Tech Tools

Battery Capacity Meters
DC Current Clamp Meters
Manometers
Speaker Impedance Meters
The Most Important Tool

USE IT !!!
Digital DC Clamp on Ammeters
Digital DC Clamp on Ammeters

- Up until recently DC digital clamp-on ammeters were not sensitive enough to measure small amounts of current accurately below 1 amp. As a result they could not be used to measure battery charging and supervisory current in many systems.
- New technologies have made meters more sensitive and accurate. I have found several meters that have accuracy to 1ma.
Application 1
FA Inspections and Verifications

• The purpose for measuring the battery voltage and current with the main power supply disconnected is to confirm the required battery capacity and operation of the battery charger.

How would you do this, the hard way or the easy way?
The Hard Way
(Standard One Multimeter Method)

• With AC power on, disconnect batteries and put the ammeter in series with the battery leads. Record the charging current.
• Disconnect the AC power and record the supervisory current.
• Activate an alarm with full system load and record alarm current.
• Reset the panel and connect the AC power. Disconnect meter and reconnect the battery leads and disconnect AC power.
• Measure the battery supervisory voltage then activate an alarm and measure the alarm voltage. Reconnect the AC power.
• Repeat for each set of batteries in the system.

Difficulties: Battery connections and meter connections.
The Easy Way
Use a DC Clamp-on Ammeter

• Measure the charging current then turn off the AC power.
• Measure the supervisory current and voltage.
• Activate an alarm with full system load and measure the voltage and current again.
• Reset and restore AC power.
Application 2
Finding Shorts in Circuits

• The traditional way to locate a short on a conventional circuit was to disconnect field devices in a logical method and test for either voltage or resistance to isolate the location of the short.

• The problem with this method is the time it takes to disconnect and reconnect the wiring and problems that can occur.
Application 2
Finding Shorts in Circuits

• Using the clamp-on ammeter can eliminate the need to disconnect wiring from the devices.

• Most control panels current limits the field wiring, usually under 100 ma. Shorts can be located by measuring current. In a class B circuit, current will flow from the panel until it reaches the short.
Speaker Circuit Load
Speaker Circuit Load

The Situation
An office building has done renovations, changing an open area design to small enclosed offices, requiring it to add speakers. Will the circuit be overloaded?

Problem: How to determine the existing load on the speaker circuit.
Method 1: Visual Conformation
(The Hard Way)

• Remove the mounting screws and look at the wattage setting on each speaker, then total it all up.

Note: This may be the preferred way by companies who are billing by Time and Material. A properly mounted speaker on a 10 foot ceiling takes me about 5 minutes, on average, to check.
Method 2: Guessing
(The hope for the best way)

• This method is simple. Count the number of speakers in the zone and use your experience to come up with the most likely wattage settings. Total it up and hope for the best.

Note: Many people use a combination of Method 1 and Method 2 to get a more accurate guess.
Method 3: Measure
The Simple and Accurate Way!

- Disconnect the speaker circuit wires from the panel and connect to the impedance/wattage meter.
- The measurement will give you the Total Wattage Load on the circuit.
Speaker Impedance/Wattage Meter

How does it work?

- The impedance of a circuit is measured by the meter applying a constant tone at a preset frequency (typical 1 to 2 kHz for speakers) and measuring the resulting impedance.
- You will hear the tone on the speakers.
- The wattage is then calculated based on the amplifier’s output voltage, either 25 or 70 volts.

*Note: Remember to check your meter’s calibration before you test!*
Battery Performance Testing
Battery Performance Testing
(It’s the “do you have enough power in them test”)

- Required by CAN/ULC-S356 Annual Inspection
- There are 5 different acceptable methods to determine this.
- There are lots of unacceptable methods I still hear Tech’s using.

Sorry I am only going to list a few!
Unacceptable Method 1
The Spark Test
this is really dumb!

- Take a piece of wire and short the battery terminals for the smallest amount of time possible. (Use a striking motion)
- If there is no spark and voltage drops several volts, the battery has a very low charge.
- This has to be one of the dumbest ideas I have ever heard. The possibilities of injury are endless, including the possibilities of the battery exploding.
Unacceptable Method 2
Performing the Inspection on Battery Test

The “it should be OK test”

• This method is to perform the annual inspection using battery power only. At the end of the day, check the battery voltage. If it’s above 24 volts the batteries are considered to be good.

• This method does have some merit. However the amount of power consumed during the inspection probably is not enough to demonstrate that the batteries meet the system requirements.
Acceptable Method 1: Actual Test

The “I’m from Missouri test”

• Operate the system on batteries only, for 24 hours of supervisory operation followed by the required full load operation.

Hope you have a lot of coffee to stay awake in case of a real alarm.
Acceptable Method 2: Silent Test
The “I don’t want be disturbed test”

Perform a silent test using load resistors. This method requires the tech to calculate a resistor value for both the supervisory load and the alarm load. Then disconnect the batteries from the system and perform a 24 hour simulated supervisory test follow by a simulated alarm test.

