

# Pro400

## **TDR Cable Fault Locator Operating Instructions**



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## Section 1 - Receiving the Pro400

Upon delivery of the Pro400, ensure the contents are consistent with the packing list, notify your supplier of any missing items.

If the equipment appears damaged, notify your carrier and supplier immediately, giving a detailed description of any damage, save the damaged packaging to substantiate your claim.

The Pro400 has a 2ft test lead, soft case, batteries and user manual.

### 1.1 Safety notices



- This instrument meets the safety requirements of IEC61010-1: 1995
- ThePro400 is designed for use on de-energized circuits only.
- Connection to line voltages will damage the instrument and could be hazardous to the operator
- This instrument is protected against connection to telecom network voltages according to EN61326-1.
- Safety is the responsibility of the operator

### International Electrical Symbols



This symbol signifies that the instrument is protected by double or reinforced insulation. Use only specified replacement parts when servicing the instrument.



This symbol on the instrument indicates a WARNING, and that the operator must refer to the user manual for instructions before operating the instrument. In this manual, the symbol preceding instructions indicates that if the instructions are not followed, bodily injury, installation/sample and product damage may result.



Risk of electric shock. The voltage of the parts marked with this symbol may be dangerous.

## 1.2 Standards

The Pro400 has been manufactured in accordance with and meets the requirements of the following international standards:

SAFETY	IEC 61010-1 EN 60950
EMC	BS/EN 61326-1
Water/Dust Proof to IP54	

## Section 2 - Introducing the Pro400

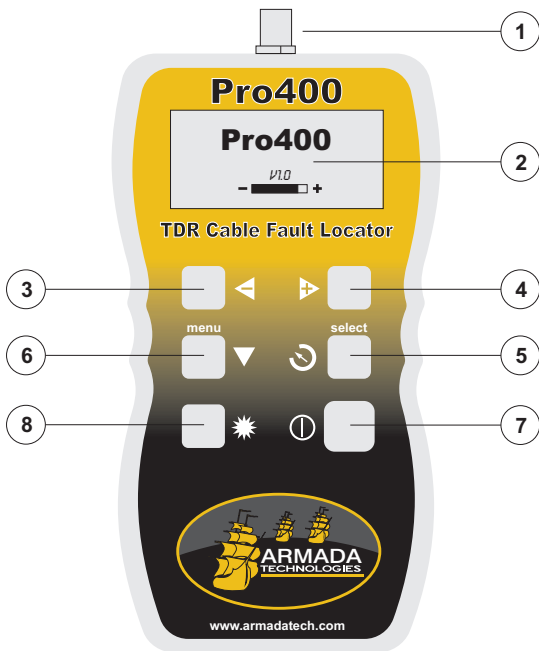
The Pro400 is a 6,000 ft (2,000m) range, hand held, time domain reflectometer weighing only 12 ozs (350 grams) designed for identifying and locating faults on Metallic cables, with a 20 ft first range scale and 2 ft dead zone.

The Pro400 injects a series of pulses into the cable under test. The velocity at which the pulses travel is determined by the type of cable, this is known as the velocity of propagation (Vp) of the cable.

The Vp value is expressed as a percentage of the speed of light i.e. 67% or ft/mtrs/micro second (ms). This value will vary according to the type of cable under test. The Pro400 can accept user selectable values between 1 and 99% (or the equivalent value in feet or meters per micro second).

Based on the selected Vp and the time taken for the pulses to travel through the cable, a reflection profile of the cable under test is displayed, identifying impedance anomalies along the cable. By aligning the moveable cursor to the selected anomaly, the distance to fault is displayed in feet or meters.

## 2.1 Pro400 Features



1. BNC Input connector
2. LCD Start up screen
3. Cursor left button / decrease range
4. Cursor right button / increase range
5. Menu and range select button
6. Test start button
7. Power on/off button
8. Back light on/off button

