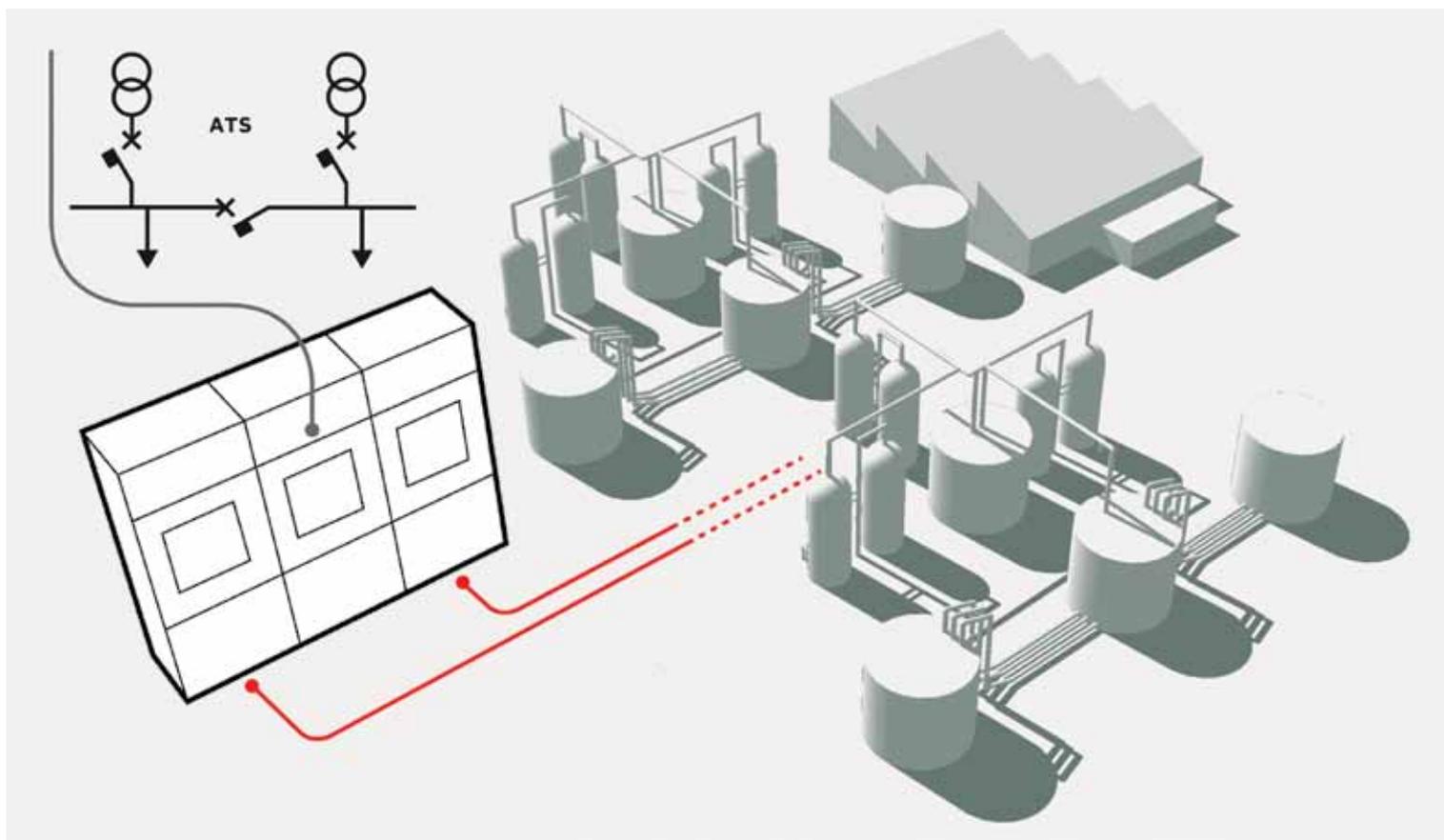


WHITE PAPER

# Emax 2, all-in-one innovation

## Embedded ATS system





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# General introduction

ABB's embedded ATS system makes it easy to monitor, control and communicate in power networks

Over the past few years, service continuity in low voltage electrical installations has played an increasingly leading role. In actual fact, this requirement is a fundamental characteristic if economically and functionally efficient installations are to be created.

A system able to switch the supply from the main line to an emergency line reduces problems caused by faulty conditions in the public network to the minimum. These operations, commonly known as "automatic switching", comprise sequences that automatically control the installation components (the circuit-breakers play a fundamental role) without interventions from the operator.

To guarantee that power is supplied to the loads, a fundamental requirement in an installation is to have a redundancy in supply sources type N+1, usually consisting of a transformer and emergency generator (or, as an alternative, a second transformer).

## **An installation with an automatic switching system:**

- Maximizes the service continuity of any process
- provides a power supply with high quality volt-

- age if the main network is out of service
- manages microgrids connection and disconnection from main grid.
- reduces the effects caused by network faults on parts of the installation (voltage reduction leads to loss of stability in the rotating machines, a higher voltage drop, faults in the equipment, etc...)
- achieves a good compromise amongst reliability, simplicity and cost-effectiveness
- provides the maintenance staff and managing system with a power source able to supply the installation or part of it when the transformer is being serviced.

## The ATS solution

### **An installation with an automatic switching system:**

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

In a world where digital communication is the predominant agent responsible for improved efficiencies and performances in industrial and power applications, ABB is moving to re-invent how digital systems are embedded.

ABB's ATS system takes advantage of the new capabilities provided by the new Ekip Connect 3 Software and the intelligent circuit breaker such as Emax 2 to deliver compact and reliable solution.

SACE Emax 2 all-in-one innovation improves efficiency in any electrical plant thanks to its unique features. It offers the highest short circuit performance in the most compact size and, for the first time, Emax 2 and its intelligent protection units integrate in one single device protection features and automatic transfer switching programmable logics. Ekip Connect is the ABB commissioning and programming software that allows the potential of Ekip electronic trip units to be fully realized. Using Ekip Connect, the user can manage power, acquire and analyze electrical values, and test protection, maintenance and diagnostic functions. So, where are you going to use ABB's ATS and why?

## Where can ATS be applied?

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- 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 benefits

### ABB's ATS solution - ready-to-go

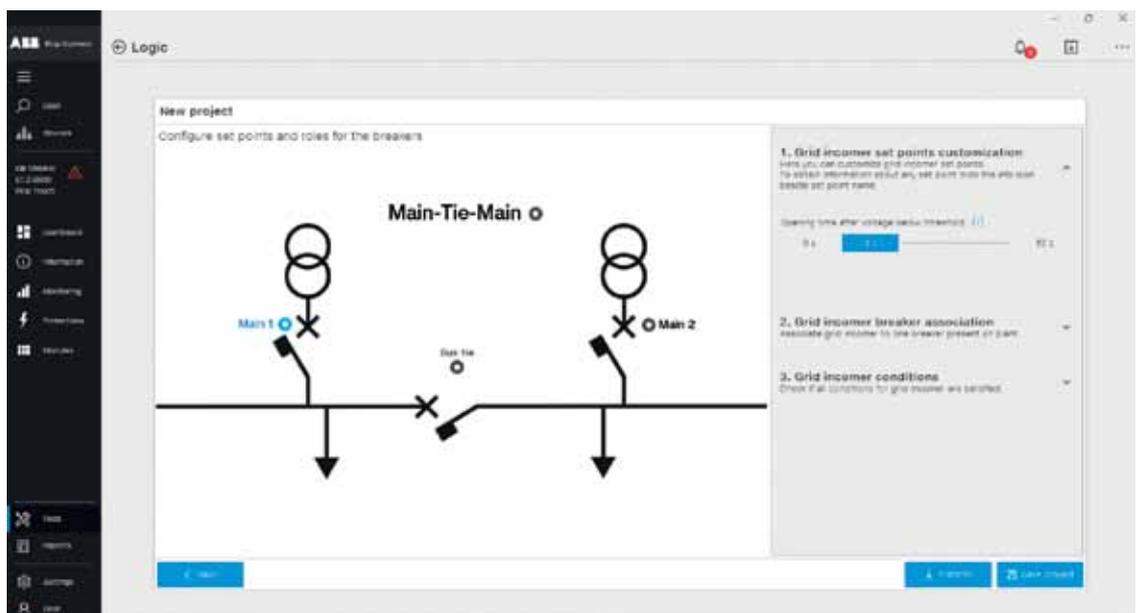
If you have ever programmed a power automation switchboard, you know that it requires PLC programming skills and electrical knowledge. Moreover, every custom-engineered system demands individual effort and personal responsibility. Moreover, if setting needs to be changed the engineer may have to re-open the project, which has associated time and money costs.

ABB's ATS now cuts this long story short by giving you general templates - tested and ready-to-go - that you can personalize by changing some basic settings via a graphical interface. When you are satisfied with how things look, a simple tool allows you to upload the template to the devices. And that is it.

The system is up and running.

And if you need to change a parameter, just connect your laptop and do the changes with the same easy graphical interface.

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



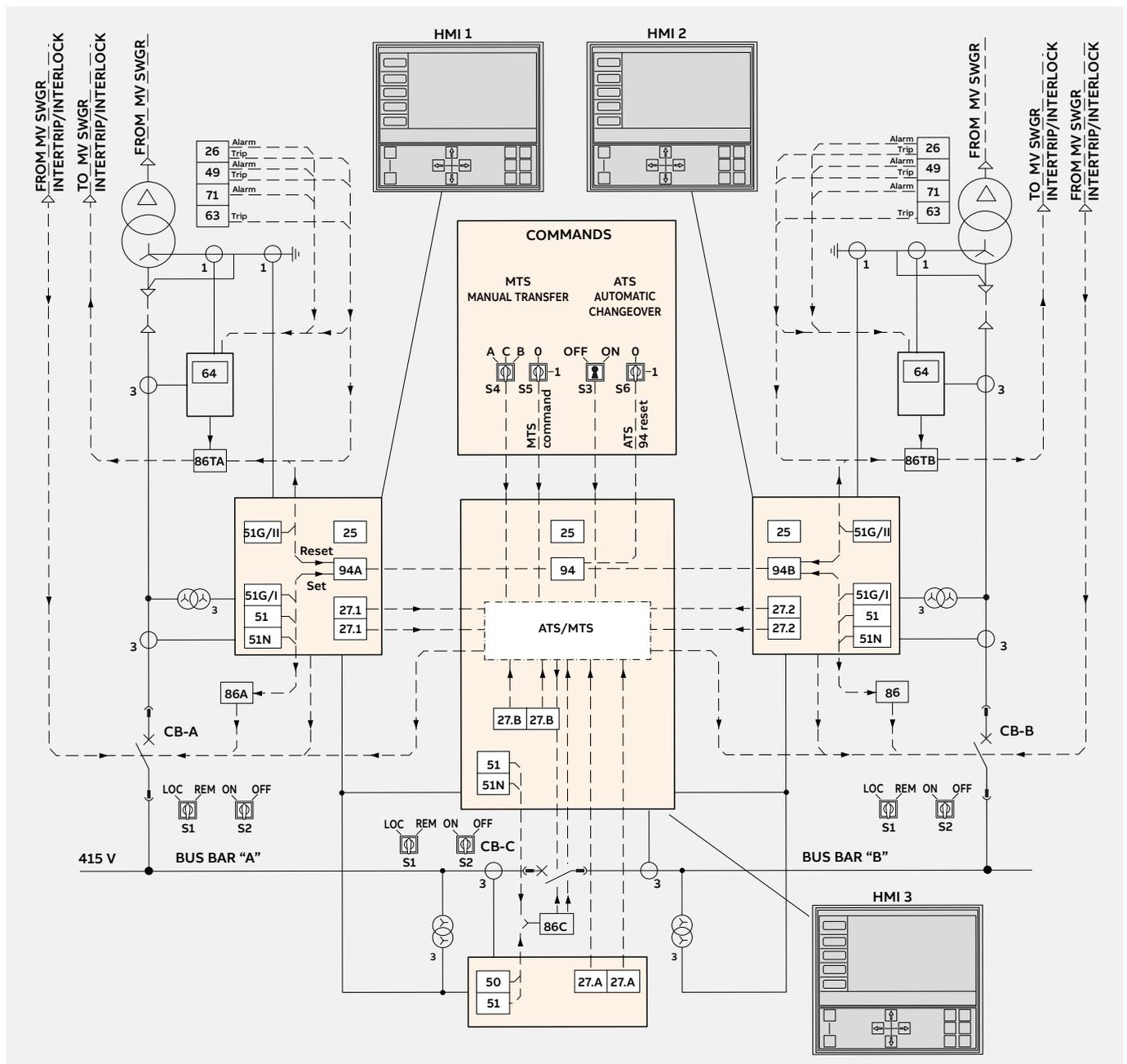
# General introduction

## Simplify the connections

The idea for the Embedded ATS solution emerged considering the complexity of the traditional solutions for power ATS. In the past, whether you were using a PLC or an external protection unit, you would have needed complex, hard-wired cabling between the protection devices, the operat-

ing devices (switch disconnectors) and the PLC, as well as the CTs (current transformers) and VTs (voltage transformers). See picture below.

