



# TECHNICAL CATALOGUE **LOW VOLTAGE AIR CIRCUIT BREAKER**

**U-POWER**  
**OMEGA**  
Air Circuit Breakers





# ABOUT US

Lauritz Knudsen Electrical & Automation, is a leading player in the electrical industry owing to its 70+ years of strong legacy and commitment to the nation's growth. The brand is dedicated to providing a wide range of electrical and automation products and solutions to vital sectors of the economy, including industries, utilities, infrastructure, buildings, and agriculture. Our extensive portfolio includes low-voltage and medium-voltage switchgear, automation solutions, tailored software, and services.

With manufacturing operations in Ahmednagar, Vadodara, and Coimbatore, we adhere to global standards of excellence. Our operations are supported by well-equipped, in-house design and development centers, as well as tooling facilities, ensuring precision in manufacturing.

We proudly operate six Switchgear Training Centers (STCs) across Pune, Lucknow, Coonoor, Vadodara, Delhi, and Kolkata. These centers offer tailor-made classroom courses and lab learning experiences for technicians, customers, engineers, professionals, and students.

With a deep national presence and one of the largest electrical distribution networks, comprising over 1500 partners across the country, we are committed to driving excellence and delivering superior products and solutions that power India's growth journey.



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# Legendary Performance

Electrical power is the lifeline of industry, but it is unpredictable. Just like an ocean, it can be calm one moment and turbulent the next. You cannot predict when a sudden dip or surge will happen, but you can protect your installation from damage, when it does. That's where our highly sophisticated OMEGA ACBs can make a world of difference to the safety of an organisation's employees, systems and infrastructure. OMEGA ACB range consists of

highly compact units designed for high current, high power applications in Low Voltage (LV) distribution network systems. They are equipped with state-of-the-art Matrix protection and control releases to meet the most demanding protection and system co-ordination requirements. All this, with the assurance of compliance to the Lauritz Knudsen Electrical & Automation's 'Safe & Sure' policy.

U-POWER

## OMEGA

Air Circuit Breakers



In 2019, our organization, as the only Electrical Switchgear Manufacturer outside Japan, was honored with the esteemed "**Deming Prize**", a highly respected award in Total Quality Management (TQM) by the Union of Japanese Scientists and Engineers (JUSE). Established in 1946, JUSE aims to foster systematic studies for the advancement of science and technology, thereby contributing to cultural and industrial development.



### Lauritz Knudsen Electrical & Automation - the Bedrock of Stability

Over the last Seven decades, Lauritz Knudsen has earned a place among the leading manufacturers of Low Voltage Switchgear in the world, with the scale, sophistication and range to meet global bench marks.

In keeping with our leadership position in the Indian market, we also provide expert assistance in product selection, installation and effective after-sales service, across the country.



# Solution for Diverse Applications

The OMEGA ACB range has been designed to adapt to changes in your requirements, and allow you to modify or upgrade your systems with ease. This means minimum down-time and enhanced protection at all times.

## Get the OMEGA Advantage

- › **Meet system upgradation needs** with ease throughout the life of your product, with click fit, easy-to-mount front accessories like UV & UV delay modules, Shunt and Closing releases.
- › **Enjoy total system flexibility and scalability** by adding power metering and communication modules or by enabling/disabling each protection function depending on the requirement.
- › **Let your systems have better co-ordination** with protection devices and downstream loads, via a wide range of protection curves and fine adjustment of current pick-up threshold and time-delay settings.
- › **Control a vast electrical installation through** Zigbee communication, along with the option of conventional industrial communication protocols such as MODBUS and PROFIBUS.
- › **Customise terminals by configuring terminal** adaptors for Vertical/Horizontal busbar arrangements, to facilitate termination of Aluminium and Copper busbars. Refer Accessories segment for recommended busbar sizes for Termination.
- › **Convert ACBs easily on site** from Fixed to Draw-out or from Manual to Electrical versions.





# Technology Tailored for You

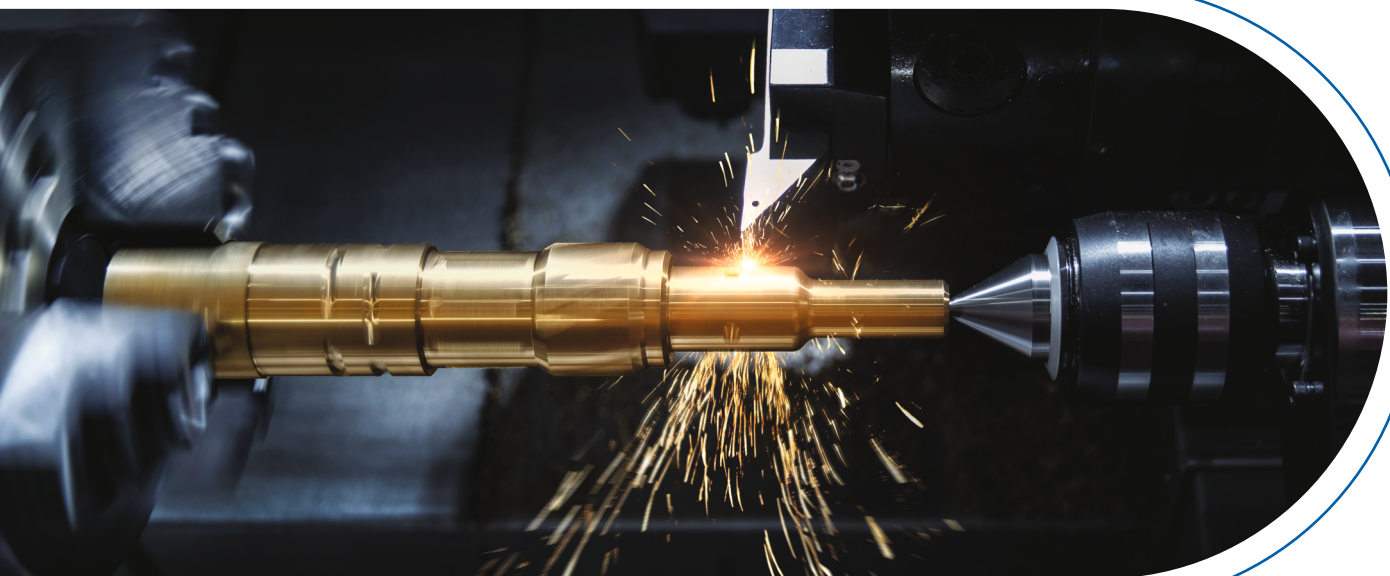
OMEGA ACBs offer you the best of both worlds - high performance coupled with a range of exclusive features that deliver the highest level of electrical safety.

## Performance par excellence

- › **Save valuable space** with world's most compact ACBs, Starting at just 347mm in width.
- › **Enjoy total reliability** in even the harshest of conditions including high ambient temperatures and humidity levels.
- › **Savour operational flexibility**, as the ACB discriminates between fault zones selectively, allowing down stream equipment to clear the fault in a prescribed time before intervening.

## Negating human error with safety features

- › **No Arc-chute, No closure:** Unique features like Arc-chute Interlocking and True Ready-to-Close (RTC) detection systems ensure that the ACB closes only when the Arc-chutes are in place and all other pre-requisite conditions are fulfilled.
- › **Power ON, No racking operation:** An inbuilt Smart racking shutter ensures that the ACB is racked-in/out only in 'OFF-state'.
- › **One signal, One closure:** An inbuilt Electrical and Mechanical Anti-pumping System cancels the persistent closing signal after successful ACB closure.
- › **No unauthorised setting changes:** An innovative Password protection feature ensures that only authorised personnel can change the release settings.



# Shield Your World with Safety and Sustainability

OMEGA ACBs are loaded with superior technology, across three frame sizes for the entire current range from 400A to 6300A. These features, including systems for communication, control and protection (Matrix), make these ACBs a dream to use.

## OMEGA ACBs allow you to

- › **View** a snapshot of all parameters and symptoms through a user-friendly, state-of-the-art O-LED Display.
- › **Control** the system parameters of vast installations easily, with a special Smart-card feature and user-friendly Touch-Screen Display.
- › **Manage** energy consumption better by monitoring various energy parameters such as phase components, power factors, energy and maximum demand.
- › **Communicate** between system elements wirelessly and stay informed at all times through mobile alerts.
- › **Add and remove** Arc-chutes and various Volt-metric releases easily, without the need for tools.
- › **Upgrade** systems for safety, protection, control and monitoring with a wide range of accessories and safety interlocks for versatile applications.
- › **Enjoy** the benefit of total system compliance with all the relevant quality, safety and environmental standards.

Lauritz Knudsen's wide range of Electrical Standard Products includes powergear, controlgear, energy management devices, building electrical and automation products – each of which matches and exceeds global benchmarks for reliability and quality. However, in order to ensure that your business sails smoothly through any electrical turbulence, every element must be in perfect working condition.

At Lauritz Knudsen, we offer you the benefit of five decades of experience in providing After-Sales Service for Low Voltage Distribution Systems in every type of industry and building in India.

## The Lauritz Knudsen Service Advantage

- › **Preventive Maintenance:** Advice is provided and preventive checks carried out on a regular basis.
- › **Service On Call:** A network of over 100 approved Service Centers across India ensures that service is just a phone call away.
- › **Annual Maintenance Contract:** Comprehensive care for your systems including obsolescence management and part replacement, as deemed necessary.
- › **Obsolescence Management:** We offer spares and retrofitment services, including upgrading all Lauritz Knudsen Switchgear, to ensure that your systems runs smoothly.
- › **Training on Product Usage:** Our service engineers work with customers' maintenance staff to train them in the operation of switchgear products.





# SmartComm Power Management Solutions

Digitally connect, operate, and optimize with our cutting-edge SCADA-based platform, designed to improve operational efficiency and promote sustainable operations



Seamless Integration from Plant floor assets to real-time dashboards



Holistic view of Power Distribution Network using intuitive Single-Line Diagram (SLD)



Highly scalable platform from 128 to unlimited tags



Gain valuable insights with Energy Analytics dashboards & Custom Reports for data-driven decisions



Embrace open communication protocols such as Modbus TCP, MQTT, IEC61850, OPC-UA, and more



Stay ahead with alerts for power system abnormalities and fault conditions.



Industry



Commercial  
complex



Building



Utility



Infra



OEM

## Customer Interaction Center (CIC)

Phone no: 022-6932 7800

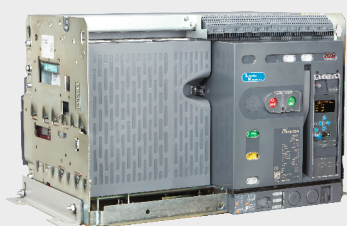
Web: [www.LK-EA.com](http://www.LK-EA.com) | e-mail: [CIC@LK-EA.com](mailto:CIC@LK-EA.com)



**U-POWER**

**OMEGA**

**Air Circuit Breakers**



# Patents

## Telescopic Racking Handle

- › Soft Rack-in & Rack-out with OMEGA ACB. Ease of racking by comfort to user while racking the breaker in cradle by having minimum effort from the user.

## Breaker and Cradle SICs

- › Block type self aligning Secondary Isolating Contacts (SIC) with unique Spring Clamp/Screwless assembly.

## Door Interlock for Panel Door (Drawout ACBs)

- › Safety feature that ensures panel door does not open when the ACB is in Test or Service position, i.e. when the power supply or control supply is live.

## Arc Shield

- › Helps to channelize the gases generated from the arcing and helps reducing the enclosure height at which ACB is installed.

## Mechanical Interlock

- › Feature available for providing interlocking upto 3 ACBs with various interlocking schemes.

## Retrofit Kit with Universal Adaptor

- › Retrofit solution with flexibility of termination orientation.

## Auto Actuated Rail Stopper

- › Prevent rails to slide in while loading Breaker onto Cradle in maintenance position.

## Contact Erosion Indicator

- › Stepped design for better visual indication of contact erosion over a life of the breaker.

## Temperature Module

- › Realtime measurement of Cradle Terminal Adaptor temperature and provision for isolating the breaker if temperature crosses a certain value (programmable).

# Certifications & Compliance

**OMEGA Air Circuit Breakers (ACBs)** are latest-generation circuit breakers designed to protect electrical systems from damage caused by excess current due to overloads, short circuits and equipment ground faults. These ACBs are manufactured as per the standardization of IEC 60947-2. Moreover, ACBs & Accessories are suitable to CE certification as well. World renowned certifying agencies like DEKRA, CPRI & ERDA have acknowledged this masterpiece through their various types of testing standard.

Lauritz Knudsen has its own NABL accredited laboratory in Navi Mumbai, India, for ensuring expedited product development and assurance of product quality and reliability.



International  
Electrotechnical  
Commission

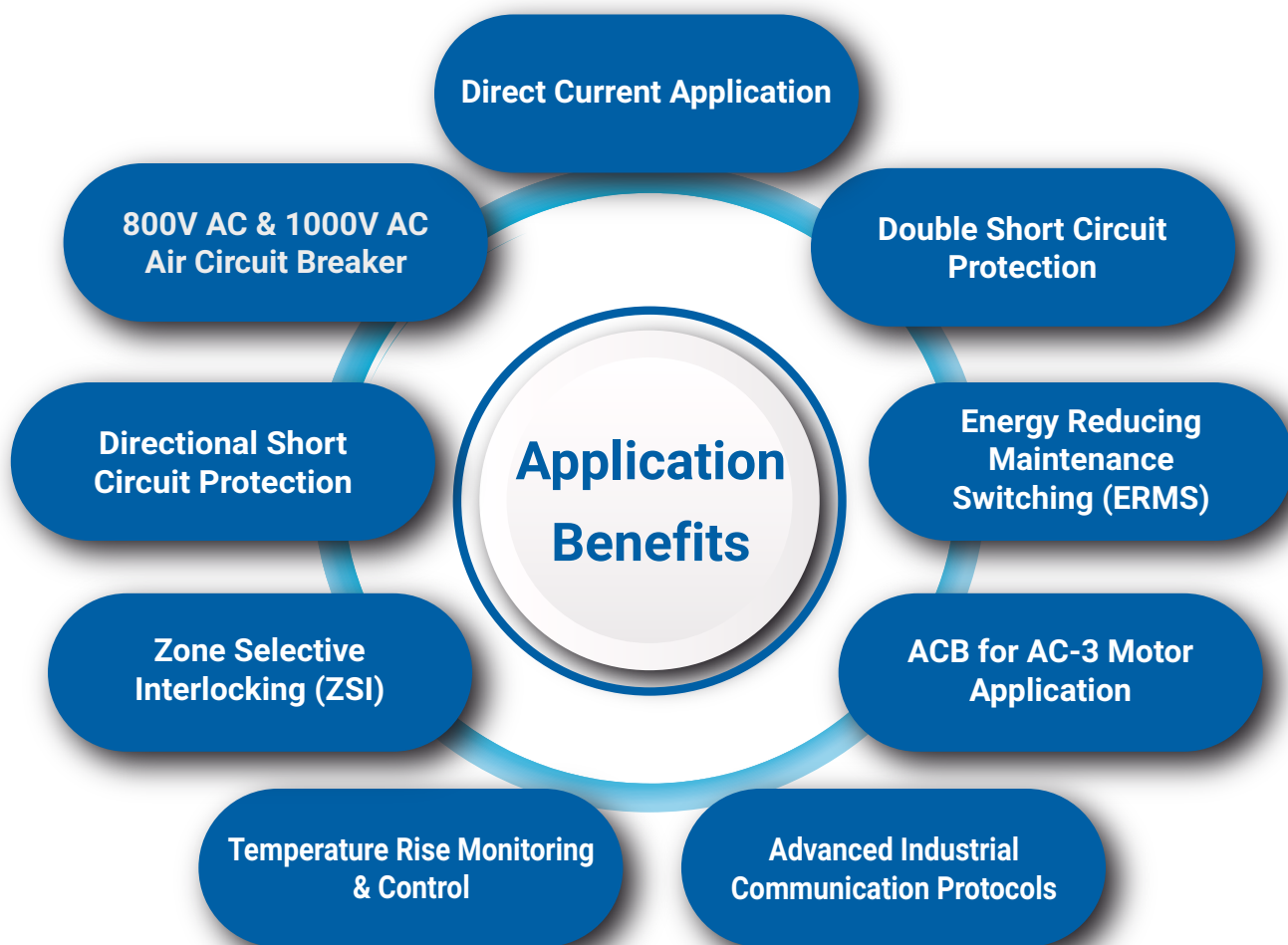


CPRI





# Application Benefits



U-POWER

# OMEGA

Air Circuit Breakers





# Air Circuit Breakers

- › Complete range conforms to IS/IEC 60947-2 & IEC 60947-2
- › Current rating from 400A to 6300A in 3 frame sizes
- › Available in 3 Pole/4 Pole, Manually & Electrically operated, Fixed & Draw-out versions
- › Common Height & Depth across the range
- › High short-time fault withstanding capacity,  $I_{cu} = I_{cs} = I_{cw}$  for 1sec for total selectivity
- › High mechanical and electrical operating life
- › Modular & snap-fit accessories
- › Ease of on-site conversion from Fixed to Draw-out & Manual to Electrical versions
- › Best in class Termination overlap with Bus bars.
- › RoHS compliant



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**OMEGA**  
Air Circuit Breakers

Breaking Capacities		$I_{cu} = I_{cs} = I_{cw}$ for 1sec									
Rated Current		800A	1000A	1250A	1600A	2000	2500A	3200A	4000A	5000	6300A
Frame-1	N : 50kA										
	S : 65kA										
	H : 80kA										
		UW1-08	UW1-10	UW1-12	UW1-16	UW1-20	UW1-25				
Frame-2	N : 50kA										
	S : 65kA										
	H : 80kA										
		UW2-08	UW2-10	UW2-12	UW2-16	UW2-20	UW2-25	UW2-32	UW2-40		
Frame-3	H : 80kA										
	V : 100kA										
		UW3-08	UW3-10	UW3-12	UW3-16	UW3-20	UW3-25	UW3-32	UW3-40	UW3-50	UW3-63

**Note:** 400A & 630A versions also available.

# Technical Data Sheet

## Circuit Breaker upto 690V AC

Frame			1					2			3			
Rated Uninterrupted Current (In) (A) at 50°C			400-2000			2500 <sup>(1)</sup>		400-4000			400-5000		6300 <sup>(2)</sup>	
Version			N	S	H	S	H	N	S	H	H	V	H	V
Rated Operational Voltage at 50/60 Hz.		Ue	upto 690V AC											
Rated Insulation Voltage at 50/60 Hz.		Ui	1000V AC											
Rated Impulse withstand Voltage		Uimp	12kV (Main Circuit) & 4kV (Auxiliary Circuit)											
Suitability for Isolation			Yes											
Degree of Protection on Breaker front			IP53 Standard, IP54 Optional											
Degree of Impact Protection on Breaker front			IK08 Standard, IK10 Optional											
Pollution Degree Suitability			4											
Utilization Category			B											
Compliance			IS / IEC 60947 (Part-2), EN 60947-2, IEC 60947-2											
Operational Temperature Range (As per IEC 60068-2-1/ IEC 60947-1-Q)			-25°C to 70°C											
Storage Temperature Range (As per IEC 60068-2-1/2)			-40°C to 85°C											
Rated Ultimate S.C. Breaking Capacity	Icu (kA)	415/440V AC	50	65	80	65	80	50	65	80	80	100	80	100
		500/550V AC	42	55	65	55	65	42	55	70	70	85	70	85
		660/690V AC	36	50	55	50	55	36	50	65 <sup>(3)</sup>	65	75	65	75
Rated Service S.C. Breaking Capacity	Ics (kA)	415/440V AC 500/550V AC 660/690V AC	100% Icu											
Rated Short-time Withstand Capacity	Icw (kA)	0.5sec	50	65	80	65	80	50	65	80	80	100	80	100
		1.0sec	50	65	80	65	80	50	65	80	80	100	80	100
		3.0sec	26	36	44	36	44	26	44	50	65	75	65	75
Rated S.C. Making Capacity	Icm (kA)	415/440V AC	105	143	176	143	176	105	143	176	176	220	176	220
		500/550V AC	88	121	143	121	143	88	121	154	154	187	154	187
		660/690V AC	76	105	121	105	121	76	105	143 <sup>(4)</sup>	143	165	143	165
Break Time (ms)		25												
Closing Time (ms)		60												
Mechanical Life <sup>(5)</sup>		With maintenance	25000					20000			15000			
Electrical Life <sup>(5)</sup>		Without maintenance	10000			5000		5000			5000		2000	

- (1) Please consult branch office for selection  
 (2) Rated Uninterrupted Current (In) (A) at 40°C and available only in Drawout Version  
 (3) 65kA upto 3200A & 55kA for 4000A  
 (4) 143kA upto 3200A & 121kA for 4000A

- (5) Value corresponds to operating cycle - Refer Users' Manual for Routine/Specific maintenance



# Technical Data Sheet

## Circuit Breaker 800V AC & 1000V AC

Frame			1		2		3	
Rated Uninterrupted Current (In) (A) at 50°C			400-2000		400-4000		400-5000	
Version			N08	D10	N08	N10	N08	S08
Rated Operational Voltage at 50/60 Hz.	Ue		800V AC	1000V AC	800V AC	1000V AC	800V AC	
Rated Insulation Voltage at 50/60 Hz.	Ui		1250V AC					
Rated Impulse withstand Voltage	Uimp		12kV (Main Circuit) & 4kV (Auxiliary Circuit)					
Suitability for Isolation			Yes					
Degree of Protection on Breaker front			IP53 Standard, IP54 Optional					
Degree of Impact Protection on Breaker front			IK08 Standard, IK10 Optional					
Pollution Degree Suitability			4					
Utilization Category			B					
Compliance			IS / IEC 60947 (Part-2), EN 60947-2, IEC 60947-2					
Operational Temperature Range (As per IEC 60068-2-1/ IEC 60947-1-Q)			-25°C to 70°C					
Storage Temperature Range (As per IEC 60068-2-1/2)			-40°C to 85°C					
Rated Ultimate S.C. Breaking Capacity	Icu (kA)	800V AC	50	-	50	50	50	65
		1000V AC	-	36	50	50	-	-
Rated Service S.C. Breaking Capacity	Ics (kA)	800V AC	100% Icu					
		1000V AC	-	100% Icu			-	-
Rated Short-time Withstand Capacity	Icw (kA)	1sec	50	36	50	50	50	65
		3sec	36	36	50	50	50	65
Rated S.C. Making Capacity	Icm (kA)	800V AC	105	-	105		105	143
		1000V AC	-	75.6	-	105	-	-
Break Time (ms)			25					
Closing Time (ms)			60					
Mechanical Life <sup>(1)</sup>	With maintenance		25000		20000		15000	
Electrical Life <sup>(1)</sup>	Without maintenance <sup>(2)</sup>		1000		1000	500	1000	

(1) Value corresponds operating cycle

(2) With Maintenance, Electrical Life is same as Mechanical Life

# Dimensions

## Circuit Breaker upto 690V AC

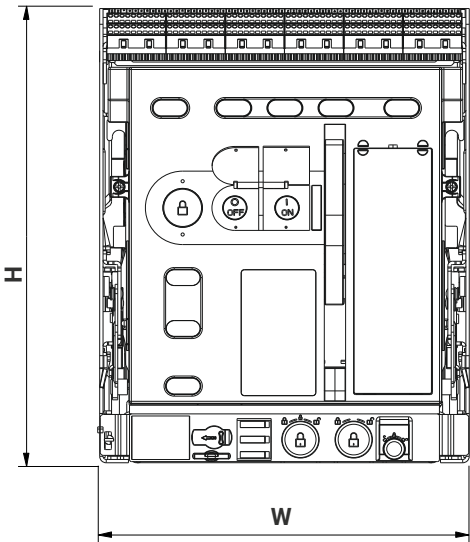
Frame			1						2			3			
Rated Uninterrupted Current (In) (A) at 50°C			400-2000			2500			400-4000			400-5000		6300	
Version			N	S	H	S	H	N	S	H	H	V	H	V	
Fixed ACB	W (mm)	Width 3P	347					447			647				
		Width 4P (100% N)	447					581			847				
	D (mm)	Depth	324									334			
	H (mm)	Height	430												
Draw-out ACB	W (mm)	Width 3P	347					447			647				
		Width 4P (100% N)	447					581			847				
	D (mm)	Depth	421									431			
	H (mm)	Height	433												

## Circuit Breaker 800V AC & 1000V AC

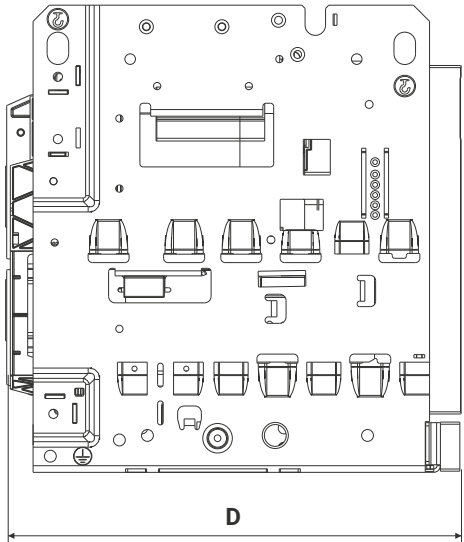
Frame			1		2		3	
Rated Uninterrupted Current (In) (A) at 50°C			400-2000		400-3200		400-5000	
Version			N08	D10	N08	N10	N08	S08
Fixed ACB	W (mm)	Width 3P	347		447		647	
		Width 4P (100% N)	447		581		847	
	D (mm)	Depth	324				334	
	H (mm)	Height	430					
Draw-out ACB	W (mm)	Width 3P	347		447		647	
		Width 4P (100% N)	447		581		847	
	D (mm)	Depth	421				431	
	H (mm)	Height	433					

# Dimensions

## Circuit Breaker upto 690V AC



H : Height  
W : Width  
D : Depth with flat terminals



Rating Specification Parameters for 50% N ACB						
Frame		1		2	3	
Version		N/S/H	S/H	N/S/H	H/V	
Rated Uninterrupted Current at 50° C		In (A)	400-2000	2500	400-4000	400-6300
Dimensions	Fixed ACB	W (mm)	447		581	747
	Draw out ACB		447		581	747
Rating Specification Parameters for 200% N ACB						
Frame		1		2	3	
Version		N/S		S/H	H	
Rated Uninterrupted Current at 50° C		In (A)	400-1250	1600-2000	2000-2500	
Dimensions	Fixed ACB	W (mm)	447	581	647	
	Draw out ACB		447	581	647	



# 800V/1000V AC OMEGA ACB

## Special Applications- 800V AC/1000V AC Rated Voltage Applications

Specially designed OMEGA ACB range offers a solution for electrical applications with system voltages of 800V and 1000V AC. This range of ACBs maintain the same dimension and accessories as the standard 690V AC range. This range of ACBs is Available with LSI and LSING Protections through following Microprocessor Releases -

- › **MTX1.0 - LSI Protection**
- › **MTX1G - LSING Protection**
- › **MTX1.5G - LSING Protection with Current Metering**
- › **MTX1Gi - LSING Protection with Inbuilt ZSI**
- › **MTX1.5Gi - LSING Protection with Current Metering & Inbuilt ZSI**
- › **MTX3.5 - LSING Protection with Current Metering & optional / Inbuilt Communication**

This range of ACBs are available for current rating of 400-5000A 50kA/65kA for 800Vac & 400-4000A 36kA/50kA for 1000Vac version, therefor it offers -

$I_{cu} = I_{cs} = I_{cw} (1 \text{ sec}) = 36/50/65\text{kA}$

**\* NOTE:** Please contact Our Sales Office for details about available advance Measurement / Protection & Features. Please contact our nearest Sales Office for further technical and ordering details.

**Protect your systems from the unpredictable - find  
your ideal OMEGA ACB solution on the following page**



# OMEGA 1000V DC ACB

## OMEGA for DC Application upto 1000V

Lauritz Knudsen has developed the OMEGA ACB switch-disconnectors to cater to direct current applications up to 1000V DC circuit breakers, like OMEGA ACBs, are utilized across a wide range of applications including rectifiers, inverters, UPS, PV solar, Battery Energy Storage Systems (BESS) and battery chargers. OMEGA ACBs are suitable for use in DC applications as switch-disconnectors without built-in release/protection. External DC over-current relays can be integrated through the Shunt release of the ACB for over current protections such as short-circuit and over-load protections. OMEGA switch-disconnectors are available for

voltages up to 1000Vdc, with breaking capacity determined by the respective circuit Breaker type and connection topology. The range can cater to various installation requirements up to 5000A – 1000V DC. Available in fixed or withdrawable versions, as well as in three-pole or four-pole versions, these circuit-breakers enable achieving a rated voltage of 750V DC with the connection of three poles in series and 1000V DC with four poles in series. OMEGA DC Switch-disconnector range maintain the overall dimensions, fixing points and accessories same as those of the standard range circuit-breakers.

### Common Data

Rated service voltage Ue [V]	upto 1000 V DC
Rated insulation voltage Ui [V]	1000 V
Rated impulse withstand voltage Uimp [kV]	12 kV
Operational Temperature Range:	-25°C to 70°C
Storage Temperature Range:	-40°C to 85°C
Number of poles	3-4
Versions	Fixed - Drawout

### OMEGA Range Frame offering

Frame			UW1						UW2			UW3	
Rating (In)			400-2000			2500			2000-4000			4000-5000	
Version			N	S	H	S	H	N	S	H	H	V	
Mechanical Life – With Routine			20000						15000			10000	
Maintenance (no. of cycles)													
Frequency of Operations - Mechanical			60 Cycles per hour										
Dimensions	Fixed Type	Width - 3P (mm)	347					447			647		
		Width - 4P 100%N (mm)	447					581			847		
		Depth (mm)	324					324			334		
		Height (mm)	430										
	Draw-out Type	Width - 3P (mm)	347					447			647		
		Width - 4P 100%N (mm)	447					581			847		
		Depth (mm)	421					421			431		
		Height (mm)	433										

# OMEGA 1000V

## DC ACB

### Selection of OMEGA ACB Switch-disconnector based on Voltage, Current and Topology:

As per  $\tau = L/R$  (time constant) requirement of less than 5 milli seconds, the table below presents the corresponding breaking

service breaking capacity  $I_{cs}$  and withstand capacity  $I_{cw}$  of the ACBs when used in conjunction with an external DC over-current relay connected through the Shunt release of the ACB.

OMEGA Frame/Rating/Version	Rated DC Voltage (Ue)	Connection Topology	Service Breaking Capacity $I_{cs}$	Withstand Capacity $I_{cw}$ for 1sec
	V		kA	kA
UW1 400-1600A N	500	2 Poles in series	42	42
	500	3 Poles in series	50	50
	750	3 Poles in series	37	37
	750	4 Poles in series	50	50
	1000	4 Poles in series	35	35
UW1 400-1600A S	500	2 Poles in series	50	50
	500	3 Poles in series	55	55
	500	4 Poles in series	65	65
	750	3 Poles in series	50	50
	750	4 Poles in series	65	65
	1000	4 Poles in series	55	55
UW1 2000A N	500	2 Poles in series	42	42
	500	3 Poles in series	50	50
	750	3 Poles in series	37	37
	750	4 Poles in series	50	50
	1000	4 Poles in series	35	35
UW1 2000A S	500	2 Poles in series	50	50
	500	3 Poles in series	55	55
	500	4 Poles in series	65	65
	750	3 Poles in series	50	50
	750	4 Poles in series	65	65
	1000	4 Poles in series	55	55
UW1-400-2000A H, UW1 2500A S, UW1 2500A H	500	2 Poles in series	60	60
	500	3 Poles in series	65	65
	500	4 Poles in series	80	80
	750	3 Poles in series	60	55
	750	4 Poles in series	70	70
	1000	4 Poles in series	60	60
UW 2 400-2500A N/S	500	2 Poles in series	50	50
	500	3 Poles in series	55	55
	500	4 Poles in series	65	65
	750	3 Poles in series	50	50
	750	4 Poles in series	65	65
	1000	4 Poles in series	55	55

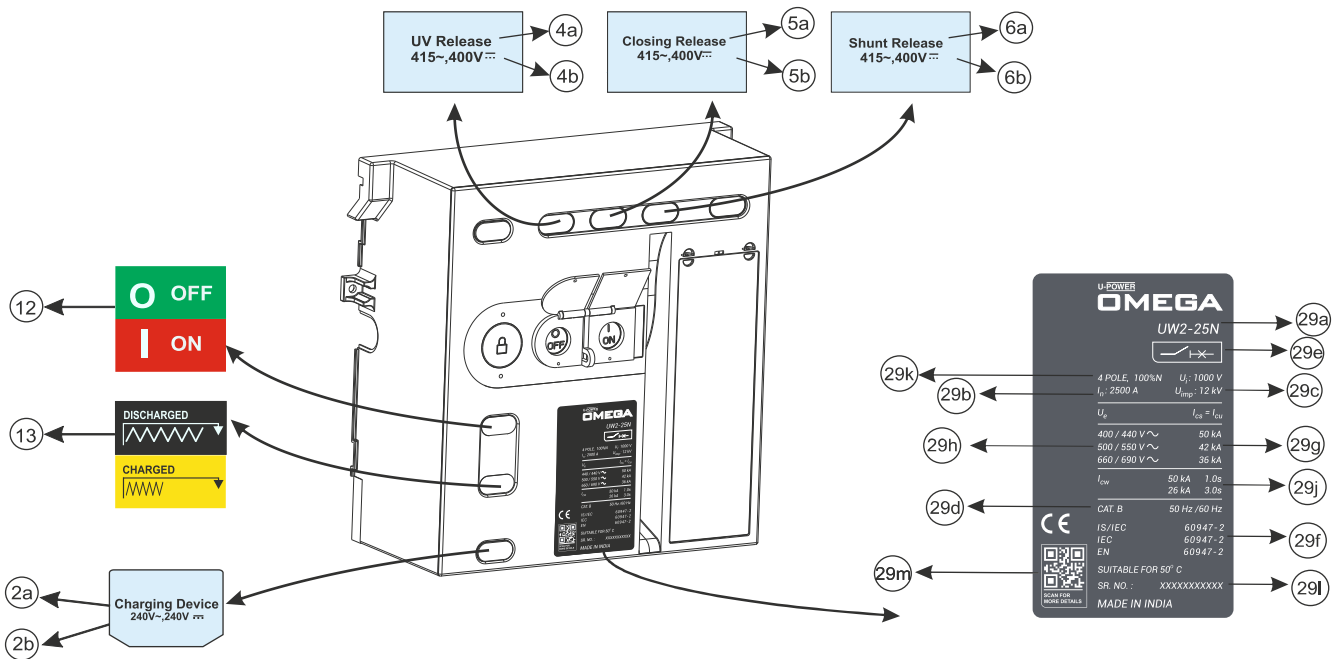


# OMEGA 1000V DC ACB

OMEGA Frame/Rating/Version	Rated DC Voltage (Ue)	Connection Topology	Service breaking capacity Ics	Withstand Capacity Icw for 1 sec
	V		kA	kA
UW2 400-2500A H UW2 3200A N/S/H UW2 4000A N/S/H	500	2 Poles in series	60	60
	500	3 Poles in series	65	65
	500	4 Poles in series	85	80
	750	3 Poles in series	60	60
	750	4 Poles in series	75	75
	1000	4 Poles in series	65	65
UW3 4000A H/V	500	2 Poles in series	85	85
	500	3 Poles in series	100	100
	750	3 Poles in series	75	75
	750	4 Poles in series	100	100
	1000	4 Poles in series	80	80
UW3 5000A H/V	500	2 Poles in series	85	85
	500	3 Poles in series	100	100
	750	3 Poles in series	75	75
	750	4 Poles in series	100	100
	1000	4 Poles in series	80	80

DC performance is verified by Lauritz Knudsen in accordance with the tables above.  
 Additionally, for queries related to certification, please contact the nearest sales office.

# Product Identification



- 2a - Type designation for Electrical Charging device (ECD)
- 2b - Operating voltage for ECD
- 4a - Type designation for Under-voltage release (UVR)
- 4b - Operating voltage for UVR
- 5a - Type designation for Closing release (CR)
- 5b - Operating voltage for CR
- 6a - Type designation for Shunt release (SR/SRW)
- 6b - Operating voltage for SR/SRW
- 12 - ON-OFF indication
- 13 - Spring status indication

- 29b - Rated Uninterrupted Current
- 29c - Rated impulse withstand voltage
- 29d - Utilization Category
- 29e - Suitability for isolation
- 29f - Standards compliance
- 29g - Rated Service breaking capacity
- 29h - Rated operational voltage
- 29j - Rated short-time withstand current
- 29k - No. of Pole & Pole details
- 29m - QR Code
- 29l - Serial Number of ACB

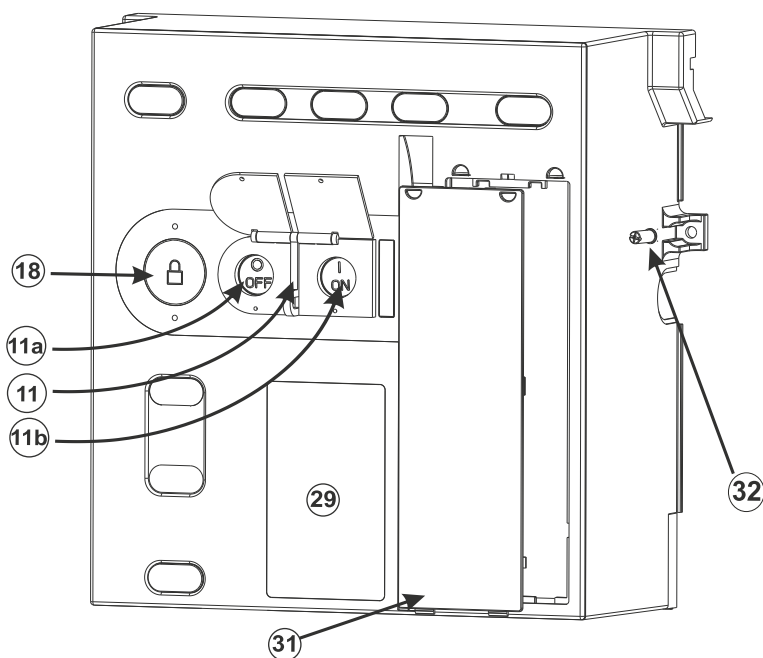
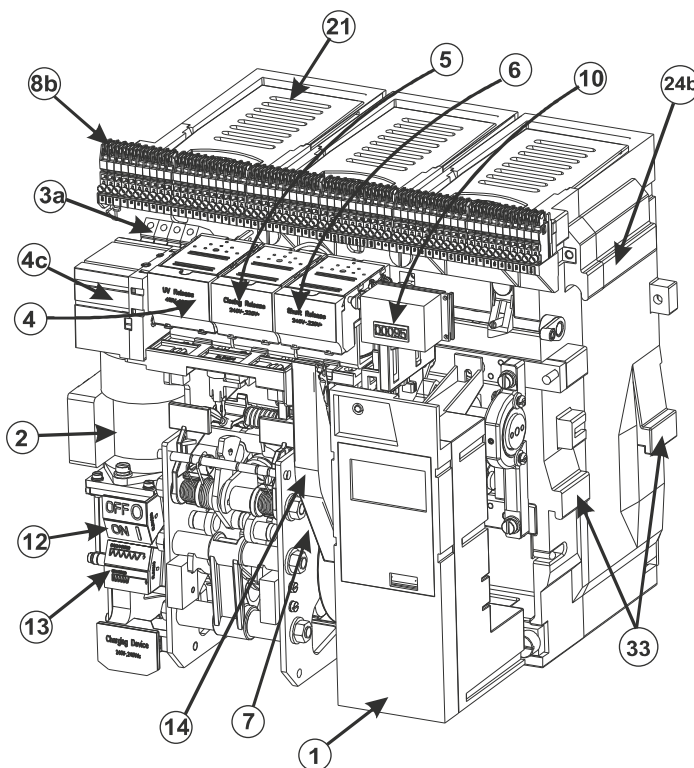
29a- **UW1-16S**

Frame		Rated Uninterrupted Current ( $I_n$ )		Version for Breaking Capacity ( $I_{cu}$ )	
1	Frame 1	04	400A	N	50 kA
2	Frame 2	06	630A	S	65 kA
3	Frame 3	08	800A	H	80 kA
		10	1000	V	100 kA
		12	A	N0	50 kA, 800V AC
		16	1250	8	65 kA, 800V AC
		20	A	S08	36 kA, 1000V
		25	1600	D10	AC
		32	A		
		40	2000		
		50	A		
		63	2500		

# Product Identification

## Breaker

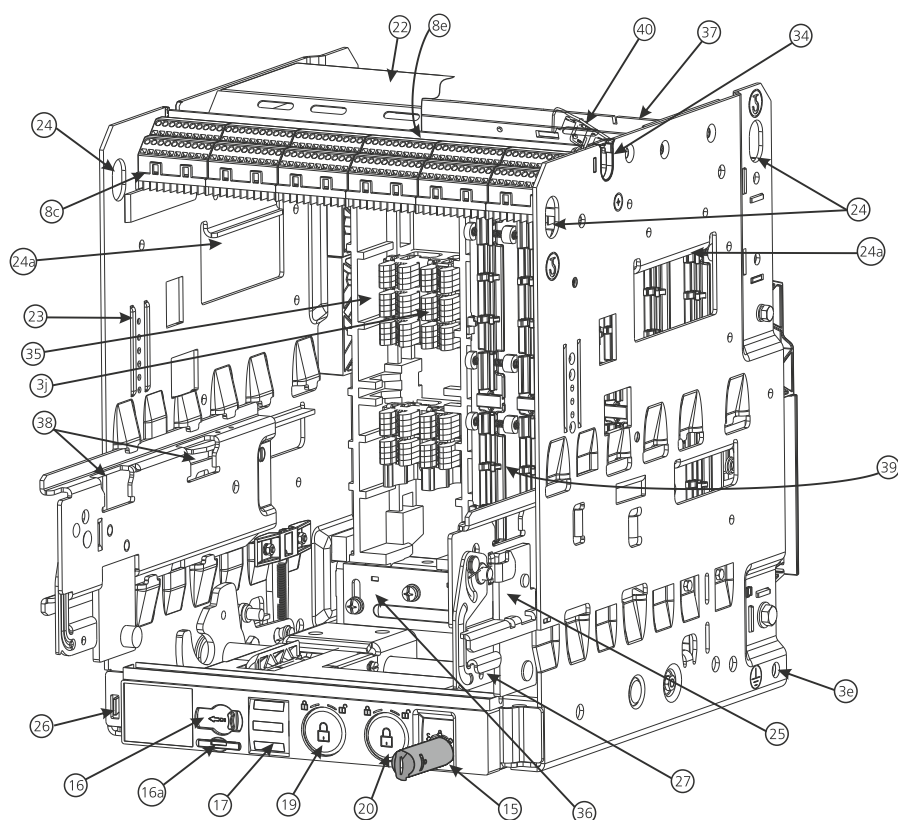
- 1 Protection & Control Unit
- 2 Electrical Charging Device
- 3a Auxiliary Contacts
- 4 Under-voltage Release
- 4c Under-voltage Release Controller
- 5 Closing Release
- 6 Shunt Release
- 7 Ready-To-Close (Microswitch)
- 8b Secondary Isolating Contacts on Breaker
- 10 Operation Counter
- 12 ON-OFF Indication
- 13 Spring Status Indication
- 14 Charging Handle
- 21 Arc-Chute
- 24b Lifting Location on Breaker
- 33 Projection for resting Breaker on Cradle



## Facia

- 11 Shroud for ON-OFF Buttons
- 11a OFF Button
- 11b ON Button
- 18 OFF Button locking
- 29 Laser Marked Breaker Specifications
- 31 Cover for Protection & Control Unit (UW-MTX Releases)
- 32 Facia Fixing screw

# Product Identification



- 3e Hole for Earthing Connection
- 3j Jaw Contacts
- 8c Secondary Isolating Contacts on Cradle
- 8e Electrical Position Indication
- 15 Racking Handle
- 16 Smart Racking-Shutter
- 16a Pad-lock for Racking-Shutter
- 17 Position Indicator
- 19 Position Lock - 1
- 20 Position Lock - 2
- 22 Arc-Shield
- 23 Rating Error-Preventer

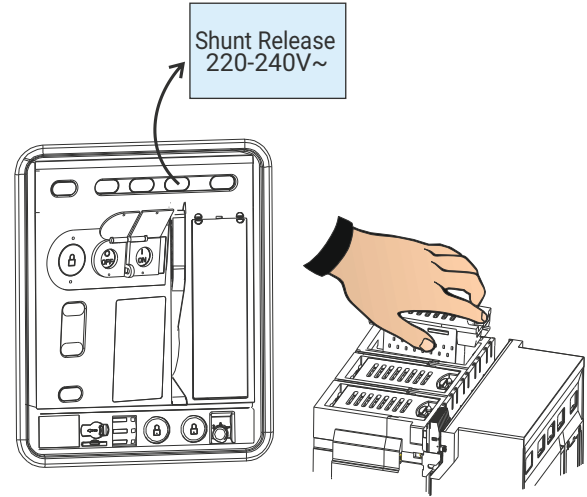
- 24 Lifting Locations (4 nos.)
- 24a Additional Lifting Locations
- 25 Withdrawal Rails
- 26 Door Racking Interlock
- 27 Breaker Pull-out Handle
- 34 Guide for routing Control Wiring
- 35 Terminal Supports
- 36 Cradle Bottom cross- component
- 37 Cradle Top cross-component
- 38 Slot for placing breaker on Cradle
- 39 Safety Shutter
- 40 Door-Interlock



# A Basket of Benefits

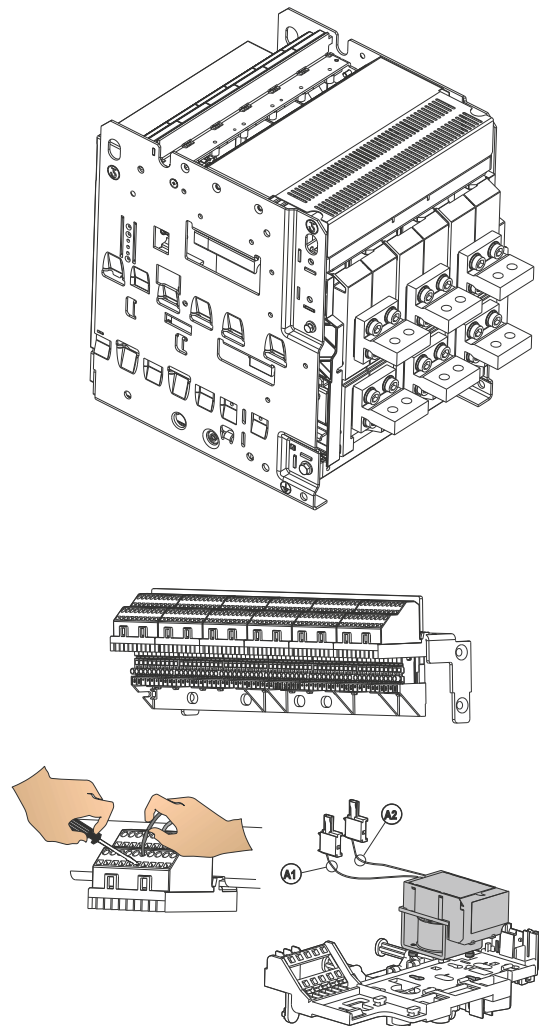
## User Friendly

- › Unique breaker front-facia architecture displays the electrical accessories mounted on the ACB (with rated control voltage & type of operating voltage)
- › Modular & snap-fit accessories such as UVR, SR & CR modules, redefine the modularity on a time scale of 5 Mins.
- › Ease of on-site convertibility from Manual to Electrical & Fixed to Draw-out version
- › Tool-less Arc-Chutes removal facilitates quick inspection of electrical contacts
- › Indelibly marked Breaker Specifications on facia with Laser Marking
- › RoHS complaint



## Switchboard Friendly

- › Three compact frame sizes help in optimizing the switch Board design
- › Right aligned design of ACB helps in better space utilization within the Switch board
- › True 50% & 200% neutral options, along with the conventional 100% neutral (as standard) help in designing the switchboards as per applications & lead to optimize switchboard design
- › Common height & depth across the range help in reducing the number of connection layouts & facilitate the easy modification of panel design & busbar layouts
- › Terminal adaptors offer ease of configuration of vertical/horizontal Busbar arrangements
- › Option of interleaving busbar design at breaker terminals offer superior performance
- › Supports multi-tier arrangement with minimal clearance with the help of arc-shield
- › Self-aligning, Snap-fit Secondary Isolating Contacts (SIC) enable the quick termination of 2 control wires (with Lugs) each of up to 2.5 sq.mm
- › Option of customized neutral configuration ( For 100%N ACBs Only)
- › 2m/3m/5m Bowden wire mechanical interlocking kit facilitates ease of mechanical interlocking among various frames of Fixed / Draw-out /Mixed versions of OMEGA ACBs
- › Minimum 45mm\* (Without Temperature Module) clearance above breaker facilitating Compact Multi-tier Switch board design
- › Best in class (40mm) Termination overlap with Busbars.



\* Minimum 300mm in case of 800V/1000V AC ACBs



# Matrix Protection Release



**UW-MTX 1.0/1G**

Basic Version



**UW-MTX 3.5 Series**



**UW-MTX 1.5G/1.5Gi**

Basic Version



**UW-MTX 4.5 Series**

Advanced Version



# Matrix Release

## A Basket of Benefits

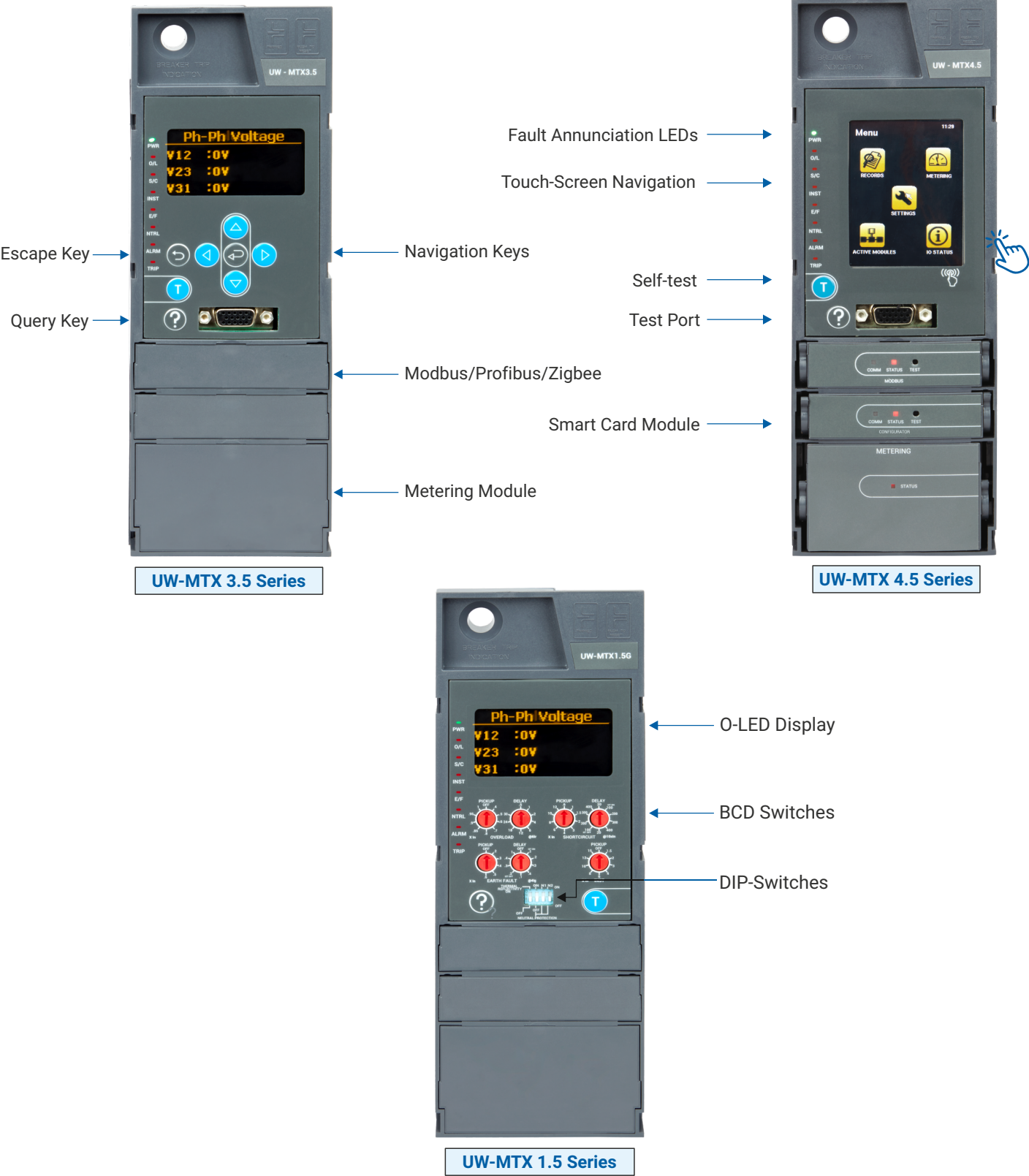
- › State-of-the-art touch-screen technology in Matrix 4.5 releases offer ease of navigation
- › Unique withdrawable power metering & communication modules offer ease of flexibility, scalability & customization of electrical systems
- › Option of both Modbus RTU, TCP/IP (ETHERNET) & Profibus industrial communication protocols
- › Zigbee offers wireless monitoring parameters of Matrix releases & supplementary modules
- › Wide range of Overload protection curves (such as I<sup>2</sup>t, I<sup>4</sup>t, SI & LI/VI) offer precise co-ordination with large variety of electrical loads
- › Option of Enabling/Disabling each protection function offers greater flexibility in designing the overall protection system
- › Directional & Double Short-circuit protection
- › Password protection in releases prevents unauthorized access to protection release
- › Unique O-LED display offers better contrast & wider viewing angle
- › Ease of parameterisation through Configurator modules
- › Dual time-based set group protection provides the option of setting two sets of protection curves
- › Front connector for hand-held testing of release
- › Soft-rating plug offers precise protection of electrical system at lower value of system currents
- › Query button for last trip information furnishes the "Trip Info" details such as cause of tripping, date and time stamping of tripping
- › Test button for self-diagnostic test
- › Lauritz Knudsen 24V DC Power Supply Module is mandatorily recommended for UW-MTX 1.5Gi & UW-MTX 3.5 Series & UW-MTX 4.5 Series trip units.
- › 20 trip & 128 event records stored in the protection release\*
- › Elimination of relays & measurement devices less time required for switchboard assembly (no wiring or cut outs on the front panel) Fewer devices required and less time spent on their selection, purchase, storage and installation
- › Harmonics metering up to 27th order of fundamental frequency along with display of THD
- › Oscillograph of fault current waveforms (10 cycles before pick-up/Trip & 5 cycles after pick-up/Trip)
- › Tested for Electromagnetic Compatibility (EMC) as per IEC 60947-2
- › Inbuilt & Optional Zone Selective Interlocking (ZSI)
- › All electronic products used inside MTX Release Units are designed to withstand temperature up to 85 degC.
- › For Release offering MTX 3.5 onwards, accuracy of metering would be 1% at nominal current (In).
- › In order to get additional functionality, SmartComm and/or BMS can be programmed using release data to achieve following :
  - » Operating and trip counters
  - » Operating hour counter
  - » Load profile

\*a : 20 trip and 10 events can be accessed on Release display.

b : 20 trip and 128 events can be accessed through communication.

# Matrix Release

## Innovation in Imagineering

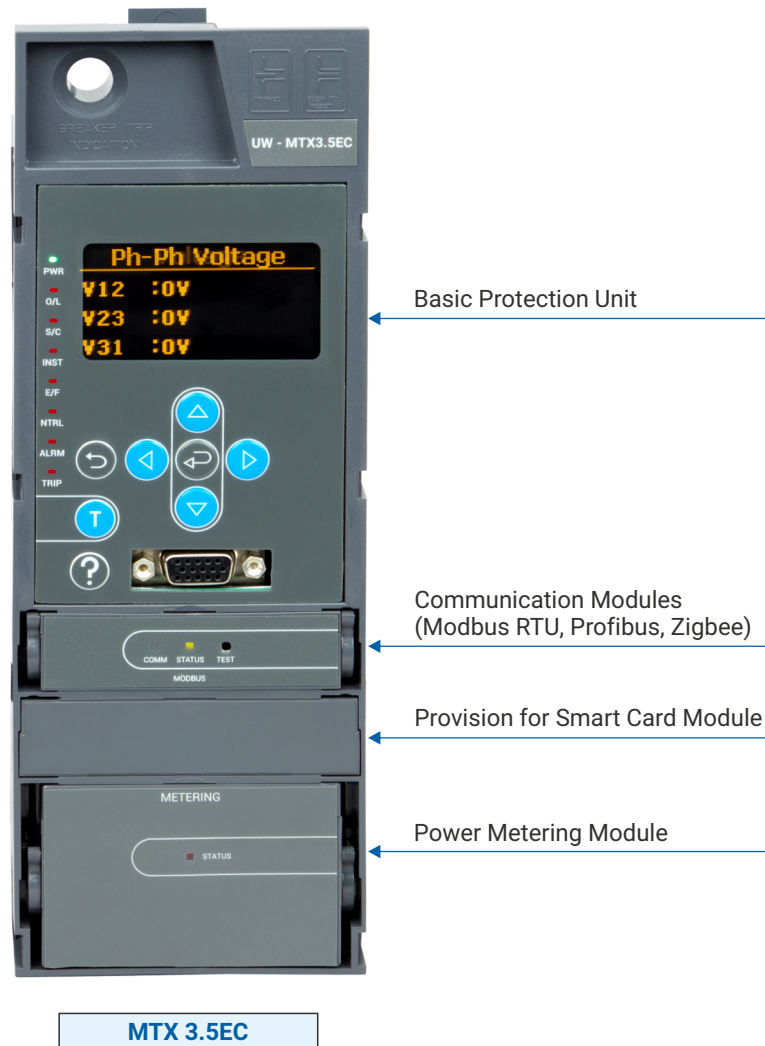


# Matrix Release

## Redefining Modularity

Matrix releases designed for "Flexibility, Scalability & Customization" offer wide variety of withdrawable modules such as Modbus, Profibus, Zigbee, Smart Configurator & Power metering. To start with one can go for a basic version of MTX3.5

release and based on future needs and system demands, one can upgrade the protection release with Power metering & Communication modules.



