

## Determining the Propagation Factors of Cables

### Calculating the Propagation Factor of a Known Cable

If the velocity of propagation or dielectric constant for a cable is known, the propagation factor can easily be found by applying either of the following formulas:

$$PF = \frac{V_p}{C}$$

Where

$V_p$  = Velocity of propagation for the cable in either m/us or ft/us

$C$  = Velocity in free space; 300 m/us or 984 ft/us; or

$$PF = \sqrt{\epsilon}$$

Where

$\epsilon$  = Dielectric constant for the cable

### Determining The Propagation Factor of an Unknown Cable

If a short length of the same type of cable is available, the propagation factor can be found by following the steps listed below.

STEP 1: Measure the physical length of the sample cable.

STEP 2: Set the TDR's propagation factor control to any value between 0.40 and 0.99.

STEP 3: Position the cursor on the TDR to the point of reflection (end of cable)

STEP 4: Adjust the propagation control until the TDR displays the true length of the sample cable. Remember that the TDR will display both the length of the test leads and length of the sample cable. Therefore, you should add the length of the test leads onto the length of the sample cable.

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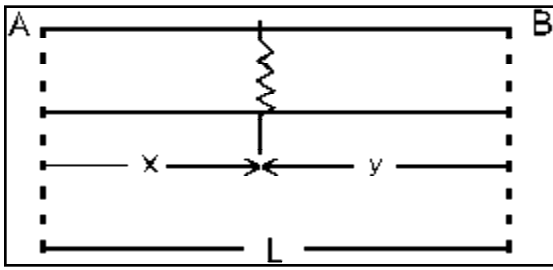
Note: This setting can be applied to any instrument, not just the one on which the measurement was taken.

### Length Known and Both Ends of the Cable Accessible

If both ends of a cable are accessible the distance to a fault can be determined by following the procedure below.

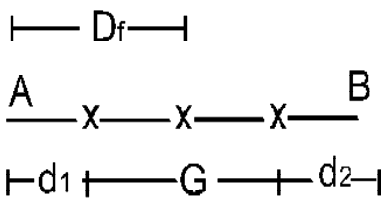
STEP 1: Set the propagation factor control to any setting between 0.40 and 0.99

STEP 2: Measure the apparent distance ( $x$ ) to the fault from end A and the apparent distance ( $y$ ) to the fault from end B.



STEP 3: The distance to the fault, from end A, is found by applying the following equation:

$$D = \frac{x}{x+y} L$$



Where

D = Distance to the fault

L = Length of the cable

### Three Stake Method

If the propagation factor for the cable is unknown and the cable's length is unknown, the three stake method can be used to figure out the true distance to the fault.

STEP 1: Set the propagation control to any setting between the range of 0.40 and 0.99. Do not change the setting for the remainder of the procedure.

STEP 2: Measure the apparent distance ( $d_1$ ) from point A. Place a marker at the location measured.

STEP 3: Measure the apparent distance ( $d_2$ ) from point B. Place a marker at the location measured.

STEP 4: Physically measure the distance (G) between markers 1 and 2.

STEP 5: Figure out a correction factor for  $d_1$  and  $d_2$ , applying either of the following equations:

$$PF = \frac{d_1}{d_1 + d_2} G = C_1$$

or

$$PF = \frac{d_1}{d_1 + d_2} G = C_2$$

Where

$C_{d_1}$  = Correction factor for  $d_1$

$d_1$

$C_{d_2}$  = Correction factor for  $d_2$

STEP 6: If the markers 1 and 2 fall short of one another, add the correction factor to your measurements. If they overlap one another, subtract the correction factor from your measurements.