



Accu-Gold Excel Templates

version 8.01.0155

Quick-Start

Overview:

'Accu-Gold Excel Templates' is an Excel interface for Radcal's Accu-Gold measurement system. Microsoft Excel for Windows (2000 and later) is required, and the interface appears as an Excel add-in. A shortcut installed on your desktop opens a folder containing Accu-Gold templates, which are installed in the 'Program Files' folder under 'Radcal\AccuGoldExcelTemplates'.

This add-in is a variation of Accu-Gold Excel that is specifically aimed at generating and/or providing Excel templates that contain one or more sheets for recording data in a user-defined format. It is particularly useful for producing a user interface that is similar to that arising from XLPRO and earlier Radcal instruments. In order to avoid the confusion of switching between sheets and providing uninteresting information to the user, the sheets normally associated with Accu-Gold Excel are present but hidden without password protection. There is also a hidden sheet that controls the transfer of data from the hidden "Data" sheet to the user's template sheet.

Installation:

NOTE: Install Accu-Gold Excel *before* connecting the Accu-Gold digitizer to a USB port.

Plug the flash drive into an available USB port. (Because some USB keys are not polarized, your computer may not recognize the key; in that case rotate the key and plug it in again.) Double-click "Setup.exe". Follow the prompts to install Accu-Gold Excel Templates.

For some applications the flash drive may contain Excel templates from Radcal that implement measurements that are specific to this application. In that case manually copy them to any folder on your computer if you wish to use these templates.

Examples:

The sub-folder "Examples" contains Radcal-produced templates. To use them double-click on the associated ".xlt" file and follow the comments on the yellow cells. You can also edit the instructions and user entries on the template sheet as long as the data-entry cells do not change.

Supplied template stubs:

The supplied template stubs allow the user to construct his own templates by copying his existing sheet(s) into the stub as described below or by modifying the included simple template sheet. Some stubs are suitable for ion-chamber (10X6) measurements; others are for the multi-sensors (AGMS-D and AGMS-M) and the dose diode (DDX6). Choose the template that matches your measurement needs. The parameters used by the templates can also be changed to suit a particular application. Note that there is a stub in the mA folder that provides the same capabilities as the base stub, but includes input from the mA sensor (90M9 or 90M10).

Creating user templates:

If you plan to make repeated measurements using parameter values that differ from the defaults in the examples or wish to customize the data entries into the template worksheets, you will need to create your own template workbook. In order to do so, open a template stub that implements your sensor configuration, and unhide the “Configuration” and “Data” sheets. At this point you can make any needed changes in the parameters on the “Data” sheet that control operation. (See the Quick Start Manual for Accu-Gold Excel.) On opening, Excel renames the stub and gives it an “xls” extension; use *File, Save As*, to name your workbook and define its folder.

You can now either modify the “Template” sheet that was supplied as part of the stub or replace it with one or more existing sheets, with one of these sheets being the one that will receive all measured data. If the copied sheets contain Visual Basic macros, you must use the Visual Basic Editor to copy them into the new workbook. You must also be sure that any links between multiple copied sheets do not refer back to the original workbook from which they were copied.

Alternatively you can unhide the sheets “Configuration”, “Data”, “Parameters” and “kVcal” (if present) in the stub and copy them into your existing workbook. Then modify the “Configuration” sheet as below to connect the values on the “Data” sheet with your template sheet. After copying and modifying, hide all of these sheets. Also use the Visual Basic Editor to copy the macro code in “ThisWorkbook” and “Module1” (if used) for the stub into the macros of your workbook.

The data on the template are grouped into tests, with each test containing at least one exposure. The results from each exposure are placed at arbitrary columns along the same row, with the format remaining fixed for a given test and the rows advancing by one between exposures. The Accu-Gold will wait up to five minutes between exposures, allowing the modification of x-ray machine settings or sensor placement. The measurements for each test are initiated by pressing Control-Shift-R with the test’s first data cell selected after setting up the conditions for the test.

