



OPERATION MANUAL

Air circuit breakers
VA-45 v2 EKF



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1 INTRODUCTION

This operating manual is designed to help maintenance personnel understand the design and operational guidelines for the air circuit breakers VA-45 v2 EKF.

The manual includes essential technical specifications, details about air circuit breaker (ACB) components, and an overview of the ACB operating principles. Additionally, the manual covers important information for proper operation, including safety precautions, installation procedures, preparation for use, operational guidelines, and rules for maintenance, storage, and transportation.



WARNING!

DO NOT operate devices with wet hands and touch live parts (conductors and terminals) to prevent electric shock and burns.

Disconnect power supply before installation and maintenance.



WARNING!

The ACBs must be installed, maintained and serviced only by qualified specialists following state and local regulations.

Before operation, make sure that the operating voltage, rated current, frequency and parameters of the product meet the required specifications.



WARNING!

To ensure optimal performance, use compatible original accessories.

The manufacturer is not responsible for any failures resulting from the use of incompatible accessories.

2 DESCRIPTION

The air circuit breakers (ACBs) VA-45 v2 EKF with microprocessor control are designed for use in up to 690 V AC 50/60 Hz circuits with ratings from 630 A to 6300 A. These ACBs belong to application category B, ensuring selectivity under short-circuit conditions relative to other short-circuit protection devices connected in series on the load side, i.e. with a specified adjustable short-term time delay. The air circuit breakers VA-45 v2 EKF are designed to carry current under normal conditions and disconnect current in case of circuit faults: short circuits and overloads, over- and undervoltage, etc.

The ACB is equipped with a microprocessor trip unit that allows for the fine-tuning of protective functions, enhancing the reliability of power supply and reducing the risk of shutdowns. The trip unit features an open data exchange protocol, providing communication between circuit breakers and data collection and control systems. The ACBs are capable of withstanding peak voltage pulses of up to 12 kV when installed at altitudes of up to 2000 m above sea level.

They can also be supplied without a trip unit and used for interrupting switched circuit sections



ACBs VA-45 v2 EKF comply with IEC 60947-2 and can break a short circuit with a current of $3 \times I_{cs}$, provided that the pause between disconnection and subsequent reconnection is at least 3 minutes.

3 TYPE CODE

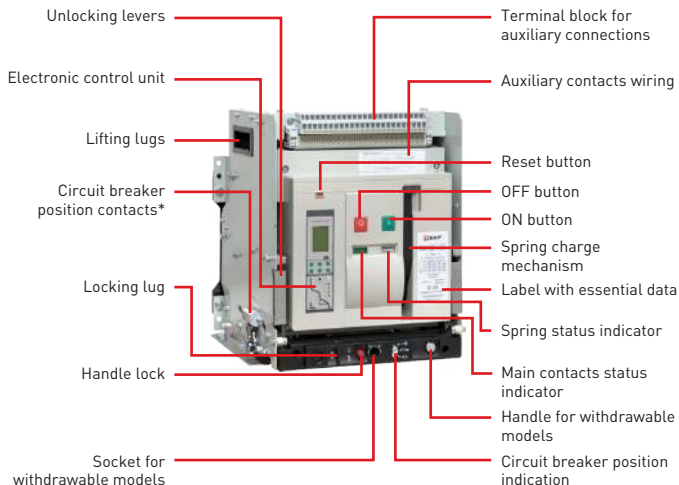
	VA-45	2000/2000A	3P	85 kA	WITHDRAWABLE	V2
Model						
Frame: 2000; 3200; 4000; 6300						
Rated current I _n , A 630A; 800A; 1000A; 1250A; 1600A; 2000A; 2500A; 3200A; 4000A; 5000A; 6300A						
Poles: 3P - three poles 4P - four poles						
Ultimate short-circuit breaking capacity I _{cu} (at 400 V): 65 kA; 85 kA; 100 kA; 120 kA						
Installation type: Fixed Withdrawable						
Version: Blank - version 1 v2 - version 2						

4 OPERATION CONDITIONS

- Min. operating ambient temperature: -15°C*.
 - Max. operating ambient temperature must not exceed +70°C*. The average operating temperature within 24 hours must not exceed +35°C (+60°C for storage).
- * - If the device will be operated at the temperature below -15°C, contact EKF for advice. If the operating temperature exceeds +40°C, the ACB current will be derated as per Table 2.
- Relative humidity must not exceed 90% at +25°C, and 50% at +40°C.
- * - If the ambient air temperature/humidity ratio is out of specified limits, the condensate may appear on the ACB surface. Contact EKF for advice.
- The environment must not contain gases, liquids, or dust concentrations that could impair the operation of the ACBs.
 - The ACBs conform to degree IV IEC 60947-1 for industrial emissions pollution.
 - Do NOT install the ACB in locations exposed to water, oil and emulsion.
 - Do NOT expose the device to direct sunlight.
 - The installation altitude above sea level must not exceed 2000 m without compromising operating characteristics.
 - The inclination angle of the installed ACB must not exceed 5° in any direction.

- The ACB must have a protection rating of IP30 against environmental influences.
- If the device is installed inside the enclosure and the controls are moved to the front panel, the protection rating must be IP40.

5 ACB FRONT PANEL AND CONTROLS



* -In earlier versions, the position contacts were positioned on the side of the housing, presented as a separate terminal block. In the most recent versions, these position contacts have been integrated with the terminals for the control circuits and auxiliary contacts (terminals 71-76).

6 ACB COMPONENTS

A fixed air circuit breaker contains as follows:

- Contacts (moving and fixed)
- Microprocessor trip unit
- Manual controls
- Remote controls
- Housing.

The contact system is mounted on an insulating base, ensuring that the contacts of each pole are insulated from one another.

The intelligent trip unit, manual and remote controls are positioned in front of the main contacts, functioning as separate and independent components of the circuit breaker.

A withdrawable air circuit breaker contains as follows:

- Contacts (moving and fixed)
- Microprocessor trip unit
- Manual controls
- Remote controls
- Basket

A withdrawable circuit breaker consists of a draw-out circuit breaker and a fixed basket. The draw-out circuit breaker can be installed or removed (drawn out) from the basket using a guiding mechanism. The main power contacts engage with the mating parts of the basket contacts during this process. Withdrawable circuit breakers can be positioned in one of three states:

- Connected.
- Disconnected. Test.
- Disconnected.

The position is adjusted by turning the handle clockwise to draw in and counter-clockwise to draw out the circuit breaker. A mechanical indicator on the basket clearly displays the current position of the circuit breaker.

'Connected' Position: In this state, both the power and secondary circuit contacts of the basket are connected to those of the circuit breaker.

'Disconnected. Test' Position: In this position, the power circuit contacts of the basket are open, while the secondary circuit contacts remain connected between the basket and the circuit breaker.

'Disconnected' Position: The contacts of both the power and secondary circuits are open and separated by an insulating air gap, ensuring no electrical connection.

7 TECHNICAL DATA

Table 1 - VA-45 v2 EKF main specifications

Characteristics	Frame size	2000		3200	4000	6300			
Rated current In, A		630, 800, 1000, 1250, 1600. 2000		2000, 2500, 3200	3200, 4000	5000, 6300			
Ultimate short-circuit breaking capacity Icu, kA	Ue=400 V AC	85		100	100	120			
	Ue=690 V AC	60		65	65	80			
Service short-circuit breaking capacity Ics, kA	Ue=400 V AC	70		65	65	80			
	Ue=690 V AC	55		50	50	70			
Rated short-time withstand current Icw, kA/1 sec.	Ue=400 V AC	70		65	65	85			
	Ue=690 V AC	55		65	50	65			
Rated maximum making capacity Icm, kA	Ue=400 V AC	187		143	143	176			
	Ue=690 V AC	132		143	143	176			
Mechanical endurance, O-C cycles	with maintenance	20 000		10 000	10 000	6000			
	without maintenance	10 000		5000	5000	3000			
Electrical endurance, O-C cycles	Ue=400 V AC	6500		3000	1500	500			
	Ue=690 V AC	3000		1500	700	300			
Overall dimensions	Type	Fixed	Withdrawable	Fixed	Withdrawable				
Width, mm	3P / 4P	370/ 465	410/ 505	422/ 537	470/ 585	585/ 825	585/ 820	960	
Depth, mm		370	460	380	490				
Height, mm		402	432	402	432				
Rated impulse withstand voltage Uimp, kV		12							
Breaking time, ms		23 to 32							
Making time, ms		< 70							
Trip unit		Microprocessor / Electronic							

Table 1 continued

Characteristics	Frame size	2000	3200	4000	6300
Location of busbars when connected to the ACB terminals	Rear horizontal				
Poles	3P and 4P				
Min. service life, years	15				
Rated insulation voltage at 50/60 Hz Ui, V AC	1000				
Rated impulse withstand voltage Uimp, kV	12				
Rated insulation resistance voltage at 50 Hz for 1 minute, V	500				
Operation ambient temperature, °C	-15 to +70				
Storage temperature, °C					

Table 2 - ACB temperature derating chart

Ambient temperature, °C	In, A										
	630	800	1000	1250	1600	2000	2500	3200	4000	5000	6300
40	630	800	1000	1250	1600	2000	2500	3200	4000	5000	6300
45	630	800	1000	1250	1550	1900	2400	3000	3800	5000	6000
50	630	800	1000	1250	1500	1850	2300	3000	3600	5000	5600
55	630	800	1000	1200	1400	1800	2200	2800	3400	4800	5400
60	550	700	1000	1150	1300	1700	2000	2800	3200	4800	5200
65	550	700	1000	1150	1300	1650	1850	2600	3000	4800	5000

Table 3 - ACB installation altitude derating chart

Altitude above sea level, m	2000	2500	3000	3500	4000	4500	5000
Power-frequency withstand voltage, V	2200	2077	1955	1857	1760	1680	1600
Insulation voltage U_i , V	1000	900	800	750	700	650	600
Rated operating voltage U_e , V	690	635	580	540	500	450	400
Rated operating current I_e , A	I_e	$0.93 \times I_e$	$0.88 \times I_e$	$0.83 \times I_e$	$0.78 \times I_e$	$0.73 \times I_e$	upon request

Changes in the characteristics listed in the table occur because increasing the installation altitude of the ACB above sea level affects the insulating and heat-conducting properties of air.

