MLTDR_P

LIGHTWEIGHT, PORTABLE, AND POWERFUL

Key Features

PORTABLE

Lightweight, robust and portable

COST-EFFECTIVE

Cost-effective monitoring of multiple coaxial cables with one device

ACCESSIBLE

Monitoring at remote or inaccessible locations

CONFIGURABLE

Field-configurable for Cable Channel, Cable Length, and Cable Velocity (Vp)

INTEGRATED

Upload readings directly to your MLSuite database

DURABLE

12V 7AHr sealed lead-acid battery (~ 20 hours)

OVERVIEW

The **Canary Systems® MLTDR-P** is a portable datalogger designed for semi-automated monitoring of any number of coaxial cables embedded in slopes or boreholes for deformation monitoring.

The MLTDR-P is field-configurable for Cable Channel, Cable Length and Cable Velocity (Vp).

A 7 AHr lead-acid battery provides power, recharging is accomplished via the power port on the side of the reader and a supplied charging cable. Communications are provided via RS-232 interface through the supplied cable. There is an optional Bluetooth interface available, on request.

THEORY OF OPERATION

Time Domain Reflectometry (TDR) is increasingly being used in geotechnical applications for deformation monitoring in soils and concrete. It provides accurate location information for faults and can provide indication of the static or dynamic nature of the faults. It is typically used to monitor slope movement of embankments including highway cuts, rail beds, bridge abutments and open pit mines.

TDR technology was originally developed by the telecommunications industry as a method for detecting faults, or breaks, in cables. The principle is similar to radar, where a signal is broadcast and distant objects cause a portion of the signal to be reflected back towards the generator. By measuring the time between transmission and reception, and knowing the speed at which the signal is traveling, accurate determinations of the distance can be calculated.

CANARY SYSTEMS®

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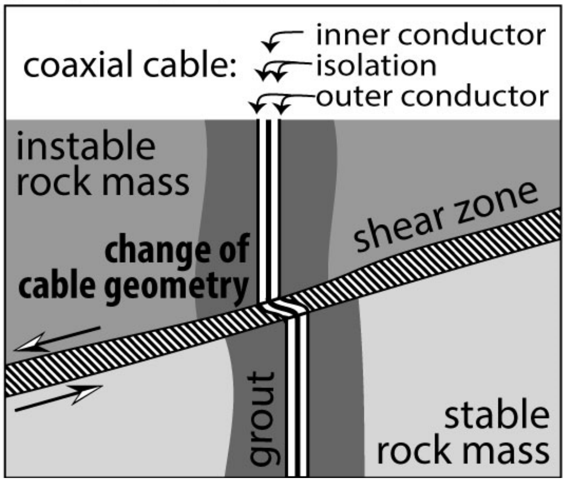
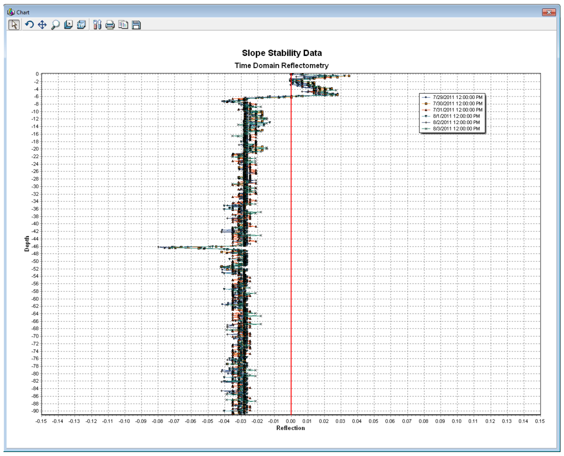
MLTDR_P

Shear zone



In TDR applications the signal is an electrical pulse broadcast down a coaxial cable, and changes in the impedance of the cable, either inductive or capacitive, cause reflections to be returned to the signal generator. The resultant reflections are measured and presented as a function of time, the **time is translated to distance** based on the known propagation velocity of the cable being utilized. In geotechnical applications the coaxial cable typically takes the form of a rugged coaxial cable with a diameter of 12mm (0.5"). The cable is usually grouted into a borehole drilled into the embankment to be monitored. Any movement of the embankment will crimp the cable, and the reflections indicate approximate magnitude of the crimp and the location. The resolution is related to the number of samples of data being collected for the waveform.

Data returned by the electronics is referred to as a **reflection coefficient**, or percentage of reflection, and is in a range of 1 (open circuit) to -1 (short circuit). A value of zero indicates no reflection. Typically, with very long cables there is some absorption of the signal down the length of the cable which shows as an increasing reflection coefficient. Deformations or abnormalities in long cable lengths will still result in an increase or decrease in the reflection coefficient at those locations. A sample data output is provided on the right.



Slope Stability - TDR chart with a decrease in the reflection coefficient indicating a potential deformation location

All distances are "apparent", not absolute. A key configuration parameter of the monitoring system is the velocity of propagation (Vp), this is the percentage of the speed of light that the electrical signal travels down the cable. Vp typically ranges between 0.65 and 0.90 but these are approximate values supplied by the manufacturer. In-situ modification of the cables, using a few crimps applied to the cable at measured distances during installation, can be useful to help establish more accurate distance measurements. Contact **Canary Systems®** for more information on this technique.

Specifications MLTDR-P

Datalogger CR6

- Universal Channels: 12
- Input Voltage Range: +/-5V
- Digital Ports: 16
- Communications:
  Ethernet, USB, CS I/O, RS-232, CPI, RS-485, SDI-12
- Power (CHG): 16 to 32VDC
- Power (BAT): 10 to 16VDC
- Power Consumption: <1mA – ~67mA
- Data Memory: 4MB SRAM
- Program Memory: 72 MB flash
- OS Memory: 128 MB Flash

AC Adaptor

- Output Voltage: 18VDC
- Output Power: 1A maximum

Physical

- Operating Temperature:
  -40 to +70° C (-40 to +160° F)
- Enclosure Size (L x W x H):
  37.1 x 25.8 x 15.2 cm
  (14.62" x 10.18" x 6.00")
- Weight: 9.3kg (20.6 lbs)
- Pelican case: type 1450NF IP-67 rated

System Power

- Battery: 12V 12AHr sealed lead-acid

Coaxial Cable Interface

- Points Range: 20-2048
- Waveform Averaging: 1-128
- Output impedance: 50 Ω ±1%
- Pulse Output: 250mV @ 14μS
- Maximum Cable Length: 2100m (7000')
- Operating Power: 300mA maximum
- Standby Power: 2mA

Model	MCU	Enclosure Type	Size (LxWxH)	Weight (lbs)	Battery	Solar	Receiving	Transmitting	Coax Support	Options
MLTDR-P	CR6	Pelican	16x13x7	21	12AHr	-	RS-232	WiFi	TDR200	-

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