From The Trenches
with Beth Hall & Rollie Cantu

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LMI Testing Laboratory

Consider a worst-case scenario in which Bob is surveying a cornfield for a radiation source with his Ludlum Model 3 Survey Meter and a Model 44-9 detector. It begins to seem as if this is Bob's lucky day when, as he is surveying, a front moves in. Temperatures soon drop to about 40° Fahrenheit, and a deluge of cold rain batter him to the ground. But Bob braves the elements and continues his survey. Soon the front moves on, and Bob looks forward to some good weather. But he didn't foresee the extreme heat as the mercury in his thermometer rises up over 100° Fahrenheit, and he is forced to withstand a sticky 95% relative humidity. And as for Bob, neither does the heat discourage him from the task at hand. As if this weren't enough, Bob drops his beloved survey meter onto a concrete slab and barely retrieves it in one piece. Finally the survey is finished. But Bob's detector and survey meter lead him not to a radiation source but instead to a beat-up, buried black 1965 Cadillac. OOPS!

If Bob had known more about the equipment he was using, he would have known that all of these horrible conditions, combined with his own clumsiness, could have hurt the instruments and affected their response. He would have known which conditions the equipment could withstand and from which he would need to protect it. Many different conditions and variables have the potential to affect the instruments' readings - or the devices themselves. Thus, these devices must be engineered to work properly under a wide variety of circumstances. And if certain conditions do affect the instrument's readings, whoever might be using the instrument should know this so that he/she might avoid these conditions and protect the device from them.

A test lab has been established at Ludlum Measurements to test instrument response to certain circumstances. A trip to this lab has become one of the first major steps in the design process for many instruments. A wide array of equipment under the supervision of Dr. Victor Pomerantsev is used to test the instruments and their ability to perform under extreme conditions, in accordance with American National Standards Institute (ANSI) requirements N42.17A-1989 and N42.17C-1989. LMI has earned a reputation for manufacturing durable and reliable instruments, a reputation based primarily upon years of field use. And now the test lab has verified that reputation with published data, readily available on the LMI web site at http://www.ludlums.com.

The purpose of Ludlum Measurements is, after all, to provide inexpensive, yet sturdy and reliable radiation measuring devices which will work under changing circumstances. The testing of these instruments also allows a better understanding of their durability and adaptability, so that in the future their performance under extreme conditions will continue to improve. At the lab, each instrument that enters testing goes through a number of different tests.

First the device is tested to determine such qualities as its accuracy and stability under normal circumstances. It is also tested for response time, battery power, and other such characteristics of the instrument which affect its performance. Then it is taken around the lab to each station and analyzed, step-by-step, to determine its response to different conditions and its performance after the manipulation of certain variables.

The specific test method is chosen in order to achieve two goals: maximum accuracy and the best determination of the device sensitivity to test conditions. Each result and any change in the reading throughout the test are analyzed to determine the reason for the change and the possibility of decreasing the instrument reaction.

The first station is the pressure chamber, where the instrument can be exposed to different levels of air pressure to determine its response. The applications for this are very simple. For instance, if the device is to be transported to its destination by airplane, it will be exposed to very low pressure as a result of the altitude, and this may affect the device's performance following the trip. Or if this instrument is to be used at, as an example, Los Alamos National Lab, then it would once again be exposed to low pressure due to the high elevations. In the pressure chamber each instrument is tested on numerous levels to see how it will perform and respond. Each device is tested to find how it would react to high or low pressure, and also rapid pressure changes.

After the instrument's dependence upon pressure is determined, it is taken to a rain chamber. In the rain chamber, the device is exposed to large amounts of water (rain) in the form of both large droplets and small droplets. The device is also exposed to a thick fog for a period of six hours. The rain chamber can bombard the instrument with large droplets at a rate of 4.0 liters per minute, or small droplets at a rate of 0.7 gallons per hour. The manufacture of an instrument which will be immune to the effects of both types of rain is a very hard task indeed. The shell of the instrument must have limited breathability, but it mustn't be impermeable. If the instrument cannot "breathe," then temperature and humidity changes on the exterior of the shell may cause the moisture trapped inside the shell to condense onto the parts inside the instrument. This can cause numerous problems, including shorted circuits and rusted wiring. On the other hand, if the device breathes too much, water may leak into the instrument and cause the same problems. Thus the rain chamber is a very important step in the testing process.

For the next step, the instrument is placed in an environmental test chamber, where the amount of heat and humidity to which it is exposed can be controlled. Temperature and humidity combined experience the greatest variations among environmental conditions as one moves from place to place. Because the instrument must be able to withstand and adapt to the variations in these conditions, this step is also of utmost importance. The environmental test chamber can generate temperatures ranging from -20°C to 70°C with a relative humidity ranging from basically 0% to 100% as long as temperatures are above freezing, though for general purposes it is used to generate from 3% to 99% relative humidity.

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The chamber has the ability to expose the instrument to basically any combination of heat and humidity, normal or extreme. Thus it can be determined how the instrument would react to either condition, or the combination of the two, which is known as the heat index.

Following this step, the instrument is tested for resistance to temperature shock in a chamber which can reach temperatures from as low as -80°C to as high as 200°C. But for general purposes, the temperatures generated range from -40°C to 70°C, which are also both extreme in their own respect. With such a great range, this chamber is used to test the instrument's resistance to rapid temperature changes over very short periods of time. The chamber is capable of exposing its contents to changes of up to 10°C per minute. In other words, it can generate a change of temperature from freezing to boiling in just 10 - 20 minutes. This chamber is also used for testing susceptibility to gradual change in temperature over the same range.