The introduction of the IEC 61850 communication standard for substation automation systems simplified things considerably by defining how devices should report their status and generally transfer data. This communication is usually



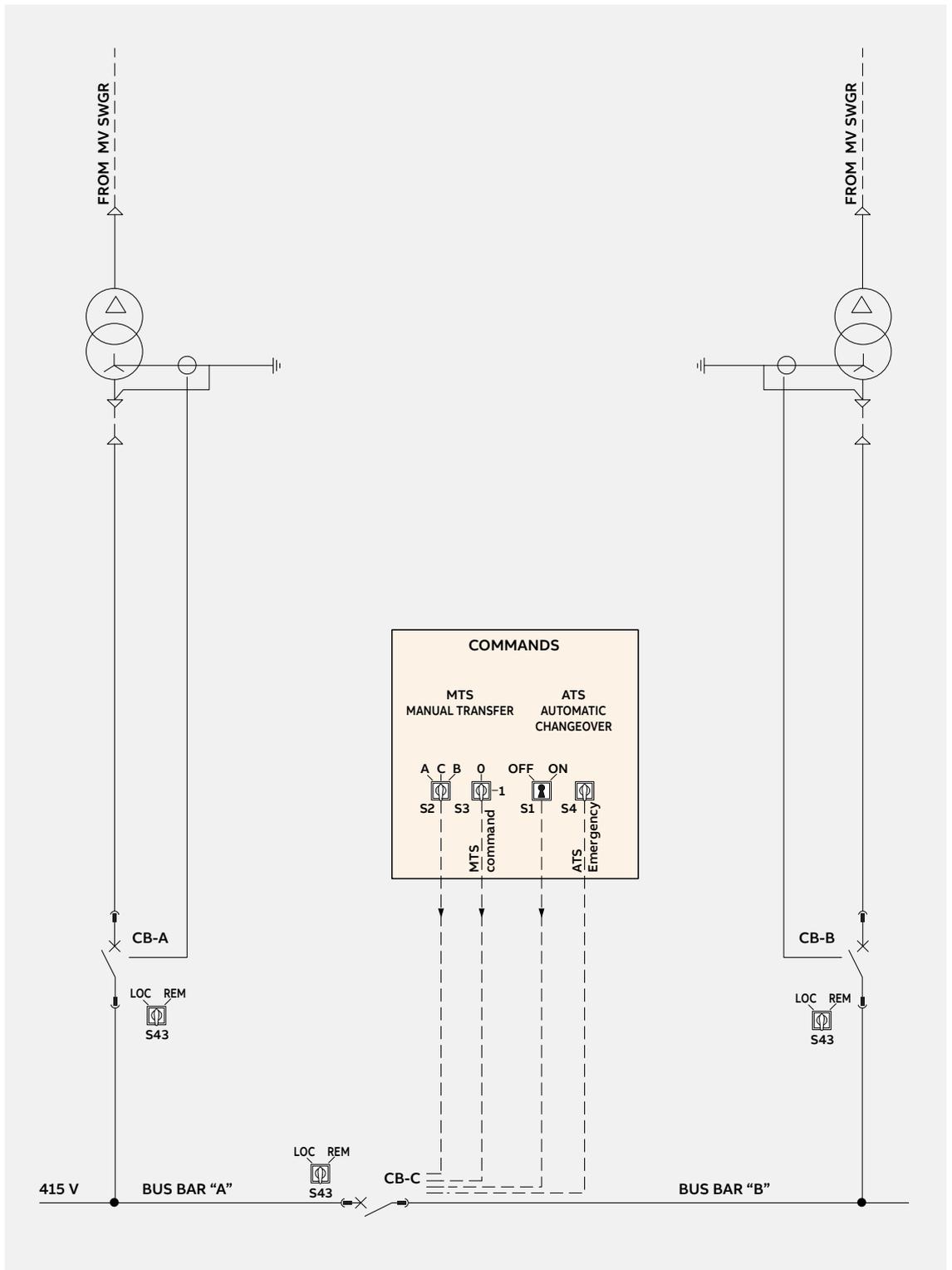
physically achieved via an Ethernet cable or similar. However, even with an architecture based on IEC 61850, many external devices are still needed to manage the complexity of the system.

Enter ABB's Emax 2 ATS solution, which masters this complexity by harnessing the power of ABB's

intelligent circuit breakers together with Ekip Connect 3 software.

And now there we are with the ABB ATS solution: With Emax 2 you can integrate the measures, the protections and the communication between the devices and to the network. See picture below.

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



# General introduction

## Emax 2 compactness

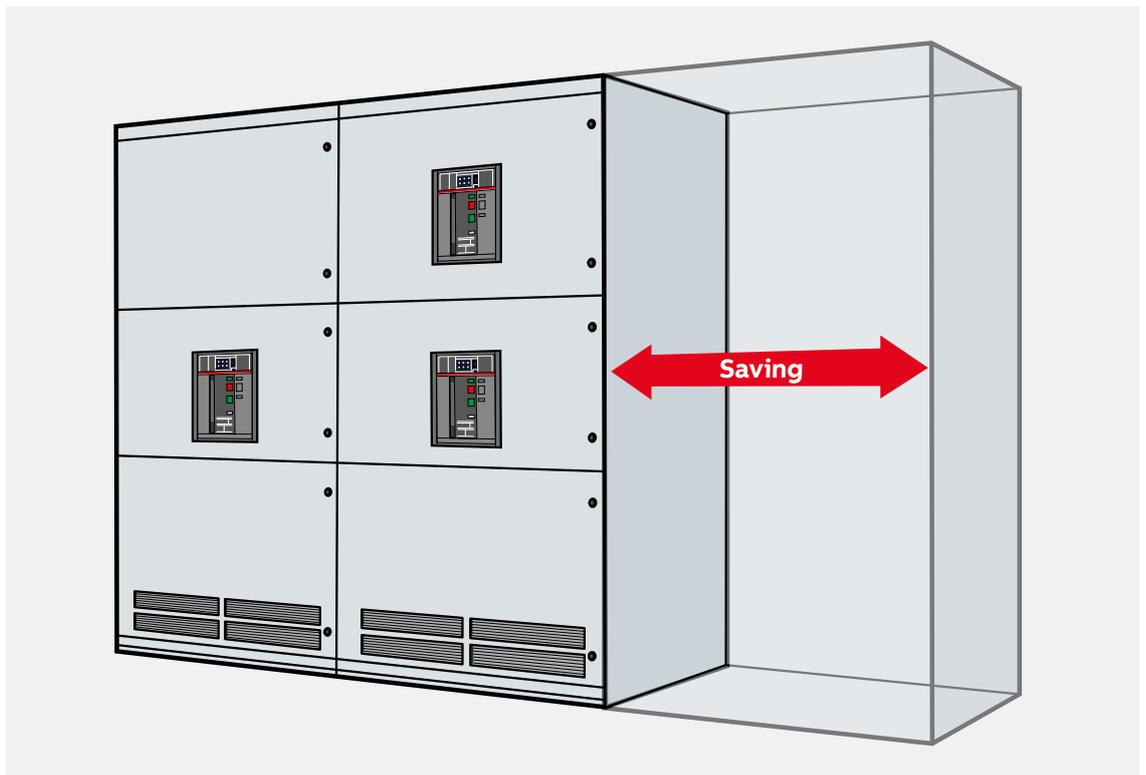
Emax 2, all-in-one solution, is the most compact air circuit breaker on the market, and it packs in a lot of functionality:

- Breaker
- HMI (human-machine interface)
- Protections
- Measurement (including the measurement transformers)

- Interlocking communication (horizontal) between devices
- Communication to the supervision system (SCADA)
- Communication to a cloud energy monitoring platform

The embedded ATS solution is as compact as the Emax 2 is. Nothing needs to be added.

### Space saving on the power switchboard: up to 30%



## Top-rate reliability

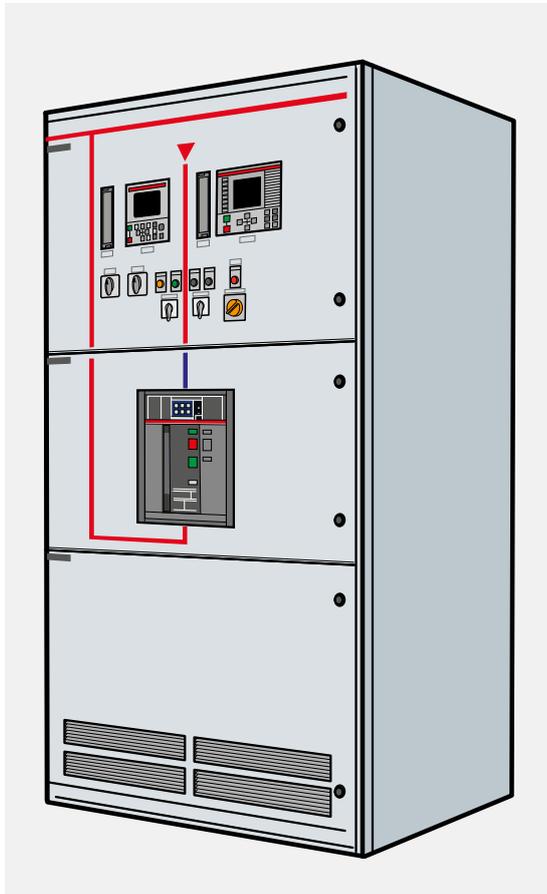
Now, let's think of that complex switchboard, with many different devices connected. What do you do if one element breaker, or one cable disconnect? See Fig. A.

Emax 2's compactness does not preclude top-rate reliability. All the protection trip units in the Emax 2 family ensure high reliability by using an electronic circuit that periodically checks the con-

tinuity of the internal connections (trip coil, rating plug and current sensors). In the event of a malfunction, the LEDs indicate the corresponding - removable - alarm to enable the fault to be rapidly identified and rectified. See Fig. B.

