

DF-600

Differential Active Probe

User's Manual

Revision I



CLOCK COMPUTER CORP.

<http://www.clock-link.com.tw>

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Differential Active Probe, Model No: DF-600



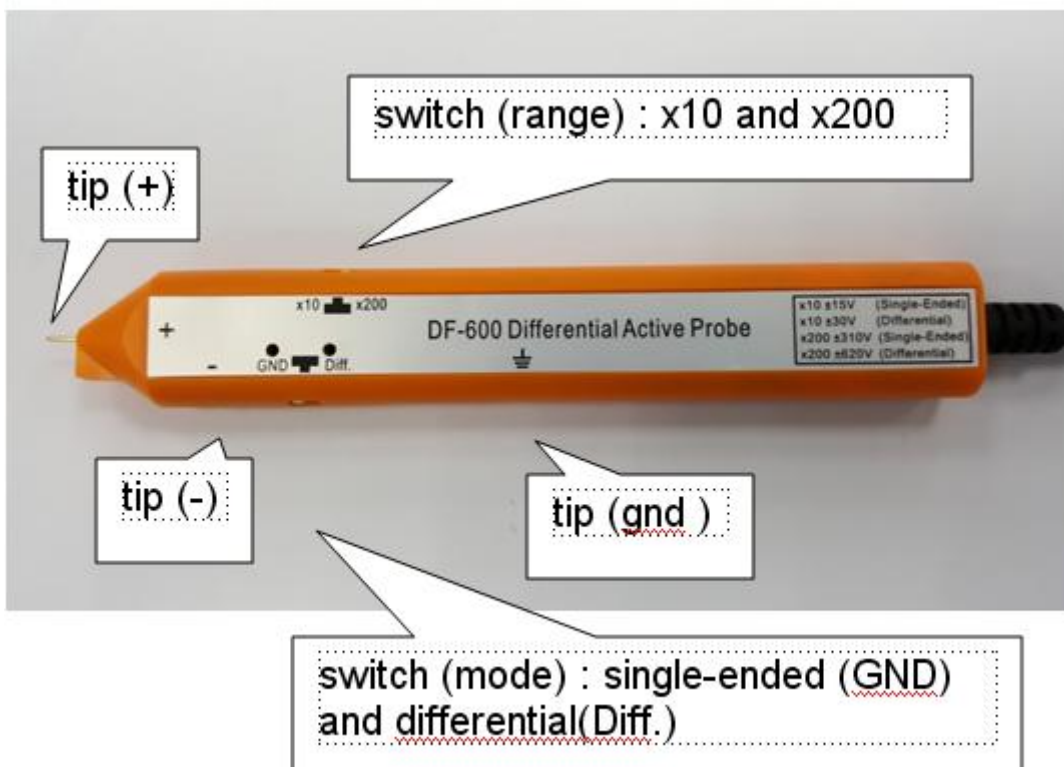
Introduction

It will spend a lot of money if user need buy a differential probe and active probe. The DF-600 accomplished this feat by combining two active FET probes into a single package. User selectable switch allows the second input to be a complementary for differential function or Ground for single ended probing.

Traditionally, an active probe is needed to measure high speed single ended signal, such probe is generally too delicate to measure high voltage signals. For High voltage signal measurements, a differential probe is typically recommended, but with a limited signal bandwidth. Modern high speed FPGA design employs an array of LVDS signals for chip to chip communication. In order to measure the LVDS signals one typically use either a high speed differential probe or tying up two oscilloscope channels for +/- side of the LVDS signal.

The DF-600 differential probe is a combination of a differential probe and an active probe. By combining both styles of oscilloscope probes into a single probe, the DF-600 provides a significant saving to the user. With up to 600V of rating and 600 MHz of bandwidth, a single DF-600 can handle bulk of the measuring tasks in a typical design lab.

This DF-600 Differential Active Probe has a switch to select differential or single-ended mode and another switch to change measured voltage range.



The Model No : DF-600 Active Differential Probe is a high input impedance and low input Capacitance probe. It also support extra high frequency bandwidth, and high voltage input.

