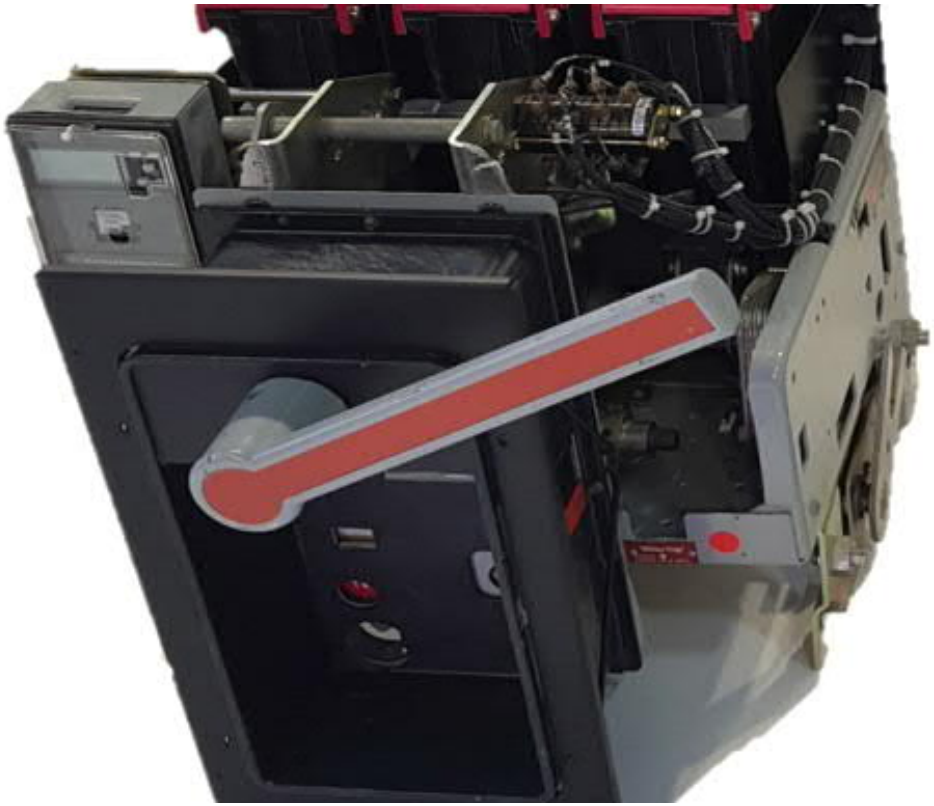


EXTERNAL

Advanced Retrofill solutions for GE legacy Breakers

Make the most of your existing equipment

EPSP Global Service

Service Product Portfolio

1-Installation and commissioning
An investment in long-term equipment's reliability

2-Training
The best way to teach how to respond efficiently in different critical situations

3-Spares and consumables
All original and genuine spare parts and upgrade kits.

4-Maintenance
Maintenance to guarantee the system's continuous operation

5-Repairs
Workshop and on site repairs by our service engineers

6-Engineering and consulting
Application recommendations and environmental best practices.

7-Extensions, upgrades and retrofits
Enhance existing equipment with the latest technologies.

8-End of life services
Equipment's recycling in line with environmental requirements

9-Replacements
Replacing old equipment can dramatically increase performance and reduce costs.

10-Advanced services
Predictive Maintenance into ABB Ability EDCS
Ekip Up to upgrade your installations

11-Service agreements
Customer support agreements for low voltage equipments

Extension, upgrades and retrofits

Time to upgrade?

Modernize by Retrofit kits

Modernize

- Safety
- Technology
- Service years
- Saving in Maintenance
- Environment-friendly
- Equipment health

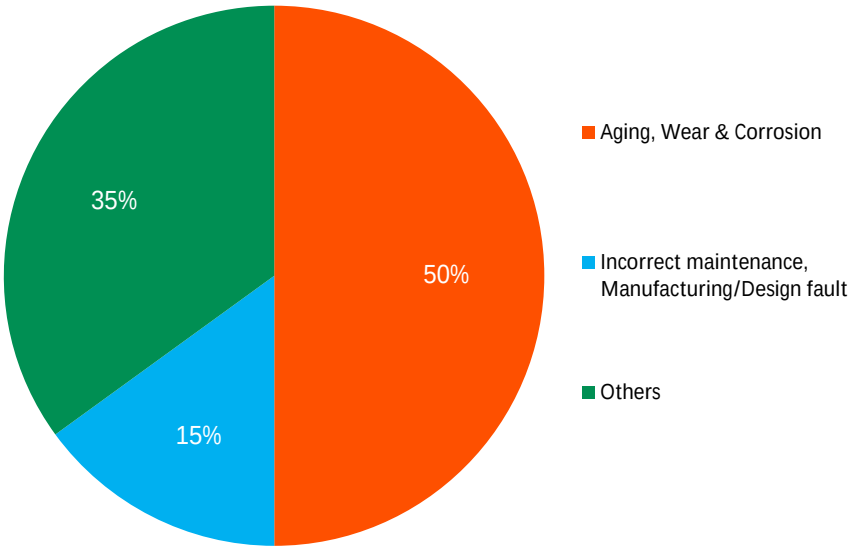
Retrofit kit

- Modern Circuit Breaker
- Low cost solution
- Profitable investment
- Sustainable solution

Upgrade of legacy systems

FACTs on maintaining outdated Switchgear

What is it?



As per the International Surveys conducted by IEEE on Circuit-Breaker Reliability Data for Substation and System Studies, 50% of the time aging, wear and corrosion have been reported as common failure mode.

Often customers continue to maintain outdated switchgear concerning

- Older power circuit breakers require extensive periodic maintenance and overhaul, which is expensive and time consuming
- Lengthens outages
- May require outside support
- Increased risk to electrical workers from arcing faults

System upgrade with Retrofill vs System Replacement

Reduced project and labor costs

Equipment needs to be replaced or upgraded in some fashion, when it exceeds normal service life. The retrofill option helps to achieve the plant's goals without a total switchgear replacement, and can result in significant project cost savings and minimized costly downtime.

Based on the Case Study

Cost savings → half of the cost of the replacement equipment, installation & Testing expenses

EVENT	TASK	INSTALLATION DURATION	SHUT DOWN REQUIRED?	PROJECT COST
Replace Switchgear	New Equipment, Wiring	>5 Days	YES	High
Swapout old Breaker with Retrofill (Assumes functions are the same)	Verify Switchgear cubicle wiring for secondary disconnect	1 to 2 hours per breaker	NO	Low
	Swapout old Breaker with Retrofill	30 minutes	NO	
	New through door installation	Based on the original equipment design	NO	

System upgrade with Retrofill vs System Replacement

Value to End User

Retrofill over complete replacement of Switch gear is especially valuable when:

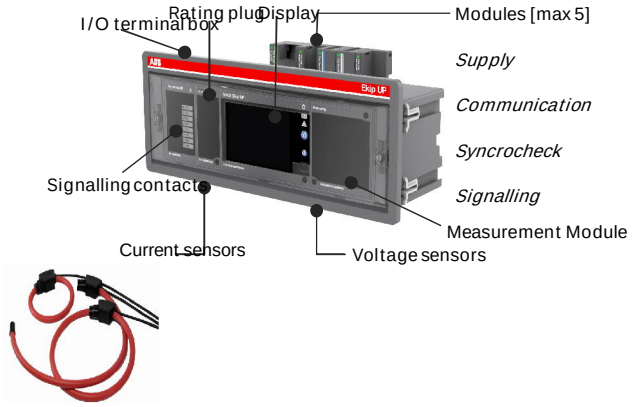
- Extended shut down of the plant to replace switchgear cannot take place due to operational commitments.
- Physical constraints of the existing space limits replacement.
- To disturb and re-terminate old existing cable systems to new switchgears is not preferred
- Where a UL certified type tested retrofill design, developed by the manufacturer, is available Equipped with new original designed power terminals and mates with existing cubicle's racking mechanism
- The switchgear structure, conduits, cabling and footprint are left intact, which saves time and money (Cost savings > half of the cost of the replacement equipment, installation & Testing expenses)
- Extend the lifespan of your electrical system keeping it live and efficient as long as possible. Minimization of CO2 emissions and raw

Switchgear Upgrade Strategies

Existing Switchgear intact, but with aging breakers

Retrofill existing Metal Frame with a modern technology, thermoset resin Power Circuit Breaker

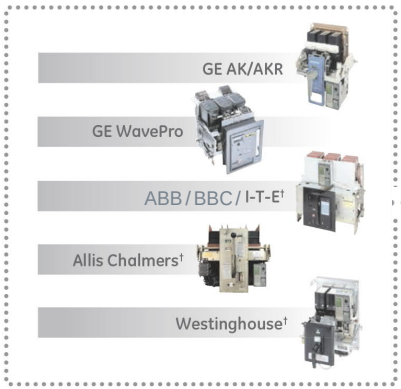
External Trip Unit Upgrade with Ekip UP



EntelliGuard TU Conversion Kits to upgrade the “Brain” of existing breaker

What is a Retrofill?

Replacing a legacy circuit breaker with a modern circuit breaker in equipment



Legacy Circuit breakers

Switchgear with legacy circuit breakers

DR or CiC solutions

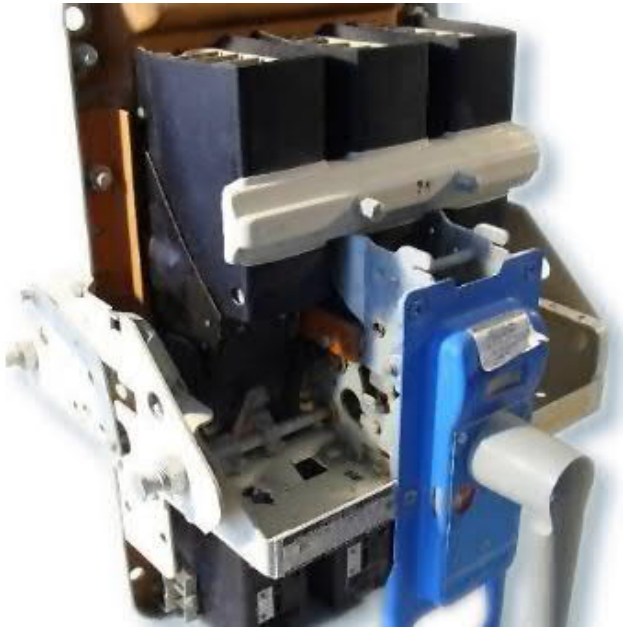
Switchgear with modern Emax2 Direct Replacement

Legacy & Installed Power Circuit Breakers and Switchgears

AK breakers for AKD5 or OEMs switchgears

AK-2A, 3A -25 / 50 / T50 / 75 / 100

AK-xA-... breaker



AKD5 switchgear

Note

AKD-5 was manufactured from 1960 until 1977, using AK-2A, 3A -25 / 50 / T50 / 75 / 100 (“A” signifies AKD-5 drawout) circuit breakers.

The switchgear is painted sand-gray (beige), with some instrument doors painted blue.

