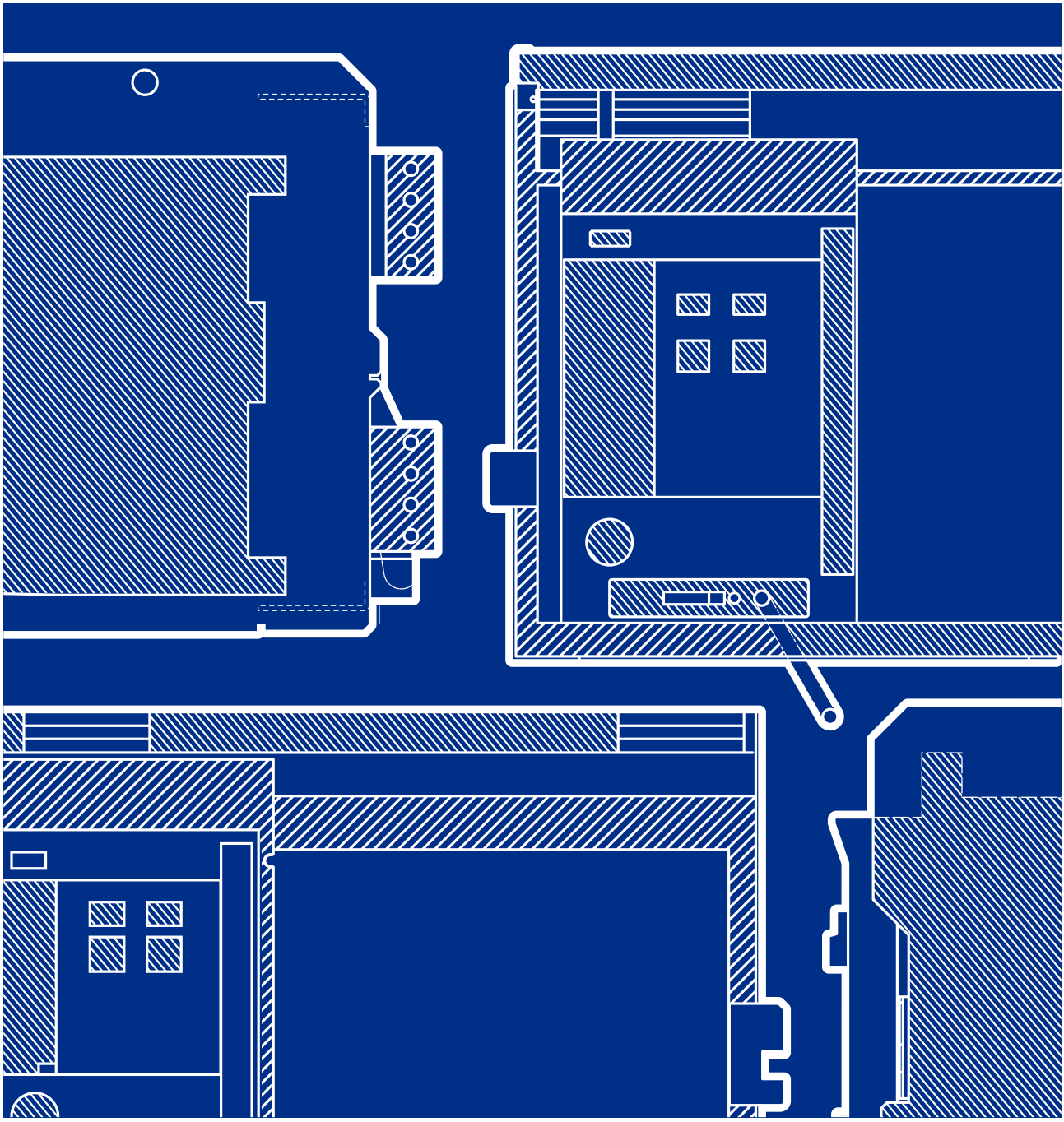
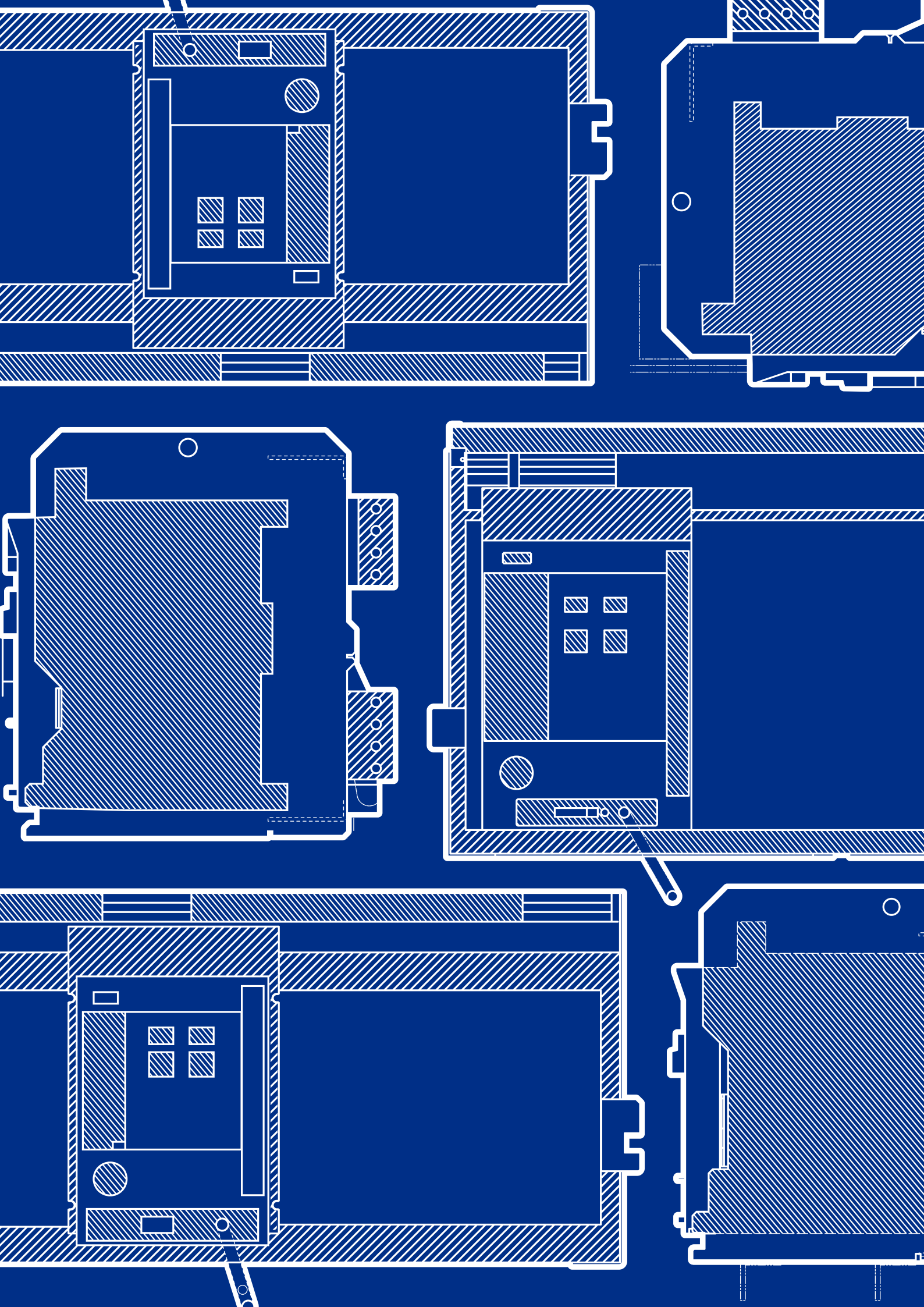
Power Distribution and Protection

Circuit Protection



ACBs

Technical Catalogue 2022



Air Circuit Breakers

Overview

TemPower 2 Air Circuit Breakers - Double Break

TemPower 2 is the world's first "Double Break" ACB, having two breaking contacts per phase. The unique pole structure means that the short time withstand rating (I_{cw} for 1 second) is equal to the service short circuit breaking capacity (I_{cs}) for all models. Full selectivity can be guaranteed up to the full system fault level. TemPower 2 ACBs have one of the world's smallest depth resulting in space saving in switchboards. More than twenty design patents have been registered for the TemPower 2 ACB.

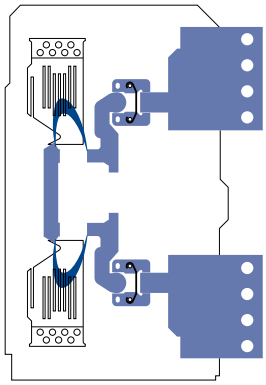
AR2-S	200 A - 2000 A
AR3-S	1600 A, 2500 A - 3200 A
AR4-S	4000 A
AR6-S	5000 A - 6300 A

The "Double Break" system ensures extremely fast interruption of short circuit currents. The maximum clearing time is 30 ms, which is less than half that of most other ACBs.

Sharing the arc energy greatly reduces main contact wear. All the arc energy is effectively dissipated within the "Double Break" arc chamber, thus achieving the required clearance distance to earthed metal of zero.

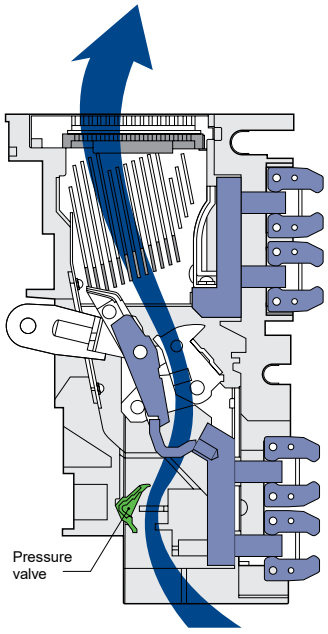
The main 3 pole contacts close simultaneously as they are driven by a common drive bar, which also drives the 4th pole in 4 pole ACBs.

Above – AR2



Above – AR2 – AR4 "Double Break" contact design

Above – AR6 6300 A



Right – AR6 "dual line side break" contact design

The 'TemPower 2 AR6 (5000 A and 6300 A) has a unique contact design that interrupts the current at two points on the line side of the ACB, while dissipating heat from essential components such as the main contacts and terminals by efficient air convection through a pressure value.

The neutral pole in TemPower 2 ACBs is fully rated as standard and is of an early make/late break design. This eliminates the risk of abnormal line to neutral voltages, which may damage sensitive electronic equipment.

"Double Break" contacts increase service life – electrical and mechanical endurance ratings are the best available, and exceed the requirements of IEC 60947-2.

The AR2-AR4 series has a maximum total clearance time of 30ms which is the time from initiation of fault to arc extinction. The maximum total clearance time for the AR6 (5000 A / 6300 A) series is 50 ms.

Application

Industry	Oil and gas, mining, food and beverage, utility
Building	Commercial, residential, government
Renewable Energy	Wind farms, battery banks
Infrastructure	Tunnel, railway, airport, shipping ports
Critical Building	Data centre, banking and insurance, healthcare building
OEMs	Genset manufacturer

Warnings

- Electrical work must be done by competent persons.
- Do not place the ACB in such an area that is subject to high temperatures, high humidity, dusty air, corrosive gases, strong vibration and shock, or other unusual conditions. Mounting the ACB in such an area could cause a fire or malfunction.
- Be careful to prevent foreign objects (such as debris, concrete powder, dust, chippings, and iron powder) and oil or rainwater from entering the ACB. These materials inside the ACB could cause a fire or malfunction.
- Prior to commencing any work on the ACB, open an upstream circuit breaker or the like to isolate all sources of power/voltage. Otherwise, electric shock may result.
- Fix the draw-out cradle of the ACB firmly on a flat, level surface using mounting screws. Otherwise, the draw-out operation may cause the breaker body or the draw-out cradle to fall, resulting in damage to the ACB or personal injury.
- Take care not to deform or bend protrusions in the bottom face of the draw-out cradle when fixing the draw-out cradle with mounting screws. Deformation of the protrusions may cause a malfunction.
- Connect conductors (including screws) to the main circuit terminals in the specified area. Otherwise, a short-circuit may result.
- When terminating conductors to the ACB, tighten terminal screws to the torque specified in this manual. Otherwise, a fire could result.
- For 4-pole ACBs, be sure to connect a 3-phase, 4-wire neutral conductor.

Rated from 200 A to 6300 A NHP can provide a withdrawable Terasaki Air Circuit Breaker (ACB) designed to meet the stringent demands of the industrial and marine market. The Terasaki ACB range is offered over two model series, the 'AR' series and the 'AR6' series.

