

Cable Length Meter

Use to measure cable length and generate tone on industrial, telco, and coax cable (not CATx).

Works on single- or two-conductor cables.
Compact, handheld unit.



Customer Support Information

Order toll-free in the U.S.: Call 877-877-BBOX (outside U.S. call 724-746-5500) • FREE technical support 24 hours a day, 7 days a week: Call 724-746-5500 or fax 724-746-0746 • Mailing address: Black Box Corporation, 1000 Park Drive, Lawrence, PA 15055-1018 • Web site: www.blackbox.com • E-mail: info@blackbox.com

FEDERAL COMMUNICATIONS COMMISSION AND INDUSTRY CANADA RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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WEEE Directive Compliance (RoHS)

This product complies with the Waste Electrical and Electronic Equipment (WEEE) Directive, 2002/96/EC. It should not be disposed of as unsorted municipal waste and should be collected separately and disposed of according to your national regulations.

Normas Oficiales Mexicanas (NOM) Electrical Safety Statement

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

Cable Length Meter

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Cable Length Meter

1. Specifications

Cable Types: Single or dual conductor, 8–30 AWG, network, coax, and telco

Temperature Tolerance: Operating: 32 to 122° F (0 to 50° C);

Storage: +14 to +140°F (-10 to +60° C)

Humidity: 10 to 90%, noncondensing

Power: (1) 9-V alkaline battery: Standby: 2.5 years;

Cable Testing: 20 hours into 60-ohm load (smaller resistance loads will result in shorter battery life)

High-Voltage Protection: 120 VAC maximum

Size: 1.3"H x 3"W x 6"D (3.3 x 7.6 x 15.2 cm)

Weight: 11.5 oz. (326 g)

Table 1-1. Length measurement range opens (maximum 0.082 μ F capacitance).

Wire Type	Typical Capacitance per foot	Length, ft. (m)	Tolerance
Telecom	17.5 pf	0–4500 ft. (1371 m)	Minimum cable length 3 ft. (0.91 m) \pm 2%, +3 digits LSD*
Network wire	15 pf	5000 ft. (1524 m)	Minimum cable length 3 ft. (0.91 m) \pm 2%, +3 digits LSD
Coax	22 pf	3500 ft. (1066 m)	Minimum cable length 3 ft. (0.91 m) \pm 2%, +3 digits LSD

*LSD = Least significant digit

Chapter 1: Specifications

Table 1-2. Length measurement range DC (resistance 0–635 ohms).

AWG	Min. (ft.)	Length	Tolerance
8, 10	5.0	0–9999 ft. (3047 m)	±2%, ±3 LSD*
12, 14, 16	4.0	0–9999 ft. (3047 m)	±2%, ±3 LSD
18, 20, 22	3.0	0–9999 ft. (3047 m)	±2%, ±3 LSD
24, 26, 28	1.0	0–9999 ft. (3047 m)	±2%, ±3 LSD
30	1.0	0–5879 ft. (1792 m)	±2%, ±3 LSD

*LSD = Least significant digit

Cable Length Meter

2. Overview

2.1 Introduction

The Cable Length Meter for industrial, network, telco, and coax cable (not CATx) is an easy-to-use, versatile compact handheld unit that measures cable length and generates tone. It works on single- or two-conductor cables for testing and troubleshooting.

CAUTION: Do not attach test leads to energized cables. The Cable Length Meter might be damaged.

2.2 Features

- Measures the distance to an open or the distance to a short
- Operates in six modes: AWG/mm/mm², Telco, Network, Coax, Tone Generator, and Ohms
- Measures one- or two-pair conductor lengths in feet or meters
- Includes an audible indicator for shorted wires
- Has a large LCD that's easy to read in sunlight
- Measures wires 8 to 30 AWG (3.264 mm/8.366 mm² to 0.255m/0.051 mm²)
- Provides copper (CU) or Aluminum (AL) wire measurements
- Protects voltages up to 120 VAC
- Features 12 preset wire gauge settings
- Choose from 12 user-programmable wire gauge settings
- Provides four selectable tones
- Requires a 9-volt battery (not included)
- Enables auto shutdown
- Supports resistance from 0 to 635 ohms
- Measures opens/capacitance from 0 to 0.82 μ f (approximately 5K feet)
- Features milliohm resolution
- CE certified

2.3 What's Included

- (1) Cable Length Meter
- (1) double-banana to BNC + BNC F to F jack
- (2) test leads
- (2) clips
- (1) carrying pouch

2.4 Hardware Description

Figure 2-1 illustrates the Cable Length Meter.

