SPECTRUM TECHNIQUES

STU
ST365 Webpage Control

User Manual

February 4, 2022

IMPORTANT NOTE

The ST365 Webpage Control application is included as a part of each Spectrum Techniques ST365 hardware device. In order to access this application it is necessary that the ST365 device be LAN-connected to your network. With the device powered on you may use a computer, smart phone, or tablet that is connected to the same network to open a Chrome browser window. From within this browser window you navigate to the URL for the given ST365 device. Click the menu item labeled "ST365 Webpage" to launch the control application.

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Contents

Introduction

The purpose of this guide is to help you learn to use the ST365 Webpage application with your Spectrum Techniques hardware device. The ST365 webpage allows the user to copy data to your device's clipboard and to use features described in the *Using Your ST365 Device* section found later in this document. The webpage is located on a web server that resides within your ST365 device.

System Setup

Connect a detector probe to your ST365 device. Note that each ST365 device has connector jacks on the back of the box for connecting to Geiger-Mueller and Scintillator detectors. Connect the detector you have available to the appropriate jack on your device. You should follow the procedure outlined in the *ST365 Spectrum Techniques* setup manual when doing this.

Accessing the ST365 Webpage

The following discussion assumes that your ST365 device is already LAN-connected to your network and the device is powered on. Further, this discussion assumes that you already know the IP address of your ST365 device on your network. If you do not already know your ST365 device's IP address, then you can use the Texas Instruments software utility called *Finder.exe* to find it. This utility will help you find the IP address your ST365 device and all other ST365 device's on your LAN.

Using a computer, smart phone, or tablet that is connected to the same network as your ST365 device open a Chrome browser window. From within the browser address bar enter the IP address of your ST365 device. Doing this causes the browser window to display the following page.

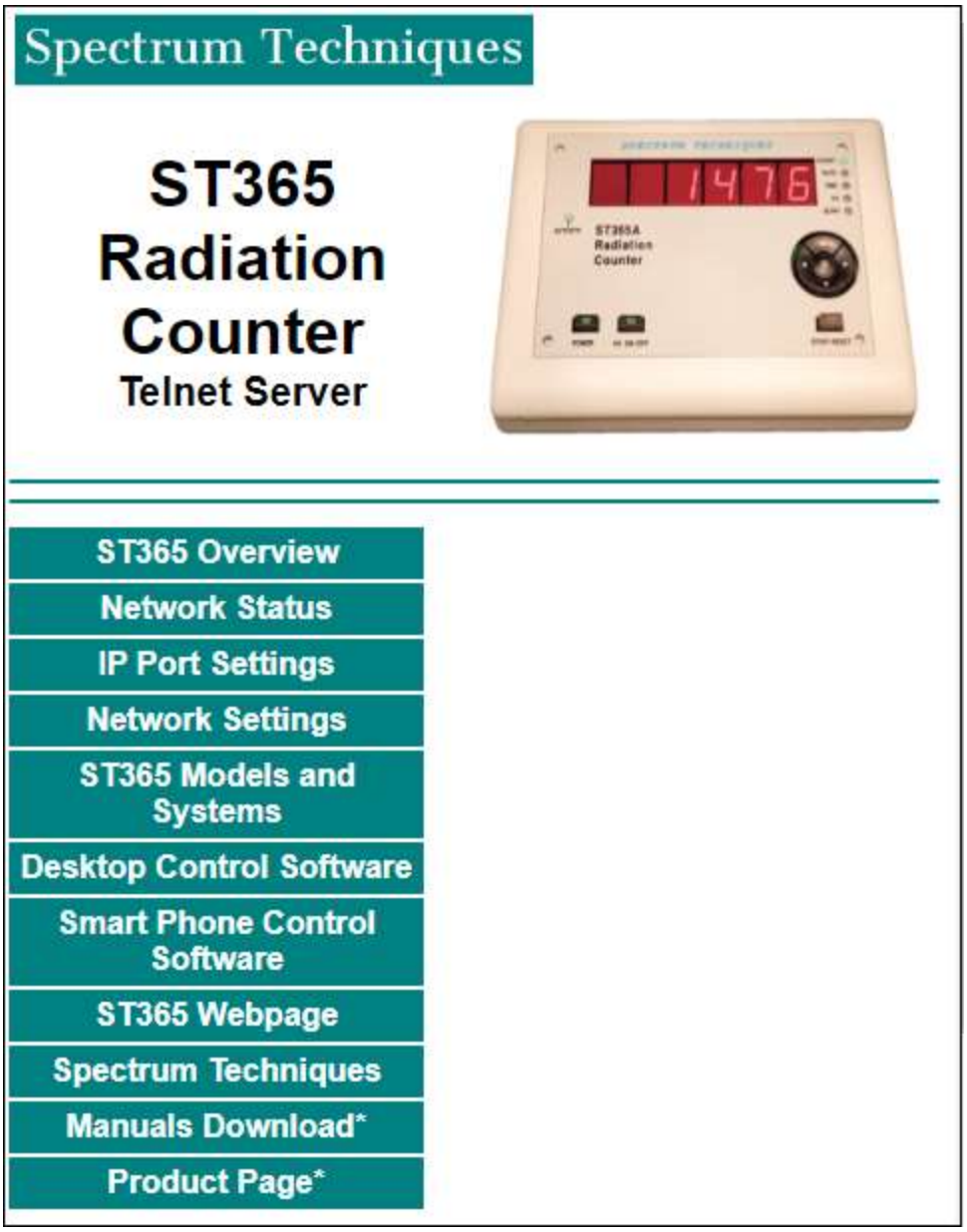


Figure 1

The webpage you see is hosted by a web server located inside your ST365 device. The menu buttons displayed in green are used to access various features of the device.

Click the menu button labeled *ST365 Webpage*. After a moment a new browser window appears that looks like this:

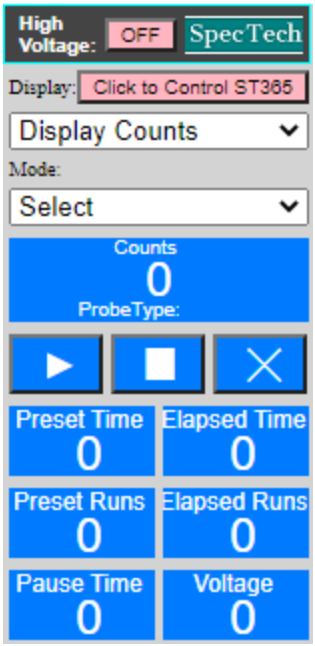


Figure 2

ST365 Home Page

Figure 2 shows the ST365 home page. This is your starting point for controlling your ST365 device through the web server. This is how the page initially looks each time you access the device. Note that the page is oriented vertically. This is so as to accommodate how users normally hold a smart phone when using their phone.

Note in Figure 2 that there is a red button labeled *Click to Control ST365*. This document refers to this as the control button. This button is always visible regardless of what operation you perform within the webpage. As long as the control button contains the label *Click to Control ST365* you do not have control of the ST365 device. The device will ignore any commands you attempt to send to it. Occasionally, you might find that the device quits responding to your commands. This could happen because someone else has acquired control of the device while you were still using it. When this happens the next command button you click will cause this message to appear:

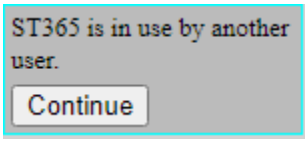


Figure 3

This message tells you that someone has used another browser window to take control of the same ST365 device that you have been using and that you no longer have control of the device. The only option you have at this point is to click the *Continue* button. Doing this takes you back to the webpage shown in Figure 2 above. Notice that the control button now says *Click to Control ST365*.