# Matrix Protection Technical Specification

## Features

- Overload, Short-circuit & Instantaneous protection with adjustable current & time-delay settings
- Inbuilt Earth-Fault & neutral protection in MTX1G/1Gi & MTX1.5G/1.5Gi
- Switchable thermal memory for cable protection on Repetitive overloads
- $I^2t$  ON curve for Short-circuit & Earth-fault protection
- Current Metering in MTX1.5G/1.5Gi through 3-line O-LED display
- Local fault annunciation through LED indication & pre-trip alarm
- Front accessible test port
- Query button for last trip record
- Inbuilt rating-plug through DIP switches
- Test button to check the health of protection release
- Self-powered protection
- Inbuilt Zone Selective Interlocking (ZSI) in MTX1Gi & MTX1.5Gi

Parameters		MTX1.0	MTX1G	MTX1Gi	MTX1.5G	MTX1.5Gi
Overload (Phase)	Protection: Enable/Disable	✓	✓	✓	✓	✓
	Pick-up (Ir)=In x... for I²t	OFF- 0.4-0.5-0.6-0.7-0.8-0.85-0.9-0.95-1				
	Delay (tr) in sec	10	0.5-1-2-4-6-12-18-24-30			
	Pre-alarm	0.9 x Ir(fixed)				
	Thermal Memory ON/OFF	✓	✓	✓	✓	✓
Overload (Neutral)	Protection: Enable/Disable	–	✓	✓	✓	✓
	Pick-up (In)=Ir X...	–	50%-100%-150%-200%			
	Pre-alarm	–	0.8 x In (fixed)			
	Delay (tr) in s	–	Same as Overload Phase			
Short-Circuit	Protection: Enable/Disable	–	–	–	–	–
	I²t ON/OFF	✓	✓	✓	✓	✓
	Pick-up (Is)=In x...	0.6-1-1.5-2-3-4-6-8-10-12				
	Delay (ts)	20-100-200-300-400 ms				
	Pre-alarm	0.5 x Is (fixed)				
Instantaneous	Protection: Enable/Disable	✓	✓	✓	✓	✓
	Pick-up (Ip)=In x.	OFF-1.5-2-3-4-6-8-10-12-15				
Earth-Fault	Protection: Enable/Disable..	–	✓	✓	✓	✓
	I²t : ON/OFF	–	✓	✓	✓	✓
	Pick-up (Ig)=In x...		OFF-0.2-0.3-0.4-0.5-0.6			
	I²t OFF (tg)		0.1-0.2-0.3-0.4-1			
	I²t ON (tg)		0.1-0.2-0.3-0.4			
	Pre-alarm		0.8 x Ig (fixed)			
Inbuilt-ZSI	Short Circuit Enable/Disable	–	–	✓	–	✓
	Earth Fault Enable/Disable	–	–	✓	–	✓
Metering	Current	–	–	–	✓	✓
	% Loading	–	–	–	✓	✓
	Max. & Min. Current	–	–	–	✓	✓
	Current Bar-graph	–	–	–	✓	✓
Trip Records	Last 20 trip data	–	–	–	✓	✓



UW-MTX1.0



UW-MTX1G/1Gi



UW-MTX1.5G/1.5Gi



# Matrix Protection Technical Specification

Features	Parameter	MTX3.5/3.5T	MTX3.5EC/3.5ET	MTX3.5H	MTX4.5/4.5T
Basic Protection	Overload - Phase	✓	✓	✓	✓
	Overload - Neutral	✓	✓	✓	✓
	Short-Circuit	✓	✓	✓	✓
	Directional Short-Circuit	✓	✓	✓	✓
	Instantaneous	✓	✓	✓	✓
	Earth-Fault	✓	✓	✓	✓
Additional Protection	Current	✓	✓	✓	✓
	Voltage	*	✓	✓	✓
	Frequency	*	✓	✓	✓
	Reverse Power	*	✓	✓	✓
	Maximum Demand	*	✓	✓	✓
Trip Records	Last 20 trip data	✓	✓	✓	✓
Event Records	Last 10 Event Data	✓	✓	✓	✓
Smart Card		*	*	*	*
Communication	Modbus RTU	*	✓	*	✓
	Profibus	*	*	*	*
	Zigbee (wireless)	*	*	*	*
	TCP/IP (ETHERNET)	- / ✓	- / ✓	-	- / ✓
Advanced Protection	Trip Circuit Supervision (TCS)	*	*	*	*
	Zone Selective Interlocking (ZSI)	*	*	*	*
	Temperature Rise (TM)	*	*	*	*
	Earth Leakage (EL)	*	*	*	*
	Restricted Earth-Fault (REF)	*	*	*	*
Additional Features	Relay Output	*	*	*	*
	Load Management (Pre Trip Alarm)	✓	✓	✓	✓
	Digital Input & Output	*	*	*	*
	Analog Output	*	*	*	*
Metering	Current	✓	✓	✓	✓
	% Loading / Bar Graph	✓	✓	✓	✓
	Voltage	*	✓	✓	✓
	Power & Energy	*	✓	✓	✓
	Harmonics	-	-	✓	✓
Storable Settings (2 sets)		✓	✓	✓	✓
Auxiliary Supply (24V DC)		*	*	*	✓

\*Optional Feature

✓Standard

- Not Available



UW-MTX3.5 Series



UW-MTX4.5 Series

# Matrix Protection Technical Specification



## UW-MTX3.5/3.5T, 3.5EC/3.5 ET

- › Overload, Short-circuit and Earth-fault protection with variable current & time delay setting
- › Instantaneous protection
- ›  $I^2t$ ,  $I^4t$ , SI, LI/VI protection curves
- › Directional & Double Short circuit protections
- › Reverse power and phase sequence protection
- › Selectable  $I^2t$  based curves for short-circuit and earth fault protection
- › Switchable neutral overload protection (50%-200%) in step of 5%
- › Additional current & voltage based protections
- › Protection against temperature rise
- › These releases have been programmed to have feature of Percentage (%) loading / bar-graph. Percentage (%) Loading Absolute values will be percentage of Rated Current ( $I_n$ ) of the Air Circuit Breaker, and bar-graph will represent relative graphical representation based on %loading values of each phase.
- › Advance protection - ZSI, TCS, REF & EL
- › Communication through Modbus, TCP/IP (ETHERNET)\*, Profibus & wireless Zigbee
- › Smart Configurator module for easy parameterisation of the release
- › Local & remote fault annunciation & pre-trip alarm
- › Current, Voltage, Power, Energy & THD metering & % loading
- › Earth Fault Protection from 10%  $I_n$
- › Dual time-based protection set Groups
- › Thermal reflectivity & soft rating-plug
- › Self-powered protection
- › Trip & Event recording

\* MODBUS TCP/IP (ETHERNET) communication is available in 3.5T, 3.5ET Releases

## UW-MTX3.5H

- › Overload, Short-circuit and Earth-fault protection with variable current & time delay setting
- › Instantaneous protection
- ›  $I^2t$ ,  $I^4t$ , SI, LI/VI protection curves
- › Current & Voltage
- › harmonics metering
- › Directional & Double Short circuit protections
- › Reverse power and phase sequence protection
- › Selectable  $I^2t$  based curves for short-circuit and earth-fault protection
- › Switchable neutral overload protection (50%-200%) in step of 5%
- › Additional current & voltage Based protections
- › Protection against temperature rise
- › Advance protection - ZSI, TCS, REF & EL
- › Optional communication through Modbus, Profibus & wireless Zigbee
- › Smart Configurator module for easy parameterisation of the release
- › Local & remote fault annunciation & pre-trip alarm
- › Current, Voltage, Power, Energy & THD metering & % loading
- › Dual time-based protection set groups
- › Thermal reflectivity & soft Rating Plug
- › Self-powered protection
- › Trip & Event recording

# Matrix Protection Technical Specification

## UW-MTX 4.5/4.5 T



- › Overload, Short-circuit and Earth fault protection with variable current & time delay setting
- ›  $I^2t$ ,  $I^4t$ , SI, LI/VI protection curves
- › Navigation through Touch-Screen
- › Bar-graph representation of current, voltage & power parameters
- › Communication through MODBUS TCP/IP (ETHERNET), MODBUS RTU, Profibus & Wireless Zigbee.
- › Directional & Double Short-circuit protection
- › Instantaneous protection
- › Selectable  $I^2t$  based curves for short-circuit and Earth-fault protection
- › Switchable neutral overload protection (50%-200%) in step of 5%
- › Harmonics metering up to 27th order of fundamental frequency along with display of THD Percentage
- › Oscillograph of fault current waveforms (10 cycles before pick-up/trip & 5 cycles after pick-up/trip)
- › Metering of sequence components of current waveform, form factor, peak factor
- › Additional current & voltage based protections
- › Protection against temperature rise
- › Advance protection - ZSI, TCS, REF & EL
- › Local & remote fault annunciation & pre-trip alarm
- › Dual time-based protection set groups
- › Thermal reflectivity & soft rating-plug
- › Self-powered protection
- › Trip & Event recording



## Simulation Kit for Matrix Releases

- › Universal test kit for all versions of Matrix releases
- › Generates 3 phase current and voltage with adjustable phase angles
- › Graphical display & smart GUI with multi-Functional key operation
- › Portable & hand held device to simulate faults
- › Dual Power ON-battery & external supply
- › Auto sensing of release connectivity
- › Stores 10 test records

# Matrix Protection

## Technical Specification

### Basic protection in UW-MTX 3.5/3.5T/3.5EC/3.5ET/3.5H/4.5/4.5T

Features	Parameter	UW-MTX3.5 Series	UW-MTX4.5 Series
Overload (Phase)	Protection : Enable/Disable	✓	✓
	Pick-Up ( $I_r$ )= $I_n \times \dots$ for $I^2t, I^2t, SI, LI/VI$	0.4 to 1 x $I_n$ in step of 0.05	
	Delay (tr) in sec	0.5-1-2-4-6-12-18-24-30	
	Pre-alarm	0.5 to 0.95 in step of 0.05 x $I_r$	
	Thermal Memory ON/OFF	✓	✓
	Tolerance: +/- 0.5 sec	✓	✓
	Protection: Enable/Disable	✓	✓
Overload (Neutral)	Pick-Up $I_n = I_r \times \dots$	0.5 to 2 in step of 0.05	
	Pre-alarm	0.5 to 0.95 in step of 0.05 x $I_n$	
	Delay (tr) in sec	same as Overload Phase	
	Tolerance: +/- 0.5 sec	✓	✓
Short-Circuit	Protection: Enable/Disable	✓	✓
	Double S/C ON/OFF	✓	✓
	$I^2t$ ON/OFF	✓	✓
	Pick-Up $I_{Lo} = I_n \times \dots$	0.6 to 12 x $I_n$ in step of 0.05	
	Pick-Up $I_{Hi} = I_n \times \dots$	0.6 to 12 x $I_n$ in step of 0.05	
	Delay $I_{Hi}$ (ts)	20-100-200-300-400 ms	
	Delay $I_{Lo}$ (ts)	20-100-200-300-400 ms	
	Pre-alarm	0.5 to 0.95 in step of 0.05 x $I_s$	
	Cold Pick-Up ON/OFF	✓	✓
	Cold Delay	100 ms to 10s in step of 100ms	
	Tolerance: +/- 40 ms	✓	✓
Directional Short-Circuit	Protection: Enable/Disable	✓	✓
	Direction: Top/Bottom	✓	✓
	$I^2t$ ON/OFF	✓	✓
	Pick-up ( $I_s$ ): $I_n \times \dots$	0.6 to 12 x $I_n$ in step of 0.05	
	Delay (ts)	20-100-200-300-400 ms	
	Pre-alarm	0.5 to 0.95 in step of 0.05 x $I_s$	
	Cold Pick-Up ON/OFF	✓	✓
	Cold Delay	100 ms to 10s in step of 0.05 x $I_s$	
	Tolerance: +/- 40 ms	✓	✓
Instantaneous	Protection: Enable/Disable	✓	✓
	Pick-up ( $I_p$ )= $I_n \times \dots$	1.5 to 10 in step of 0.1; 10 to 15 in step of 1	
Earth-Fault	Protection: Enable/Disable	✓	✓
	$I^2t$ ON/OFF	✓	✓
	Pick-Up ( $I_g$ )= $I_n \times \dots$	0.1-0.2-0.3-0.4-0.5-0.6	
	$I^2t$ OFF (tg)	100 ms to 1s in step of 100 ms	
	$I^2t$ ON (tg)	100-200-300-400 ms	
	Pre-alarm	0.5 to 0.95 in step of 0.05 x $I_g$	
	Cold Pick-Up: ON/OFF	✓	✓
	Cold Delay	100ms to 5sec in step of 100 ms	
	Tolerance: +/- 60 ms	✓	✓



# Matrix Protection

## Technical Specification

### Advanced protection in UW-MTX 3.5/3.5T/3.5EC/3.5ET/3.5H/4.5/4.5T

Features	Parameter	UW-MTX3.5 Series*	UW-MTX4.5 Series
Under Current	Protection: Enable/Disable	✓	✓
	Pick-Up= $I_{rx}$ ...	0.2 to 0.8 in steps of 0.05	
	Delay	1 to 255 sec in steps of 1 sec	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 40 ms	✓	✓
Current Unbalance	Protection: Enable/Disable	✓	✓
	Pick-Up= $I_{nx}$ ...	10 to 90% in steps of 5%	
	Delay	500 ms to 60s in steps of 0.5s	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 40 ms	✓	✓
Under Voltage	Protection: Enable/Disable	✓	✓
	Pick-Up ( $V_s$ )= $V_{nx}$ ...	0.7 to 0.95 in steps of 0.01	
	Delay	100 ms to 5s in steps of 100 ms	
	$V_s$ reset	1.01/1.02/1.03/1.04 x $V_s$	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 0.15 sec	✓	✓
Over Voltage	Protection: Enable/Disable	✓	✓
	Pick-Up ( $V_s$ )= $V_{nx}$ ...	1.05 to 1.5 $V_n$ in steps of 0.01	
	Delay	100 ms to 5s in steps of 100 ms	
	$V_s$ reset	0.95 to 0.99 $V_s$ in steps of 0.01	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 0.15 sec	✓	✓
Voltage Unbalance	Protection: Enable/Disable	✓	✓
	Pick-Up ( $V_s$ )= $V_{nx}$ ...	5 to 20% in steps of 1%	
	Delay	500ms to 60s in steps of 0.5s	
	$V_s$ reset	0.95 to 0.99 x $V_s$ in steps of 0.01	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 0.15 sec	✓	✓
Residual Voltage	Protection: Enable/Disable	✓	✓
	Pick-Up ( $V_s$ )= $V_{nx}$ ...	0.15/0.2/0.25/0.3/0.4	
	Delay	100ms to 5s in steps of 100 ms	
	$V_s$ Reset	0.95 to 0.99 x $V_s$ in steps of 0.01	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 0.15 sec	✓	✓
Under Frequency	Protection: Enable/Disable	✓	✓
	Pick-Up ( $F_n$ )	45-50 Hz in steps of 0.1Hz	
	Delay	1-30 sec in steps of 0.1 sec	
	Reset Freq	1.01 to 1.05 x $F_n$ in steps of 0.01	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 0.15 sec	✓	✓
Over Frequency	Protection: Enable/Disable	✓	✓
	Pick-Up ( $F_n$ )	50-55 Hz in steps of 0.1 Hz	
	Delay	1-30 sec in steps of 0.1 sec	
	Reset Freq	0.95 to 0.99 x $F_n$ in steps of 0.01	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 0.15 sec	✓	✓
Reverse Power	Protection: Enable/Disable	✓	✓
	Pick-Up= $P_{nx}$ ...	0.05 to 0.4 in steps of 0.01	
	Delay	100ms to 20s in steps of 0.1s	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 0.5 sec	✓	✓

\*For Advanced Voltage based Protection in MTX 3.5/3.5T release, additional Power Metering module is required.

# Matrix Protection

## Technical Specification

Features	Parameter	UW-MTX3.5 Series	UW-MTX4.5 Series
Earth Leakage**	Mode: Trip/Alarm/Both	✓	✓
	Protection: Enable/Disable	✓	✓
	Pick-Up(Ir)	0.3 to 30A in steps of 0.1 A	
	Delay	100-200-300-400-500 ms	
Restricted EF**	Protection: Enable/Disable	✓	✓
	I <sup>2</sup> t: OFF/ON	✓	✓
	Pick-Up(Ig)=In x ...	0.1 to 0.6 in steps of 0.1	
	I <sup>2</sup> t OFF(tg)	100 ms to 5sec in step of 0.1s	
	I <sup>2</sup> t ON(tg)	100-200-300-400 ms	
	Pre-alarm	0.5 to 0.95 in step of 0.05 x Ig	
	Cold Pick-Up: ON/OFF	60 ms to 10s in step of 20ms	
	Mode: Trip/Alarm/Both	✓	✓

✓ Available \*\* Requires additional modules

### Advanced protection in UW-MTX 3.5/3.5T/3.5EC/3.5ET/3.5H/4.5/4.5T

Features	Parameter	UW-MTX3.5 Series*	UW-MTX4.5 Series
Leading PF	Protection: Enable/Disable	✓	✓
	Pick-Up=PF x ...	0.5 to 0.99 in steps of 0.01	
	Delay	1/2/3/4/5 sec	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 0.5 sec	✓	✓
Lagging PF	Protection: Enable/Disable	✓	✓
	Pick-Up=PF x ...	0.5 to 0.99 in steps of 0.01	
	Delay	1/2/3/4/5 sec	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 0.5 sec	✓	✓
MD Active	Protection: Enable/Disable	✓	✓
	Type	Deliver/Receive	
	Pick-Up=En x ...	0.4 to 1 in steps of 0.01	
	Mode: Trip/Alarm/Both	✓	✓
MD Reactive	Protection: Enable/Disable	✓	✓
	Type	Deliver/Receive	
	Pick-Up=En x ...	0.4 to 1 in steps of 0.01	
	Mode: Trip/Alarm/Both	✓	✓
MD Apparent	Protection: Enable/Disable	✓	✓
	Type	Deliver/Receive	
	Pick-Up=En x ...	0.4 to 1 in steps of 0.01	
	Mode: Trip/Alarm/Both	✓	✓
Phase Sequence	Protection: Enable/Disable	✓	✓
	Delay	100ms to 5s in steps of 100ms	
	Mode: Trip/Alarm/Both	✓	✓
	Tolerance: +/- 0.25 sec	✓	✓
Breaker Failure	Protection: Enable/Disable	✓	✓
	Delay	50ms to 2sec in steps of 0.05sec	

✓ Available

\* Requires Power Metering module for Advanced protections in MTX 3.5 Release.

# Matrix Protection

## Technical Specification

### Metering Functions

Parameter	Screen abbreviation	Details	UW-MTX3.5 Series	UW-MTX4.5 Series
Current	I	Phase, Neutral and Earth	✓	✓
	I <sub>Δ</sub> , IREF <sup>\$</sup>	Earth Leakage, Restricted EF Current	✓	✓
	I max	Maximum Running Current Per Phase	✓	✓
	% Load	Percentage Loading Per Phase	✓	✓
	Avg. I	Average Phase Current	✓	✓
		Tolerance: +/- 5%	✓	✓
Voltage	V	Phase-Neutral Voltage*	✓	✓
	Max V	Maximum Voltage Per Phase*	✓	✓
	V12	Ph-Ph Voltage*	✓	✓
	Max V12	Maximum Ph-Ph Voltage*	✓	✓
	Avg. Vp-p	Average Ph-Ph Voltage*	✓	✓
	Avg Vp-n	Average Ph-N Voltage*	✓	✓
		Tolerance: +/- 2%	✓	✓
Frequency	F	System Frequency*	✓	✓
		Tolerance: +/- 0.01 Hz		
Power Factor	PF	System Power Factor*	✓	✓
Power	W	Active Power Per Phase and Total (kW)*	✓	✓
	VAr	Reactive Power Per Phase and Total (kVar)*	✓	✓
	VA	Apparent Power Per Phase and Total (kVA)*	✓	✓
		Tolerance: +/- 5%		
Energy	Wh	Active Energy Per Phase and Total (kWh)*	✓	✓
	VArh	Reactive Energy Per Phase and Total (kVarh)*	✓	✓
	VAh	Apparent Energy Per Phase and Total (kVAh)*	✓	✓
Max Demand	Wh	Active Energy*	✓	✓
	VArh	Reactive Energy*	✓	✓
	VAh	Apparent Energy*	✓	✓
Temperature <sup>#</sup>	Ø	Temperature Per Phase & Neutral (°C)	✓	✓
Harmonics Metering**	THD, Current & Voltage components	Phase-1, 2 & 3-Total, Fundamental, THD	-	✓

<sup>\$</sup> Requires additional REF module

\* For these metering functions in MTX 3.5/MTX 3.5T releases, additional Power Metering module is required.

<sup>#</sup> Requires Temperature module

\*\* Available only in MTX 3.5H & MTX 4.5 Series

# Matrix Release Factory Settings

## Protection Settings for UW-MTX1.0/1G/1Gi/1.5G/1.5Gi

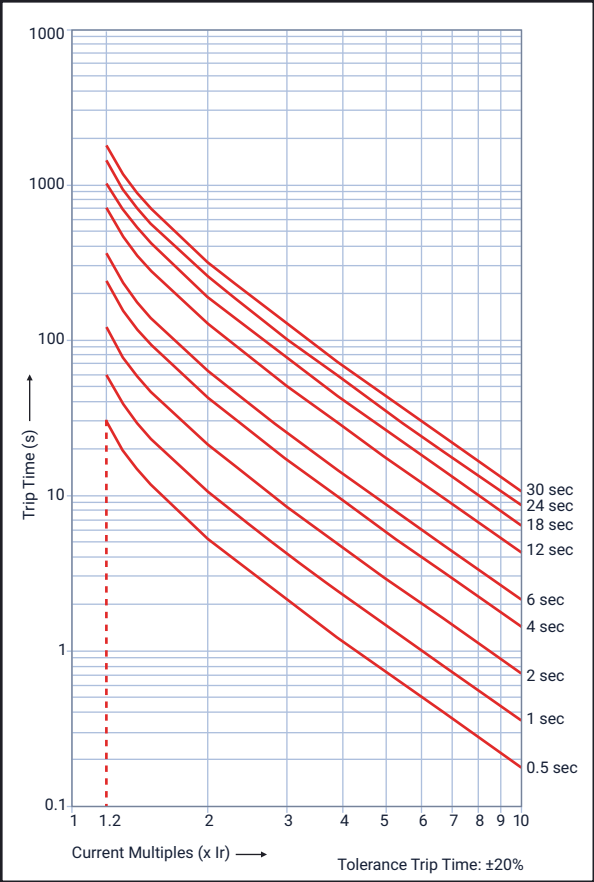
Parameters		MTX1.0	MTX1G	MTX1Gi	MTX1.5G	MTX1.5Gi	Factory Settings
Overload (Phase)	Protection: Enable/Disable	✓	✓	✓	✓	✓	Enable
	Pick-up (Ir)=In x... for I²t	OFF- 0.4-0.5-0.6-0.7-0.8-0.85-0.9-0.95-1					1
	Delay (tr) in sec	10	0.5-1-2-4-6-12-18-24-30				12
	Pre-alarm	0.9 x Ir(fixed)					-
	Thermal Memory ON/OFF	✓	✓	✓	✓	✓	OFF
Overload (Neutral)	Protection: Enable/Disable	-	✓	✓	✓	✓	Disable
	Pick-up (In)=Ir X...	-	50%-100%-150%-200%				50%
	Pre-alarm	-	0.8 x In (fixed)				-
	Delay (tr) in s	-	Same as Overload Phase				-
Short-Circuit	Protection: Enable/Disable	-	-	-	-	-	Enable
	I²t ON/OFF	✓	✓	✓	✓	✓	OFF
	Pick-up (Is)=In x...	0.6-1-1.5-2-3-4-6-8-10-12					6In
	Delay (ts)	20-100-200-300-400 ms					400ms
	Pre-alarm	0.5 x Is (fixed)					-
Instantaneous	Protection: Enable/Disable	✓	✓	✓	✓	✓	Disable
	Pick-up (Ip)=In x.		OFF-1.5-2-3-4-6-8-10-12-15				10In
Earth-Fault	Protection: Enable/Disable..	-	✓	✓	✓	✓	Enable
	I²t : ON/OFF	-	✓	✓	✓	✓	OFF
	Pick-up (Ig)=In x...	OFF-0.2-0.3-0.4-0.5-0.6					0.6 In
	I²t OFF (tg)	0.1-0.2-0.3-0.4-1					1
	I²t ON (tg)	0.1-0.2-0.3-0.4					
	Pre-alarm	0.8 x Ig (fixed)					
Inbuilt-ZSI	Short Circuit Enable/Disable	-	-	✓	-	✓	Disable
	Earth Fault Enable/Disable	-	-	✓	-	✓	Disable



# Matrix Protection Curves

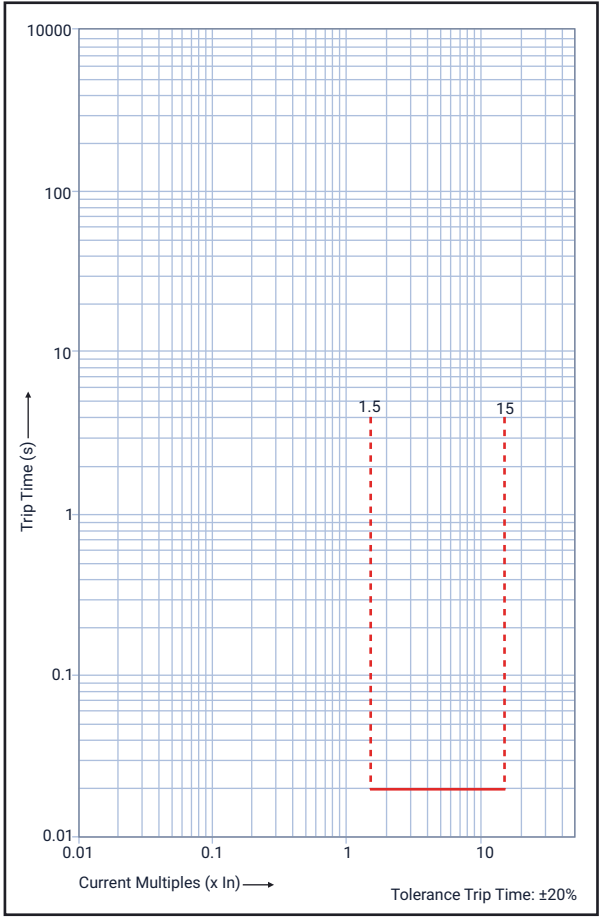
## Overload $I^2t$

(UW-MTX 1.0/1G/1Gi/1.5G/1.5Gi/3.5 Series/4.5 Series)



## Instantaneous

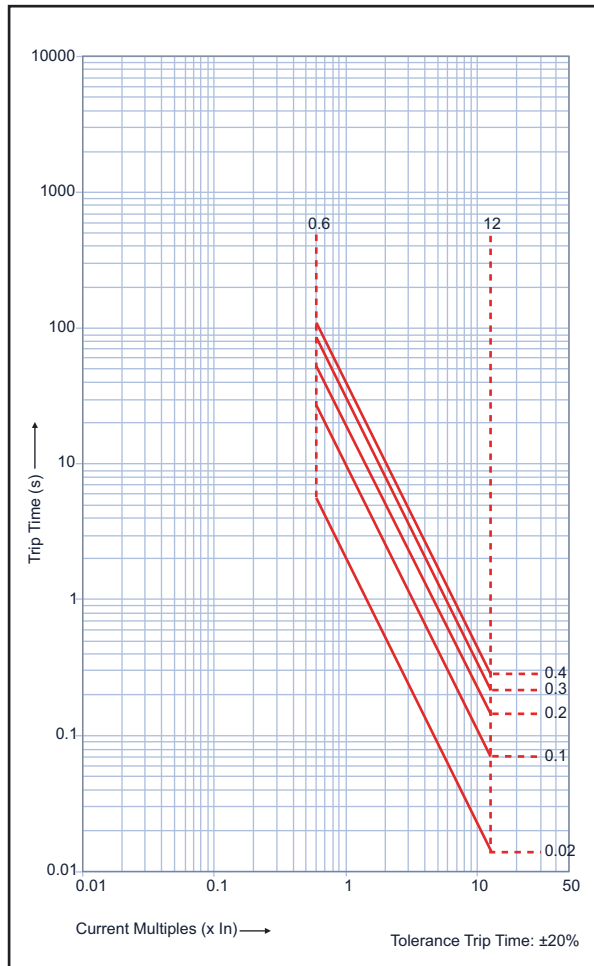
(UW-MTX 1.0/1G/1Gi/1.5G/1.5Gi/3.5 Series/4.5 Series)



# Matrix Protection Curves

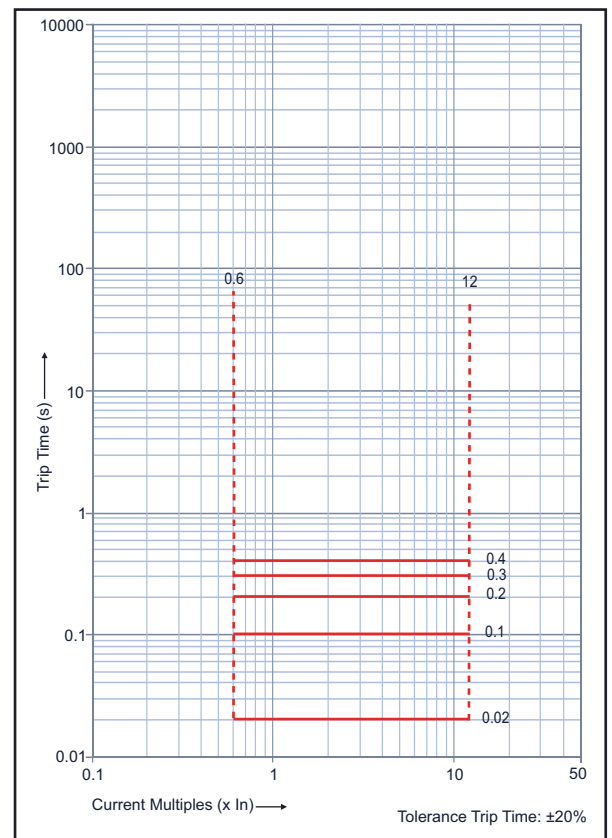
## Short-Circuit $I^2t$ ON

(UW-MTX 1.0/1G/1Gi/1.5G/1.5Gi/3.5 Series/4.5 Series)



## Short-Circuit $I^2t$ OFF

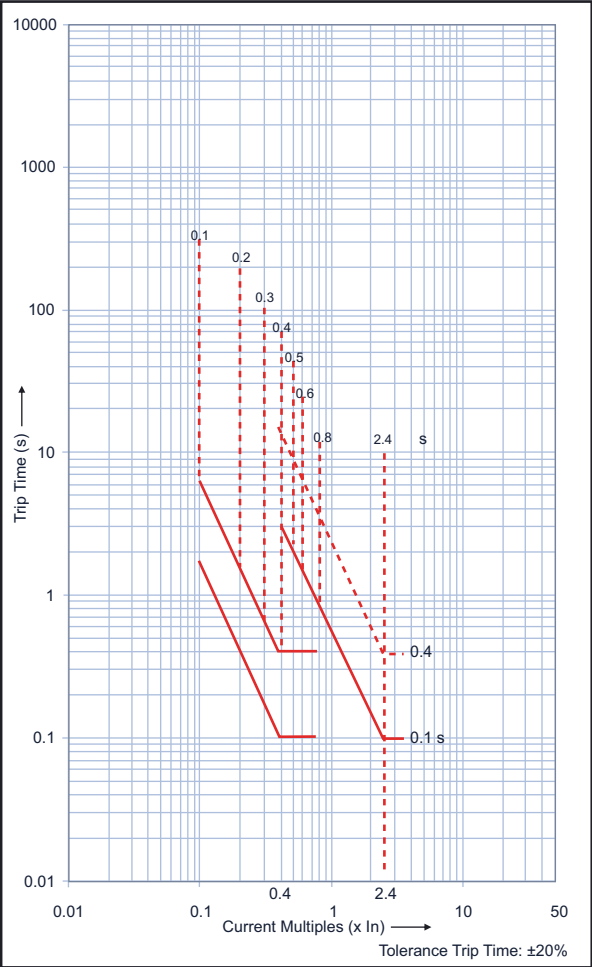
(UW-MTX 1.0/1G/1Gi/1.5G/1.5Gi/3.5 Series/4.5 Series)



# Matrix Protection Curves

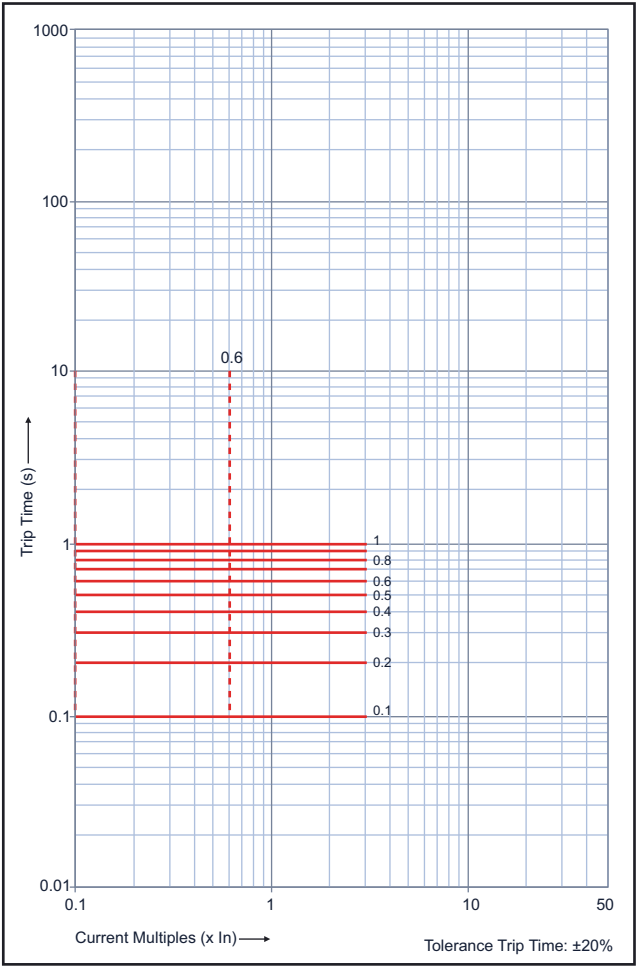
## Ground Fault - $I^2t$ ON

(UW-MTX 1G/1.5G/1.5Gi/3.5 Series/4.5 Series)



## Ground Fault - $I^2t$ OFF

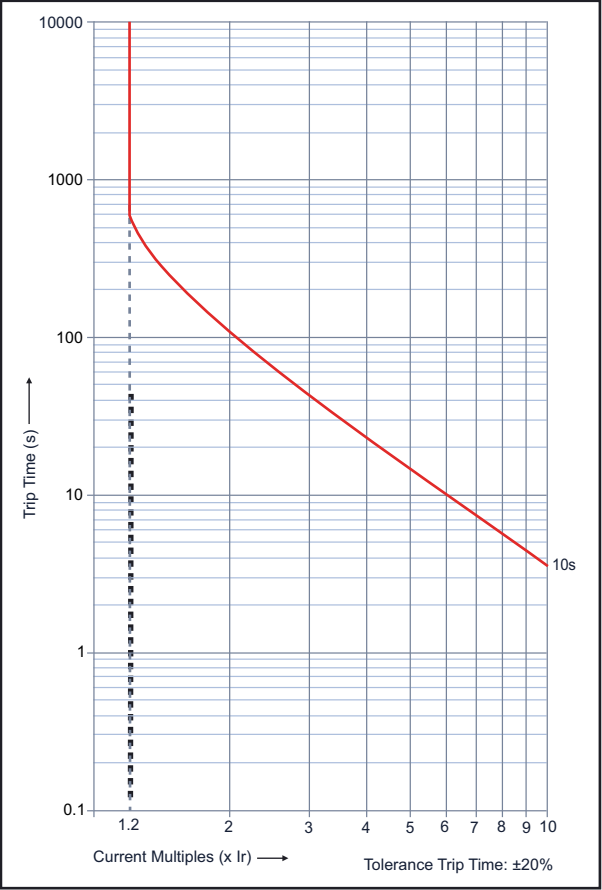
(UW-MTX 1G/1.5G/1.5Gi/3.5 Series/4.5 Series)



# Matrix Protection Curves

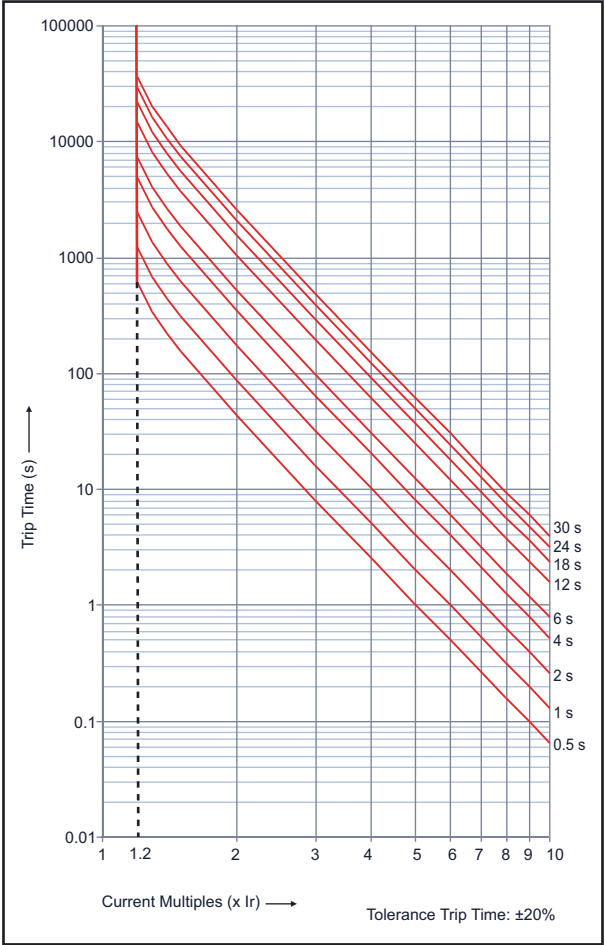
## Overload $I^2t$

(UW-MTX 1.0)



## Overload $I^4t$

(UW-MTX 3.5 Series/4.5 Series)

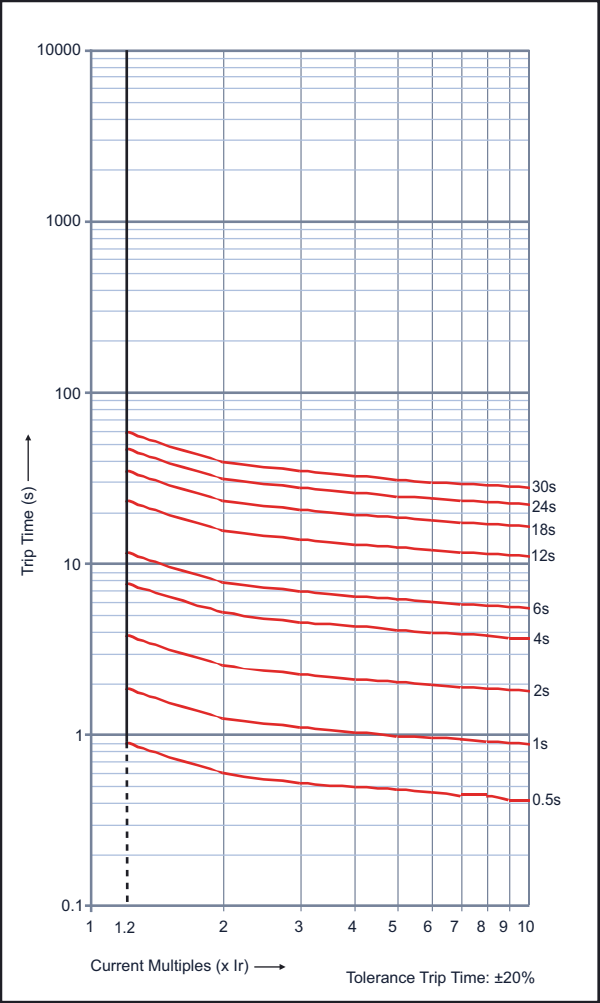




# Matrix Protection Curves

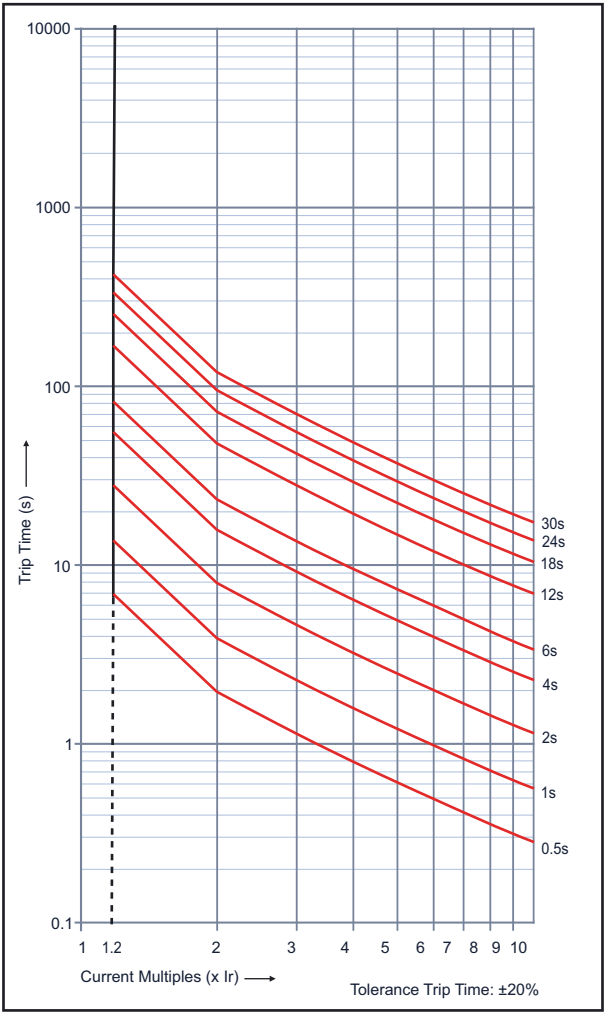
## Overload - SI

(UW-MTX 3.5 Series/4.5 Series)



## Overload - LI/VI

(UW-MTX 3.5 Series/4.5 Series)



# Protection Settings

## Overload Protection (L or ANSI 51)

Overload protection also known as Long-time protection, refers to safeguarding installations like BBT, busbars and cables from excessive current for extended periods. It is an over current time dependant protection which follows a magnitude-duration curve of current to determine corresponding trip time. As the current increases, the trip time decreases to ensure that the breaker trips quickly in the event of a fault. Rated current ( $I_r$ ) is the maximum amount of current that the feeder can carry for infinite time continuously without any damage. If current is higher than the rated current then the feeder will be able to sustain the current for a definite time after which the insulation of cables will melt which can create hazardous condition. This happens because of the temperature rises above the desired value.

The temperature value corresponding to the insulation breakdown threshold is reached in a definite time inversely proportional to the fault current flowing through the feeder. Greater the fault current, lower is the time in which the temperature reaches the threshold. This concept provides the basis of IDMT (Inverse Definite Minimum Time defined by IEC 60255) curve-based overload protection where the trip time is inversely proportional to the fault current. MTX1.0 and MTX1.5 series, follows only I2T curve whereas in MTX3.5 series, the type of curves are selectable as follows

- › SI – Standard Inverse (I0.02t)
- › VI – Very Inverse (It)
- › Extremely Inverse- I2T
- › High Inverse - I4T

## Thermal Memory

The thermal memory function helps to protect cables and busbars from overheating in case of repetitive faults. Such faults can be due to repetitive motor starts, fluctuating load, intermittent ground faults, or subsequent closing after an electrical fault. Each overload involves a temperature rise in the installation. The cumulative effect of successive overloads can overheat the system. Thanks to its thermal memory function, the trip unit remembers and integrates thermal heating caused by each overload detected above the threshold setting.

- › Before tripping, the integrated heating value reduces the associated time delay. The reaction of the control unit is closer to the real heating of the power network system.
- › After tripping, the thermal function reduces the time delay when closing the circuit breaker on an overload.

If the thermal memory is disabled the trip time follows the curve selected and delay settings. Whereas, if TM is enabled then the associated time delay is reduced.

- › This protection is available in MTX1G, MTX1.5 and MTX3.5 series and MTX4.5 series

## Neutral Overload

Neutral Protection has the same characteristics of Overload protection for phases. The pickup value is multiple of Overload pickup for phase. It is settable at 50%, 100% and 200% of  $I_r$  (Overload pickup). It follows the same trip time setting as

selected for phase overload.

- › This protection is available in MTX1.0, MTX1.5 and MTX3.5 series and MTX4.5 series

## Short Circuit Protection (S or ANSI 50TD/51)

Short-time over current protection helps to protect equipment against phase-to-phase, phase-to-neutral and phase-to-ground short circuits. A short circuit occurs when a low-resistance path(short) is created between two conductors, causing an abnormal flow of current leading to a sudden and excessive current surge, potentially causing damage to the electrical system, fire hazards, or equipment failure. The short-time or short-circuit protection in MTX releases protects the installation against short-circuits with selectivity between two characteristics:

- a. I2t OFF definite time characteristics
- b. I2t ON inverse time characteristics

### With I2t ON.

- › Up to 10  $I_r$ , the tripping curve is an inverse time curve. The time delay decreases as the current increases.
- › Above 10  $I_r$ , the tripping curve is a definite time curve with a constant tripping time.

### With I2t OFF.

- › The tripping curve is a definite time curve with a constant tripping time.
- › This protection is available in MTX1.0, MTX1.5 and MTX3.5 series and MTX4.5 series

# Protection Settings

## Directional Short Circuit (ANSI 67)

Directional Short circuit protection helps to protect an installation against short-circuit currents that could circulate in

both directions through the circuit breaker. (Top/Bottom) The direction of the current is settable in the trip unit. This protection is available in MTX3.5 series and above

## Instantaneous Protection (I or ANSI 50)

Instantaneous protection helps to protect equipment against phase-to-phase, phase-to-neutral and phase-to-ground short circuits. The protection operates with a definite time characteristic. It trips without additional time delay as soon as the setting current is exceeded. Instantaneous protection is interlocked with Short Circuit protection. At a time either of the

protection must be enabled. Instantaneous protection overrides short-circuit protection when the instantaneous threshold is adjusted to the same or a lower setting than the short-circuit threshold.

- › This protection is available in MTX1.0, MTX1.5 and MTX3.5 series and MTX4.5 Series

## Earth Fault Protection (G or ANSI 50N-TD/51N)

Earth-fault protection provides protection against phase-to-earth fault, which is more sensitive than protection based on phase current only. It is generally used in TN-S systems but could also be used in other earthing systems.

**Note:** Earth-fault protection is also called Ground-fault protection. Earth-fault protection is based on the vector summation of the phases and neutral current

$I_g = I_R + I_Y + I_B$  ...3 pole system  
 $I_g = I_R + I_Y + I_B + I_N$  ...4 pole system

To mitigate the risks associated with earth faults that occurs due to an unintended electrical connection occurs between an energized conductor and the earth or ground. Earth or ground fault protection is provided with selectable pickup and delay settings with two characteristics:

- 12t OFF definite time characteristics
- 12t ON inverse time characteristics

**Note:** 10% Earth Fault pickup setting is provided by the release only if 24V Aux supply is available.

- › This protection is available in MTX1G, MTX1.5G and MTX3.5 series and MTX4.5 Series

## Restricted Earth Fault Protection (ANSI 87N)

Restricted E/F protection is used to protect the star winding of transformer or generator against earth faults. In case of transformer, sometimes there arises a condition when some of the turns come in the contact of earthed parts instead of entire winding. In this situation, the fault current may be too low to be detected by the upstream breaker installed at the primary side (as the current is much lower at the HV side) and fault may persist ultimately damaging the winding permanently. To avoid this situation and protecting the transformer from such faults, REF protection scheme is employed on the LV side of the transformer. Similarly, in generators if earth fault occurs on the generator winding, generator protection scheme may not be able to sense the fault. To avoid this situation, REF protection is employed in the winding to protect it against earth faults. During earth fault, current leaks through the body of the equipment. A person in contact of such equipment may get severe shock. As

REF protection scheme is very sensitive, it prevents equipment and personnel damage. Zone of protection of REF scheme depends upon the position of CTs. There are two zones of occurrence of the fault,

- Outside the vicinity of protection scheme (external earth fault).
- Within the vicinity of protection scheme (internal earth fault).

- › This protection is available in MTX3.5 series and above using REF module. This module can also be used as a standalone module. It detects the zone of Earth fault in restricted zone i.e upstream of the breaker upto the transformer and requires specified external CTs. This module is DIN rail / Base mountable. For external indications, it offers NO contact OP1-OP2 (24Vdc/240Vac, 6A).

# Protection Settings

## Earth Leakage Protection (ANSI 50G-TD)

Earth-leakage protection is a residual current protection or earth fault protection with a very high sensitivity. It is generally used in TT or IT earthing systems.

- › This protection is available in MTX3.5 series and above using

EL module. This module can also be used as a standalone module. It monitors Earth leakages using specified CTs. This module is DIN rail / Base mountable. For external indications, it offers NO contact (24Vdc/240Vac, 6A).

## Undercurrent Protection (ANSI 37)

Undercurrent protection can also refer to the function that detects the passing current in a feeder after the opening of the in-feed circuit breaker and the loss of loads. This function operates when the current decreases below a predetermined value. Undercurrent can cause alarms or disconnection of the

motor in case a low current value is detected, revealing a no-load condition. For example, this can happen in the case of a broken shaft, pump drain, or cavitation.

- › This protection is available in MTX3.5 series and above.

## Current / Voltage Unbalance Protection (ANSI 46/47)

Current unbalance protection is a mechanism that detects and prevents unbalanced currents in motor operation. This protects the motor from damage and improves its reliability and performance. Current unbalance is the maximum deviation of any current phase from the average current, divided by the average current, and is often expressed as a percentage. Current unbalance can be caused by unbalanced phase voltage, an unbalanced number of turns in the windings, and an uneven air gap. Unbalanced currents can lead to:

- › Torque pulsations
- › Increased vibrations and mechanical stresses
- › Increased losses resulting in lower efficiency
- › Motor overheating, which reduces winding insulation life

Unbalance in the voltage is often caused by unbalance in the current. An unbalance protection system serves two primary functions:

- › It provides over voltage protection to capacitors. These over voltages are primarily caused by blown fuses and can cause damage to the capacitors.
- › It provides blown fuse indication.
- › This protection is available in MTX3.5 series and above.

## Under / Over Voltage Protection (ANSI 27/59)

Overvoltage and undervoltage protection systems protect electrical and electronic appliances from damage caused by sudden changes in mains voltage. The protection logic trips the circuit breaker or gives an alarm when the voltage goes outside the set voltage limits. In addition, the constant monitoring of phase-to-phase or phase-to-neutral voltages enables

appropriate action to be initiated to safeguard the operation of the installation during abnormal or critical situations, for example, load shedding, source change-over, and emergency generator starting.

- › This protection is available in MTX3.5 series and above.

## Residual Voltage Protection (ANSI 59N)

Residual voltage is the voltage that remains even after the power is switched off, mainly due to the components that store electrical charges, such as capacitors, inductors, and filter components. If residual voltage is too large, it may cause harm

to the human body. The presence of a residual voltage may lead to irreversible chemical reactions at the electrode-tissue interface and cause tissue damage.

- › This protection is available in MTX3.5 series and above.

# Protection Settings

## Under / Over Frequency Protection (ANSI 81U/81O)

Under/Over frequency protection is used whenever deviations from nominal system frequency need to be detected. Frequency deviations can be harmful to connected objects, such as generators and motors, or when abnormal frequency creates inconvenience for power consumers and may cause failures of electrical apparatuses. It is also used where detection of high or low frequency indicates system abnormalities, such as faults in speed regulation units or system overload. Under frequency

protection should be considered for applications where the detection of underspeed conditions for synchronous motors and condensers is required. Whereas, Overfrequency protection is generally utilized for the protection of AC machines from possible damage due to overspeed conditions.

- › This protection is available in MTX3.5 series and above.

## Reverse Power Protection (ANSI 32P)

Reverse power protection is a feature in electrical systems that prevents power from flowing in the opposite direction of normal operation. It's essential when power can flow in the reverse direction, such as when generators are connected to an electrical grid or in parallel operation. It is a protective feature

employed in electrical systems to prevent power flow from an external power source back into a generator or a power supply. The protection is activated when Active Power is negative and the threshold setting is crossed.

- › This protection is available in MTX3.5 series and above.

## Leading / Lagging Power Factor Protection (ANSI 55)

Leading power factor is when the current in a circuit is advanced in phase with respect to the voltage, while lagging power factor is when the current lags behind the voltage. A leading power factor is produced by a capacitive load, while a lagging power factor is produced by an inductive load. Leading power factor

can produce dangerous over-voltages, which can cause excessive torques in an alternator or motor. Lagging power factor indicates that the load is inductive, as the load will consume reactive power.

- › This protection is available in MTX3.5 series and above.

## MD Active / Reactive / Apparent Protection

Maximum demand protection is a way to avoid penalties on an electricity bill by ensuring that the maximum demand value does not exceed the contracted power. The maximum demand value is the average of the instantaneous power over a defined

time interval. If the maximum demand value is higher than the contracted power, there will be a penalty.

- › This protection is available in MTX3.5 series and above.

## Phase Sequence Protection (ANSI 47)

Phase sequence protection continuously monitors three-phase electrical systems for phase rotation and prevents damage from a sequence change. They are commonly used in industrial and commercial applications to protect equipment from phase sequence reversal or incorrect phase sequence. phase

sequence protection is critical on elevators, conveyors, and pumps, anywhere where direction of rotation is important.

- › This protection is available in MTX3.5 series and above.



# Matrix Protection & Control Units

## Over Voltage Causes and Effects

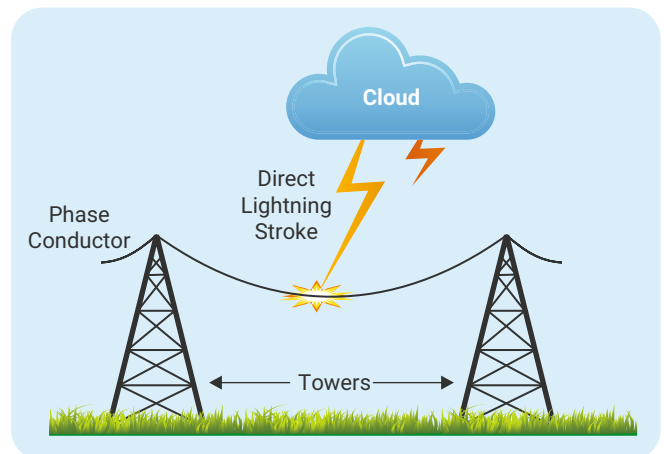
Over voltage (or surges) in the power system are the abrupt rise in the voltage level in the system. There could be several reasons for over voltage. The normal operating voltages of the system do not stress the insulation severely. But the voltage stresses due to over voltages can be so high that they may

become dangerous to both the cables and the connected equipment and may cause damage, unless some protective measure against the over-voltages are taken. Over-voltages occurrence in the system can be categorized by reasons:

### External Over Voltages

These over-voltages originate from the atmospheric disturbances, mainly due to lightning. These over-voltages take the form of a unidirectional impulse whose maximum possible amplitude has no direct relation with the operating voltage of the system. They may be due to any one of the following causes:

- › Direct Lightning Strokes
- › Electromagnetically induced voltages due to the lightning discharge near the line (sidestroke)
- › Voltage induced due to the changing atmospheric condition along the transmission line
- › Electrostatically induced over voltages due to the presence of the charged clouds
- › Due to the friction of the charged particles like dust, snow in the atmosphere or due to change in the altitude of the line



### Internal Over Voltages

Caused due to changes in the operating condition of the network. Can be further classified in two groups:

#### › Switching or transient over voltages

These over voltages are generally of oscillatory nature caused by the transient phenomena which appears when the state of the network is changed by switching operation or a fault condition.

The frequency of the oscillations is governed by the inherent inductance and capacitance of the system & may vary from few hundred Hz to few kHz

Fore.g.

- › Switching ON & OFF of equipment, like switching of high voltage reactors or switching of transformer on no load

› If fault occurs in any one phase the voltage of other phases with respect to the ground increases until the faults get cleared

› Because of the re-striking voltage across the contacts of the breaker, when breaker has tripped on fault, voltage of amplitude nearly twice the system voltage and relatively high frequency gets generated

#### › Steady-state or temporary over voltages

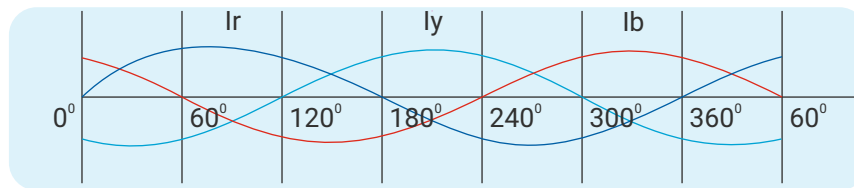
These are over voltages developed due to the disconnection of loads at power frequency.

# Matrix Protection & Control Units

## Linear Loads

The AC loads are called linear loads when the current and voltage resultant waveform is sinusoidal in nature (i.e. Not distorted). Also the current at any instant is proportional to the voltage at that instant.

Thus in linear systems there are no harmonic components in current and the voltage waveforms. e.g. Heaters, Power factor improvement capacitors, etc.



CURRENT WAVE FOR LINEAR LOAD

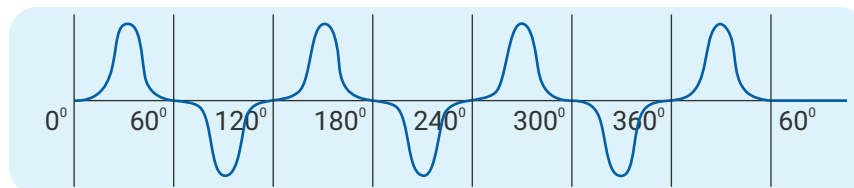
3 PHASE FUNDAMENTAL WAVE  
RESULTANT CURRENT  $I = I_r + I_y + I_b = 0$

## Non-Linear Loads

The AC loads which cause the current waveform to distort from the normal sinusoidal nature are called as non-linear loads. Current distortion leads to the distortion of the voltage waveform also. Thus the voltage and current are no longer proportional. The distorted current and the voltage waveforms can be decomposed into pure sinusoidal and associated frequencies of the higher order through Fourier Transformation.

Harmonic spectrum gives a clear analysis of amount and order of the harmonics present in the system, which helps in the designing the filter for the system.

**Example:** SMPS, Rectifiers, PLC, Electronic Ballasts, Laser Printers, Computers, etc.



CURRENT WAVEFORM FOR NON-LINEAR LOAD

RESULTANT CURRENT  
WITH 3rd HARMONICS  
RESULTANT CURRENT  $I = I_r + I_y + I_b$

# Matrix Protection & Control Units

## Harmonic Spectrum

Harmonics are basically the sinusoidal component of the periodic wave with frequency that is an integral multiple of the fundamental frequency. Harmonics content purely determines the quality of power. Having harmonics in the system will affect the system and the severity of effect on the system/equipment will depend on the stiffness of the system and the amount of the harmonic pollution.

### Harmonics can be generated in the system because of the following reasons

- » Non-linear loads generate current harmonics
- » Harmonic currents flow largely through capacitors
- » Harmonic currents also flow through network
- » The flow of harmonic currents causes voltage harmonics
- » Harmonics are thus injected to other linear loads connected in the same bus
- » Harmonics injected into the network flow towards other users connected to the network

### Some of the typical loads causing the generation of the harmonics in the system are

- » **Equipment using switched mode power supply:**
  - » Television
  - » Computers, other IT loads
- » **Equipment using power electronic devices:**
  - » AC & DC drives
  - » Frequency converters
  - » Rectifiers
  - » Arc & induction furnaces
  - » UPS

### Some of the typical results of the harmonics in the system

- » Neutral over current: Odd triplen harmonics because of its additive nature adds up in the Neutral current causing the overheating of the neutral.
- » **As shown in the Fig.1**
  - » Any odd triplen harmonic when multiplied by 120 degrees will always produce the product which is integral multiple of the 360 degrees. Thus being shifted by integral multiples of the 360 degrees, the odd triplen harmonics will always be in Phase with each other in neutral.
  - » Incorrect readings: In case of induction disc W-hr meters and averaging type current meters
  - » Additional losses in capacitors and rotating machines
  - » Reduced true PF:  $PF = \text{watts}/VA$
  - » Transformer overheating especially delta windings where triplen harmonics generated on the load side of a delta-wye transformer will circulate in the primary side. Some type of losses go up as the square of harmonic value (such as skin effect and eddy current losses). This is also true for solenoid coils and lighting ballasts.
  - » Zero, negative sequence voltages on motors and generators. In a balanced system, voltage harmonics can either be positive (fundamental, 4th, 7th...), negative (2nd, 5th, 8th...) or zero (3rd, 6th, 9th,...) sequencing values. This means that the voltage at that particular frequency tries to rotate the motor forward, backward, or neither (just heats up the motor), Respectively. There is also heating from increased losses as in a transformer.

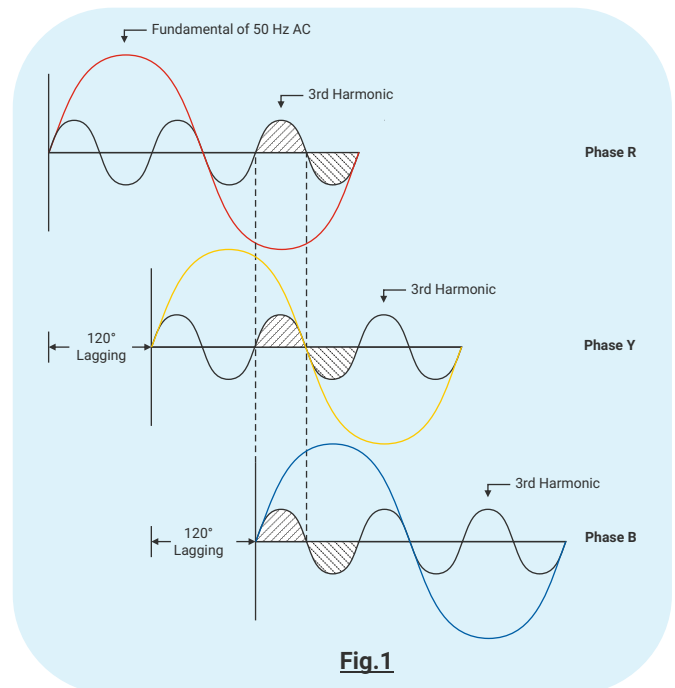
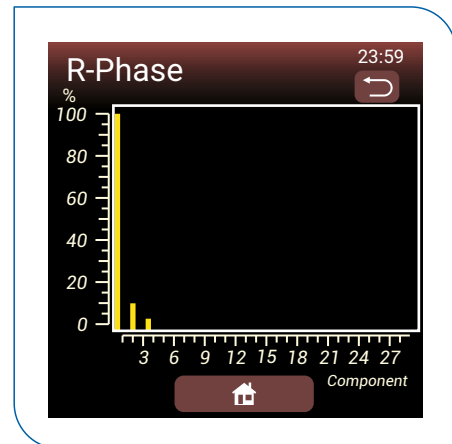


Fig.1

# Matrix Protection & Control Units

Harmonic order	1	2	3	4	5	6	7	8	9
Phase	+	-	0	+	-	0	+	-	0

- » Nuisance operation of protective devices, including false tripping of relays and failure of a UPS to transfer properly, especially if controls incorporate zero crossing sensing circuits.
- » Bearing failure from shaft currents through uninsulated bearings of electric motors.
- » Blown-fuses on PF correction caps, due to high voltage and currents from resonance with line impedance.
- » Mis-operation or failure of electronic equipment.
- » If there are voltage sub-harmonics in the range of 1-30Hz, the effect on lighting is called flicker. This is especially true at 8.8Hz, where the human eye is most sensitive, and just 0.5% variation in the voltage is noticeable with some types of lighting.

## Total Harmonic Distortion

Power sources act as non-linear loads, drawing a distorted waveform that contains harmonics. These harmonics can cause problems ranging from telephone transmission interference to degradation of conductors and insulating material in motors and transformers. Therefore it is important to gauge the total effect of these harmonics. The summation of all harmonics in a system is known as Total Harmonic Distortion (THD).

Harmonics have frequencies that are integral multiples of the waveform's fundamental frequency. For example, given a 50Hz

fundamental waveform, the 2nd, 3rd, 4th and 5th harmonic components will be at 100Hz, 150Hz, 200Hz and 250Hz respectively. Thus, harmonic distortion is the degree to which a waveform deviates from its pure sinusoidal values as a result of the summation of all these harmonic elements.

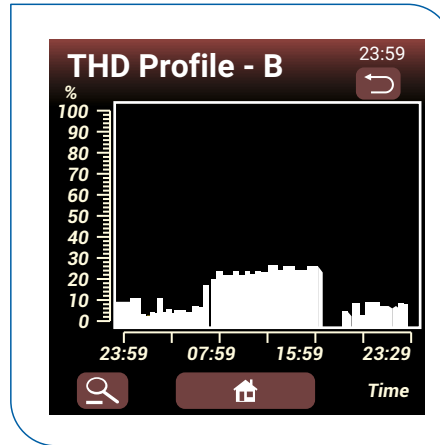
The ideal sine wave has zero harmonic components. In that case, there is nothing to distort this perfect wave. Total Harmonic Distortion or THD, is the summation of all harmonic components of the current waveform compared against the fundamental component of the current wave:

$$THD = \left[ \frac{\sqrt{I_2^2 + I_3^2 + I_4^2 + \dots + I_n^2}}{I_1} \times 100 \right] \%$$

The formula above shows the calculation for THD on a current signal. The end result is a percentage comparing the harmonic components to the fundamental component of a signal. The higher the percentage, the more distortion that is present on the mains signal.

# Matrix Protection & Control Units

## THD Profiling



## Crest Factor (CF)

- › The Crest Factor of a power source is defined as:  $I_{\text{peak}} / I_{\text{RMS}}$

Crest Factor is an important parameter to understand when trying to take accurate measurements of low frequency signals.

**CF for sine wave = 1.414**

However, the Crest Factor for a non-sinusoidal current waveform can differ dramatically for loads that are not power factor corrected, such as a switching power supply or lamp ballast, which gives a current waveform that is short in duration but high in amplitude. CF specified in various communication devices QPSK, QAM, WCDMA should be maintained in the system for reliable communication.

## Form Factor (FF)

- › The Form Factor of a power source is defined as:  $I_{\text{RMS}} / I_{\text{avg}}$

**FF for pure sine wave = 1.11**

FF remains independent of the amplitude of the waveform and will remain same for a particular waveform.

## Peak Factor (PF)

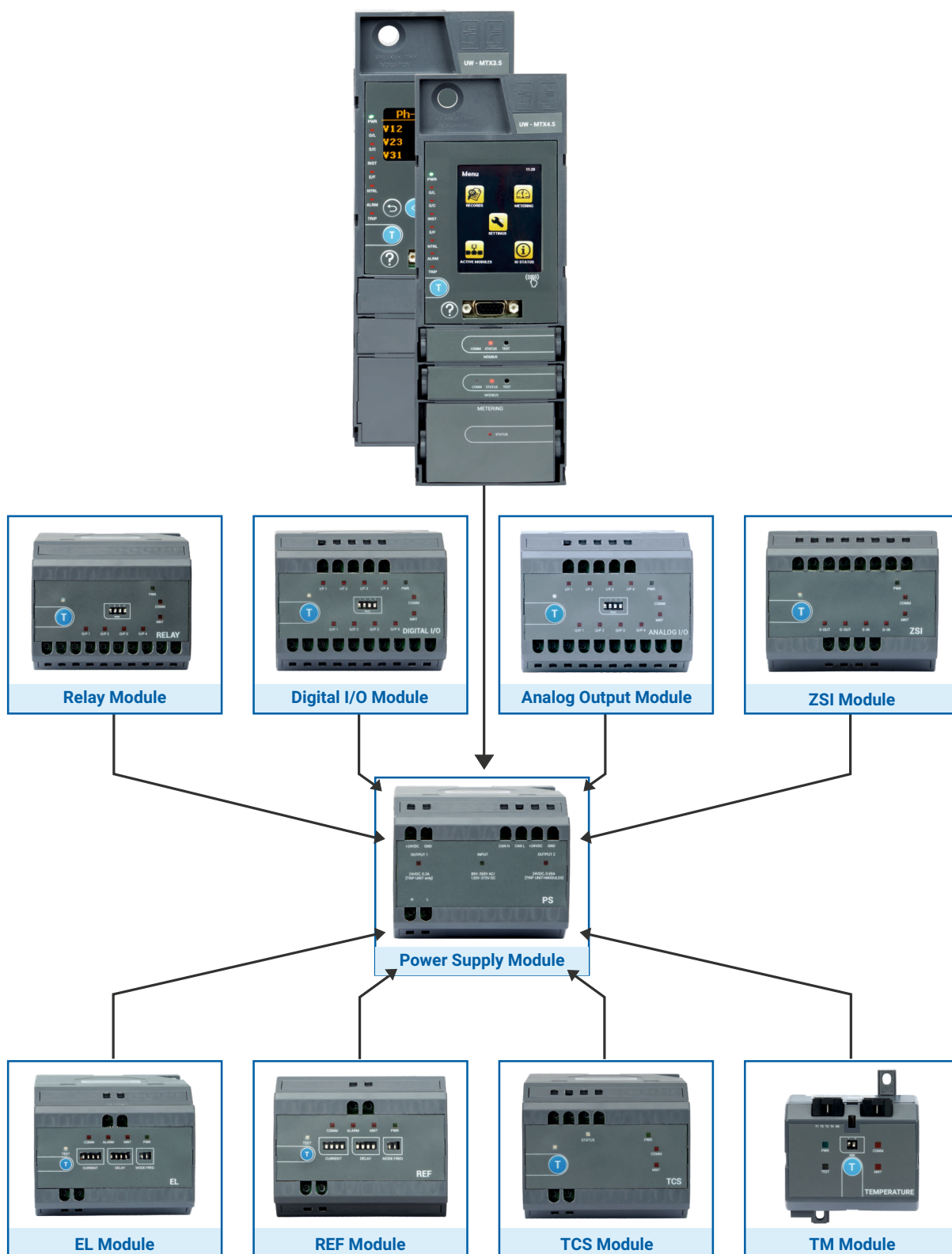
- › The Peak Factor of a power source is defined as:  $I_{\text{peak}} / I_{\text{avg}}$

All the above power quality indicators are inbuilt in MTX 4.5 Series.