The AR series is available in three frame sizes:

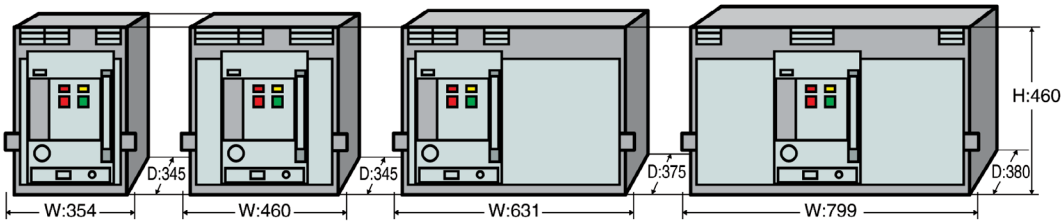
- Frame size 1 which ranges from 200 to 2000 A (AR2)
- Frame size 2 which ranges from 2500 to 3200 A (AR3)
- Frame size 3 which is rated at 4000 A (AR4)
- Fixed ACBs are also available from 200 to 3200 A

The AR6 series is available in two models with the one fixed frame size:

- AR650 which is rated at 5000 A (AR6)
- AR660 which is rated at 6300 A (AR6)

Maximum Power from Minimum Volume

3 pole withdrawable models shown



Size	Size AR2	Size AR3	Size AR4	Size AR6

Reduce Fire Risk for Critical Buildings with 3C Technology

Overheating is the commonest cause of failure in switchgear. A thermal management system is the best method of identifying potential future failures. Continuous overheating protection minimises the need for invasive maintenance and improves the integrity of critical assets.

TemPower 2 ACBs have a unique '3C' integrated monitoring system which continually checks the temperature condition of the ACB's main contacts, connections and conductive paths (3C).

"Datacentres have a constant, non-cyclic, high load which will tend to increase over time. Many overheating problems in electrical panels are caused by this type of load profile combined with a faulty connection. Terasaki's contact monitoring system is a good solution because it is based on actual temperature measurement, so it protects the connections as well as the circuit breakers".

Gary Burgon, *Technical Director, The Rosebery Group*

Data Centre Case Study: The Rosebery Group

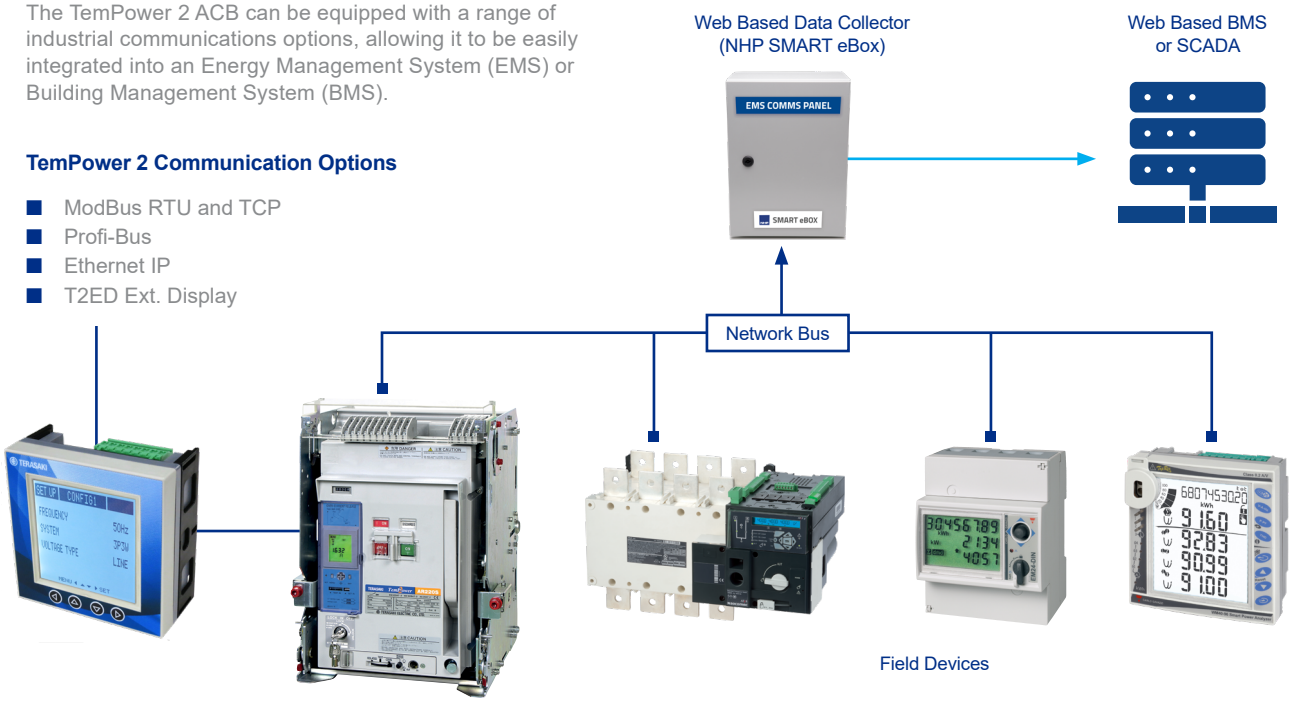
The Rosebery Group used Terasaki's 3C Overheating Protection for a 12MW datacentre (pictured right). TemPower 2 ACBs with overheating protection, integrated display and data communication.

Communications

The TemPower 2 ACB can be equipped with a range of industrial communications options, allowing it to be easily integrated into an Energy Management System (EMS) or Building Management System (BMS).

TemPower 2 Communication Options

- ModBus RTU and TCP
- Profi-Bus
- Ethernet IP
- T2ED Ext. Display



Power of Protection - System Protection Requirements

Hosting an impressive range of standard features and options, the Terasaki range of trip units are suitable for commercial, industrial and marine applications

The Terasaki Trip Unit is divided into 3 performance ranges; the TemPro AGR11, TemPro PLUS and TemPro PREMIER.

Overload Protection

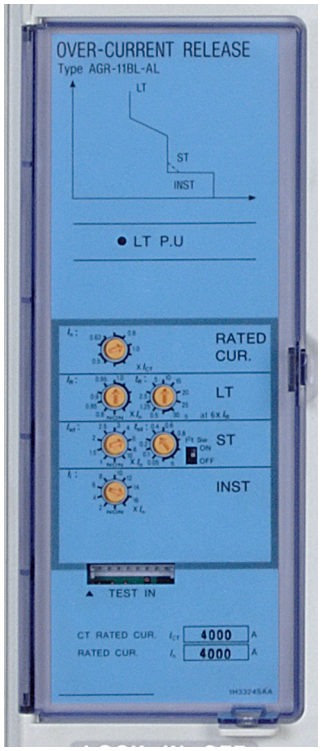
Adjustable from 40 - 100% of rated current. True r.m.s. detection up to the 19th harmonic. All trip units have “thermal memory” as standard and optional neutral pole protection for triplen harmonics, such as, 3rd, 9th and 15th.

Rapid Short Circuit Protection

Total fault clearance in less than 30ms for up to 4000A to suit most critical load protection. Conventional ACBs take twice this time to interrupt a fault, but due to its unique “DoubleBreak” system, the TemPower 2 ACB is the quickest on the market compared to ACBs with comparable withstand ratings.

Ground Fault Protection

Restricted and unrestricted ground protection options are available with the TemPro Premier trip unit (AGR31) and TemPro PLUS trip unit (AGR21). There is no need for a separate relay, thus saving cost. Furthermore, fewer CTs and busbar joints are required which reduces heat and power consumption.



AGR-11B

Basic Trip Unit with adjustment dials TemPro AGR11

AGR-21C

Standard Trip Unit with Ammeter display TemPro PLUS

AGR-31C

Advaned Trip Unit with LCD “Analyser” TemPro PREMIER

The TemPower 2 range trip units are available in three protection types:

- L-characteristic – for general feeder applications and will achieve most selectivity and protection requirements
- R-characteristic – provides curve characteristics to IEC 60255-3 to use when selectivity cannot be achieved with other system protective devices (ie. fuses or other relays)
- S-characteristic – specifically designed for generator applications

Setting / Opt	TemPro AGR11	Curve Type	TemPro PLUS (AGR21	Curve Type	TemPro PREMIER (AGR31)	Curve Type
Current-Ia	✔	L	✔	L, R, S	✔	L, R, S
Current-Ib	✔	L	✔	L, R, S	✔	L, R, S
Current-Ic	✔	L	✔	L, R, S	✔	L, R, S
Current-IN	✔	L	✔	L, R, S	✔	L, R, S
Current-Ig	✘	–	✔	L, R	✔	L, R, S
Line voltage-Vab	✘	–	✘	–	✔	L, R, S
Line voltage-Vbc	✘	–	✘	–	✔	L, R, S
Line voltage-Vca	✘	–	✘	–	✔	L, R, S
Power factor-Pf	✘	–	✘	–	✔	L, R, S
Frequency (Hz)	✘	–	✘	–	✔	L, R, S
Active power (kW)	✘	–	✘	–	✔	L, R, S
Total real energy (kWh)	✘	–	✘	–	✔	L, R, S
Maximum current	✘	–	✘	–	✔	L, R, S
Maximum active power (kW)	✘	–	✘	–	✔	L, R, S
Maximum voltage	✘	–	✘	–	✔	L, R, S
Reactive power	✘	–	✘	–	✔	L, R, S
Apparent power	✘	–	✘	–	✔	L, R, S
Harmonic current 3rd to 19th	✘	–	✘	–	✔	L, R, S
Trip history (10 events)	✘	–	✔	L, R, S	✔	L, R, S

Special Protection Options

Reverse Power Protection	Provides protection when paralleling generators
Load Shedding Relay	Provides protection when paralleling generators
Neutral Phase Protection	The N-phase protection function prevents the neutral conductor from sustaining damage or burnout due to large currents [1]
Under and Over Voltage Alarm	With adjustable voltage pick up and an adjustable time delay. This provides fine tuning of all the voltage requirements [1] [2]
Zone Interlocking	Short time delay zone interlocking guarantees selectivity and minimises thermal and mechanical stress during a fault
Overheat Protection	Continuous monitoring of the contact temperature provides input for preventative and predictive maintenance programs [1]
Phase Rotation Protection	Protects from negative-phase current occurring due to reverse phase or phase loss and prevents motor burnout or equipment damage [1]

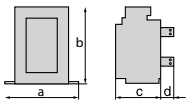
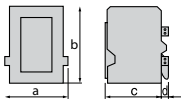
For Trip Unit types with specific features and options refer the following pages

Notes
1) Available on some Trip Unit models.
2) 3 Phase UVT available only with external module.

Short Circuit kA Rating at 440 V AC by Frame Size

	Rating (A)								
kA	**800**	**1250**	**1600**	**2000**	**2500**	**3200**	**4000**	**5000**	**6300**
65	AR208S	AR212S	AR216S	AR220S					
80			AR216H	AR220H					
85					AR325S	AR332S			
100					AR325H	AR332H	AR440S AR440SB		
120								AR650S	AR663S
135								AR650H	AR663H

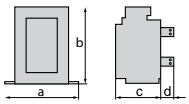
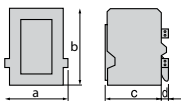
Performance Specification of the Standard (S) Type AR

Frame Size	Symbol	Unit	Condition	AR2 -S 800	AR2 -S 1250
Number of Poles	–	–	–	3 , 4	3 , 4
Available CT Ratings	*Ict*	(A)		200	200
				400	400
				800	800
					1000
					1250
Electrical Characteristics					
Rated Maximum Operational Voltage	*Ue*	(V)	AC 50 / 60Hz	690	690
Rated Insulation Voltage	*Ui*	(V)	–	1000	1000
Rated Impulse Withstand Voltage	*Uimp*	(kV)	–	12	12
Ultimate Breaking Capacity	*Icu*	(kA)	690V AC	50	50
(IEC, AS/NZS)			440V AC	65	65
			400 / 415V AC	65	65
DC Voltage (IEC, AS/NZS)			250V DC	40	40
Service Breaking Capacity	*Ics*	(kA)	690V AC	50	50
(IEC, AS/NZS)			440V AC	65	65
			400 / 415 V AC	65	65
DC Voltage (IEC, AS/NZS)			250V DC	40	40
Short-Time Withstand Current	*Icw*		1 sec.	65	65
			3 sec.	50	50
Latching Current		(kA)		65	65
Motor Charging Time		*sec.*		10	10
Closing Time (max.)		*sec.*		0.08	0.08
Total Breaking Time (max.)		*sec.*		0.03	0.03
Installation (Standard / Optional / -)					
Fixed (Optional)				□	□
Withdrawable (Standard)				■	■
Dimensions (Fixed) 	*a (3P / 4P)*	(mm)		360 / 445	360 / 445
	b			460	460
	c			290	290
	d			75	75
Dimensions (Withdrawable) 	*a (3P / 4P)*	(mm)		354 / 439	354 / 439
	b			460	460
	c			354	354
	d			40	40
Weight (Fixed)		(kg)	3 pole	53	53
			4 pole	59	59
Weight (Withdrawable)		(kg)	3 pole	73	73
			4 pole	86	86
Endurance	Electrical	Cycles	460V AC	12000	12000
			690V AC	10000	10000
	Mechanical (with maintenance)	Cycles		30000	30000
	Mechanical (without maintenance)	Cycles		15000	15000