This method of acquire-and-release exists in your ST365 LAN-connected device because of the possibility that another user might go to its internal webpage and attempt to control the device at the same time you are using it. To prevent two users from having control of the same device at

the same time the web server uses a lockout mechanism that assures that only one user may control a given ST365 device at a time.

To take control of the ST365 device click the control button. Assuming the device is not already in use the control button will turn green and its label will update to say *Click to Release ST365*. In the case where someone else is currently controlling the device the control button will instead turn yellow and its label will update to say *Locked by another user. Continue?* If you click the control button again the web server will disconnect the other user and give you control of the ST365 device. The control button within your browser window turns green and its label updates to say *Click to Release ST365*. As a courtesy to others you should take control of an ST365 device only after you have assured that the device is not in use by someone else. There is no technical way to prevent a user from taking control of an already-in-use ST365 device.

When you first gain control of the ST365 device the home page updates to look like this:

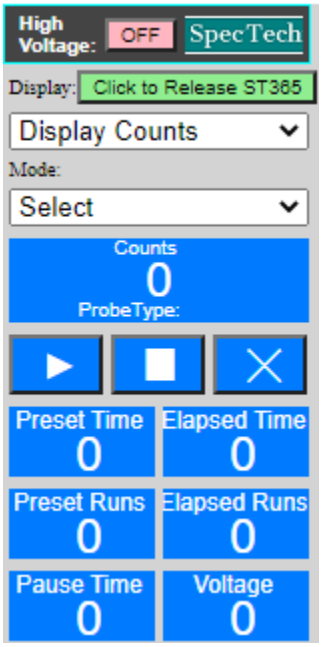


Figure 4

When you are finished controlling the ST365 device you should click the control button again. Doing this notifies the web server that the device has been released from use and is now available for the next user to acquire control of the device and to begin using it. The control button updates to say *Click to Control ST365.* This indicates that the ST365 device is ready for someone else to take control of it and to begin using it.

USING YOUR ST365 DEVICE

The ST365 home page is comprised of five pushbuttons and two dropdown menus. The control button is used to acquire and release control of the ST365 device. The function of this button was described previously in this manual in the section entitled *ST365 Home Page*. The following discussion assumes that the user has used the control button to acquire control of their ST365 device and that the web server is now displaying its home page.

Along the top row of the webpage is a button that says *OFF*. This is the high voltage button and is used to toggle the high voltage on and off. Click this button once to turn the ST365 device voltage on. The button now says *ON*. Click it once again to turn the ST365 device voltage off. Notice that when the high voltage is off the button says *OFF* and is colored red. When the high voltage is on the button says *ON* and is colored green. There is a physical button labeled *HV ON/OFF* located on the ST365 device. See Figure 5 for location of *HV ON/OFF* button circled in red.

Figure 5

The LED on this button will light up in green when the user toggles the high voltage button on within the webpage. The LED on this button will go dark when the user toggles the high voltage button off within the webpage.

Immediately below the control button is a *Display* dropdown menu. See Figure 6.

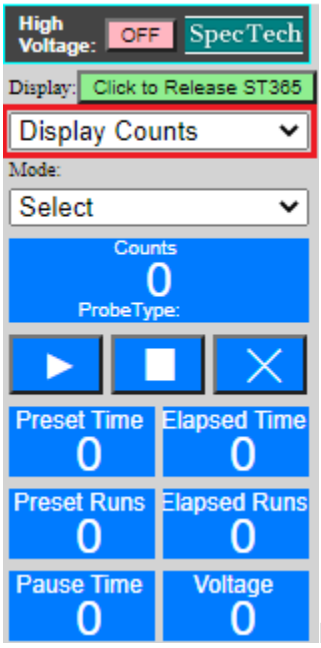


Figure 6

This menu allows the user to select from one of seven display options for the device. These options are:

- Counts
- Counts per Second
- Counts per Minute

- Elapsed Time
- High Voltage
- Probe Type GM Tube
- Probe Type Scintillator

Select any one of these seven display options to cause the information displayed in the Display window to change. Initially, the text shown at the top of this window says *Counts*. However, the user may change this to say Counts / Second, Counts / Minute, Elapsed Time, or High Voltage. The number shown immediately below this text is the value of the selected display option. Initially, the text shown at the bottom of this window says *Probe Type:*. However, the user may change this to say *Probe Type: GM Tube* or *Probe Type: Scintillator*. Setting the probe type in this manner instructs the ST365 device to use the corresponding jack on the back of the device when acquiring count data from an attached probe.

Immediately below the *Display* dropdown menu is the *Mode* dropdown menu. See Figure 7.

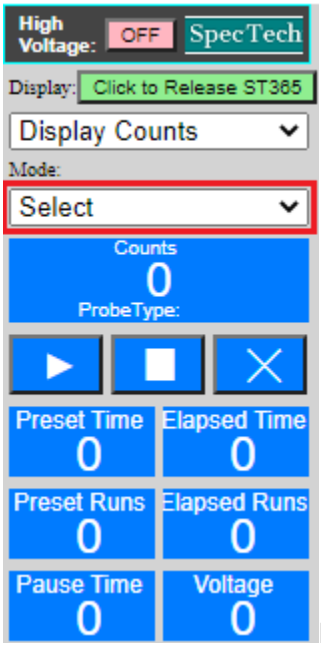


Figure 7

This menu allows the user to select from one of nine mode options for the device. These options are:

- Home
- Plateau Experiment
- Half-Life Experiment
- Set Preset Time
- Set Preset Runs
- Set Pause Time
- Set High Voltage

- Data Table
- Data Graph

Select any one of these nine mode options to initiate a mode change for your ST365 device.

Approximately midway down the webpage is a horizontal blue bar that extends the entire width of the webpage. This is the *Display* window for the page. See Figure 8 for the location of the *Display* window outlined in red.

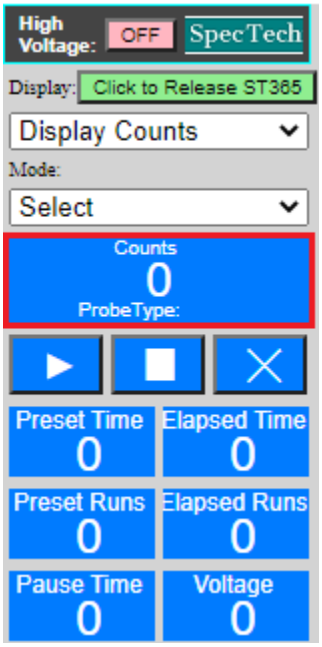


Figure 8

Immediately below the Display window is a row of three pushbuttons. See Figure 9.

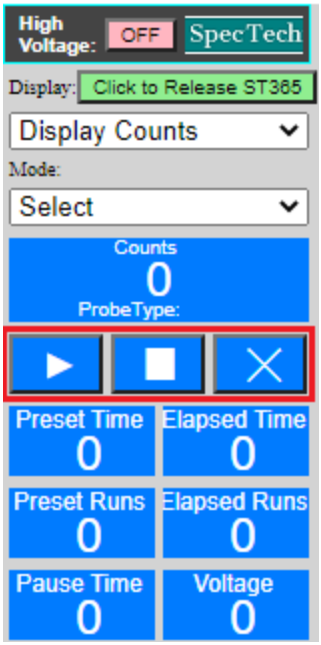


Figure 9

These are the *Start Counts* button, the *Stop Counts* button, and the *Clear Counts* button. The *Start Counts* button is shown in Figure 10.

