

LESSON PLAN

PART I
COVER SHEET

LESSON TITLE: ADM-300A Multi Function Survey Meter

TRAINING METHOD: Demonstration - Performance

REFERENCES: T.O. 11H2-2-31, Operator's Manual ADM-300A Survey Meter and ADM-300A Radiological Assessment Kits, 4 August 95.

AIDS AND HANDOUTS: ADM-300A Multi Function Survey Meter with available probes
Verification Test Kit
Attachment 1 - ADM-300A Survey Meter Illustration
Attachment 2 - ADM-300A Display Panel Illustration
Attachment 3 - Trouble Shooting Chart

LESSON OBJECTIVE: Given a lecture on an ADM-300A Multi-Function Survey Meter, the student, during the final course exam, must correctly answer questions covering task steps below and the two samples of behavior listed below:

TASK STEPS:

1. Identify the major components of the ADM-300A.
2. Inspect and determine serviceability of the ADM-300A.
3. Adjust the Alarm Set Points for use with the survey meter.
4. Operate the ADM-300A with each probe.

SAMPLES OF BEHAVIOR:

1. Identify the purpose of the ADM-300A.
2. Identify the unit of measurement the ADM-300A and auxiliary probes use.
3. Identify capabilities and limitations of the ADM-300A and its auxiliary probes.

ORGANIZATIONAL PATTERN: Topical

STRATEGY: Explain the purpose of the ADM-300A upon issuing the instrument to the students. Describe the main components of the kit and the different modes of operation for the meter. During student performance, stress the samples of behavior (i.e. purpose, unit of measurement, ranges, etc.) Stress all cautions or warnings listed in the operator's manual. When teaching the unit of measurement of this instrument, remember the differences in symbols: μmR = micro roentgens; mR = milliroentgens. Also, There are a number of specific applications for the ADM-300A such as programming survey points and interfacing with computer software. Teaching these applications will depend on the users and different scenarios. Therefore, this lesson plan teaches the basic principles and operations and you should use the manufacturer's manuals for more detailed applications.

LESSON OUTLINE:

- MAIN POINT 1. PURPOSE OF THE ADM-300A SURVEY METER

- MAIN POINT 2. FEATURES AND MAJOR COMPONENTS OF THE ADM-300A
 - A. Features
 - B. Components

- MAIN POINT 3. UNIT OF MEASUREMENT, RANGE, AND LIMITATIONS
 - A. Unit of Measurement
 - B. Range
 - C. Capabilities and Limitations

- MAIN POINT 4. PREVENTATIVE MAINTENANCE
 - A. Visual Inspection
 - B. Normal Operating Procedures

- MAIN POINT 5. PRINCIPLES OF OPERATION
 - A. Functional Description
 - B. Normal Operating Procedures
 - C. Modes of Operation

PART II
TEACHING PLAN
INTRODUCTION

ATTENTION:

Radiation, caused by a nuclear attack or accident, is a hazard that must be identified quickly and accurately. Besides identification, intensity levels must be established to determine the amount of risk to personnel and the extent of decontamination and restoration required.

MOTIVATION:

Specialized equipment, such as the ADM-300A, Multi-Function Survey Meter, allow you to assess the situation and advise the commander on the pre-cautions to take to continue the mission.

OVERVIEW:

During this block we will cover :

1. The purpose of the ADM-300A.
2. The meter's features and major components.
3. The meter's unit of measurement, range, and limitations.
4. Preventive maintenance for the ADM-300A.
5. Principles of operation for the ADM-300A.

BODY**MAIN POINT 1.
PURPOSE OF THE
ADM-300A SURVEY
METER**

The ADM-300A, with auxiliary probes, is a portable, multi-functional, microprocessor-based survey meter used to detect and measure.

This survey meter is designed for large area surveying to find the extent and intensity of radioactive contamination. It can also be used for area and personnel monitoring to determine the presence and intensity of residual radiation.

**MAIN POINT 2.
FEATURES AND
COMPONENTS**

Designed with particular features and capabilities for expanded use once components are added.

A. FEATURE

A. The ADM-300A is a fully self-contained instrument with batteries, controls, indicators, and electronics necessary to display dose rate, dose, and alarm indications. This particular radiation detector is designed to be used as a stand alone instrument, as well as, built with a standard RS-232 serial computer port to collect and store data in a computer.

