PHYWE

excellence in science

| Multichannel Analyser (MCA) | 13727-99 |

PHYWE Systeme GmbH & Co. KG
Robert-Bosch-Breite 10
D-37079 Göttingen

Phone   +49 (0) 551 604-0
Fax   +49 (0) 551 604-107
E-mail   info@phywe.de
Internet   www.phywe.de

Operating instructions
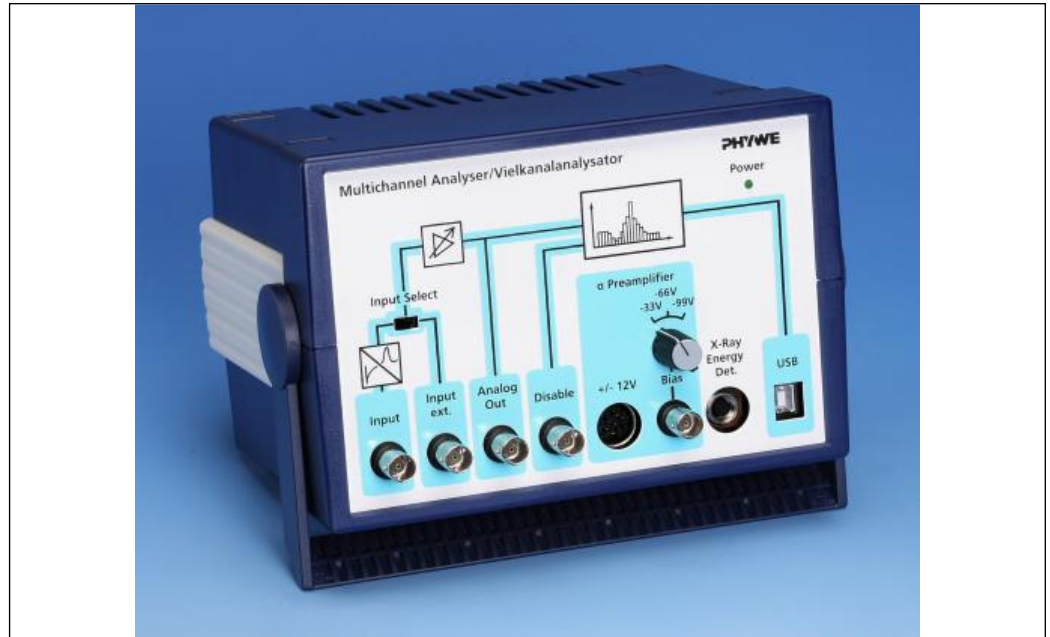
Fig. 1: 13727-99, Multichannel Analyser (MCA)

TABLE OF CONTENTS

1   SAFETY PRECAUTIONS

⚠️

- Carefully read these operating instructions completely before operating this instrument. This is necessary to avoid damage to it, as well as for user-safety.
- Only use the instrument for the purpose for which it is intended.

- Only use the instrument in dry rooms in which there is no risk of explosion.
- Before applying the mains voltage, ensure that the earth lead of the power supply is properly connected to the earth lead of the mains. Only plug the mains plug into a mains socket which has an earth lead. Do not cancel the protective effect by using an extension cable without an earth lead.
- Check that your mains supply voltage corresponds to that given on the type plate fixed to the instrument.
- Take care that no liquids or objects enter in through the ventilation slots.
- Do not connect any other equipment to the instrument than that intended for it.
- Switch the instrument off when cable connections are to be disconnected or newly made.
- The present-day state of software development makes it impossible to guarantee that a product is free of faults. PHYWE Systeme GmbH & Co. KG therefore does not take on any liability for damages that occur during the installation or the use of the instrument.

2   PURPOSE AND CHARACTERISTICS

The Multichannel Analyser (Fig. 1), named MCA for short in the following, is part of an instrument system for the generation of pulse height spectra that correspond to, for example, the energy spectra of ionizing radiation. This instrument system has been specifically developed for demonstration and practical work that fulfills needs in the teaching of Natural Science in schools and colleges.

The MCA classifies incoming voltage pulses according to their pulse height and assigns a value interval for the channel pulse height. The content of a particular channel then corresponds to the number of voltage signals registered, whose
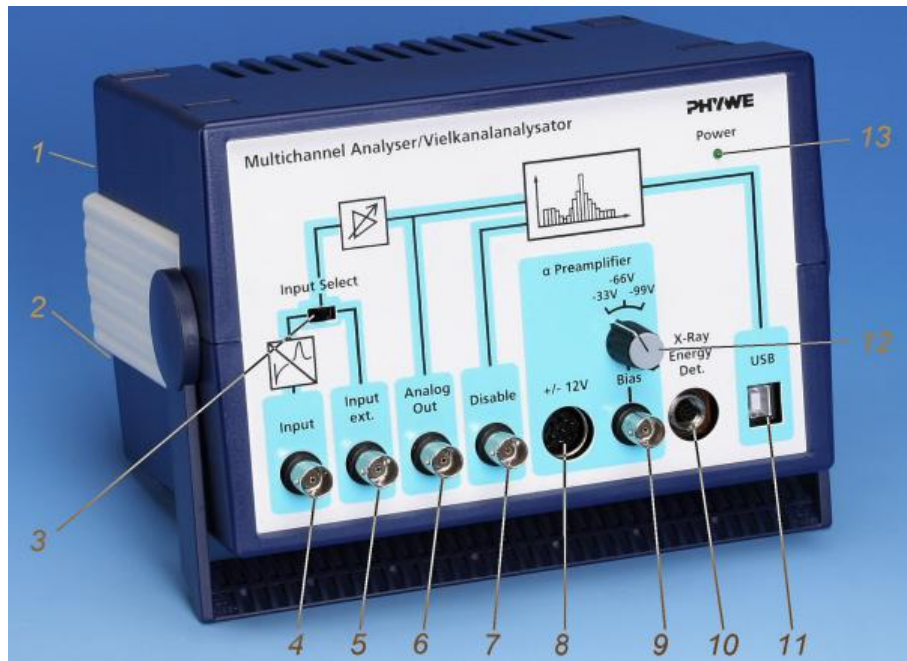
Fig. 2:
Functional and
operating elements of the MCA

pulse heights are within the assigned value interval of that channel. The registration of each new voltage pulse that has a pulse height that is within the respective value interval increases the channel content by 1. The spectra result from the plotting of the channel content against the channels.