 Figure 10

Click the *Start Counts* button to instruct the ST365 device to begin counting.

The *Stop Counts* button is shown in Figure 11.

 Figure 11

Click the Stop button to instruct the ST365 device to stop counting.

The *Clear Counts* button is shown in Figure 12.

 Figure 12

Click the *Clear Counts* button to reset the counts and the elapsed time to zero (0) as shown in the *Display* and *Elapsed Time* windows.

Immediately below this row is a 3 x 2 grid of blue boxes. See Figure 13.

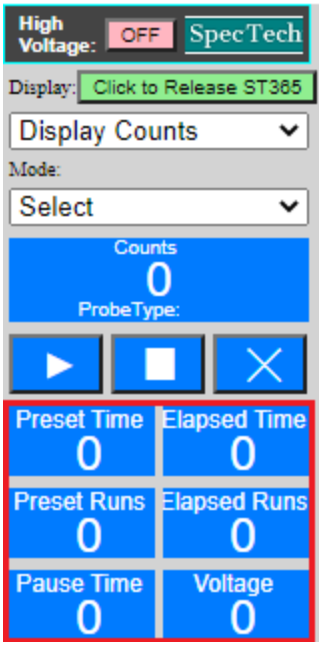


Figure 13

Taken together these six boxes show the current parameter settings for your ST365 device. As you interact with your device the parameters displayed here may change depending on the operation you are performing with your ST365 device.

Assigning Parameter Values

There are seven parameters available for assignment by the user. These are:

- Preset Time
- Preset Runs
- Pause Time
- High Voltage
- Start Voltage
- End Voltage
- Step Voltage

The settings for these parameters determine how your ST365 device behaves when it executes one of three possible counting commands. These commands are named Counts, Plateau Experiment, and Half-Life Experiment. Not all of these commands use all seven parameters when executing a command. The following discussion describes each of these commands in detail and discusses which parameters are used by each command.

Counts Command

The Counts Command is the simplest of the three commands. There are four parameters used by this command and that control how it operates. They are:

- Preset Time
- Preset Runs
- Pause Time
- High Voltage

The *Preset Time* parameter determines the amount of time (in seconds) that the ST365 device spends counting in order to obtain a counts result. If you leave this parameter set to zero, then the device will continue counting until you tell it to stop.

The Preset Runs parameter determines the number of times that the ST365 device counts starting at zero up to the preset time. If you leave this parameter set to zero or set to one, then when you start counts the device will only count for preset time seconds and then stop. If you set this parameter to the value of two or larger, then when you start counts the device will count multiple times in a row based on the preset time and preset runs that you specified.

The *Pause Time* parameter determines the amount of time (in seconds) that the ST365 device waits before starting another run. This parameter applies when the *Preset Runs* parameter is set to a value of two or larger. If you leave *Pause Time* set to zero, then there will be no time delay between runs. Setting *Pause Time* to a non-zero value is useful when you have the device configured for several preset runs and your want to see what the counts are at the end of each run before the next run starts.

The *High Voltage* parameter determines the voltage for the selected probe; either Geiger-Muller or Scintillator. When you set this parameter the voltage change takes place immediately; it does not wait for you to begin counts for the voltage to get assigned. Note that the voltage gets applied to the probe only if the High Voltage button is set to ON and is colored green. While the High Voltage button is set to OFF there is no voltage applied to the probe.

Once you have these four parameters set you should specify the probe type for the probe you have connected to your ST365 device. Make sure you have only one probe physically connected to the back of your ST365 device before you run a counts command. Do not have both a GM tube and a scintillator probe connected to the device at the same time. This assures that the device receives counts from only one source while a counts command is in progress. To specify which probe is used click the Display dropdown menu and observe that there are menu options *Probe Type GM Tube* and *Probe Type Scintillator* located at the bottom of the menu. Select the option that applies for the probe you have connected to your device. Confirm that the probe type you selected now displays within the Display window. After confirming that you have the correct probe selected be sure to click the Display dropdown menu again and select Display Counts. This step is needed in order to display the number of counts during execution of a counts command.

At the top of the window notice that high voltage is turned OFF. Click the OFF button to turn on the high voltage. After you do this the button will update to look like this:

Figure 14

The HV ON/OFF button on the ST365 device lights up confirming that high voltage is now on.

You are now ready to start counting with your ST365 device. To execute a counts command click the *Start Counts* button. Assuming you have a probe connected to the device and that you have an active isotope sample located under the probe you should see counts begin to appear within the display window on the ST365 device and on the Display window within your web browser. If counts do not appear from the beginning, then this is likely because the voltage simply is not high enough for the probe to be able to generate counts. For the duration of the

counts the parameters section on the web page will update to show the current status of the counts. The Counts command remains active until the specified number of runs has fully elapsed and counting has completed.

Plateau Experiment Command

The correct operating voltage for a Geiger-Mueller tube or a scintillator probe may be determined experimentally using a long-lived radioactive source such as Cs-137 or Co-60. The plateau experiment consists of repeatedly running counts of a fixed length of time while the high voltage gets increased by a constant step amount between each run. The resulting graph of count vs. runs can be examined to determine the optimum voltage to set for the detector attached to the ST365 device.

The Plateau Experiment Command is useful for finding the optimum high voltage value for a particular isotope sample located under the probe that is connected to an ST365 device. This optimum voltage is typically found within a narrow voltage range where for each run the number of counts remains relatively constant for the voltages used when executing a counts command. To assist the user in locating this optimum voltage the plateau experiment includes an on-screen data graph and data table. Once a plateau experiment has completed the user may inspect the data graph and data table so as to locate the optimum voltage for the given isotope sample used.

There are four parameters used by the plateau experiment and that control how it operates. They are:

- Start Voltage
- End Voltage
- Step Voltage
- Preset Time

The *Start Voltage* parameter determines the voltage the ST365 device is set to at the start of the plateau experiment. When you set this parameter the voltage change takes place immediately; it does not wait for you to begin counts for the voltage to get assigned. Note that the voltage gets applied to the probe only if the High Voltage button is set to ON and is colored green. While the High Voltage button is set to OFF there is no voltage applied to the probe.

The *End Voltage* parameter determines the voltage the ST365 device is set to at the end of the plateau experiment. During the experiment it is used by the device to decide whether to increase the voltage and perform another run.

The Step Voltage parameter determines the voltage increment that gets added to the high voltage in the device before performing another counting run. The experiment will continue making counting runs until it has performed a run at the end voltage.

The *Preset Time* parameter determines the amount of time (in seconds) that the ST365 device spends counting in order to obtain a counts result. If you leave this parameter set to zero, then the device will continue counting until you tell it to stop.

Plateau Experiment Setup

Before setting up a plateau experiment make sure you have only one probe physically connected to a jack on the back of the ST365 device. Do not have both a GM tube and a

scintillator probe connected to the device at the same time. This assures that the device receives counts from only one source during a plateau experiment. To specify which probe is used click the Display dropdown menu and observe that there are menu options *Probe Type GM Tube* and *Probe Type Scintillator* located at the bottom of the menu. Select the option that applies for the probe you have connected to your device. Confirm that the probe type you selected now displays within the Display window. After confirming that you have the correct probe selected be sure to click the Display dropdown menu again and select Display Counts. This step is needed in order to display the number of counts during execution of a plateau experiment. Typically, a plateau experiment gets performed using a GM tube but a scintillator probe may be used instead.