Table 4 - ACB power derating chart

Frame size	Rated current, A	Withdrawable	Fixed
2000	630	70	35
	800	110	50
	1000	172	78
	1250	268	122
	1600	440	200
	2000	530	262
3200	2000	384	200
	2500	600	312
	3200	737	307
4000	4000 (3P)	921	450
	4000 (4P)	900	-
6300	5000	898	-
	6300	1426	-

Table 5 - Recommended quantity and cross-section of connected copper bars at -15 to +40°C

Frame size	Rated current, A	Busbar specifications	
		Dimensions	Quantity
2000	630	60 x 5	2
	800	60 x 5	2
	1000	60 x 5	2
	1250	60 x 10	2
	1600	60 x 10	2
	2000	60 x 10	3
3200	2000	100 x 10	2
	2500	100 x 10	3
	3200	100 x 10	4
4000	3200	100 x 10	4
	4000	100 x 10	5
6300	4000	100 x 10	6
	5000	100 x 10	7
	6300	100 x 10	8

Power supply can be connected both to top and bottom ACB terminals without derating.

Both aluminium and copper cables and busbars can be connected. Do not connect both types concurrently.

8 INSTALLATION

8.1 General requirements

A. Before installing, check the insulation resistance of the circuit breaker using a megohmmeter. At a test voltage of 500 V, the resistance should be a minimum of 10 MOhm at ambient temperature of 25 ± 5 °C and relative humidity of max. 70%. Measure the resistance of the circuit breaker in the OFF state between the input and output power terminals. For the ON state, measure the resistance between the poles and the housing, as well as in series between the poles.

B. If the measured resistance is below 500 MOhm, dry the circuit breaker until the resistance exceeds this threshold.

C. The circuit breaker should be installed on a horizontal surface, allowing a deviation of no more than 5° from the horizontal plane. Use the following hardware (not included in the delivery scope) for secure installation:

- Bolts M8 - 4 pcs.
- Flat washers M8 - 4 pcs.
- Spring washers M8 - 4 pcs.
- Hex nuts M8 - 4 pcs.

D. Ensure that the circuit breaker is properly grounded in accordance with current standards and regulations. Grounding points on the ACB housing are clearly marked with  sign.

E. Power supply can be connected to both the top and bottom terminals of the ACB without any derating.

8.2 Installation of withdrawable ACB models

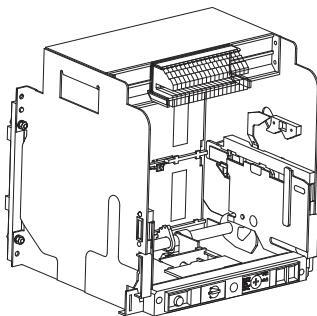


Figure 1

Place the ACB basket horizontally and secure it using bolts.

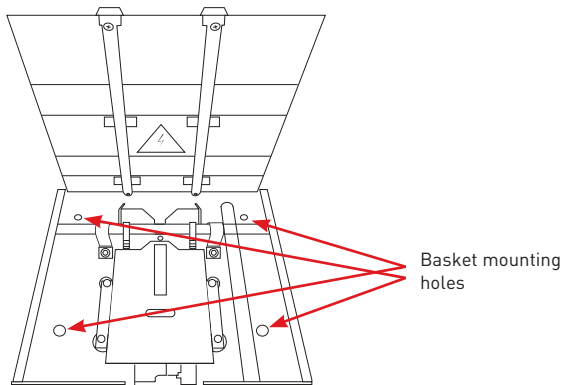


Figure 2

Pull both release levers towards you until they stop to draw out the ACB.

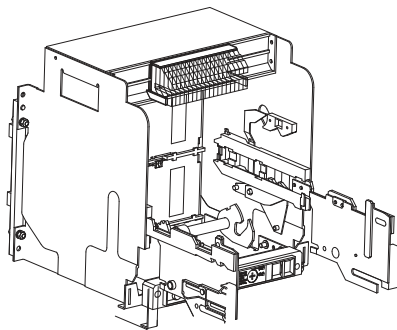


Figure 3

Position the ACB so that the protrusions align above the slots in the basket.

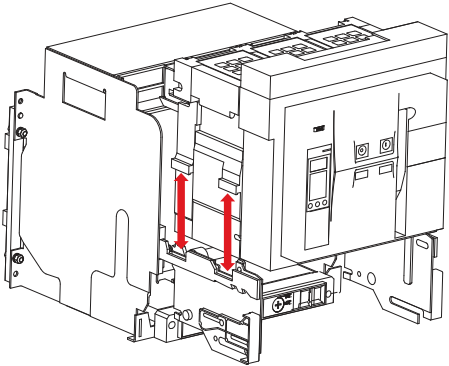


Figure 4

Move the ACB onto the guides while ensuring that the basket is secure and does not tip.

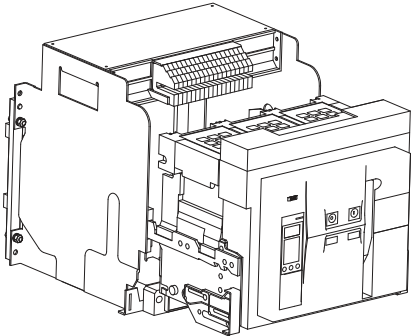


Figure 5

Verify that there are no foreign objects obstructing the path of the ACB in the basket. Push the ACB into the basket until it stops. Press the handle rotation lock button. Take out and install the draw-out handle into the slot. Rotate the handle clockwise; the ACB will begin to move towards the basket. Once the ACB reaches the "disconnected for testing" position, the handle rotation lock will engage, preventing further rotation.

Keep the handle in the slot while pressing the lock, then continue to rotate the handle clockwise until the ACB is in the "connected" position.

NOTE: The force required to rotate the handle when moving the ACB from the "disconnected for testing" position to the "connected" position will increase as the ACB contacts make contact with the basket contacts. This additional force is necessary to overcome the friction of the contacts and is a normal part of the operation, indicating that the draw-out mechanism is functioning correctly.

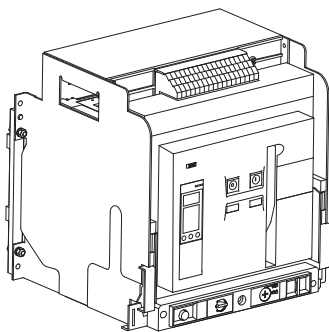


Figure 6

8.3. Inspection before power supply connection

After mounting the circuit breaker and connecting its control circuits according to the diagram, perform the following preparatory steps before applying power to the main contacts. For withdrawable circuit breakers, ensure these operations are carried out in the "TEST" position:

Ensure, that the control circuit voltage matches the rated voltages of the installed accessories (closing coil, shunt release, undervoltage release, and motor drive).

- To close the circuit breaker contacts, ensure at least $0.85 \times U_n$ is applied to the undervoltage release.
- Check the spring status indicator to confirm it shows "Discharged." If it indicates "Charged," proceed to the next step. Pull the spring charging handle down seven times until it stops. A characteristic click should be heard, and the spring status indicator should change to a yellow flag with the inscription "Charged."

- Ensure that the "Reset" button is pressed and does not protrude from the housing.
- Press the "I" button or apply power to the ACB coil (terminals 29-30).



WARNING!

Power must be supplied to both the closing coil and the opening coil in pulses using a self-return button. Continuous power supply can lead to coil failure.

When power is applied, the ACB should close, and the main contact position indicator should change from green "0" to red "I."

- Apply power to the motor drive (terminals 33-35). The drive will charge the spring for a few seconds until a characteristic click is heard. At this point, the spring status indicator should change to a yellow flag with the inscription "Charged." The motor drive will automatically de-energize.
- Press the "I" button or apply power to the ACB coil (terminals 29-30). When power is applied, the ACB should close, and the main contact position indicator should change from green "0" to red "I."
- To open the main contacts of the ACB, press the "O" button, apply power to the shunt release (terminals 29-30), remove power from the undervoltage release (terminals 27-28), or conduct a trip test of the release.



WARNING!

Power must be supplied to the opening coil (shunt release) in pulses using a self-return button. Continuous power supply can lead to coil failure.

9 MICROPROCESSOR TRIP UNIT

9.1 General information

The trip unit can be powered in two ways:

1. Directly through terminals 1-2 of the trip unit. Different trip units operate at varying supply voltages. Ensure that the controller's rated voltage matches the system's input voltage to prevent potential damage or malfunction.
2. Through built-in current transformers when the current waveform passes through the circuit breaker's main contacts. In this case, if the circuit breaker opens or the current falls below the minimum threshold, the trip unit disconnects, clearing any incorrect information stored in memory. For proper operation, the one-phase current through the circuit breaker should be at least $0.8 \times I_n$, while the three-phase current must be at least $0.4 \times I_n$ across all phases (where I_n is the rated current of the circuit breaker).

To ensure reliable operation of the trip unit under low currents and during short circuits, utilize external power sources.

Table 6 - Trip unit power supply

Supply voltage	Max. deviation	Consumption power
24 V DC	± 5%	7 W
220 V AC	± 15%	
380 V AC		
110 V DC		
220 V DC		

9.2. Protections

9.2.1. Selection of protection settings

Table 7 - Protection setting ranges

Characteristics		Current settings	Step	Time settings	Step	Accuracy	Comments
Overload protection with long time delay, Ir1		{0,2...1}In, OFF	1A	0,6 to 1120 sec.		±10%	Depending on curve type
Short circuit protection with shot time delay, Ir2	Inverse	{1,5...15}Ir1, OFF		T*			Ir1 - set overload current If Ir1=OFF, Ir1 changes to In
	Fixed			0,1 to 1 sec.	0,1		
Instant short circuit protection, Ir3		{1...20}In, OFF				±15%	
T* is the setting for the trip delay of the inverse protection against short circuit Ir2. The value of T is one-tenth of the selected trip delay for the overload protection Ir1.							