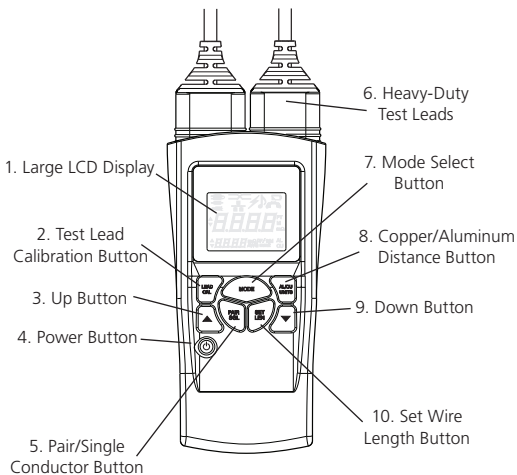


Figure 2-1. Cable Length Meter.

Cable Length Meter

3. General Functions

3.1 PWR Key and Auto Power Off

Press the **PWR** key to turn the unit on and off. If no keys have been pressed, the Cable Length Meter powers off automatically after 10 minutes. The timer resets every time you press a key. In Tone mode, the unit will automatically power off after 1 hour.

3.2 Mode Key

The Cable Length Meter operates in eight modes. Press the "Mode" key to cycle through the various modes:

- **AWG/mm/mm² mode:** measures cable length in AWG/mm/mm², feet/meters, copper/aluminum
- **Coax mode:** measures cable length, distance to opens, or distance to short
- **Telco mode:** measures cable length, distance to opens or distance to short
- **Network:** measures cable length, distance to opens, or distance to short
- **Ohm:** measures resistance from 0 to 635 ohms
- **Tone:** generates four different tones

3.3 AL/CU Units Key

The AL/CU key functions in two ways.










Function #1: Press the **AL/CU/Units** key to select wire alloy type: copper (CU) or aluminum (AL). When selected, the "AL" or "CU" icon will light in the lower right corner of the display.

Function #2: Hold the **AL/CU/Units** key down for approximately 1.5 seconds. The unit will toggle between "Feet" or "Meters". When selected, the "FT" or "M" icon will light in the center right hand side of the screen.

3.4 LCD Display Icons

Table 3-1 describes the icons that appear on the LCD display.

Table 3-1. LCD display icons.

Icon	Description
	Coax mode
	Telco mode
	Network mode
	Tone mode
	Two-conductor icon (AWG/mm/mm ² mode)
	One-conductor icon (AWG/mm/mm ² mode)
	Short symbol, indicates the presence of a short between two conductors. An audible tone is also generated. (Coax, Telco, and Network mode)
	Unit detects voltage on the line
	Battery low icon. The Cable Length Meter monitors the battery status continuously when it is powered on. When the battery low icon is activated, the unit has approximately 15 minutes of battery life. Replace the battery as soon as possible. If the 15-minute period is exceeded, then cable testing results will become unreliable.

Cable Length Meter

4. Using the Cable Length Meter

4.1 AWG Mode

This mode allows length measurements from 8 to 30 AWG (8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, and 30 AWG). Use the **UP/DOWN** keys to scroll through the various wire gauges. Select from copper or aluminum type wires and meters or feet. Figure 4-1 shows a typical AWG Mode screen.



Figure 4-1. AWG Mode screen.

Chapter 4: Using the Cable Length Meter

Table 4-1. AWG/mm/mm² cross-reference data.

AWG	Diameter (mm)	Area (mm ²)
#8	3.264	8.37
#9	2.906	6.63
#10	2.588	5.26
#11	2.305	4.17
#12	2.053	3.31
#13	1.828	2.62
#14	1.628	2.08
#15	1.450	1.65
#16	1.291	1.31
#17	1.150	1.04
#18	1.024	0.823
#19	0.912	0.653
#20	0.812	0.518
#21	0.723	0.410
#22	0.644	0.326
#23	0.573	0.258
#24	0.511	0.205
#25	0.455	0.162
#26	0.405	0.129
#27	0.361	0.102
#28	0.321	0.081
#29	0.286	0.064
#30	0.255	0.051

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4.2 Pair SGL Key

The Cable Length Meter can measure single- or two-conductor wires. Press the **PAIR SGL** key to toggle between single or two conductor. For single-conductor measurement, the unit is connected at both ends of the wire/conductor. For two-conductor measurements, the unit is connected one end of the wire and the other end of the pair is shorted (wire length = total resistance/2).