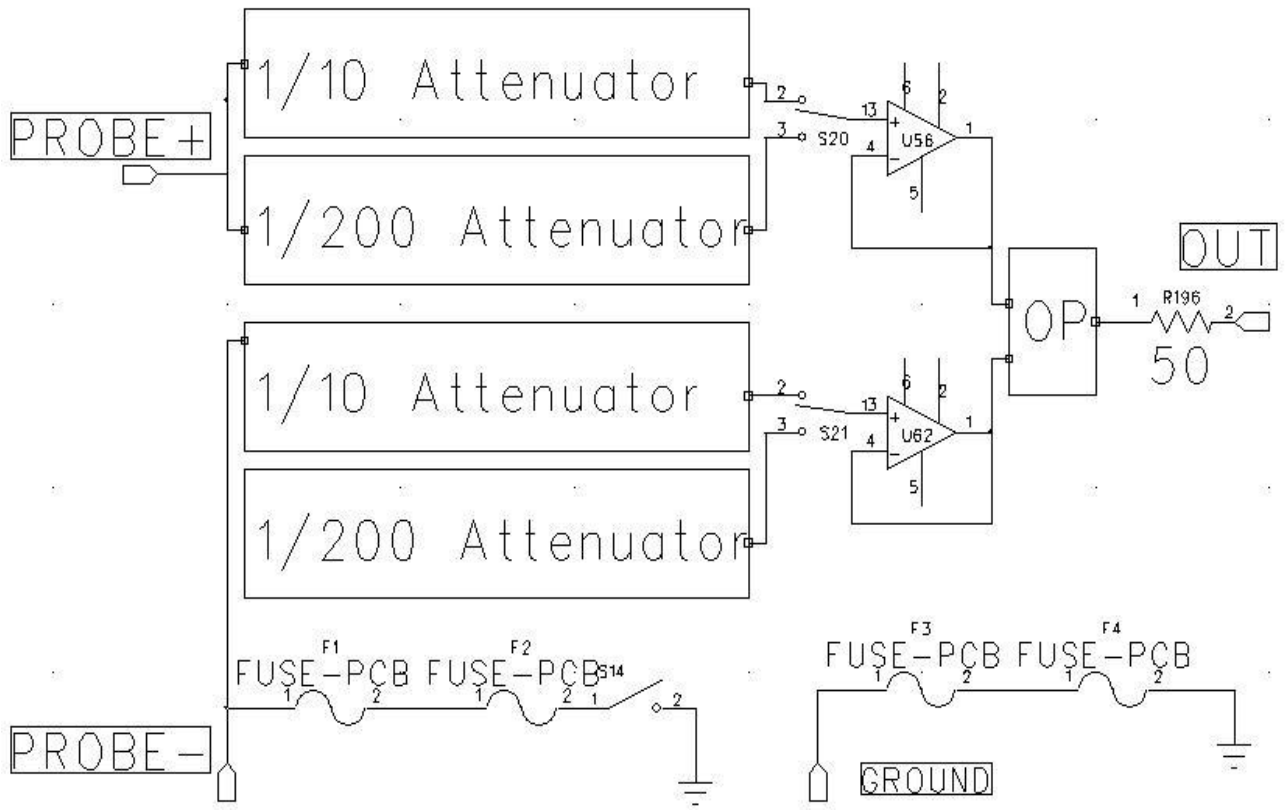
It is designed by three OP, two FET buffer OP and a low offset OP.

So even long term operation, The voltage by measured will not drift.

The voltage offset always approach to 0 volts. (USB power supply should be 4.98V - 5.1 V)

The DF-600 Active Differential Probe allows measurement of small differential signal.

The following diagram shows the circuit of DF-600.



The following table gives characteristics for DF-600.