Note: If all protections (long-term, short-term, and instantaneous) are selected, ensure that the tripping current values follow this order: Ir1 < Ir2 < Ir3.

9.2.2. Overload protection with long time delay

The user can choose from 6 overload protection characteristics (see section 9.4.1 for more details). The default factory setting is a universal characteristic with an inverse time delay I²T. The tripping time of the circuit breaker when selecting the long delay protection is determined using the formula: $I^2 \times T_L = 2.25 \times I_r1^2 \times t_L$, where I is the fault current value

t_L is the user-defined tripping delay time for long delay protection

T_L is the actual tripping time of the circuit breaker

Example: For a circuit breaker with a rated current of 2500 A, if the user sets the long delay protection tripping current to $I_r1 = 0.8 \times I_n = 2000$ A and the protection tripping delay $t_L = 30$ seconds, when the current flowing is $I = 2 \times I_r1 = 2 \times 2000 = 4000$ A, the circuit breaker tripping time can be calculated as follows:

$$T_L = \frac{2.25 \times 2000^2}{4000^2} \times 30 = 0.5625 \times 30 = 16.9 \text{ sec.}$$

Table 8 - Actual tripping time of the circuit breaker (with an accuracy of $\pm 15\%$) at a current of $2I_{r1}$ based on the selected time delay t_L

1,05 I_{r1}	1,3 I_{r1}	Delay setting 1,5 I_{r1} , sec.	15	30	60	120	240	480
non-tripping > 2 hours	tripping < 1 hour	Tripping time at $2I_{r1}$, sec.	8,4	16,9	33,7	67,5	135	270

9.2.3. Short circuit protection with short delay

Table 9 - Short circuit protection with short delay

Inverse and fixed time delays	$I_r2=I_{r1} \times$	1,5...15 + OFF
	Event	$\leq 0,9 I_{r2}$ - non-tripping > 1,1 I_{r2} - delayed tripping
Fixed time delay	t_{r2} (sec.)	0,1 to 1 (0,1 sec. step)
	Accuracy	$\pm 10\%$
Inverse time delay		Curves 1 to 5 provide overload protection with a long time delay, featuring a slope that is ten times steeper.
		Curve 6 is defined by the formula $T_{r2}=t_{r2} * (I_{r1}/I)^2$
Thermal memory with inverse time delay (resets when power is disconnected or when the circuit breaker is opened)		15 min. + OFF by default

There are two types of short-circuit protection with a short time delay:

1. Protection with inverse time delay. If the current flowing through the circuit breaker exceeds the set value and you have selected protection curve from 1 to 5, the trip unit will function similarly to overload protection. In this case, a higher current results in a faster tripping signal, with the circuit breaker tripping 10 times quicker than the overload protection delay (the protection curve is 10 times steeper). If protection curve 6 is chosen, the tripping delay will be calculated based on the short-circuit protection curve with a short delay.
2. Protection with fixed delay. If the current surpasses the set value, the circuit breaker will trip after a duration equal to the set time delay.

Note: If inverse time delay protection is disabled or if the tripping current of the fixed time delay protection is less than or equal to that of the inverse time delay protection, the circuit breaker will trip according to the fixed time delay protection curve. When the fixed time delay protection is active, the circuit breaker tripping time will not be less than the set time delay, regardless of whether the tripping is caused by fixed or inverse time delay protection.

9.2.4. Instantaneous short-circuit protection

Table 10 - Instantaneous short circuit protection

I _{r3}	(1...20)I _n + OFF
Event	≤0,85xI _{r3} – non-tripping
	>1,15xI _{r3} – tripping
Tripping time	<100 ms (incl. contact opening time)

9.2.5. Ground fault and residual current protection

Table 11 - Ground fault protection

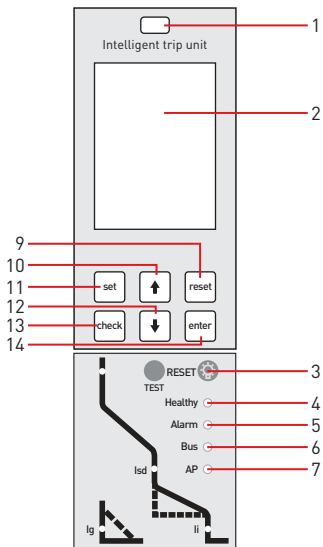
Ground fault protection	Current setting	I _g =I _n x ...	0,2...1 + OFF Min. 100 A
		Event	< 0,8 I _g - non-tripping
			≥1,0 I _g - delayed tripping
	Time setting	Fixed time delay t _g (sec.)	0,1...1 + OFF. Step: 0,1. OFF - alarm indicating without tripping
		Inverse time delay KG	1,5...6 + OFF. Step: 0,5. OFF - alarm indicating with fixed delay
		Accuracy	±10%

Table 12 - Residual current protection

Residual current protection	Current setting	I _{Δn} (A)	0,3...30 + OFF. Step: 0,1.
		Event	< 0,8 I _{Δn} - non-tripping
			≥1,0 I _{Δn} - delayed tripping
	Time setting	Fixed time delay t _{Δn} (sec.)	ON: 0,06; 0,08; 0,10-0,96; 0,98; 1,00.OFF - alarm indicating without tripping
		Inverse time delay KG	5 (<5I _{Δn} - inverse delay, ≥5I _{Δn} - fixed delay)
		Accuracy	±10% (or ±40 ms)

Note: Ground fault protection is not compatible with residual current protection. Specify the protection type in the purchase order.

9.3 Trip unit front panel and controls



Indication

- | | |
|----------------|--------------------|
| 1. RESET flag | 5. Alarm LED |
| 2. LCD | 6. Bus LED |
| 3. Reset LED | 7. AP LED |
| 4. Healthy LED | 8. Protection LEDs |

Push buttons

- | | |
|----------|-----------|
| 9. Reset | 12. Down |
| 10. Up | 13. Check |
| 11. Set | 14. Enter |

9.3.1. Ground fault and residual current protection

1. RESET flag

The flag pops up when testing the trip unit or the tripping device in case of an emergency. To switch on the circuit breaker, press the flag, sinking it completely.

4. Healthy LED

If the trip unit is powered and working properly, the LED blinks green.

5. Alarm LED

When the circuit breaker is operating normally, the LED does not light. If the circuit breaker is tripped, the LED blinks red. If a warning signal (Alarm) occurs, the LED is constantly lit.

6. Bus LED

When there is no data transmission, the LED does not light. If data is being exchanged, the LED blinks.

7. AP LED

AP – Additional protection. The LED lights up when the circuit breaker is tripped by additional protection (phase loss, overvoltage, voltage imbalance, over-/under-frequency, phase sequence, reverse power, etc.).

8. Protection LEDs

When one of the main protections is activated (overload, short circuit with or without time delay, ground fault), the corresponding LED blinks, indicating which protection caused the contacts to open. When setting the parameters, the corresponding LED lights up continuously.

9.3.2. Trip unit buttons

9. Reset button

Press this button to exit the current menu and return to the previous level or to cancel any changes made.

10. UP button

Press this button to move up the menu or to increase the value of the parameter being edited.

11. SET button

Press this button to scroll through the pages of the measurement menu or the parameter setting menu.

12. DOWN button

Press this button to move down the menu or to decrease the value of the parameter being edited.

13. Check button

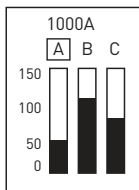
Press this button to scroll through the pages of the system settings menu or the history and maintenance menu.

14. Enter button

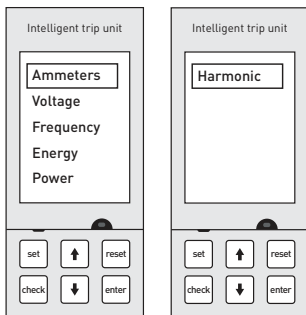
Press this button to move to the next menu level, select the current parameter, or save the change made.

9.3.3. Default Menu

By default, the trip unit displays a histogram of the current values consumed by each phase.



9.3.4. Measurement Menu



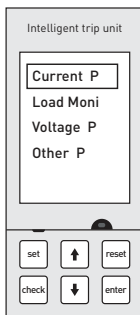
Press the **Set** button once in the default menu to access the main measurement menu.

Press the **Reset** button once to return to the current consumption histogram. From any menu except the alarm messages menu, press the **Set** button once to return to the main measurement menu.

If the unit is idle for more than 5 minutes, it will automatically go to the start screen.

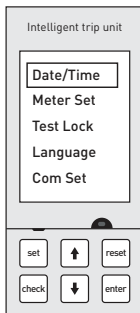
9.3.5. Protection Parameter Setting Menu

From any menu except the alarm messages menu, press the **Set** button twice to access the Protection Parameter Setting Menu.



Press the **Reset** button once to return to the current consumption histogram. If the unit is idle for more than 5 minutes, it will automatically go to the start screen.

9.3.6. System Parameter Setting Menu



At the histogram screen, press the **Check** button once to access the System Parameter Setting Menu.

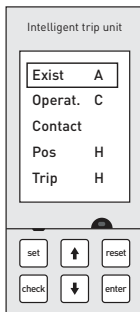
Press the **Reset** button once to return to histogram screen.

From any menu except the alarm messages menu, press the **Check** button once to move to the System Parameter Setting Menu.

If the unit is idle for more than 5 minutes, it will automatically go to the start screen.

9.3.7. History and Maintenance Menu

At the histogram screen, press the **Check** button twice to access the History and Maintenance Menu.



Press the **Reset** button once to return to the current consumption histogram.

From any menu except the alarm messages menu, press the **Check** button twice to move to the History and Maintenance Menu.

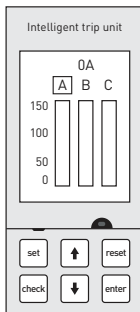
If the unit is idle for more than 5 minutes, it will automatically go to the start screen.

