

TECHNICAL CATALOG

Ekip UP

The low voltage digital unit for next generation of plants



Ekip UP

Consultation guide



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Chapter 4



Commissioning and Connectivity Supervision, Energy Management and complete integration in the sys

and complete integration in the systems with the possibility of communicating with several protocols and with internet.





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EKIP UP THE LOW VOLTAGE DIGITAL UNIT FOR NEXT GENERATION OF PLANTS

MAIN CHARACTERISTICS

CHAPTER 1

Main characteristics

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Designed for the latest market trend

New electrical grid architectures and system device connectivity are changing the energy flows.

The power-distribution grid architecture is continuously evolving from the traditional architecture to the next level approach. The centralized grid with top-down energy flow has been changing towards the distributed multi-source configuration.

Power grids combines more and more the presence of big size powerhouses, spread-out high voltage transmission lines and bulk load centres together with a constellation of distributed areas of local production and consumption at the distribution layer. Sections of the electrical network have bidirectional energy flows thanks to low voltage generation resources installed in buildings, factories and communities.

Renewables penetration is promoted by technology cost and environmental pollution emissions reductions in comparison with fuel fossil sources. The **Microgrid** concept is the answer to this market trend. Distributed energy resources and loads mainly in low voltage network defined by specific boundaries that can work together in a controlled and coordinated way, either connected to weak/ strong main grid or in "islanded" mode depending on the scenario. Speeding up the innovation, microgrids simplify the higher power distribution complexity ensuring lower cost, optimizing the resources and the services.

Today more than 1,5GW of low-voltage microgrids are installed worldwide and these will increase to more than 6GW by 2020.



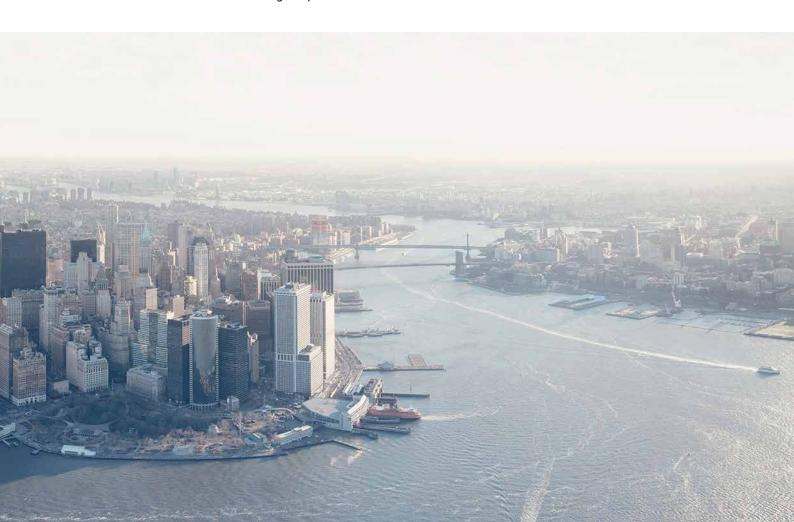
In order to get as much as possible the energy efficiency and self-consumption, in parallel of the new electrical layouts, communication networks and **Internet of Things** technology unlocks the power of data to make people understand energy consumption and allocate resources. Indeed, connectivity has become in the last ten years a must to have in energy distribution.

Up to 33 billion of internetconnected devices will be used by 2020, that means 4.3 for every person on the planet and this regards not only the consumer but also the business world.

The digital transformation is coming to power. What can not miss are, of course, the switching devices, like the circuit breakers or the switch disconnectors located at the different Microgrid electrical points, so that they naturally become the leaders for the grid speed evolution.

In the last ten years, more than 50M of Air Circuit Breakers and 300M of Molded Case Circuit Breakers have been installed worldwide from all the different brands, without advanced features for monitoring or resources optimization.

As almost more than 95% are conventional devices, there is a big potential for technology upgrade on existing facilities, avoiding big impact on investment like device replacement.



Leveraging our digital innovation

Ekip UP is the low-voltage digital unit able to monitor, protect and control the next generation of plants.

Thanks to the built-in software-based function, part of ABB Ability™ portfolio of connected and software enabled solutions, Ekip UP is the unit that digitalizes the plant performance. Sharing all the electronics solutions of "all-in-one" platform, Ekip UP completes the ecosystem to fit all the market opportunities.

The traditional approaches of customer towards the installed base is quite conservative. The cultural inertia for the innovation and the barrier of retrofitting hw/sw cost make them not to change the power distribution philosophy, loosing all the opportunity offered by advanced solutions. In case of switchgear with traditional breakers, still good for the mechanical performance but old for the electronics capabilities, trusting the customer to have the whole device replacement is more than complex. On the other side, there are many projects that need customization and engineering efforts, which are not usually addressed to switching devices but, generally, they are related to external devices. Ekip UP upgrades existing systems in digital plants.

As multifunctional unit, Ekip UP wants to cover the power distribution and automation applications according to monitor, protect, control and ease of use pillars and guaranteeing plug&play flexibility and modularity.

Monitor

- Measurement capability of main energy parameters
- Network analyzer to evaluate the power quality.
- Datalogger based on event triggers for fast fault diagnosis.
- Connectivity for system integration up to 8 field-bus protocols, plus a property bus for power automation applications that require advanced cyber-security.
- Embedded gateway that ensures power understanding by cloud-based energy management system.

Protect

- Distribution protection based on current and voltage measurement.
- Generator protection and interface protection systems.
- Adaptive threshold according to grid topology.
- Digital selectivity for resource coordination.
- Load shedding algorithms to prevent blackouts.
- Programmable logics to manage transfer-switching operations and maximize service continuity.
- Synchronization function of different power sources inside

Control

 Power management systems to optimize plant resources and enable Demand Response applications.

Having ease of use as the main philosophy to unlock all the technology values to the customer, the evolution of ABB external unit is so setting a new standard in their market, leveraging the value of digital innovations.



MAIN CHARACTERISTICS

Ekip UP makes every switchgear smart adding value for everyone.



UP-date basic switchgear

Ekip UP updates basic switchboard with new monitoring, protection and power control solutions.

- Compatible with all switching devices.
- 100% applicable for every low/voltage scenario.



UP-load your electrical system

Ekip UP uploads your system data to the cloud/connected ABB Ability platform.

- Enabling full microgrid control.
- In less than 10 minutes.



UP-grade your facilities

Ekip UP is the unit that upgrades the electronics of old facilities making them digital.

- 30% operational cost saving via the energy management system.
- Cost/effective solution compared with traditional retrofitting approach.



Maximize UP-time

Ekip UP maximizes uptime for system integration as a plug & play unit.with easy installation

- 50% time saving when retrofitting, with reduced impact on switchboard design.
- · Zero downtime during commissioning.

One unit, more markets

Ekip UP is ready for many applications to cover spread market opportunities worldwide.

Commercial buildings

Ekip UP monitors the energy consumption of existing hotels, shopping malls, campuses or office facilities that become immediate connected to the cloud.

Thanks to the remote energy management system and smart power management algorithm embedded in the digital unit, facility manages and end users can increase the energy efficiency of the electrical plant. Even in new infrastructures with e-mobility chargers, Ekip UP is the solution to understand current flows, enabling peak shaving and load shifting strategies.

Industrial plants

Ekip UP protects plant power systems and automation processes with the direct interface to every switching devices. The relay satisfies a complete list of distribution and generation ANSI protections as well as it embeds programmable logics.

For example, sending tripping commands to switch disconnectors is a typical case for oil & gas industries, where Ekip UP can also add granted transfer switching logics without needed of other products.

Having both DIN-rail and door-mounted options in the same unit, it fits the installation requirements of O&Ms and panel builders with a small space needed in the switchboard.









Marine

Ekip UP easily revamps the electronics of old breakers installed onboard ships, being a cost-effective solution in respect to traditional approaches.

The unit maximizes the continuous operation vessels using own plug-in sensors, so to save time for maintenance & operation technicians during the installation compared with other retrofitting solution.

The mechanical vibration performances of the unit match the marine application specifications. Besides, through adaptive protections and digital buses, the unit enables complete coordination of motors, generators and distribution bus-bars.

Microgrids

Ekip UP controls urban or remote communities, coordinating the different resources from loads to generators.

Thanks to the all-in-one software functions, Ekip UP maximizes the service continuity of critical power microgrids, like datacenters, hospitals or solar factories.

Leveraging on advanced connectivity capability, system integrators can easily introduce the digital unit is in plant networks.

Package selling upload-model guarantees modularity and flexibility in every microgrid project for design institutes.

Product overview

Ekip UP product family is CE marked and conform to the IEC 60255 standard - "Measuring relays and protection equipment standard".

IEC 60255 certification makes Ekip UP suitable globally as this standard is usually recalled by other local regulatory organization, for example IEEE. Ekip UP Protect+ and Control+ versions are in compliance with CEI 0-16 - "Reference technical rules for the connection of active and passive consumers to the HV and MV electrical networks of distribution company".

Ekip UP operates in low voltage grids according to the following ranges and characteristics:

Operating voltage, Ue [V]	Up to 1150
Operating current, In [A]	From 100 to 4000
Operating frequency [Hz]	50 - 60
Operating temperature [°C]	From -25 to +70
Protection degree	IP40

More technical and standard features are available in the dedicated manual, doc. 1SDH002003A1001.

Ekip UP unit is standard provided in the optimized bag-packaging with:

- ABB current sensors among three type options and cabling kit
- · installed rating plug
- · power supply cartridge module
- measurement module
- four I/O programmable contacts.
 Ekip UP is also able to be equipped with optional:
- · communication and gateway modules
- · synchrocheck cartridge module
- embedded or external signalling modules
- · software functions
- external differential or homopolar toroids.

If required, commercial voltage sensors can be applied into the specific sockets, where plastic-printed indications ensure right installation.

All the details of the accessories are described in cap. 5 and ordering instructions are listed in cap. 8.



MAIN CHARACTERISTICS

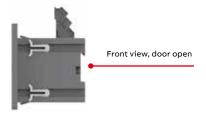
The same Ekip UP unit may be DIN-rail or door-mounted according to the specific requirement. Many clips fix the unit guaranteeing stability in every installation.

Rotating capability of digital contacts and two dedicated labels ensure easy of use in both the mounting options.

Serial Number information is available in the label applied on the unit side as well as in the touch-screen display. Indeed, all the configurations are possible from the display or using the commissioning software Ekip Connect.

1. Door mounted, door open





2. DIN mounted



CHAPTER 2

The ranges

12 -15	Ekip UP units
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Ekip UP units

The innovative Ekip UP digital units are the new benchmark for the protection, measurement and control for low voltage electrical systems.

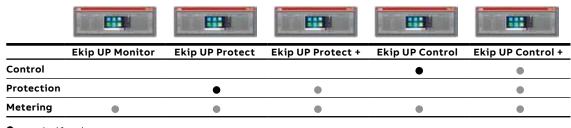
The result is a single unit suitable for all the different applications including every required functionalities without the need for other external devices

The ABB plug&play solution improves the plant efficiency, increases awareness of resources and process behaviors, and delivers an easier, more intuitive user experience.

As multifunctional unit, there are five different commercial versions that guarantees flexibility and modularity to match all market opportunities in measurement, protection and control applications.

- Ekip UP Monitor
- Ekip UP Protect
- Ekip UP Protect +
- Ekip UP Control
- Ekip UP Control +

Besides standard accessory supply, all the unit types can be equipped with connectivity and signalling modules. Besides, advanced software functions can be uploaded into Ekip UP Protect, Protect+ and Control+. These same versions are ready for external toroids that enable more earth fault protections.



⁼ standard functions

⁼ advanced functions

MONITOR

Ekip UP Monitor is more than a measurement unit:

- Power quality Network Analyzer according to IEC61000-4-30 (up to 50th harmonics)
- Fault analysis Datalogger based on events withtwo independent memory buffers
- Maximum, minimum and average value registers.

Ekip UP Accuracy						
Measure	Ekip UP unit	→ with Sensors *				
Current	0.50%	1.00%				
Voltage	0.50%	0.70%				
Power	1.00%	2.00%				

^{*} With Type C current sensors based on installation conditions mentioned in dedicated manual, doc 1SDH002003A1001 and in case of VT (voltage transformer) used cl. 0,2 or below.

Advanced communication capabilities are unlocked by 8 fieldbus protocol + 1 property bus to get it easily integrated in systems. Thanks to cartridge modules and four available slots, it is very simple to share its up to 3000 data with supervision systems, guaranteeing modularity for each application.

Using an optional gateway module, it can be connected also to the cloud-platform ABB Ability™ Electrical Distribution Control System thanks to a simple architecture able to connect most of the ABB low voltage devices to the cloud.

This follows the technology focus for big data in the commercial and industrial market segments. Ekip UP Monitor is the perfect solution for comprehensive plant energy metering, full connectivity for integration in every supervision system, power grid hub for energy management platform to make every switchgear smart.



Ekip UP units

PROTECT

Ekip UP Protect and Protect+ add the protection functions besides the monitoring and connectivity ones.

Ekip UP Protect enables protection based on current, voltage, frequency and power as a basic protective relay for power feeders. Ekip UP Protect+ has, instead, also generator protections, adaptive and overcurrent directional ones for power distribution grids. Using Ekip Protect+ is possible to get digital selectivity with proprietary bus, plus distinguish restricted/unrestricted earth fault. Ekip UP Protect and Ekip UP Protect+ can be equipped with the software kits from "all-in-one" platform, like ATS (automatic transfer switch),

load shedding innovations, synchro reclosing capability, interface certified protections. Those advanced features can ensure service continuity and energy efficiency in the plants, reducing the complexity of different device installation.

Typical application of Ekip UP Protect and Ekip UP Protect+ are:

- Adding protection functionalities to switch-disconnectors, guaranteeing short-circuit breaking capacity as their short time withstand current.
- Leveraging on more ANSI protections and other innovations for installed circuit breaker with simple trip unit, like thermo-magnetic, with the possibility to maintain current short-circuit values.
 Ekip UP can be also the best solution when trip unit spare parts are anymore available or as relay backup.



CONTROL

Ekip UP Control add to Ekip UP Monitor version the power management algorithm. This demand management function cuts power billing for end-users meanwhile it makes the plants ready for demand response programs.

Demand response is a new business that from US is going to be global. It consists of remote power management: utilities or load aggregators change the power consumption or generation on the plant sites sending specific signals, according on grid services required, weather forecasts or pricing strategies.

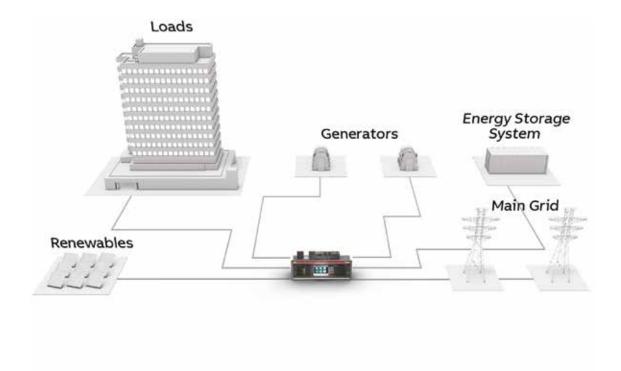
Using embedded dedicated protocols, like openADR, Ekip UP is able to set the power locally the load power absorption at the threshold fixed remotely in a single smart unit.

Besides, Ekip UP Control enables electricity bill reduction thanks to peak shaving and load shifting strategies.

This capability is also integrated in ABB Ability™ Electrical Distribution Control System,so that it can be managed directly for the webapp everywhere directly from tablet or smartphone.

Ekip UP Control+ is the top version of the Ekip UP family. It completes the Ekip Protect+ with control features, making it really a Microgrid controller. Ekip UP Control+ is ready for "all-in-one" software platform so to achieve every target in power distribution and automation.

Ekip UP Control and Ekip UP Control+ answer the requests of energy efficiency, understanding power and acting to enhance plant productivity with optimization logics.



Technical characteristics for measurement functions

Instantaneous measurements		Parameters	Precision with sensors (1)
Currents (RMS)	[A]	L1, L2, L3, Ne	1%
Earth fault current (RMS)	[A]	Ig	2%
Phase-phase voltage (RMS)	[V]	U12, U23, U31	0,7%
Phase-neutral voltage (RMS)	[V]	U1, U2, U3	0,7%
Phase sequence			
Frequency	[Hz]	f	0,2%
Active power	[kW]	P1, P2, P3, Ptot	2%
Reactive power	[kVAR]	Q1, Q2, Q3, Qtot	2%
Apparent power	[KVA]	S1, S2, S3, Stot	2%
Power factor		Total	2%
Peak factor		L1, L2, L3, Ne	

Counters recorded from installation or from the last reset		Parameters	Precision
Active energy	[kWh]	Ep total, Ep positive, Ep negative	2%
Reactive energy	[kVARh]	Eq total, Ep positive, Ep negative	2%
Apparent energy	[KVAh]	Es total	2%

Network Analyzer		Parameters	Intervals
Hourly average voltage value		Umin= 0.750.95 x Un Umax= 1.051.25 x Un Events counter (nr. of events day by day in the last year plus the total events in the breaker's lifetime)	t = 5120min
Short voltage interruptions	[no]	Umin= 0.750.95 x Un Events counter (nr. of events day by day in the last year plus the total events in the breaker's lifetime)	t <40ms
Short voltage spikes	[no]	Umax= 1,051,25 x Un Events counter (nr. of events day by day in the last year plus the total events in the breaker's lifetime)	t <40ms
Slow voltage sags and swells	[no]	Umin1= 0.750.95 x Un Umin2= 0.750.95 x Un Umin3= 0.750.95 x Un Umax1= 1.051.25 x Un Umax2= 1.051.25 x Un Events counter (nr. of events day by day in the last year plus the total events in the breaker's lifetime)	t = 0.02s60s
Voltage unbalance		U neg. seq.= 0.020.10 x Un Events counter (nr. of events day by day in the last year plus the total events in the breaker's lifetime)	t = 5120min
Harmonic analysis		Current and Voltage up to 50° Alarm THD: 520% Single harmonic alarm: 310% plus a count of minutes the harmonic has been exceeded	

⁽¹⁾ With Type C current sensors based on installation conditions mentioned in dedicated manual, doc 1SDH002003A1001 and in case of VT used cl. 0.2 or below.