Breakers up to 2000A had primary finger clusters. 3000 & 4000A breakers had a circular primary finger cluster arrangement in the switchgear compartment. They are equipped with EC-1-or EC2 electromagnetic overcurrent trip device or type ECS, SST or PS-1 POWER SENSOR™ Solid-State Overcurrent Trip Device

AK-AKR breakers for AKD6 or OEMs Switchgear

AKR-30/30H, AKR-50/50H/T50H, AKR-75/75H, AKR-100

(ie. AKR-4A-30…50 & AKR-4C-75…100 for AKD6 and AKR-4B-30…100 for OEMs)

AKR-xA-... breaker

AKD6 switchgear

Note

AKD-6 was manufactured in Salisbury, NC from 1977 to 1981

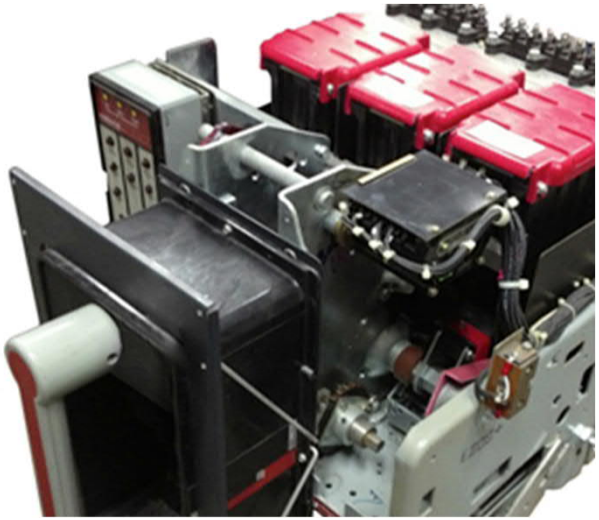
AKD-6 should mark a shift away from all AK breakers and to AKR breakers

They are painted ANSI 61 light gray and AKR breakers have ECS, SST or PS-1 POWER SENSOR™ Solid-State Overcurrent Trip Device.

AKR breakers for AKD8 or OEMs Switchgears

AKR-30/30H/30L, AKR-50/50H/T50H, AKR-75/75H, AKR-100, AKR125
(i.e. AKR-7D-30)

AKR-xD-.. Breaker



AKD10 Switchgear

Note

AKD-8 was manufactured in Salisbury, NC from 1980 to 1984 and in Burlington, Iowa from 1984 to 1999.

It was mostly replaced by AKD-10 in 1999 to 2000 but was available thru 2015.

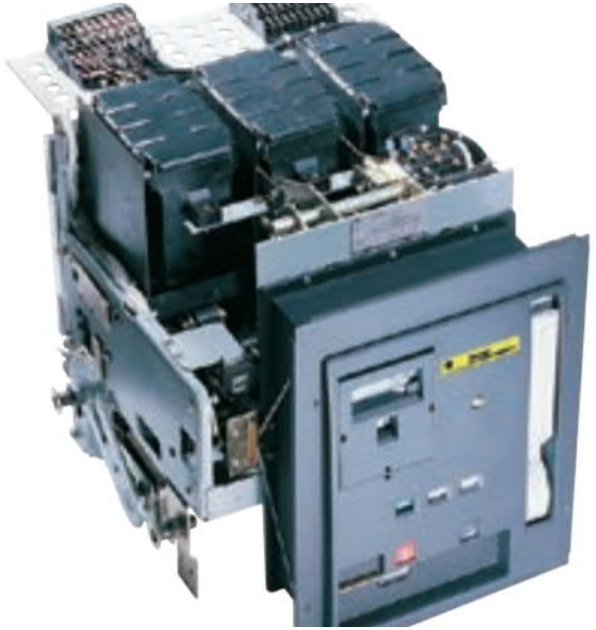
AKR breakers use MicroVersaTrip 9, MVT RMS9, EPIC, MVT Plus, MVT PM, or EntelliGuard TU trip units.

In AKD-8, most 800-2000A breakers are “feeder” breakers with vertical lower stud & primary disconnect fingers clusters, but 800-2000A breakers designated as “Main” breakers, have horizontal lower finger clusters.

WavePro breakers for AKD10 or OEMs Switchgears

WPS-08, WPH-08, WPX-08, WPS-16, WPH-16, WPS-20, WPS-32, WPH-32 WPX-32, WPS-40, WPX-40, WPS-50, WPX-50

WavePro breaker



ADK10 switchgear

Note

AKD-10 was manufactured in Burlington, IA from 1999 thru 2015.

AKD10 use WavePro™ circuit breakers. Power+ trip, MicroVersaTrip Plus and MicroVersaTrip PM are the trip unit systems installed in WP breakers

WavePro circuit breaker with electrical accessories has dedicated wiring into secondary plugs (1 or 2 plugs according installed ones)

Emax2 Retrofill solutions

Direct Replacement & Cradle in Cradle with Emax 2 power circuit breaker

Value propositions

Reduced project and labor costs

- Retains existing switchgear structure, conduits, cabling and footprint
- Secondary disconnect wiring connection works without modifications to your switchgear
- Innovative neutral CT adapter design allows you to use existing neutral CT in your switchgear
- Maintains UL listings without additional charges

Minimized downtime

- Minimal or no cubicle modifications means less time to change out
- Compatible with shutters racking mechanism in existing circuit breaker cubicles
- Interfaces with original cubicle secondary disconnects, position switches and neutral disconnects

Protection for people and equipment

- Exclusive Ekip Trip Unit technology uses zone selective interlocking (ZSI), Dual setting protection, reduced energy let-through (RELT), and can reduce arc flash energy without sacrificing selectivity settings.
- Trip unit and all indicators are visible through the door; through-the-door and remote racking helps reduce exposure to arc flash or electrical shock

Continuous operation

- PREDICT feature in ABB AbilityTM ECDS for Predictive Maintenance. Reduction of the total life cost of the switchgear and spare parts availability.
- Diagnosis and installation with Ekip Connect Software.

Sustainability

- Extend the lifespan of your electrical system keeping it live and efficient as-long-as possible. Minimize CO2 emissions and natural resources usage.

DR Emax 2 for AK

ANSI C37 / UL 1066 – for GE AKD5 and OEMs Switchgears

Emax E2.2 into EGG cradle Envelope 1 (up to 1600A)

DR Emax E2.2 for AKT-50 (up to 2000A)

Switchgear type	Thermal rating max [A]	Legacy Breaker type	Frame size [A]	Retrofill solution	Interrupting rating with inst. [kA]			Interrupting rating without inst. [kA]		
					240V	480V	600V	240V	480V	600V
AKD5/OEM	600	AK-25	600	CiC Emax E1.2B	42‡	42‡	30‡	22	22	22
	1600	AK-50, AKJ-50, AKS-50	1600	CiC Emax E2.2S	65	65	50	65	65	50
	2000	AKT-50, AKJT-50, AKST-50, AKJT-50H	2000	DR Emax E2.2S	65	65	50	65	65	50
	3000	AK-75	3000	CiC Emax E4.2H	85	65	65	65	65	65
	4000	AK-100	4000	CiC Emax E6.2V	100*	85	85	85	85	85

‡Retrofill offers increased ratings on AK25 and AKR30S with no cubicle modifications required. AK25 was 22 kAIC and AKR30S was 30 kAIC.

Orders from

Senatobia, US

Applications

GE AKD5 and OEMs switchgears

3p

Factory involved

Senatobia, US

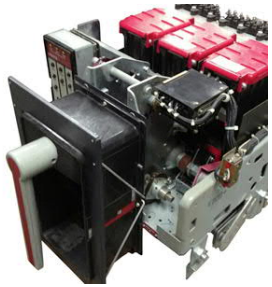
Availabilty for orders:

Wave1: Available for sales

Wave2 (above 2000A): scheduled in Q1-2021

DR Emax 2 for AKR

ANSI C37 / UL 1066 – for GE AKD8 and OEMs Switchgears



Emax E2.2 for AKR-30

DR Emax E4.2 for AKR-100

Switchgear type	Thermal rating max [A]	Legacy Breaker type	Frame size [A]	Retrofill solution	Interrupting rating with inst. [kA]			Interrupting rating without inst. [kA]		
					240V	480V	600V	240V	480V	600V
AKD8/OEM	800	AKR-30S	800	DR Emax E2.2S	42‡	42‡	42‡	42‡	42‡	42‡
		AKR-30, AKR-30H		DR Emax E2.2S	50	42	42	42	42	42
		AKR-30L		DR Emax E2.2S	65	65	50	65	65	50
	1600	AKR-50, AKR-50H	1600	DR Emax E2.2S	65	65	50	65	65	50
	2000	AKRT-50, AKRT-50H	2000	DR Emax E2.2S	65	65	65	65	65	65
	3200	AKR-75	3200	DR Emax E4.2H	85	65	65	65	65	65
		AKR-75H		DR Emax E4.2V	100*	85	85	85	85	85
	3600	AKR-100	3600	DR Emax E4.2V	100*	85	85	85	85	85
	4000	AKR-100	4000**	DR Emax E4.2V	100*	85	85	85	85	85
	5000	AKR-125	5000	DR Emax E6.2V	100*	85	85	85	85	85

*Retrofill perfomances are reduced from 130kA to 100kA.

** fan coled for 4000A, 3600A without fans

‡Retrofill offers increased ratings on AK25 and AKR30S with no cubicle modifications required. AK25 was 22 kAIC and AKR30S was 30 kAIC.

Orders from

Senatobia, US

Applications

GE AKD8 and OEMs switchgears

3p

Factory involved

Senatobia, US

Availabilty for orders:

Wave 1: Available for sales

Wave 3 (fusible solutions): Scheduled in Q2-2021

DR Emax 2 for WavePro™

ANSI C37 / UL 1066 – for GE AKD10 and OEMs Switchgears

DR Emax for WP 20

DR Emax E6.2 for WP-50

Switchgear type	Thermal rating max [A]	Legacy Breaker type	Frame size [A]	Retrofill solution	Interrupting rating with inst. [kA]			Interrupting rating without inst. [kA]		
					240V	480V	600V	240V	480V	600V
AKD10 / OEM	800	WPS-08	800	DR Emax E2.2S	42	30	30	30	30	30
		WPH-08		DR Emax E2.2S	50	42	42	42	42	42
		WPX-08		DR Emax E2.2S	65	65	50	65	65	50
	1600	WPS-16	1600	DR Emax E2.2S	65	50	42	50	50	42
		WPH-16		DR Emax E2.2S	65	65	65	65	65	65
	2000	WPS-20	2000	DR Emax E2.2S	65	65	65	65	65	65
	3200	WPS-32	3200	DR Emax E4.2H	85	65	65	65	65	65
		WPH-32		DR Emax E4.2V	100*	85	85	85	85	85
		WPX-32		DR Emax E4.2V	100*	100	85	100	100	85
	3600	WPS-40	3600	DR Emax E4.2V	100*	85	85	85	85	85
		WPX-40		DR Emax E4.2V	100*	100	85	100	100	85
	4000	WPS-40	4000**	DR Emax E4.2V	100*	85	85	85	85	85
		WPX-40		DR Emax E4.2V	100*	100	85	100	100	85
	5000	WPS-50	5000	DR Emax E6.2V	100*	85	85	85	85	85
		WPX-50		DR Emax E6.2V	100*	100	85	100	100	85

*Retrofill perfomances are reduced from 130kA to 100kA.