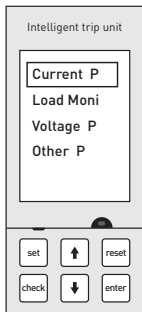
9.4. Protection against overload and short-circuit

9.4.1. Protection against overload

Selection Menu

In the start menu, press the **Set** button.





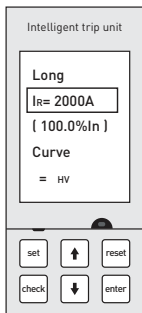
Press UP and DOWN (↓↑) buttons to move to Current P option and press the **Enter** button to confirm.

You will then access the protection settings selection menu.

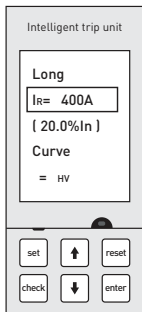


Long Time – overload protection with a time delay.
Short Time – short circuit protection with a time delay.
Instant – instantaneous short circuit protection (no time delay).

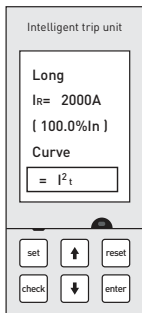
In the protection menu, use the arrow ↓ button to select the Long Time option for overload protection and press **Enter**.



Press **Enter** again and use the arrow ↑ & ↓ buttons to set the overload current value I_r (adjustable from 0,2 to $1 \times I_{nom} + OFF$). To save the selected value, press **Enter**.



Press the **↓** (down) button to select Curve option and press the **Enter** button to confirm.



Use the arrow **↑** & **↓** buttons to select one of the 6 available protection curves. Your choice of curve will determine the range of available trip delays.

SI – inverse time standard protection.

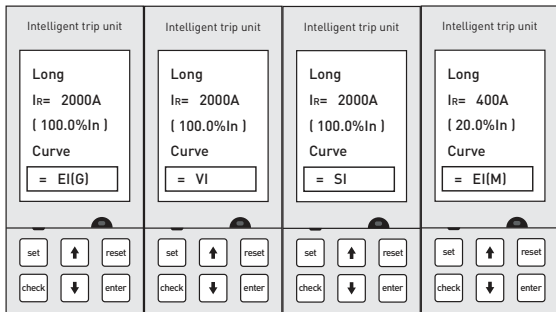
VI – fast protection with shorter trip delay compared to SI.

EI (G) – express protection, standard option for circuits powered from the network.

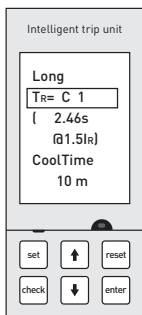
EI (M) – express protection for motor power supply circuits.

HV – selective protection with high-voltage fuses and short trip delays.

I²T – universal protection with inverse time delay.



After selecting the required curve type, press **Enter**. Press the ↓ (down) button to select Curve Time delay option and press the **Enter** button to confirm.

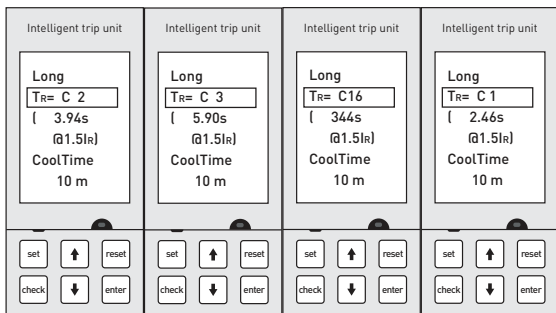


The delay time is set by selecting one of 16 values C1 - C16. The C1-C16 time delay values depend on the selected protection curve. Refer to Table 13.

Table 13 - Time delay vs tripping curves

Curve type	Delay time, sec.																
	Current ratio	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
SI	1.5×I _r	0,6	0,98	1,47	2,46	3,68	4,91	6,14	8,29	11,1	17,2	24,6	36,8	49,1	61,4	73,7	86
	2×I _r	0,36	0,57	0,86	1,43	2,15	2,87	3,58	5,37	6,45	10,03	14,33	21,49	28,65	35,82	42,98	50,15
	6×I _r	0,14	0,22	0,33	0,55	0,82	1,1	1,37	2,06	2,47	3,84	5,48	8,22	10,96	13,7	16,45	19,19
	7.2×I _r	0,12	0,2	0,3	0,5	0,74	0,99	1,24	1,86	2,23	3,48	4,97	7,45	9,93	12,42	14,9	17,38
VI	1.5×I _r	2	3,2	4,8	8	12	16	20	27	36	56	8	120	160	200	240	280
	2×I _r	1	1,6	2,4	4	6	8	10	13,5	18	28	40	60	8	100	120	140
	6×I _r	0,2	0,32	0,48	0,8	1,2	1,6	2	2,7	3,6	5,6	8	12	16	20	24	28
	7.2×I _r	0,16	0,26	0,39	0,65	0,97	1,29	1,61	2,18	2,9	4,52	6,45	9,68	12,9	16,13	19,35	22,58
EI	1.5×I _r	8	12,8	19,2	32	48	64	80	180	144	224	32	480	640	800	960	1120
	2×I _r	3,33	5,33	8	13,33	20	26,67	33,33	45	60	93,33	133,33	200	266,67	333,33	400	433,33
	6×I _r	0,29	0,46	0,69	1,14	1,71	2,22	2,86	3,86	5,14	8	11,43	17,14	22,86	28,57	34,29	37,14
	7.2×I _r	0,2	0,31	0,47	0,79	1,18	1,57	1,97	2,66	3,58	5,51	7,87	11,80	15,74	19,67	23,6	25,57
EI	1.5×I _r	6,22	9,96	14,9	24,9	37,3	49,8	62,2	84	112	174	249	373	498	622	747	871
	2×I _r	2,95	4,72	7,07	11,79	17,69	23,58	29,48	39,79	53,06	82,53	117,9	176,86	235,81	294,76	353,71	383,19
	6×I _r	0,28	0,45	0,68	1,13	1,69	2,26	2,82	3,81	5,08	7,90	11,29	16,94		28,23	33,88	36,7
	7.2×I _r	0,2	0,31	0,47	0,78	1,17	1,56	1,95	2,63	3,51	5,46	7,8	11,7	15,61	19,51	23,41	25,36
HV	1.5×I _r	2,46	3,94	5,9	9,85	14,8	19,7	24,6	33,20	44,3	68,9	98,5	147	197	246	295	344
	2×I _r	0,67	1,07	1,6	2,67	4	5,33	6,67	9	12	18,67	26,67	40	53,33	66,67	8	86,67
	6×I _r	0,01	0,01	0,02	0,03	0,05	0,06	0,08	0,1	0,14	0,22	0,31	0,46	0,62	0,77	0,93	1
	7.2×I _r	0	0,01	0,01	0,01	0,02	0,03	0,04	0,05	0,07	0,1	0,15	0,22	0,3	0,37	0,45	0,48
I ² T	1.5×I _r	15	30	60	120	240	360	480	600	720	840	960					
	2×I _r	8,44	16,88	33,75	67,5	135	202,5	270	337	405	472,5	540					
	6×I _r	0,94	1,88	3,75	5,5	15	22,5	30	37,5	45	52,5	60					
	7.2×I _r	0,65	1,3	2,6	5,21	10,42	15,63	20,83	26,04	31,25	36,46	41,67					

Use arrow $\uparrow$ & $\downarrow$ buttons to adjust the T_R values



When you select a specific C1 to C16, its numerical value will be displayed in seconds for a current of 1.5x I_R, shown in brackets. After choosing the correct TR value, press **Enter**.

To set the thermal memory parameters (optional), press the down $\downarrow$ button, then press **Enter**. For further details, see the section below.

Thermal memory

This function aims to minimize the effects of overload currents on cables, insulation, and motor windings.

When the current exceeds 1.1 I_R, the trip unit calculates the total accumulated thermal energy, which increases with both the current value and the duration of exposure. This applies to all overload protection curves, except for the EI (M) curve, which is specifically designed to protect motors. The energy accumulation curve required to trip the circuit breaker varies for each protection curve.

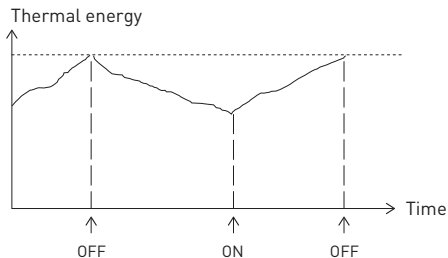


Figure 7 - Thermal memory is activated and the trip unit is securely powered.

The accumulated thermal energy decreases exponentially in the following situations:

1. When the circuit breaker is tripped.
2. When the current falls below the threshold.

Users can adjust the thermal memory by selecting a "cooling time" option: no delay, 10 min, 20 min, 30 min, 45 min, 1 h, 2 h, or 3 h.

Note that for the EI (M) protection curve, the cooling time cannot be adjusted; thermal energy changes in response to the current flowing.

If the trip unit is not supplied with guaranteed power, opening the circuit breaker will cause the trip unit to trip due to power loss, resulting in the reset of the accumulated thermal energy. For details, refer to Figure 8.

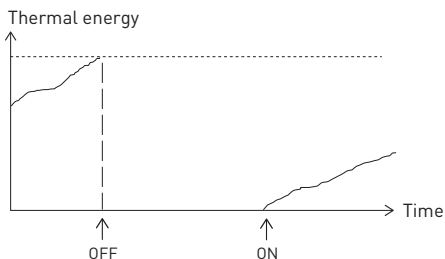
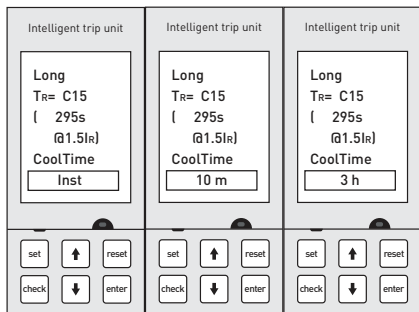


Figure 8 - Thermal memory is deactivated or the trip unit is securely powered.