If a detector for ionizing radiation is used whose pulse height is proportional to the energy of the recorded event, then the spectrum of the pulse height correlates with that of the energy of the measured radiation.

The counting rate can be up to 2,000 events per second.

Multichannel analysis with the MCA is controlled by a connected computer and a Phywe Systeme GmbH Software "measure" MCA Module (14452-61).

The pulse height analyser itself has 4,000 channels with the same voltage interval width, each, and processes pulse heights within a voltage interval from 0 V to 4 V. Received pulses of different pulse heights are discarded, so each channel corresponds to a pulse height interval of 1 mV. The respective pulses that are assigned to that pulse height interval by preamplifier, main amplifier, and the offset step are registered. The main amplifier extends the imaged input pulse height interval linearly; the offset step displaces it line-

arly to higher voltages.

Besides the application as multichannel analyser, the MCA also provides operating voltages and bias voltages to a pre-connected preamplifier or the x-ray energy detector. These operating and bias voltages can be set and taken directly at the device.

3   FUNCTIONAL AND OPERATING ELEMENTS

1   *Main switch at the back*

2   *Socket for mains connection at the back*
    The device is delivered with a connecting cable for the mains. The socket for mains connection is equipped with a fuse. The fuse is only to be replaced by a fuse of the type that is given on the type plate.

3   *Input Select*
    Selector switch for switching to input *4* or *5*.

4   *Input*
    BNC Socket for feed-in of measurement signals from a preamplifier or directly from a detector. A Pulse shape
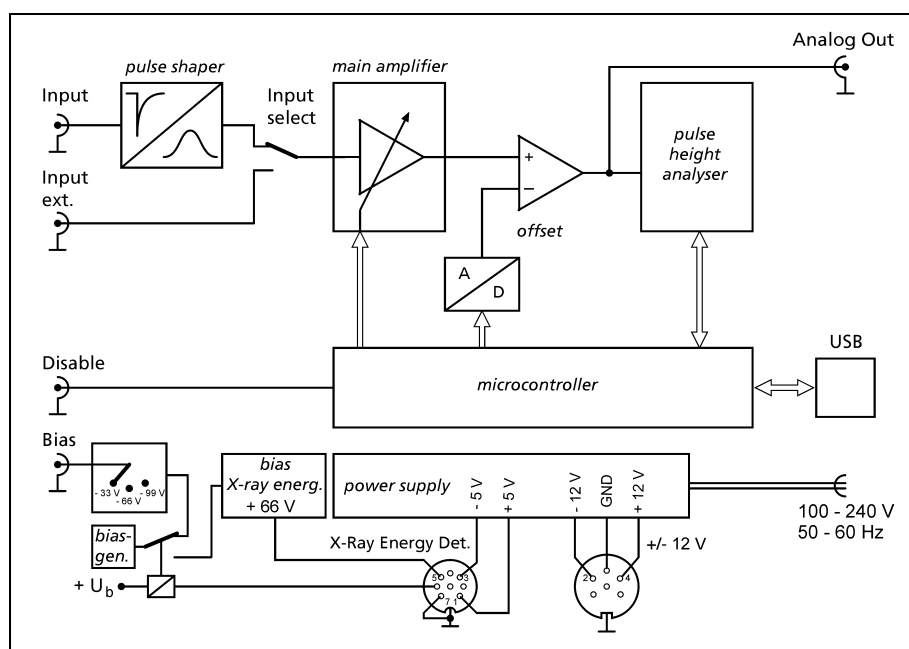

Fig. 3:
Functional diagram of the MCA

and preamplifier input at which all pulses are converted to positive pulses, regardless of which polarity. The pulses are shaped and amplified that their height is defined and proportional to the integral above the input pulse.

5   *Input ext.*
     BNC socket for feed-in directly to the main amplifier. This input can be used when the MCA is used to record pulse height spectra from other instruments that supply pulses with a well-defined height, i.e. without sharp peaks, and with a positive polarity within the range from 0 V to 5 V.

6   *Analog Out*
     BNC socket at which the analogue measurement signal is available after amplification by the main amplifier and reduction by the offset step, e.g. for display and examination using an oscilloscope.

7   *Disable*
     BNC socket for feed-in of TTL-signals. Without a connected device, this input is at +5 V, i.e. a logic "high". The data of a signal evaluated in the pulse height analyser can be stored in the microcontroller when a high potential is applied here, and only then. When the input comes from a connected device or, for example, from a shorting plug at a logic "low", i.e. is almost brought to chassis earth, then pulse evaluation is blocked and no signals are recorded.

8   *Socket +/−12 V*
     A 5-pin socket for the voltage supply of preamplifier 09100-10 or for an operating voltage of 12 V for an α-detector (positive or negative, can be selected); preamplifier 09100-10 is delivered with the corresponding cable.

9   *Bias*
     BNC Socket which provides the detector bias voltage for a detector. The bias voltage can be switched between −33 V, −66 V and −99 V with switch *12*. The bias voltage can be used to supply the detector via preamplifier 09100-10.

10   *X-Ray Energy Det.*
     An 8-pin socket intended for connection to x-ray energy detector 09058-30. Operating voltages of +5 V and −5 V

and a detector bias voltage of +66 V are provided. The corresponding cable is supplied with 09058-30. The MCA must be switched off while connecting or disconnecting to the x-ray energy detector.

11   *USB*
     USB interface for connection to a computer.