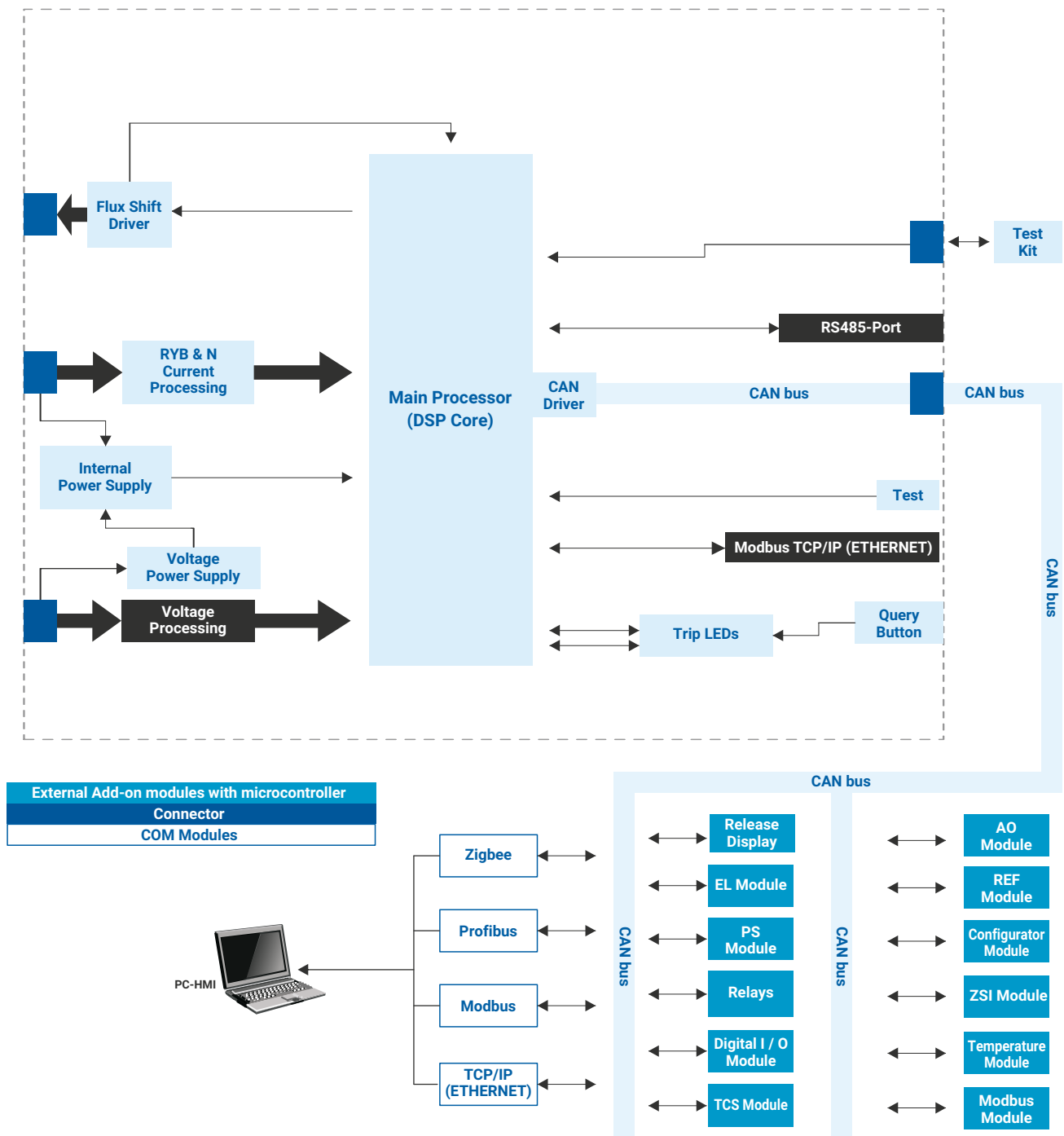


# Matrix Modules Architecture

## Release System Architecture with Supplementary Modules



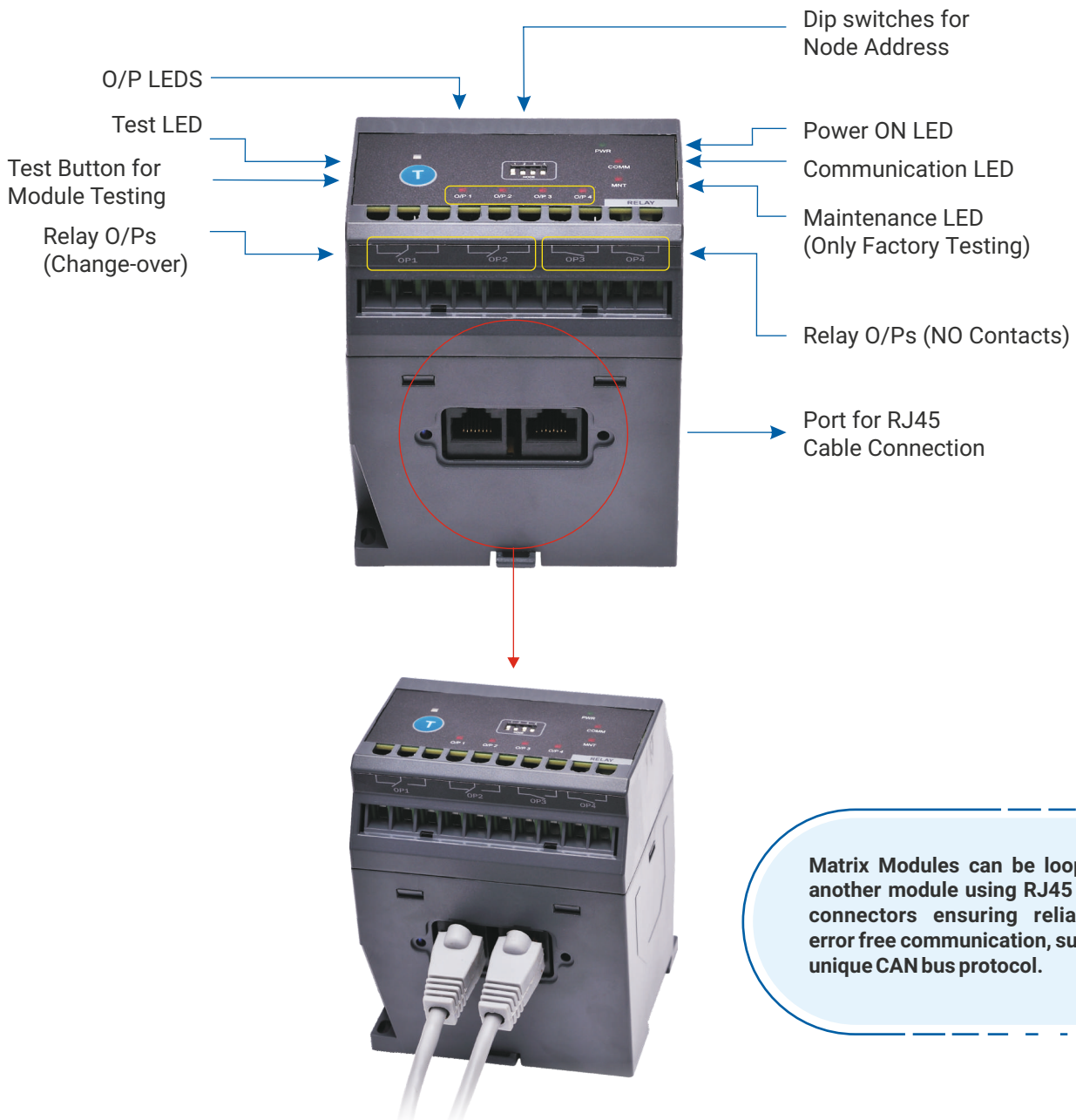
# Matrix CAN Architecture



# Matrix Modules

## Matrix Protection Releases Supplementary Modules

UW MTX 3.5 Series & 4.5 Series releases are backed up by different supplementary modules to enhance the functionality of the Protection & Control Unit to provide customer more advanced & complete system protection



Matrix Modules can be looped with another module using RJ45 modular connectors ensuring reliable and error free communication, supporting unique CAN bus protocol.

### Self Diagnostic Test

All the modules (Except PS Module) are having self diagnostics test button provided on the front facia. Self test of the supplementary module can be performed by removing the CAN communication connection of the P & C unit with the PS module

and 24V DC supply connected (which is looped with the supplementary modules). After test RED LED indicates module is not healthy and GREEN indicates module is healthy.

# Matrix Modules

## Relay Module

Relay module helps in remote annunciation, interlocking and load management of the system. Relay module consists of four configurable O/Ps (2NO & 2 Changeover) which can be programmed through the release on any of the following protection:

- I. Overload

ii. Short circuit

iii. Instantaneous

iv. Earth fault

V. Neutral overload

vi. Reverse power

vii. Phase sequence

viii. Under voltage

ix. Over voltage

X. Under frequency

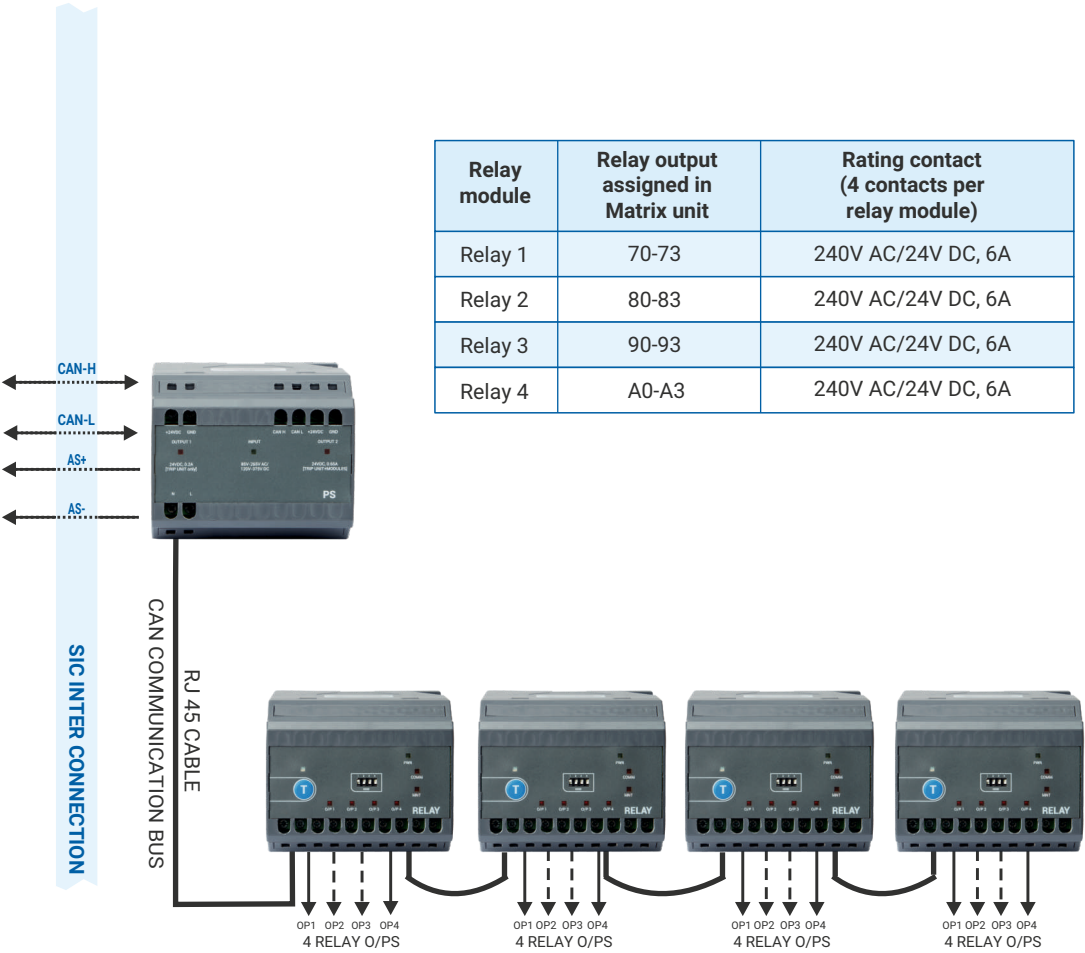
xi. MD (Active)

xii. Breaker operation

Each of the above protection can be programmed for “Trip” mode or “Alarm” mode (Breaker operation can be programmed for breaker ON or breaker OFF mode).

Relay module can also be used for switching off the non-critical loads during the Overload condition so as to prevent the complete shutdown of the system.

Four relay modules can be looped together to one release at a time. Each relay module node address can be set using the dip switches on the module.

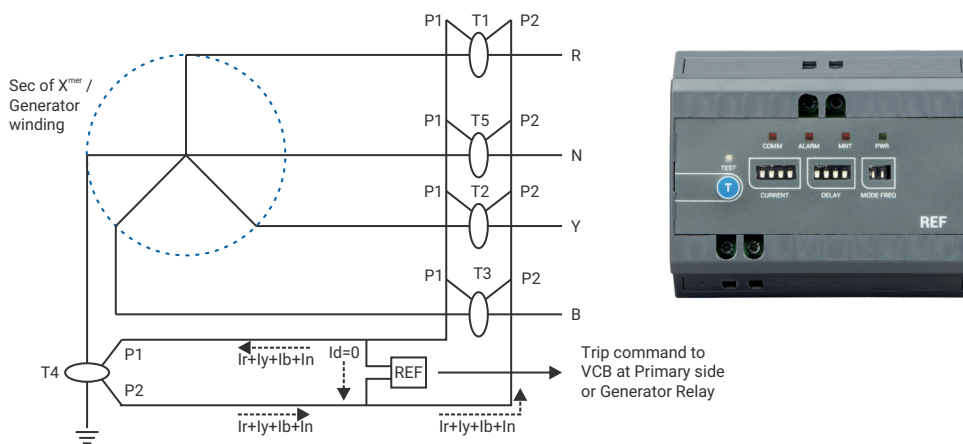


# Matrix Modules

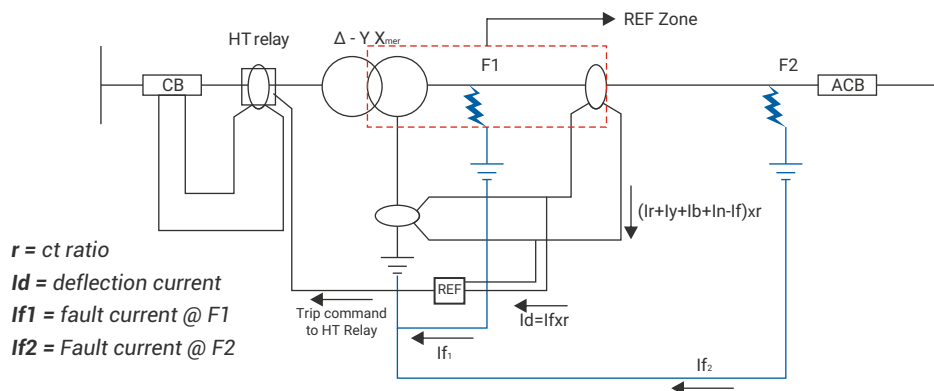
## Restricted Earth Fault (REF) Module

REF protection is usually applied for star winding of Transformer & Generator. Special protection class CTs i.e. Class PS CTs are to be used for achieving the protection. Protection works on differential principle.

REF protection is used to detect and to trip the breaker in the selected zone only i.e. secondary winding of the transformer/generator.



If transformer star node is further used as a neutral in the system, the 5th CT (T5) should be used to avoid the nuisance tripping during the unbalance condition.



**Case 1. EF inside the restricted zone (F1)** - During EF within the zone, current flows back to Transformer star point through neutral sensing CT. The REF module will give trip command to the breaker depending on pickup value.

**Case 2. EF outside the restricted zone (F2)** - For EF outside the zone, fault current flows through phase CT & neutral CT in opposite direction preventing the nuisance tripping from REF.

During the unbalanced load condition the unbalanced current will flow back through neutral. As the direction of the neutral current is in opposite direction as that of phases, the REF relay will not give nuisance tripping on current unbalance.

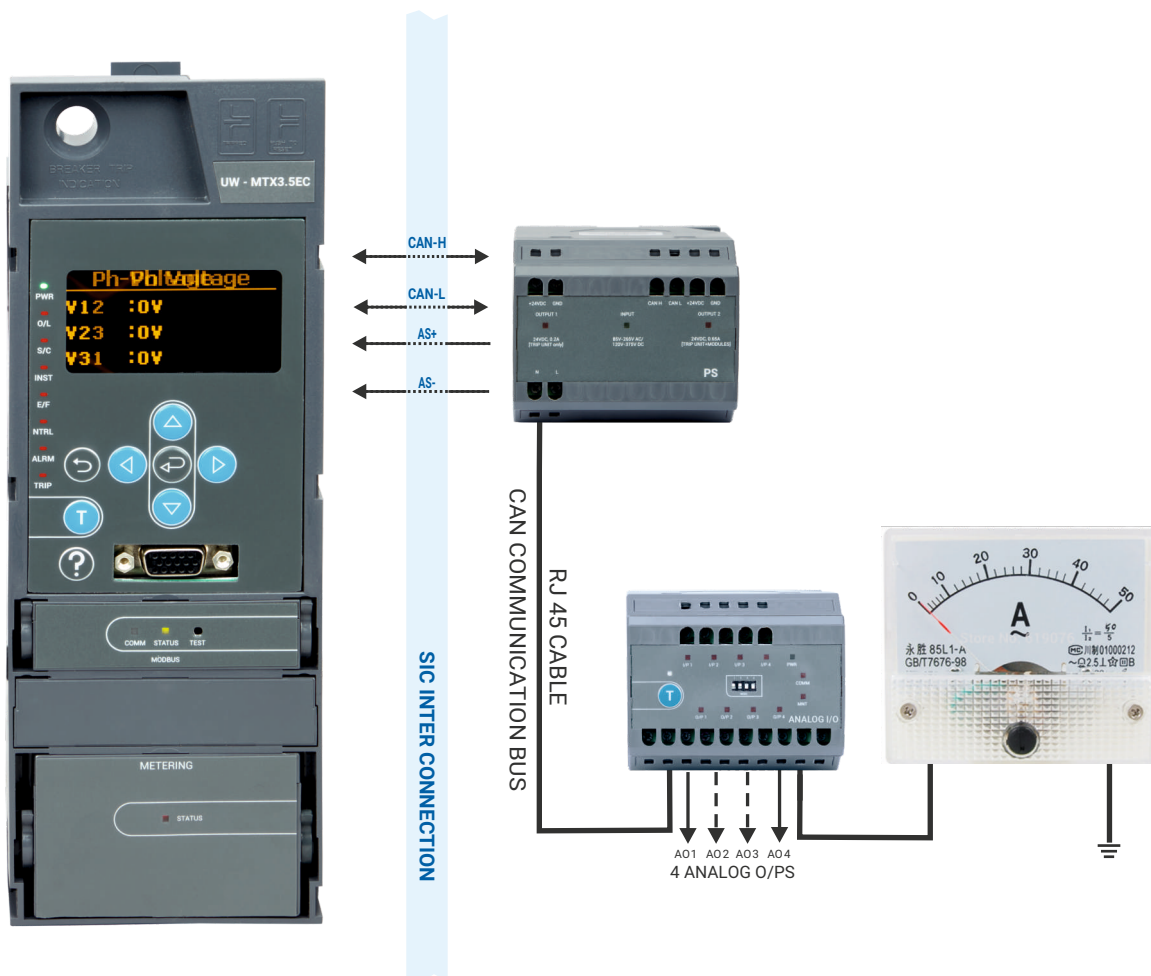
In absence of the 5th CT, the breaker will not be able to sense the unbalance condition flowing through the neutral and relay may give trip command.



# Matrix Modules

## Analog Output (AO) Module

Analog module can be seen as metering option to other panel display meters. Four different outputs can be configured for voltage metering or current metering with analog signal output in range of 4-20mA to which analog ammeter and voltmeter can be connected. 4mA corresponds to zero current and voltage while 20mA corresponds to 1.5 times the set I-frame value of current or 1.5 times set Vn value in Matrix release. AO module communicates on CAN bus protocol with the Matrix Protection and control Unit.



# Matrix Modules

## Temperature (TM) Module

Overheating of the Bus-bar can reduce the life of the insulation sleeves, Bus-bar / cables & even Breakers. Periodic loading conditions can cause the metal to heat and cool continuously resulting in the deterioration of the Bus-bar material and loosening of the joints. This becomes even more critical in case of Bus-bars consist of metals of different heat coefficient.



## Causes of overheating

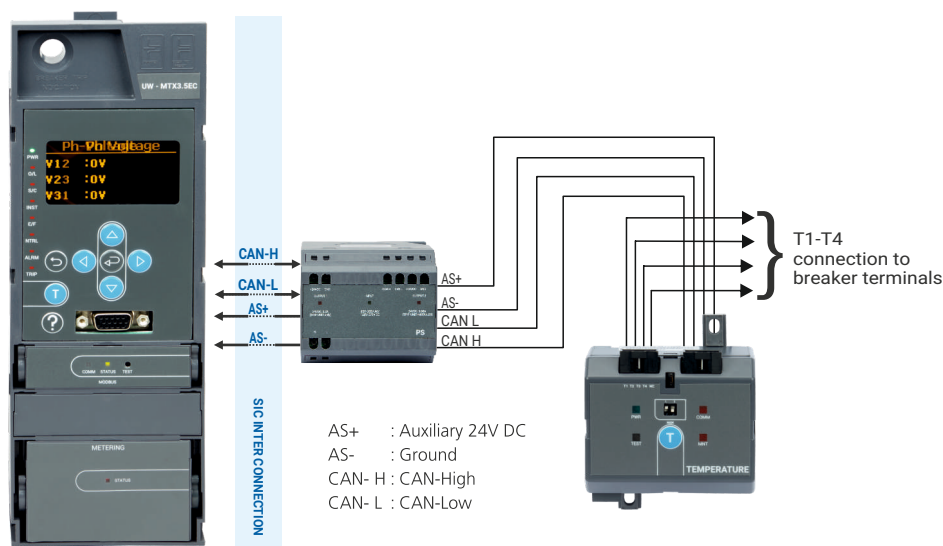
- › Any of the following reasons can lead to heat generation at the breaker terminal
  - › Improper termination
  - › Improper Bus-bar design
  - › Loosen Joints
  - › De-rating not considered while selection of breaker
  - › Eddy currents

- › Temperature protection range is 85-115°C
- › Communicates with MTX Release on CAN bus (Controlled Area Network)
- › 24V dc Spike free power supply is required for its functioning
- › The TM is given as a supplementary module and works with Matrix Releases UW-MTX3.5 and above
- › Factory fitted option
- › Provision for self-diagnostic test

## Specifications

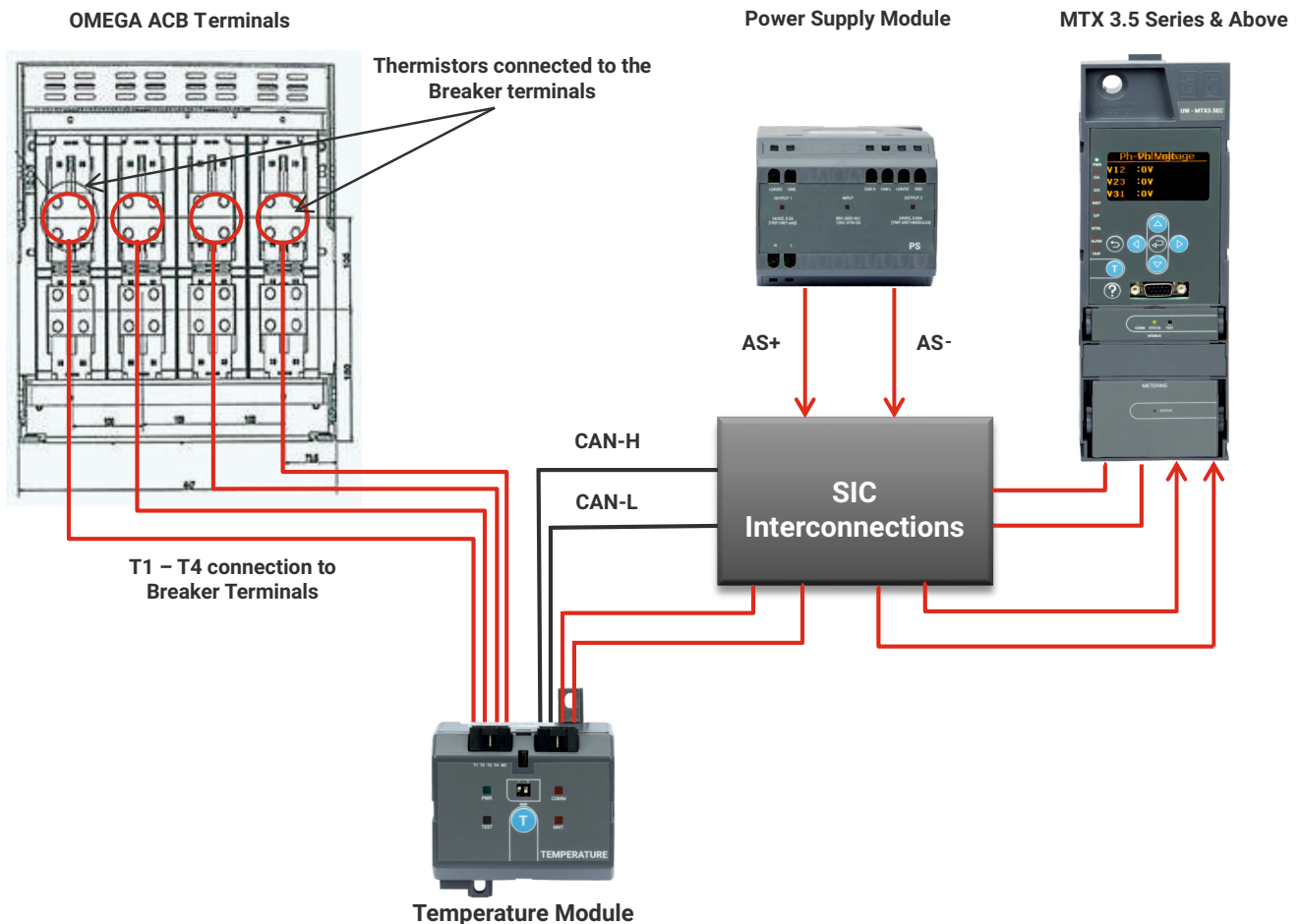
- › Pick up (Tp) - 85°C to 115°C
- › Pre alarm - 0.5Tp to 0.95Tp in the steps of 0.05Tp
- › Delay - 0 Min to 15 Mins in Steps of 1 Min (It delays the tripping of the breaker by the set delay time.)
- › Input supply - 24V DC (Directly at Module Terminals)
- › Temperature Module senses the real time temperature at the Cradle terminals and displays on the Matrix release screen.
- › TM module can be used to give alarm on the release or to trip the breaker with the temperature pickup range from 85°C to 115°C, which can be configured through Matrix release.

- › The TM monitors the temperature at the breaker terminals continuously and provides protection by **tripping the breaker** and/or by giving an **alarm**
- › Located inside the breaker, it senses real time temperature through thermistors placed on the breaker terminals and provides information on the Release display



# Matrix Modules

## Connection of Temperature Module



### Conceptual Diagram of Temperature Module Connection

**Note :** As TM is a factory fitted option, the connections are internal to the breaker and depiction here is purely for Understanding purpose

- › The Temperature at the terminals can be seen on the display of Matrix Release.
- › The provision is made to trip the Breaker and/or give an alarm when the temperature at Breaker terminals goes beyond the specified limit which is settable pick-up

range from 85°C to 115°C (configured through MTX Release).

- › It takes temperature inputs through thermistors from all the four terminals (NRYB) of air circuit breaker.
- › The connections of the TM (AS+, AS-, CAN-H, CAN-L) is brought to SIC from where it is connected to PS Module & Release.

# Matrix Modules

## Earth Leakage (EL) Module

› In industrial installations, the current leakage to earth can happen because of the following main reasons:

- › Current leakage through phase to earth insulations
- › Leakage of current through phase to earth leakage capacitance



Due to the high insulation resistance the leakage current magnitude remains low in terms of milliamps or micro amps. Assuming that the phase-to-earth insulation resistance in an LV network is just 1 Mega-ohm(\*), then the leakage current to earth will be (240V/1 Mega-ohm) 240 microamperes. But, generally the phase-to-earth insulation resistance would be much higher than just 1Mega-ohm, normally a few tens or even hundreds of Mega-ohms. Thus, the leakage current to earth will be a further fraction of the micro-ampere or even nano-amperes. As human body's sensible current is more than 1 milli-ampere, this remains un-sensed by a human being coming in contact with the earthed frame of an LV electrical installation.

Any leakage current above 300mA can result into fire in electric installations. In Industrial areas especially in mining application the earth leakage protection becomes critical for the fire safety. OMEGA Matrix Earth Leakage module has Earth leakage current monitoring range of 300mA to 30A. The EL module communicates on CAN bus with the Matrix releases which can be set in Alarm, Trip or "Both" mode.

## Some more features of EL module

- › "NO" contact for external indications (24V DC/240V AC, 6A)
- › Standalone module
- › Dip switches for configuring pickup and delay settings
- › Self-diagnostic check for module healthiness.

**\* As per Indian Electricity rule, 1956, Rule No. 48(ii) For Medium & Low Voltage Installations, Voltage at a pressure of 500 V applied between each live conductor and earth for a period of one minute, the insulation resistance of medium and low voltage installations shall be at least 1 Mega ohm.**

## Power Supply (PS) Module

PS module is used to power ON other supplementary modules of OMEGA Matrix release family as well as to communicate on the CAN bus through RJ45 shielded cable.

Specifications	AC	DC
Input	85-265V	125-300V
Output 1*	-	200mA @ 24V DC
Output 2	-	650mA @ 24V DC

**Note:** For VA burden details of modules & optimal usage of PS modules refer Matrix User's manual

\* For using Output 1, Output 2 should be loaded first



# Matrix Modules

## Digital Input Output (DIO) Module

Matrix DIO module is provided with 4 digital inputs and 4 digital outputs for the implementation of various Boolean logic equations into the system.

### › Some features of DIO module

- › Up to 4 DIO modules can be looped together to one MATRIX release
- › Dip switches on the Module facia for setting the node address
- › 16 different logic equations can be assigned
- › Self-diagnostic test provision

Contact Ratings	
Input contacts	24V DC or 240V AC
Output Contacts	24V DC or 240V AC, 6A (resistive load)



## Trip Circuit Supervision (TCS) Module

TCS module of Matrix Releases continuously monitors the healthiness of the shunt trip coil irrespective of the breaker operational position. Protection can be set in both, trip or alarm mode in the release unit.

- › Detects circuit breakage, contact degeneration in connections, resistance increase in wires, contacts and coils of the supervised shunt release
- › Complete range of rated voltage (24-415V) either AC or DC
- › Stand alone module
- › Self-diagnostic test provision





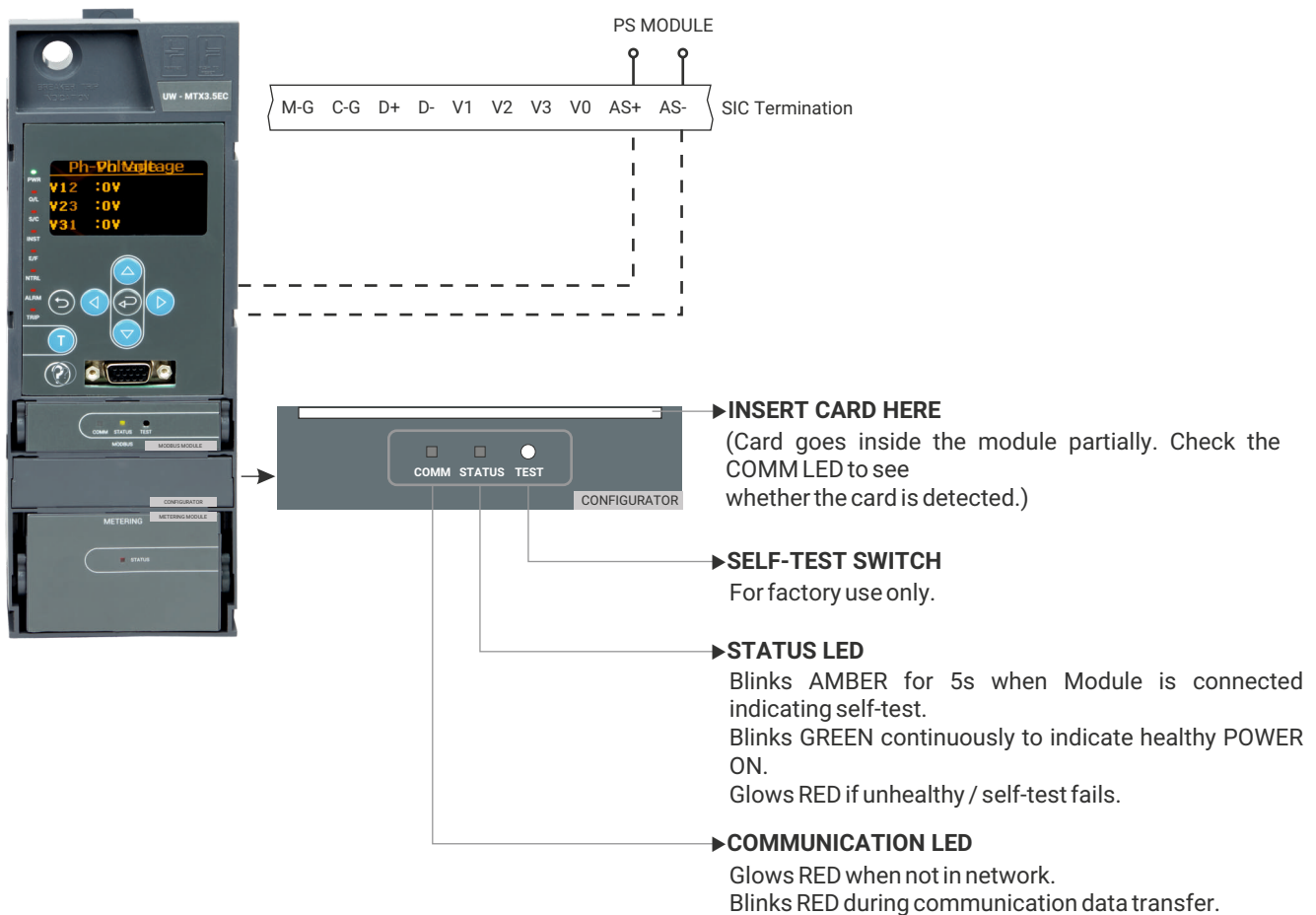
# Matrix Modules

## Smart Configurator

UW-MTX3.5 & above has an optional Smart Configurator Module which is used for easy parameterisation of the release. In large electrical installations, where many ACBs are in use; one can copy the release protection parameters setting on smart card and then copy the parameters on various releases. Smart Configurator Module in MTX releases with its ease of use can reduce the gestation period of electrical installation. Smart Configurator works on the principle of RF interface at 106kbps speed between the module and the Smart Card.

**The following operations can be performed on the Smart Card:**

- › Write File: Copy files from the release to the card
- › Read File: Copy files from the card to the release
- › Delete File: Delete selected file from the card
- › Format Card: Delete all the files from the card and format it



# Communication Modules

## Modbus

Modbus Module is used for the Configuration, Monitoring and Control of Matrix releases and its supplementary modules. It offers Client/Server communication in RTU Mode/TCP/IP Mode (ETHERNET).

### Configuration function

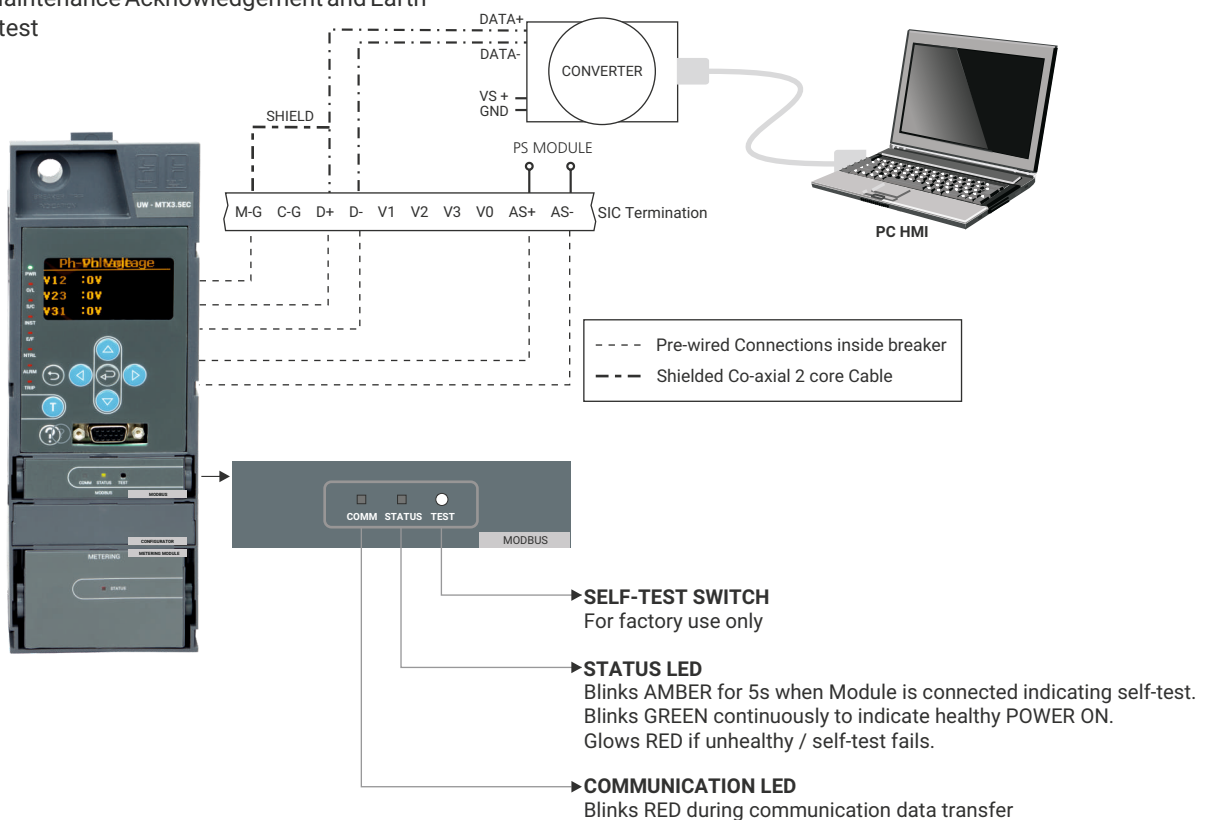
- › Unit Settings
- › System Settings
- › Protection Settings Group 1
- › Protection Settings Group 2
- › Module Settings

### Monitoring function

- › Metering Data - Voltage, Current, Power, Energy, Power Factor, Online Module Status
- › Status Data Alarm & Trip Status, Digital Input Output Module & Relay Module Status
- › Record Data Trip Records, Event Records, Maintenance Records

### Control function

- › Commands for Set group Change, Restore Factory Defaults, Clear Maximum Demand
- › Maximum Current value, Maximum Voltage Value and Energy, Open and Close Circuit
- › Breaker, Maintenance Acknowledgement and Earth Fault (EF) test

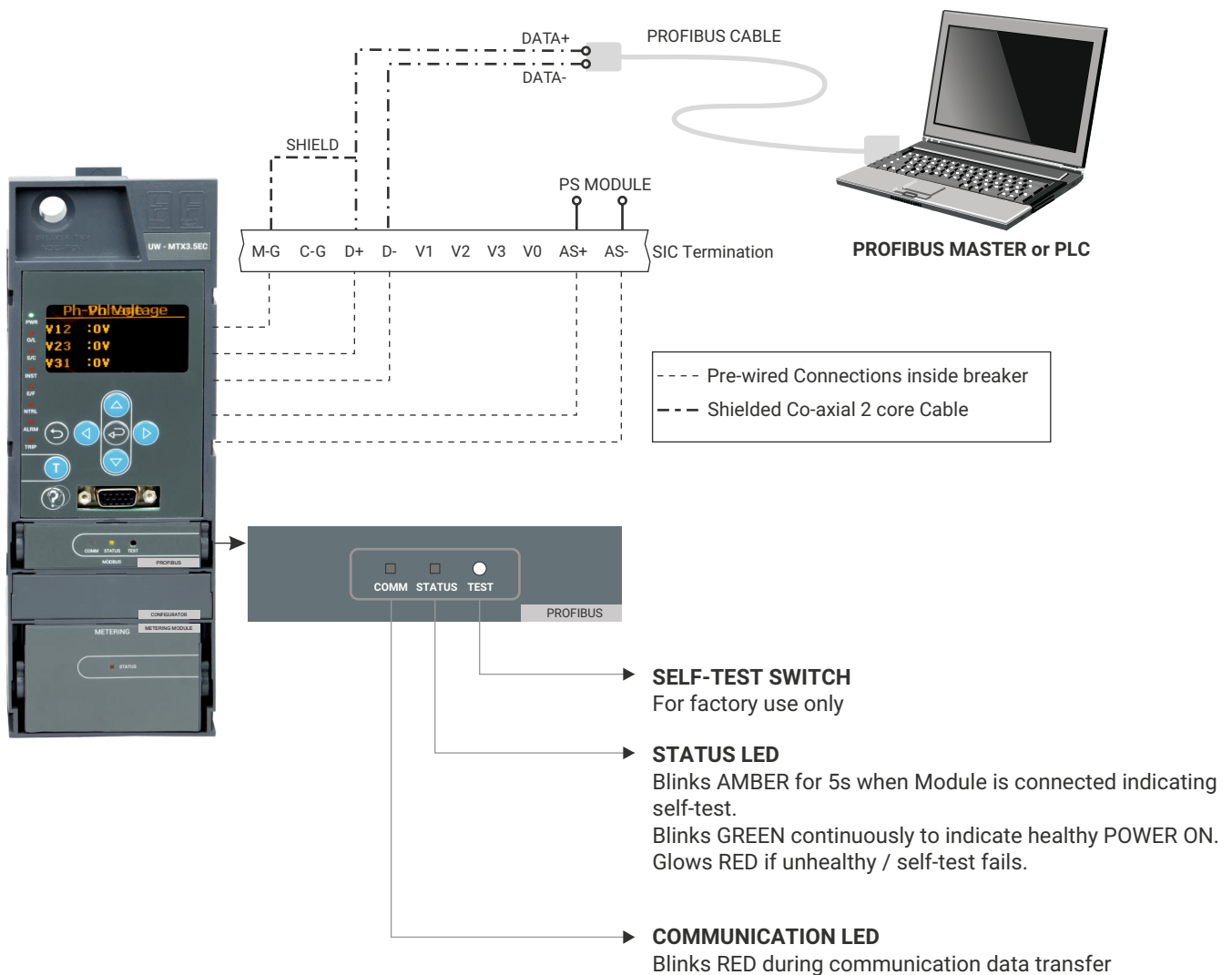


# Communication Modules

## Profibus

Profibus Module supports PROFIBUS DP V0 slave protocol. This module communicates with PROFIBUS Class 1 and / or Class 2 Master. GSD file should be used/loaded in PROFIBUS master for understanding the device functions. Network termination switch is provided at the rear end of the module. Thus this module can be used as end node in the network. It

communicates on baud-rates 9.6Kbps, 19.2Kbps, 45.45Kbps, 93.75Kbps, 187.5Kbps, 500Kbps, 1.5Mbps, 3Mbps, 6Mbps, 12Mbps. It automatically detects the baud-rate selected by PROFIBUS master for communication. PROFIBUS module is used to monitor and configure critical status parameters of Matrix Release like Pick-up, Alarm and Trip status.



# Communication Modules

## Zigbee

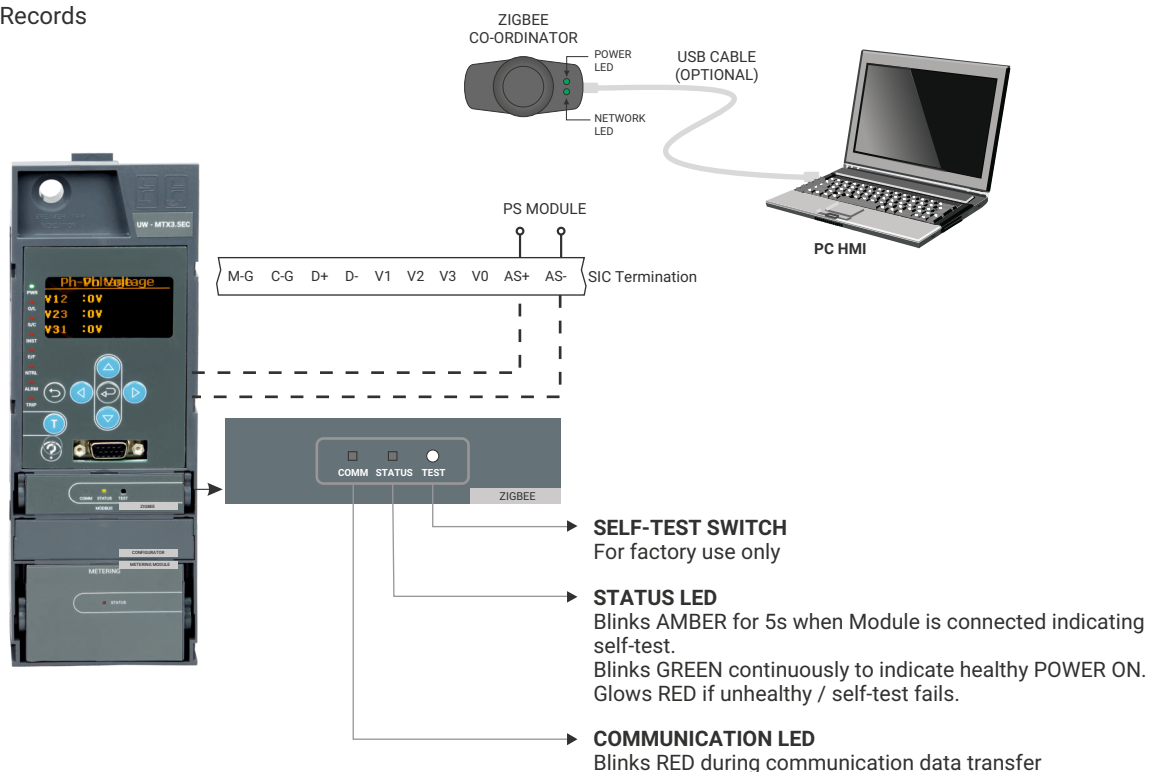
Our innovative Matrix releases are designed to let consultants & system designers help their customers & end-users- gain greater control of, and improve their everyday business & industrial processes by means of "ZigBee wireless communication" capability.

UW-MTX3.5 & above provides Wireless Communication using ZigBee protocol formulated under IEEE 802.15.4 Standard for Wireless Personal Area Network (WPANs). Zigbee operates in ISM radio bands of 2.4GHz.

The Communication range is 200m Line Of Sight (LOS) with over the air data rates upto 250 Kbps. Zigbee module is used for Monitoring parameters of Matrix releases and its supplementary modules.

## Monitoring Function

- › Metering Data - Voltage, Current, Power, Energy, Power Factor, Online Module Status
- › Status Data - Alarm & Trip Status, Digital Input Output Module & Relay Module Status
- › Record Data - Trip Records, Event Records, Maintenance Records



### Note:

- › It is necessary to first switch on the configurator module and form a network. Co-ordinator Module can be directly plugged in to the PC USB port or USB cable can be used.
- › Power LED on Co-ordinator Module will glow GREEN when connected to the port. Network LED on Co-ordinator module will glow GREEN when it forms a network.
- › Zigbee Module should be now inserted in the Matrix P&C unit.

# Communication Modules

## ETHERNET Communication with OMEGA Range

Communication Offers of OMEGA ACB:- Here is a list of various Communication Options available with OMEGA range of ACBs (Figure-1). Directly compatible with OMEGA ACBs are three widely used communication protocols,

1. Modbus TCP/IP (on ETHERNET Physical layer)
2. Modbus RS-485
3. Profibus

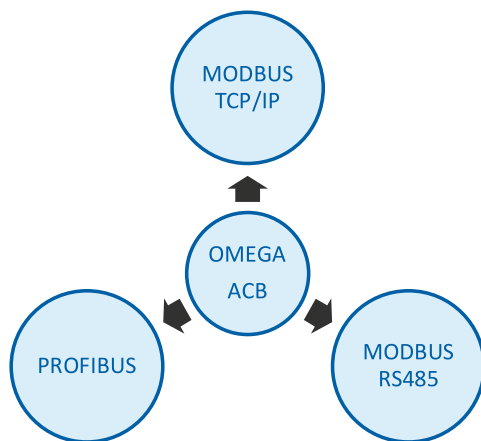


Figure-1

For OMEGA MTX releases, various communication options are available. (Figure-2) Notably, MODBUS TCP/IP (ETHERNET) is a factory-fitted solution, with a separate catalogue number.

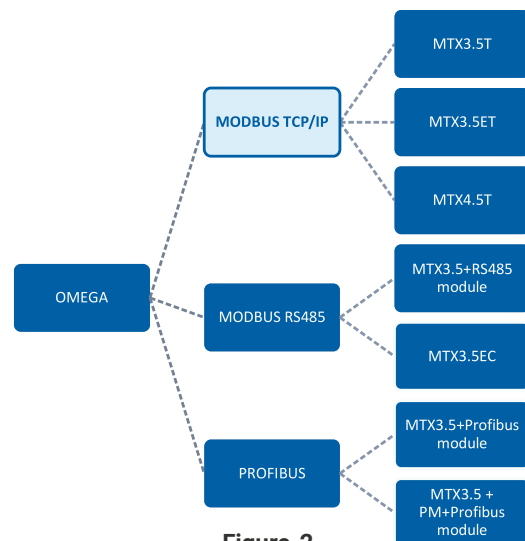


Figure-2

OMEGA MTX releases with ETHERNET communication is factory fitted option with MTX3.5T\*, MTX3.5ET\* and MTX4.5T\* releases of OMEGA ACB. It comprises of Release and ETHERNET module; it is the communication interface that allows the OMEGA Release to be directly connected to the ETHERNET network.

\*These Releases are available on request.

For further details please contact nearest sales office



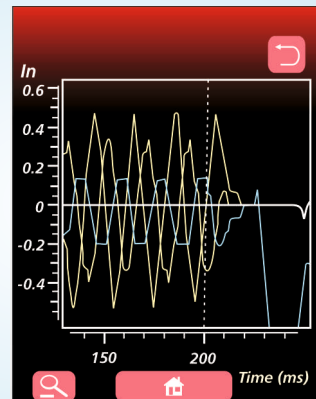
# Fault Trip Diagnostic

## Trip Oscillograph

MTX 4.5 Series gives user the unique advantage of analyzing the post fault waveforms of the system. After the fault, the system waveform gets captured in the release with the trip timing and the waveform deformation of voltage and current of the individual phases. The data remain stored in the memory of the release so as to empower the user to check the speed and the correctness of the protection system, as well for further power system analysis.

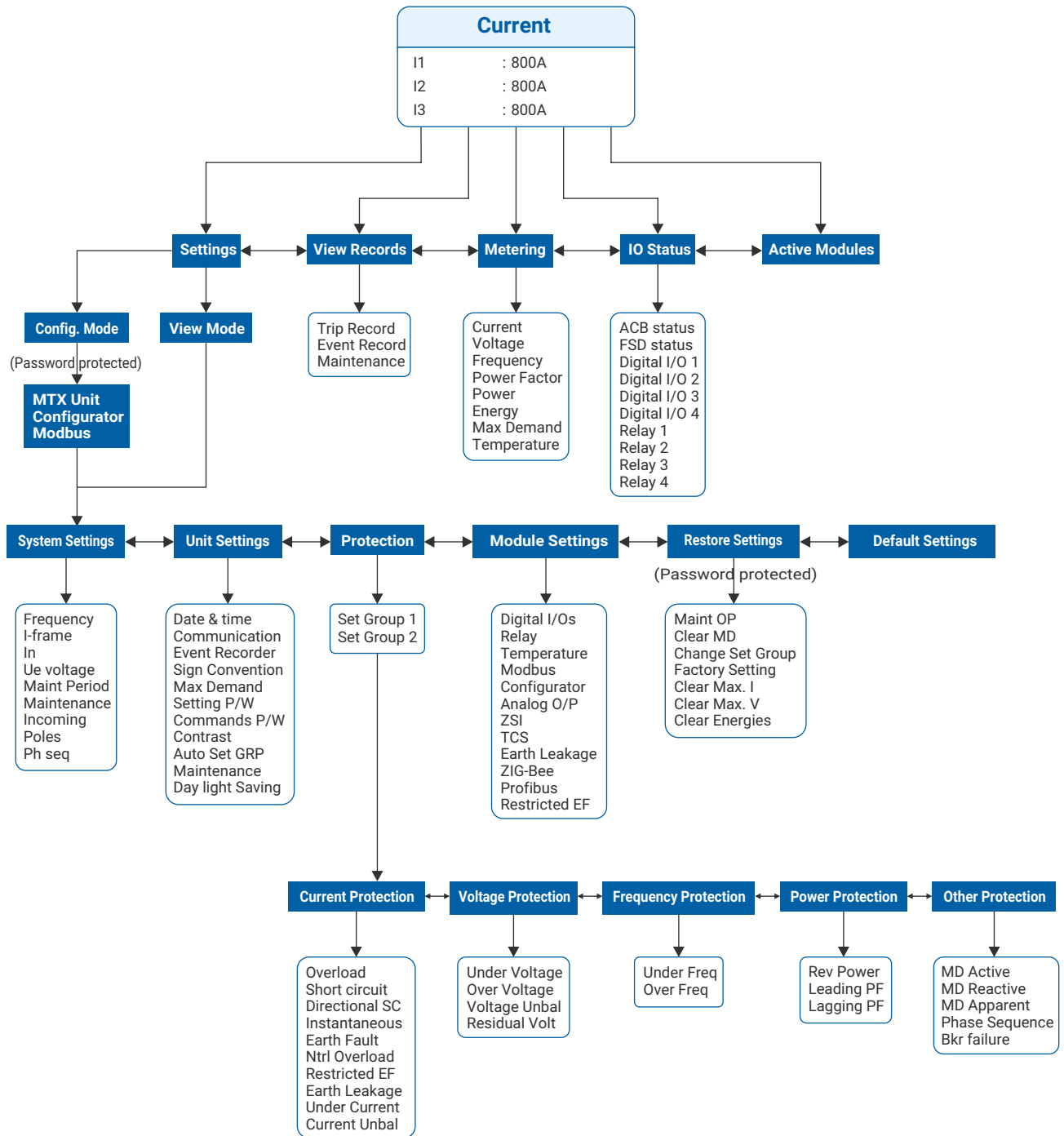
**Some of the unique points of the MTX4.5 Trip Oscillograph are:**

- › 300ms record with 10 cycles before and 5 cycles after the trip/pickup of fault
- › 15 cycle record useful to monitor and analyze the current and voltage disturbances
- › 4x zoom



# Matrix Protection Release Navigation

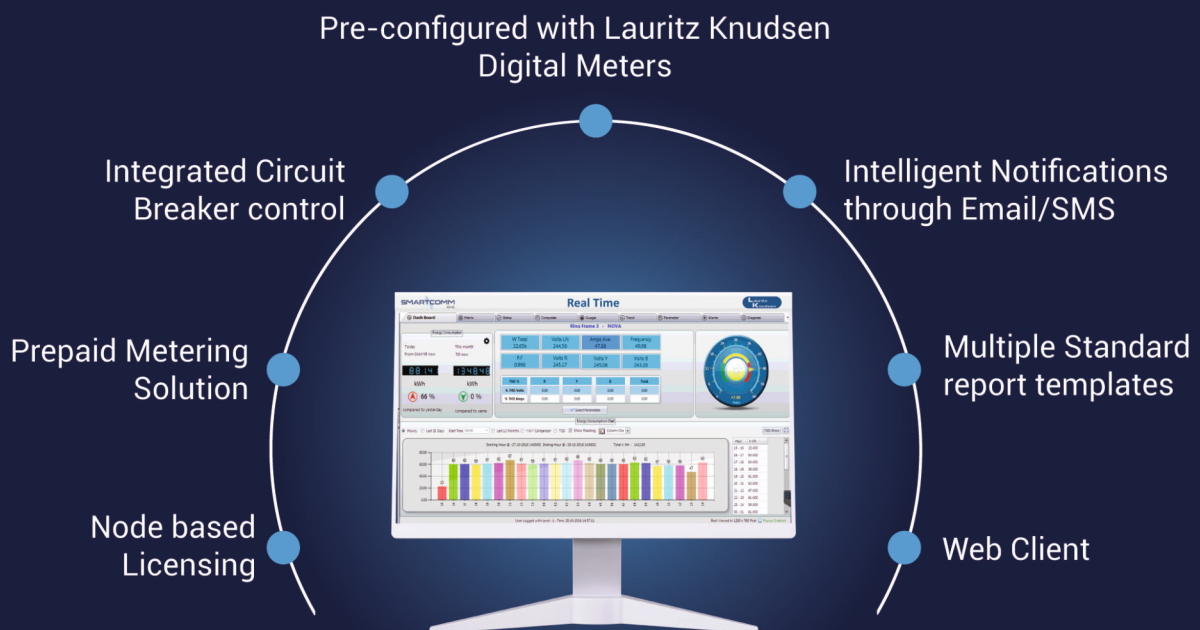
## Navigation Overview for UW-MTX 3.5/3.5EC/3.5H



## THE ENERGY MANAGEMENT SYSTEM THAT FOSTERS ENERGY EFFICIENCY



SmartComm EMS is a simple yet robust solution for organizations seeking to optimize energy consumption and operational efficiency, all within a user-friendly environment. The on-premise implementation gives you direct control and oversight of energy-related data, allowing for real-time monitoring, analysis, and decision-making through an intuitive and easy-to-use interface. With cutting edge features, SmartComm EMS empowers you to proactively manage energy usage, identify savings opportunities, and ensure compliance with sustainability goals and regulations.



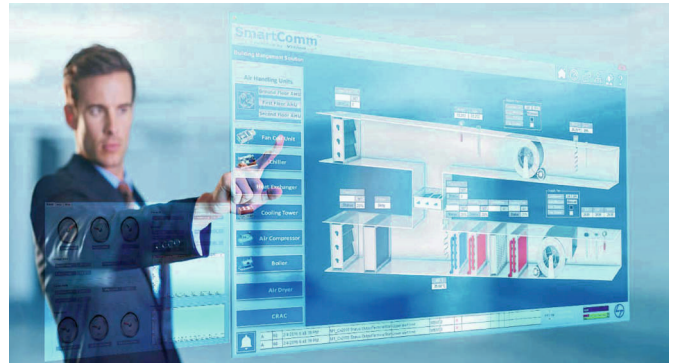
**Customer Interaction Center (CIC)**

Phone no: 022 6932 7800

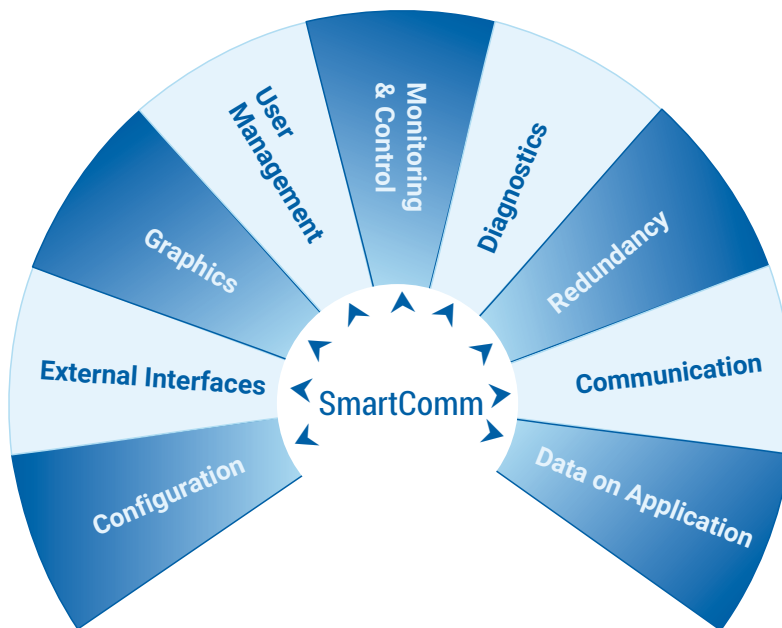
Web: [www.LK-EA.com](http://www.LK-EA.com) | e-mail: [CIC@LK-EA.com](mailto:CIC@LK-EA.com)

# SmartComm Integrated Solutions

- › SmartComm is a state-of-the-art SCADA-based unified software platform for device communication, integration, data acquisition, data management, monitoring & control and preemptive and predictive data analysis.
- › OMEGA ACBs can be integrated with SmartComm.
- › SmartComm supports a wide range of devices and protocols. It can expand its functionality to address the growing requirements of the installation



## OMEGA ACBs - Integration with SmartComm brings a host of benefits



- › OMEGA ACBs integrated with SmartComm enable users to perform various configuration, monitoring and measurement tasks remotely
- › Real-time communication for monitoring, control and diagnostics. The system also provides facility of alarms, event alerts and acknowledgements
- › Enables user to get immediate reports and swiftly initiate corrective action, if required
- › Remotely control and monitor the circuit breaker from centralized location.
- › Get 'trip info' details such as cause of tripping, date and time stamping of tripping and fault event history.
- › Monitor ACB terminal temperature along with real-time trending and Over-temperature annunciation.
- › Undertake time-based harmonic monitoring and analysis for the complete plant.
- › Implementing dual set group for intelligent selection of protection settings based on Real Time Clock.
- Plan and schedule maintenance to reduce energy and operation cost.
- › View instantaneous parameters like voltage, current, power factor etc. at a single location.
- › SmartComm can be configured to e-mail reports and SMS critical alerts.
- › Communication through multiple protocols and drivers like Modbus TCP/IP, Modbus RTU, BACnet.



# OMEGA ACB with SmartComm

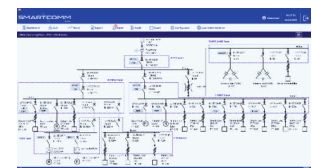
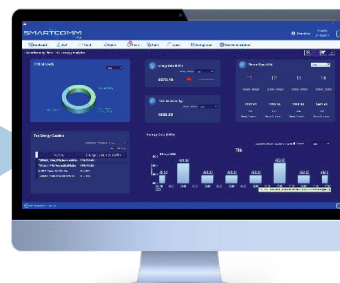
## OMEGA ACB communication with SmartComm PMS

OMEGA ACB communicates the data to centralized Software like SmartComm PMS and enables the User to digitally operate the ACB, empowering the user to make data-based decisions holistically along with other communication-capable products' data on Software. OMEGA ACB communicates with SmartComm PMS to provide valuable capabilities such as:

- › **Remote Monitoring and Control:** Real-time status (On/Off/Trip), breaker position (Service/Test/Isolated), protection settings and last trip cause & time monitoring of ACBs, and digital command to ACBs enabling faster operation & improving Power reliability.
- › **Data Analytics:** Collection of operational data like V, I, pf, f, kW, kWh, THD, etc from ACBs for performance analysis and energy management.

- › **Alarm Notifications:** Instant alerts for fault conditions, allowing rapid response to potential issues.
- › **Energy Management:** Integration with Power Management Software enables better energy usage monitoring and optimization.
- › **Historical Data:** Recording and analysis of historical ACB data for trend identification and performance optimization, monitoring of ACB's previous Trip Records, Event Records, and Maintenance Records.

By leveraging ACB communication with SmartComm PMS, facilities can enhance operational efficiency, improve safety, and optimize energy usage



ACB status & control through SLD in SmartComm PMS



Dedicated Dashboard for ACB in SmartComm PMS

# Technical Application Benefits

## 800V & 1000V AC Rated Voltage Applications

Specially designed OMEGA ACB range offers a solution for electrical applications with system voltages of 800Vac & 1000Vac. This range of ACBs maintain the same dimension and accessories as the standard 690V a.c. range.



## Key Feature

- › Range: 400-5000A\*, 800Vac & 1000Vac, 3P/4P
- › Variants: Manually & Electrically operated, Fixed & Draw Out
- › High short-time Fault withstanding capacity, upto  $I_{cs} = I_{cw} (1 \text{ sec}) = 50\text{kA}$
- › Conforms to IS 60947-2, IEC 60947-2 and EN 60947-2
- › RoHS compliant
- › Modular & snap-fit accessories such as UVR, SR & CR modules, redefine the modularity on a time scale of 5 mins.
- › Unique breaker front-facia architecture display the electrical accessories mounted on the ACB
- › Ease of on-site convertibility from Manual to Electrical & Fixed to Draw-out version
- › Best in class (40mm) Termination overlap with Bus bars.

Microprocessor	MTX 1.0	LSI
	MTX 1.0G	LSING
	MTX 1.5G	LSING + Display + Current Metering + fault history
	MTX 3.5 + communication module	LSING + Display + Current Metering + Inbuilt Communication

### Note:

For 6300A 800V AC Frame - 3 ACB, please contact our nearest branch office.