## 2.2 Specifications

Ranges Feet	23, 49, 98, 197, 394, 820, 1640, 3280, 6560
Meters	7, 15, 30, 60, 120, 250, 500, 1km, 2km
Range Selection	Manual range control
Accuracy	1% of selected range*
Resolution	Approx 1% of range
Sensitivity	Min 3 pixel return at 1750 meters on 0.6mm Ø, PE, TP
Velocity Factor	Adjustable from 1% to 99%
Output Pulse	5 volts peak to peak. Into open circuit
Output Impedance	Selectable 25, 50, 75 & 100 ohms
Output Pulse Width	3 ns to 3 ms, Automatic with range
Scan Rate	2 scans / second or scan held
Tone Generator	810 – 1100Hz
Battery Life	60 hours continuous scanning
Power Supply	6 volts 4 x 1.5 AAA Alkaline cells
Power Down	Selectable 1, 2, 3, 5 minutes or disabled
Back Lit Display	128 x 64 pixel
Voltage Protection	250 volts AC
Operating Temp	-10° / 50°C
Storage Temp	-20° / 70°C
Dimensions	165 x 90 x 37 (6.5 x 3.5 x 1.5 ins)
Weight	350 gms (12oz)
Safety	IEC 61010-1 EN 60950
EMC	BS/EN 61326-1
Water/Dust Proof	IP54

\* Measurement accuracy of  $\pm 1\%$  assumes the instrument setting for velocity of propagation (Vp) of the cable under test to be accurately set, homogeneity of the Vp along the cable length, and accurate cursor positioning.

## 2.3 Accuracy

The Pro400 is able to measure distances to faults and cable lengths to an accuracy of +/- 1%.

This measurement accuracy is based on the correct value of Vp being used for the cable under test, and homogeneity of the Vp along the cable length.

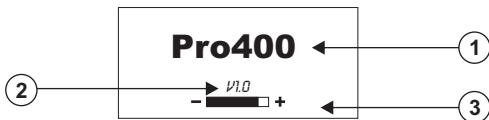
If the Vp is set incorrectly by the operator, or the Vp varies along the length of the cable, then additional errors will be incurred and the measurement accuracy will be affected.

**Note:-** The Vp is less well defined with unshielded multicore cable, including power cable, and is lower when a cable is tightly wound on a drum than when installed.

## Section 3 - First Operation

### 3.1 Preparing the Pro400 for use

Press button ① to power the tester, the following screen will be displayed:



- 1 Model
- 2 Software version programmed into tester
- 3 Battery condition indicator (all black battery, fully charged, as charge decreases symbol changes to white) Battery condition indicator is permanently displayed.

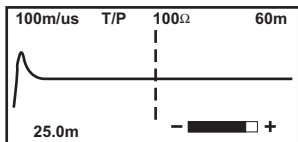
Prior to use the following parameters will need to be set

- |   |                                |             |
|---|--------------------------------|-------------|
| 1 | Auto shutdown                  | section 3.3 |
| 2 | Set contrast                   | section 4.5 |
| 3 | Select unit of measure         | section 3.4 |
| 4 | Select velocity of propagation | section 3.6 |

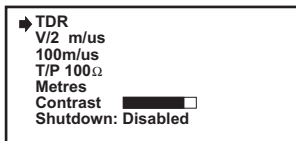
## 3.2 Menu and Screen Displays

### Level 1. Start up screen

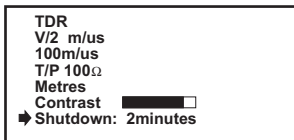
To access level 2 menu. Press down SELECT button and hold, press ▼ release both buttons.  
To exit press ⏻ button.



### Level 2. Menu



## 3.3 Set Auto Shutdown



To preserve battery life, the Pro400 has an auto shutdown feature. Shutdown time is selectable between disabled, 1 minute, 2 minutes or 3 minutes.

To change settings press ▼ to move ➡ to shutdown, use ◀ or ▶ to select setting. To exit press ⏻ button.



### 3.4 Set Unit of Measure (Level 2)

TDR	
V/2 m/us	
100m/us	
T/P 100 $\Omega$	
➡ Metres	
Contrast	<input type="checkbox"/>
Shutdown: 2minutes	

Press ▼ to move ➡ to unit of measure (feet or meters). Press ◀ or ▶ to scroll between feet and meters. Press ⏮ button to exit, selected value will be automatically stored.

**Note:-** When unit of measure has been selected, this will automatically change the V/2 figure, which will also be displayed in the selected unit of measure.