B. COMPONENTS

⇒ DISPLAY

⇒ SOUNDER

⇒ CONTROL PANEL

B. Components Include

⇒ The display is an LCD panel with a switchable backlight capable of showing dose rate, accumulated dose, low battery conditions, alarm set points, and test and fault indicators.

⇒ A sounder is installed for audible monitoring and alarm signaling when set points are exceeded.

⇒ The control panel includes six switches which lets the operator select modes and functions for normal use and testing of the instrument. The six switches are:

⇒ - POWER ON/OFF

⇒ - LIGHT ON/OFF

⇒ - AUDIO ON/OFF

⇒ - MODE (Selects five modes of operation)

⇒ - SET (Adjusts the alarm set points)

⇒ - UP ARROW ↑ (Adjusts characters or functions depending on the mode selected)

⇒ AUXILIARY PROBES

⇒ Auxiliary probes increase the capability of the ADM-300A by providing detection capabilities of Alpha, Neutron, and X-ray radiation. These probes are:

⇒ AP - 100 Alpha Probe

⇒ BP - 100 Beta Probe

⇒ XP - 100 X-ray Probe

⇒ NP - 100 Neutron Probe

⇒ BGP - 100 Beta Gamma Probe

⇒ CARRYING CASE

⇒ A transportation case is provided which holds the entire system (meter, probes, spare batteries, handle, etc.) A smaller, vinyl case with a carrying strap is provided for the survey meter alone.

⇒ PISTOL GRIP

⇒ The pistol grip mounts under the survey meter for better handling.

⇒ ADDITIONAL
EQUIPMENT

⇒ Available options include an auxiliary headset, AC power converter, and a vehicle mounting bracket.

TRANSITION:

Now let's talk about the unit of measurement, range, and limitations of this instrument.

MAIN POINT 3.
UNIT OF
MEASUREMENT,
RANGE, AND
LIMITATIONS

A. UNITS OF
MEASUREMENT

3. It's important to point out that the radiation range and units of measurement adjust automatically depending on the MODE selected and the probe attached.

INSTRUCTOR'S NOTE: Keep in mind, when referring to units of measurement, that Centigray (the standard unit) is equal to Roentgens. However, the ADM-300A displays Roentgens.

A. The ADM-300A detects, measures, and digitally displays levels of gamma radiation from 10 $\mu\text{R/h}$ (micro roentgen per hour) to 10,000 R/h. The analog display is a bar graph which covers 10 $\mu\text{R/h}$ to 1,000 R/h.

The Alpha and X-ray probes use a different unit of measurement than the basic meter.

Three units of measurement are available:

(1) $\mu\text{Curie/MxM}$ ($\mu\text{Ci/MxM}$)

(2) DPM/Cm x Cm (disintegrations per minute/cpm)

(3) C/mn ALPHA (counts per minute)

B. RANGE

B. As mentioned, the survey meter will automatically provide and display the proper readings and units of measurement over its entire operating range.

1. SURVEY METER

1. The survey meter will automatically select one of four operating modes (2 low and 2 high):

**LOW-RANGE IN
DOSE RATE MODE**

(a) The low-range detector in the dose RATE mode:

(1) Detects and measures gamma and detects beta radiation.

(2) Ranges from 10 μ R/h to 5 R/h.

**LOW-RANGE IN
ACCUMULATED DOSE
MODE**

(b) The low-range detector in the accumulated DOSE mode:

(1) Measures gamma and detects beta radiation.

(2) Ranges from 1 μ R/h to 1,000 R.

**HIGH-RANGE IN DOSE
RATE MODE**

(c) The high-range detector in the dose RATE mode:

(1) Detects and measures gamma radiation only.

(2) Ranges from 3 R/h - 10,000 R/h.

**HIGH-RANGE IN
ACCUMULATED DOSE
MODE**

2. ALPHA PROBE

C. CAPABILITIES AND
LIMITATIONS

Note: Detects and measures up to 10,000 R, but only displays 1,000 R. The T.O. does not distinguish between low and high range for accumulated dose.

(d) The high range detector in the accumulated DOSE mode:

(1) Detects and measures gamma radiation only.

(2) Ranges from 1 μ R to 1,000 R.

