

Professional  
technologies  
for public  
radiation  
protection

$^{40}\text{K}$

$^{134}\text{Cs}$

$^{137}\text{Cs}$

# FOOD CONTAMINATION MONITOR

## PM1406

Quick Start

 **POLIMASTER**<sup>®</sup>

## PURPOSE AND SPECIFICATIONS

PM1406 Food Contamination Monitor (hereafter referred to as "Instrument") is intended to measure the radionuclide activity in various samples – food stuffs, drinking water, convenience foods, raw food materials and so on. Instrument measures specific (for solid and dry substances) or volumetric (for liquids) activity of  $^{137}\text{Cs}+^{134}\text{Cs}$  and  $^{40}\text{K}$  nuclides in the sample.

Instrument also enables permanent or periodic radiation monitoring of the ambient radiation background.

- Radionuclides of interest:  $^{137}\text{Cs}+^{134}\text{Cs}$ ;  $^{40}\text{K}$ ;
- Measuring range of specific activity (volumetric activity) for  $^{137}\text{Cs}$ : 10 Bq/kg (Bq/l) to 105 Bq/kg (Bq/l) for background level not more than  $0.15 \mu\text{Sv/h}$ ;
- Automatic correction for sample density: from 0.2 to  $1.6 \text{ g/cm}^3$
- Intrinsic error of  $^{137}\text{Cs}$  specific activity (volumetric activity) measurement in the range of 102-105 Bq/kg (Bq/l) is 35% with confidence probability 0.95;
- Intrinsic error of  $^{137}\text{Cs}$  specific activity (volumetric activity) measurement in the range of 25-102 Bq/kg (Bq/l) is 50% with confidence probability 0.951);
- Operational temperature range: 0 to  $+50^\circ\text{C}$  (32 to  $122^\circ\text{F}$ );
- Ingress Protection Rating: IP 55 <sup>2)</sup>;
- PC connection and power source: USB 2.0.

<sup>1)</sup> With Lead Box

<sup>2)</sup> Marinelli beakers are washable and dishwasher safe. Detector is protected against water jets but is not waterproof. Use a wet cloth to clean Detector.



**Do not immerse Instrument in water! Do not use dishwasher to clean detector!**

### DELIVERY SET

1. Detector, 1 pc
2. Marinelli beakers, 3 pcs
3. Plastic storage container, 1 pc
4. Lead box (optional), 1 pc
5. CD with software (not shown), 1 pc
6. Warranty card (not shown), 1 pc
7. Calibration certificate (not shown), 1 pc.



# USING THE INSTRUMENT

## General information

Take Instrument with Marinelli beakers out of the Plastic storage container and place it on a level surface. If you are using the Lead box place the Instrument inside it.



**Don't drop the Instrument or Lead box on the floor.  
The lead box is extremely heavy!**

Insert the supplied CD and install the PM1406 software on your Windows-based PC, laptop or tablet <sup>1)</sup>. Connect the Detector cable to the USB port.

<sup>1)</sup>Windows 7, Windows Vista and Windows XP are currently supported.



## Start the PM1406 software. Background Measurement.



Click the icon **PM1406** to start the software. At initial start the **Background Measurement** window will appear. English interface is set by default.

While in **Background Measurement** mode, the Instrument measures the natural ambient radiation intensity, which is determined by cosmic rays, natural earth radiation and radiation of the natural nuclides (in various ordinary objects around us). Background value will be automatically saved after required interval is over. During future measurements this value will be automatically

Background Measurement - measurement of the ambient radiation intensity: natural - space radiation; natural earth radiation; radiation of the natural nuclides (in different ordinary objects around us).  
The measured background value will be automatically recorded into the instrument memory when the measurement is finished. In the following this value will be automatically deducted from the sample.

Elapsed Time: 0:00:00 Estimated Time Left: 0:00:00

Show details

Isotope Name	Status	Count Rate	Tolerance	Activity, Bq/kg(L)
Cs	N/A	---	---	---
K 40	N/A	---	---	---

Close  Resume Measurement Start

Latest Results

Completed At	Estimated Time	Elapsed Time	Standard	Configuration
2/26/2012 2:23 PM	0:00:00	2:26:28	Japan (no water) (JPN)	My name
7/24/2012 3:48 PM	N/A	0:07:07	P20-09 (BLR)	My name

Ready

subtracted from the sample measurement results to achieve high accuracy of the activity measurement.

