

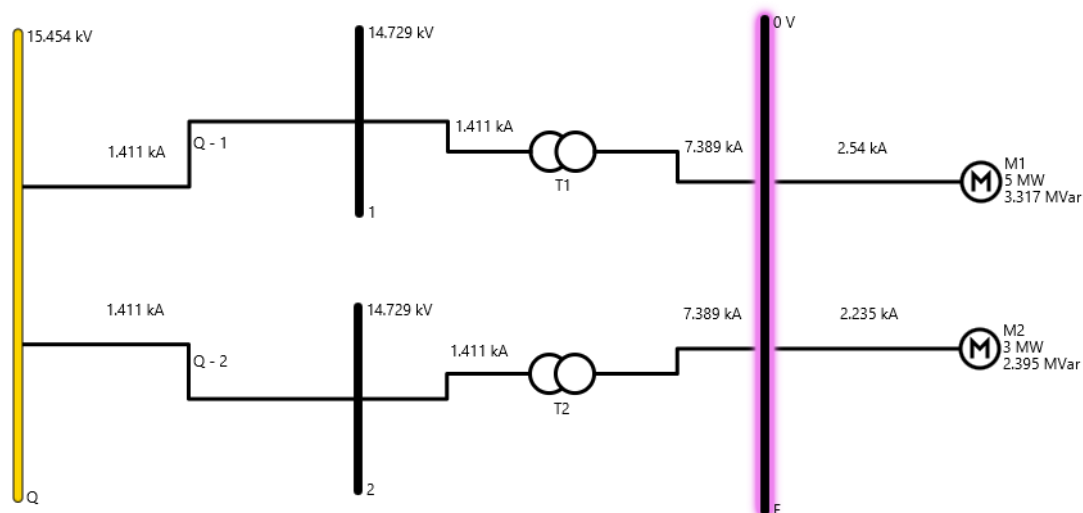
## EA-PSM Symmetrical Short Circuit verification validation case IEC Short Circuit Case 4 validation case

### Introduction

Verification validation cases are run before each EA-PSM version release. Calculation results are compared to Published Examples. EA-PSM short circuit conditions are calculated according to IEC 60909 standard. This is case example of IEC60909 part 4, example 4. EA-PSM software validation is performed using 3 phase symmetrical and unbalanced short circuit calculation results. The difference in the results is less than **0.18%** for all bus voltages and short circuit currents.

### System Description

A medium-voltage system 33/6 kV and  $f = 50$  Hz is given in Fig. 1. Short-circuit current  $I_k$  at short-circuit location F and currents from all sources shall be determined. Network contains cable lines, 33/6.3 kV transformers and asynchronous motors.



**Fig. 1.** Case 3 test network diagram

The elements impedances are described in Table 2.

**Table 1.** Element parameters

Title	Voltage level	Resistance	Reactance
System	33 kV	158.94 mΩ	1.5894 Ω
Cable lines Q-1 and Q-2	33 kV	485 mΩ	485 mΩ
Transformers T1 and T2	6.3 kV	15.222 mΩ	380.234 mΩ
Motor M1	6 kV	149.26 mΩ	1.4926 Ω
Motor M2	6 kV	169.65 mΩ	1.6965Ω

## Calculation Results

Symmetrical K3 short circuit calculations were performed at short-circuit location F. Voltage factor used in calculations  $c = 1.1$ . Fault branch current and current from all sources are depicted in Table 2.

**Table 2.** Fault branch current results comparison with reference

Location	EA-PSM	Reference	Difference
	I, kA	I, kA	$\Delta I$
From system	14.779	14.78	0.01%
From M1	2.54	2.542	0.08%
From M2	2.235	2.231	0.18%
At fault branch	19.554	19.55	0.02%

## References

International standard IEC 60909-4, *Short-circuit currents in three-phase A.C. systems*, ch. 4, 2000.