After selecting the required thermal memory option, press the **Enter** button. To move to the next setting, press the **Reset** button.

9.4.2. Short circuit protection setting



Enter the protection settings menu and select Short Time option. Press the **Enter** button.

Short

Fixed

Inverse

Select time delay option and press **Enter**:
Fixed time delay.
Inverse inverse time delay.

Table 14 - Short circuit protection with fixed and inverse time delay

Characteristics	Range	Step	Comments
Inverse time delay, Ir2	1,5 to 15xIr, OFF	1 A	Ir1 - set overload current. If Ir1=OFF, Ir1 changes to Inom
Fixed time delay, Isd	1,5 to 15xIr, OFF	1 A	
Time delay, Tsd	0,1 to 1 sec.	0,1 sec.	

Note: The inverse time delay short circuit protection operates in the same way as the overload protection, with the only difference being that the trip delay is 0,1 of the overload trip delay.

To adjust the current value, press the **Enter** button. Use the **Up** ↓ and **Down** ↑ buttons to increase or decrease the value. Pressing the buttons once will change the setting by 1A, while holding them down will allow for quicker adjustments.

Intelligent trip unit

Fixed

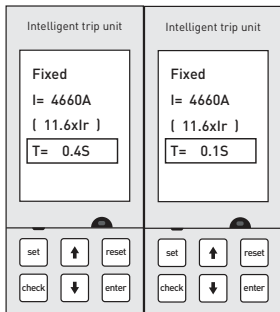
I= 4660A
(11.6xIr)
T= 0.1S

set
↑
reset

check
↓
enter

Once you've selected the desired current value, press the **Enter** button again.

To move on to setting the time, press the down ↓ button followed by the **Enter** button.

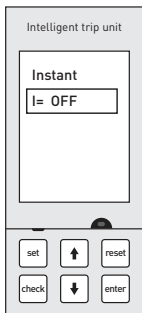


After selecting the required time, press the **Enter** button.

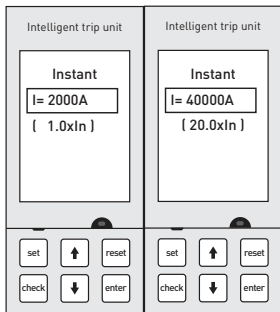
To move to short circuit protection without time delay, press the **Reset** button twice.



Instant – instantaneous short circuit protection (no time delay). Press the **Enter** button.



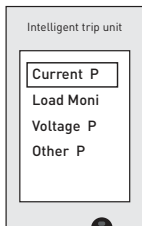
Press the **UP** ↑ button to enter the setting mode.
Press **Enter** to enter the current adjusting mode.



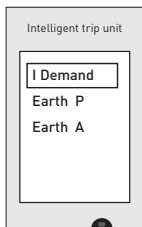
Use the **↑** and **↓** buttons to select the required setpoint current and press **Enter** to confirm.

To move back to the home screen, press the **Reset** button three times.

9.4.3. Ground fault protection setting



In the protection settings selection menu, use the arrow **↓** **↑** buttons to navigate to the Earth P menu item and press **Enter**. Then, select either Trip (to enable ground fault protection) or OFF (to disable ground fault protection) using the arrow **↓** **↑** buttons. To save the selected value, press **Enter**.



Next, use the arrow **↓** **↑** buttons to set the values for the parameters I, T, and K in sequence, pressing **Enter** to save the settings.

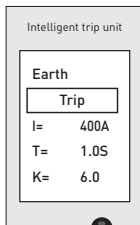


Table 15 - Ground fault trip setting

Characteristics	Range	Step	Comments
Ground fault setpoint I_g	0,2 to $1 \times I_n$, OFF	1 A	
Inverse factor, K	1,5 to 6, OFF	1,5	
Trip delay, T_g	0,1 to 1 sec.	0,1 sec.	

Table 16 - Ground fault protection thresholds

Characteristics	I / I_g	Error
Non-tripping	< 0,8	
Tripping	> 1,0	
Tripping delay		$\pm 10\%$ (min. ± 40 ms)

The inverse factor K influences the tripping delay behavior. When the ratio of the fault current I to the ground fault protection setting I_g is less than K, the tripping delay is inversely proportional; this means that a higher fault current results in a shorter delay. The delay is calculated as follows:

$$t = T_g \times K \times \frac{I_g}{I}$$

t is the actual tripping time.

T_g is the set tripping delay.

K is the value of the inverse factor.

I_g is the set value of the ground fault tripping current.

I is the actual ground fault current value.

If the ratio of the fault current I to the ground fault protection setting I_g is greater than K, or if K is set to OFF, the tripping delay becomes fixed and is equal to the set value of T_g (considering any allowable error).

9.4.4. Ground fault alarm setting

In the protection setting selection menu, use the arrow $\downarrow$ $\uparrow$ buttons to navigate to the Earth A menu item and press **Enter**.

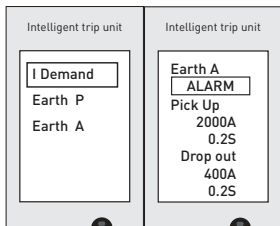


Table 17 - Ground fault alarm setting

Characteristics	Range	Step	Comments
Ground fault alarm setpoint	0,2 to 1xIn, OFF	1 A	
Alarm delay	0,1 to 1 sec.	0,1 sec.	
Ground fault alarm disable setpoint	0,2 to 1xIn	0,1 sec.	
Alarm disable delay	0,1 to 1 sec.	0,1 sec.	
Alarm setting	Set one of the DO* output contacts to "Earth A". If none of the DO contacts are set to output an alarm signal, the protection trip will only be displayed on the trip unit display.		

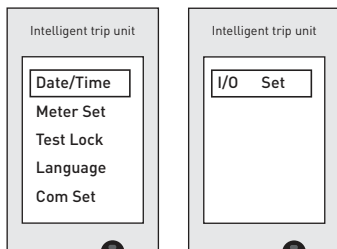
Table 18 - Ground fault alarm thresholds

Characteristics	I / Ig	Error
Non-tripping	< 0,8	
Tripping	>1,0	
Tripping delay		±10% (min. ±40 ms)

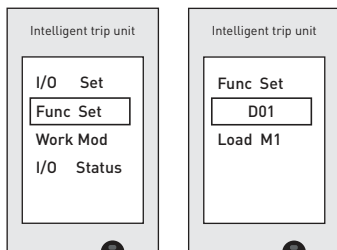
Table 19 - Ground fault alarm disable thresholds

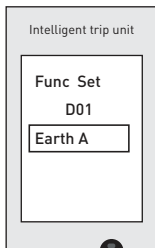
Characteristics	I / Ig	Error
Not disable	< 0,8	
Disable	>1,0	
Tripping delay		±10% (min. ±40 ms)

To configure the DO output contact for issuing an alarm signal, follow these steps:
In the histogram screen, press the **Check** button. Use the arrow **↓** button to navigate to the I/O Set menu and press **Enter**.



Select the Func Set menu and press **Enter**. Press **Enter** again and use the arrow **↓** **↑** buttons to choose one of the four DO contacts you wish to assign to the ground fault alarm signal. Confirm your selection by pressing **Enter**.





Press the **↓** button to navigate and then press **Enter** to confirm. Use the **↓** **↑** buttons to navigate to Earth A menu item and press **Enter** to confirm.

EXPLANATION OF GROUND FAULT PROTECTION TYPES

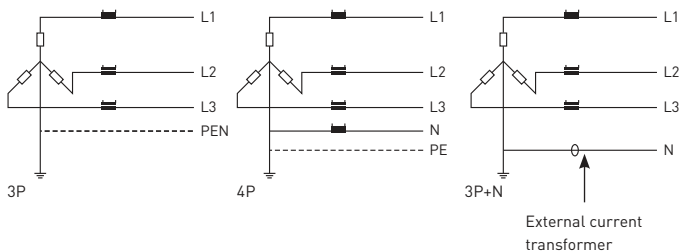
In the second generation VA-45 circuit breakers, single-phase ground fault protection can be implemented in two ways:

- Vector Protection (Type T): This method relies on the vector sum of the three-phase currents flowing through the circuit breaker in both 3-wire (3-phase) and 4-wire (3-phase + neutral) systems.
- Ground Current Measurement Protection (Type W): This method measures the current flowing through the PE conductor using an external transformer. Ensure the distance between the ACB and the external transformer does not exceed 10 meters.

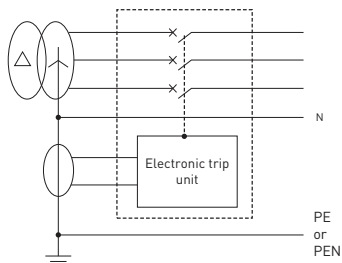
Note: In 4-wire systems, the currents in the three phases may vary due to the unbalanced connection of single-phase loads across the three phases of the supply network. When installing 3-pole ACBs in such systems, it is highly recommended to disable the ground fault protection based on the vector sum of currents (Type T) to avoid frequent false tripping.

GROUND FAULT PROTECTION WIRING

- Vector protection (Type T)



- Ground current measurement (Type W)



Protection that measures current through the ground (type W) requires a special external current transformer. This transformer should be installed on the protective earth conductor of the power transformer and is responsible for monitoring the current flowing through this conductor.

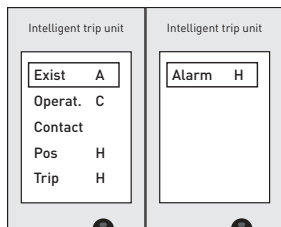
10 TRIP UNIT AUXILIARY CONTACTS

Table 20 - Trip unit auxiliary contacts

Utilization category	Closing			Opening			Switching frequency, 1/min.
	I/I _e	U/U _e	cos φ	I/I _e	U/U _e	cos φ	
AC-15	10	1,1	0,3	10	1,1	0,3	10
DC-13	1,1	1,1	δPe	1,1	1,1	δPe	10

11 EVENT LOG

At the histogram screen, press the **Check** button twice to access the History and Maintenance Menu.



