INSTALLATION AND OPERATING INSTRUCTION

Automatic transfer switches

TruONE® ATS, OX_ 30. . .1600_

Receiving, handling and storage

Warning

HAZARD OF EQUIPMENT OVERTURNING

When moving with a fork lift, do not remove the shipping package until the device is in its final location.

Failure to follow this instruction will result in personal injury or equipment damage.

Receiving and handling

Upon receipt, carefully inspect the switch for damage that may have occurred during transit. If damage is evident, or there is visible indication of rough handling, immediately file a damage claim with the transportation company, and notify your local ABB sales office.

Do not remove the shipping package until ready to install the switch.

Storage

If the unit will not be placed into service immediately, store the switch on its original package in a clean, dry location. To prevent condensation, maintain a uniform temperature. Store the unit in a heated building, allowing adequate air circulation and protection from dirt and moisture. Storing the unit outdoors could cause harmful condensation inside the switch enclosure.

Read these safety instructions carefully before using this product!

Danger

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment and follow safe electrical work practices.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Before performing visual inspections, tests, or maintenance on the equipment, disconnect all sources of electric power. Assume that all circuits are live unless they are completely deenergized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Turn off switch before removing or making load side connections.
- Always use a properly rated voltage sensing device at all line and load to confirm switch is off.
- Turn off power supplying switch before doing any other work on or inside switch.

Failure to follow these instructions could result in death or serious injury.

Installation and operating instruction

Automatic transfer switches, TruONE® ATS

OPERATING INSTRUCTIONS, TRUONE® ATS, OX_30...1600 CHAPTERS 1–7

INSTALLATION INSTRUCTIONS, TRUONE® ATS, OX_30...1600 CHAPTERS 8–10

Operating instruction
Automatic transfer switches, TruONE® ATS

1. Introduction

This manual describes the installation and the basic operation of the automatic transfer switches TruONE® ATS (OX_30…1600_), manufactured by ABB. Mounting instructions for the switch and for the available accessories are situated at the end of the manual; Part 2, chapters 8 and 9.

1.1 Use of symbols in manual

Hazardous voltage
Warns about a situation where a hazardous voltage may cause physical injury to a person or damage to equipment.

General warning
Warns about a situation where something other than electrical equipment may cause physical injury to a person or damage to equipment.

Caution
Provides important information or warns about a situation that may have a detrimental effect on equipment.

Information
Provides important information about the equipment.

1.2 Explanations of abbreviations and terms

ATS
Automatic transfer switches

Ekip
Electronic accessories / Ekip-modules; communication, signaling and connectivity modules

HMI
Control interface (Human Machine Interface), operating and configuration, available in three different level types

Level 2
HMI with DIP-switches

Level 3
HMI with LCD-screen

Level 4
HMI with touch screen and sensor module OXCT_

OX_
Automatic transfer switches, type name

OXA_B
Automatic transfer switch, open transition I - II, SOURCE on bottom, type name

OXA_T
Automatic transfer switch, open transition I - II, SOURCE on top, type name

OXB_B
Automatic transfer switch, delayed transition I - O - II, SOURCE on bottom, type name

OXB_T
Automatic transfer switch, delayed transition II - O - I, SOURCE on top, type name

Programming port
Only for Ekip Programming and Ekip Bluetooth -modules (USB port)

Slide switch
Switch for operating mode selection (Hand - Locking - AUTO)

S1
SOURCE 1, power supply

S2
SOURCE 2, power supply

TruONE® ATS
Automatic transfer switches, product name

2. Product overview

Automatic transfer switches TruONE® ATS (type OX_), from 30 A up to 1600 A, are designed for use in emergency or standby systems to choose and to switch between two power supplies. TruONE® ATS automatic transfer switches can be operated either electrically by DIP, LCD or Touch control interface (HMI) or manually by using the handle. You can select the operating mode by the slide switch (Hand - Locking - AUTO) on switch front. Configuration is done by HMI. TruONE® ATS automatic transfer switches are suitable for low voltage automatic transfer switch applications.

The available operation types for automatic transfer switches:

- Automatic transfer switch TruONE® ATS, type OXA30...1600_: Open transition
  - OXA30...1600_B_: I - II, source on bottom
  - OXA30...1600_T_: II - I, source on top
- Automatic transfer switch TruONE® ATS, type OXB30...1600_: Delayed transition
  - OXB30...1600_B_: I - O - II, source on bottom
  - OXB30...1600_T_: II - O - I , source on top

2.1 General overview

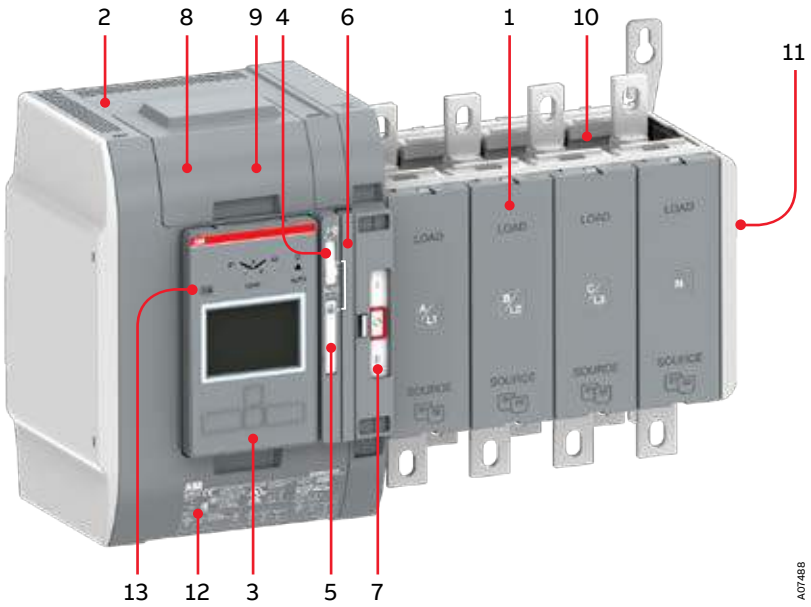


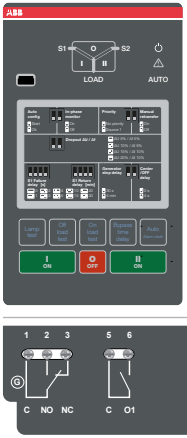
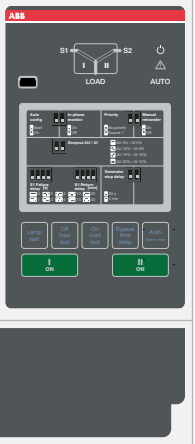
Fig. 2.1 Automatic transfer switch, TruONE® ATS

1 Transfer switch
2 Embedded ATS control unit and mechanism
3 DIP-switches, LCD or touch control interface (HMI) for configuration and automatic operation
4 Slide switch (Hand - Locking - AUTO) for selection of the operation mode
5 Padlocking the automatic transfer switch to prevent automatic and manual operation. Remark: Slide switch (Hand - Locking - AUTO) has to be in Locking-position
6 Handle for manual operation
7 Position indication
8 Terminals for control circuit connections
9 Place for Ekip-modules; communication, signaling and connectivity modules
10 Place for sensor module
11 Place for auxiliary contact blocks
12 The product identification label
13 Programming port, only for Ekip Programming and Ekip Bluetooth-modules

2.1.1 Differences of level types / operation types and suitability of Ekip-modules

In this table you can find the differences of the level types 2, 3 and 4 in the automatic transfer switch operation types of open and delayed transitions. The differences are on HMI and on wiring of I/O contacts. More information of HMIs, see the chapter 2.2 and the wiring, see chapter 7.

In addition you can find to which level types the Ekip-modules mounted with auxiliary power supply module (see chapters 5.4 ...5.8) are suitable.

Operation types, TruONE® ATS, type OX_30...1600_		**Ekip- modules suitable**
Delayed transition, OXB_	Open transition, OXA_	
S1 I O II S2 Load	S1 I II S2 Load	
Level 2: HMI (with DIP-switches) and connections of control circuit		
		Not suitable 

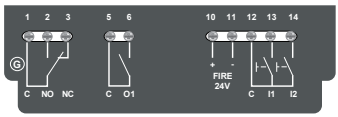
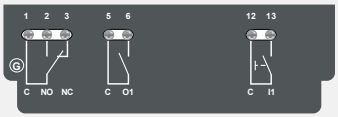
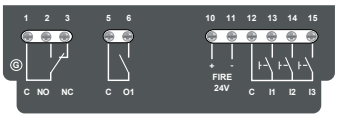
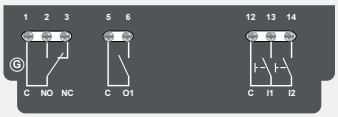
Operation types, TruONE® ATS, type OX_30...1600_		**Ekip-modules suitable**
Delayed transition, OXB_	Open transition, OXA_	
S1 I O II S2 Load	S1 I II S2 Load	
Level 3: HMI (with LCD-screen) and connections of control circuit		
 	 	Suitable 
Level 4: HMI (with touch-screen) and connections of control circuit, sensor unit includes		
  	  	Suitable 

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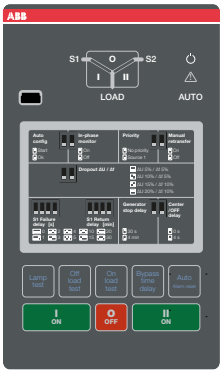
Table 2.1 The differences of level types / operation types and the suitability of Ekip-modules

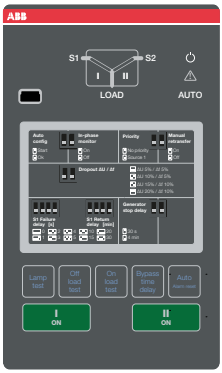
2.2 HMI

HMI is the control interface (Human Machine Interface), it is available in three different level types. Level 2 contains the HMI with DIP-switches, Level 3 contains the HMI with LCD-screen and level 4 contains the HMI with touch screen. The HMI is used for configuration and automatic operation.

Level 2:
HMI with
DIP-switches



I - O - II (or II - O - I)



I - II (or II - I)

Level 3:
HMI with
LCD-screen

I - O - II (or II - O - I)

I - II (or II - I)

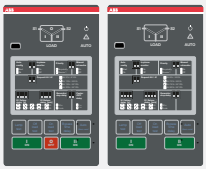
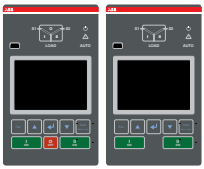
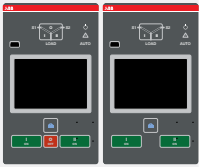
Level 4:
HMI with
touch screen

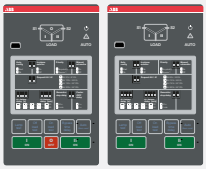
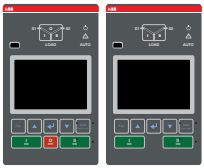
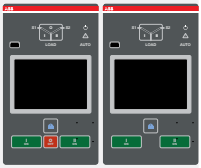
I - O - II (or II - O - I)

I - II (or II - I)

Fig. 2.2 HMI:s available in three Level types: upper pictures; delayed transition I - O - II (or II - O -I) and lower pictures; open transition I - II (or II - I)

2.3 TruONE® ATS feature comparison

Feature comparison	Level 2 controls (DIP)	Level 3 controls (LCD)	Level 4 controls (TOUCH)
			
Ampere sizes available	IEC: 200...1600 A	IEC: 200...1600 A	IEC: 200...1600 A
	UL: 30...1200 A	UL: 30...1200 A	UL: 30...1200 A
Rated voltage	200...480 Vac	200...480 Vac	200...480 Vac
Rated frequency	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz
Phase system	Single and Three	Single and Three	Single and Three
Number of poles	2, 3 and 4	2, 3 and 4	3 and 4
Neutral configuration			
Switched	Yes	Yes	Yes
Overlapping	No	Yes	Yes
Product type			
Open transition (I-II)	Yes	Yes	Yes
Delayed transition (I - O - II or II - O - I)	Yes	Yes	Yes
Voltage and frequency settings			
Pick up SOURCE 1 Voltage	Fixed 2% above drop out	81...99%, 101...119%	81...99%, 101...119%
Drop out SOURCE 1 Voltage	+/-5, 10, 15, 20%	80...98%, 102...120%	80...98%, 102...120%
Pick up SOURCE 2 Voltage	Fixed 2% above drop out	81...99%, 101...119%	81...99%, 101...119%
Drop out SOURCE 2 Voltage	+/-5, 10, 15, 20%	80...98%, 102...120%	80...98%, 102...120%
Pick up SOURCE 1 Frequency	Fixed 1% above drop out	80,5...99,5%, 100,5...119,5%	80,5...99,5%, 100,5...119,5%
Drop out SOURCE 1 Frequency	+/-5, 10%	80...99%, 101...120%	80...99%, 101...120%
Pick up SOURCE 2 Frequency	Fixed 1% above drop out	80,5...99,5%, 100,5...119,5%	80,5...99,5%, 100,5...119,5%
Drop out SOURCE 2 Frequency	+/-5, 10%	80...99%, 101...120%	80...99%, 101...120%
Time delay settings			
Override momentary SOURCE 1 Outage, sec	0, 1, 2, 3, 4, 5, 10, 15, 20, 25, 30	0...60	0...60
Transfer from SOURCE 1 to SOURCE 2, sec	Fixed 2 seconds	0...3600	0...3600
Override momentary SOURCE 2 Outage, sec	Fixed 1,5 seconds	0...60	0...60

Feature comparison	Level 2 controls (DIP)	Level 3 controls (LCD)	Level 4 controls (TOUCH)
			
Transfer from SOURCE 2 to SOURCE 1, min	0, 1, 2, 3, 4, 5, 10, 15, 20, 25, 30	0…120	0…120
Generator stop delay, min	30 secs or 4 mins	0…60	0…60
Center-OFF delay, sec	0 or 4	0…300	0…300
Pre-transfer delay S1 to S2, sec	No	0…60	0…60
Post-transfer delay S1 to S2 , sec	No	0…60	0…60
Pre-transfer delay S2 to S1, sec	No	0…60	0…60
Post-transfer delay S2 to S1, sec	No	0…60	0…60
Load shed delay, sec	No	0…60	0…60
Source failure detections			
No voltage	Yes	Yes	Yes
Undervoltage	Yes	Yes	Yes
Overvoltage	Yes	Yes	Yes
Phase missing	Yes	Yes	Yes
Voltage unbalance	Yes	Yes	Yes
Invalid frequency	Yes	Yes	Yes
Incorrect phase sequence	Yes	Yes	Yes
Features			
Controls	DIP + keys	LCD + keys	Touch + keys
LED indications for ATS, S1 and S2 status	Yes	Yes	Yes
Open transition - Standard digital inputs/ outputs	0 / 1	1 / 1	1 / 2
Delayed transition - Standard digital inputs/ outputs	1 / 1	1 / 2	1 / 3
Programmable digital inputs/outputs	No	Yes	Yes
Auto config (voltage, frequency, phase system)	Yes	Yes	Yes
Source priority	SOURCE 1, No priority	SOURCE 1/2, No priority	SOURCE 1/2, No priority
Manual re-transfer	Yes	Yes	Yes
In-phase monitor	Yes	Yes	Yes

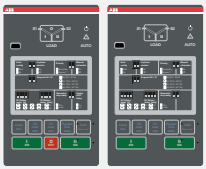
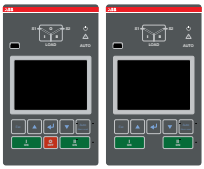
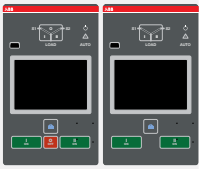
Feature comparison	**Level 2 controls (DIP)**	**Level 3 controls (LCD)**	**Level 4 controls (TOUCH)**
			
Genset exercising: on-load, off-load	Yes	Yes	Yes
In-built power meter module	No	No	Yes
Load shedding	No	Yes	Yes
Real time clock	No	Yes	Yes
Event log	No	Yes	Yes
Field-mount accessories			
Auxiliary contacts for position indication	Yes	Yes	Yes
Digital input/output modules	No	Yes	Yes
12-24 Vdc aux supply module for controller	No	Yes	Yes
Communication modules	No	Yes	Yes
Connectivity			
Modbus RS485	No	Yes	Yes
Modbus/TCP	No	Yes	Yes
Profibus DP	No	Yes	Yes
ProfiNet	No	Yes	Yes
DeviceNet	No	Yes	Yes
Ethernet IP	No	Yes	Yes
IEC 61850	No	Yes	Yes
Monitoring via ABB Abilitytm: EDCS	No	Yes	Yes
Enclosures			
Open style	Yes	Yes	Yes
IP54	No	Yes	Yes
Type 1	No	Yes	Yes
For applications			
Mains - Mains	Yes	Yes	Yes
Mains - Generator	Yes	Yes	Yes

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Table 2.2 ATS feature comparison, main features - but not limited to - in the table above

2.4 Typical applications

Automatic transfer switches TruONE® ATS are designed for choosing and switching between two power supplies.

See possible supply phase scenarios on next page. You have to define your own supply phase system on Chapter 4 / Navigating menu / Parameters: Power distribution systems (Level 3 and Level 4). Factory setting: 3 phases with neutral.

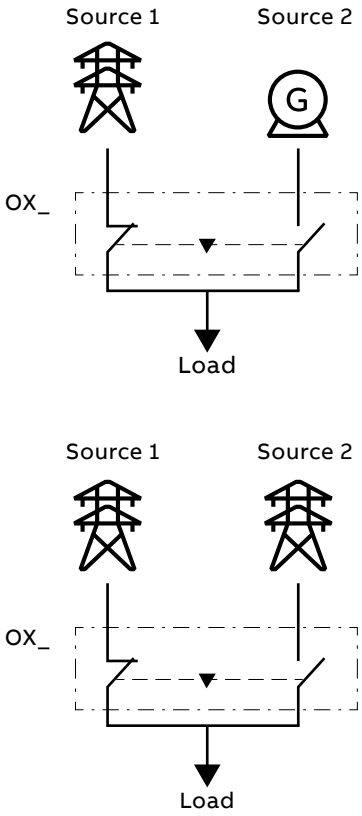
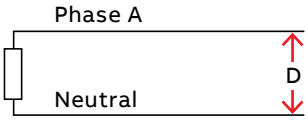
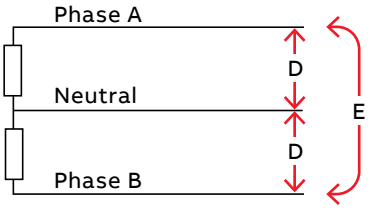


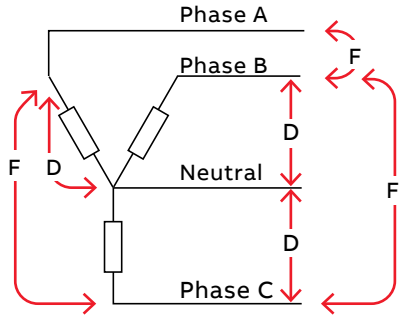
Fig. 2.3 Typical applications of automatic transfer switches



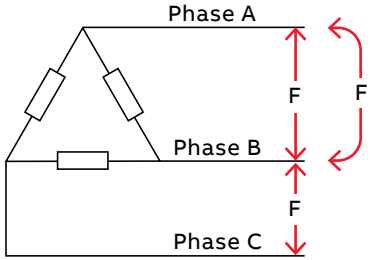
Single-phase, two-wire



Single-phase, three-wire

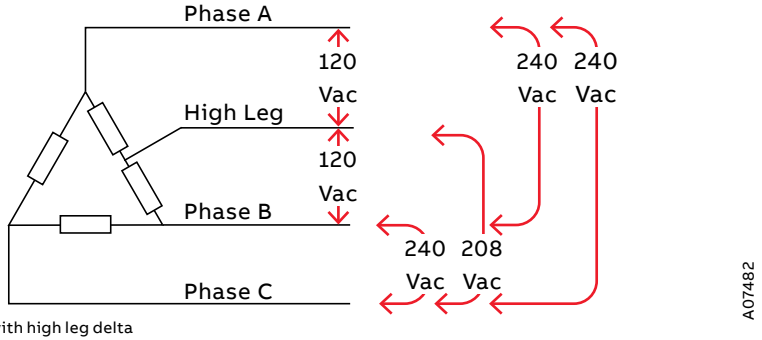


Three-phase, four-wire



Three-phase, three-wire

D	E	F
200...480 Vac L-N	200...480 Vac L-L	200...480 Vac L-L



Three-phase, with high leg delta

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Fig. 2.4 Possible supply phase scenarios

2.5 Description of basic functionality

2.5.1 Switching sequence / Automatic -

2.5.1.1 SOURCE 1 Priority (SOURCE 2 = Generator)

The switching sequence can be summarized in following steps:

- An anomaly occurs on the SOURCE 1
- Override momentary S1 outage delay
- Generator start
- SOURCE 2 OK
- Transfer from S1 to S2 delay
- Pre-transfer signal on
- Load shed signal on
- Pre-transfer S1 to S2 delay
- Load shed delay
- Transfer switch (SOURCE 1) to the position O
- Center-off delay (only with Delayed transition I - O - II type)
- Transfer switch (SOURCE 2) to the position II
- Post-transfer S1 to S2 delay
- Pre-transfer signal off

And the re-transfer sequence can be summarized in the following steps:

- The SOURCE 1 is restored
- Transfer from S2 to S1 delay
- Pre-transfer signal on
- Pre-transfer S2 to S1 delay
- Transfer switch (SOURCE 2) to the position O
- Center-off delay (only with Delayed transition I - O - II type)
- Transfer switch (SOURCE 1) to the position I
- Load shed signal off
- Generator stop delay
- Post-transfer S2 to S1 delay
- Pre-transfer signal off
- Generator stop
- SOURCE 2 off

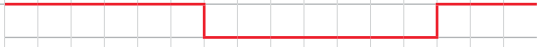
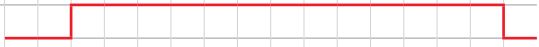
SOURCE 1 priority (SOURCE 2 = generator)	
Switch position I	
Switch position O	
Switch position II	
SOURCE 1 OK	
SOURCE 2 OK	
Generator started	
Pre-transfer signal	
Load shed signal	
Override momentary S1 outage delay	
Transfer from S1 to S2 delay	
Override momentary S2 outage delay	
Transfer from S2 to S1 delay	
Generator stop delay	
Center-off delay, I - O - II	
Pre-transfer S1 to S2 delay	
Post-transfer S1 to S2 delay	
Pre-transfer S2 to S1 delay	
Post-transfer S2 to S1 delay	
Load shed delay	

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Table 2.3 Automatic Switching Sequences, SOURCE 1 Priority (SOURCE 2 = Generator)

2.5.1.2 SOURCE 2 Priority (No generator)

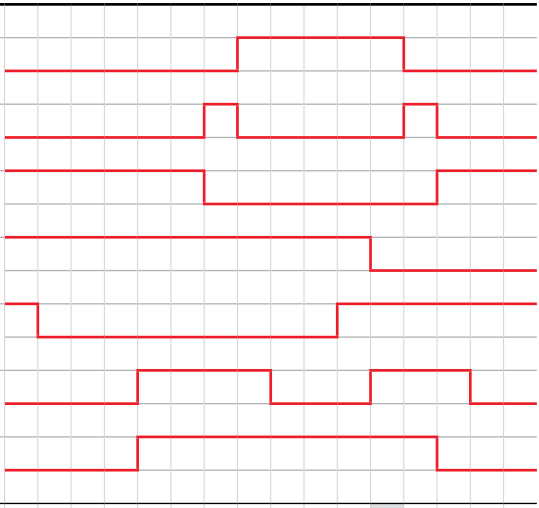
The switching sequence can be summarized in following steps:

- An anomaly occurs on the SOURCE 2
- Override momentary S2 outage delay
- Transfer from S2 to S1 delay
- Pre-transfer signal on
- Load shed signal on
- Pre-transfer S2 to S1 delay
- Load shed delay
- Transfer switch (SOURCE 2) to the position O
- Center-off delay (only with Delayed transition I - O - II type)
- Transfer switch (SOURCE 1) to the position I
- Post-transfer S2 to S1 delay
- Pre-transfer signal off

And the re-transfer sequence can be summarized in the following steps:

- The SOURCE 2 is restored
- Transfer from S1 to S2 delay
- Pre-transfer signal on
- Pre-transfer S1 to S2 delay
- Transfer switch (SOURCE 1) to the position O
- Center-off delay (only with Delayed transition I - O - II type)
- Transfer switch (SOURCE 2) to the position I
- Load shed signal off
- Post-transfer S1 to S2 delay
- Pre-transfer signal off

SOURCE 2 priority (no generator)



Override momentary S1 outage delay	
Transfer from S1 to S2 delay	
Override momentary S2 outage delay	
Transfer from S2 to S1 delay	
Center-off delay, I - O - II	
Pre-transfer S1 to S2 delay	
Post-transfer S1 to S2 delay	
Pre-transfer S2 to S1 delay	
Post-transfer S2 to S1 delay	
Load shed delay	

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Table 2.4 Automatic Switching Sequences, SOURCE 2 Priority (No generator)

2.5.1.3 No Source Priority (Generator and load shed usage disabled)

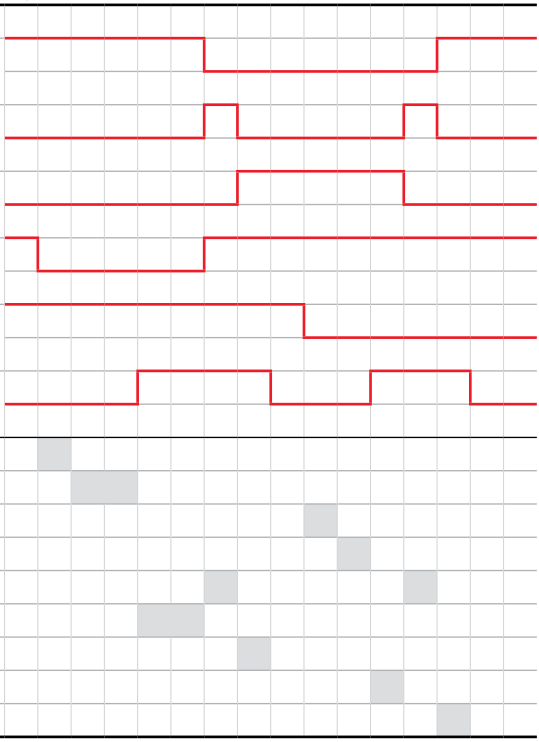
The switching to available source can be summarized in following steps:

- An anomaly occurs on the SOURCE 1
- Override momentary S1 outage delay
- Transfer from S1 to S2 delay
- Pre-transfer signal on
- Pre-transfer S1 to S2 delay
- Transfer switch (SOURCE 1) to the position O
- Center-off delay (only with Delayed transition I - O - II type)
- Transfer switch (SOURCE 2) to the position II
- Post-transfer S1 to S2 delay
- Pre-transfer signal off

After an anomaly in the source functioning, the re-transfer to available source can be summarized in the following steps:

- The SOURCE 1 is restored
- An anomaly occurs on the SOURCE 2
- Transfer from S2 to S1 delay
- Pre-transfer signal on
- Pre-transfer S2 to S1 delay
- Transfer switch (SOURCE 2) to the position O
- Center-off delay (only with Delayed transition I - O - II type)
- Transfer switch (SOURCE 1) to the position I
- Post-transfer S2 to S1 delay
- Pre-transfer signal off

No source priority (generator and load shed usage disabled)



—

Table 2.5 Automatic Switching Sequences, No Source Priority (Generator and load shed usage disabled)

2.5.2 Automatic configuration

Basic system parameters can be automatically configured: rated voltage, rated frequency, both supplies power distribution systems, neutral location. Other parameters are set to factory values; see Chapter 4, Navigating menu.

2.5.3 In-phase monitor

In-phase monitor is a feature that user can set On/Off. The feature is named in HMI: In-phase Monitor. When the in-phase monitor is set to On, the device measures that the sources are in sync with each other. The ATS allows transfer from SOURCE 1 (S1) to SOURCE 2 (S2) only when they are in sync. Load supply transfer is delayed or disabled in conditions that are considered invalid for the application:

- Phase difference between sources is too big
- Phase order between sources is not the same
- Voltage amplitude is out of range
- Phase is missing
- Voltage is asymmetric
- Frequency is out of range

In-phase monitor calculates the phase difference of supply lines.

2.5.4 Powering supply scenarios

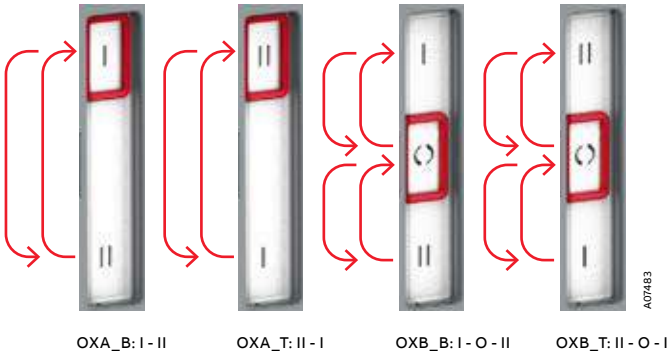
Device can be powered from the:

- Direct from SOURCE 1 or SOURCE 2: Whole device is powered and ATS can be operated electrically.
- Auxiliary power supply module, OXEA1: Powering the whole device (including HMI), but load transfer cannot be performed.
- Programming port on HMI (USB port): Powering only the main board. Allows software update to main device and connection of Ekip Connect commissioning tool.

3. Operating

3.1 Position indication

Contact movement and position indication is indicated in the figure below, on left side: Open transition I - II (or II - I) and on right side: Delayed transition I - O - II (or II - O - I)



—
Fig. 3.1 Contact movement / position indication: OXA_, Open transition; OXB_, Delayed transition

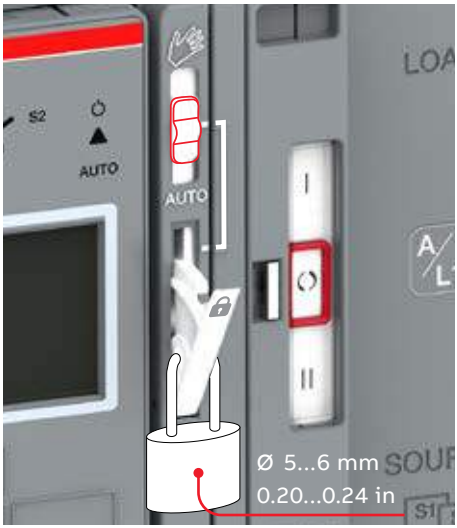
3.2 Operating and locking

The operation mode is selected by using the slide switch (Hand - Locking - AUTO) located on the front of the automatic transfer switch (ATS).

- **Hand**-position = **Manual mode**, enabling emergency manual operation using the handle. ATS functionality is disabled when in Hand position.
- **Lock**-position = **Locking mode**, padlocking the automatic transfer switch in a specific position to prevent automatic and manual operation. Remark! The handle has to set standby slot (not in use), after that the slide switch will move to the Locking mode automatically and the switch is allowed to be padlocked. To set the operating handle back to its place, see the left picture in Fig. 3.6.
- **AUTO**-position = **Automatic control mode enabled**, operating by DIP, LCD or Touch control interface (HMI). When the slide switch is moved to the AUTO position, the ATS is functioning immediately in the automatic control mode.

Manual mode

Automatic mode



Locking mode

Fig. 3.2 Above the selection of the operation modes (Manual or Automatic) by the slide switch. Below padlocking the automatic transfer switch; The handle has to set standby slot (not in use), after that the slide switch will move to the Locking mode automatically and the switch is allowed to be padlocked.

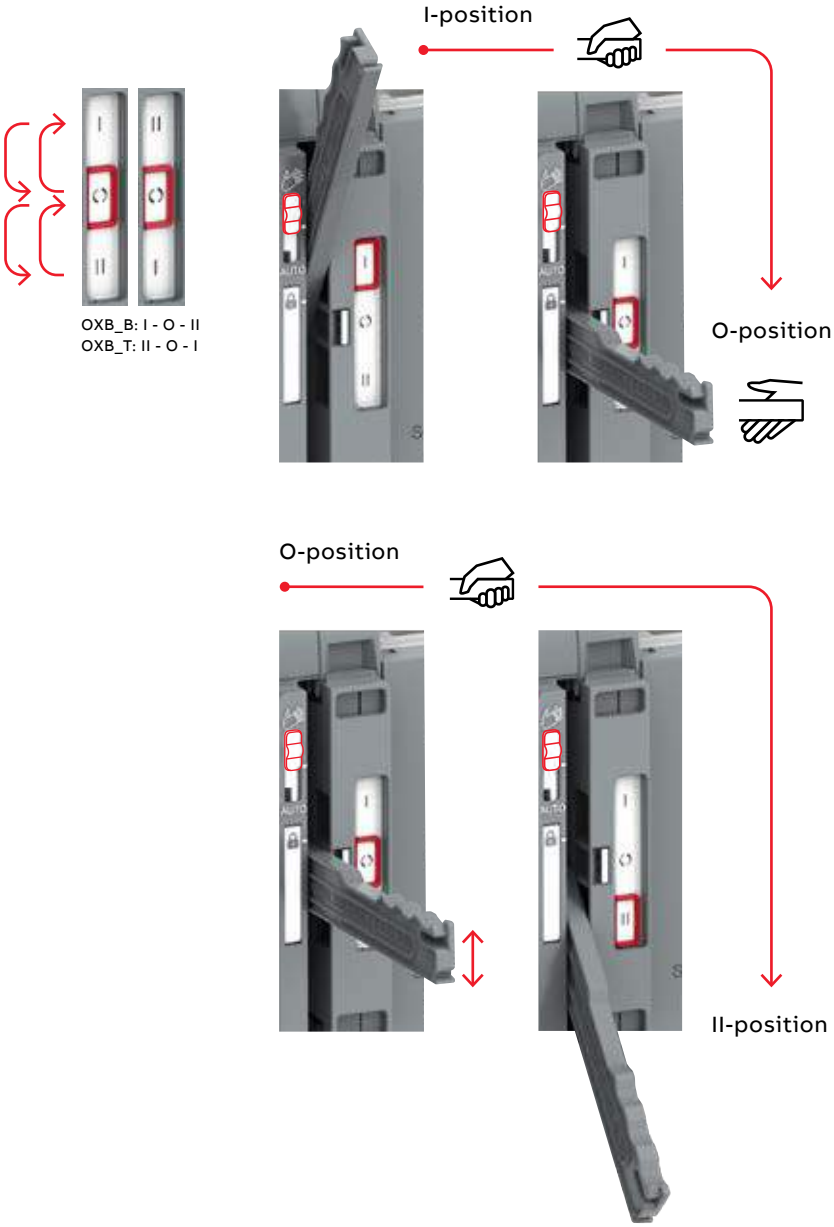
3.3 Manual mode, operating by the handle

General warning
Verify the condition of power source prior to manually transferring. Manual operation may result in out-of-phase transfer when both sources are energized.

Mounting the handle to the operating position; turn the slide switch to the Manual mode (Hand), lift the handle from its place inside and place it to the operating position.

More information, see animation: Manual and automatic operation - TruONE® ATS (https://youtu.be/bosvSPVi2sM).

Fig. 3.3 Mounting of the handle to the operating position



—
Fig. 3.4 Manual mode, operating by handle, delayed transition I - O - II or II - O - I. You have to stop and release (= take the hand off) the handle in O-position when moving from position I to II (or from position II to I)

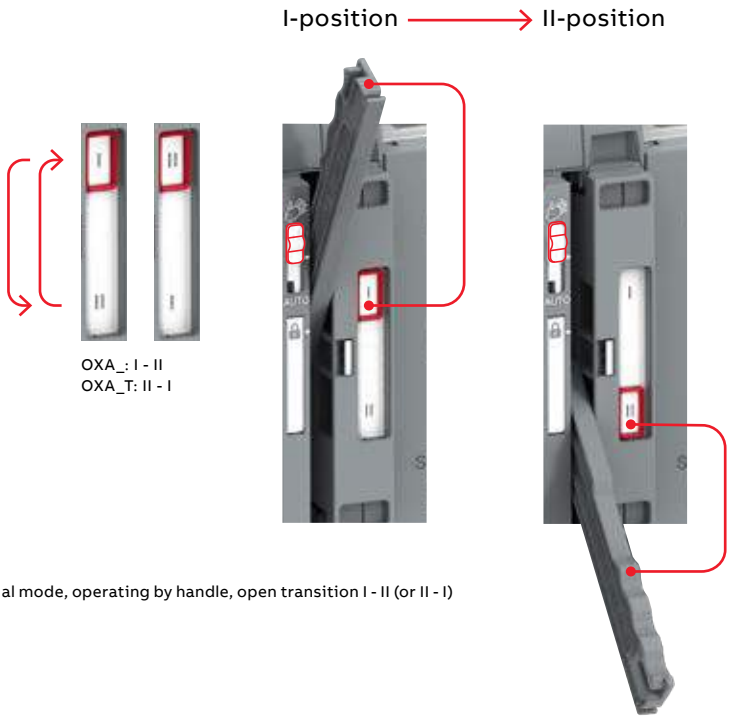


Fig. 3.5 Manual mode, operating by handle, open transition I - II (or II - I)

3.4 Automatic mode, operating by HMI

When operating the automatic transfer switch by HMI, turn the slide switch to Automatic mode (AUTO). Remark! The handle has to be standby slot (not in use) before turning to automatic mode.

Information
When the slide switch is moved to the AUTO position, the ATS is functioning immediately in the automatic control mode.

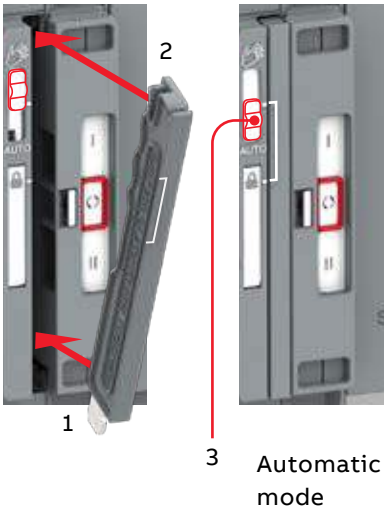


Fig. 3.6 The operating handle must set back to standby slot before moving to the automatic mode

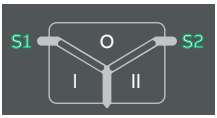
3.5 LED functionality in HMI

LED functionality is common to every HMI-type.

I - O - II

I - II

Fig. 3.7 On left: LEDs in OXB_, delayed transition, I - O - II. On right: LEDs in OXA_, open transition I - II.

LED	Indication	Description
Power led		
	ON, fixed light	Power supply and communication present
	2 quick flashes/1s	Power supply present, communication absent between switch and the HMI
	OFF	No power available for HMI.
S1 and S2 leds		
	ON, fixed light	S1 or / and S2 is present and within user defined limits
	2 quick flashes/1s	Undervoltage
	Flash/1 s, 90%/10 %	Invalid frequency
	Flash/1 s, 10%/90 %	Unbalance
	5 flashes/1 s, 50%/50 %	Overvoltage
	Flash/2 s, 50%/50%	Incorrect phase sequence
	Flash/4 s, 50%/50 %	Phase missing
	Flash/1 s, 50%/50 %	Generator stop delay ongoing
	OFF	No voltage

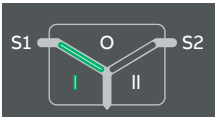
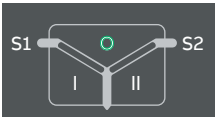
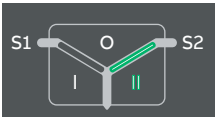
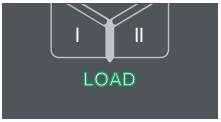
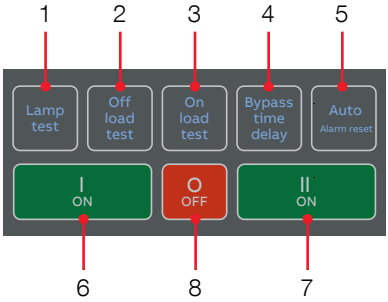
I, II and 0 leds		
	ON, fixed light	Switch position is indicated with fixed light in I, O or II led. Only one can be on simultaneously
	Flash/1 s, 50%/50 %	Delay ongoing. Going to move away from the blinking status
		
Load led		
	ON	Supply ok and connected to load
	OFF	Not connected to load
Auto led		
	ON, fixed light	Switch is in automatic mode
	Flash/1 s, 50%/50 %	Test on load
	Flash/1 s, 90%/10 %	Test off load
	5 flashes/1 s, 50%/50 %	Autoconfig completed
Alarm led		
	OFF	No alarms
	ON, fixed light	Handle attached, locked, other alarm
	2 quick flashes/1s	Control Alarm
	5 flashes/1 s, 50%/50%	Auto configuration ongoing
	Flash/1 s, 50%/50%	Control Retry
	Flash/1 s, 10%/90%	Auto mode off

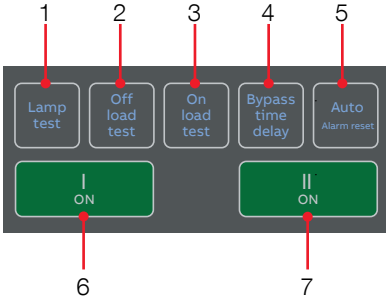
Table 3.1 LED functionality, common to every HMI-type

3.6 Using DIP control interface HMI, level 2

3.6.1 Keypad



OXB_, delayed transition, I - O - II



OXA_, open transition, I - II

1 **Lamp test:** Turns on all LEDs simultaneously to see if all LED's are working
2 **Off load test:** Starts off load test (Starts generator but does not transfer the load on generator)
3 **On load test:** Starts on load test (Starts the generator and transfers the load on generator)
4 **Bypass time delay:** Bypass any ongoing time delay
5 **Auto (Alarm reset):** If there are any alarms, by pressing this button you can reset all alarms. If there are not alarms, you will move to Auto-mode.
6 **I ON:** Operate switch to I position
7 **II ON:** Operate switch to II position
8 **O OFF:** Operate switch to O position, only in delayed transition switches (OXB_), I - O - II or II - O - I.

Fig. 3.8 Keypad in HMI with DIP-switches

3.6.2 Configuration by DIP-switches

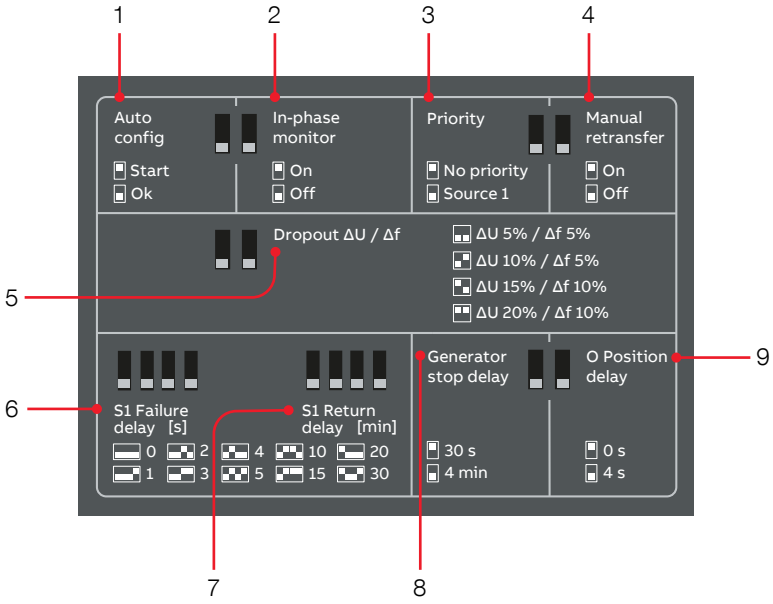


Fig. 3.9 DIP-switches for configuration in HMI, level 2

1 **Auto config:** Automatic configuration of device parameters. Turn the DIP-switch to Start-position. The configuration is indicated with LEDs, see chapter 3.2 / LED functionality in HMI. Some of the parameters are default values and some of them the device will measure. While measuring during the automatic configuration the Alarm led will flash fast (5 flashes / 1s, 50%/50%). When the device has got all the parameters, the Alarm led will turn off and Auto led starts to flash fast (5 flashes / 1s, 50%/50%). Turn DIP-switch to OK-position. Auto led will turn to fixed light if the switch is on automatic mode or the Auto led will turn off, if the switch is on manual mode (see chapter 3 / Operating). The parameters are now configured.
The procedure is:
Turn DIP-switch to Start-position >> Wait until Alarm led will flash and after that the Auto led starts to flash >> Turn DIP-switch to OK-position. Parameters are now configured.

2 **In-phase monitor:** When DIP-switch is turned to On-position, the device measures that the lines are in sync with each other. The device allows switching from SOURCE 1 (S1) to SOURCE 2 (S2) only when they are in sync. Voltage supply transfer is delayed or disabled in conditions that are considered invalid for the application:
   - Phase difference of supply lines is out of range
   - Phase order of supply lines is not the same
   - Voltage amplitude is out of range
   - Phase is missing
   - Voltage is asymmetric
   - Frequency is out of range

   In-phase monitor calculates the phase difference of supply lines and disables transfers when angle is outside of range +-15 degrees.

3 **Priority:** When DIP-switch is turned to SOURCE 1 -position, then SOURCE 1 (S1) is considered as main power source. When it is turned to No priority -position, then neither source have priority.

4 **Manual retransfer:** When DIP-switch is turned to On-position, the back switching in done manually and the device inhibits automatic back switching sequence. When the DIP-switch is turned to Off-position, the automatic back switching sequence is in operation.

5 **Dropout dU / dF:** With these two DIP-switches you can define thresholds values of the voltage and frequency within the network is allowed to vary so that the device accepts the network to be in order.

6 **S1 Failure delay:** With these four DIP-switches you can define the time in seconds (0, 1, 2, 3, 4 or 5 s) or in minutes (10, 15, 20 or 30 min) that the device waits before changing to the SOURCE 2 (S2) after SOURCE 1 (S1) failure.

7 **S1 Return delay:** With these four DIP-switches you can define the time in seconds (0, 1, 2, 3, 4 or 5 s) or in minutes (10, 15, 20 or 30 min) that the device waits before changing back to the SOURCE 1 (S1) from SOURCE 2 (S2). This delay is bypassed in case of failure in SOURCE 2 (S2).

8 **Generator stop delay:** With this DIP-switch you can define the time (30 s or 4 min) to keep the generator running without load after returning back to main power source.

9 **O Position delay:** (only in delayed transition switches OXB_, I - O - II): With this DIP-switch you can define the time (0 s or 4 s) to wait in O-position when switching from I to II via O or II to I via O.

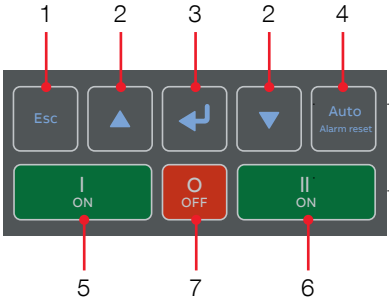
3.7 Using LCD control interface HMI, level 3

3.7.1 Keypad

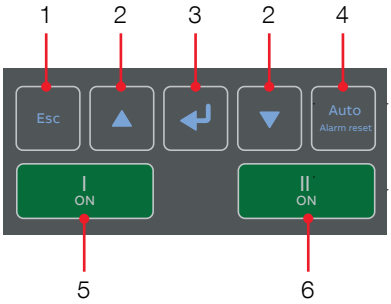
1 **Esc:** Go back in menu. When pressed in root page, the alarm list is shown.
2 **Up, Down:** Move in menu or choose parameter values.
3 **Enter:** Opens menu in root page. Enter a new menu page and accept function.
4 **Auto (Alarm reset):** If there are any alarms, by pressing this button you can reset all alarms. If there are not alarms, you will move to Auto-mode.
5 **I ON:** Operate switch to I position.
6 **II ON:** Operate switch to II position.
7 **O OFF:** Operate switch to O position, only in delayed transition switches (OXB_), I - O - II or II - O - I.