** fan coled for 4000A, 3600A without fans

Orders from

Senatobia, US

Applications

GE AKD10 and OEMs switchgears

3p

Factory involved

Senatobia, US

Availabilty for orders:

Wave 1: Available for sales

Wave 3 (fusible solutions): Scheduled in Q2-2021

DR solution for Wave Pro are prewired to secondary disconnect according to intalled accessories

SACE Emax 2

Features and Trip unit versions

Emax 2 Retrofill solutions

Concept

SACE Emax 2 Retrofill solutions use the robust Emax 2 power circuit breakrs as their core to improves the efficiency of electrical systems, creating the new standard in:

1. **Performance** — Satisfying all requirements at the right size
2. **Control** — Optimization of power flow even in emerging microgrid application
3. **Connectivity** — Integration into any digital system
4. **Ease of use** — Simplified user experience; at all customer interactions during the product's lifecycle

SACE Emax 2 is the evolution of the Circuit Breaker into the Power Manager

SACE Emax 2
Trip unit solutions

Ekip Dip: The standard trip unit

- Current protection for basic distribution
- Thermal memory, separate settings for neutral
- LED signals trip cause; time and date of last trip available

Ekip Touch: The smart trip unit

More than Ekip Dip:

- Ready to be upgraded and customized
- Advanced protection set for more sophisticated systems (GFext + 2I)
- Ready for measuring
- Embedded Bluetooth
- Suitable for Predict on EDCS

Ekip Hi-Touch: The ultimate trip unit

More than Ekip Touch:

- Advanced preloaded feature set
- Class 1 accuracy
- Exclusive directional protection for complex grids
- Dual setting for smart grids and arc-flash
- Self-power

SACE Emax 2

Performance

Measures

All the electrical parameters at your disposal without any additional components

Current, Voltage, Phase sequence, Frequency, Power, Energy, Power factor, Peak factor

Accuracy

Class 1 in Energy and Power according to IEC 61557-12

Accuracy: Current 0.5%, Voltage 0.5%, Power 1%, Energy 1%

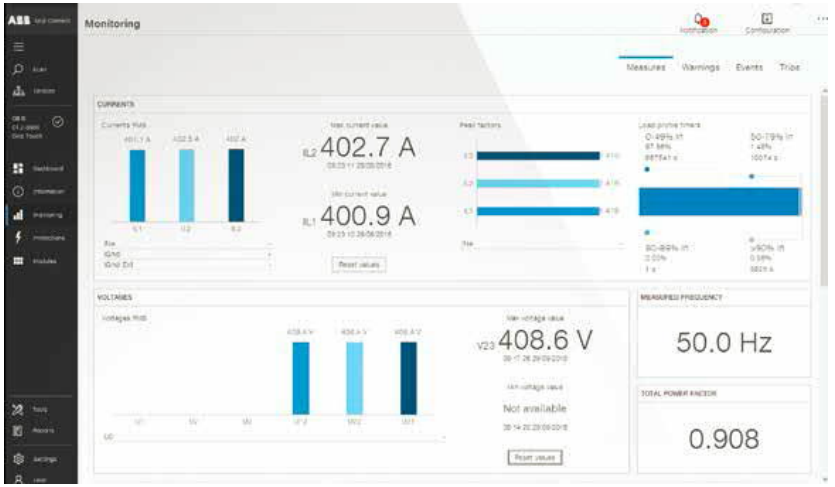
Availability

Data available at any time

24/7

Instantaneous values

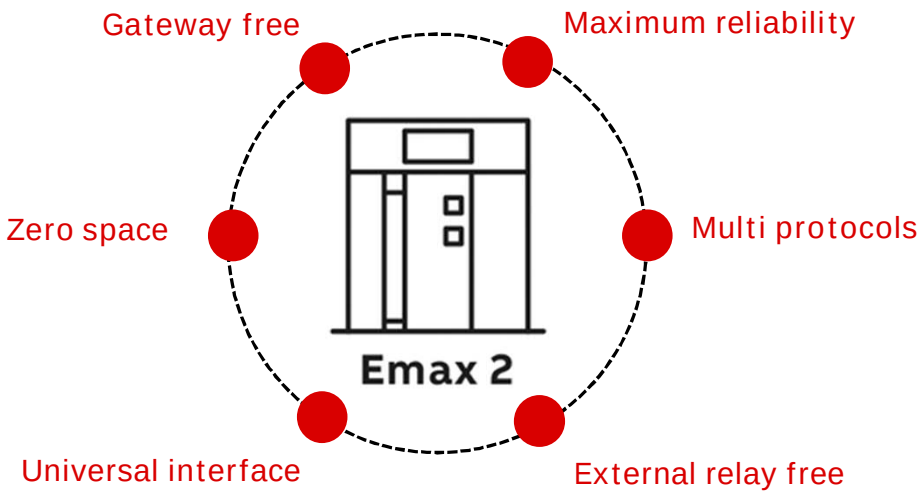
Historical measurement



A complete, accurate and easily accessible solution

SACE Emax 2

Connectivity



Key features

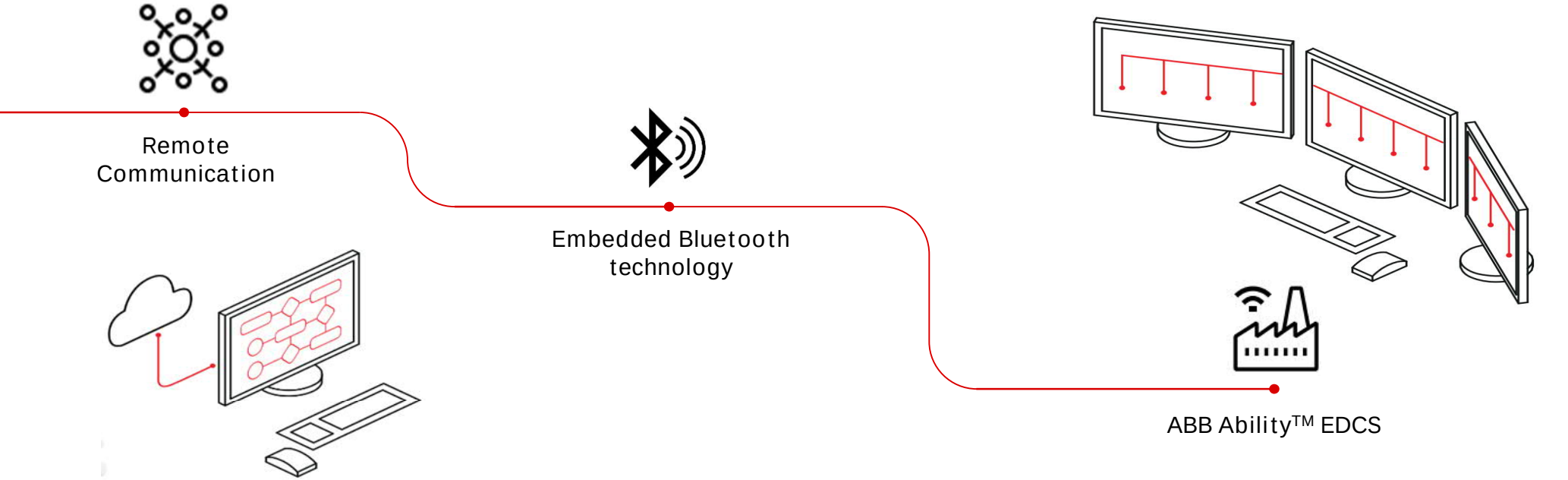
- Plug & play communication cartridge modules avoiding external gateway and other interfaces
- A wide selection of field bus protocols to simplify integration to any system and network
- First circuit breaker with IEC61850 communication, avoiding external relays and complex integration
- Multi-protocol platform ensuring different protocols work together
- Direct cloud connectivity to ABB Ability for valued added services
- Wide set of analog and digital interfaces to interact with any ecosystem
- Embedded Bluetooth connectivity

Fully integrated, just one single product can replicate the functionality of many

SACE Emax 2

Connectivity

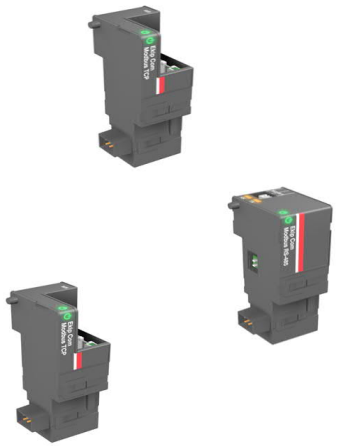
A full range of possibilities



SACE Emax 2

Connectivity

Plug & Play modules



Plug&play communication cartridge modules enable direct communication with the seven most common industrial communication protocols and the cloud:

- Modbus RTU, Modbus TCP, Profibus DP, DeviceNet, ProfiNet, Ethernet/IP, IEC 61850, Com Hub

Multiple modules can be used simultaneously.

Additionally, Emax 2 offers a wide range of analog and digital I/O to acquire external measurement (i.e temperature) and signals.

The most flexible and comprehensive connectivity offering

SACE Emax 2

Connectivity

Embedded Bluetooth

- Easy protection setting and information access
- Possibility to upgrade the circuit breaker through SW packages available on ABB Ability Marketplace™
- Safe commissioning of the device
- Import and export settings by EPIC

Always connected and up to date

SACE Emax 2

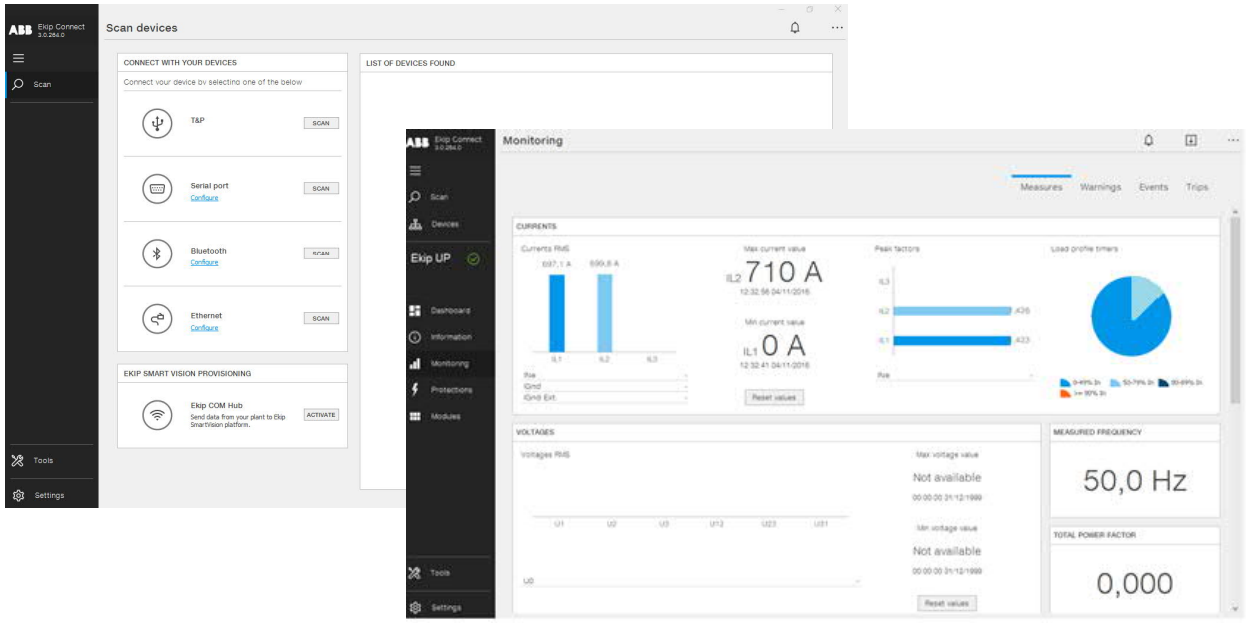
Ease of use - Commissioning

Easy and fast commissioning by Ekip Connect:

- Device setting
- Protection setting
- Diagnostics
- Reporting
- Testing

Versions:

- Ekip connect 3 laptop
- EPiC Mobile app



50% time saved during trip units commissioning

Trip unit Evolution / Comparison

Trip Units features 1/2

	Trip Unit Type	Power Sensor (PS1)	Type ECS	Type SST	MicroVersaTrip®	RMS9	EPIC™ RMS9	MicroVersaTrip® Plus /PM	Enhanced MicroVersaTrip® Plus / PM	Power+™	MicroVersaTrip® Plus / PM	EntelliGuard® TU AKR, Power Break®, Conv. Kits	EntelliGuard® TU Power Break® II, WavePro	EntelliGuard® TU EntelliGuard® G	Ekip Dip	Ekip Touch / Ekip Hi-Touch
	Products	AK	AK, AKR	AK, AKR	AKR, Power Break	AKR, Power Break	AKR, Power Break	AKR, Power Break	Replaces RMS9 & MicroVersaTrip® Plus/PM trip units	WavePro / Power Break II	WavePro / Power Break II	AKR & Power Break® circuit breakers & Conv. Kits	Power Break® II & WavePro circuit breakers	EntelliGuard® G, EntelliGuard R Retrofills	Emax2 & Emax 2 Retrofill circuit breakers	Emax2 & Emax 2 Retrofill circuit breakers
Trip functions	LCD Display	-	-	-	-	-	-	S	S	-	S	S	S	S	-	S
	LT, LT Delay	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	Short Time (ST), ST Delay	O	O	O	O	O	O	O	O	O	O	S	S	S	O	O
	ST I^2t In/Out	O	O	O	O	O	O	O	O	O	O	S	S	S	O	O
	Instantaneous	O	O	O	O	O	O	O	O	O	O	S	S	S	S	S
	Ground Fault (GF), GF Delay	O	-	O	O	O	O	O	O	O	O	O	O	O	O	O
	GF I^2t In/Out	-	-	-	O	O	O	O	O	O	O	O	O	O	O	O
	Neutral Sensor for 3pole CB on 4 wire systems	O	O	O	O	O	O	O	O	O	O	O	O	(1)	(1)	(1)
	Switchable GF (not UL)	-	-	-	-	O	O	O	O	O	O	O	O	O	O	O
	Zone Selective Interlock	-	-	-	O	O	O	O	O	-	O	O	O	O	-	O
	Directional Zone Selective Interlock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O / S
Local metering	Current (A, kA)	-	-	-	-	-	M	S	S	-	S	S	S	Y	-	S
	Voltage (V)	-	-	-	-	-	M	- / Y	- / Y	-	- / Y	O	O	O	-	O / S
	Energy (kWh,MWh,GWh)	-	-	-	-	-	M	- / Y	- / Y	-	- / Y	O	O	O	-	O
	Non-Volatile Memory	-	-	-	-	-	M	-	- / Y	-	- / Y	Y	Y	Y	-	Y
	Real Power (kW,MW)	-	-	-	-	-	M	- / Y	- / Y	-	- / Y	O	O	O	-	O
	Total Power (kVA,MVA)	-	-	-	-	-	M	- / Y	- / Y	-	- / Y	O	O	O	-	O
	Frequency (Hz)	-	-	-	-	-	M	- / Y	- / Y	-	- / Y	O	O	O	-	O
Local Protective relays	Current Unbalance	-	-	-	-	-	M	- / O	- / O	-	- / O	O	O	O	-	O
	Voltage Unbalance	-	-	-	-	-	M	- / O	- / O	-	- / O	O	O	O	-	O
	Overvoltage	-	-	-	-	-	-	- / O	- / O	-	- / O	O	O	O	-	O
	Undervoltage	-	-	-	-	-	M	- / O	- / O	-	- / O	O	O	O	-	O
	Power Reversal	-	-	-	-	-	M	- / O	- / O	-	- / O	O	O	O	-	O
	Power Reversal Direction	-	-	-	-	-	-	-	- / O	-	- / O	O	O	O	-	O
	Fault Current Magnitude/Phase	-	-	-	-	-	-	-	Y	-	Y	Y	Y	Y	-	O

* Some options require 24VDC additional hardware to enable Metering, Relaying, RELT, ZSI, Communication to be added to the breaker, equipment cubicle and equipment sections.
S= supplied as standard
M= module or device needed

O= Optional
1 = Optional (with NCT adapter for Retrofill)
2 = Optional (with summing CTs)
3 = Optional (with summing CTs & MDGF connector)

Trip unit Evolution / Comparison

Trip Units features 2/2

	Trip Unit Type	Power Sensor (PSI)	Type ECS	Type SST	MicroVersaTrip®	RMS9	EPIC™ RMS9	MicroVersaTrip® Plus /PM	Enhanced MicroVersaTrip® Plus / PM	Power+™	MicroVersaTrip® Plus / PM	EntelliGuard® TU AKR, Power Break®, Conv. Kits	EntelliGuard® TU Power Break®II, WavePro	EntelliGuard® TU EntelliGuard® G	Ekip Dip	Ekip Touch / Ekip Hi-Touch
	Products	AK	AK, AKR	AK, AKR	AKR, Power Break	AKR, Power Break	AKR, Power Break	AKR, Power Break	Replaces RMS9 & MicroVersaTrip® Plus/PM trip units	WavePro / Power Break II	WavePro / Power Break II	AKR & Power Break® circuit breakers & Conv. Kits	Power Break® II & WavePro circuit breakers	EntelliGuard® G, EntelliGuard R Retrofills	Emax2 & Emax 2 Retrofill circuit breakers	Emax2 & Emax 2 Retrofill circuit breakers
Misc.	Overcurrent Trip Operations Counter	-	-	-	-	-	-	-	Y	-	Y	Y	Y	Y	M	Y
	UVR, Shunt Trip Targets	-	-	-	-	-	-	-	-	-	Y	-	Y	-	-	-
Enhancements	Waveform Recognition Instantaneous	-	-	-	-	-	-	-	-	-	-	S	S	S	-	S
	Status and Event Log with Date Time* (10 Events)	-	-	-	-	-	-	-	-	-	-	S	S	S	M	S
	Thermal Memory	-	-	-	-	-	-	-	-	-	-	S	S	S	S	S
	Waveform Capture*	-	-	-	-	-	-	-	-	-	-	O	O	O	-	S
	Zone Selective Interlock Instantaneous*	-	-	-	-	-	-	-	-	-	-	O	O	O	-	O / S
	Reduced Energy Let Through*	-	-	-	-	-	-	-	-	-	-	O	O	O	-	O
	Suitable with IGF protection for multi-sourced electrical system	-	-	-	O	O	O	O	O	O	O	O	O	(1)	(1)	(1)
	Suitable with MDGF protection for multi-sourced electrical system	-	-	-	-	-	-	-	-	-	-	-	-	(2)	-	(3)
	Setup Software	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	-	Y

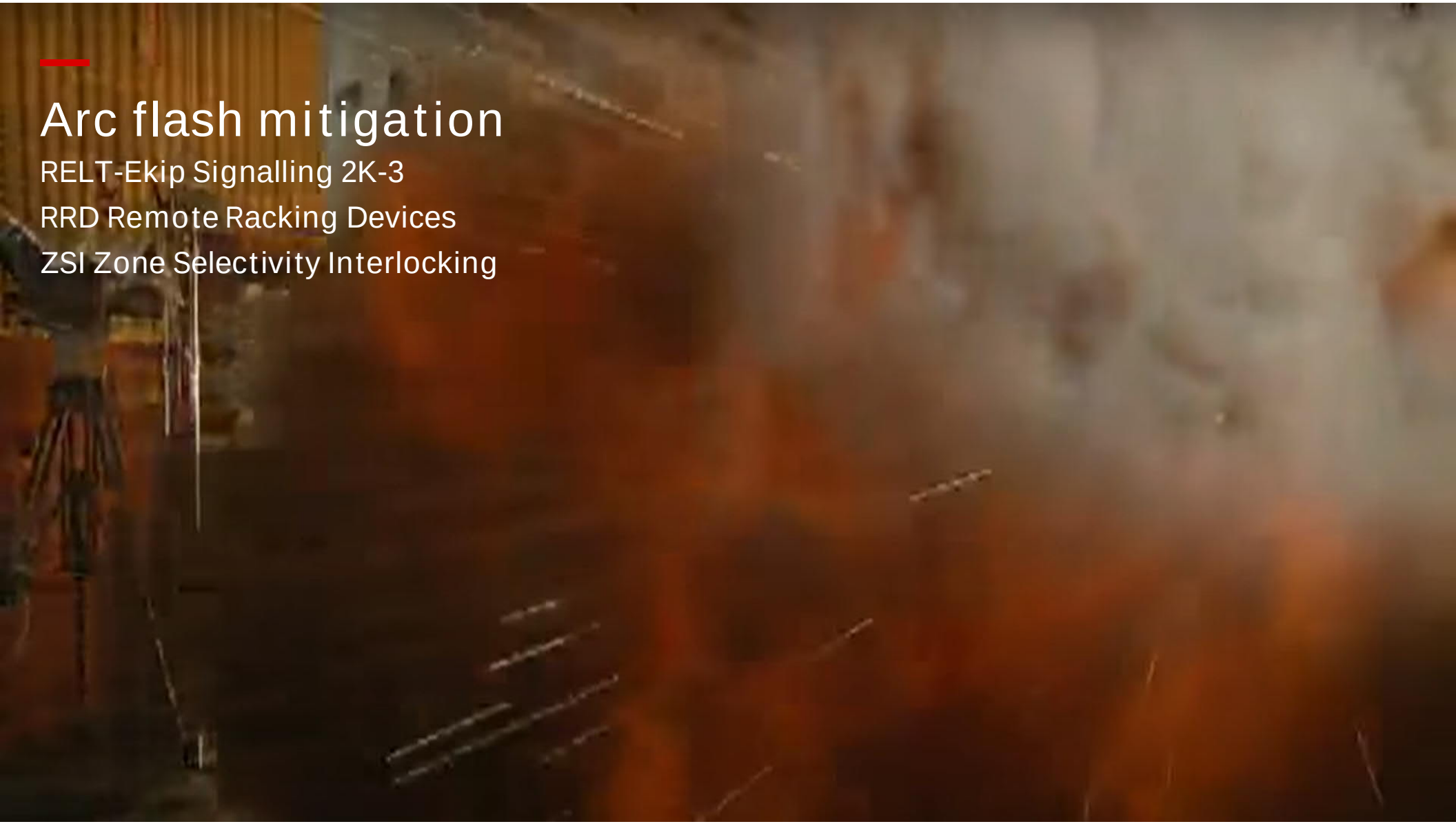
* Some options require 24VDC additional hardware to enable Metering, Relaying, RELT, ZSI, Communication to be added to the breaker, equipment cubicle and equipment sections.
S= supplied as standard
M= module or device needed