Background level must be re-measured if ambient environment condition or instrument position changes. Refer to **Background Monitoring** section for more information.

**Step 1:** Select the appropriate standard (defined by your country) in the “Standard” drop-down list. Sample activity will be compared to local regulations according to the selected standard. User can choose between the standards for long-term measurements with the lead box, as well as for express measurements without the lead box. Do background measurement each time a different standard is selected.

**Step 2:** Select (create) required location or use a currently selected location.

**Step 3:** Flag the Resume Measurement check-box if you want the measurement process to resume after manual interruption or leave it unchecked if you want to start a new measurement (if measurement will be resumed, the remaining time will be automatically recalculated).

**Step 4:** Press Start button to initiate the background measurement.

Software will display a current background measurement time (in the **Elapsed Time** field) and an approximate time period left to the end of the measurement (**Estimated Time Left** field) during the process. Use  $\ominus/\oplus$  buttons in the **Show Details** field to see more parameters.

The most important is the Activity, or Bq/Kg(L), parameter. It shows an approximate level of the activity ( $^{137}\text{Cs}$ + $^{134}\text{Cs}$  and  $^{40}\text{K}$ ) that can be measured right away if the background measurement is stopped.

Press **Stop** button to stop background measurement at any time. The following dialog window will appear:



- Click Get Back to resume background measurement;
- Click **Stop** to stop background measurement;
- Click **Stop&Save Data** to stop background measurement and save the results in the PC.

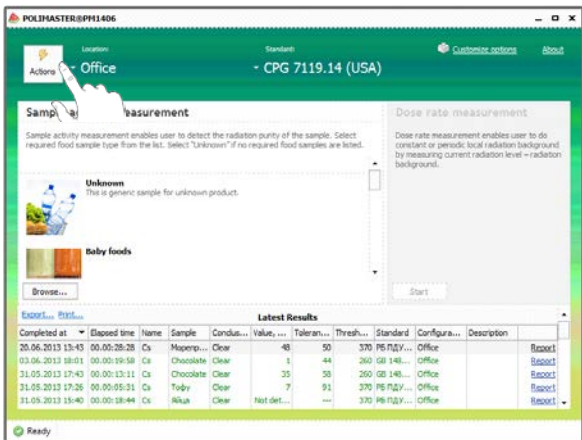
If you click **Stop&Save Data** before the end of the background measurement interval, measurement will be stopped. Now the Instrument is able to measure products only with the activity thresholds higher than the current level of estimated minimum measurable product activity.

To measure samples with detection thresholds lower than this current value, resume or restart the background measurement (see Step 3) to have a more accurate background value.

The background measurement process can take a long time depending on selected standard.

## Main Program Window

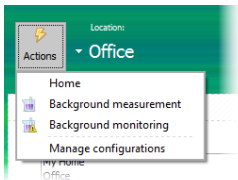
Main Program Window is displayed at software start and each time after background measurement is completed.



## Operation Menu. "Actions" Tab.

Click the **Actions Tab** to display the following list of functions:

- **Home.** This item allows returning to the main program window.
- **Background Measurement.** Select this command to initiate the background measurement function.
- **Background Monitoring.** Select this command to initiate background monitoring function.



- **Manage Configurations.** Create or select location profiles (Location) if measurement is conducted in different locations.

To create a new instrument location profile after selecting the menu item **Manage configurations** click **Add** button, then in the window enter the new location name in accordance with the requirements, click **Save and close** to save the new location.



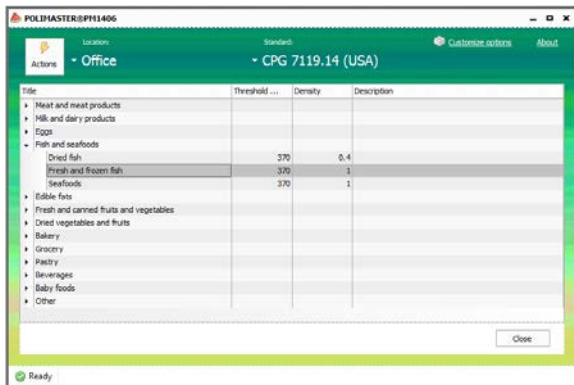
## Sample Activity Measurement

Sample activity measurement results are automatically compared to permissible radiation limits (thresholds) of  $^{137}\text{Cs}$ + $^{134}\text{Cs}$  and  $^{40}\text{K}$  nuclides content in food stuffs according to selected national standard.

