USER MANUAL FOR PORTAL MP-03

Version 1.0

I n d e x

I. Introduction

A. General Description

The ***MP-03 Monitor Portal*** is a “Walk Through” type of system designed to detect possible superficial gamma and beta radioactive contamination in people and their clothing in usual environmental background work areas.

It is basically composed of five detectors, distributed as follows: one on each column (to check body, arms, legs and clothes); two on the base (to check feet and shoes) and one on the upper bridge, between the two columns (to check the head). The person being checked stops a few seconds (adjustable) within the Portal, which starts to check him.

The System notifies audibly and visibly when the pre-set measuring time is over, also indicating audibly and visibly if the result shows possible contamination or not.

A visible liquid quartz screen (LCD) reports the number of counts detected for each column, the base and the top crossbeam.

It also reports various warnings that may exist, by means of a one-digit character for each count.

For supervision purposes, the system communicates with an external computer, to which it sends background information and the results of the last measurement made.

To adjust the alarms, both for background and people, column “A” must be accessed (Column A is the one that contains the general emergency switch next to the red light), the TRC monitor and keyboard must be connected and turned on; the keyboard gives access to the corresponding menus. The same procedure is used for the different tests of the system, to simplify technical service.

Column A contains the electronic system. To access it, the corresponding locks must be opened with a master key that is common to all the locks.

The following picture shows column “A” open.

B. Start of the Operation

When a radioactive element produces disintegration, excess energy is freed, in some cases as γ rays (photons). When these photons impact on the ad-hoc detectors, their energy is transformed into light, which in turn becomes an electric impulse when detected by the photomultiplying tubes.

Likewise, the beta particles issued as of the weakening of some nuclides that reach the detectors also generate an electric signal.

These electric signals are amplified and sent to the processing module where they are discriminated according to their amplitude, processed, counted and compared to the background radiation measurements. The results are then displayed on the screen.

An audible signal can be configured in order to raise an alarm caused by the detection of a higher contamination than is permissible for that area.

When the System is not busy checking a person, it constantly checks and evaluates the background, for future computation.

The System's detector assembly includes shields that substantially increase detection efficiency of the measurement, reducing the incidence rate of environmental exposure that is typical of such areas.

The Portal foresees the output of logical signals for connection to external devices such as semaphores, a gate to allow clean people to pass and to stop those that are contaminated, sends alert signals to the control room, etc.

II. Use

A. Using the system

- Immediately after the Portal is turned on, a few moments must elapse for the System to complete its start-up routine. The start-up is finished when the following welcoming message appears on the screen:

NuclearLab SRL
Monitor MP 03

- After that, the System begins to warm up; during this time, the green lights on the columns will blink.
- The System will remain in this state for around 10 seconds, during which it will make the first background check.
- Once the system if warmed up the green lights on the columns will remain lit, without blinking, and the welcome message is replaced by the check screen:

A0	***B0***
F0	***U0***

As of that moment, the System is ready to measure.

- Entrance of person to be checked: access to the Portal can be from either side; the portal is bi-directional.
  Before entering, make sure that the green light is on. If it is blinking, this indicates "conditional operation" of the Portal (for instance, high background level). If the red light is on, it means that the System is not ready to make the check, because there is another person being checked, or it is out of order.

- The System automatically detects that a person has entered the measuring area, and alerts with a short tone (1000 Hz) that checking has begun.

  The green light goes off and the red light goes on, to alert other users that the Portal is busy.

- People waiting to be checked should stand at a distance of not less that 1 meter from the Portal, in order to avoid any possible influence on the ongoing measurement.

- People must stand in the middle of the System, feet on the lower grid, arms alongside the body and facing the columns.

- When the check ends and the result is “clean”, two short sound tones (1000 Hz) notify the person that he may exit. Results appear on the LCD screen:

A14	***B43***
F23	***U12***

Field ***“A”*** shows the count (background discounted) of column ***“A***”, likewise, field ***“B”*** refers to column ***“B”***, field ***“F”*** shows the result of the foot detectors and ***“U”*** those of the top detector on the crossbeam between the two columns.

- Should there be a radiation count that is higher than the preset alarm levels, a louder sound will be heard, as a signal. As in the previous case, the results are displayed on the LCD screen, but in this instance there will be a warning symbol that indicates that the preset levels have been exceeded. This symbol is an exclamation point ***“!”*** that will appear next to each field in which the alarm level has been exceeded. Should this symbol appear in all fields, it may be that the alarm level in all the detectors has been exceeded or else that the ***"Global"*** alarm level has been surpassed (sum of the count of all the detectors).