### 3.5 Set cable Impedance (Z)

TDR	
V/2 m/us	
100m/us	
➡ Coax 75 $\Omega$	
Metres	
Contrast	<input type="checkbox"/>
Shutdown: 2minutes	

Press ▼ to move cursor ➡ to Z, to scroll between values press ◀ or ▶ To exit press ⏮, selected values will be automatically stored.

### 3.6 Set Velocity of Propagation (Vp) Level 2


Velocity of propagation (Vp) may be set as % or speed in micro seconds (ms). The unit of measure, the speed is displayed in (feet or meters), will be determined by the setting selected in section 3.4

TDR	
➡ V/2 m/us	
100m/us	
Coax 75 $\Omega$	
Metres	
Contrast	<input type="checkbox"/>
Shutdown: 2minutes	

Press ▼ to move ➡ to displayed unit, press ◀ to scroll between v/2 M/Ms or Vp % UC.

Press ▼ to move ➡ to displayed unit, press ◀ or ▶ to increase or decrease displayed value, press ⏮ to return to screen. Selected values will be automatically stored.

### 3.7 Backlight

The LCD display has L.E.D. backlight to enable easy viewing under a variety of different lighting conditions. The backlight is switched on and off with the  key.

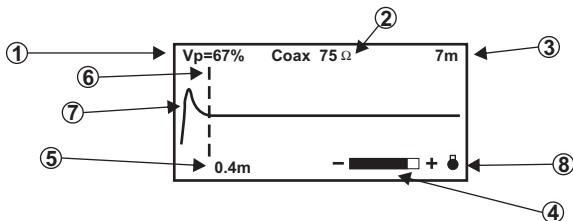
### 3.8 How to determine Vp settings

If the TDR Pro400 is to be used with a cable type for which the Vp is unknown, this must first be determined.

1. Take a sample of the cable at least 100m or 300ft long.
2. Measure the actual length of cable using a rule or tape measure, or some other reliable method.
3. Connect the TDR Pro400 and adjust the Vp setting such that the tester gives a correct reading of the sample length.

## Section 4 - Using the Pro400

Upon completion of the set up procedures in section 3, press button ▼ and the following test screen will be displayed

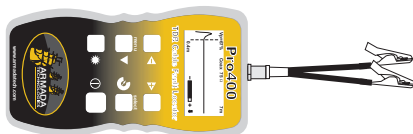


1. Vp Setting
2. Impedance setting (Z)
3. Range scale 7 mtrs
4. Battery condition indicator
5. Distance of cursor
6. Cursor
7. Output pulse
8. Scan mode icon (indicating scan mode selected)



Attach the test lead set to the Pro400 via the BNC connector located at the top of the unit,

1. Ensure that no power supply or equipment is attached to the cable to be tested
2. Ensure that the far end of the cable under test is open or shorted (not fitted with a resistive termination)
3. Attach the Pro400 to one end of the cable to be tested



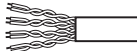
Coaxial Cable



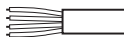
Shielded Cable



Twisted Pair



Multi-conductor Cable



**Coaxial Cable:** Connect the red clip to the centre wire and the black clip to the shield/screen.

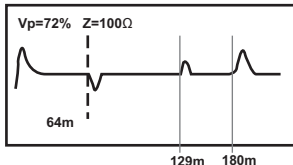
**Shielded Cable:** Connect the red clip to a wire adjacent to the shield and the black clip to the shield.

**Twisted Pair:** Separate out one pair and connect the red and black clips to the two wires of the pair.

**Multicore Cable:** Connect the clips to any two wires.

## 4.1 Testing a cable

Having followed the set up procedures in the preceding sections, a typical display showing impedance anomalies is shown below. Further examples are shown in section 4.6.



The vertical cursor line is moved left or right along the line of the trace by pressing ◀ and ▶ buttons to determine the distance to the event. Position the cursor at the beginning of the event and read off the distance at the bottom left corner.

On the fault display shown above a low impedance fault occurs at 64 meters shown by a negative spike, and a high impedance at 129 meters. The open end of the cable is shown as a large positive spike, this is used to determine the end of the cable run and the overall length of the cable being 180 meters.

## 4.2 Selecting Range Scales

The Pro400 has 9 range scales covering the range of 20 ft to 6,000 ft.

To select a range scale, or scan the cable run, press and hold down the Select button and press ◀ to decrease range, press ▶ to increase range.