3.7.2 Navigating in menu

See the menu tree in Chapter 4.



OXB_, delayed transition, I - O - II



OXA_, open transition, I - II

Fig. 3.10 Keypad in HMI with LCD screen

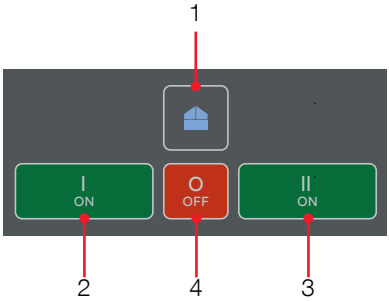
3.8 Using touch control interface HMI, level 4

3.8.1 Keypad

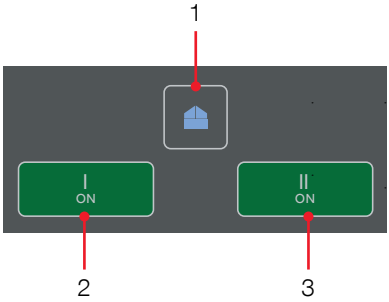
1 **Home Button:** Opens up the root menu or brings user to the homepage if defined. While viewing a specific page, it can be defined as the home page by pressing the home button for 3 seconds. All pages, except for the menus, can be set as home page. Home page is automatically shown after inactivity.
2 **I ON:** Operate switch to I position.
3 **II ON:** Operate switch to II position.
4 **O OFF:** Operate switch to O position, only in delayed transition switches (OXB_), I - O - II or II - O - I.

3.8.2 Navigating in menu

See the menu tree in Chapter 4.



OXB_, delayed transition, I - O - II



OXA_, open transition, I - II

Fig. 3.11 Keypad in HMI with touch screen

4. Navigating menu

4.1 LCD control interface, level 3, menu tree

The default password is 00001, enter the password when prompted (see Fig. 4.1).

The keypad is described In Chapter 3.7, see Fig. 3.10. By pressing the Enter-key (3) you can:

- open the menu in root page
- enter a new menu page
- accept the function

By pressing Up and Down -keys (2) you can:

- move in the menu
- choose the parameter value

By pressing Esc-key (1) you can:

- go back in the menu

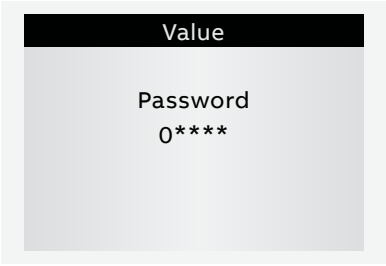


Fig. 4.1 Enter the password when asked, choose the right number by Up and Down -keys (2) and confirm by Enter-key (3), go forward setting number after number

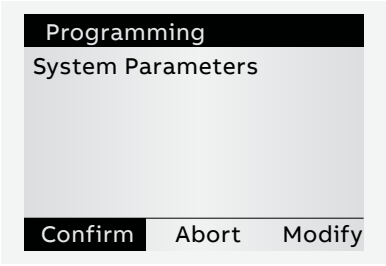


Fig. 4.2 After you have changed the parameter, always go back in the menu by pressing Esc-key and when prompted confirm changes with Enter-key

Description of the icons

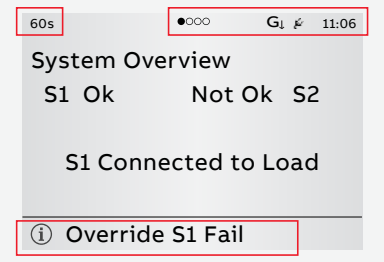


Fig. 4.3 Location of the small icons and the alarms

Alarm List

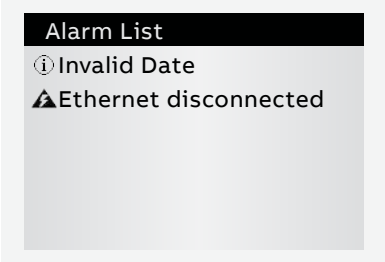


Fig. 4.4 When pressed Esc-key (1) in System Overview -pages, the alarm list is shown.

The small icons in System Overview -pages are:

On upper right corner

●○○○ Indicates the amount of pages and the page where you are at the moment

Auxiliary voltage connected

11:06 Time

G↓ Generator selected, not started

G↑ Generator selected, started

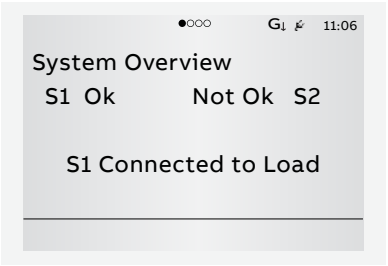
On upper left corner

60s Time delay, in Alarm list you can see the name of delay at the same time, e.g. Override S1 Fail

On the lower edge of the screen you can see the Alarms. When pressed Esc-key (1) in System Overview -pages, the alarm list is shown.

Information
The default values are marked in the menu tree by *-marking.

4.1.1 Start screens



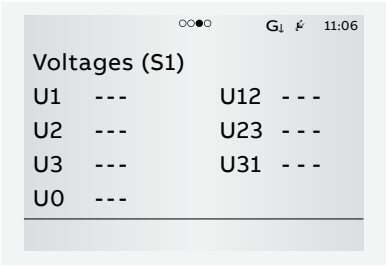
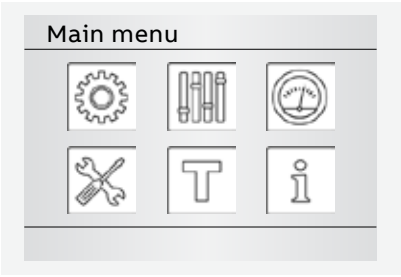


Fig. 4.5 From System Overview screen you will find Switch status and Supply info views, and by pressing Up and Down -keys (2), you can go forward to see Voltages and Synchronization view, see the table below.

Start screens
System Overview (Switch status)
Shows voltages and frequencies of both supplies and the switch position.
Supply info view
Shows Phase to Phase voltages of both supplies and the frequencies.
Voltages (S1)
S1 phase voltages
S1 main voltage
Voltages (S2)
S2 phase voltages
S2 main voltage
Synchronization view
Enabled only when In-phase monitor is on.
Show the time to next sync, sync period

4.1.2 Enter key, main menu



—
Fig. 4.6
By pressing Enter-key (3) you will move to the main menu page of Operation, Parameters, Measurements, Settings, Test and About, see the table below for the selections. You can move in menu or choose parameter values by Up and Down -keys (2) and by Enter-key (3) you can accept function and enter a new menu page. By Esc-key (1) you can go back in menu.

Information
When you have changed the parameter, always go back in the menu by pressing Esc-key and when prompted confirm changes with Enter-key.

Operation		***Default**
Automatic Mode		
	Off*	
	On	
Alarm Reset		
Bypass running time Delay		
HMI Control Keys		
	Enabled*	
	Disabled	

Parameters			***Default**
System parameters			
Start Automatic Configuration			
Power distribution systems (see Fig. 2.2)			
	Source 1	1 Phase, 2 Wire	
		2 Phases, 3 Wire (Split Neutral)	
		3 Phases, no Neutral (3ph3w)	
		3 Phase with Neutral (3ph4w)*	
		3 Phase, High-Leg Delta	
	Source 2	1 Phase, 2 Wire	
		2 Phases, 3 Wire (Split Neutral)	
		3 Phases, no Neutral (3ph3w)	
		3 Phase with Neutral (3ph4w)*	
		3 Phase, High-Leg Delta	
Rated Voltage			
	200 V, 208 V, 220 V, 230 V, 240 V, 277 V, 347 V, 380 V, 400 V*, 415 V, 440 V, 460 V, 480 V		
Rated Frequency			
	50 Hz*		
	60 Hz		
Neutral Position			
	Pole 4*		
	Pole 1		
Phase Sequence			
	ABC*		
	ACB		
	Not Enabled		

Continued on the next page

Parameters (continued)			***Default**
Device Parameters			
In-phase Monitor			
	Enable	Off*	
		On	
	Synchronization Delay	0...60* s	
Delay Times			
	Transfer from S1 to S2	0...60 min (2* s)	S1 priority: How long the controller is keeping the load on failed SOURCE 1 although SOURCE 2 is already available. S2 priority: How long the controller waits before transfer sequence back to available SOURCE 2 begins. This delay is overridden by 'Override S1 failure delay' in case of SOURCE 1 failure.
	Transfer from S2 to S1	0...120 min (2* s)	S1 priority: How long the controller waits before transfer sequence back to available SOURCE 1 begins. This delay is overridden by 'Override S2 failure delay' in case of SOURCE 2 failure. S2 priority: How long the controller is keeping the load on failed SOURCE 2 although SOURCE 1 is already available.
	Override S1 Fail	0...60 s (2* s)	S1 priority: How long the controller is waiting SOURCE 1 recovery before starting the generator or starting transfer sequence to SOURCE 2. S2 priority: How long the controller is keeping the load on failed SOURCE 1 although SOURCE 2 is already available.
	Override S2 Fail	0...60 s (2* s)	S1 priority: How long the controller is keeping the load on failed SOURCE 2 although SOURCE 1 is already available. S2 priority: How long the controller is waiting SOURCE 2 recovery before starting the generator or starting transfer sequence to SOURCE 1.
	Center-off	0*...300 s	I-O-II models: How long the switch is stopped at position O while transferring from primary to secondary source or vice versa. This delay is bypassed if the source from being transferred is down completely.
	Generator Stop	0*...60 min	Generator cooling time, how long the controller keeps generator running without load after returning to primary source.

Continued on the next page

Parameters (continued)			***Default**
Device Parameters (continued)			
Delay Times (continued)			
	Pre-transfer S1 to S2	0*...60 s	S1 priority: How long the controller waits before starting the transfer sequence from SOURCE 1 to SOURCE 2 after activating the pre-transfer signal output. S2 priority: How long the controller waits before starting the retransfer sequence from SOURCE 1 to SOURCE 2 after activating the pre-transfer signal output. At least one output must be configured as pre-transfer signal before this parameter becomes visible in HMI menu.
	Post-transfer S1 to S2	0*...60 s	S1 priority: How long the controller waits before inactivating pre-transfer signal output after transfer from SOURCE 1 to SOURCE 2 is completed. S2 priority: How long the controller waits before inactivating pre-transfer signal output after retransfer from SOURCE 1 to SOURCE 2 is completed. At least one output must be configured as pre-transfer signal before this parameter becomes visible in HMI menu.
	Pre-transfer S2 to S1	0*...60 s	S1 priority: How long the controller waits before starting the retransfer sequence from SOURCE 2 to SOURCE 1 after activating the pre-transfer signal output. S2 priority: How long the controller waits before starting the transfer sequence from SOURCE 2 to SOURCE 1 after activating the pre-transfer signal output. At least one output must be configured as pre-transfer signal before this parameter becomes visible in HMI menu.
	Post-transfer S2 to S1	0*...60 s	S1 priority: How long the controller waits before inactivating pre-transfer signal output after retransfer from SOURCE 2 to SOURCE 1 is completed. S2 priority: How long the controller waits before inactivating pre-transfer signal output after transfer from SOURCE 2 to SOURCE 1 is completed. At least one output must be configured as pre-transfer signal before this parameter becomes visible in HMI menu.
	Load Shed	0*...60 s	How long the controller waits before starting transfer sequence to secondary source after activating load shed signal output. At least one output must be configured as load shed signal before this parameter becomes visible in HMI menu.

Continued on the next page

Parameters (continued)			***Default**
Device Parameters (continued)			
Voltage & Frequency Setpoints			Defines the voltage and frequency limits for source being acceptable. Source has an anomaly when measured voltage/frequency goes out of range drop-out lower/drop-out Upper. Source becomes acceptable when measured voltage/frequency goes back in range pick-up lower/pick-up higher.
	S1 Setpoints		
		S1 Drop-out Voltage	Upper Threshold
			Lower Threshold
		S1 Pick-up Voltage	Upper Threshold
			Lower Threshold
		S1 Drop-out Frequency	Upper Threshold
			Lower Threshold
		S1 Pick-up Frequency	Upper Threshold
			Lower Threshold
	S2 Setpoints		
		S2 Drop-out Voltage	Upper Threshold
			Lower Threshold
		S2 Pick-up Voltage	Upper Threshold
			Lower Threshold
		S2 Drop-out Frequency	Upper Threshold
			Lower Threshold
		S2 Pick-up Frequency	Upper Threshold
			Lower Threshold
Generator Exercisers			
	Exciser 1 / 2 / 3 / 4		
		Status	Disabled
			Non-periodic
			Daily
			Weekly
			Bi-weekly
			Monthly
			Yearly
		Function	No function
			Test on Load
			Test off load
		Duration	0...60s
		Time	Time of the exercising event
		Date	Date of the exercising event

Continued on the next page

Parameters (continued)		***Default**
 Device Parameters (continued)		
Application		
S1-Transformer/S2-Generator*		
S2-Transformer/S1-Generator		
2 Transformers/S1 Priority		
2 Transformers/S2 Priority		
2 Transformers/No Priority		
Manual Retransfer		
Off*		Off: When in automatic mode the controller transfers the switch to priority source when it returns according to transfer configuration.
On		On: When in automatic mode the controller does not transfer the switch to priority source despite it has returned. User has to retransfer manually with HMI control buttons or by a remote command.
Commit Transfer		
Off*		Off: Priority source return cancels transfer to non-priority source.
On		On: Load is transferred to non-priority source after priority source failure even if the priority source returns before the non-priority source is ready to accept the load.
Harmonics Phase		Voltage/current phase that is used for calculating harmonic components 2-15. Phase-to-neutral voltage is used when neutral is present, phase-to-phase voltages otherwise.
Disabled*		
Phase 1/12		
Phase 2/23		
Phase 3/31		

Measurements		
Switch Diagnostics		
	HMI internal temperature	
	Total operations	I-O-II switches: Total number of transitions I-O, O-II, II-O and O-I I-II switches: Total number of transitions I-II and II-I
	Number of load transfers	Total number of transitions I-II and II-I
	Transfer time	Time it took to transfer the load between sources
	Source fail transfers	Number of times the switch has transferred load due to source unacceptable.
	Days energized	
	Total time on S1	
	Total time on S2	
	Time S1 available	
	Time S2 available	
	Last generator start	
	Generator starting time	How long it took for the generator voltage to become acceptable after latest start.
	In-phase time	How long it took for the generator voltage to become acceptable after latest start.
Event Log		

Settings				*Default
Standard I/O Settings				
	I 01 / I 02 / I 03			
		Function	No function	
			Emergency Stop* (default in I 01)	
			Remote Test On Load* (default in I 02)	
			Remote Test Off Load* (default in I 03)	
			Inhibit AUTO Mode	Prevent switch control operations, configuration and test sequences. Allows generator start in case of primary source failure.
			Manual Retransfer to Priority	
			Source Priority S1	
			Source Priority S2	
			Inhibit Transfer	Disables automatic transfer from primary to secondary source.
			Bypass Running Time Delays	
			Remote Control to I	
			Remote Control to O	
			Remote Control to II	
			Reset Alarm	
		Contact Type	NC	
			NO*	
	O 01			
		Signal Source	No Function	
			Alarm / Product availability*	
			Load Connected to S1	
			Load Disconnected	
			Load Connected to S2	
			Pre-transfer Signal	Activates the signal before the transfer according to pre-transfer delay and inactivates the signal after the transfer according to post-transfer delay.
			SOURCE 1 available	
			SOURCE 2 available	
			Load Shed 1	Shedding non-critical loads before transferring to secondary source.
			Load Shed 2	User can set a kVA level when non-critical loads are shed.
		Contact Type	NC	
			NO*	

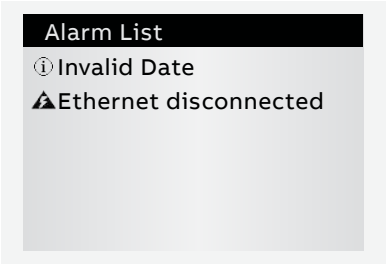
Continued on the next page

Settings (continued)			*Default
	Modules (See Chapter 5, Electronic accessories)		
	System		
		Date	
		Time	
		Language	
			English
			Italian
			French
			German
			Spanish
			Russian
			Chinese
		New Password	
		Temperature Unit	
			Celsius*
			Fahrenheit
	Display Contrast		
		10 - 100% (30 %*)	

Test			*Default
	HMI test (LED, display)	Initiate display test screen and turn all LED's on	
	Test On Load	Test generator without transferring the load	
		Test without switch transfer	
	Test Off Load	Test generator with transferring the load	
		Test with switch transfer	
	On-Load Test Settings	Bypass local or remote test on load when generator voltage fails	
		Bypass Local Test	
		Bypass if Generator fails*	
		Stay on Generator	
		Bypass Remote Test	
		Bypass if Generator fails*	
		Stay on Generator	
	Optional modules (See Chapter 5, Electronic accessories)		

About		
	HMI	HMI serial number
		Software version
		Software subversion
		HMI Type code
	Controller Unit	Time
		Date
		Serial number
		Normative
		Main board software version
		Software subversion
	Automatic Transfer Switch	TAG name
		Device Type Code
		ATS serial number
		Rated current
		Pole number
		ATS Type
	Modules (See Chapter 5, Electronic accessories)	

4.1.3 Esc key



—
Fig. 4.7
By pressing Esc-key (1) in System Overview -pages, the alarm list is shown.

Alarm list
More information, see chapter 6, Troubleshooting

4.2 Touch control interface, level 4, menu tree

Password

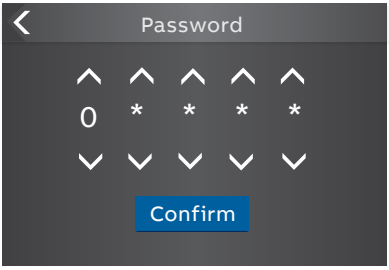


Fig. 4.8

The default password is 00001, enter the password when prompted (see Fig. 4.1).

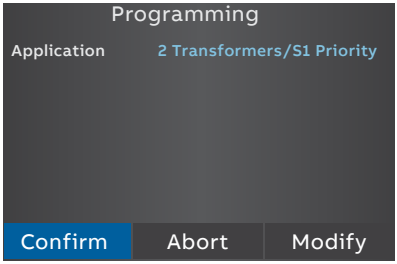


Fig. 4.9

Description of the icons

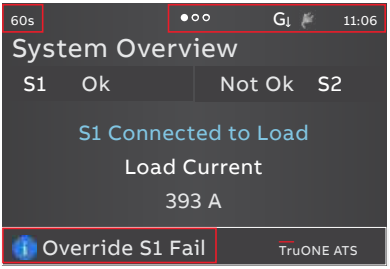


Fig. 4.10

The small icons in System Overview -pages are:

On upper right corner

●○○	Indicates the amount of pages and the page where you are at the moment
	Auxiliary voltage connected
11:06	Time
G↓	Generator selected, not started
G↑	Generator selected, started

On upper left corner

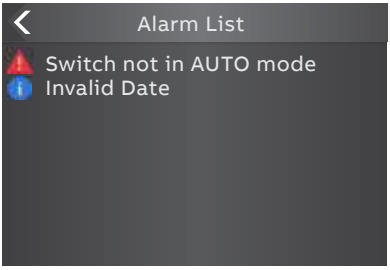
60s	Time delay, in Alarm list you can see the name of delay at the same time, e.g. Override S1 Fail

Fig. 4.8
Enter the password when asked, choose the right number by arrowheads and confirm, go forward entering number after number

Fig. 4.9
After you have changed the parameter, always go back in the menu by pressing Esc-key and when prompted confirm changes with Enter-key

Fig. 4.10
The location of the small icons and the alarms

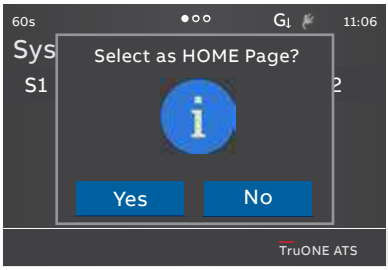
Alarm List



—
Fig. 4.11

On the lower edge of the screen you can see the Alarms. If you touch on the alarm you will get the Alarm List.

To define the home page

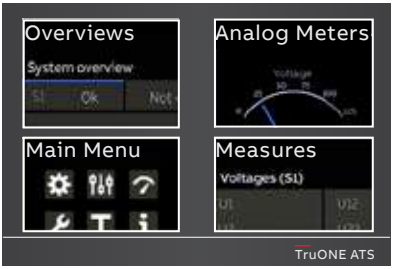


—
Fig. 4.12

While viewing a specific page, it can be defined as the home page by pressing the home button for 3 seconds. All pages, except for the menus, can be set as home page. Home page is automatically shown after inactivity.

Fig. 4.11
By touching on the alarm indication on the lower edge of the screen you will get the Alarm List
—
Fig. 4.12
Home page definition, acceptance of the function

4.2.1 Start Menu

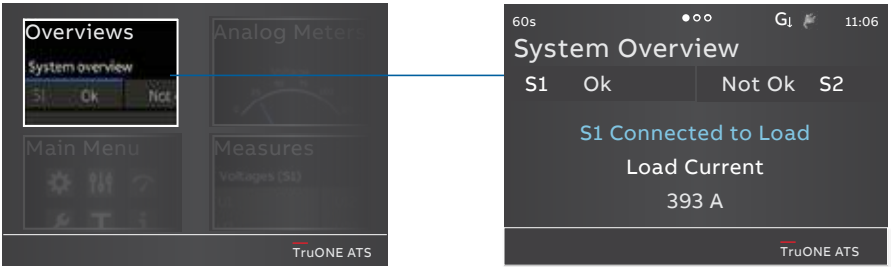


—
Fig. 4.13

—
Fig. 4.13 By touching on one of Start Menu choices, you can choose the Overviews -pages (upper left corner), Main Menu -pages (lower left corner), Analog Meters -pages (upper right corner) or Measures -pages (lower right corner)

—
Fig. 4.14 By touching on Start Menu upper left corner -image you can move to the Overviews -pages, where you will find Switch status and Supply info views, see the table below

4.2.1.1 Overviews



—
Fig. 4.14

System Overview (Switch status)
Shows voltages and frequencies of both supplies and the switch position.
Supply info view
Shows voltages and frequencies of both supplies
Temperature view
Shows the temperature measured from the switch environment
HMI, device and pole temperatures
Synchronization view (Enabled only when In-phase monitor is on)
Show the time to next sync, sync period

4.2.1.2 Main Menu

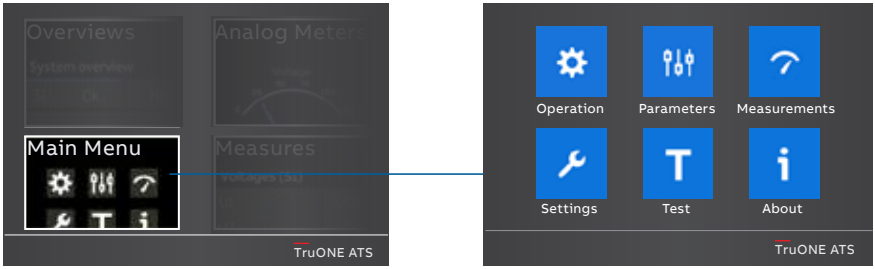


Fig. 4.15 By touching on Start Menu lower left corner -image you can move to the Main Menu page of Operation, Parameters, Measurements, Settings, Test and About, see the table below for the selections

Information
When you have changed the parameter, go always back in the menu and confirm the change always when asked.