\* Available up to 4000A for 1000Vac



# Technical Application Benefits

## Circuit Breaker 800V AC & 1000V AC

Frame			1		2		3	
Rated Uninterrupted Current (In) (A) at 50°C			400-2000		400-4000		400-5000	
Version			N08	D10	N08	N10	N08	S08
Rated Operational Voltage at 50/60 Hz.	Ue		800V AC	1000V AC	800V AC	1000V AC	800V AC	
Rated Insulation Voltage at 50/60 Hz.	Ui		1250V AC					
Rated Impulse withstand Voltage	Uimp		12kV (Main Circuit) & 4kV (Auxiliary Circuit)					
Suitability for Isolation			Yes					
Degree of Protection on Breaker front			IP53 Standard, IP54 Optional					
Degree of Impact Protection on Breaker front			IK08 Standard, IK10 Optional					
Pollution Degree Suitability			4					
Utilization Category			B					
Compliance			IS / IEC 60947 (Part-2), EN 60947-2, IEC 60947-2					
Operational Temperature Range (As per IEC 60068-2-1/ IEC 60947-1-Q)			-25°C to 70°C					
Storage Temperature Range (As per IEC 60068-2-1/2)			-40°C to 85°C					
Rated Ultimate S.C. Breaking Capacity	Icu (kA)	800V AC	50	-	50	50	50	65
		1000V AC	-	36	50	50	-	-
Rated Service S.C. Breaking Capacity	Ics (kA)	800V AC	100% Icu					
		1000V AC	-	100% Icu			-	-
Rated Short-time Withstand Capacity	Icw (kA)	1sec	50	36	50	50	50	65
		3sec	36	36	50	50	50	65
Rated S.C. Making Capacity	Icm (kA)	800V AC	105	-	105		105	143
		1000V AC	-	75.6	-	105	-	-
Break Time (ms)			25					
Closing Time (ms)			60					
Mechanical Life <sup>(1)</sup>	With maintenance		25000		20000		15000	
Electrical Life <sup>(1)</sup>	Without maintenance <sup>(2)</sup>		1000		1000	500	1000	

(1) Value corresponds operating cycle

(2) With Maintenance, Electrical Life is same as Mechanical Life

# Technical Application Benefits

## Energy Reducing Maintenance Switching (ERMS)

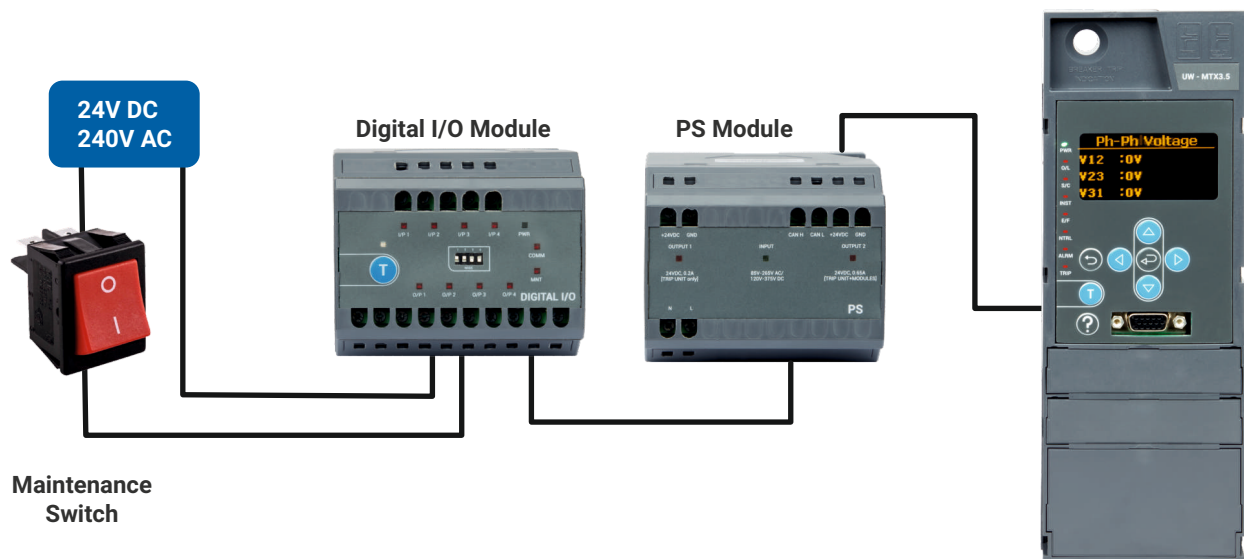
To achieve **ENERGY REDUCING MAINTENANCE SWITCHING (ERMS)**-Alternate Maintenance Switch (AMS) feature implemented in MTX3.5 trip unit provides facility to the user to set the Circuit breaker operating limits to different level during maintenance and then bring it to the normal setting once the maintenance activity is completed.

In the MTX trip units, various protection parameters are stored as a set of group. These trip units have two such set groups to hold setting parameters such as set group 1 and set group 2, which are independent of each other. At a time one set group will be active and corresponding protection would be provided. to

use AMS functionality user has to configure protection parameters in one group according to normal load and another group protection parameters should be as per the protection level required at a time of maintenance or critical task execution. By default Set Group 1 will be active. And at a time of maintenance by pressing maintenance switch, Set Group 2 can be activated.

To activate the AMS functionality, connections have to be made as per following wiring diagram.

## Reference Diagram



# Technical Application Benefits

## Zone Selective Interlocking (ZSI)

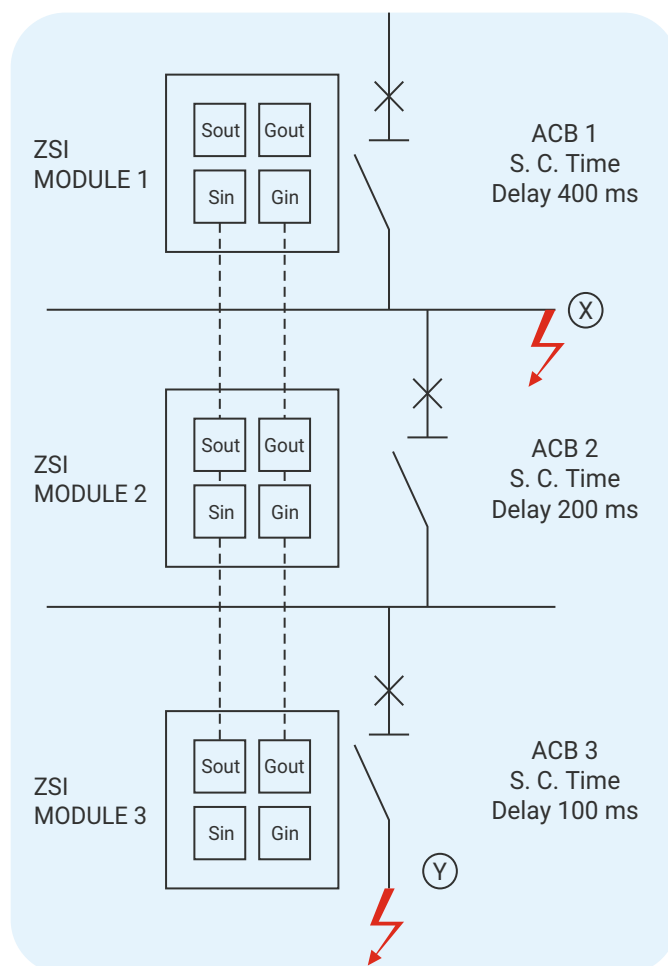
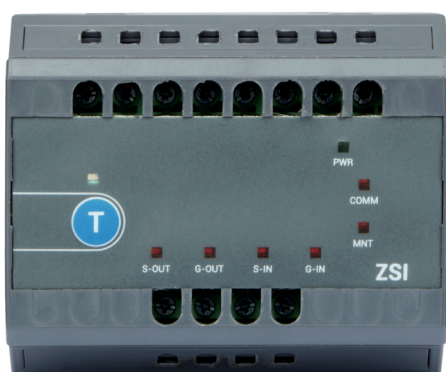
Using the **Zone Selective Interlocking (ZSI)** feature of the Matrix releases, intelligence can be imparted into the electrical system for the quick trip and isolation of the fault element of the system.

For ZSI feature, P&C units are hardwired as shown and they communicate with each other through restraining signals. In ZSI active mode, time delays in short circuit and earth fault are set progressively higher towards the main incomer ACB.

In the given diagram, ACB 1 has the highest delay of 400ms for short circuit. ACB 2 and ACB 3 are having delays 200ms, 100ms respectively. For fault at Y, ACB3 will send restraining signal to ACBs 1 & 2 and hence pre-set delays are honored. ACB 3 will trip in 100ms and the fault will be cleared.

ACB 2, ACB 3 will remain closed, for faults at immediate locations like X, there will be no restraining signal from feeder breakers ACB 2, ACB 3 and hence ACB 1 will Issue Trip command immediately instead of Pre-set 400ms delay.

MTX Releases of OMEGA provides two type of options for achieving Zone Selective Interlocking (ZSI)-



## ZSI through MTX1Gi & MTX1.5Gi

MTX1Gi & MTX1.5Gi are having inbuilt ZSI. Wiring for ZSI to be done directly through SICs of ZSI (available at SIC Block-6 & marked in yellow color). When MTX1Gi / 1.5Gi Releases are used in Downstream with an External Matrix ZSI module in Upstream,

an additional 24V DC Supply needs to be connected to the SIC at AS+/AS- of SIC Block 6.

ZSI Wiring Cable Specification and compatibility with other Releases & ZSI Module is mentioned in below Tables.

ZSI Cable Specification	
Description	PVC sheathed shielded twisted pair wire
Size	7/0.2 tinned copper
Shield	Braided tinned copper ID: 4.6 max
Impedance	Approx. 76 Ohm/km at 200 MHZ
No. of Twists	Approx. 11 twists / ft.

# Technical Application Benefits

## ZSI through External Module with MTX3.5 & above

ZSI Module for Releases MTX3.5 & above is available as an accessory.

This module provides optional upgrade to Zone Selective Interlocking (ZSI)

ZSI feature provides:

- › Discrimination for Short-Circuit & Earth Fault protection
- › CAN Bus protocol for communication in ZSI Module
- › Support 20 downstream & 3 upstream OMEGA ACB
- › Provision for self-diagnostics Test

**Note:** Input supply 24V DC, need to be applied directly on Terminals of ZSI Module

S01	D+	S02	D-	G01	M-G	G02	C-H	S11	C-L	S12	C-G	G11	V1	G12	V2	AS+	V3	AS-	V0
-----	----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	-----	----	-----	----

ZSI Contacts on SIC Block-6 (Marked in Yellow)

ZSI Compatibility Chart				
MTX Releases		Releases in Upstream		
		MTX1Gi	MTX1.5Gi	MTX3.5 & above with ZSI Module
Releases in Downstream	MTX1Gi	✓	✓	*
	MTX1.5Gi	✓	✓	*
	MTX3.5 & above with ZSI Module	✓	✓	✓

✓ Compatible

\* Compatible-Additional External 24V DC Supply to be provided at AS+/AS- of SIC Block-6

# Technical Application Benefits

## Double Short Circuit Protection

### What is Double Short Circuit Protection?

Double Short Circuit Protection feature in Air Circuit Breakers provide the ability to set two levels of short circuit settings with adjustable time delays. This enables us to provide two values at which the circuit breaker is tripped at short circuit (under short time protection). The higher value of current usually corresponds to a much lower delay setting (hence lower tripping time), thus enabling a lower let through energy.

One of the prime considerations while designing electrical circuits and selecting protection devices is the let-through energy. The let-through energy is the energy passing through the Circuit Breaker when it is under short circuit. This energy causes a huge stress on the downstream devices and hence we, as electrical engineers, try to always minimize the let through energy as much as possible. These stresses reduce the life of the system components and also threatens the safety of the overall system

### Illustrative Case

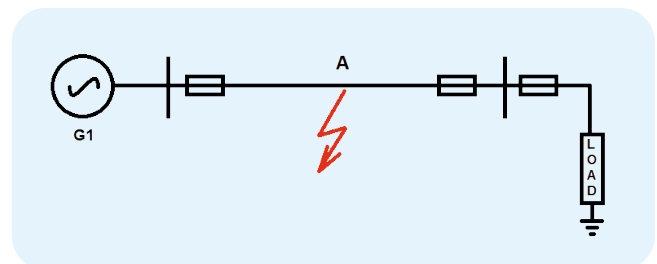
Consider a circuit operating under normal condition with loads connected.

We have set the SC settings as follows: the pickup current for short time protection is 4 times the rated current. ( $I_s = 4 \times I_n$ ) and the delay time ( $t_s$ ) as 400msec.

Suppose a short circuit happens at a point A and let the magnitude of the Short Circuit Current be 8 times the rated current.

Now since the fault current (8 times the rated current) is greater than the pickup current (4 times the rated current), the breaker upstream of the fault will sense it and trip after its preset time delay (ie. 400msec).

As discussed earlier, the time for which the system remains under fault is very critical since the let through energy, the stress on the system, and to some extent even the overall system stability depends on it.

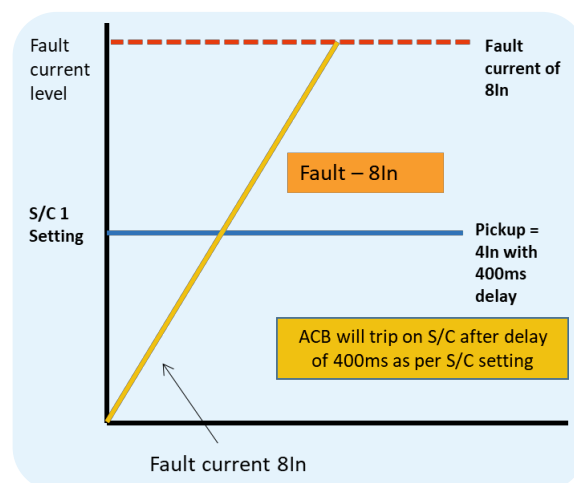


# Technical Application Benefits

## Without Double Short Circuit Protection

In the absence of Double Short Circuit Protection feature, the fault current that is 8 times the rated current will be seen by the CB immediately upstream to the fault with short time protection setting of 4 times the rated current. It will now wait through its delay of 400ms and then trip. Let the rated current be 1000A, then the let through energy flowing into the system during this fault is equal to

$$8\text{kA} \times 8\text{kA} \times 400\text{ msec} = 25.6\text{ kA}^2\text{ sec.}$$



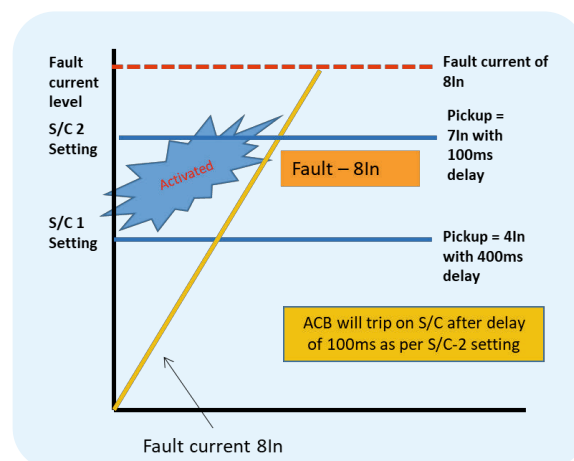
## With Double Short Circuit Protection

Circuit Breakers with Double Short Circuit Protection Feature can be set up with two group of short circuit parameters (pick up current and time delay).

In presence of a CB with this feature, the Pickup (Lo) can be set to 4 x In with a delay of 400msec and Pickup (Hi) can be set at 7 x In with a delay of 100msec.

So, when the fault current of 8 times the rated current will be seen by the CB immediately upstream to the fault, the Higher pickup (Hi) will be activated and the corresponding delay before tripping will only be 100msec.

This way, for In=1000A, the let through energy will be equal to  $8\text{kA} \times 8\text{kA} \times 100\text{msec} = 6.4\text{ kA}^2\text{ sec}$ , which is significantly lower as compared to CBs without this feature (25.6  $\text{kA}^2\text{ sec}$ ).



Feature	Conventional Short Circuit	Double Selective-Short Circuit Protection
Pickup	4 x In @ 400msec	S/C 1 : 4 x In @ 400msec S/C 2 : 7 x In @ 100msec
Fault Magnitude	8 x In	8 x In
Let-through energy (for In = 1000A)	$(8 \times 1000)^2 \times 400 = 25.6\text{ kA}^2\text{ sec}$	$(8 \times 1000)^2 \times 100 = 6.4\text{ kA}^2\text{ sec}$



# Technical Application Benefits

## Application wise

Applications include a wide variety of switchgear industry wherein short circuit protection is required.

**Lauritz Knudsen's OMEGA range of ACBs** starting from the MTX 3.5 Series & above, all Releases are equipped with Dual Short Circuit Protection wherein separate Short Circuit settings and time delays can be configured.

Feature	UW-MTX3.5 Series	UW-MTX4.5 Series
Protection: Enable/Disable	✓	✓
Double S/C ON/OFF	✓	✓
I2T ON/OFF	✓	✓
Pick-up Lo, $I_s = I_n \times \dots$	0.6 to 12 $I_n$ in steps of 0.05	
Pick-up Hi, $I_s = I_n \times \dots$	0.6 to 12 $I_n$ in steps of 0.05	
Delay Hi (ts)	20-100-200-300-400 ms	
Delay Lo (ts)	20-100-200-300-400 ms	
Pre-alarm	0.5 to 0.95 in steps of 0.05 x $I_s$	
Cold-Pickup ON/OFF	✓	✓
Cold Delay	100ms to 10s in steps of 100ms	

# Technical Application Benefits

## Directional Short Circuit Protection

### What is Directional Short Circuit Protection?

The ability of circuit breakers to operate only if the short circuit current is in a particular direction and refuse to operate when current is in the other direction is called directional short circuit protection.

A directional relay/protection release will operate only if the short circuit current is in a particular direction and is above a certain threshold value, called the pickup current.

We use directional relays/protection release where, if in the event of a fault, there is a possibility current reverses its direction and starts flowing in a direction opposite to its original direction.

Whenever there is a line-ground fault on the Transmission line, current from every possible source start feeding the fault, as it is the path of the least impedance. It is pertinent to note that the load, if passive, will not feed the fault, Active Loads like Synchronous machines can act like synchronous generators.

### Illustrative Case

Consider a parallel feeder system as shown in Figure 1A having two generators and one load. The system is in synchronism and running at the rated voltage and frequency. In the healthy condition, the current flows as indicated by the blue lines. Now suppose if a Line-Ground fault occurs at point A (Fig1B). Then,

the current from all sources start feeding the fault. Circuit Breaker 3 senses the fault in its Zone of Protection and isolates the faulted line from the circuit while Circuit Breaker 4 does not trip. After isolating the faulted line, the circuit looks as follows (Fig 1C)

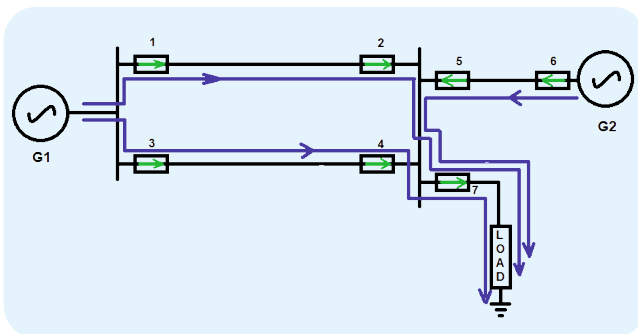


Fig. 1A

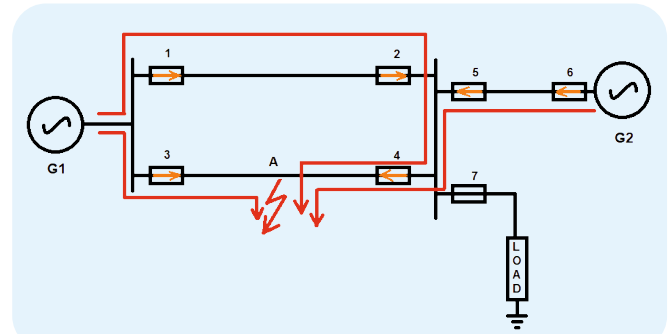


Fig. 1B

# Technical Application Benefits

## Without Directional Short Circuit Protection

Now it would seem that opening of circuit breaker 3 would isolate the faulty line and system would return to healthy state. But even after that, the short circuit fault current can keep flowing through the paths shown in Figure 1C. This means that circuit breaker 4 would have to be opened as well. In cases like these, directional short circuit protection comes to our rescue.

If Circuit Breaker 4 could somehow trip by sensing that the direction of current that was previously passing through it in healthy condition has now reversed in faulty condition, our problem would be solved at once. That is exactly what directional short circuit protection offers. Circuit Breakers with directional short circuit protection sense that the direction of current is reversed and trip if the value is above a certain threshold (called the pickup point).

At this point, we are tempted to conclude that directional short circuit protection is quintessential at the feeder end. But if we take a step back, we can notice that this might not hold true when the load is an active load.

### Application wise

Directional Protection equipment come at a higher cost, so economic aspect also needs to be considered. The general practice followed is that directional protection is required wherever load/source current may reverse its direction in case of a fault occurrence. In our example, (Fig 1D)directional relays are required for Circuit Breaker 2 and Circuit Breaker 4.

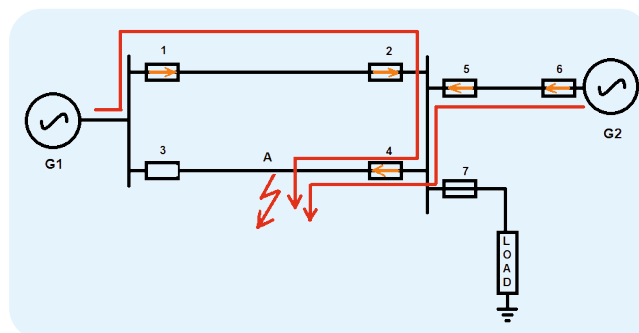


Fig. 1C

## Lauritz Knudsen's OMEGA range of ACBs

All OMEGA ACBs with Protection Release MTX3.5 and above are equipped with inbuilt Directional Short Circuit Protection with Pickup Value adjustable from 0.6 times to 12 times the rated current (adjustable in steps of 0.05). Time Delays of 20ms, 100ms, 200ms, 300ms, 400ms. A feature for Pre-trip alarm is also offered, with an adjustable setting of 0.5 to 0.95 times the short circuit current.

As a general practice, the time delay of the directional short circuit is kept lower than the normal short circuit protection. This ensures that the circuit breaker in which fault is flowing in the opposite direction trips first.

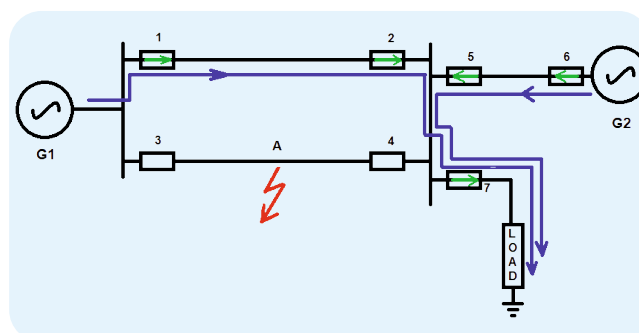


Fig. 1D

	Parameter	UW-MTX3.5 Series	UW-MTX4.5 Series
Directional Short-Circuit	Protection: Enable/Disable	✓	✓
	Direction: Top/Bottom	✓	✓
	I't: ON/OFF	✓	✓
	Pick-up(Is): In x ...	0.6 to 12 In in step of 0.05	
	Delay(ts)	20-100-200-300-400 ms	
	Pre-alarm	0.5 to 0.95 in step of 0.05 x Is	
	Cold Pick-Up ON/OFF	✓	✓
	Cold Delay	100 ms to 10s in step of 0.05 x Is	

# Technical Application Benefits

## OMEGA ACB for AC-3 Motor Application

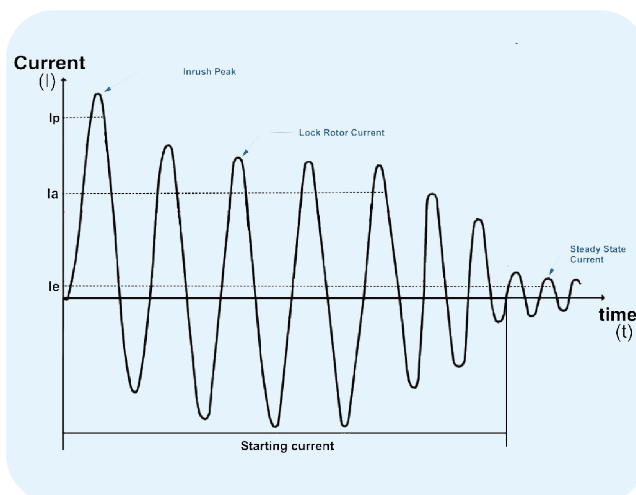
As we know, during motor starting operation, there is a high value of current to be drawn by the motor, known as inrush current. The peak inrush current is almost 8–15 times the nominal load current of the motor.

AC-3 is the utilization category that applies to motors starting and breaking during their normal operation. ACBs that are rated for AC-3 applications would be suitable for use in applications where the primary load consists of an induction motor, such as in industrial settings or large commercial facilities.

**Lauritz Knudsen's OMEGA ACBs are capable of –**

- › Short-Circuit Protection
- › Overload Protection
- › Switching Operation

It is known that the peak value of the inrush is momentary, and transients will be for a few cycles until it achieves steady state current.



Here,

$I_p$  = RMS value of Peak current (Inrush current)

$I_a$  = RMS value of locked rotor current (Transient current)

$I_e$  = RMS value of nominal current (Steady-state current)

Lauritz Knudsen's OMEGA ACB's different frame size and current carrying capacity cater to AC-3 applications for a varied range of motors.

## Frame-1 (N/S/H Version)

Motor Power (kW)								
Type	UW04	UW06	UW08	UW10	UW12	UW16	UW20	UW25
<b><math>I_e</math> (A)</b>	<b>400</b>	<b>630</b>	<b>800</b>	<b>1000</b>	<b>1250</b>	<b>1600</b>	<b>2000</b>	<b>2500</b>
<b>380/415</b>	<=200	200-310	310-420	420-520	520-630	630-850	850-1050	1050-1300
<b>440</b>	<=225	225-330	330-450	450-560	560-670	670-900	900-1120	1120-1400
<b>690</b>	<=350	350-530	530-700	700-900	900-1050	1050-1400	1400-1750	1750-2200

Table 1.1

# Technical Application Benefits

## Frame - 2 (N/S/H Version)

Motor Power (kW)										
Type	UW04	UW06	UW08	UW10	UW12	UW16	UW20	UW25	UW32	UW40
Ie (A)	400	630	800	1000	1250	1600	2000	2500	3200	4000
<b>380/415</b>	<=200	200-310	310-420	420-520	520-630	630-850	850-1050	1050-1300	1300-1700	1700-2100
<b>440</b>	<=225	225-330	330-450	450-560	560-670	670-900	900-1120	1120-1400	1400-1800	1800-2250
<b>690</b>	<=350	350-530	530-700	700-900	900-1050	1050-1400	1400-1750	1750-2200	2200-2800	2800-3500

Table 1.2

## Frame-3 (H/V Version)

Motor Power (kW)												
Type	UW04	UW06	UW08	UW10	UW12	UW16	UW20	UW25	UW32	UW40	UW50	UW60
Ie (A)	400	630	800	1000	1250	1600	2000	2500	3200	4000	5000	6300
<b>380/415</b>	<=200	200-310	310-420	420-520	520-630	630-850	850-1050	1050-1300	1300-1700	1700-2100	2100-2800	2800-3150
<b>440</b>	<=225	225-330	330-450	450-560	560-670	670-900	900-1120	1120-1400	1400-1800	1800-2250	2250-3000	3000-3400
<b>690</b>	<=350	350-530	530-700	700-900	900-1050	1050-1400	1400-1750	1750-2200	2200-2800	2800-3500	3500-4600	4600-5200

Table 1.3

For a breaker to be used with AC-3 utilization category with frequent switching, reduces standard electrical life of a breaker.

# Technical Application Benefits

## Temperature Rise Monitoring & Control for OMEGA ACB

The effects of overheating at breaker terminals are detrimental to the circuit breaker as well as other equipments inside the panel.

**Some major effects are given below :**

- › Reduction in the life of Bus-bar/cables & even Breakers
- › Insulation deterioration and eventually insulation failure
- › Deterioration of Busbar insulating sleeve as overheating results in melting of Bus bar insulating sleeves
- › Blackening or Tarnishing of silver plated copper components
- › Overheating can also lead to uneven expansion of the busbar and could result in undesirable operation
- › Increased power losses and low reliability
- › Temperature rise at terminals may eventually result in Fire hazards

**Thus, overheating is one of the major concerns in ACBs (or Switchgear) and is therefore needed to be controlled at every cost.**

- › Generation of heat at Main contacts of ACB is inevitable & depends upon the design efficiency and the quality of materials used. Thus, as a user this is not in our hands to control.
- › Overheating at terminals is the bigger concern. It can be reduced by using correct termination practices & ensuring proper ventilation inside the panel. The temperature rise can be kept in check by monitoring the temperature at the terminals.
- › Therefore temperature at the terminals shall be monitored continuously to check for overheating that can have adverse impact on the system & subsequently corrective measure shall be taken in order to protect the equipment & the system from any damage or interruptions.





# Technical Application Benefits

## ETHERNET Communication with OMEGA Range

Communication Offers of OMEGA ACB:- Here is a list of various Communication Options available with OMEGA range of ACBs (Figure-1). Directly compatible with OMEGA ACBs are three widely used communication protocols,

1. Modbus TCP/IP (on ETHERNET Physical layer)
2. Modbus RS-485
3. Profibus

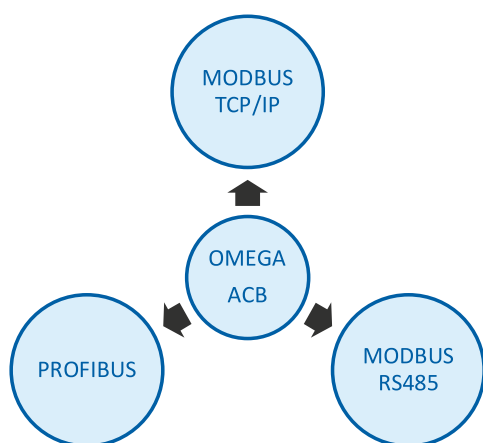


Figure-1

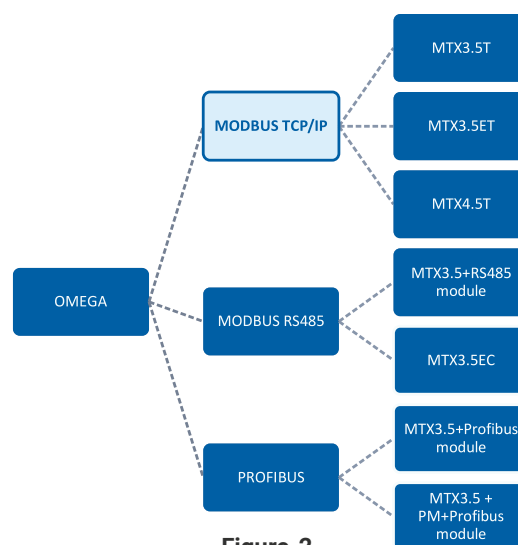


Figure-2

**ETHERNET Communication with OMEGA Range:** To enable communication use the MTX Power supply module, through which 24V DC is to be connected to the ETHERNET Module and ACB release. It is possible to use MTX Temperature module, ZSI module and all other add-on non-communication modules along with ETHERNET Communication.

OMEGA ACB with ETHERNET module can be easily connected to form Star topology in network.

This module allows circuit-breaker to access Release data. Therefore, it should only be connected to networks that meet all the security requirements and prevent access from unauthorized addresses (e.g. a plant's control system network). It's the panel builder's responsibility to ensure that all the necessary security measures, such as firewalls, are in place. The module should not be connected directly to the Internet. It's recommended to connect them only to dedicated ETHERNET networks using the Modbus TCP communication protocol.

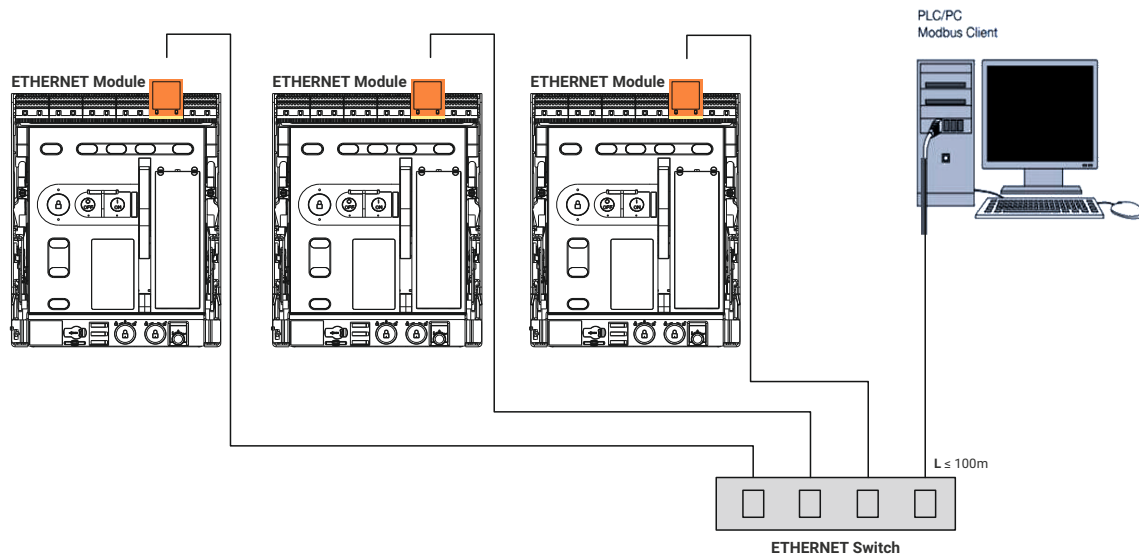
### ETHERNET Communication Architecture with OMEGA ACB:

The circuit-breaker is connected to the ETHERNET network via the RJ45 female connector of the ETHERNET Module, according to the following diagram. Use of ETHERNET Cat6 S/FTP cables is recommended.

Regarding the setup of communication networks, which falls under the customers' responsibility, it's important to follow standard installation procedures for ETHERNET industrial networks. This includes adhering to guidelines for maximum cable length and cable types. Customers are responsible for selecting and installing ETHERNET switches. The maximum cable length for connecting the ETHERNET module to the switch is 100 meters (using ETHERNET Cat6 S/FTP cable).

# Technical Application Benefits

## MODBUS TCP/IP (ETHERNET) Communication Architecture with OMEGA Range

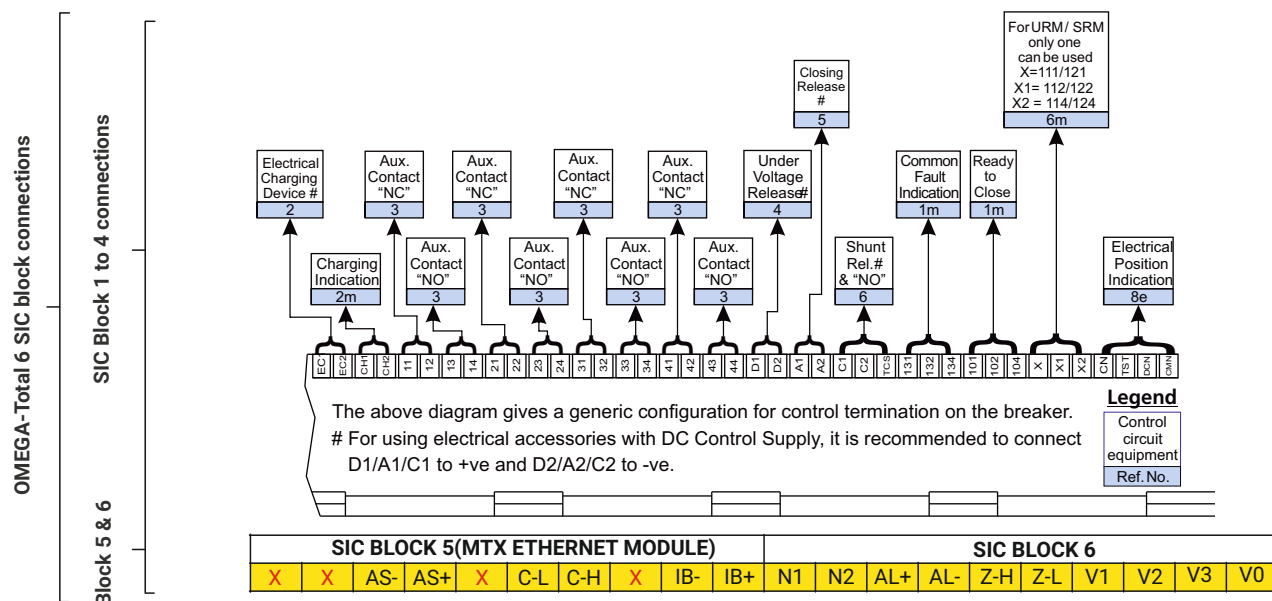


Ref. Diagram : ETHERNET Communication Architecture with OMEGA ACBs

### Characteristics of Modbus TCP/IP (ETHERNET) Communication

Characteristics of MTX TCP/IP	
Protocol	Modbus TCP/IP on the communication port
Baud Rate	10-100 Mbps
Port Ethernet	RJ45 female connector(W9)

### Wiring Diagram - SIC connections with ETHERNET Connectivity



"X" denotes unused SIC connections

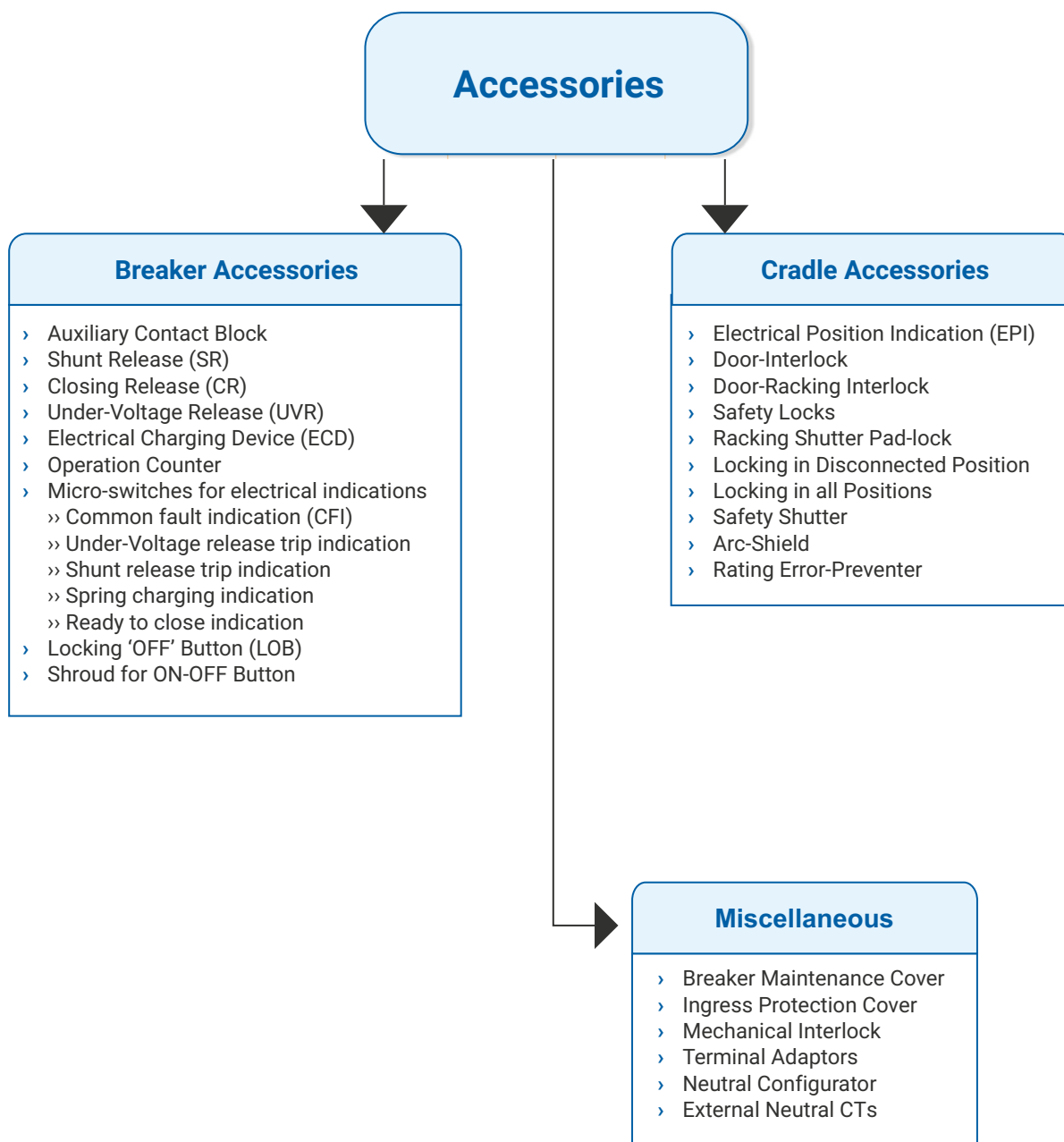


Electrical & Automation

A decorative graphic on the left side of the page. It features a circular frame with a thick blue border and a dashed grey line. Inside the circle, the text 'Air Circuit Breaker Accessories' is written in a bold blue font. To the right of the circle, there are stylized blue circuit lines and grey squares, suggesting a technical or electronic theme.

## **Air Circuit Breaker Accessories**

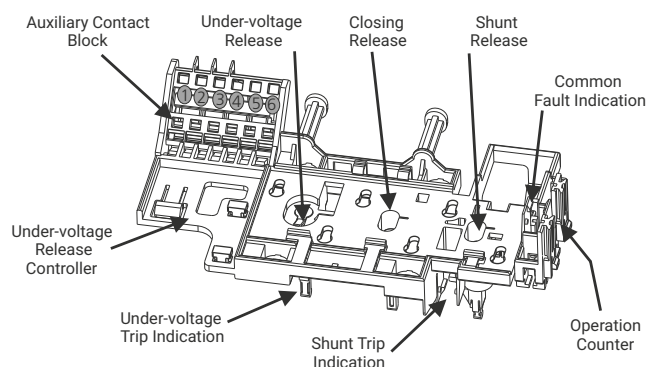
# Accessories



# Accessories

## Breaker Accessories

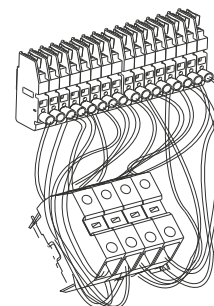
Modularity, the key design aspect of OMEGA ACBs facilitates the quick fixing & removal of several breaker mounted accessories such as CR, SR, UVR, Auxiliary contact blocks & various indicating micro-switches. These accessories are located on the front top-side of breaker mechanism & have specified positions.



## Auxiliary Contact Block

Auxiliary Contact Block contains the change-over switch contacts in combination of 4 units of 1NO+1NC each. Auxiliary contact block reflects the breaker ON/OFF state in control circuit.

Operational voltage (Ue)	upto 24V	110V	220/230V	400V
In (AC-12) at 50/60 Hz	10A	10A	10A	10A
In (AC-15) at 50/60 Hz	6A	6A	6A	4A

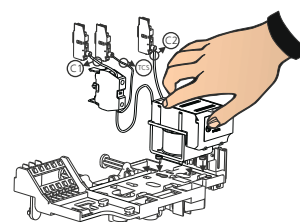


Operational voltage (Ue)	24V	40V	110V	220V
In (DC-12)	10A	8A	3.5A	1A
In (DC-13)	10A	4A	1.2A	0.4A

## Shunt Release (SR)

Shunt Release when energized opens the breaker instantaneously. OMEGA ACBs offer general purpose Shunt Release which can reliably trip the Circuit Breaker through external trip command.

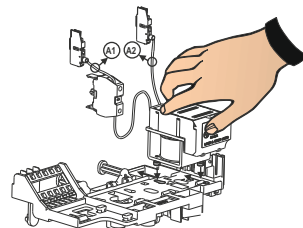
Operational voltage (Ue)	Power consumption	Operating range
110, 240, 415V AC at 50/60Hz	200VA for 0.5 sec	70-110% of Ue
24, 30, 48, 60, 110, 125, 220, 250V DC	200W for 0.5 sec	70-110% of Ue



# Accessories

## Closing Release (CR)

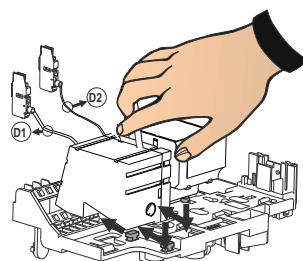
Closing Release remotely closes the Circuit Breaker if the spring mechanism is already charged. Closing Releases in OMEGA Air-circuit breakers come with inbuilt Electrical anti-pumping feature. Inbuilt electrical anti-pumping feature prevents auto-reclosing of Circuit Breaker on faults. Anti-pumping relay cancels the persistent closing signal after successful completion of the closing operation.



Operational voltage (Ue)	Power consumption	Operating range
110, 240, 415V AC at 50/60Hz	200VA for 0.5 sec	85-110% of Ue
24, 30, 48, 60, 110, 125, 220, 250V DC	200W for 0.5 sec	85-110% of Ue

## Under-voltage Release + Time Delay Module (UVR)

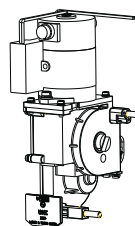
The Under-voltage Release causes the Circuit Breaker to open if the operational voltage falls to a value between 35% and 70% of its rated voltage or not applied. UV Release mechanically locks the closing of breaker & it makes it impossible to close the Circuit breaker, either manually or electrically. The Circuit breaker can be closed with operation voltage of 85-110% of its rated value. UV Release can be used for monitoring the voltage in the primary (power circuit) or secondary (control circuits) circuits or can be used for electrical interlocking scheme (for DG synchronization, paralleling of transformers etc). In order to avoid the nuisance tripping of the circuit breaker during short voltage dips, UV release comes with the UV-delay module. Operation of UVR can be delayed between 0 to 5 secs. in steps of 0-1-3-5 sec.



Type	Normal Voltage	Short-time Power Consumption	Operating Limit
UVR (Delay Setting-0,1, 3 & 5 sec)	110, 220, 240, 415 V AC 50Hz / 60Hz	200 VA max, 3s	85 - 110%
	24, 30, 48, 110, 220 V DC	200 W max, 3s	

## Electrical Charging Device (ECD)

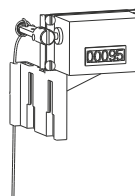
Electrical Charging Device automatically charges the closing springs of the circuit breaker operating mechanism. After Circuit Breaker closing operation, the geared motor immediately recharges the closing spring. Thus instantaneous re-closing of the circuit breaker is possible following opening operation. The closing springs can also be charged manually (using the spring-mechanism charging handle) in the event of an auxiliary power supply failure or during maintenance work.



Operational voltage (Ue)	Power consumption	Operating range
110, 240, 415V AC at 50/60Hz	300VA for 1 sec	85-110% of Ue
24, 30, 48, 60, 110, 125, 220, 250V DC	300W for 1 sec	85-110% of Ue

## Operation Counter

The Operation Counter indicates the number of operating cycles the Circuit breaker has been subjected to and it is visible on the Circuit breaker front-facia. It is compatible with manual and electrical controlfunctions. Counter readings serve as a guide for maintenance & inspection.





# Accessories

## Micro-Switches for Electrical Indications

**Common Fault Indication (CFI):** CFI provides the electrical indication of circuit breaker tripping due to operation of protection & control unit.

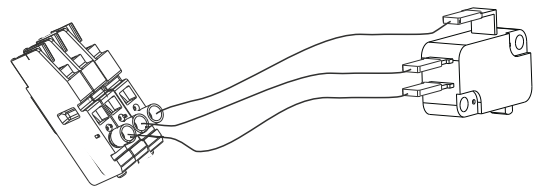
**Under-Voltage Release Trip Indication:** Under-voltage Release Trip Indication micro-switch provides electrical indication of circuit breaker tripping with the operation of under-voltage release.

**Shunt Release Trip Indication:** Shunt Release Trip Indication micro-switch provides electrical indication of circuit breaker tripping with operation of shunt release.

**Spring Charging Indication:** Spring Charging Indication micro-switch provides the electrical indication whether main mechanism spring is charged or not.

**Ready-To-Close Indication (RTC):** RTC takes into account all the safety parameters that are part of the control & monitoring system of electrical installation. OMEGA RTC allows the circuit breaker to close only if following conditions are met:

- › Main spring is charged
- › Circuit Breaker is OFF
- › Shunt release is de-energized
- › Under-Voltage release is energized
- › All Arc-chutes are properly placed
- › Mechanical trip indication lever on release is reset
- › Racking shutter is closed



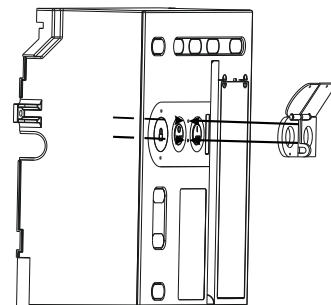
## Lockable Trip Push Button (LTPB/LOB)

LOB locks the breaker in OFF position by continuously pressing the OFF push button. Lock defeats all the positive closing signals (mechanical or electrical) coming to the breaker and thus prevents the nuisance closing of the breaker. Locking 'OFF' button (LOB) can be implemented using C-Type / R-Type of locks. The locks are designed in such a way that the keys cannot

be removed out till the breaker is locked (OFF button pressed). Locking of the breaker in OFF position ensures safety of the maintenance person working on downstream equipment. Locking 'OFF' button (LOB) can be used to design the interlocking schemes with other devices in the system.

## Shroud for ON-OFF Button

Transparent shroud blocks the access to the ON/OFF push-buttons used to open and close the breaker. It prevents inadvertent or unauthorized operation of the ON or OFF button. It's possible to independently lock the ON/OFF push button with the help of ON-OFF button shroud & mechanical lock. It can be pad-locked with lock of 6mm diameter.

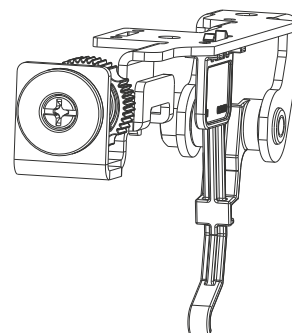


# Accessories

## Cradle Accessories

### Electrical Position Indication (EPI)

Secondary Isolating Contact (SIC) blocks on ACB cradle assembly facilitates the electrical indication for the exact position of the breaker within the cradle. 3 SIC contacts electrically indicates the Connected / Test / Disconnected positions of breaker.

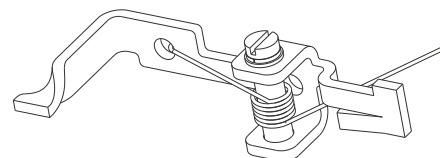


### Door-interlock

Door-interlock inhibits the opening of door if ACB is in Test or Service position. Door-interlock can be mounted on either side of the cradle (LHS or RHS).

### Door-racking interlock

Door-racking interlock prevents the racking-in operation of the breaker if panel door is open.

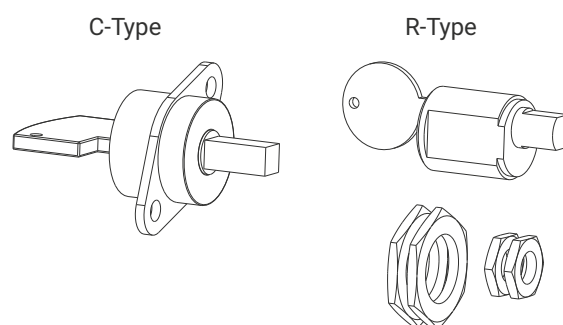


### Safety Locks

Any of C-Type, R-Type locks can be used for locking the ACB in "Any position"/"Isolated position" & locking "OFF" push button, for interlocking with other electrical devices in the control scheme of the system.

### Racking Shutter Pad-lock

Racking Shutter Pad-lock inhibits the access to the racking mechanism such that racking handle cannot be inserted to rack-in/rack-out the breaker. Racking Shutter Pad-lock is an inbuilt feature with OMEGA ACBs. It can be pad-locked with lock hasp of 6mm diameter.



# Accessories

## Locking in Disconnected position

Locking in Isolated/Disconnected position inhibits the undesirable racking-in operation of the breaker from the isolated position. Locking in isolated position can be implemented using C-Type, R-Type locks. Locking of the breaker in disconnected position ensures safety of the maintenance person working on downstream equipment.

The locks are designed in such a way that the keys cannot be removed out till the breaker is locked, at the same time the breaker cannot be locked in "Service/Connected" or "Test" positions. Locking in Disconnected position can be used to design the interlocking schemes with other devices in the system.

## Locking in all positions

Locking in all positions facilitates the locking of breaker in Connected/Test or isolated positions. Locking in all positions can be implemented using C-Type, R-Type locks.

## Safety Shutter

The fixed part (cradle) of withdrawable Circuit Breaker contains safety shutters for preventing inadvertent access to live terminals of Circuit Breaker when breaker is withdrawn from the cradle. Safety shutters can be locked in closed position using pad-lock devices.

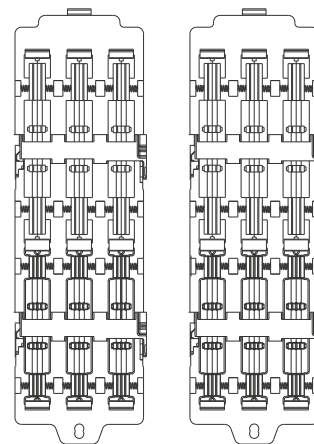
## Arc-shield

Arc-shield helps in reducing the vertical clearance between two ACBs in vertical tier panels from 300mm to mere 45mm\*. Arc-shield facilitates in compact design of switchboards

## Rating Error-Preventer

Rating Error-Preventer ensures that the breaker of proper rating goes with the cradle of corresponding rating. It is made up of two sub-assemblies one on the cradle and other one on the breaker. Rating Error-Preventer offers distinct combination for a particular breaking capacity version within a particular rating of the breaker. Rating Error-Preventer comes as an inbuilt feature with OMEGA ACBs.

\* In case of Temperature Module mounted on the Cradle this dimension should be 70 mm.

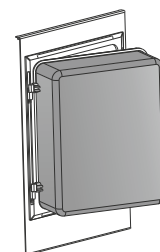
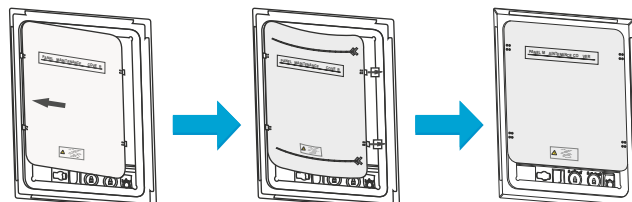


# Accessories

## Miscellaneous Accessories

### ACB Maintenance Cover

Using Cover, panel door can be covered during maintenance at site to prevent the entry of dust or foreign material in the panel enclosure and cradle. The same can be fitted on the bezel without any tool and is common for fix and draw-out version of OMEGAACB.



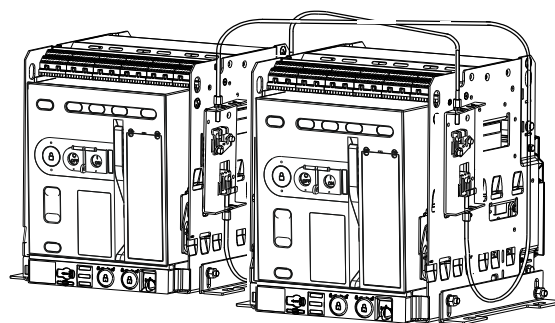
### Ingress Protection Cover

A transparent safety cover mounted on the door-sealing frame on panel door increases the Ingress Protection (IP) of the ACB from IP53 to IP54. Safety cover can be mounted in Left hinge / Right hinge combinations.

# Accessories

## Mechanical Interlock

Mechanical Interlock is used for interlocking breakers as per the desired control scheme. It can interlock up to three OMEGA ACBs of Fixed/Draw-out/Mixed version. The breakers can be interlocked in Vertical or Horizontal configuration. Cable length: 2/3/5 meter, minimum radius at cable bend: 70mm













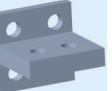

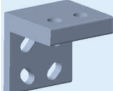


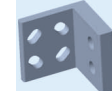
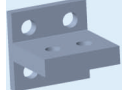


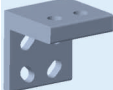




## Possible mounting arrangements

Type of Interlock	Typical Circuit	Interlocks Possible	Schematic Diagram																								
Two Incomers (2 I/C)		<table><tr><td>A</td><td>B</td></tr><tr><td>O</td><td>O</td></tr><tr><td>I</td><td>O</td></tr><tr><td>O</td><td>I</td></tr></table>	A	B	O	O	I	O	O	I																	
A	B																										
O	O																										
I	O																										
O	I																										
Three Incomers (3 I/C)		<table><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>O</td><td>O</td><td>O</td></tr><tr><td>I</td><td>O</td><td>O</td></tr><tr><td>O</td><td>I</td><td>O</td></tr><tr><td>O</td><td>O</td><td>I</td></tr></table>	A	B	C	O	O	O	I	O	O	O	I	O	O	O	I										
A	B	C																									
O	O	O																									
I	O	O																									
O	I	O																									
O	O	I																									
Two Incomers & One Standby (2 I/C + 1 S/B)		<table><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>O</td><td>O</td><td>O</td></tr><tr><td>I</td><td>O</td><td>O</td></tr><tr><td>O</td><td>I</td><td>O</td></tr><tr><td>I</td><td>I</td><td>O</td></tr><tr><td>O</td><td>O</td><td>I</td></tr></table>	A	B	C	O	O	O	I	O	O	O	I	O	I	I	O	O	O	I							
A	B	C																									
O	O	O																									
I	O	O																									
O	I	O																									
I	I	O																									
O	O	I																									
Two Incomers & One BusCoupler (2 I/C + 1 B/C)		<table><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>O</td><td>O</td><td>O</td></tr><tr><td>I</td><td>O</td><td>O</td></tr><tr><td>O</td><td>I</td><td>O</td></tr><tr><td>O</td><td>O</td><td>I</td></tr><tr><td>O</td><td>I</td><td>I</td></tr><tr><td>I</td><td>I</td><td>O</td></tr><tr><td>I</td><td>O</td><td>I</td></tr></table>	A	B	C	O	O	O	I	O	O	O	I	O	O	O	I	O	I	I	I	I	O	I	O	I	
A	B	C																									
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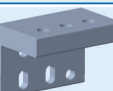
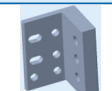
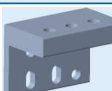










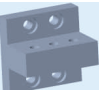

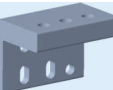







O - Breaker Open    I - Breaker Closed

# Accessories

## Dimension of Terminal Adaptors

Frame	Rating	Drawout Versions				Fixed Versions			
		Upto 690V		800/1000V		Upto 690V		800/1000V	
		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Frame 1	400A-1000A	CL604380000	CL604380000	CL609630000	CL609630000	N/S: CL609670000 H: CL609680000	N/S: CL609670000 H: CL609680000	CL609670000	CL609670000
									
		w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15
	1250A-1600A	CL609630000	CL609630000	CL609630000	CL609630000	N/S: CL609670000 H: CL609680000	N/S: CL609670000 H: CL609680000	CL609670000	CL609670000
									
		w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15
	2000A	CL609630000	CL609630000	Vertical Only	CL609640000	N/S: CL609670000 H: CL609680000	N/S: CL609670000 H: CL609680000	Vertical Only	CL601220000
									
		w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 65 x 15	w x Th: 100 x 20
	2500A	Vertical Only	CL609640000	NA	NA	Vertical Only	N/S: CL609760000	NA	NA
									
			w x Th: 98 x 20				w x Th: 100 x 20		

Qty: 1 No. per phase (Each incoming and Outgoing)

Frame	Rating	Drawout Versions				Fixed Versions			
		Upto 690V		800/1000V		Upto 690V		800/1000V	
		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Frame 2	400A-2000A	CL609640000	CL609640000	CL609640000	CL609640000	N/S: CL601220000 H: CL609770000	N/S: CL601220000 H: CL609770000	CL609770000	CL609770000
									
		w x Th: 98 x 20	w x Th: 98 x 20	w x Th: 98 x 20	w x Th: 98 x 20	w x Th: 100 x 20	w x Th: 100 x 20	w x Th: 100 x 20	w x Th: 100 x 20
	2500A	CL609640000	CL609640000	CL609640000	CL609640000	N/S: CL601220000 H: CL609770000	N/S: CL601220000 H: CL609770000	Vertical Only	CL603180000
									
		w x Th: 98 x 20	w x Th: 98 x 20	w x Th: 98 x 20	w x Th: 98 x 20	w x Th: 100 x 20	w x Th: 100 x 20		w x Th: 125 x 20
	3200A	CL609640000	CL609640000	CL603160000	CL604190000	CL609770000	CL609770000	Vertical Only	CL604170000
									
		w x Th: 98 x 20	w x Th: 98 x 20	w x Th: 100 x 32	w x Th: 125 x 20	w x Th: 100 x 20	w x Th: 100 x 20		w x Th: 150 x 20
	4000A	CL603160000	CL604200000	CL603160000	CL604200000	Vertical Only	N/S: CL604170000	NA	NA
									
		w x Th: 100 x 32	w x Th: 150 x 20	w x Th: 100 x 32	w x Th: 150 x 20		w x Th: 150 x 20		

Qty: 1 No. per phase (Each incoming and Outgoing)



# Accessories

Frame	Rating	Drawout Versions				Fixed Versions			
		Upto 690V		800/1000V		Upto 690V		800/1000V	
		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Frame 3	400A-3200A	CL600730000	CL601280000	CL600730000	CL601280000	CL603730000	CL604180000	CL603730000	CL604180000
		W x Th: 165 x 15	H x Th: 125 x 15	W x Th: 165 x 15	H x Th: 125 x 15	W x Th: 165 x 20	H x Th: 125 x 20	W x Th: 165 x 20	H x Th: 125 x 20
	4000A	CL600730000	CL601280000	CL609660000	CL600670000	CL603730000	CL604180000	CL603730000	CL604180000
		W x Th: 165 x 15	H x Th: 125 x 15	W x Th: 165 x 20	H x Th: 125 x 20	W x Th: 165 x 20	H x Th: 125 x 20	W x Th: 165 x 20	H x Th: 125 x 20
	5000A	CL609660000	CL600670000	Vertical Only	CL609650000	CL603730000	CL603470000	Vertical Only	CL603470000
		W x Th: 165 x 20	H x Th: 125 x 20		H x Th: 150 x 20	W x Th: 165 x 20	H x Th: 150 x 20		H x Th: 150 x 20
	6300A	Vertical Only	CL609650000	-	-	NA	NA	NA	NA
			H x Th: 150 x 20						

Qty: 2 Nos. per phase for Vertical and 1 No. per phase for Horizontal (Each incoming and Outgoing)  
 Upto 690V: 4000A and 5000A Horizontal is for buscoupler applications. Please consult us for further details

# Accessories

## Neutral Configurator

Neutral configurator helps in customization of Neutral Sequence or Phase Sequence at the Air Circuit Breaker end. Neutral Configurator can be connected with the breaker on-site. It enables user to customize the phase sequence at breaker end without any design modification required in panel. In case of standard phase sequence the output of the Breaker CTs directly connected to the MTX Release with the help of

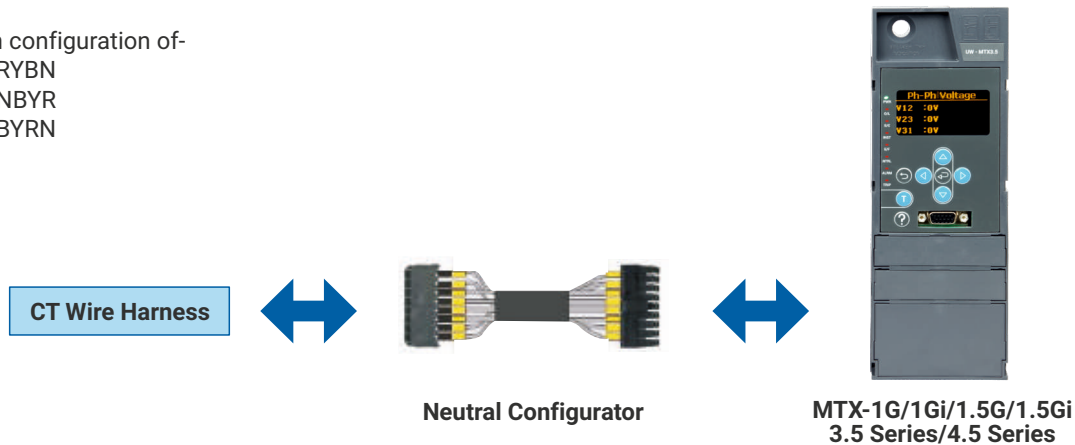
**Note 1:** While Neutral Configurator is being used for interchanging Neutral Pole with any other pole, the CTs of respective Poles must also be interchanged. Therefore CT of the old Neutral-Pole should now be placed in new Neutral Pole.