The standard operating voltage for a GM tube is usually between 800 to 1200 volts. If the manufacturer's recommended operating voltage is not known, the correct operating voltage may be determined experimentally using a radioactive source such as Cs-137 in the GM tube when running an experiment.

A properly functioning GM tube will exhibit a "plateau" effect, where the counting rate remains nearly constant even while the high voltage is incremented from one run to the next. A plateau curve is generated by using the same preset time to count activity from a source for several runs, while increasing the high voltage by some constant amount between runs. The procedure below describes this process in detail.

Click the Mode dropdown menu and select the option *Plateau Experiment*. Doing this takes you to a page that lets you set four plateau experiment parameters. See Figure 15.

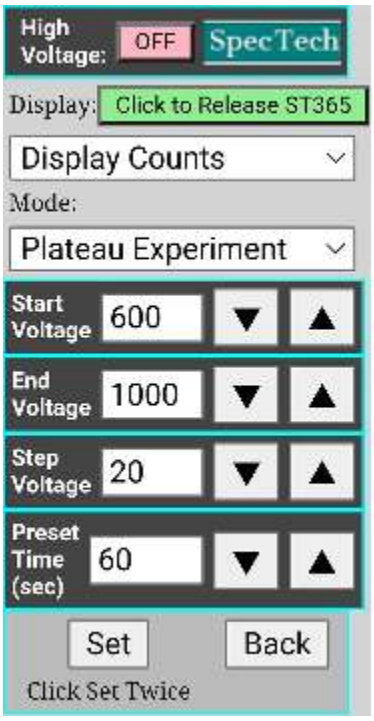


Figure 15

From here you may either type in the values you want to use or you may click the up or down arrow buttons to increment or decrement the parameter settings until each matches the value that you want. This example shows a typical plateau experiment setup where the start voltage

is 600 volts and the end voltage is 1000 volts. The voltage will step up 20 volts between runs and each run will last for a preset time of 60 seconds. All the collected data will be recorded in a data table for later inspection and evaluation.

Once you have all four parameters set the way you want click the *Set* button located at the bottom of the page. The *Set* button turns green to let you know that you have clicked the button. Click the *Set* button a second time in order to assure that the device has accepted the new parameter values.

Plateau Experiment

Once you are satisfied with the parameter settings, click the *Back* button. Doing this takes you to a page that looks like Figure 16.

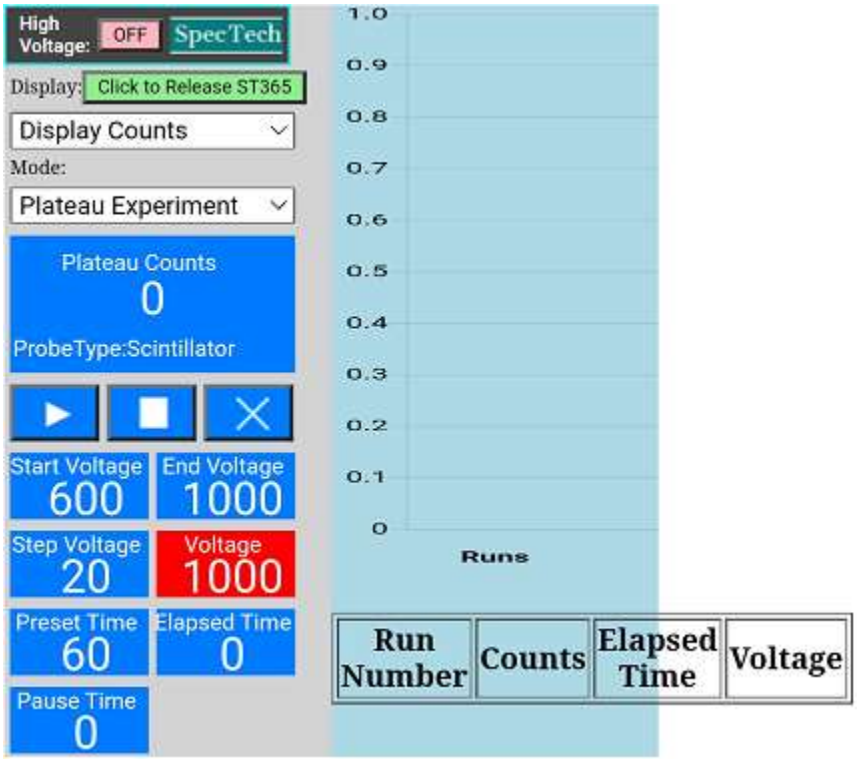


Figure 16

The parameters that you entered are shown in blue boxes on the left-hand side of the page. At the top of the window notice that the high voltage is turned OFF. Click the OFF button to turn on the high voltage. After you do this the button updates to look like this:

Figure 17

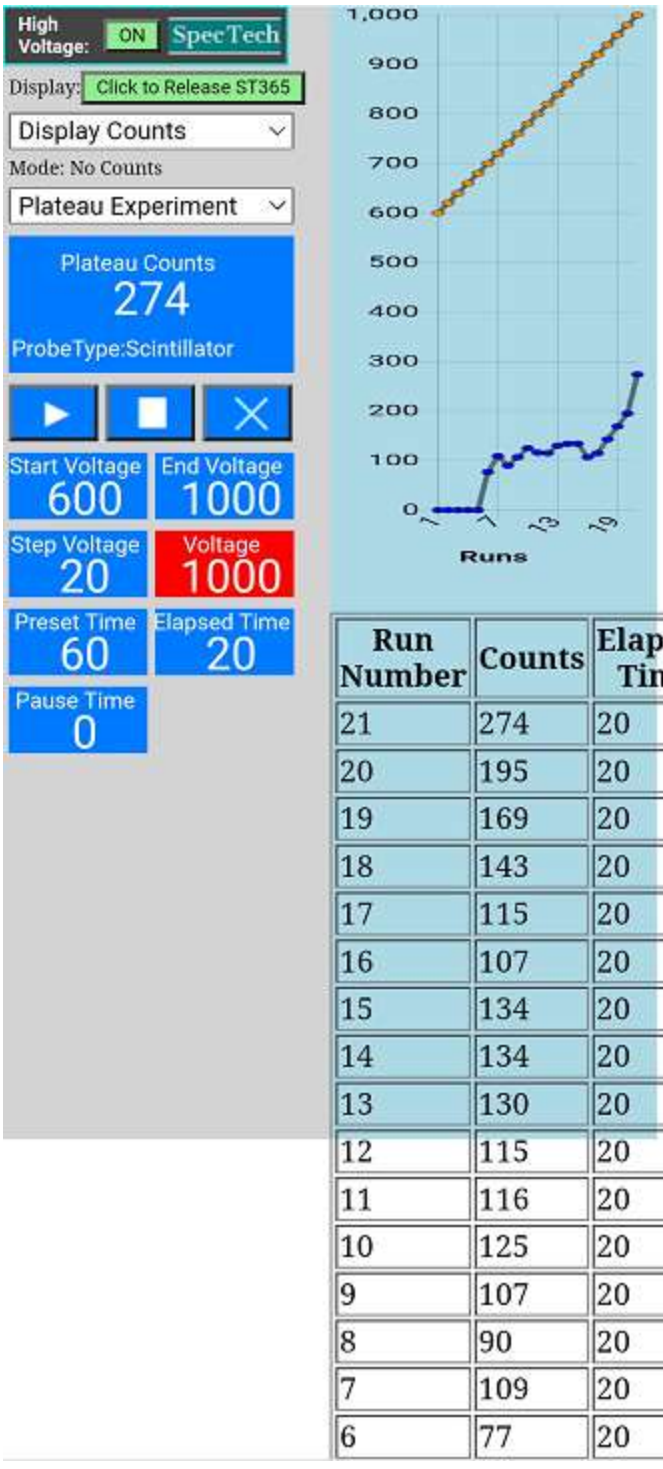
The HV ON/OFF button on the ST365 device will light up confirming that high voltage is now on.

