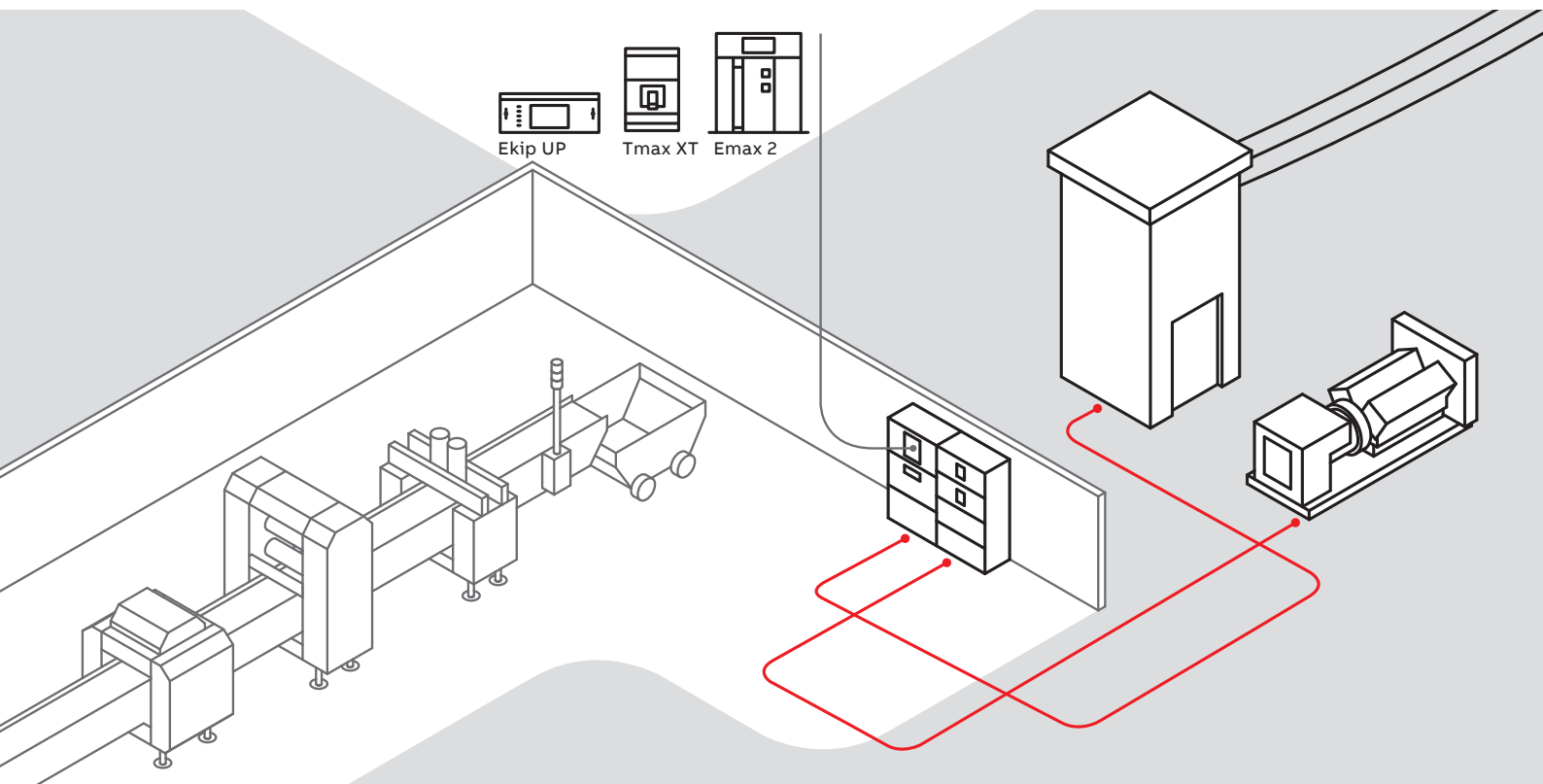


PERFORMANCE FOR SEGMENTS

Ekip G

Generator protection for low-voltage applications



An advanced trip unit to have powerful functionalities at hand.