Available in configuration of-

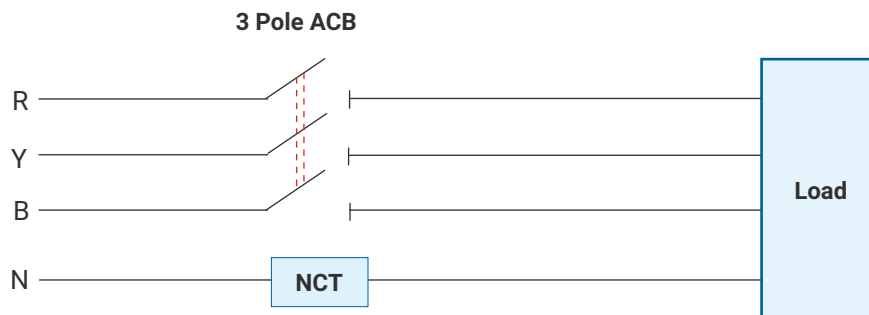
- › NRYB to RYBN
- › NRYB to NBYR
- › NRYB to BYRN

Wire harness. When Neutral Configurator is being used it will be connected to the MTX Release and harness wire will be connected to the other end of the Neutral Configurator. It can be used irrespective of Breaker frame sizes, Ratings and MTX Release types. **Neutral configurator is compatible with 100%N systems only.**

**Note 2:** For Releases MTX3.5 Series and MTX4.5 Series Voltage Tapping Input at SIC Contacts V0 (N), V1 (R), V2 (Y) & V3 (B) should also be interchanged in accordance with used Neutral Configurator.



## External Neutral CTs



In case of TPN system, NCT must be used to avoid nuisance tripping of the three pole ACB under unbalanced load condition.

In case of current unbalance,  
 $I_R + I_Y + I_B + I_N = 0$ , but  
 $I_R + I_Y + I_B \neq 0$

In absence of NCT, the EF enabled Protection & Control Unit will follow the second equation resulting in false indication of

EF, and will trip if it exceeds threshold value, causing undesirable interruptions in the Electrical system and deterioration of ACB life.

Installation of NCT can also be used for Neutral Overload Protection for sensing overcurrent flowing through the neutral conductor.

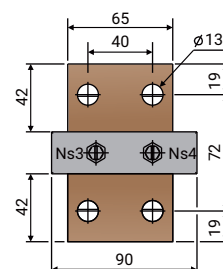
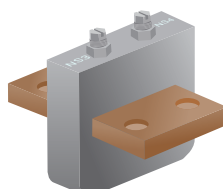
# Accessories

For Earth fault protection and protection of Neutral against overloads, Neutral CT is required. For 4-Pole breakers, the CT is provided inside the breaker, to be used on 4 wire system whereas for 3-pole breakers, external CT is available separately. It is important that with OMEGA System of breaker, special neutral CTs supplied by Lauritz Knudsen are mandatorily to be used.

Frame Size	Rating
1, 2 & 3	400/630/800/ 1000/1250/1600
1#	1000/2000

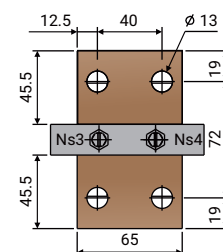
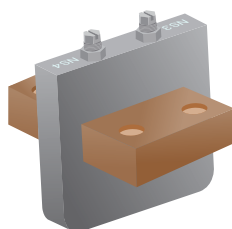
(#: For all ACB's having batch code after Jan. 2022)

TERMINAL THICKNESS 15 mm.



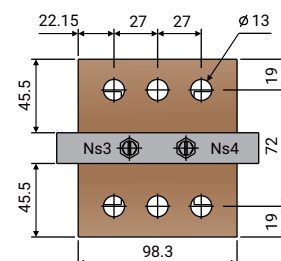
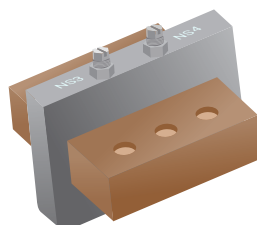
Frame Size	Rating
1	2000/2500

TERMINAL THICKNESS 30 mm.



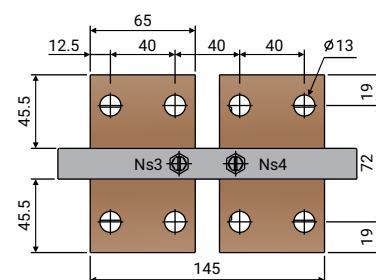
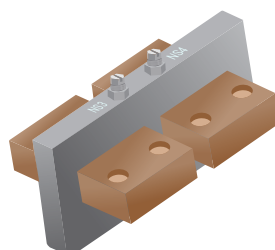
Frame Size	Rating
2 & 3	2000/2500/ 3200/4000

TERMINAL THICKNESS 30 mm.



Frame Size	Rating
3	5000/6300

TERMINAL THICKNESS 30 mm.



M12 / Equivalent bolts to be used for links termination.

Tightening torque: 3.2 kgfm

All Dimensions are in mm

# Performance

## In-Air Temperature Derating of OMEGA ACB

Current carrying capacity at different temperatures OMEGA Air Circuit Breaker can operate at higher temperatures than the reference temperature of 40°C as prescribed in IS & IEC standards, under certain installation conditions. However in some cases current-carrying capacity needs to be reduced in order to follow temperature rise limits and safe working conditions.

The table below shows the current carrying capacity of OMEGA ACB's where T = temperatures measured around the rear connections of the Air Circuit Breaker.

### Current carrying capacity with copper as bus-bar material & vertical configuration

Frame size & current rating	Versions	Current carrying capacity at different temperature (T)				
		40°C	50°C	55°C	60°C	70°C
UW1-08	N	800	800	800	800	800
	S/N08/D10	800	800	800	800	800
	H	800	800	800	800	800
UW1-10	N	1000	1000	1000	1000	1000
	S/N08/D10	1000	1000	1000	1000	1000
	H	1000	1000	1000	1000	1000
UW1-12	N	1250	1250	1250	1250	1250
	S/N08/D10	1250	1250	1250	1250	1250
	H	1250	1250	1250	1250	1250
UW1-16	N	1600	1600	1530	1450	1360
	S/N08/D10	1600	1600	1600	1550	1460
	H/N08	1600	1600	1600	1600	1600
UW1-20	N	2000	2000	2000	2000	1800
	S/N08/D10	2000	2000	2000	2000	1890
	H	2000	2000	2000	2000	2000
UW2-25	N	2500	2500	2500	2500	2250
	S	2500	2500	2500	2500	2500
	H/N08/N10	2500	2500	2500	2500	2500
UW2-32	N/S/H/N08/N10	3200	3200	3200	3200	3050
UW2-40	N/S/H	4000	4000	3800	3600	3300
UW3-40	H/V/N08/S08	4000	4000	4000	4000	3850
UW3-50	H/V/N08/S08	5000	5000	5000	5000	4770
UW3-63	H/V	6300	6130	5840	5540	5230

**Note:** The values indicated in the above tables are for general guideline for product selection. These values have been extrapolated from test data and theoretical calculations.

They cannot replace practical industrial application or a temperature rise test. However de-rating of switchgear depends on others factors such as cross section area, orientation and material of bus-bar, healthiness of bus-bar joints, panel construction, and ventilation etc.

Kindly take note of the following important points: The in-panel temperature performance may vary depending on panel configurations, ambient conditions, and load current in the circuit. Therefore, it is advisable to consider these factors when making a final selection of OMEGA ACB.

# Performance

## Altitude derating of OMEGA ACB

As altitude rise from sea level, the density of that air reduces dramatically. Reduced air density at altitudes greater than 2000 meters affects the ability of a circuit breaker to transfer heat and interrupt faults compared with sea

level. The ability of fault interruption reduces with the increase of altitude, because di-electric strength of air also reduces with density.

Altitude derating						
Altitude	H	(m)	<2000	3000	4000	5000
Rated service voltage (at 50/60 Hz)	Ue	(V)	Ue	0.9Ue	0.8Ue	0.7Ue
Rated Uninterrupted Current at 40°C	In	(A)	In	0.98In	0.96In	0.94In
Impulse withstand voltage	Uimp	(kV)	12	11	10	8
Rated insulation voltage	Ui	(V)	1000	900	780	700

## Watt-loss Data of 690V OMEGA ACB

Watt loss plays an important role in the electrical performance of Air Circuit Breaker. Factors like overall dimension, rated current carrying capacity of Bus-bar and watt loss of apparatus attached to the Air Circuit Breaker also plays an important role in calculation of watt loss data.

Total watt loss value is measured at rated current (In) of 3 Pole Air Circuit Breaker at 50/60 Hz. ( $W=3 \times I_n^2 \times R$ ), where R is the resistance measured across the upper & lower terminated of ACB.

Frame Size & Current Rating	For Draw-out ACB (Watt)			
	N	S	H	V
UW1-08	100	50	35	
UW1-10	160	65	50	
UW1-12	210	100	65	
UW1-16	325	160	100	
UW1-20	440	390	220	
UW2-25	560	560	465	
UW2-32	600	600	600	
UW2-40	770	770	770	
UW3-40			500	500
UW3-50			750	750
UW3-63			1000	1000

# Performance

## Inside Switchboards

The current carrying capacity of a circuit breaker is highly dependent on the installation conditions and installation environment in which it is assembled, i.e. switchboard. Various factors like cross section of busbars, connection orientation of busbars, IP of switchboard, ambient temperature, ventilation of switchboard, dimension of switchboards, etc..directly affect the current carrying capacity

of ACB inside switchboard. Hence, it is very difficult to give exact values of current rating without performing a temperature rise test in the actual switchboard configuration, as indicated in IEC 61439-1 (Low Voltage switchgear and controlgear assemblies - Part 1: General rules). However, the following derating data give a general guideline for ACB selection and indicative performance.

## Considerations

- › Indoor application
- › Drawout circuit breakers
- › Termination done on Terminal Adaptors provided with the product
- › Conductivity of Links: Copper - Atleast 99% IACS, Aluminium - Atleast 55% IACS
- › One ACB per switchboard - Single Tier Construction
- › ACB located centrally in panel height wise
- › For Natural Cooling: Area of inlet vents/louvres - Atleast 250 cm<sup>2</sup>, Area of outlet vents/louvres - Atleast 350 cm<sup>2</sup>. Applicable for both IP4X & IP5X.
- › Location of vents/louvres and Bus Bars Link sizes should be as per the recommendations from OEM
- › Horizontal Bus Bars (HBB) Arrangement: DDIL - Double Deck Inter Leaved



# Busbar Drilling Details

Refer to the below guidelines for ACB terminal details and busbar selection/hole drilling:

1. Below table shows ACB terminal height/width details along with no. of holes.
2. Busbar selection and hole drilling to be done as per ACB terminal.
3. Height/Width of busbar should be equal to or more than the terminal height/width
4. No. of holes to be drilled on busbar should be equal to no. of holes on terminal



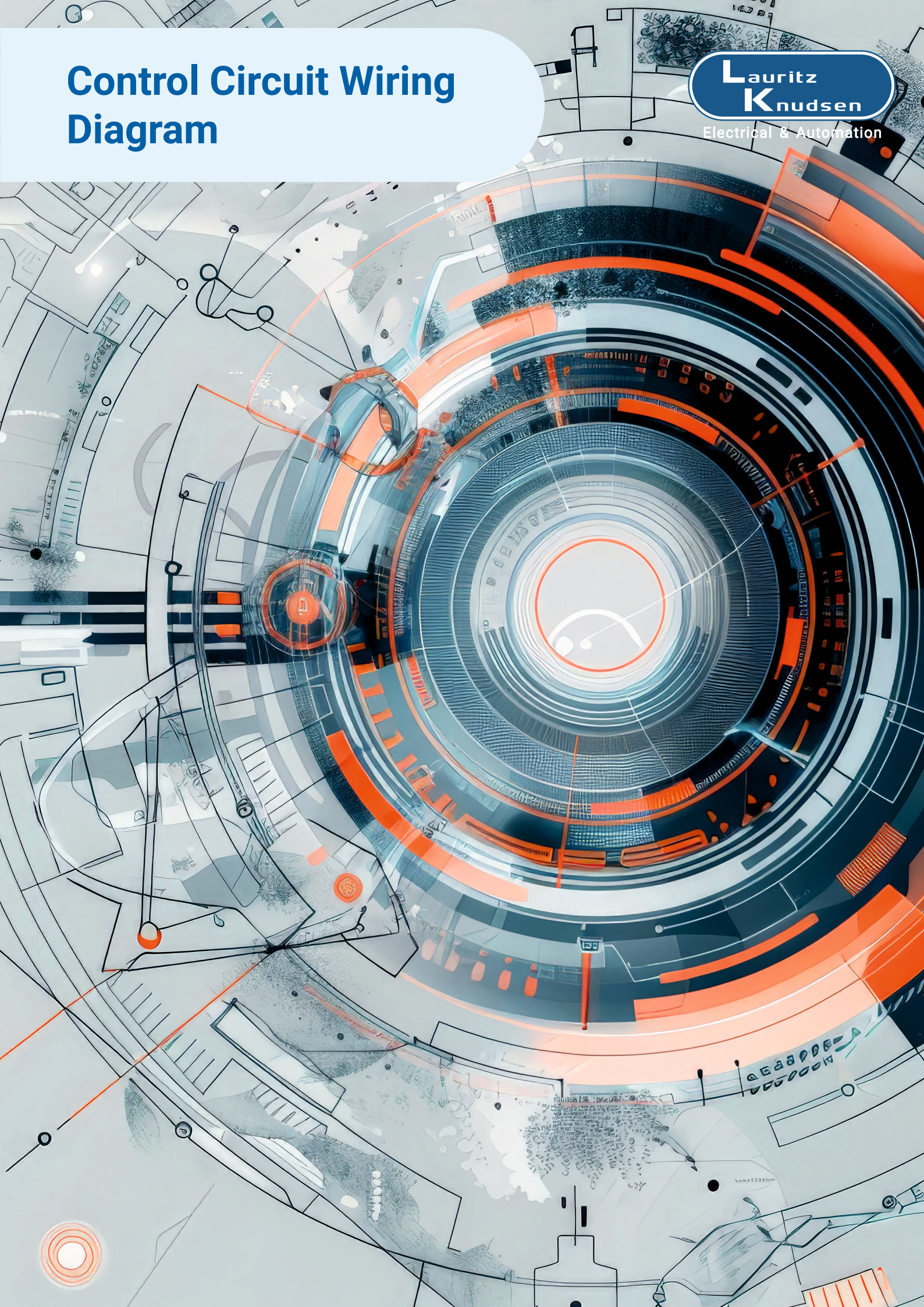
Upto 690V AC									
		FIXED				DRAW-OUT			
		Vertical		Horizontal		Vertical		Horizontal	
Frame	Current	No of holes	ACB Terminal Height (mm)	No of holes	ACB Terminal Width (mm)	No of holes	ACB Terminal Height (mm)	No of holes	ACB Terminal Width (mm)
1	400-2000	2	65	2	65	2	65	2	60
	2500	3	100	NA		3	98	NA	
2	400-3200	3	100	3	100	3	98	3	100
	4000	5	150	NA	NA	5	150	3	100
3	400-4000	4	125	6	165	4	125	6	165
	5000	5	150	6	165	4	125	6	165
	6300	NA		NA		5	150	NA	

800V AC									
		FIXED				DRAW-OUT			
		Vertical		Horizontal		Vertical		Horizontal	
Frame	Current	No of holes	ACB Terminal Height (mm)	No of holes	ACB Terminal Width (mm)	No of holes	ACB Terminal Height (mm)	No of holes	ACB Terminal Width (mm)
1	400-1600	2	65	2	65	2	65	2	60
	2000	3	100	NA		3	98	NA	
2	400-2000	3	100	3	100	3	98	3	100
	2500	4	125	NA		3	98	3	98
	3200	5	150	NA		4	125	3	100
	4000*	NA		NA		5	150	3	100
3	400-4000	4	125	6	165	4	125	6	165
	5000	5	150	NA		5	125	NA	



# Control Circuit Wiring Diagram

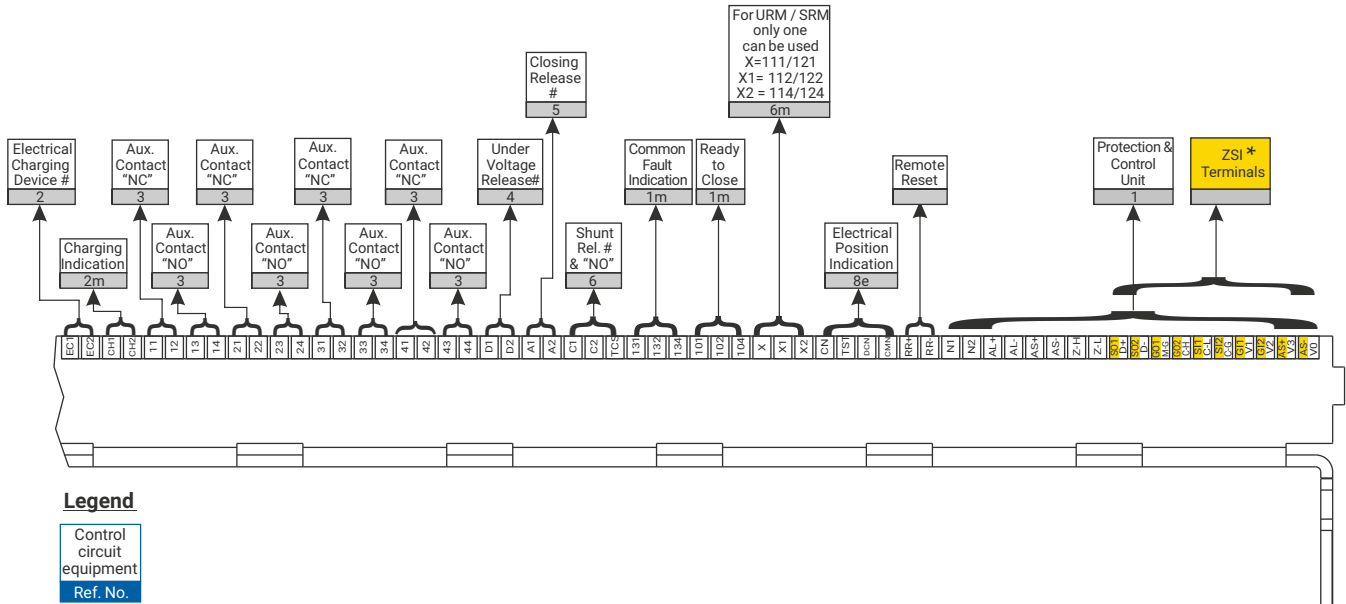
**Lauritz  
Knudsen**  
Electrical & Automation





# SIC Terminations

## UW-MTX1.0/1G/1Gi/1.5G/1.5Gi/3.5 Series/4.5 Series



The above diagram gives a generic configuration for control termination on the breaker. For individual Trip Unit's SIC Connection Details, please refer next pages.

**Note:** For Modbus TCP/IP (ETHERNET) SIC Connection, please refer page 86.

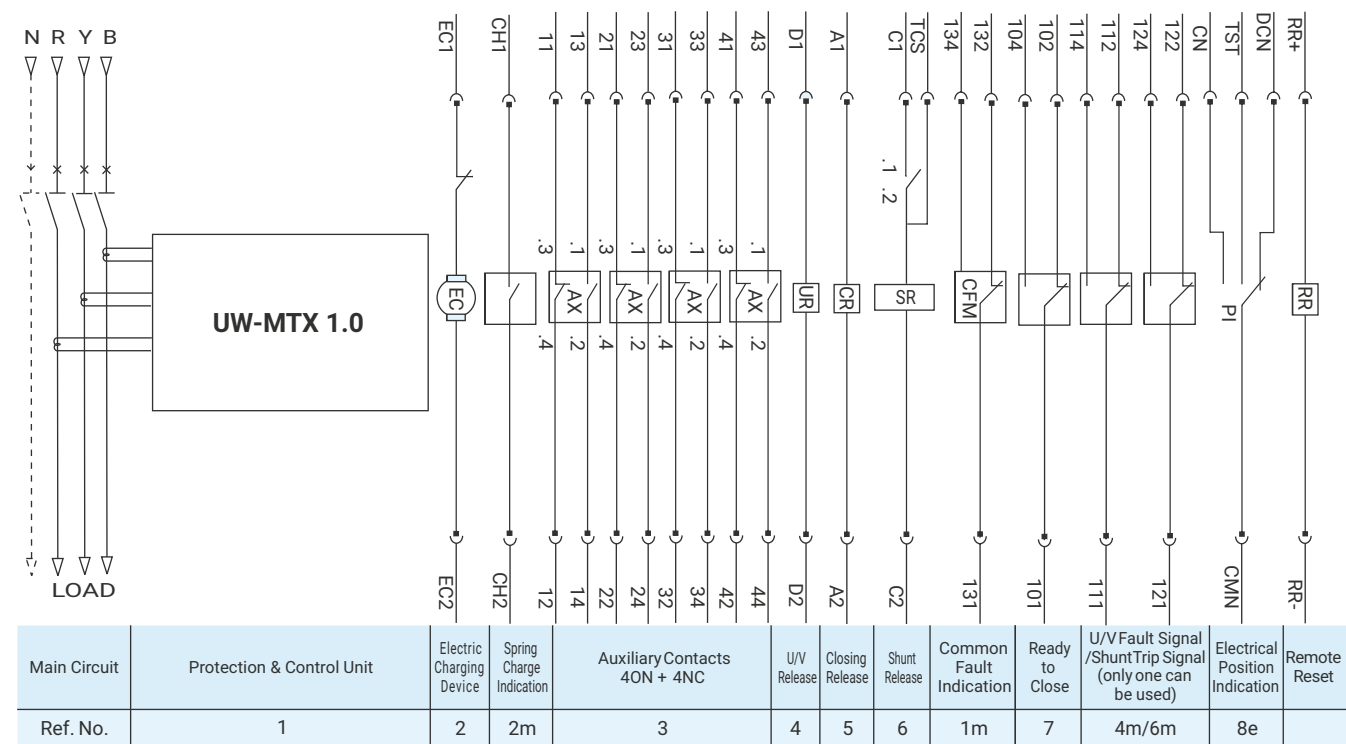
# For using electrical accessories with DC Control Supply, it is recommended to connect D1/A1/C1 to +ve and D2/A2/C2 to -ve.

\* These ZSI Terminals should only be used for MTX 1Gi/1.5Gi Releases.

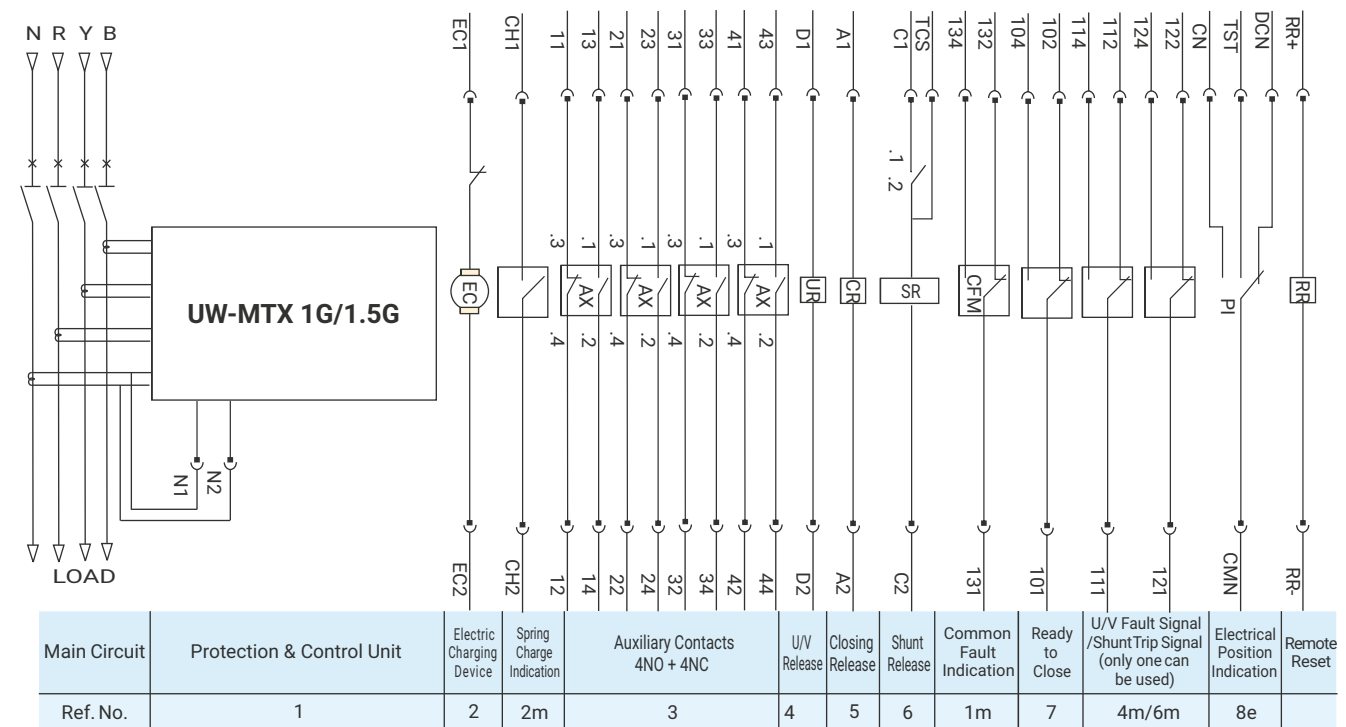
# m indicates micro switch

# Connection Details

## UW-MTX1.0



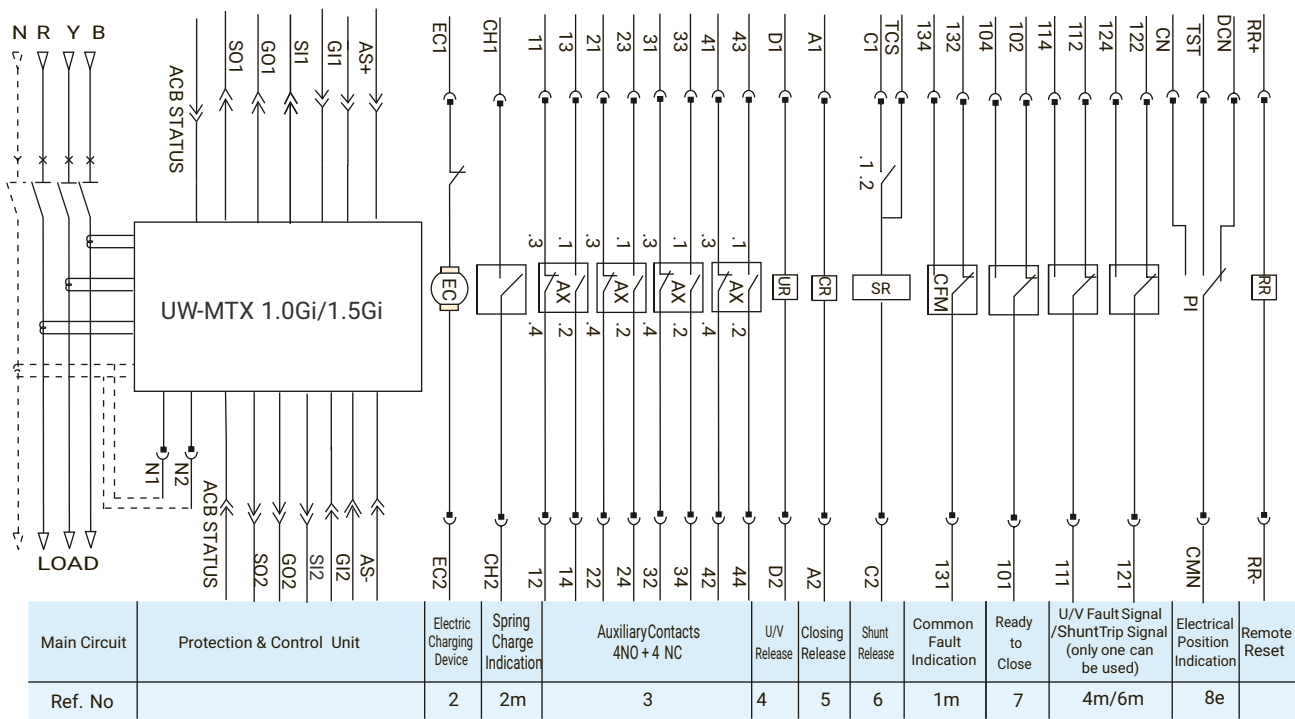
## UW-MTX 1G/1.5G



N1, N2, External Neutral CT

# Connection Details

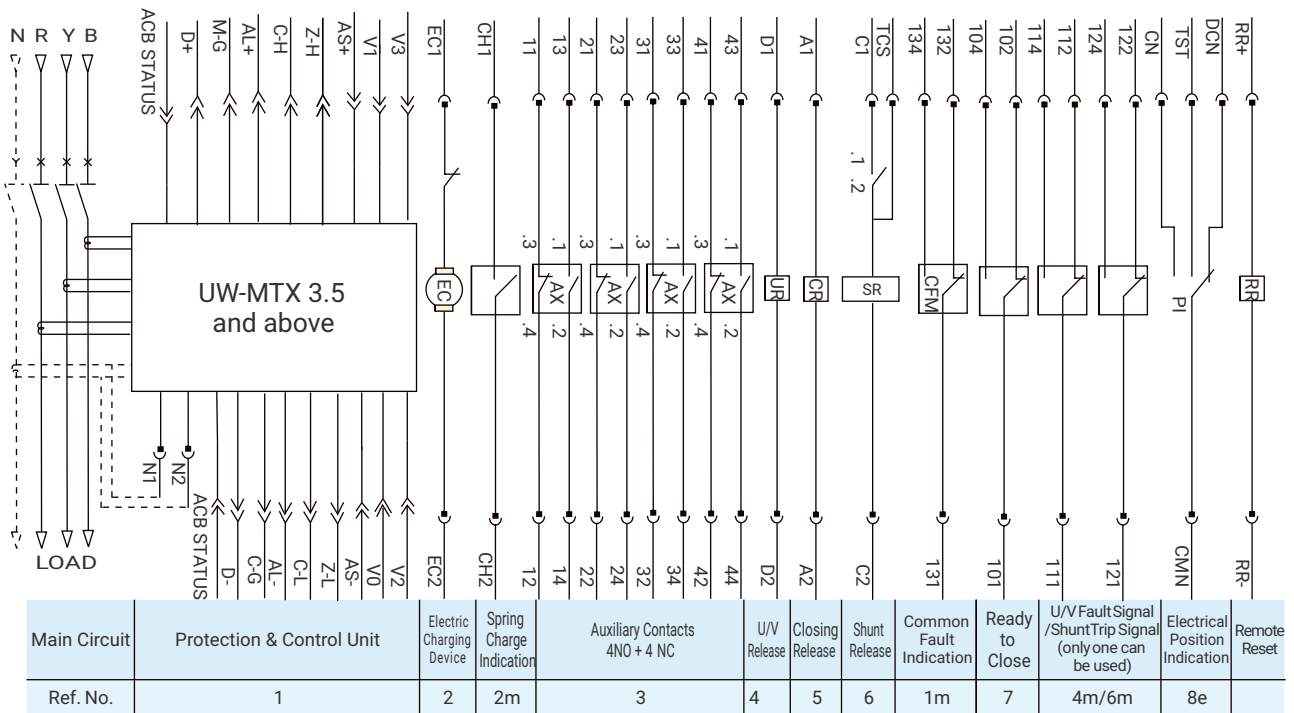
## UW-MTX 1Gi/1.5Gi



AS+ : Auxiliary 24V DC  
AS- : Ground  
SOUT : ZSI S/C Output  
SIN : ZSI S/C Input  
GOUT : ZSI E/F Output  
GIN : ZSI E/F Input  
N1 : External Neutral CT  
N2 : External Neutral CT

## Connection Details

## UW-MTX 3.5 and above



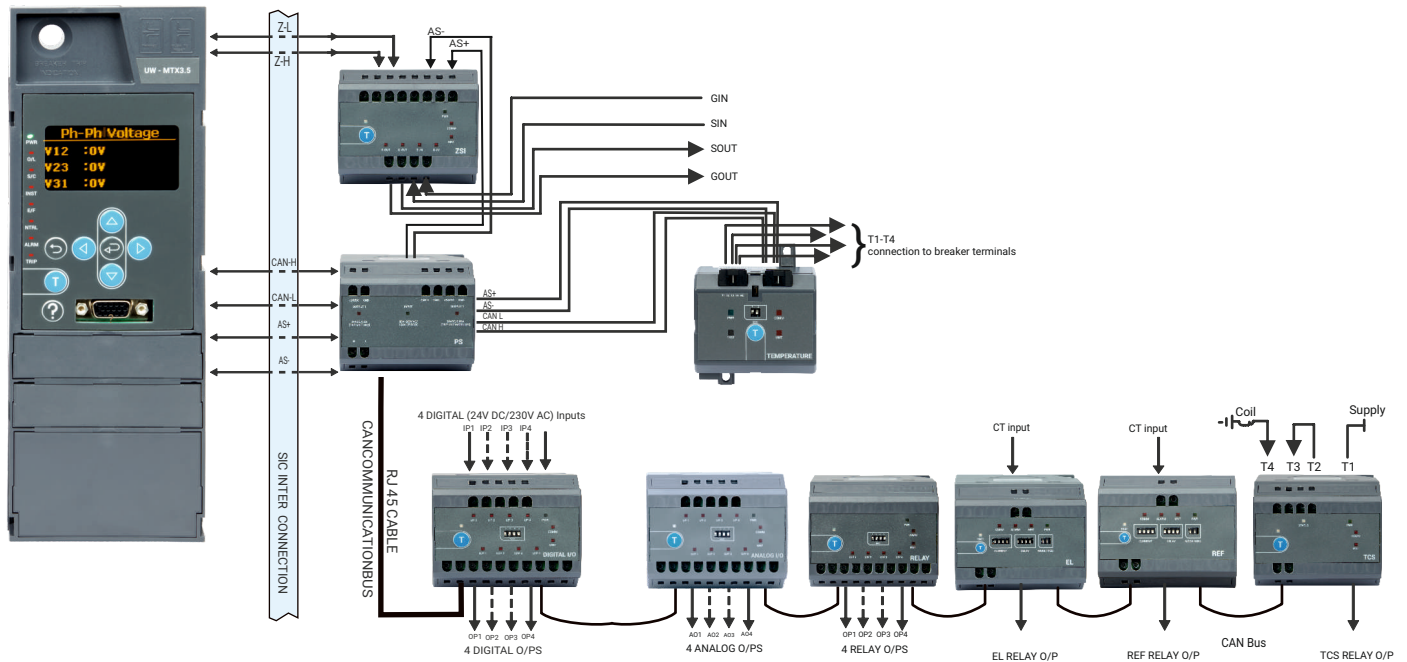
AS+, AS- : 24V DC Power Supply  
AL+, AL- : OL ALARM+, OL ALARM-  
This output can be connected to 5V-30V dc 150mA relay or any indicating device for indication or Load shedding purpose.

C-L : CAN-Low  
C-H : CAN-High  
M-G : MOD-GND  
C-G : CAN-GND  
V0,V1,V2,V3 : N, R,Y,B, VOLTAGE VP.

D+	: MOD A
D-	: MOD B
N1	: External Neutral CT
N2	: External Neutral CT
Z-L	: ZSI CAN-Low
Z-H	: ZSI CAN-High



# Matrix Connection Diagram



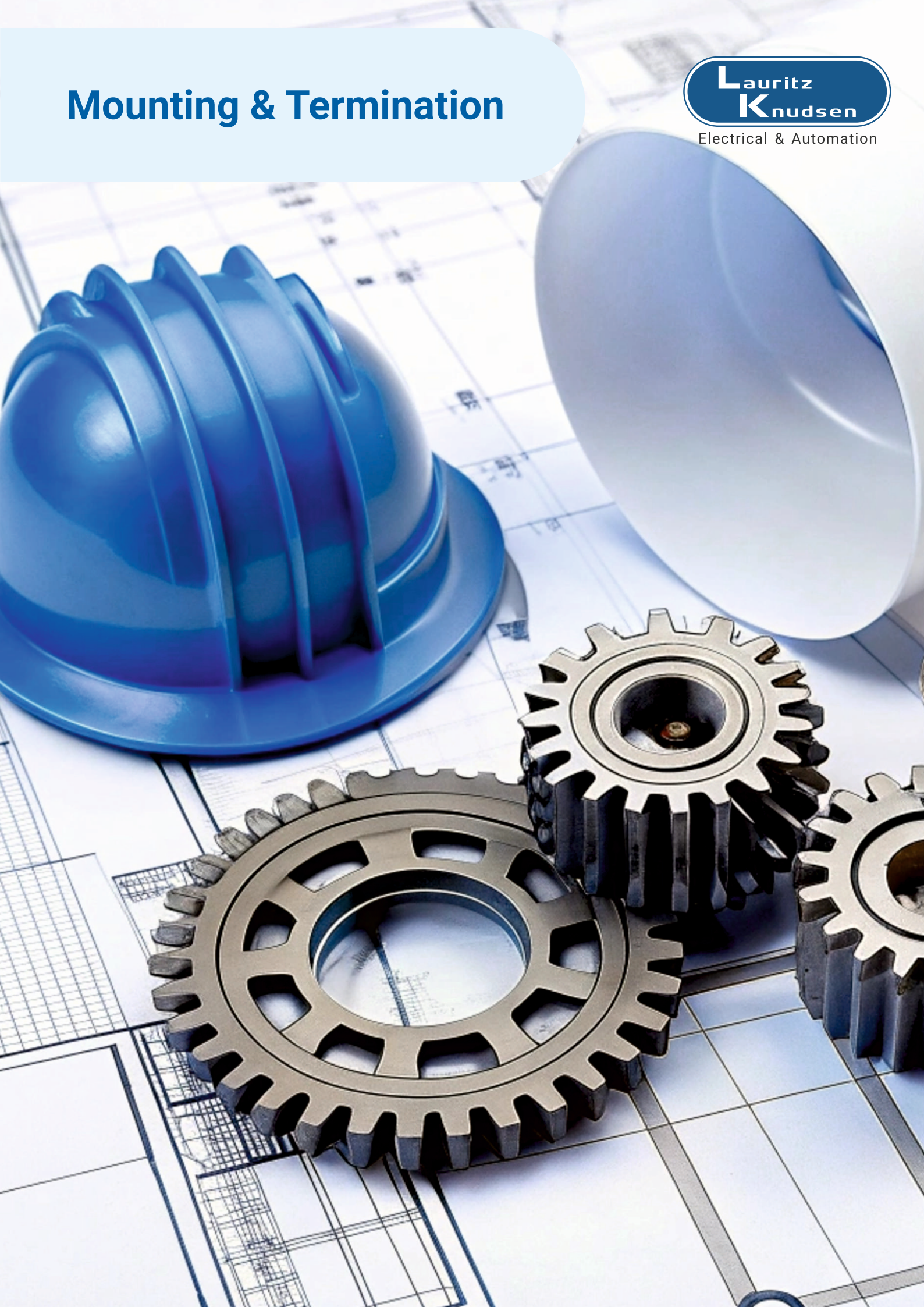
## Legends

AS+ : Auxiliary 24V DC  
 AS- : Ground  
 SOUT : S/C Output  
 SIN : S/C Input  
 GOUT : E/F Output  
 GIN : E/F Input  
 T1-T4 : Thermistor Inputs  
 Z-L : ZSI CAN-Low  
 Z-H : ZSI CAN-High  
 CAN-H : CAN-High  
 CAN-L : CAN-Low

**NOTE:** One Power Supply module can be connected to maximum 5 modules

Reference Diagram

# Mounting & Termination

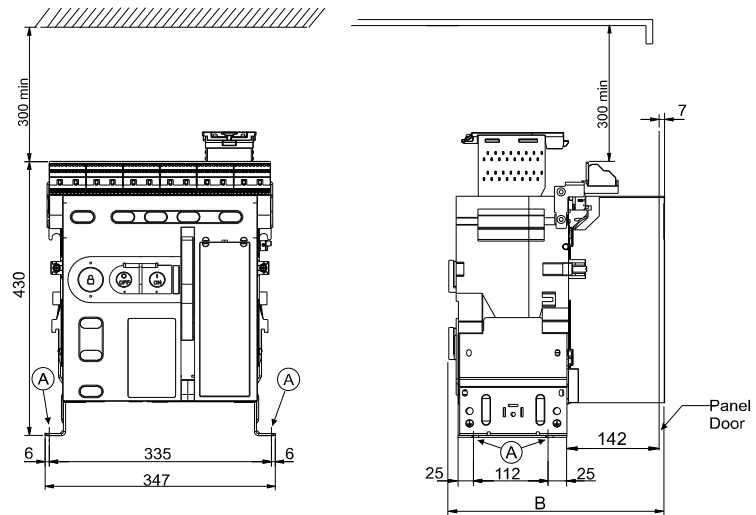


# Mounting

## 400A-2000A N/N08/D10 & 400A-2500A S/H Fr.1 3P

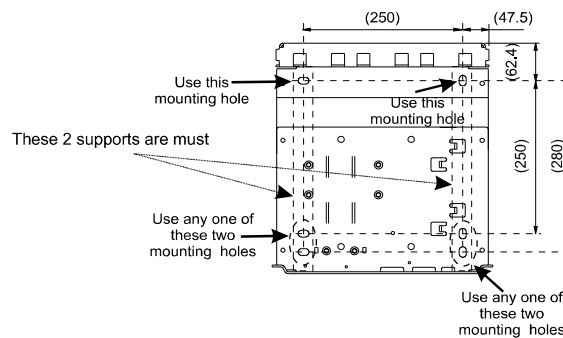
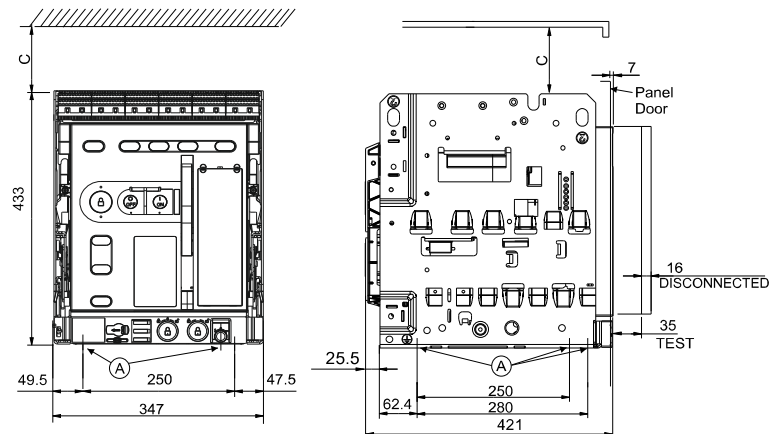
### Fixed Circuit Breaker

VERSION	DIM. B
400-2000A N, S, N08, D10	326
400-2000A H	324
2500A S & H	324



### Drawout Circuit Breaker

VERSION	DIM. C (min.)	DIM. C <sup>s</sup> (min.)
N, S, H	45	70
N08/D10	300	300



Mounting holes suitable for M10 / Equivalent BS bolt

<sup>s</sup>In case of Temperature Module mounted on cradle

All Dimensions in mm

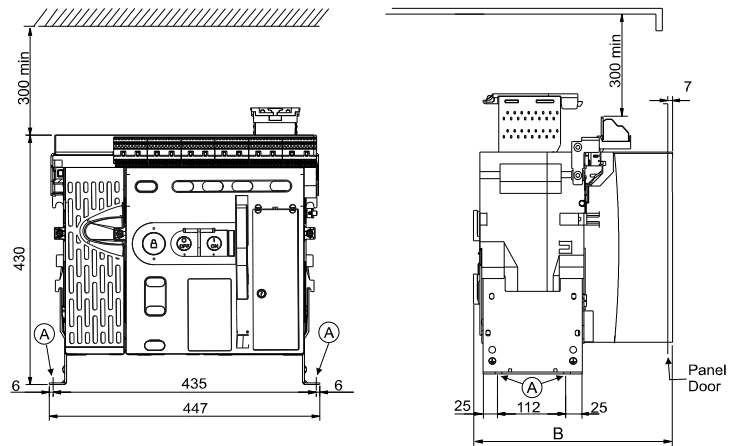


# Mounting

## 400A-2000A N/N08/D10 & 400A-2500A S/H Fr.1 4P

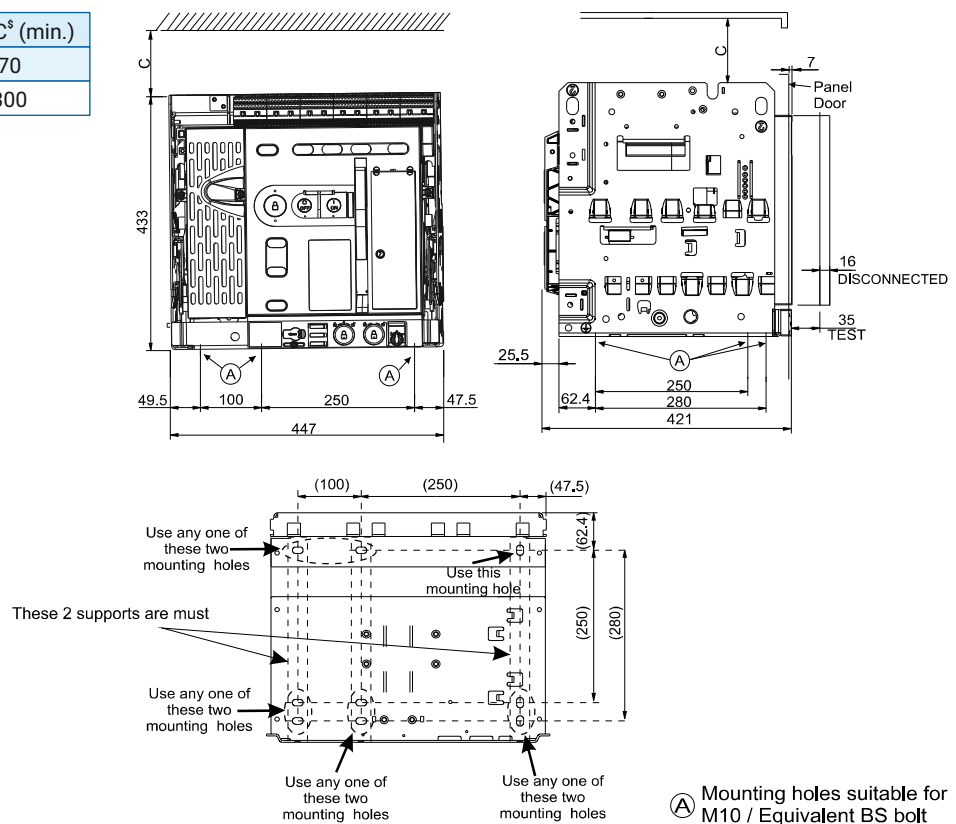
### Fixed Circuit Breaker

VERSION	DIM. B
400-2000A N, S, N08, D10	326
400-2000A H	324
2500A S & H	324



### Drawout Circuit Breaker

VERSION	DIM. C (min.)	DIM. C <sup>s</sup> (min.)
N, S, H	45	70
N08/D10	300	300



Ⓐ Mounting holes suitable for M10 / Equivalent BS bolt

<sup>s</sup>In case of Temperature Module mounted on cradle

All Dimensions in mm

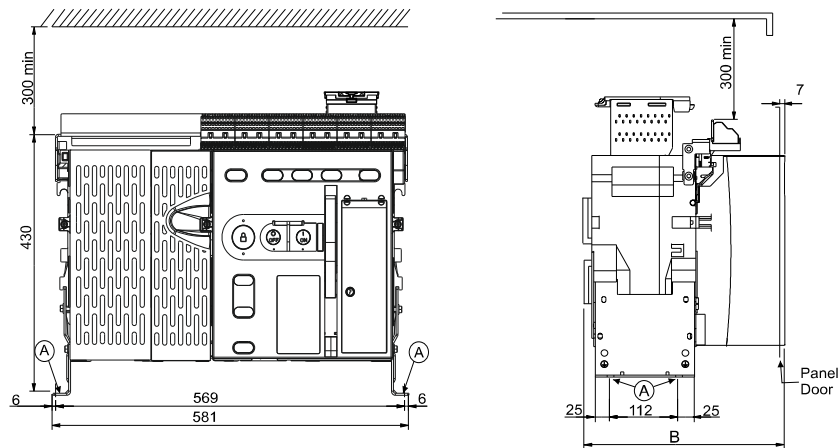


# Mounting

## 400A-4000A N /N08/N10/S/H Fr.2 4P

### Fixed Circuit Breaker

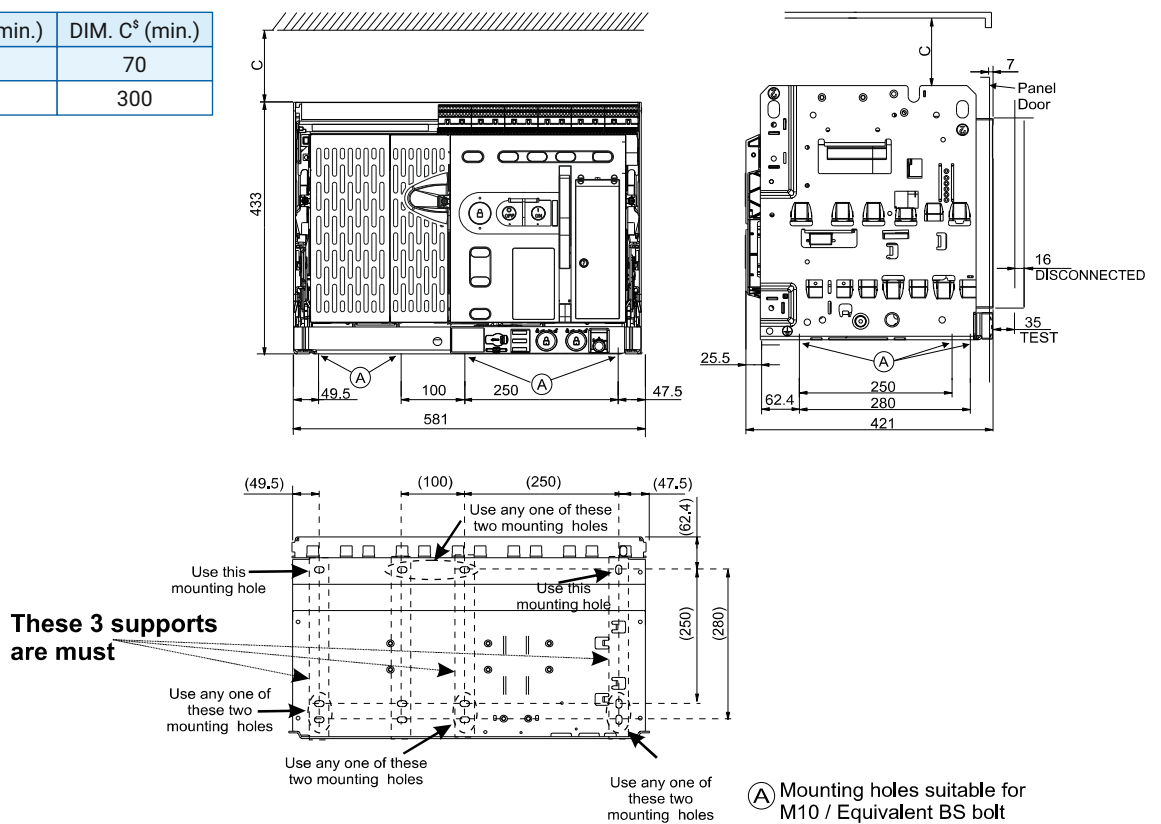
VERSION	DIM. B
400-2500A N/S	326
3200-4000A N /S	324
400-4000A N08*/N10*/H	324



\* Available till 3200A

### Drawout Circuit Breaker

VERSION	DIM. C (min.)	DIM. C <sup>s</sup> (min.)
N, S, H	45	70
N08, N10	300	300



<sup>s</sup>In case of Temperature Module mounted on cradle

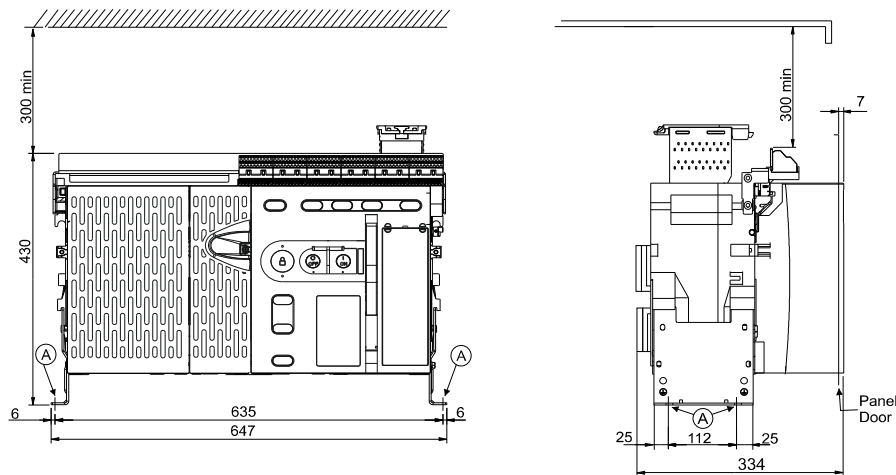
All Dimensions in mm



# Mounting

## 400A-6300A N08/S08/H/V Fr.3 3P

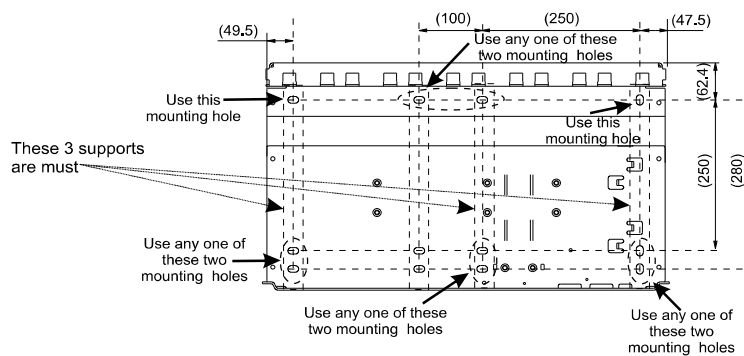
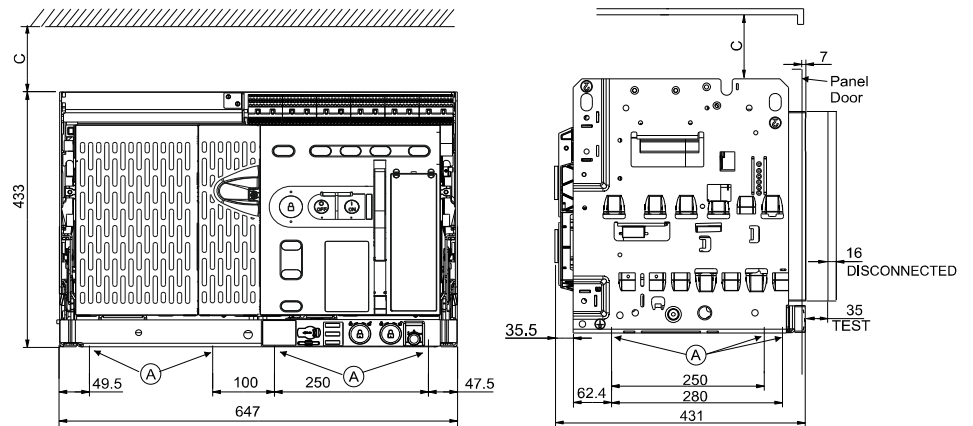
### Fixed Circuit Breaker



\*Available till 5000A

### Drawout Circuit Breaker

VERSION	DIM. C (min.)	DIM. C <sup>§</sup> (min.)
H, V	45	70
N08*, S08*	300	300



**A** Mounting holes suitable for M10 / Equivalent BS bolt

\*Available till 5000A

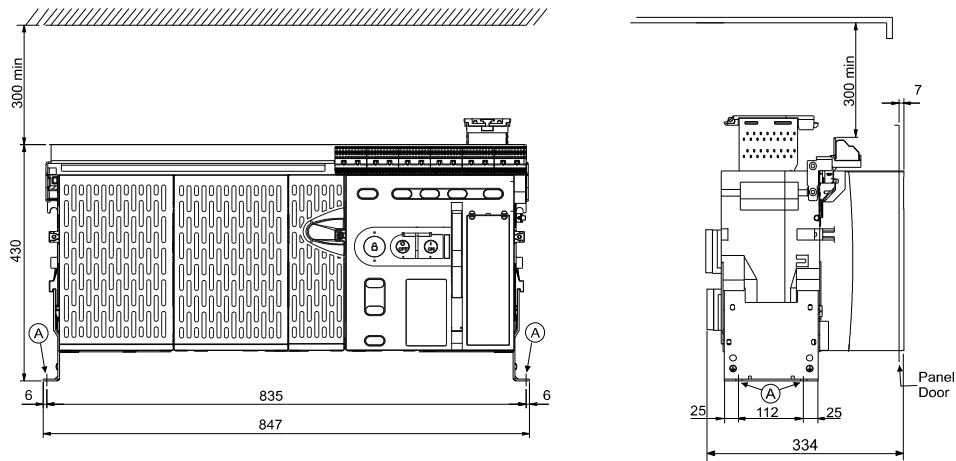
§In case of Temperature Module mounted on cradle

All Dimensions in mm

# Mounting

## 400A-6300A N08/S08/H/V Fr.3 4P

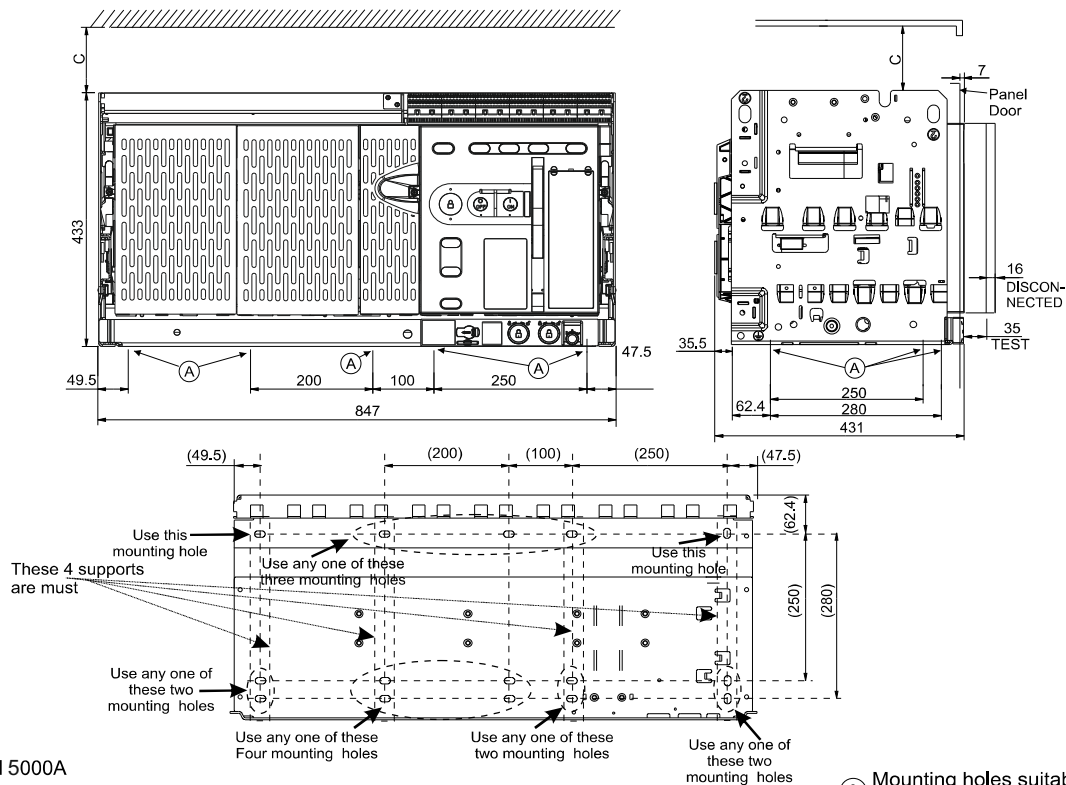
### Fixed Circuit Breaker



\* Available till 5000A

### Drawout Circuit Breaker

VERSION	DIM. C (min.)	DIM. C* (min.)
H, V	45	70
N08*, S08*	300	300



\*Available till 5000A

§ In case of Temperature Module mounted on cradle

All Dimensions in mm

Ⓐ Mounting holes suitable for M10 / Equivalent BS bolt

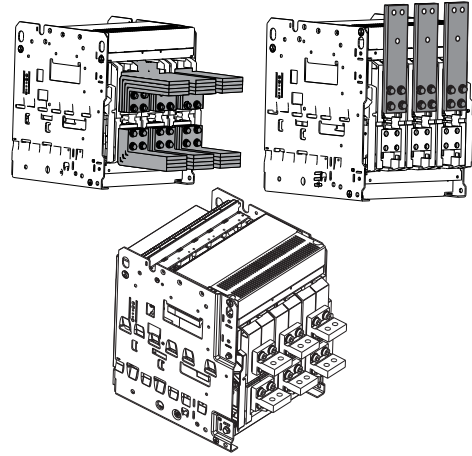
# Termination

## Termination on Draw-out Breakers

OMEGA System of ACB terminals offer more contact area to accept Aluminium Links.

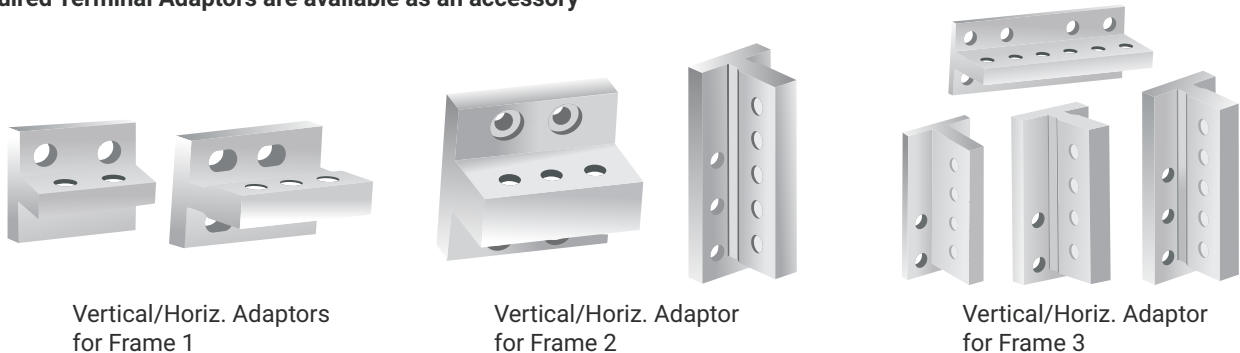
OMEGA System of ACBs Universal Flat terminals greatly facilitate termination. These terminals directly support all commonly used types of termination as shown in adjoining figure.

OMEGA System of ACBs are having inbuilt nutplates (M12 Threading) in Cradle terminal, to facilitate termination.



## Terminal Adaptor

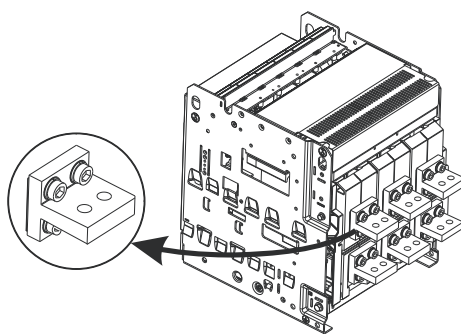
If required Terminal Adaptors are available as an accessory



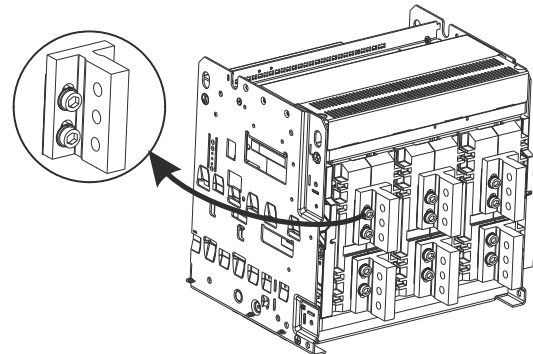
Vertical/Horiz. Adaptors  
for Frame 1

Vertical/Horiz. Adaptor  
for Frame 2

Vertical/Horiz. Adaptor  
for Frame 3



Installation of Terminal Adaptor  
for frame 1



Installation of Terminal Adaptor  
for frame 2

### Note:

Terminal Adaptors supplied with Breakers Upto 1600A - Bottom only  
Rest Breakers - Top & Bottom both sides.