Key ■ = Standard □ = Optional – = Not available

	AR2 -S 1600	AR2 -S 2000	AR3 - S 2500	AR3 - S 3200	AR4 - S 4000	AR6 - S 5000	AR6 - S 6300
	3 , 4	3 , 4	3 , 4	3 , 4	3 , 4	3 , 4	3 , 4
	200	200	200	200	4000	5000	6300
	400	400	400	400			
	800	800	800	800			
	1000	1000	1250	1250			
	1250	1250	1600	1600			
	1600	1600	2000	2000			
		2000	2500	3200			
	690	690	690	690	690	690	690
	1000	1000	1000	1000	1000	1000	1000
	12	12	12	12	12	12	12
	50	50	65	65	75	85	85
	65	65	85	85	100	120	120
	65	65	85	85	100	120	120
	40	40	40	40	40	40	40
	50	50	65	65	75	85	85
	65	65	85	85	100	120	120
	65	65	85	85	100	120	120
	40	40	40	40	40	40	40
	65	65	85	85	100	120	120
	50	50	65	65	85	85	85
	65	65	85	85	100	120	120
	10	10	10	10	10	10	10
	0.08	0.08	0.08	0.08	0.08	0.08	0.08
	0.03	0.03	0.03	0.03	0.03	0.05	0.05
	□	□	□	□	–	–	–
	■	■	■	■	■	■	■
	360 / 445	360 / 445	466 / 586	467 / 586	–	–	–
	460	460	460	460	–	–	–
	290	290	290	290	–	–	–
	75	75	75	75	–	–	–
	354 / 439	354 / 439	460 / 580	461 / 580	631 / 801	799 / 1034	800 / 1034
	460	460	460	460	460	460	460
	354	354	354	354	375	380	380
	40	40	40	40	53	60	60
	54	54	80	80	–	–	–
	60	60	92	92	–	–	–
	79	79	105	105	139	200	220
	94	94	125	125	176	260	285
	12000	10000	7000	7000	3000	1000	1000
	10000	7000	5000	5000	2500	500	500
	30000	25000	20000	20000	15000	10000	10000
	15000	12000	10000	10000	8000	5000	5000

Performance Specification of the 'H' Type AR

Frame Size	Symbol	Unit	Condition	AR2 - H 1250
Number of Poles	–	–	–	3 , 4
Available CT Ratings	*Ict*	(A)		200
				400
				800
				1000
				1250
Electrical Characteristics				
Rated Maximum Operational Voltage	*Ue*	(V)	AC 50 / 60Hz	690
Rated Insulation Voltage	*Ui*	(V)	–	1000
Rated Impulse Withstand Voltage	*Uimp*	(kV)	–	12
Ultimate Breaking Capacity (IEC, AS/NZS)	*Icu*	(kA)	690V AC	55
			440V AC	80
			400 / 415V AC	80
DC Voltage (IEC, AS/NZS)			250V DC	40
Service Breaking Capacity (IEC, AS/NZS)	*Ics*	(kA)	690V AC	55
			440V AC	80
			400 / 415V AC	80
DC Voltage (IEC, AS/NZS)			250V DC	40
Short-Time Withstand Current	*Icw*		1 sec.	80
			3 sec.	55
Latching Current		(kA)		80
Motor Charging Time		*sec.*		10
Closing Time (max.)		*sec.*		0.08
Total Breaking Time (max.)		*sec.*		0.03
Installation (Standard / Optional / -)				
Fixed (Optional)				□
Withdrawable (Standard)				■
Dimensions (Fixed) 	*a (3P / 4P)*	(mm)		360 / 445
	b			460
	c			290
	d			75
Dimensions (Withdrawable) 	*a (3P / 4P)*	(mm)		354 / 439
	b			460
	c			354
	d			40
Weight (Fixed)		(kg)	3 pole	53
			4 pole	59
Weight (Withdrawable)		(kg)	3 pole	73
			4 pole	86
Endurance	Electrical	Cycles	460V AC	12000
			690V AC	10000
	Mechanical (with maintenance)	Cycles		30000
	Mechanical (without maintenance)	Cycles		15000

Key ■ = Standard □ = Optional – = Not available

	AR2 -H 1600	AR2 -H 2000	AR3 - H 2500	AR3 - H 3200	AR6 - H 5000	AR6 - H 6300
	3 , 4	3 , 4	3 , 4	3 , 4	3 , 4	3 , 4
	200	200	200	200	5000	6300
	400	400	400	400		
	800	800	800	800		
	1000	1000	1250	1250		
	1250	1250	1600	1600		
	1600	1600	2000	2000		
		2000	2500	3200		
	690	690	690	690	690	690
	1000	1000	1000	1000	1000	1000
	12	12	12	12	12	12
	55	55	85	85	85	85
	80	80	100	100	135	135
	80	80	100	100	135	135
	40	40	40	40	40	40
	55	55	85	85	85	85
	80	80	100	100	135	135
	80	80	100	100	135	135
	40	40	40	40	40	40
	80	80	100	100	135	135
	55	55	75	75	85	85
	80	80	100	100	135	135
	10	10	10	10	10	10
	0.08	0.08	0.08	0.08	0.08	0.08
	0.03	0.03	0.03	0.03	0.03	0.03
	–	–	–	–	–	–
	■	■	■	■	■	■
	360 / 445	360 / 445	360 / 445	466 / 586	467 / 586	–
	460	460	460	460	460	–
	290	290	290	290	290	–
	75	75	75	75	75	–
	354 / 439	354 / 439	460 / 580	461 / 580	799 / 1034	800 / 1034
	460	460	460	460	460	460
	354	354	354	354	380	380
	40	40	40	40	60	60
	54	54	80	80	–	–
	60	60	92	92	–	–
	79	79	105	105	200	220
	94	94	125	125	260	285
	12000	10000	7000	7000	1000	1000
	10000	7000	5000	5000	500	500
	30000	25000	20000	20000	10000	10000
	15000	12000	10000	10000	5000	5000

Standard ACBs

Stock ACB Types for AR2: 800A - 2000A

Stocked ACBs are kept on the shelf in a standard pre-built configuration providing fast customer delivery. ACB bodies (withdrawable part) and carriages (fixed part) are ordered separately according to the required carriage terminal configuration. Standard stocked types include: non-motorised versions, motorised versions, non-auto versions, motorised non-auto versions.

Stocked ACB specification

- Approvals and test: AS/NZS 60947, IEC 60947, A.S.T.A. certified
- AR-S type ACB body, 3 pole
- TemPro PLUS overcurrent release (type AGR21CL-PG) (240 VAC control voltage)
- Adjustable 'LSI' + GF protection standard (GF comes set enabled as default) [2)]
- Single trip indicator contact for 'LSI + GF' standard
- MODBUS communications facility (data monitoring as standard)
- Ground fault ready (external 4th CT required, see below) [1)]
- 240V AC continuous rated shunt trip
- 7 C/O auxiliary switch
- IP 41 door flange
- ON / OFF push button covers are padlockable as standard
- Position padlock facility (locks ACB inside carriage in 'connected' or 'test' position)
- Additional feature options include either a spring charging 240V AC motor, Non-Auto disconnector or Non-Auto disconnector version, with 240V AC spring charge motor fitted [3)]

Ordering Catalogue Numbers

Description	Current Rating (A)	400 / 415V Interrupting Capacity (kA)	ACB Body AGR21 Trip Unit	ACB Body AGR21 Trip Unit With 240V AC Spring Charge Motor	ACB Body Non-Auto (No Trip Unit)	ACB Body Non-Auto (No Trip Unit) With 240V AC Spring Charge Motor
AR-S ACB body with AGR21 Trip Unit [1)]	1250	65	ARB2123 STD	ARB2123 MSTD	ARB2123 NASTD	ARB2123 NAMSTD
	1600	65	ARB2163 STD	ARB2163 MSTD	ARB2163 NASTD	ARB2163 NAMSTD
Or Non Auto types without a trip unit [3)]	2000	65	ARB2203 STD	ARB2203 MSTD	ARB2203 NASTD	ARB2203 NAMSTD

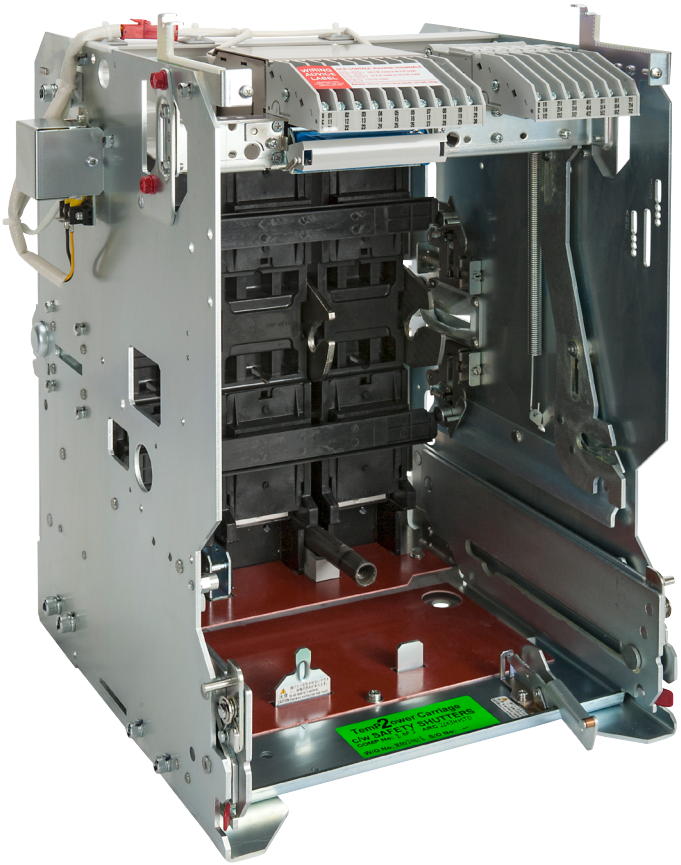
Notes

- The above specification is fixed. If other accessories are required (e.g. UVT, Trip Unit, different shunt voltage) contact NHP to place a custom order.
- LSI+GF" is defined as being: long time delayed trip, short time delayed trip, instantaneous trip, ground fault trip

1) This function provides ground fault protection to TN-C or TN-S power distribution systems on the load side.
2) The GF protection setting is set to "enabled" as default. If GF is not required, GF must be disabled by the user, via the Trip Unit screen setting menu before ACB energisation.
3) Non Auto stocked ACB versions do not include an AGR21 Over Current Release, GF, trip indicator, or communications. Other standard specification details and inclusions remain unchanged.

Stock ACB Carriages for AR2 types: 800A - 2000A

3 pole carriage for standard stock ACB body types: STD, MSTD, NASTD and NAMSTD. STD and MSTD types are configured for AGR21 Trip Units.



Description	Suits ACB Body Catalogue No.	Current rating	Terminal Arrangement		ACB Carriage Catalogue No.[4]
			Top	Bottom	
AR-S ACB Carriage	ARB2123STD	1250A	Horizontal	Horizontal	ARC2123HHSTD
			Vertical	Vertical	ARC2123VVSTD
			Horizontal	Vertical	ARC2123HVSTD
			Vertical	Horizontal	ARC2123VHSTD
	ARB2163STD ARB2203STD	1600A 2000A	Horizontal	Horizontal	ARC2203HHSTD
			Vertical	Vertical	ARC2203VVSTD
			Horizontal	Vertical	ARC2203HVSTD
			Vertical	Horizontal	ARC2203VHSTD

Notes

4) Stock carriages are suitable for use with the "stock body" shown above. If a different ACB specification is required, contact NHP sales for a custom manufactured order. ACBs and CARRIAGES for AGR31 ACB Trip Units have different wiring and terminal configurations compared to AGR21 types and are not interchangeable.

Stock ACB types for AR3: 2500A - 3200A

Stocked ACBs are kept on the shelf in a standard pre-built configuration providing fast customer delivery. ACB bodies (withdrawable part) and carriages (fixed part) are ordered separately according to the required carriage terminal configuration. Standard stocked types include: non-motorised versions, motorised versions, non-auto versions, motorised non-auto versions.

Stocked ACB specification

- Approvals and test: AS/NZS 60947, IEC 60947, A.S.T.A. certified
- AR-S type ACB body, 3 pole
- TemPro PLUS overcurrent release (type AGR21CL-PG) (240 VAC control voltage)
- Adjustable 'LSI' + GF protection standard (GF comes set enabled as default) [2)]
- Single trip indicator contact for 'LSI+GF' standard
- MODBUS communications facility (data monitoring as standard)
- Ground fault ready (external 4th CT required, see below)[1)]
- 240V AC continuous rated shunt trip
- 7 C/O auxiliary switch
- IP 41 door flange
- ON/OFF push button covers are padlockable as standard
- Position padlock facility (locks ACB inside carriage in 'connected' or 'test' position)
- Additional feature options include either a spring charging 240V AC motor, Non-Auto disconnector or Non-Auto disconnector version, with 240V AC spring charge motor fitted [3)]

Ordering Catalogue Numbers

Description	Current Rating (A)	400 / 415V Interrupting Capacity (kA)	ACB Body AGR21 Trip Unit	ACB Body AGR21 Trip Unit With 240V AC Spring Charge Motor	ACB Body Non-Auto (No Trip Unit)	ACB Body Non-Auto (No Trip Unit) With 240V AC Spring Charge Motor
AR-S ACB body with AGR21 Trip Unit [1)]	2500	85	ARB3253 STD	ARB3253 MSTD	ARB3253 NASTD	ARB3253 NAMSTD
Or Non Auto types without a trip unit [3)]	3200	85	ARB3323 STD	ARB3323 MSTD	ARB3323 NASTD	ARB3323 NAMSTD

Notes

- The above specification is fixed. If other accessories are required (e.g. UVT, Trip Unit, different shunt voltage) contact NHP to place a custom order.
- LSI+GF" is defined as being: long time delayed trip, short time delayed trip, instantaneous trip, ground fault trip

1) This function provides ground fault protection to TN-C or TN-S power distribution systems on the load side.
2) The GF protection setting is set to "enabled" as default. If GF is not required, GF must be disabled by the user, via the Trip Unit screen setting menu before ACB energisation.
3) Non Auto stocked ACB versions do not include an AGR21 Over Current Release, GF, trip indicator, or communications. Other standard specification details and inclusions remain unchanged.