The “Configuration” sheet controls the transfer of measured data from the “Data” sheet, where Accu-Gold Excel normally places its results after each exposure, to the template sheet that displays the data from multiple tests and exposures. The first column under “Test No.” enumerates the tests; these values are for information only. The next two columns give the starting and ending rows on the template sheet for this test, followed by the number of values obtained from each exposure in this test. For each value five columns give in order the column of the data on the template sheet, the row of the source data on the “Data” sheet, the column of the source data on the “Data” sheet, and a scale factor, which amongst other things can convert seconds to milliseconds or minutes. The source data can be text like units, in which case the scale factor must be one. The number of these five-column sets must be at least as large as the value in column D of “Configuration”, and the first set gives the starting cell for the test. A negative value for the source column indicates that this output will become a real-time output.

In addition, Cell D1 on the “Configuration” sheet must contain the name of the template sheet for the data. Cells K1 and M1 give the row and column on the template for identification information regarding the Accu-Gold and its sensors; if any value is zero, this information is not transferred. Depending on the number of sensors being used, the identification can require up to five rows and columns. Cells O1 and Q1 give the row and column for the current date, with cells S1 and U1 giving them for the time. Again any value of zero will inhibit this transfer.

When the modification of “Configuration” is complete, hide this sheet as well as “Data”. Then close and save the file. If you want to convert your file to a template that remains unchanged after subsequent uses, modify its file extension in Windows Explorer from “xls” to “xlt”.

Using the templates:

Connect the digitizer to your computer using the USB cable. Attach your desired sensor(s), place them in the x-ray beam and open the relevant template. Excel macros must be enabled.

The starting cell for a test usually has a yellow background and is initially selected. When you have properly set the measuring conditions, execute Control-Shift-R to start Accu-Gold. When the selected cell turns green, make an exposure. After the exposure completes, the results appear in the selected cell, and the selection moves to the next row for this test. When that cell turns green, make its exposure. The selection continues to advance until you reach the last exposure for this test, at which time the selection moves to the first cell for the next test, and you must start this process over with Control-Shift-R. See the comments on the stub template sheets.

During the exposure, measured results are updated once per second and recorded in the blue-background area under "Real-Time Outputs" on the hidden "Data" sheet. The selected cell on the template can continuously show these values if the relayed source column on the "Configuration" sheet is negative. (Its absolute value will be used to find the actual source data; the negative value just flags a real-time output.) After the exposure is complete, the selected cell will then show the results for positive source columns. If the exposure overloads the output for a relevant sensor, you will see the error message: "Runtime errors in Analyze cause an early exit".

Control-Shift-C clears the digitizer's USB connection, causes recognition of sensor or parameter changes, and selects the first cell of the first test. Except for chambers, it is needed to recognize sensor changes.

Software updates:

If you execute Control-Shift-U, Radcal's website will be queried to determine if your software is the newest version. If it is not, you will be given the option to follow a link to the web page where an update is available. Access to this page depends on your specific Accu-Gold digitizer. This correspondence is established automatically when you execute Control-Shift-R for the first time with a given template and digitizer. Saving the file also saves the digitizer specifics.

Auto-Activation:

The macros that interface with the Accu-Gold are contained in the file AccuGoldExcel801.xls. This file is stored in the Windows System folder and is accessible from anywhere on your computer. When the operational file is opened, macros as a part of it open the macro file and run it to establish communication with the Accu-Gold. If the operational file has been moved to different computer where the macro file is no longer available, you will see an error message when the file opens. To avoid this error message when the operational file has been moved after data accumulation is complete, you will be asked at the time of closing of the operational file with the macro file still present if you want to keep the auto-activation feature. If you no longer wish to add Accu-Gold data to this workbook, answer "No". Then subsequent openings of this file will not generate the error message or run the macro file. If you change your mind and want to use Accu-Gold again with this workbook, open it and then open the macro file in Excel; the macros will automatically re-activate.

The supplied template stubs and their description are as follows:

AccuGold-AGMS.xlt\AccuGold-AGMSmA.xlt /AccuGold-AGMS-Dental.xlt

Multi Sensor (AGMS) only; full bandwidth; narrow pulses.