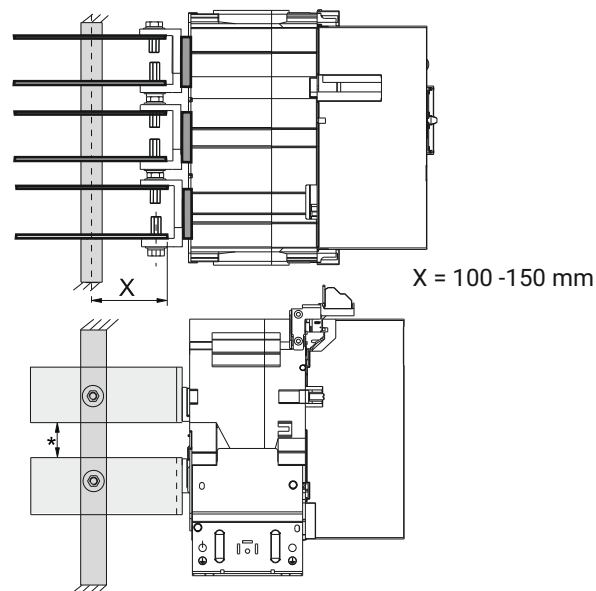
For Frame 3 Breakers, 2 pole constructions are followed per phase, hence Vertical Terminal Adaptors shall be considered 2 nos. per pole per side.

# Termination

## Termination Methods For Fixed Breakers

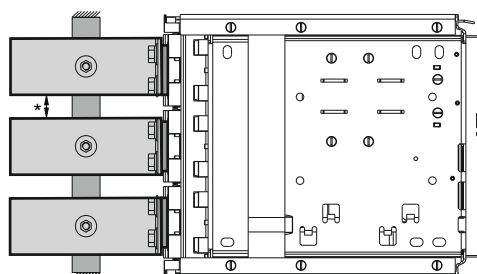
### CAUTION:

Inadequate termination support may result in overheating & adversely affect performance during short circuit conditions.

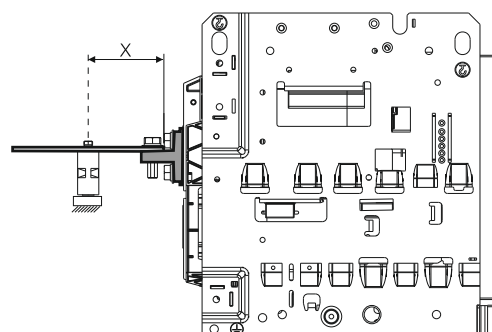
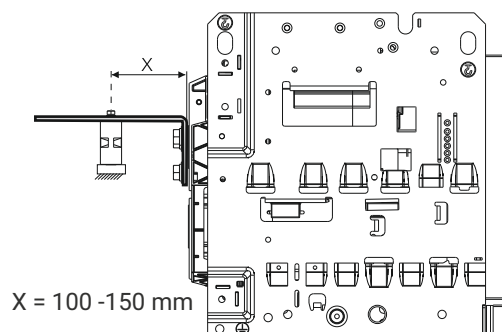
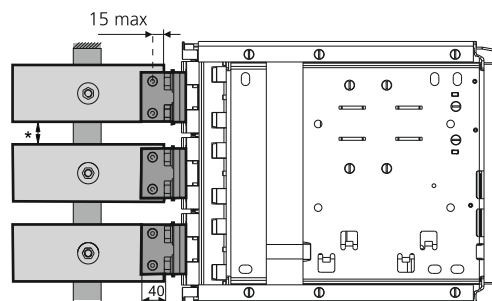


## Termination Methods For Draw-out Breakers

With Universal Terminals



With Terminal Adaptor

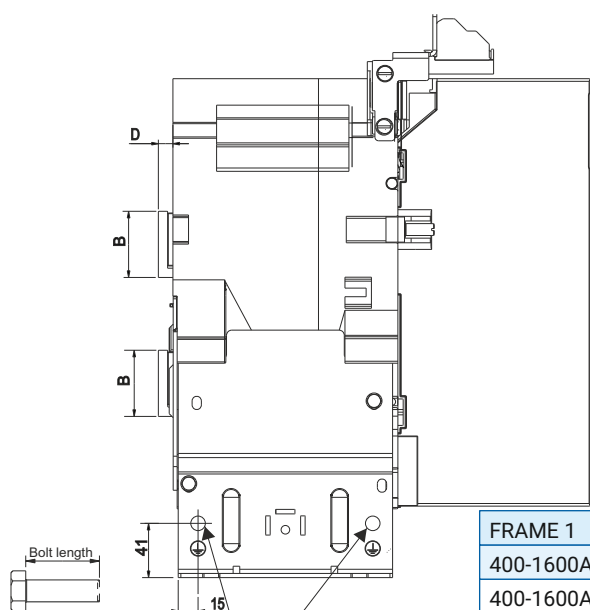


\* Maintain adequate clearance between links as applicable standards  
All Dimensions in mm

# Termination - Fixed Breakers

## Flat Termination

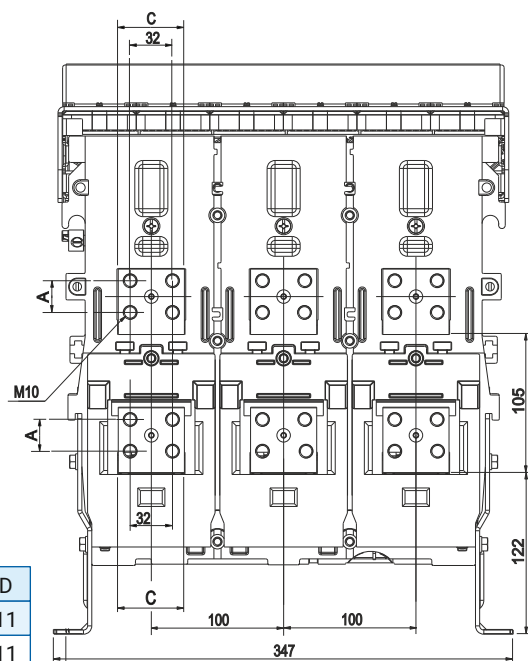
400A-1600A N/S/H Fr.1-3P



Bolt length for mounting link(s) on Flat Terminals to be cumulative link(s) thickness + 15 mm.

Holes (on both sides) for Earthing connections by M10/Equivalent BS bolt

FRAME 1	A	B	C	D
400-1600A N	24	50	50	11
400-1600A S	24	50	65	11
400-1600A H	30	55	65	9



M10 bolts to be used for link termination  
Tightening torque: 3.0 kgfm

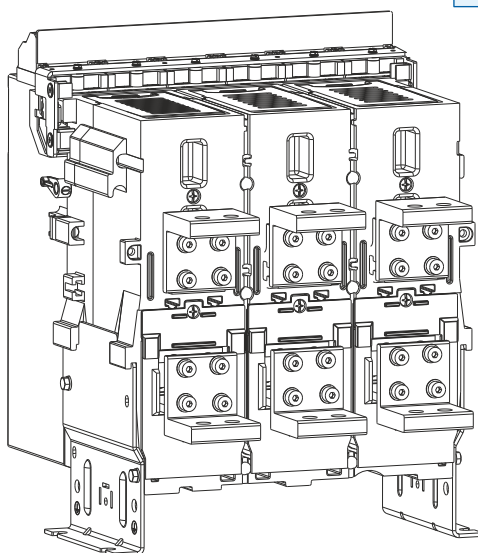
## Horizontal Termination

400A-2000A N/S/H Fr.1-3P

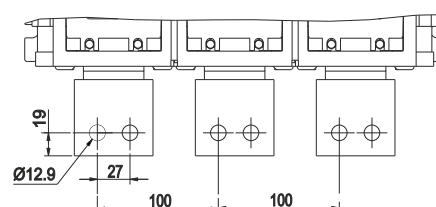
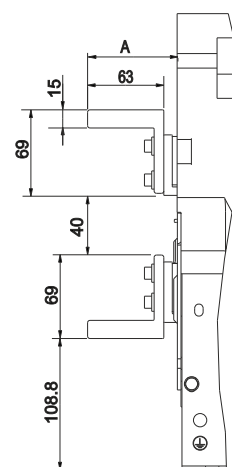
400A-1600A N08/D10 Fr.1-3P

BREAKER RATING	ADAPTOR CAT. No
400-2000A N/S	CL609670000
400-1600A N08/D10	CL609670000
400-2000A H	CL609680000

BREAKER RATING	DIMENSION A
400-2000A N/S	74
400-1600A N08/D10	74
400-2000A H	72



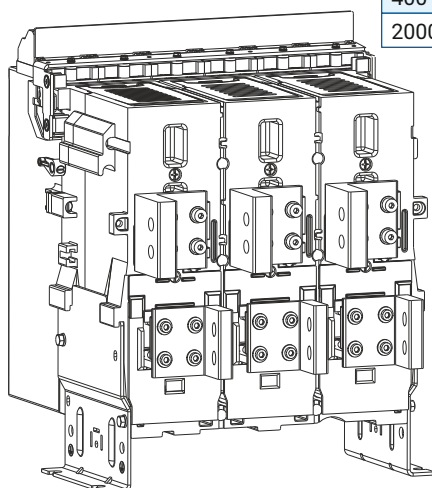
M12 / Equivalent BS bolts to be used for link termination  
Tightening torque: 3.2 kgfm



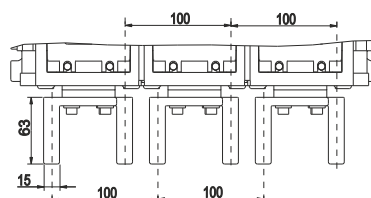
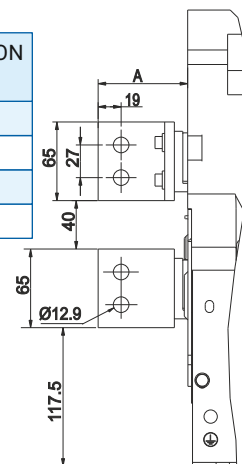
# Termination - Fixed Breakers

## Vertical Termination

400A-2000A N/S/H/N08/D10 Fr.1-3P



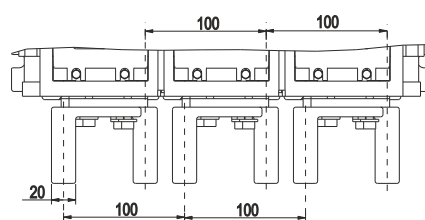
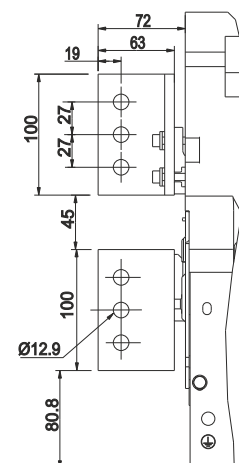
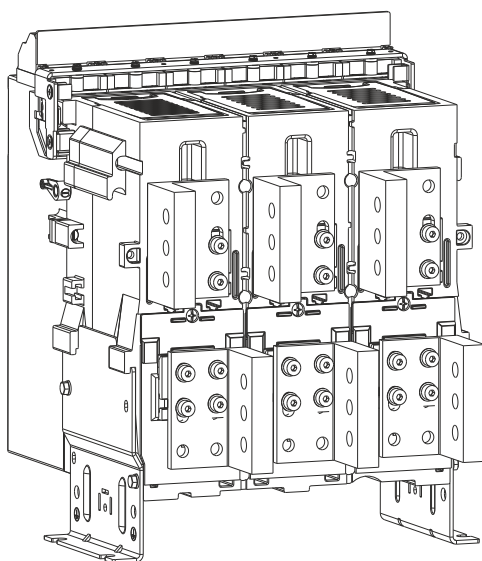
BREAKER RATING	ADAPTOR CAT. No	DIMENSION A
400-2000A N/S	CL609670000	74
400-2000A H	CL609680000	72
400-1600A N08/D10	CL609670000	74
2000A N08/D10	CL601220000	74



M12 / Equivalent BS bolts to be used for link termination  
Tightening torque: 3.2 kgfm

## Vertical Termination

2500A S/H Fr.1-3P  
(Adaptor-CL609760000)



M12 / Equivalent BS bolts to be used for link termination  
Tightening torque: 3.2 kgfm

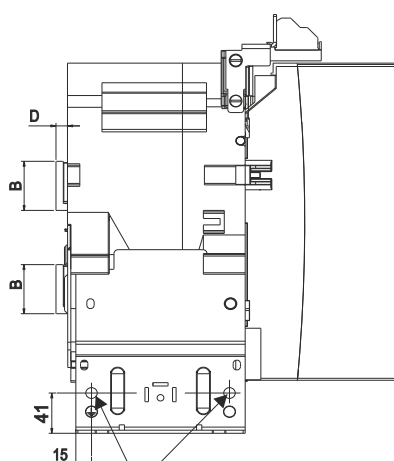


# Termination - Fixed Breakers

## Flat Termination

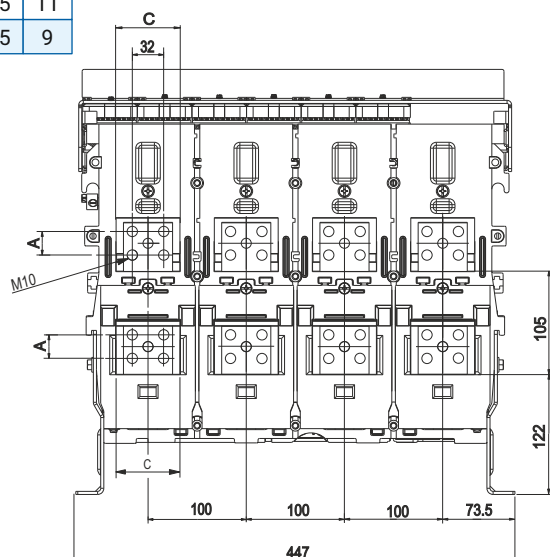
400A-1600A N/S/H Fr.1-4P

FRAME 1	A	B	C	D
400-1600A N	24	50	50	11
400-1600A S	24	50	65	11
400-1600A H	30	55	65	9



Holes (on both sides) for Earthing connections by M10/Equivalent BS bolt.

M10 bolts to be used for link termination  
Tightening torque: 3.0 kgfm



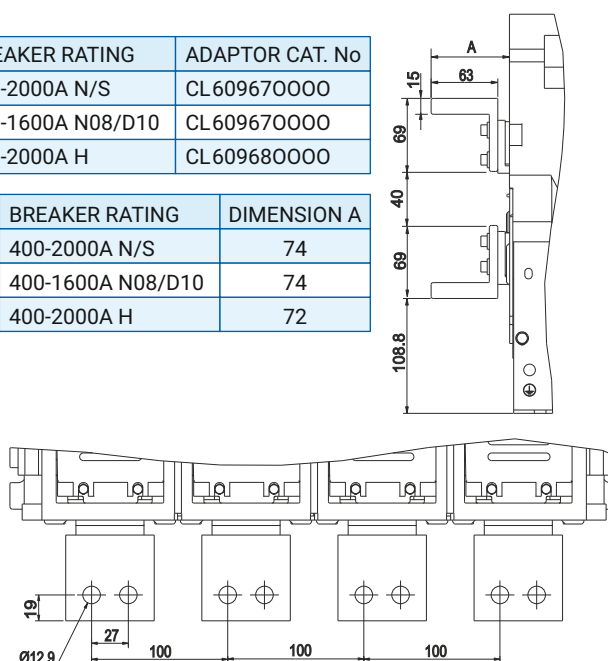
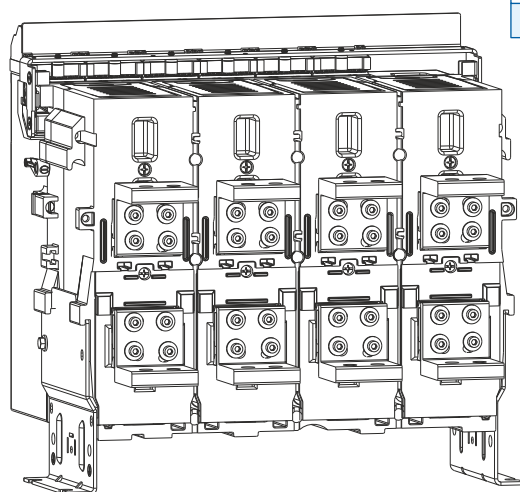
Bolt length for mounting link(s) on Flat Terminals  
to be cumulative link(s) thickness + 15 mm.

## Horizontal Termination

400A-2000A N/S/H Fr.1-4P  
400A-1600A N08/D10 Fr.1-4P

BREAKER RATING	ADAPTOR CAT. No
400-2000A N/S	CL609670000
400-1600A N08/D10	CL609670000
400-2000A H	CL609680000

BREAKER RATING	DIMENSION A
400-2000A N/S	74
400-1600A N08/D10	74
400-2000A H	72

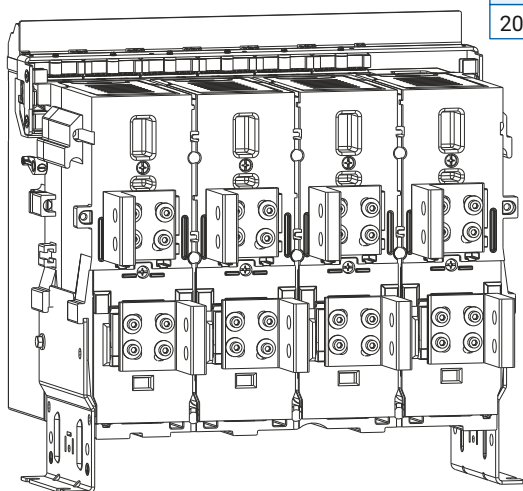


M12 / Equivalent BS bolts to be used for link termination  
Tightening torque: 3.2 kgfm

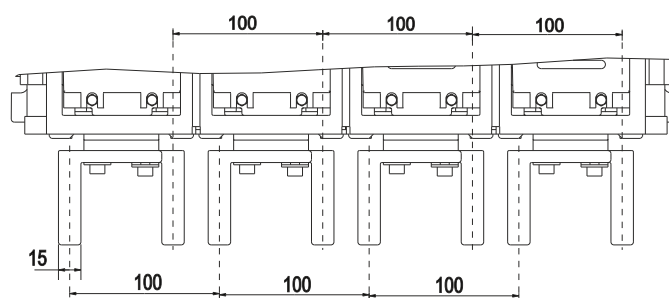
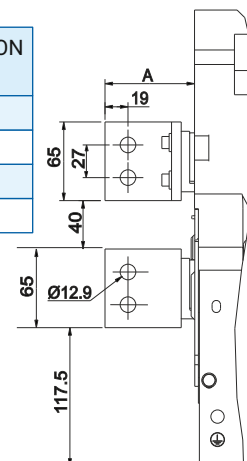
# Termination - Fixed Breakers

## Vertical Termination

400A-2000A N/S/H/N08/D10 Fr.1-4P



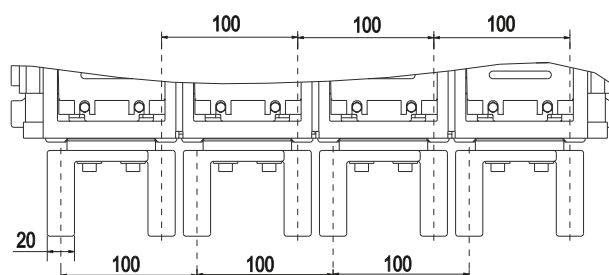
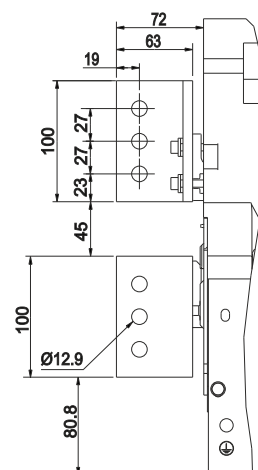
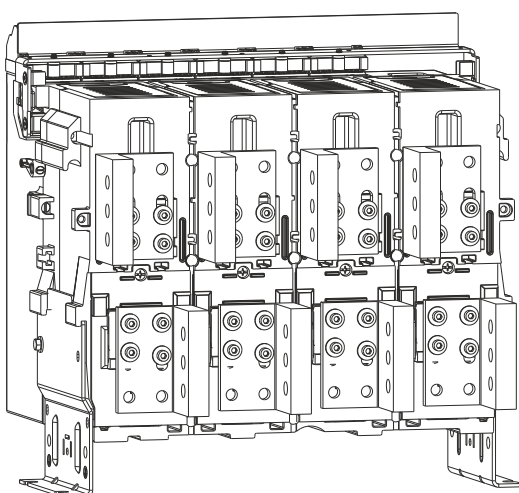
BREAKER RATING	ADAPTOR CAT. No	DIMENSION A
400-2000A N/S	CL609670000	74
400-2000A H	CL609680000	72
400-1600A N08/D10	CL609670000	74
2000A N08/D10	CL601220000	74



M12 / Equivalent BS bolts to be used for link termination  
Tightening torque: 3.2 kgfm

## Vertical Termination

2500A S/H Fr.1-4P (Adaptor-CL609760000)



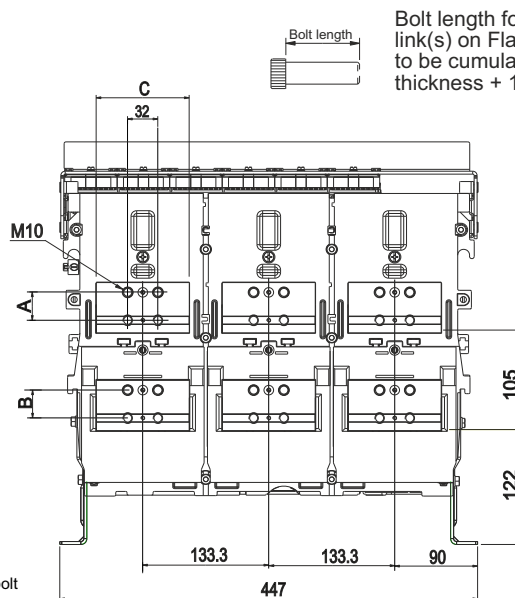
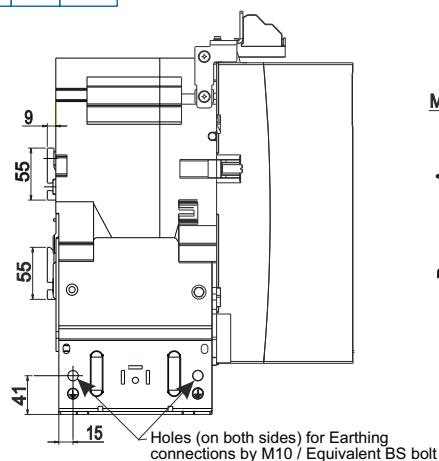
M12 / Equivalent BS bolts to be used for link termination  
Tightening torque: 3.2 kgfm

# Termination - Fixed Breakers

## Flat Termination

### 400A-1600A N/S/H Fr.2-3P

VERSION	A	B	C
400-1600 N/S	24	24	81.2
400-1600A H	30	30	98.4

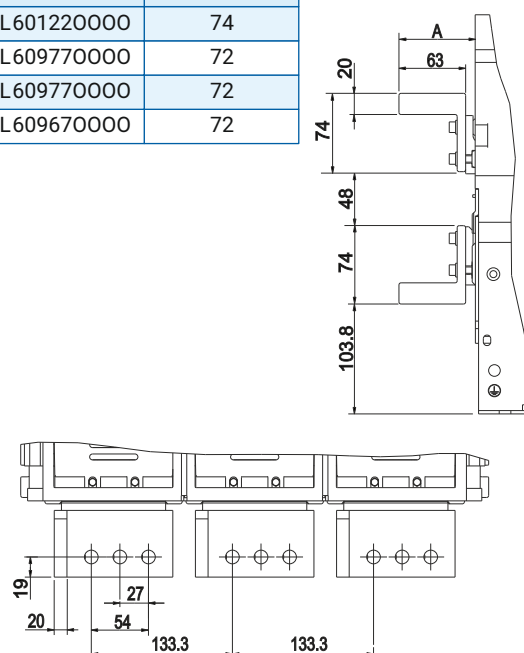
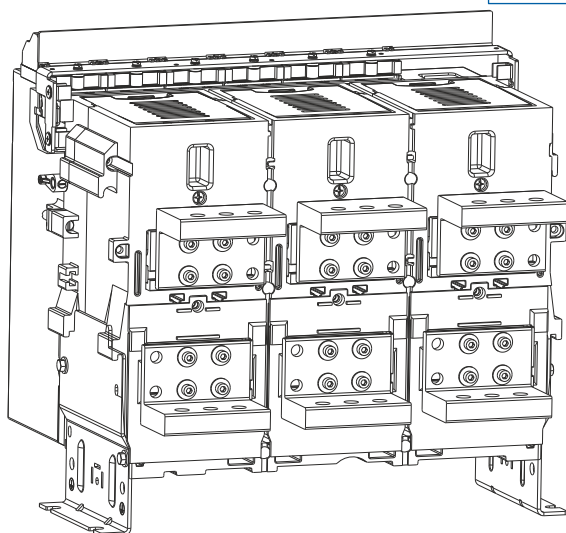


M10 bolts to be used for link termination  
Tightening torque: 3.0 kgfm

## Horizontal Termination

### 400A-3200A N/S/H Fr.2-3P 400A-2000A N08/N10 Fr.2-3P

VERSION	ADAPTOR	DIMENSION A
400-2500A N/S	CL601220000	74
400-2500A H	CL609770000	72
3200A N/S/H	CL609770000	72
400-2000A N08/N10	CL609670000	72



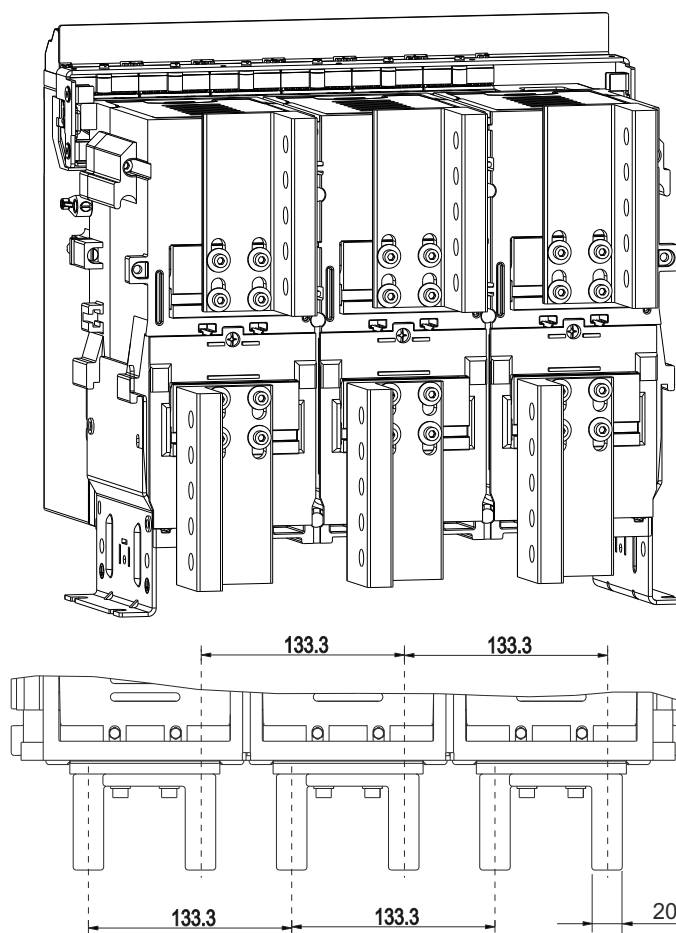
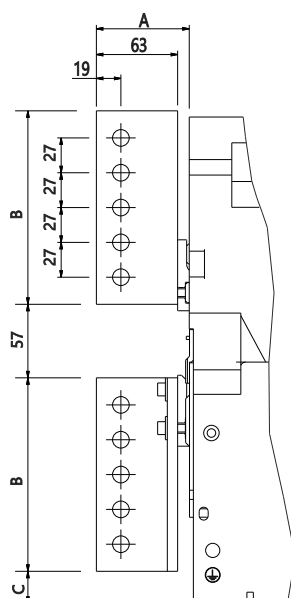
M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

# Termination - Fixed Breakers

## Vertical Termination

400A-4000A N/S/H Fr.2-3P  
400A-3200A N08/N10 Fr.2-3P

VERSION	ADAPTOR	DIMENSION A	DIMENSION B	DIMENSION C	NO OF HOLES
400-2500A N/S	CL601220000	74	100	77.2	3
400-2500A H	CL609770000	72	100	77.2	3
3200A N/S/H	CL609770000	72	100	77.2	3
4000A N/S/H	CL604170000	72	150	25	5
400-2000A N08/N10	CL609770000	72	100	77.2	3
2500A N08/N10	CL603180000	72	125	77.2	4
3200A N08/N10	CL604170000	72	150	25	5



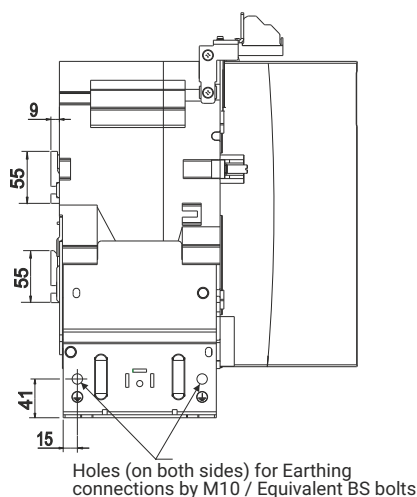
M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

Details of 4P(200% N) on request  
All Dimensions in mm

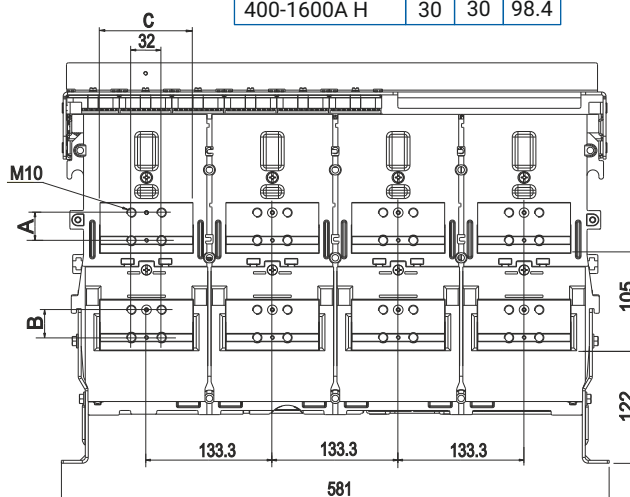
# Termination - Fixed Breakers

## Flat Termination

400A-1600A N/S/H Fr.2-4P



M10 bolts to be used for link termination  
Tightening torque: 3.0 kgfm



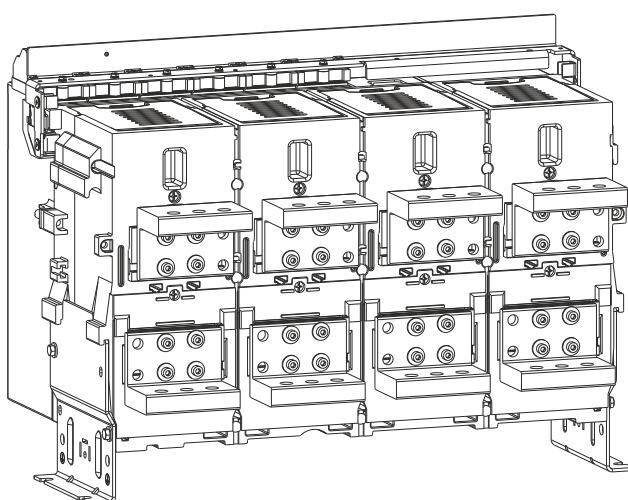
VERSION	A	B	C
400-1600A N/S	24	24	81.2
400-1600A H	30	30	98.4



Bolt length for mounting link(s) on Flat Terminals to be cumulative link(s) thickness + 15 mm.

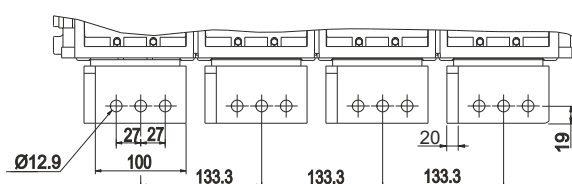
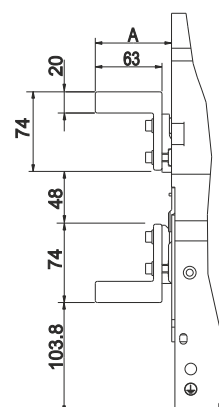
## Horizontal Termination

400A-3200A N/S/H Fr.2-4P  
400A-2000A N08/N10 Fr.2-4P



M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

VERSION	ADAPTOR	DIMENSION A
400-2500A N/S	CL601220000	74
400-2500A H	CL609770000	72
3200A N/S/H	CL609770000	72
400-2000A N08/N10	CL609670000	72

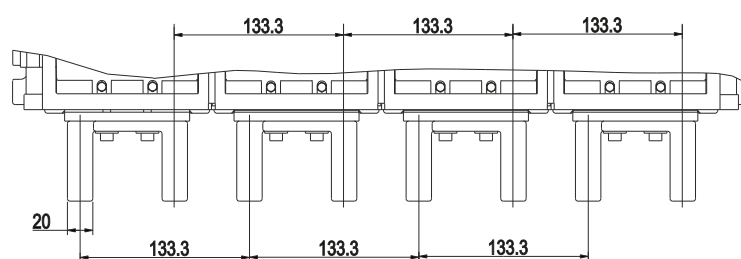
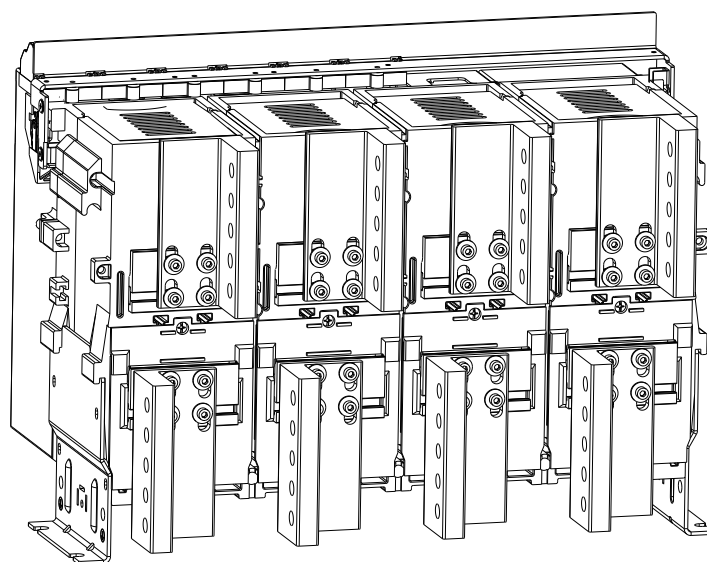
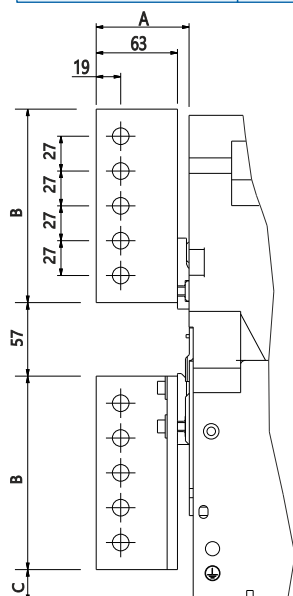


# Termination - Fixed Breakers

## Vertical Termination

400A-4000A N/S/H Fr.2-4P  
400A-3200A N08/N10 Fr.2-4P

VERSION	ADAPTOR	DIMENSION A	DIMENSION B	DIMENSION C	NO OF HOLES
400-2500A N/S	CL601220000	74	100	77.2	3
400-2500A H	CL609770000	72	100	77.2	3
3200A N/S/H	CL609770000	72	100	77.2	3
4000A N/S/H	CL604170000	72	150	25	5
400-2000A N08/N10	CL609770000	72	100	77.2	3
2500A N08/N10	CL603180000	72	125	77.2	4
3200A N08/N10	CL604170000	72	150	25	5



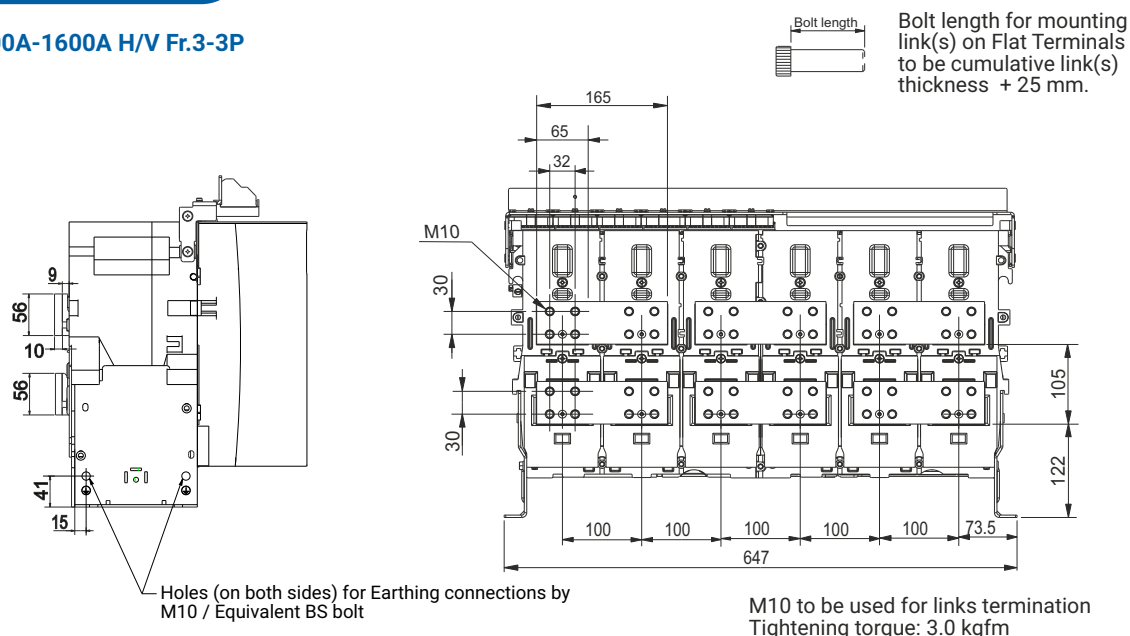
M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm



# Termination - Fixed Breakers

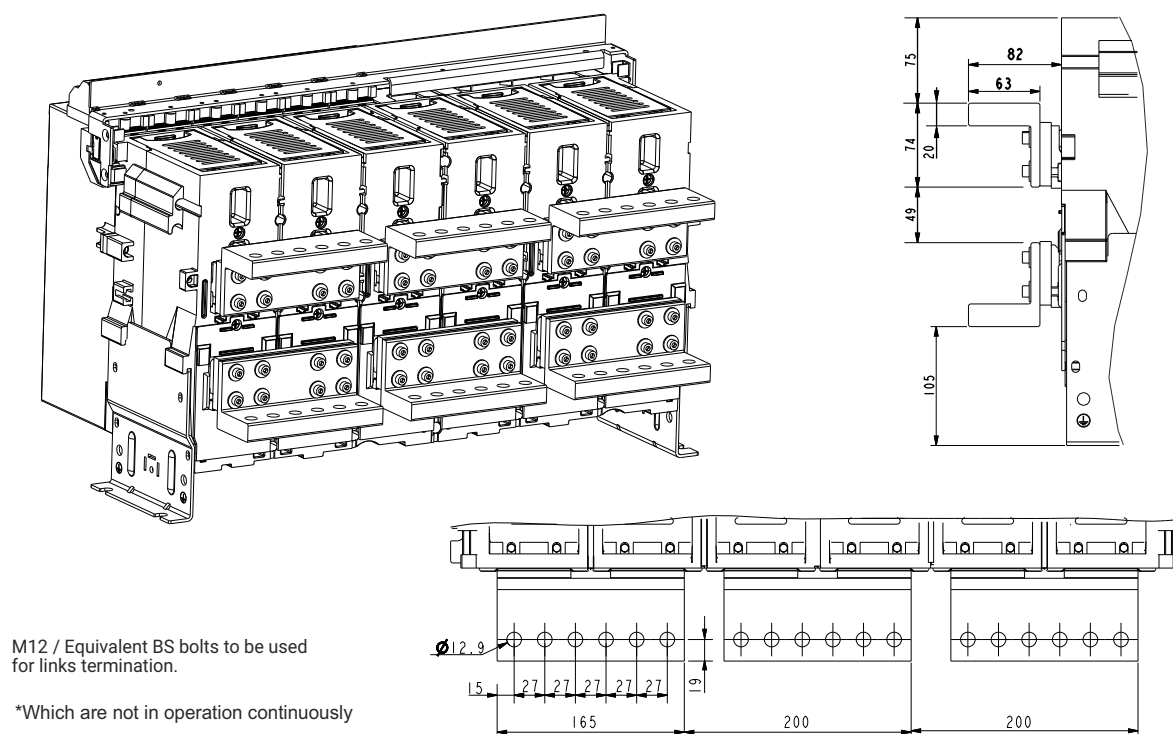
## Flat Termination

400A-1600A H/V Fr.3-3P



## Flat Termination (Bus Coupler Application Only\*)

400A-5000A H/V Fr.3-3P  
400A-4000A N08/S08/H/V Fr.3-3P  
(Adaptor-CL603730000)

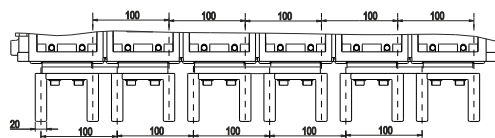
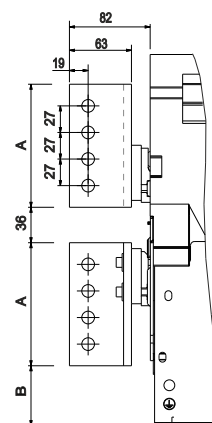
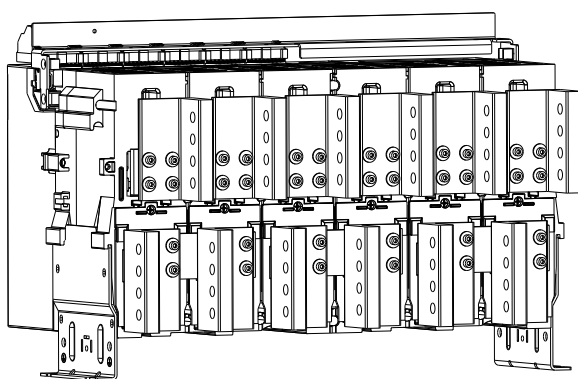


## Termination - Fixed Breakers

## Vertical Termination

## 400-5000A N08/S08/H/V Fr.3-3P

BREAKER RATING	Adaptor Cat. No.	Dim. A	Dim. B	No of Holes
400-4000A	CL604180000	125	61	4
5000A	CL603470000	150	36	5

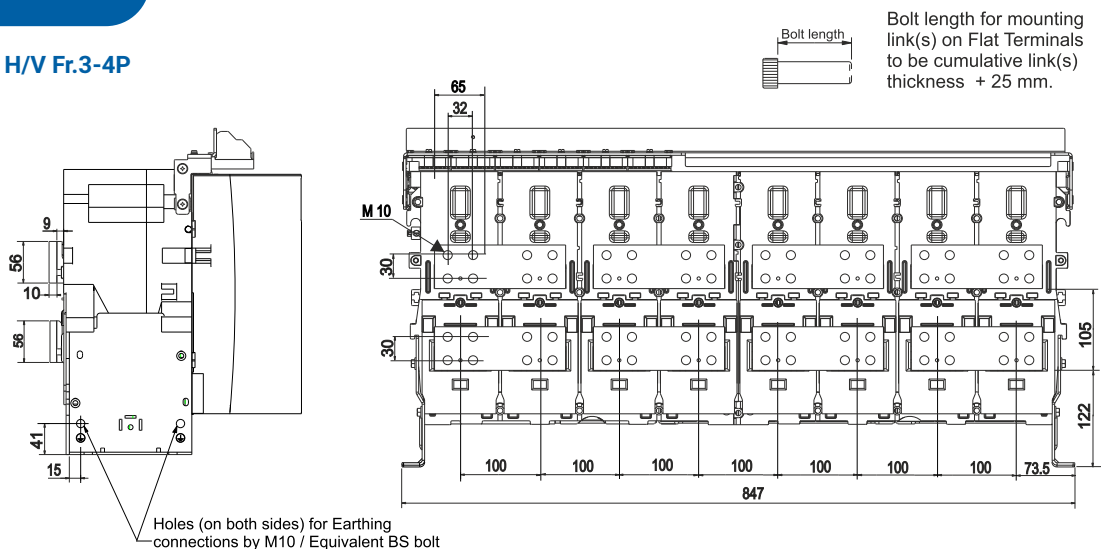


M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

# Termination - Fixed Breakers

## Flat Termination

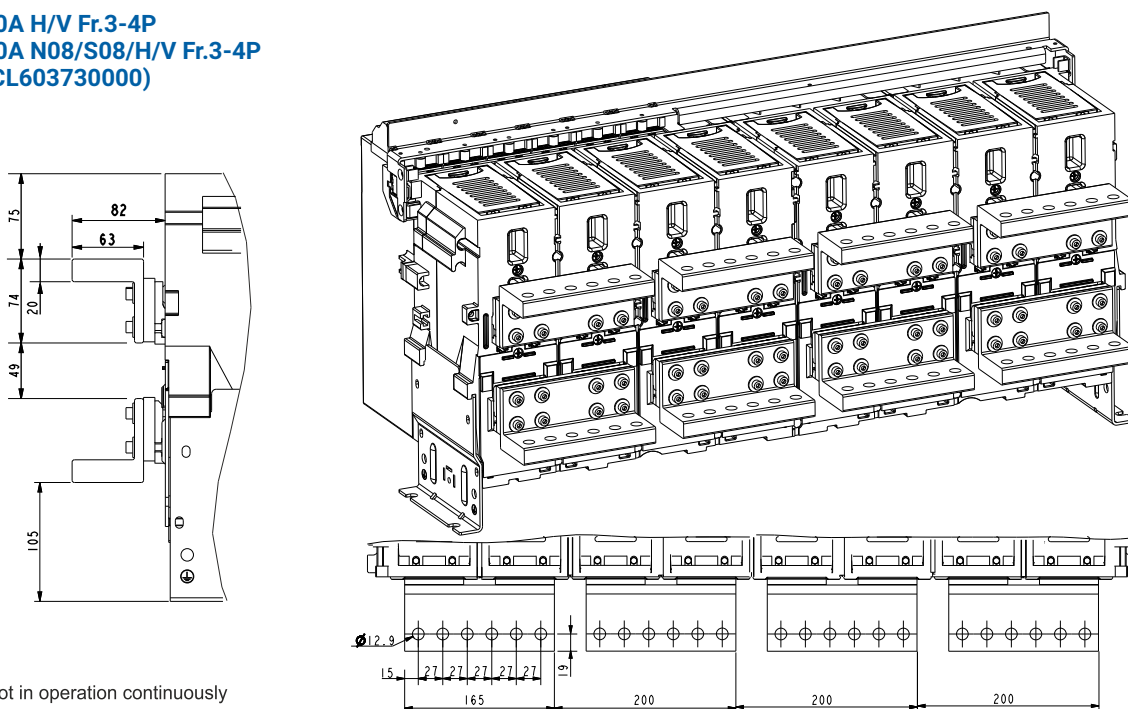
400A-1600A H/V Fr.3-4P



M10 bolts to be used for links termination  
Tightening torque: 3.0 kgfm

## Horizontal Termination (Bus Coupler Application Only\*)

400A-5000A H/V Fr.3-4P  
400A-4000A N08/S08/H/V Fr.3-4P  
(Adaptor-CL603730000)



\*Which are not in operation continuously

Tightening torque: 3.2 kgfm

M12 / Equivalent BS bolts to be used for links termination

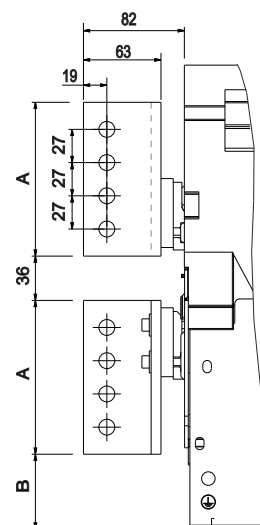
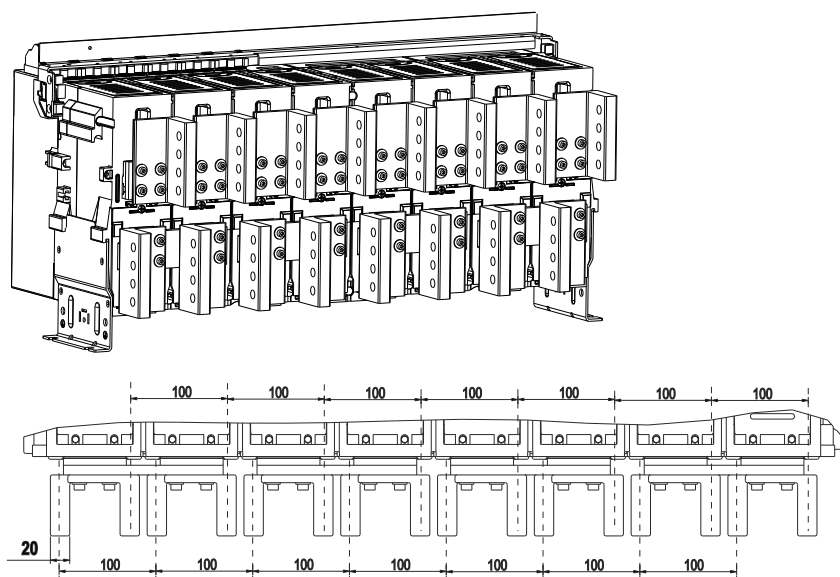
All Dimensions in mm

# Termination - Fixed Breakers

## Vertical Termination

### 400A-5000A N08/S08/H/V Fr.3-4P

BREAKER RATING	Adaptor Cat. No.	Dim. A	Dim. B	No of Holes
400-4000A	CL604180000	125	61	4
5000A	CL603470000	150	36	5



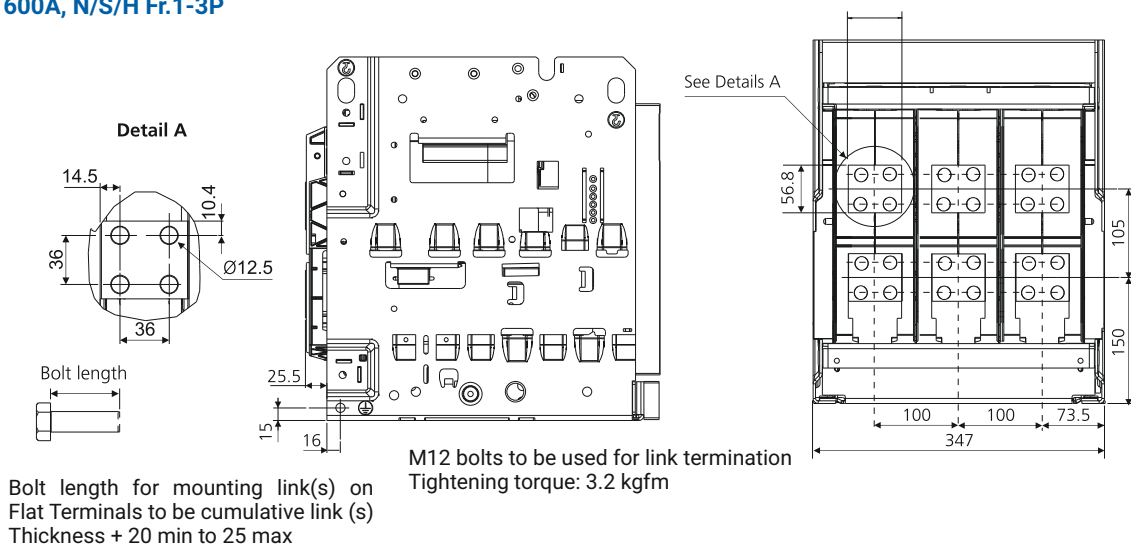
M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

All Dimensions in mm

# Termination - Draw Out Breakers

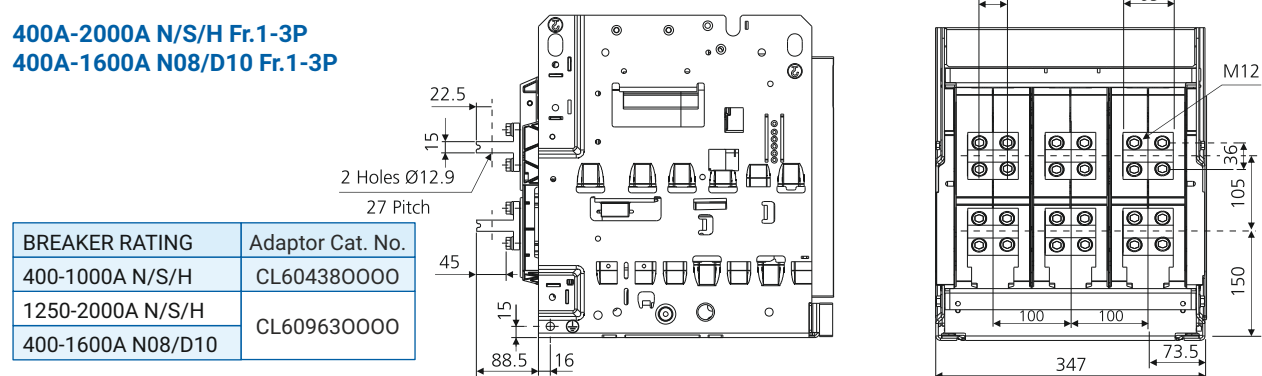
## Flat Termination

400A-1600A, N/S/H Fr.1-3P



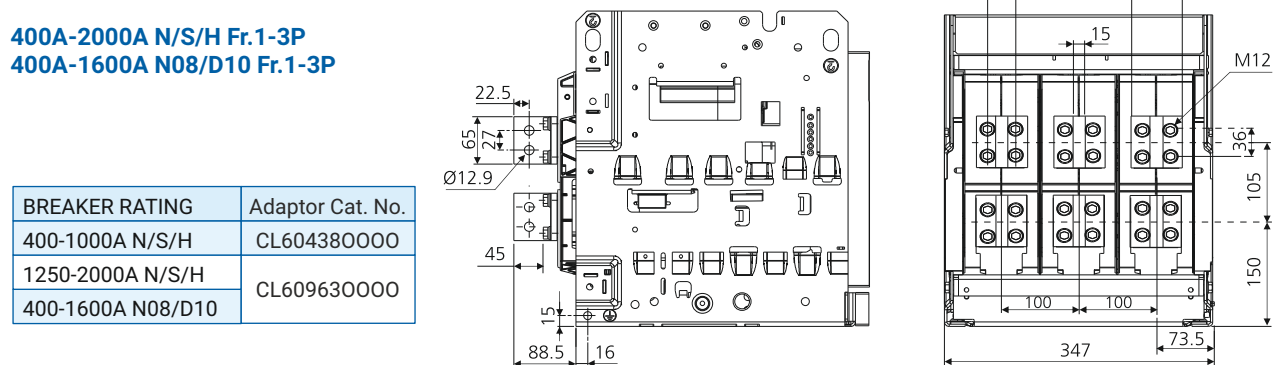
## Horizontal Termination

400A-2000A N/S/H Fr.1-3P  
400A-1600A N08/D10 Fr.1-3P



## Vertical Termination

400A-2000A N/S/H Fr.1-3P  
400A-1600A N08/D10 Fr.1-3P



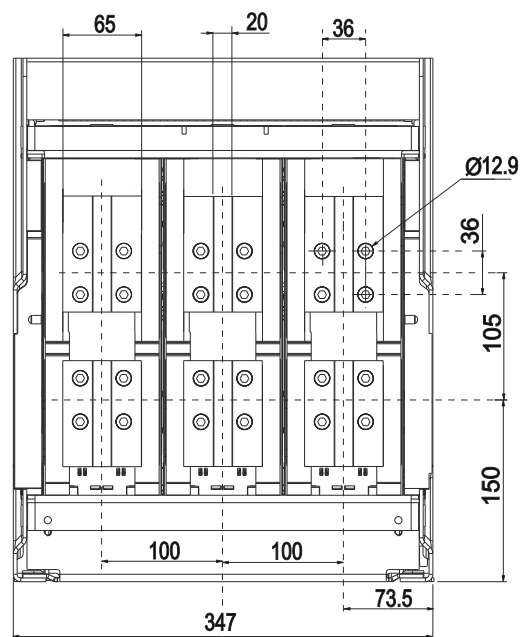
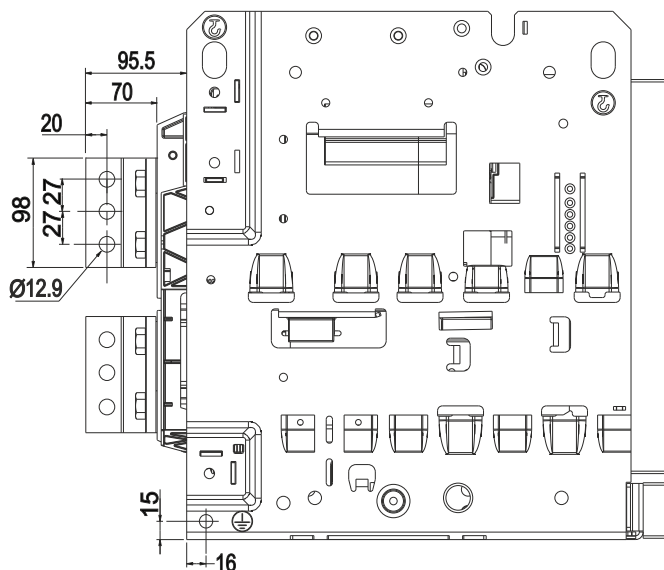
All Dimensions in mm

M12 / Equivalent BS bolts to be used for links termination Tightening torque: 3.4 kgfm

# Termination - Draw Out Breakers

## Vertical Termination

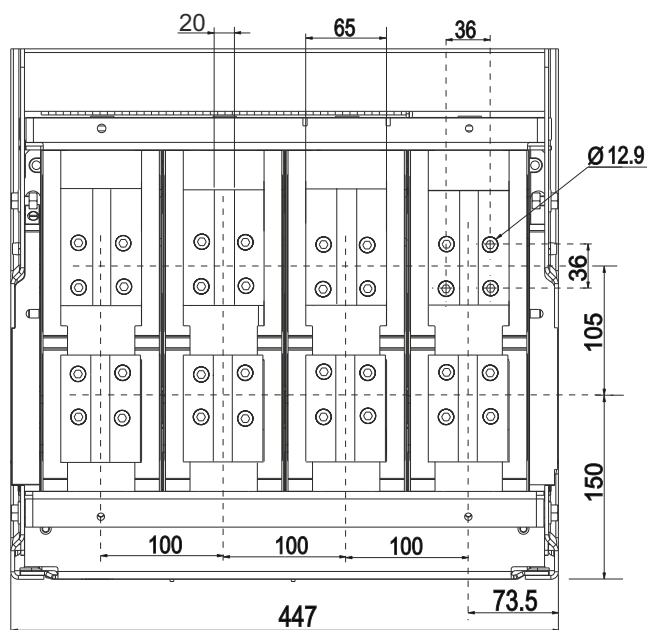
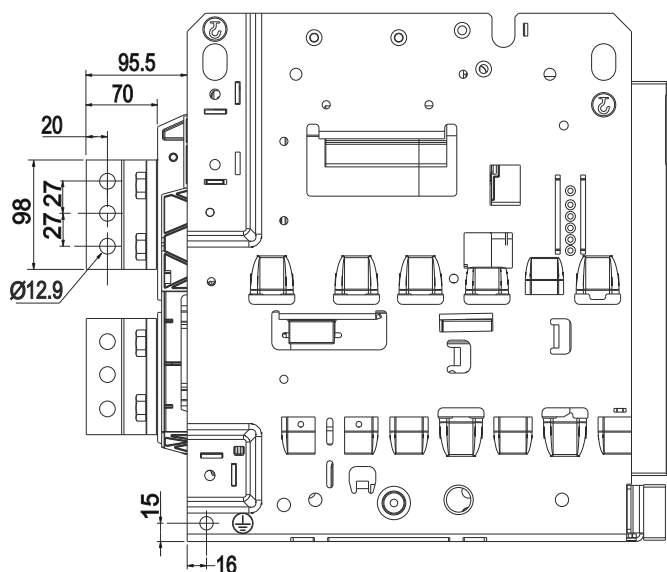
2500A S/H Fr.1-3P  
2000A N08/D10 Fr.1-3P  
Adapter - CL609640000



M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

## Vertical Termination

2500A S/H Fr.1-4P  
2000A N08/D10 Fr.1-4P  
Adapter - CL609640000



M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

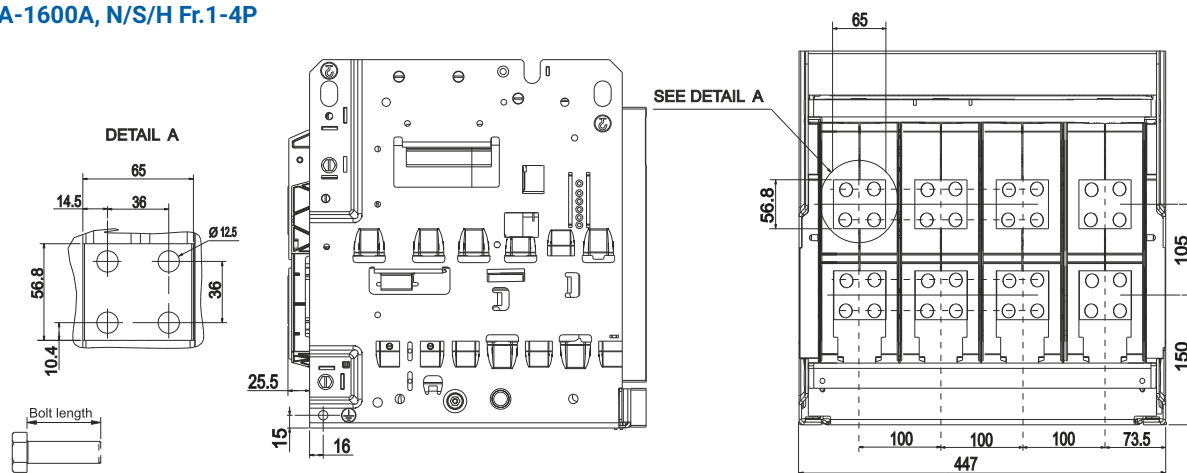
All Dimensions in mm



# Termination - Draw Out Breakers

## Flat Termination

400A-1600A, N/S/H Fr.1-4P

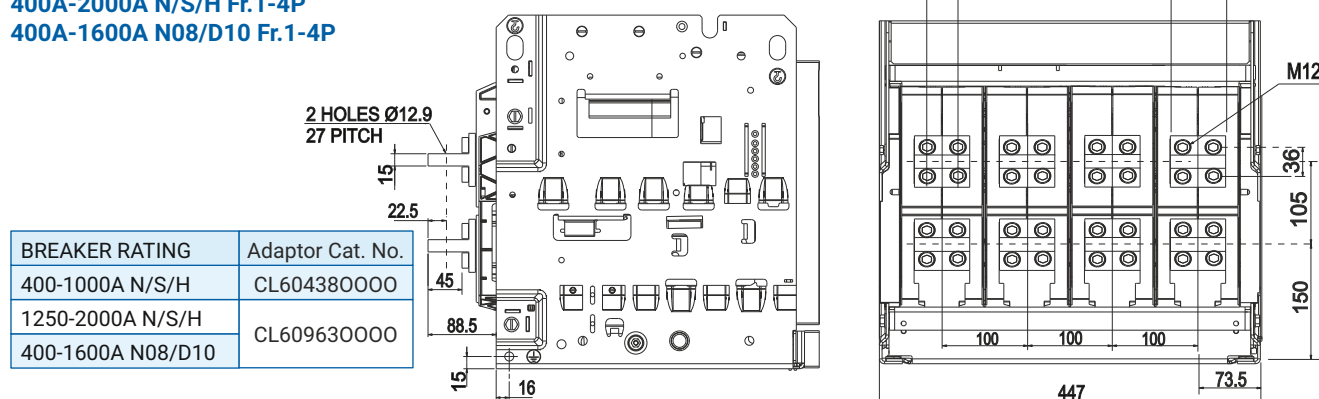


Bolt length for mounting link(s) on Flat Terminals to be cumulative link(s) thickness +20 min to 25 max.