Information
The default values are marked in the menu tree by *-marking.

Operation		***Default**
	Automatic Mode	Off*
		On
	Alarm Reset	
	Bypass running time Delay	
	HMI Control Keys	Enabled*
		Disabled

Parameters			***Default**
System parameters			
	Start Automatic Configuration		
	Power distribution systems (see Fig. 2.2)		
		Source 1	1 Phase, 2 Wire
			2 Phases, 3 Wire (Split Neutral)
			3 Phases, no Neutral (3ph3w)
			3 Phase with Neutral (3ph4w)*
			3 Phase, High-Leg Delta
		Source 2	1 Phase, 2 Wire
			2 Phases, 3 Wire (Split Neutral)
			3 Phases, no Neutral (3ph3w)
			3 Phase with Neutral (3ph4w)*
			3 Phase, High-Leg Delta
	Rated Voltage	200 V, 208 V, 220 V, 230 V, 240 V, 277 V, 347 V, 380 V, 400 V*, 415 V, 440 V, 460 V, 480 V	
	Rated Frequency	50 Hz*	
		60 Hz	
	Neutral Position	Pole 4*	
		Pole 1	
	Phase Sequence	ABC*	
		ACB	
		Not Enabled	

Continued on the next page

Parameters (continued)			***Default**
Device Parameters			
In-phase Monitor			
	Enable	Off*	
		On	
	Synchronization Delay	0...60* s	
Delay Times			
	Transfer from S1 to S2	0...60 min (2* s)	S1 priority: How long the controller is keeping the load on failed SOURCE 1 although SOURCE 2 is already available. S2 priority: How long the controller waits before transfer sequence back to available SOURCE 2 begins. This delay is overridden by 'Override S1 failure delay' in case of SOURCE 1 failure.
	Transfer from S2 to S1	0...120 min (2* s)	S1 priority: How long the controller waits before transfer sequence back to available SOURCE 1 begins. This delay is overridden by 'Override S2 failure delay' in case of SOURCE 2 failure. S2 priority: How long the controller is keeping the load on failed SOURCE 2 although SOURCE 1 is already available.
	Override S1 Fail	0...60 s (2* s)	S1 priority: How long the controller is waiting SOURCE 1 recovery before starting the generator or starting transfer sequence to SOURCE 2. S2 priority: How long the controller is keeping the load on failed SOURCE 1 although SOURCE 2 is already available.
	Override S2 Fail	0...60 s (2* s)	S1 priority: How long the controller is keeping the load on failed SOURCE 2 although SOURCE 1 is already available. S2 priority: How long the controller is waiting SOURCE 2 recovery before starting the generator or starting transfer sequence to SOURCE 1.
	Center-off	0*...300 s	I-O-II models: How long the switch is stopped at position O while transferring from primary to secondary source or vice versa. This delay is bypassed if the source from being transferred is down completely.

Continued on the next page

Parameters (continued)			***Default**
Device Parameters (continued)			
Delay times (continued)			
	Generator Stop	0*...60 min	Generator cooling time, how long the controller keeps generator running without load after returning to primary source.
	Pre-transfer S1 to S2	0*...60 s	S1 priority: How long the controller waits before starting the transfer sequence from SOURCE 1 to SOURCE 2 after activating the pre-transfer signal output. S2 priority: How long the controller waits before starting the retransfer sequence from SOURCE 1 to SOURCE 2 after activating the pre-transfer signal output. At least one output must be configured as pre-transfer signal before this parameter becomes visible in HMI menu.
	Post-transfer S1 to S2	0*...60 s	S1 priority: How long the controller waits before inactivating pre-transfer signal output after transfer from SOURCE 1 to SOURCE 2 is completed. S2 priority: How long the controller waits before inactivating pre-transfer signal output after retransfer from SOURCE 1 to SOURCE 2 is completed. At least one output must be configured as pre-transfer signal before this parameter becomes visible in HMI menu.
	Pre-transfer S2 to S1	0*...60 s	S1 priority: How long the controller waits before starting the retransfer sequence from SOURCE 2 to SOURCE 1 after activating the pre-transfer signal output. S2 priority: How long the controller waits before starting the transfer sequence from SOURCE 2 to SOURCE 1 after activating the pre-transfer signal output. At least one output must be configured as pre-transfer signal before this parameter becomes visible in HMI menu.
	Post-transfer S2 to S1	0*...60 s	S1 priority: How long the controller waits before inactivating pre-transfer signal output after retransfer from SOURCE 2 to SOURCE 1 is completed. S2 priority: How long the controller waits before inactivating pre-transfer signal output after transfer from SOURCE 2 to SOURCE 1 is completed. At least one output must be configured as pre-transfer signal before this parameter becomes visible in HMI menu.

Continued on the next page

Parameters (continued)				***Default**
Device Parameters (continued)				
	Delay times (continued)			
		Load Shed	0*...60 s	How long the controller waits before starting transfer sequence to secondary source after activating load shed signal output. At least one output must be configured as load shed signal before this parameter becomes visible in HMI menu.
	Voltage & Frequency Setpoints			Defines the voltage and frequency limits for source being acceptable. Source has an anomaly when measured voltage/ frequency goes out of range drop-out lower/drop-out Upper. Source becomes acceptable when measured voltage/ frequency goes back in range pick-up lower/pick-up higher.
		S1 Setpoints		
			S1 Drop-out Voltage	Upper Threshold
				Lower Threshold
			S1 Pick-up Voltage	Upper Threshold
				Lower Threshold
			S1 Drop-out Frequency	Upper Threshold
				Lower Threshold
			S1 Pick-up Frequency	Upper Threshold
				Lower Threshold
		S2 Setpoints		
			S2 Drop-out Voltage	Upper Threshold
				Lower Threshold
			S2 Pick-up Voltage	Upper Threshold
				Lower Threshold
			S2 Drop-out Frequency	Upper Threshold
				Lower Threshold
			S2 Pick-up Frequency	Upper Threshold
				Lower Threshold

Continued on the next page

Parameters (continued)				***Default**
Device Parameters (continued)				
	Generator Exercisers			
		Exerciser 1 / 2 / 3 / 4		
			Status	Disabled
				Non-periodic
				Daily
				Weekly
				Bi-weekly
				Monthly
				Yearly
			Function	No function
				Test on Load
				Test off load
			Duration	0...60s
			Time	Time of the exercising event
			Date	Date of the exercising event
	Application			
		S1-Transformer/S2-Generator*		
		S2-Transformer/S1-Generator		
		2 Transformers/S1 Priority		
		2 Transformers/S2 Priority		
		2 Transformers/No Priority		

Continued on the next page

Parameters (continued)		***Default**
Device Parameters (continued)		
Manual Retransfer		
Off*	Off: When in automatic mode the controller transfers the switch to priority source when it returns according to transfer configuration.	
On	On: When in automatic mode the controller does not transfer the switch to priority source despite it has returned. User has to retransfer manually with HMI control buttons or by a remote command.	
Commit Transfer		
Off*	Off: Priority source return cancels transfer to non-priority source.	
On	On: Load is transferred to non-priority source after priority source failure even if the priority source returns before the non-priority source is ready to accept the load.	
Harmonics Phase	Voltage/current phase that is used for calculating harmonic components 2-15. Phase-to-neutral voltage is used when neutral is present, phase-to-phase voltages otherwise.	
Disabled*		
Phase 1/12		
Phase 2/23		
Phase 3/31		

Measurements		
Switch Diagnostic		
	HMI internal temperature	
	Device internal temperature	
	Total operations	I-O-II switches: Total number of transitions I-O, O-II, II-O and O-I I-II switches: Total number of transitions I-II and II-I
	Number of load transfers	Total number of transitions I-II and II-I
	Transfer time	Time it took to transfer the load between sources
	Source fail transfers	Number of times the switch has transferred load due to source unacceptable.
	Days energized	
	Total time on S1	
	Total time on S2	
	Time S1 available	
	Time S2 available	
	Last generator start	
	Generator starting time	How long it took for the generator voltage to become acceptable after latest start.
	In-phase time	How long it took for the generator voltage to become acceptable after latest start.
Event Log		250 latest device status changes listed with time stamped events.
Energy		
	Energy counters	Shows EP [kWh], EQ [kVARh], ES [kVAh] on screen
	Reset counters	

Settings				*Default
Standard I/O settings				
	I 01 / I 02 / I 03			
		Function	No function	
			Emergency Stop* (default in I 01)	
			Remote Test On Load* (default in I 02)	
			Remote Test Off Load* (default in I 03)	
			Inhibit AUTO Mode	Prevent switch control operations, configuration and test sequences. Allows generator start in case of primary source failure.
			Manual Retransfer to Priority	
			Source Priority S1	
			Source Priority S2	
			Inhibit Transfer	Disables automatic transfer from primary to secondary source.
			Bypass Running Time Delays	
			Remote Control to I	
			Remote Control to O	
			Remote Control to II	
			Reset Alarm	
		Contact Type	NC	
			NO*	
	O 01			
		Signal Source	No Function	
			Alarm / Product availability*	
			Load Connected to S1	
			Load Disconnected	
			Load Connected to S2	
			Pre-transfer Signal	Activates the signal before the transfer according to pre-transfer delay and inactivates the signal after the transfer according to post-transfer delay.
			SOURCE 1 available	
			SOURCE 2 available	
			Load Shed 1	Shedding non-critical loads before transferring to secondary source.
			Load Shed 2	User can set a kVA level when non-critical loads are shed.
		Contact Type	NC	
			NO*	
		Load Shedding kW limit	(Only when Load shedding selected + power metering on)	

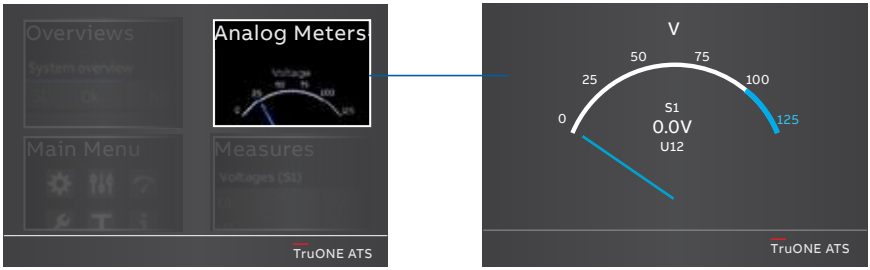
Continued on the next page

Settings (continued)				***Default**
Modules				
	See Chapter 5, Electronic accessories			
System				
	Date			
	Time			
	Language			
		English		
		Italian		
		French		
		German		
		Spanish		
		Russian		
		Chinese		
	New Password			
	Temperature Unit			
		Celsius*		
		Fahrenheit		
View				
	Ammeter Phase			
		I Max*		
		Ne		
		L1		
		L2		
		L3		
	S1 Voltmeter Phase			
		V Max*		
		U12		
		U23		
		U31		
	S2 Voltmeter Phase			
		V Max*		
		U12		
		U23		
		U31		

Test			*Default
T	HMI test (LED, display)		Initiate display test screen and turn all LED's on
	Test On Load		
	Test Off Load		
	On-Load Test Settings		Bypass local or remote test on load when generator voltage fails
		Bypass Local Test	Bypass if Generator fails*
			Stay on Generator
		Bypass Remote Test	Bypass if Generator fails*
			Stay on Generator
	Optional modules (See Chapter 5, Electronic accessories)		

About		
	HMI	HMI serial number
		Software version
		Software subversion
		HMI Type code
	Controller Unit	Time
		Date
		Serial number
		Normative
		Main board software version
		Software subversion
	Automatic Transfer Switch	TAG name
		Device Type Code
		ATS serial number
		Rated current
		Pole number
		ATS Type
	Modules (See Chapter 5, Electronic accessories)	

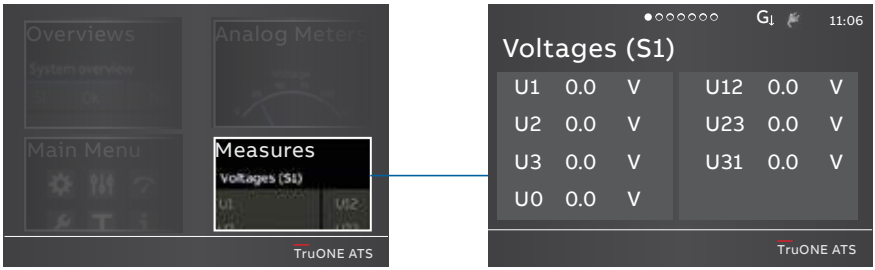
4.2.1.3 Analog meters



—
Fig. 4.16 By touching on Start Menu upper right corner -image you can find the analog meters information, see the table below

S1 Voltage meter
S2 Voltage meter
Current meter
Power meter
VAR meter
VA meter

4.2.1.4 Measures



—
Fig. 4.17 By touching on Start Menu lower right corner -image you can find the measured data, see the table below

Voltages (S1)
Voltages (S2)
Current
Active power
Reactive power
Apparent power
Energy counters

5. Electronic accessories

Ekip Connect Sofware and Bluetooth and Programming -modules are suitable for all OX_ automatic transfer switches, see chapters 5.1…5.3.

- Ekip Connect -software
- Ekip Bluetooth -module
- Ekip Programming -module

Ekip Signalling, Com and Link -modules are available for OX_ automatic transfer switches with HMI level 3 and 4 (LCD and touch control interfaces). These modules are mounted with auxiliary power supply module, OXEA1 (see the mounting in section 2, Chapter 9, Mounting of accessories).

Ekip-modules mounted with auxiliary power supply module are (see chapters 5.4 …5.8):

- Ekip Signalling 2K-_
- Ekip Com modules
- Ekip Com Modbus RTU
- Ekip Com Profibus DP
- Ekip Com DeviceNet
- Ekip Com Modbus TCP
- Ekip Com Profinet
- Ekip Com EtherNet/IP
- Ekip Com IEC 61850
- Ekip Link

Fig. 5.1 Programming and bluetooth -modules

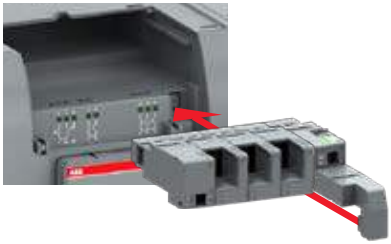


Fig. 5.2 Ekip Signalling, Com and Link -modules are mounted to automatic transfer switch OX_ with a auxiliary power supply module, OXEA1

5.1 Using Ekip Connect -software

Ekip Connect is a free software for communication and testing of ABB automatic transfer switches. The software is compatible with all OX_ automatic transfer switches. It can be installed on PCs equipped with the Microsoft Windows® operating system. Download it from the site, see the address below: http://www.abb.com/abblibrary/DownloadCenter/

With its communication function, it allows you to:

- Monitor the state of the automatic transfer switches connected and record information.
- Configure the automatic transfer switches with customized parameters.
- Configure the electronic accessories, connected to the automatic transfer switch via Local Bus.
- Download information from automatic transfer switches equipped with Datalogger (level 4).
- Create communication reports.
- Reset configurations.

Further information on the Ekip Connect application is available from the web site, see the address below, in particular in the manual 1SDH000891R0002.

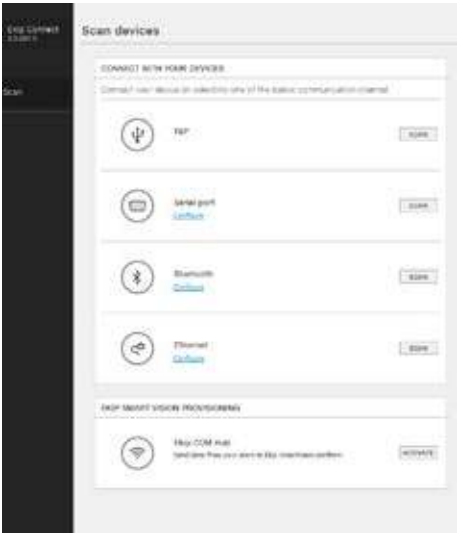


Fig. 5.3 Ekip Connect -software

5.2 Using Ekip Bluetooth-module

The Ekip Bluetooth allows connection via Bluetooth between the automatic transfer switch and a support (PC, tablet, or smart phone) with the Ekip Connect software installed (see the previous paragraph). Ekip Bluetooth -module is suitable to use with all OX_ automatic transfer switches.

Information
The Ekip Bluetooth module can be used without powering the mains. (Local Bus Accessories, including HMI, are not operative).

It draws its power from a rechargeable lithium-polymer battery supplied with the unit. It is connected directly to the programming port (see Fig. 5.6) and allows a main switch without auxiliary voltage to be powered. The programming port is only allowed to use for Ekip Bluetooth and Ekip Programming -modules.

Note
Ekip Bluetooth only powers the main switch (HMI and modules excluded). Therefore, in order to identify all connected parts with Ekip Connect, the auxiliary power supply module, type OXEA1, must be used (see chapter 5.4).

5.2.1 Signallings

Ekip Bluetooth -module is switched on by pressing the power button on the side, and is equipped with two LEDs:

- The first lit in green with the device on and the battery charge, red with the device turned on and low battery.
- The second flashing blue with active Bluetooth communication.

Fig. 5.4 Ekip Bluetooth-module

5.3 Using Ekip Programming -module

Ekip Programming -module is suitable to use with all OX_ automatic transfer switches. You can connect the module via the programming port, see Fig. 5.6. The programming port is only allowed to use for Ekip Programming and Ekip Bluetooth -modules.

Ekip Programming -module allows you to:

- With Ekip Connect software update the softwares and load, set and read the parameters

Information
The Ekip Programming module can be used without powering the mains. (Local Bus Accessories, including HMI, are not operative).

Ekip Programming -module draws its power from the PC and connects one side directly to the programming port (see Fig. 5.6) and on the other to the USB ports of the PC with the cable supplied.

Note
Ekip Programming only powers the main switch (HMI and modules excluded). Therefore, in order to identify all connected parts with Ekip Connect, the auxiliary power supply module, type OXEA1, must be used (see chapter 5.4).

5.3.1 Signallings

Ekip Programming -module turns on after connecting to the PC, and is equipped with two LEDs, a green one indicating that the module is on, and a yellow one indicating active communication.

Fig. 5.5 Ekip Programming -module

Fig. 5.6 Programming port (USB port) is situated in the front of the HMI, on left side

5.4 Auxiliary power supply module

The auxiliary power supply module, type OXEA1, supplies non-insulated power to the external Ekip-modules, HMI and main control unit. It is supplied by external supply, for example from generator battery or from isolated transformer connected to the main circuit. Powering product only with Auxiliary power supply module limits some operation functions of the main control unit, for example: Operation of Sensor module isn't possible.

5.4.1 Electrical characteristics

The following table lists the electrical characteristics:

Module	OXEA1
Power supply input voltage	12 - 24 V DC ± 10% SELV
Nominal power consumption	5 - 12 W
Inrush current	Maximum 2 A

Table 5.1 Electrical characteristics of auxiliary power supply module OXEA1

5.4.2 Signallings

LED	Indication	Description
Power LED, green	On, fixed	Power is connected to the input of the module.
	Off	Power is not connected.

Table 5.2 Indication / auxiliary power supply module OXEA1

Fig. 5.7 Auxiliary power supply module, type OXEA1, is needed when Ekip Signalling, Com and Link -modules are mounted to automatic transfer switch OX_

Fig. 5.8 Signals of auxiliary power supply module OXEA1

5.5 Using Ekip Signalling 2K-_ -module

The Ekip Signalling 2K-_ is a signalling accessory module. It is suitable for HMI-types level 3 and 4; LCD and touch control interfaces. 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).

Information
On each ATS, a maximum of three Ekip Signalling 2K modules can be installed: one 2K-1, one 2K-2, and one 2K-3. These modules differ by their name and label, and have distinct wiring, but they are identical in terms of their characteristics and manner of installation.

Fig. 5.9 Ekip Signalling 2K -module

5.5.1 Electrical characteristics of Ekip Signalling 2K-_ -module

The following table lists the electrical characteristics of the module:

Component	Characteristics
Output contacts	Maximum switching voltage*: 150 V DC / 250 V AC
	Breaking power*: 2 A @ 30 V DC, 0.8 A @ 50 V DC, 0.2 A @ 150 V DC, 4A @ 250 V AC
	Dielectric strength between each contact and coil: 1000 V AC (1 minute @ 50 Hz)
	Dielectric strength between open contacts: 1000 V AC (1 minute @ 50 Hz)

*Data relating to a resistive load

Table 5.3 Electrical characteristics of Ekip Signalling 2K-_ -module

5.5.2 Access from the display / Ekip Signalling 2K-_ -module

With modules energized, and Local Bus enabled, the presence of the modules on the module slot activates additional menus on the display:

- In order to configure the inputs and output contacts.
- To display information on the modules and the state of inputs and outputs.

The following table illustrates the path for accessing the configuration parameters of the module from the display:

Settings (*Default)			Description
Modules (Optional modules)			
Ekip Signalling 2K-1 / -2 / -3			
I 11/12, I 21/22, I 31/32			
	Function	No Function*	
		Emergency Stop	
		Remote Test on Load	
		Remote Test off Load	
		Inhibit AUTO Mode	Prevent switch control operations, configuration and test sequences. Allows generator start in case of primary source failure
		Manual Retransfer to Primary	
		Source Priority S1	
		Source Priority S2	
		Inhibit Transfer	Disables automatic transfer from primary to secondary source
		Bypass Running Time Delays	
		Remote Control to I	
		Remote Control to O	
		Remote Control to II	
		Reset Alarm	
	Contact Type	NC	Normally closed
		NO*	Normally open
O 11/12, O 21/22, O 31/32			
	Function	No Function*	
		Alarm/Product Availability	
		Load Connected to S1	
		Load Disconnected	
		Load Connected to S2	
		Load Shed 1	Shedding non-critical loads before transferring to secondary source
		Load Shed 1	User can set a kVA level when non-critical loads are shed
		Pre-transfer Signal	Activates the signal before the transfer according to pre-transfer delay and inactivates the signal after the transfer according to post-transfer delay
		Source 1 Available	
		Source 2 Available	
	Contact Type	NC	Normally closed
		NO*	Normally open

Test	
:	
Modules (Optional modules)	
Ekip Signalling 2K-1 / -2 / -3	Auto Test
:	

—

Table 5.5 Configuration and test parameters of Ekip Signalling 2K-_ -module in HMI

The following table illustrates the path from the display for accessing information on the module:

About	**Description**
:	
Modules (Optional modules)	
Ekip Signalling 2K-1 / -2 / -3	
SN	Serial number
Version	Software version
Input 1	The logical state of the inputs: “Off” if not active, “On” if active
Input 2	
Output 1	The state of the output contacts: “Open” if open, “Closed” if closed
Output 2	
:	

—

Table 5.4 Information of Ekip Signalling 2K-_ -module in HMI

5.5.3 Signals and inputs/outputs of Ekip Signalling 2K-_ -module

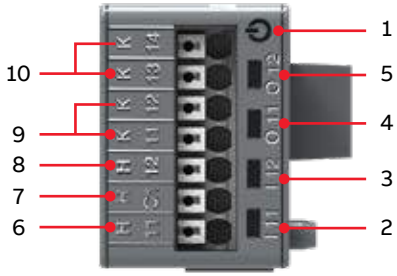


Fig. 5.10 Signals and inputs/outputs of Ekip Signalling 2K-_ -module

1 Power LED, green. The possible states are:
- Off: power supply absent.
- On fixed: power supply and communication with the device present (with a device with the Alive LED option disabled).
- On, with one flash per second (synchronized with that of the green LED on the device): power supply and communication with device present (with a device with the Alive LED option enabled)
- On, with two quick flashes per second (not synchronized with those of the green LED on the device): power supply present, and communication with device absent (for example: for Local Bus disabled) [1)]

2 Green[3)] LED for signalling the physical state of the input H x12). The possible states are:
- Off: floating input
- On fixed: input short-circuited on H Cx[2)]

3 Green[3)] LED for signalling the physical state of the input H x2[2)]. The possible states are:
- Off: floating input
- On fixed: input short-circuited on H Cx

4 Green[3)] LED for signalling contact K x1 - K x2[2)]. The possible states are:
- Off: contact open
- On fixed: contact closed

5 Green[3)] LED for signalling the state of the contact K x3 - K x4[2)]. The possible states are:
- Off: contact open
- On fixed: contact closed

6 Input I x1

7 Conductive part of the inputs H x1 and H x2[2)]

8 Input I x2[2)]

9 Output contact pin O x1[2)]

10 Output contact pin O x2[2)]

1) The absence of communication is signalled immediately by the power LED, unlike the outputs which (apart from those programmed to be activated in the case of disconnection) are deactivated if the condition persists for at least 8 s
2) With x = 1, 2, or 3
3) The LED turns on and off according to the physical state of the input, without taking any account of how the Delay parameter is set.