Threshold for determining start of measurement = 5 ppm of full-scale¹; except 10 ppm for dental.

Used for low-level signals.² Dental (Type Code 1) eliminates the pre-heat region, if present, for exposure-width, pulse-count, dose-rate and kVp measurements.

AccuGold-LowDoseAGMS.xlt\AccuGold-LowDoseAGMSmA.xlt

This file has a very-low trigger level (0.42 ppm FS) and will measure dose rates down to about 150 nGy/s with a minimum total dose of about 150 nGy using the diagnostic sensor.

To avoid noise triggers, the filter time constant for the start trigger is set to 36 ms. This file may not trigger properly with very-narrow pulses. In that case use AccuGold-AGMS.xlt, which has a trigger threshold that is 12-times larger and an 0.8-ms filter.

AccuGold-DoseDiode.xlt\AccuGold-DoseDiodeMA.xlt

Dose Diode (DDX6) only; full bandwidth; wider pulses; 30-ms start-trigger time constant.

Threshold for determining start of measurement = 5 ppm of full-scale (FS)

Used for low-level signals.

AccuGold-Chamber.xlt\AccuGold-ChamberMA.xlt

Ion chamber only with no rise-time correction³; wider pulses.

Threshold for determining start of measurement = 5 ppm of full-scale (FS) or set by user in C54 to reduce false triggers. Used for low-level signals.

AccuGold-ChamberAGMS.xlt\AccuGold-ChamberAGMSmA.xlt

AGMS trigger threshold of 5 ppm FS plus ion chamber with rise-time correction; OK for narrow pulses; 0.8-ms start-threshold time constant.

AccuGold-DiodeAGMS.xlt\AccuGold-DiodeAGMSmA.xlt

AGMS trigger threshold of 5 ppm FS; OK for narrow pulses; 0.8-ms start-threshold time constant.

AccuGold-AutoChamberDose.xlt\AccuGold-AutoChamberDoseMA.xlt

Trigger threshold of 100 ppm FS or set by user in cell C54 to reduce false triggers; chamber rise-time correction; narrow pulses OK; 1.4-ms start-threshold time constant; larger signals.

AccuGold-AutoDiodeDose.xlt\AccuGold-AutoDiodeDoseMA.xlt

Trigger threshold of 25 ppm FS; narrow pulses OK; 0.6-ms start-threshold time constant; used for larger signals.

AccuGold-General.xlt

Full Excel interface; complicated and not recommended for the average user. Trigger from Multi Sensor with 100 ppm FS threshold. Full bandwidth; chamber rise-time corrected; OK for narrow pulses; 0.8-ms start-threshold time constant; larger signals.

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Full-scale (FS) refers to the dynamic range of the sensor. See the sensor specifications.

NOTE: When measuring low-level signals, electrical interference can be important. Portable computers that are isolated from earth ground, such as those with rechargeable-battery power supplies, are susceptible to noise pickup from power-line sources. In that case, the computer should be earth-grounded using a Radcal-supplied grounding cable.

The chamber electrometer has a 28-ms 1/e rise-time. Compensation controlled by cells C36:C37 reduces it below 1 ms, which will render fast pulses while including added noise.

Using the light meter (Type Code 2) ----

The special template **AccuGold-LightMeter.xlt** supports operation with the light meter, which must be plugged into the auxiliary input to the digitizer. The base unit of the light meter contains a photo-diode that can be exposed to ambient light through an optical filter, which simulates the spectral response of the human eye, in order to measure illuminance in lx. An adapter with a 1:1 relay lens can be screwed onto the base unit above the photo-diode for the measurement of luminance in cd/m^2 through an aperture with a 10-mm diameter. Whenever Control-Shift-R is executed, the existence of the adapter is queried, and the right units are automatically selected.