M12 bolts to be used for link termination  
Tightening torque: 3.2 kgfm

## Horizontal Termination

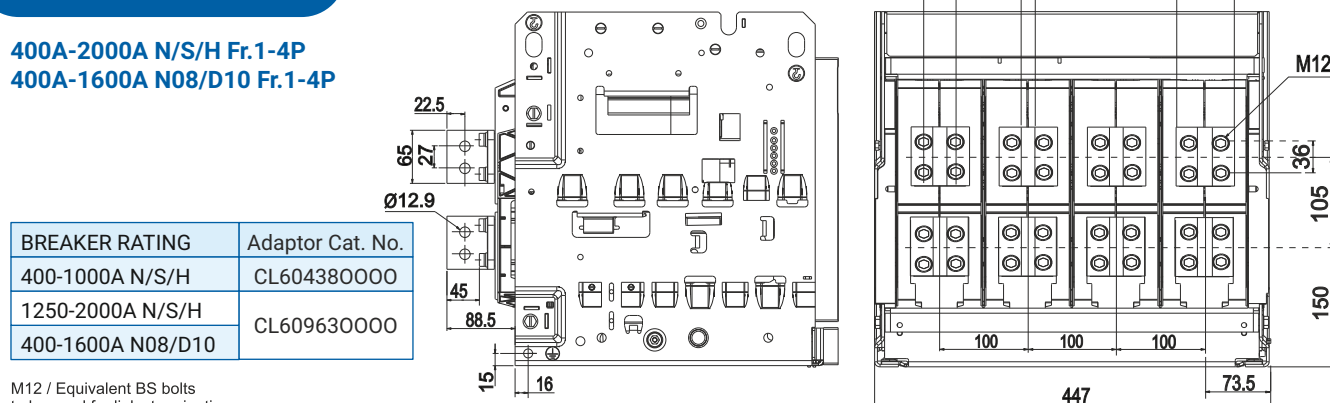
400A-2000A N/S/H Fr.1-4P  
400A-1600A N08/D10 Fr.1-4P



BREAKER RATING	Adaptor Cat. No.
400-1000A N/S/H	CL604380000
1250-2000A N/S/H	CL609630000
400-1600A N08/D10	CL609630000

## Vertical Termination

400A-2000A N/S/H Fr.1-4P  
400A-1600A N08/D10 Fr.1-4P



BREAKER RATING	Adaptor Cat. No.
400-1000A N/S/H	CL604380000
1250-2000A N/S/H	CL609630000
400-1600A N08/D10	CL609630000

M12 / Equivalent BS bolts  
to be used for links termination  
Tightening torque: 3.2 kgfm

All Dimensions in mm

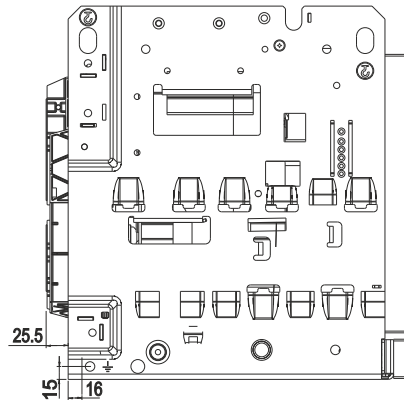
# Termination - Draw Out Breakers

## Flat Termination

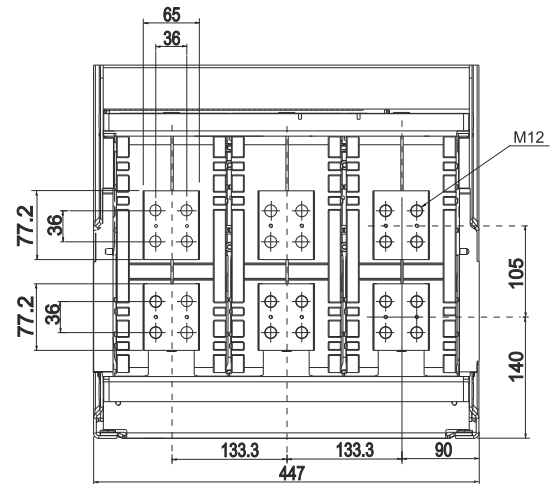
400A-1600A, N/S/H Fr.2-3P



Bolt length for mounting link(s) on Flat Terminals to be cumulative link(s) thickness+20 min to 25 max

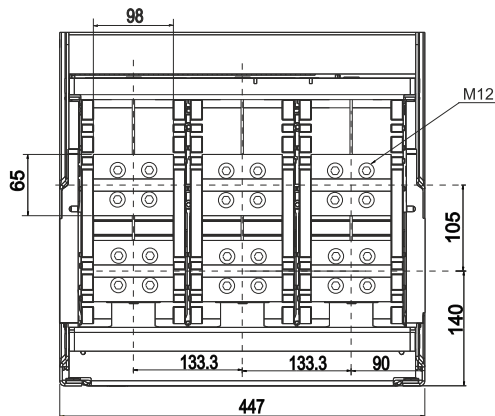
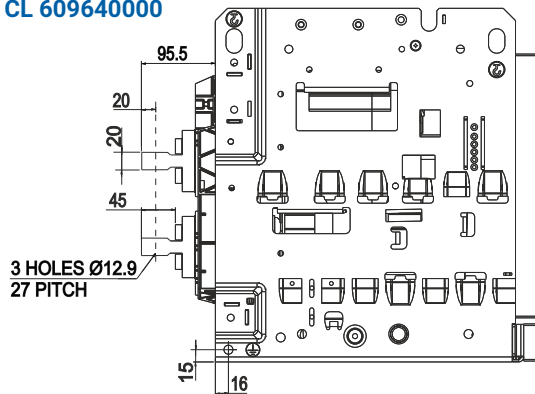


M12 bolts to be used for link termination  
Tightening torque: 3.2 kgfm



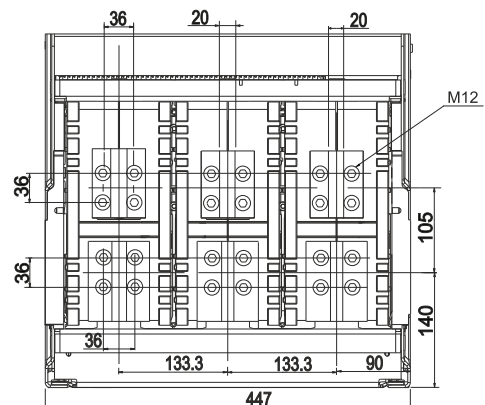
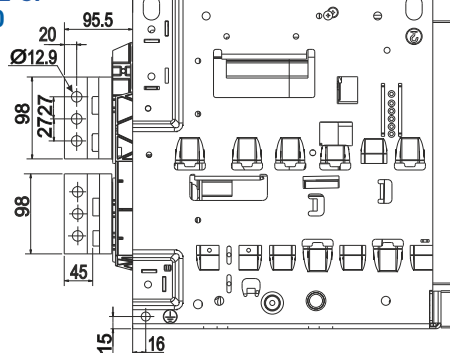
## Horizontal Termination

400-3200A N/S/H Fr.2-3P  
400-2500A N08/N10 Fr.2-3P  
Adaptor - CL 609640000



## Vertical Termination

400-3200A N/S/H Fr.2-3P  
400-2500A N08/N10 Fr.2-3P  
Adaptor - CL 609640000



All Dimensions in mm

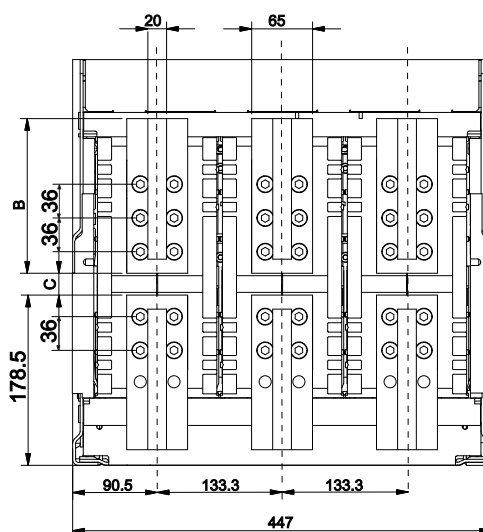
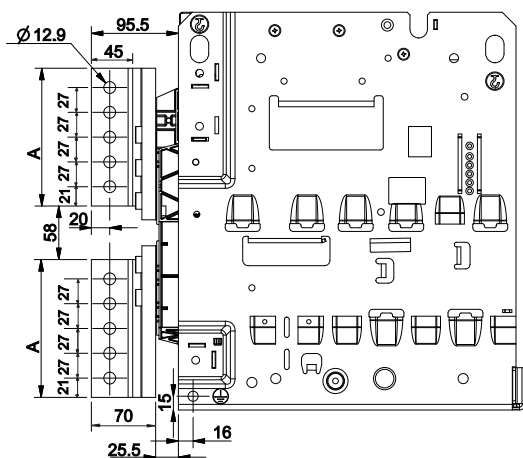
M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

# Termination - Draw Out Breakers

## Vertical Termination

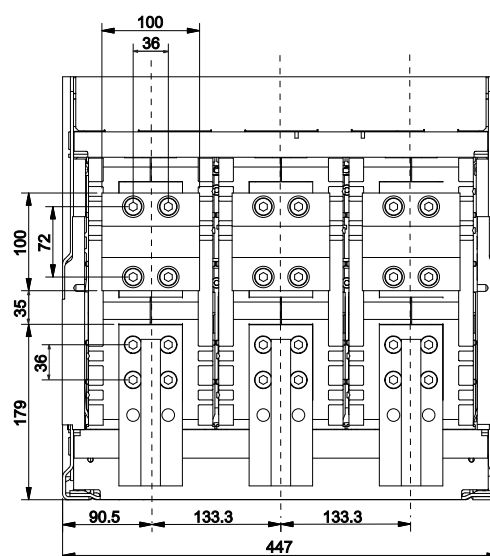
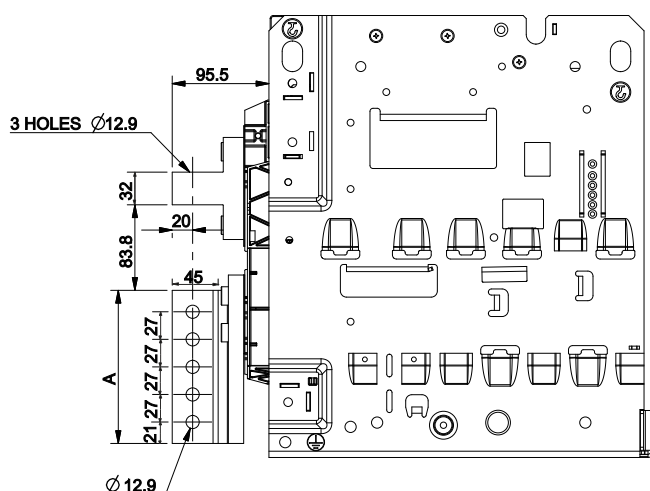
4000A N/S/H, Fr.2-3P  
3200A N08, Fr.2-3P  
4000A N08/N10, Fr.2-3P

Breaker Rating	Adaptor Cat. No.	Dim. A	Dim. B	Dim. C	No of Holes
3200A N08	CL604190000	125	134	40	4
4000A	CL604200000	150	165	29	5



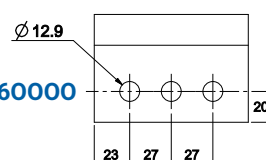
## Top Horizontal & Bottom Vertical Terminal

Breaker Rating	Vertical Adaptor Cat. No.	Dim. A	No of Holes
3200A N08	CL604190000	125	4
4000A	CL604200000	150	5



Adaptor - Horizontal: CL603160000

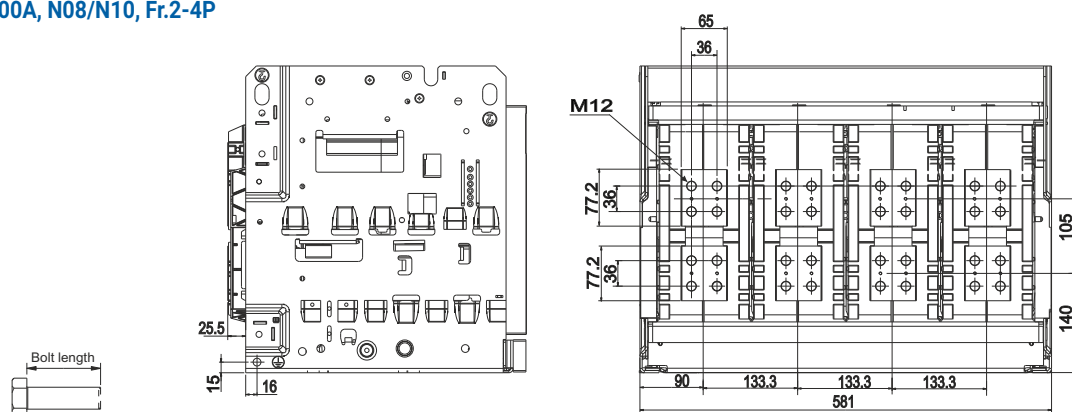
M12 / Equivalent BS bolts to be used for links termination.  
Tightening torque: 3.2 kgfm



# Termination - Draw Out Breakers

## Flat Termination

400A-3200A, N/S/H, Fr.2-4P  
400A-3200A, N08/N10, Fr.2-4P

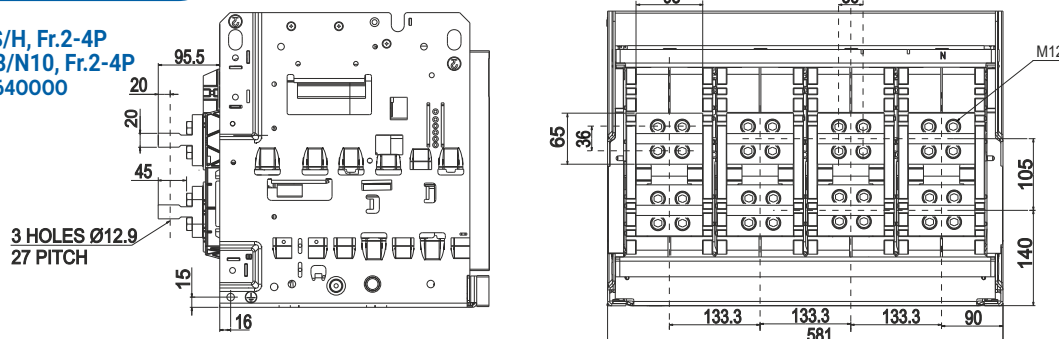


Bolt length for mounting link(s) on  
Flat Terminals to be cumulative link(s)  
thickness+20 min to 25 max

M12 bolts to be used for link termination  
Tightening torque: 3.2 kgfm

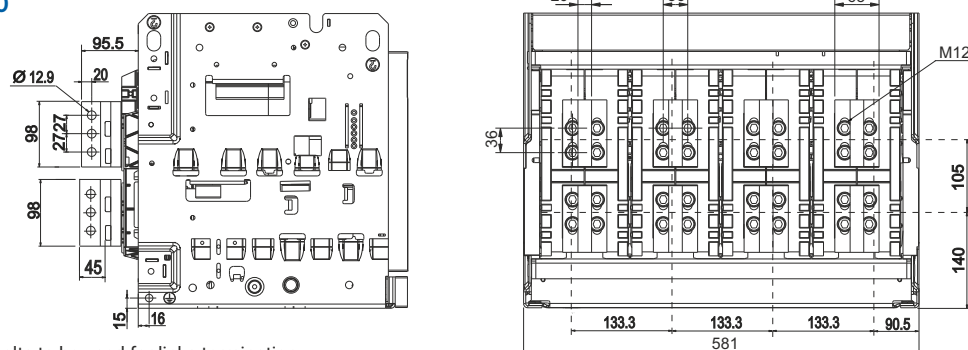
## Horizontal Termination

400-3200A N/S/H, Fr.2-4P  
400-2500A N08/N10, Fr.2-4P  
Adaptor - CL609640000



## Vertical Termination

400-3200A N/S/H, Fr.2-4P  
400-2500A N08/N10, Fr.2-4P  
Adaptor - CL609640000



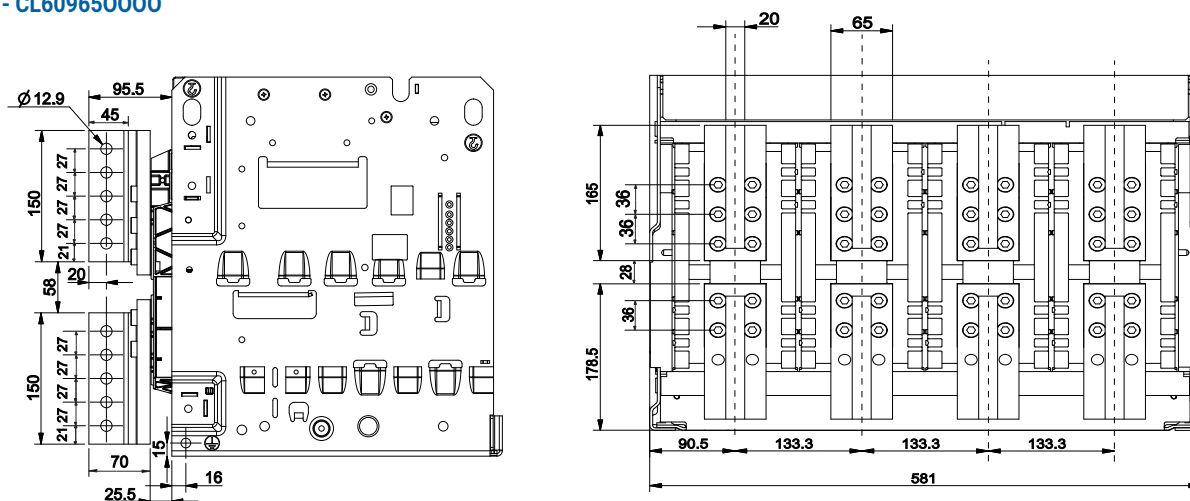
M12 / Equivalent BS bolts to be used for links termination.  
Tightening torque: 3.2 kgfm

All Dimensions in mm

## Termination - Draw Out Breakers

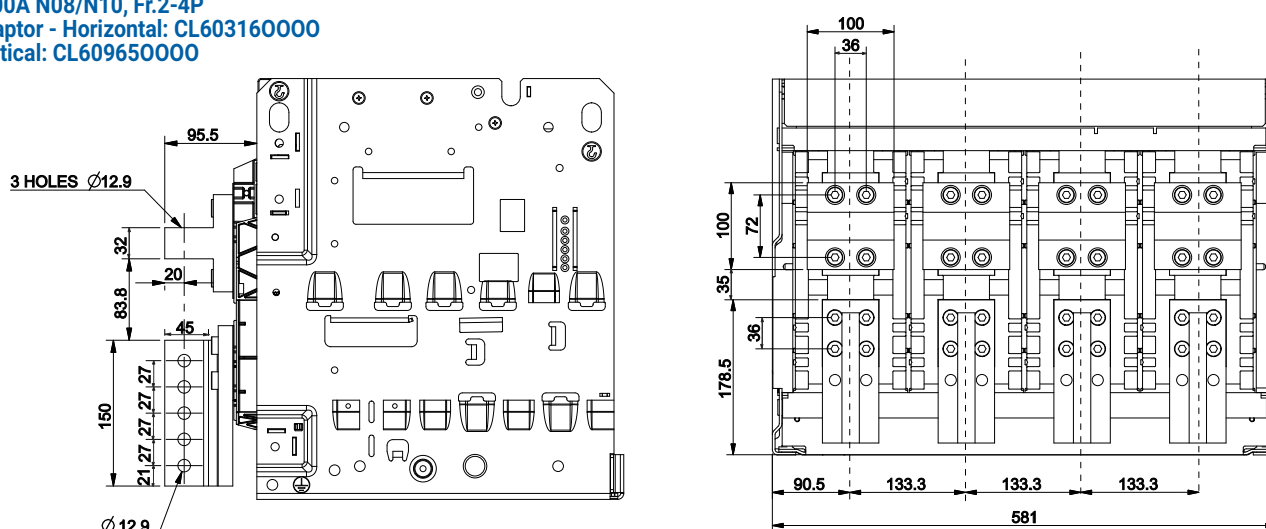
## Vertical Termination

4000A S/H, Fr.2-4P  
4000A N08/N10, Fr.2-4P  
Adaptor - CL609650000

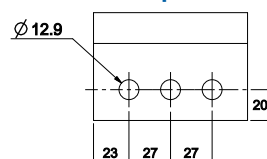


## Top Horizontal & Bottom Vertical Terminal

4000A S/H, Fr.2-4P  
4000A N08/N10, Fr.2-4P  
Adaptor - Horizontal: CL603160000  
Vertical: CL609650000



**Horizontal Adaptor: CL603160000**

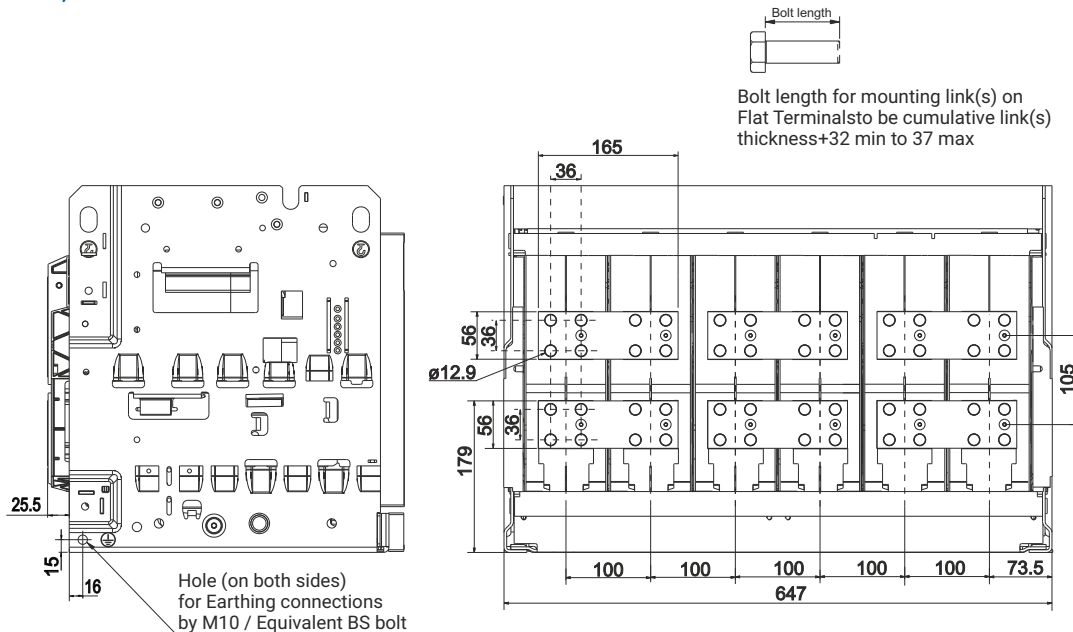


M12 / Equivalent BS bolts to be used for links termination.  
Tightening torque: 3.2 kgfm

# Termination - Draw Out Breakers

## Flat Termination

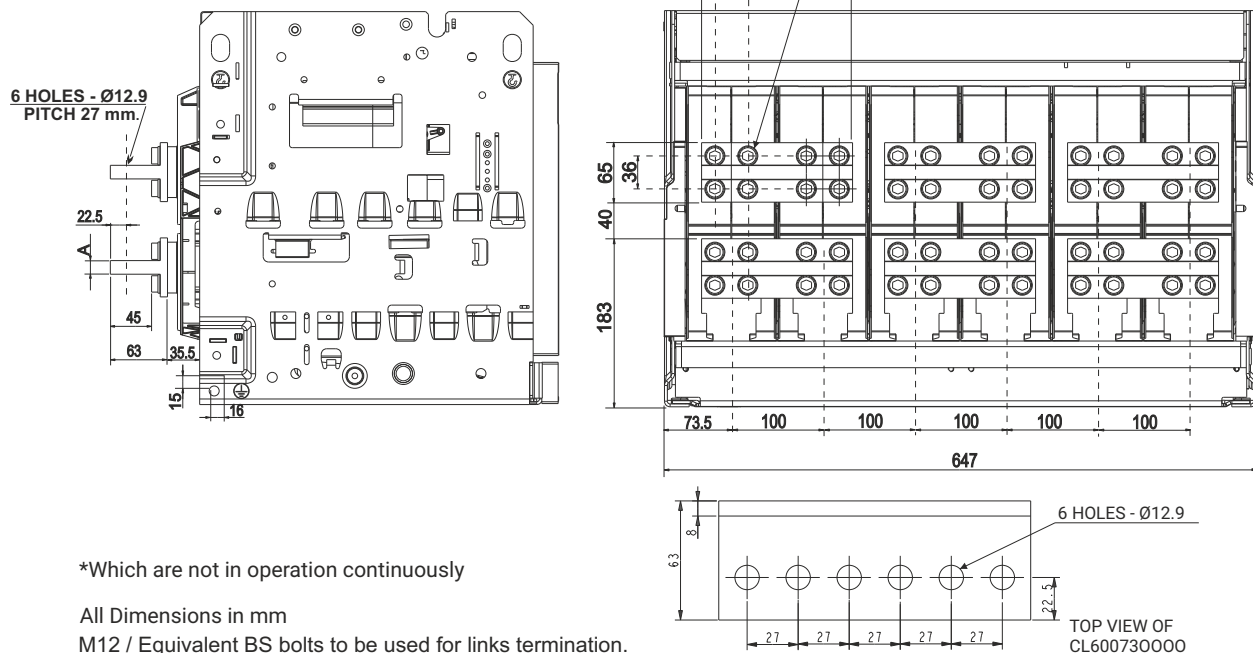
400A-1600A H/V, Fr.3-3P



## Horizontal Termination (Bus Coupler Application Only\*)

400A-4000A H/V, Fr.3-3P  
400-3200A N08/S08, Fr.3-3P  
Adaptor - CL600730000  
DIM. A - 15mm

5000A H/V, Fr.3-3P  
4000A N08/S08, Fr.3-3P  
Adaptor - CL609660000  
DIM. A - 20mm

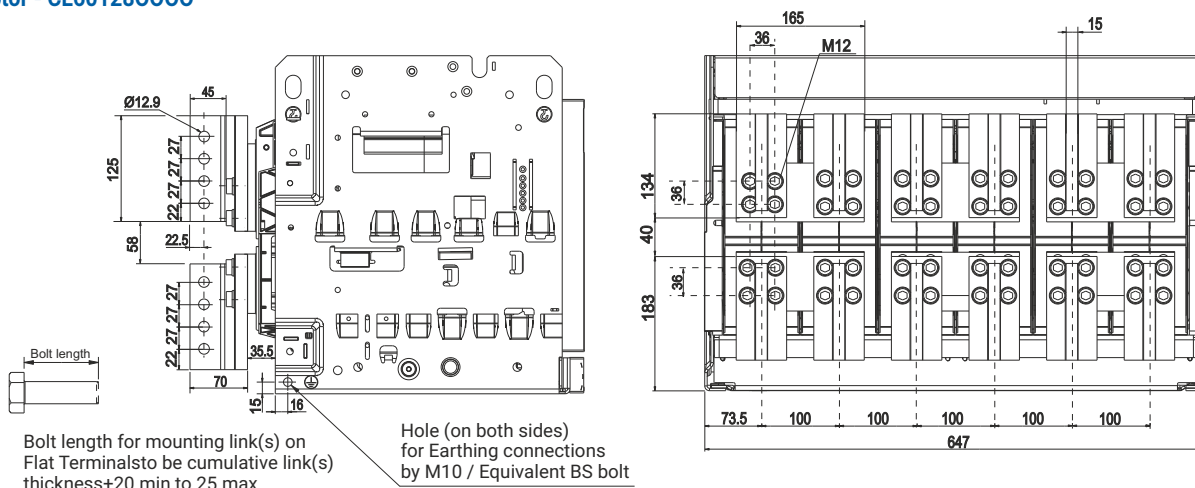




# Termination - Draw Out Breakers

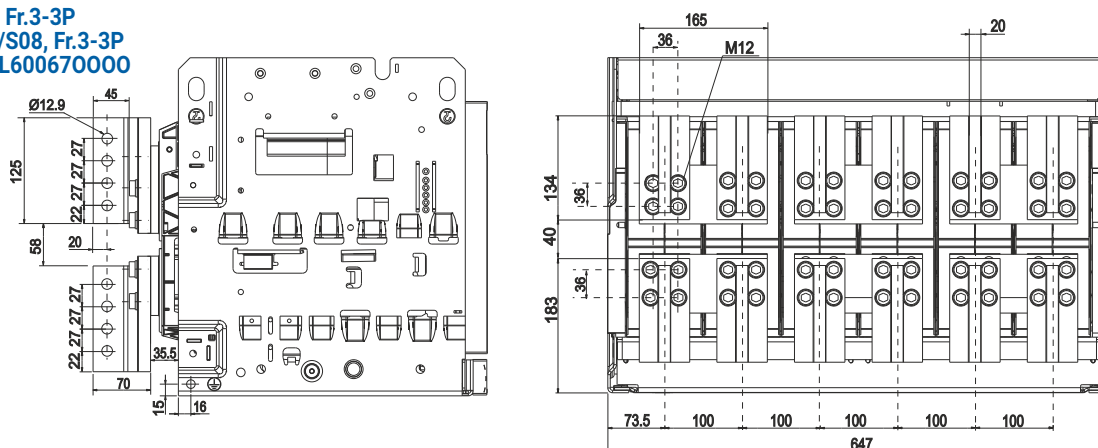
## Vertical Termination

400A-4000A H/V, Fr.3-3P  
400A-3200A N08/S08, Fr.3-3P  
Adaptor - CL601280000



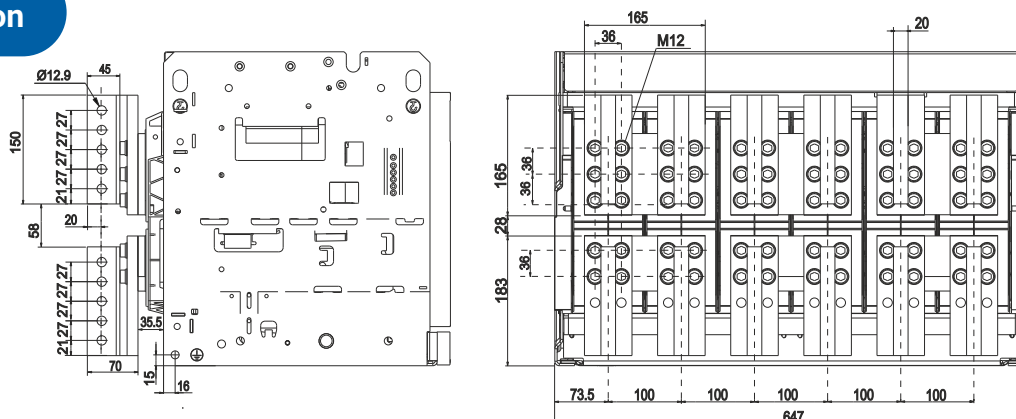
## Vertical Termination

5000A H/V, Fr.3-3P  
4000A N08/S08, Fr.3-3P  
Adaptor - CL600670000



## Vertical Termination

6300A H/V, Fr.3-3P  
5000A N08/S08, Fr.3-3P  
Adaptor - CL609650000

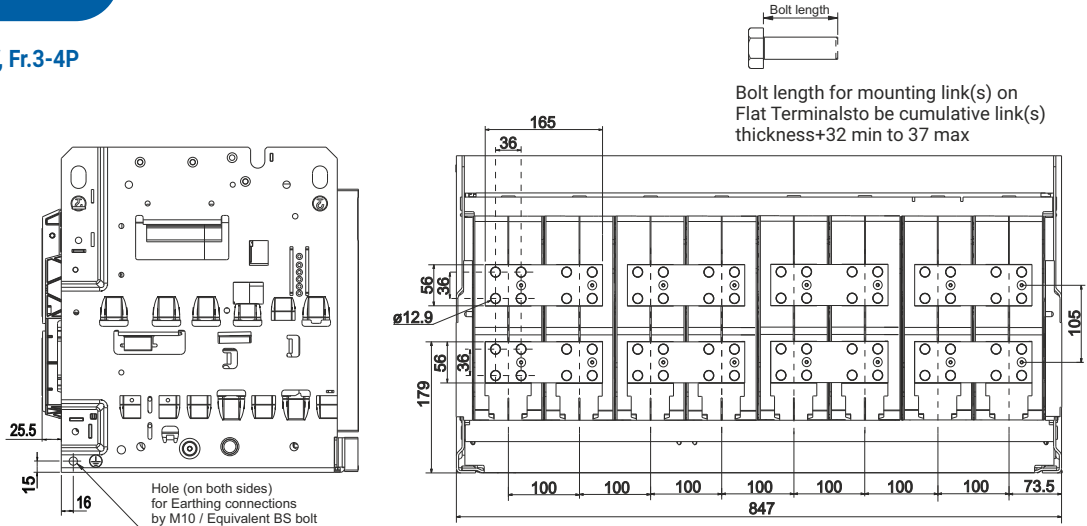


M12 / Equivalent BS bolts to be used for links termination.  
Tightening torque: 3.2 kgfm

# Termination - Draw Out Breakers

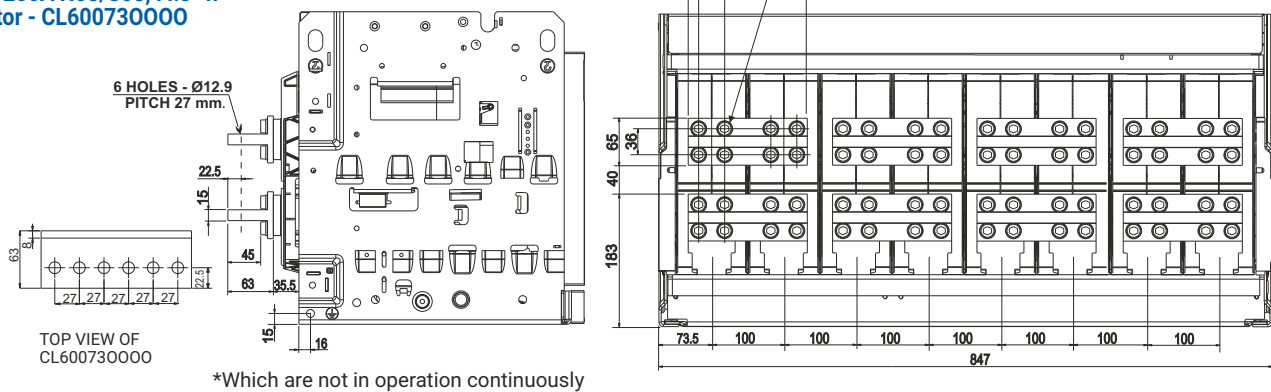
## Flat Termination

400A-1600A H/V, Fr.3-4P



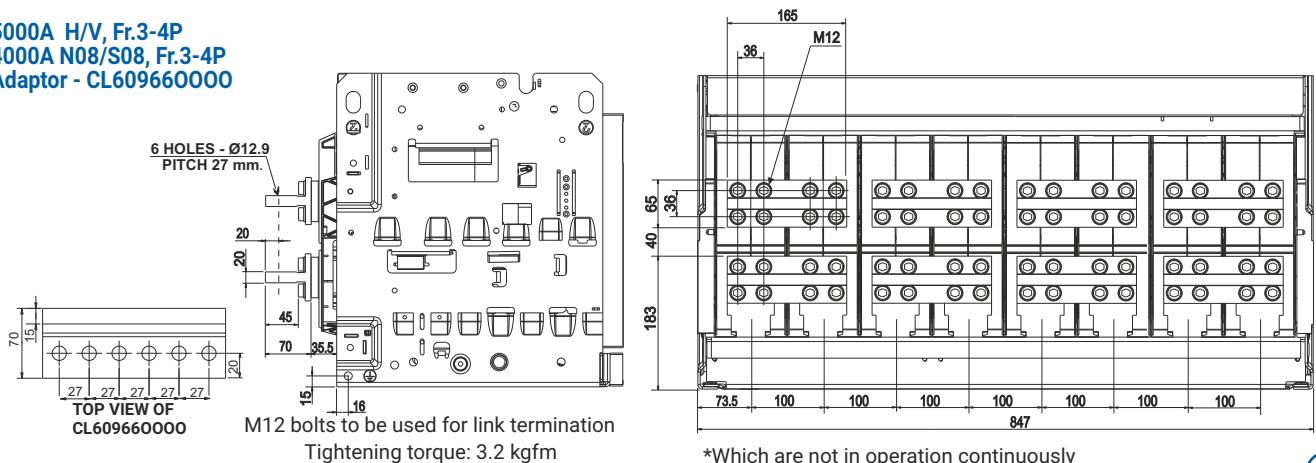
## Horizontal Terminals (Bus Coupler Application Only\*)

400A-4000A H/V, Fr.3-4P  
400-3200A N08/S08, Fr.3-4P  
Adaptor - CL600730000



## Horizontal Terminals (Bus Coupler Application Only\*)

5000A H/V, Fr.3-4P  
4000A N08/S08, Fr.3-4P  
Adaptor - CL609660000

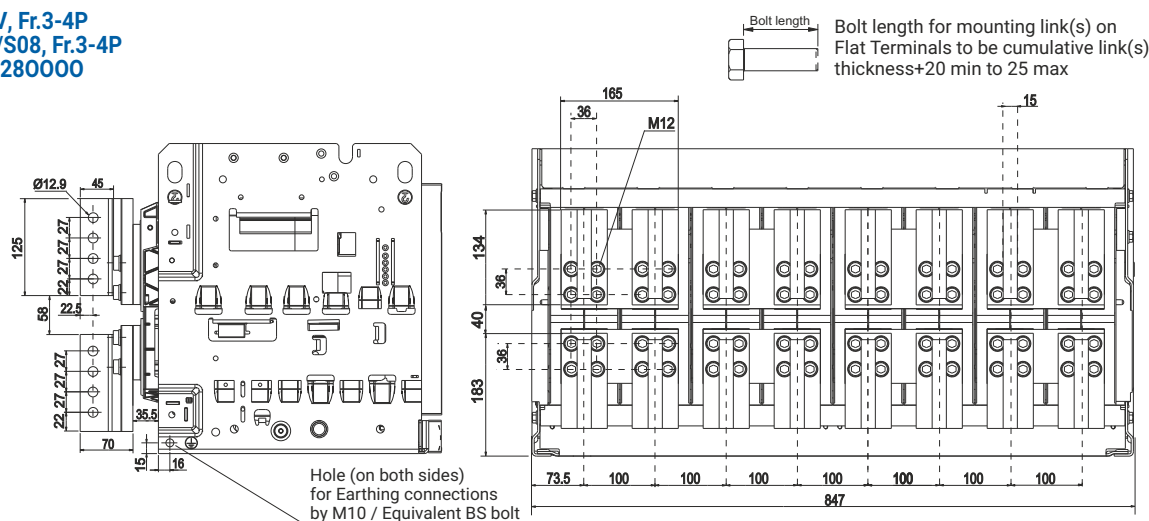


All Dimensions in mm

# Termination - Draw Out Breakers

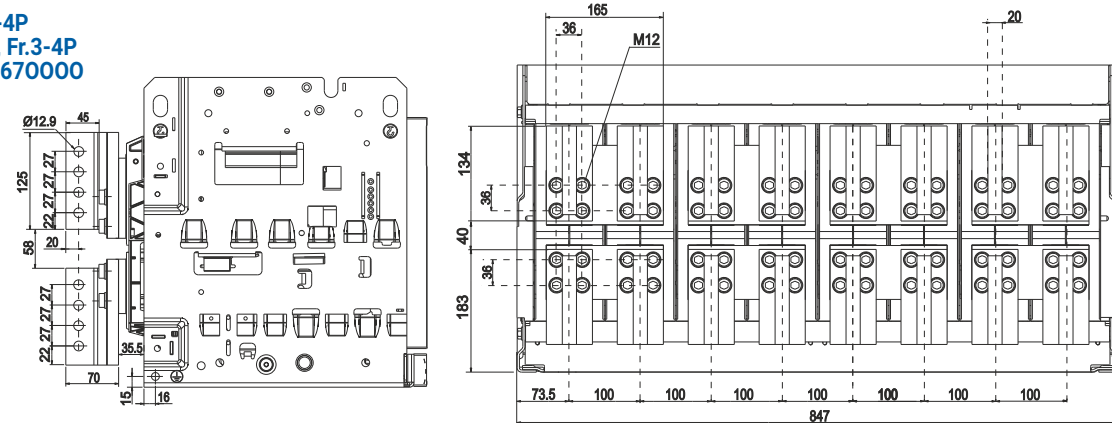
## Vertical Termination

400A-4000A H/V, Fr.3-4P  
400-3200A N08/S08, Fr.3-4P  
Adaptor - CL601280000



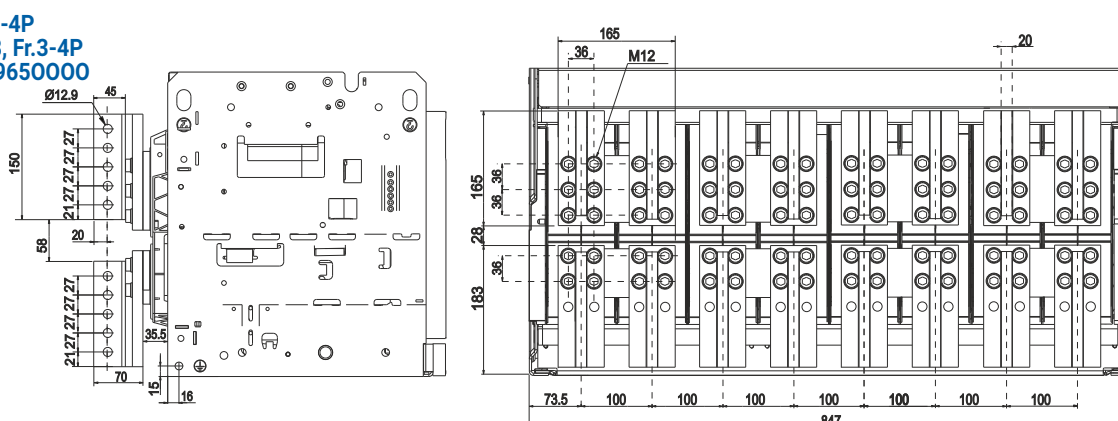
## Vertical Termination

5000A H/V, Fr.3-4P  
4000A N08/S08, Fr.3-4P  
Adaptor - CL600670000



## Vertical Termination

6300A H/V, Fr.3-4P  
5000A N08/S08, Fr.3-4P  
Adaptor - CL609650000

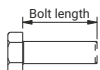


M12 / Equivalent BS bolts to be used for links termination.  
Tightening torque: 3.2 kgfm

## Termination - Draw Out Breakers

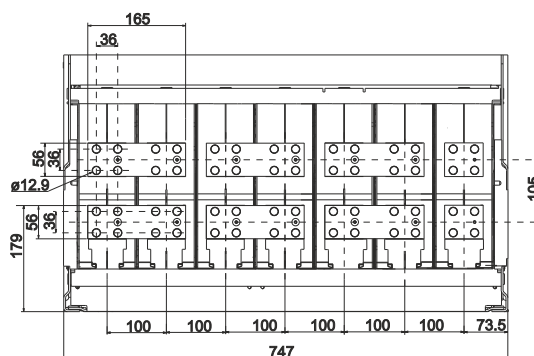
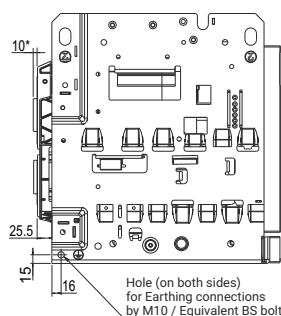
## Flat Termination

**400A-1600A H/V, Fr.3-4P (50% N)**



\*For Phase poles R, Y, B only  
Not applicable for Neutral pole

Bolt length for mounting link(s) on  
Flat Terminals to be cumulative link(s)  
thickness+32 min to 37 max

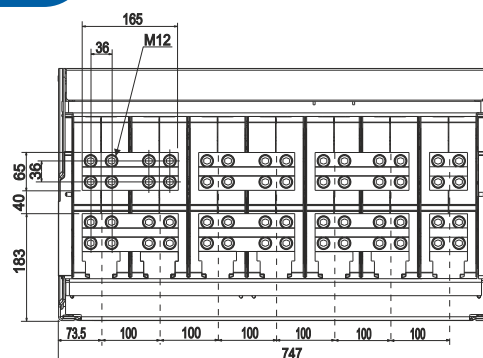
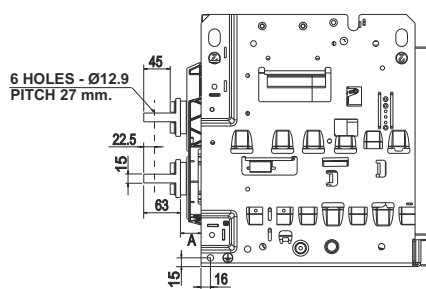


## Horizontal Termination (Bus Coupler Application Only\*)

**400A-4000A H/V, Fr.3-4P  
Adaptor - CL600730000  
- CL609630000**

Poles	A
Phase: R, Y, B	35.5
Neutral: N	25.5

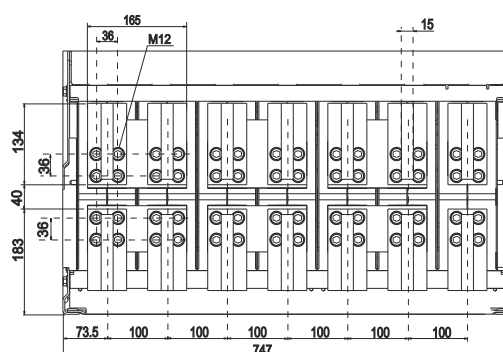
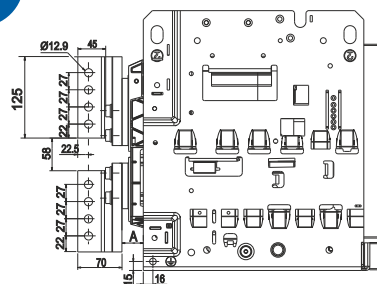
\*Which are not in operation continuously



## Vertical Termination

**400A-4000A H/V, Fr.3-4P  
Adaptor - CL601280000**

Poles	A
Phase: R, Y, B	35.5
Neutral: N	25.5

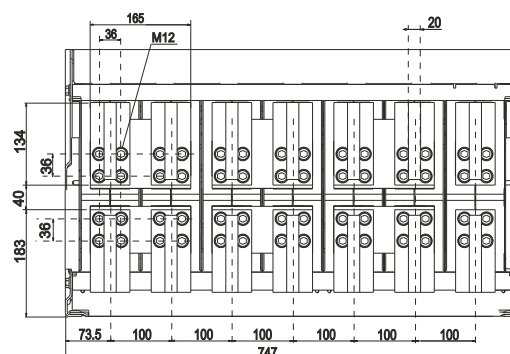
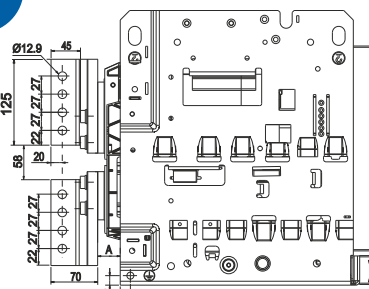


## Vertical Termination

**5000A H/V, Fr.3-4P**  
**Adaptor - CL600670000**

Poles	A
Phase: R, Y, B	35.5
Neutral: N	25.5

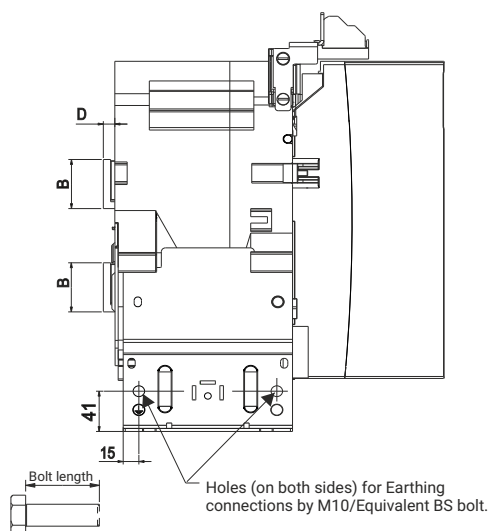
M12/Equivalent BS bolts to be used for link termination  
Tightening torque: 3.2 kqfm



# Termination - Fixed Breakers

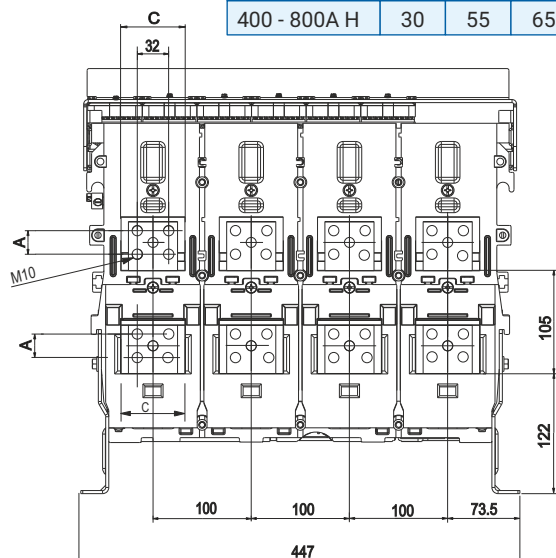
## Flat Termination

400A-800A N/S/H, Fr.1-4P (200% N)



Bolt length for mounting link(s) on Flat Terminals to be cumulative link(s) thickness + 15 mm.

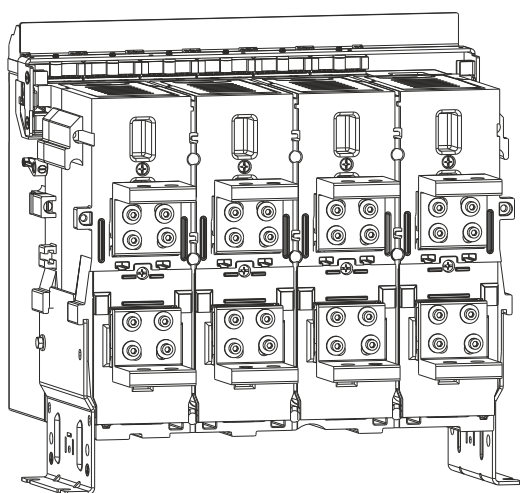
FRAME 1	A	B	C	D
400 - 800A N	24	50	50	11
400 - 800A S	24	50	65	11
400 - 800A H	30	55	65	9



M10 bolts to be used for link termination  
Tightening torque: 3.0 kgfm

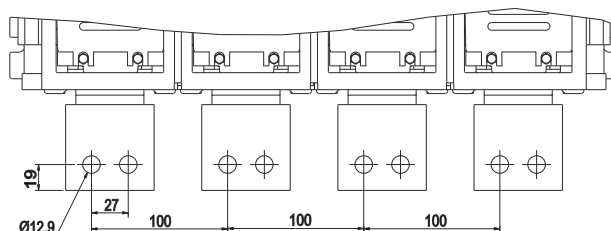
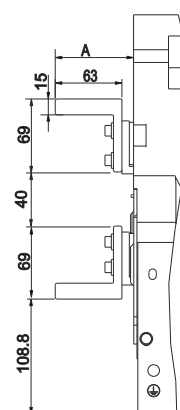
## Horizontal Termination

400A-1000A N/S, Fr.1-4P (200% N)  
400A-1000A H, Fr.1-4P (200% N)



Breaker Rating	Adaptor CAT. No.
400 - 1000A N/S	CL609670000
400 - 1000A H	CL609680000

Breaker Rating	Dimension A
400 - 1000A N/S	74
400 - 1000A H	72

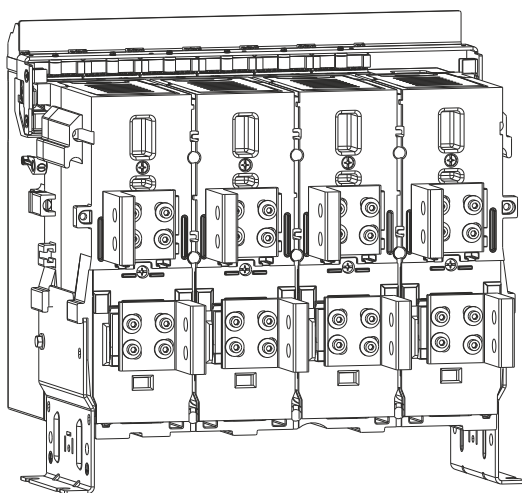


M12 / Equivalent BS bolts to be used for link termination  
Tightening torque: 3.2 kgfm

# Termination - Fixed Breakers

## Vertical Termination

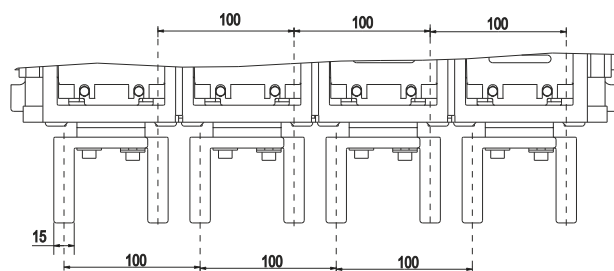
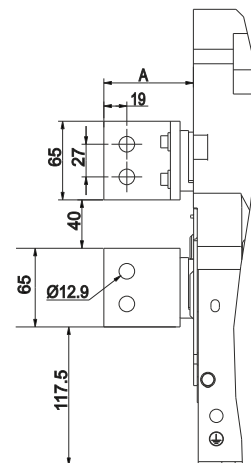
400A-1000A N/S/H, Fr.1-4P (200% N)



M12 / Equivalent BS bolts to be used for link termination  
Tightening torque: 3.2 kgfm

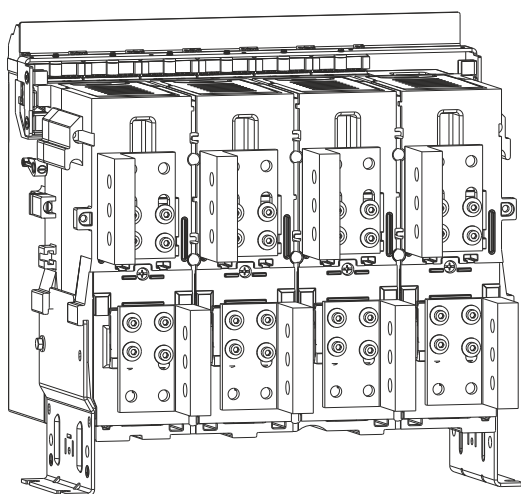
Breaker Rating	Adaptor CAT. No.
400 - 1000A N/S	CL609670000
400 - 1000A H	CL609680000

Breaker Rating	Dimension A
400 - 1000A N/S	74
400 - 1000A H	72

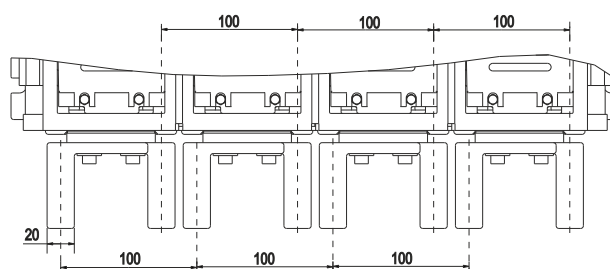
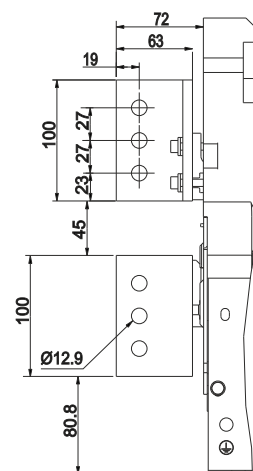


## Vertical Termination

1250A N/S/H, Fr.1-4P (200% N)  
(Adaptor-CL609760000)



M12 / Equivalent BS bolts to be used for link termination  
Tightening torque: 3.2 kgfm



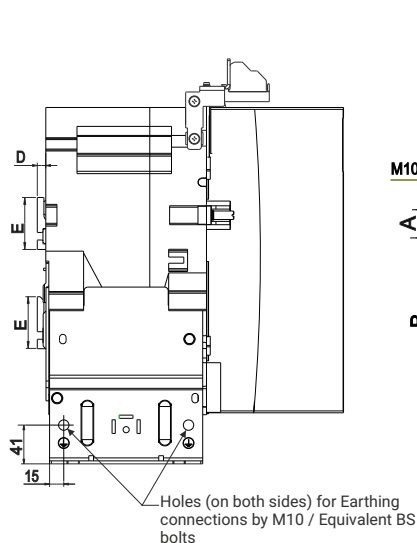


# Termination - Fixed Breakers

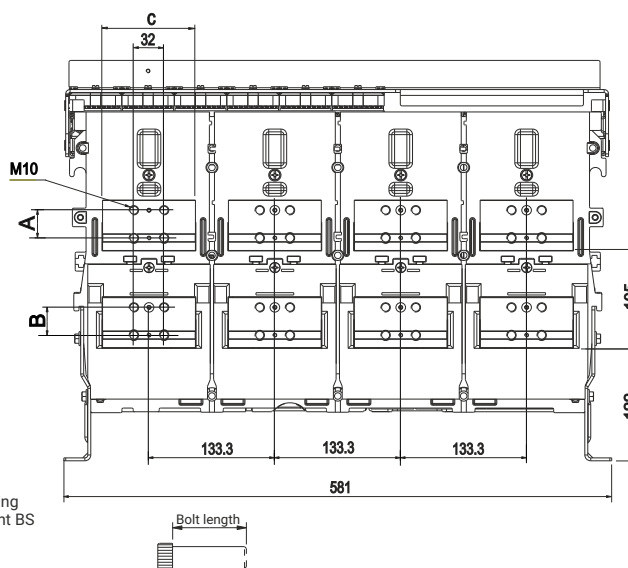
## Flat Termination

400A-1600A N/S/H, Fr.2-4P (200% N)

FRAME 1	A	B	C	D	E
400 - 1250A N/S	24	24	81.2	11	50
1600A N/S	30	30	98.4	9	55
400 - 1600A H	30	30	98.4	9	55



M10 bolts to be used for link termination  
Tightening torque: 3.0 kgfm



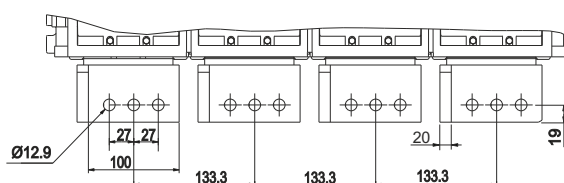
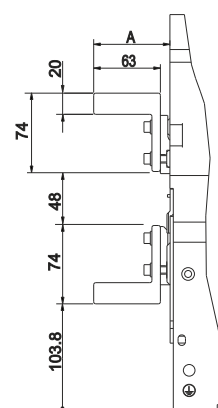
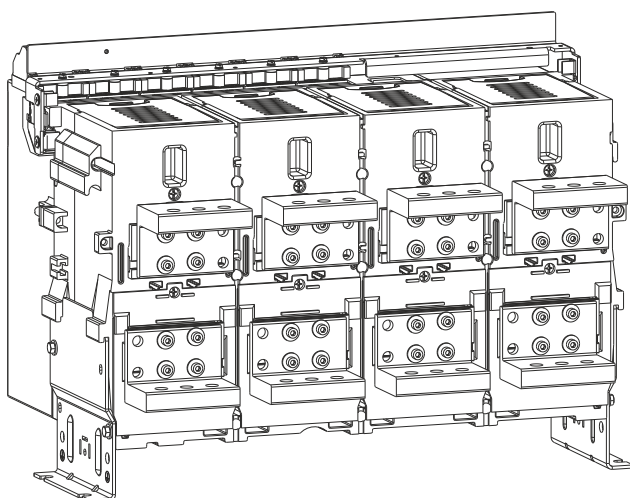
Bolt length for mounting link(s) on  
Flat Terminals To be cumulative link(s)  
Thickness + 15 mm.

## Horizontal Termination

400A-2000A N\*/S/H, Fr.2-4P (200% N)

Version	Adaptor
400 - 1250A N/S	CL601220000
1600 - 2000A N*/S	CL609770000
400 - 2000A H	CL609770000

Version	Dimension A
400 - 1250A N/S	74
1600 - 2000A N*/S	72
400-2000A H	72



\* Available till 1600A

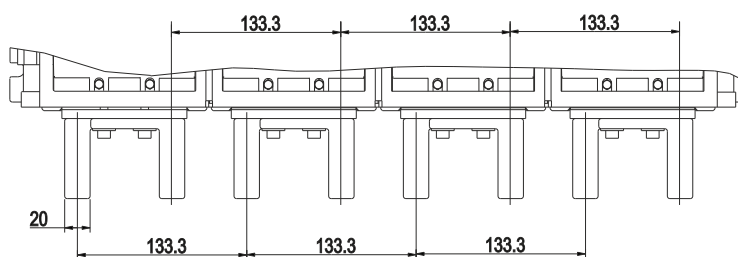
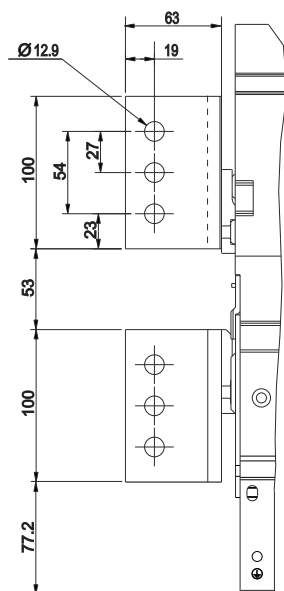
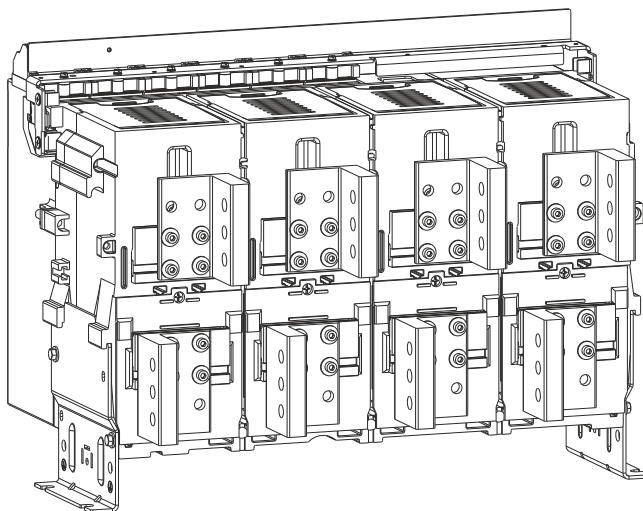
M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

# Termination - Fixed Breakers

## Vertical Termination

400A-2000A N\*/S/H, Fr.2-4P (200% N)

Version	Adaptor
400 - 1250A N/S	CL601220000
1600 - 2000A N*/S	CL609770000
400 - 2000A H	CL609770000



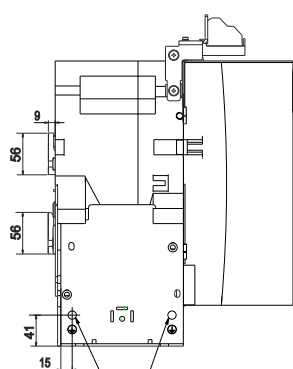
\* Available till 1600A

M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

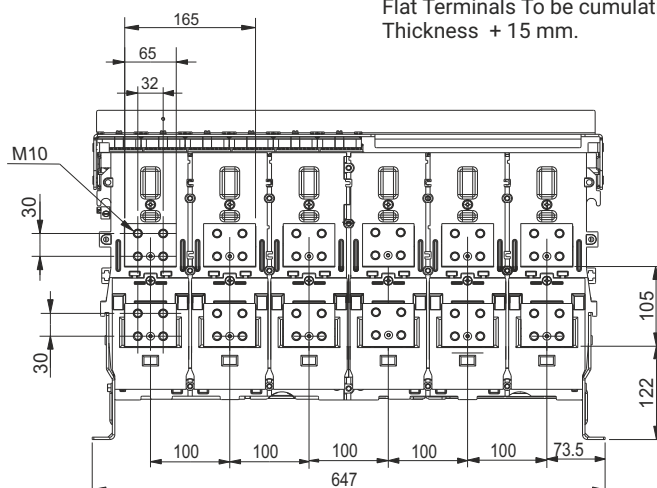
# Termination - Fixed Breakers

## Flat Termination

400A-1600A H/V, Fr.3-4P(200% N)



Holes (on both sides) for Earthing connections by M10 / Equivalent BS bolt

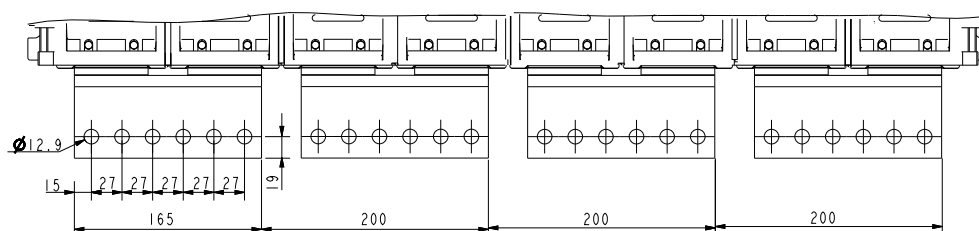
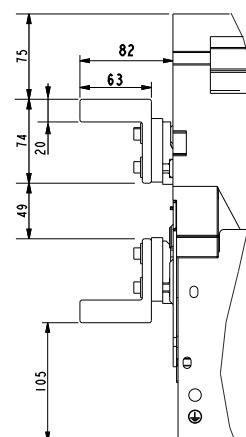
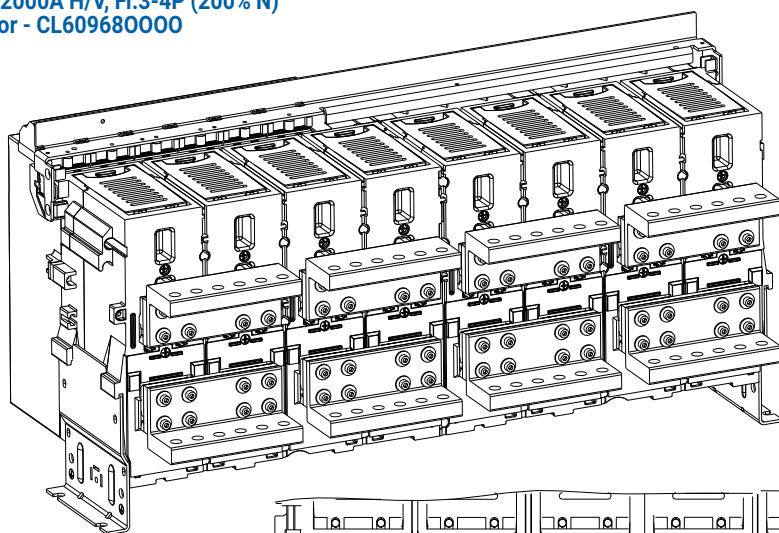


Bolt length for mounting link(s) on Flat Terminals To be cumulative link(s) Thickness + 15 mm.