Characteristics

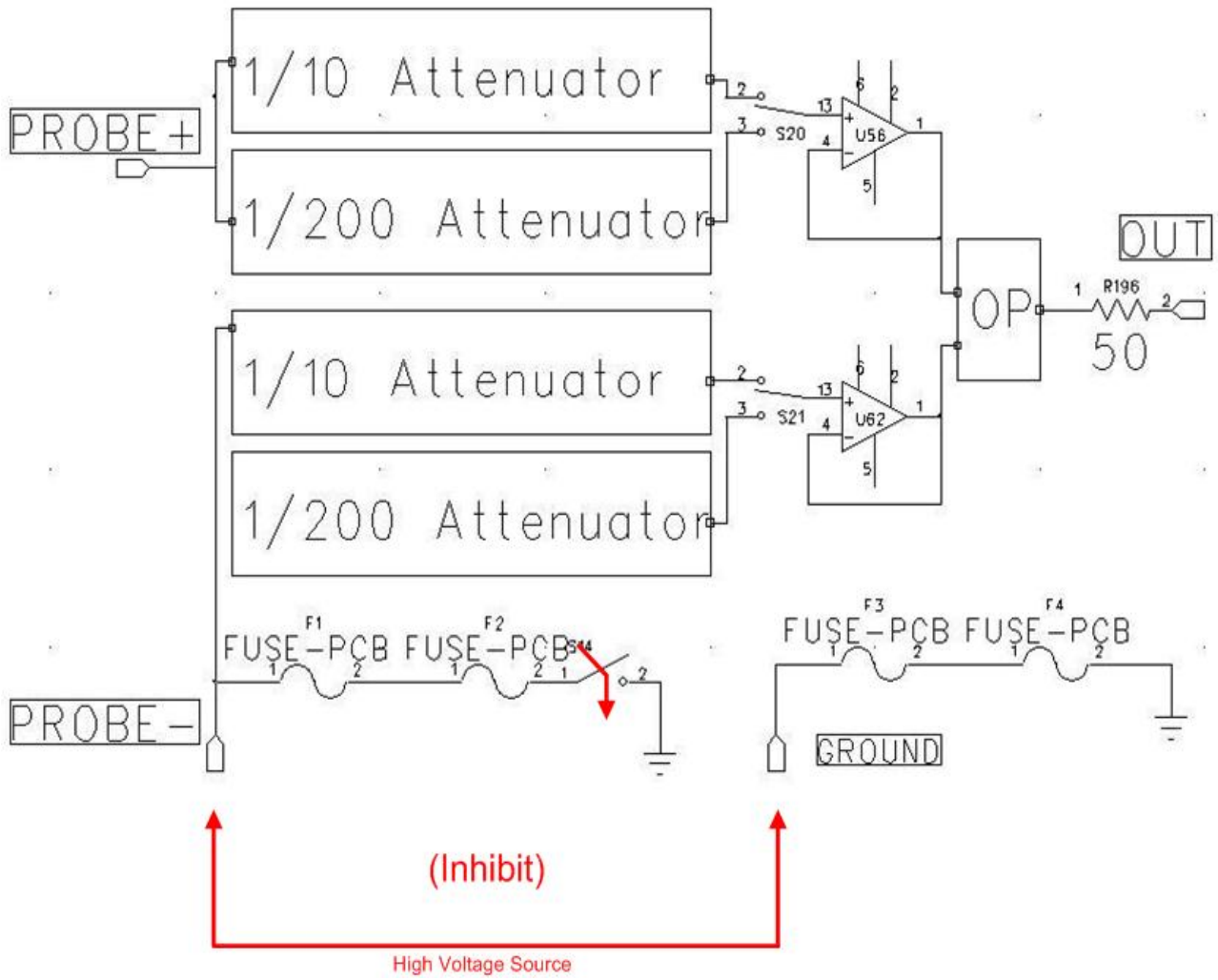
Parameter	With 10:1 attenuator	With 200:1 attenuator	Remark
Bandwidth	600MHz differential 400MHz single ended		50 ohm input impedance oscilloscope
DC gain accuracy	1.0%		
Voltage Input Range (differential)	≤ 30 V	≤ 620 V	(DC+AC peak to peak)
Voltage Input Range (single ended)	≤ 15 V	≤ 310 V	(DC+AC peak to peak)
Non-Destructive Input Range	± 1600 V(Max differential voltage) ± 800 V (Between terminals and ground)	± 1600 V(Max differential voltage) ± 800 V (Between terminals and ground)	(DC+AC peak to peak)
Rising time	≤ 300 ps		
Input Impedance Resistance Capacitance	2.06 M Ω (Between terminals and ground) 1.5 pF (Between terminals and ground) 4.12 M Ω (differential) 0.9 pF (differential)		
Output termination impedance	50 Ω		
Power Requirement	USB support 5V/160 mA		
weight	Approximately 110 Grams		
Cable Length	1.2m		