!A14554	***!B43435***
!F2367	***U12***

- An external semaphore (OPTIONAL) will show a green light if the result of the measurement is ***“clean”*** or a green light and sound if it is ***“contaminated”.***

Clean ***Contaminated***

- If the person does not exit the Portal once the measuring cycle is ended, the System will insist its warning with more repeated sound tones (440 Hz) to let him know that the check is over and he must leave.
- In case the alarm should sound indicating possible contamination, follow the procedure indicated by the Radiological Safety officer for such instances.
- Once the person leaves the portal, the green light goes on again and the portal continues checking the background, until another person enters it.
- If a person leaves the Portal before the check is completed, a sound tone (200 Hz) followed by a deeper tone (150 Hz) and a question mark ***("?")*** on the LCD screen will notify the user that he must be checked again, from the beginning of the routine.
- If the system detects that the background radiation level exceeds the preset limits, it will show that its operation is conditional by the blinking of the green lights on the columns, as it is highly probable that any count under such conditions will produce an unreliable result. Any check of a person under such conditions will appear on the screen with a question mark ***("?")***

?A14	***?B4***
?F23	***?U12***

- If the system detects that any one of the detectors is not operating normally, it will also indicate that its operation is conditional by the blinking of the green lights on the

columns, as it is highly probable that any count under such conditions will produce an unreliable result. Any check of a person under such conditions will appear on the screen with the ***"#"*** symbol.

#A14	***#B0***
#F23	***#U12***

B. Supervision and Configuration

The ***Model MP-03*** Portal is totally autonomous; that is to say, it does not need a remote computer to operate properly, since it has an in-built PC that handles all the local supervision and configuration of the operating parameters.

However, there are two other optional programs that can be simultaneously associated to one or several portals: one is used to supervise the measuring and the other one to configure the parameters of the systems. Both run on Windows on a computer (OPTIONAL) used for remote control and supervision.

This computer offers a means to supervise what is happening in the associated portal(s) and also allows the configuration of the operating parameters at a center such as, for instance, the radioprotection officer's room.

During normal supervisory use, as many windows will be opened as portals need to be supervised; each window will display the results of the last measurement made in each portal, showing the corresponding values.

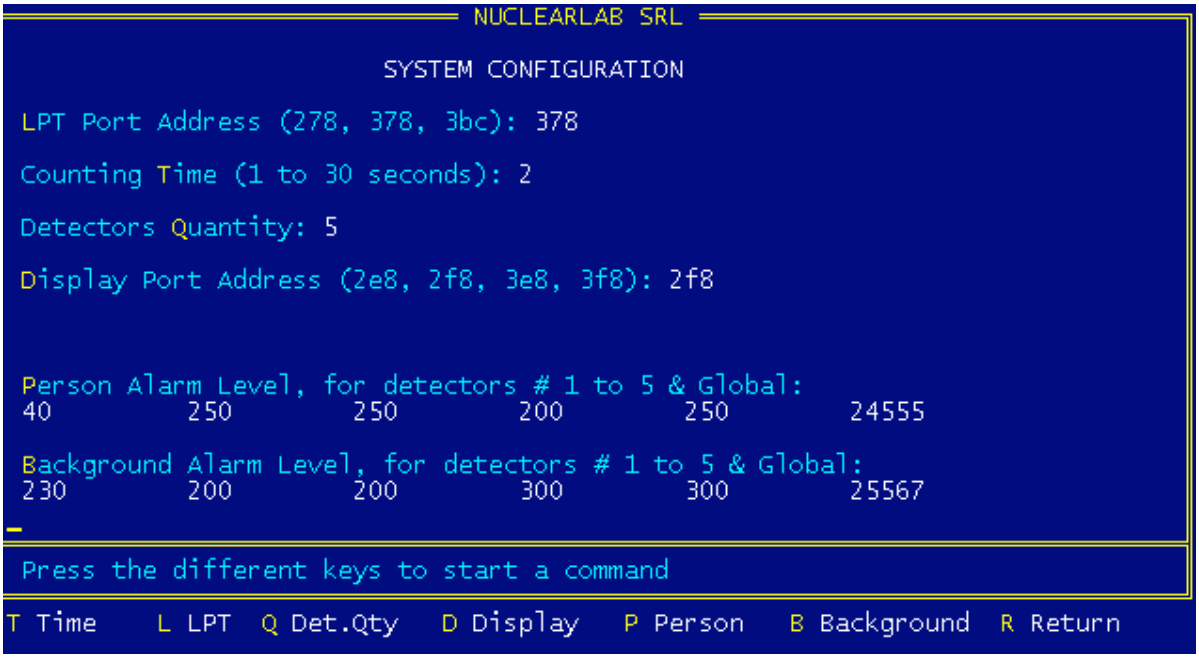
For remote supervision and configuration, the *MP-03 Portal* communicates with the external PC via RS-422.