12   *Switch*
     A turn-switch which enables the bias voltage (see *9*) to be switched between −33 V, −66 V and −99 V.

13   *Power*
     This green light emitting diode indicates the operating mode of the MCA (on/off).

4   DETAILS ON CONNECTORS AND OPERATING ELEMENTS

Gamma detector
Use a BNC cable to connect the signal output of γ–detector 09100-00 to input (*4*) of the MCA. The γ–detector is separately supplied with high voltage from PHYWE high precision power supply 1.5 kV DC 09107-99. The MCA input also accepts pulses from other gamma-detectors commonly used in Nuclear Physics.

Alpha detector
Use a BNC cable to connect the output of α-preamplifier 09100-10 to input (*4*) of the MCA. The ±12 V operating voltage for preamplifier 09100-10 can be picked up at 5-pin socket (*8*) using the connecting cable that is supplied with a preamplifier 09100-10; a smoothed 12 V biasing voltage is then provided to the α-detector from the preamplifier. Should the α-detector be operated at higher bias voltages (to fully utilize the resolving power), then a negative bias voltage that can be selected from −33 V, −66 V and −99 V is available at BNC socket (*9*) and likewise provided to the α-detector via the α–preamplifier using another BNC cable.

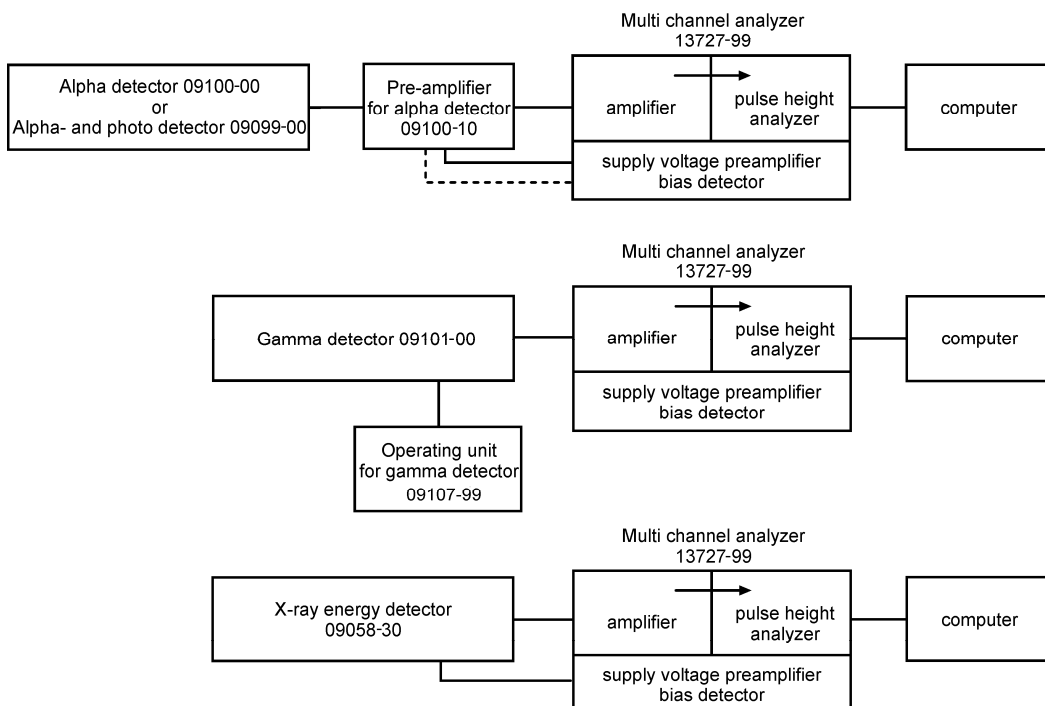Typical experimental set-up schemes with the multi channel analyzer:

Fig. 4:
Typical use of the MCA

Turn-switch (*12*) allows switching between the selectable bias voltages. α-detector 09100-00 can be operated with bias voltages of –12 V, –33 V, –66 V and –99 V; alpha and photodetector 09099-00 can be operated with bias voltages of –12 V, –33 V. Do not apply higher voltages.

Oscilloscope
Use a BNC cable to connect analogue output (*6*) of the MCA to the input of the oscilloscope.
Oscilloscope settings:
- Triggering on rising edges
- Amplitude range from 0.1 V to 10 V
- Time-base deflection 10 µs/cm to 100 µs/cm.

By use of the oscilloscope, measuring signal voltage pulses can be analysed and, if necessary, optimized after pulse shaping and amplification.

Coincidence conditions
The feed-in of TTL-signals to disable socket (*7*) enables signal processing to be made dependent on a further device, e.g. to set coincidence conditions. When the multichannel analysis is under coincidence conditions, only those voltage pulses of measuring signals are taken into consideration with which a "high" TTL-signal (momentary direct voltage of values between 2.3 V and 5 V) simultaneously bears on the disable socket, e.g. because another detector has registered a further event. When the disable socket is open, then all measurement signal voltage pulses are classified by the multichannel analysis.

The digital processing requires a certain time. Therefore, the condition of the disable input is not processed until about 50 µs after the arrival of the measurement signal and it must remain "high" for 1 µs to be passed to the memory.

Attention must be paid to the fact that the processing time might possibly be dependent on the height of the input pulse with other instruments that emit TTL-pulses when they register input pulses.

X-ray energy detector
A special cable is required for x-ray energy detector 09058-30 and is supplied with it. This cable has an angled plug at one end and a straight plug at the other end.

When x-ray energy detector 09057-99 should be used, first lead the cable end with the straight plug from the inside through the cable passage at the back of the x-ray energy detector to the outside.

Now plug the straight plug of the cable into 8-pin socket (*10*) of the switched-off MCA, but, before plugging it in, ensure that the catch-lug is correctly positioned. Finally screw the union nut tight. Now correspondingly connect the angled end to the detector. Switch on the MCA only after these connections have been properly made.