For the first time a trip unit offers several functions dedicated to the protection of a generation set and its interconnection with the grid, in order to comply with international Standards as IEC 60034-1, IEEE C37.102 and IEEE 242.

Any time a low-voltage synchronous generator is involved (typically for applications of about 1 MVA: mini-hydro installation, medium size cogeneration, generation from biomasses, diesel generation), Ekip G provides a complete set of dedicated protection functions.

And, at the same time, when a source of distributed energy is connected to the grid, Ekip G provide a simple and effective set of anti-islanding functions (e.g. ROCOF - Rate of Change of Frequency).

Ekip G works acquiring signals from both the line and the load side while, currently, the most popular solution for generator protection needs the installation of external relays.

In addition to its standard distribution functions, Ekip G incorporates some dedicated functionalities into an embedded solution for all the range of Ekip devices. The advantage is to forget the need of extra equipment and related troubles.

Furthermore, it is possible to have two thresholds for every voltage and frequency protection in order to meet the widest range of interconnection requirements all over the world.

Applications

For a typical installation of 1MVA, the point of coupling with the national grid will be very likely in medium-voltage.

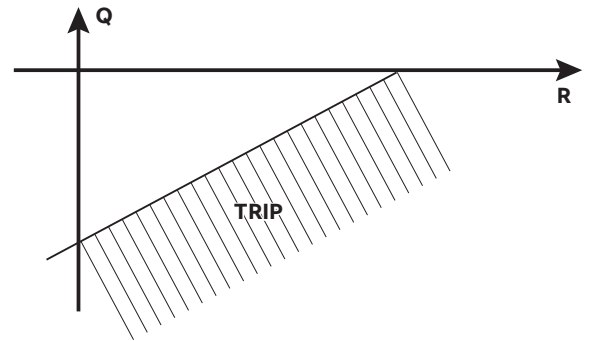
For this reason, we can consider a generic diagram with a medium-voltage network and a low-voltage generator with transformer. In a medium-voltage connection to the public utility network, the natural goal of an Ekip architecture with Ekip G protection is to protect the single low-voltage generator.

The protections most commonly used in the example are those defined by the following ANSI codes:

- 40 (loss of excitation)
- 27 (undervoltage)
- 59 (overvoltage)
- 50 (instantaneous overcurrent)

- 51 (time-delayed overcurrent)
- 81H (overfrequency)
- 81L (underfrequency)
- 49 (overload)
- 32R (reverse reactive power).

Power protection RQ - ANSI 40



Some of the existing off-the-shelf low-voltage breakers may offer up to eight out of these nine protection functions. But only Ekip G can offer an integrated protection against the loss of excitation.

The loss of excitation in a synchronous generator mainly arises from faults in the energizing unit or in the field circuit.

Consequently, the electromotive force in the generator is disabled and there is a reduction in the reactive power supplied.

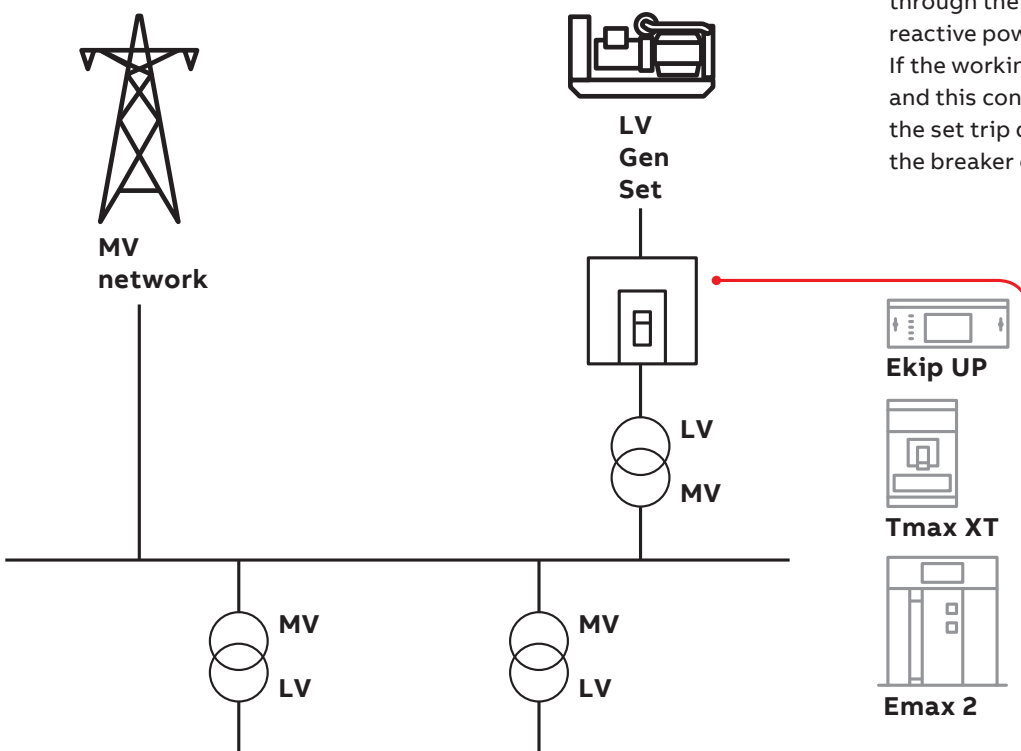
The machine then operates as an asynchronous generator, consuming reactive power from the network.