O= Optional
1 = Optional (with NCT adapter for Retrofill)
2 = Optional (with summing CTs)
3 = Optional (with summing CTs & MDGF connector)

Accessories comparison

Legacy vs Active accessories compatibility

AK for AKD5/OEM	AKR for AKD-6, AKD8/OEM	WavePro for AKD10/OEM		Emax 2 Retrofill Solutions	
				DR	CiC
Shunt Trip 1 (*)	Shunt Trip 1 (*)	Shunt Trip 1 (*)	→	Emax 2 YO - shunt opening release	Emax 2 YO - shunt opening release
Shunt Trip 2 (*)	Shunt Trip 2 (*)	Shunt Trip 2 (*)	→	Emax 2 YO2 - second shunt opening release (alternative YU)	Emax 2 YO2 - second shunt opening release (alternative YU)
Remote Close Solenoid by remote contact	Remote Close Solenoid - in series w/ "F" Switch & aux "B" contact	Remote Close Accessory (*)	→	Emax 2 YC - shunt closing release	Emax 2 YC - shunt closing release
(*) = coil continuity of legacy equipment is obtained with simple low voltage injection	(*) = coil continuity of legacy equipment is obtained with simple low voltage injection	(*) = coil continuity of legacy equipment is obtained with simple low voltage injection	→	Emax 2 YO/YC Test Unit - necessary rewiring in the cubicle	Emax 2 YO/YC Test Unit - necessary rewiring in the cubicle
Under Voltage Device	Under Voltage Device	Under Voltage Device	→	Emax 2 standard YU - undervoltage release	Emax 2 standard YU - undervoltage release
Time Delay Devices	Time Delay Devices	Time Delay Devices	→	Emax 2 UVD - Necessary a re-wiring on the cubicle	Emax 2 UVD - Necessary a re-wiring on the cubicle
Electric Lockout (must energize at least 85% of rated Voltage to Close CB. Will not Trip breaker)	Electric Lockout (must energize at least 85% of rated Voltage to Close CB. Will not Trip breaker)	Electric Lockout (must energize at least 85% of rated Voltage to Close CB. Will not Trip breaker)	→	Not available - Necessary a re-wiring on the cubicle with new logic	Not available - Necessary a re-wiring on the cubicle with new logic
AK-25 (Solenoid) AK-50/75/100 Motor Operator	Spring Charge Motor	Spring Charge Motor	→	Emax 2 Spring charge motor	Emax 2 Spring charge motor
O/C Aux Switch	O/C Aux Switch (5NO-5NC)	O/C Aux Switch (6NO-6NC)	→	Emax 2 O/C Aux switch (internal Q4 standard+Q6optional). Form C (**)	Emax 2 O/C Aux switch (internal Q4 standard+Q6optional). Form C (**)
Remote Charge Indicator Switch (F Switch part of closing Circuit)	Remote Charge Indicator Switch (F Switch used in Closing Control Circuit)	Remote Charge Indicator Switch - Optional N.O. dry contact	→	Emax 2 AUX Spring charged S33 M/2 (**)	Emax 2 AUX Spring charged S33 M/2 (**)
Optional Bell Alarm w or w/o Lockout (Two Dry Contacts) 2 NO or 2 NC or 1NO + 1 NC	Optional Bell Alarm w or w/o Lockout (Two Dry Contacts) 2 NO or 2 NC or 1NO + 1 NC	Optional Bell Alarm w or w/o Lockout (two Form C switch Contacts) Mechanical Yellow button (Local Push to Reset or automatic Reset upon Reclosing)	→	Emax 2 bell alarm (change over form C) S51/1 (standard supply for automatic CBs), S51/2 (Dry contacts) (**)	Emax 2 bell alarm (change over form C) S51/1 (standard supply for automatic CBs), S51/2 (Dry contacts) (**)
N/A	N/A	Bell Alarm Indication - Mechanical Yellow button (Local Push to Reset or automatic Reset upon Reclosing)	→	Emax 2 - TU reset (standard supply for automatic CBs)	Emax 2 - TU reset (standard supply for automatic CBs)
Position Switch In compartment to show Connected Position (6 switches max)	Position Switch In compartment to show Connected Position (6 switches max)	Position Switch In compartment to show Connected Position (6 switches)	→	Re-use switchgear position switch - Replacement Breaker frame will push pos switch	Emax 2 AUP - (5 or 10 form C contacts) (**)
Key Interlock in open Position	Key Interlock in open Position	Key Interlock in open Position	→	Emax 2 - KLC	Emax 2 standard - KLC
Pad Locks in open position	Pad Locks in open position	Pad Locks in open position	→	Emax 2 - PLC	Emax 2 standard - PLC
Kirk Key Interlocks	Kirk Key Interlocks	Kirk Key Interlocks	→	Use Switchgear Kirk Key. Interface is part of Standard replacement breaker	CiC New Kirk key Interlock
N/A	Operations Counter	Operations Counter	→	Emax 2 - Mechanical operation counter MOC	Emax 2 standard - MOC
Neutral CT - Power Sensor in AKD-5 (circa 1963-1975) incompatible. Must change to MVT compatible iron core neutral & use NCT Adapter for Emax 2. If compartment has single pin Neutral Connector, must update to two plunger design.	Neutral CT -SST in AKD-6 (circa 1975-'80) incompatible. Must change to MVT compatible iron core neutral & use NCT Adapter. Neutral CT = MVT in AKD-8 (circa 1980) and later. Any MVT, RMS-9, MVT Plus/PM or EntelliGuard TU Conversion Kits used this type iron core neutral CT. Use NCT Adapter to convert the Neutral signal from MVT milliamps to Rogowski voltage. NCT Adapters for EntelliGuard R Retrofills are different from series required for Emax 2 Retrofills.	Neutral CT - iron core MVT compatible from ~1980-2015. 200, 400 or 800 milliAmp Output at rated current. Use NCT Adapters as noted for AKD-8.	→	Replace Power Sensor or SST Neutral CT. Confirm MVT compatible CT (TSVG type or other) - convert output from amps to volts with New NCT adapter mounted on Retrofill CB.	Replace or confirm MVT compatible CT (TSVG type or other) - convert output from amps to volts with New NCT adapter



Arc flash mitigation

RELT-Ekip Signalling 2K-3

RRD Remote Racking Devices

ZSI Zone Selectivity Interlocking

What is an arc flash

Arc flash is a dangerous condition that occurs when there is a loss of insulation between two live conductors inside electrical equipment.

Arc Flash numbers per year

400 arc flash deaths

7,000 burn injuries every year

2,000 hospitalizations

30,000 arc flash incidents

It is the light and heat generated by the electrical arc that can cause substantial damage.

Temperature of 20000°C

Fire

Noise blast up to 160 db

Explosion spray molten metal at speed up to 1600 km/h

Arc Flash is measured in terms of incident energy (cal/cm2) used to determine the level of the Personal Protective Equipment (PPE)

https://allumiax.com/blog/2019-statistics-arc-flash-explosions-occur-every-day-arc-flash-accidents

Arc flash standard regulations

NEC 2017 -ARTICLE 240.87

240.87 Arc Energy Reduction. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200 A or higher, 240.87(A) and (B) shall apply.

(A) Documentation. Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).

(B) Method to Reduce Clearing Time. One of the following or approved equivalent means shall be provided:

1. Zone-selective interlocking
2. Differential relaying
3. Energy-reducing maintenance switching with local status indicator
4. Energy-reducing active arc flash mitigation system
5. An instantaneous trip setting that is less than the available arcing current
6. An instantaneous override that is less than the available arcing current
7. An approved equivalent means

RELT - Reduced energy let through feature

Energy-Reducing Maintenance Switching with local status indicator

Energy-reducing maintenance switching with local status indicator is the most common technique to reduce the risks when personnel are near the equipment. When activated, this switch decreases the circuit breaker's tripping time and threshold to a safer level.

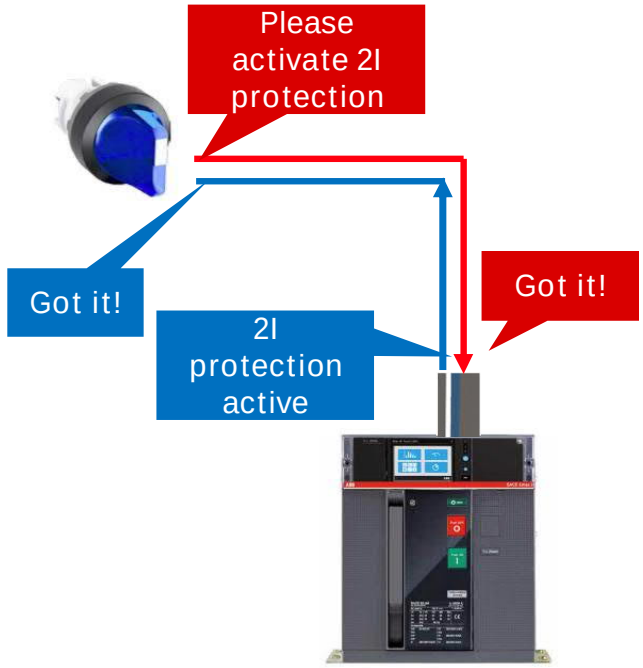
The local switch is typically mounted in front of the cabinet door in order to have the possibility to activate the switch when the door is closed. This switch should include a means to LOTO (Lock Out Tag Out).

This switch should include positive feedback input with indication that confirms the circuit breaker is in the safer condition.

RELT - Reduced energy let through feature

How it works

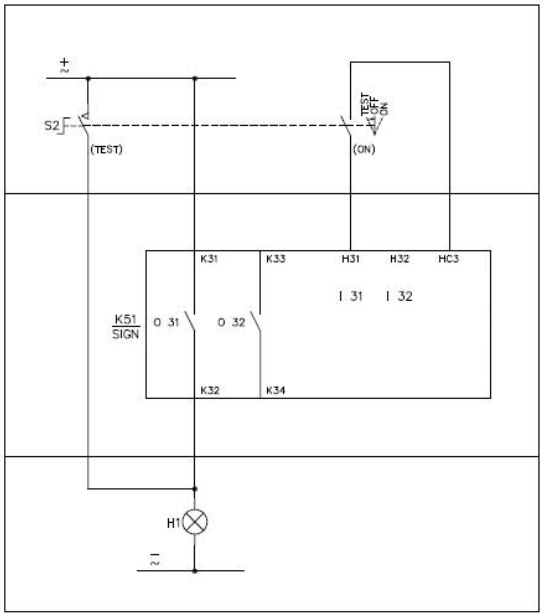
- Prior to approaching the equipment, the maintenance operator activates the Energy Reducing Maintenance Switch
- This switch sends the input to the circuit breaker in order to activate the 2I protection
- Once the protection is active the circuit breaker closes an output that provides the positive feedback to the operator. This output should be wired to a visual indicator (example selector switch with embedded LED)
- When the work is over, the switch can be turned OFF ensuring the circuit breaker returns to its normal configuration.