The right-hand side of the window contains a data graph at the top and a data table at the bottom. During execution of a plateau experiment the data graph and data table will automatically update with each run in the experiment. The data graph will update to show the number of counts associated with each run. The data table will update to show the run number, counts, elapsed time, and voltage associated with each run. See *Data Table* section later on in

this user manual for a discussion of how to copy the data table contents to your device's clipboard.

You are now ready to begin a plateau experiment with your ST365 device. To execute this command click the *Start Counts* button. Assuming you have a probe connected to the device and that you have an active isotope sample located under the probe you should eventually see counts begin to appear within the display window on the ST365 device and on the Display window within your web browser. If counts do not appear from the beginning, then this is likely because the voltage simply has not reached a level high enough where the probe is be able to generate counts. For the duration of the experiment the parameters section on the web page will update to show the current status of the counts. The plateau experiment command remains active until runs over the full voltage range have executed and counting has completed.

Figure 18 shows a typical result after completion of a plateau experiment.



Run Number	Counts	Elapsed Time	Voltage
21	274	20	1000
20	195	20	980
19	169	20	960
18	143	20	940
17	115	20	920
16	107	20	900
15	134	20	880
14	134	20	860
13	130	20	840
12	115	20	820
11	116	20	800
10	125	20	780
9	107	20	760
8	90	20	740
7	109	20	720
6	77	20	700

Figure 18

Note that the data graph has a region located roughly between 860 and 880 volts where the measured counts from one run to the next remains fairly constant. This result from the plateau experiment indicates that the optimum voltage setting for the given isotope is around 870 volts.

Half-Life Experiment Command

The Half-Life Experiment Command is useful for verifying the half-life of an isotope with a relatively short half-life. An ideal isotope to use with this experiment is a *Spectrum Techniques Cs-137/Ba-137m isotope Generator set (Item ID: ISO)*. This isotope generator allows the user to 'milk' a Cs-137 source to produce a small sample of Ba-137m with a half-life of 2.55 minutes.

The half-file experiment involves taking repeated count runs of an isotope using the same preset times and detector voltages. The radioactive decay of the isotope is measured by the decrease in the number of counts across several runs.

There are three parameters used by the half-life experiment and that control how it operates. They are:

- Number of Runs
- Preset Time
- High Voltage

The Number of Runs parameter determines how many times the ST365 device measures the number of counts for a given isotope during a half-life experiment.

The *Preset Time* parameter determines the amount of time (in seconds) that the ST365 device spends counting in order to obtain a counts result. If you leave this parameter set to zero, then the device will continue counting until you tell it to stop.

The *High Voltage* parameter determines the voltage the ST365 device uses when running a half-life experiment. When you set this parameter the voltage change takes place immediately; it does not wait for you to begin counts for the voltage to get assigned. The voltage remains at this setting for the duration of the half-life experiment. Note that the voltage gets applied to the probe only if the High Voltage button is set to ON and is colored green. While the High Voltage button is set to OFF there is no voltage applied to the probe.

Half-Life Experiment Setup

Before setting up a half-life experiment make sure you have only one probe physically connected to a jack on the back of the ST365 device. Do not have both a GM tube and a scintillator probe connected to the device at the same time. This assures that the device receives counts from only one source during a half-life experiment. To specify which probe is used click the Display dropdown menu and observe that there are menu options *Probe Type GM Tube* and *Probe Type Scintillator* located at the bottom of the menu. Select the option that applies for the probe you have connected to your device. Confirm that the probe type you selected now displays within the Display window. After confirming that you have the correct probe selected be sure to click the Display dropdown menu again and select Display Counts. This step is needed in order to display the number of counts during execution of a half-life experiment. Typically, a half-life experiment gets performed using a GM tube but a scintillator probe may be used instead.

Click the Mode dropdown menu and select the option *Half-Life Experiment*. Doing this takes you to a page that allows you to set three half-file experiment parameters. See Figure 19.

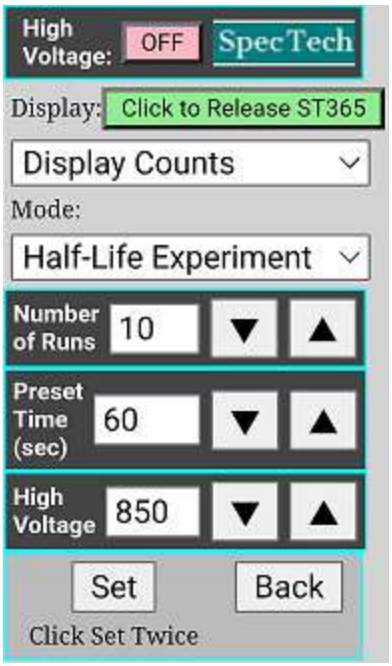


Figure 19

From here you may either type in the values you want to use or you may click the up or down arrow buttons to increment or decrement the parameter settings until each matches the value that you want. This example shows a typical half-life experiment setup where the number of runs is 10 and each run will last for a preset time of 60 seconds. The half-life experiment runs at 850 volts. All the collected data will be recorded in a data table for later inspection and evaluation.

Once you have all three parameters set the way you want click the *Set* button located at the bottom of the page. The *Set* button turns green to let you know that you have clicked the button. Click the *Set* button a second time in order to assure that the device has accepted the new parameter values.

Half-Life Experiment

Once you are satisfied with the parameter settings, click the *Back* button. Doing this takes you to a page that looks like Figure 20.

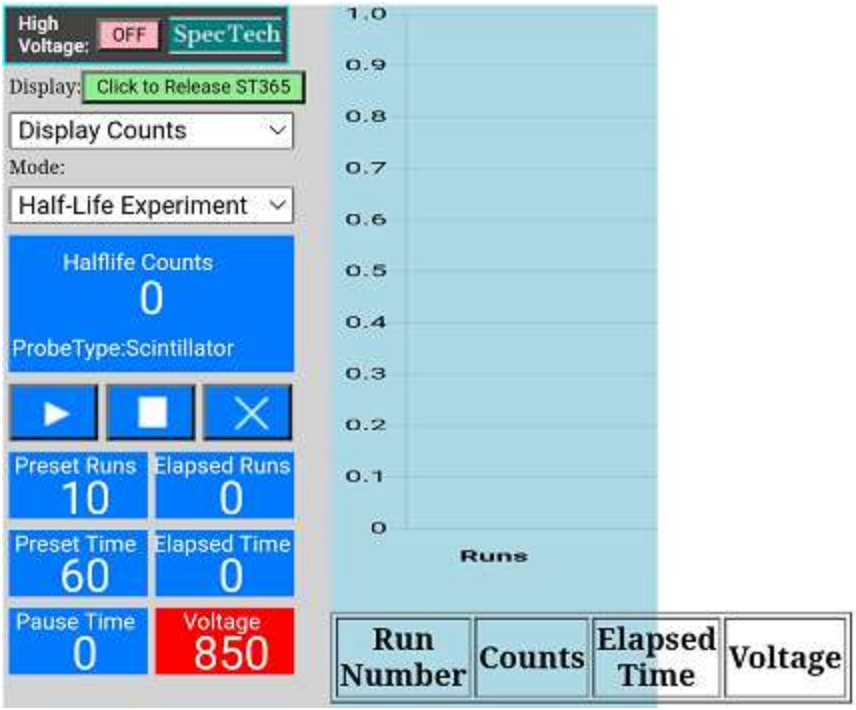


Figure 20

The parameters that you entered are shown in blue boxes on the left-hand side of the page. At the top of the window notice that the high voltage is turned OFF. Click the OFF button to turn on the high voltage. After you do this the button will update to look like this:

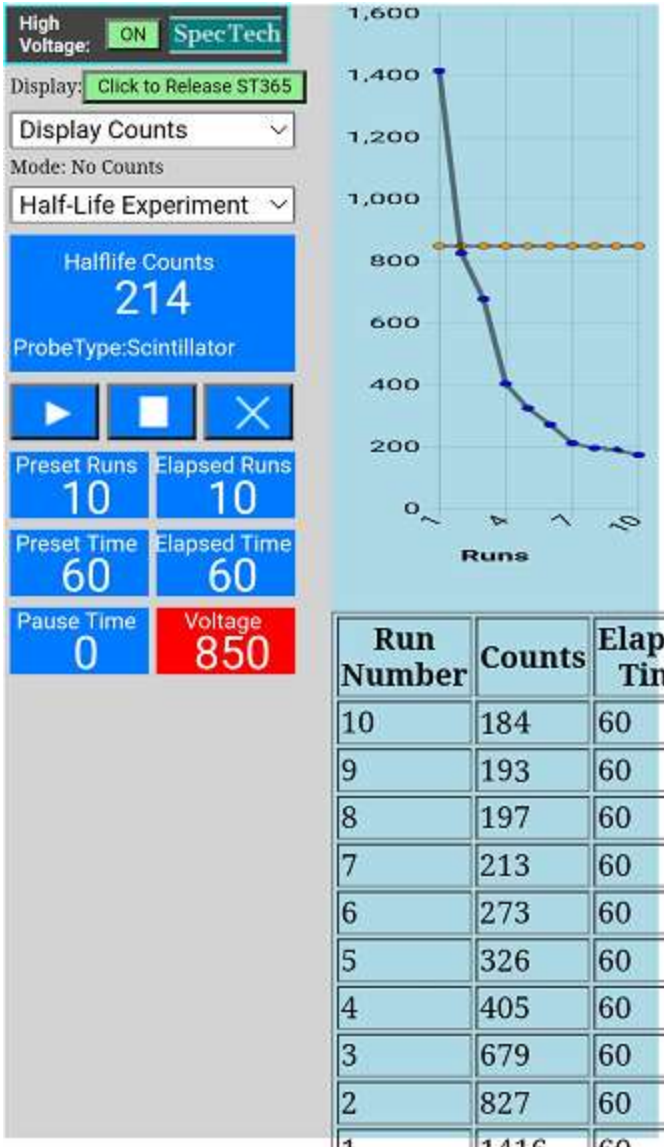
Figure 21

The HV ON/OFF button on the ST365 device will light up confirming that high voltage is now on.

The right-hand side of the window contains a data graph at the top and a data table at the bottom. During execution of a half-life experiment the data graph and data table will automatically update with each run in the experiment. The data graph will update to show the number of counts associated with each run. The data table will update to show the run number, counts, elapsed time, and voltage associated with each run. See *Data Table* section later on in this user manual for a discussion of how to copy the data table contents to your device's clipboard.

You are now ready to begin a half-life experiment with your ST365 device. To execute this command click the *Start Counts* button. Assuming you have a probe connected to the device and that you have an active isotope sample located under the probe you should see counts begin to appear within the display window on the ST365 device and on the Display window within your web browser. If counts do not appear from the beginning, then this is likely because the voltage simply is not high enough for the probe to be able to generate counts. For the duration of the experiment the parameters section on the web page will update to show the current status of the counts. The half-life experiment command remains active until it has counted for the specified number of runs.

Figure 22 shows a typical result after completion of a half-life experiment.



Run Number	Counts	Elapsed Time	Voltage
10	184	60	850
9	193	60	850
8	197	60	850
7	213	60	850
6	273	60	850
5	326	60	850
4	405	60	850
3	679	60	850
2	827	60	850
1	1416	60	850

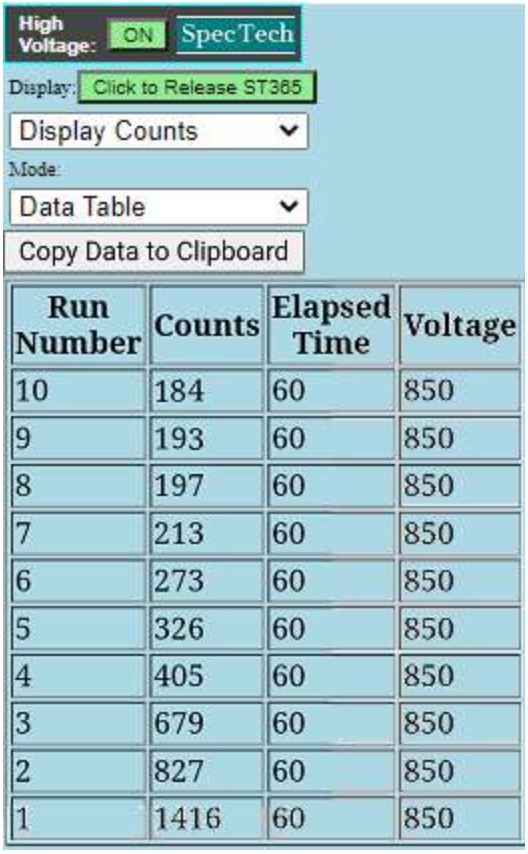
Figure 22

Note that the data graph shows a monotonically decreasing number of counts for each run. The data table contains count data useful for determining the half-life constant for the experiment. See the Spectrum Techniques Lab Manual for an in-depth discussion of how to compute this constant for a given set of data. You may download this lab manual by visiting the Spectrum Techniques public website at

https://www.spectrumtechniques.com/wp-content/uploads/2016/12/Spectrum-Techniques-Student-Lab-Manual.pdf

Data Table

Click the Mode dropdown menu and select the option *Data Table*. Doing this takes you to a page that allows you to view the tabular data contained in the data table. See Figure 23 for an example.



Run Number	Counts	Elapsed Time	Voltage
10	184	60	850
9	193	60	850
8	197	60	850
7	213	60	850
6	273	60	850
5	326	60	850
4	405	60	850
3	679	60	850
2	827	60	850
1	1416	60	850

Figure 23

Note that the data displayed here is from the half-life experiment results discussed earlier in this user manual. The difference here is that only the data table is displayed and there is a button here that says *Copy Data to Clipboard*. This button appears on the *Data Table* page anytime when there is at least one row to data contained in the table. When you click the *Copy Data to Clipboard* button, the tabular data in the page gets copied to your device's clipboard. From here you may paste the data into an appropriate application such as Notepad or Microsoft Excel for further use. To return to the previous webpage click the back button on your browser.

Data Graph

Click the Mode dropdown menu and select the option *Data Graph*. Doing this takes you to a page that allows you to view the graphical data contained in the data graph. See Figure 24 for an example.