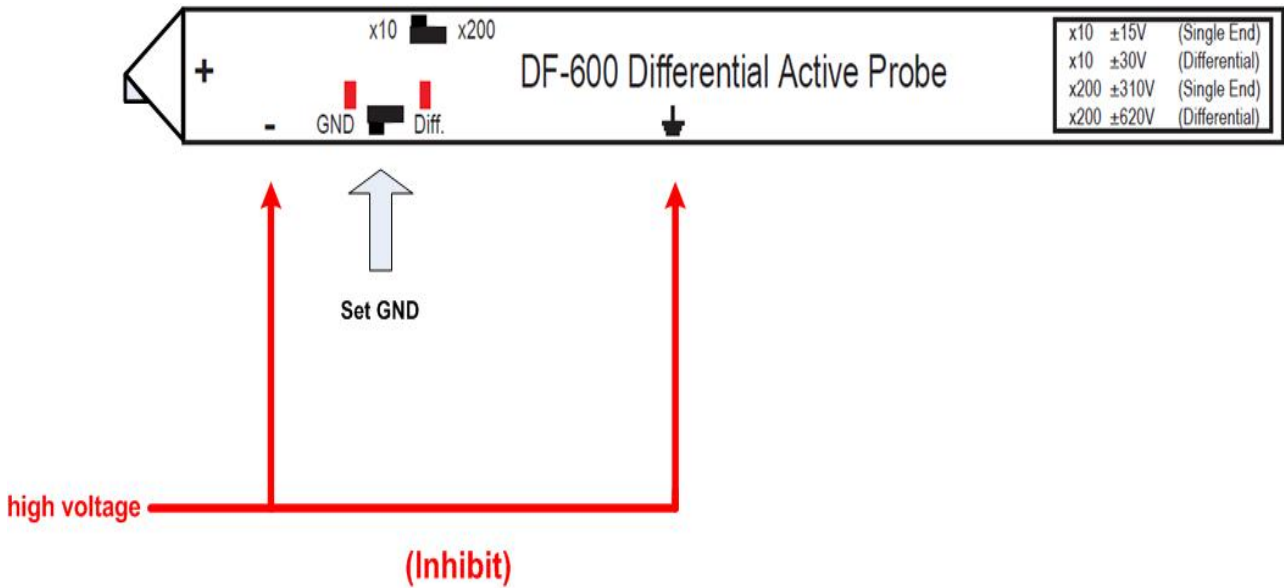
Safety operation

1. Do not use the probe over the max input voltage.

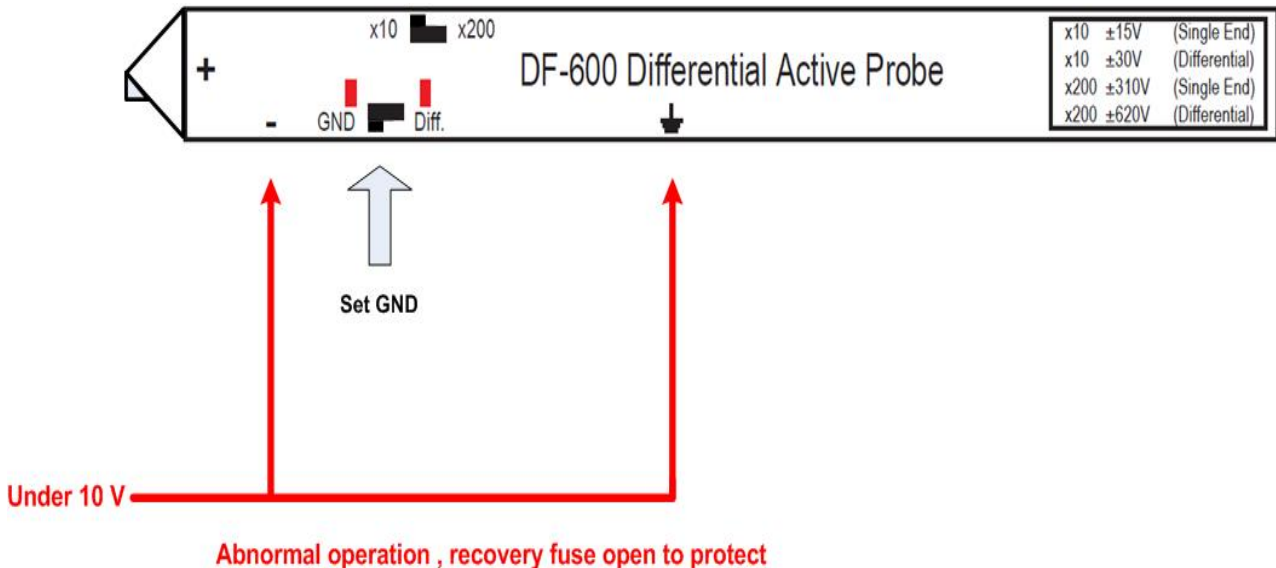
Parameter	With 10:1 attenuator	With 200:1 attenuator	Remark
Voltage Input Range (differential)	≤ 30 V	≤ 620 V	(DC+AC peak to peak)
Voltage Input Range (single ended)	≤ 15 V	≤ 310 V	(DC+AC peak to peak)

2. Do not use the probe in moisture environment or risk of explosion.
3. Do not use the hook, line from any voltage source special high voltage source to ground of probe or high voltage source to (probe -) when switch to singled ended (ground).