For access to the local programs, column A of the portal must be opened. That is where the industrial Advantech PC is located, with its monitor and keyboard. Make sure that these are connected and turned on.

The screens are extremely friendly and clear for simple guidance of the operator. Detailed information on the various screens can be found in the Service Manual.

C. Local Configuration Program

Through its various screens, this program allows the operator to see and configure the System's parameters.



1. Adjustable parameters

Access to the configuration of the various parameters is through the keyboard, pressing the key indicated in bold letters for each one.

B – Alarm limits due to high background level for each detector and the sum of all detectors (Global) in CPS (counts per second): allows establishing the threshold number of counts per second that each detector and their sum total may reach; an alarm signal will be emitted when there is an increase in background radiation. Any measurement that results in the same or a larger amount of counts will trigger the alarm.

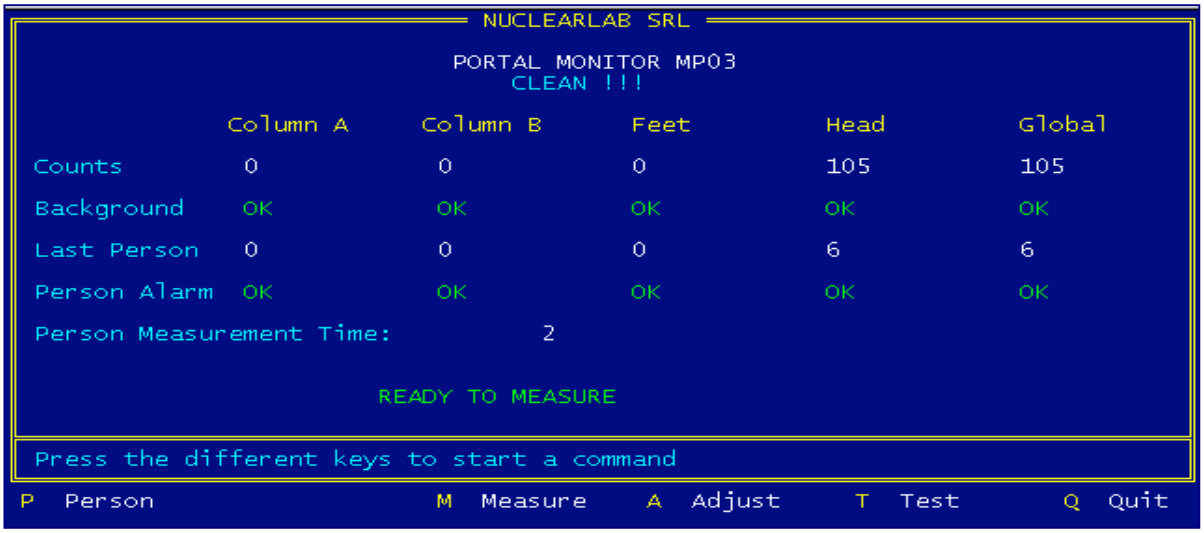
P – Alarm limits for people: for each detector and the sum of all detectors (Global) in CPS (counts per second): allows establishing the threshold number of counts per second that each detector and their sum total may reach; an alarm signal will be emitted when there is an increase in the values measured in people. Any measurement that results in the same or a larger amount of counts will trigger the alarm.

T – Time of measurement in seconds (1 to 30 seconds)

L – Directions of the internal PC communications ports (only for service)

Q – Number of active Detectors (only for service)

D. Local supervision program



The previous screen provides the following information:

1 Results of the Measurement

CLEAN: means that the values obtained from the measurement are below the preset alarm limits.

CONTAMINATED: means that one or some of the values obtained from the measurement are above the preset alarm limits.

CONDITIONAL: means that the measurement was made when the portal was in conditional operation.

INVALID: means that the measurement is not valid because the person left the portal before the measurement was finished.

2 Counts

Provides information on the counts registered in CPS (counts per second) for each column: feet, head and total. (Gross count)

3 Background

OK: means that the background measured is below the preset alarm limit.
HIGH: means that the background measured is above the preset alarm limit.

4 Last Person

Shows the number of counts (in CPS) of the last person checked (net count)

5 Person Alarm

Shows, for each detector and for the total, if the measurement exceeded any of the preset alarm limits.