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

5.6 Using Ekip Com _ -modules

Suitable Ekip Com_ -modules are:

- Ekip Com Modbus RTU
- Ekip Com Profibus DP
- Ekip Com DeviceNet
- Ekip Com Modbus TCP
- Ekip Com Profinet
- Ekip Com EtherNet/IP
- Ekip Com IEC 61850

5.6.1 Ekip Com Modbus RTU -module

The Ekip Com Modbus RTU is a communication accessory module, that integrates the automatic transfer switch in an industrial remote supervision and control network. The module is suitable for HMI-types level 3 and 4; LCD and touch control interfaces.

It can be connected to a RS-485 network with a Modbus RTU communication protocol, and allows you to:

- Connect the automatic transfer switch to the network, with dialog functionality.
- Provide the status information of the automatic transfer switch (open, closed).

For the communication lines W1 and W2, Belden type 3105A or equivalent cables must be used.

Fig. 5.11 Ekip Com Modbus RTU -module

5.6.1.1 Signallings

The following table illustrates the possible signals, and their meaning:

LED	Indication	Description
Power LED, green	Off	Power supply absent.
	On fixed	Power supply and communication with the device present.
	On, with one flash per second	Power supply and communication with device present.
	On, with two quick flashes per second	Power supply present, and communication with device absent.
RX and TX LEDs, green	Off	Modbus RTU communication not active.
	On, flashing rapidly	Modbus RTU communication active.

Table 5.6 Indication / Ekip Com Modbus RTU -module

5.6.1.2 Termination resistor

The modules provide the possibility to insert a 120 Ω termination resistor on the RS-485 bus, by setting the DIP-switches Rterm on the side of the modules, in position on. This option must be selected before the installation of the modules.

Fig. 5.12 Signals of Ekip Com Modbus RTU -module

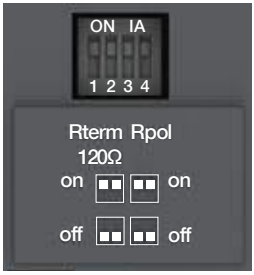


Fig. 5.13 Termination resistor, this option must be selected before the installation of the modules

5.6.1.3 Access from the display / Ekip Com Modbus RTU –module

With modules energized the presence of the modules on the module slot activates additional menus on the display.
The following table illustrates the path for accessing the configuration parameters of the modules from the display:

Settings (*Default value)			Description
:			
Modules (Optional modules)			
	Ekip Com Modbus RTU		
		Serial address	1… 247, default 247*	Address to be assigned to the modules. NOTE: devices connected to the same network must have different addresses
		Baudrate	9600 bit/s, 19200 bit/s*, 38400 bit/s	Data transmission speed
		Physical protocol	8.E,1*, 8.O,1, 8.N,2, 8.N,1	8.E,1 = 8 data bits, 1 EVEN parity bit, 1 STOP bit
				8.O,1 = 8 data bits, 1 ODD parity bit, 1 STOP bit
				8.N,2 = 8 data bits, no parity bit, 2 STOP bits
				8.N,1 = 8 data bits, no parity bit, 1 STOP bit
:				

Table 5.7 The path for accessing the configuration parameters of the Ekip Com Modbus RTU -module from the display

The following table illustrates the path from the display for accessing information on the module:

About		Description
:		
Modules (Optional modules)		
	Ekip Com Modbus RTU	
		SN	Serial number
		Version	Software version
:		

Table 5.8 Information of Ekip Com Modbus RTU -module in HMI

5.6.2 Ekip Com Profibus DP -module

The Ekip Com Profibus DB is a communication accessory module, that integrates the automatic transfer switch in an industrial remote supervision and control network. The module is suitable for HMI-types level 3 and 4; LCD and touch control interfaces.

It can be connected to a network RS-485 with protocol of Profibus communication, and allows of:

- Connect the automatic transfer switch as slaves to the network, with dialog functionality.
- Provide the status information of the automatic transfer switch (open, closed).

For the communication lines W5 and W6, Belden type 3079A or equivalent cables must be used.

Fig. 5.14 Ekip Com Profibus DP -module

5.6.2.1 Signallings

The following table illustrates the possible signals, and their meaning:

LED	Indication	Description
Power LED, green	Off	Power supply absent.
	On fixed	Power supply and communication with the device present.
	On, with one flash per second	Power supply and communication with device present.
	On, with two quick flashes per second	Power supply present, and communication with device absent.
RX LED, green	Off	Communication not active.
	On, fixed	Communication active.
TX LED, green	Off	Communication not active.
	On, flashing	Communication active.

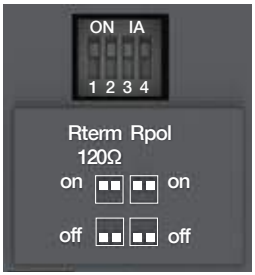
Table 5.9 Indication / Ekip Com Modbus RTU -module

Fig. 5.15 Signals of Ekip Com Profibus DB -module

5.6.2.2 Termination resistor

The modules provide the possibility to insert a 220 Ω termination resistor on the RS-485 bus, by setting the DIP-switches Rterm on the side of the modules, in position on.

In the event of termination of the bus, a 390 Ω pull-up or pull-down resistor must also be inserted on the lines, by setting the DIP-switches Rpoll, in position on. These options must be selected before installation of the modules.



—
Fig. 5.16 Termination resistor, this option must be selected before the installation of the modules

5.6.2.3 Access from the display / Ekip Com Profibus DB -module

With modules energized the presence of the modules on the module slot activates additional menus on the display.

The following table illustrates the path for accessing the configuration parameters of the modules from the display:

Settings (*Default value)		Description
:		
Modules (Optional modules)		
Ekip Com Profibus DB		
Serial address	1...125, default 125*	Address to be assigned to the modules. IMPORTANT: devices connected to the same network must have different addresses
:		

Table 5.10 Configuration of Ekip Com Profibus DB -module in HMI

The following table illustrates the path from the display for accessing information on the module:

About	Description
:	
Modules (Optional modules)	
Ekip Com Profibus DB -module	
SN	Serial number
Version	Software version
:	

Table 5.11 Information of Ekip Com Profibus DB -module in HMI

5.6.3 Ekip Com DeviceNet -module

The Ekip Com DeviceNet –module is a communication accessory module, that integrates the automatic transfer switch in an industrial remote supervision and control network. The module is suitable for HMI-types level 3 and 4; LCD and touch control interfaces.

It can be connected to a CAN network with a DeviceNetTM communication protocol, and allows you to:

- Connect the automatic transfer switch as slaves to the network, with dialog functionality.
- Provide the status information of the automatic transfer switch (open, closed).

For the communication lines, Belden type 3084A or equivalent cables must be used.

—
Fig. 5.17 Ekip Com DeviceNet -module

5.6.3.1 Signallings

The following table illustrates the possible signals, and their meaning:

LED	Indication	Description
Power LED, green	Off	Power supply absent.
	On fixed	Power supply and communication with the device present.
	On, with one flash per second	Power supply and communication with device present.
	On, with two quick flashes per second	Power supply present, and communication with device absent.
Network LED, red	Off	Device off line (with red LED off) [1], or in error conditions (with red LED on).
	On, fixed	Device on line, and allocated on a master (operating condition).
	On, flashing	Device on line, but not allocated on a master (device ready for communication).
Status LED, green	Off	No error.
	On, fixed	Device in bus off, or Network Power absent condition.
	On, flashing	I/O connection (cyclic data) in timeout.

[1] The device has not yet sent Duplicate ID sequence on line.

—

Table 5.12 Indication / Ekip Com DeviceNet -module in HMI

—

Fig. 5.18 Signals of Ekip Com DeviceNet -module

5.6.3.2 Termination resistor

The modules provide the possibility to insert a 120 Ω termination resistor on the CAN bus, by setting the DIP-switches Rterm on the side of the modules, in position on. This option must be selected before the installation of the modules.

Information
The termination resistors must never be included in the nodes. The inclusion of this capability could easily lead to a network with improper termination (impedance too high or too low), potentially causing a failure. For example the removal of a node, which includes a termination resistor, could result in a network failure.

The termination resistors must not be installed at the end of a branch (drop line), only at the two ends of the main backbone (trunk line).

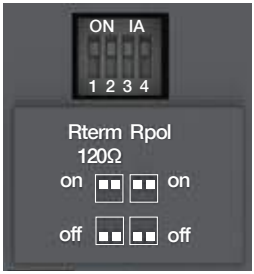


Fig. 5.19 Termination resistor, this option must be selected before the installation of the modules

5.6.3.3 Access from the display / Ekip Com DeviceNet –module

With modules energized the presence of the modules on the module slot activates additional menus on the display.

The following table illustrates the path for accessing the configuration parameters of the modules from the display:

Settings (*Default value)		Description
:		
Modules (Optional modules)		
Ekip Com DeviceNet		
MAC address	1… 63, default 63*	Address to be assigned to the modules. IMPORTANT: devices connected to the same network must have different addresses
Baudrate	125 kbit/s, 250 kbit/s*, 500 kbit/s	Data transmission speed
:		

Table 5.13 The path for accessing the configuration parameters of the Ekip Com DeviceNet -module from the display

The following table illustrates the path from the display for accessing information on the module:

About	Description
:	
Modules (Optional modules)	
Ekip Com DeviceNet	
SN	Serial number
Version	Software version
:	

Table 5.14 Information of Ekip Com DeviceNet -module in HMI

5.6.4 Ekip Com Modbus TCP -module

Ekip Com Modbus TCP is an accessory module that can function as a communication module integrating the automatic transfer switch in an industrial remote supervision and control network or as an HTTP Server. The module is suitable for HMI-types level 3 and 4; LCD and touch control interfaces.

As a communication module, it can be connected to an Ethernet network with the Modbus TCP communication, and allows:

- Connect the automatic transfer switch to the network, with dialog functionality.
- Provide the status information of the automatic transfer switch (open, closed).

As an HTTP Server, connected to an Ethernet network it allows read-only access to the information of the automatic transfer switch. This access is possible through a browser, inserting the IP address of the module as the URL. Once the switch has been found, a login page is opened that asks for the user password to be inserted, which is the same password to be inserted in the display in order to edit parameters.

Information
Since the module allows access to the data contained in the automatic transfer switch, it can only be connected to networks that meet all the necessary requirements for safety and prevention of unauthorized access (for example, the network of the control system of an installation). It is the installer's responsibility to ensure that all the necessary safety measures are adopted (for example, firewalls, and so on). The module cannot be connected directly to the Internet. It is recommended to connect it only to dedicated Ethernet networks, with the Modbus TCP communication protocol.

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

Fig. 5.20 Ekip Com Modbus TCP -module

The following table illustrates the ports used by the module:

Port	Service	Notes
502/tcp	Modbus TCP	When the module is used as a Modbus TCP/IP communication module.
80/tcp	Server HTTP	When the module is used as a Server HTTP.
319/udp	IEEE 1588	When IEEE protocol 1588 is enabled
320/udp		

Table 5.15 Ports of Ekip Com Modbus TCP -module

5.6.4.1 Signallings

The following table illustrates the possible signals, and their meaning:

LED	Indication	Description
Power LED, green	Off	Power supply absent.
	On fixed	Power supply and communication with the device present.
	On, with one flash per second	Power supply and communication with device present.
	On, with two quick flashes per second	Power supply present, and communication with device absent.
Link LED, green	Off	Connection error (signal absent).
	On, fixed	Correct connection.
Activity LED, yellow	Off	No activity on the line.
	On, flashing	Activity present on the line (in reception and/or transmission).

Table 5.16 Indication / Ekip Com Modbus TCP -module

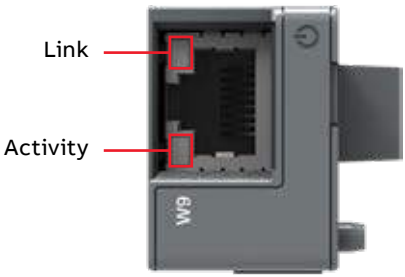


Fig. 5.21 Signals of Ekip Com Modbus TCP -module

5.6.4.2 Access from the display / Ekip Com Modbus TCP –module

With modules energized the presence of the modules on the module slot activates additional menus on the display:

- For setting the function and addressing of the modules.
- In order to display information on the modules.

The following table illustrates the path from the display, for setting the function and addressing of the modules:

Settings (* Default value)		Description
:		
Modules (Optional modules)		
Ekip Com Modbus TCP		
Function	HTTP Server	HTTP Server operating mode.
	TCPModbus*	Communication module operating mode.
Force Static IP address	Off*	Dynamic IP address.
	On	Static IP address.
Static IP Address		Displayed with static IP Address enabled, it must be selected in order to insert the IP Address of the modules.
Static Network Mask		Displayed with static IP Address enabled, it must be selected in order to insert the subnet mask of the modules.
Static Gateway addr		Displayed with static IP Address enabled, it must be selected in the presence of multiple subnets, in order to insert the IP Address of the node to which the modules are connected.
:		

Table 5.17 The path for setting the function and addressing of the modules of the Ekip Com Modbus TCP -module from the display

The following table illustrates the path from the display for accessing information on the module:

About	Description
:	
Modules (Optional modules)	
Ekip Com Modbus TCP	
SN	Serial number
Version	Software version
IP Address	This is the address assigned to the modules at the moment of connection to the network. It consists of four bytes (for a total of 32 bits), each of which can have value from 0 to 255. By default, allocation is dynamic. With dynamic allocation, the modules wait to receive the IP address from a DHCP server. Without a DHCP server, the modules adopt an Autoconfiguration IP Address in the range 169.254.xxx.xxx, calculated in a pseudo random manner so as to be the same at every switch-on. Alternatively, you can enable the static IP address option, which allows the IP address to be forced. In this case, you must make sure that the IP Address inserted is different to that of the other devices connected to the same network.
Network Mask	This is the subnet mask, and identifies the method to recognize the subnet to which the modules belong, with the possibility of searching for the modules within a defined set of recipients. If you enabled the option Static IP Address, you must also enter the correct Network Mask.
Gateway Address	The IP address of the node to which the module it is connected, in the presence of multiple subnets. If you enabled the Static IP Address option, you must also enter the correct Gateway Address.
TCP Client	There are three IP Addresses of the client devices connected to the modules.
MAC Address	It is the address assigned by ABB, having a OUI equal to ac:d3:64[1)].
:	

[1)] Organizationally Unique Identifier, formed from the first three bytes of a MAC address, and which uniquely identifies the manufacturer of an Ethernet device.

—

Table 5.18 Information of Ekip Com Modbus TCP -module in HMI

5.6.5 Ekip Com Profinet -module

The Ekip Com Profinet is a communication accessory module, that integrates the automatic transfer switch in an industrial remote supervision and control network. The module is suitable for HMI-types level 3 and 4; LCD and touch control interfaces.

It can be connected to an Ethernet network with a Profinet communication protocol, and allows you to:

- Connect the automatic transfer switch to the network, with dialog functionality.
- Provide the status information of the automatic transfer switch (open, closed).

Information
The module can only be connected to networks that meet all the necessary requirements for safety and prevention of unauthorized access (for example, the network of the control system of an installation). It is the installer's responsibility to ensure that all the necessary safety measures are adopted (for example, firewalls, and so on). It is recommended to connect it only to dedicated Ethernet networks, with the Profinet communication protocol. The module cannot be connected to the Internet.

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

Fig. 5.22 Ekip Com Profinet -module

The following table illustrates the ports used by the module:

Ethertype	Port	Service	Notes
0x88CC	-	LLDP	Link Layer Discovery Protocol
0x8892 (Profinet)	-	Profinet IO	Specific for real time communications (RT)
0x0800	34964/udp	Profinet-cm (Context Manager)	DCE/RP

Table 5.19 Ports of Ekip Com Profinet –module

5.6.5.1 Signallings

The following table illustrates the possible signals, and their meaning:

LED	Indication	Description
Power LED, green	Off	Power supply absent.
	On fixed	Power supply and communication with the device present.
	On, with one flash per second	Power supply and communication with device present.
	On, with two quick flashes per second	Power supply present, and communication with device absent.
Link LED, green	Off	Connection error (signal absent).
	On, fixed	Correct connection.
Activity LED, yellow	Off	No activity on the line.
	On, flashing	Activity present on the line (in reception and/or transmission.

Table 5.20 Indication / Ekip Com Profinet -module

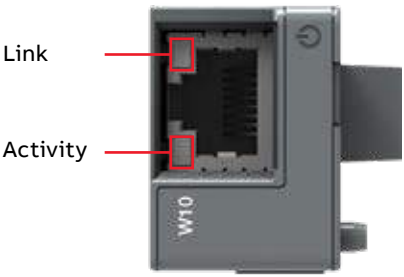


Fig. 5.23 Signals of Ekip Com Profinet -module

5.6.5.2 Access from the display / Ekip Com Profinet -module

The following table illustrates the path from the display for accessing information on the module:

About		
:		
Modules (Optional modules)		
	Ekip Com Profinet -module	
		SN — Serial number
		Version — Software version
		MAC Address — It is the address assigned by ABB and with an OUI (Organizationally Unique Identifier, formed of the first three bytes of a MAC address, and which uniquely identifies the manufacturer of an Ethernet device) equal to ac:d3:64.
:		

—

Table 5.21 Information of Ekip Com Profinet -module

5.6.6 Ekip Com EtherNet/IP -module

The Ekip Com EtherNet/IP is an accessory module that can act as a communication module integrating the automatic transfer switch in an industrial remote supervision and control network. The module is suitable for HMI-types level 3 and 4; LCD and touch control interfaces.

It can be connected to an Ethernet network with a EtherNet/IP™ -communication protocol, and allows you to:

- Connect the automatic transfer switch to the network, with dialog functionality.
- Provide the status information of the automatic transfer switch (open, closed).

Information
Since this module allows the access to the data contained in the automatic transfer switch, it can only be connected to networks possessing all the necessary requirements for security and prevention of unauthorized access (for example, the network of the control system of an installation). It is responsibility of the installer to make sure that all the necessary security measures are adopted (for example firewalls and so on). The module cannot be connected directly to the Internet. It is recommended to connect it only to dedicated Ethernet networks using the EtherNet/IP™ -communication protocol.

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

The following table illustrates the ports used by the module:

Port	Protocol	Notes
44818	TCP	Encapsulation Protocol (example: ListIdentity, UCMM, CIP Transport Class 3)
44818	UDP	Encapsulation Protocol (example: ListIdentity)
2222	UDP	CIP Transport Class 0 or 1

Table 5.22 Ports of Ekip Com EtherNet/IP -module

Fig. 5.24 Ekip Com EtherNet/IP -module

5.6.6.1 Signallings

The following table illustrates the possible signals, and their meaning:

LED	Indication	Description
Power LED, green	Off	Power supply absent.
	On fixed	Power supply and communication with the device present.
	On, with one flash per second	Power supply and communication with device present.
	On, with two quick flashes per second	Power supply present, and communication with device absent.
Link LED, green	Off	Connection error (signal absent).
	On, fixed	Correct connection.
Activity LED, yellow	Off	No activity on the line.
	On, flashing	Activity present on the line (in reception and/or transmission).

Table 5.23 Indication / Ekip Com EtherNet/IP -module

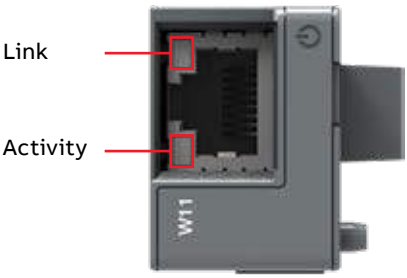


Fig. 5.25 Signals of Ekip Com EtherNet/IP -module

5.6.6.2 Access from the display / Ekip Com EtherNet/IP

With modules energized the presence of the modules on the module slot activates additional menus on the display:

- To set the addressing of the modules.
- In order to display information on the modules.

The following table illustrates the path from the display, for setting the function and addressing of the modules:

Settings (*Default value)		Description
:		
Modules (Optional modules)		
Ekip Com EtherNet/IP		
Force Static IP address	Off*	Dynamic IP address.
	On	Static IP address.
Static IP Address		Displayed with static IP Address enabled, it must be selected in order to insert the IP Address of the modules.
Static Network Mask		Displayed with static IP Address enabled, it must be selected in order to insert the subnet mask of the modules.
Static Gateway addr		Displayed with static IP Address enabled, it must be selected in the presence of multiple subnets, in order to insert the IP Address of the node to which the modules are connected.
:		

Table 5.24 The path for setting the function and addressing of the modules of the Ekip Com Modbus TCP -module from the display

The following table illustrates the path from the display for accessing information on the module:

About	Description
:	
Modules (Optional modules)	
Ekip Com EtherNet/IP	
SN	Serial number
Version	Software version
IP Address	This is the address assigned to the modules at the moment of connection to the network. It consists of four bytes (for a total of 32 bits), each of which can have value from 0 to 255. By default, allocation is dynamic. With dynamic allocation, the modules wait to receive the IP address from a DHCP server. Without a DHCP server, the modules adopt an Autoconfiguration IP Address in the range 169.254.xxx.xxx, calculated in a pseudo random manner so as to be the same at every switch-on. Alternatively, you can enable the static IP address option, which allows the IP address to be forced. In this case, you must make sure that the IP Address inserted is different to that of the other devices connected to the same network.
Network Mask	This is the subnet mask, and identifies the method to recognize the subnet to which the modules belong, with the possibility of searching for the modules within a defined set of recipients. If you enabled the option Static IP Address, you must also enter the correct Network Mask.
Gateway Address	The IP address of the node to which the module it is connected, in the presence of multiple subnets. If you enabled the Static IP Address option, you must also enter the correct Gateway Address.
TCP Client	There are three IP Addresses of the client devices connected to the modules.
MAC Address	It is the address assigned by ABB, having a OUI equal to ac:d3:64[1)].
:	

[1)] Organizationally Unique Identifier, formed from the first three bytes of a MAC address, and which uniquely identifies the manufacturer of an Ethernet device.

—

Table 5.25 Information of Ekip Com EtherNet/IP -module in HMI

5.6.7 Ekip Com IEC 61850 -module

The Ekip Com IEC 61850 is an accessory module that can function as a communication module by integrating the automatic transfer switch in an industrial remote supervision and control network. The module is suitable for HMI-types level 3 and 4; LCD and touch control interfaces.

It can be connected to an Ethernet network with a IEC 61850 -communication protocol, and allows you to:

- Connect the automatic transfer switch to the network, with dialog functionality.
- Provide the status information of the automatic transfer switch (open, closed).
- Provide vertical communication (report) towards higher-level supervision systems (SCADA) with states and measurements (re-transmitted whenever, and only if, they change with respect to the previous report).