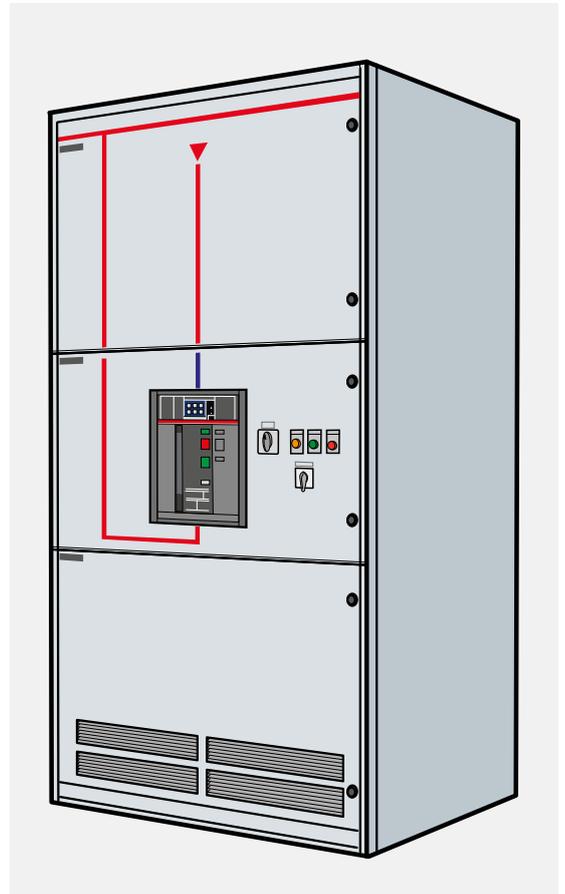
- Fig. A  
 Traditional system:  
 - Switch disconnector  
 - external protection units  
 - Voltage sensors  
 - Amperometric transformer  
 - HMI  
 - Cabling  
 - Rotary selectors  
 - Pushbuttons

Fig. A



- Fig. B  
 Emax 2 system:  
 - Circuit breaker  
 - Rotary selector  
 - Pushbuttons

Fig. B



# How it works

ABB's embedded ATS solution is based on four main elements:

- Ekip trip units that enable logic operations
- Ekip Link
- Ekip Synchrocheck (only in case of closed transition systems)
- The Ekip Connect 3 tool for ATS



## Logic operations with Ekip trip units

The capabilities of ATS can be achieved thanks to a variety of Emax 2 components. Two examples of these are the Ekip Touch and Ekip Hi-Touch trip units.

Ekip Touch/Hi-Touch represent a new generation of protection trip units that are easy to program and read.

They can be programmed via their HMI or by using Ekip Connect 3 software (see below) running on a laptop or mobile device.

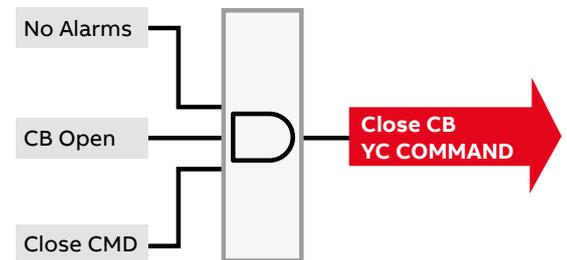
The Ekip Touch/Hi-Touch trip units measure power and energy with precision and save the most recent alarms, events and measurements to prevent faults to the installation and trip effectively when necessary.

It is access to this type of data that makes ATS so powerful.

The Ekip Touch/Hi-Touch trip units (also in Generator Protection versions) have the capability of managing complex Boolean logic, rather like a PLC. Moreover, every physical, electrical and digital condition of the breaker is digitally mapped.

This means that you have at your disposal thousands of parameters and statuses that can be shared with other devices and used to monitor the entire system. You can use this capability to automate the response of the system according to any circuit breaker status or event – and precisely this is the essence of what ATS does.

Let's show an example. Here you can see a very simple logic:



The basic elements are the input statuses (No Alarms, Circuit Breaker Open, Close Command), the Boolean AND operator and the output, which is active when all the input conditions are satisfied (this is the logic of the AND function).

In other words, only if the breaker is open and it shows no alarms, will it close when a Close command is sent. This type of logic - and logic much more complex - is well within the capabilities of ABB's ATS.

## Ekip Link

Everything described above about the computing power and logic capability of one circuit breaker can be extrapolated to realize a fast and powerful network of interconnected breakers that are able to exchange information with each other directly.

This approach introduces a multiplier in terms of overall system capability that delivers unparalleled performance.

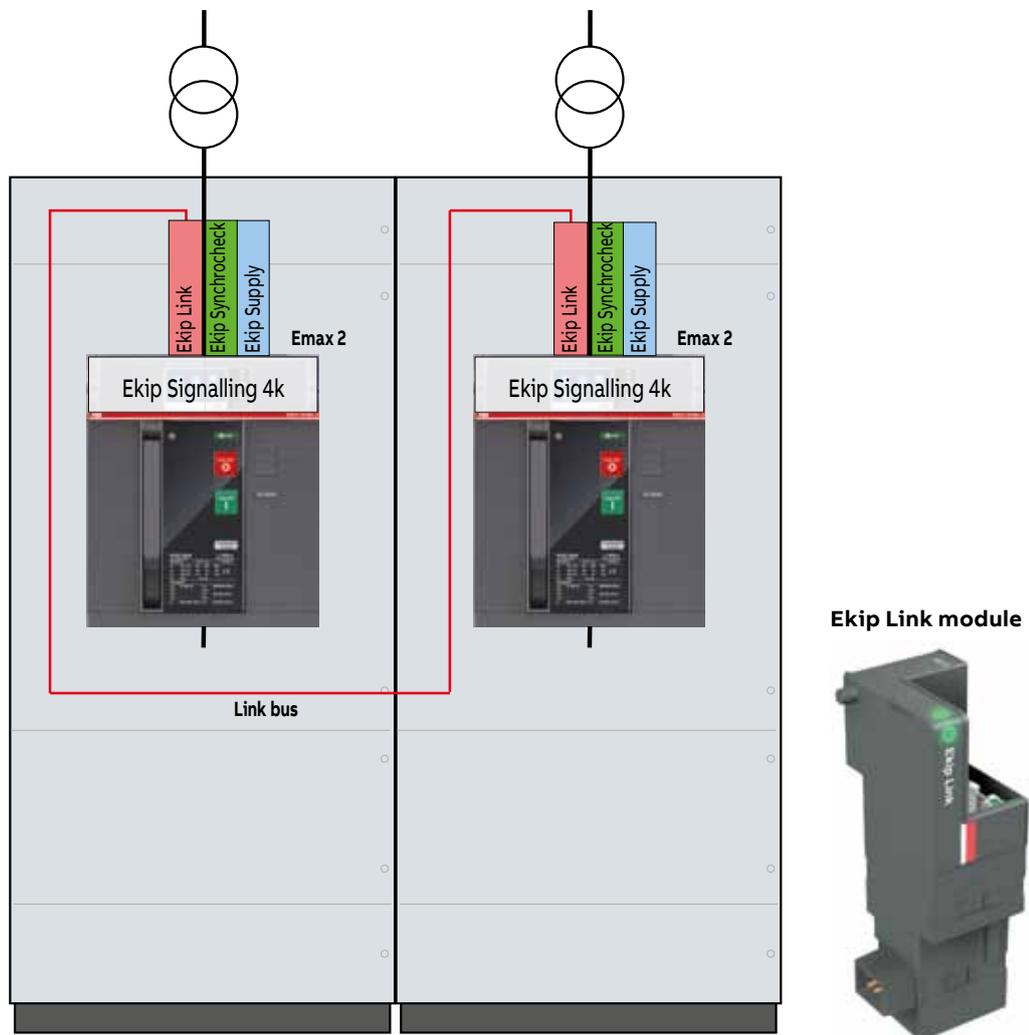
Ekip Link is the ABB tool that lets this peer-to-peer communication happen.

Ekip Link enables Emax 2 circuit breakers to perform various tasks:

- Connect to the Ekip Control Panel operator panel
- Connect to build a logical selectivity
- Be part of a power controller system
- Enable horizontal communication between circuit-breakers

The horizontal (ie, direct) communication between the Emax 2 breakers eliminates the need for a supervising device or master and makes data exchange - concerning, for example, status and protection interlocks between circuit breakers - direct and fast<sup>1</sup>.

<sup>1</sup>Another prominent method of horizontal communication is by the GOOSE messages described in the IEC 61850 standard.



# How it works

## Ekip synchrocheck (Required only in case of closed transition)

A closed transition is when a load is switched from one power source to another and for a short, transitional time the two power sources both supply the load, in a parallel fashion.

If you want to set up what is called a closed transition ATS, then you need an Ekip Synchrocheck module. Conducting a closed transition is a delicate operation and many parameters must be checked and be within limits before the power sources can be paralleled.

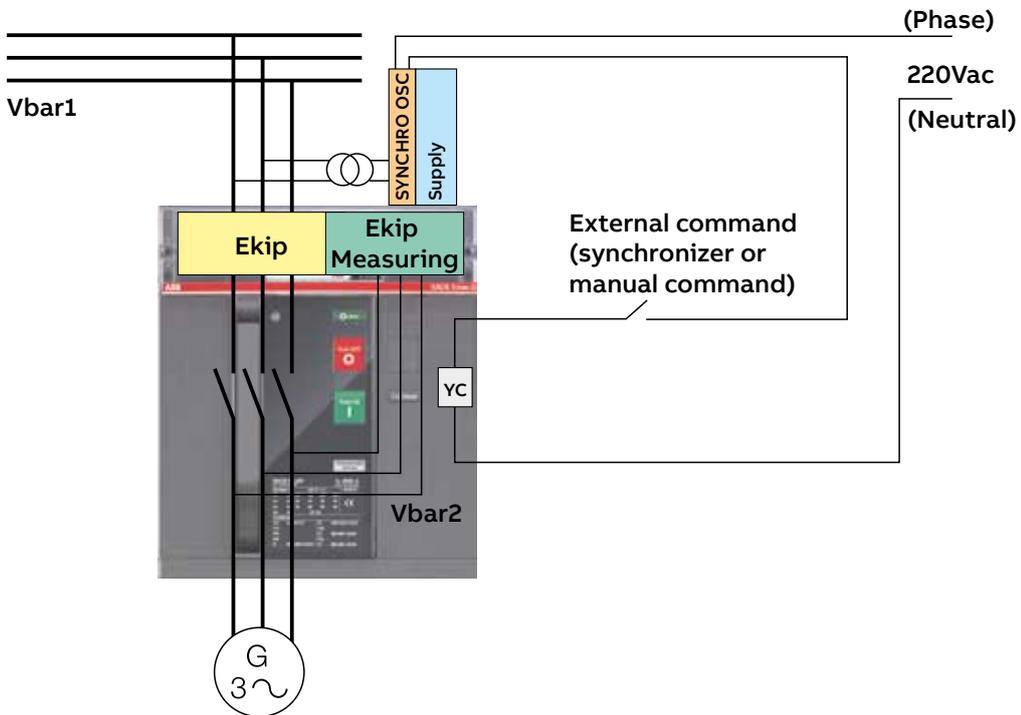
The ABB accessory that checks that all the conditions are satisfied for the transfer procedure is the Ekip Synchrocheck module, available with Emax 2 circuit breakers.

Fulfilling ANSI 25 protection, this module compares the angles, phases and frequencies of two voltages: One on the circuit breaker internal voltage plugs and the other on the line to be compared.

When the results of the comparison match predetermined set ranges, a confirmation is generated by an analog and digital contact.

However, that is not the only function of the Ekip Synchrocheck module: It also acts as dead busbar detector. The Synchrocheck module automatically switches between these two functions.

Imagine you can take all the digital information it provides and use them inside the Logic system. That's how we are able to meet the challenge of the most complex ATS systems.



