



DMM Testing



Application Note ANPRESTO 16

xDSL



UNDERSTANDING ADVANCED DMM MEASUREMENTS FOR EFFECTIVE LOCAL LOOP TESTING

Now Updated to Include Application Information on the
NEW ADVANCED TDR/DMM Solution from Trend

Introduction

Effective DSL service testing requires that every layer of the DSL stack can be tested individually; at the Physical, DSL, ATM, IP, PPP and Application layer.

Before higher layer testing is performed, it is important to check the quality of the local loop. The quality of the local loop can be easily determined with the standard tip-to-ring (T-R), tip-to-ground (T-G), and ring-to-ground (R-G) parameters used to perform the following basic measurements:

- DC Voltage
- DC Current
- AC Voltage,
- Resistance
- Capacitance

This application note describes the application of the standard T-R, T-G and R-G measurements to the testing of DSL circuits.

Basic Principles of Operation

The use of a digital multimeter provides the telecomms technician with an invaluable source of information regarding the condition of the local loop. The DMM can be used for both basic installation/commissioning and basic troubleshooting activities.

The Aurora Presto DMM is one of a number of physical test tools that form part of the TDR/DMM test option.

Performing DMM Measurements On Aurora Presto

The following measurements are fundamental to the use of the DMM and its applications described later.

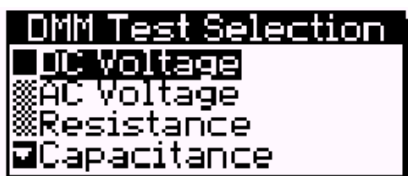
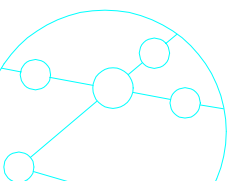


Figure 1

Aurora Presto DMM Test Selection Screen Shot



Tip to Ring (T-R) Measurements

1. Connect the black lead to the tip and the red lead to the ring.
2. From the **DMM Test** screen, select the measurement you want to perform and press **ENTER** to start the test.

Tip to Ground (T-G) Measurements

1. Connect the black lead to the tip and the red lead to the ground.
2. From the **DMM Test** screen, select the measurement you want to perform and press **ENTER** to start the test.

Ring to Ground (R-G) Measurements

1. Connect the black lead to the ring and the red lead to the ground.
2. From the **DMM Test** screen, select the measurement you want to perform and press **ENTER** to start the test.

DMM Applications

The following measurements are designed to allow the telecomms technician to perform some basic installations and troubleshooting operations with the Aurora Presto DMM.

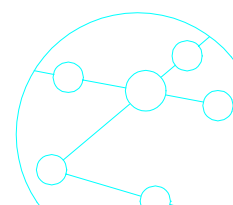
Checking Isolation Resistance

The resistance measurement verifies the isolation resistance between the tip and ground (T-G) and the ring and ground (R-G) with an open at the far end. Both should be a minimum of 5 MOhm (indicating good isolation between pairs), however >20 Mohm is typical.



Figure 2

Aurora Presto DMM Typical Isolation Resistance Measurement



Checking Tip – Ring (T-R) Isolation

Tip to Ring (T-R) isolation measurements for DSL circuits should be performed with a short circuit at the far end of the pair. Measurements should not exceed 600 Ohms for ADSL circuits.



Figure 3 Aurora Presto DMM Typical Tip - Ring Isolation Measurement

Checking Capacitance for a Balanced Pair

You can run a capacitance test to check for a balanced pair. A balanced pair means that both the tip and ring leads are of equal length.

The Tip-ground and Ring-ground measurements should be roughly equal. If not, the tip and ring leads are not of equal length. If one of the leads is longer, this could indicate a split pair.