Information
Since this module allows the access to the data contained in the automatic transfer switch, it can only be connected to networks possessing all the necessary requirements for security and prevention of unauthorized access (for example, the network of the control system of an installation). It is responsibility of the installer to make sure that all the necessary security measures are adopted (for example firewalls and so on). The module cannot be connected directly to the Internet. It is recommended to connect it only to dedicated Ethernet networks using the IEC 61850 -communication protocol.

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

Fig. 5.26 Ekip Com IEC 61850 -module

The following table illustrates the ports used by the module:

Ethertype	Port	Protocol
0x0800 - IP	102	ISO Transport Service on top of the TCP (RFC 1006)
0x88B8	-	GOOSE Messages
0x0800 - IP	123 UDP	NTP - Network Time Protocol
0x0800 - IP	69 UDP	TFTP - Trivial File Transfer Protocol

Table 5.26 Ports of Ekip Com IEC 61850 -module

5.6.7.1 Signallings

The following table illustrates the possible signals, and their meaning:

LED	Indication	Description
Power LED, green	Off	Power supply absent.
	On fixed	Power supply and communication with the device present.
	On, with one flash per second	Power supply and communication with device present.
	On, with two quick flashes per second	Power supply present, and communication with device absent.
Link LED, green	Off	Connection error (signal absent).
	On, fixed	Correct connection.
Activity LED, yellow	Off	No activity on the line.
	On, flashing	Activity present on the line (in reception and/or transmission).

Table 5.27 Indication / Ekip Com IEC 61850 -module

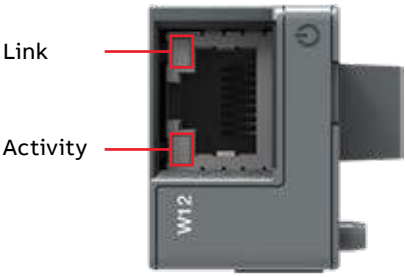


Fig. 5.27 Signals of Ekip Com IEC 61850 -module

5.6.7.2 Access from the display / Ekip Com IEC 61850

With modules energized the presence of the modules on the module slot activates additional menus on the display:

- To set the addressing of the modules.
- In order to display information on the modules.

The following table illustrates the path from the display, for setting the function and addressing of the modules:

Settings (*Default value)		Description
:		
Modules (Optional modules)		
Ekip Com IEC 61850		
Force Static IP address	Off*	Dynamic IP address.
	On	Static IP address.
SNTP client abilit.	Off*	Synchronism with the SNTP clock signal disabled.
	On	Synchronism with the SNTP clock signal enabled.
Static IP Address		Displayed with static IP Address enabled, it must be selected in order to insert the IP Address of the modules.
Static Network Mask		Displayed with static IP Address enabled, it must be selected in order to insert the subnet mask of the modules.
Static Gateway addr		Displayed with static IP Address enabled, it must be selected in the presence of multiple subnets, in order to insert the IP Address of the node to which the modules are connected.
SNTP Indir. Server		Displayed with SNTP client enabled. “On” has to be selected to insert the IP address of the server with whose SNTP clock signal the modules are to be synchronised.
:		

Table 5.28 The path for setting the function and addressing of the modules of the Ekip Com IEC 61850 -module from the display

The following table illustrates the path from the display for accessing information on the module:

About	Description
:	
Modules (Optional modules)	
Ekip Com EtherNet/IP	
SN	Serial number
Version	Software version
IP Address	This is the address assigned to the modules at the moment of connection to the network. It consists of four bytes (for a total of 32 bits), each of which can have value from 0 to 255. By default, allocation is dynamic. With dynamic allocation, the modules wait to receive the IP address from a DHCP server. Without a DHCP server, the modules adopt an Autoconfiguration IP Address in the range 169.254.xxx.xxx, calculated in a pseudo random manner so as to be the same at every switch-on. Alternatively, you can enable the static IP address option, which allows the IP address to be forced. In this case, you must make sure that the IP Address inserted is different to that of the other devices connected to the same network.
Network Mask	This is the subnet mask, and identifies the method to recognize the subnet to which the modules belong, with the possibility of searching for the modules within a defined set of recipients. If you enabled the option Static IP Address, you must also enter the correct Network Mask.
Gateway Address	The IP address of the node to which the module it is connected, in the presence of multiple subnets. If you enabled the Static IP Address option, you must also enter the correct Gateway Address.
TCP Client	There are three IP Addresses of the client devices connected to the modules.
MAC Address	It is the address assigned by ABB, having a OUI equal to ac:d3:64[1)].
:	

[1)] Organizationally Unique Identifier, formed from the first three bytes of a MAC address, and which uniquely identifies the manufacturer of an Ethernet device.

—

Table 5.29 Information of Ekip Com IEC 61850 -module in HMI

5.7 Using Ekip Link -module

Ekip Link is a communication accessory module that integrates the device in an internal Ethernet network with an ABB proprietary protocol. The module is suitable for HMI-types level 3 and 4; LCD and touch control interfaces.

The network to which the module is to be connected must be dedicated and comprising only Ekip Link and Ethernet switches that declare support for level L2 multicast on the datasheet. In this case the Ethernet switches do not require any configuration. If, instead, the network also includes routers, multicast must be enabled and configured on all VLAN interfaces with level L3.

Information
The module can be connected only to internal Ethernet networks with one or more switchboards, to which automatic transfer switches are connected. It is the installer's responsibility to ensure that all the necessary safety measures are adopted for all the connected devices (for example, the necessary access authorizations, and so on). The module cannot be connected to other Ethernet networks (for example, with the purpose of monitoring the system, or the office), or to the Internet.

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

More information, see the document 1SDH001330R0002, Sace Emax 2, Operating instructions for the design engineer.

Fig. 5.28 Ekip Link -module

The following table illustrates the ports used by the module:

Port	Service	Notes
502/tcp	Modbus TCP	When the module is used as a Modbus TCP/IP communication module.
80/tcp	ABB proprietary	In case of exchange of fast information between ABB devices.
319/udp	IEEE 1588	When IEEE protocol 1588 is enabled.
320/udp		

Table 5.30 Ports of Ekip Link -module

5.7.1 Signallings

The following table illustrates the possible signals, and their meaning:

LED	Indication	Description
Power LED, green	Off	Power supply absent.
	On fixed	Power supply and communication with the device present.
	On, with one flash per second	Power supply and communication with device present.
	On, with two quick flashes per second	Power supply present, and communication with device absent.
Link LED, green	Off	Connection error (signal absent).
	On, fixed	Correct connection.
Activity LED, yellow	Off	No activity on the line.
	On, fixed or flashing	Activity present on the line (in reception and/or transmission). When it is on, it may be fixed or flashing (communication is active in both cases).

Table 5.31 Indication / Ekip Link -module

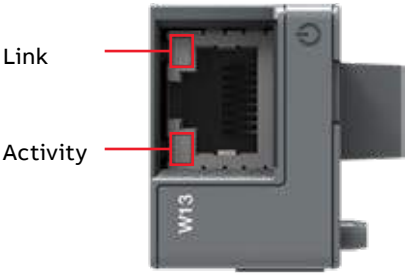


Fig. 5.29 Signals of Ekip Link -module

5.7.2 Access from the display / Ekip Link

The following table illustrates the path from the display, for setting the function and addressing of the modules:

Settings (*Default value)		Description
:		
Modules (Optional modules)		
Ekip Link		
Force Static IP address	Off*	Dynamic IP address.
	On	Static IP address.
Static IP Address		Displayed with static IP Address enabled, it must be selected in order to insert the IP Address of the modules.
Static Network Mask		Displayed with static IP Address enabled, it must be selected in order to insert the subnet mask of the modules.
Static Gateway addr		Displayed with static IP Address enabled, it must be selected in the presence of multiple subnets, in order to insert the IP Address of the node to which the modules are connected.
:		

—

Table 5.32 The path for setting the function and addressing of the modules of the Ekip Link -module from the display

The following table illustrates the path from the display for accessing information on the module:

About		Description
:		
Modules (Optional modules)		
Ekip Link		
	SN	Serial number
	Version	Software version
	IP Address	This is the address assigned to the modules at the moment of connection to the network. It consists of four bytes (for a total of 32 bits), each of which can have value from 0 to 255. By default, allocation is dynamic. With dynamic allocation, the modules wait to receive the IP address from a DHCP server. Without a DHCP server, the modules adopt an Autoconfiguration IP Address in the range 169.254.xxx.xxx, calculated in a pseudo random manner so as to be the same at every switch-on. Alternatively, you can enable the static IP address option, which allows the IP address to be forced. In this case, you must make sure that the IP Address inserted is different to that of the other devices connected to the same network.
	Network Mask	This is the subnet mask, and identifies the method to recognize the subnet to which the modules belong, with the possibility of searching for the modules within a defined set of recipients. If you enabled the option Static IP Address, you must also enter the correct Network Mask.
	Gateway Address	The IP address of the node to which the module it is connected, in the presence of multiple subnets. If you enabled the Static IP Address option, you must also enter the correct Gateway Address.
	MAC Address	It is the address assigned by ABB, having a OUI equal to ac:d3:64[1)].
:		

[1)] Organizationally Unique Identifier, formed from the first three bytes of a MAC address, and which uniquely identifies the manufacturer of an Ethernet device.

—

Table 5.33 Information of Ekip Link -module in HMI

6. Troubleshooting

6.1 Alarms

LCD Touch

Message	Fault	Action
Locked, Alarm LED on	Lock input activated	Unlock
Switch not in AUTO mode, Alarm LED on	Slide switch is in handle or lock position	Turn slide switch into the AUTO position
Phases crossed	Phase rotation of sources 1 and 2 are different	Connect the phases of both sources in the same order
S1 undervoltage	Voltage of source 1 is under the threshold level set in parameter “Drop-out voltage, lower threshold“	Check the correlation between power source and device configuration
S1 overvoltage	Voltage of source 1 is over the threshold level set in parameter “Drop-out voltage, upper threshold“	Check the correlation between power source and device configuration
S1 phase missing	One or two phases of source 1 are missing	Check the power source and connections
S1 unbalance	Phases of source 1 are not symmetric	Check the power source
S1 phase rotation	Phase rotation of source 1 is different from the value of parameter “Phase sequence“	Connect the phases according to the configuration
S1 invalid frequency	Frequency of source 1 is out of range set in parameters “Drop-out frequency, upper threshold“ and “Drop-out frequency, lower threshold“	Check the correlation between power source and device configuration
S2 undervoltage	Voltage of source 2 is under the threshold level set in parameter “Drop-out voltage, lower threshold“	Check the correlation between power source and device configuration
S2 overvoltage	Voltage of source 2 is over the threshold level set in parameter “Drop-out voltage, upper threshold“	Check the correlation between power source and device configuration
S2 phase missing	One or two phases of source 2 are missing	Check the power source and connections
S2 unbalance	Phases of source 2 are not symmetric	Check the power source
S2 phase rotation	Phase rotation of source 2 is different from the value of parameter “Phase sequence“	Connect the phases according to the configuration

Table 6.1 Alarms-list in level 3 and 4, LCD and touch control interfaces

Message	Fault	Action
S2 invalid frequency	Frequency of source 2 is out of range set in parameters “Drop-out frequency, upper threshold“ and “Drop-out frequency, lower threshold“	Check the correlation between power source and device configuration
High current alarm	Measured current is higher than ten times the nominal value	
Open I failure, Alarm LED blinking	Switch transfer from position I to O or II failed	Reset alarm by pressing Auto button or via menu page Operation / Alarm Reset
Close I failure, Alarm LED blinking	Switch transfer to position I failed	Reset alarm by pressing Auto button or via menu page Operation / Alarm Reset
Open II failure, Alarm LED blinking	Switch transfer from position II to O or I failed	Reset alarm by pressing Auto button or via menu page Operation / Alarm Reset
Close II failure, Alarm LED blinking	Switch transfer to position II failed	Reset alarm by pressing Auto button or via menu page Operation / Alarm Reset
Switch position alarm, Alarm LED on	More than one switch position indication inputs are activated	Switch service needed
Pole temperature alarm	Measured pole temperature is too high	Switch service needed
Contact wear alarm	Switch contact wear is near the limit that requires maintenance	Switch service needed
Local bus	Communication between HMI and switch controller is off	Check connection
Ethernet disconnected	Ethernet module not connected	Check connection
Fire Fighting	Fire fighting input activated	Switch must be in O/Off position
Control Voltage Failure	Control voltage dropped during switch control	Check power source
Incompatible HMI	Controller and HMI are not compatible	Change HMI
Control Voltage Low	Switch control voltage is below the minimum	Check power source
Configuration Error	Invalid configuration	Check parameter values
IEC 61850 Error	IEC 61850 failure	Check configuration file
Ekip Com Hub Alarm	Ekip Com Hub failure	Check configuration

Table 6.1 Alarms-list in level 3 and 4, LCD and touch control interfaces

6.2 Warnings

LCD Touch

Message	Reason
Test on load	Test on load sequence activated
Test off load	Test off load sequence activated
Autoconfig completed	Automatic configuration sequence is completed
Voltage supply lines not in sync	Voltage sources are not synchronized
Voltage Not Calibrated	Calibration data in power module is invalid or unavailable
Current Not Calibrated	Calibration data in current measurement module is invalid or unavailable
Pole temperature warning	Measured pole temperature is near the alarm level
Control Retry	Failed transfer sequence retry activated
Auto Control Disabled	Device is in manual operating mode
Local Bus	Module heartbeat error
Configuration	Configuration session ports are open

Table 6.2 Warnings-list in level 3 and 4, LCD and touch control interfaces

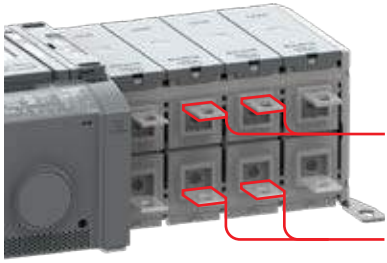
6.3 Information

LCD Touch

Message	Description
Invalid Date	Date not set
Test on Load	Test on load sequence active
Test off Load	Test off load sequence active
Alarm/Product Availability	Digital output function activated
In Position I	Digital output function activated
In Position O	Digital output function activated
In Position II	Digital output function activated
Pre-transfer Signal	Digital output function activated
Source 1 Available	Digital output function activated
Source 2 Available	Digital output function activated
Load Shed	Digital output function activated
Emergency Stop	Digital input function activated
Remote Test on Load	Digital input function activated
Remote Test off Load	Digital input function activated
Inhibit Auto Mode	Digital input function activated
Manual Retransfer	Digital input function activated
Priority S1	Digital input function activated
Priority S2	Digital input function activated
Inhibit Transfer	Digital input function activated
Bypass Running Delays	Digital input function activated
Remote Control to S1	Digital input function activated
Remote Control to Off	Digital input function activated
Remote Control to S2	Digital input function activated
Alarm Reset	Digital input function activated

Table 6.3 Info statements in level 3 and 4, LCD and touch control interfaces

7. Technical data



Operating voltage for control circuit 200...480 Vac. Generator supply; min. power rating 40 kVA

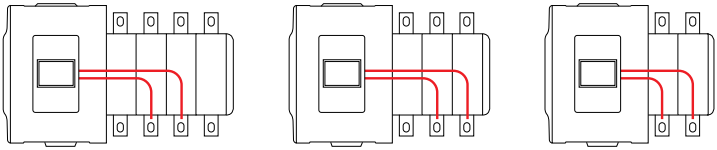
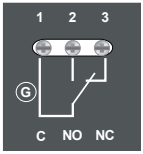
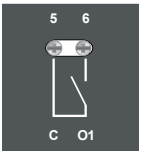
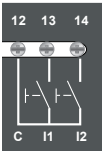
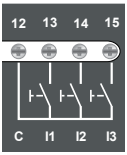


Fig. 7.1 Power supply for control circuit, in figure type OX_B (source on bottom)

Automatic transfer switch, power circuit	**Value**	
Rated operational voltage U	200...480 Vac	
Rated frequency f	50 / 60 Hz	
Rated impulse withstand voltage U_{imp}	12 / 8 kV	
Operating times	See Table 7.2	
Automatic transfer switch, control circuit	**Value**	**Remark**
Voltage supply	200...480 Vac	Integrated, see Fig. 7.1
Operating voltage range	±20%	
Voltage measurement accuracy		
Rated frequency f	50 / 60 Hz	
Operating frequency range, Level 2	±10%	Level 2 = HMI with DIP-switches
Operating frequency range, Level 3 and 4	±20%	Level 3 = HMI with LCD screen, Level 4 = HMI with touch screen
Frequency measurement accuracy		
Rated impulse withstand voltage U_{imp}	6 kV	

Automatic transfer switch, I/O contacts		Cabling	Rating / Remark
Generator start/stop		0.5…2.5 mm²	
	Common, voltage supply	1	5A AC-1/250 V 30 Vdc
	Generator start/stop NO	2	
	Generator start/stop NC	3	
Output relay features		0.5…2.5 mm²	
Common, voltage supply		5	5A AC-1/250 V 30 Vdc
	Level 2		Level 2 = HMI with DIP-switches
	Product available	6	
	Level 3 and 4		Level 3 = HMI with LCD screen, Level 4 = HMI with touch screen
	Programmable output (default; Product available)	6	
Fire Fighting applications		0.5…2.5 mm²	Only in OXB_-types, delayed transition, I – O – II or II – O – I
	Fire fighting input 24 Vdc (+)	10	SELV
	Fire fighting input 24 Vdc (-)	11	
Input contact features		0.5…2.5 mm²	Do not connect to any power supply
Common input		12	24 Vdc 5 mA
	Level 2		Level 2 = HMI with DIP-switches
	Emergency stop	13	Only in OXB_-types, delayed transition, I – O – II or II – O – I
	Level 3		Level 3 = HMI with LCD screen
	Programmable input (default; Remote test on load)	13	
	Programmable input (default; Remote test off load)	14	Only in OXB_-types, delayed transition, I – O – II or II – O – I
	Level 4		Level 4 = HMI with touch screen
	Programmable input (default; Remote test on load)	13	
	Programmable input (default; Remote test off load)	14	
	Programmable input (default; Emergency stop)	15	Only in OXB_-types, delayed transition, I – O – II or II – O – I

Environmental	Value
Environments category	E
EMC environment	Environment A
Operating temperature (without derating)	-20... +40 °C
Operating temperature (with derating)	-25... +70 °C
Transportation and storage temperature	-40... +70 °C
Altitude (without derating)	Up to 2000 m

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Table 7.1 General technical data of automatic transfer switch

Type	Voltage U_e [Vac]	Nominal current* I_n [A]	Operating time* = current duration I-0, 0-I, 0-II, II-0 [ms]	Operating transfer time* AUTO mode I-II or II-I [ms]	Contact transfer time* I-II or II-I [ms]
OXA30...260_	200...480	35	-	< 500	< 50
OXB200...400_	200...480	35	< 110	< 500	< 50
OXA400...600_	200...480	40	-	< 500	< 50
OXB500...800_	200...480	40	< 130	< 500	< 50
OXA800...1200_	200...480	40	-	< 500	< 50
OXB1000...1600_	200...480	40	< 130	< 500	< 50

* Under nominal conditions

—

Table 7.2 Specified technical data of operating times

Installation instruction
Automatic transfer switches

8. Installation

Before mounting the product, please, check the product identification from the product identification label, which is located on the front panel under the control interface unit (HMI). This label indicates the product model (type number), some important technical data information, minimum enclosure size, suitable wire information, etc.

8.1 Mounting the OX30...1600 automatic transfer switch

8.1.1 Drilling hole distances and labeling

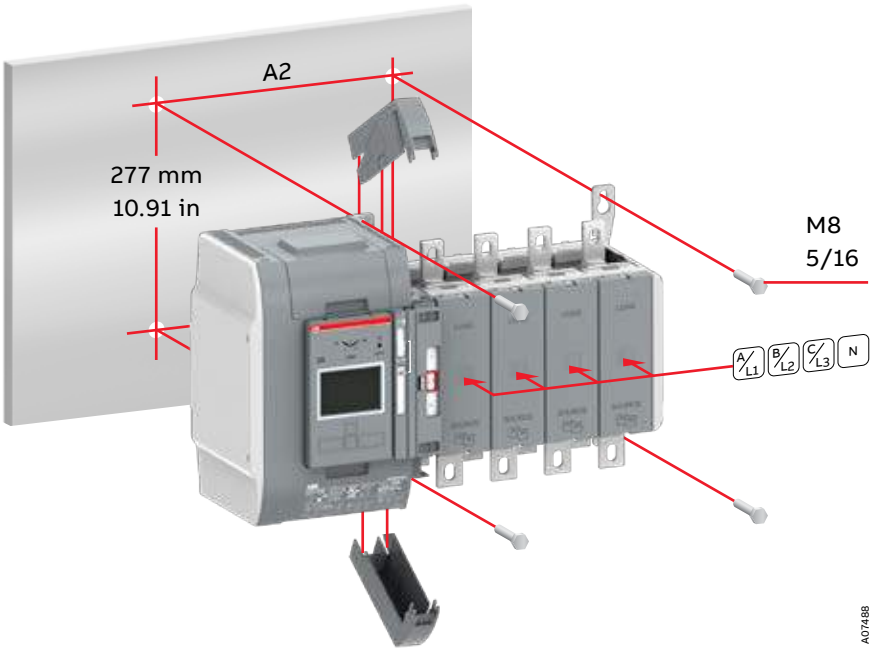


Fig. 8.1 Automatic transfer switches, drilling hole distances / screw-mounting, [mm/in] and attachment of the self-adhesive labels

Automatic transfer switch	A2 [mm / in]		
	2-pole	3-pole	4-pole
OX_30...250_	120 / 4.72	165 / 6.50	210 / 8.27
OX_260...400_	160 / 6.30	225 / 8.86	290 / 11.42
OX_500...800_	160 / 6.30	225 / 8.86	290 / 11.42
OX_800U...1600_	-	375 / 14.77	490 / 19.30

Table 8.1 Automatic transfer switches, drilling

8.1.2 Protection against direct contact

For protection against direct contact you can use the terminal shrouds when possible or a plexiglass mounted over the product.

—

Fig. 8.2 On top: Protection against direct contact with terminal shrouds.
On bottom: Protection against direct contact with a plexiglass mounted over the product

8.2 Wiring

8.2.1 Wiring of OX_30...800 / cable lugs

Automatic transfer switch	Bolt size	Tightening torque T [Nm / lb.in]
OX_30...250_	M8	15...22 / 133...195
OX_260...400_	M10	30...44 / 266...390
OX_500...800_	M12	50...75 / 443...664

Table 8.2 OX_30...800_/ bolt sizes and tightening torques

Automatic transfer switch	Max. distance from switch frame to nearest cable support	
	SOURCE	LOAD
	[mm / in]	[mm / in]
OX_30...250_	300 / 11.8	150 / 5.9
OX_260...400_	300 / 11.8	150 / 5.9
OX_500...800_	300 / 11.8	150 / 5.9

Table 8.3 OX_30...800_/ cable support with breaker or fuses (SCPD)

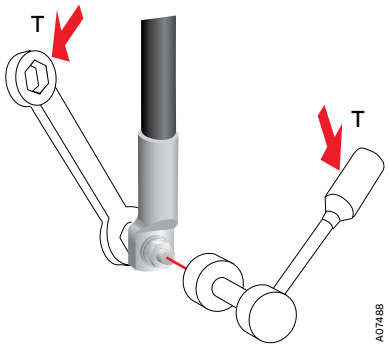


Fig. 8.3 Wiring, the tightening torques, see the tables 8.2 and 8.3

Hazardous voltage
Only an authorised electrician may perform the electrical installation and maintenance of OX_ automatic transfer switches. Do not attempt any installation or maintenance actions when an OX_ automatic transfer switch is connected to the electrical mains. Before starting work, make sure that the switch is de-energised.