2. The range of the Alpha probe is 0 - 1,200,000 counts per minute.

C. The instrument will display both a dose rate as well as an accumulated dose amount. With additional auxiliary probes, the ADM-300A has extended capability such as detecting and measuring alpha radiation. In its stand alone configuration it detects and measures gamma and detects beta radiation.

1. HIGHLY RESISTANT

1. The ADM-300A operates in temperatures from -25° to 50°C (-14° to 122°F) and in humidity up to 100%. It is highly resistant to most harsh environmental conditions. For example, it is engineered to operate even after being accidentally immersed in water.

NOTE: The unit will not operate under water.

2. OPERATES ON TWO 9 VOLT BATTERIES

2. The meter primarily operates on two standard 9 volt alkaline batteries and will last about 100 hours at 25°C (76°F).

3. ELECTROMAGNETIC PULSE

3. The instrument is also electromagnetic pulse (EMP) hardened and will not saturate at a dose rate of up to 100,000 R/h.

Basically, EMP is high energy electromagnetic pulse that, at the moment of nuclear burst, can damage electrical, solid state, and unprotected electronic components.

TRANSITION:

Now let's look at the operator's maintenance on the ADM-300A.

MAIN POINT 4.
PREVENTIVE
MAINTENANCE

A. VISUAL INSPECTION

Preventive maintenance or routine checks include a visual inspection, operational check, cleaning, and storing the unit.

A. The procedures for visual inspection are:

(1) Check membrane switch cover for cracks and breaks.

(2) Check external probe connector to ensure pins are straight and free of dirt or debris.

(3) Check the beta window cover for damage, dirt, or moisture.

(4) Check for broken display window.

(5) Check carrying case for cracks, breaks, or damaged strap.

(6) Check battery compartment for clean contacts. Check cover gasket for cracks.

B. OPERATIONAL CHECKS

B. When turned on, the ADM-300A automatically runs a diagnostic test. It will display any malfunctions if they occur. Any problems other than low batteries will be displayed as FAILURE and then the type of failure. If this occurs, turn unit off, retry unit after 30 seconds. If failure still exists, turn unit off and contact NRC or box unit and return to NRC for repair.

INSTRUCTOR'S NOTE: Refer to Attachment 3 and 4, in Part IV, for a complete explanation of diagnostic failures and possible solutions.

1. ACCURACY VERIFICATION

1. The ADM-300A requires an annual calibration. A performance test on the instrument and probe accuracy should be accomplished prior to use and every 180 days.

Accuracy verification of the meter and probes is done using a test set containing test sources and a fixture to position the test sources.

INSTRUCTOR'S NOTE: Refer to Verification Set Manual for verification testing procedures (11H2-2-31, chapter 4, pages, 43-46).

2. CLEANING AND
STORING

2. Wipe the ADM-300A with a clean, dry cloth to remove dust, dirt, and moisture. Clean the case with a cloth and warm soapy water. Always store the unit in the carrying case with the batteries removed when not in use.

TRANSITION:

Now let's talk about how an operator will use this equipment.

MAIN POINT 5.
PRINCIPLES OF
OPERATION

We will cover the functional description of the ADM-300A and the normal operating procedures.

A. FUNCTIONAL
DESCRIPTION

A. The ADM-300A is microprocessor-based. This means that the internal electronics control all functions including detection, calculation, compensation, and display.

The central processing unit (CPU) control both low range and high range Geiger - Mueller (GM) tubes. The two GM detectors produce electrical signals when exposed to gamma rays and beta particles.

B. NORMAL OPERATING
PROCEDURES:

B. Install batteries.

-- POWER ON

Turn unit on by pressing **and holding** the POWER ON/OFF switch for 2 seconds.

-- POWER OFF

C. MODES OF OPERATION

The display indicates "**PLEASE WAIT.**" The meter will conduct the programmed self-diagnostic test. The "RATE" display will appear and ambient gamma rates will be indicated.

Press **and hold** POWER ON/OFF for 2 seconds.