The next two steps involve exposing the instrument to a magnetic or electrostatic field, either strong or weak. First the device is tested within a magnetic field with a strength of 10 Oe produced by a wire coil. Then the device is tested within an electrostatic (direct current, or DC) field and an electric (alternating current, or AC) field. It is generally exposed to a direct current of 5 kV/meter and then an alternating current of 100V/meter. The instrument is tested while exposed to fields of both 60Hz and 400Hz. These two fields have a strong potential to affect an instrument's readings, and so they are important aspects of the testing process.

The final step of testing within the lab itself is the test for the device's resistance to mechanical shock. This tests the device's ability to work properly, for instance, after being bounced around in a car during transportation. And of course there always comes the time when someone happens to drop one of these devices.

For this test, each instrument is forced to undergo both an acceleration of 50G for 18 milliseconds and then an acceleration of 100G over 6 milliseconds with very little variation in performance. With certain special instruments this is a very necessary part of testing. Some instruments which cannot handle the shock well may require special care and special equipment, especially during transportation.

When each instrument is through at the lab, it must be tested under more unique circumstances. The most common of these is the testing of most devices for photon radiation overload. This is the term for the situation in which an instrument is exposed to more radiation than its maximum limit. This causes the device's response to read lower than the actual amount of radiation to which it is being exposed. It can also cause more serious problems for the instrument itself. The instruments must also be tested for sensitivity. Each instrument's sensitivity and ability to discern between different types of radiation affects its performance regardless of the conditions.

It is obvious that, as in any research, all conditions other than those which are being examined must be held constant from one test to another. For example, the amount of radiation to which the instrument is exposed must be controlled and held the same. As in any other experiment, the results of each test remain insignificant and inconclusive if this control is not held constant. Some problems may go unnoticed, or a flaw may be found where in reality there is none. All of the testing means nothing without this control.

The testing lab at Ludlum Measurements has allowed a greater insight into the ways in which the environment and other conditions affect the instruments and their readings. In the future this will help LMI to continue to improve upon the design of every instrument so that they will be even more reliable under any and all circumstances - and for all the "Bobs" of the world.

DIRECT READING DOSIMETERS

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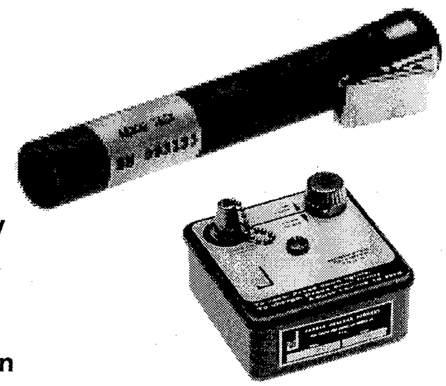
The direct reading dosimeter is a rugged instrument which measures accumulated quantities of gamma and x-ray radiation. Applications include personal and environmental monitoring. The low energy feature has hospital applications including flouroscopy, portable radiography, and angiography. This pocket size instrument is light weight and has a sturdy clip to attach to individual's pocket.

Superior Energy Response: 16 keV to 2 MeV
Rugged: Meets ANSI Specification N13.5 and N322
Low Leakage: Measures Background



SPECIFICATIONS

Radiation Detected:	Gamma and x-ray from 16keV to 2 MeV
Ranges:	Several Models Available (0-200 mR to 0-600 R)
Energy Resp. Curve:	within ± 15% of true value from 25 keV - 1.25 MeV
Detector:	Fiber electrometer mounted in an electrically conducting plastic ion chamber
Detector Housing:	Very low permeable plastics hermetically sealed
Accuracy:	Within ± 10% of true exposure
Rate Response:	Dose rate independent for gamma and x-radiation
Electrical Leakage:	< 0.5% of full scale for 24 hours at 50° C
Temperature Range:	-20° C to +50° C
Relative Humidity:	Up to 90%
Dimensions:	Length: 4.5" (12.4cm), Diameter: 0.6" (1.5cm)
Weight:	1.0 oz (25 grams)
Finish:	Barrel and end caps: Natural matte black, Clips: metal clips
Warranty:	2 year limited warranty

Price: $ 125.00 each
(quantity discounts available)

SALE

LMI Demo Close-out Sale

SALE

Need a back-up or spare unit at a discounted price. Check out some of these incredible low prices. If you would like a complete list of instruments and detectors available, please call or fax. Supplies are limited, so hurry and place your order today!

Warranty- Items have same warranty as new items - one year parts and labor.

Model Number.	QTY	Old List	Disc. %	Sale Price
M 3A Alarm Survey Meter w/ Digital Scaler	1	745.00	20%	$ 596.00
M 4 Survey Meter	2	575.00	20%	$ 460.00
M 6 Geiger Counter	1	395.00	30%	$ 276.50
M 15 Complete w/ 44-7 w /Medium case	2	1350.00	20%	$ 1080.00
M 177 Alarm Ratemeter	4	575.00	25%	$ 431.25
M 177-50 Alarm Ratemeter	1	685.00	25%	$ 513.75
M 177-61 Alarm Ratemeter	1	650.00	20%	$ 520.00
Model 300 Area Monitor less detector	1	750.00	25%	$ 562.50
Model 375/4 Area Monitor w/ detector	2	795.00	30%	$ 556.50

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