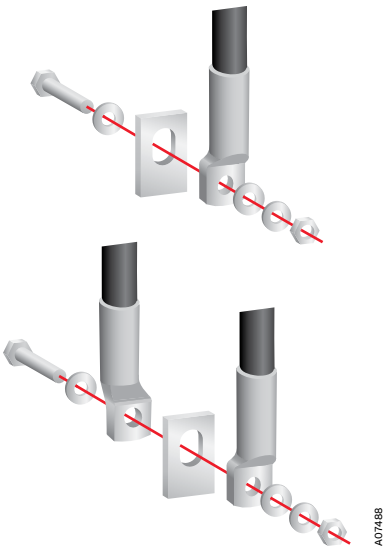


Fig. 8.4 OX_30...800, wiring by cable lugs

8.2.2 Wiring of OX_800U...1600 / busbar connections and cable lugs

Automatic transfer switch	Bolt size	Tightening torque [Nm / lb.in]
OX_800U...1600_	M12	50...75 / 443...664

Table 8.4 OX_800U...1600_/ bolt size and tightening torque

Automatic transfer switch	Max. distance from switch frame to nearest cable/busbar support	
	SOURCE [mm / in]	LOAD [mm / in]
OX_500...800_	300 / 11.8	150 / 5.9
- Busbar	225 / 8.9	150 / 5.9
OX_800U...1600_	400 / 15.7	200 / 7.8

Table 8.5 OX_500...1600_/ cable/busbar support with breaker or fuses (SCPD)

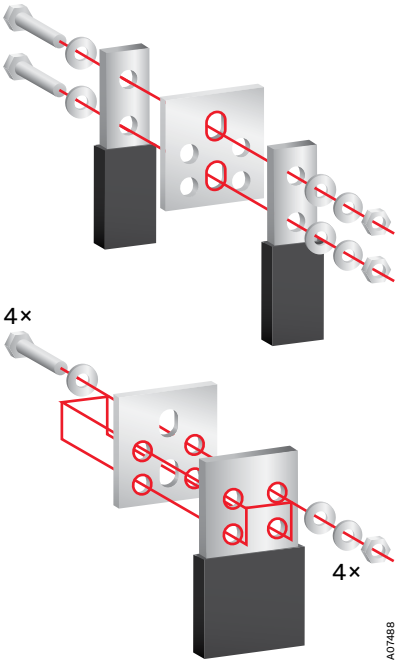


Fig. 8.5 OX_800U...1600, busbar connection

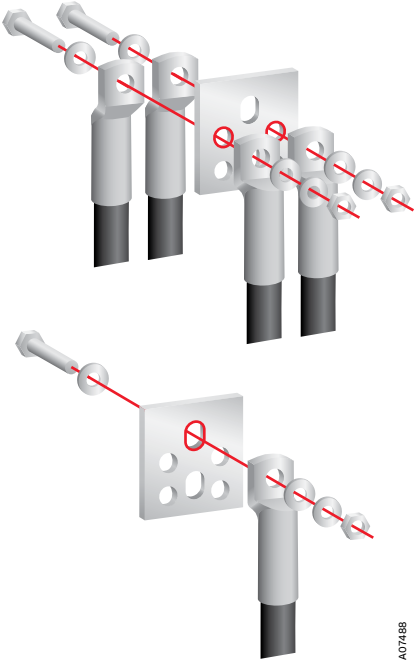
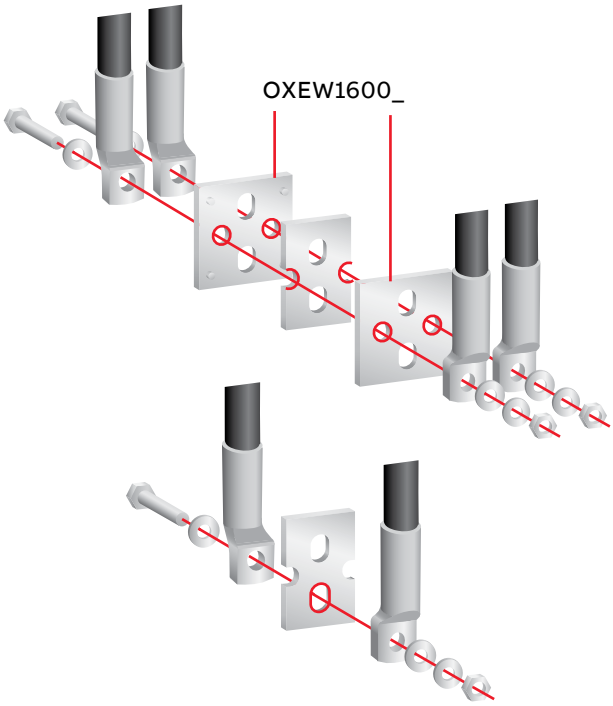
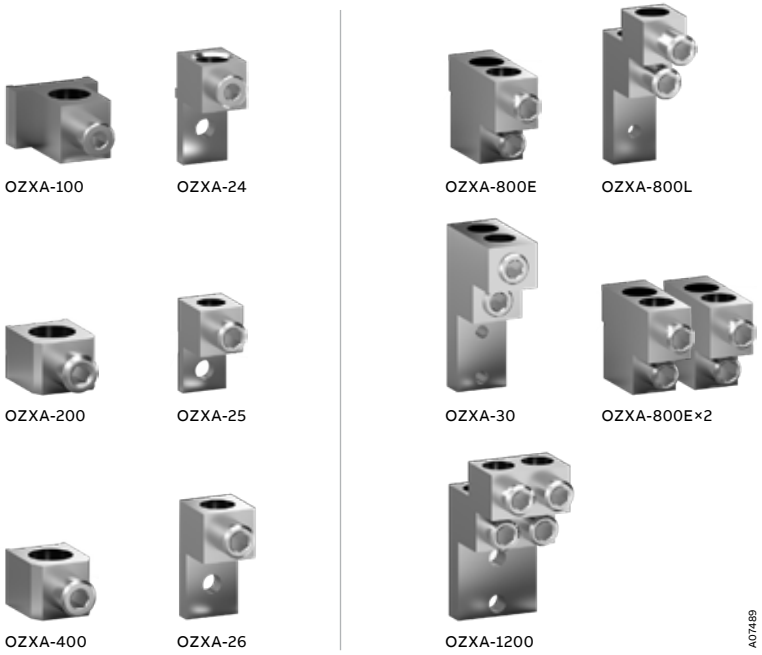


Fig. 8.6 OX_800U...1600, wiring / cable lugs



—
Fig. 8.7 Wiring with cable lugs in automatic transfer switches OX_800U...3200: For load side terminals the busbars OXEW1600_ are needed to mount on both sides of the switch terminal for connecting the cable lugs. Tightening torque and bolt size, see the table 8.4

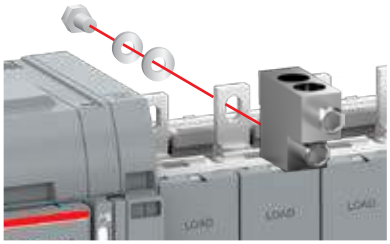
8.2.3 Lug assembly



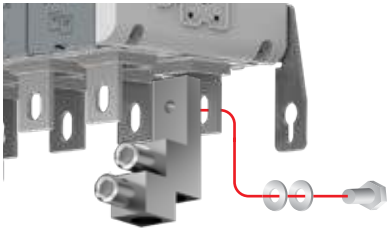
—
Fig. 8.8 Lug assembly

Lug assembly	Lug assembly/ Fixing screws [pcs]	Lug assembly/ Mounting torque [lb.in / Nm]	Wire/ Size	Wire/ Tightening torque [lb.in / Nm]
OZXA-100, OZXA-24	1	OZXA-100: 124 / 14	14...10 AWG	35 / 4
		OZXA-24: 132 / 14.9	8 AWG	40 / 4.5
			6...4 AWG	45 / 5.1
			3...2/0 AWG	50 / 5.6
OZXA-200	1	132 / 14.9		200 / 22.6
OZXA-25	1	132 / 14.9		275 / 31.1
OZXA-400	1	228 / 25.8		375 / 42.4
OZXA-26	1	228 / 25.8		375 / 42.4
OZXA-800E	1	480 / 54.2		500 / 56.5
OXZA-800L	1	480 / 54.2		500 / 56.5
OZXA-30, OZXA-1200	2	443 / 50.1		500 / 56.5

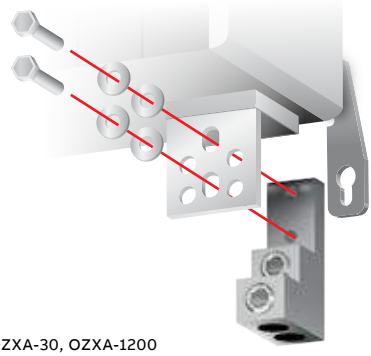
—
Table 8.6 Lug assembly, mounting information



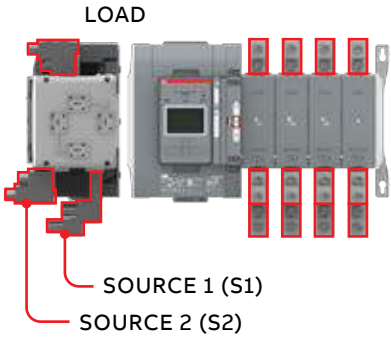
OZXA-100...400, OZXA-800E



OZXA-24...26, OZXA-800L



OZXA-30, OZXA-1200



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Automatic transfer switch			Lug assembly
	LOAD	SOURCE S2	SOURCE S1
	OZXA-100	OZXA-100	OZXA-24
OX_30...200_	OZXA-200	OZXA-200	OZXA-25
OX_260/400_	OZXA-400	OZXA-400	OZXA-26
OX_600_	OZXA-800E	OZXA-800E	OZXA-800L
OX_800_	OZXA-800E	OZXA-800E	OZXA-30
OX_1000/1200_	OZXA-1200	2 x OZXA-800E	OZXA-1200

—

Table 8.7 OX_30...1600_ / suitable lug assembly

Automatic transfer switch	Max. distance from switch frame to nearest cable/busbar support	
	SOURCE [in / mm]	LOAD [in / mm]
	11.8 / 300	5.9 / 150
OX_30...200_	11.8 / 300	5.9 / 150
OX_260_	11.8 / 300	5.9 / 150
OX_400_	11.8 / 300	5.9 / 150
OX_600_	11.8 / 300	5.9 / 150
OX_800_	15.7 / 400	7.8 / 200
OX_1200_	15.7 / 400	7.8 / 200

—

Table 8.8 OX_30...1600_/ cable/busbar support with breaker or fuses (SCPD)

8.2.4 Phase barriers

Phase barriers must be used to maintain a clearance of 1 inch on the automatic transfer switch types. The switch types OX_400U/500...1600 include the phase barriers for LOAD side, otherwise the phase barriers have to be ordered separately when needed.

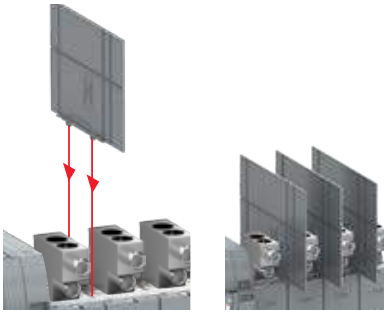


Fig. 8.9 Mounting of phase barriers.

8.3 Clearances per UL1008

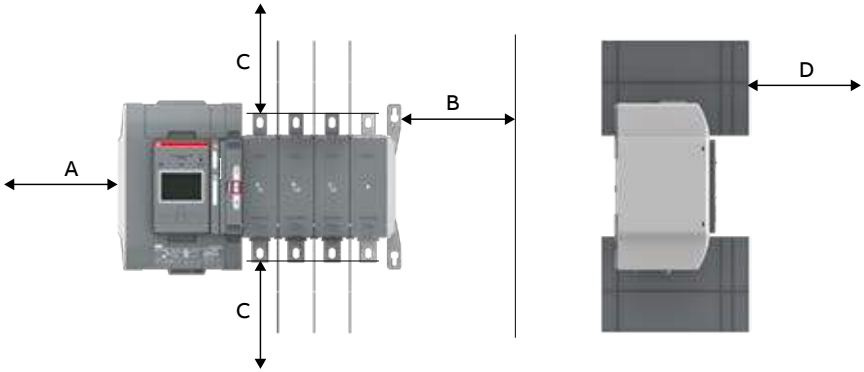


Fig. 8.10 UL standard switches, clearances per UL1008

Size (Current)	A [in /mm]	B [in /mm]	D [in /mm]	C
OX_30...200U_	1 / 26	0.5 / 13	0.5 / 13	According to the
OX_260...400U_	1 / 26	0.5 / 13	0.5 / 13	UL1008 standard
OX_600U_	1 / 26	0.5 / 13	0.5 / 13	
OX_800U_ ...OX_1200U_	1 / 26	0.5 / 13	0.5 / 13	

Minimum enclosure size or equivalent volume

Size (Current)	Width [in /mm]	Height [in /mm]	Depth [in /mm]
OX_30...200U_	23.6 / 600	31.5 / 800	11.8 / 300
OX_260...400U_	23.6 / 600	31.5 / 800	11.8 / 300
OX_600U_	23.6 / 600	31.5 / 800	11.8 / 300
OX_800U_ ...OX_1200U_	31.5 / 800	39.4 / 1000	11.8 / 300

8.4 Mounting of the handle and HMI

For more information of operating, position indication and the selection of the operating mode, see the Chapter 3.2 Operating and locking.

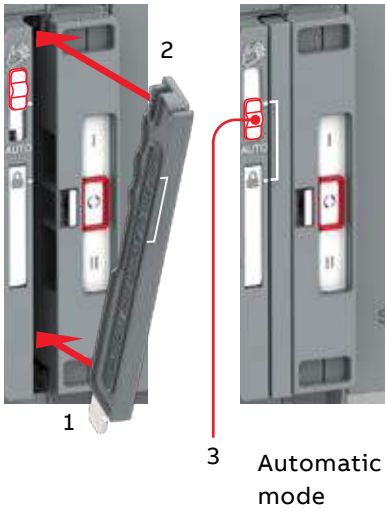
More information, see animation: Manual and automatic operation - TruONE® ATS (https://youtu.be/bosvSPVi2sM).

General warning
Verify the condition of power source prior to manually transferring. Manual operation may result in out-of-phase transfer when both sources are energized.

8.4.1 Mounting of the handle to operation position, manual mode

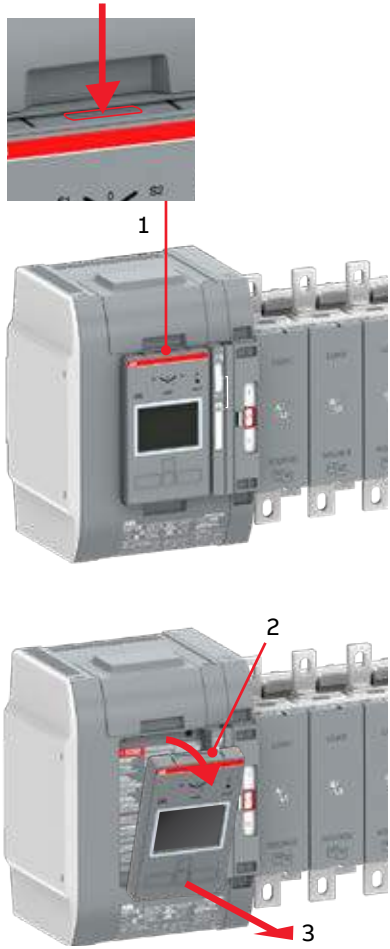
Fig. 8.11 Mounting the handle to the operating position; turn the slide switch to the Manual mode (Hand), lift the handle and place it to the operating position

8.4.2 Mounting of the HMI, automatic mode



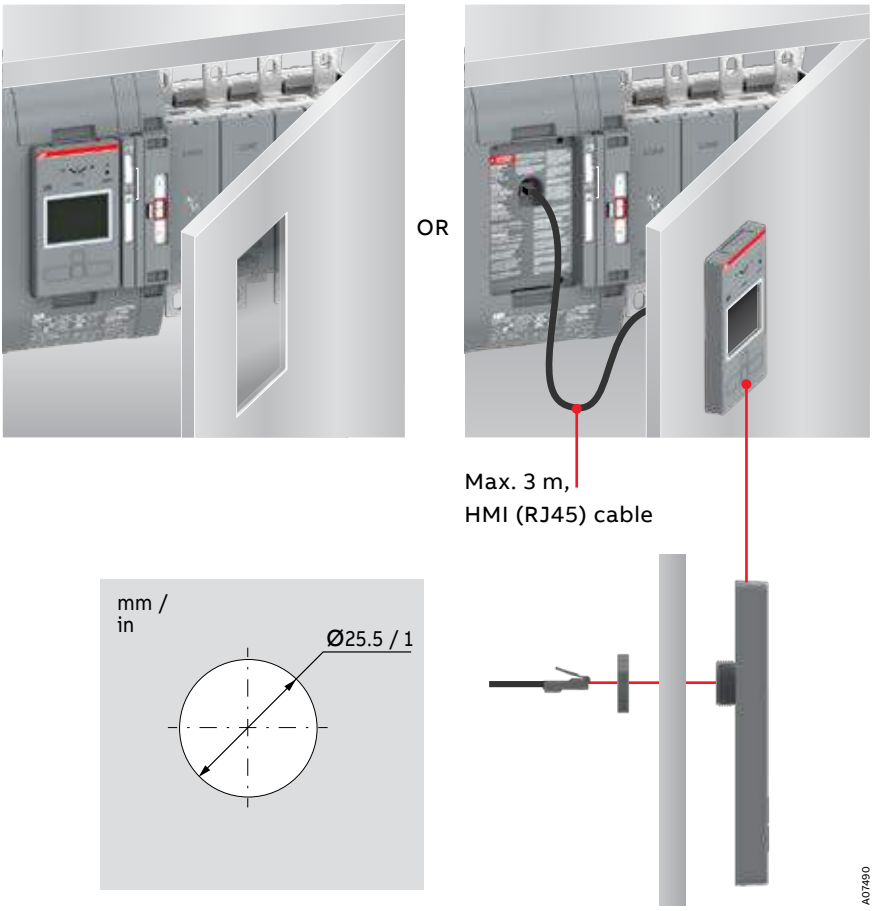
Information
When the slide switch is moved to the AUTO position, the ATS is functioning immediately in the automatic control mode.

More information, see animation: Installation of ATS in the panel and HMI on door - TruONE® ATS (https://youtu.be/PnvjhCVWQak).



—
Fig. 8.12 Before moving to the Automatic mode, the operating handle must set to its place. When the handle is in its place properly, the slide switch will move to the Locking mode automatically and the switch is allowed to be padlocked, if needed. From the Locking mode the slide switch can be moved to the Automatic mode

—
Fig. 8.13 Removing the HMI from the switch



—
Fig. 8.14 HMI can be mounted on the switch or the door, door drilling. HMI protective cover available as accessory, type OXEC21, provides protection against accidental contact, see Chapter 9, Mounting of accessories

9. Mounting of accessories

More information, see animation:
Installation of accessories - TruONE® ATS
(https://youtu.be/qV2KoIv38GY).

9.1 Terminal shrouds

Automatic transfer switch	Suitable terminal shroud G= Grey	
	Short type	Long type
OX_30...250	OXES250G1S	OXES250G1L
OX_260...800	OXES800G1S	OXES800G1L
OX_800U...1600	-	OXES1600G1L

Table 9.1 Terminal shrouds, type OXES_

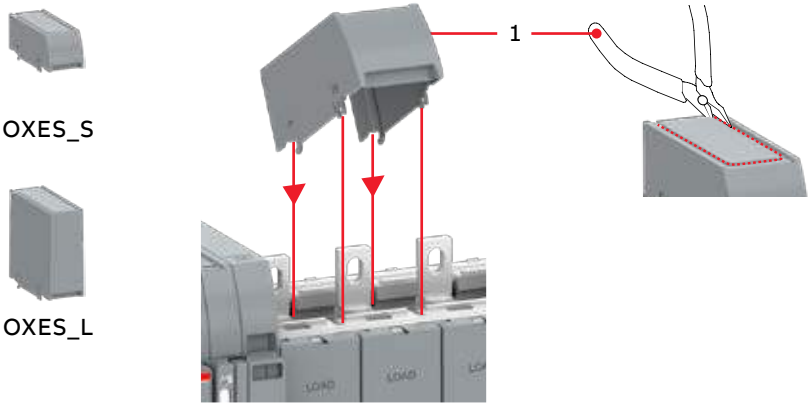


Fig. 9.1 Mounting of the terminal shrouds to the automatic transfer switches, TruONE® ATS

9.2 Phase barriers

Phase barriers must be used to maintain a clearance of 1 inch on the automatic transfer switch types.

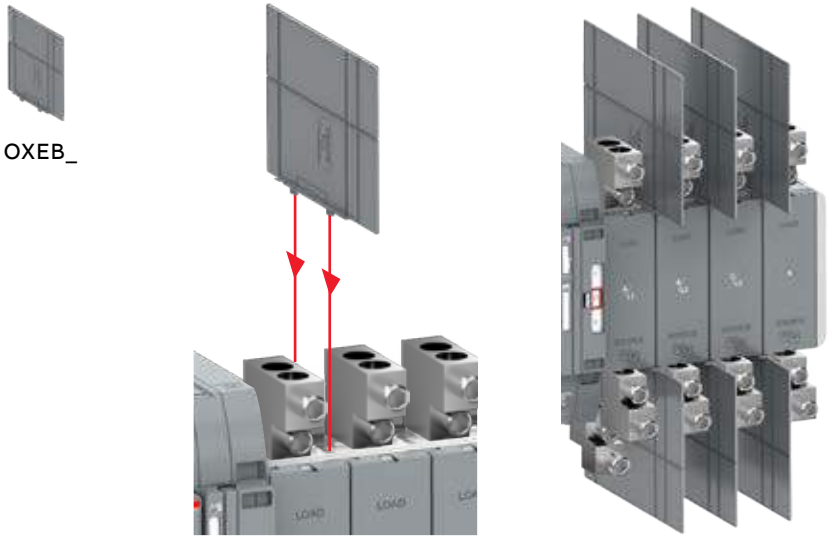


Fig. 9.2 Mounting of phase barriers, type OXEB_

9.3 Auxiliary contact blocks

Position	OA1G10	OA3G01
SOURCE 1 (S1), max 2+2		
I		
O		
II		
SOURCE 2 (S2), max 2+2		
I		
O		
II		

Table 9.2 Contact positions

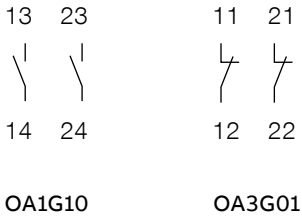


Fig. 9.4 Labels for contact numbering

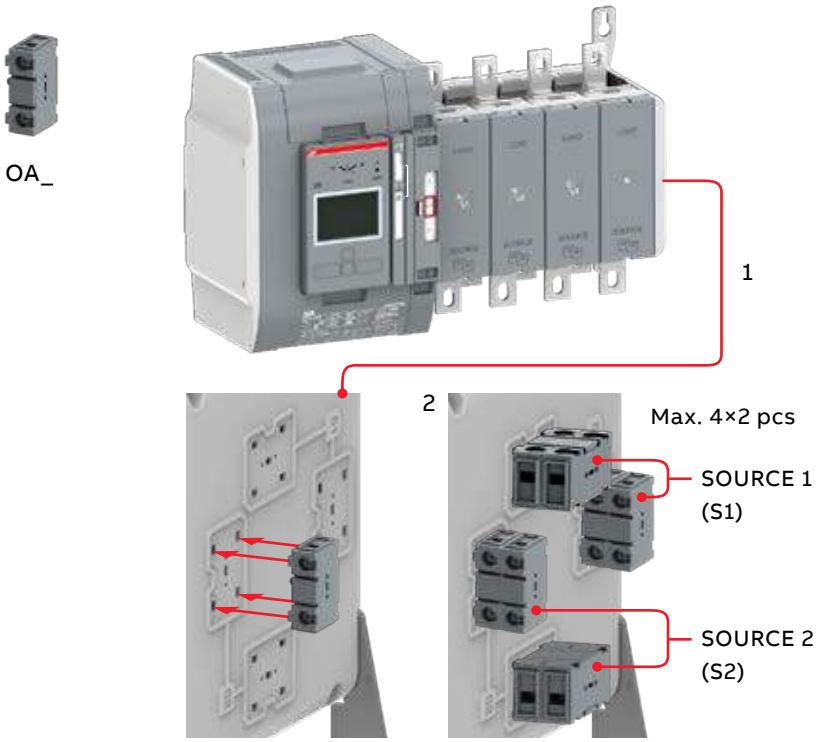


Fig. 9.3 Mounting of the auxiliary contact blocks, type OA_

9.4 Sensor module

Sensor module, type OXCT_, is used for energy and temperature measurement. There are available modules for 2, 3 and 4-pole switches and for different switch sizes.

