

# Extending DAC and DP Tap Cable Lengths

---

**Issue Date: 12/24/03**

## Issue

Wiring issues are among the more common problems call logging customers experience when installing their call logging equipment in the field.

This application note deals with general issues customers encounter while tapping digital lines; both on proprietary digital PBXs as well as digital T1/E1 trunks.

Common symptoms of cabling problems include loss of sync on the tap card (DAC or DP series), static in the recordings, or phone sets not initializing properly.

## Background

The problem that customers experience occurs when the Tap Point (length B in the following diagram) for the DAC or DP exceeds the distance for which the PBX or trunk line is rated. High speed digital PBX or T1/E1 trunk lines are best characterized as a transmission line. For the purposes of this application note, all cabling is 1200 ohm twisted pair. Cat 5 cable is recommended, but Cat 3 is acceptable.

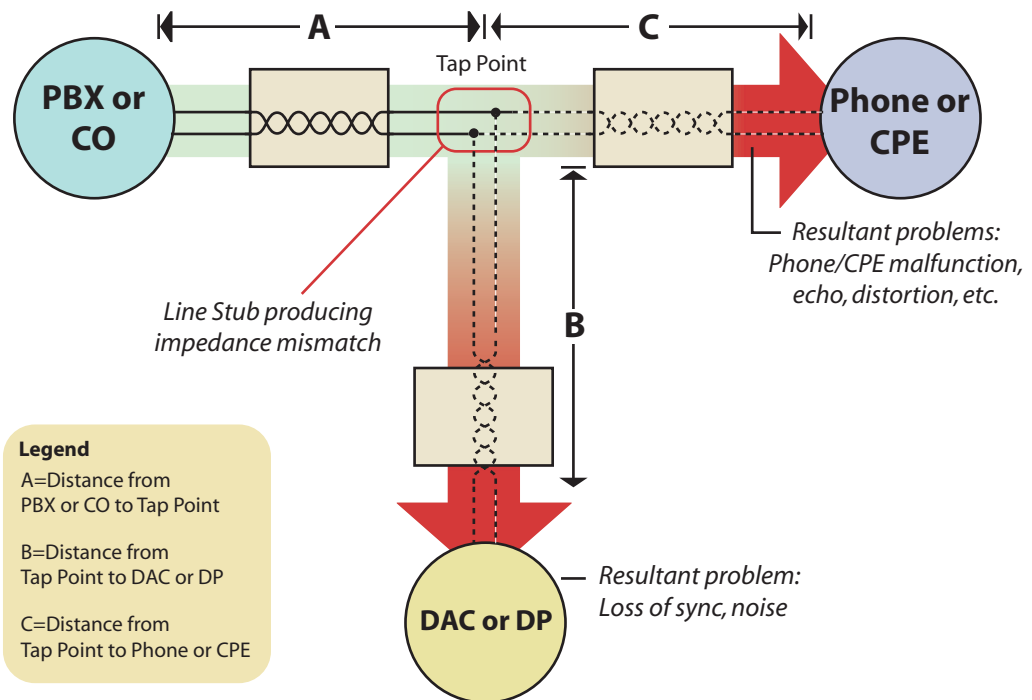
When a tap is added to this transmission line, reflections caused by an impedance mismatch will distort the signal to both the phone/CPE and the DAC/DP. The level of distortion seen at either end of the two transmission lines (A+C and A+B) is directly proportional to the frequency of the signal and the distance of each line. As the length of the tap approaches the  $\frac{1}{4}$  wavelength, the signal reflected from the tap (length B) will nullify any signal in line A+C. It is not feasible to declare exact universal tap lengths for all users because signal frequency from the PBX/CO varies from 128 kHz to 2048 Hz.

The tap length ratings, as outlined in the relevant AudioCodes user guide(s), are specified such that a customer can tap in to a PBX/trunk line at any point along distance A+C with out loss of signal. These ratings are generally kept at a fraction of the wavelength distance to ensure reliable operation.

There may be no control over where a customer can place the Tap Point, however, AudioCodes technical support tests have concluded that there is a way to increase Tap Cable lengths.

*NOTE: AudioCodes can only guarantee the operational effectiveness of its products when they are configured as described in their relevant user manuals. Individual results using the solutions outlined in this application note may vary.*

**Problem: Impedance mismatch due to Transmission Line Stub**



## Solution 1:

This first solution is to simply reduce the distance from the PBX/CO to the tap point. In theory, if distance A is reduced to zero, the stub (and resulting impedance mismatch) is effectively removed from the circuit. As seen in the diagram below, the tap can now be modeled as two separate transmission lines instead of a single three-way line.

In practice, if the A distance is kept to 20 feet or less; the tap length (distance B) can safely be increased to upwards of 250 feet.