With proper connection, the control lamp at the back of the detector lights up and the required bias and operating voltages are applied to it.

Now use the BNC cable with the angled plug that is supplied with the x-ray energy detector to connect the signal output of the detector to MCA input (*4*), leading it through the cable passage of the x-ray unit if possible.

Computer
Use a BNC cable to connect the MCA to a computer via USB interface (*11*).

Note:
Electromagnetic malfunctions, even those at other inputs of the computer, e.g. at the Ethernet port, can cause faults in USB data transmission.

Should transmission faults occur in the USB connection during measurement, then the MCA is no longer recognized by the measurement module (e.g. spectra recording) – the counting rate apparently drops to zero, but the measurement data already collected can be acquired. The measurement module must be switched off. The USB connection can be restored by switching the MCA off and on again. Otherwise the failure message states that no MCA can be recognized.
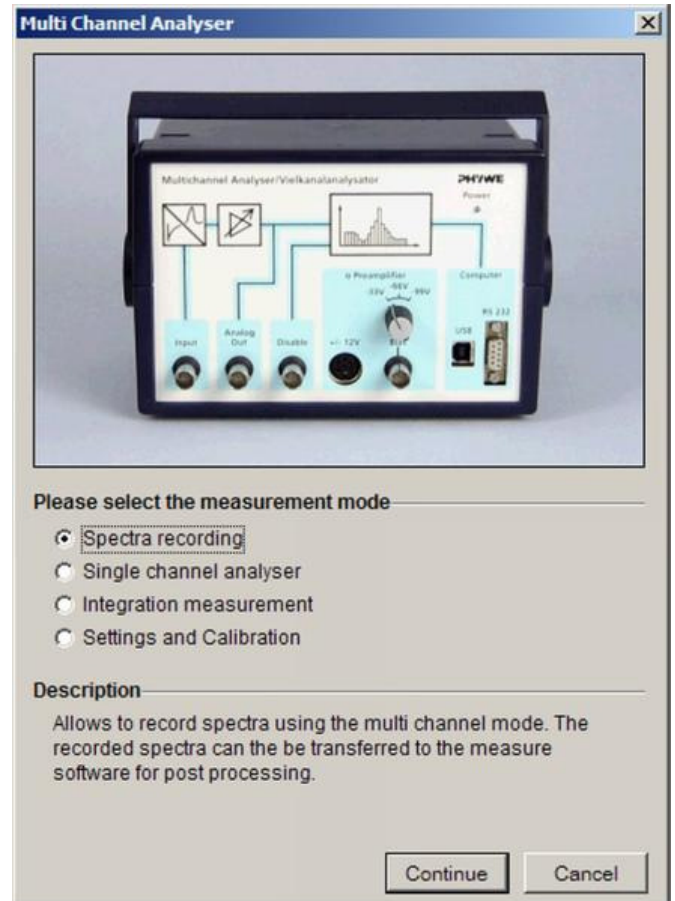

Fig. 5: Menu window of the MCA measuring instrument.

5 HANDLING

When all connections are set up, start the "measure" programme on the computer and select "Measuring instrument" > "Multichannel Analyser". A menu window opens with four menu prompts (Fig. 5):

- Record spectra
- Single channel analyser
- Integration measurement
- Setting and calibrating

5.1 Record spectra

User interface (Fig. 6) for the control of the MCA and for recording and spectra display. The following controls for the MCA and/or for data capture are available:

Controls

- Start/Stop button: Starts and stops the recording of a spectrum. After stopping, the spectrum is still shown. When data capture is started again, the new measurement signals are added to the shown spectrum.
- Reset button: Located below the Start/Stop button. Deletes a spectrum and is available both during the recording of a spectrum and also after data recording has ended.

MCA – Settings

- Gain button: For setting the amplification factor of the main amplifier in the MCA, steps of 1, 2 and 4 are possible.

  The (physical) equisignal line lies at a higher amplification factor with higher channel numbers (further to the right) in the spectrum than with lower channel numbers.

  In order to allow a suitable amplification factor to be set, this can be changed during a running measurement. The spectrum recorded before the change in the amplification factor is hereby further shown in gray as background spectrum. Only the partial data of the spectrum subsequently shown in red will be acquired.

- Offset button: Serves to suppress noise. Noise can lead to events that do not originate from the specimen, but from the electronics at low channel numbers. The percentage given for the offset relates to a pulse height of 4 V after amplification, therefore 100 % corresponds to 4 V. The measurement signals that enter the pulse height analyser after pulse shaping and amplification are subjected to a subtraction of the given percentage of the offset from their voltages and the pulse height window is displaced to higher voltages. Pulses which have a negative maximum value after subtraction of the offset are no longer taken into consideration and do not appear in the spectrum. Basically, each 1 percent of the offset displaces the spectrum 40 channels to the left.

The offset can also be used to view a certain section of a spectrum, as the signals are sorted into lower channels appropriate to their reduced voltage values. In interaction with the adjustable gain, therefore, the relevant spectrum section can be optimally viewed by utilization of the 4,000 channels that are available.

The main amplifier overdrives for input signals higher than 5 V. Higher voltage input pulses are capped and show the same height of 5 V. They are all displayed in the same narrow channel range. This channel range can be made visible by setting the gain to 1 and the offset to above 25 %, or the gain to 2 and the offset to above 75 %. The resulting line in the pulse height spectrum then has no physical counterpart in the energy spectrum of the measured radiation.

The offset can be changed during a running measurement. The spectrum generated after the change in offset is shown in red. The spectrum generated prior to the change is shown gray-colored in the background.