6 Person Measurement Time
Shows the time of measurement used to check the person.

7 Shows the state of the System: System ready to check a person or System busy.

Q (Quit): to exit from the program; will show the Operative System cursor.

T (Test): testing of lights, audible alarms, counters, passage sensor and serial port

A (Adjust): Access to the local Configuration program.

P (Person): simulates the passage of a person

M (Measure): to renew the normal measurements when returning from the Test or Adjust menus

III. Technical Specifications

A. Plastic scintillation detectors

Five (5) Detectors of plastic scintillation:
One (1) Detector 2” thick x 4” wide x 70” long on each column
One (1) Detector 2” thick x 6” wide x 12” long on top crossbeam
Two (2) Detectors 2” thick x 6” wide x 12” long on the base

The associated PMTs have an aluminum capsule and MHV connector for the signal and high voltage

B. People detector

The barrier that detects people is IR reflective type.

The light emitted by the barrier is reflected on a passive mirror and detected again in the issuer. It detects the entrance of a person to the Portal, to be measured.

C. Features of the Internal Processing Module

The internal processing module has all the components needed to operate properly.

It includes an industrial type PC, with high speed processing and is compatible with the Intel Pentium MMX set of instructions; it does not have any movable parts, thus improving the average time between faults. It is for this reason that a cold type processor has been used, since it does not require forced ventilation. Likewise, a solid-state data memory system was chosen instead of hard disks so as to avoid having any mechanism that could wear down.

The operative System is the latest DOS version; the manual, original disks and license are delivered together with the system.

Nor does the commutation power source requires forced ventilation and is over-sized, so that the operating temperature remains low.

D. General Features

Mechanical

Housing: Steel with epoxy paint finish

Passage Height: 200cm

Passage Width: 70cm

Estimated weight of the System: 350Kg

Electrical

Input: 240Vac / 50-60Hz

Environmental Requirements

Operating Temperature: 10 to 35^{o}C

Operating Humidity: less than 80%, non-condensation

IV. Recommended periodic actions

A. Adjustments

The *MP-03 Portals* fulfill the following detection levels:

For Gamma radiation: 1 μCi (37KBq) of Co-60 with a measurement time of two seconds for background checks.

For Beta radiation: 1 μCi of Sr-90 with a measurement time of two seconds for background checks.

It is advisable to test compliance with these specifications; it is good practice to compare, from time to time --i.e. monthly-- the proper operation of the portal with known radioactive sources.

Should the counts per second vary significantly between one check and another, it is advisable to check the efficiency of each detector separately and the background radiation level detected for each one. This measurement must be made by personnel qualified to diagnose and calibrate electronic radiological protection instruments. Calibration of each detector and its measuring channel can be adjusted independently as to gain, threshold and high voltage values, as explained in the “Technical Reference Manual” of the MP-03 Portal Monitor.

It should be pointed out that the MP-03 Portal has been developed to operate in normal environmental conditions; Therefore, to assure its proper operation certain precautions must be taken: do not store boots, clothes, shoe-covers, gloves, waste material or any other contaminated element nearby as these may generate an increase in the background near the Monitor.

In general, make it a rule that at the slightest suspicion of malfunction of the system due to excessive high background alarms, the first thing to do is to check the magnitude of the background and its stability in time with external background monitoring systems that will allow keeping a record of successive measurements over a sufficient period of time.

B. In case of contamination of the foot detectors:

It is quite possible that after a person is checked with contaminated shoe-covers, the “protective film” will be contaminated and the System will show excessive background.

To solve this matter, this protector must be replaced with a clean one.

In order to avoid the “High background” situation due to the mentioned cause, it is advisable to do this procedure from time to time even if the protector is not very contaminated. Practice will dictate the necessary time lapse between each installation.

To replace the “film protector”, remove the stainless steel cover by simply lifting it; two people should do this, one at each side of the portal, to simplify the maneuver and avoid taking risks.

C. General cleaning

For general cleaning of the portal, use only a slightly water-damp cloth. Do not use alcohol or any type of solvents that may damage the painted or plastic surfaces.

It is reasonable to expect that, in time, some dust will settle on the plastic protection grills of the column detectors.

ATTENTION: it is advisable to remove the grills to clean them, to avoid possible damages to the sensitive face of the detector. To this end, remove the two plain aluminum rods that support them and that run from the foot module to the display or speaker module

respectively. After washing and drying them, they must be re-installed following the reverse process of their dismantling.

The portal can continue operating during the washing, without the protective grills, but it is advisable not to use it, in order to avoid damaging the detectors with pointed or sharp elements that the people may carry in their hands or pockets and could inadvertently graze them.

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