Available Submenus:

Exist A: Active alarm messages (Alarm).

Operat. C: Total number of main contact closures and openings (Total Num), closures and openings under load (Op Num).

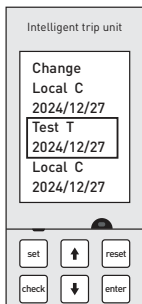
Contact: Total wear of the main contacts and their temperature. The circuit breaker starts with zero contact wear after leaving the assembly line. This value increases during operation. When wear reaches 100%, the circuit breaker will issue an alarm signal indicating the need for maintenance.

Pos H: History of main contact closures and openings of the circuit breaker.

Trip H: History of circuit breaker trips.

Alarm H: History of circuit breaker alarm messages.

11.1 Pos H: History of main contact closures and openings of the circuit breaker



This menu provides a log of the opening and closing history of the circuit breaker's main contacts. Each entry includes the reason for the contact opening and a time tag in the year/month/date format. Use the arrow **↓↑** buttons to navigate to the desired event and press **Enter** to view additional details.

Menu Legend:

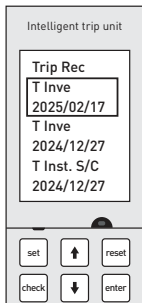
Local C - Contact Closure

Local O - Contact Opening

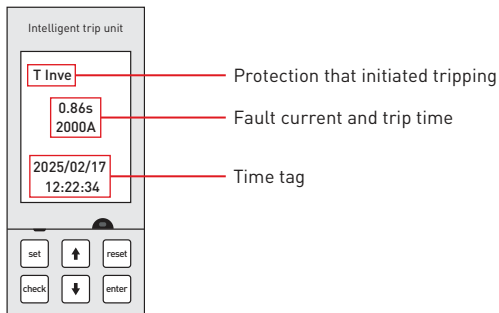
Test T - Circuit Breaker Tripping during Trip Unit Test

Fault T - Circuit Breaker Tripping due to Protection Activation

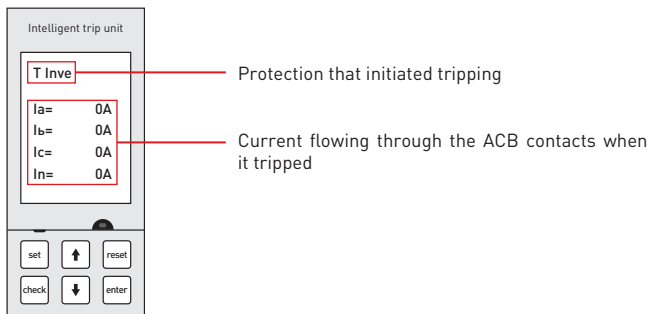
11.2 Trip H: History of circuit breaker trips



This menu provides a log of the circuit breaker trips. Each entry includes the reason for the ACB tripping and a time tag in the year/month/date format. Use the arrow **↓↑** buttons to navigate to the desired event and press **Enter** to view additional details.



Press **Enter** to view values of the current flowing through the ACB when it tripped.

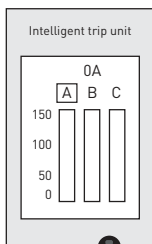


Current values are zero in this example. This indicates that the tripping was initiated by a test of the tripping unit for protection operation.

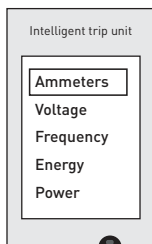
12 PROTECTIVE FUNCTIONS OF THE TRIP UNIT CHECK

To verify the protective functions of the trip unit, follow these steps:

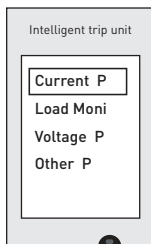
1. Set the appropriate values for current and time delay for the protection you wish to test. Additionally, configure the simulated current value to ensure it trips the protection being tested.
2. In the initial menu, press the **Set** button twice, then press the **Enter** button. This will open the settings menu.
3. Verify the accuracy of the entered values. Adjust any settings if necessary.



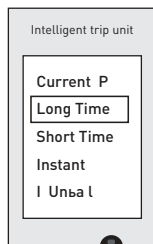
Step 1:
Home screen



Step 2:
Screen after **Set**
button pressed
once

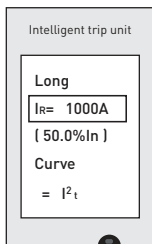


Step 3:
Screen after **Set**
button pressed
twice



Step 4:
Press once to
access trip unit
settings

4. Use the arrow $\downarrow \uparrow$ buttons to navigate between the characteristics you wish to test. To modify a characteristic, select it by pressing the **Enter** button. Then, use the arrow $\downarrow \uparrow$ buttons to input the desired value and confirm by pressing the **Enter** button again.

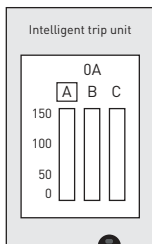


5. Check all remaining characteristics. Ensure the hierarchy of protections is maintained as follows: $I_{r1} < I_{r2} < I_{r3}$. This means the overload current setting (I_{r1}) must be lower than the short-circuit protection current with time delay (I_{r2}), which should be lower than the instantaneous short-circuit protection current (I_{r3}).

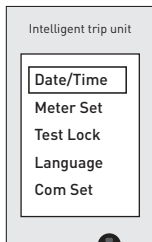
6. Press the **Reset** button once to return to the tripping settings menu, as shown in Step 4.

7. In the tripping settings menu, use the arrow $\downarrow \uparrow$ buttons to navigate through additional settings and adjust their values for further verification as needed.

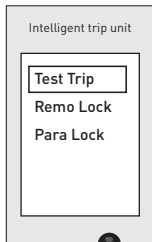
Press the **Reset** button to return to the main menu of the tripping unit.



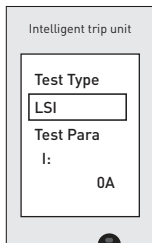
Press the **Check** button and use the arrow **↓** **↑** buttons to select TEST LOCK menu item.



Press **Enter** to confirm and navigate to the next menu.

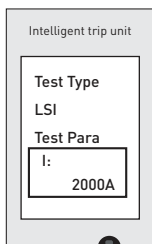


Press the **Enter** button to select TEST TRIP. This setting determines the protection type to be tested.

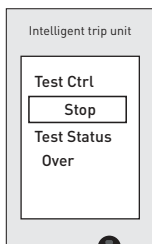


To change the protection type, select it by pressing the **Enter** button. Use the arrow $\downarrow$ $\uparrow$ buttons to choose the required value, then press the **Enter** button once to confirm.

In this case, we select LSI.

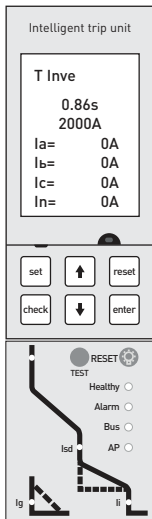


Set the test current value, which is the simulated test current. Choose the current setting by pressing the **Enter** button, then use the arrow $\downarrow$ $\uparrow$ buttons to set the desired value in 1A increments. Confirm the setting by pressing the **Enter** button again.

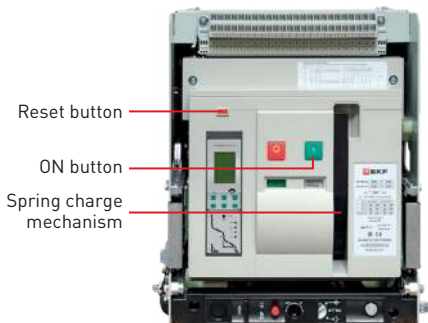


Navigate to the TEST CONTROL item using the arrow $\downarrow$ button. Set the test control to START and press **Enter** to initiate the test.

An emergency current will be simulated. Depending on the state of the circuit breaker, it will either open (if it was ON) or indicate an emergency state without opening. The tripping unit screen will display the current and trip time values. During this test, the red Alarm LEDs and the LED corresponding to the protection that was triggered will flash on the front panel.



To reset the circuit breaker, press the **Reset** button. Then, charge the spring by using the handle or by applying power to the motor drive at terminals 34-35. Finally, press the ON button to complete the reset process.



13 MODBUS-RTU COMMUNICATION PROTOCOL

ACB VA-45 v2 trip unit supports Modbus-RTU protocol.

Table 21 – ACB VA-45 v2 communication

Characteristics	Interface	RS-485
	Protocol	Modbus-RTU
	Media	Screened twisted pair
	Speed	9600 bps, 19 200 bps, 38 400 bps, 115 200 bps (option)
	Max. quantity of devices	255
	Distance	1200 m
Functions	Monitoring	Tracking operating parameters of devices within the network
	Configuration	Remotely adjusting circuit breaker protection settings
	Status Monitoring	Observing the state of the circuit breaker's main contacts
	Data collection	Real-time data gathering on the operating mode of the electrical installation

For Modbus-RTU communication, refer to Figure 9.