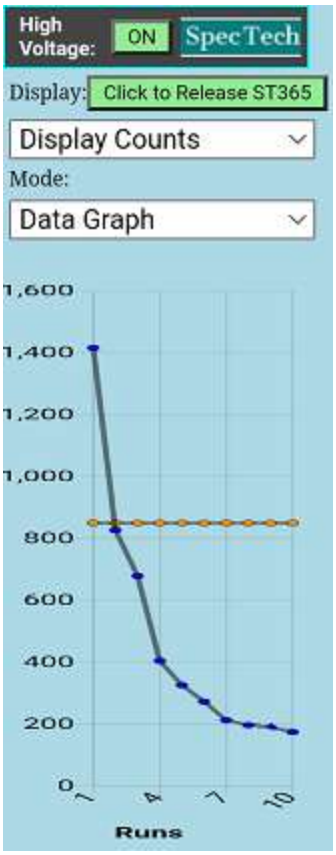


Figure 24

Note that the data displayed here is from the half-life experiment results discussed earlier in this user manual. The difference here is that only the data graph is displayed. To return to the previous webpage click the back button on your browser.

SYSTEM OPERATION

Basic GM Tube Setup and Operation

Warning!

Dangerous voltages can exist at the GM and SCINT connectors. Ensure that the high voltage is set to zero or that the device is turned OFF before connecting or disconnecting a detector.

Caution:

Simultaneously connecting a GM tube and a scintillation detector to the Spectrum Techniques hardware device will result in erroneous data. Only connect one or the other, not both.

1. Connect the Spectrum Techniques hardware device to its AC adapter.
2. Connect a GM tube to the GM connector via a BNC cable.
3. Enter the HIGH VOLTAGE mode and set the high voltage to the recommended value for the GM tube.
4. Place the radioactive source close to the GM tube's window.
5. Using the Operating Mode information described above set the unit up to perform the desired function.

6. Click the START COUNTS button to begin data acquisition. Click the STOP COUNTS button to halt data acquisition. Click the CLEAR CONFIGURATION PARAMETERS button to reset the time and data to zero.

GM Tubes

Geiger-Mueller tubes produce electrical pulses when ionizing radiation events occur within their sensitive volume. For proper operation, run these detectors only at the manufacturer's specified voltage. If this voltage is not known, then it must be derived empirically by graphing a plateau (see below). To improve sensitivity to alpha and beta particle radiation, many GM tubes have extremely thin entrance windows, which require considerable care in handling. Do not remove protective caps unless necessary and never touch the window.

GM Tube Plateau

The correct operating voltage for the Geiger-Mueller tube may be determined experimentally using a radioactive source such as Cs-137 or Co-60. A properly functioning tube will exhibit a "plateau" effect, where the counting rate remains nearly constant while the high voltage is increase from one *run* to the next. A plateau chart is obtained by using a constant preset time to count a source over several runs, while increasing the high voltage by some constant amount after each run. This process is described in detail in the next section, *Creating a Plateau Chart*.

Creating a Plateau Chart

Running the unit as a stand-alone unit

1. Place the radioactive source in a fixed position close to the window or in the well of the detector.
2. Put the Spectrum Techniques device into *Count* mode and slowly increase the high voltage until the device begins to register count activity. Stop counts.
3. Set the Preset Time to 10 seconds and start counts.
4. When the preset time expires, record the counts and the high voltage setting.
5. Increase the voltage by 20 volts and collect count data again.
6. When the preset time expires, record the counts and the high voltage setting again.
7. Repeat steps 5 and 6 until the high voltage reaches its upper limit (this is determined by the upper operating voltage limit of the detector).
8. Create an X-Y graph of the data, with “Y” being the Counts, and “X” being the voltage, and graph the chart.

Using the ST365 application software

1. Place the radioactive source in a fixed position close to the window or in the well of the detector.
2. Put the unit into COUNT mode and click the Start Counts button. Slowly increase the high voltage until counts start to appear in the Information Window. This is the *starting* voltage.
3. Determine the upper operating voltage limit of the detector. This is the *ending* voltage.
4. Subtract the *starting* voltage from the *ending* voltage. Divide the result by the high voltage step size (20 volts in this case). This tells you the number of *runs*.
5. Select *High Voltage Setting* in the *Setup* menu and set the High Voltage to the *starting* voltage and the *Step Voltage* to 20. Also, turn the *Step Voltage Enable ON*.
6. Select Preset Time in the Preset menu and set it to 10 seconds.
7. Select Runs in the Preset menu and set it to the number calculated in step 3.

8. After counting has begun, it will automatically stop when *runs* equals zero.
9. Save the data to a file. Before saving, a description of the data may be entered into the
1. *Description* box.
10. Open the saved file version with a *.TSV* (tab separated values) extension into a spreadsheet program such as *Microsoft Excel*.

See Figure 40 for an illustration of a typical detector plateau.

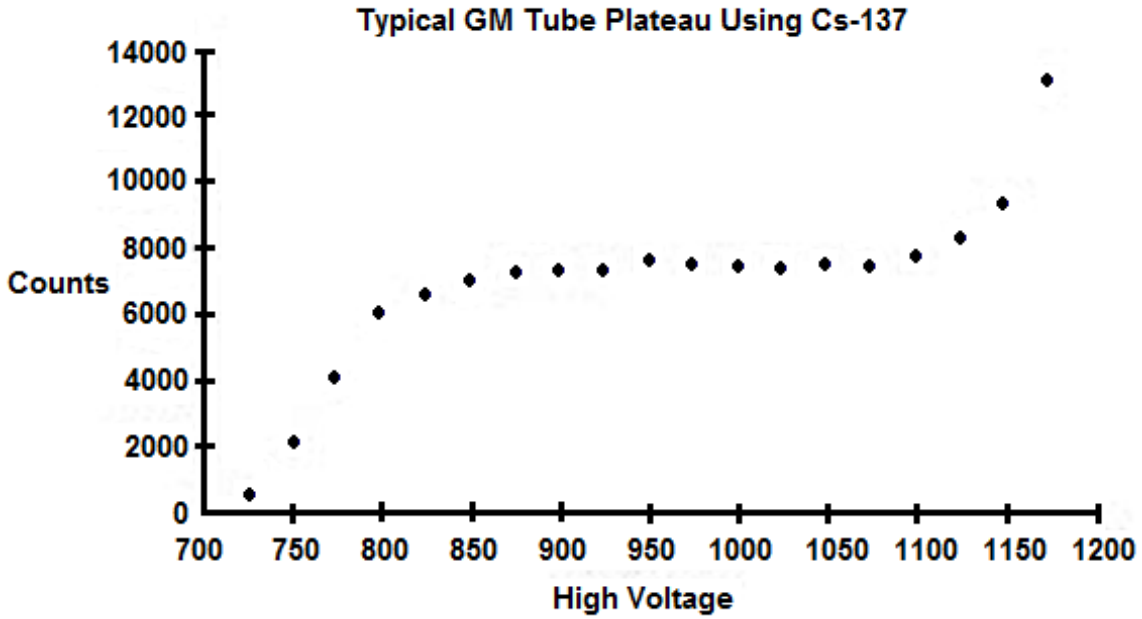


Figure 40

Notice that the counts form a relatively flat place on the graph between 850 and 1100 volts. The center of this area, at approximately 1000 volts, is the recommended operating voltage for the detector. However, any voltage in this flat region would be acceptable. Also, notice that the counts increase rapidly as the high voltage nears its upper limit. This indicates that the tube is entering its breakdown region. Do not continue to operate the tube in this region.