Record of values: of the parameter for each interval with time-stamping	Parameters	Window	Intervals			
Current: minimum and maximum	[A]	Min, I Max	Fixed	Duration:		
Phase-phase voltage: minimum and maximum	U Min, U max synchronizable 5120 by remote Number					
Reactive power: average and maximum	[kVAR]	Q Mean, Q Max		intervals: 24		
Apparent power: average and maximum	S Mean, S Max	_				
Data logger: record of high sampling rate parameters		Parameters				
Currents	[A]	L1, L2, L3, Ne, Ig				
Voltages	[V]	U12, U23, U31				
Active power: average and maximum	[kW]	P Mean, P Max				
Sampling rate	[Hz]	1200-2400-4800-9600				
Maximum recording duration	[s]	16				
Recording stop delay	[s]	0-10s				
Number of registers	[no]	2 independent				
Information on trip and opening data:		Parameters				
Type of protection tripped ¹⁾		eg. L, S, I, G, UV, OV				
	I] eg. II, I2, I3, neutral for S protection V12, V23, V32 for UV protection					
Time-stamping		Date, time and progressive number				
Maintenance indicators		Parameters				
Information on last 30 trips 1)		Type of protection, fault values a	and time stamping			
Information on last 200 events			and time-stamping			
	[n.a]	Type of event, time-stamping				
	[no]	Can be associated to alarm				
Number of mechanical operations	[nc]					
Total number of trips 1)	[no]					
Total number of trips ¹⁾ Total operating time	[no] [h]	Lock				
Total number of trips ¹⁾ Total operating time Date of maintenance operations performed	[h]	Last				
Total number of trips ¹⁾ Total operating time	[h]	Last Type of unit, assigned device na	ıme, serial number			
Total number of trips ¹⁾ Total operating time Date of maintenance operations performed Indication of maintenance operation needed	[h]		ıme, serial number			
Total number of trips ¹⁾ Total operating time Date of maintenance operations performed Indication of maintenance operation needed Unit I.D.	[h]		ıme, serial number			
Total number of trips ¹⁾ Total operating time Date of maintenance operations performed Indication of maintenance operation needed	[h]	Type of unit, assigned device na	nme, serial number Note: Opening of device can be so			
Total number of trips ¹⁾ Total operating time Date of maintenance operations performed Indication of maintenance operation needed Unit I.D. Self-diagnosis	[h]	Type of unit, assigned device na Parameters Alarm due to disconnection:	Note: Opening o			

Technical characteristics for protection functions

ABB Code	ANSI Code	Function	Threshold	Threshold step	Tripping time
L	49	Overload Protection	I1 = 0,41 x In	0,001 x ln	with I = 3 I1, t1 = 3144 s
		Thermal Memory			
		Tolerance	Trip between 1,05 and 1,2 x I1		± 10% l ≤ 6 x ln ± 20% l > 6 x ln
	49	Overload Protection	I1 = 0,41 x In	0,001 x In	with I = 3 I1, t1 = 3144 s Standard inverse SI: k=0,14 • α =0,02 Very Inverse VI: k=13,5 α =1 Extremely Inverse EI: k=80 α =2 t=k/I4: k=80 α =4
		Tolerance	Trip between 1,05 e 1,2 x I1		± 10% l ≤ 6 x ln ± 20% l > 6 x ln
S	50TD	Time-delayed overcurrent protection	I2 = 0,610 x In	0,1 x ln	with I > 12, t2 = 0,050,8s
	68	Zone selectivity			t2sel = 0,040,2s
		Start up	Activation: 0,610 x In	0,1 x ln	Range: 0,130s
		Tolerance	± 7% l ≤ 6 x ln ± 10% l > 6 x ln		The better of the two data: $\pm 10\%$ o ± 40 ms
	51	Time-delayed overcurrent protection	I2 = 0,610 x In	0,1 x ln	with I = 10 In, t2 = 0,050,8s
		Thermal Memory			
		Tolerance	± 7% I ≤ 6 x In ± 10% I > 6 x In		± 15% l ≤ 6 x ln ± 20% l > 6 x ln
I	50	Istantaneous overcurrent protection	I3= 1,515 x In	0,1 x ln	with I> I3 Instantaneous
		Start up	Activation: 1,515 x In	0,1 x ln	Range: 0,130s
		Tolerance	± 10%		≤ 30 ms
G	50N TD	Earth fault protection	I4 ⁽¹⁾ = 0,11 x In	0,001 x In	with I > I4 t4 = Istantaneous (with vaux) + 0,11s
	68	Zone selectivity			t4sel = 0,040,2s
		Start up	Activation: 0,21 x In	0,02 x In	range: 0,130s
		Tolerance	± 7%		The better of the two data: \pm 10% o \pm 40 ms or 50 ms with t4=Istantaneous
	51N	Earth fault protection	I4 ⁽¹⁾ = 0,11 x In	0,001 x ln	with I = 4 In, t4 = 0,11s
		Tolerance	± 7%		± 15%
IU	46	Current unbalance protection	16= 290% In unbalance	1%In	with unbalance > 16 t6 = 0,560s
		Tolerance	± 10%		The better of the two data: $\pm 10\%$ o ± 40 ms (for $t < 5$ s) $/ \pm 100$ ms (for $t \ge 5$ s)
21	50	Programmable Istantaneous overcurrent protection	I31= 1,515 xIn	0,1 x In	with I> I31, Instantaneous
		Tolerance	± 10%		≤ 30 ms
MCR		Closing on short-circuit protection	I3= 1,515 x In	0,1 x In	with I> I3 Instantaneous Monitor time Range: 40500ms
		Tolerance	± 10%		≤ 30 ms

Time Step	Excludibility	Excludibility trip	Blocks	Pre-allarm	Trip curve	Monitor	Protect	Protect+ (Control	Control+
1s	yes	no	no	5090% I1 step 1%	t = k / I ²		•	•		•
	yes						•	•		•
1s	yes	no	no	5090% I1 step 1%	$t = \frac{kxt1}{\left(\frac{ f }{ 1 }\right)^{\alpha}-1}$	-	•	•		•
0,01s	yes	yes	yes	no	t = k		•	•		•
0,01s	yes	,					•	•		•
0,01s	yes						•	•		•
0,01s	yes	yes	yes	no	t = k / I ²		•	•		•
,	yes						•	•		•
	•			,						
-	yes	no	yes	no	t = k		•	•		•
0,01s	yes						•	•		•
0,05s	yes	yes	yes	5090% I4 step 1%	t = k		•	•		•
0,01s	yes						•	•		•
0,01s	yes						•	•		•
0,05s	yes	yes		5090% I4 step 1%	t = k / I ²		•	•		•
0,5s	yes	yes	no	no	t = k		•	•		•
	yes	no	no		t = k		•	•		•
	· 									
0,01s	yes	no	yes	no	t = k		•	•		•

Technical characteristics for protection functions

ABB Code	ANSI Code	Function	Threshold	Threshold step	Tripping time
Gext	50G TD	Earth fault protection	I41 ⁽¹⁾ = 0,11 x In Toroid	0,001 x In Toroid	with > 41, t41 = 0,11s
	68	Zone selectivity			t41sel = 0,040,2s
		Start up	Activation: 0,11 x In	0,02 x In	range: 0,130s
		Tolerance	± 7%		The better of the two data: ± 10% o ± 40 ms
	51G	Earth fault protection	I41 ⁽¹⁾ = 0,11 x In	0,001 x In	with I = 4 In, t41 = 0,11s
		Tolerance	± 7%		± 15%
Rc	64 50N TD 87N	Residual current protection Differential ground fault protection	IΔn= 3 - 5 - 7 - 10 - 20 - 30A		with I > IΔn tΔn = 0,06 - 0,1 - 0,2 - 0,3 - 0,4 - 0,5 - 0,8s
		Tolerance	- 20% ÷ 0%		140ms@0.06s (maximum trip time) 950ms@0.80s (maximum trip time)
LC1/2 lw1/2		Current threshold LC	LC1=50%100% I1 LC2=50%100% I1	1% 1%	
		Current threshold Iw	Iw1= 0,110 In Activation Iw1: Up/Down Iw2= 0,110 In Activation Iw2: Up/Down	0,01 x ln 0,01 x ln	
		Tolerance	± 10%		
UV	27	Undervoltage Protection	U8= 0,50,98 x Un	0,001 x Un	with U < U8, t8 = 0,05120s
		Tolerance	± 2%		The better of the two data: $\pm 10\%$ o ± 40 ms (for t < 5 s) $/ \pm 100$ ms (for t ≥ 5 s)
OV	59	Overvoltage protection	U9= 1,021,5 x Un	0,001 x Un	with U > U9 t9 = 0,05120s
		Tolerance	± 2%		The better of the two data: $\pm 10\%$ o ± 40 ms (for t < 5 s) $/ \pm 100$ ms (for t ≥ 5 s)
VU	47	Voltage unbalance protection	U14= 290% Un unbalance	1%Un	with unbalance > U14, t14 = 0,560s
		Tolerance	± 5%		The better of the two data: $\pm 10\%$ o ± 40 ms (for t < 5 s) $/ \pm 100$ ms (for t ≥ 5 s)
UF	81L	Underfrequency protection	f12= 0,90,999 x fn	0,001 x fn	with f < f12 t12 = 0,15300s
		Tolerance	± 1% (with fn ± 2%)		The better of the two data: \pm 10 % (min=30ms) o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
OF	81H	Overfrequency protection	f13= 1,0011,1 x fn	0,001 x fn	with f > f13, t18 = 0.15300s
		Tolerance	± 1% (with fn ± 2%)		The better of the two data: $\pm 10\%$ o ± 40 ms (for $t < 5$ s) $/ \pm 100$ ms (for $t \ge 5$ s)
RP	32R	Reverse active power protection	P11= -10,05 Sn	0,001 Sn	P > P11, t11 = 0,5100s
		Tolerance	± 10%		The better of the two data: $\pm 10\%$ o ± 40 ms (for t < 5 s) $/ \pm 100$ ms (for t ≥ 5 s)
Cyclical direction	47	Cyclical direction of the phases	1-2-3 o 3-2-1		
Power factor	78	3phase Power factor	PF3= 0,50,95	0,01	
S2	50TD	Time-delayed overcurrent protection	I5 = 0,610 x In	0,1 x ln	with I > I5, t5 = 0,050,8s
	68	Zone selectivity			t5sel = 0,040,2s
		Start up	Activation: 0,610 x In	0,1 x ln	Range: 0,130s
		Tolerance	± 7% l ≤ 6 x ln ± 10% l > 6 x ln		The better of the two data: $\pm 10\%$ o ± 40 ms

Time Step	Excludibility	Excludibility trip	Blocks	Pre-allarm	Trip curve	Monitor Protect	Protect+ Control	Control
0,05s	yes	yes	yes	5090% I41 step 1%	t = k		•	•
0,01s								
0,01s	yes	,					•	•
0,05s	yes	yes	yes	5090% I41 step 1%	t = k / I ²		•	•
	Attivabile with rating plug Rc	no		no	t = k	•	•	•
	yes	only signalling	no	no	-	•	•	•
,								
	yes	only signalling	no	no	-	•	•	•
0,01s	yes	yes	yes	no	t = k	•	•	•
 0,01s	yes	yes	yes	no	t = k	•	•	•
0,5s	yes	yes	yes	no	t = k	•	•	•
0,01s	yes	yes	yes	no	t = k	•	•	•
 0,01s	yes	yes	yes	no	t = k	•	•	•
0,1s	yes	yes	yes	no	t = k	•	•	•
	yes	only signalling	no	no	-	•	•	•
	yes	only signalling	no	no	-	•	•	•
0,01s	yes	yes	yes	no	t = k		•	•
0,01s	yes						•	•
0,01s	yes						•	•

Technical characteristics for protection functions

ABB Code	ANSI Code	Function	Threshold	Threshold step	Tripping time
D	67	Directional overcurrent protection (Forward & backward)	I7 = 0,610 x In	0,1 x ln	with I > I7, t7 = 0,10,8s
	68	Zone selectivity			t7sel = 0,10,8s
		Start up (Forward & backward)	Activation: 0,610 x In	0,1 x ln	range: 0,130s
		Trip direction	Forward or/& backward		
		Minimun angle direction	3.6, 7.2, 10.8, 14.5, 18.2, 22, 25.9, 30, 34.2, 38.7, 43.4, 48.6, 54.3, 61, 69.6 (°)		
		Tolerance	± 7% l ≤ 6 x ln ± 10% l > 6 x ln		The better of the two data: $\pm10\%$ o ±40 ms
UV2	27	Undervoltage Protection	U15= 0,50,98 x Un	0,001 x Un	with U < U15, t15 = 0,05120s
		Tolerance	± 2%		The better of the two data: \pm 10 % o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
OV2	59	Overvoltage protection	U16= 1,021,5 x Un	0,001 x Un	with U > U16, t16 = 0,05120s
		Tolerance	± 2%		The better of the two data: \pm 10 % o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
UF2	81L	Underfrequency protection	f17= 0,90,999 x fn	0,001 x fn	with f < f17, t17 = 0,15300s
		Tolerance	± 1% (with fn ± 2%)		The better of the two data: \pm 10 % (min=30ms) o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
OF2	81H	Overfrequency protection	f18= 1,0011,1 x fn	0,001 x fn	with f > f18, t18 = 0.15300s
		Tolerance	± 1% (with fn ± 2%)		The better of the two data: \pm 10 % o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
S(V)	51V	Voltage controlled overcurrent protection	I20 = 0,610 x In	0,1 x ln	with I > I20, t20 = 0,0530s
		Step Mode	Ul= 0,21 x Un	0,01 x Un	
			Ks= 0,11	0,01	
		Linear Mode	Ul= 0,21 x Un	0,01 x Un	
			Uh= 0,21 x Un	0,01 x Un	
			Ks= 0,11	0,01	
		Tolerance	± 10%		The better of the two data: \pm 10 % o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
RV	59N	Residual overvoltage protection	U22= 0,050,5 x Un	0,001 x Un	with U > U22, t22 = 0,05120s
		Tolerance	± 5%		The better of the two data: \pm 10 % o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
OP	320F	Active overpower protection	P26= 0,42 Sn	0,001 Sn	P > P26, t26 = 0,5100s
		Tolerance	± 10%		The better of the two data: \pm 10 % o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
OQ	32OF	Reactive overpower protection	Q27= 0,42 Sn	0,001 Sn	Q > Q27, t27 = 0,5100s
		Tolerance	± 10%		The better of the two data: \pm 10 % o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
UP	32LF	Active underpower protection	P23 = 0,11 x Sn	0,001 x Sn	with P < P23 t23 = 0,5100s
		Start up			range: 0,130s
		Tolerance	± 10%		The better of the two data: \pm 10 % o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)

Time Step	Excludibility	Excludibility trip	Blocks	Pre-allarm	Trip curve	Monitor Protect	Protect+ Control	Control
0,01s	yes	yes	yes	no	t = k		•	•
0,01s	yes		yes				•	•
0,01s	yes						•	•
							•	•
							•	•
0,01s	yes	yes	yes	no	t = k		•	•
0,01s	yes	yes	yes	no	t = k		•	•
0,01s	yes	yes	yes	no	t = k		•	•
0,01s	yes	yes	yes	no	t = k		•	•
0,01s	yes	yes	yes	no	t = k		•	•
							•	•
							•	•
0,01s	yes	yes	yes	no	t = k		•	•
				,				
 0,5s	yes	yes	yes	no	t = k		•	•
0,5s	yes	yes	yes	no	t = k		•	•
0,5s	yes	yes	yes	no	t = k		•	•
	· 	усэ	yes		K			
0,01s	yes							

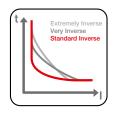
Technical characteristics for protection functions

ABB Code	ANSI Code	Function	Threshold	Threshold step	Tripping time
RQ	40/32R	Loss of field or reverse	Q24= -10,1 Sn	0,001 Sn	Q > Q24, t24 = 0,5100s
		reactive power protection	Kq= -22	0,01	
		Loss of field or reverse	Q25= -10,1 Sn	0,001 Sn	Q > Q25
		reactive power protection	Kq2= -22	0,01	
		Voltage minimum threshold	Vmin= 0.51,2	0,01	
		Tolerance	± 10%		The better of the two data: \pm 10 % o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
		Secondary voltage	100120	100, 110, 115, 120	
		Tolerance	± 10%		
RQ	40/32R	Loss of field or reverse reactive power protection	Q24= -10,1 Sn	0,001 Sn	Q > Q24 t24 = 0,5100s
			Kq= -22	0,01	
		Loss of field or reverse	Q25= -10,1 Sn	0,001 Sn	Q > Q25
		reactive power protection	Kq2= -22	0,01	
		Voltage minimum threshold	Vmin= 0.51,2	0,01	
		Tolerance	± 10%		The better of the two data: \pm 10 % o \pm 40 ms (for t < 5 s) / \pm 100 ms (for t \geq 5 s)
S2(V)	51V	Voltage controlled overcurrent protection	I21 = 0,610 x In	0,1 x ln	with I > I21 t21 = 0,0530s
		Step Mode	Ul2= 0,21 x Un	0,01 x Un	
			Ks2= 0,11	0,01	
		Linear Mode	Ul2= 0,21 x Un	0,01 x Un	
			Uh2= 0,21 x Un	0,01 x Un	
			Ks2= 0,11	0,01	
		Tolerance	± 10%		The better of the two data: $\pm 10\% \text{ o} \pm 40 \text{ ms (for t} < 5 \text{ s)} / \pm 100 \text{ ms (for t} \ge 5 \text{ s)}$
ROCOF	81R	Rate of change of frequency protection	f28= 0,410 Hz/s	0,2 Hz/s	with f > f28, t28 = 0,510s
		Trip direction	Up or down up&down		
		Tolerance	± 5%		The better of the two data: ± 20% o ± 200 ms
Synchro- check SC		5 Synchrocheck (Live busbars)	Ulive=0,51,1 Un ΔU=0,020,12 Un	0,001 Un 0,001 Un	Stability voltage time for live state = 10030000s
			Δf= 0,11Hz Δφ= 550° elt	0,1Hz 5° elt	minimum matching Time= 1003000s
		Tolerance	± 10%		
		Synchrocheck (Live,Dead busbars)	Ulive=0,51,1 Un Udead=0,020,2 Un	0,001 Un 0,001 Un	tref= 0,130s
		Frequency check off			
		Fase check off			
		Dead bar configuration	Reversed/standard		
		Primary voltage	1001150	100, 115, 120, 190, 208, 220, 230, 240, 277, 347, 380, 400, 415,440, 480, 500, 550, 600, 660, 690, 910, 950, 1000, 1150	
		Secondary voltage	100120	100, 110, 115, 120	
		Tolerance	± 10%	<u> </u>	

Time Step	Excludibility	Excludibility trip	Blocks	Pre-allarm	Trip curve	Monitor Protect	Protect+ Control	
0,1s	yes	yes	yes	no	t = k		•	•
0,5s	yes	yes		no	t = k		•	•
0,33	yes	yes		110	τ - κ			
	yes							
0,1s	yes	yes	yes	no	t = k		•	•
0,5s	yes	yes		no	t = k		•	•
	yes							
0,01s	yes	yes	yes	no	t = k		•	•
							•	•
							•	•
0,01s	yes	yes	yes	no	t = k		•	•
 								-
1s	yes	only signalling	no	no	-		∞	00
10								
-								
0.1-								
0,1s	yes	only signalling		no	-			
	yes		<u> </u>					
	yes							
	yes							

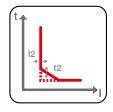
Description of protection functions

Ekip UP offers current, voltage and power based protection functions to be set with a few simple steps directly from the wide touchscreen display or using Ekip Connect commissioning software. Here there is the description of all ANSI protections listed. All the protections can be excluded. Information on trip and opening data as well as maintenance indicators are available in Ekip UP memory.