The new operating condition, with the circulation of reactive power supplied by the network, increases the temperature in the rotor circuit.

In addition to the phenomenon that involves the machine, the voltage is significantly reduced, with a consequent loss of the system stability.

The protection against this phenomenon works through the acquisition of the total active and reactive power values.

If the working point is below the set protection line and this condition persists for a time greater than the set trip delay time, the protection trips to open the breaker or generates an alarm signal.



Further application: interconnection with the grid
Islanding is the condition in which a distributed generator continues to supply location even though the electrical grid supply is no longer present.

Islanding can be dangerous, that's why distributed generators must be equipped with anti-islanding features.
Generally speaking, limits are set for voltage and frequency values.

Often, a more sensitive anti-islanding function is required as well: the Rate of Change of Frequency (ROCOF – ANSI code 81R).
This protection enables both positive and negative frequency changes to be detected rapidly and with greater sensitivity, thus ensuring a protection that is faster than what is possible with traditional minimum or maximum frequency functions.
Typical setting ranges between 0.2 Hz/s and 1 Hz/s, with some differences depending on different Countries practices.

Protection Available on EKIP G

Function	Description	ANSI	ABB
Synchrocheck	Control of adequate conditions for parallel connection	25	SC
Active overpower protection	Protection against active overpower supply	32OF	OP
Reactive overpower protection	Protection against reactive overpower supply	32OF	OQ
Reverse active power protection	Protection against active power absorption (reverse power)	32R	RP
Directional overcurrent protection	Protection against directional current	67	D
Active underpower protection	Protection against active underpower supply	32LF	UP
Loss of excitation or reverse reactive power protection	Protection against energizing anomalies, check of reactive power absorption	40/32R	RQ
Overload protection	Current protection against temperature rise	49	L
Instantaneous overcurrent protection	Instantaneous protection against phase overcurrents	50	I
Time-delayed overcurrent protection	Inverse/definite time protection against phase overcurrents	51 50TD	S
Earth fault protection	Inverse/definite and instantaneous time protection against earth overcurrents	51N 50NTD 50N; 51G 50GTD	G; Gext
Differential ground fault protection	Definite time protection against earth overcurrents in the generator windings	87N	Rc
Voltage controlled overcurrent protection	Protection against short circuit between phases with current threshold depending on voltage (controlled/restrained mode)	51V	S(V)
Residual overvoltage protection	Protection detecting loss of insulation in the machine	59N	RV
Undervoltage protection	Protection against voltage decrease	27	UV
Overvoltage protection	Protection against voltage increase	59	OV
Current unbalance protection	Protection against phase current unbalance	46	IU
Voltage unbalance protection	Protection against voltage unbalance and detection of rotation direction of phases	47	VU
Rate of change of frequency protection	Protection against rapid frequency variations	81R	ROCOF
Overfrequency protection	Protection against frequency increase	81H	OF
Underfrequency protection	Protection against frequency reduction	81L	UF

- 01 Tmax XT
- 02 Emax 2
- 03 Ekip UP



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