This probe has built - in two series auto recovery fuse as show at diagram, It can protect this probe and target circuit if input voltage source under 10 volts when user set up - probe to ground or short input voltage source to ground, Over 10 voltage operation will not guarantee, and maybe burn out fuse, It will be very dangerous if user input high voltage in this situation.



High frequency operation

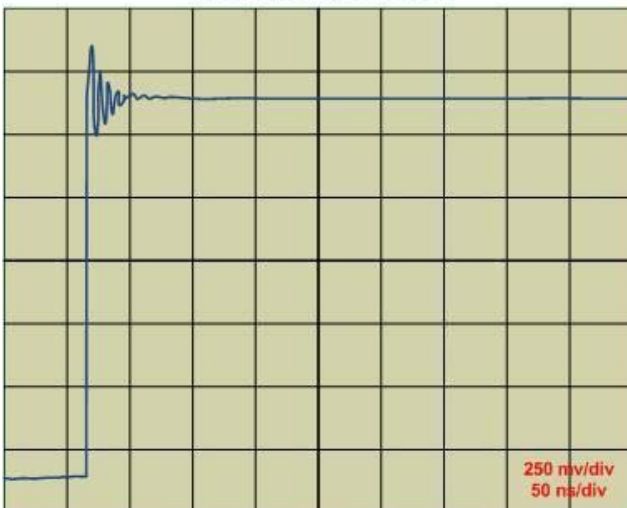
The ground line is an extension leads. It is convenience for user to measure target circuit. Because it is very long line. But if user need to measure high frequency, It need change ground line to short lead, below is ground line with extension lead.