Resolving Time

Geiger-Mueller tubes exhibit dead time effects due to the recombination time of internal gas ions after an ionizing event occurs. The actual dead time depends on several factors including the active volume and shape of the detector. Dead time can range from a few microseconds for miniature tubes, to over 1000 microseconds for large volume devices.

When making absolute measurements it is important to compensate for dead time losses at higher counting rates. If the resolving time of the detector is known, the true counting rate may be calculated from the measured rate using the following expression:

n= m / (1 - mt)

where ***n*** is the true counting rate, ***m*** the measured rate, and **t** the detector resolving time.

If the detector resolving time is unknown, it may be determined experimentally using two radioactive sources. Maintaining constant counting geometry is important throughout the experiment. A special source split into two halves (Spectrum Techniques part # RSS-2) is available for making the measurement, but good results may be obtained by careful positioning of two standard check sources. Perform the following steps to calculate the resolving time:

1. Set the Spectrum Techniques device to *Rate* mode.
2. Position the two sources (***a+b***) side by side and close enough to the GM tube's window to obtain a count rate of at least 10,000 CPM.
3. Record the count rate as ***R(a+b).***
4. Remove source (***b***) and record the count rate as ***R(a)***.
5. Carefully replace source (***b***) to its original position, remove source (***a***) and record the count rate of source (***b***) as ***R(b)***.

Solve for the resolving time using this equation

T = (R(a)+R(b)-R(a+b)) / (2R(a) *R(b))

The resolving time of the Spectrum Techniques RADIATION COUNTER is very short and is not a significant factor compared to that of the GM tube.

The Wipe Test System

The Spectrum Techniques Radiation Counter will also operate with scintillation tubes for detecting low-level gamma and X-ray emission from a variety of samples. The *Wipe-Test* system includes a well detector, base, cable, and lead shield for measuring wipes or tube samples.

This system will detect gamma and X-rays ranging in energy from 20 keV to several meV. Each system is factory calibrated and should not require further adjustment unless a different detector or base is used. A Cs-137 calibration source is included for routine checking of overall system performance and quality assurance. Details of the Wipe Test system setup, operation, and calibration are covered in the following sections.

The Wipe Test

The Wipe Test system should be set up in the following manner:

1. Install the scintillation detector into socket in the base of the stand. Note that the base of the detector is keyed and will only locate in one position of the socket.
2. Place the lead shield over the top of the detector allowing it to rest on the vertical metal support tube.
3. Insert the plastic liner into the well.

Caution:
This liner provides protection from mechanical damage and contamination. The aluminum wall inside the well is very thin and can be damaged if a tube is inadvertently dropped into the well without the liner in place.

1. Connect the coaxial cable from the detector assembly to the input labeled *SCINT* on the rear of the Spectrum Techniques device.
2. Turn the Spectrum Techniques device *ON*. Using either the ST365 software application or the front panel controls set the high voltage to the value marked on the detector assembly.
3. Set the *Preset Time* to the desired number of seconds and begin counting.

Checking the System Calibration

Use the supplied calibrated Cs-137 source to check the counting efficiency and overall system performance. This source has its activity marked in counts per minute (cpm) and the date of manufacture.

Over time, the source decays with a half-life of 30.1 years and it will be necessary to periodically correct the activity.

1. Place the calibrated Cs-137 source into the plastic well-liner and into the well of the detector.
2. Set the *Preset Time* to 60 seconds and begin counting.
3. After counting is finished, the reading should correspond within ±10% of the activity in counts per minute recorded on the source. For better accuracy, use the average of three separate readings.

Taking a Background Reading

Wipe tests are inherently low-level measurements and it is necessary to perform background subtraction on all samples to generate accurate activity data. Because the background reading is low, it should be counted for a longer period to improve the statistics.

1. Remove all radioactive material from the vicinity of the detector.
2. Set a preset time of 600 seconds and begin counting.
3. When counting is complete, record the value and divide it by 10 to derive the background counts per minute.

Measuring Wipes

1. Using the well-liner, position the sample into the well of the detector.
2. Set the preset time to 60 seconds and begin counting.
3. When counting is complete, record the number of counts.
4. Subtract the background counts-per-minute and record the value. This is the correct counts per minute for the sample.

System Re-calibration

The system is calibrated at the factory, and under normal circumstances, recalibration should not be required. However, in the event of a detector or detector base replacement, it will be necessary to determine the correct operating voltage for the system. Using the Cs-137 source supplied with the system, refer to the section *Creating a Plateau Chart* to obtain the correct operating voltage. See Figure 41 for an illustration of a typical detector plateau showing the optimum operating voltage.

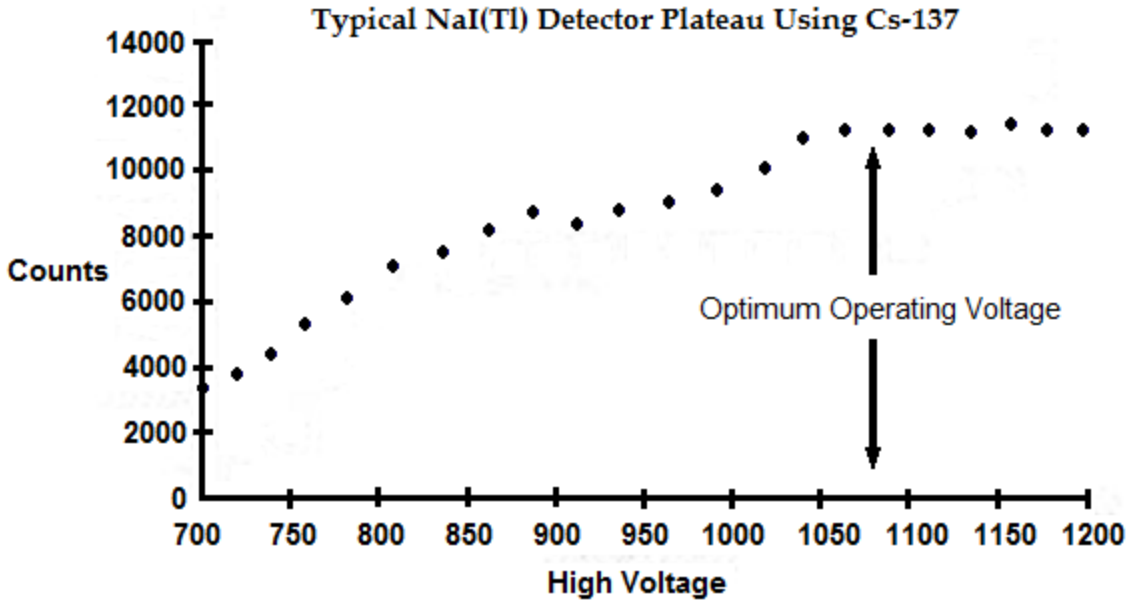


Figure 41

Warranty and Repair Information

Spectrum Techniques warrants products of our manufacture against defects in workmanship or material for a period of one year from date of shipment. We will repair or replace, at our option, any device that is deemed defective during this time. This warranty covers all replacement parts and labor. The device must be returned to our factory prepaid and we in turn will pay the cost of the return shipping.

The warranty does not cover damage caused by mishandling or misuse. GM tubes with broken windows are specifically excluded from this warranty. Accessory items not manufactured by Spectrum Techniques but supplied as part of our systems will be subject to the original manufacturer's warranty.

For warranty-repair information or return authorization, contact customer service at:

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