Note:

If the gain is set to a maximum value of 4 without an offset (0 %), the amplified noise will overlap the signal in such a way that no useful measurement can be performed. To reset, unplug the BNC cable, set the offset in "measure" to ~6 % temporarily, and plug the cable again.
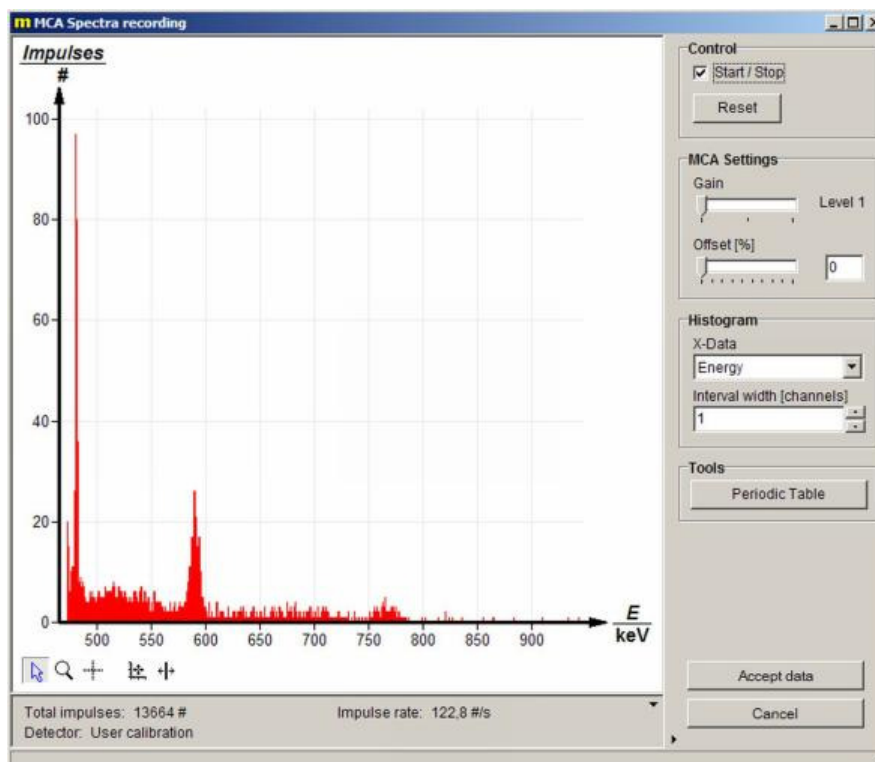

Fig. 6:
Spectra recording window.

Histogram

- x-data record button: Switches between the display of the channels content via the channel number or (in the case that an energy calibration has been carried out) via the energy.
- Interval width button: Allows the summation of the content of neighbouring channels. The sum is then assigned to all channels whose content was summed up.

Accept data

- Accept data button: A measured spectrum is acquired by the "measure" software from the multichannel analyser module and can be processed with all the functions that are available. The multichannel analyser software module quits, then. The multichannel analyser module starts with the same settings as used before when it is started again.

Abort

- Cancel button: Terminates the multichannel analyser module without data transmission.

Other buttons that are accessible during measurement

- Cursor mode ▷ : Preset mode in which, for example, markings in the spectrum can be moved with the mouse (see below).
- Magnifier ◌ : Enables spectrum sections to be magnified. Keeping the left mouse key pressed and dragging magnifies the marked section, doing this with the right mouse key reduces the section size by a factor of two.
- Crosshair ⊹ : Can be moved with the mouse to any position in the spectrum, whereby the channel number and channel content of that channel are shown.

  - Scaling ⊞ : Allows switching between automatic scaling (x, y), automatic scaling (only y) and manual scaling. With (x, y) automatic scaling, the whole spectrum is shown, whereas with (only y) automatic scaling, the y-axis of the spectrum is matched to the greatest channel content of the visible section of the spectrum, while maintaining the selected section of the x-axis. Selection of manual scaling opens a window in which the lower and upper limits of the wanted section can be entered on the x- and y-axes.

- Marking lines ⊹ : One or two marking lines can be moved by the cursor to any position in the section of the spectrum that is shown. The channel number of their position is displayed, and, when two marking lines are used, their distance is shown. The reset function brings the marking lines back to their original positions.

Below the spectrum, the total number of the events registered during the recent measurement, the pulse rate per second, and the used calibration are displayed.

5.2 Single channel analyser

With the selection of the single channel analyser menu prompt, the multichannel analyser is limited in use to a single channel. In single channel analysis, the spectrum is determined stepwise. A particular energy interval is examined at each step. The interval or window is determined by the lower and upper limit, whereby the distance between the limits is the same for all intervals. During a step, the MCA counts the number of signal pulses whose energy, or height, is within the examined interval and which are registered within a certain period. The number obtained is the interval content. When a step has finished, then the lower and upper limits of the interval are each shifted to the right by the same step width, i.e. by a certain energy difference. This gives the interval for the next step. The start is made at zero with gain 1 and offset 0 % of the pulse height – the actual calibration must be previously carried out for this setting for the results to be useful.

The interval width can be greater or smaller than the step width. When it is greater, the intervals might overlap, i.e. the same pulse height might belong to different intervals. When it is smaller, then there are pulse heights that cannot be assigned to any interval and will not be analysed.

Operating elements for the MCA under the Single channel analyser menu prompt:

- Window width field: Establishes the interval width.
- Step width field: Establishes the step width.
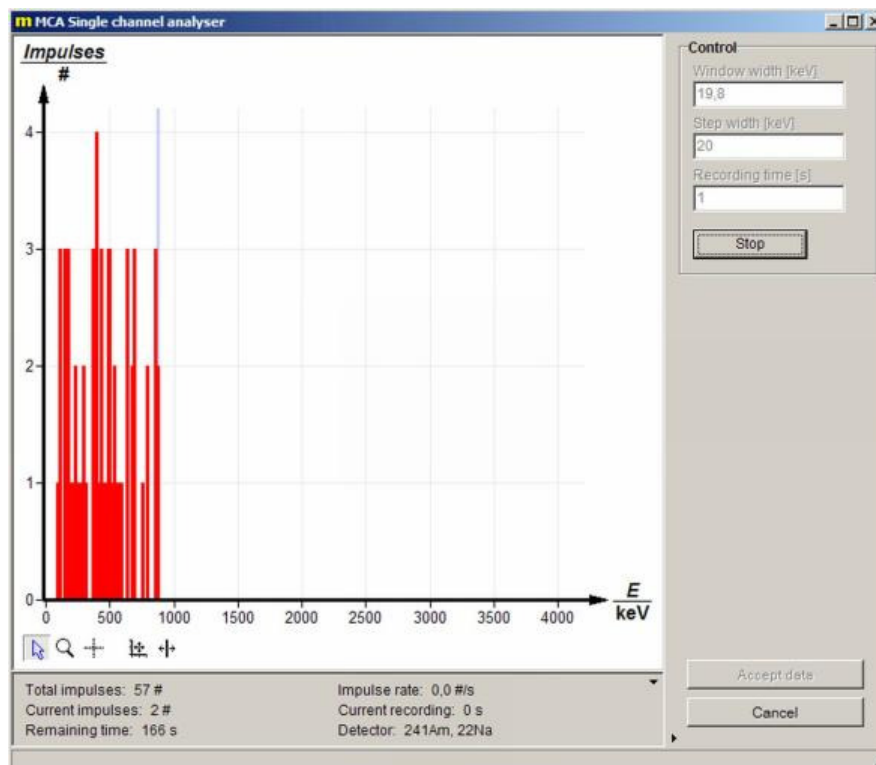- Gate time field: Establishes the period for the determination of the interval content.

Fig. 7:
Single channel analyser window

- Start/Stop button: Starts single channel analysis or brings it to a stop.
- Accept data / Cancel button: As described in Record spectra.
- Button within the area for spectrum display: As described in Record spectra.

The following are given below the spectrum: The total number of pulses from the actual measurement, the number of pulses in the actual channel, the time remaining for the total measurement, the actual pulse rate per second, the actual gate time, and the detector calibration.

5.3 Integration measurement

In integration measurements, the number of pulses whose energy or pulse height lies within a certain interval is determined. The interval or window is fixed by the entered upper and lower limits. The period for which registered pulses are to be counted must also be set. An integration measurement can be repeated for different parameterizations of the window and the measuring time. Parameterization and the process of individual integration measurements must be manually performed.

The results of the various integration measurements are presented in a graph against the running number of the integration measurements. A table of the data is also shown.

The following operating elements for the MCA are offered under the Integration measurement menu prompt.

Control

- Reduce window check box: The lower and upper limits of the interval and the measurement time are manually set. When the window is not reduced, then the MCA counts all pulses that are registered during the gate time.
- Lower limit / upper limit fields: Establish the lower and upper interval limits.
- Recording time field: For establishment of the measurement time.
- Perform measurement button: (Abort measurement) Serves to start or stop an integration measurement. The measurement can also be stopped manually before the recording time has expired. At the end of the recording time, the measurement stops automatically.

- Delete data button: The measurement data of the actual and of the previous integration measurement are deleted.

MCA Settings

- MCA Settings Field: As described above under Record spectra.

X-Data record

- x-Data record field: The individual integration measurements can be freely indexed.
- Title field: Determines the identifier for the integration measurement. The preset identifier is number. An - identifier for a measured quantity can be set by an entry in the Symbol field. The running number for the integration measurement is preset. The unit for the measured quantity can be set in the Unit field.

Accept data / Abort

- Accept data and abort buttons: As described above in Record spectra.
- Buttons below the graphical presentation: As described in the menu prompt Record spectra.

The following are given under the graphical representation: The total count of registered pulses, the number of pulses for the actual integration measurement, the actual pulse rate per second, the time remaining for the actual integration measurement and the detector calibration.

5.4 Settings and calibration

The settings and calibration menu window allows the user to carry out either a two-point or a three-point calibration that determines the connection between the channel number and the energy of registered events. The equation for a straight line is fixed by the slope (keV per channel multiplied by the channel number) and x-axis section (keV of the zeroed channel). It is valid for a pair of values for offset and gain. The programme changes the energy displayed by changing the offset and the gain. Whereas the calibration remains usable in the bounds of the linearity of the detector when the offset is changed, it is only very roughly correct when the gain is changed. It is best to calibrate for each particular setting
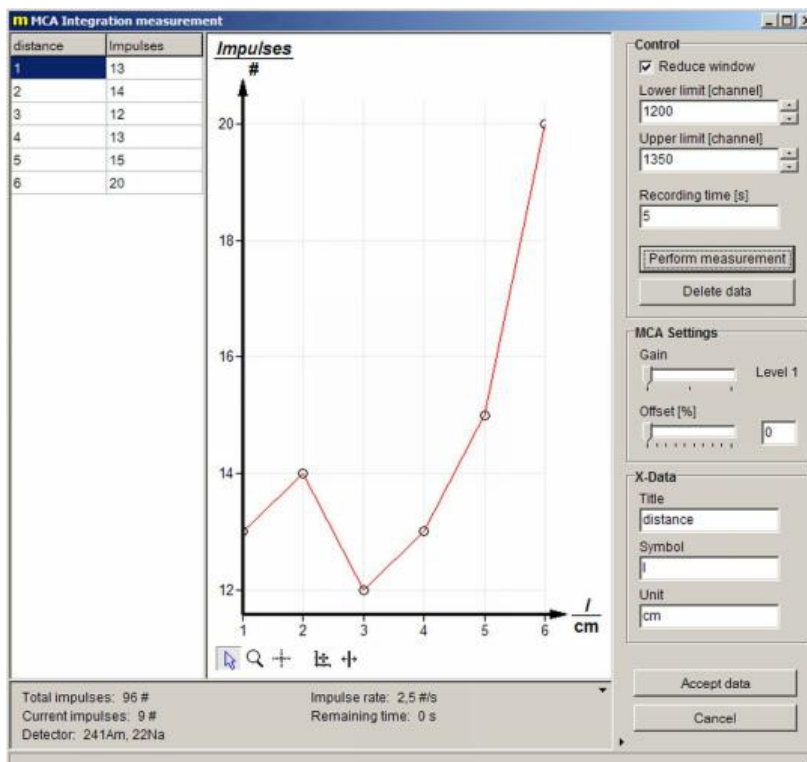
First, the Settings window opens.

