

Zappi 6mA DC protection to IEC 62955

Summary

The myenergi zappi contains built in protection to trip the output if a residual current of 6mA DC is detected. This protection is provided in accordance with IEC 62955:2018 which refers to a general class of protective device, the RDC-DD or “Residual Direct Current Detecting Device”

The standard requires that the operation of the protection be tested in the presence of

- a) The sudden appearance of direct current (clause 9.9.2.1)
- b) The steady increase of a smooth DC component (clause 9.9.2.2) (Ramped DC)

The requirements of the ramped DC test are ambiguous and this has led to a difference in the results obtained when testing an RDC-DD with test sets from different manufacturers. This has led to Metrel, one of the leading test equipment manufacturers, issuing a software update to ensure consistent test results¹.

Performance requirements

IEC 62955 specifies a number of key performance requirements:

- Rated DC Residual Operating Current ($I_{\Delta dc}$)
Defined in clause 5.3.2 as 6mA
- Rated DC Residual Non-Operating Current ($I_{\Delta ndc}$)
Defined in clause 5.3.3 as $0.5 I_{\Delta dc} = 3mA$
- Limiting values of break time at sudden appearance of direct current
Defined in clause 5.3.10.1 and table 2

Standard values of maximum break time at a residual direct current equal to		
s		
6 mA	60 mA	200 mA
10,0	0,3	0,1

In accordance with these requirements, zappi is designed to trip within 900ms once the measured value of residual DC current exceeds 5.5mA

¹ <https://www.testers.co.uk/blog/electrical/metrel-mi3152-multifunction-tester-ev-firmware-update/>

Zappi protection performance – steadily increasing DC component

Clause 9.9.2 states:

9.9.2 Verification of correct operation of RDC-DDs with smooth DC residual current

9.9.2.1 Verification of correct operation in case of a steady increase of smooth DC residual current

The test switches S1 and S2 and the RDC-DD being in the closed position, the residual current is steadily increased, starting from a value not higher than 2 mA, trying to attain the value of 6 mA within 30 s, the tripping current being measured each time. The test is repeated five times.

The auxiliary switch S3 shall be in position I for the first two measurements and in position II for the remaining measurements.

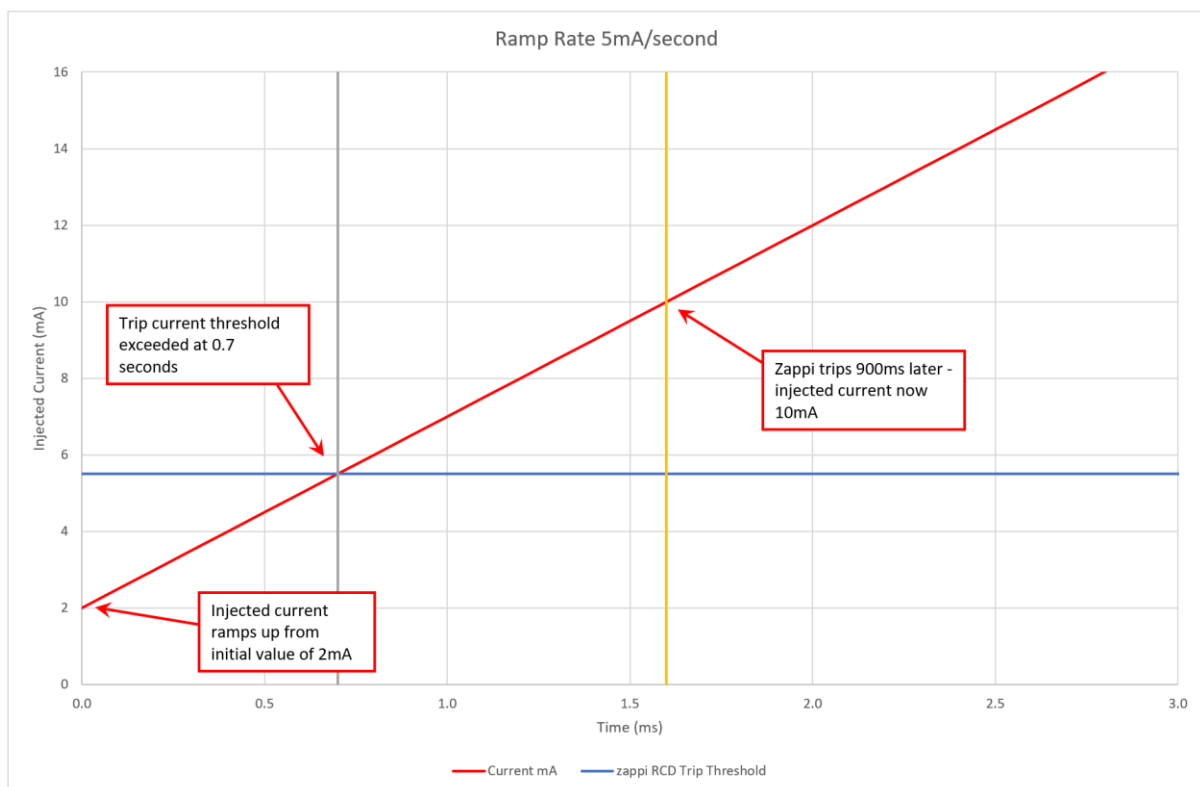
All five measured values shall be between 3 mA and 6 mA DC.