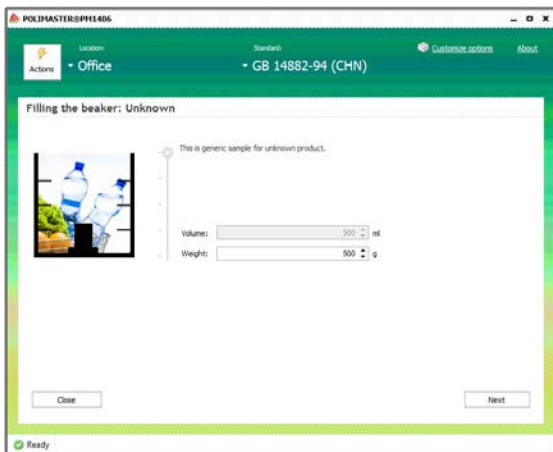
**Step 1:** Click **Browse** in the main program window (**Sample Activity Measurement**) and select the required product from the list of food types. The appropriate column shows the predetermined specific density value and the activity limit (threshold) according to selected national standard. Double click to select the product.

Select **Unknown** if the specific product is not listed. Products list contains only those products which estimated minimum measurable activity allows making samples measurement.

Determine the product's weight and volume. The beaker should be filled up with the measured product. If this condition is not met, the measurement results are approximate. Flag corresponding checkbox(es) to select required radionuclide(s) (only for unknown products).



Your product will be controlled according to the selected nuclide(s). Set threshold value(s) for the selected nuclide(s) and press Next button. For listed products press **Next** button to enter directly the sample activity measurement mode.




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Location: Office Standard: GB 14882-94 (CHN) Customize colors About

Actions

### Sample activity measurement: Unknown

Select nuclides to control and measure the activity. It is necessary to set up thresholds for selected nuclides to make "Clear/Contaminated" decision. Press "Set" button to continue.



N/A

500 ml  
500 g

Activity threshold, Cs

Activity threshold, K

Resume measurement

Ready

**Step 2:** Prepare the product sample as required. Put the prepared sample into Marinelli beaker.

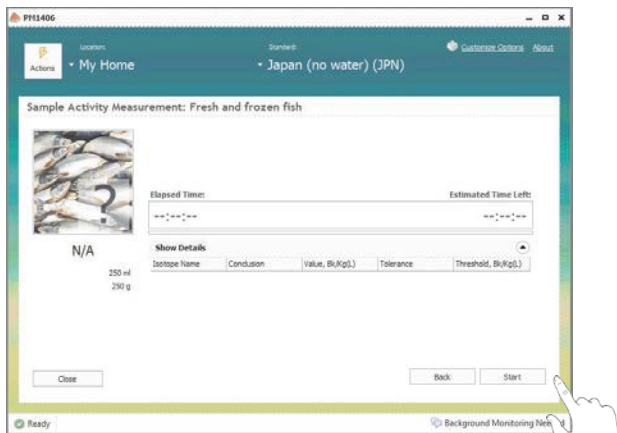
To prepare the sample: Clean and chop product as required to enable sample homogeneity and to properly fill the measuring vessel.

Product type	Cleaning	Chopping
Meat, fish, roots, tubers, fruit, culinary plants, etc.	Wash with running water, remove inedible parts	Chop using a knife or a food processor, etc.
Sausages, cheese, confectionery products	Wash with running water, remove inedible parts	Chop/grind food using a knife/food processor/grater, etc.
Dry products, cereal, bean, pasta and bakery products	—	Chop/grind food using a knife/a food processor/grater/coffee-grinder,



		etc.
Liquid, thick (viscous) food	–	Thoroughly mix

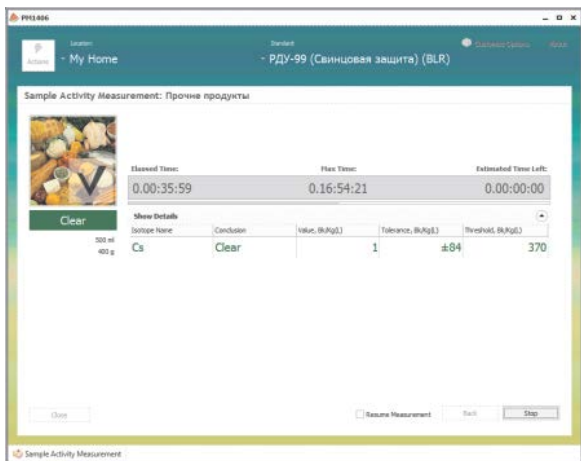
Fill the clean, dry Marinelli beaker full with the prepared sample. Place Marinelli beaker filled with the sample onto Detector and press **Next** button. Press **Start** button in the window to start the sample radiation activity measurement.