C. Press the MODE switch until the desired reading is displayed. The mode is displayed as follows:

MODE	DISPLAY
DOSE Rate	RATE
Dose	DOSE
Dose Rate Alarm	RaAlm
Dose Alarm	DoAlm
Scaler (used for accumulation over a preset period of time)	Scaler
Survey (used for tracking up to 100 pre-designated monitoring points)	Survey

-- ALARM SET POINTS

To see the current alarm set points, repeatedly press the **MODE** switch until **RaAlm** or **DoAlm** is displayed. The default point for rate alarm is 600 $\mu\text{R/h}$ and the dose alarm default is 100 mR. The unit memory retains the last setting when the power is turned off.

To adjust the desired **RaAlm** or **DoAlm**, use the **MODE** switch to select the appropriate alarm. Then use the **UP ARROW** \uparrow to set the desired points before the display stops flashing.

After selecting the desired adjustment points, reset the accumulated dose. To reset accumulated dose:

\Rightarrow Move to **DOSE** display (using the **MODE** switch).

\Rightarrow Press and hold **SET** switch.

\Rightarrow While holding **SET** press **UP ARROW** \uparrow for at least 3 seconds. "**CLEAR DOSE**" will be displayed.

\Rightarrow Release all switches.

-- ALARM DISPLAY

When the survey meter has detected radiation above the preset alarm levels, the audible and flashing visual alarms are activated. The display shows the type of alarm.

- GAMMA SURVEYING

To perform gamma surveys with the ADM-300A, the beta window on the meter's rear panel must be closed. The survey meter will auto range to detect gamma radiation without interruption.

During ground radiological reconnaissance the instrument should be at a consistent angle to the ground to assure accuracy and uniformity of readings.

- BETA MONITORING

CAUTION: THE BETA WINDOW GUARD CAN BE RUPTURED BY SHARP OBJECTS, USE EXTREME CARE TO PROTECT THE WINDOW GUARD WHEN THE WINDOW IS OPEN FOR MONITORING BETA RADIATION.

To monitor for beta, hold the ADM-300A in your hand or by the handle, if attached. Open the window cover and point window towards the suspected contaminated area.

- EXTERNAL PROBE
OPERATION

In the "low range" mode, the beta particles will enter the window if contamination is present. If the reading is 15 or higher with the window cover open, then Beta particles are present. Gamma reading can be observed while the window is closed.

As mentioned earlier, external probes are available for remote detection. Both the Alpha and Beta external probes lend themselves to convenient personnel and material contamination checks.

The X-ray probe is designed to find gross contamination under cover of dust, snow etc., where alpha detectors would have no sensitivity. When the X-ray probe is attached the internal detectors and alarm set points are deactivated and the accumulation of Dose is suspended.

--NEUTRON PROBE

The neutron probe is an accessory to the ADM-300A kit and is used to measure neutrons in a nuclear environment. The probe is not a standard component to the kit; it must be ordered as a separate component.

There are a limited number of these probes in the Air Force inventory due to the nature of their use.

INSTRUCTOR'S NOTE: Use the Operator's Manual to teach specifics on each external probe.

CONCLUSION

SUMMARY:

We have covered the main points of the ADM-300A multi-function survey meter. Specifically, we addressed:

- ⇒ The purpose of the ADM-300A, it's design and intent for detecting and measuring radiation.
- ⇒ The features and major components along with its wide variety of modes.
- ⇒ The units of measurement, range, and limitations of the unit.
- ⇒ Preventive maintenance, self-diagnostics, and verification testing.
- ⇒ Principles of operation.

REMOTIVATION:

By knowing the capabilities of the ADM-300A and how to properly use the instrument, you will be able to quickly detect and determine the intensity of radioactive contamination. This information will be essential to assist the commander in determining restoration and decontamination procedures.

CLOSURE:

This concludes this lesson.

TRANSITION:

(Develop locally to transition to the next topic.)

PART III
EVALUATION
STUDENT PERFORMANCE STANDARDS

1. Identify the major components of the ADM-300A multi-function survey meter.
2. Inspect and determine serviceability of the ADM-300A.
3. Adjust the Alarm Set Points for use with the survey meter.
4. Prepare the ADM-300A for operation with each external probe.

TEST ITEMS

1. LESSON OBJECTIVE: Identify the purpose of the ADM-300A.

QUESTION: (MULTIPLE CHOICE) The ADM-300A, in its "stand-alone" configuration will...