Stock ACB Carriages for AR3 types: 2500A - 3200A

3 pole carriage for standard stock ACB body types: STD, MSTD, NASTD and NAMSTD. STD and MSTD types are configured for AGR21 Trip Units.

Description	Suits ACB Body Catalogue No.	Current rating	Terminal Arrangement		ACB Carriage Catalogue No. [4]
			Top	Bottom	
AR-S ACB Carriage	ARB3253STD ARB3323STD	2500A 3200A	Horizontal	Horizontal	ARC3323HHSTD
			Vertical	Vertical	ARC3323VVSTD
			Horizontal	Vertical	ARC3323HVSTD
			Vertical	Horizontal	ARC3323VHSTD

Notes

4) Stock carriages are suitable for use with the “stock body” shown above. If a different ACB specification is required, contact NHP sales for a custom manufactured order. ACBs and CARRIAGES for AGR31 ACB Trip Units have different wiring and terminal configurations compared to AGR21 types and are not interchangeable.

Stock ACB types for AR4: 4000A

Stocked ACBs are kept on the shelf in a standard pre-built configuration providing fast customer delivery. ACB bodies (withdrawable part) and carriages (fixed part) are ordered separately according to the required carriage terminal configuration. Standard stocked types include: non-motorised versions, motorised versions, non-auto versions, motorised non-auto versions.

AR440S

Stocked ACB specification

- Approvals and test: AS/NZS 60947, IEC 60947, A.S.T.A. certified
- AR-S type ACB body, 3 pole
- PLUS overcurrent release (type AGR21CL-PG) (240 V AC control voltage)
- Adjustable 'LSI' + GF protection standard (GF comes set enabled as default) [2)]
- Single trip indicator contact for 'LSI+GF' standard
- MODBUS communications facility (data monitoring as standard)
- Ground fault ready (external 4th CT required, see below) [1)]
- 240V AC continuous rated shunt trip
- 7 C/O auxiliary switch
- IP 41 door flange
- ON/OFF push button covers are padlockable as standard
- Position padlock facility (locks ACB inside carriage in 'connected' or 'test' position)
- Additional feature options include either a spring charging 240V AC motor, Non-Auto disconnector or Non-Auto disconnector version, with 240V AC spring charge motor fitted [3)]

Ordering Catalogue Numbers

Description	Current Rating (A)	400 / 415V Interrupting Capacity (kA)	ACB Body AGR21 Trip Unit	ACB Body AGR21 Trip Unit With 240V AC Spring Charge Motor	ACB Body Non-Auto (No Trip Unit)	ACB Body Non-Auto (No Trip Unit) With 240V AC Spring Charge Motor
AR-S ACB body with AGR21 Trip Unit [1)] Or Non Auto types without a trip unit [3)]	4000	100	ARB4403 STD	ARB4403 MSTD	ARB4403 NASTD	ARB4403 NAMSTD

Notes

- The above specification is fixed. If other accessories are required (e.g. UVT, Trip Unit, different shunt voltage) contact NHP to place a custom order.
- LSI+GF" is defined as being: long time delayed trip, short time delayed trip, instantaneous trip, ground fault trip

1) This function provides ground fault protection to TN-C or TN-S power distribution systems on the load side.
2) The GF protection setting is set to "enabled" as default. If GF is not required, GF must be disabled by the user, via the Trip Unit screen setting menu before ACB energisation.
3) Non Auto stocked ACB versions do not include an AGR21 Over Current Release, GF, trip indicator, or communications. Other standard specification details and inclusions remain unchanged.

Stock ACB types for AR4: 4000A

3 pole carriage for standard stock ACB body types: STD, MSTD, NASTD and NAMSTD. STD and MSTD types are configured for AGR21 Trip Units.

Description	Suits ACB Body Catalogue No.	Terminal Arrangement*		ACB Carriage Catalogue No.[4)]
		Top	Bottom	
AR-S ACB Carriage	ARB4403STD	Vertical	Vertical	ARC4403VVSTD

Notes

4) Stock carriages are suitable for use with the "stock body" shown above. If a different ACB specification is required, contact NHP sales for a custom manufactured order. ACBs and CARRIAGES for AGR31 ACB Trip Units have different wiring and terminal configurations compared to AGR21 types and are not interchangeable.

* not available in other terminal configurations

1250-2000 A (AR2) Frame Size 1

The Terasaki 'TemPower 2 AR' series of Air Circuit Breakers (ACBs) are intended for both industrial and commercial applications.

Key Features of the Terasaki TemPower 2 Range

Highest Levels of Performance

Unique Breaking Contact Design

TemPower 2 is the world's first Double Break ACB, having two breaking contacts per phase, allowing the short time withstand rating (Icw 1 second) to equal to the service short circuit breaking capacity (Ics) ensuring short circuit selectivity.

Rapid Fault Clearance

The TemPower 2 clears short-circuit faults in less that 30ms [1)] which minimises thermal and mechanical stress on busbars and reduces arc flash energy during a fault.

Highest Levels of Protection and Safety

Flexible LSI Protection Curve Characteristics

TemPower 2 is the only ACB that offers trip units with time-current characteristics to comply with three different standards and super fine level setting adjustment.

3C Temperature Condition Monitoring and Fire Hazard Prevention System

TemPower 2 has a breakthrough self-monitoring temperature system for checking the condition of the main contacts and conductive path using integrated thermistors.

Early-make-late-break Neutral (N) design

4-pole models have a fully rated, early-make-late-break Neutral (N) design which eliminates the risk of abnormal line to neutral voltages, which may damage sensitive electronic equipment (i.e. Hospital etc).

Notes: 1) 30 ms figure applicable for all models except 5000/6300 A frame size.

Highest Levels of Reliability

Operational Endurance

Double Break contacts increase service life. Endurance ratings are the best available and exceed the requirements of AS/NZS 60 947-2

Reduced Time to Repair and Easy Maintenance

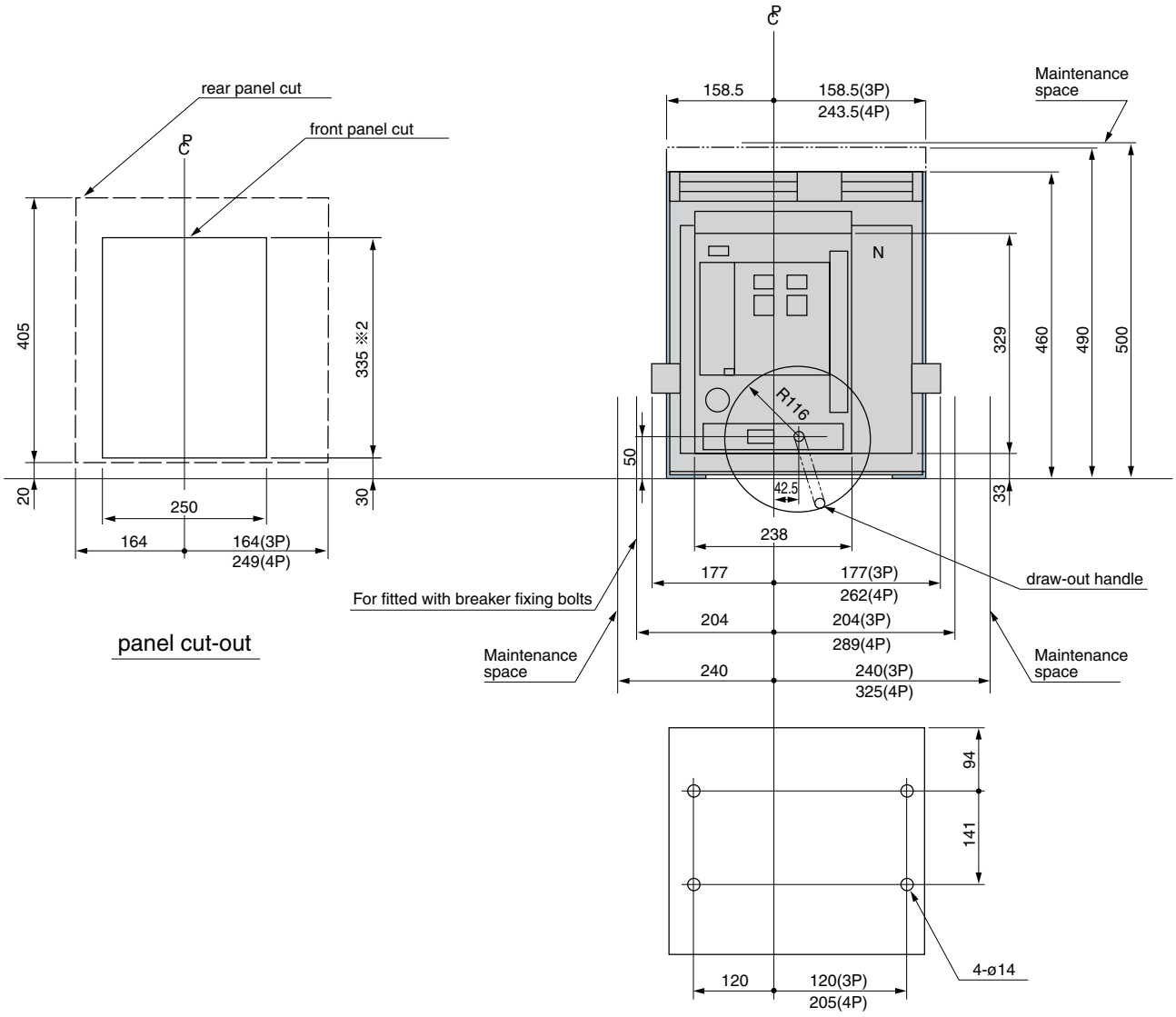
The modular Double Break contact construction allows on-site replacement of each contact set in minimal time.

Contact clusters are uniquely located on the ACB body, all serviceable parts are available for inspection, dramatically reducing power down time.

General	The Terasaki AR ACB in frame size 1 is one of the worlds smallest 65kA Icu rated ACBs at 440V AC. This small yet powerful ACB makes it ideal for new and retrofit installations	
Nominal Current Ratings	800A, 1250A, 1600A, 2000A	
Number of Poles	3 or 4	
Short Circuit Ratings	**Standard Type**	65kA @ 440V AC
		50kA @ 690V AC
	High Capacity Type	80kA @ 440V AC
		65kA @ 690V A C
Connection Type	Withdrawable as standard, fixed type as a special order	
Terminal Configurations	Vertical / Vertical, Horizontal / Horizontal, Front / Front or combinations of the above	

Detailed Dimensions - Draw-Out Type

Type AR208S, AR212S, AR216S, AR220S, AR212H, AR216H, AR220H



Terminal Size

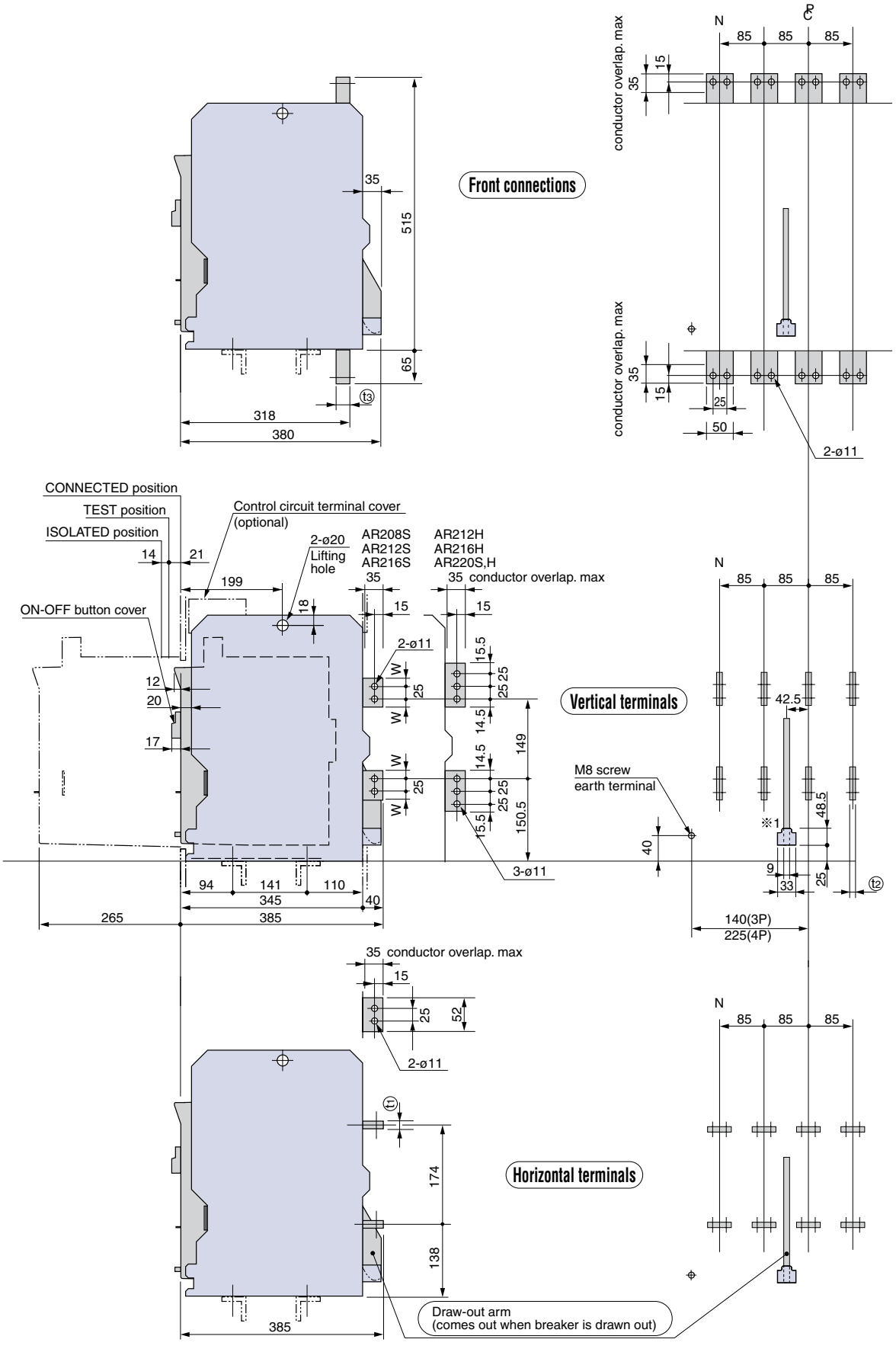
Type	(t1)	(t2)	(t3)	W
AR208S	10	10	15	17.5
AR212S	10	10	15	17.5
AR216S	20	15	25	22.5
AR220S	20	15	25	-
AR212H	20	15	-	-
AR216H	20	15	-	-
AR220H	20	15	-	-

Notes

※ 1: Conductors including connecting bolts should be separated min. 7 mm from Draw-out arm.