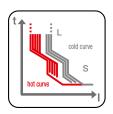


Overload (L - ANSI 49): available with three different types of trip curve:

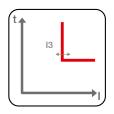
- 1. $t = k/l^2$ with inverse long time;
- 2. IDMT in accordance with 60255-151 for coordination with medium voltage protection, which are available according to the Standard Inverse (SI), Very Inverse (VI) and Extremely Inverse (EI) curves;
- 3. with $t = k/l^4$ curve for better coordination with upstream switching devices or with fuses. The thresholds can be fine tuned and the timings to the second can be set directly from the display. The settable pre-alarm indicates the set threshold is reached before the protection is tripped.



Time-delayed overcurrent (S - ANSI 51 & 50TD): with constant tripping time (t = k), or with constant specific let-through energy (t = k/l_2), this provides 15 current thresholds and 8 curves, for fine adjustment.



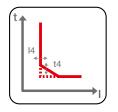
Thermal memory: for protections L and S it is used to protect the components, such as transformers, against overheating following overloads. The protection adjusts the trip time of the protection according to how much time has elapsed after the first overload, taking account of the overheating caused.



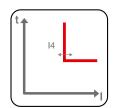
Instantaneous overcurrent (I - ANSI 50): with trip curve without intentional delay, it offers 15 tripping thresholds.

Closing on short-circuit (MCR): the protection uses the same algorithm as the protection I, limiting operation to a settable time window from the closing of the switching device. The protection can be disabled, also alternatively to protection I.

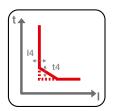
The function is active with an auxiliary supply.



Earth fault (G - ANSI 51N & 50NTD): with trip time independent of the current (t = k) or with constant specific let-through energy ($t = k/l^2$). A pre-alarm indication is also available when 90% of the threshold is reached to activate corrective measures before the protection is tripped. The function also enables the trip to be excluded so that only the alarm is indicated, for use in installations where continuity of service is an essential requirement.



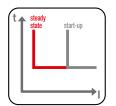
Instantaneous Earth Fault (G-ANSI 50N): with trip curve without instantaneous delay.



Earth fault on toroid (G ext - ANSI 51G & 50GTD): with trip time independent of the current (t = k) or with constant specific let-through energy (t = k/l^2). Pre-alarm that 90% threshold has been reached permits the fault to be reported to supervision systems without interruption of continuity. The protection uses the external toroid installed, for example, on the star centre of the transformer, and is an alternative to the G and Rc functions. The function is active with an auxiliary supply.

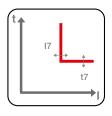


Neutral protection: available at 50%, 100%, 150% or 200% of the phase currents, or disabled, it is applied to the overcurrent protections L, S and I.

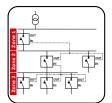


Start-up function: enables protections S, I and G to operate with higher trip thresholds during the starting phase, avoiding untimely trips due to high inrush currents of certain loads (motors, transformers, lamps). The starting phase lasts 100 ms to 30 s and is recognized automatically by the trip unit:

- at the closing of the switching device with a self-supplied trip unit;
- when the peak value of the maximum current exceeds the set threshold (0.1...10 x In) with an externally supplied trip unit; a new start-up is possible after the current falls below the threshold.



Current unbalance (IU – ANSI 46): with constant trip time (t = k), protects from an unbalance between the currents of the single phases protected by the switching device.



Zone selectivity for S and G protection (ANSI 68): can be used to minimize circuit- breaker trip times closer to the fault. The protection is provided by connecting all the zone selectivity outputs of the trip units belonging to the same zone and taking this signal to the trip unit input that is immediately upstream.

Each switching device that detects a fault reports it to the switching device upstream; the circuit-breaker thus detects the fault but does not receive any communication from those downstream and opens without waiting for the set delay to elapse. It is possible to enable zone selectivity if the fixed-time curve has been selected and the auxiliary supply is present.

Current thresholds: this function enables four independent thresholds to be indicated in order to enable corrective action implementation before the overload L protection trips the switching device. For example, by disconnecting loads located downstream of the switching device that are controlled by Ekip Signalling.

Description of protection functions

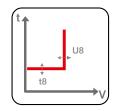
Protection functions with Ekip Measuring

Ekip UP protection functions can be further increased thanks to the embedded Ekip Measuring module. With this module, all the protection functions linked to voltage, frequency and power can be enabled, thus making Ekip UP a complete protection unit that can measure, control and protect even the most complex installation.

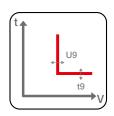
A different operating mode can be chosen for each protection function:

- 1. Active: protection enabled by opening of the circuit- breaker when the threshold is reached;
- 2. Only alarm: protection active, with only alarm indication when the threshold is reached;
- 3. Deactivated: protection disabled.

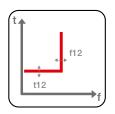
Furthermore, when the voltage and frequency protections are activated, they indicate an alarm status even when the switching device is open so that a fault can be identified before the switching device closes.



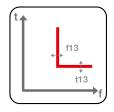
Undervoltage (UV - ANSI 27): with constant trip time (t = k), function is tripped when phase voltage falls below set threshold.



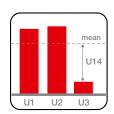
Overvoltage (OV - ANSI 59): with constant trip time (t = k), function is tripped when phase voltage exceeds the set threshold.



Underfrequency (UF - ANSI 81L): with constant trip time (t = k), function is tripped when network frequency falls below set threshold.



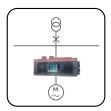
Overfrequency (OF - ANSI 81H): with constant trip time (t = k), function is tripped when network frequency exceeds the set threshold.



Voltage unbalance (VU – ANSI 47): with constant trip time (t = k), protects against an unbalance between the voltages of the individual phases that are protected by the circuit- breaker.

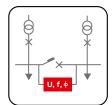


Residual current (Rc – ANSI 64 & 50NDT): with constant temperature (t=k) protects against indirect contacts and is integrated into Ekip UP Protect and Ekip UP Protect+ by a dedicated residual current rating plug and external toroid. The protection is an alternative to the functions G and Gext and it is activated by dedicated rating plugs..



Reverse active power (RP - ANSI 32R): with constant trip time (t = k), function is tripped when total active power – in the opposite direction of the current - exceeds the set threshold.

In addition to the protection functions, the following indication and control functions are available to warn the user that a given condition has been reached. The active indications are always shown on the display and are also available by communication on the system bus (with Ekip Com modules) or electrical indication (with Ekip Signalling modules).



Synchrocheck (SC - ANSI 25): the synchronism control function compares the voltages in the modules as well as the frequencies and phases of two switching devices to which the switching device is connected. Ekip UP indicates that conditions have been reached also with display synchronism indicators that enable the two lines to be made parallel.

The function is available with two work modes:

• In systems with both busbars supplied, where synchronism is determined by:

1. voltage of the two half-busbars above the Ulive threshold for the set time

2. difference of the module of the two voltages

3. difference in the frequency of the two

4. difference in the phase of the two voltages

5. desirable time for synchronism condition tsyn

6. switching device open

• In systems with an out-of-service line (dead busbar), where the synchronism condition is determined by the concurrence of the following conditions for the tref set time:

below the threshold ΔU

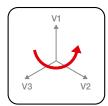
below the threshold Δ

voltages below the threshold Δf

- 1. voltage of the active half-busbar above threshold Ulive
- 2. voltage of the dead half-busbar below threshold Udead
- 3. switching device open

In both cases, synchronism consent is withdrawn when one of the above conditions is missing and it has not been less than 200ms from the change of the circuit- breaker condition (when the relationship has been set).

The indication of reached synchronism is available directly as an electrical indication via a contact that is always supplied with the module. The function can be activated simply by connecting the Ekip Synchrocheck module to any Ekip UP Protect or Protect+.



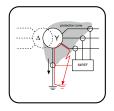
Cyclical direction of the phases (ANSI 47): indicates an alarm through inversion of the phases sequence.

Power factor (ANSI 78): available with a three-phase threshold, warns when the system operates with a power factor that is less than the set power factor.

Description of protection functions

The following protections are also available:

Second time-delayed overcurrent protection (S2 – ANSI 50TD): in addition to the standard protection S, a second (excludable) time-constant protection is available that enables two independent thresholds to be set in order to ensure precise selectivity, especially in highly critical conditions.



Second protection against earth fault (ANSI 50GTD/51G & 64REF): whereas with Ekip UP Protect the user can choose the implementation of the protection G by own current sensors (calculating the vector sum of the currents), Ekip UP Protect+ offers the simultaneous management of both configurations by two independent earth fault protection curves. Owing to this characteristic, the trip unit is able to distinguish a non-restricted earth fault and then activate the opening of low voltage switching device, from a restricted earth fault, and to thus command the opening of the medium voltage switching device.

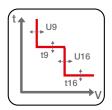
Another possible configuration is with the residual current protection replacing the Gext protection, whilst the G protection remains active. The residual current protection is activated in the presence of the residual current rating-plug and of the toroid.

Directional overcurrent (D – ANSI 67): the protection is able to recognize the direction of the current during the fault period and thus detect if the fault is upstream or downstream of the circuit-breaker. The protection, with fixed time trip curve (t=k), intervenes with two different time delays (t7bw and t7fw), according to the current direction. In ring distribution systems, this enables the distribution portion to be identified in which the fault occurred and to disconnect it while maintaining the operation of the rest of the installation.

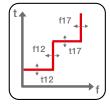


Zone selectivity for protection D (ANSI 68): enables the possibility to interconnect switching devices so that, in the event of a fault, the fault area can be rapidly isolated. Disconnection only occurs at the level close to the fault and operation to the rest of the operation continues uninterrupted. The function is particularly useful in ring and grid installations where, in addition to the zone, it is also essential to define the flow direction of the power that supplies the fault. It is possible to enable directional zone selectivity alternatively to the zone selectivity of the protections S and G, and in the presence of an auxiliary supply.

Start-up function for protection D: enables higher trip thresholds to be set at the outgoing point, as available for protections S, I and G.



Second protection against undervoltage and overvoltage (UV2 and OV2 – ANSI 27 and 59): enables two minimum and maximum voltage thresholds to be set with different delays in order to be able to discriminate, for example, between voltage dip transients due to the start-up of a motor and an actual fault.

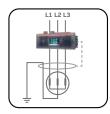


Second protection against underfrequency and overfrequency (UF2 and OF2 – ANSI 81L and 87H):

enables two minimum and maximum frequency thresholds to be set simultaneously. For example, only an alarm can be set to be tripped when the first threshold is reached, and the switching device can be set to be opened when the second threshold is reached.

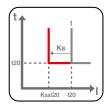
Dual setting of protections: Ekip UP Protect+ can store a set of alternative parameters for all protections. This second series (set B) can replace, if necessary, the default series (set A) by an external command. The command can be given when the network configuration is edited, for example when an emergency source is activated in the system, changing the load capacity and the short-circuit levels. Another typical application is protecting the operator opposite the switchgear against the electric arc. In this case, protection delays are minimized to safeguard the operator (Set A), whereas in the absence of an operator the protections are set to ensure selectivity with the switching devices downstream (Set B). It is possible to activate series B by:

- Digital input available with an Ekip Signalling module;
- · Communication network, by means of one of the Ekip Com communication modules;
- · Directly from the Ekip UP display;
- By a settable internal time, after the circuitbreaker has closed.

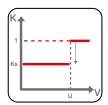


Differential ground fault (Rc - ANSI 87N): protects against internal earth fault on generator winding. It is required that the toroid hugs the active conductors and the ground conductor. Rc protection is integrated by a dedicated residual current rating plug and the external toroid.

The specific functions for generator protections are described below. For each of these it is possible to choose the operating mode: active, only alarm or deactivated. All the voltage and frequency protections also operate when the circuit- breaker is open, enabling the fault to be identified before the closing of the switching device.

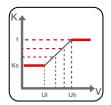


Voltage controlled overcurrent protection (S(V) - ANSI 51V): protection from maximum current with a constant trip time (t = k) that is sensitive to the voltage value. The set current threshold, following a voltage drop, decreases by steps or linearly.



In step mode (controlled mode) the protection is tripped at the set threshold (I20) if the voltage is above U, whereas it is tripped at the lower threshold of the factor Ks (I20 * Ks) if the voltage is below U.

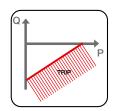
Description of protection functions



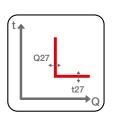
On the other hand, in linear mode (restrained mode) two voltage limits are selected within which the protection is tripped at the set threshold (I20) reduced by the factor K corresponding to the measured voltage. The variation of the factor K is proportional to the voltage, and for voltages greater than the upper threshold (Uh) the threshold I20 works, whereas for voltages below the lower threshold (II) the minimum threshold (I20 * Ks) applies.



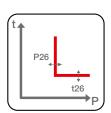
Residual overvoltage (RV – ANSI 59N): with constant trip time (t = k), protects against insulation loss in systems with insulated neutral or with neutral earthed with impedance.



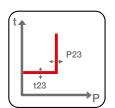
Loss of field or reverse reactive power (RQ – ANSI 40 or 32RQ): with constant trip time (t = k), the switching device tripped when the total reactive power absorbed by the generator exceeds the set threshold. It is possible to select the constant threshold (k=0) or a function of the delivered active power of the generator ($k\neq 0$).



Reactive overpower (OQ – ANSI 320F): with constant trip time (t = k), the function is tripped when reactive power exceeds the set threshold in the generator to network direction.



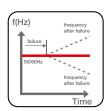
Active overpower (OP – ANSI 320F): with constant trip time (t = k), the function is tripped when the active power exceeds the threshold set in the delivering direction of the generator.



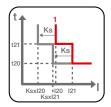
Active underpower (UP – ANSI 32LF): with constant trip time (t = k), the function is tripped when the active power delivered by the generator is lower than the set threshold. It is possible to disable the protection temporarily, to manage the start-up phase, by setting a time window from the closing of the switching device, by using an electrical signal or via incoming communication to a relay.

THE RANGES 33

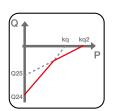
In addition, the following protections are also available:



Rate of change of frequency (ROCOF – ANSI 81R): enables both positive and negative frequency variations to be rapidly detected. The protection is constant and is tripped when the frequency variation in Hz/s is greater than the set threshold.



Second protection against voltage controlled overcurrent protection (S2(V) - ANSI 51V): available in addition to the protection S(V), enables total selectivity to be achieved in all installations.



Second protection against loss of field or reverse reactive power (RQ – ANSI 40 or 32R): enables the generator's de-energization curve to be followed very accurately, thereby avoiding any unnecessary disconnection.

CHAPTER 3

Software functions

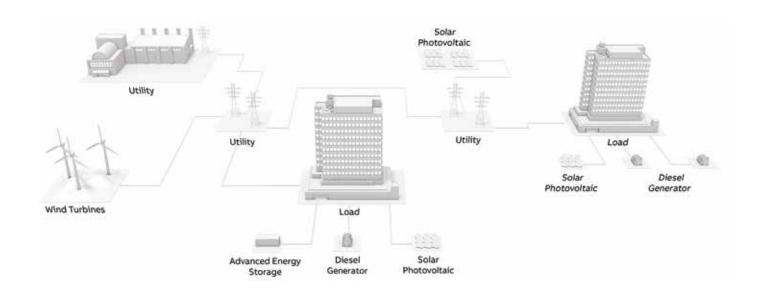
36 -37	Introduction
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40 -41	Adaptive Protections
42 -43	Load Shedding
44 -45	Automatic Transfer Switch
46 -47	Synchro Reclosing
48 -50	Power Controller

Introduction

Renewables have been growing during the last 10 years reducing the polluting emission for a greenest world. Due to environmental changes, people has started to think about ecology and sustainability, increasing their awareness of energy self-consumption in a perspective of energy efficiency.

Ekip UP is the first unit to upgrade low-voltage plants with advanced protection, programmable logic, full connectivity, easy integration and comprehensive energy management in a single revolutionary device or at the local generation side. Installed downstream the MV/LV transformer, Ekip UP works like a certified Interface Protection System in order to check the Main Grid conditions and disconnect the User's plant whenever grid voltage and frequency are out of the ranges prescribed by the connection local standard.

Ekip UP and its Adaptive Protections recognize the network change and automatically set new thresholds to guarantee protection and coordination in on-grid and off-grid conditions.



In order to maximize the service continuity, local generation starts to supply the islanded User's plant. Ekip UP is the first digital unit able to integrate in one device protection features and Automatic Transfer Switching (ATS) programmable logics. This unique integrated solution avoids the usage of other external control unit, guaranteeing switchgear footprint and commissioning time saving.

Strong reduction of wiring connection simplify the installation and commissioning phase. The Load Shedding embedded algorithm is able to manage power system for the comprehensive microgrid energy management.

Before the transfer from the main grid to local line, selected loads are shed to support power balance. Ekip UP using slope of frequency disconnects loads only in case of emergency unbalance condition.

When the main grid comes back stable, thanks to **Synchro Reclosing** logics, synchronizes the plant voltage and frequency to reconnect it. in grid-connected operation, Ekip UP manages the **Power Controller** algorithm to shave peaks and shift loads in order to optimize system performance and productivity.

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Ekip UP advanced features are easily customized thanks to commissioning software tools which do not require high level engineering competencies. Ready to use templates enable the download of all the logics directly into the trip unit. The solutions become plug & play, increasing modularization and standardization for design and installation. Here following the description of the several Adanced functionalities wich have been developed and integrated in Ekip UP follows the below compatibility table.

Interface	Load	Automatic	Synchro	Power
Protection	Shedding	Transfer Switch	Reclosing	Controller
	•		,	•
•		•	•	•
	•		•	•
	•	•		•
•	•	•	•	

Interface Protection System

Ekip UP embeds interface protections for active plant or renewable sources connected to medium voltage grid.

Purpose

The connection of Active Users to the Utility is subject to the satisfaction of the Standard requirements. The Interface Protection System is a relay with dedicated protections able to satisfy such requirements. In particular, the generating units installed in the User's plant shall be disconnected from the grid whenever voltage and frequency values of the grid itself are out of the ranges prescribed by the standard. Such a disconnection is usually carried out by means of an Interface Device that trips after receiving an opening command provided by an external Interface Protection System.

ABB Ekip UP Protect+ or Control+ is able to perform the functions of Interface Protection System as a unique flexible solution. This advanced feature is possible thanks to the implementation of the several interface protections into the trip unit installed on board Ekip UP. Today Ekip UP is suitable for Standard CEI 0-16, the most important Standard for the connection of Active Users. CEI 0-16 is a reference for a lot of other local standards, in particular in South America and Middle East.

Application examples

ABB has been able to integrate in a single device the following functions to be used in the scenarios described below. Thanks to these embedded functions, the number of devices to be installed is reduced, with consequent space saving inside the switchboard. Ekip UP with embedded Interface Protection System have been tested and certified in compliance with the Standard CEI 0-16 and are suitable for the following scenarios.

Ekip UP as Microgrid Main protection unit

In such scenario, Ekip UP with embedded Interface Protection System can fulfill the function of Interface Protection System (IPS). In case of IPS tripping, microgrid, downstream Ekip UP main unit, remains active thanks to both the local generation and the load shedding feature also embedded in the main unit.