RELT - Reduced Energy Let Through

How to activate the RELT funtion

Wire



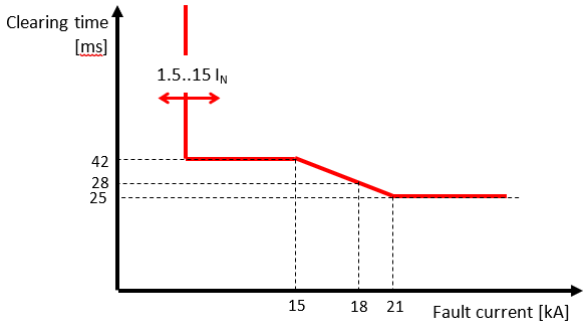
Install

- Install the module and power up with 24V*
- Select the menu Advanced → 2I protection → RELT Wizard
- Press YES on the installation wizard

*RELT Wizard page appear automatically at the first trip unit starting up

Protect

- Less than 28ms clearing time above 18kA at 60Hz



RELT - Reduced Energy Let Through

Emax 2 and Retrofill solutions

The ABB low voltage circuit breaker's version of an Energy Reducing Maintenance switch is RELT, or Reduced Energy Let Through.

When enabled, this feature automatically assigns the digital I/O to allow for remote activation and positive feedback. When triggered, the input activates the fast and safe 2I protection while the output provides the maintenance personnel an indication that the circuit breaker is in its safe mode.

The "2I" protection, is a temporary protection that is faster than the normal instantaneous protections. Depending on the fault current this function can provide a full clearing time as low as 1.5 cycles at 60Hz!

Shopping List

Emax 2
with touch trip unit

Switch with led indication
(example: GTURSK or ABB pilot devices)

RELT-Ekip Signalling 2K-3*
I/O module + Ekip Supply module

RRD - Remote Racking Devices

ABB is constantly committed to the safety of the personnel during every phase of use of its products, including installation and maintenance. During the rack-in operations of the circuit-breaker, the RRD prevents risk of injuries due to possible electric arc.

The device only works with the circuit breaker in the open position and with the springs discharged.

The remote control is connected to the main device with 30 ft cable which allows the Racking-in/out command from a remote location.

The cable length guarantees enough distance from the arc flash boundary for traditional LV switchgear.

Two solutions are available for DR or CiC solutions

RRD for
CiC Emax2

RRD for
DR Emax2

ZSI – Zone Selectivity Intelocking

On S, I or D protection

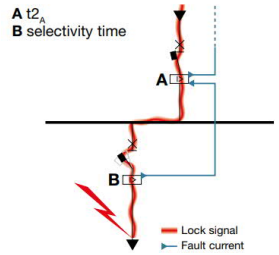
ZSI can be used to minimize circuit-breaker trip times closer to the fault.

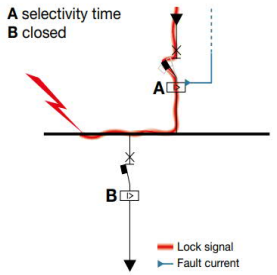
The protection is provided by connecting all the zone selectivity outputs of the trip units belonging to the same zone and taking this signal to the trip unit input that is immediately upstream.

Each circuit breaker that detects a fault reports it to the circuit breaker 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.

Emax 2 ZSI signal is not compatible with mixed solution with other legacy GE breakers





Scenario 1:

For ZSI – S Protection: circuit breaker (CB) will commit to trip per the t2 time (50-800ms) upon receiving a restrain signal.

For ZSI – G Protection: CB will commit to trip per the t4 time (Instantly to 1 second) upon receiving a restrain signal.

Scenario 2:

On the other hand, if a circuit breaker does not receive any restrain signal from the load side, it will commit to trip per the Tsel time which is 40-200ms in all cases.

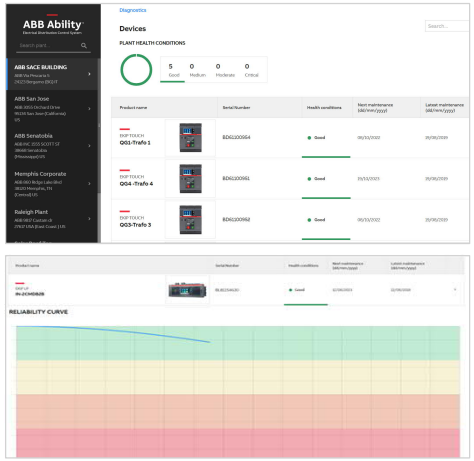
ABB Ability™ Electrical Distribution Control System

Remote Monitor – Operation and Service

ABB Ability™ Electrical Distribution Control System

Elevator pitch

Energy management	Asset monitoring	Predictive maintenance



What?

– ABB Ability™ EDCS is a cloud-based energy management and asset supervision solution for buildings and industrial sites

Why?

– Customers want to have transparency and visibility to reduce electricity consumption, improve performance and optimize their assets to reduce total operating costs

How?

– EDCS connects to the energy distribution system with plug and play devices

– Built on Microsoft cloud architecture to simplify and make data collection, storage and computing more cost-effective

Competitive Advantage?

– Design simplicity is the key value: simple & customizable interface

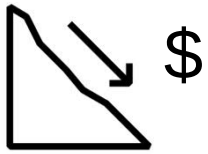
– Great scalability. No need for SW programming / configuration and IT infrastructure

– Connectivity integrated into ABB protection and metering devices

Simple Solution for Electrical Distribution

ABB Ability™ Electrical Distribution Control System

Key Value Proposition



Reduce operational cost

Reduce energy consumption

- Power Factor
- Harmonics
- Avoid waste

Energy billing Optimization

- Tariff optimization
- Load shifting / Peak shaving
- Cost allocation

Smarter Asset Management

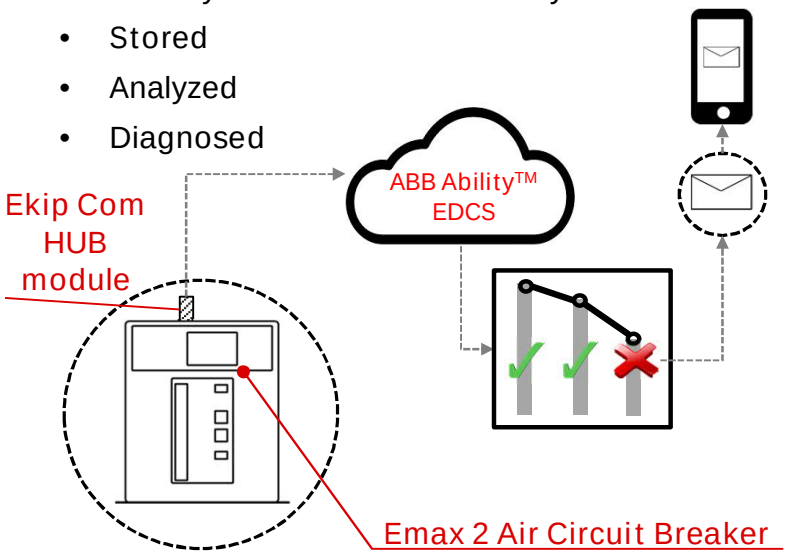
- Alerts before something happen
- Proactive alarms
- Predictive Maintenance

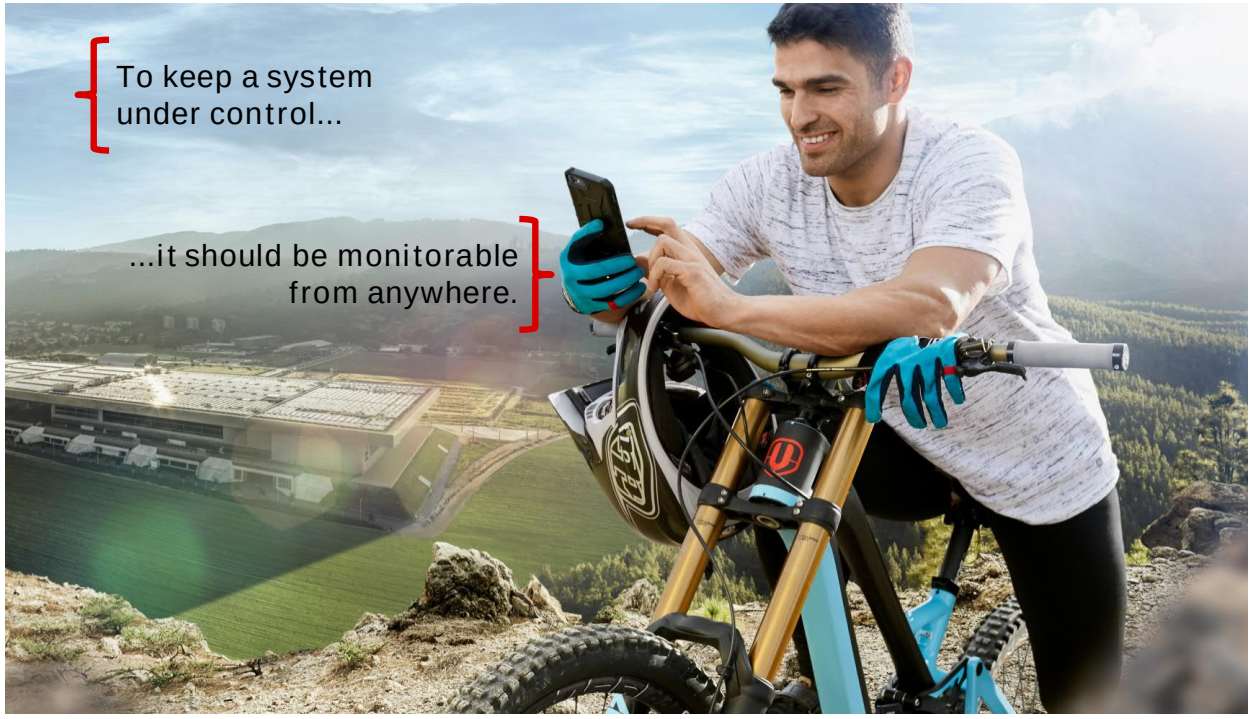
ABB Ability EDCS - Predict function

Monitoring with Cloud

With a module (integrated or external) product's data ca be continuously sent to the ABB Ability EDCS Cloud where they are:

- Stored
- Analyzed
- Diagnosed





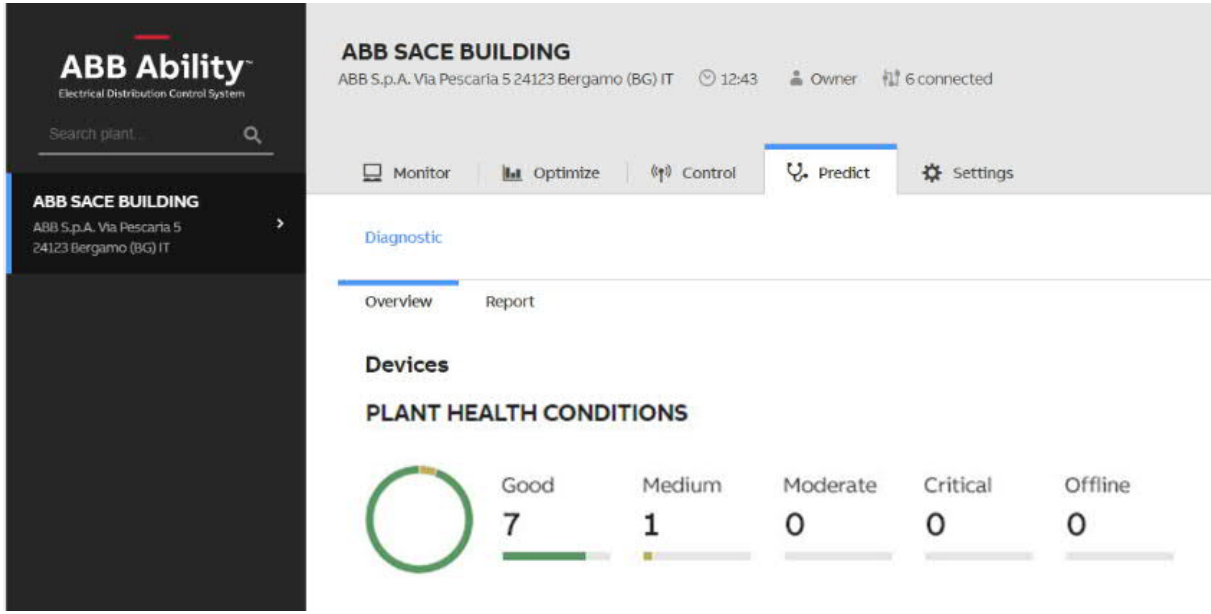
Predict function

The mission

Our mission is support the customer with the best maintenance plan tailor made on his devices needs

The new feature lets:

- Monitoring the circuit breakers conditions though ABB Ability™ EDCS
- Predicting when it's time to maintain the product according to its real needs
- Increasing safety, reliability and quality
- Protecting customer's investments



Predict function

Operation & Service

Plant management of the future

With Predict feature maintenance is perfectly optimized according to product's real needs taking in account both product's utilization and environmental conditions

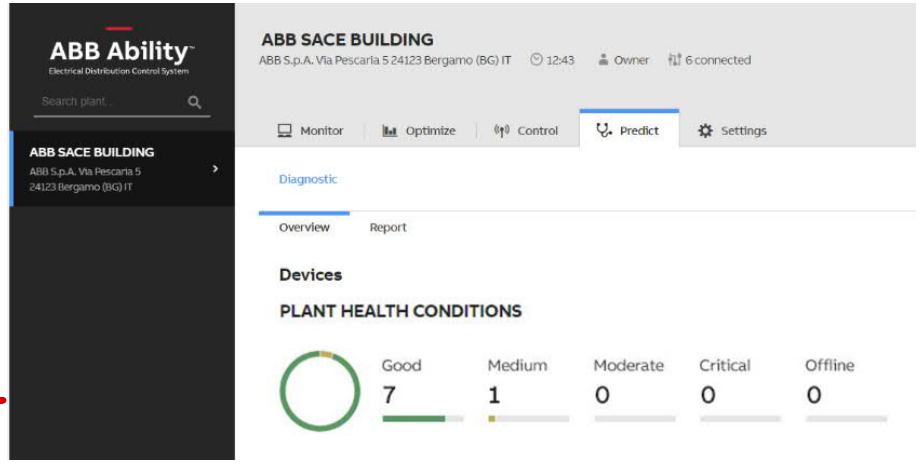
Number of operations (open/close)
Current/Short Circuit/Overload/...

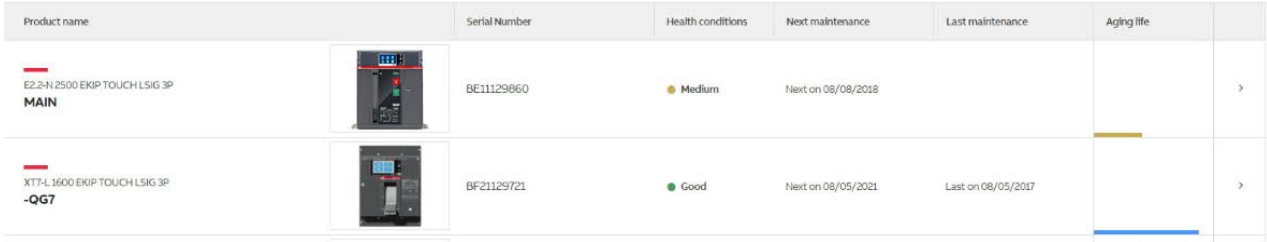
Temperature
Vibrations
Dust level
Humidity
Corrosion level

Effects of performed maintenance: activity and items replaced

Make maintenance...

...only when it is necessary optimizing costs

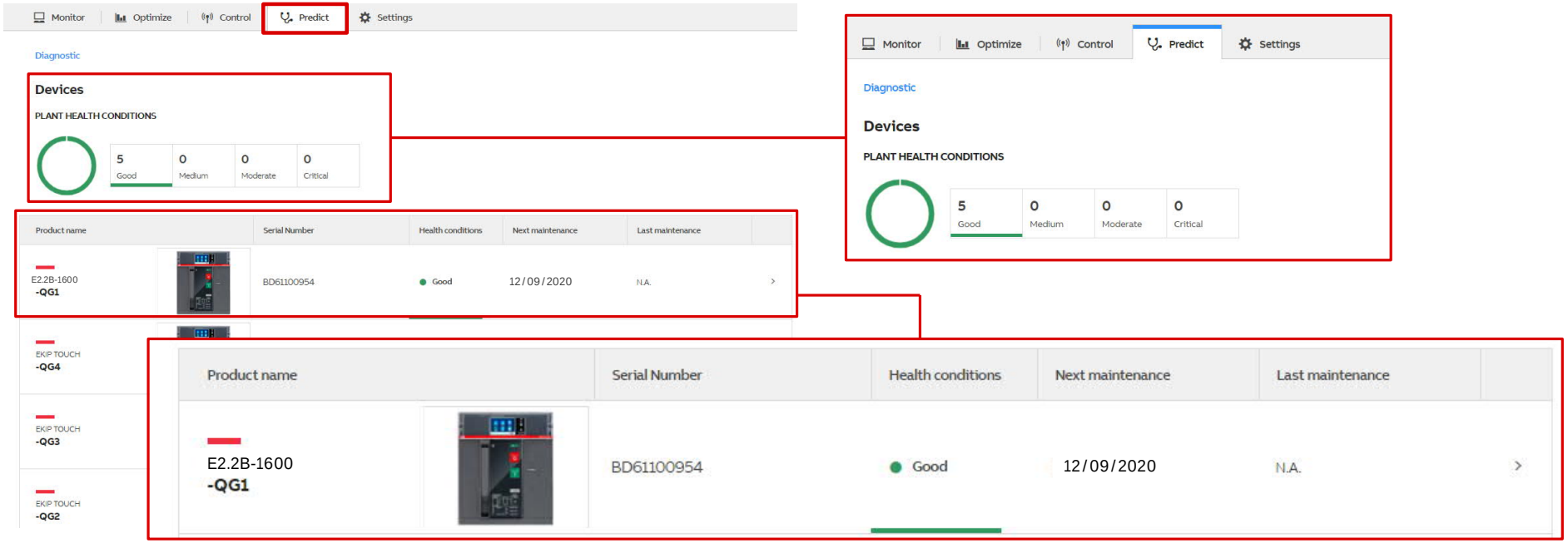




Predict function

Operation & Service

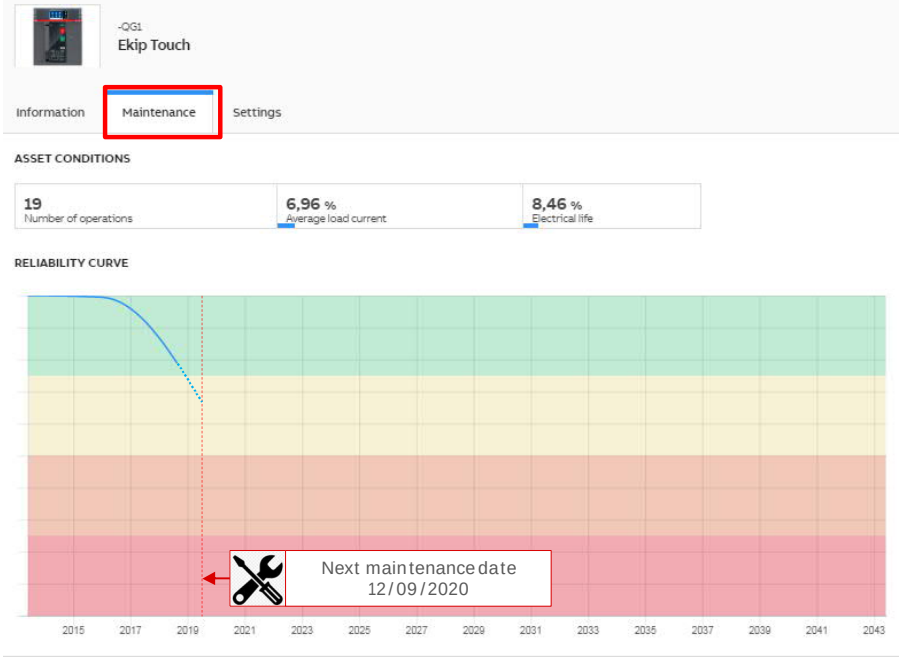
Plant management of the future



Predict function

Operation & Service

Plant management of the future



A Maintenance Page shows the circuit breaker's reliability curve according to the data collected and analyzed.

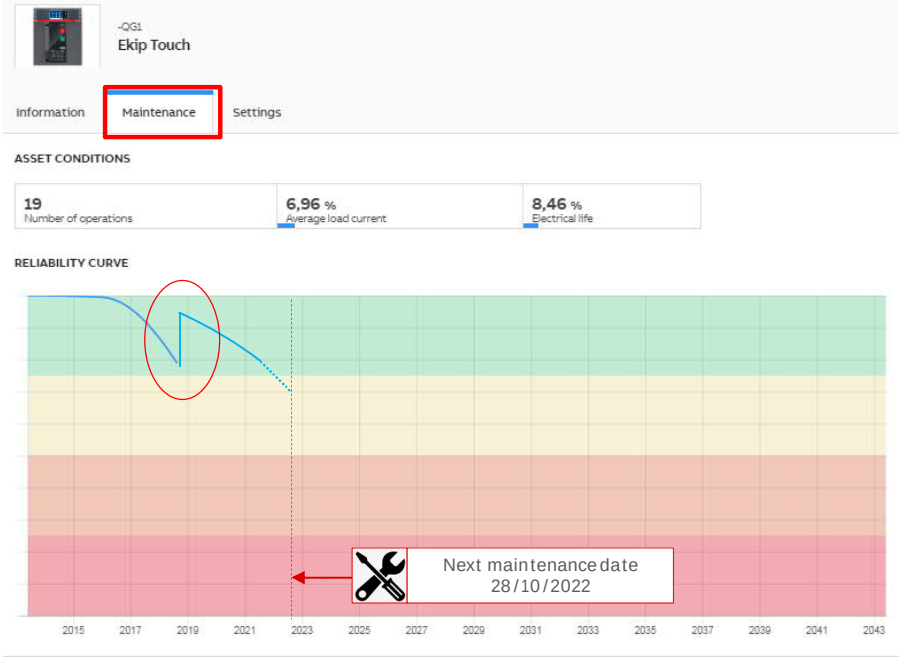
It also forecasts the next maintenance date if the utilization and environmental conditions do not change.