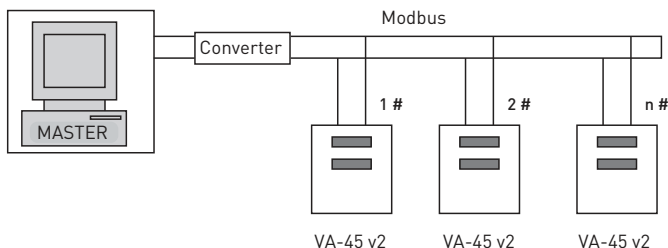


Figure 9 - Modbus-RTU communication

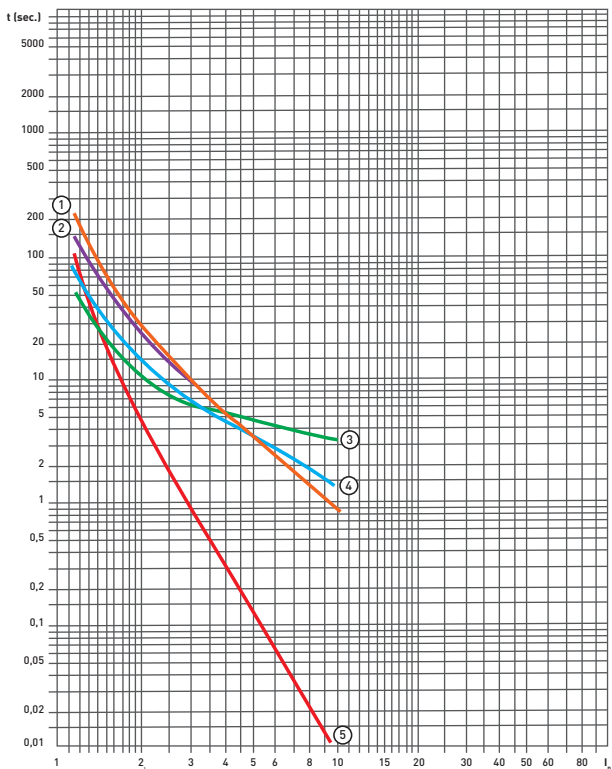
Modbus-RTU is a communication protocol designed for serial data transfer, facilitating data exchange within a local area network (LAN) among devices. It operates on a master-slave architecture, where the VA-45 v2 circuit breakers function as slave devices.

This system can perform the following functions:

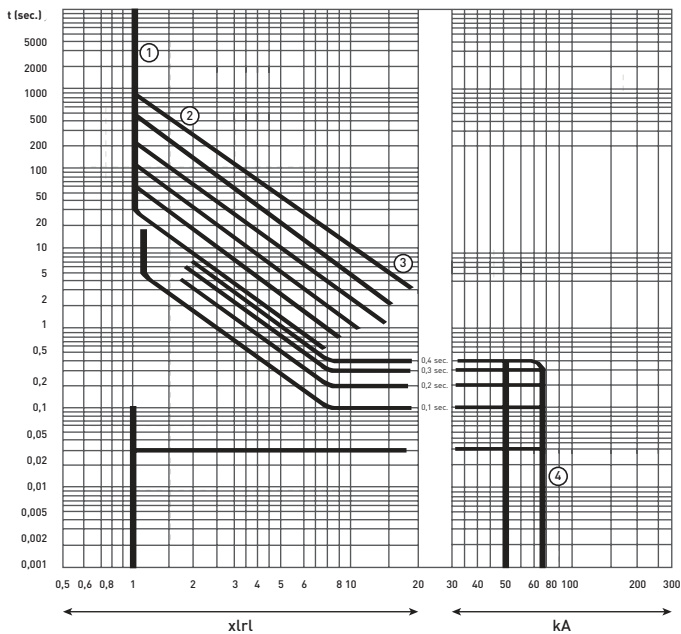
- Remote telemetry of the power plant state
- Monitoring various parameters of the power supply network
- Reading and modifying protection settings and circuit breaker parameters
- Transmitting data on the current state of circuit breakers
- Remote control & signaling

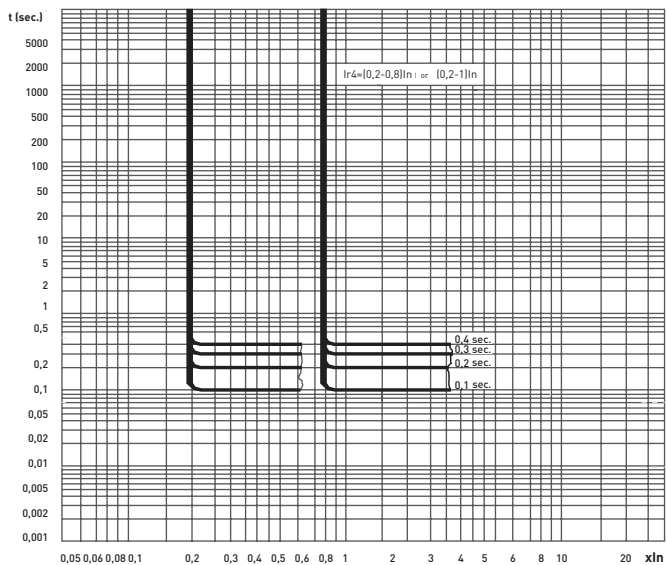
Communication between devices occurs via the RS-485 interface using a shielded twisted pair. Connect the wires to terminals 10-11 on the circuit breaker's secondary terminal block. For more detailed information on data exchange using the Modbus protocol and the register map, refer to the Manual "Communication via the MODBUS protocol of VA-45v2 and VA-450v2 ACBs."

14 TRIPPING CHARACTERISTICS

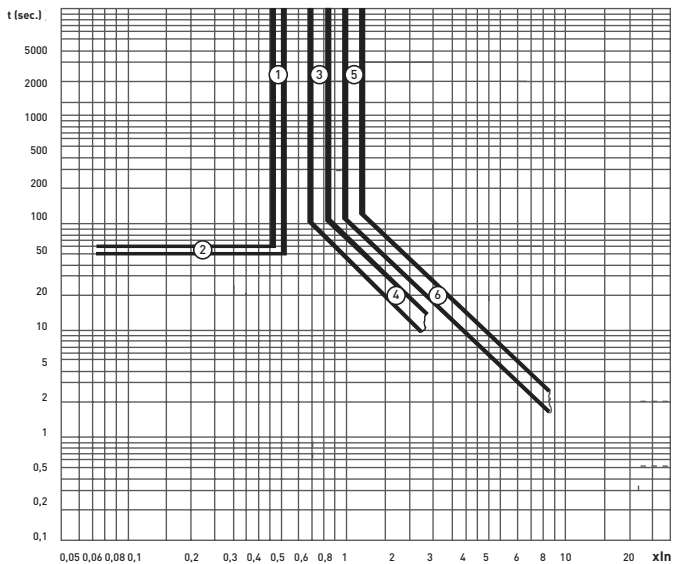


- 1 — EI (G) – instant protection
 2 — EI (M) - instant protection
 3 — SI – inverse time standard protection
 4 — VI – prompt protection
 5 — HV – fused selective protection
- Overload (long-term delay) tripping curves