Ekip UP as local generation protection unit

In such scenario, there are loads non-operating in islanding condition, so, when there is an Utility outage, Ekip UP detects that voltage and frequency values are out of the range prescribed. According to the standard the local generation must be disconnected from the Utility, so Ekip UP opens, acting as interface device, thanks to the IPS embedded. In this condition loads are not operating as there is no voltage on the secondary of the MV/LV transformer and no local generation connected.

Benefits

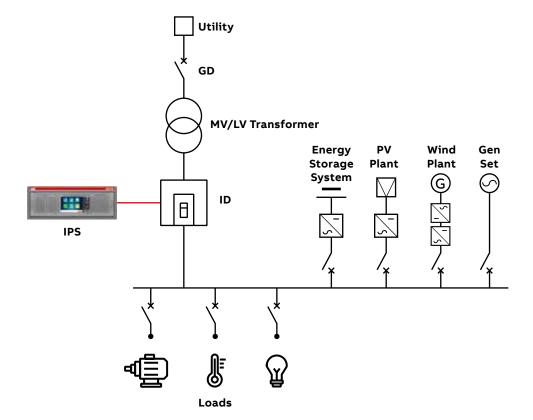
Thanks to Ekip UP with embedded Interface Protection System, the following benefits are guaranteed:

- Ekip UP performs interface protections with every possible switching device, ensuring also reclosing operation.
- If the Ekip UP is installed on the generator feeder, the unit will be able to perform the triple function of Interface Protection System and Generator Device thanks to the Interface Protection System integrated also in the Ekip UP Protect+ or Control+ unit.
- Ease of use, thanks to Ekip Connect software which allows an immediate and intuitive commissioning phase.

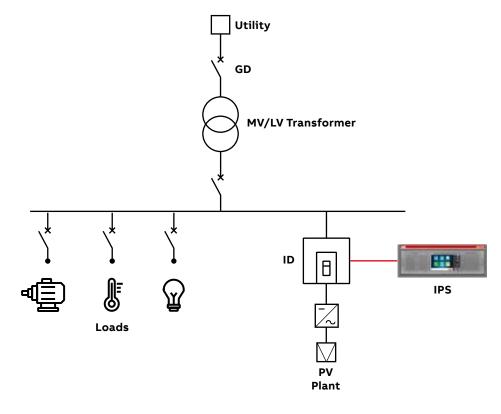
For more info check out the white papers from ABB Emax 2 as Ekip UP digital unit shares the same electronics platform For Interface Protection Systems, please refers to "Emax 2, all in one innovation: Interface Protection System and Interface Device" - 1SDC007117G0201.



Ekip UP as Microgrid Main protection unit



Ekip UP as local generation protection unit



Adaptive Protections

Ekip UP adds dual setting capability to switching device to ensure continuous coordination.

Purpose

User's plants can work as a LV Microgrid thanks to the energy produced by renewable and local power sources, in particular as a consequence of lacking of the Utility power supply, e.g. due to a fault on the MV voltage side. In order to still guarantee a high level of selectivity and continuity of service, it is important to take into account the variation of the short circuit power when moving from. Indeed, during grid connected condition the fault current on a microgrid feeder is supplied by the Utility, so it is higher than the one supplied only by the local generation during islanded condition.

As a result, it is desirable that the several protection thresholds of the units can be automatically changed during the transition to the islanding condition.

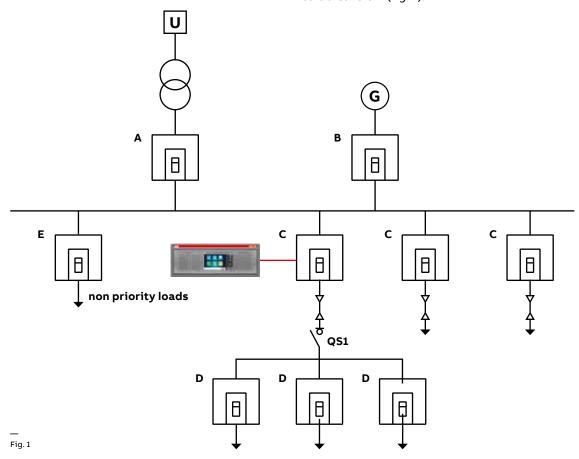
Application example

We have a plant connected to the MV Utility by means of a MV/LV transformer. If the Utility shuts down, the plant will become a Microgrid supplied by the local generator G, which will feed the priority loads by using the loads shedding feature of Ekip UP.

In grid-connected condition, the generator G is disconnected. With reference to fig.1:

- · Circuit breaker A is closed
- · Circuit breaker B is open
- Circuit breakers C are closed. The protections of the one that supplies loads D are upgraded using "Set A" of Ekip UP unit.
- Circuit breakers D are closed
- · Circuit breaker E is closed
- · Circuit breaker QS1 is closed
- · All loads supplied.

The circuit breakers C are selectively coordinated with the upstream main circuit breaker A, supplied by the Utility, and the downstream load circuit breakers D (fig. 2).



Condition with Adaptive protections when there is a Utility outage, circuit breaker A opens and B closes in order to have operation in islanded condition. In order to still guarantee selectivity, an alternate set of protection settings is required. Adding Ekip UP adaptive protections to circuit breaker C ensure this behaviour. The second protection setting is optimized for the characteristics of the local generator ensuring the incoming supply and load side switching devices will remain selectively coordinated.

With reference to Figure 1:

- Circuit breaker A is open
- · Circuit breaker B is closed
- Circuit breakers C are closed and the protection thresholds move automatically to "Set B"
- Circuit breakers D are closed
- · Circuit breaker E is open
- Circuit breaker QS1 is closed
- No priority loads can be disconnected using another functionality of Ekip UP units (see next paragraph).

The following Figure shows how it is possible to switch to a set of parameters which guarantees selective coordination between switching devices C and B by means of the "Adaptive protections" function embedded in the trip unit of the circuit-breaker C.

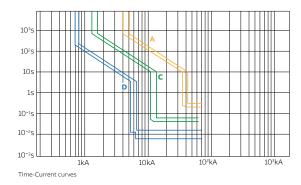
Benefits

Thanks to Ekip UP Protect+ or Control+ it is possible to have two sets of settings implemented in a single device. As a result, the following benefits are guaranteed:

- Overcurrent protection and selectivity 100% guaranteed both in grid-connected and islanded condition
- The service continuity is is granted just adding a single unit in the switchboard in every plant condition
- Ease of use, thanks to the Ekip Connect software which allows an immediate and intuitive commissioning phase.

For more info check out the white paper "Emax 2, all in one innovation: Adaptive protections" - 1SDC007116G0201.





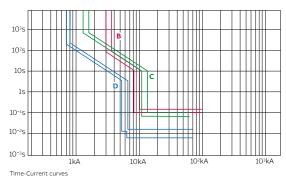


Fig. 2 Fig. 3

Load Shedding

Ekip UP has many load shedding algorithms to avoid power unbalance in the low voltage plant and stress for all the components.

Purpose

ABB Ekip UP embeds patented functions based on load shedding which reduces the Microgrid stress in all situations. Typically it is the main protection relay of the low voltage Microgrid located at the interface point with the medium voltage grid, able to control the plant in every circumstances.

Microgrid in islanding operation

After the opening of the circuit breaker or switching device due to Ekip UP protection, because of interface protection systems intervention or external command, the Microgrid should transit from on-grid to off-grid state with bumpless transition. When it is standalone, the power absorption from the main grid ceases, so that the Microgrid loads remains supplied by the local generation, like diesel GenSet or energy storage systems. This Microgrid generation can be always active or started up by an automatic transfer switching (ATS) logic after the disconnection from the main grid, depending on the plant configuration. During the islanding transition, it is very important to avoid the frequency drop, otherwise the generation protections could trip jeopardizing the Microgrid stability with consequently a long downtime. Ekip UP, employing the current and voltage measurements, integrates two different fast load shedding logics to reduce this blackout risk, protecting the Microgrid during the intentional or unintentional islanding operation:

- Basic Load Shedding, simple logic able to recognize the Microgrid disconnection event and shed a group of not priority loads thus ensuring a fast time response and power balance.
- Adaptive Load Shedding, the advanced algorithm available with Ekip UP as an enhancement of the basic version. The intelligent software embedded in the unit sheds very quickly the not priority loads according to the Microgrid power consumption and frequency measurements. Moreover, such software has a dedicated configuration for backup generation related to ATS and the software itself is even able to estimate the energy produced by a solar plant based on plant geography settings.

Microgrid in grid-connected operation

During normal circumstances, the microgrid point is generally connected to the Utility in order to inject/adsorb the surplus or the lacking energy. During this power overload should be avoided not to stress too much the plant elements. In order to satisfy this, the digital unit embeds a patented load shedding algorithm:

 Predictive Load Shedding, slow disconnection of loads based on the limit of the average power flow towards the Microgrid according to the transformer size designed for the power peak profile.

All the versions are available on Ekip UP Protect, Protect+, Control+ for both the Microgrid situations, sharing some information about the loads under control in the plant.

Application examples

- Grid-connected plants with running GenSets, which contribute to the self-consumption together with potential renewable sources and support the load power supply in emergency conditions. It is the case of hybrid PV-diesel remote communities connected to weak distribution-grids where there are a lot of daily faults, or of facilities located in geographical areas where there are frequent environmental events, for example hurricanes or earthquakes.
- Grid-connected plants with back-up GenSets started up after main - gen transfer switching logics that require high reliability. For example, hospitals, banks or data centers.

Benefits

Thanks to Ekip UP with embedded Load Shedding innovation, the following benefits are guaranteed: Service continuity

 When a plant remain disconnected from the main grid, even if local production is present, there is a significant stress that turns off all the generators with consequent blackout. Load Shedding logics embedded in Ekip UP reduce the frequency drop that usually makes the local generation protection trip, maintaining the plant live.

Space saving

- No other Programmable Logic Controllers (PLC) are needed as Ekip UP has embedded the intelligence to realize the load shedding logics, taking advantage of the current and voltage sensors for electrical parameter measurements.
- In addition, static converters for low voltage photovoltaic production have typically anti-islanding protections: this implies another power deficit to be added to the main grid contribution during the Microgrid islanding. Ekip UP is the first digital unit that estimates solar production without additional sensors.
- Load Shedding is suitable with ATS architectures like Main-BusTie-Gen used to distinguish priority/not priority loads.
 - Where feasible, BusTie switching device is not required anymore and this means:
- Significant space and material saving up to 50% in the power distribution switchgear for panel builders.
- Load Shedding is self-tuned with the specific power unbalance identification and dynamically choses the controllable loads to be shed, reducing constraints for consultants during plant design.

 ATS unit manages only two sources, without interlock, logic programming and wiring connections for the third circuitbreaker with less time required for installation.

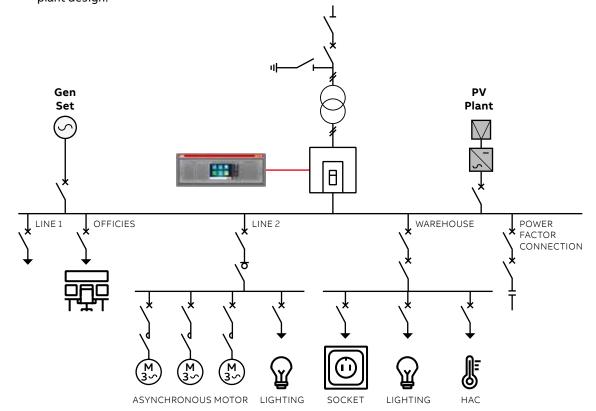
Ease of use

- Load shedding logics are generally set with high engineering skills and customization effort with devices as programmable logic controllers.
- Ekip UP guarantees easy installation thanks to predefined templates and the user-friendly graphic interface in the SW commissioning tool.

For more info check out the white paper "Emax 2, all in one innovation: Load Shedding" - 1SDC007119G020.



Typical load shedding application



Automatic Transfer Switch

Ekip UP is ready for transfer switching applications reducing time for logics programming and commissioning.

The ATS solution

ABB's Automatic Switching (ATS) system takes advantage of the new capabilities provided by the new Ekip Connect 3 Software and the intelligent digital unit such as Ekip UP to deliver versatile and reliable solution.

Ekip UP units embeds closed transition transfer switching logics to be applied to other switching devices with Ethernet-based communication.

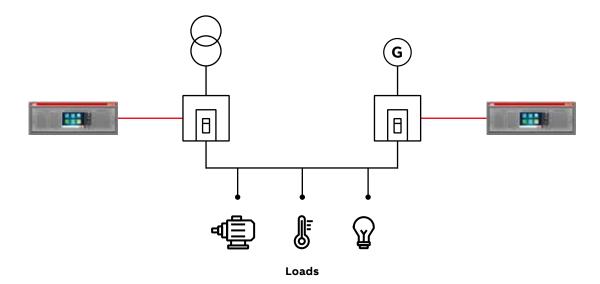
Application example

Automatic Transfer Switch systems is common in all application where service continuity is essential and where there are multi source supplies.

The main applications are:

- Power supplies of UPS groups in general
- · Oil & Gas
- Operating theatres and primary hospital services
- Emergency power supplies for civil building, hotels and airports
- Data banks and telecommunication systems
- Power supply of industrial line for continuous processes.

Another case of use of ATS is in all cases where a portion of grid with local generation, called microgrid, can be disconnected from main grid.

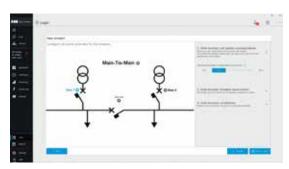


The ATS is a high-performances energy automation system, easy to install and program.

Benefits

Ready-to-go Programming

Estimated time and cost savings on the ATS Engineering on the low voltage project 95%.



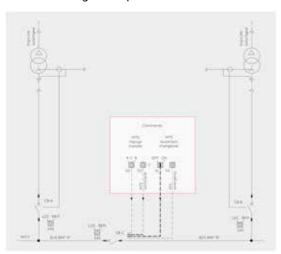
Ekip UP ready

Possibility to configure ATS logics in existing switchboards with reduced impact on the design.



Simplify the connections

Estimated time and cost savings on cabling and commissioning of the power switchboard: 50%.



ATS logics are already integrated in on Ekip UP Protect, Protect+ and Control+.

For more info check out the white paper "Emax 2, all in one innovation: Embedded ATS system" - 1SDC007115G0201.



Synchro Reclosing

Ekip UP is able to synchronize voltage waveforms from different power sources.

Purpose

Thanks to its advanced electronics, Ekip UP is the first smart unit able to island the Microgrid from disturbances such as in the presence of faults or power quality events and reconnect it to the distribution network, when there are the right conditions.

This last feature mentioned is the Synchro Reclosing function. It consists in synchronization support of the Microgrid reconnection operation or generator paralleling procedure as prescribed by Std. ANSI 25A, with additional automatic re-closing capabilities based on the synchronism status detection.

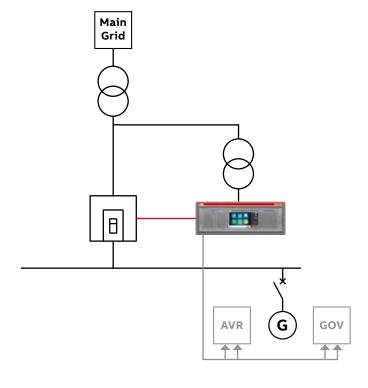
Using the Ekip Synchrocheck cartridge module, Ekip UP monitors the voltage amplitude, the frequencies and the phase displacement and realizes simple logics to adapt the Microgrid voltage and frequency to the main grid ones. This regulation based on up and down signals sent to the local generator controllers is realized by Ekip Signalling contacts in order to reach synchronization. The switching device is automatiically reclosed when Ekip UP understands that the synchronism is achieved using Ekip Synchrocheck and the closing actuator.

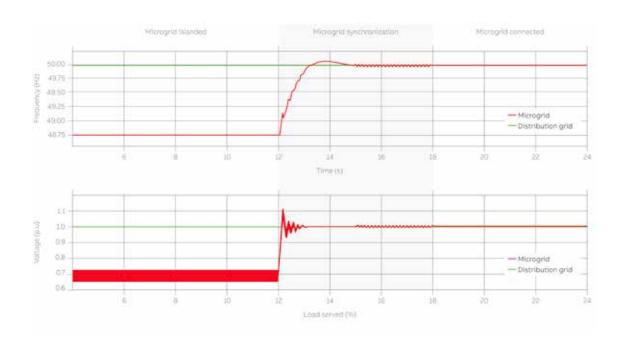
Sometimes this operation can be very critical, because the current following during the transient of the reconnection must not reach values that can potentially cause the Microgrid shut down. With the aim to avoid complex analysis and customizations, Ekip Connect 3.0 commissioning tool completes the Synchro Reclosing functionality, recommending the right settings according to the plant configuration.

Application examples

Synchro Reclosing function is useful in the following plant-engineering situations:

- During the Microgrid reconnection to the main grid, speeding up the paralleling procedure between two systems with different steady states. This scenario comes after the islanding Microgrid operation.
- When there is the closed transition of an automatic transfer switch, the main grid should be connected to the same busbar with the backup Microgrid generation in order to guarantee continuos load operation, with or without a bus-tie switching device.
- Besides Microgrid cases, it is possible to adopt this solution also for single GenSet paralleling operation.





Benefits

Thanks to Ekip UP with embedded Synchro Reclosing, the following benefits are guaranteed:

- A single unit, more ANSI functions
 - Components reduction with no external synchronizer and less voltage transformers required if compared with traditional approaches.
 - Increased reliability & time saving during the installation having less cabling and related installation complexity.

Ease of use

- The logics are embedded in the trip unit so there is no need of programming and engineering skills.
- Simplified configuration with Ekip Connect software that offers predefined configuration templates with suggested values and a clear user interface for customizations.

For more info check out the white paper "Emax 2, all in one innovation: Synchro Reclosing" - 1SDC007118G0201.

Power Controller

Ekip UP is able to control loads and generator to ensure bill savings and enable demand response applications according to power management strategies.

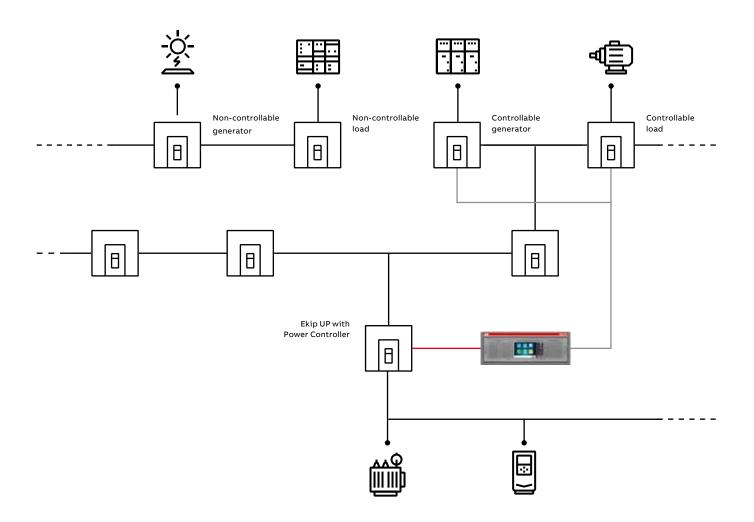
Purpose

Thanks to Power Controller software, Ekip UP manages the power to shave the peaks and shift the loads. In this way, it possible to cut electricity bills, increase energy efficiency up to 20% and be ready for demand response programs. Power Controller function is based on a patented calculation algorithm that allows a load list to be controlled through the remote command of relevant switching device (like switching device, switching device, contactor, drive) or control circuit according to a priority defined locally by the user ore remotely by a load aggregator or utility, based on his own requirements and types of load.