Switch size	Nominal current of OXCT_ [A]
OX_30...250	250
OX_260...800	800
OX_800U...1600	1600

Table 9.3 Nominal currents

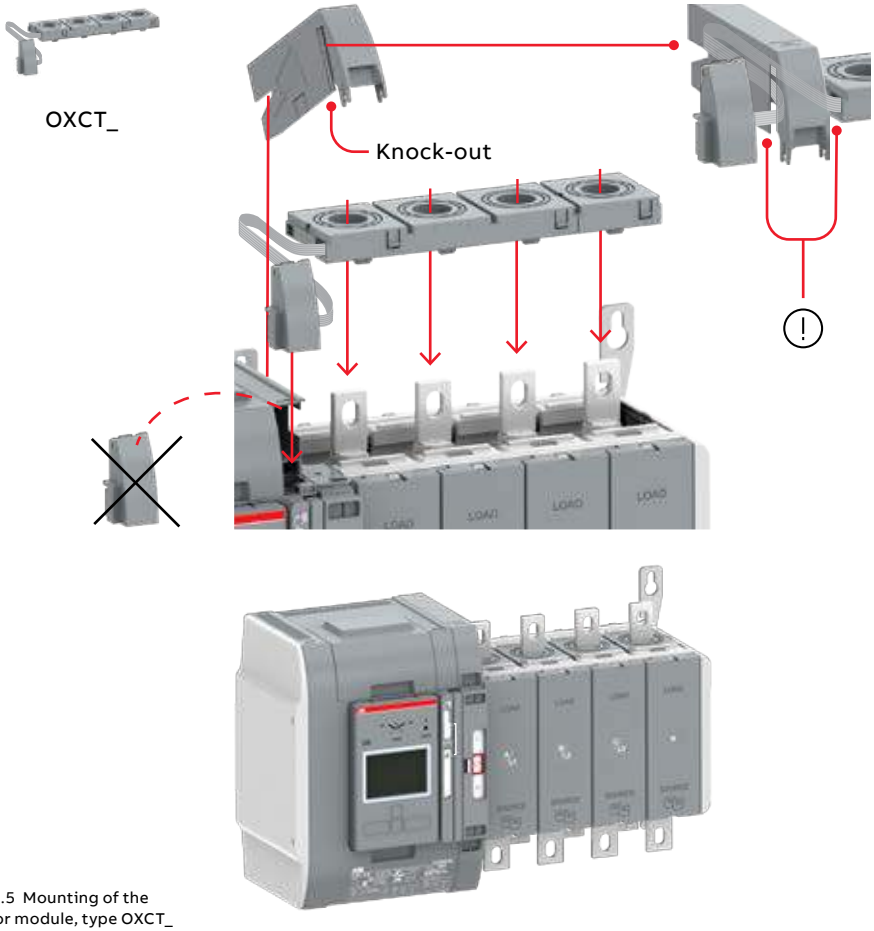


Fig. 9.5 Mounting of the sensor module, type OXCT_

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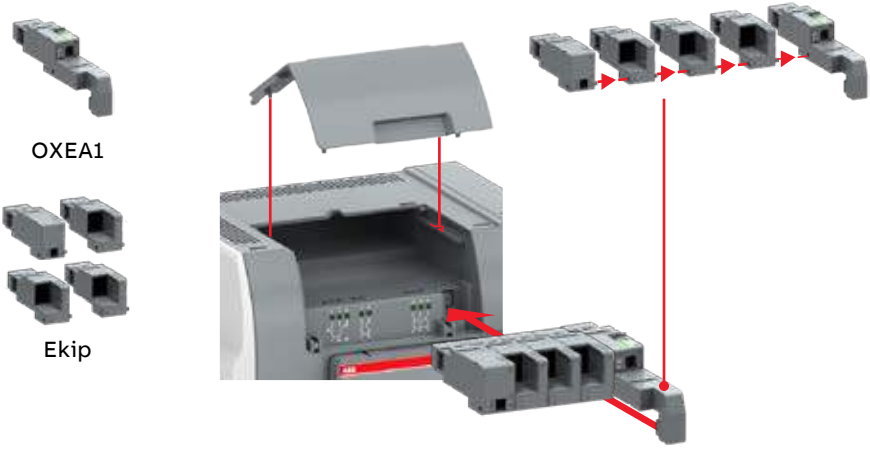
9.5 Auxiliary power supply and Ekip -modules

Automatic transfer switches OX_ can be equipped with Ekip-modules. Ekip-modules are mounted with a auxiliary power supply module, OXEA1. Suitable Ekip-modules are: Ekip link, signalling and connectivity modules. For more information, see Chapter 5, Electronic accessories.

Max. Ekip-modules: OX_30...250: 3 pcs, OX_260...1600: 4 pcs



—
Fig. 9.6 Mounting of the auxiliary power supply module OXEA1 and Ekip –modules

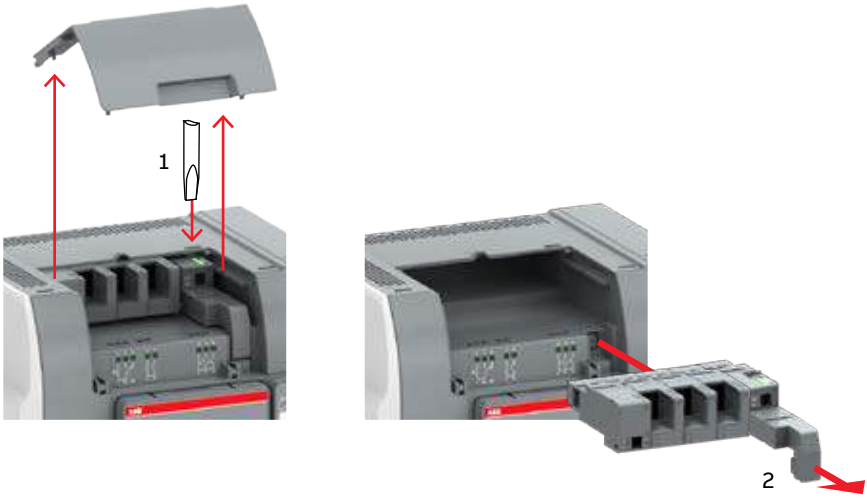


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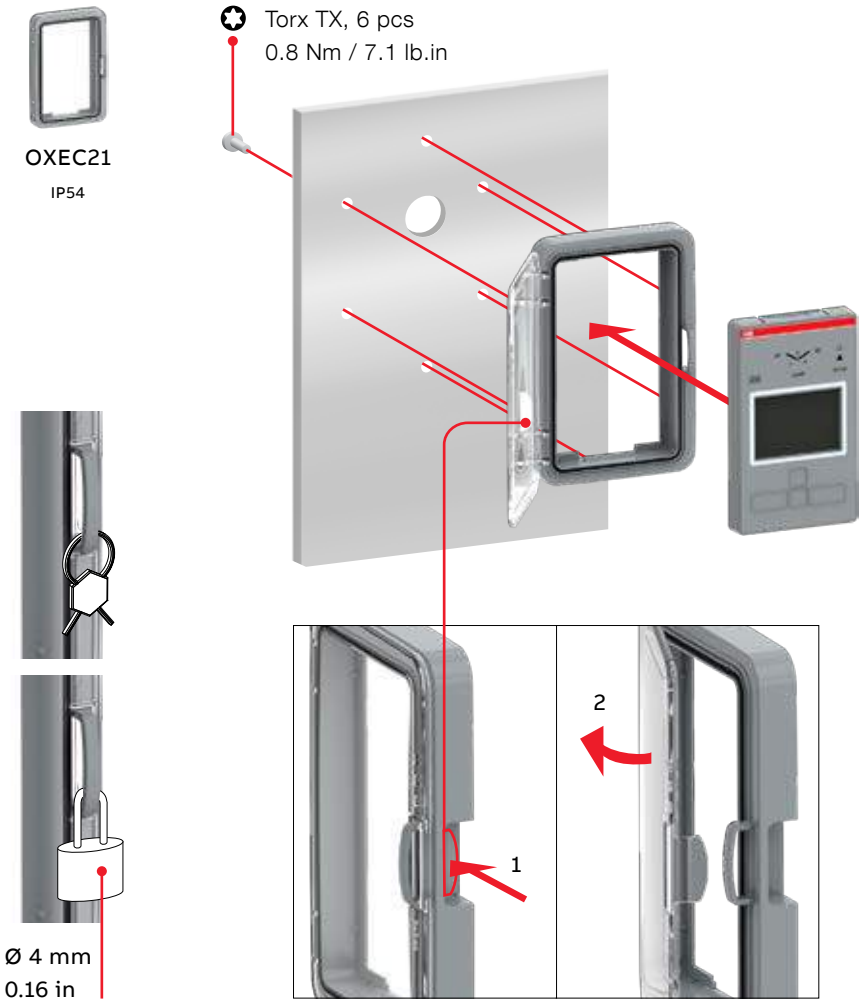
Fig. 9.7 Removing the auxiliary power supply module OXEA1 and Ekip –modules from the automatic transfer switch

9.6 HMI protective cover

HMI protective cover is available as accessory, type OXEC21, provides protection against accidental contact.

Fig. 9.8 Mounting of HMI protective cover, type OXEC21, door drilling, see next page



mm / in

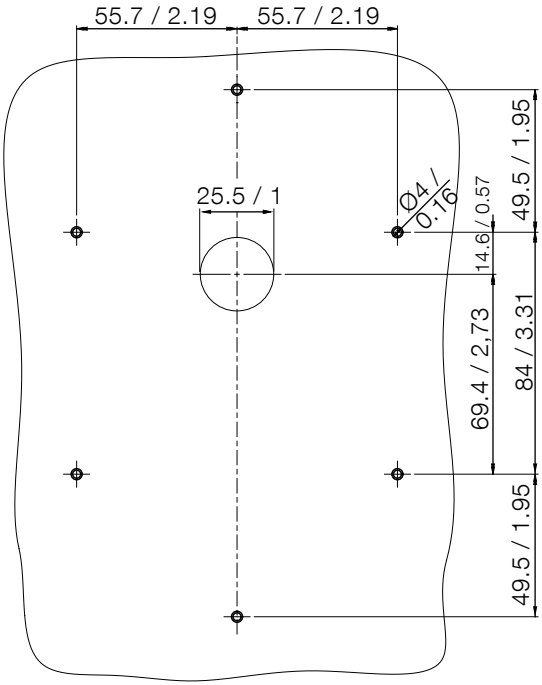


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Fig. 9.9 Door drilling of the HMI protective cover

9.7 Terminal busbar

Terminal busbar, type OXEW1600_, is needed for automatic transfer switches OX_800U...3200A on LOAD side terminals, when wiring is done with cable lugs. It is needed to mount on both sides of the terminal for connecting the cable lug.

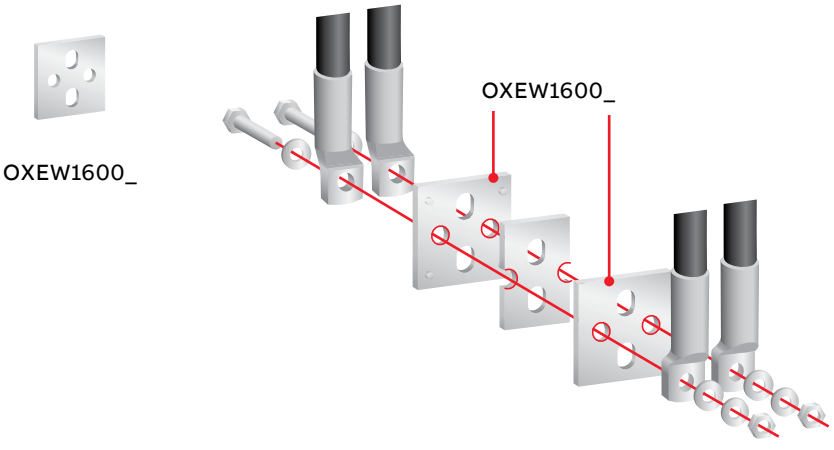
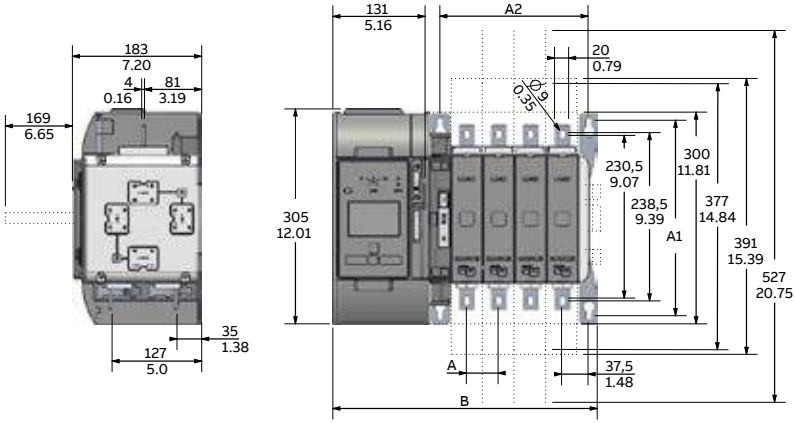


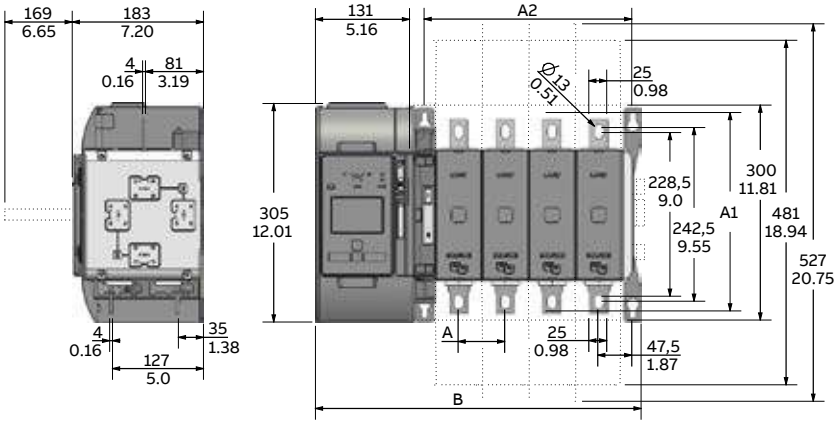
Fig. 9.10 For OX_800U...3200 is needed the terminal busbars, type OXEW1600_, for connecting the cable lug. The busbars have to be mount on both sides of the load side terminals. Tightening torque and bolt size, see the table 8.4

10. Dimension drawings



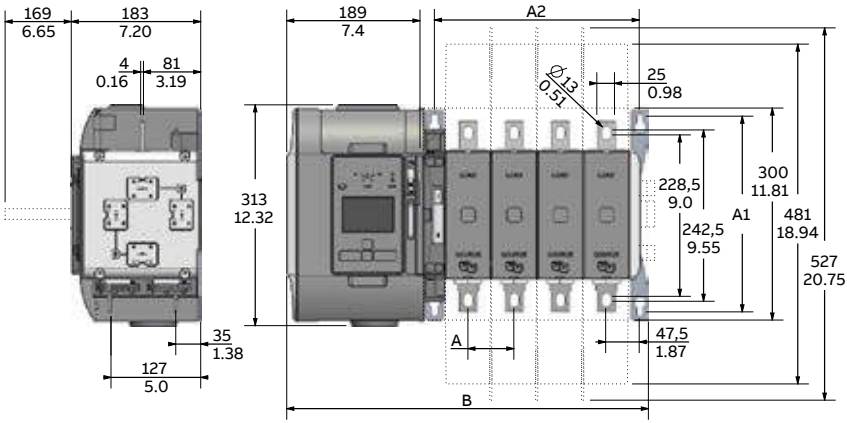
—
Fig. 10.1 OX_30...250_B

OX_30-250_			
No. of poles	**2**	**3**	**4**
A	45/1.77	45/1.77	45/1.77
A1	277/10.91	277/10.91	277/10.91
A2	120/4.72	165/6.50	210/8.27
B	285/11.22	330/12.99	375/14.76



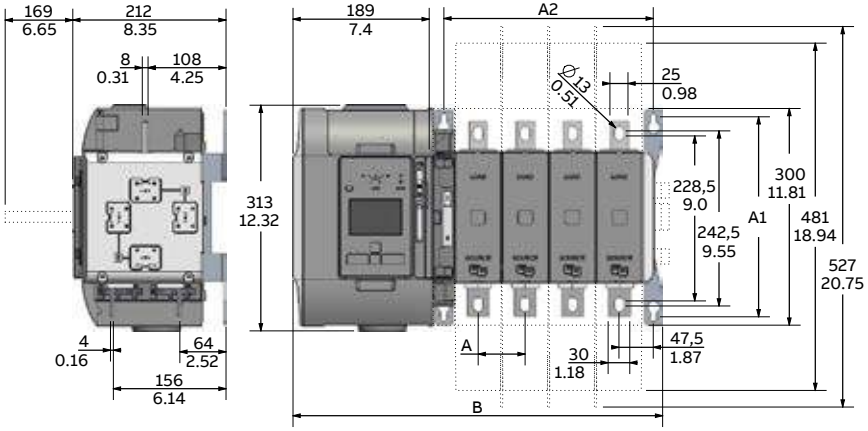
—
Fig. 10.2 OX_260...400_B

OX_260_400			
No. of poles	**2**	**3**	**4**
A	65/2.56	65/2.56	65/2.56
A1	277/10.91	277/10.91	277/10.91
A2	160/6.30	225/8.86	290/11.42
B	325/12.80	390/15.35	455/17.91



—
Fig. 10.3 OX_400U_B

OX_400U_B			
No. of poles	**2**	**3**	**4**
A	65/2.56	65/2.56	65/2.56
A1	277/10.91	277/10.91	277/10.91
A2	160/6.30	225/8.86	290/11.42
B	382/15.04	447/17.60	512/20.16



—
Fig. 10.4 OX_500...800_B

OX_500-800_			
No. of poles	**2**	**3**	**4**
A	65/2.56	65/2.56	65/2.56
A1	277/10.91	277/10.91	277/10.91
A2	160/6.30	225/8.86	290/11.42
B	382/15.04	447/17.60	512/20.16

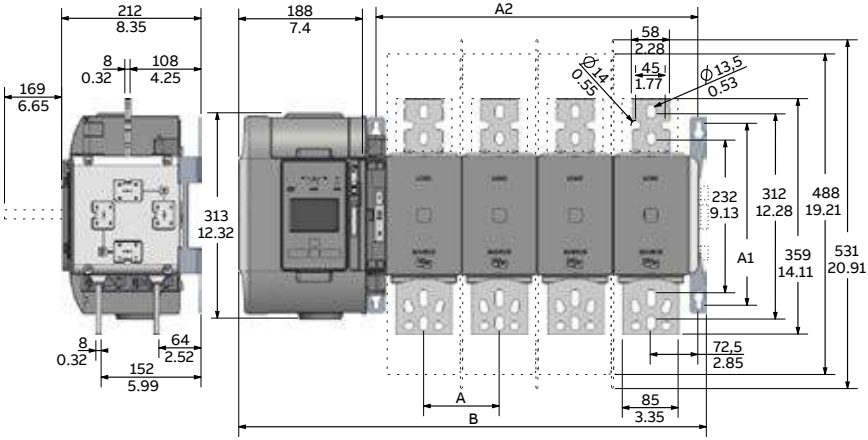


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Fig. 10.5 OX_800U...1600_B

OX_800U-1600		
No. of poles	**3**	**4**
A	115/4.53	115/4.53
A1	227/10.91	227/10.91
A2	375/14.77	490/19.30
B	597/23.51	712/28.04

BG Внимание! Опасно напрежение! Да се монтира само от лице с електротехническа квалификация.
FR Avertissement! Tension électrique dangereuse! Installation uniquement par des personnes qualifiées en électrotechnique.
MT Twissija! Vultaġġ perikoluż! Għandu jiġi installat biss minn persuna b'kompetenza elettroteknika.
HR Upozorenje! Opasan napon! Postavljati smije samo elektrotehnički stručnjak.
DE Warnung! Gefährliche Spannung! Installation nur durch elektrotechnische Fachkraft.
PL Ostrzeżenie! Niebezpieczne napięcie! Instalacji może dokonać wyłącznie osoba z fachową wiedzą w dziedzinie elektrotechniki.
CS Varování! Nebezpečné napětí! Montáž smí provádět výhradně elektrotechnik!
EL Προειδοποίηση! Υψηλή τάση! Η εγκατάσταση πρέπει να γίνεται μόνο από εξειδικευμένους ηλεκτροτεχνικούς.
PT Aviso! Tensão perigosa! A instalação só deve ser realizada por um eletricista especializado.
DA Advarsel! Farlig elektrisk spænding! Installation må kun foretages af personer med elektroteknisk ekspertise.
HU Figyelmeztetés! Veszélyes feszültség! Csak elektrotechnikai tapasztalattal rendelkező szakember helyezheti üzembe.
RO Avertizare! Tensiune periculoasă! Instalarea trebuie efectuată numai de către o persoană cu experienţă în electrotehnică.
NL Waarschuwing! Gevaarlijke spanning! Mag alleen geïnstalleerd worden door een deskundige elektrotechnicus.
IE Rabhadh! Voltas guaiseach! Ba chóir do dhuine ag a bhfuil saineolas leictriteicniúil, agus an té sin amháin, é seo a shuiteáil.
SK Varovanie! Nebezpečné napätie! Montáž môže vykonávať iba skúsený elektrotechnik.
EN Warning! Hazardous voltage! Installation by person with electrotechnical expertise only.
IT Avvertenza! Tensione pericolosa! Fare installare solo da un elettricista qualificato.
SL Opozorilo! Nevarna napetost! Vgradnjo lahko opravi le oseba z elektrotehničnim strokovnim znanjem.
ET Hoiatus! Ohtlik pinge. Paigaldada võib ainult elektrotehnika-alane ekspert.
LV Uzmanību! Bīstami - elektrība! Montāžas darbus drīkst veikt tikai personas, kurām ir atbilstošas elektrotehniskās zināšanas.
ES ¡Advertencia! ¡Tensión peligrosa! La instalación deberá ser realizada únicamente por electricistas especializados.
FI Varoitus! Vaarallinen jännite! Asennuksen voi tehdä vain sähköalan ammattihenkilö.
LT Dėmesio! Pavojinga įtampa! Dirbti leidžiama tik elektrotechniko patirties turintiems asmenims.
SE Varning! Farlig spänning! Installation får endast utföras av en elektriker.
CN 警告！电压危险！只能由专业电工进行安装。
RU Осторожно! Опасное напряжение! Монтаж должен выполняться только специалистом-электриком.

Contact us

ABB Oy
Protection and Connection
P.O. Box 622
FI-65101 Vaasa
Finland

new.abb.com/low-voltage

www.abb.com/truone

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