SET LEN Key (AWG Mode Example)

The Set Length function allows the user to change factory default ohms per feet coefficients values, based on a sample length of wire. Press the **SET LEN** key to toggle between the AWG Mode screen (Figure 4-1) and the Set Length Mode screen (Figure 4-2, below). In Set Length mode, the unit measures the sample wire's resistance. Press the **UP/DOWN** keys to adjust the wire length from 100 to 200 feet (31.3 to 62.5 m). The smaller digits display ohms per feet, based on the sample wire. Press and hold the **SET LEN** key down for a few seconds to store the new coefficients and override factory default values.

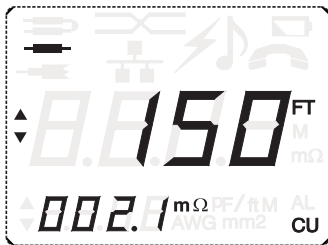


Figure 4-2. Set Length Mode screen.

Example: The factory default for 12 AWG copper is .0017 ohms/feet.

1. Using the **MODE** key, select AWG mode.
2. Using the **UP/DOWN** keys, set the AWG to 12.

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3. Press the **SET LEN** (LEN = Length) key, and the Set Length screen (Figure 4-2) appears. In this mode, use the **UP/DWN** keys to adjust the larger digits to match the length of the sample wire (100–200 ft. range). If the sample wire is 150 feet and its resistance is equal to 0.315 ohms, the smaller digits on the left-hand side of the screen will display “0.0021 ohms/ft. (150 feet/0.315 ohms = 0.0021 ohms/ft.)
4. To store the new value, press the **SET LEN** key for approximately 1.5 seconds. The unit generates a confirmation beep. The new 12 AWG length coefficient of 0.0021 ohms/feet will be stored in memory in place of the factory default of 0.0017 ohms/feet.

NOTE: Restoring Factory Default Values. To restore factory coefficients back to their original values, hold the **UP/DOWN** keys and the **Power** key down at the same time when powering down the unit. Any previous values stored by the user will be deleted from memory. Table 4-2 lists the factory default values.

Table 4-2. Factory default values, ohms/feet.

AWG	Aluminum	Copper
8	0.00103	0.00063
10	0.00164	0.0011
12	0.00261	0.0017
14	0.00414	0.0025
16	0.00659	0.00455
18	0.0105	0.0061
20	0.0167	0.00945
22	0.0265	0.0168
24	0.0421	0.0273
26	0.067	0.0436
28	0.106	0.0637
30	0.169	0.108

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4.3 Coax, Network, and Telco Modes

Coax, Network, and Telco modes detect the distance to opens and the distance to shorts.

The Cable Length Meter determines the length by measuring line capacitance when the line is open or by measuring resistance when the line is shorted. When measuring opens, use the **UP/DOWN** keys to adjust the capacitance coefficient (10 to 40 pf per foot) to calculate the cable length. The Cable Length Meter supports three user-adjustable length coefficients, one for each type of cable (Coax, Network and Telco). It stores these coefficients in memory even when the unit is powered off.

Short/Resistance coefficients are stored in memory (see Table 4-2 for factory default values). These values can be changed by running the Set Length Function. The Set Length function allows the user to change factory default values, ohms per feet coefficients, based on a sample known length of wire. Press the **SET LEN** key to toggle between Normal Measuring screen (Figure 4-3) and Set Length Mode screen, Figure 4-4. In Set Length mode (line shorted), the unit will measure the resistance of the sample wire. Adjust the length of the sample wire using the **UP/DOWN** keys in the range of 100 to 200 feet. The smaller digits display the ohms per feet based on the sample wire. Press and hold the **SET LEN** key down for a few seconds to store the new coefficients.



Figure 4-3. Normal Network Measuring screen.

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Example: The factory default for Network wire is .0273 ohms per feet.

Press the **MODE** key to select Network mode.

Press the **SET LEN** (LEN = Length) key, and a new screen will pop up (see Figure 4-4). In this mode, use the **UP/DOWN** keys to adjust the larger digits to match the length of the sample wire (100–200 feet range). If the sample wire is 150 feet and its resistance is equal to .315 ohms, the smaller digits on the left hand side of the screen will display “002.1m Ω ”.

To store the new value, press the **SET LEN** key for approximately 1.5 seconds. The unit will generate a confirmation beep. The unit stores the new network length coefficient of .0021 Ω per feet in memory.

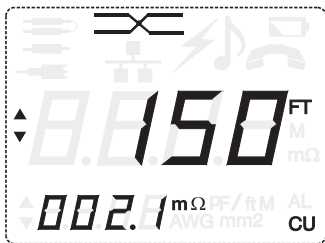


Figure 4-4. Set Length Mode screen.

NOTE: Restoring Factory Default Values. To restore ohms per feet factory coefficients back to their original values, hold the Power and **UP/DOWN** keys down at the same time while powering down the unit. Any previously stored values will be overwritten by the factory default values.