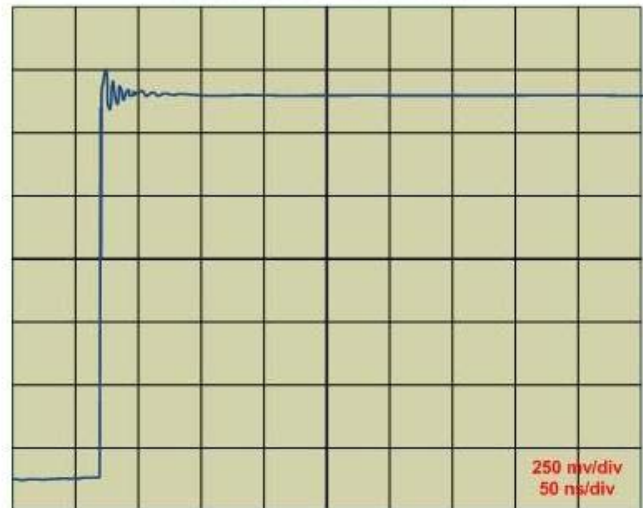
Below is ground line or (-) differential tip with short lead, can work up to 600 MHz for differential signal, or 400 MHz for single ended signal.



With extension leads



Without extension leads



Isolation circuit operation

Some time differential probe can be used to an singled ended active probe, But it will make mistake if the measure target circuit ground had big voltage different with oscilloscope ground.

If target is device supported by battery. It will fully isolation with oscilloscope. In this situation just shift switch to ground, probe tip (-) will become ground.

But if target circuit is a differential signal, you need let probe ground hook to target ground. Let target ground same as oscilloscope ground. Below diagram show how to use ground line.



Oscilloscope BNC feed thru terminal operation

Some oscilloscope has not support 50 ohm input impedance.

User can use feed thru terminal show at below let oscilloscope input impedance change to 50 ohm. Even some oscilloscope has 50 ohm input impedance option, User need manually set oscilloscope to 50 ohm input impedance.



Light up dark environment

Some time the target circuit environment was dark, this probe has a LED to light up the dark background.



Differential measurements:

1. Connect the DF-600 to the oscilloscope input. Select 50 ohm as input impedance on the oscilloscope.



If 50 ohm setting is not available, insert the included 50 ohm BNC adapter between the DF-600's BNC connector and the oscilloscope's BNC connector.

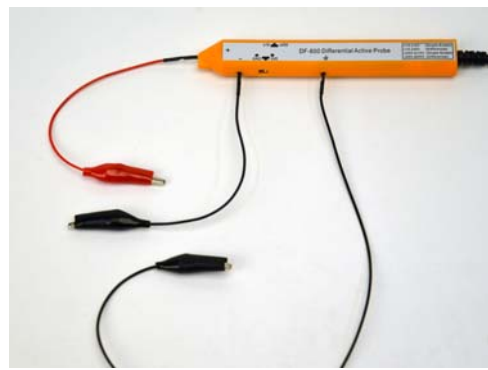
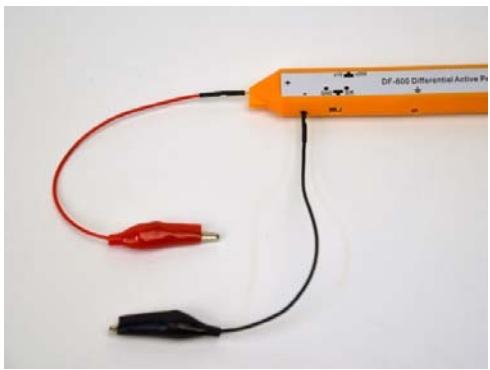
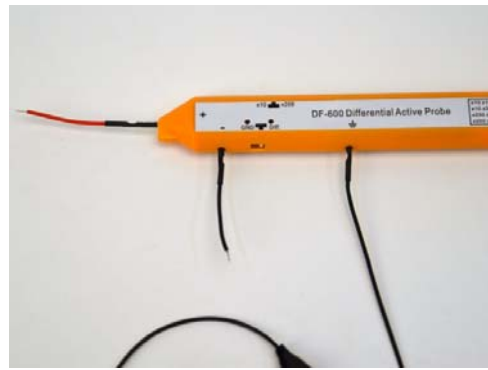
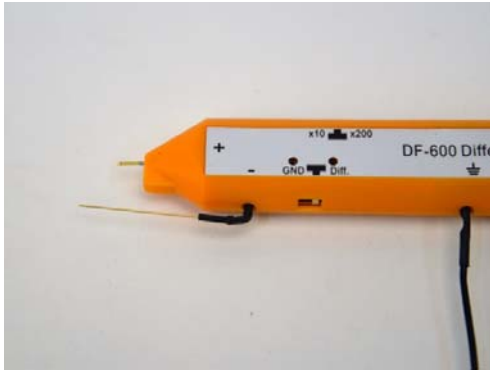