A normally-open push-button switch in the light-meter base unit causes its output to fall to the zero level even while exposed to light, and this state is present during the zeroing modes. In order to make a measurement, depress the push-button to close the switch when the Measure cell turns green and observe the real-time 'Aux Rate' output. Then adjust the placement of the meter such that it is located where you desire to measure the luminance or the illuminance. When you are at the proper location and the reading steadies, release the push-button. The resulting sudden drop in the auxiliary output then causes the template to record the last real-time output whose signals, after stop-threshold filtering, continuously exceed the adaptive stop threshold. (The light-meter template uses a special three-block [0.6-s] update rate for the real-time outputs.) This procedure may be repeated many times as re-triggers extend the measurement, resulting in many recorded values in cell E51 and below that also appear in subsequent columns on a single row on the 'Record' sheet with the proper units in the last column. (See 'Making repeated measurements'.) The measuring mode ends when the output remains below its re-trigger threshold for 30 blocks or 6 s; changing the value in cell C32 varies this number. The default start threshold is 0.0001% of full scale or about 0.05 in light units, but, if cell C54 is not blank, its value sets this threshold, which can be raised to avoid false triggers unless low light levels are being measured.

Using the personal-dose calibrator (PDC) (Type Code 3) ----

The PDC has two outputs, one of which must be plugged into the ion-chamber input of the digitizer and the other into the auxiliary input using the supplied cables. Then the special template **AccuGold-PDC.xlt** supports the measurement of dose-area product (DAP) and its rate in radiation per minute. In most other aspects this template is similar to **AccuGold-Chamber.xlt**.

Adding Visual Basic code to modify the "Data" sheet based on the test being run ----

The template stub called **AccuGold-Chamber-Programmed.xlt** illustrates how to add Visual Basic code to change operating conditions based on the test number. In this case the code causes the second test to enter the dose-accumulate mode and continuously sum the dose until Escape is pressed or the measure mode times out. The code is placed in Module1 and is tied to the key CONTROL-SHIFT-R. Looking at the selected cell on the template defines the test number, and, when test two is found, the value of "Max refine blocks" on "Data" is changed to zero. The measurement is then run, and, after it completes, the number of refine blocks is returned to its original value of 1500.

Common Error Messages:

Cannot find AccuGoldExcel801.xls:

The macros did not load because the security settings prevented it. See 'Enable Macros.pdf' in the Manuals folder.

The macro file with its path and name does not exist:

The indicated file is not in the Windows System folder with the indicated path.

Driver failed to open:

Windows did not load the driver, probably because the digitizer is not connected. C3 turns rose.

Driver not found:

The drivers were not installed during setup. The color of cell C3 turns rose. Call tech support.

A relevant sensor was not found:

A sensor that was needed for this template was not connected.

A relevant zero value is out of range:

The zero value that is measured is outside of its specified limits. Possibly the sensor was exposed to radiation during this interval, or it is defective.

Insufficient dose signal:

The width of the waveform that is specified in cells C40 and C41 is too small. Change these values to include more of the waveform or increase the width of the exposure pulse. Triggering from a brief noise transient can also cause this error.

Insufficient kV signal:

The width of the waveform that is specified in cells C42 and C43 is too small. Change these values to include more of the waveform or increase the width of the exposure pulse. Triggering from a brief noise transient can also cause this error.

Insufficient valid points for FFT kVp:

The width of the waveform that is specified in cells C42 and C43 is too small for a valid kVp output. Change these values to include more of the waveform or increase the width and/or the intensity of the exposure pulse. Triggering from a brief noise transient can also cause this error. The selected part of the waveform can be too narrow or too small for a valid kVp measurement but still wide enough and large enough to measure average kV and dose.

Post analysis requires stored data from digitizer:

The change in parameters cannot be applied to the current data. Make a new measurement.

The exposure was made too soon:

An insufficient number of blocks was accumulated in Zero Initialize and Zero Refine to fill the zero buffer. Wait until the selected cell turns green before making an exposure.

A light meter is not connected:

The light-meter template is being used without connecting the light meter to the auxiliary input of the digitizer.

A PDC is not connected:

The PDC template is being used without connecting the PDC to the auxiliary input of the digitizer.