The algorithm is designed on a foreseen average power absorption which can be set by the user over a determined time interval. Whenever this value exceeds the fixed power, Power Controller function intervenes to bring it back within the limits.

This system can be realized with a single Ekip UP Control or Ekip UP Control+ standard equipped with this function and installed as the low voltage plant controller.

Furthermore, the control unit, shall not only command the passive loads, but it can also manage a reserve generator.



In installations that are already equipped with energy management systems, the load limit can also be modified remotely. Another possibility to receive power setpoints from load aggregators or utilities is thanks to openADR communication standard (see cap. 4).

The command sent to the downstream devices can be performed in two different ways:

- through the wired solution, by commanding the shunt opening/closing releases or acting on the motor operators of the loads to be managed;
- through a dedicated communication system Ekip Link (see cap. 4).

The ability to control the loads according to a list of priorities already defined provides significant advantages from both economic as well as technical points of view:

- economical: energy consumption optimization is focused on the control of the costs linked in particular to the penalties that are levied when the contractual power is exceeded or when the contractual power is increased by the Distribution System Operator (DSO) as a consequence of exceeding the limit repeatedly. If used for demand response, Power Controller grants profits for the service offered.
- technical: the possibility of power absorption over the contractual limits for shorter periods and, as well as, the management and the control of the power consumption over long periods of time. Thus it is possible to reduce the likelihood of malfunctioning due to overloads, or worse, complete inefficiency of the entire plant due to tripping of the LV main switching device.

The exclusive Power Controller function available on the new Ekip UP units monitors the power, keeping it below the limit set by the user. As a result of this more effective use, the peak of power consumed can be limited allowing savings on electricity bills.

The Power Controller, patented by ABB, disconnects non-priority utilities, such as electric car charging stations, lighting or refrigeration units, during the times when consumption limits need to be respected, and connects them again as soon as it is appropriate. When required, it automatically activates auxiliary power supplies such as generator sets. No other supervision and control system is required: it is sufficient to set the required load limit on Ekip UP, which can control any switching device located downstream, even if it is not equipped with a measurement function.

Application examples

Electricity bill savings, demand response, avoiding power overload are the typical scenarios where Power Controller is adopted.

As it operates on not critical loads, it is common of office building, shopping malls, hotels, campuses, waste and water industries or every plant that works like a low voltage microgrid.

Power Controller

Benefits

Thanks to Ekip UP with embedded Power Controller, the following benefits are guaranteed:

- Reduction of energy costs with minimum impact.
- The loads are disconnected from the power supply for short periods, in the minimum number necessary and in a fixed order of priority, enabling power consumption peaks to be limited. This allows the contract drawn up with the energy provider to be renegotiated, reducing the power allocated, with a consequent reduction in total energy costs.
- Power limited only when necessary.
 Power Controller function manages up to four different time bands, it is therefore possible to respect a particular power limit according to whether it is during the day (peak) or night (off peak). In this way, consumption during the day when rates are at their highest can be limited.
- Power Controller function allows the installation to be managed efficiently with a simple architecture. Thanks to a patented design, it is sufficient to measure the total power of the installation without having to measure the power consumed by each load. Installation costs and times are thereby reduced to a minimum.
 Power Controller function does not require the writing, implementation and testing of complicated programmes for PLC or computer because the logic has already been implemented in the protection unit and is ready to use; it is sufficient to set the installation parameters from a smartphone or directly from the switching device display.

Power Controller significantly helps to flatten the load curve, limiting the use of peaking power plants in favour of base load power plants with greater efficiency.

- · Thanks to integrated communication modules, Power Controller can receive the maximum absorbable power directly from the medium voltage control system, determining consumption for the next 15 minutes. Power Controller, according to the information received, manages the switching off of non-priority loads or the switching on of reserve generators. The software gives maximum priority to non-programmable preferred energy sources, such as wind and solar, and they are therefore considered uninterruptable. In the event the production of internal power to the controlled network is reduced, due, for example, to decreased production of solar power, Power Controller will disconnect the necessary loads to respect the consumption limit set.
- This benefit is used, for example, in installations with a system of cogeneration. Indeed
 Power Controller controls the total consumption drawn from the electrical network, interrupting non-indispensable loads when production is reduced and reconnecting them when generator power is sufficient to not exceed limits. There are multiple advantages: reduction in energy costs, maximum use of local production and greater overall energy efficiency.

For further information, please refer to the White Paper "Load management with Ekip Power Controller for Emax 2" - 1SDC007410G0202.

CHAPTER 4

Commissioning and connectivity

52 -52	Introduction
53 -55	Commissioning Software Ekip Connect
56 -57	Connectivity and Supervision from the field
58 -59	Connectivity and Supervision from the cloud

Introduction

Ekip UP digital units are easily configured and provide a complete and flexible offering that can be adapted to the actual level of supervision and control required.

Ekip UP simplifies the business upgrading plants without new design or replacements.

In addition, its commissioning is really easy leveraging free commissioning tools.

Ekip Connect simplifies the user experience without any programming skills required. Everyone can visualize energy and power quality measured by Ekip UP, set protections thresholds, configure communication and signalling modules.

Even the setup of advanced software functions, like automatic transfer switch or load shedding logics, becomes intuitive like using an app on a laptop.

The supervision of the power grid is enabled by advanced connectivity built-in Ekip UP, where more than 3000 data of the system are available. The low voltage plant, like microgrid, can be monitored from the field by the integration with Scada systems leveraging on embedded up to 7 fieldbus or from the cloud, based on Internet technology.

Ekip UP, indedded, is able to connect the low voltage switchgear to the energy management system based on Microsoft Azure cloud patform called ABB Ability™ Ekectrical Distribution Control System.

Thanks to this, Ekip UP is the single unit that digitalizes every gear, even existing ones.



Commissioning software

Ekip Connect

ABB offers Ekip Connect free tool that allows the potential of the digital units to be utilized in the best possible way in terms of the management of power, acquisition and analysis of the electrical values, and testing of the protection, maintenance and diagnostic functions.

Overview of the software

An overview of the software available and their main characteristics are given below:

Software	Functions	Distinctive characteristics
Ekip Connect	- commissioning	- simple and intuitive use
	- analysis of faults	- integrated with DOC electrical design software
	- testing of communication bus	- useable via EtherNet™
		- automatic updating from Internet
		- off-line mode
		- multi-media (smart phone, tablet or PC)

Most of the configurations are available from Ekip UP intuitive touchscreen display. Anyway the ABB programming and commissioning Ekip Connect software tool allows the user to unlock the full potential of Ekip UP, having a user-friendly graphic interface and saving all project settings. From commissioning to implementation, through monitoring, testing and analysis, Ekip Connect is the perfect tool for guiding the user in the management of ABB devices throughout the whole product life cycle.

Using Ekip Connect, the user can manage power, acquire and analyze electrical values, and test protection, maintenance and diagnostic functions. Ekip UP units can be connected to the laptop, PC or tablet simply using the mini-USB interface port with Ekip Programming or Ekip T&P accessories. Other possibility is to scan the unit from the communication network where integrated.

Commissioning Software

Ekip Connect

Panel builders
- 50% commissionig



Ease of use

Imagine you are a panel builder. You have to commission a switching device and you need to save time. You can! Using Ekip Connect it is possible to cut commissioning time by up to 50% instead of doing it manually. Providing a stress-free relationship with the device complexity, Ekip Connect is an easy-to-use software that has all the answers.

Ekip Connect's simple and intuitive interface means that, from the very start, it is possible to easily navigate through the tool and access every switching device operation. At a glance, the user can see all the information he needs, giving him the possibility to quickly and effectively assess any situation.

Facility manager 100% full exploitation of your device



Full exploitation

Imagine you are a facility manager. You need to perform fast and precise diagnosis in order to have everything under control and avoid failures. You can! Using Ekip Connect you can exploit the full capabilities of your device and thanks to the customizable dashboard you can organize your window into the deepest functions of the device just the way you want it. It is possible to manage all the CB settings and specifications directly with Ekip Connect, making it the perfect instrument for exploring and using the breaker.

Diagnostics are easy too: It is possible to consult and download the log of events, alarms and unit trips, thereby facilitating the identification and understanding of any anomalies.

One single software able to manage all ABB low voltage devices, giving a full integration.

Consultant/system integrator
Complex logic at your fingertips



Product enhancement

Imagine you are a consultant or a system integrator and you want to implement advanced features while avoiding the risk of any error. You can! Using Ekip Connect it's possible to implement complex logic with a few clicks of your mouse. To add, set and manage advanced functions has never been so easy. Automatic transfer switch logic, load shedding, advanced protection and demand management can be managed and

easily set through the Ekip Connect software.

Expand software features by purchasing and downloading software packages for advanced functions directly using Ekip Connect.

Accessing the full potential of the switching device is finally possible. Thanks to Ekip Connect software, you can achieve complete utilization of the unit and more with a few clicks of your mouse.



Configuration

- Set protections
- Configure system and communication parameters
- Unit start-up



Monitoring & analysis

- View CB status and measure
- · Read events list



Product implementation

- Set advanced protections
- Logic activation
- Enable advanced functions



Testing & reporting

- Check correct functionality
- Perform tests
- Export report

Ekip Connect is available for free download at http://www.abb.com/ abblibrary/Download-Center/



Connectivity

Supervision from the field

The integration of low voltage devices in fieldbus communication networks is required in particular for: automated industrial processes, industrial and petrochemical sites, modern data centres and intelligent electricity networks, better known as microgrids or smart grids.

Ekip Com Modules

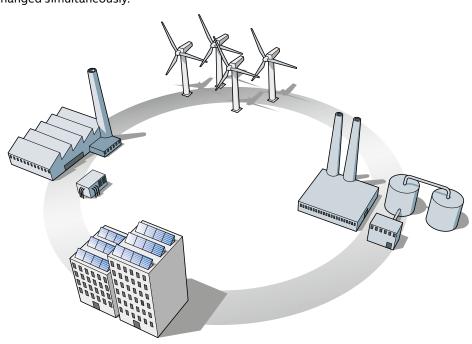
Thanks to the wide range of communication protocols supported, Ekip UP can be integrated into communication networks without the need for external interface devices.

The distinctive characteristics of the Ekip UP offering for industrial communication are:

- Wide range of protocols supported; the Ekip Com communication modules enable integration with the most common communication protocols based on RS485 serial lines and the most modern communication systems based on EtherNet™ infrastructures, which guarantee an exchange of data in the order of 100 Mbit/s.
- Installation times reduced to a minimum due to the plug & play technology of the communication modules,
- Repetition of communication for greater reliability of the system; the unit can be equipped with two communication modules at the same time, allowing the information on two buses to be exchanged simultaneously.

Having advanced protocol connectivity, Ekip UP is ready for:

- interaction with medium voltage grid: the Ekip Com IEC61850 module is the solution for integrating Ekip UP into the automated systems of electrical substations based on the IEC 61850 standard without the need for complex external devices. Having both input and output goose capability, Ekip UP communicates easily with MV relay to realize selectivity and interlocking logics.
- Demand response programme: the Ekip Com openADR module enables Ekip UP to exchange data-reports with load aggregators and utilities as well receive power set point to be managed.
 Based on Internet wireless technology, the openADR standard certifies cybersecurity.
- Power automation logics: Ekip Link is based on proprietary ABB bus that ensures robustness granted by third party and unlock control capability in low voltage plants.



Ekip UP range	monitor/control	protect/protect+/control-
Protocols supported:		
Modbus RTU	Ekip Com Modbus RTU	
Profibus-DP	Ekip Com Profibus	
DeviceNet™	Ekip Com DeviceNet™	
Modbus TCP/IP	Ekip Com Modbus TCP	
Profinet	Ekip Com Profinet	
EtherNet/IP™	Ekip Com EtherNet™	
IEC61850	Ekip Com IEC61850	
Open ADR	Ekip Com OpenADR	
ABB bus	Ekip Link	
Control functions		
Switching devices opening and closing	•	•
Measurement functions		
Currents	•	•
Voltages	•	•
Powers	•	•
Energies	•	•
Harmonics	•	•
Network analyzer	•	•
Data logger	•	•
Adjustment functions		
Setting of thresholds		•
Resetting of alarms		•
Diagnostic		
Protection function alarms		•
Device alarms	•	•
Protection unit tripping details		•
Events log	•	•
Protection unit tripping log		•
Other data		
Local/remote mode	•	•

Connectivity

Supervision from the cloud

ABB Ability™ Electrical
Distribution Control System is the innovative cloudcomputing platform designed to monitor, optimize and control the electrical system.

Part of the ABB Ability™ offering, ABB Ability™ Electrical Distribution Control System is built on a state-of-the-art cloud architecture for data collection, processing and storage. This cloud architecture has been developed together with Microsoft in order to enhance performance and guarantee the highest reliability and security Through a compelling web app interface, ABB Ability™ Electrical Distribution Control System assists anytime and anywhere via smartphone, tablet or personal computer so the user can:

Monitor

Discover plant performance, supervise the electrical system and allocate costs to improve productivity and efficiency.

Optimize

Schedule and analyze automatic reports, improve the use of assets and take the right business decision.

Control

Set up alerts and notify key personnel, and remotely implement an effective power management strategy to achieve energy savings in a simple way.

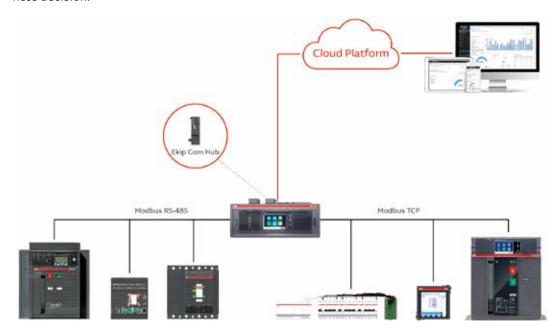
The user can choose Ekip Com Hub module plugged into Ekip UP units to connect the switch-gear into the cloud. ABB Ability™ Electrical Distribution Control System immediately connects to the low-voltage power distribution panel with plug and play devices:

- · Air circuit breakers
- Molded-case circuit breakers
- Miniature circuit breakers
- · Metering devices
- Switches and fusegears
- · Arc-guard devices
- Soft starters
- · Low voltage or medium voltage relay

Ekip UP solution with Ekip Com Hub

Ekip UP equipped with Ekip Com Hub cartridge module establishes the cloud connection for the whole switchboard. This dedicated cartridge type communication module just needs to be inserted into the terminal box and connected to the internet using an external router.

For more information, plase visit http://new.abb.com/low-voltage/launches/abb-ability-edcs.





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CHAPTER 5

Accessories

62 -62	Ekip UP standard supply
63 -63	Accessories for Ekip UP units
64 -64	Power supply
64 -64	Connectivity
65 -66	Signalling
66 -67	Measurements and protection
68 -69	Current sensors
70 -70	Testing and programming

Ekip UP standard supply

ABB Ekip UP is always equipped with four input/output contact andmeasuring module for voltage metering. Installed rating plug module is chosen during ordering (see cap. 8 for instructions).

(1) Type A are provided with a pallet packaging due to weight. Ekip UP is provided in a compact and elegant bag-packaging where there are:

- Mounting clips (DIN-rai, door-mounted) and terminals
- Mandatory accessory
 - Current sensors in the different types available (1)
- Cable kit
- Power supply module
- · Optional accessory
 - Cartridge module for connectivity, signaling, synchrocheck
- Getting Started and module Kit Sheet

The content of the bag-packaging depend on the order and is visible from the ordering label. Other accessories are loose and external from the bag-packaging.



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Accessories for Ekip UP units

All accessories are automatically recognized by the Ekip UP units without the need for any specific configuration. Based on the installation method and connection of the trip units, the electronic accessories can be divided into:

Installation	Modules	Highlights
Terminal box	Cartridge modules:	- The Ekip Supply module enables the trip units to be supplied with a range of DC control voltages
	- Ekip Com - Ekip Link	- The Ekip Supply module is a mandatory accessory.
	- EKIP LINK - Ekip 2K - Ekip Supply	- The Ekip Supply module has a dedicated position in the installation area in the terminal box; the other modules can be installed as desired in the positions available
	- Ekip Synchrocheck - Ekip 3T	- Up to 4 additional modules, among Ekip 2k, Ekip 3T, Ekip Com and Ekip Synchrocheck, can be installed together with Ekip Supply. Up to 3 Ekip 2k can be used.
Accessorizing		- These are installed in specific housings
area		 Ekip Measuring module is all time provided with Ekip UP units and enables voltage measurements, directly or using voltage sensors.
		 Ekip Signallling 4k makes the interface of Ekip UP units for protection easy with switching devices or switch-disconnectors. As 4 digital I/O, these can be used also for signalling based on event, increasing the remote signalling possibilities, or activating internal logics. In Ekip UP Protect, Protect+ and Control+ versions the I/O contacts enable opening and closing commands of switching devices as well as status feedbacks.
		 Ekip UP from the factory installed own rating plug according to plant rated current. It is possible to change it, even after the installation according to new requirements (for example, plant extension).
		 Internal battery enables the cause of the fault to be indicated after a trip, without a time limit. In addition, the battery enables date and time to be updated, thus ensuring the chronology of the events.
Ekip trip unit test port	Ekip T&P Ekip TT	 These accessories can be connected to the front test port of the trip units even with the device in operation to perform commissioning activity on Ekip Connect.
		- Compatible also with the SACE Tmax XT and SACE Emax 2 ranges.
External	Ekip 10K	- Several Ekip Signalling 10K can be connected at the same time to the same Ekip UP units using local bus or ABB Ekip Link bus based on ethernet.
	Ekip Signalling Modbus TCP	 This DIN-rail distributed I/O allow open/closed contacts to be received by Ekip UP in the cloud architecture.
	Homopolar toroid Differential toroid	 These are connected to the trip unit by the terminal box of the Ekip UP to perform Rc (differential earth fault) and Gext (source ground fault, also for restriced/unrestricted earth fault diagnosis) protections.

Accessories for Ekip UP units

Thiston Co.

Fig. 1

Power supply

Ekip Supply module (Fig.1)

The Ekip Supply module supplies all Ekip UP units and modules present on the terminal box and of the circuit-breaker with DC auxiliary power available in the switchgear.

The module is mounted in the terminal box and permits the installation of the other advanced modules. It is installed at the first installation of the device.

The available module is:

• Ekip Supply 24-48V DC

Electrical diagram reference: figures 31, 32



Fig. 2

Connectivity (Fig.2)

The Ekip Com modules enable all Ekip UP units to be integrated in an industrial communication network for remote supervision and control of the circuit-breaker. They are suitable for all Ekip UP versions. Several Ekip Com modules can be installed at the same time, thereby enabling connection to communication systems that use different protocols.