2. Power the DF-600 via the micro USB connector using the included micro USB cable. External USB power supply can be used to power the DF-600, provided that it can supply a minimum of 160mA @ +5V. Although internally the DF-600 has its own isolated power supply, a high quality USB power supply should be used to reduce potential noise contamination.



3. Depending on the type of signal one needs to measure, various connectors are provided in the DF-600 accessory kit. For high voltage signals, alligator clips along with banana

and shrouded banana plugs are provided. For low voltage signals such as LVDS, various types of dual terminated and single terminated wires are included in the kit along with clips and spring pins.



4. Select the attenuation that suit your measurement, x10 (max 30V) or x200 (max 620V).
5. Slide the Gnd / Diff switch to **Diff**.
6. Probe + and Probe – should be connected to the LVDS signal's P and N pins.
7. Ground connection to D.U.T. via the Gnd clip will also be necessary to provide a signal reference point.

Single Ended measurements:

1. Connect the DF-600 to the oscilloscope input. Select 50 ohm as input impedance on the oscilloscope.



If 50 ohm setting is not available, insert the included 50 ohm BNC adapter between the DF-600's BNC connector and the oscilloscope's BNC connector.

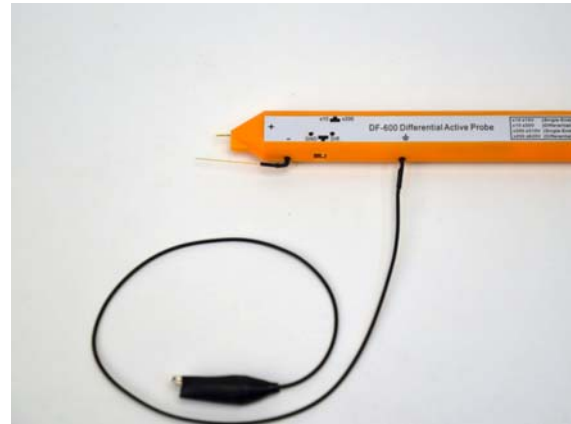