Ground fault protection



1 - $ILC2=[0,2-1]I_n$

2 - $t_{LC2}=60s$

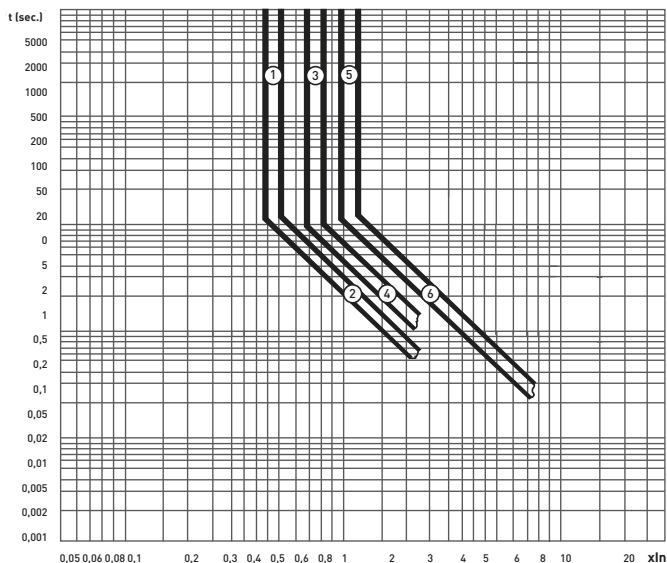
3 - $ILC1=[0,2-1]I_n$

4 - $t_{LC1}=t_L/2$

5 - $I_{r1}=[0,4-1]I_n$

6 - $t_L=15-480s$

I load monitoring curves



1 - $ILC2 = [0, 2-1] \ln$

2 - $tLC2 = tL/4$

3 - $ILC1 = [0, 2-1] \ln$

4 - $tLC1 = tL/2$

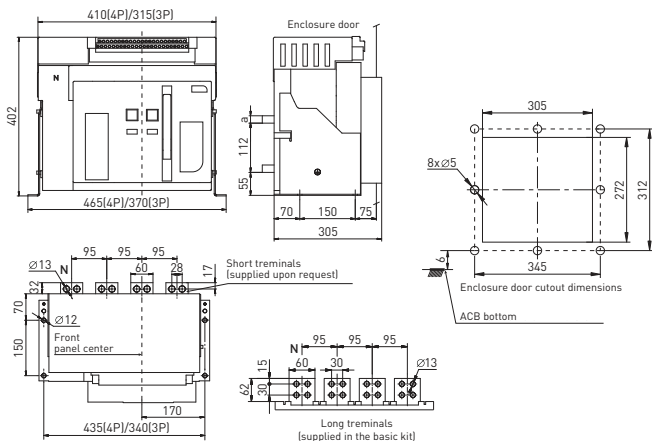
5 - $\ln 1 = [0, 4-1] \ln$

6 - $tL = 15-480s$

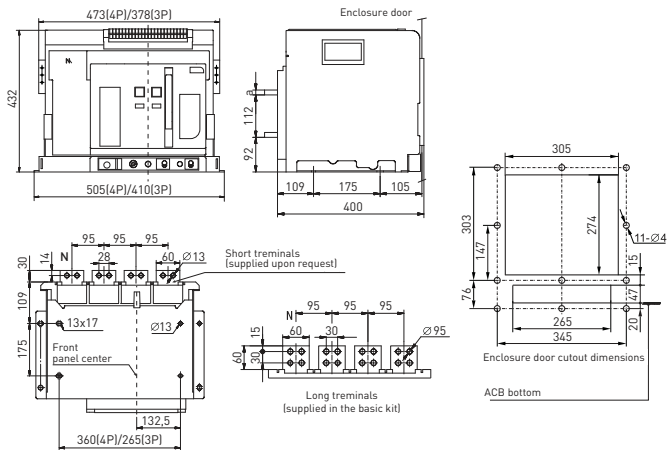
II load monitoring curves

15 OVERALL AND INSTALLATION DIMENSIONS

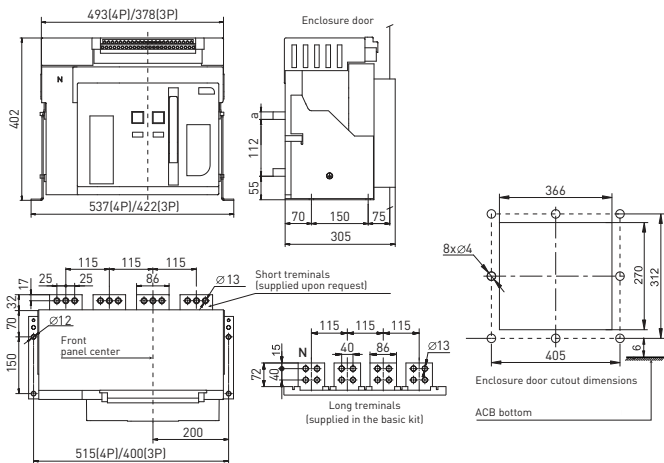
VA-45 v2 2000 FIXED



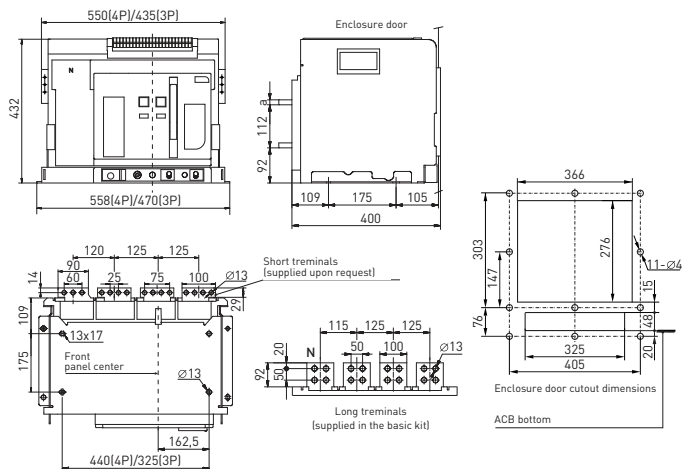
VA-45 V2 2000 WITHDRAWABLE

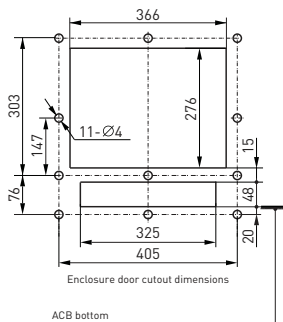
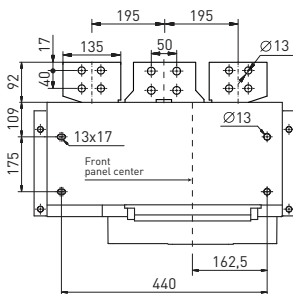
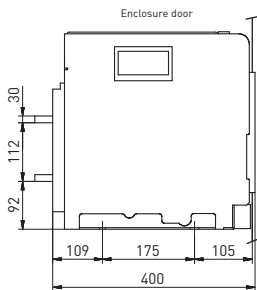


VA-45 V2 3200 FIXED

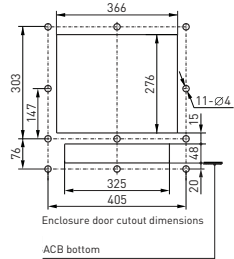
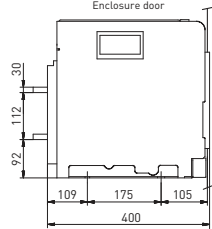
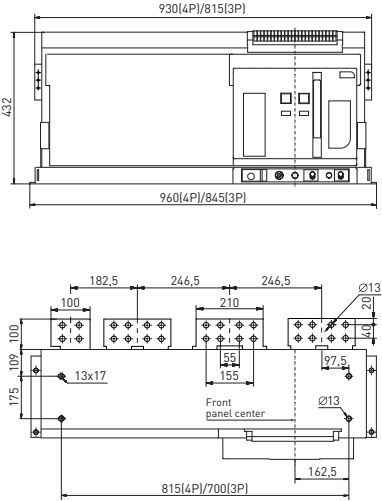


VA-45 V2 3200 WITHDRAWABLE

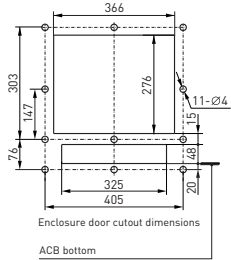
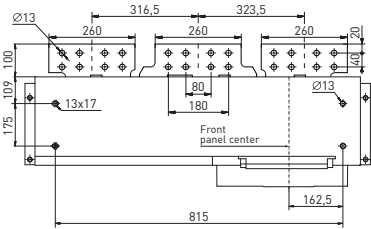
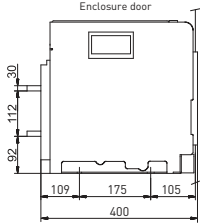
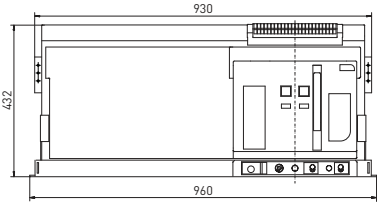




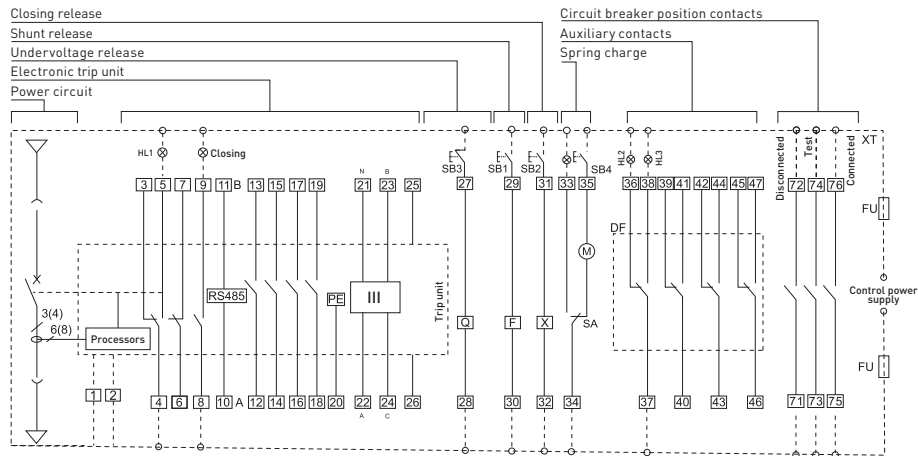
VA-45 V2 5000 WITHDRAWABLE



VA-45 V2 6300 WITHDRAWABLE



Wiring diagram of secondary and control circuits of air circuit breakers VA-45 v2 EKF



Description

I – Controller power supply
 II – Programmable relay outputs
 III – Voltage measuring inputs
 HL1 – ACB Trip indicator
 HL2 – ACB OFF indicator
 HL3 – ACB ON indicator

Q – Undervoltage release (to be ordered separately)
 F – Shunt release
 X – Closing release
 M – Motor mechanism
 XT – Terminals (screw terminals) of

secondary circuits
 FU – Fuse

Control circuit outputs:

1-2 - Controller power supply. The trip units operate at different supply voltages. Before proceeding with operation, make sure that the rated voltage of the controller in your system matches the system's input voltage to avoid potential damage or failure.

3-4-5 — CO contact (4th common pin) - trip alarm contact.

Contact capacity: 250 V AC, 16 A (resistive load).

6-9 — Auxiliary contacts of the ACB status (closed – open)

Contact capacity: 250 V AC, 16 A (resistive load).

10-11 — RS-485 communication interface (Modbus by default)

12-19 — 4 Programmable inputs / outputs (DI / DO).

Contact capacity: DO – 110 V DC / 0,5A, 250 V AC / 5A; DI – 110...130 V DC or 110...250 V AC.

20 — Protective earthing.

21-24 — Voltage measuring inputs. Connect to the incoming line according to the specified sequence (21 – N, 22 – A, 23 – B, 24 – C.

25, 26 – Connection contacts for external neutral current transformer

27, 28 – Undervoltage release

29, 30 – Shunt release

31, 32 – Closing release

33, 34, 35 – Motor mechanism

36-47 - Auxiliary contact blocks

Circuit breaker position contacts (applicable to withdrawable version only):

71, 72 – position contact "Disconnected" (CO)

73, 74 – position contact "Disconnected" (CO)

75, 76 – position contact "Connected" (CO).

17 DELIVERY SCOPE

1. Air circuit breaker VA-45 v2 (complete with electric motor, closing release, shunt release, undervoltage release, 4 CO contacts) - 1 pc.;
2. Set of bolts - 1 pc.;
3. Door frame - 1 pc.;
4. Interphase barriers - 2 pcs. (3 pcs. for 4P version)
5. Technical manual - 1 pc.

18 DISPOSAL

Life-expired and failed ACBs shall be disposed of in compliance with the national and local laws and regulations in force. To dispose of the product, send it to an authorized company for recycling in compliance with the effective national and local laws and regulations.

19 MANUFACTURER'S WARRANTY

The manufacturer guarantees the products comply with the declared characteristics, provided that consumers follow operation, transportation and storage conditions.

Warranty period: 7 years from the date of sale specified in the sales receipt.

Shelf life: 7 years from the date of manufacture specified on the product package or housing.

Service life: 15 years.

Manufacturer: OOO Electroresheniya, Otradnaya st., 2b/9, 127273, Moscow, Russia, tel. +7 (495) 788-88-15.

MEA regional headquarters: EKF ELECTRICAL SOLUTION FZCO, Techno Hub-2, Dubai Silicon Oasis, P.O. box 341079, Dubai, United Arab Emirates, tel. +971-4-547-06-18.

Importer and EKF trademark service representative in the territory of the Republic of Kazakhstan: TOO Energoresheniya Kazakhstan, Kazakhstan, Almaty, Bostandyk district, Turgut Ozal st., 247, apt 4.



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