The Ekip Com modules for Modbus RTU, Profibus-DP and DeviceNet™ contain a terminating resistor and dip switch for optional activation to terminate the serial network or bus.

The Profibus-DP module also contains a polarization resistor and dip switch for its activation. For industrial applications where superior reliability of the communication network is required, the Ekip Com R communication modules, installed together with the corresponding Ekip Com modules, guarantee redundant connection to the network.

The Ekip Com modules enable Ekip trip units to be connected to networks that use the following protocols:

Protocol	Ekip Com Module	Ekip Com Redundant Module
Modbus RTU	Ekip Com Modbus RS-485	Ekip Com R Modbus RS-485
Modbus TCP	Ekip Com Modbus TCP	Ekip com R Modbus TCP
Profibus-DP	Ekip Com Profibus	Ekip Com R Profibus
Profinet	Ekip Com Profinet	Ekip Com R Profinet
EtherNet/IP™	Ekip Com EtherNet/IP™	Ekip Com R EtherNet/IP™
DeviceNet™	Ekip Com DeviceNet™	Ekip Com R DeviceNet™
IEC61850	Ekip Com IEC61850	Ekip Com R IEC61850
Open ADR	Ekip Com Open ADR	-
Cloud connectivity	Ekip Com Hub	_



Electrical diagram reference: figures from 51 to 59. Redundant version from 61 to 67.



— Fig. 3

Ekip Link Module (Fig.3)

The Ekip Link module enables the Ekip UP units to be connected to ABB communication system for power automation logics, like Power Controller, ATS or load shedding logics.

It is suitable for all Ekip units and can be factory or field installed in time to the device terminal box, even when Ekip Com communication modules are present. In this way, it is possible to have a complete supervision of the system by means of the Ekip Com modules connected to the communication network.

Electrical diagram reference: figure 58



— Fig. 4

Ekip Com Hub (Fig.4)

Ekip Com Hub is the new communication module for Ekip UP cloud-connectivity.

Ekip UP equipped with Ekip Com Hub can establish the connection to ABB Ability™ Electrical Distribution Control System for the whole low-voltage power distribution panel. This dedicated cartridge-type communication module just needs to be inserted into the terminal box and connected to the internet. For further information related to ABB Ability™ Electrical Distribution Control System, please see cap. 4.

Electrical diagram reference: figures 59

ACCESSORIES 65



Fia. 5

Signalling

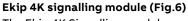
Ekip 2K Signalling modules (Fig.5)

The Ekip 2K Signalling modules supply two input and two output contacts for control and remote signalling of alarms and switching device status/trips. They can be programmed from the unit's display or through the Ekip Connect software. Furthermore, when using Ekip Connect, combinations of events can be freely configured. They are suitable for all Ekip UP versions. Three versions of the Ekip 2K Signalling modules are available: Ekip 2K-1, Ekip 2K-2, Ekip 2K-3.

Electrical diagram reference: figures 41, 42, 43

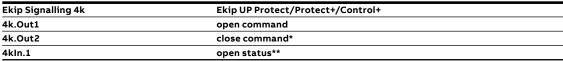
Ekip 3T Signalling

The Ekip 3T Signalling modules supply three analog inputs for thermo-resistances PT1000 and one analog input 4-20mA for external sensors (for example, gas/water meters). These input data are available in the digital unit. Through the Ekip Connect software is possible to set different thresholds and link them to digital signals. Up to two cartridge module can be installed in the same unit. PT1000 sensors are available as options. The Ekip 3T Signalling modules are suitable for all Ekip UP versions.



The Ekip 4K Signalling module, available as standard in all Ekip UP units, supplies four digital input contacts and four digital output contacts for control and remote signalling. Related to the contact, green led lights are available from the front of the unit. It can be programmed from the touchscreen display or through the Ekip Connect software.

Furthermore, when using Ekip Connect, combinations of events can be freely configured. The terminals are provided in the bag-packaging of Ekip UP. In Ekip UP Protect/Protect+/Control+ versions, there is this configuration to be ready for protection:



^{*} possible change to normal use with Ekip Connect

The signaling contact switching time is 10ms max.

It is possible to connect directly the open and closing contacts to actuators on switching devices. These can be opening or under-voltage coils to open the switching device and closing coils or motor operators to close it. If the actuators inrush power requested is over the value listed below, it is necessary to use auxiliary relays.

Rated Voltage [V]	Inrush Power [W/VA]
30 Vdc	60
50Vdc	40
150Vdc	30
250Vac	1000

For more details, please refer to dedicated manual, doc. 1SDH002003A1001.

Electrical diagram reference: figure 20A, 20B



Fig. 6

^{**} possible change to normal use or with 4K. In2 for close status with Ekip Connect

Accessories for Ekip UP units



Fig. 7

Ekip 10K signalling unit (Fig.7)

Ekip 10K Signalling is an external signalling unit designed for DIN rail installation for Ekip UP distributed I/O. The unit provides ten contacts for electrical signalling of timing and tripping of protection devices. If connected via the Ekip Connect software, the contacts can be freely configured in association with any event and alarm or combination of both.

The Ekip 10K Signalling module can be powered either by direct or alternating current and can be connected to all the units via internal bus or Ekip Link modules.

Several Ekip 10K Signalling can be installed at the same time on the same Ekip unit; max 4 by local bus, according to Ethernet band rate if using Ekip Link architecture.

Electrical diagram reference: figure 103



Eig 8

Ekip Signalling Modbus TCP (Fig.8)

It is an external signalling unit designed for DIN rail installation. Function of the signalling module is to share, via an Ethernet network with Modbus TCP communication protocol, information about the state of other switching devices that might not have the ability to provide such information via Ethernet, and also to allow these products to be operated via remote control.

Characteristics of output contacts		Number of contacts			
Туре		Monostable	Ekip 2K	Ekip 4K	Ekip 10K
Maximum swit	ching voltage	150V DC / 250V AC			
Maximum swit	ching current				
	30V DC	2A			
	50V DC	0.8A	2 output + 2 input	4 output +4 input	10 output + 11 input
	150V DC	0.2A	· Z iiiput	· + input	· II IIIput
	250V AC	4A			
Contact/coil in	sulation	1000 Vrms (1min @50Hz)			

Ekip 10K signalling unit power supply		
Auxiliary supply	24-48V DC, 110-240V AC/DC	
Voltage range	21.5-53V DC, 105-265V AC/DC	
Rated power	10VA/W	
Inrush current	1A for 10ms	



Fig. 9

Measurement and protection

Ekip Measuring module (Fig.9)

The Ekip Measuring module enables the unit to measure the phase and neutral voltages, powers and energy. The Ekip Measuring module is always installed on the front, right housing of the units, without having to remove the touchscreen display itself. The voltage busbars can be connected to the Ekip Measuring four input sockets according to scheme in cap. 7:

- directly with insulation requirements according to IEC 61010 dielectric standards
- using single-phase voltage transformers in order to be in compliance with IEC 60255-27 standard for protective relays with these specifications
 - secundary voltage rating 100:√3
 - precision class 0,2
 - power absorprtion 4VA

The module must be disconnected during the dielectric strength tests on the main busbars.

Electrical diagram reference: figures 11, 12, 13, 14

ACCESSORIES 67



— Fig. 10

Ekip Synchrocheck (Fig.10)

This module enables the control of the synchronism condition when placing two lines in parallel enabling ANSI25. The module can be used with Ekip UP Protect/Protect+/Control+.

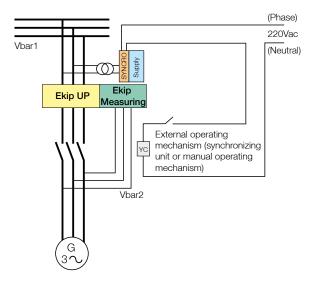
Ekip Synchrochek measures the voltages from two phases of one line through an external transformer and, compares them to the measured voltages at Ekip UP. An output contact is available, which is activated upon reaching synchronism, and enables the switching device interfaced to be closed by means of wiring with the closing coil.

Ekip Synchrocheck is also a fundamental accessory for Synchro Reclosing logics for ANSI25A (see cap. 3).

Characteristics of output contacts			Number of contacts
Туре		Monostable	Ekip Synchrocheck
Maximum switching voltage		150V DC / 250V AC	
Maximum sw	ritching current		
	30V DC	2A	1
	50V DC	0.8A	output
	150V DC	0.2A	
	250V AC	4A	
Contact/coil insulation		1000 Vrms (1min @50Hz)	

_

Electrical diagram reference: figure 44





— Fig. 11

Rating Plug (Fig.11)

The rating plugs are field interchangeable from the front on all units and enable the protection thresholds to be adjusted according to the actual rated current of the system. Rating Plug is mandatory accessory for Ekip UP units, but can be purchased also as loose accessory.

This function is particularly advantageous in installations that may require future expansion or in cases in which the power supplied needs to be limited temporarily (e.g. mobile Gen Set).

Digital unit	Rating plugs available (both in standard and L OFF versions)
Ekip UP all versions	100-200-250-400-600-630-800-1000-1200-1250-1600-2000-2500-3000-3200-3600 -4000

Special rating plugs are also available for differential protection against earthing faults in combination with a suitable toroid to be installed externally.

Digital unit	Rating plug available for Rc protection
Ekip UP all versions	100-200-250-400-600-630-800-1000-1200-1250-1600-2000-2500-3000-3200-3600 -4000

Accessories for Ekip UP units

Current sensors

Current sensors for three/four lines

Ekip UP units have three types of current sensors technology suitable that are included in the bag-packaging as mandatory accessories. Being based on on Rogowski technology, they guarantee high flexibility, huge range linearity and easy detection of quickly current variations as well as harmonic contents. Ekip UP has a compact solution for every situation, available both for 3 or 4 poles. 2 or 3 meters of cable enable the connection in every switchgear, maintaining EMC performances. A specific getting started explain the installation procedure.

• Type A (Fig.12)

This type is a closed sensor with copper terminals for busbars. Type A current sensors are suggested for new plants to optimize current capacity in reduced space inside the switchgear. Type A current sensors has a dedicated label for phase and polarity, so to get a easy installation. They are calibrated directly from the factory.

Type B (Fig.13)

This type is a closed sensor without copper terminals inside. Type B current sensors are recommended as a cost-effective solution for new and existing electrical systems, especially with cable connections. As Type A, also type B current sensors has a dedicated label for phase and polarity as well as the same calibration procedure.

Type C (Fig.14)

This type is a plug-in sensor, very light and flexible with no external power supplier required. Type C current sensors are typically used in old switchgear, as they can be added even without shutdown if the technician can work under voltage condition according to local standards. They have a dedicated printed label for polarity indication. The busbars or cables can be centred using dedicated devices.

The following table summarize main performances.

Electrical diagram reference: figure 17, 18

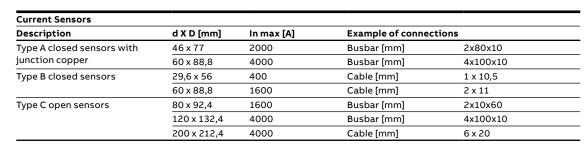




Fig. 12



Fig. 13



Fig. 14

ACCESSORIES 69



— Fig. 15

Homopolar toroid for the earthing conductor of main power supply (Fig.15)

Ekip UP Protect/Protect+/Control+ can be used with an external toroid positioned, for example, on the conductor that connects the star centre of the MV/LV transformer to earth (homopolar transformer): in this case, the earth protection is called Source Ground Return. There are four sizes of the toroid: 100A, 250A, 400A, 800A. The homopolar toroid is an alternative to the toroid for differential protection.

Electrical diagram reference: figure 25



__

Toroid for differential protection (Fig.16)

Connected to the Ekip UP Protect/Protect+/Control+ equipped with a rating plug for differential protection, this toroid enables earth fault currents of 3...30A to be monitored.

To be installed on the busbar system, it is an alternative to the homopolar toroid.

Electrical diagram reference: figure 24, 24A

Accessories for Ekip UP units



Testing and programming

Ekip TT testing and power supply unit (Fig.17)

Ekip TT is a device that allows you to verify that the Ekip UP opening contact based on protection trip mechanism is functioning correctly (protection test).

The device can be connected to the front test connector of any touschreen display of Ekip UP; trip test can be also performed with auxiliary supply using dedicated section in the touschreen display.

— Fig. 17



Fig. 18

Ekip T&P testing kit (Fig.18)

Ekip T&P is a kit that includes different components for programming and testing the electronic protection trip units. The kit includes:

- Ekip T&P unit;
- Ekip TT unit;
- USB cable to connect the T&P unit to the Ekip units:
- installation CD for Ekip Connect and Ekip T&P interface software.

The Ekip T&P unit is easily connects from your PC (via USB) to the unit (via mini USB) with the cable provided. The Ekip T&P unit can perform simple manual or automatic tests on the unit functions. The Ekip T&P will also provide the ability to conduct more advanced function configuration that allows the addition of harmonics and the shifting of phases to more accurately represent the real conditions of an application. Thus, leading to more concise protection function parameters that may be required for critical applications. It can also generate a test report as well as help you to monitor maintenance schedules.

— Fia. 19

Ekip Programming Module (Fig.19)

The Ekip Programming module is used for programming Ekip units via USB to a PC using the Ekip Connect software that can be downloaded on-line. This can be useful for uploading/ downloading entire sets of parameters for multiple switching devices both for set-up as well as for maintenance (for periodic cataloging protection parameters in case of a catastrophic situation).

For more details about Ekip Connect, please see cap. 4.

DIMENSIONS 71

CHAPTER 6

Dimensions

72-76 **Ekip UP unit dimensions**

77-78 Current sensor dimensions

Ekip UP unit dimensions

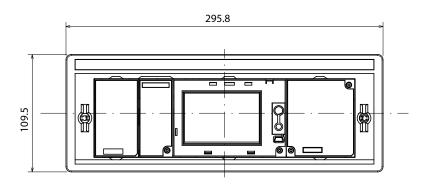
Ekip UP is a plug&play unit that ensures easy installation, even adding current and voltage sensors wherever wanted in the plant layout.

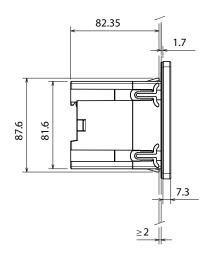
Ekip UP can be door on din-rail mounted, fitting all the requirements either in power distribution either in process automation. Ekip UP depth is one of the smallest among external units, so it is suitable for many switchgear models. Besides, specific labels and signaling contact can rotate according to the mounting options with supporting mold-printed indication.

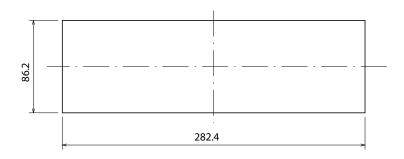
Current and voltage sensors should be applied to the dedicated numbered sockets. Current sockets are directly provided by ABB in different versions, as 3/4 poles or opening/closing Rogowski coils. They fit the current range and the space available among bus-bars/cables in the switchgear. Commercial voltage sensors can be applied following ABB specifications as described in cap. 5.

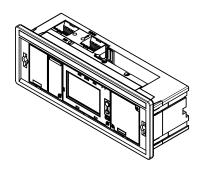
DIMENSIONS 73

Ekip UP unit door-mounted without modules/terminals



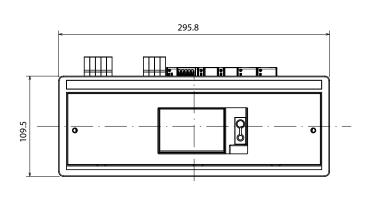


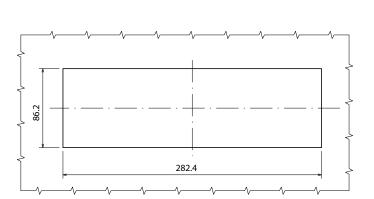


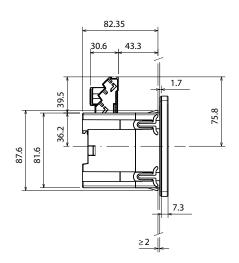


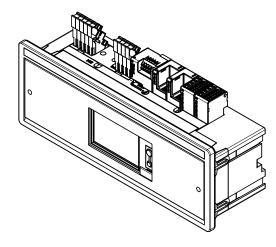
Ekip UP unit dimensions

Ekip UP unit door-mounted with modules/terminals



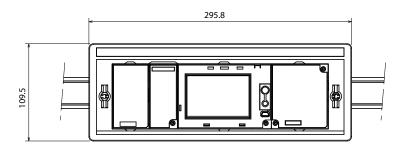


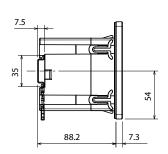


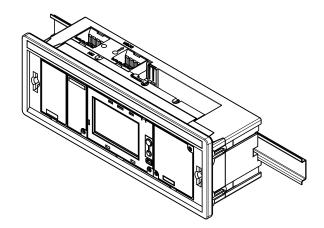


DIMENSIONS 75

Ekip UP unit DIN-rail mounted without modules/terminals

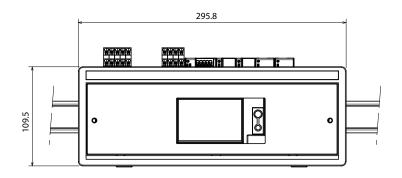


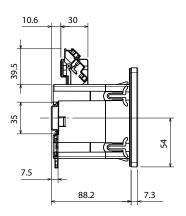


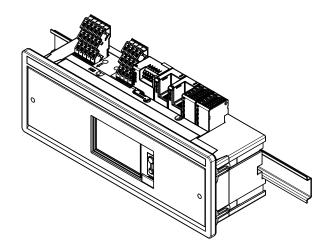


Ekip UP unit dimensions

Ekip UP unit DIN-rail mounted with modules/terminals



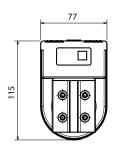


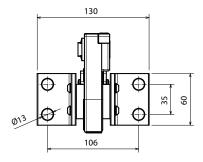


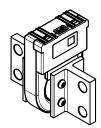
DIMENSIONS 77

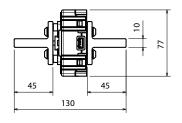
Current sensor dimensions

Current sensor type A 100A-2000A

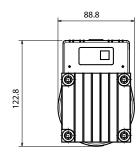


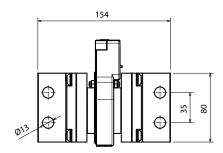




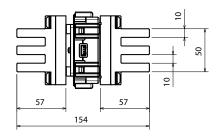


Current sensor type A 2000A-4000A



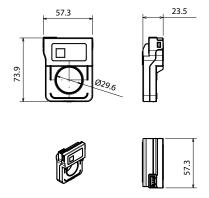




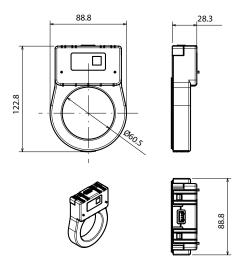


Current sensor dimensions

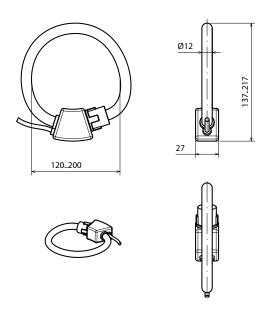
Current sensor type B 100A-400A



Current sensor type B 400A-1600A



Current sensor type C 80mm-120mm-200mm



CHAPTER 7

Wiring diagrams

80 -82	Reading information
83 -83	Terminal blocks
84 -89	Ekip UP unit
9∩ _1∩1	Flectrical accessories