## 4.3 Single shot and Continuous Scanning Modes

When the Pro400 is first switched on, it is set to “Single Shot” mode.

In this mode the Pro400 only fires a pulse into the cable under test when either the ◀ and ▶ buttons or ▼ button is pressed.

**Single Shot Mode:** Saves on battery life and also enables the Pro400 to be disconnected from the cable while still leaving the fault display on the screen

To enter “**Continuous Scanning**” mode press down and hold the ▼ button.


The  icon will appear at the bottom right of the display, when continuous scanning mode is activated.

**Continuous Scanning Mode:** fires pulses into the cable under test. In this mode the Pro400 is able to more easily identify intermittent cable faults.

#### 4.4 Tone Generator

The Pro400 may also be used as a tone generator to trace and identify cables and wires. The user will need a conventional inductive tone probe within the range 810 Hz to 1110Hz.

To select tone generator (Level 2)


➡ TDR  
V/2 m/us  
100m/us  
Coax 75Ω  
Metres  
Contrast   
Shutdown: 2minutes

Press ▼ to move ➡ to TDR, press ◀ to scroll between TDR and warble.  
Press ⏻ button to exit.

When tone has been selected, connect test lead to cable pair to be traced and using tone probe which will emit a tone, the volume will increase the nearer the probe is to the cable / being traced.

**Note:-** The auto off function is disabled in tone generator mode so that the tone can be injected into a cable for extended periods while tracing takes place.

## 4.5 Set Contrast (level 2)

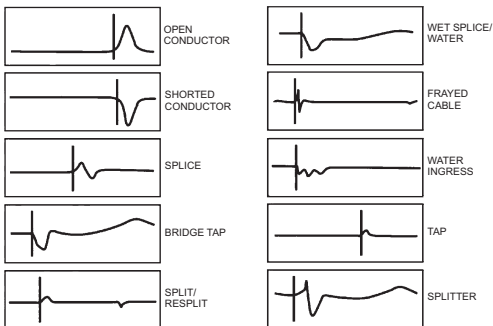
TDR  
V/2 m/us  
100m/us  
Coax 75 $\Omega$   
Metres  
➡ Contrast   
Shutdown: 2minutes

Press ▼ to move ➡ to contrast. Press  
◀ to decrease contrast, press ▶ to  
increase contrast.

Press ⏻ button to exit.

## 4.6 Typical Fault Displays

The following diagrams show typical fault traces to assist you in the identification of faults using the Pro400:



## 4.7 Typical Cable V.P and Impedance Values

Type	Vp	Z	Type	Vp	Z
Cat5 STP	72	100	T/Pair Jelly PE	64	100
Cat5 UTP	70	100	T/Pair PE	67	100
Coax Air	98	50/75	T/Pair PTFE	71	100
Coax Air Space	94	50/75	T/Pair PVC	58	100
Coax Foam PE	82	50/75	T/Pair Paper 72nF	88	100
Coax Solid PE	67	50/75	T/Pair Paper 83nF	72	100

## **Section 5 - Maintenance**

### **5.1 Battery Replacement**



Disconnect the instrument from any cable or network link

- Turn the instrument off
- Loosen the two black screws and remove the battery compartment cover
- Replace the batteries with 4 x 1.5 volt Alkaline batteries, observing the polarities
- Refit the battery compartment cover and refit the two screws

### **5.2 Cleaning**



Disconnect the instrument from any source of electricity

- Turn the instrument off
- Use a soft cloth lightly dampened with soapy water, wipe over the instrument, rinse the cloth in clean water squeezing out any excess water, wipe over the instrument removing any soap residue, dry instrument with a dry cloth
- Do not splash water directly on the instrument
- Do not use alcohol, solvents or hydrocarbons

### **5.3 Storage**



If the instrument is not to be used for a period of more than 60 days, it is recommended that the batteries are removed and stored separately (see 5.1)

## **Section 6 - Repair and Warranty**

The instrument contains static sensitive devices and is not user serviceable. If an instrument fails, or its protection has been impaired, it should not be used but sent back for repair by suitably trained and qualified personnel.

New instruments are guaranteed against breakdown due to manufacturing or component defects for 12 months after the purchase date by the user.

**Note:-** Any unauthorized prior repair or adjustment to the instrument will automatically invalidate the warranty

### **6.1 Contacting Us**

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