The problem is, if you are going to leave the site you must install a temporary charged set of batteries.
Acceptable Method 3: Silent Accelerated Test
The “I’m not coming back tomorrow test”

This test is similar to method 2 except it uses resistors calculated to draw high currents to complete the test faster. However, please note that most batteries have a maximum discharge current. Exceeding it will cause damage.

*Problems with this method occur when you have a very small system which can be inspected in less than 2hr.*

*Do you wait around just to do a battery test?*
Acceptable Method 4: Replacement
(The" I don’t care about money test")

In lieu of testing, replace the batteries with a new set.

This method is easy and practical for very small systems but hard on the wallet for large.
Acceptable Method 5: Battery Capacity Meter

*The newest and easiest test!*

Testing is performed by disconnecting the battery from the system, connecting the meter and recording the results. Average test time is 5 minutes per set.

The amount of time saved in most cases is **Huge**. But remember, as in any test, there are restrictions and you need to understand how it works and how to interpret the results!!!
Battery Capacity Meter
How it Works

It appears that all manufacturers have a different patented method but in general most appear to pulse a load on the battery for a very short time and measure how the battery responds.

Most meters are designed for specific types of batteries. Using them on incorrect types will give false readings.
Common Problems Using Battery Capacity Meter

• Results are often misinterpreted. If testing measures a battery at 60% of its listed ratings, many techs assumed the battery to be failing. However it could be the battery charger is defective or not adjusted correctly, charging the battery less than 100%.

• Several makes of meters have digital displays with 3 digits. However reading the manuals often indicate only a 10% accuracy. This is often misleading.

• Calibration can be a big issue. Many meters require at least annual recalibration.
Demonstration for the need to Recalibrate

The meters below are at least 7 years old and have never been recalibrated.

Test results using a partly discharged 6 Ah battery

<table>
<thead>
<tr>
<th>Meter</th>
<th>Capacity (Ah)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meter 1</td>
<td>3.95</td>
</tr>
<tr>
<td>Meter 2</td>
<td>3.43</td>
</tr>
<tr>
<td>Meter 3</td>
<td>3.80</td>
</tr>
<tr>
<td>Meter 4</td>
<td>5.10</td>
</tr>
</tbody>
</table>
Sound Level Meters
Sound Level Meters

Information from the OFM publication OFM-TG-02-1998 Fire Alarm Audibility in Existing Residential Occupancies

- Appendix A Sound Level Measurement
- The sound level meter shall have a measurement range that permits readings as low as 35 dBA and shall be calibrated immediately before and after the audibility measurements are taken. The use of a quality meter is important to minimize any measurement errors.
A.2 Measurement Method

The meter is to be held approximately 1.5 meters above the floor and at least 0.5 meters away from hard reflecting surfaces.

The meter should also be held as far away as practical from the body of the person taking the measurement.

The meter is to be set to the “A” weighted measurement scale and to the fast response setting.
A Very Non Scientific Experiment!

Ever wonder why your sound level measurements are different than others for the same building in the same location?

Having observed this a few times, I decided to conduct a simple experiment.
Meters Before Calibration

The meters shown in the next few slides are at least 7 years old and have been used and abused. (Probably dropped a dozen times)

Accuracy for this meter is listed at .7 dB after calibration @ 94 dB
Calibrated as per Manufacturer’s Instructions using **Internal** Calibration Method 94dBA +/- 00.1
Testing Room Ambient Sound Level
(Fan Running)

Variance 44.7 to 48.8 = 4.1 DBA
Alarm Signal

Piezo at 15 feet

Variance 79.7 to 87.5 = 7.8 DBA
After Test Calibration Check
Observation

Internal calibration does not perform an actual test on the sensor. Reading further in the instructions, I found this piece of info.

NOTE:
“If intend to make calibration accurately, it is recommended to use the calibration procedures of aboe 8-1 “Calibrated via EXTERNAL SOUND CALIBRATOR”

Wording direct from the manual
Manometers  Differential Pressure Measurements For Duct Smoke Detectors
Manometers  Differential Pressure Measurements For Duct Smoke Detectors

Yes it’s required on Annual Inspections!

• This is the old way and still a great tool for some applications.
• However duct detectors in the past few years have been developed to operate on very small flow rates as low as .015” H₂O (inches of water)

These meter are not sensitive enough to measure this.

Differential pressure gauge, range 0-1.0" H₂O minor divisions .02
New Digital Manometer

- Much easier to use and can measure much smaller flow rates. However before buying one check its specifications to insure that it will do the job.

- Make sure that you buy one that can be calibrated!!

Highly sensitive pressure measurements down to 0.001" H₂O
Manometer Problems

• The most common method to connect the meter to the duct detector is by plastic tubing and stoppers. The problem is that not all manufacturers have the sampling tubes easily accessible to connect the round stoppers.

• *Solution: call the manufacturer*
Thank You

GOOD LUCK IN TESTING