Reading information

Desc	ription of figures	Key	
11)	Ekip UP with external voltage transformer	*	= See the note indicated by the let-
	and 3P configuration		ter
12)	Ekip UP with external voltage transformer	A3	= Applications located on terminal
	and 4P configuration		board and connector of Ekip Up
13)	Ekip UP with external voltage transformer	A4	= Indicative devices and connec-
	and 3P configuration		tions for control and signalling,
14)	Ekip UP with external voltage transformer		outside Ekip Up
	and 4P configuration	BUS1	= Serial interface with external bus
15)	Ekip UP for residual voltage protection	BUS2	= Redundant serial interface with
	(only for protect+ and control +) with exter-		external bus
	nal transformer	LINK BUS	= Interface with the external Link
16)	Ekip UP for residual voltage protection		bus
	(only for protect+ and control +) without	GZi(DBi)	= Zone selectivity input for G
	external transformer		protection or input in "reverse" di-
17)	Ekip UP current sensor connection and 4P		rection for D protection
	configuration	GZo(DBo)	= Zone selectivity output for G
18)	Ekip UP current sensor connection and 4P		protection or output in "reverse"
	configuration		direction for D protection
	Ekip UP 4k	10132	= Programmable digital inputs
20B)		K51	= Electronic device Ekip Up for con-
24)	control+ version with 1 status input	KE1 (COM	trol and measuring
24)	RC residual current protection sensor input	K51/COM	= Communication module
244	(ANSI 64&50NTD)	K51/MEAS	= Measurement module
24A)	•	K51/SIGN	= Signalling module
25)	sor input (ANSI 87N)	K51/SUPPLY	' = Auxiliary supply module (110-
25)	Transformer star centre sensor input	VE1/CVNC	240VAC/DC and 24-48VDC)
26)	Zone selectivity Auxiliary supply through module 24-48V DC	K51/SYNC	= Synchronization module
32)	and local bus	K51/YC	 Closing control from the EKIP protection trip unit
41)	Ekip Signalling 2K-1	K51/YO	= Opening control from the EKIP
42)	Ekip Signalling 2K-2	K31/10	protection trip unit
43)	Ekip Signalling 2K-3	М	= Motor for loading closing springs
44)	Ekip Sinchrocheck	O 0132	= Programmable signalling contacts
51)	Ekip Com Modbus RTU	0 SC	= Contact for synchronism control
52)	Ekip Com Modbus TCP	RC	= RC (residual current) protection
53)	Ekip Com Profibus DP	NC .	sensor
54)	Ekip Com Profinet	SZi(DFi)	= Zone selectivity input for S protec-
55)	Ekip Com Devicenet ™	321(311)	tion or input in "direct" direction
56)	Ekip Com Ethernet/IP™		for D protection
57)	Ekip Com IEC 61850	SZo(DFo)	= Zone selectivity output for S pro-
58)	Ekip Link	(/	tection or output in "direct" direc-
59)	Ekip Hub		tion for D protection
61)	Ekip Com Redundant Modbus RTU	TU1TU2	= Insulation voltage transformer
62)	Ekip Com Redundant Modbus TCP		(outside circuit-breaker)
63)	Ekip Com Redundant Profibus DP	Uaux	= Auxiliary supply voltage
64)	Ekip Com redundant Profinet	UI/L1-L2-L3	= Current sensor phase L1-L2-L3
65)	Ekip Com redundant Devicenet ™	UI/N	= Current sensor on neutral
66)	Ekip Com redundant Ethernet/IP™	UI/O	= Homopolar current sensor
67)	Ekip Com redundant IEC 61850	W2	= Serial interface with internal bus
103)	Ekip Signalling 10k		(local bus)
		W9W14	= RJ45 connector for communica-
			tion modules
		W9R.W12R	= RJ45 connector for redundant
			communication modules

Notes

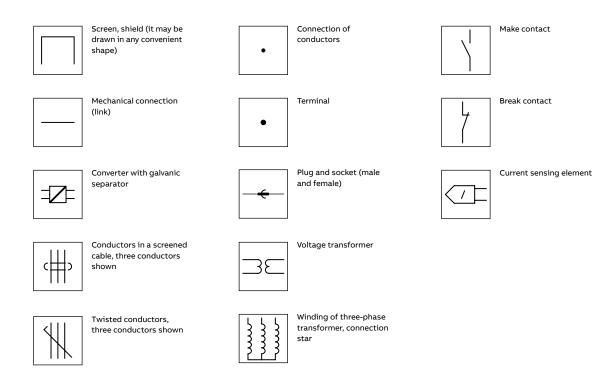
- A. For the zone selectivity and local bus function is required the presence of auxiliary power supply (refer to diagram 1SDM000116R0001 figure 32)
- B. The connections between the RC residual current protection sensor and the poles of X connector of Ekip Up must be made with 4-pole shielded cable with conductors interwoven in pairs (type BELDEN 9696 or equivalent) of length no greater than a 10 m.
- C. The connection between terminals 1 and 2 of the UI/O current transformer and Ge+ and Gepoles of the X connector must be made with shielded and stranded 2-pole cable (type BELDEN 9841 or equivalent) of length no greater than a 15 m.
- D. Obligatory in the case of the presence of any Ekip module.
- E. The Ekip Com module selected can be duplicated if required, by choosing between Fig. 61...67.
- F. Use cables type BELDEN 3105A or equivalent.
- G. Terminal box at disposal in DIN mounting configuration.
- H. Use cables type BELDEN 3105A or equivalent, with maximum length 15m.
- I. Suggested RJ45 cable: CAT6 STP.
- J. For the serial line connection EIA RS 485, refer to "Technical Application Paper QT9: Bus Communication with ABB Circuit-Breakers".
- K. Connect terminals 120 Ω on if you want to insert a termination resistance on the Local Rus
- L. Use cables type Belden 3079A or equivalent.
 For further details see White Paper
 1SDC007412G0201 "Communication with
 SACE Emax2 Circuit-Breakers"
- M. Use cables type Belden 3084A or equivalent. For further details see White Paper 1SDC007412G0201 "Communication with SACE Emax2 Circuit-Breakers"
- O. For connection of W3 and W4 see Fig 32.
- P. Use a twisted pair shielded and stranded cable type BELDEN 8762/8772 or equivalent. The shield must be earthed on the selectivity input side (for zone selectivity) or on both sides (for others applications).
- Q. The maximum secondary rated voltage admit ted is 120V.
- R. The connection without transformer doesn't agree the insulation of standard IEC 60-255-1.

S. Input and output shown as factory default setting with 1 status input: O 01 output connect to opening coil of the circuit-breaker/disconnector; O 02 output connected to the closing coil (or motor) of the circuit-breaker/disconnector; I 01 input connected to status input (contact closed equals to CB status = Open). For the working limits, the configuration solutions of O 02 and I 01 and for the set of all other input/output see the Ekip UP user manual, section dedicated to 4K module.

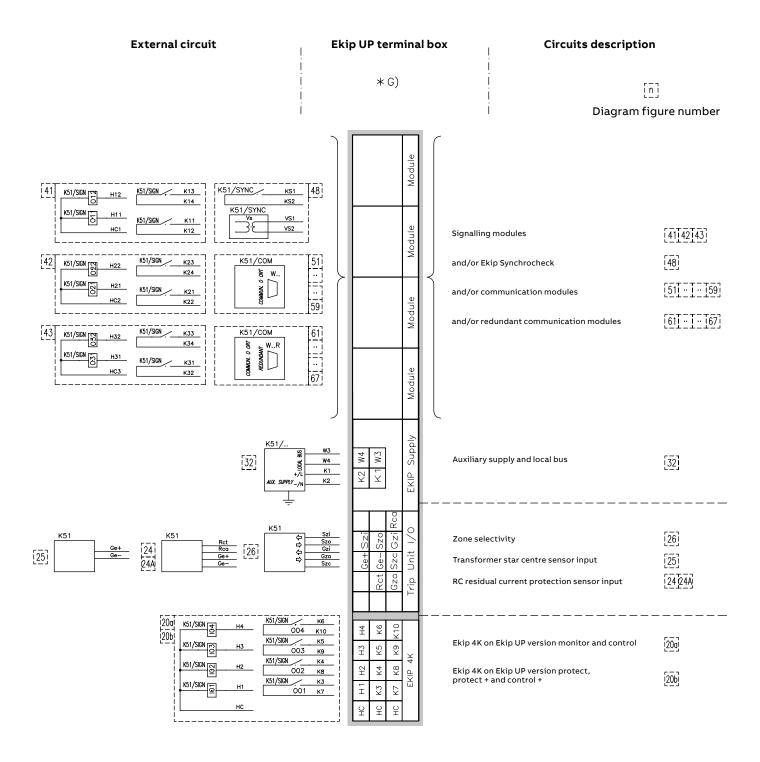
For more Ekip UP wiring diagrams, please refer to 1SDM000116R0001.

Reading information

Graphical symbols for electrical diagrams (617 IEC standards)

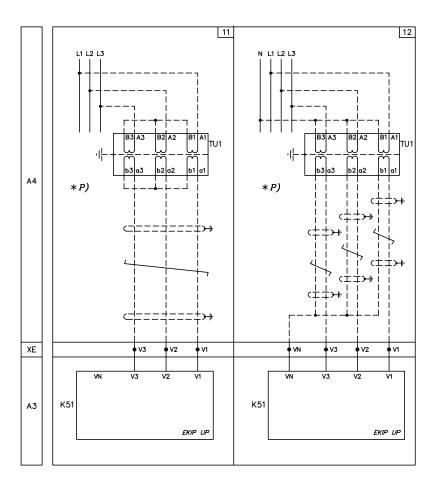


Terminal blocks

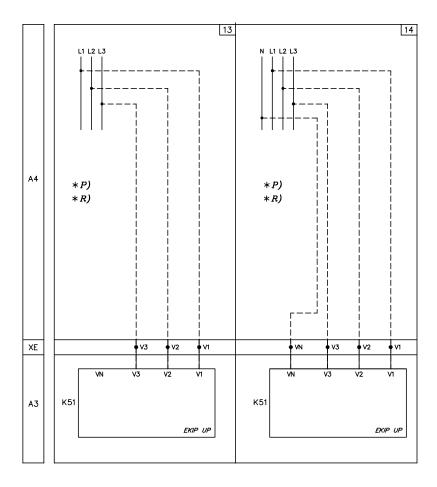


Ekip UP unit

- 11) Ekip UP with external voltage transformer and 3P configuration
- 12) Ekip UP with external voltage transformer and 4P configuration

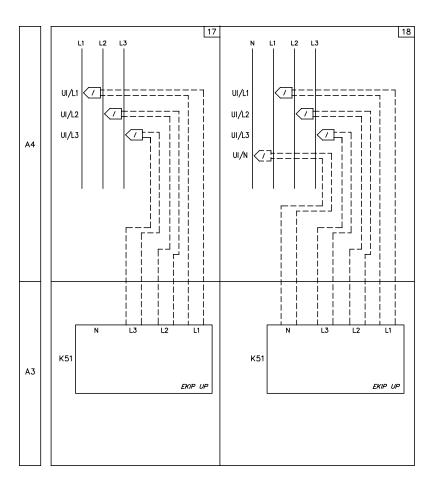


- 13) Ekip UP without external voltage transformer and 3P configuration
- 14) Ekip UP without external voltage transformer and 4P configuration



Ekip UP unit

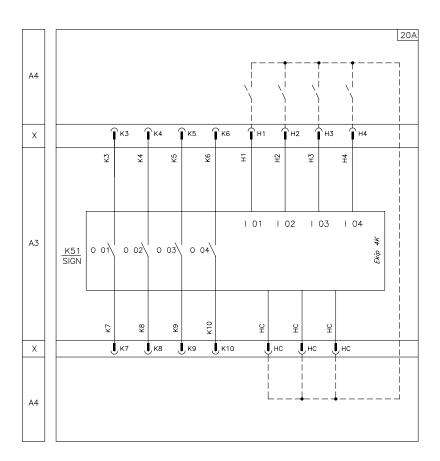
- 17) Ekip UP current sensor connection and 4P configuration
- 18) Ekip UP current sensor connection and 4P configuration



нс	Н1	H2	НЗ	Н4		Ge+	Szi		K2	W4								
нс	К3	K4	K5	К6	Rct	Ge-	Szo		K1	W3								
нс	K7	K8	K9	K10	Gzo	Szc	GziR	ca										
	E	KIP 4	-K		Trip	Unit	1/0		EKIP	Supp	oly	١	Module	Module	Мос	ule	Мо	dule

H	H1	H2	Н3	H4
НС	К3	K4	K5	K6
НС	K7	K8	K9	K10
	El	KIP 4	łK	

20A) Ekip 4k on Ekip UP monitor and control version

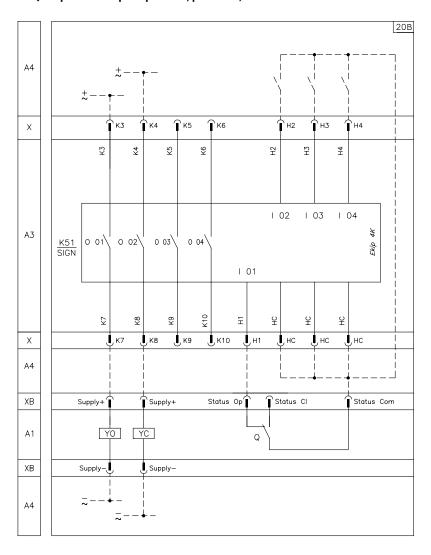


Ekip UP unit

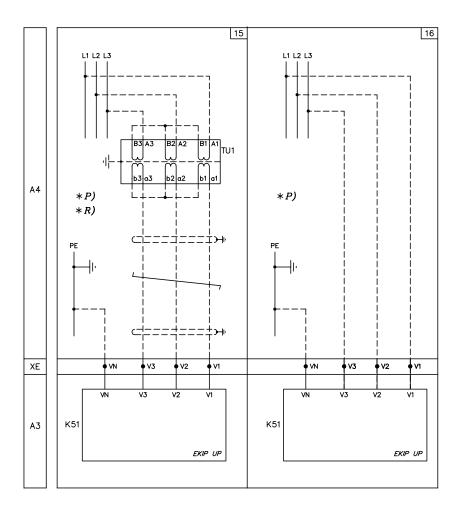
НС	Н1	H2	нз	Н4		Ge+	Szi		K2	W4					
НС	К3	K4	K5	К6	Rct	Ge-	Szo		K1	w3					
нс	K7	K8	K9	K10	Gzo	Szc	Gzi Rcc								
	E	KIP 4	ŀK		Trip	Unit	1/0	E	KIP	Supply	Module	Module)	Module	Module

НС	Н1	H2	Н3	H4
НС	К3	K4	K5	K6
НС	K7	K8	K9	K10
	Εŀ	KIP 4	łK	·

20B) Ekip 4k on Ekip UP protect, protect+, and control+ version with 1 status input



15) Ekip UP for residual voltage protection (only for protect+ and control +) with external transformer 16) Ekip UP for residual voltage protection (only for protect+ and control +) without external transformer

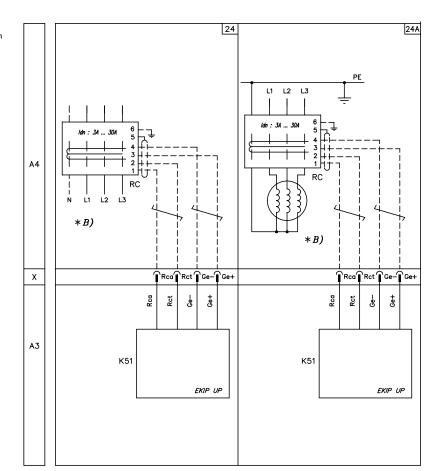


Electrical accessories

НС	Н1	H2	нз	H4		Ge+	Szi		<2 W	+							
нс	К3	K4	K5	К6	Rct	Ge-	Szo		< 1 W	3							
нс	K7	K8	К9	K10	Gzo	Szc	Gzi Rca										
	Ε	KIP 4	ŀK		Trip	Unit	1/0	EK	IP Su	pply	M	lodule	M	lodule	Mod	ule	Module



24) RC residual current protection sensor input (ANSI 64&50NTD)
24A) RC differential ground fault protection sensor input (ANSI 87N)



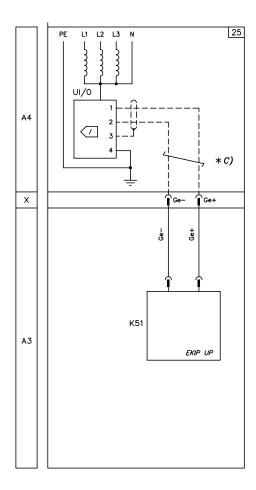
As an alternative to each other or to figure 25

НС	Н1	H2	НЗ	Н4		Ge+	Szi			K2	W4								\Box
нс	К3	K4	K5	К6	Rct	Ge-	Szo			K1	W3								
нс	K7	K8	К9	K10	Gzo	Szc	Gzi	Rca											
	E	KIP 4	-K	-	Trip	Unit	: 1/0		Ε	KIP	Sup	ply	Module	Мо	dule	Мо	dule	Module)

		Ge+	Szi	
	Rct	Ge-	Szo	
	Gzo	Szc	Gzi	Rca
T	rip	Unit	: 1/0)

25) Transformer star centre (homopolar) current sensor input

As an alternative to figures 24-24A

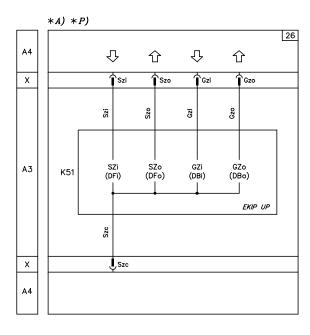


Electrical accessories

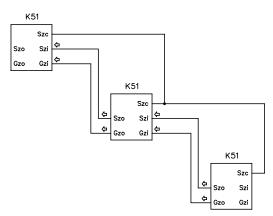
нс	Н1	H2	НЗ	H4		Ge+:	Szi		K2	W4									
Н	К3	K4	K5	K6	Rct	Ge-S	Szo		K1	W3									
НС	K7	K8	K9	K10	Gzo	Szc	Gzi Rcc												
	E	KIP 4	ŀΚ		Trip l	Unit	1/0	E	KIP	Supp	ly	Мс	dule	М	odule	Мо	dule	М	odule



