To measure voltage drop on a starter circuit connect scope as follows.

All channel grounds connected to battery negative.

(Channels A, B, & C in this test.)

Connect channel A (Blue) to battery positive

Connect channel B (Red) to the B+ cable on the starter or starter solenoid

Connect channel C (Green) to the starter case or mounting bolt

Connect channel D (Yellow) Using a high current probe around all the battery cables connected to either the positive or negative terminal. For proper signal direction note the direction of the arrow on the probe. On the positive terminal the arrow needs to point away from the battery. On the negative terminal the arrow needs to point towards the battery.

Setup the software as follows.

Timebase, 500 milliseconds per division (ms/div)

Verify sample rate is 1 Million Samples per second (1MS/s) sample rate or greater

Set trigger Mode to Repeat

Set trigger Type to Simple Edge

Set trigger Source to channel D (Yellow)

Set Threshold To 200Amps

Set the Direction to Rising

Locate trigger 10-20% across the screen from the left with Pre-trigger

Adjust Scale and Offset of each channel for desired location and separation

See Display tab in channel options menu.

Start Scope

Traces should move across the screen up to the trigger location. Once the Trigger is armed, Engaging the starter should draw sufficient amperage to meet the trigger requirements to start drawing the rest of the screen. Continue cranking the engine for 3-5 seconds.

Stop Scope

Save capture

Apply Math channel to calculate voltage drop for whole starter circuit.

The mathematical equation to calculate voltage drop for the entire circuit in this setup is (A-B)+C=Total voltage drop.

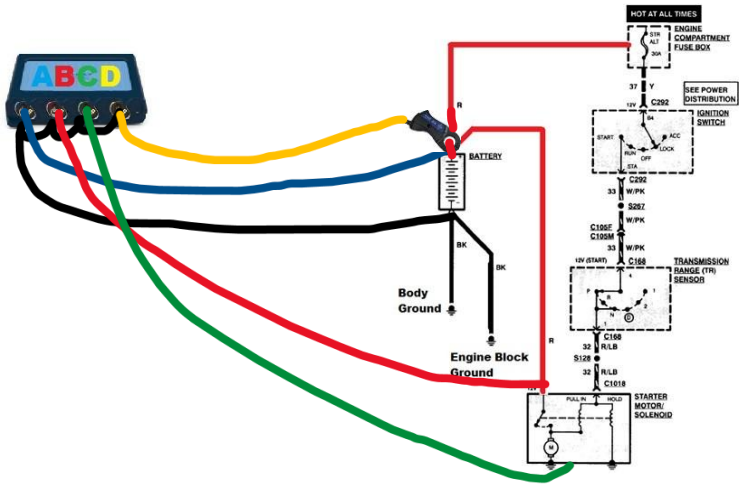
Typically in the automotive field a total voltage drop of less than 500mV while the engine is cranking is considered acceptable. You can apply a ruler to the Math Channel trace and set it to the 500mV level to help you determine if your capture is a pass or fail.