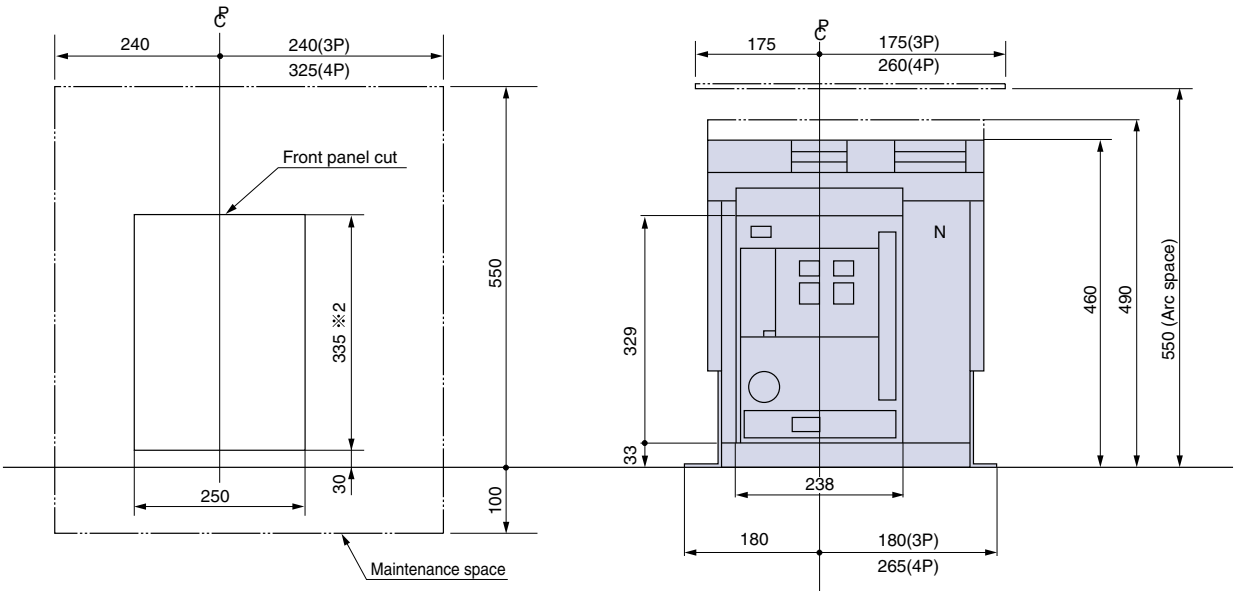
※ 2: Panel cut should be 339 mm not 335 mm when the door flange is used.

- N represents the neutral pole of 4-pole ACBs. The neutral pole is positioned to the right as standard when viewed from the front of the ACB. However, the neutral pole can be customised so that it is positioned to the left.
- For High fault series vertical terminal is standard and horizontal terminal is optional, and front connection is not available.
- The vertical terminal for the main circuit with its length extended by 70 mm from the standard is specially available on request.
- For the outline drawing for the version with earth leakage tripping, contact us.

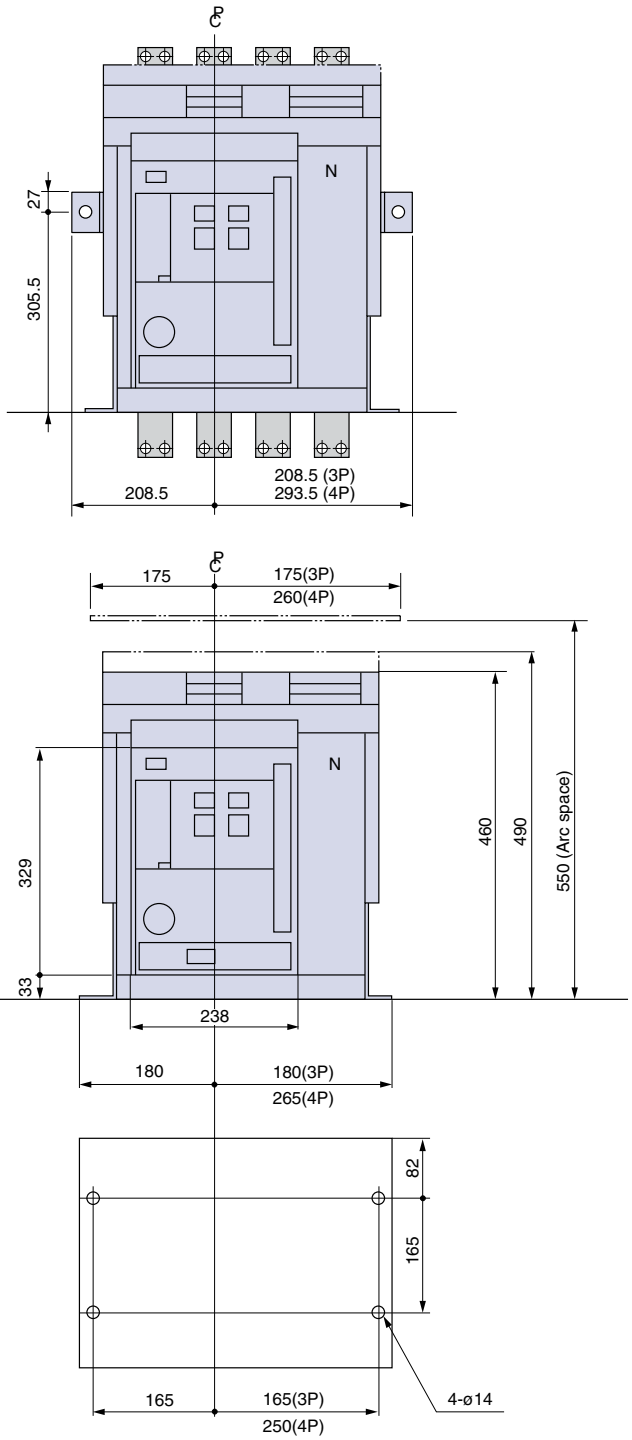

Front connections
conductor overlap. max
N
P
85
85
85
35
15
515
65
t3
318
380
25
50
2-ø11
CONNECTED position
TEST position
ISOLATED position
Control circuit terminal cover
(optional)
2-ø20
Lifting
hole
AR208S
AR212S
AR216S
AR212H
AR216H
AR220S,H
35 conductor overlap. max
14
21
199
18
ON-OFF button cover
12
20
17
W
25
15.5
14.5
149
150.5
3-ø11
94
141
110
345
40
265
385
Vertical terminals
42.5
M8 screw
earth terminal
※1
48.5
9
33
t2
140(3P)
225(4P)
52
t1
174
138
Horizontal terminals
Draw-out arm
(comes out when breaker is drawn out)

Detailed Dimensions Fixed Type

Type AR208S, AR212S, AR216S, AR220S, AR212H, AR216H, AR220H



Panel cutout



Mounting holes

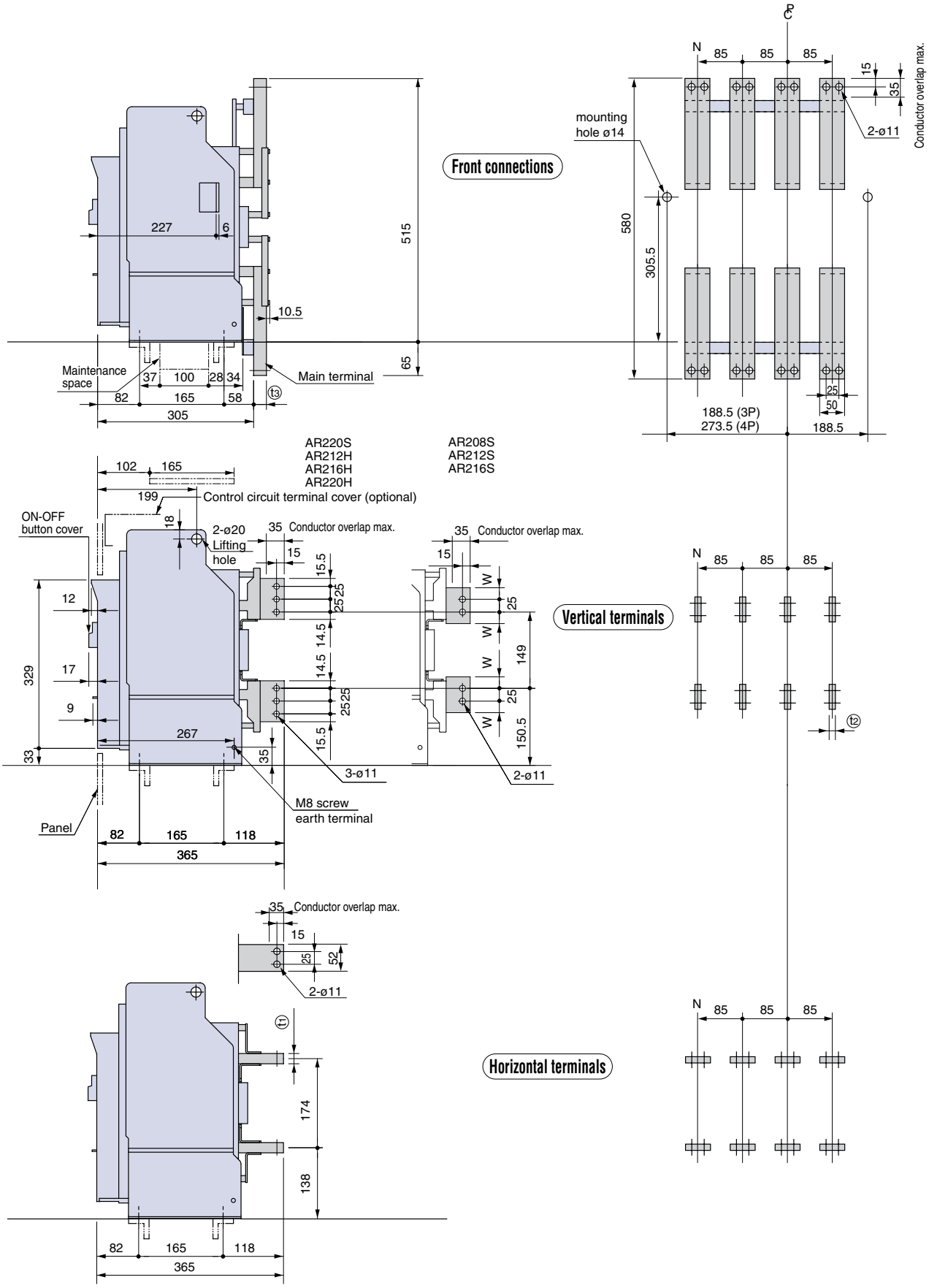
Terminal Size

Type	t1	t2	t3	W
AR208S	10	10	15	17.5
AR212S	10	10	15	17.5
AR216S	20	15	25	22.5
AR220S	20	15	25	-
AR212H	20	15	-	-
AR216H	20	15	-	-
AR220H	20	15	-	-

Notes

※ 2: Panel cut should be 339 mm not 335 mm when the door flange is used.

- N represents the neutral pole of 4-pole ACBs. The neutral pole is positioned to the right as standard when viewed from the front of the ACB. However, the neutral pole can be customised so that it is positioned to the left.
- For type AR-H high fault series, vertical terminals are standard, horizontal terminals are optional and front connections are not available.
- For the outline drawing for the version with earth leakage tripping, contact us.