## Ekip Connect 3 ATS tool

Up to now, we saw how we meet the complex technical requirements of the ATS systems, but how do we let our customers use all this functionality in the easiest possible way?

The Ekip Connect 3 software opens the door to the Ekip electronic trip units so their functionality can be fully exploited, in an easy-to-use manner.

The Ekip Connect 3 software is built to facilitate and speed up the management of all the functions on offer: A simple and smart user interface and a thoughtful design of the programming processes make network configuration a breeze.

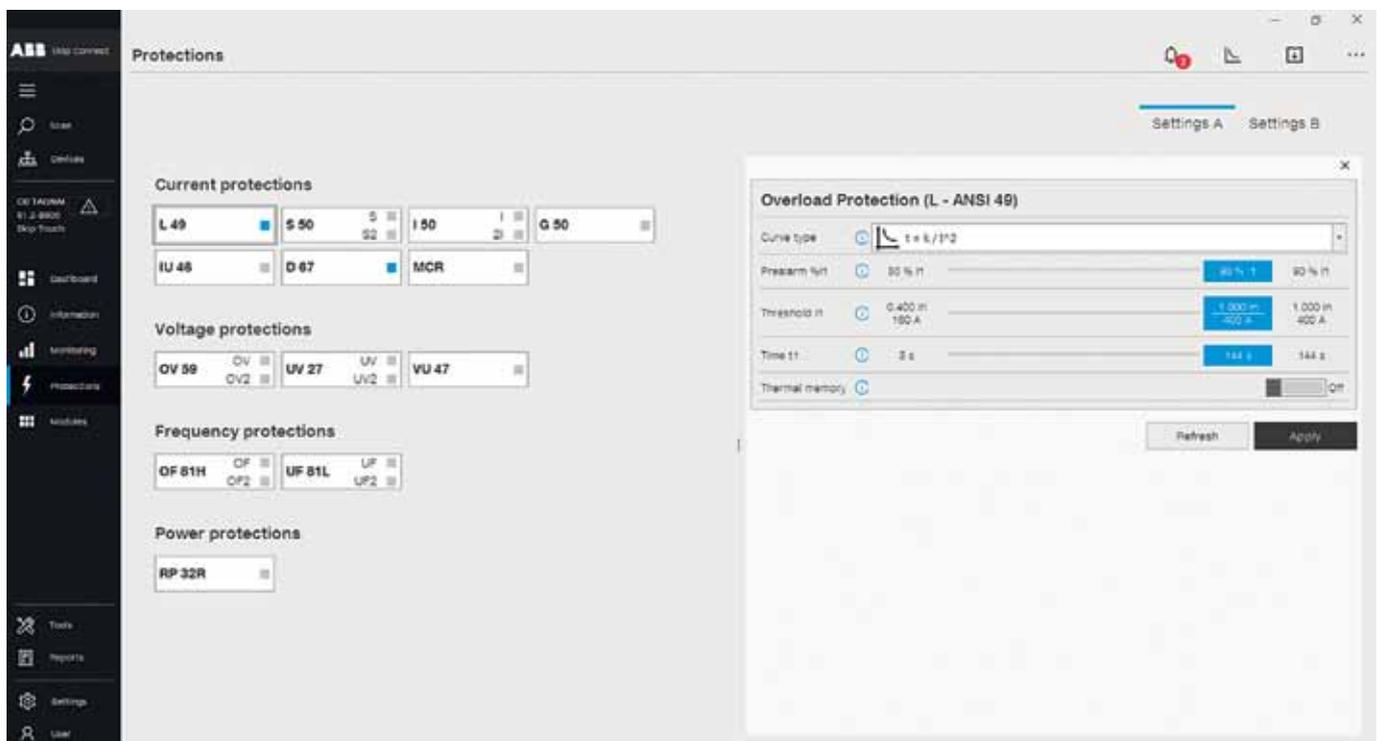
Plus, you get measurement visualization, a freely configurable dashboard and various tools to manage information, signals, statuses and documents associated with your devices.

Inside Ekip Connect 3, the ATS software tool is a one-step wizard that lets you:

- Manage your ATS projects, including the ability to save, load and share projects
- Set up projects quickly, with an intuitive interface
- Upload projects to the trip units

This way you get a solution that is:

- Engineering-free
- Error-free
- Fast



# How to use it and how to buy the license

## How to use it

Once you order a code (See “How to Buy the license” chapter), you will receive a USB key containing the license that unlocks your ATS system.

- Step 1:** Open Ekip Connect 3
- Step 2:** Perform a scan of the network to find the available devices
- Step 3:** enter the Logic section and follow the contextual help to configure your ATS system.
- Step 4:** Once configured, use the lower right buttons to save the project or transfer the project to the circuit breakers.

You can transfer the project to multiple devices if you are connected through a Modbus TCP network. You can transfer the project to one device per time using the Ekip T&P or the Ekip Programming accessories. In case you are transferring the project one by one, you shall repeat the scan of the device each time; after the scan click again on Tools: the project will stay open and on hold, waiting for the next transfer command to be sent. If you transfer a project, you permanently associate the project with the selected breakers. To break an association, you should contact ABB.

To transfer a project to the circuit breakers you need to perform a Scan of the network clicking on the “Scan” section on the left column and following the procedure. After the scan the available circuit breakers will appear on the list of the ATS commissioning tool.

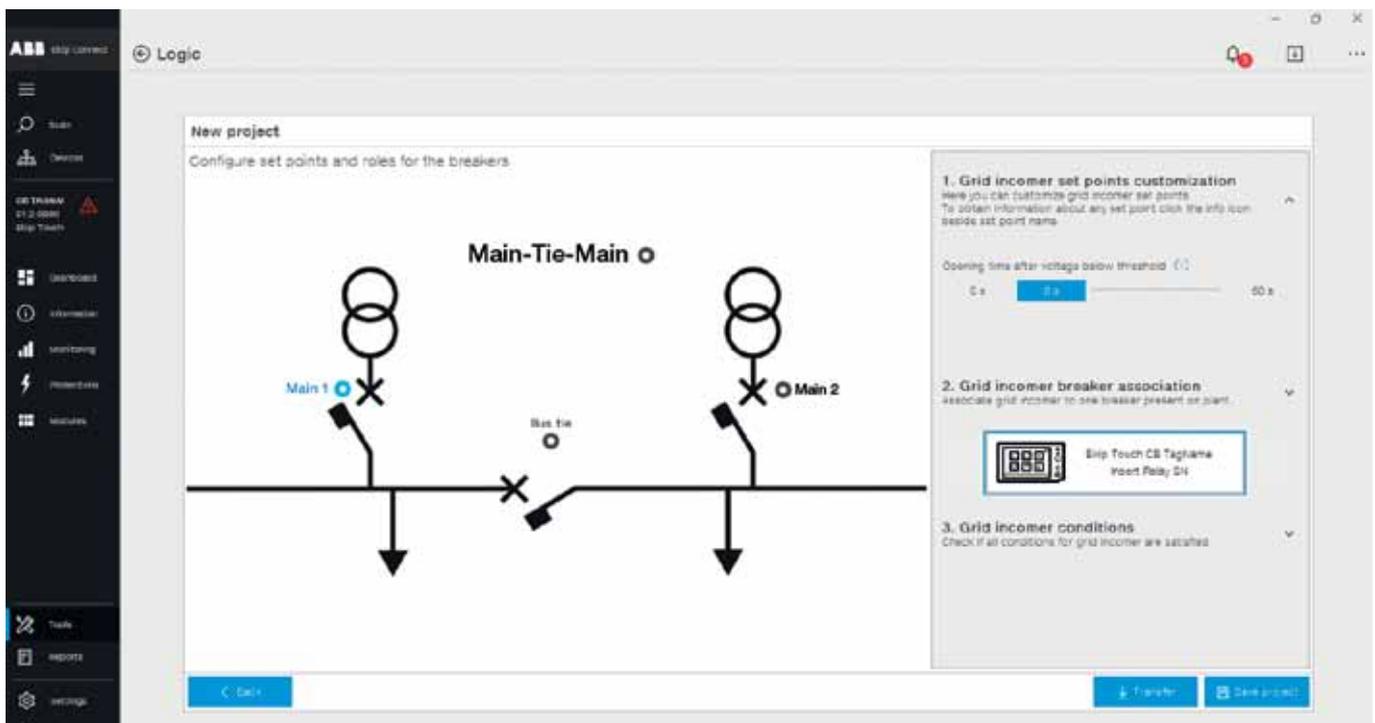
You will see a progress bar and a confirmation message will appear once operations are completed.

## How to buy the license

Order the USB key containing the unlocking license.

Every license unlocks the whole system. You can swap the role of each authorized circuit breaker any time if you have the USB key inserted (eg. Main 1 become bus-tie and vice-versa). You can also change every setting with the USB key inserted.

You cannot substitute a breaker associated with the ATS system with a breaker not associated (eg. the Main 1 breaker needs to be changed in the switchboard, the new breaker cannot be associated automatically). Call ABB to break an association or to change a breaker into the system.



# Annex A

## Technical specification Main-Tie- Main Closed Transition

### Scope

This specification describes the operating philosophy of the ATS Main-Tie-Main Closed transition system of Emax 2 low-voltage circuit breakers. The system is a Main-Tie-Main. The two electrical power sources are transformers.

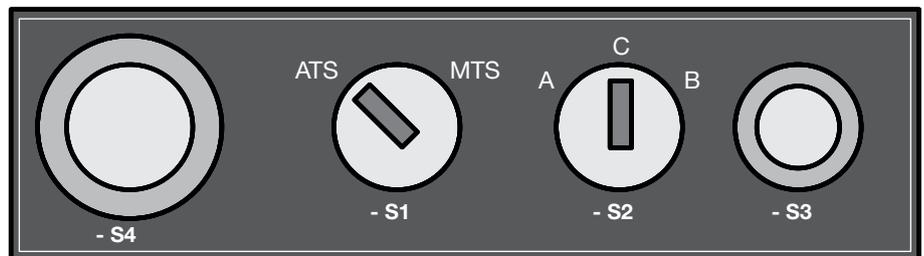
### Glossary and acronyms

<b>ATS</b>	Automatic transfer switch
<b>MTS</b>	Manual transfer switch
<b>CB</b>	Circuit Breaker
<b>Un</b>	Nominal voltage of the system
<b>RTC</b>	Ready to close
<b>-CB-A</b>	Circuit breaker incomer from line A
<b>-CB-B</b>	Circuit breaker incomer from line B
<b>-CB-C</b>	Circuit breaker incomer from line C
<b>IPCS</b>	Embedded protection and control system
<b>HMI</b>	Human-machine interface

### Modes of operation and controls

Four modes of operation and control are foreseen and are described in this document:

- Local (manual control)
- Remote control
- Automatic transfer switch (ATS)
- Manual transfer switch (MTS)
- One of the operation modes is selected by means of one of the following switches:
  - S1: ATS/MTS mode switch selector
  - S2: A-C-B CBs selection for CB trip in MTS mode
  - A = -CB-A
  - C = -CB-C
  - B = -CB-B
- S3: Push-button for starting manual transfer mode.
- S4: Emergency latching push-button to exclude the automatic logic.
- S43: Local/remote-IPCS selector. (One for each circuit breaker. Can be wired by the customer by following the connection schemes in the Emax 2 installation manual.)



# Annex A

The following table shows the combination of switches/selectors/push-buttons needed to get each condition ready to operate.