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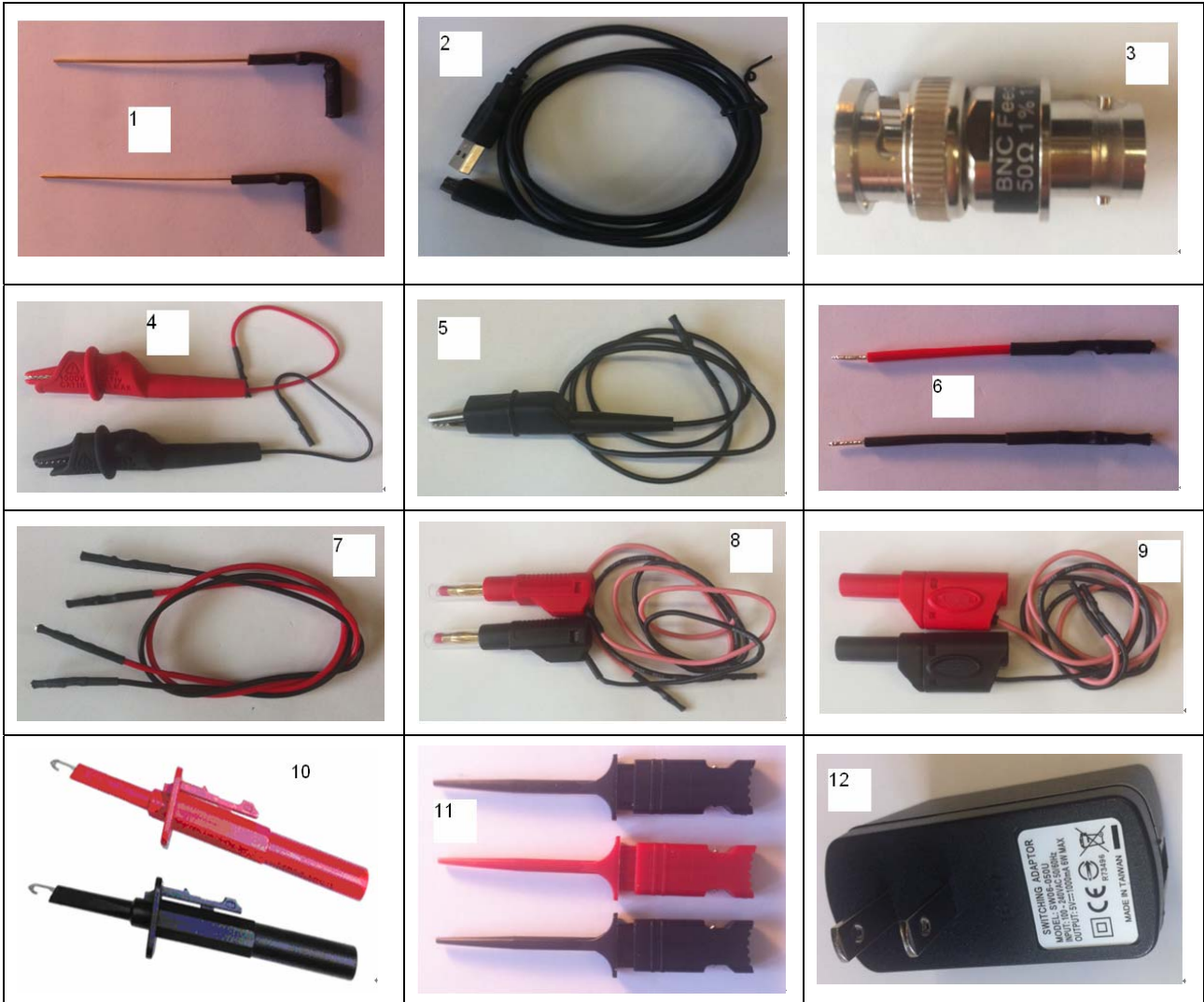
3. Select the attenuation that suit your measurement, x10 (max 30V) or x200 (max 620V).
4. Slide the Gnd / Diff switch to **GND**.
5. Connect the Probe + pin to the signal of interest and Probe – should be connected to the Gnd of the D.U.T.



6. Secondary ground connection to D.U.T. via the Gnd clip might be necessary.
7. Care should be taken that the Probe – terminal and Ground wire should be at the same Voltage potential.
Although internal protection circuit will kick in, prolong voltage potential difference above 10V will damage the DF-600.

Accessories List

Item	Accessories	Description	Q'ty
01	Earth Tip		2
02	Micro USB power line	1M	1
03	<i>BNC 50Ω impedance –thru terminator</i>	1Watt, 1GHz	1
04	Signal line with little alligator clip 1A-0055 (Red), 1A-0056 (Black)	15cm	2
05	Long signal line with little alligator clip	40cm (Black)	1
06	Signal line with wire strip	4.5cm (Red / Black)	2
07	Signal line with terminal	27cm (Red / Black)	2
08	Signal line with 4mm Retractable Stackable Plug (BP4450)	40cm (Red / Black)	2
09	Signal line with 4mm Safety Stackable Plug (BP4502)	40cm (Red / Black)	2
10	full insulation sprung hook with 4mm banana Socket / Plug (TC-4170)	(Red / Black)	2
11	Easy Hook (Red x 1 / Black x 2)	0.64mm square post	3
12	Switching adapter 5V/1A (SW06-050U)	USB power supply	1



Dec 20, 2017.