Front connections
227
6
515
10.5
65
Maintenance space
37
100
28
34
82
165
58
305
t3
Main terminal
mounting hole ø14
580
305.5
N
85
85
85
15
35
Conductor overlap max.
2-ø11
25
50
188.5 (3P)
273.5 (4P)
188.5
AR220S
AR212H
AR216H
AR220H
AR208S
AR212S
AR216S
102
165
199
Control circuit terminal cover (optional)
ON-OFF button cover
18
2-ø20
Lifting hole
35
Conductor overlap max.
15
15.5
25
25
14.5
14.5
25
25
15.5
329
12
17
9
33
267
35
3-ø11
M8 screw earth terminal
Panel
82
165
118
365
Vertical terminals
W
W
W
25
25
149
150.5
2-ø11
t2
Horizontal terminals
52
t1
174
138

Ratings

AR-S Standard Break / AR-H High Break TemPower 2		AR208S	AR212S	AR216S	AR220S	AR216H*	AR220H*
Rated Current (I_N) 1) 2)	A	800	1250	1600	2000	1600	2000
Number of Poles 3) 4)		3 or 4	3 or 4	3 or 4	3 or 4	3 or 4	3 or 4
Current Transformer Ratings (I_{ct})	A	200 i)	200 i)	200 i)	200 i)	200 i)	200 i)
		400 i)	400 i)	400 i)	400 i)	400 i)	400 i)
		800	800	800	800	800	800
			1250	1250	1250	1250	1250
				1600	1600	1600	1600
					2000		2000
Insulation Voltage (U_i) (50 / 60 Hz)	V AC	1000	1000	1000	1000	1000	1000
Operational Voltage (U_e) (50 / 60 Hz)	V AC	690	690	690	690	690	690
Impulse Voltage (Uimp)	kV	12	12	12	12	12	12
Rated Short Time Withstand (I_{CW})	1 sec	65	65	65	65	80	80
	3 sec	50	50	50	50	55	55
Total Breaking Time	Sec	0.03	0.03	0.03	0.03	0.03	0.03
Motor Charging Time (Max)	Sec	10	10	10	10	10	10
Closing Time (Max)	Sec	0.08	0.08	0.08	0.08	0.08	0.08
Latching Current	kA	65	65	65	65	65	65

Notes

1) Values in open air at 45 ºC. Contact NHP for other temperature ratings.
2) Values for AR208S, AR212S, AR216S types with horizontal terminals. Values for others, including all AR-H types, have vertical terminals (see Horizontal options).
3) For 2 pole ACBs use outside poles of 3 pole ACB.
4) 4 Pole ACBs without Neutral phase protection cannot be applied to “IT” type earthing systems, which do not include a neutral.
5) Please contact NHP for DC application ACBs. AGR Trip Units cannot be used with DC currents.
6) NEMA / ANSI rated AR ACBs are not UL Certified. NEMA / ANSI ratings are shown for markets outside of North America, or for marine use, using NEMA ratings.

- When the INST trip function is set to NON, the MCR function should be enabled, otherwise, the breaking capacity equals the latching current.

i) = Available indent delivery only.

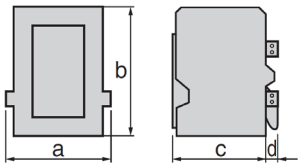
* AR-H High Fault series ACBs are available on an INDENT delivery basis. Refer NHP for delivery.

Short Circuit Capacity

AS / NZS and IEC Breaking and Making Capacities		AR208S	AR212S	AR216S	AR220S	AR216H	AR220H
Breaking Capacity kA 5) (ICS = ICU) [kA sym rms] to AS / NZS and IEC	690V AC	50	50	50	50	55	55
	550V AC	50	50	50	50	55	55
	500V AC	65	65	65	65	65	65
	440V AC	65	65	65	65	80	80
	415V AC	65	65	65	65	80	80
Making Capacity (kA peak) to AS / NZS and IEC	690V AC	105	105	105	105	121	121
	550V AC	105	105	105	105	143	143
	500V AC	143	143	143	143	143	143
	440V AC	143	143	143	143	176	176
	415V AC	143	143	143	143	176	176

Physical

Number of Operating Cycles		AR208S	AR212S	AR216S	AR220S	AR216H	AR220H
Mechanical Life	with maintance	30000	30000	30000	25000	30000	30000
	without maintance	15000	15000	15000	12000	15000	15000
Electrical Life	460V AC	12000	12000	12000	10000	12000	12000
	690V AC (without maintenance)	10000	10000	10000	7000	10000	10000
Outline Dimensions: ACB + Carriage	a	354 / 439	354 / 439	354 / 439	354 / 439	354 / 439	354 / 439
	b	460	460	460	460	460	460
	c	345	345	345	345	345	345
	d	40	40	40	40	40	40



Standards

Based Standards	
AS/NZS 60947-2	Australian / New Zealand Standard
IEC 60947-2	International Electrotechnical Commission
EN60947-2	European Standard
JIS C8372	Japanese Industrial Standard
NEMA PUB NO.SG3	National Electrical Manufacturers Association
ANSI C37.13	American National Standard Institute

Certification and Authorisation	
ASTA, UK	ASTA Certification Services
NK, Japan	Nippon Kaiji Kyokai
LR, UK	Lloyd's Register of Shipping
ABS, USA	American Bureau of Shipping
GL, Germany	Germanischer Lloyd
BV, France	Bureau Veritas

Environmental

Standard Environment	The standard environment for ACBs is as follows:
Ambient Temperature	– 5°C to + 40°C. See following pages for ACB temperature ratings and busbar sizing for different temperatures
Relative Humidity	45% to 85%
Altitude	Below 2000m. A derating factor applies for higher elevations
Atmosphere	Excessive water vapor, oil vapor, smoke, dust, or corrosive gases must not exist. Sudden change in temperature, condensation, or icing must not occur. Otherwise, refer NHP for its range of climate control products
Vibration	TemPower 2 ACBs are designed to withstand electromagnetic and mechanical vibrations in accordance to IEC 68-2-6. (2-13.2Hz with amplitude of +/- 1 mm; 13.2 to 100Hz with an acceleration of 0.7 g)
Low and High Temperatures	NHP can also supply environmental control solutions for switchboards – low and high temperature conditioning

Installation Types

Fixed Type	Yes
Draw-out Type	Yes

Temperature Ratings

Based Standard	JIS C 8201-2-1 Ann.1 Ann.2, IEC60947-2, EN60947-2, AS3947.2		
Type	**Terminal Arrangement**		
	Horizontal Terminals	**Vertical Terminals**	**Front Connections**
AR208S	800	800	800
AR212S	1250	1250	1250
AR216S	1600	1600	1600
AR220S	2000	2000	2000
AR212H	1250	1250	-
AR216H	1600	1600	-
AR220H	2000	2000	-

Notes
1) Contact NHP for details.

If different types of terminal arrangement are used for line and load sides refer to the ratings for the horizontal terminals.

Front connection cannot be specified with the different types of terminal arrangement for line and load sides.

General Guidelines

When a circuit breaker operates in an ambient temperature higher than the standard 50°C, the current carrying capacity of the circuit breaker may require a level of derating.

The degree to which circuit breaker derating is necessary depends upon the size and arrangement of busbars, ACB tag connection orientation, the size of the switchboard compartment where the ACB is mounted, the switchboard enclosure size, the degree of the enclosure ventilation, as well as other environmental factors.

The following tables can be used as a general guide to rating AR ACBs when the ambient temperature around the circuit breaker and its connections is known. It is possible however that varying conditions or the addition of other heat producing devices or even obstructions within the enclosure may require additional derating or an increased level of ventilation.

The values presented in the following tables are based upon test results and theoretical extrapolation. These tables are only intended to provide guidance and in no way substitute proven industrial design practices or temperature rise tests.

For When the Temperature Inside a Switchboard is Known

Standard Fault Series

Based Standards	Ambient Temperature (°C)	Type	AR208S	AR212S	AR216S	AR220S
		Connecting bar sizes	**2 x 50 x 6.3**	**2 x 80 x 6.3**	**2 x 100 x 6.3**	**3 x 100 x 6.3**
JIS C 8201-2-1 Ann.1 Ann. 2 IEC60947-2 EN 60947-2 AS3947.2	40 (Standard Ambient Temperature)		800	1250	1600	2000
	45		800	1250	1600	2000
	50		800	1250	1600	2000
	55		800	1250	1540	1820
	60		800	1150	1460	1740
NEMA, SG-3 ANSI C37.13	40 (Standard Ambient Temperature)		800	1250	1540	2000
	45		800	1190	1470	1960
	50		800	1130	1390	1860
	55		790	1070	1310	1750
	60		740	1000	1230	1640

Notes Standard Fault Series
- The values are applicable for Draw-out type.
- The values of AR208S, AR212S and AR216S are for horizontal terminals on both line and load side.
- The values of AR220S, AR332S, AR440SB, AR440S, AR650S and AR663S are for vertical terminals on both line and load side.
- Above figures are subject to the design of the enclosure and rating of busbar.

High Fault Series

AR212H	AR216H	AR220H
2 x 80 x 6.3	**2 x 100 x 6.3**	**3 x 100 x 6.3**
1250	1600	2000
1250	1600	2000
1250	1600	2000
1250	1600	820
1250	1550	1740
1250	1600	2000
1250	1600	1960
1250	1600	1860
1250	1510	1750
1240	1420	1640

Notes High Fault Series
- The values are for vertical terminals on both line and load side.
- Above figures are subject to the design of the enclosure and rating of busbar.

TemPower 2 Busbar Connection Sizing

The temperatures shown represent the °C ambient temperature inside a switchboard where the ACB is installed.

- Busbars are to be of high conducting copper
- The maximum permissible busbar temperature is 100°C
- Spacers must be used where multiple busbars are connected For example, 6.3 mm spacers for 6.3 mm busbars and 10 mm spacers for 10 mm busbars

Example of a typical selection situation:

- Draw out ACB
- Horizontal connections
- 50°C ambient temperature
- Service current to be 1600 A

Solution:

Refer to the table for horizontal connections. By looking at the 50°C column and 1600A row, the ACB required would need to be an AR216S 1600A ACB, with 3 x 63 mm by 6.3 mm or 2 x 50 mm by 10 mm busbars connected.

Horizontal Connections for a Draw Out ACB

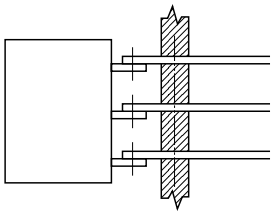
Standard Series	40°C			50°C			60°C		
	ACB	6.3 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar
800	AR208S	1 - 63 X 6.3	1 - 50 X 10	AR208S	1 - 63 X 6.3	1 - 50 X 10	AR208S	2 - 40 X 6.3	1 - 50 X 10
1000	AR212S	2 - 50 X 6.3	1 - 50 X 6.3	AR212S	2 - 50 X 6.3	1 - 63 X 10	AR212S	2 - 50 X 6.3	1 - 63 X 10
1000	AR212H	2 - 63 X 6.3	2 - 50 X 10	AR212H	3 - 50 X 6.3	2 - 50 X 10	AR212H	3 - 50 X 6.3	2 - 50 X 10
1250	AR212S	2 - 63 X 6.3	2 - 50 X 10	AR212S	3 - 50 X 6.3	2 - 50 X 10	AR212S	3 - 50 X 6.3	2 - 50 X 10
1250	AR212H	3 - 50 X 6.3	2 - 50 X 10	AR212H	3 - 63 X 6.3	2 - 50 X 10	AR212H	4 - 63 X 6.3	2 - 50 X 10
1400	AR216S / H	2 - 63 X 6.3	2 - 50 X 10	AR216S / H	3 - 50 X 6.3	2 - 50 X 10	AR216S / H	4 - 63 X 6.3	2 - 50 X 10
1600	AR216S / H	3 - 50 X 6.3	2 - 50 X 10	AR216S / H	3 - 63 X 6.3	2 - 50 X 10	AR216S / H	4 - 63 X 6.3	2 - 63 X 10
2000	AR220S / H	4 - 63 x 6.3	3 - 63 x 10	AR220S / H	5 - 63 X 6.3	3 - 63 - 10	AR220S / H	-	3 - 80 x 10
2000	AR320H	4 - 63 x 6.3	3 - 63 x 10	AR320H	5 - 63 x 6.3	3 - 63 x 10	AR320H	-	3 - 80 x 10