M10 to be used for links termination  
Tightening torque: 3.0 kgfm

## Horizontal Termination (Bus Coupler Application Only\*)

400A-2000A H/V, Fr.3-4P (200% N)  
Adaptor - CL609680000



M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

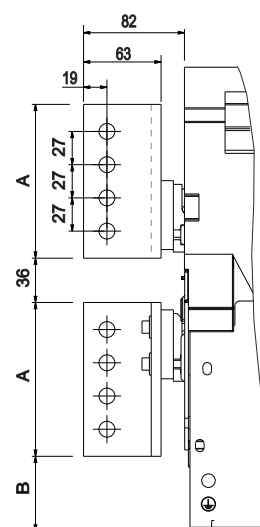
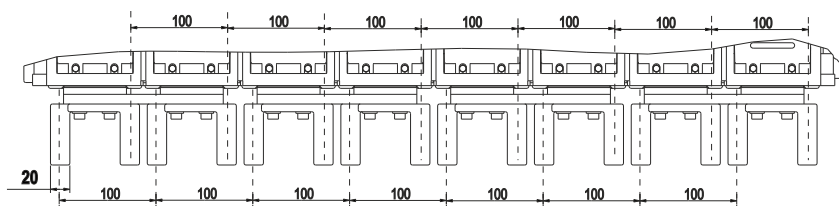
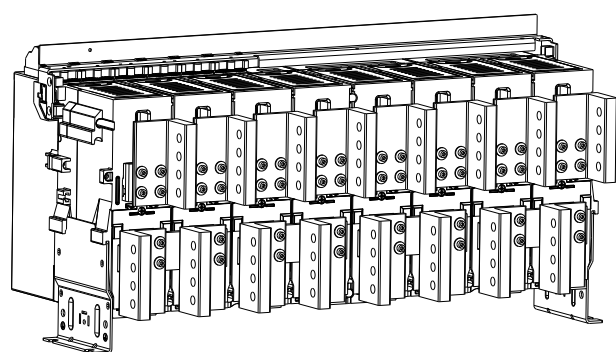
\* Which are not in continuous service.

# Termination - Fixed Breakers

## Vertical Termination

400A-2500A H/V Fr.3-4P (200% N)

Breaker Rating	Adaptor Cat. No.	Dim. A	Dim. B	No of Holes
400-2500A	CL604180000	125	61	4

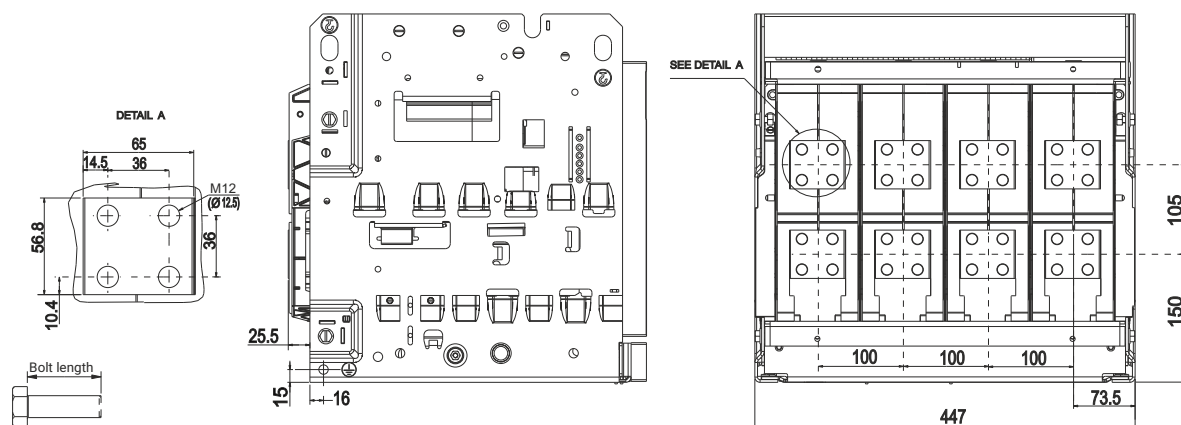


M12 / Equivalent BS bolts to be used for links termination  
Tightening torque: 3.2 kgfm

# Termination - Draw Out Breakers

## Flat Termination

400A-1000A N/S/H, Fr.1-4P (200%N)

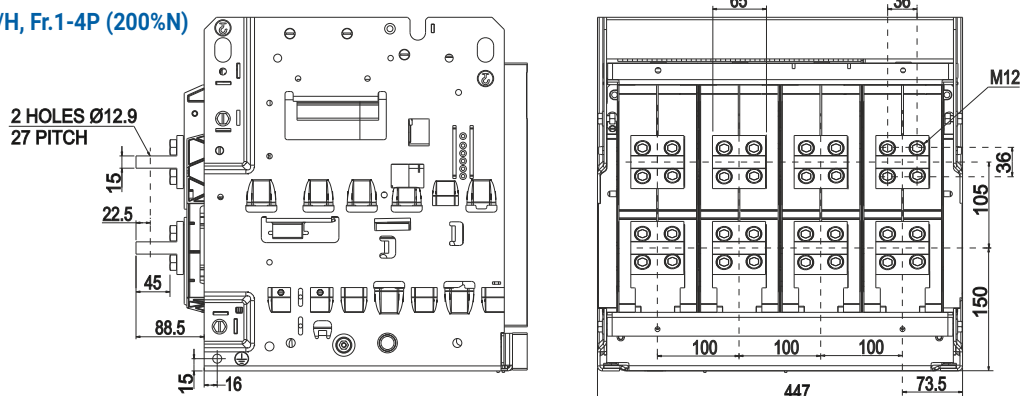


Bolt length for mounting link(s) on Flat  
Terminals to be cumulative link(s)  
thickness +20 min to 25 max.

M12 bolts to be used for link termination  
Tightening torque: 3.2 kgfm

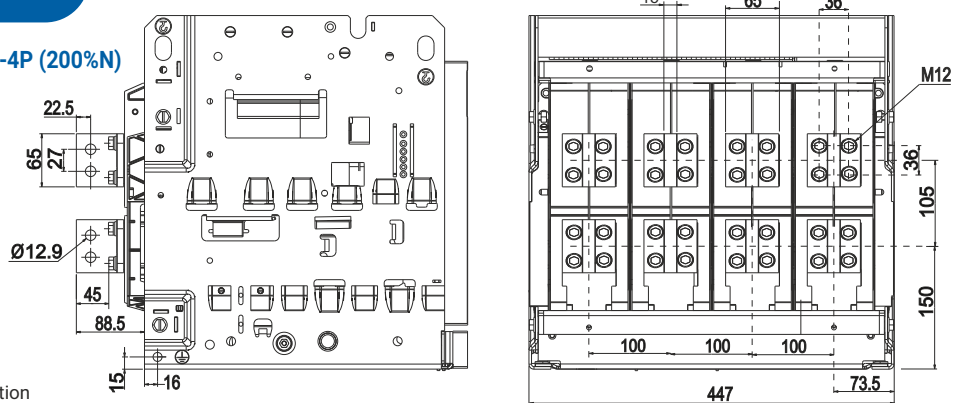
## Horizontal Termination

400A - 1000A N/S/H, Fr.1-4P (200%N)  
CL609630000



## Vertical Termination

400A - 1000A N/S/H, Fr.1-4P (200%N)  
Adaptor - CL609630000



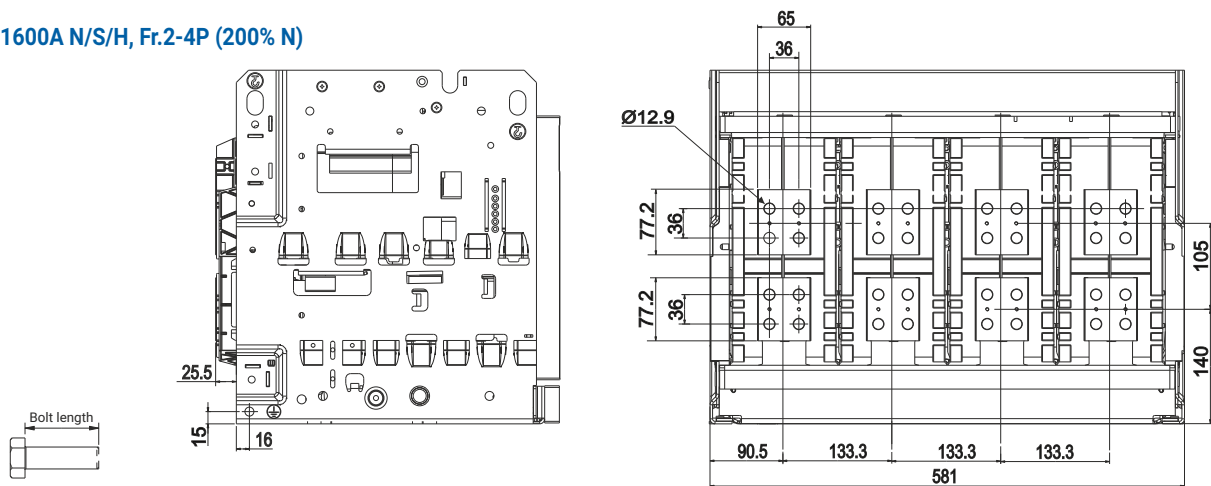
M12 / Equivalent BS bolts  
to be used for links termination  
Tightening torque: 3.2 kgfm

All Dimensions in mm

# Termination - Draw Out Breakers

## Flat Termination

400A-1600A N/S/H, Fr.2-4P (200% N)

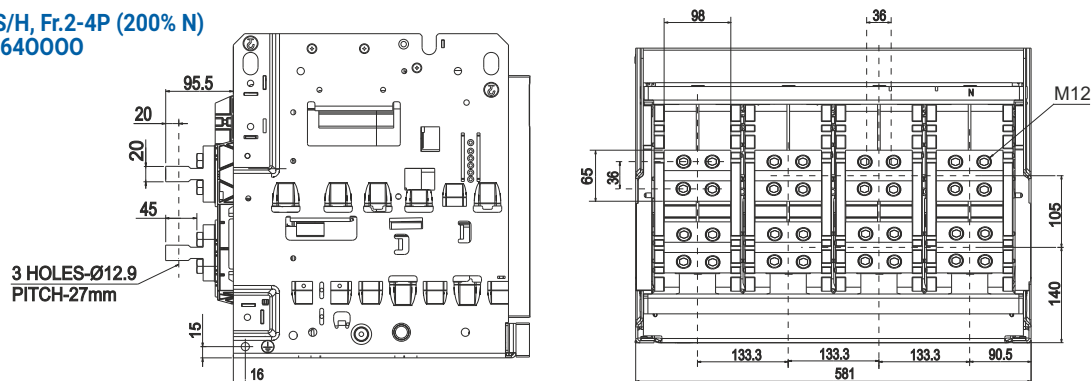


Bolt length for mounting link(s) on Flat Terminals to be cumulative link(s) thickness+20 min to 25 max

M12 bolts to be used for link termination  
Tightening torque: 3.2 kgfm

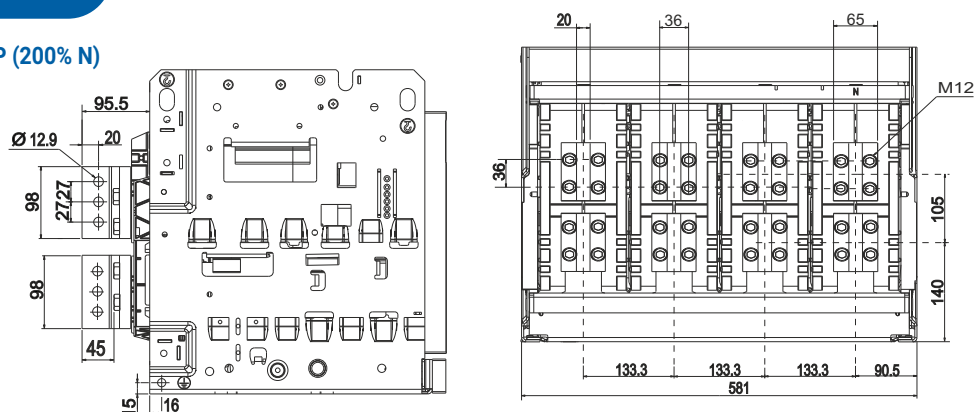
## Horizontal Termination

400A-1600A N/S/H, Fr.2-4P (200% N)  
Adaptor - CL609640000



## Vertical Termination

400A-1600A N/S/H, Fr.2-4P (200% N)  
Adaptor - CL609640000



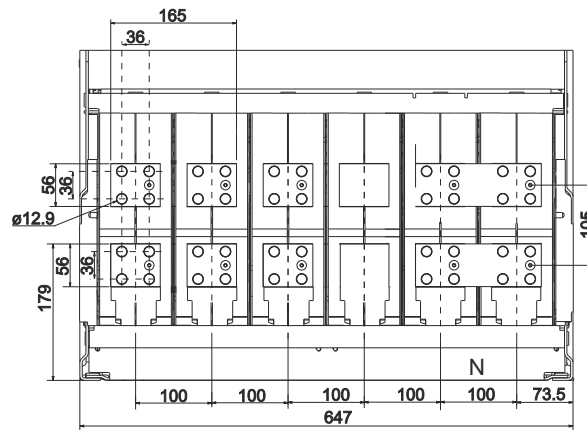
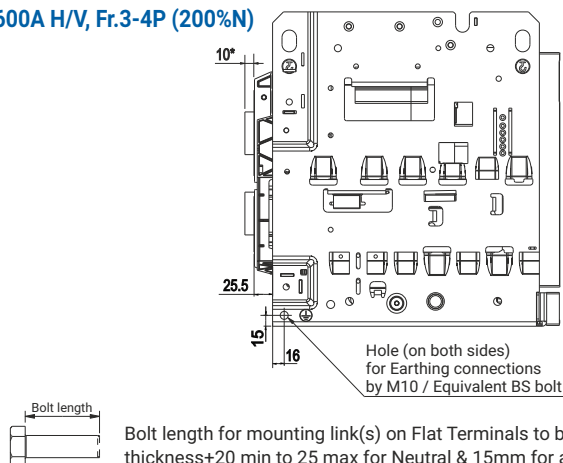
M12 / Equivalent BS bolts to be used for links termination.  
Tightening torque: 3.2 kgfm



# Termination - Draw Out Breakers

## Flat Termination

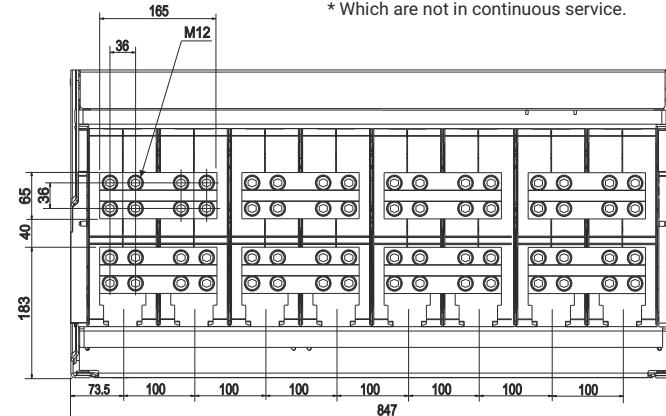
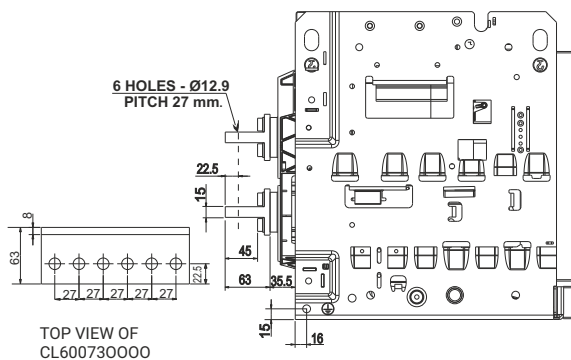
400A-1600A H/V, Fr.3-4P (200%N)



\*10 mm Equalizer link in Neutral Terminal only. Hence height difference between Phase & Neutral

## Horizontal Termination (Bus Coupler Application Only\*)

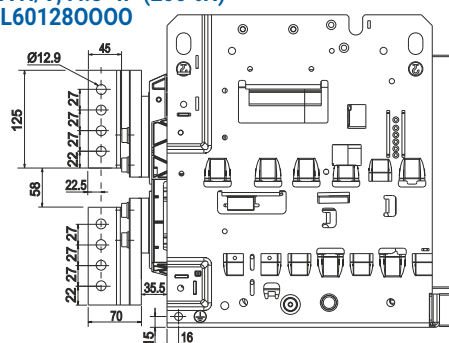
400A-2000A H/V, Fr.3-4P (200%N)  
Adaptor - CL600730000



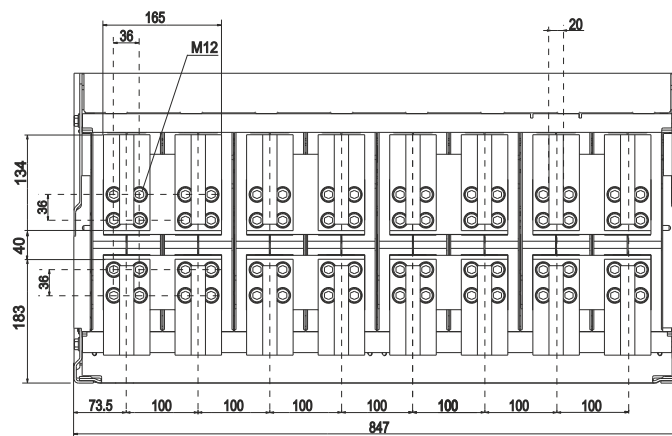
\* Which are not in continuous service.

## Vertical Termination

400A-2500A H/V, Fr.3-4P (200%N)  
Adaptor - CL601280000



M12 / Equivalent BS bolts to be used for links termination.  
Tightening torque: 3.2 kgfm



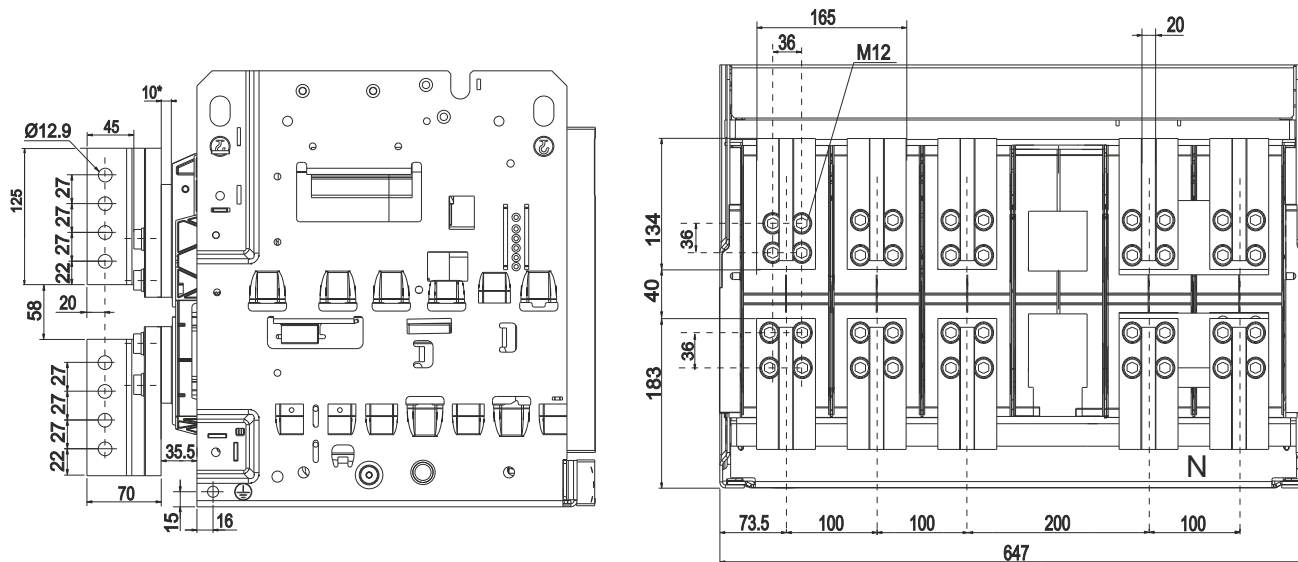
All Dimensions in mm

# Termination - Draw Out Breakers

## Vertical Termination

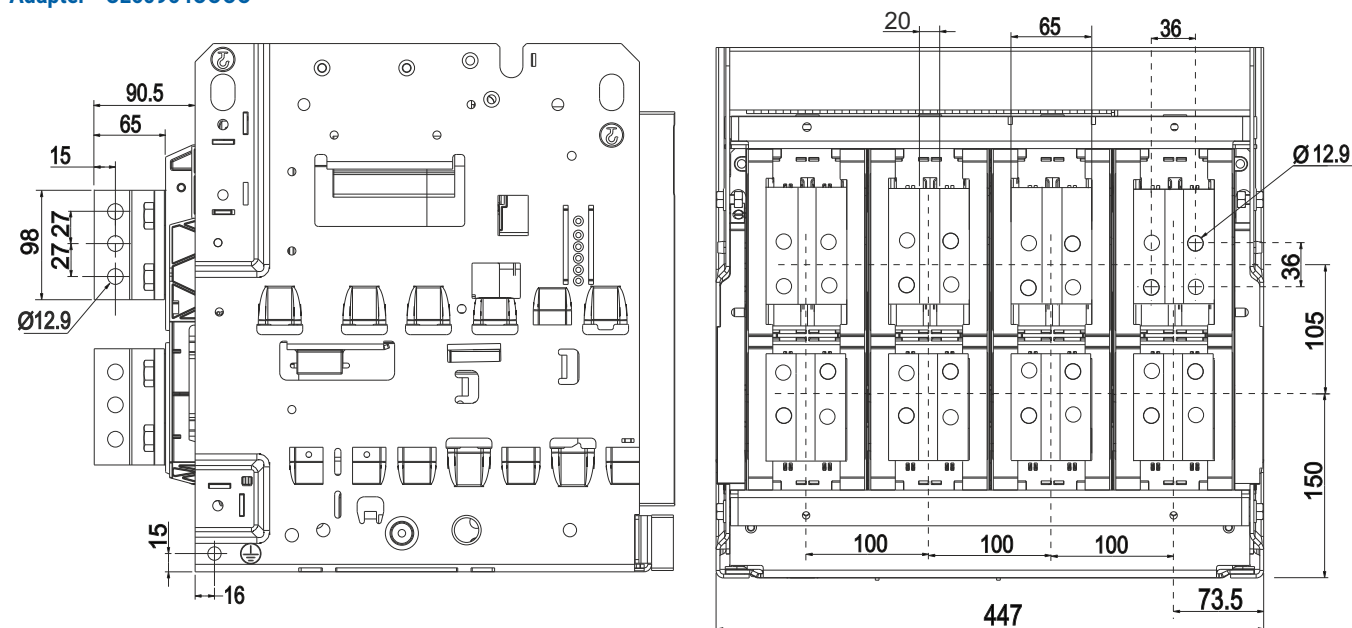
2500A H/V, Fr.3-4P (200%N)  
Adaptor - CL600670000

\*10 mm Terminal height difference due to equalizer for Neutral.



## Vertical Termination

1250A S/H, Fr.1-4P (200%N)  
Adaptor - CL609640000



M12 / Equivalent BS bolts to be used for links termination.  
Tightening torque: 3.2 kgfm

All Dimensions in mm

# Termination - Busbar Cross Section Details

## Direct Aluminium Termination

### Frame-1 : 400 - 1600A N/S/H/N08/D10 & 2000A N/N08/D10/S/H

Frame Size	Rating (A)	Aluminium cross section as per IEC (in sq. mm)	Popular Aluminium Termination								
			Flat			Horizontal (with Terminal adaptor)			Vertical (with Terminal adaptor)		
			6 mm	10 mm	12 mm	6 mm	10 mm	12 mm	6 mm	10 mm	12 mm
1	800	800	75-2 runs	-	-	75-2 run 50-3 run	-	-	75-2 run 50-3 run	-	-
	1000	1000	60-3 runs	-	-	60-3 runs	50-2 runs	-	60-3 runs	50-2 run	-
	1250	1600	-	-	75-2 runs	60-5 runs 75-6 runs	60-3 runs	75-2 runs	60-4 runs	-	75-2 runs
	1600	2000	-	60-3 runs	75-2 runs	60-6 runs	-	-	-	100-2 runs	-
	2000	3000	-			-	75-4 runs	-	-	75-4 runs	-

**Note:** Above table is based on extensive study of popular bus-bar sizes used to terminate Air Circuit Breakers. However other bus-bar sizes (in terms of thickness & width) can also be used to achieve bus-bar cross section recommended by IS & IEC. De-rating of switchgear depends upon various factors such as cross section area, orientation and material of bus bar,

### Frame-2 : 400 - 3200A N/S/H/N08/N10 & 4000A S/H

Frame Size	Rating (A)	Aluminium cross section as per IS/IEC (in sq. mm)	Popular Aluminium Termination					
			Horizontal (with Terminal adaptor)			Vertical (with Terminal adaptor)		
			6 mm	10 mm	12 mm	6 mm	10 mm	12 mm
2	2500	4000	-	100-4 runs	-	-	100-4 runs	-
	3200	6000*	-	-	-	-	150-4 runs	-
	4000 <sup>#</sup>	7200*	-	-	100-6 runs	-	-	150-4 runs

# For Fr-2 4000A, for Aluminum termination, first link **COPPER** of **300mm** length (minimum) to be used.

**Note:** Above table is based on extensive study of popular bus-bar sizes used to terminate Air Circuit Breakers. However other bus-bar sizes (in terms of thickness & width) can also be used to achieve bus-bar cross section recommended by IS & IEC. De-rating of switchgear depends upon various factors such as cross section area, orientation and material of bus bar, healthiness of bus-bar joints, panel construction, and ventilation, etc.

### Frame-3 : 400 - 4000A H/V/N08 & 5000-6300A H/V

Frame Size	Rating (A)	Aluminium cross section as per IS/IEC (in sq. mm)	Popular Aluminium Termination					
			Horizontal (with Terminal adaptor)			Vertical (with Terminal adaptor)		
			6 mm	10 mm	12 mm	6 mm	10 mm	12 mm
3	4000	7200	-	150-5 runs	150-4 runs	-	125-6 runs	125-5 runs
	5000	8000*	Copper termination recommended					
	6300	10000*	Copper termination recommended					

\*Not as per standard but generally followed

**Note:** Above table is based on extensive study of popular bus-bar sizes used to terminate Air Circuit Breakers. However other bus-bar sizes (in terms of thickness & width) can also be used to achieve bus-bar cross section recommended by IS & IEC. De-rating of switchgear depends upon various factors such as cross section area, orientation and material of bus bar, healthiness of bus-bar joints, panel construction, and ventilation, etc.

# Termination - Busbar Cross Section Details

## Direct Copper Termination OR Aluminium Terminations with Copper Links

### Frame-1 : 400 - 1600A N/S/H/N08/D10 & 2000A N/S/H/N08/D10

Frame Size	Rating (A)	Copper cross section as per IEC (in sq. mm)	Popular Copper Termination								
			Flat			Horizontal (with Terminal adaptor)			Vertical (with Terminal adaptor)		
			6 mm	10 mm	12 mm	6 mm	10 mm	12 mm	6 mm	10 mm	12 mm
1	800	500	-	60-1 run	-	-	50-1 run 60-1 run	-	-	50-1 run 60-1 run	-
	1000	600	-	60-1 run	-	-	60-1 run	-	-	60-1 run	-
	1250	800	75-2 runs	-	-	75-2 runs	-	-	75-2 runs	-	-
	1600	1000	60-3 runs	-	-	60-3 runs	-	-	60-3 runs	-	-
	2000	1500	-	-	-	-	75-2 runs	-	-	75-2 runs	-

**Note:** Above table is based on extensive study of popular bus-bar sizes used to terminate Air Circuit Breakers. However other bus-bar sizes (in terms of thickness & width) can also be used to achieve bus-bar cross section recommended by IS & IEC. De-rating of switchgear depends upon various factors such as cross section area, orientation and material of bus bar, healthiness of bus-bar joints, panel construction, and ventilation, etc.

### Frame-2 : 400 - 3200A N/S/H/N08/N10 & 4000A S/H

Frame Size	Rating (A)	Copper cross section as per IEC (in sq. mm)	Popular Copper Termination					
			Horizontal (with Terminal adaptor)			Vertical (with Terminal adaptor)		
			6 mm	10 mm	12 mm	6 mm	10 mm	12 mm
2	2500	2000	-	100-2 runs	-	-	100-2 runs	-
	3200	3200*	-	80-4 runs	-	-	80-4 runs	-
	4000	4000*	-	100-4 runs	-	-	100-4 runs 150-3 runs	-

**Note:** Above table is based on extensive study of popular bus-bar sizes used to terminate Air Circuit Breakers. However other bus-bar sizes (in terms of thickness & width) can also be used to achieve bus-bar cross section recommended by IS & IEC. De-rating of switchgear depends upon various factors such as cross section area, orientation and material of bus bar, healthiness of bus-bar joints, panel construction, and ventilation, etc.

### Frame-3 : 400 - 4000A H/V/N08 & 5000-6300A H/V

Frame Size	Rating (A)	Copper cross section as per IEC (in sq. mm)	Popular Copper Termination					
			Horizontal (with Terminal adaptor)			Vertical (with Terminal adaptor)		
			6 mm	10 mm	12 mm	6 mm	10 mm	12 mm
3	4000	4000*	-	100-4 runs	-	-	100-4 runs	-
	5000	6000*	Vertical termination recommended			-	100-6 runs	-
	6300	8000*	Vertical termination recommended			-	200-4 runs	-

\*Not as per standard but generally followed

**Note:** Above table is based on extensive study of popular bus-bar sizes used to terminate Air Circuit Breakers. However other bus-bar sizes (in terms of thickness & width) can also be used to achieve bus-bar cross section recommended by IS & IEC. De-rating of switchgear depends upon various factors such as cross section area, orientation and material of bus bar, healthiness of bus-bar joints, panel construction, and ventilation, etc.

# Retrofit Solution



Air Circuit Breaker (ACB)  
experiences maximum stress  
in an Electrical Switchboard



Replacing the ACB helps to  
extend the life of Electrical  
Switchboard



Retrofit your existing make  
ACBs with New Generation  
OMEGA ACBS

# Retrofit Solution

## CNCS ACB TO OMEGA ACB RETROFIT SOLUTION

Pre-Engineered Solution with ETP Grade Copper links with Silver Plating

This pre-engineered solution allows upgrade from OLD CNCS ACB TO OMEGA ACB

### Advantage of this Retrofit Solution

- › No Busbar Modification
- › Minimum Shutdown Time
- › Minimised Retrofitting Cost
- › Maximum Safety
- › Extended Panel Life
- › Enhanced Reliability

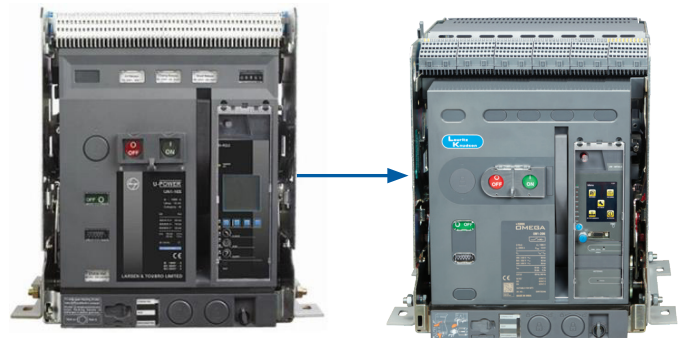


## U-POWER ACB TO OMEGA ACB RETROFIT SOLUTION

This pre-engineered solution allows upgrade from U-Power ACB TO OMEGA ACB

### Advantage of this Retrofit Solution

- › No Busbar Modification
- › Minimum Shutdown Time
- › Minimised Retrofitting Cost
- › Maximum Safety
- › Extended Panel Life
- › Enhanced Reliability



## RETROFIT ADVANCED TECHNOLOGY

**Pre-Engineered Retrofit Solution: YOUR OLD ACB TO OMEGA ACB**

**Minimal modification, Maximum benefits**

- › Ready-made solution
- › No busbar modification
- › Minimised Retrofitting Cost
- › Extended Panel Life
- › Enhanced Reliability



# Summary of U-POWER to OMEGA Retrofit Solution

Rating	Retrofit Solution
Frame 1 : 400 2000A	✓
Frame 2 : 400 2500A	✓
Frame 2 : 3200A	✓
Frame 3 : 400 4000A (For U POWER ACBs with equalizers at site)	✓
Frame 3 : 5000A (For U POWER ACBs with equalizers at site)	✓
Frame 3 : 400 4000A (For U POWER ACBs without equalizers at site)	✓
Frame 3 : 5000A (For U POWER ACBs without equalizers at site)	✓

Solutions	Availability
CNCS to OMEGA	✓
Your old ACB to OMEGA	✓
HE Breaker	✓
Release Upgradation	✓

# OMEGA Matrix Release Retrofitting

MTX releases provide ease of upgradation as per the change in customer needs.

Lower variants of releases can be easily upgraded to their higher versions with added features with minimum changes.

MTX 1G, MTX 1Gi, MTX 1.5G, MTX 1.5Gi can be replaced by MTX 3.5 Series & MTX 4.5 Series with the following changes:

- › Addition of PS module (auxiliary supply- 24V DC)
- › Addition of wire harness for auxiliary supply injection

This upgradation offers advantages like:

- › Modbus and Profibus communication to monitor and update various parameters and breaker statuses.
- › Voltage metering
- › Provision to add various modules depending on requirements like Relay, Digital I/O, Temperature, ZSI and REF.
- › Harmonic metering
- › Wide touch screen display in MTX 4.5 Series

Type of Releases	MTX 1G	MTX 1.5G	MTX 1.5Gi	MTX 3.5	MTX 3.5 EC	MTX 4.5
MTX 1G		Only Release Retrofitting	Release Retrofitting & PS Module & Cradle SIC Block 1No.	Release Retrofitting & PS Module & Cradle SIC Block 2Nos.	Release Retrofitting & PS Module & Cradle SIC Block 2Nos.	Release Retrofitting & PS Module & Cradle SIC Block 2Nos.
MTX 1.5G			Release Retrofitting & PS Module & Cradle SIC Block 1No.	Release Retrofitting & PS Module & Cradle SIC Block 2Nos.	Release Retrofitting & PS Module & Cradle SIC Block 2Nos.	Release Retrofitting & PS Module & Cradle SIC Block 2Nos.
MTX 1.5Gi				Release Retrofitting & Cradle SIC Block 1No.*	Release Retrofitting & Cradle SIC Block 1No.*	Release Retrofitting & Cradle SIC Block 1No.*
MTX 3.5					Release Retrofitting *	Release Retrofitting *
MTX 3.5 EC						Release Retrofitting *
MTX 4.5						

\* Considering PS Module is already available with the earlier configuration.

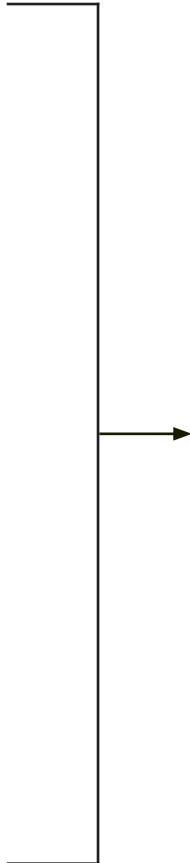
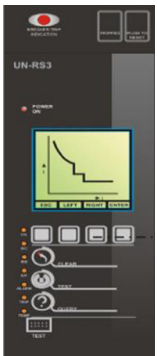
\* For Modbus TCP/IP (ETHERNET) type Releases MTX 3.5T/3.5ET/4.5T trip units are recommended, which are factory-fitted offerings.

# U-POWER to OMEGA Retrofit Solutions



- › Frame 1, 400A - 2000A
- › Frame 2, 2500A - 3200A
- › Frame 3, 400A - 5000A
- › 100% Engineered Solution
- › 0 % Bus bar Modification
- › No additional joint /link
- › 50% Less Downtime
- › Standardization & Professional Solution

# Release Upgradation Solutions

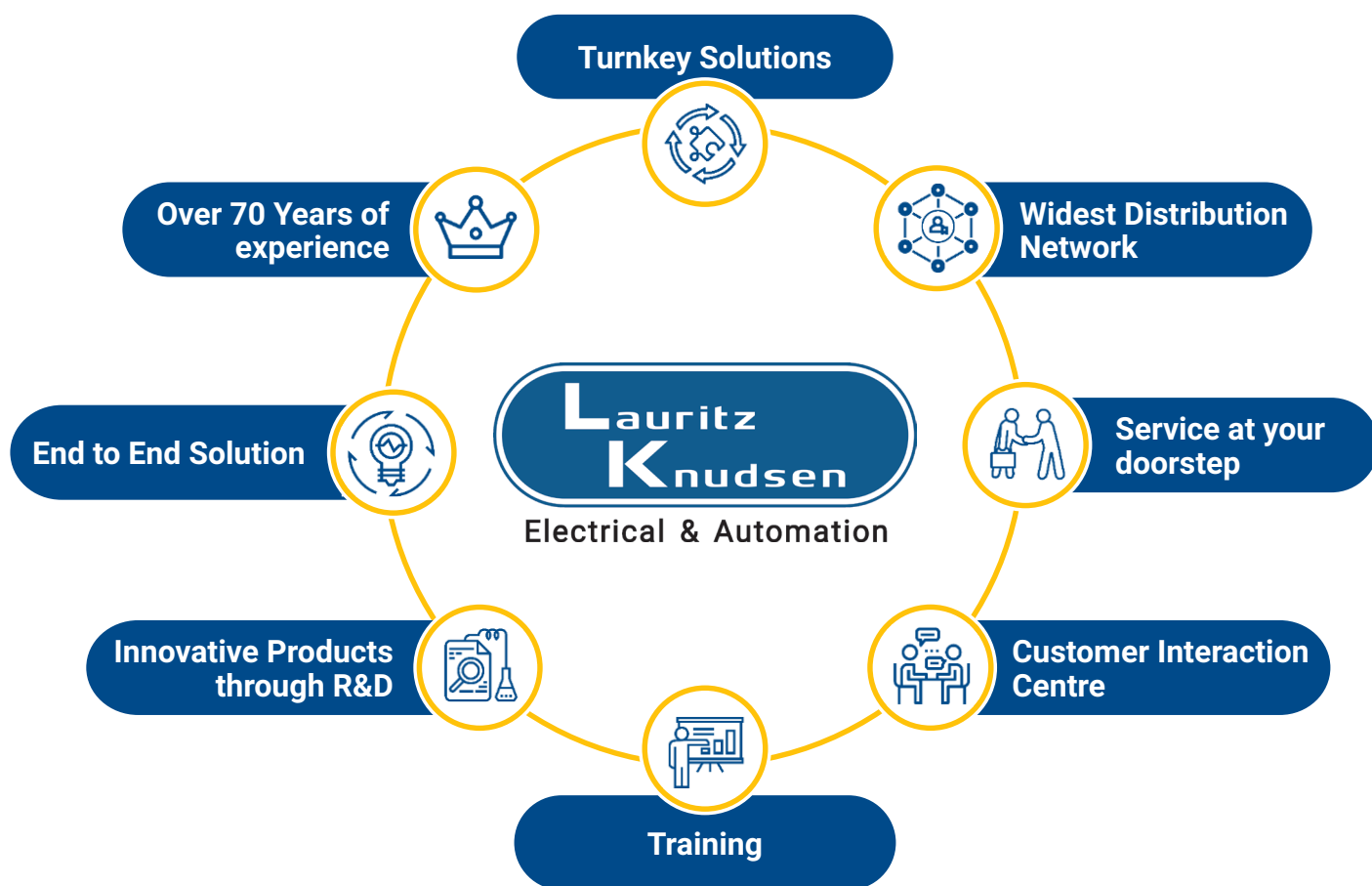


## ACB Release upgradation through modules

- › Temperature Protection (85 to 115 degree C)
- › REF (Used for detecting Earth Fault between Transformer/ DG and Incomer Breaker).
- › Earth Leakage (300mA to 30A Protect against Fire)
- › Relay Module for Load Control (2NO & 2CO, Indication Current Level, Time & Fault)
- › MD Control
- › ZSI
- › TCS
- › Analog Module
- › Communication (Modbus, Profibus, Zigbee etc)
- › Directional SC, EF with 0.1In, Double Protection Time based & Selection based Safety through AMS & Load Shedding etc in High End Versions of Release

# Lauritz Knudsen's Advantages

We Listen. We Partner. We Innovate



# ORDERING CODES

Description	CAT No
<b>Shunt Release (SR)</b>	
24-30V DC	CL908160400
48/60V DC	CL908160500
110V AC & DC	CL908160A00
125/127V DC	CL908160100
240V AC / 220 - 250V DC	CL908160B00
415V AC	CL908160D00
<b>Closing Release (CR)</b>	
24-30V DC	CL908174000
48/60V DC	CL908175000
110V AC & DC	CL90817A000
125/127V DC	CL908171000
240V AC / 220 - 250V DC	CL90817B000
415V AC	CL90817D000
<b>Electrical Charging Device (ECD)</b>	
24-30V DC	CL903620000
48/60V DC	CL903630000
110V AC / 110-125V DC	CL903600000
220V AC / 200V DC	CL903640000
240V AC / 250V DC	CL903590000
415V AC / 400V DC	CL903610000
<b>Under Voltage Release (UVR) with time delay (0-1-3-5 sec)</b>	
24-30V DC	CL908184000
110V AC/DC	CL90818A000
240V AC/ 220V DC	CL90818B000
415V AC	CL90818D000
<b>Mechanical Interlock using Key &amp; Lock</b>	
R - Lock Type - 1	CL006590000
R - Lock Type - 2	CL006600000
R - Lock Type - 3	CL006610000
R - Lock Type - 12	CL006620000
R - Lock Type - 23	CL006630000
Locking arrangement for OFF button with R - Lock (on Breaker)	CL908150000
Locking arrangement for ISO position with R - Lock (on Cradle)	CL908650000
Locking arrangement for ANY position with R - Lock (on Cradle)	CL909270000
C - Lock Type - S	CL006640000
C - Lock Type - T	CL006650000
C - Lock Type - ST	CL006660000
C - Lock Type - SS	CL006670000
C - Lock Type - TT	CL006680000
Locking arrangement for OFF button with C - Lock (on Breaker)	CL908140000
Locking arrangement for OFF button with C - Lock (on Cradle)	CL909820000
Locking arrangement for ANY button with C - Lock (on Cradle)	CL909810000



Description	CAT No
<b>Mechanical Interlock using Bowden Cable (2 meters length)</b>	
Between 2 Incomers	CL908100000
Between 3 Incomers	CL908110000
Between 2 Incomers & 1 Standby	CL908120000
Between 2 Incomers & 1 Buscoupler	CL908130000

**Note:** Common from 400A to 6300A and can be interlocked between Fixed / Draw-out / Mixed version

<b>Mechanical Interlock using Bowden Cable (3 meters length)</b>	
Between 2 Incomers	CL906590000
Between 3 Incomers	CL906600000
Between 2 Incomers & 1 Standby	CL906610000
Between 2 Incomers & 1 Buscoupler	CL906620000
<b>Mechanical Interlock using Bowden Cable (5 meters length)</b>	
Between 2 Incomers	CL906630000
Between 3 Incomers	CL906640000
Between 2 Incomers & 1 Standby	CL906650000
Between 2 Incomers & 1 Buscoupler	CL906660000
Operation Counter	CL909830000
Door Interlock	CL909780000
Electrical Position Indication (EPI)	CL958260000
Microswitch for Common Fault Indication (CFI)	CL909490000
Microswitch for Ready To Close Indication (RTC)*	CL909530000
Microswitch for Shunt Release	CL909510000
Microswitch for Undervoltage Release	CL909470000
Microswitch for Spring Charging Indication	ST426720000
Safety Cover for IP54	CL908400000
Panel Maintenance Cover (Fixed & Drawout ACB)	CL900490000
<b>External Neutral CT for UW - MTX Releases</b>	
Frame-1, 2 & 3 400-800A	CL007170000
Frame-1 1000A	CL001330000
Frame-1, 2 & 3 1250-1600A	CL007180000
Frame-1 2000A	CL001340000
Frame-1 - 2500A	CL007190000
Frame-2 & 3 2000-4000A	CL007200000
Frame-3 5000-6300A	CL007210000
<b>Additional Auxillary Contacts for Drawout Breakers</b>	
Additional 6NO+6NC Aux Contacts	CL905580000
Additional 2NO+2NC Aux Contacts	CL905590000
<b>Phase Barriers for OMEGA\$</b>	
Fixed ACB Phase Barrier: HORIZONTAL (2 Nos.)	CL912560000
Fixed ACB Phase Barrier: HORIZONTAL (3 Nos.)	CL912570000
Fixed ACB Phase Barrier: VERTICAL (2 Nos.)	CL912580000
Fixed ACB Phase Barrier: VERTICAL (3 Nos.)	CL912590000
Drawout ACB Phase Barrier: Horizontal/VERTICAL	CL907690000
Drawout ACB Phase Barrier: Horizontal/VERTICAL	CL907700000
<b>Matrix Release &amp; Modules</b>	
UW-MTX 1.0	CL919660000
UW-MTX 1G	CL919710000
UW-MTX 1.5G	CL919650000
UW-MTX 1Gi	CL905620000
UW-MTX 1Gi	CL905620000
UW-MTX 1.5Gi	CL905520000

**Note:** \*Cradle SIC block CL958250000 needs to be ordered separately, If EPI not installed in same ACB.

Description	CAT No
UW-MTX 3.5	CL906450000
UW-MTX 3.5EC	CL906440000
UW-MTX 3.5H	CL904640000
UW-MTX 4.5	CL906470000
UW-MTX 3.5T	*
UW-MTX 3.5ET	*
UW-MTX 4.5T	*
Power supply module	CL907220000
Relay Module	CL907160000
MODBUS Module**	CL907090000
Profibus Module	CL902950000
Smart Configurator Module	CL907050000
Power Metering Module (415V)	CL906490000
Power Metering Module (690V)	CL906850000
ZSI (Zone Selective Interlocking) Module	CL907180000
TCS (Trip Circuit Supervision) Module	CL907190000
Digital I/O Module	CL907150000
REF Module (CTs need to be considered extra)	CL907210000
Analog Module	CL907170000
EL (Earth Leakage Module)	CL907200000
Matrix Release Simulation Kit	CL907240000
Terminal Adaptor for Fixed OMEGA ACBs	
Frame-1 400-2000A N/S (Vertical/Horizontal)	CL609670000
Frame-1 400-2000A H (Vertical / Horizontal)	CL609680000
Frame-1 2500A S/H (Vertical)	CL609760000
Frame-2 400-2500A N/S (Vertical/Horizontal)	CL601220000
Frame-2 400-3200A H, 3200A N/S (Vertical/Horizontal)	CL609770000
Frame-2 4000A S/H (Vertical)	CL604170000
Frame-3 400-4000A H/V (Vertical )#	CL604180000
Frame-3 5000A H/V (Vertical) #	CL603470000
Frame-3 400-5000A H/V (Horizontal) #	CL603730000
Frame-3 6300A H/V (Vertical)#	CL906690000
Terminal Adaptor for Drawout OMEGA ACBs	
Frame-1 400-1000A N/S/H (Vertical / Horizontal)	CL604380000
Frame-1 1250-2000A N/S/H (Vertical / Horizontal)	CL609630000
Frame-1 2500A S/H (Vertical)	CL609640000
Frame-2 400-3200A N/S/H (Vertical / Horizontal)	
Frame-2 4000A S/H (Vertical)	CL604200000
Frame-2 4000A S/H (Horizontal)	CL603160000
Frame-3 400-4000A (Vertical)#	CL601280000
Frame-3 400-4000A (Horizontal-Long)	CL600730000
Frame-3 5000A (Horizontal-Long)	CL609660000
Frame-3 5000A (Vertical)#	CL600670000
Frame-3 6300A (Vertical)#	CL609650000

**Note:** \*Available on request as a factory-fitted option along with ACB.

\*\*TCP/IP (ETHERNET) communicable release is a factory fitted option & available along with breaker only.

#Please consider 4 terminal adaptors per phase.

Description	CAT No
<b>Cradle Base Plates</b>	
Base Plate Assembly Frame-1:3P	CL910300000
Base Plate Assembly Frame-1:4P/Frame-2:3P	CL910310000
Base Plate Assembly Frame-2:4P	CL920280000
Base Plate Assembly Frame-3:3P	CL930270000
Base Plate Assembly Frame-3:4P	CL930280000
Base Plate Assembly Frame-3:4P (50% N)	CL930290000
<b>Breaker Terminal Adaptors without Ribs<sup>\$</sup></b>	
Breaker Terminal Adaptors Frame-1 400-2000A N, Frame-1 1600A S	CL616160000
Breaker Terminal Adaptors Frame-1 400-1250A S	CL700520000
Breaker Terminal Adaptors Frame-1 2500A S, Frame-1 400-2500A H	CL600440000
Breaker Terminal Adaptors Frame-3 400-5000A H/V	CL600440000
Breaker Terminal Adaptors Frame-2 400-3200A H, Frame-2 3200A S, Frame-3 6300A H/V (Bottom)	CL600450000
Breaker Terminal Adaptors Frame-3 6300A H/V (Top)	CL600460000
Breaker Terminal Adaptors Frame-1 2000A S (ACBs manufactured upto May 2015)	CL600440000
Breaker Terminal Adaptors Frame-2 2500A S (ACBs manufactured upto Sep 2015)	CL600450000
<b>Breaker Terminal Adaptors with Ribs<sup>\$</sup></b>	
Breaker Terminal Adaptors Frame-1 2500A S, 400-2500A H	CL606020000
Breaker Terminal Adaptors Frame-3 400-4000A H/V, 5000A H/V	CL606020000
Breaker Terminal Adaptors Frame-1 2000A S (ACBs manufactured from June 2015)	CL600380000
Breaker Terminal Adaptors Frame-2 400-2500A N	CL600830000
Breaker Terminal Adaptors Frame-2 3200A N/S, 400-3200A H	CL606030000
Breaker Terminal Adaptors Frame-2 4000A N/S/H - BOTTOM	CL606030000
Breaker Terminal Adaptors Frame-3 6300A H/V - BOTTOM	CL606030000
Breaker Terminal Adaptors Frame-2 4000A N/S/H - TOP	CL606050000
Breaker Terminal Adaptors Frame-3 6300A H/V - TOP	CL606050000
Breaker Terminal Adaptors Fr-2 2500A S (ACBs manufactured from Oct 2015 upto April 2016)	CL606030000
Breaker Terminal Adaptors Frame-2 2500A S (ACBs manufactured from May 2016)	CL600830000
<b>Cradle Terminals &amp; Supports (Left and Right from ACB Front)<sup>\$</sup></b>	
Terminal Support (LEFT & RIGHT) Frame-1 400A-2500A	CL907500000
Terminal Support (LEFT & RIGHT) Frame-3 400A-5000A	CL907500000
Terminal Support (LEFT & RIGHT) Frame-2 400A-3200A	CL907510000
Terminal Support (LEFT & RIGHT) Frame-2 4000A	CL913010000
Terminal Support (LEFT & RIGHT) Frame-3 6300A	CL904680000
Cradle Terminal Frame-1 400A-2500A	CL600310000
Cradle Terminal Frame-3 upto 5000A	CL600310000
Cradle Terminal Frame-2 upto 3200A	CL600320000
Cradle Terminal Frame-2 4000A (Bottom)	CL600320000
Cradle Terminal Frame-3 6300A (Bottom)	CL600320000
Cradle Terminal Frame-2 4000A (Top)	CL600330000
Cradle Terminal Frame-3 6300A (Top)	CL600330000

**Note:** \$ Depending on the configuration of breaker (3P/4P), the quantity of these products per breaker shall vary. Kindly refer Manual for the same.

Description	CAT Nos
<b>Breaker Housing (Front &amp; Rear)</b>	
Front Housing Frame-1:3P	CL914110000
Front Housing Frame-1:4P	CL914120000
Front Housing Frame-2:3P	CL924110000
Front Housing Frame-2:4P	CL924120000
Front Housing Frame-3:3P	CL930850000
Front Housing Frame-3:4P	CL930860000
Front Housing (LEFT) Frame-3:4P (50%N)	CL934120000
Front Housing (RIGHT) Frame-3:4P (50%N)	CL934130000
Rear Housing Frame-1:3P (400A-1600A)	CL914130000
Rear Housing Frame-1:4P (400A-1600A)	CL914140000
Rear Housing Frame-1:3P (2000A)	CL914150000
Rear Housing Frame-1:4P (2000A)	CL914160000
Rear Housing Frame-2:3P	CL924130000
Rear Housing Frame-2:4P	CL924140000
Rear Housing (RIGHT) Frame-3:3P	CL934250000
Rear Housing (LEFT) Frame-3:3P, 4P (50%N)	CL934260000
Rear Housing (RIGHT) Frame-3:4P, 4P (50%N)	CL934270000
Rear Housing (LEFT) Frame-3:4P	CL934280000
<b>Cradle Side Plate Assembly (Left &amp; Right from ACB Front)</b>	
Cradle Side Plate Assembly (Right)	CL900190000
Cradle Side Plate Assembly (Left)	CL900200000
<b>Rail Assembly (Left and Right from ACB Front)</b>	
Rail Assy.(RIGHT)	CL900230000
Rail Assy. (LEFT)	CL900240000
<b>OMEGA - Matrix Neutral Configuration</b>	
Matrix Neutral Configuration Adaptor (NRYB to RYBN on site)	CL016280000
Matrix Neutral Configuration Adaptor (NRYB to BYRN on site)	CL000830000
Matrix Neutral Configuration Adaptor (NRYB to NBYR on site)	CL000410000
<b>Old SIC Retrofit Kit for OMEGA</b>	
Cradle Block SIC Cross Piece Assembly Frame-1: 3P	CL910420000
Cradle Block SIC Cross Piece Assy Frame-1:4P/Frame-2:3P	CL910430000
Cradle Block SIC Cross Piece Assembly Frame-2:4P	CL920420000
Cradle Block SIC Cross Piece Assembly Frame-3:3P	CL930420000
Cradle Block SIC Cross Piece Assy Frame-3: 4P (50% N)	CL930430000
Cradle Block SIC Cross Piece Assembly Frame-3:4P	CL930440000
Breaker Retrofit Kit for Block type SICs	CL912080000
Breaker Front Facia; OMEGA	CL900570000
<b>Maintenance Kit</b>	
Maintenance Kit - OMEGA	CL007430000

Description	CAT Nos
<b>Main Contact Assembly<sup>\$</sup></b>	
Main contact assy. Frame-1 400A-1600A(N)	CL911810000
Main contact assy. Frame -1 400A-1600A(S)	CL911820000
Main contact assy. Frame-1 2000A(N)	CL901920000
Main contact assy. Frame-1 2000(S) (Upto June-2015)	CL911830000
Main contact assy. Frame-1 2000(S) (July-2015 Onwards)	CL902960000
Main contact assy. Frame-1 400A-2500A(H) & 2500A(S)	CL911830000
Main contact assy. Frame-2 400A-2500A(N)	CL903310000
Main contact assy. Frame-2 400A-2500A(S) (Upto July-2015)	CL921810000
Main contact assy. Frame-2 400A-2500A(S) (Aug-2015 to May-2016)	CL902970000
Main contact assy. Frame-2 400A-2500A(S) ( June-2016 Onwards)	CL903310000
Main contact assy. Frame-2 3200(N)	CL906420000
Main contact assy. Frame-2 3200(S)	CL921810000
Main contact assy. Frame-2 400A-3200A(H)	CL921820000
Main contact assy. Frame-2 4000A(N/S/H)	CL906430000
Main contact assy. Frame-3 400A-6300A(H)	CL931810000
Main contact assy. Frame-3 400A-6300A(V)	CL931820000
<b>Jaw Contact Assembly<sup>\$</sup></b>	
Frame-1 : 400A - 1600A (N)	CL911840000
Frame-1 : 2000A (N) & 400A - 1600A (S)	
Frame-1 : 2000A (S)	
Frame-1 : 2500A (S) & 400A - 2500A (H)	
Frame-2 : 400A - 2500A (N/S)	
Frame-2 : 3200A (N/S) & 400A - 3200A (H)	
Frame-2 : 4000A (N/S/H)	
Frame-3 : 400A - 5000A (H/V)	
Frame-3 : 6300A (H/V)	
Jaw Puller	CL904600000
<b>CT wire harness</b>	
CT wire-harness Frame-1:3P	CL006870000
CT wire-harness Frame-1: 4P	CL006880000
CT wire-harness Frame-2:3P	CL006890000
CT wire-harness Frame-2 : 4P	CL006900000
CT wire-harness Frame-3:3P	CL006910000
CT wire-harness Frame-3:4P	CL006920000
CT wire-harness Frame-3: 4P (50%N)	CL006930000
<b>SIC blocks</b>	
New SIC block	CL958250000
New SIC block for EPI	CL958260000

**Note:** \$ Depending on the configuration of breaker (3P/4P), the quantity of these products per breaker shall vary. Kindly refer Manual for the same.

Description	CAT Nos
<b>OMEGA - Matrix CTs (Internal)<sup>\$</sup></b>	
Frame-1-400/630/800A	CL007000000
Frame-1-1000A(For ACBs Ordered After January-2022)	CL000790000
Frame-1-1000/1250/1600A	CL007010000
Frame-1-2000A(For ACBs Ordered After January-2022)	CL000800000
Frame-1-2000/2500A	CL007020000
Frame-2-400/630/800A	CL007250000
Frame-2-1000/1250/1600A	CL007030000
Frame-2-2000/2500/3200/4000A	CL007040000
Frame-3-400/630/800A	CL007260000
Frame-3-1000/1250/1600A	CL007270000
Frame-3-2000/2500/3200/4000A	CL007050000
Frame-3-5000/6300	CL007060000
<b>OMEGA Frame 3 Equaliser<sup>\$</sup></b>	
OMEGA EQUALISER Frame-3 400A-5000A(For Fixed Breakers)	CL634100000
OMEGA EQUALISER Frame-3 400A-5000A (For Drawout Breakers)	CL634220000
OMEGA EQUALISER Frame-3 6300A Top (For Drawout Breakers)	CL634190000
OMEGA EQUALISER Frame-3 6300A Bottom (For Drawout Breakers)	CL634200000
<b>Safety Shutter &amp; Padlock<sup>\$</sup></b>	
Safety shutter Frame-1/2	CL900160000
Safety shutter Frame-3	CL900160000
Safety shutter padlock Frame-1	CL909970000
Safety shutter padlock Frame-2	CL900560000
Safety shutter padlock Frame-3	CL909970000

**Note:** \$ Depending on the configuration of breaker (3P/4P), the quantity of these products per breaker shall vary. Kindly refer Manual for the same.



<b>UW</b>	<b>1</b>	<b>08</b>	<b>N</b>	<b>X</b>	<b>D</b>	<b>1</b>	<b>2</b>	<b>9</b>	<b>0</b>	<b>0#</b>	<b>UW1 800N 3P ED 1.5G BotV</b>
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Frame Size	
Frame - I	1
Frame - II	2
Frame - III	3

Current Ratings	
400A	04
630A	06
<b>800A</b>	<b>08</b>
1000A	10
1250A	12
1600A	16
2000A	20
2500A <sup>(4)</sup>	25
3200A	32
4000A	40
5000A	50
6300A	63

Selection for Breaking Capacity (Icu=Ics) <sup>(1)</sup>	
50kA (Fr-I upto 2000A & Fr-II upto 4000A)	<b>N</b>
65kA (Fr-I & Fr-II)	S
80kA (Fr-I, Fr-II & Fr-III)	H
100kA (Fr-III)	V

Type	
Manually Operated	1
<b>Electrically Operated</b>	<b>2</b>

Version	
Draw-out	D
Fixed	F
Cradle/Fixed Part	C
Breaker/Moving Part	B

Selection for Termination (For Drawout ACBs Only)	
Standard Termination	0
For Top Horizontal (Long), Bottom Vertical for Fr2 & Fr3	X
For Top & Bottom Horizontal (Long) for Fr3	Y
Note: X is applicable for 4000A (Fr2 & Fr3) and 5000A (Fr3). Y is applicable for 4000A (Fr3) & 5000A (Fr3). X & Y recommended for Buscoupler only.	
For 800V AC Application	ZM
For 1000V AC Application	ZH

Temperature Rise Monitoring <sup>(3)</sup>	
<b>Not Required</b>	<b>0</b>
Required	1

Selection for P&C Units	
B/C (w/o protection)	0
UW - MTX1.0	7
UW - MTX1G	8
UW - MTX1Gi	B
UW - MTX1.5G	9
UW - MTX1.5Gi	C
UW-MTX3.5	3
UW-MTX3.5EC <sup>(5)</sup>	4
UW-MTX4.5	5
UW-MTX3.5H	6
UW-MTX3.5T	E
UW-MTX3.5ET	F
UW-MTX4.5T	G

Selection for control voltage <sup>(2)</sup>	
For Manually Operated	0
240V AC/DC ECD & CR + 240V AC/DC SR	1
240V AC/DC ECD & CR + 24V DC SR	2
110V AC/DC ECD & CR + 110V AC/DC SR	3
240V AC/DC ECD & CR + 110V AC/DC SR	4

Selection for No. of Poles	
3 Pole	X
4 Pole 100% N	F
4 Pole 50% N (in Fr-III only)	H
4 Pole 200% N (upto 2500A)	D

**Please Note:**

- (1) For Icu values please refer technical specification  
 (2) Other options of control voltage are available as accessory  
 (3) Temperature protection is available in UW-MTX3.5 Series & UW-MTX4.5 Series  
 (4) For Fr-1, 2500A selection, please contact the nearest branch office  
 (5) For system requiring 690V metering, kindly order separate Power Metering module with MTX3.5.

## OMEGA ACBs are offered with following standard features

Air Circuit Breakers

<b>Draw-out Version:</b>	<p>OMEGA ACBs with UW-MTX release will have inbuilt- Current Metering (MTX 1.5G/1.5Gi/3.5 Series/4.5 Series), Common Fault Indication microswitch, 4NO+4NC Aux. contacts, Smart-racking shutter, Safety shutter assembly, Racking Handle, Door sealing frame, Pad-locking arrangement for ON/OFF button, Rating Error Preventer, Arc shield.</p> <p>A) For ratings upto 1600A, one side vertical terminal adaptors (Bottom) for Frame 1, 2 &amp; 3.          B) For ratings 2000A &amp; above, both side vertical terminal adaptors (Top &amp; Bottom) for Frames 1, 2 &amp; 3.          C) For rating 4000A and above operation counter inbuilt for Frames 2 &amp; 3 both.</p>
<b>Fixed Version:</b>	<p>OMEGA ACBs with UW-MTX release will have inbuilt- Current Metering (MTX 1.5G/1.5Gi/3.5 Series/4.5 Series), Common Fault Indication microswitch, 4NO+4NC Aux. contacts, Door sealing frame &amp; Pad-locking arrangement for ON/OFF push button.</p> <p>A) For ratings upto 1600A, one side vertical terminal adaptors (Bottom) for Frames 1, 2 &amp; 3.          B) For ratings 2000A &amp; above, both side vertical terminal adaptors (Top &amp; Bottom) for Frames 1, 2 &amp; 3.          C) For ratings 4000A &amp; above, operation counter inbuilt for Frames 2 &amp; 3 both.</p>

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Product improvement is a continuous process. For the latest information and special application, please contact any of our offices listed here. Product photographs shown for representative purpose only.



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