This clause is ambiguous and the measured values obtained will depend very heavily on the ramp rate selected by the test equipment manufacture.

Consider the case where the ramp rate is set to increase at 5mA / second and the protection operates at 5.5mA

Starting at 2mA, the DC current exceed the 5.5mA upper threshold after 700ms.

If the protection operates once the current exceed 5.5mA and trips within 1 seconds then the current at the moment the protection operates will be 10.5mA

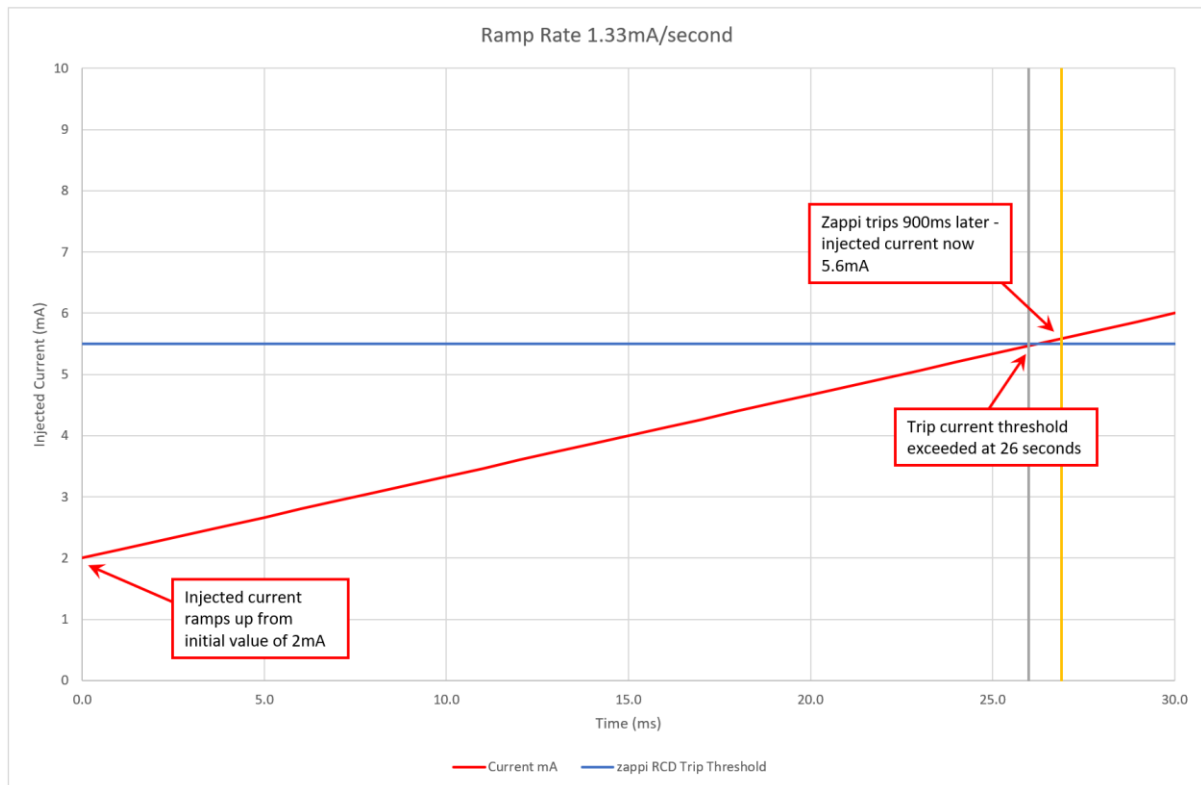


Clause 9.9.2.1 states that the “(residual current) trying to attain the value of 6mA with 30s. Starting at 2mA, a ramp rate of 0.133mA per second if required to obtain the 6mA value 30 seconds after starting the test.

Now consider the case that the test set ramps the DC current at a rate of 0.133mA per second.

For zappi, the trip threshold (5.5mA) is reached after 26.25 seconds.

Zappi trips one second later when the residual DC current will be 5.6mA which is within the 6mA limit specified for this test.



It is clear therefore that the test depends heavily on the ramp rate of the test set which, to avoid false failures, must be set to ramp at a rate of 0.133mA per second.

Dr Chris Horne CEng FIET
CEO myenergi Ltd

Zappi Test Results

Serial Number: CTB18085451

When tested with the Metrel MI 3152 all tests pass. The Metrel MI 3152 has had the software update that was issued specifically to deal with the IEC 62955 DC ramp rate test

Tests carried out with the Megger MFT1741+ fail as this tester does not respect the ramp rate restrictions for the DC ramp rate test

	Megger MFT1741+	Metrel MI 3152
AC - I▲N x0.5 - 0°	>1999ms	>300ms
AC - I▲N x0.5 - 180°	>1999ms	>300ms
AC - I▲N x1 - 0°	142ms	143.6ms
AC - I▲N x1 - 180°	151ms	139.7ms
AC - I▲N x5 - 0°	20.4ms	19.3ms
AC - I▲N x5 - 180°	18.9ms	19.3ms
DC RAMP - 0°	8.0mA	6.0mA
DC RAMP - 180°	8.1mA	6.0mA