Selector status				
	S1 (automanual)	S2 (A-C-B)	S3 (start MTS)	S4 (logic off)
ATS	ATS	#	#	0
MTS	MTS	#	#	0
Local CBA	#	#	#	#
Local CBB	#	#	#	#
Local CBC	#	#	#	#
Automation OFF	#	#	#	1
MTS-open CBA	M	A	1	0
MTS-open CBB	M	B	1	0
MTS-open CBC	M	C	1	0

Selector status			
	S43 CBA (local/ remote)	S43 CBC (local/ remote)	S43 CBC (local/ remote)
ATS	Remote	Remote	Remote
MTS	Remote	Remote	Remote
Local CBA	Local	#	#
Local CBB	#	Local	#
Local CBC	#	#	Local
Automation OFF	Remote	Remote	Remote
MTS-open CBA	Remote	Remote	Remote
MTS-open CBB	Remote	Remote	Remote
MTS-open CBC	Remote	Remote	Remote

### Main switchgear working philosophy

The main switchgear configuration (see fig.2) under normal operating condition is “TT”:

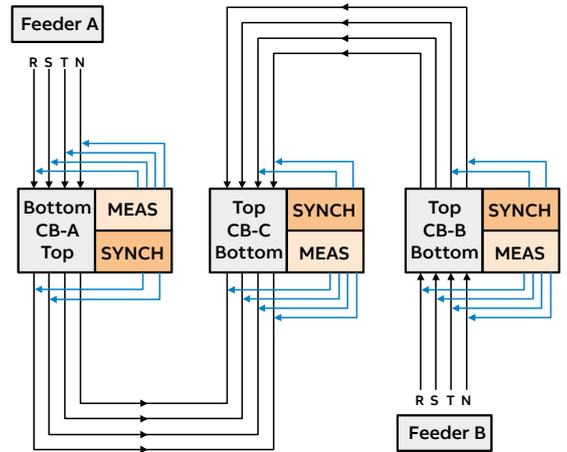
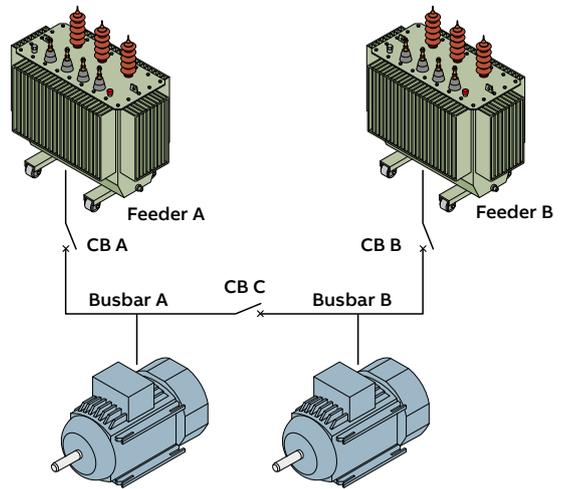
- Incomer lines from transformer (-CB-A and -CB-B): Close condition.
- Bus-tie (-CB-C): Open condition.

The circuit breakers shall be manually controlled locally (switchgear) or remotely (IPCS).

ATS “break-before-make” and MTS “make-before-break” systems are provided.

The local/remote mode selection shall be done using the selector switch S43 located in each incomer or bus tie cubicle.

Figure 2 - Main switchgear configuration



### Legend

- R, S, T, N: Three phases + neutral
- MEAS: Ekip Measuring Pro / internal voltage plug
- SYNCH: Ekip Synchrocheck
- Feeder A/B: Power sources (transformer or generator)comer or bus tie cubicle.

Note:  
ABB provide the internal voltage plug connected as standard to the bottom terminals. To obtain the breaker with the voltage plugs connected to the top terminals, please use the specific extra ordering code.

**Local (manual controls)**

When the local/remote selector S43 is set to “Local” at each corresponding CB, opening and closing operations are permitted by using the ON or OFF push-buttons provided with every CB (see fig.3).

The selector excludes any automatic logic (ATS or MTS) or IPCS remote operations.

In practice, the local/remote selector S43 activates the Emax 2 Ekip actuator or the YC/YO direct control.

See the scheme 1 for details.

The system permits the closing of every circuit breaker, if done manually.

No Interlock are provided in Manual operations.

**Remote control**

-CB-A / -CB-B / -CB-C (incomers and bus tie) IPCS controls are allowed with local/remote switch S43 in the Remote position.

The CBs can be controlled by the IPCS via the defined communication protocol.

In remote mode, the CB status can also be controlled by Ekip Connect.

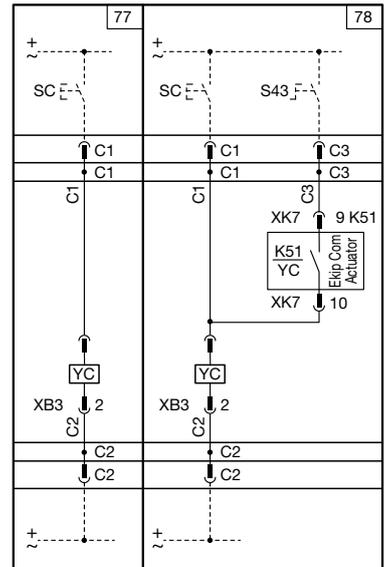
If the Emergency latching push-button S6 is pushed, it is possible to open or close any circuit breaker.

It's not possible to start an MTS sequence in remote mode.

Figure 3 - Emax 2 front



Scheme 1



# Annex A

## ATS automatic transfer switch

The ATS logic works as follows:

Starting from a TT configuration (-CB-A and -CB-B closed, -CB-C open)

- In case of undervoltage (ANSI27) [set point] or Ekip Signalling 4K Digital Input 1, 2 or 3 activated on one line (A or B), the relevant CB opens within the set time [set point].
- After the pre-set time and checking for Ready to Close status, checking for dead busbar (under 10 percent of  $U_n$ ), checking that no electric protection element caused the line to open, checking that the other line is available and healthy (Over 90 percent of  $U_n$ ), -CB-C closes.

The ATS shall operate under the following conditions:

- ATS Emergency latching push-button not pressed
- Bus-tie open and RTC
- Other bus bar voltage level > 90 percent of  $U_n$

The automatic changeover shall be locked in case of

- Any protection Trip or alarm (The protections activation and settings must be carried out by the customer)
- Emergency push-button pressed

After a current protection trip of any circuit breaker, the ATS logic is locked. The lock shall be removed by resetting the circuit-breaker locally or remotely.

When the “ATS Logic Disabled” normally closed pushbutton is pressed:

- The ATS logic is deactivated
  - The line breakers CB A and CB B can open for ANSI27
  - The bus-tie breaker CB C does NOT close after the opening by ANSI27 of one line
- The MTS logic is deactivated

When the “ATS Logic Disabled” normally closed pushbutton is reset after being pressed:

- If no events occurred (ANSI27 or digital input) the ATS system is restored and ready to operate
- If one line breaker opened for ANSI27 while the pushbutton was pressed:
  - If the line voltage is still absent, the ATS system starts the bus-tie closing procedure after the preset time.
  - If the line voltage is back over 90 percent of  $U_n$ , the system keeps the previous status (line breaker open, bus tie open) and the operator shall manually restore the desired condition.

Starting from an L configuration (-CB-A and -CB-C closed, -CB-B open / -CB-B and -CB-C closed, -CB-A open)

- In the case of undervoltage (ANSI27) on the healthy line, the relevant breaker and the bus-tie open. The system shall be manually restored.
- In the case of return of voltage (over 90 percent of  $U_n$ ) on the previously faulty line, the system is locked. The operator shall activate the MTS operating mode to change the status of the system.

If the ATS system is working properly, the CB-A 4K Output 1 is lit. You can connect the output to a switchboard signalling system or you can communicate the contact status to the IPCS.

**MTS manual transfer switch**

MTS mode can:

- Restore the normal operating condition (TT) without loss of supply after an ATS operation
- Transfer the load from one transformer to another without loss of supply
- Change the system configuration from TT to L without loss of supply

The ANSI25 Syncrocheck function prevents the paralleling of out-of-synch sources

The “A-C-B” Selector has three positions. Each position acts as follow:

Position A : -CB-C or -CB-B will close and -CB-A will open;

Position C: -CB-A or -CB-B will close and -CB-C will open;

Position B: -CB-A or -CB-C will close and -CB-B will open;

The manual transfer shall be locked in case of:

- Emergency push-button S4 pressed
- The two power sources are out of sync as stated by ANSI25

- ANSI27 alarm on closing breaker
- Closing breaker not RTC
- Any alarm or timing protection on the opening line
- Any Loc/Rem selector on local

The manual transfer will happen if the operator follows the sequence:

1. Select the “Manual” mode with the “Auto/Manual” Switch S1
2. Select which breaker shall open with the “A-C-B” Selector S2
3. Press the “Open” pushbutton S3

And if:

- The two power sources are in sync as stated by the ANSI25
- There is no ANSI27 alarm on closing breaker
- The closing breaker is RTC
- There is no alarm or timing protection on the opening line
- All Loc/Rem selectors are on Rem

**Available setting points**

**CB-A**

Name	Description	Threshold	Step
<b>Set point A</b>	Opening time after a voltage drop below the ANSI27 threshold	[0 s...60 s]	1s
<b>Set point B</b>	Parallel time	[300 ms...10 s]	[300 ms, 500 ms, 800 ms, 1 s, 3 s, 5 s, 10 s]
<b>UV (ANSI 27)</b>	Undervoltage protection	$U8=0.5...0.98xUn$	0.001xUn

UV setting available at the "Protection" section of Ekip Connect 3.

**CB-B**

Name	Description	Threshold	Step
<b>Set point A</b>	Opening time after a voltage drop below the ANSI27 threshold	[0 s...60 s]	1s
<b>Set point B</b>	Parallel time	[300 ms...10 s]	[300 ms, 500 ms, 800 ms, 1 s, 3 s, 5 s, 10 s]
<b>UV (ANSI 27)</b>	Undervoltage protection	$U8=0.5...0.98xUn$	0.001xUn

UV setting available at the "Protection" section of Ekip Connect 3.

**Fixed settings**

<b>Synchrocheck</b>	<b>ΔU threshold</b>	voltage difference module	10%
	<b>Δf threshold</b>	frequency difference	0.2 Hz
	<b>Δφ threshold</b>	phase angle difference	10°
	<b>Dead busbar Threshold</b>		0.1 x Un
	<b>Live busbar threshold</b>		0.8 x Un
	<b>Synchro voltage</b>	Reference voltage for the synchronism check	U12
	<b>Synchro Primary voltage</b>		400 V
	<b>Synchro Secondary voltage</b>		100 V

**SOS Opening Sequence: C - A - B**

# Annex A

## Breakers configuration

Each Emax 2 CB involved shall be an E2.2 / E4.2 / E6.2 of the withdrawable type and equipped with the following accessories:

Ekip Hi-Touch or Touch + Measuring Pro
Ekip Supply
Ekip Link
Ekip Synchrocheck
Ekip Signalling 4K
Ekip Com Actuator
Spring charger Motor
YO
YC

## Compatibility

The Embedded ATS tool is compatible with all the Emax 2 electronic trip units starting from version v02.20.08 of the Ekip Mainboard firmware.

To check the firmware version of your device you can:

- 1) use the "Information" section of Ekip Connect 3, Nominal Data field.
- 2) press the "i" button on the front of the trip unit until the page "Protection Unit" appears.

## Notes on Ekip Synchrocheck module

### Insulation transformer

Between the external contacts of the circuit-breaker and the inputs of the module, an isolation transformer must always be installed that has the characteristics listed in the following table: until the page "Protection Unit" appears.