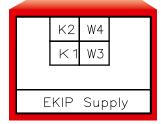
26) Zone selectivity



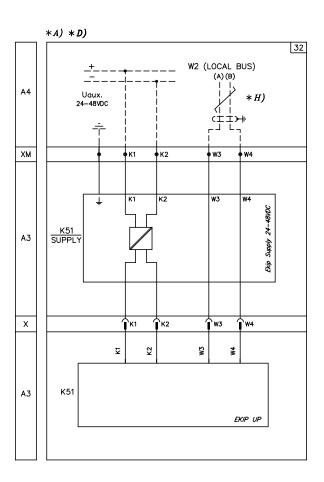
Example for application diagram (among 3 devices)



нс	Н1	H2	НЗ	Н4		Ge+	Szi		K2	W4								
нс	К3	K4	K5	К6	Rct	Ge-	Szo		K1	W3								
нс	K7	K8	K9	K10	Gzo	Szc	GziR	ca										
	E	KIP 4	-K		Trip	Unit	1/0		EKIP	Supp	oly	١	Module	Module	Мос	ule	Мо	dule

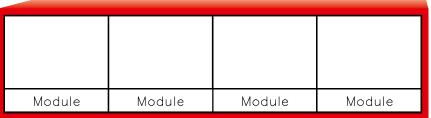


32) Auxiliary supply through module 24-48V DC and local bus

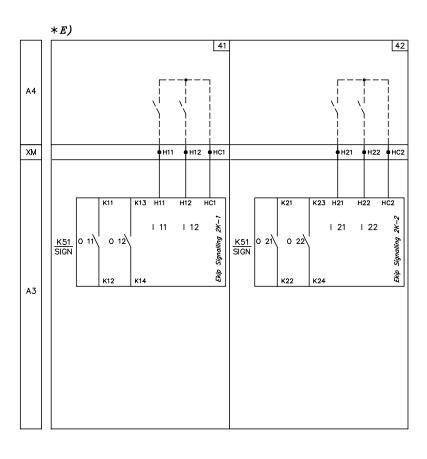


Electrical accessories

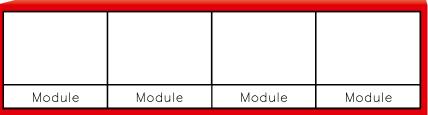
HC HC	\rightarrow	-	H3 K5 K9	H4 K6 K10	Rct Gzo	-	Szo		K2					
	EK	IP 4	K		Trip	Unit	: 1/	С	EKIP	Supply	Module	Module	Module	Module



- 41) Ekip Signalling 2K-1
- 42) Ekip Signalling 2K-2

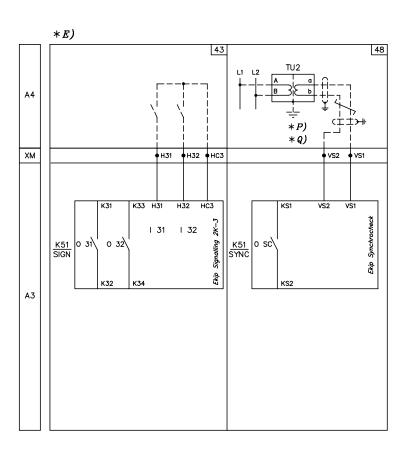


HC H1 H2 H3 H4 HC K3 K4 K5 K6	Ge+ Szi Rct Ge- Szo	K2 W4				
HC K7 K8 K9 K10 EKIP 4K	Gzo Szc Gzi Rca Trip Unit I/O	EKIP Supply	Module	Module	Module	Module



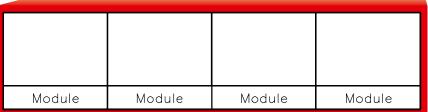
43) Ekip Signalling 2K-3

44) Ekip Sinchrocheck

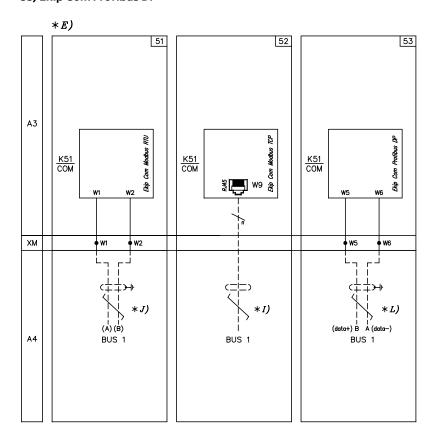


Electrical accessories

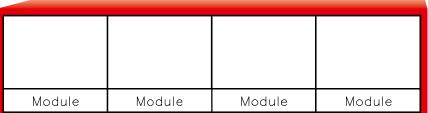
HC K3 K4 K5 K6 Rct Ge-Szo	K1 W3				
HC K7 K8 K9 K10 Gzo Szc Gzi Rca					
EKIP 4K Trip Unit I/O	EKIP Supply	Module	Module	Module	Module



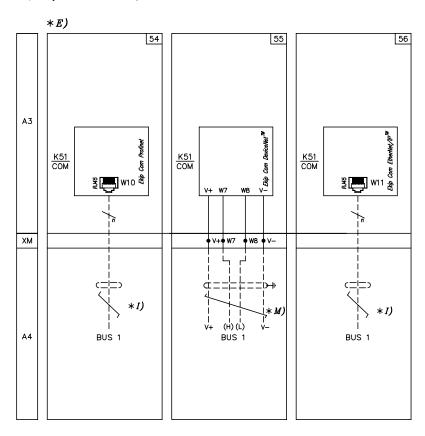
- 51) Ekip Com Modbus RTU
- 52) Ekip Com Modbus TCP
- 53) Ekip Com Profibus DP



НС	Н1	H2	НЗ	Н4				Ge+	Szi		K2	2 W4									
НС	К3	K4	K5	К6]			_	Szo			1 W3									
нс	K7	K8	K9	K10			Gzo	Szc	Gzi	Rca											
	E	KIP 4	łK			Т	rip	Unit	: 1/0)	EKIF	Sup	ply	Modu	ıle	Mod	ule	Mod	ule	Module	е



- 54) Ekip Com Profinet
- 55) Ekip Com Devicenet ™
- 56) Ekip Com Ethernet/IP ™



Electrical accessories

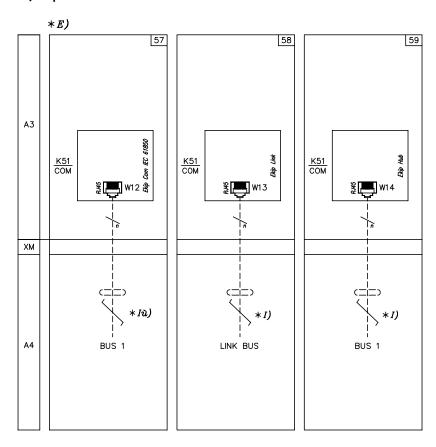
HC H1 H2 H3 H4 HC K3 K4 K5 K6 HC K7 K8 K9 K10	Ge+Szi Rct Ge-Szo Gzo Szc Gzi Rcq	K2 W4 K1 W3				
EKIP 4K	Trip Unit I/O	EKIP Supply	Module	Module	Module	Module

Module

Module

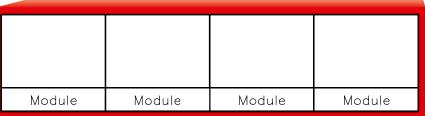
Module

- 57) Ekip Com IEC 61850
- 58) Ekip Link
- 59) Ekip Hub

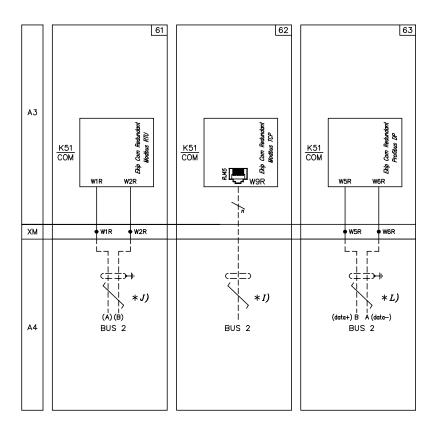


Module

НС	Н1	H2	НЗ	Н4	П		Ge+	Sz	i		K2	W4					Т				
НС	К3	K4	K5	К6		Rct	Ge-	Szc			K1	W3									
HC	K7	K8	К9	K10	¢	Gzo	Szc	Gz	i Rcc												
	EI	KIP 4	ŀK		Tı	rip	Unit	: 1/	O	Е	KIP	Sup	ply	Module	Мо	dule		Mod	ule	Мо	odule



- 61) Ekip Com Redundant Modbus RTU
- 62) Ekip Com Redundant Modbus TCP
- 63) Ekip Com Redundant Profibus DP



Module

Electrical accessories

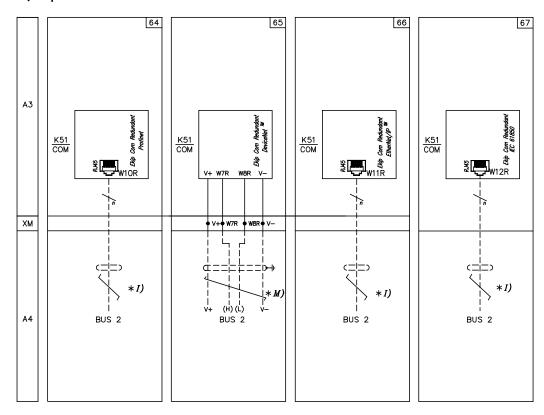
HC HC	H1 K3 K7	H2 K4 K8	K5	H4 K6 K10		Rct	Ge+S Ge-S Szc		┥ └─	1 W3					
	E	KIP 4	K		Т	rip	Unit	1/0	EKIP	Supply	Module	Modu	e M	1odule	Module

Module

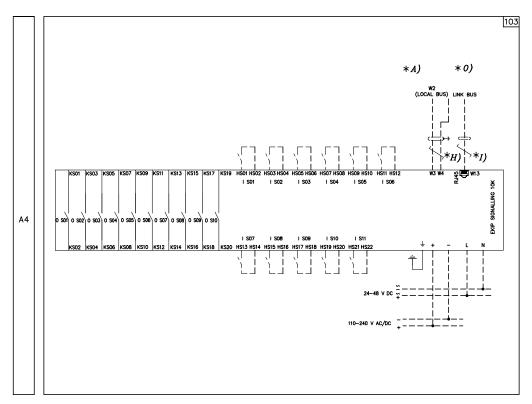
Module

Module

- 64) Ekip Com redundant Profinet
- 65) Ekip Com redundant Devicenet ™
- 66) Ekip Com redundant Ethernet/IP™
- 67) Ekip Com redundant IEC 61850



103) Ekip Signalling 10k



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CHAPTER 8

Ordering codes

104 -105	Instructions for ordering
106 -107	Ekip UP versions
107 -108	Ekip UP mandatory accessories
109 -111	Fkin UP ontional accessories

Instructions for ordering

Ordering examples

Standard version Ekip UP units are identified by means of commercial codes that can be accessorized.

Ekip UP unit as order follows this steps:

- 1. Choose of Ekip UP version with main code.
- 2. Continue to select mandatory accessories:
 - a. One type of current sensors
 - b. Installed rating plugs related to curren sen sor type chosen
 - c. Power supply module
- 3. Select optional accessories, as they can ordered mounted on the unit or loose:
 - a. Cartridge connectivity modules
 - b. Cartridge synchrocheck module
 - c. Cartridge signalling modules Remind that maximum 4 slots can be occupied by cartridge connectivity, signaling and synchrocheck modules in the Ekip UP accessoring area.
 - d. DIN-rail signalling modules
 Remind that maximum or 3 pieces of Ekip
 Signalling 10k can be connected by local bus.
 This limit is not present with Ekip Link connectivity.
 - e. External toroids
 - f. Software functions
 Remind the software compatibility described in cap. 3.
 - g. Commissioning modules
 - h. Spare parts
 - Loose rating plugs as spare part or change of nominal current, even related to installed current sensors.

Ekip UP bag-packaging contains:

- Ekip UP unit
- · Current sensors
- · Power supply modules
- Optional cartridge connectivity, synchrocheck, signaling modules

DIN-rail signalling modules (Ekip Signalling 10k, Ekip Signalling Modbus TCP), external toroids, commissioning modules, spare parts, loose rating plugs are provided only external from Ekip UP bag-packaging.

Standard warranty granted is 2 years.

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Example

Shopping list for unit with advanced protection to be installed in existing 4 pole-plant, rating plug 2500A, Modbus TCP/IP connectivity and connection to cloud platform, cartridge signalling module, synchrocheck module and 3 pieces of DIN-rail signaling modules for load shedding function:

Ekip UP version

Туре	Code
Ekip UP Protect +	1SDA083361R1

Mandatory accessories

Туре	Code	
Open CS 4P type C 120	1SDA083373R1	
Rating Plug 2500A	1SDA074268R1	
Ekip Supply 24-48Vdc	1SDA074173R1	

Optional accessories

Туре	Code
Ekip Com Modbus TCP	1SDA074151R1
Ekip Com Hub	1SDA082894R1
Ekip Synchrocheck	1SDA074183R1
Ekip Signalling 2K-1	1SDA074167R1
Load shedding - adaptive	1SDA082921R1
Ekip Signalling 10K*	1SDA074171R1
Ekip Signalling 10K*	1SDA074171R1
Ekip Signalling 10K*	1SDA074171R1

 $^{{}^*\}text{provided externally from the bag-packaging}.$

Ekip UP

Ekip UP versions



Туре	Code	
Ekip UP Monitor	1SDA083359R1	
Ekip UP Protect	1SDA083360R1	
Ekip UP Protect +	1SDA083361R1	
Ekip UP Control	1SDA083362R1	
Ekip UP Control +	1SDA083363R1	

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Ekip UP

Mandatory accessories



Current sensors







Ekip UP

Mandatory accessories



Installed Rating Plugs

Rating plugs for Ekip UP units

Туре	Code
Rating Plug 100A	1SDA074258R1
Rating Plug 200A	1SDA074259R1
Rating Plug 250A	1SDA074260R1
Rating Plug 400A	1SDA074261R1
Rating Plug 600A	1SDA079826R1
Rating Plug 630A	1SDA074262R1
Rating Plug 800A	1SDA074263R1
Rating Plug 1000A	1SDA074264R1
Rating Plug 1200A	1SDA079828R1
Rating Plug 1250A	1SDA074265R1
Rating Plug 1600A	1SDA074266R1
Rating Plug 2000A	1SDA074267R1
Rating Plug 2500A	1SDA074268R1
Rating Plug 3200A	1SDA074269R1
Rating Plug 3600A	1SDA079829R1
Rating Plug 4000A	1SDA074270R1
Rating Plug RC 100A	1SDA074288R1
Rating Plug RC 200A	1SDA074289R1
Rating Plug RC 250A	1SDA074290R1
Rating Plug RC 400A	1SDA074291R1
Rating Plug RC 630A	1SDA074292R1
Rating Plug RC 800A	1SDA074293R1
Rating Plug RC 1250A	1SDA074294R1
Rating Plug RC 2000A	1SDA074295R1
Rating Plug RC 3200A	1SDA074296R1
Rating Plug RC 4000A	1SDA074297R1



Power supply modules

Туре	Code	
Ekip Supply 24-48V DC	1SDA074173R1	

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Ekip UP

Optional accessories





Cartridge connectivity modules

Туре	Code
Ekip Com Modbus RS-485	1SDA074150R1
Ekip Com Modbus TCP	1SDA074151R1
Ekip Com Profibus	1SDA074152R1
Ekip Com Profinet	1SDA074153R1
Ekip Com DeviceNet™	1SDA074154R1
Ekip Com EtherNet/IP™	1SDA074155R1
Ekip Com IEC61850	1SDA074156R1
Ekip Com Hub	1SDA082894R1
Ekip Com R Modbus RS-485	1SDA074157R1
Ekip Com R Modbus TCP	1SDA074158R1
Ekip Com R Profibus	1SDA074159R1
Ekip Com R Profinet	1SDA074160R1
Ekip Com R DeviceNet™	1SDA074161R1
Ekip Com R EtherNet/IP™	1SDA074162R1
Ekip Com R IEC61850	1SDA076170R1
Ekip Link	1SDA074163R1



Cartridge synchrocheck modules

Туре	Code
Ekip Synchrocheck	1SDA074183R1



Cartridge signalling modules

Туре	Code
Ekip Signalling 2K-1	1SDA074167R1
Ekip Signalling 2K-2	1SDA074168R1
Ekip Signalling 2K-3	1SDA074169R1
Ekip Signalling 3T-1 AI - Temp PT1000*	1SDA085693R1
Ekip Signalling 3T-2 AI - Temp PT1000*	1SDA085694R1

^{*} External probe PT1000 with 3m cable are available as option with 1SDA085695R1

Ekip UP

Optional accessories



DIN-rail signalling modules

Туре	Code
Ekip Signalling 10k	1SDA074171R1
Ekip Signalling Modbus TCP	1SDA082485R1



External toroids

Homopolar toroid for the earthing conductor of main power supply

Туре	Code
Homopolar toroid 100A*	1SDA073743R1
Homopolar toroid 250A*	1SDA076248R1
Homopolar toroid 400A*	1SDA076249R1
Homopolar toroid 800A*	1SDA076250R1

^{*}Only as loose part

Toroid for differential protection

Туре	Code
Toroid RC small size*	1SDA073741R1
Toroid RC ig size*	1SDA073742R1

^{*}Only as loose part

SW functions

Туре	Code
IPS - Interface Protection	1SDA082919R1
Synchro reclosing	1SDA082923R1
Load shedding - adaptive	1SDA082921R1
Load shedding - predictive	1SDA082922R1



Commissioning modules

Туре	Code	
Ekip T&P - Programming and Test unit	1SDA066989R1	
Ekip TT - Trip Test unit	1SDA066988R1	
Ekip Programming	1SDA076154R1	

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Loose Rating Plugs

Rating plug for Ekip UP units

Туре	Code
Rating Plug 100A	1SDA074218R1
Rating Plug 200A	1SDA074219R1
Rating Plug 250A	1SDA074220R1
Rating Plug 400A	1SDA074221R1
Rating Plug 600A	1SDA079826R1
Rating Plug 630A	1SDA074222R1
Rating Plug 800A	1SDA074223R1
Rating Plug 1000A	1SDA074224R1
Rating Plug 1200A	1SDA079730R1
Rating Plug 1250A	1SDA074225R1
Rating Plug 1600A	1SDA074226R1
Rating Plug 2000A	1SDA074227R1
Rating Plug 2500A	1SDA074228R1
Rating Plug 3200A	1SDA074229R1
Rating Plug 3600A	1SDA079827R1
Rating Plug 4000A	1SDA074230R1
Rating Plug RC 100A	1SDA074248R1
Rating Plug RC 200A	1SDA074249R1
Rating Plug RC 250A	1SDA074250R1
Rating Plug RC 400A	1SDA074251R1
Rating Plug RC 630A	1SDA074252R1
Rating Plug RC 800A	1SDA074253R1
Rating Plug RC 1250A	1SDA074254R1
Rating Plug RC 2000A	1SDA074255R1
Rating Plug RC 3200A	1SDA074256R1

Spare Parts

Туре	Code	
DIN/DOOR installation kit	1SDA085567R1	
Cable kit	1SDA085568R1	
Cover	1SDA085569R1	
Centring device type C	1SDA085570R1	



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