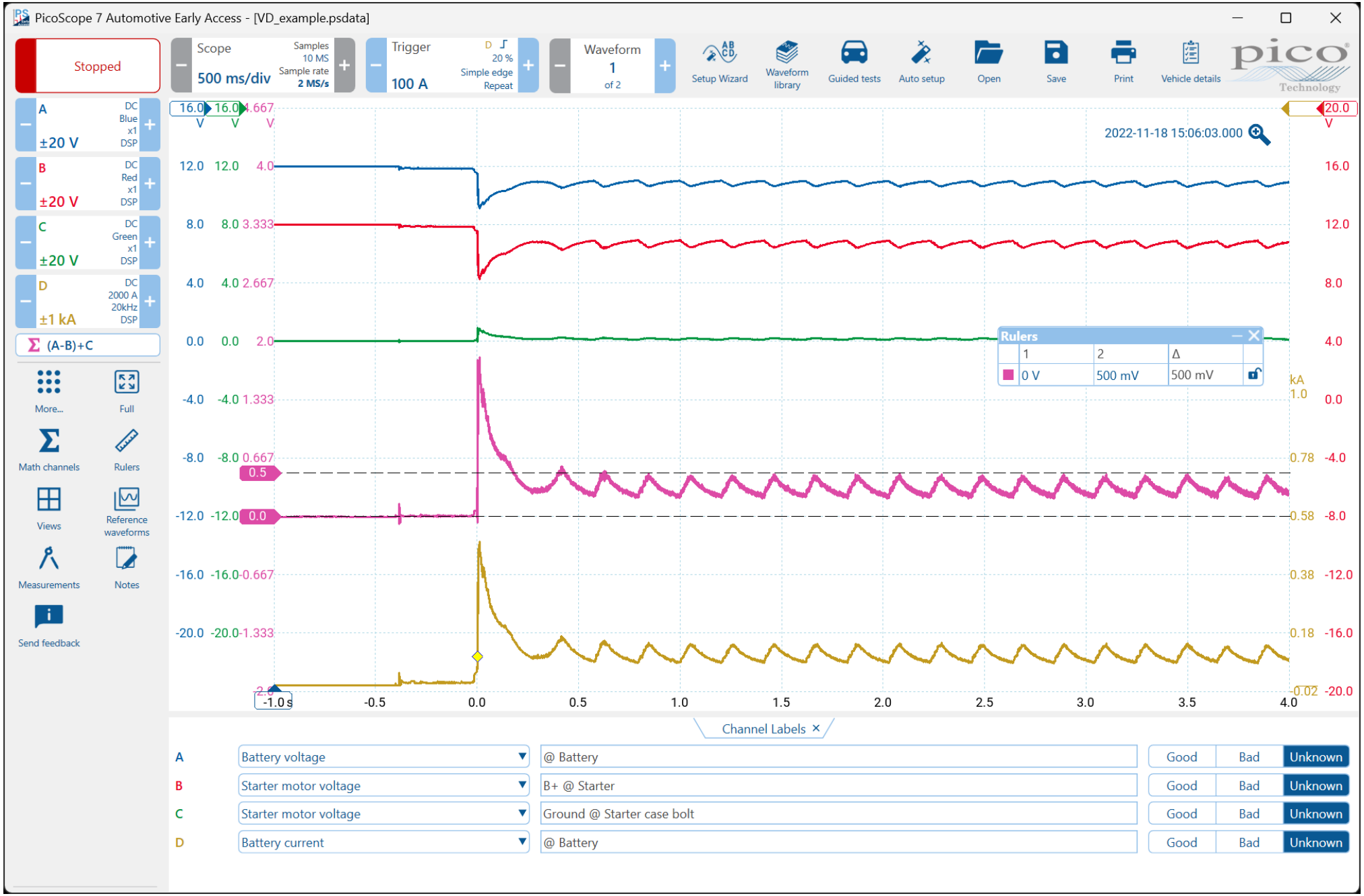
It is normal and expected to have higher voltage drop during the high amperage flow at starter in-rush.

See reverse side for an example of a known good waveform

Autonerdz

(A-B) + C = Total Voltage Drop
D = Battery Amperage




PicoScope 7 Automotive Early Access - [VD_example.psdata]
Stopped
Scope
500 ms/div
Samples
10 MS
Sample rate
2 MS/s
Trigger
100 A
20 %
Simple edge
Repeat
Waveform
1
of 2
Setup Wizard
Waveform library
Guided tests
Auto setup
Open
Save
Print
Vehicle details
pico Technology
A
DC
Blue
x1
DSP
±20 V
B
DC
Red
x1
DSP
±20 V
C
DC
Green
x1
DSP
±20 V
D
DC
2000 A
20kHz
DSP
±1 kA
(A-B)+C
More...
Full
Math channels
Rulers
Views
Reference waveforms
Measurements
Notes
Send feedback
2022-11-18 15:06:03.000
Rulers
1
2
Δ
0 V
500 mV
500 mV
Channel Labels
A
Battery voltage
@ Battery
B
Starter motor voltage
B+ @ Starter
C
Starter motor voltage
Ground @ Starter case bolt
D
Battery current
@ Battery
Good
Bad
Unknown