Characteristics	Description
<b>Mechanical</b>	<ul style="list-style-type: none"> <li>- Mounting: EN 50022 DIN43880 guide.</li> <li>- Material: self-extinguishing thermoplastic.</li> <li>- Protection class: IP30.</li> <li>- Electrostatic protection: with screen to be connected to earth.</li> </ul>
<b>Electrical</b>	<ul style="list-style-type: none"> <li>- Precision class: <math>\leq 0.5</math>.</li> <li>- Performance: <math>\geq 5</math> VA.</li> <li>- Overload: 20 % permanent.</li> <li>- Insulations: 4 kV between inputs and outputs, 4 kV between screen and outputs,</li> <li>- 4 kV between screen and inputs.</li> <li>- Frequency: 45...66 Hz.</li> </ul>

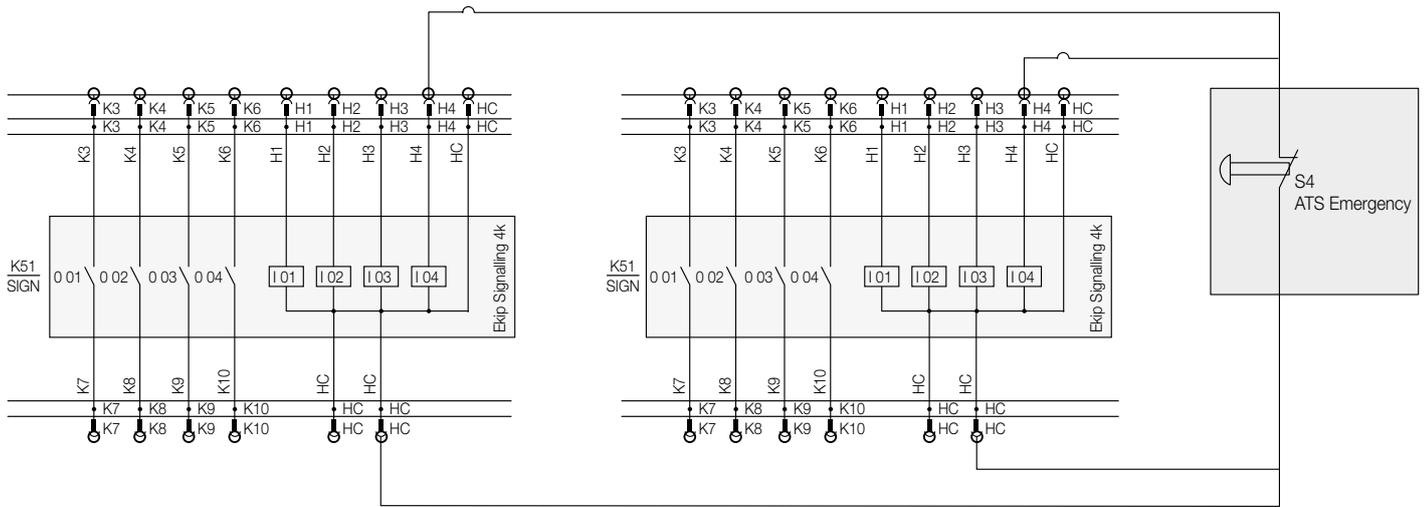
The standard Fixed Setting of the module is:

Primary voltage 400 V

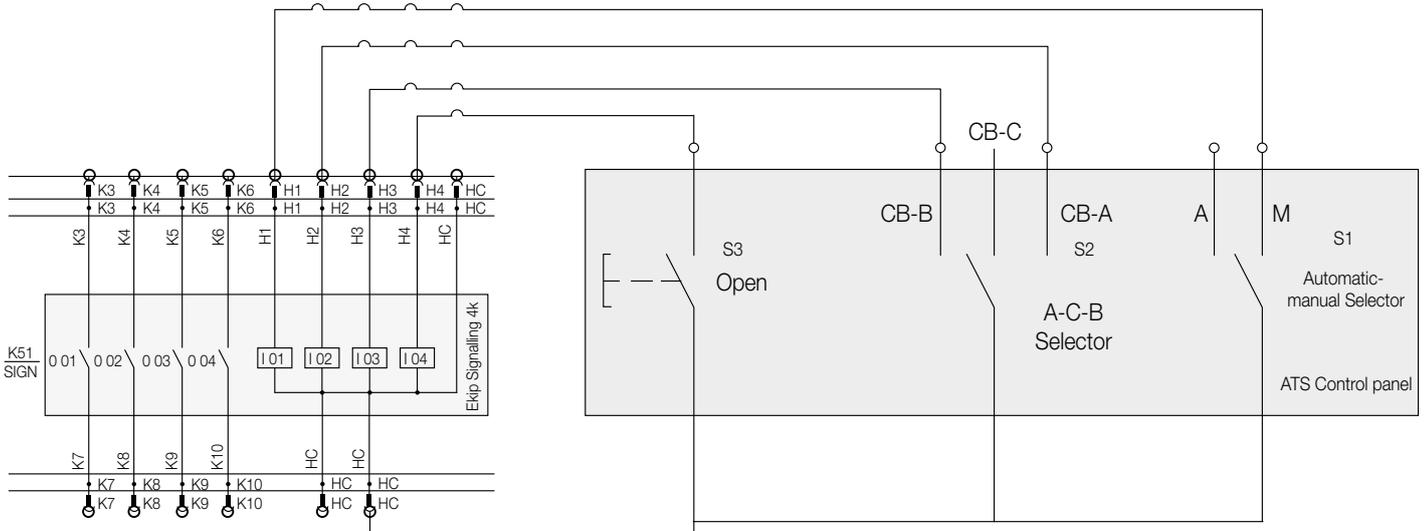
Secondary voltage 100 V

For more information about the Ekip Synchrocheck Module, please refer to the Emax 2 instruction manual.