Fig. 8:
Integration window

Settings window

The window is divided into two sections, Detector calibration and Device information.

Detector / calibration section

- Detector/calibration selection box: A calibration that has already been saved can be selected. The parameterisation of the actual calibration is shown under the selection box. In the Comment panel, information is given on the selected calibration, in case such information has been saved with the calibration. The Mode panel shows if the chosen calibration was a two-point or a three point calibration. The Gain panel displays the amplification step and the offset with which the selected calibration was carried out. The Equation panel shows the equation resulting from the calibration which connects the channel number with the energy of the event.
- Calibrate button: Opens the calibration window (see below) for creation of a new calibration.
- Save button: For storing a newly created calibration and the parameters of it. Opens a window in which the user can enter a name for the calibration and comments, if necessary.
- Delete button: Deletes calibrations that have already been stored and is only active when there is a saved calibration in the Detector/calibration selection box selected.

Device information section

Serves for the matching of the MCA and is only to be used with the agreement of Phywe Systeme GmbH & Co. KG.

Close button

The Close button lies outside of the detector calibration and device information sections in the Settings window. A click on it causes the actual calibration to be accepted and brings the user back to the starting window of the Multichannel Analyser "measure" module. When one of the three other menu prompts is executed from this window, then the calibration is accepted for these menu prompts.

Calibration window

Clicking on the Calibration selection box leads to this window. The interface of the calibration settings window resembles the window of the Record spectra menu prompt.

MCA Settings section

Has the same function as the Record spectra menu prompt, so that the description of this section is to be found under the Record spectra menu prompt.

Calibration section

This serves for the parameterisation of the calibration.

- Mode selection box: Select two-point or three-point calibration or manual calibration.
- Unit selection box: Select keV or MeV as energy unit.
- Input entry boxes: Two-column Table with two rows for two-point calibration and three rows for three-point calibration. Channel numbers are entered in the left-hand column and the corresponding energy values in the right-hand column. Manual entry of the channel numbers and corresponding energy values is possible, or the channel numbers can be entered by use of the cursor. To do this, move the marking lines with the cursor to lines of known energy in the spectrum. The numbers of channels selected with the marking lines are automatically entered in the Table. Each row in the Table corresponds to a marking line and different colors assist the assignment. In Manual calibration mode, input boxes for the slope and axis section of calibration straight lines are displayed.
- Clear diagram button: Deletes the spectrum that is on display.
- Apply and Cancel button: Apply closes the calibration window, accepts the parameters of the calibration that was carried out and returns to Window settings. Cancel closes the calibration window without application of the parameters. The user returns to Window settings.
- Buttons below the settings are the same as those described in the Record spectra menu prompt.
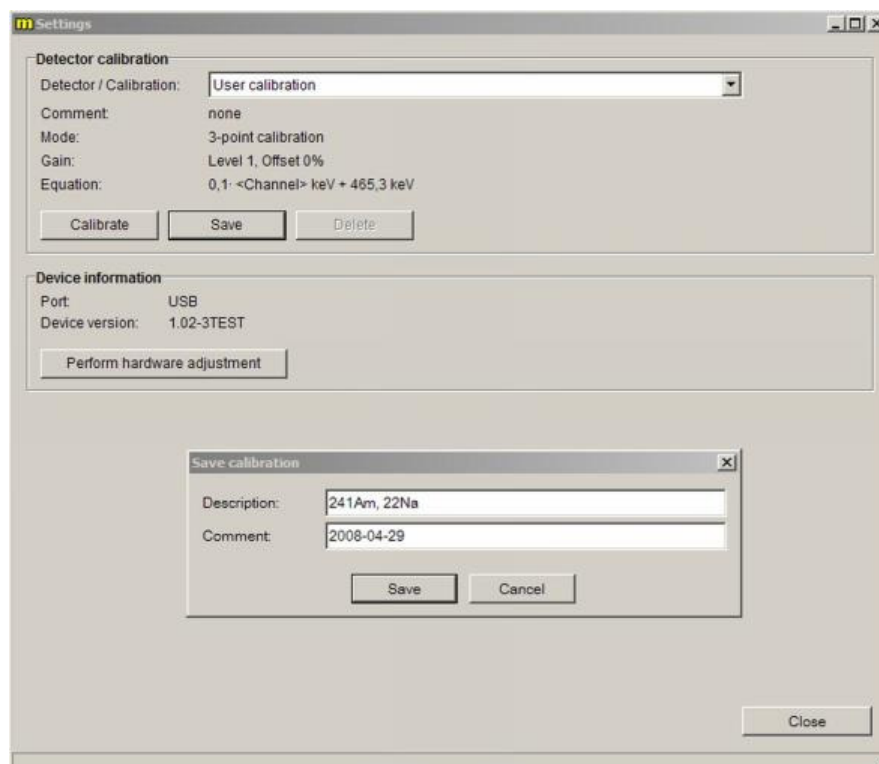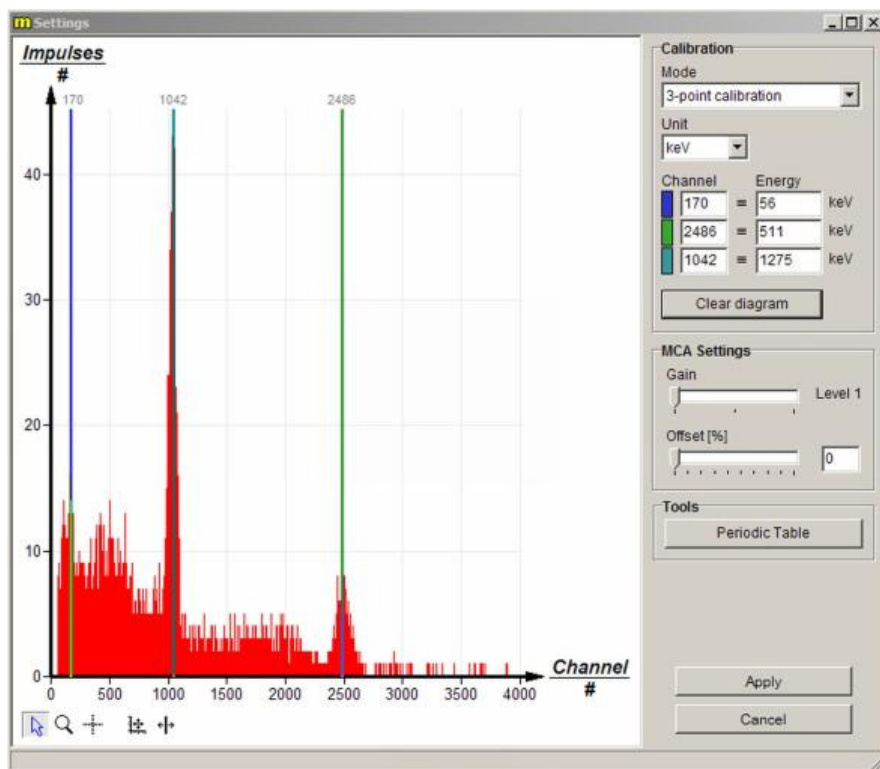

