB-MSP's average value once per 60 seconds in the form of CPM (counts per minute), first use the **V** command above (or use Aw-Radw) to set the USB-MSP display units to CPM. Next use the **I** command (sets running average for alarm and real-time ASCII data as described above) to set the running average depth to 60 seconds and then send **N**. USB-MSP then begins sending the radiation data in the form of CPM (the 60 second running average CPM), followed by tab units tab time code followed by carriage-return line-feed.

The numbers received have the USB-MSP's dead-time correction applied unless set to zero. In the case of MicroR, MicroSV and MilliR display units, the USB-MSP's calibration factor is applied.

An example using Windows HyperTerminal program (Windows "Start" button – "All Programs" – "Accessories" – "Communications" – "HyperTerminal") or the free terminal programs Putty and Tera Term. Set the terminal program's COM port to the USB-MSP's virtual COM port and set 9600 Baud, 8 Data Bits, No Parity, 1 Stop Bit, No Flow Control.

Hold down Ctrl key and tap G key. Let go of Ctrl key then tap V key and USB-MSP sends back "UNITS X" where X indicates the radiation units. (0=cps 1=cpm 2=microR 3=microSV

4=milliR 5=Total). Type 2(enter) and USB-MSP sends back 2 to indicate it set the radiation units to microR.

Hold down Ctrl key and tap G key. Let go of Ctrl key then tap I key and USB-MSP sends back "Ave. Depth X" where X is the current running average depth. Type 60(enter) and USB-MSP sends back 60 to indicate it set the running average depth to 60 seconds.

Next hold down Ctrl key and tap G key. Let go of Ctrl key and tap N key then every sixty seconds USB-MSP sends the radiation level followed by a tab character followed by the UNIX time code followed by carriage-return line-feed. (Note UNIX time code is the number of seconds since Jan. 1st 1970).

As regards radiation unit Total, the ASCII data sent will be the incrementing total number of counts, starting at zero counts.

If you first set the USB-MSP's time to zero using the **T** command, the time codes in the above example will be sent starting from zero seconds.

To convert UNIX time code to Excel-Quattro-Lotus spreadsheet time code, one can use the formula: $+(X-18000)/86400+25569$ where X equals the UNIX time code.

One could use the conversion formula in a spreadsheet by importing the ASCII data such that column A contains the radiation values, column B contains the UNIX time code and column C contains the formula $+(B1-18000)/86400+25569$. Format column C to display as Date-Time format, then one could graph column A as Y-axis and column C as X-axis.

For examples of simple batch files to send commands to the USB-MSP, including syncing the USB-MSP's date-time to the PC's date-time, see the on disk file [command_batch_files.zip](http://www.aw-el.com/command_batch_files.zip) also found here: http://www.aw-el.com/command_batch_files.zip

Windows HyperTerminal program as-well-as the free terminal programs Putty and Tera Term, can save the received ASCII data to a file as it is received. Microsoft Excel can be set to auto load and auto refresh the same file that HyperTerminal is saving to. For information about using Excel to load and auto-refresh ASCII data see: <http://www.aw-el.com/excel.htm>

This diagram shows the USB-MSP's RJ-12 jack pins allowing one to wire any device with a pulse output to the USB-MSP:



(For the latest firmware updates, see http://www.aw-el.com/usb_msp_firm.htm)

Note Version V2.9A includes a + and a – labeled solder vias (holes) next to "BAT 4.5VDC", seen on the bottom of the board. To these holes one can solder leads from a triple cell AAA

battery box which then will continue to power the USB-MSP and the RM even when removing the USB-MSP from the USB port of the PC. (Poke holes in the plastic cover over the + - holes then solder the leads from the battery box) (Note three 1.5VDC batteries = 4.5VDC)

When power is being drawn from the USB port, an internal diode in the USB-MSP prevents voltage from feeding back to the batteries. When the USB port is then unplugged, power is drawn from the batteries.

A use could be as follows: Plug RM into USB-MSP and USB-MSP to PC's USB port.

Turn on the batteries (if battery box has a switch). Start collecting data to the USB-MSP's internal memory using Aw-Radw's menu items (which automatically sets the USB-MSP's time to the PC's time), or by-way-of the ASCII command sequence. Remove USB-MSP's USB cable. USB-MSP continues to power the RM, continues to store radiation data to its internal FLASH memory and continues to flash its LEDs with each detection and with alarm condition, drawing power from the batteries (less than 1 ma including power draw by the RM near background levels).

Carry the USB-MSP + RM to another location of interest, using a balloon, drone, your pocket, etc .

Return the USB-MSP to the PC, plug the USB-MSP into the PC's USB port, then download the collected data using Aw-Radw, or by-way-of the ASCII command sequence.

All collected data in the USB-MSP internal memory will remain even if the batteries are removed, until erased using Aw-Radw menu item or ASCII command sequence. Note one could use hook and loop (VELCRO) to attach battery box to the USB-MSP.

New Firmware Update V2.9A includes battery connection and isolation diode for running the USB-MSP + RM from batteries. See description near bottom of this file.

Firmware Update V2.6G, dated 09/15/2013 for ASCII output, adds user selectable precision floating point number with three digit decimal precision including automatic rounding. Allows, for example, an ASCII output in CPS or CPM running average with values incrementing in units of 1/1000th of a CPS or CPM, or, with a microR/hr or microSv/hr running average, in units of 1/1000th of a microR/hr or microSv/hr. The update also allows calibration factors in units of 1/1000th the previous version's factors and deadtime correction in units of 1/1000th of a microsecond versus one microsecond with the previous version.

ASCII input-output to any program capable of reading and writing ASCII data from a COM or USB port (for example Window's free Hyper-Terminal) has also been greatly improved, allowing real-time and flash memory download with deadtime and calibration factors applied, in any of the supported radiation units, as-well-as the three digit decimal precision. Even accepts ASCII commands as it is downloading ASCII data

V2.6G also adds a new feature that works in conjunction with a new feature added to the Aw-Radw Windows program, namely, "Send LCD-90 or USB-MSP Alarm Signal On-Off" allows Aw-Radw's sophisticated alarm algorithm to activate the USB-MSP's alarm, even over a wireless (radio) connection. The Aw-Radw menu option opens a pop-up menu with two options, namely "Send LCD-90 or USB-MSP Alarm Signal with Aw-Radw's High Alarm" and "Send LCD-90 or USB-MSP Alarm Signal with Aw-Radw's Low Alarm"

They can be checked or un-checked by clicking on them. If either are checked, then, when Aw-Radw is using the USB-MSP as a real time data source, it will send a command to the USB-MSP telling it not to use its internal alarm system to activate its alarm, but rather, activate its alarm only when Aw-Radw sends it an alarm command i.e. when Aw-Radw enters an alarm state. The alarm actions carried out by the USB-MSP depend upon the "Alarm's Action Settings"

V2.6G adds improved ASCII output options, including real time and memory data download options..

Please Note this is a preliminary manual with enough information to get started with the USB-MSP.

If you have any questions, no matter how small, feel free to contact us.

Phone: 800-729-5397 or Phone-Fax: +302 655-3800

E-mail Aware@aw-el.com

[Aware Electronics Corp. Website](#)