After a while the elapsing current measurement time (**Elapsed Time**) will be displayed along with the maximal measurement time (Max. time) and approximate time remaining until the measurement interval ends (**Estimated Time Left**). Use buttons in the Show Details field to see more parameters. The column **Threshold, Bq/Kg(L)** displays sample activity limits predefined by selected national regulatory standard. Software will automatically compare this value with the current activity value of the product.

If the sample cannot be measured, software will display the Sample can't be estimated message. This may appear for two reasons:

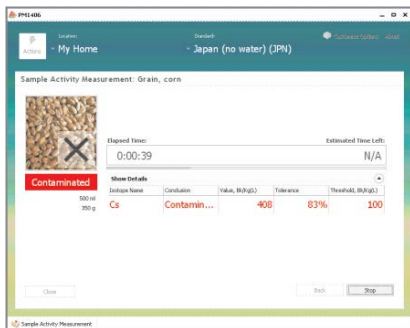
- Background accumulation time was too short (insufficient background measurement);
  - Selected standard doesn't allow current sample estimation.
- To correct it, either redo background accumulation, or select another standard.



If the tested sample is confidently below the limit (Threshold) the ✓ sign will be displayed and the **Clear** message will appear. See the screenshot.

At this time the measurement process will be automatically prolonged to ensure accuracy. It may be stopped at any time.

If the tested sample is confidently above the limit (Threshold), the sign ✗ will be displayed and the message **Contaminated** will appear. See the screenshot.



At this time the measurement process will be automatically prolonged to ensure accuracy. It may be stopped at any time.

## Background Monitoring

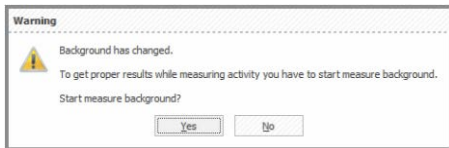
Background monitoring enables the user to check whether the ambient radiation background has changed since the initial background measurement. The background monitoring process takes significantly less time than the background measurement process. It is recommended to do background monitoring periodically (at least once per week or every time after instrument location is changed) to ensure measurement accuracy. To set the background monitoring frequency reminder refer to **Customize Options** chapter. The **Background Monitoring** function can also be used to check the beaker for radiation contamination.

To start background monitoring go to the **Actions** tab and select the **Background Monitoring** command. Click **Start** to begin monitoring.

Isotope Name	Status
Cs	Completed
K 40	Completed

If the radiation background hasn't changed, the **Completed** status will be displayed. See the screenshot.

If radiation background has changed or the Marinelly beaker has been contaminated, the following message will be displayed:

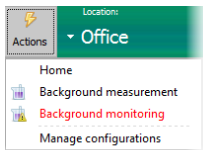


Press the **Yes** button to switch the Instrument to the **Background Measurement** mode.

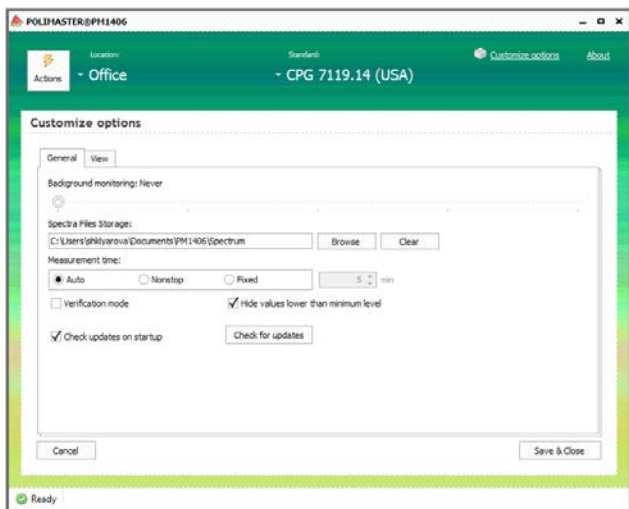
Background monitoring also enables the user to check the Marinelli beaker for radiation contamination. To do so, first start the background monitoring function without the beaker. To estimate the radiation level of the beaker, put it on the Detector and repeat background monitoring. If the **Warning! Background has changed** message appears, thoroughly wash the beaker

using standard washing liquid. Repeat the Background Monitoring procedure.