Ekip Signalling 4K CB-A / CB-B



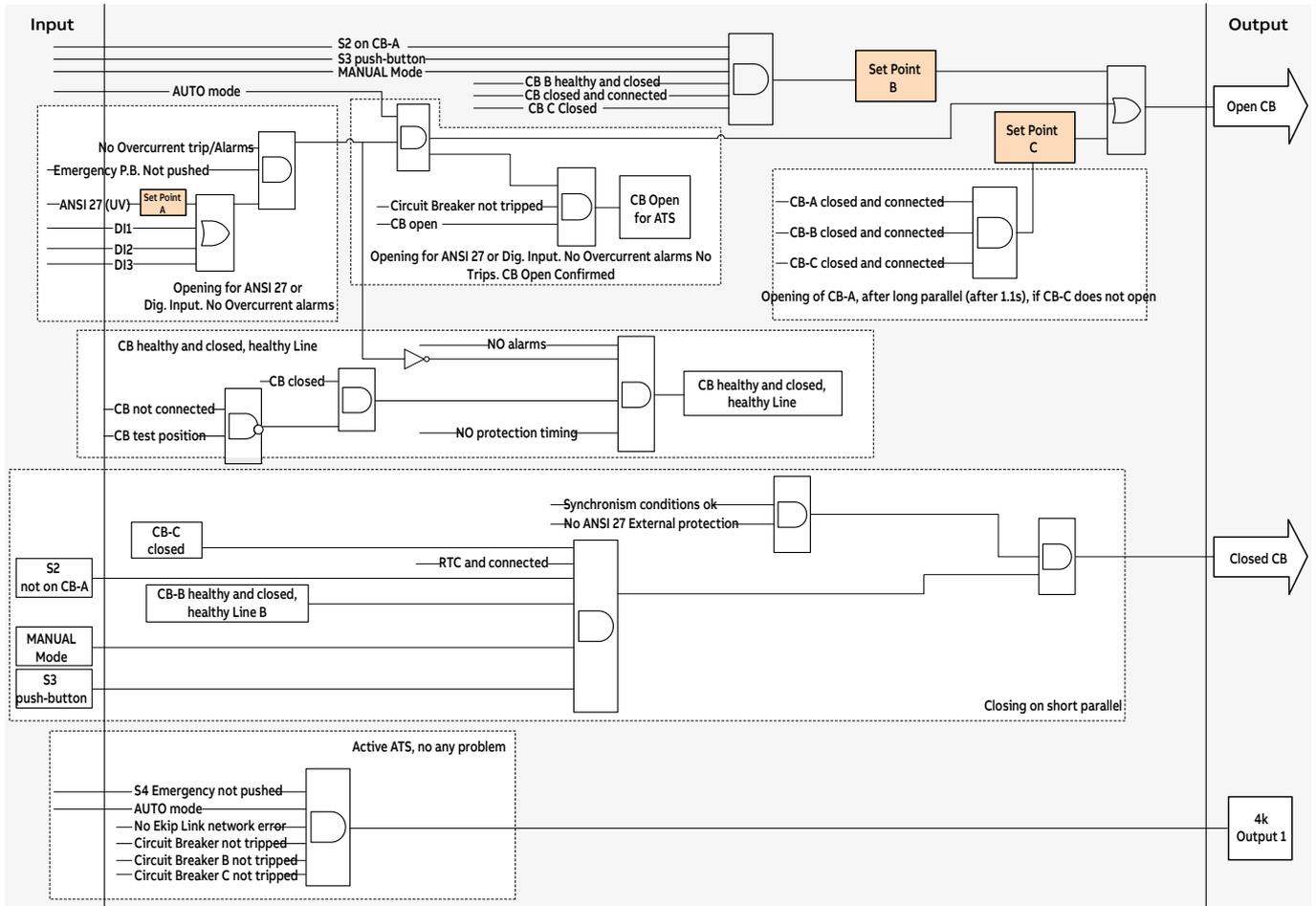
Ekip Signalling 4K CB-C



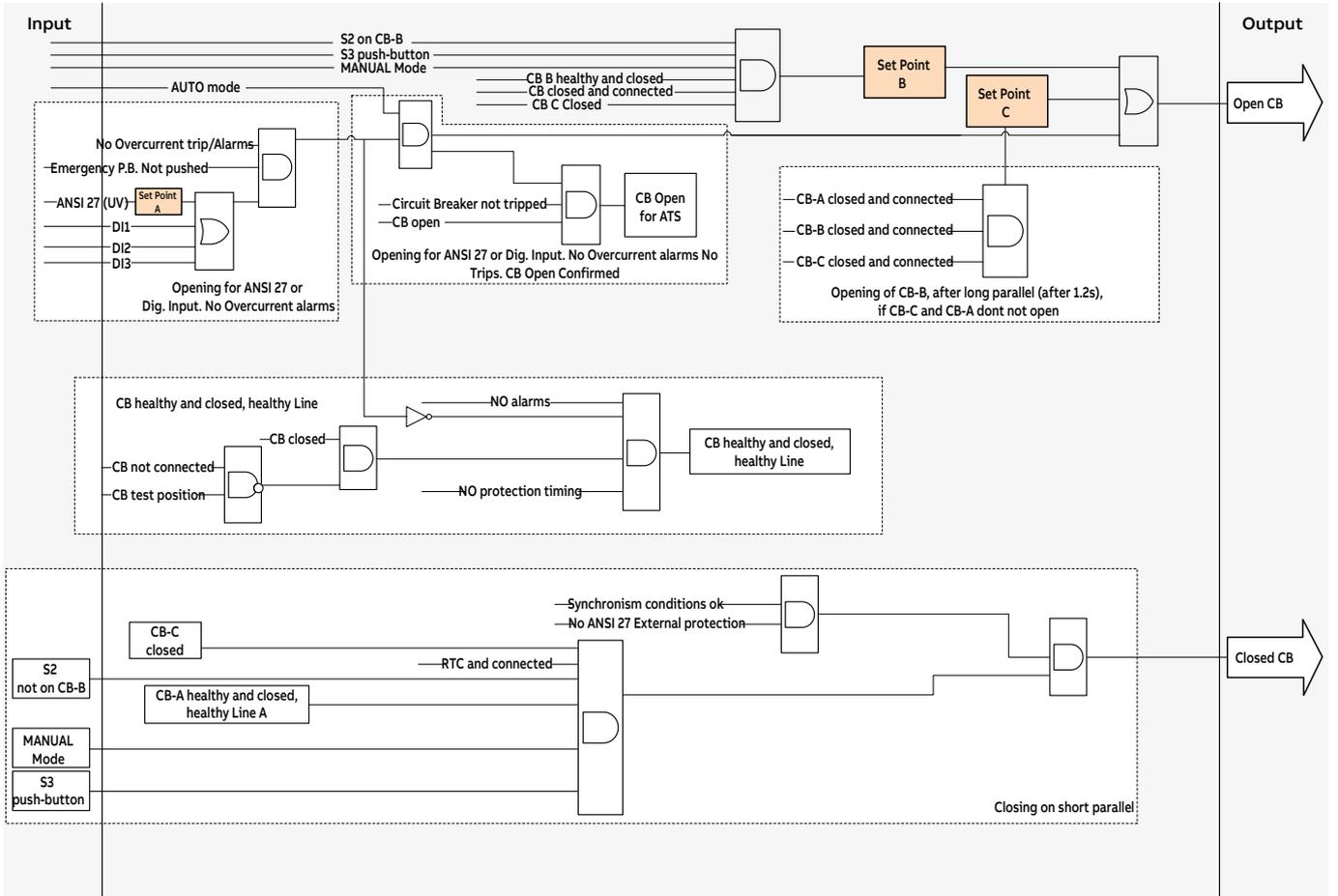
# Annex A

## Logic diagrams

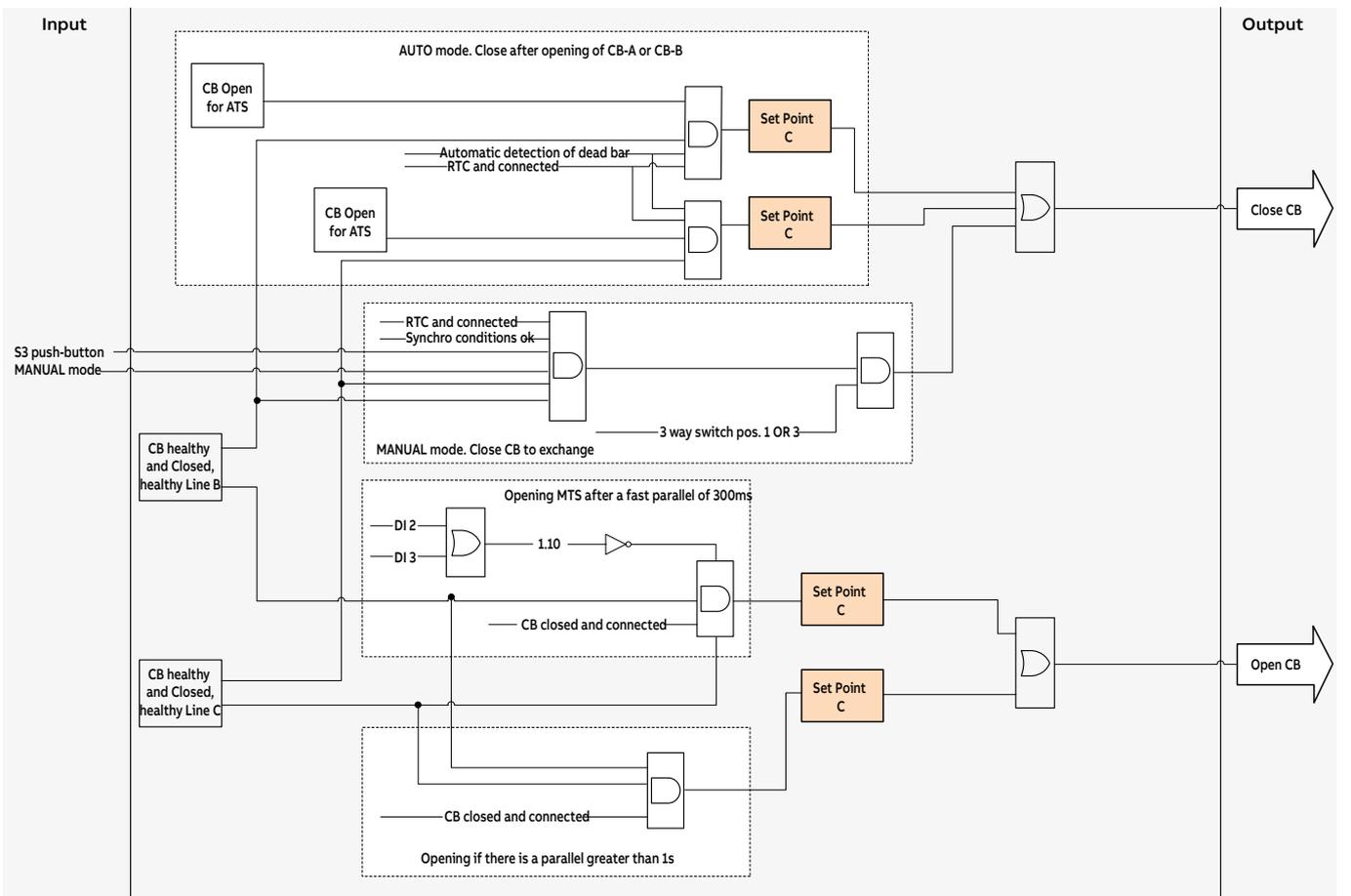
—  
CB-A



—  
CB-B



—  
CB-C



# Annex B

## Technical specification for Main-Gen open Transition

### Scope

This specification describes the operating philosophy of the ATS Main-Gen Open transition system of Emax 2 low-voltage circuit breakers.

The device monitors the voltage of the main line and generator line and reacts to the following faults:

- Maximum and minimum voltage
- Maximum and minimum Frequency

### Glossary and acronyms

- ATS - Automatic transfer switch
- CB - Circuit Breaker
- Un - Nominal voltage of the system
- RTC - Ready to close
- CB-A - Circuit breaker incomer from line A
- CB-B - Circuit breaker incomer from Generator
- HMI - Human-machine interface

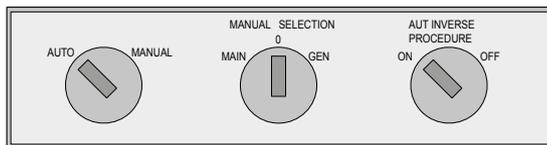
### Modes of operation and controls

There are three mode of operation available:

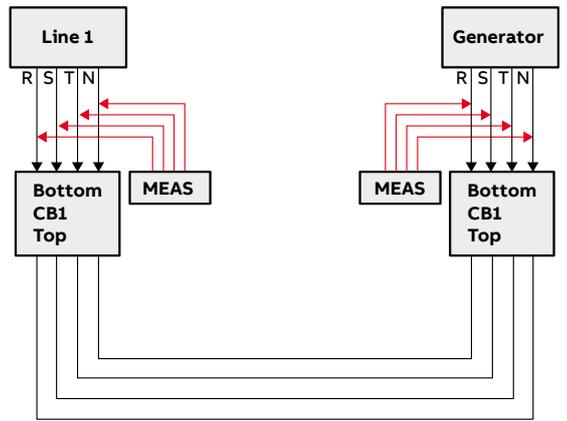
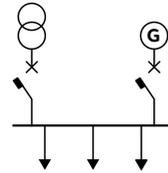
- Automatic with inverse procedure
- Automatic without Inverse procedure
- Manual

Switches mounted on the panel door (installed by the customer) do the operation mode selection:

- Auto/Manual Switch. A two-position stay put selector switch.
- Manual selection switch. A three-position stay put selector switch
- Inverse procedure selector switch. A two-position stay put selector switch.



### Application Layout



### Legend

- R, S, T, N: 3phases+neutral
- MEAS: Ekip Measuring/Internal Voltage Plug
- Line 1/Generator: Power source (Transformer or generator)

### Application Limits

- Un: up to 1150V
- Aux:24-240V
- In= 100-6300A
- Frequency=50-60hz
- Three-phase with neutral and three phase without neutral

### Application Description

#### Auto Mode

In case of main line failure, the system starts up the emergency generator and, as soon as power on the generator side is available, the system starts the automatic switching procedure according to TS and TCE times.

When the voltage on the main line comes back, two different behaviors can take place:

- 1) If the system is set to “Automatic switching without inverse procedure”, the system locks in the current configuration (CB1 OPEN, CB2 CLOSED, generator running)
- 2) If the system is set to “Automatic switching with inverse procedure”, the system will go back to the original configuration (CB1 CLOSED and CB2 OPEN) with a “Brake-Before-Make” switching, according to the set times. Once the transition is completed, the generator switches off.

#### Manual mode

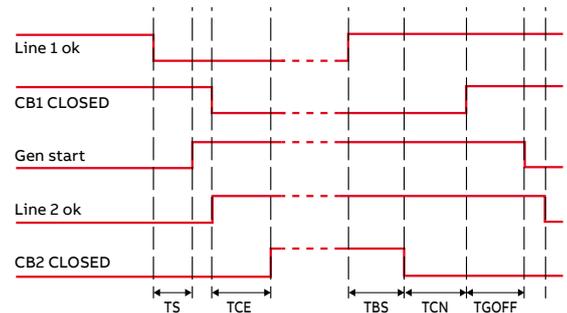
In manual mode the system can be manually configured to run under transformer or under generator.

### Auto/manual times

<b>TS:</b>	Generator start delay, after detection of fault in mains (generator in use).
<b>TCE:</b>	Closing delay of CB2 of line LN2.
<b>TBS:</b>	Opening delay of emergency line CB, after detection of stabilized voltage on main line.
<b>TCN:</b>	Closing delay of CB1 of line LN1.
<b>TGOFF:</b>	Generator switching off delay, after closure of main line LN1 CB.
<b>TL</b>	Delay in activation of outlet DO7, after detection of the fault on both lines LN1 and LN2.

### Time Diagrams

Figure 1 application time diagram



#### Special cases:

if LN1 returns to normal and it is stabilized before LN2 is normal, the sequence interrupts and the generator must be turned off;  
 if LN1 returns to normal and it is stabilized during TCE, the sequence is completed.  
 If LN1 disappears during TBS, the sequence interrupts;  
 if LN1 disappears during TCN, the switchboard starts TS running in order to re-enter on LN2.

# Annex B

## System settings

The system settings can be adjusted from the Ekip Connect 3 Software interface.

Table 4.1: Description of time delays

Time delays	Description	Value	Default
TS Delay	Generator start delay after detection of a fault in the mains	0...30s Step 1s	0 s
TBS Delay	Opening delay of emergency line CB	0...100s, Step 1s	0 s
TCE Delay	Closing delay of line LN2 CB2.	0...60s Step 1s	0 s
TCN Delay	Closing delay of CB1 of line LN1	0...60s Step 1s	0 s
TGOFF Delay	Generator switching off delay after closure of line LN1 CB1.	0...100s Step 1s	0 s
TL Delay	Delay in activation of outlet DO7, after detection of the fault on both lines LN1 and LN2	0...60s Step 1s	0 s
Min/max voltage threshold	The voltage threshold at which the ATS starts the transfer procedure when in AUTO mode	-30% ...-5%, +5% ... +30%, step ± 1%	-10% +10%
Min/max frequency threshold	The frequency threshold at which the ATS starts the transfer procedure when in AUTO mode	-10% ...-1%, +1% ... +10%, step ± 1%	-2% +2%

## Breakers configuration

Breakers can be E1.2, E2.2, E4.2, E6.2, fixed or withdrawable, 3 poles or 4 poles.