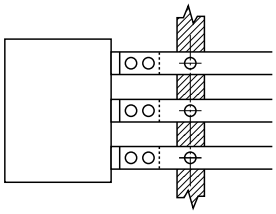
Vertical Connections for a Draw Out ACB

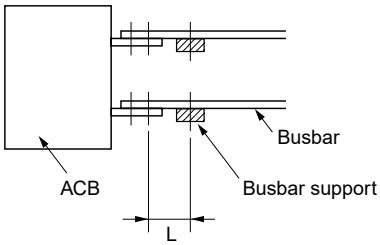
Max. Service Amps	40°C			50°C			60°C		
	ACB	3.6 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar
800	AR208S	1 - 63 X 6.3	1 - 50 X 10	AR208S	1 - 63 X 6.3	1 - 50 X 10	AR208S	1 - 63 X 6.3	1 - 50 X 10
1000	AR212S	1 - 80 X 6.3	1 - 50 X 10	AR212S	1 - 80 X 6.3	1 - 50 X 10	AR212S	1 - 80 X 6.3	1 - 50 X 10
1000	AR212H	2 - 63 X 6.3	1 - 80 X 10	AR212H	2 - 63 X 6.3	1 - 80 X 10	AR212H	2 - 80 X 6.3	2 - 50 X 10
1250	AR212S	2 - 63 X 6.3	1 - 63 X 10	AR212S	2 - 63 X 6.3	1 - 63 X 10	AR212S	2 - 80 X 6.3	2 - 50 X 10
1250	AR212S	1 - 100 X 6.3	1 - 63 X 10	AR212S	1 - 100 X 6.3	1 - 63 X 10	AR212S	2 - 80 X 6.3	2 - 50 X 10
1250	AR212H	2 - 63 X 6.3	1 - 80 X 10	AR212H	2 - 63 X 6.3	1 - 80 X 10	AR212H	2 - 80 X 6.3	2 - 50 X 10
1400	AR216S / H	2 - 63 X 6.3	1 - 80 X 10	AR216S / H	2 - 63 X 6.3	1 - 80 X 10	AR216S / H	2 - 80 X 6.3	2 - 50 X 10
1600	AR216S / H	2 - 80 X 6.3	1 - 80 X 10	AR216S / H	2 - 80 X 6.3	1 - 100 X 10	AR216S / H	2 - 100 X 6.3	2 - 63 X 10
2000	AR220S / H	2 - 100 X 6.3	2 - 63 X 10	AR220S / H	2 - 125 x 6.3	2 - 80 x 10	AR220S / H	3 - 100 x 6.3	2 - 80 x 10
2000	AR320H	2 - 100 x 6.3	2 - 63 x 10	AR320H	2 - 125 x 6.3	2 - 80 x 10	AR320H	3 - 100 x 6.3	2 - 80 x 10

Technical Data – Busbar Connection Supports

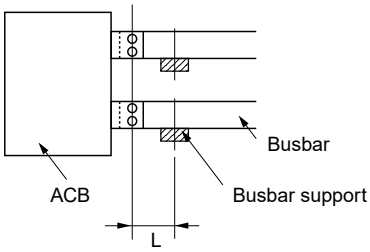
The busbars to the ACB should be firmly supported near the ACB terminal. Fault current flow through the busbars can develop significant electromagnetic force between the busbars, and the support must be strong enough to withstand such forces. The ACB terminals should not be relied upon as a busbar support, as in addition to potential electrical forces, the weight may also cause damage to the ACB terminals and mouldings.



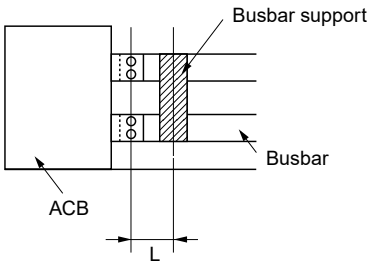




Horizontal terminals



Vertical terminals



Vertical terminals

Horizontal Terminals

Vertical Terminals

Front Terminals

Short Circuit Current (kA)		30	50	65	80	100	120
Distance L (mm)	AR2 type	300	250	150	150	-	-

Technical Data – Dielectric Strength, Internal Resistance, Power Consumption

Dielectric Strength

Circuit			Withstand Voltage (at 50 / 60Hz)		Rated Impulse Withstand Voltage U_{imp}
Main Circuit			Between terminals, terminal group to earth	AC 3500V for 1 minute	12kV
Control Circuits	Auxiliary switches	For general service	terminal group to earth	AC 2500V for 1 minute	6kV
		For microload	terminal group to earth	AC 2000V for 1 minute	4kV
	Position switches		terminal group to earth	AC 2000V for 1 minute	4kV
	Trip Unit		terminal group to earth	AC 2000V for 1 minute	4kV
	Power supply for undervoltage / reverse power trip function		terminal group to earth	AC 2500V for 1 minute	6kV
Other Accessories			terminal group to earth	AC 2000V for 1 minute	4kV

Notes
The values shown above are those measured on phase connections and cannot be applied to control terminals on the ACB.

Internal Resistance and Power Loss

	Standard Series				High Fault Series		
Type	**AR208S**	**AR212S**	**AR216S**	**AR220S**	**AR212H**	**AR216H**	**AR220H**
Rated Current (A)	800	1250	1600	2000	1250	1600	2000
DC Internal Resistance Per Pole (mΩ)	0.033	0.033	0.028	0.024	0.024	0.024	0.024
DC Power Consumption for 3 poles (W)[1)]	64	155	215	288	113	184	288
AC Power Consumption for 3 poles (W)	200	350	350	490	260	350	490

Notes
1) Above figures are based on the calculation of 3 x I2R. For more information please contact NHP.

2500-3200 A (AR3) Frame Size 2

The Terasaki 'TemPower 2 AR' series of Air Circuit Breakers (ACBs) are intended for both industrial and commercial applications.

Key Features of the Terasaki TemPower 2 Range

Highest Levels of Performance

Unique Breaking Contact Design

TemPower 2 is the world's first Double Break ACB, having two breaking contacts per phase, allowing the short time withstand rating (Icw 1 second) to equal to the service short circuit breaking capacity (Ics) ensuring short circuit selectivity.

Rapid Fault Clearance

The TemPower 2 clears short-circuit faults in less that 30 ms* which minimises thermal and mechanical stress on busbars and reduces arc flash energy during a fault.

Highest Levels of Protection and Safety

Flexible LSI Protection Curve Characteristics

TemPower 2 is the only ACB that offers trip units with time-current characteristics to comply with three different standards and super fine level setting adjustment.

3C Temperature Condition Monitoring and Fire Hazard Prevention System

TemPower 2 has a breakthrough self-monitoring temperature system for checking the condition of the main contacts and conductive path using integrated thermistors.

Early-make-late-break Neutral (N) design

4-pole models have a fully rated, early-make-late-break Neutral (N) design which eliminates the risk of abnormal line to neutral voltages, which may damage sensitive electronic equipment (ie. Hospital etc).

*30 ms figure applicable for all models except 5000/6300 A frame size

Highest Levels of Reliability

Operational Endurance

Double Break contacts increase service life. Endurance ratings are the best available and exceed the requirements of AS/NZS 60 947-2

Reduced Time to Repair and Easy Maintenance

The modular Double Break contact construction allows on-site replacement of each contact set in minimal time.

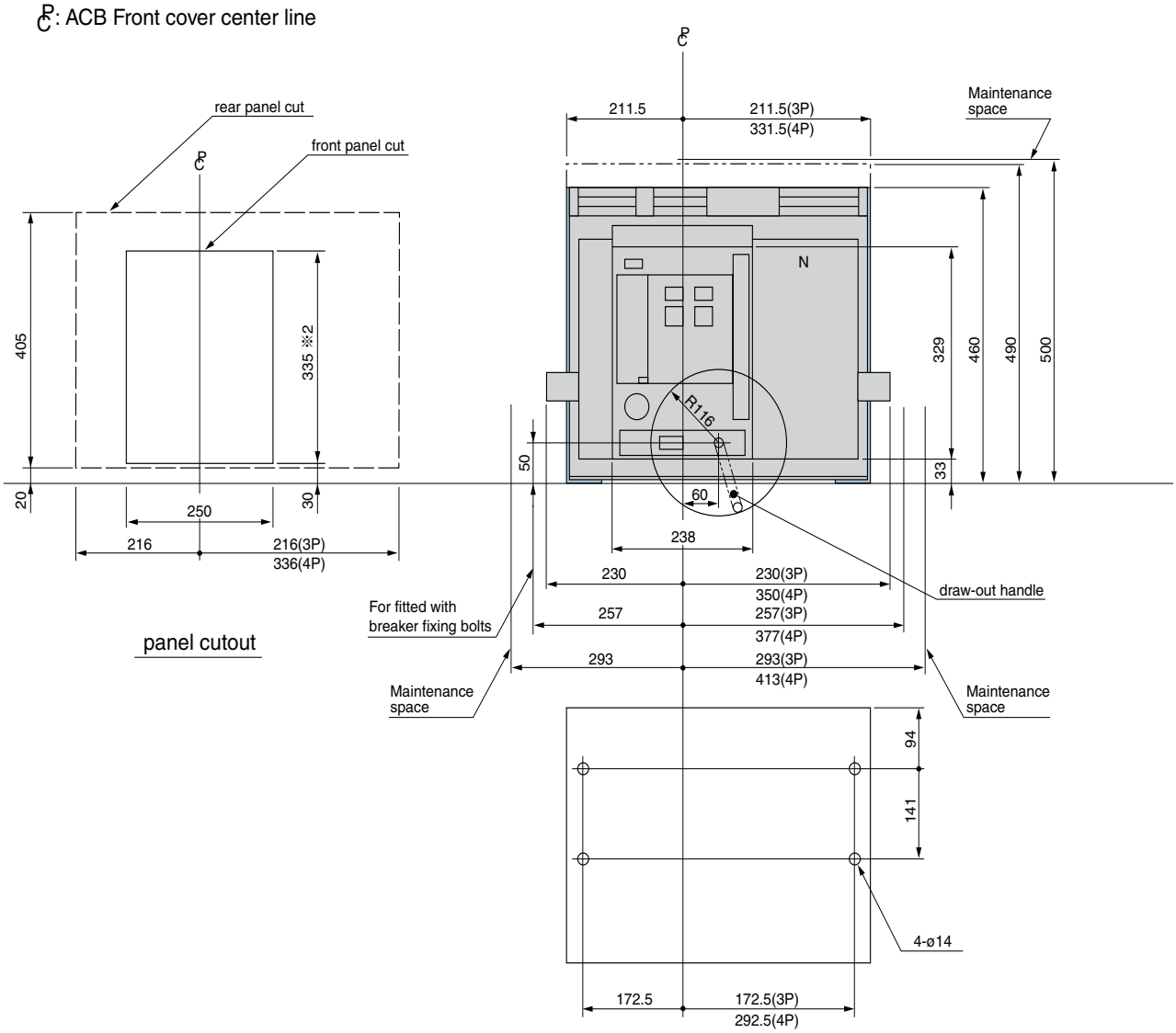
Contact clusters are uniquely located on the ACB body, all serviceable parts are available for inspection, dramatically reducing power down time.

General	The Terasaki AR ACB in frame size 2 is a compact design 85kA Icu rated ACBs at 440V AC.	
Nominal Current Ratings	2500A, 3200A	
Number of Poles	3 or 4	
Short Circuit Ratings	**Standard Type**	85kA @ 440V AC
		65kA @ 690V AC
	High Capacity Type	100kA @ 440V AC
		85kA @ 690V AC
Connection Type	Withdrawable as standard, fixed type as a special order	
Terminal Configurations	Vertical / Vertical, Horizontal / Horizontal, Front / Front or combinations of the above	

Detailed Dimensions - Draw-Out Type

Type AR325S, AR332S
AR316H, AR320H, AR325H, AR332H

℄: ACB Front cover center line

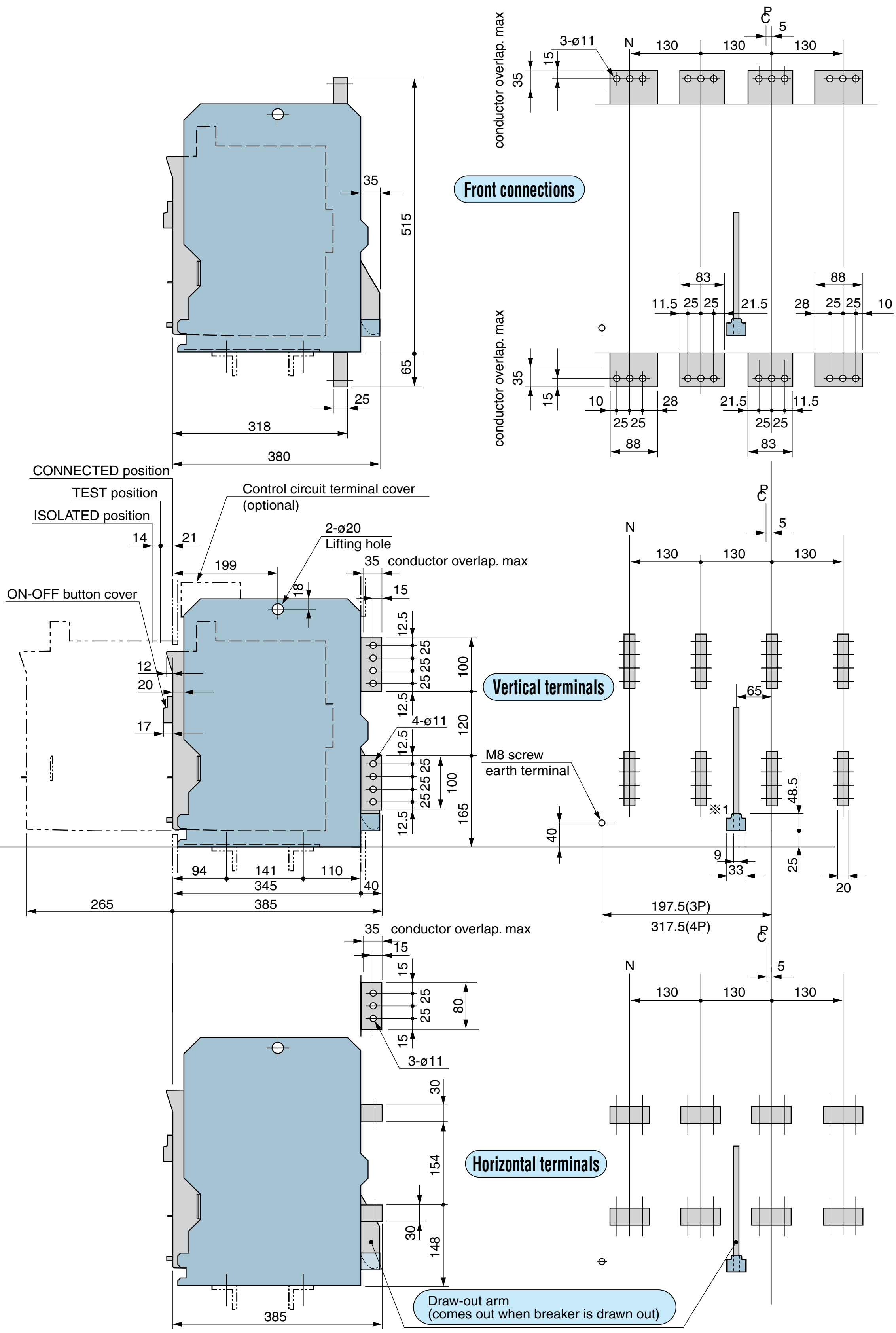


Notes

1) Conductors including connecting bolts should be separated min. 7 mm from Draw-out arm.
2) Panel cut should be 339 mm not 335 mm when the door flange is used.