## User Settings



Select **Customize Options** to open the user settings window. Use a scale slider to select required frequency for background monitoring: **Never, Before activity measurement, Weekly, Monthly, Yearly**. When the background checking date is approaching, the **Background monitoring** line in the Actions menu will be displayed in red.



There is also a possibility to select the measurement time depending on the measurement conditions:

- **Auto** - measurement time is calculated automatically depending on the measured background, selected standards and parameters;

- **Nonstop** - measurement is carried out permanently, regardless of the results;
- **Fixed** - when this option is activated, there is a possibility to set the exact measurement time in a separate window:

Checkbox **Verification mode** exists to carry out the instruments verification. When you select the checkbox **Hide values lower than the minimum level**, measurement results for samples with activity below the minimum level are displayed as a **Not detected** conclusion; otherwise they are presented as a numerical value.

**View** tab allows you to change the menu language.

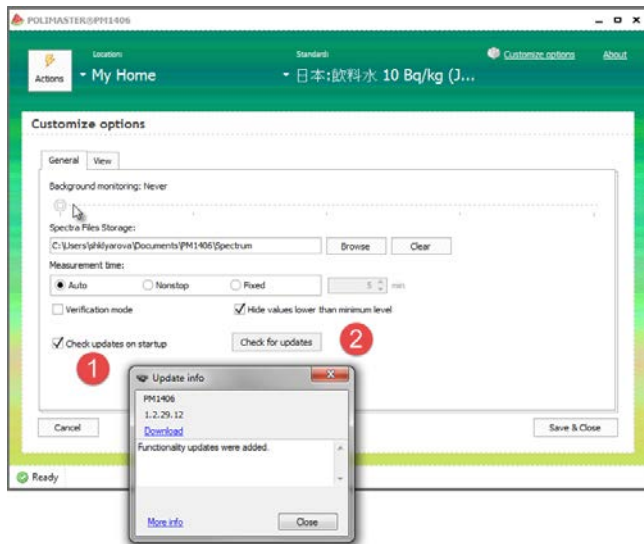


Software has the function of checking the availability of information about new releases for the product. If there is a software update available, the user can download it from the company's website.

1 If the checkbox **Check update on startup** is selected, the notification window appears automatically each time you start the software.

2 To check the availability of the updates manually press the **Check for updates** button.

In the updates are available, notification window displays the changes related to the instrument or software, as well as the links for getting more information and downloading the updated software.



## Measurement results

Measurements results of the samples activity are stored in the instrument memory and displayed at the bottom of the main program window in the table form.

It is possible to save the measurement results using **Export** function, to print them using **Print** function (in the upper left corner of the table), or to print a report for each particular measurement using the **Report** function in the last column of the table.

Completed at	Elapsed time	Name	Sample	Conclus...	Value, Bq/Kg	Tolera...	Thresh...	Standard	Configur...	Description	
31.05.2013 17:43	0:13:11,1...	Cs	Chocolate	Clear	35	58	260	GB 148...	Office		<a href="#">Report</a>
31.05.2013 17:26	0:05:31,3...	Cs	Тофу	Clear	7	91	370	Р5 ПД...	Office		<a href="#">Report</a>
31.05.2013 15:40	0:18:44,9...	Cs	Яйца	Clear	Not detected	---	370	Р5 ПД...	Office		<a href="#">Report</a>
31.05.2013 14:13	0:19:51,2...	Cs	Проче...	Clear	Not detected	---	370	Р5 ПД...	My Home		<a href="#">Report</a>
31.05.2013 12:14	0:22:06,7...	Cs	Проче...	Clear	40	48	370	Р5 ПД...	My Home		<a href="#">Report</a>

## Activity measurement report

31.05.2013 17:43:32

Result: Clear  
Measurement time: 31.05.2013 17:43  
Time elapsed: 00:13:11.1645558  
Sample activity: Cs 35 Bq/Kg  
Standard: GB 14882-94

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