Additional notes and details referring to cells on the “Data” sheet:

The Mammo Multi-Sensor (AGMS-M) is calibrated for Lorad/Hologic Mo/Mo and Mo/Rh; GE DMR Mo/Mo, Mo/Rh and Rh/Rh; and Selenia W/Rh, W/Ag and W/Al. The compression paddle is assumed to be used.

In order to accumulate dose for very-low dose rates, enter zero in cell C20. Accu-Gold will begin accumulating dose almost immediately after zeroing is complete. It will continue to accumulate until you press escape or the time defined by the value in C22 times 0.2 seconds has passed in Measure; kV and filtration are not measured. Use this Dose-Accumulate Mode with the AccuGold-Chamber, AccuGold-DoseDiode and AccuGold-AGMS templates. This mode is not available with the AGMS-M.

One use of the regions of interest is to exclude distorted outputs at the leading and trailing edges of the exposure waveforms. A typical value of 5 ms on both edges has often been used as the default, but you may change these values. Other potential exclusions are the pre-heat region for dental x-ray machines and scout pulses for mammo machines. The template ‘AccuGold-AGMS-Dental.xlt’ provides an automatic setting of the AGMS region of interest to exclude any detected pre-heat region in the measurement of width, number of pulses, dose rate and kVp.

The absolute value of the entry in cell C32 determines the number of 0.2-s blocks in the zero interval after the signal falls below its stop threshold. If this value is positive, a signal above a start threshold during this interval will re-trigger the measurement, which continues until the signal once again falls below the stop threshold, after which the zero interval with a possible re-trigger repeats. The default value of 5 allows a 1-s period for re-starting the measurement after the end of a scout pulse or in pulsed fluoro. If one second is insufficient, increase the value in C32. Negative values inhibit the re-trigger process. The ‘Pulses’ output in E28 gives the number of triggers and re-triggers.

The exposure width between the start and stop triggers is found in cell E13 and is called ‘Trig. Width’, whereas the values in cells J3 and P3 represent the exposure width in the selected regions of interest. The ‘RT Width’ in cell E14 gives the time that the Real-Time Outputs were active from the beginning of the block containing the start trigger until the end of the last block including the trailing-zero interval; it is always an integral multiple of the 0.2-s block width. This interval is used for the entire-exposure (Real-Time) outputs, except for mAs in E21 that uses the trigger width.

For the Multi-Sensor (AGMS), cell E26 shows the total dose in the entire exposure, whereas the dose rate in P9, the dose per mAs in P10 and the dose per pulse in P11 refer to the selected region of interest. This region also defines the kV and HVL, as well as the pulse rate derived from the kV waveform.

Similarly, cell E17 gives the total dose for the dose diode and cell E19 provides the same for the ion chamber. The values in columns J and M refer to the region of interest defined by cells C40 and C41 for the diode, ion chamber and mA probe.

For a negative value in cell C39 the data for the waveforms are passed through a low-pass filter and then averaged before being decimated for display. The absolute value in C39 specifies the half-power (-3-dB) bandwidth. The averaging filter has notches at integrally-related frequencies above its half-power cut-off, and for the proper specification of the cut-off they can be used to reject pick-up at line frequencies. Specify a 18.6-Hz cut-off to reject 60 Hz and 15.56 Hz to reject 50 Hz at the first notch. Positive values specify the maximum number of points in the waveform and control averaging followed by decimation.

Whenever an ion chamber is relevant and the digitizer is first plugged into the USB and Control-Shift-R is then executed, a message indicating that the chamber zero is out of range may appear; respond by clicking OK. After a few such messages, a 60-s delay should start, during which the chamber and its bias should stabilize. During this stabilization period the status bar and the value in cell G3 show the remaining time in the period. If you are not interested in low-level measurements, you can shorten this

period by pressing Escape. This delay also appears if the chamber is changed. Whenever Control-Shift-R is executed, the chamber type and serial number, as well as its temperature and pressure, are updated.

The 10A96 adapter to 10X5 chambers is supported. If the adapter is used, the chamber serial number in cell F40 becomes 10A96. If no chamber is plugged into the adapter, the missing-relevant-sensor error message appears, and the chamber volume in F41 becomes "Chamber ID Error".