In case of different asset, the date can be changed

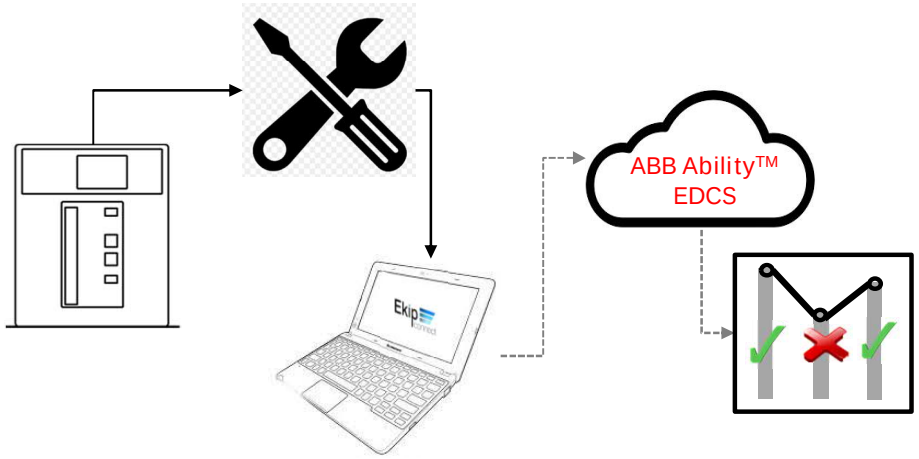
Predict function

Operation & Service

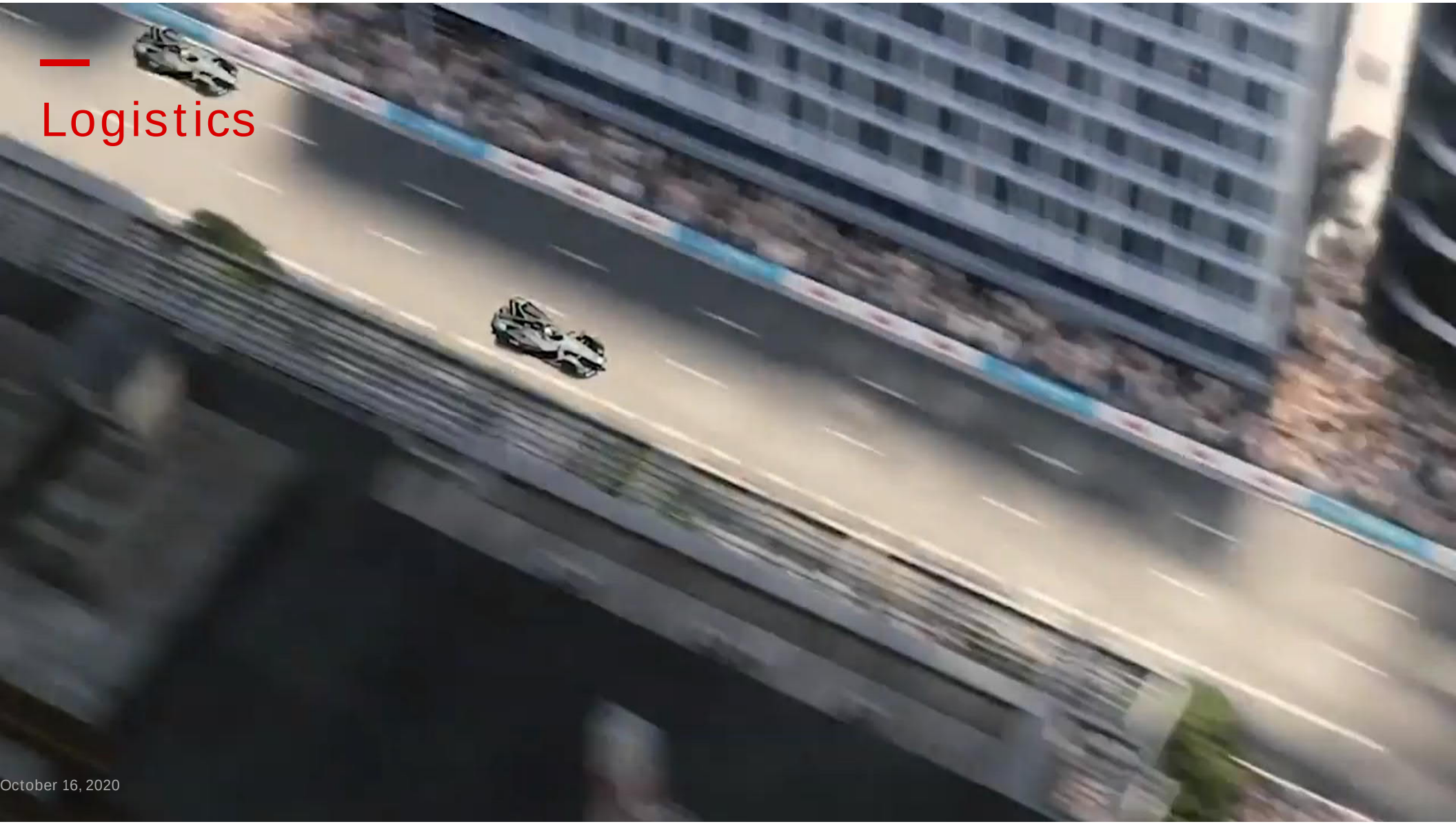
With Maintenance



When maintenance is performed by an ABB authorized Field Service Engineer, the Predict function can also show the effects of maintenance performed



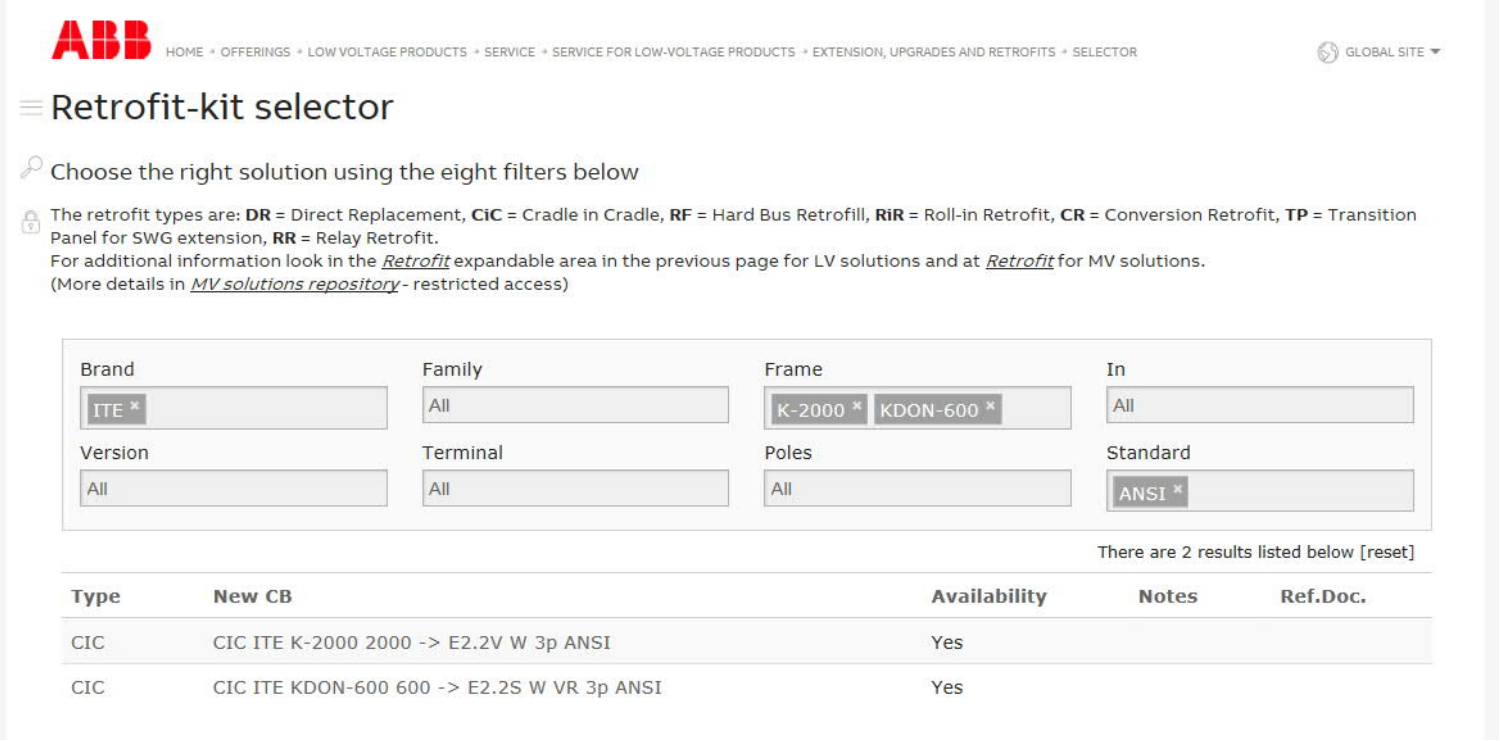
Logistics



October 16, 2020

Easy selection. To discover Upgrade offering portfolio

Combined portfolio of ABB/ELPS LV Power Circuit Breakers retrofit solutions in Retrofit selector



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GLOBAL SITE

Retrofit-kit selector

Choose the right solution using the eight filters below

The retrofit types are: **DR** = Direct Replacement, **CiC** = Cradle in Cradle, **RF** = Hard Bus Retrofill, **RiR** = Roll-in Retrofit, **CR** = Conversion Retrofit, **TP** = Transition Panel for SWG extension, **RR** = Relay Retrofit.
For additional information look in the *Retrofit* expandable area in the previous page for LV solutions and at *Retrofit* for MV solutions.
(More details in *MV solutions repository* - restricted access)

Brand	Family	Frame	In
ITE ×	All	K-2000 × KDON-600 ×	All
Version	**Terminal**	**Poles**	**Standard**
All	All	All	ANSI ×

There are 2 results listed below [reset]

Type	New CB	Availability	Notes	Ref.Doc.
CIC	CIC ITE K-2000 2000 -> E2.2V W 3p ANSI	Yes		
CIC	CIC ITE KDON-600 600 -> E2.2S W VR 3p ANSI	Yes		

https://new.abb.com/low-voltage/service/service-breakers-switches/extension-upgrades-and-retrofits/selector

Retrofill solution to Emax 2

Advanced retrofitting kit solutions – Availability

Products Availability and Delivery Times

The products are available for orders with the following delivery times

Quantity	Standard Delivery Lead Time* (from 10/1/2020)	Standard Delivery Lead Time* (from 01/01/2021)
≤ 5 psc/order	12 weeks	8 weeks
> 5 psc/order	Contact Quotation Team	Contact Quotation Team

*Transportation time is not included

Manufacturing location: Senatobia, MS