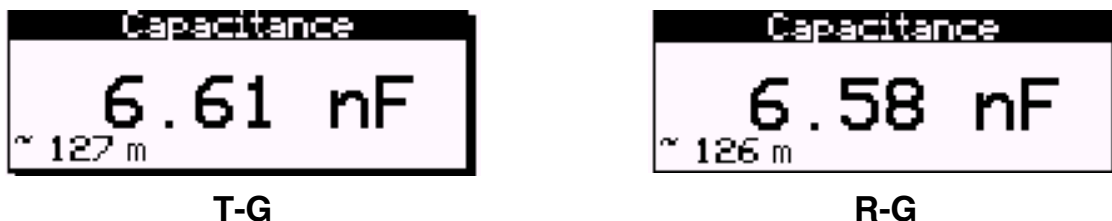
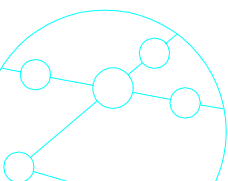


Figure 4 Aurora Presto T-G and R-G Measurements On A Balanced Pair

Checking Approximate Distance To The Central Office

Distance approximations on DSL circuits are useful for 2 key reasons.

- Firstly, distance is often a limiting factor on the data rates that can be achieved by a DSL service. Typically the greater the length of the local loop, the lower the achieved bit rate on the circuit.
- Secondly, where the distance of a circuit is known, opens or shorts in the circuit can be quickly identified if the measured distance is significantly shorter than expected. Furthermore, if the distance measurement is longer than expected, this can be indicative of a bridged tap or split pair on the circuit.



There are two different method that can be used to approximate the length of a pair, the capacitance method and the resistance method.

Capacitance Method

This is the least reliable of the two methods but has the benefit that it does not require a short at the end of the loop.

Effectors such as resistive faults on the line will cause the distance reading based on capacitance to be greater than the actual length of the cable.

Measurements are performed between the tip and ring (T-R) and distance calculations as performed according to the following:

$$83 \text{ nF} = 1 \text{ mile (5280 feet)} \text{ or } 51 \text{ nF} = 1 \text{ km}$$



Figure 5 Typical Aurora Presto Screen Shot of Capacitance With Distance Approximation

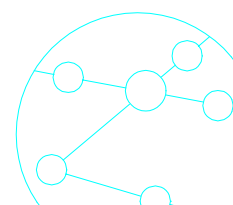
Resistance Method

This is the more reliable of the two methods but has the drawback that a short must be placed on the far end of the loop.

Measurements are performed between the tip and ring (T-R) and distance calculations as performed according to ANSI T1.601 Annex G. The ANSI formula is based on cable type and temperature. A cable gauge of either 19, 22, 24 or 26 AWG or 0.9, 0.6, 0.5, or 0.4 mm must be selected from the DMM resistance setup.



Figure 6 Typical Aurora Presto Screen Shot of Resistance With Distance Approximation



Checking For POTS Voltages On The Line

Annex A (ADSL over POTS) based ADSL circuits may include the POTS loop supply powered by 48 VDC from the central office. The 48 VDC is found on the ring, with the tip acting as ground.

A DC voltage test will confirm that the POTS voltage is present and that the pair is connected to the MDF in the central office.

Two measurements should be performed, tip to ring (T-R) which should give +48 VDC and Ring to Ground (R-G) which should give – 48 VDC.

Checking For ISDN Voltages On The Line

Annex B (ADSL over ISDN) based ADSL circuits may have unique remote power feed voltages provided from the LT. These voltages can vary depending on the prevalent national safety requirements and can range as follows:.

Table 1

Minimum and Maximum Voltages

Minimum (VDC)	Maximum (VDC)
51	69
66	70
91	99
90	110
105	115

Checking For AC Interferers On The Line

An AC voltage check for unwanted power interferes such as AC induction or crossover. This power is caused by induction between the tip-ground and ring-ground from power lines running adjacent to the cable pair.

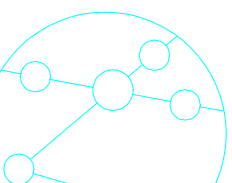
Two measurements should be performed, Tip to Ring (T-R) and Ring to Ground (R-G), both of which should nominal values around 0 VAC.



Figure 7

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Typical Aurora Presto Screen Shot With Mains AC indicated





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