Fig. 9:
Settings window

Fig. 10:
Calibration window

6 NOTES ON OPERATION

This high-quality instrument fulfils all of the technical requirements that are compiled in current EC guidelines. The characteristics of this product qualify it for the CE mark.

This instrument is only to be put into operation under specialist supervision in a controlled electromagnetic environment in research, educational and training facilities (schools, universities, institutes and laboratories).
This means that in such an environment, no mobile phones etc. are to be used in the immediate vicinity. The individual connecting leads are each not to be longer than 2 m.

The device can be influenced in ways by electrostatic charges and other electromagnetic phenomena that it no longer functions within the given technical specifications. The following measures reduce or resolve malfunctions:
Avoid fitted carpets; ensure potential equalization; carry out experiments on a conductive, earthed surface, use screened cables, do not operate high-frequency emitters (radios, mobile phones) in the immediate vicinity. To carry out an instrument restart (reset), unplug the USB-cable, plug it back in again and then start measurement anew in the "measure" programme.
This instrument corresponds to Class A, Group 1 of the EN 55011 standard and can only be operated without limitation outside of residential areas. Should electromagnetic disturbances occur in surrounding residential areas although operation is limited to the technical room of a school or other training facility, then it can be demanded of the operator that he carries out adequate measures (e.g. screening, greater distance, reduction in the operating time) at his own cost.

7 TECHNICAL DATA

(Typical for 25 °C)
Operating temperature range 5…40 °C
Relative humidity   < 80 %

Mains power supply

The unit is a class 1 unit and it may only be connected to power sockets with a protective earth conductor (PE).

Connection voltage   110 V…240 V
Mains frequency   50 Hz…60 Hz
Power consumption   20 VA
Fuses   see the label
(5 mm x 20 mm)
Housing dimensions (mm³)   205 x 155 x 135 (W, H, D)
Weight   approx. 1.37 kg

Signal input (for negative pulses)

Impedance: 3.3 kΩ ‖ 150 pF
Pull zero   internal
The input works integratingly for a short time of 0.2 µs to 4 µs, and differentially for longer times. The preamplifier works totally pulse shaping and converts negative peak pulses to approximately Gaussian shaped positive pulses.

Gain

Total amplification   in three steps of approx. 6, 12 and 24 (can be digitally set)
Limitation of the pulse height
at the A/D-converter of the
pulse height analyser: 4.7 V
Length of the shaped pulse approx. 10 µs
Maximum pulse rate   2000 s^{-1}

Offset

Digital   12 bit resolution
Maximum offset   3.6 V

Analog output

Amplified positive pulse reduced by the offset
Pulse height   0 V to 5 V
Pulse length   approx. 15 µs

Pulse height analyser

Measured value resolution   12 bit
Number of channels   4000
Maximum pulse rate $2000\ \text{s}^{-1}$

Disable input

Logic input (TTL) for coincidence measurements
Enable (default) log 1 > 2.5 V
Disable log 0 < 0.7 V

Voltage outputs

α-detector supply   ±12 V max. 30 mA
Pin assignment clockwise (top view)
    2: –12 V; 3: GND; 4: +12 V
X-ray energy detector
supply   ±5 V max. 30 mA
Pin assignment clockwise (top view)
    1: +5 V; 3: –5 V; 5: +66 V; 6: +U_b; 7: GND
Bias voltage   BNC socket, high impedance
Bias voltage   –33 V, –66 V, –99 V switchable

Computer

USB with USB-B socket

8   ACCESORIES

Some of the instruments that can be used with the MCA are listed here, together with their order numbers:

Alpha detector	09100-00
Alpha and photodetector	09099-00
Preamplifier for alpha Detector	09100-10
Gamma detector	09101-00
PHYWE high precision power supply 1.5 kV DC	09107-99
XR 4.0 X-ray energy detector (XRED)	09058-30
XR 4.0 expert unit, X-ray unit, 35 kV	09057-99
measure Software multi channel analyser	14452-61

9   WASTE DISPOSAL

The packaging mainly consists of environmentally-friendly materials that should be returned to the local recycling stations.

Do not dispose of this product with normal household waste. If this unit needs to be disposed of, please return it to the address that is stated below for proper dispoal.

PHYWE Systeme GmbH & Co. KG
Customer Service
Robert-Bosch-Breite 10
37079 Göttingen
Germany

Telephone   +49 (0) 551 604-274
Fax   +49 (0) 551 604-246