NOTE: To obtain symmetrical test results for Shorts and Opens measurements, the Cable Length Meter must have the correct “capacitance per feet coefficient” and “resistance per feet coefficient” of the wire under test.

Cable Length Meter

Changing Opens/Capacitance Coefficient Using Set Length

To change capacitance coefficients, follow the steps above (cable/wire must be open) based on the sample wire (100 to 200 feet). The Cable Length Meter measures the total capacitance of the cable and displays the value in the lower left-hand corner of the LCD (the cable must be within 10 to 40 pf per feet range, otherwise meter will indicate OL).

Table 4-3. Opens/shorts factory default values.

Mode	Capacitance Opens	Ohms per Feet/AWG Shorts
Coax	22.0 pf	0.0663 ohms/NA
Network	15.0 pf	0.0273 ohms/24 AWG
Telco	17.5 pf	0.0273 ohms/24 AWG

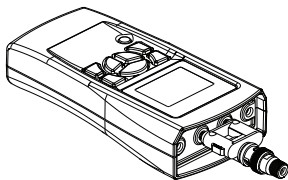


Figure 4-5. BNC-to-F connection for measuring coax.

4.4 Tone Mode

To generate a tone on the cable/wire, select Tone Mode (see Figure 4-6). The Cable Length Meter has four unique tones. Use the **UP/DOWN** keys, to scroll through the four tones. The tones generated match audio frequencies used with tone tracers/probes. The signal generated on a pair is nominal 5 volts peak-to-peak across the pair. The unit will power down automatically after 1 hour.

Available tones include:

1. High tone 1 KHz
2. Low tone 704 Hz
3. Warble tones, low tone for 160 ms, followed by 115 ms of high tone

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4. Warble tones, low tone for 365 ms, followed by 65 ms of high tone.



Figure 4-6. Tone Mode screen.

4.5 Calibrating the Test Lead

1. Hold down the **LEAD CAL** key until the unit displays **CAL**. The unit will display **CAL** for a few seconds then display **Shrt Lead**.
2. Short the leads as illustrated Figure 4-7. Once connected properly to the bus wire, press the **LEAD CAL** key again. The unit will beep and display **OPEN LEAD**.
3. Disconnect the leads from the short. With the test leads open, press the **LEAD CAL** button. The unit will be beep and go into its normal operation mode. This completes the calibration procedure. This procedure must be done correctly for good measuring results.

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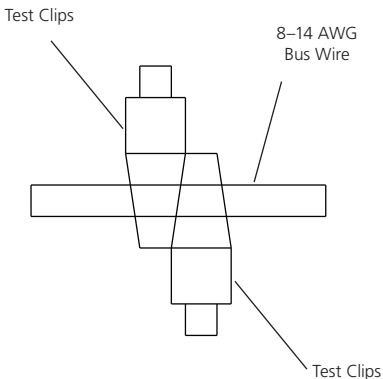


Figure 4-7. Wire under test.

NOTE: Make sure the wire surface is clean and the clips are making good contact. For best results, use solid wire 8 to 14 AWG. Make sure clips are as close together as possible.

5. Installing the Battery

Batteries are not included. Use only an alkaline 9-volt battery. When installing a new battery, disconnect any test cables connected to the Cable Length Meter. (See Figure 5-1.)

1. Using a #2 Phillips screwdriver, unscrew the battery cover screw and remove the battery cover on the back of the unit.
2. Remove the old battery from the battery compartment and detach the battery cap.
3. Connect a new alkaline 9-volt battery to the battery cap.
4. Slide the battery into the cavity.
5. Close the battery cover and replace the screw. Do not overtighten.

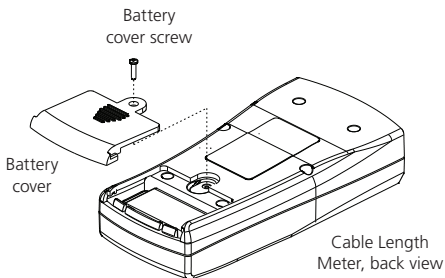


Figure 5-1. Battery installation.

Cable Length Meter

6. Troubleshooting

6.1 Calling Black Box

If you determine that your Cable Length Meter is malfunctioning, do not attempt to alter or repair the unit. It contains no user-serviceable parts. Contact Black Box Technical Support at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

6.2 Shipping and Packaging

If you need to transport or ship your Cable Length Meter:

- Package it carefully. We recommend that you use the original container.
- If you are returning the unit, make sure you include everything you received with it. Before you ship for return or repair, contact Black Box to get a Return Authorization (RA) number.

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