- a. Detect gamma, beta, and alpha radiation
- b. Detect and measure gamma and beta radiation
- c. Detect and measure gamma, but only detects beta radiation
- d. Detect Beta and measure gamma, alpha, and neutron radiation

KEY: c

REFERENCE: MAIN POINT 1

2. LESSON OBJECTIVE: Identify the unit of measurement that the ADM-300A and auxiliary probes use.

QUESTION: (MULTIPLE CHOICE) Which of the following has a range for measuring radiation of up to 1×10^6 counts per minute?

- a. ADM-300A survey meter in the "stand alone" configuration.
- b. ADM-300A with the AP-100 Alpha probe attached.
- c. ADM-300A with the BP-100 Beta probe attached.

KEY: b

REFERENCE: MAIN POINT 2

3. LESSON OBJECTIVE: Identify and explain the six modes of operations of the ADM-300A.

QUESTION: (MATCHING) Match the following MODEs of operation with their appropriate functions:

- | | |
|--------------------|--|
| 1. Dose Rate Alarm | a. Shows total accumulated amount of radiation. |
| 2. Scaler | b. Adjusted set points for indicating various radiation |
| 3. Survey rates. | c. Shows accumulated radiation of a preset period of time. |
| 4. Dose | d. Tracks radiation for up to 100 pre-designated points |

KEY: 1b, 2c, 3d, 4a

REFERENCE: MAIN POINT 5

4. LESSON OBJECTIVE: Identify capabilities and limitations of the ADM-300A and probes.

QUESTION:(MULTIPLE CHOICE) Which of the following is false?

- The ADM 300A is designed to operate under water.
- The ADM 300A will display the dose rate and accumulated dose.
- The ADM 300A will operate in temperatures from -25 to 50 Celsius and 100% humidity.
- The ADM 300A is EMP hardened and will operate about 100 hours on two 9 volt batteries at 25 Celsius.

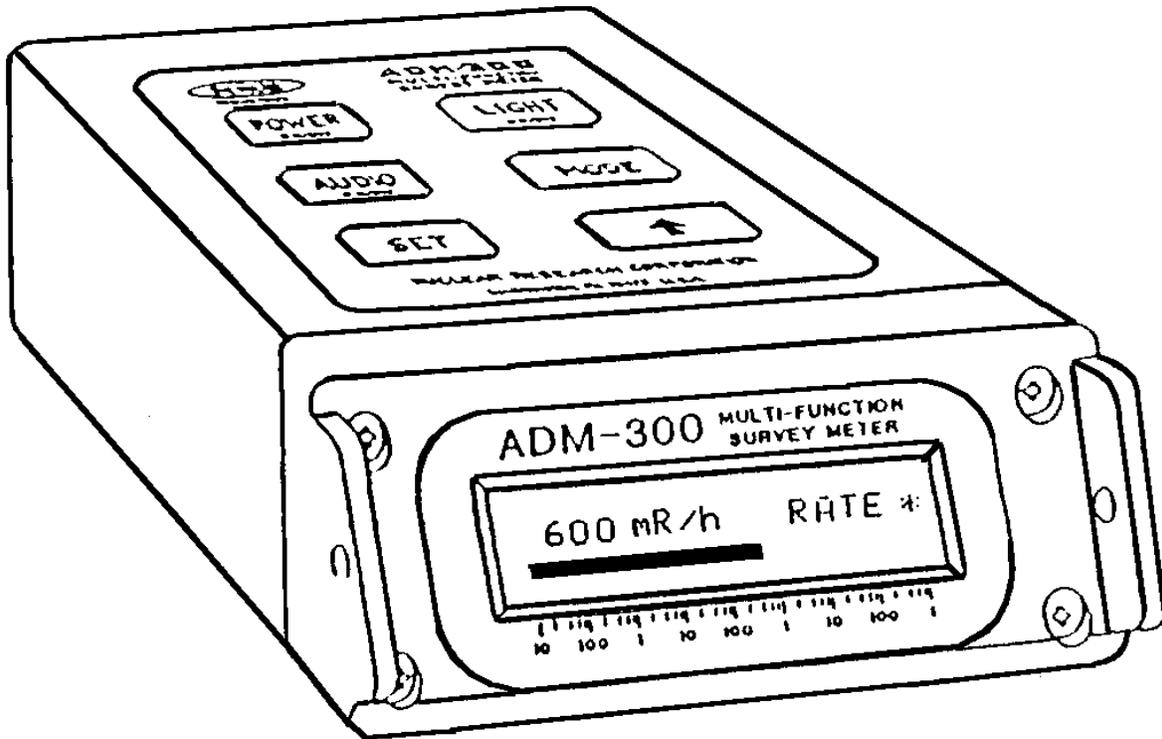
KEY: a.