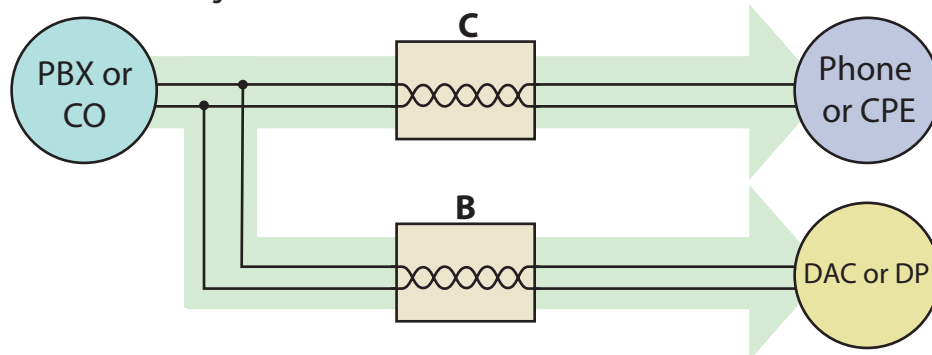
This solution applies to customers who can control the placement of the Tap Point between the PBX/CO and the Phone/CPE. If this condition does not apply, see "Solution 2:" on page 4.

### For example:

Testing with a standard PBX (we used the Lucent 2-wire), our results show that with an A distance of 16 feet, and a C distance of 2,500 feet, the tap length could be increased to over 250 feet. (Note that the illustration below does not show an A distance)

Be cautioned that field results may vary due to factors like noise, cross talk, etc.

**Solution 1: Eliminating the transmission line stub**



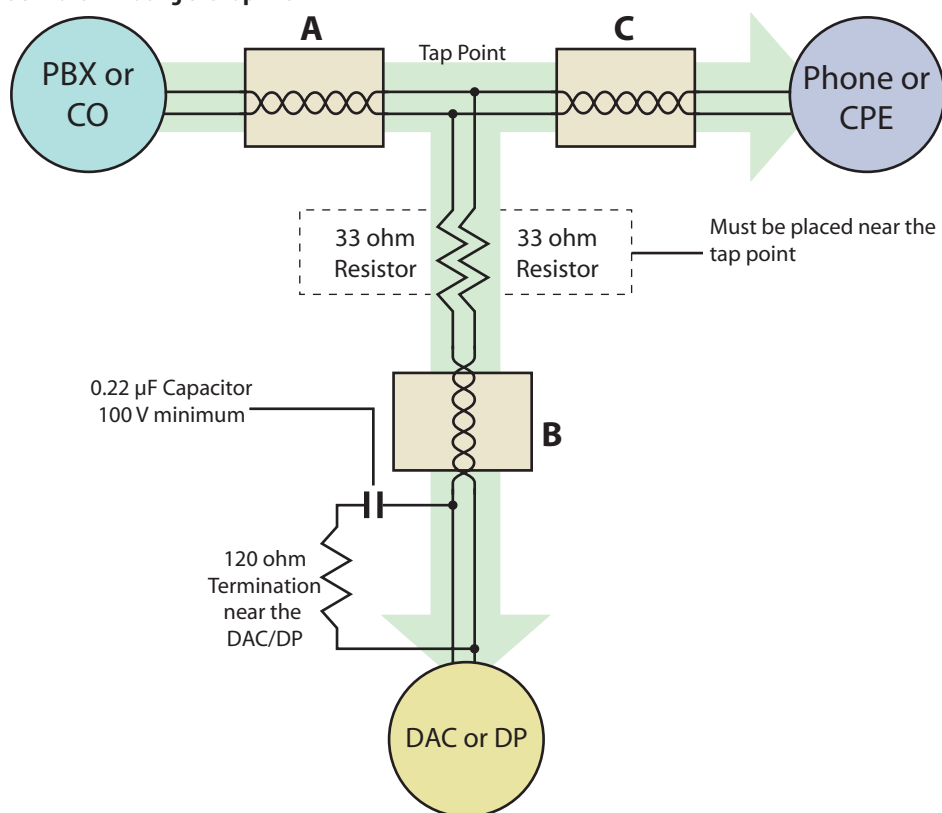
*Note: This solution is best suited for DAC users owing to the fact that its improbable that a tap can be added close to the PBX/CO in a T1/E1 configuration. Solution 2 on the next page is better suited to users connected to a T1/E1 line.*

## Solution 2:

In many installations, it may not be feasible to place a 20 foot restriction on the PBX/CO to tap point length. In this event, the problem of impedance mismatch can be resolved by adding terminations to the tap line.

In this solution, placing two 33-ohm series resistors at or near the Tap point and a 120-ohm parallel termination near the DAC/DP will correct the mismatch. With this solution, the A distance does not need to be restricted and the tap length (B) can be increased upwards of 500 to 1,000 feet.

**Solution 2: Terminating the Tap line**



*Note: This solution is best suited to users connected to a T1/E1 line using a SmartWORKS DP. For this solution to work on a DAC, the PBX may have to be adjusted on the DAC. DAC users should consider Solution 1 on the previous page before trying this solution.*