Each breaker must be equipped with the following. Please order the accessories as mounted by factory parts.

Please order the components accordingly to your system and auxiliary voltages

Part name	Ordering Code
Ekip Touch Trip Unit (or higher)	Depends on Breaker Type
Ekip Measuring (or Higher)	1SDA074186R1
Ekip Supply	Depends on Aux Voltage
Ekip Link	1SDA074163R1
Ekip Signalling 2K	1SDA074167R1
Ekip Com Actuator	1SDA074166R1
Spring Charger Motor	Depends on Aux Voltage
YO	Depends on Aux Voltage
YC	Depends on Aux Voltage
ATS License	1SDA082889R1

The Ekip Connect 3 commissioning tool for ATS has an auto/manual system that check the correct configuration of the circuit breakers. The commissioning succeed only if the configurations are correct.

## Mechanical Interlock

We strongly recommend to install a mechanical interlock between the breakers. Please refer to the Emax 2 catalogue to order the right interlock for the breaker you are using.

## Compatibility

The Embedd ATS Main Gen Open Transition is compatible with the Emax 2 products starting from the following firmware version:

<b>Mainboard</b>	02.22.37
<b>Ekip Touch</b>	02.22.34
<b>Link</b>	02.40

To check the firmware version you can do one of the following:  
 1) use the "Information" section of Ekip Connect 3, Nominal Data field.  
 2) press the "i" button on the front of the trip unit until the page "Protection Unit" appears.



## Outputs and Visual feedback with Ekip Signalling 2k

### Description

The Ekip Signalling 2K is a signalling accessory module.

The module has:

- Two digital inputs, and two contacts for output signals.
- A power status LED, and four signalling LEDs (one LED for every input/output).

### IMPORTANT:

on each circuit-breaker, a maximum of two (for E1.2 circuit-breakers) or three (for E2.2-E4.2-E6.2 circuit breakers) Ekip Signalling 2K modules can be installed: one 2K-1, one 2K-2, and one 2K-3 (only for E2.2-E4.2-E6.2 circuit breakers).

These modules by their name and label, and have distinct wiring, but they are identical in terms of their characteristics and manner of installation.

### Compatibility and power supply

The modules can be installed in the presence of Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch releases, and require the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

### Electrical characteristics

The following table lists the electrical characteristics of the modules:

Component	Characteristics
Output contacts	<ul style="list-style-type: none"> <li>• Maximum switching power<sup>(1)</sup>: 1250 VA.</li> <li>• Maximum switching voltage<sup>(1)</sup>: 150 V DC / 250 V AC.</li> <li>• Breaking power<sup>(1)</sup>: 2 A @ 30 V DC, 0.8 A @ 50 V DC, 0.2 A @ 150 V DC, 4A @ 250 V AC.</li> <li>• Dielectric strength between open contacts: 1000 V AC (1 minute @ 50 Hz).</li> <li>• Dielectric strength between each contact and coil: 1000 V AC (1 minute @ 50 Hz).</li> </ul>

### ATS System Outputs

Circuit Breaker	Contact	Type	Meaning
CB-A (Line CB)	2K-O11	NO	<b>ATS Ready</b> (Circuit breakers not tripped. No Ekip Link Errors. No internal or hardware errors. Auto mode ON. Circuit breakers connected)
CB-A (Line CB)	2K-O12	NO	<b>Alarm</b> (Circuit breakers command failed. Protection releases tripped. Ekip Link Errors. Internal or hardware errors.)
CB-B (Generator CB)	2K-O11	NO	<b>Generator Start</b>
CB-B (Generator CB)	2K-O12	NO	<b>DO7 Alarm</b> (Line and generator voltages missing for a TL Time)

# Annex B

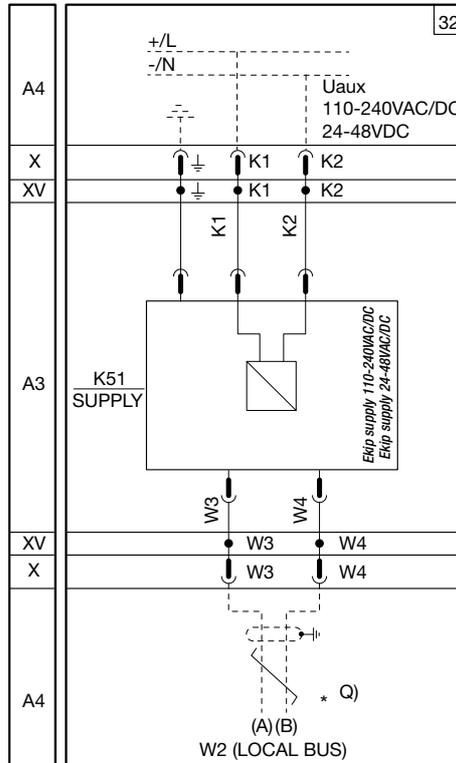
## Wirings and connections

### Ekip Units supply

The Ekip Supply modules must be continuously fedded, also during the transfer phase.

You can order a low voltage Ekip Supply (24-48V), or any voltage which fits, and supply it from the engine starting battery.

Alternatively, an isolated secondary circuit (UPS) must be provided.



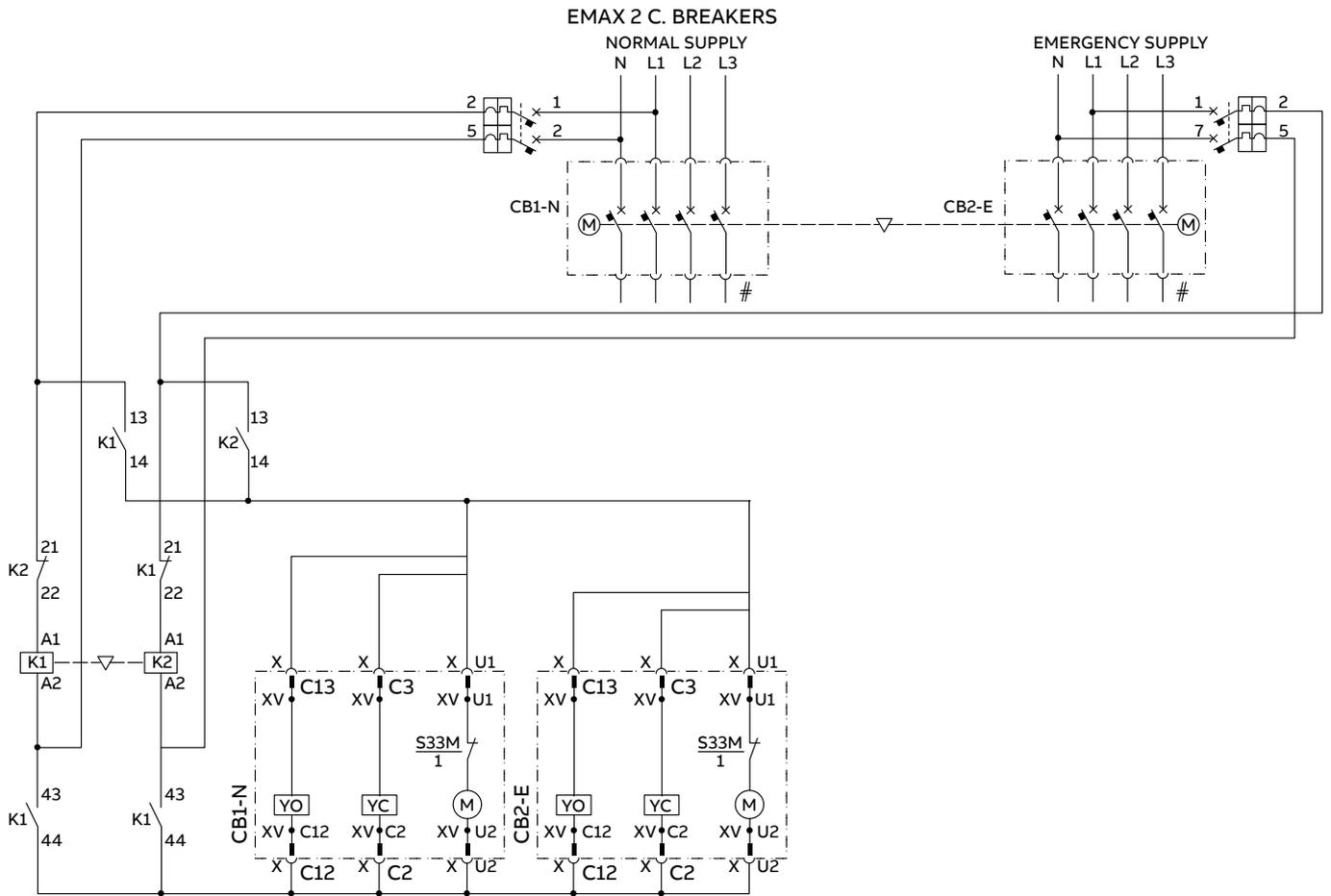
\*A); \*I)

### Diagrams 32

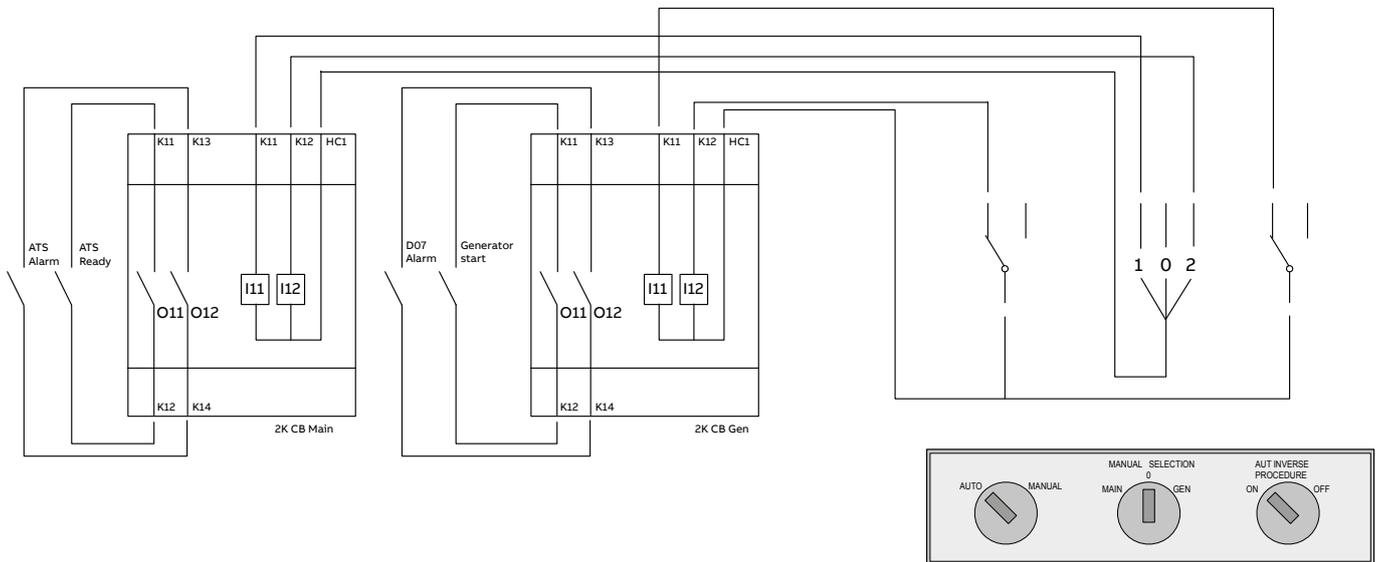
For external wiring. AWG 22-16 cables with a maximum external diameter of 1.4 mm must be used.

Further information is available on pag 55, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available 1SDM000091R0001.

Auxiliaries



Controls, alarms and generator start









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