REFERENCE: MAIN POINT 3

PART IV
RELATED MATERIALS

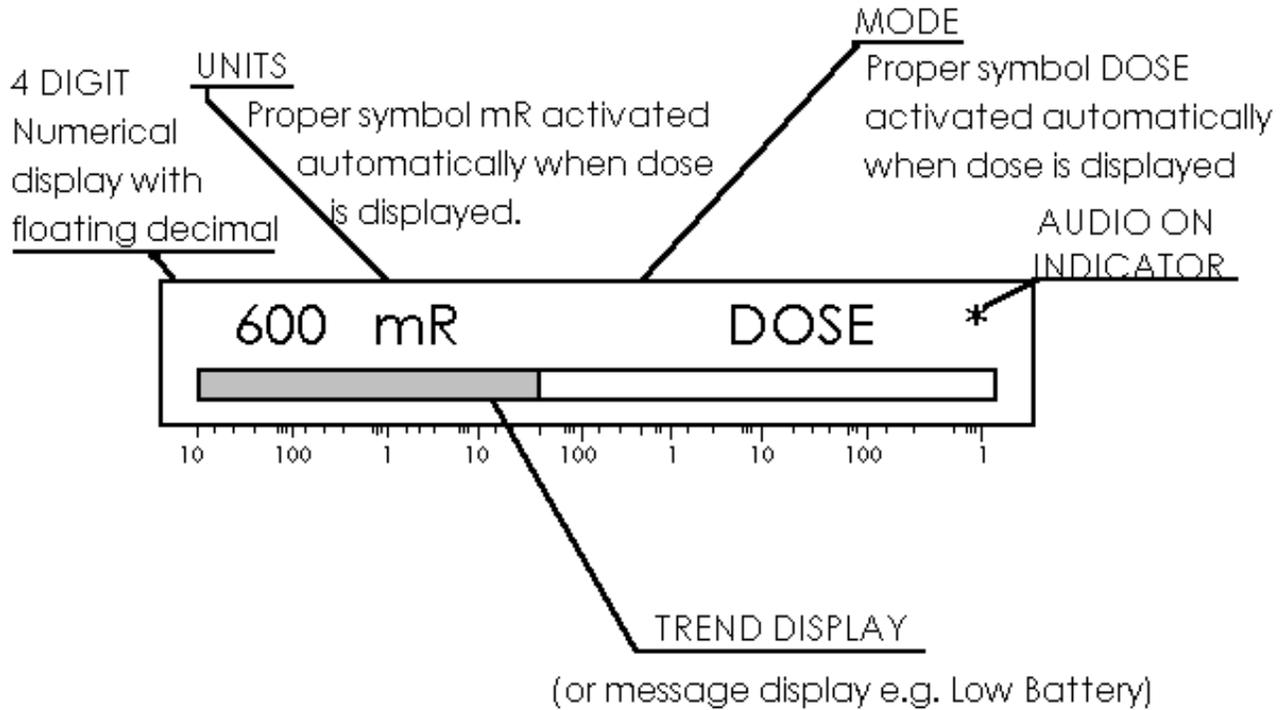
ADM-300A OPERATOR'S MANUAL
VERIFICATION SET MANUAL
RTP C1 (Nuclear Warfare Defense Actions)
RTP F11 (Chargers and Dosimeters)
RTP H12 (Initial Monitoring Point and Contamination Control Station - CCS)
ATTACHMENT 1. Illustration of ADM-300A Multi-function Survey Meter
ATTACHMENT 2. Illustration of ADM-300A Display Panel
ATTACHMENT 3. Failure Table (self-diagnosed)
ATTACHMENT 4. Failure Table (not self-diagnosed)

ADM-300A
MULTI-FUNCTION SURVEY METER



ADM-300A

DISPLAY PANEL



TRAINING PACKAGE COMMENT REPORT

RTP #	RTP DATE
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