- N represents the neutral pole of 4-pole ACBs. The neutral pole is positioned to the right as standard when viewed from the front of the ACB. However, the neutral pole can be customised so that it is positioned to the left.
- For High fault series vertical terminal is standard and horizontal terminal is optional, and front connection is not available.
- The vertical terminal for the main circuit with its length extended by 70mm from the standard is specially available on request.
- For the outline drawing for the version with earth leakage tripping, contact us.

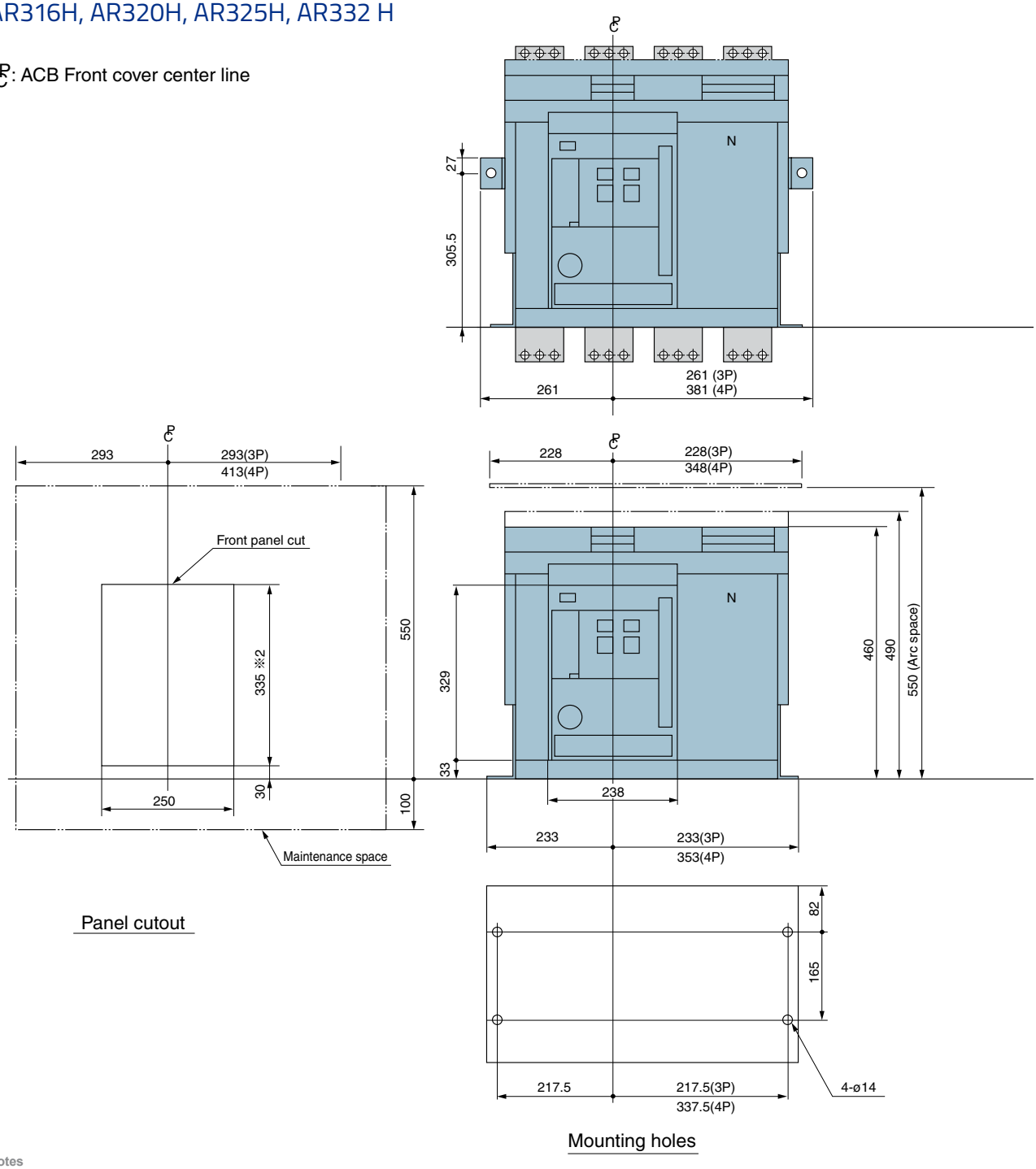
ACBs


Front connections
conductor overlap. max
3-ø11
N
Vertical terminals
CONNECTED position
TEST position
ISOLATED position
Control circuit terminal cover
(optional)
2-ø20
Lifting hole
35 conductor overlap. max
ON-OFF button cover
4-ø11
M8 screw
earth terminal
※1
197.5(3P)
317.5(4P)
Horizontal terminals
3-ø11
Draw-out arm
(comes out when breaker is drawn out)

Detailed Dimensions - Fixed Type

Type AR325S, AR332S, AR316H, AR320H, AR325H, AR332 H

℄: ACB Front cover center line



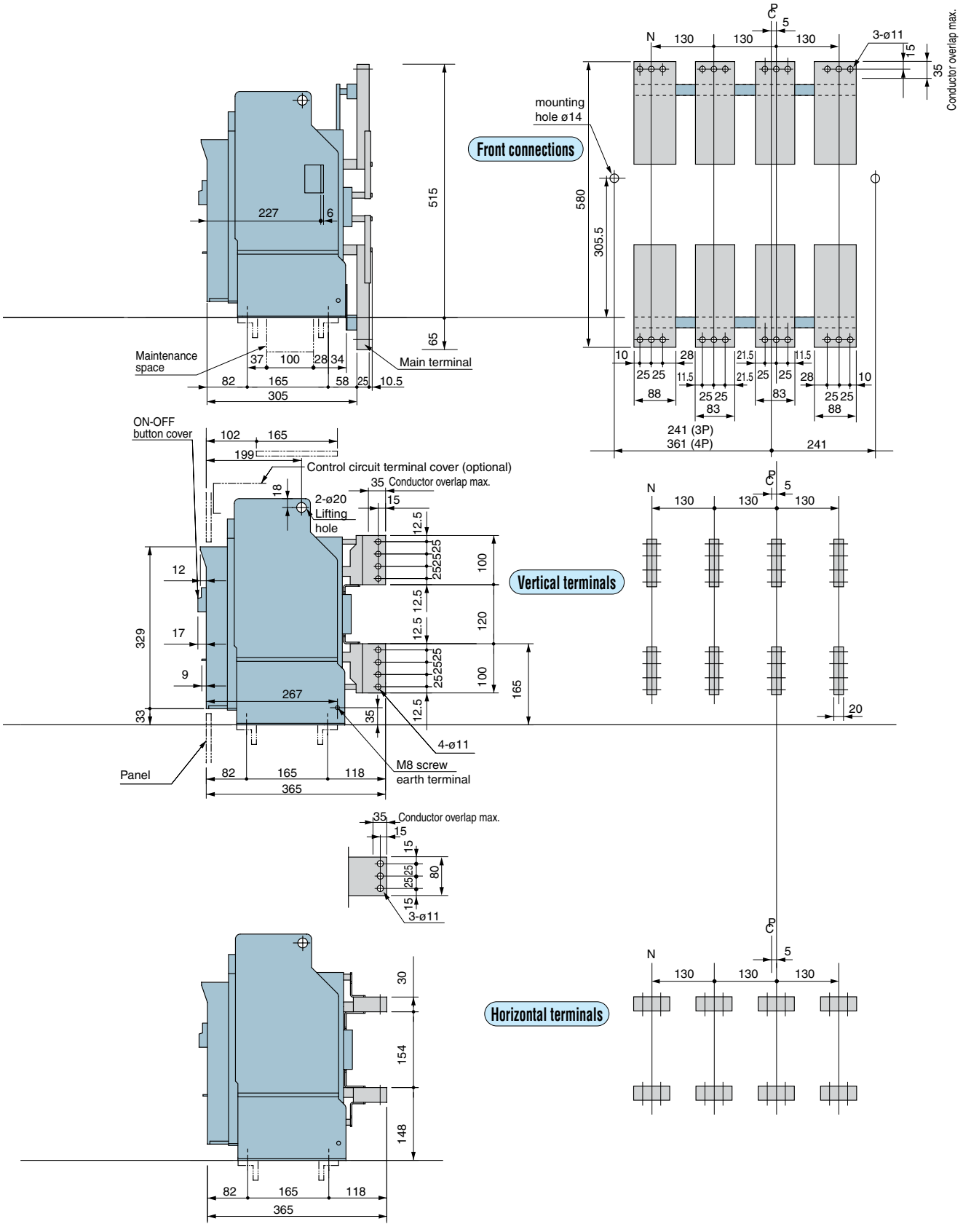
Panel cutout

Mounting holes

Notes

※ 2: Panel cut should be 339 mm not 335 mm when the door flange is used.

- N represents the neutral pole of 4-pole ACBs. The neutral pole is positioned to the right as standard when viewed from the front of the ACB. However, the neutral pole can be customised so that it is positioned to the left.
- For type AR-H high fault series, vertical terminals are standard, horizontal terminals are optional and front connections are not available.
- For the outline drawing for the version with earth leakage tripping, contact us.


Front connections
mounting hole ø14
3-ø11
Conductor overlap max.
241 (3P)
361 (4P)
Maintenance space
Main terminal
ON-OFF button cover
Control circuit terminal cover (optional)
2-ø20 Lifting hole
Vertical terminals
4-ø11
M8 screw earth terminal
Panel
Horizontal terminals

Ratings

AR-S Standard Break / AR-H High Break TemPower 2		AR325S	AR332S	AR316H	AR320H	AR325H*	AR332H*
Rated Current (I_N)[1) 2)]	A	2500	3200	1600	2000	1600	2000
Number of Poles[3) 4)]		3 or 4	3 or 4	3 or 4	3 or 4	3 or 4	3 or 4
Current Transformer Ratings (I_{ct})	A	200	200	200	200	200	200
		400	400	400	400	400	400
		800	800	800	800	800	800
		1250	1250	1250	1250	1250	1250
		1600	1600	1600	1600	1600	1600
		2000	2000		2000	2000	2000
		2500	3200			2500	3200
Insulation Voltage (U_i) (50 / 60Hz)	V AC	1000	1000	1000	1000	1000	1000
Operational Voltage (U_e) (50 / 60Hz)	V AC	690	690	690	690	690	690
Impulse Voltage (Uimp)	kV	12	12	12	12	12	12
Rated Short Time Withstand (I_{CW})	1 sec	85	85	100	100	100	100
	3 sec	65	65	75	75	75	75
Total Breaking Time	Sec	0.03	0.03	0.03	0.03	0.03	0.03
Motor Charging Time (Max)	Sec	10	10	10	10	10	10
Closing Time (Max)	Sec	0.08	0.08	0.08	0.08	0.08	0.08
Latching Current	kA	85	85	85	85	85	85

Notes

1) Values in open air at 45 ºC. Refer chart at rear of catalogue for other temperature ratings.
2) Values for AR208S, AR212S, AR216S types with horizontal terminals. Values for others, including all AR-H types, have vertical terminals (see Horizontal options).
3) For 2 pole ACBs use outside poles of 3 pole ACB.
4) 4 Pole ACBs without Neutral phase protection cannot be applied to "IT" type earthing systems, which do not include a neutral.
5) Please contact NHP for DC application ACBs. AGR Trip Units cannot be used with DC currents.
6) NEMA / ANSI rated AR ACBs are not UL Certified. NEMA / ANSI ratings are shown for markets outside of North America, or for marine use, using NEMA ratings.

- When the INST trip function is set to NON, the MCR function should be enabled, otherwise, the breaking capacity equals the latching current.

i) = Available indent delivery only.

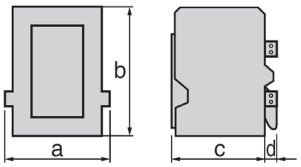
* AR-H High Fault series ACB's are available on an INDENT delivery basis. Refer NHP for delivery.

Short Circuit Capacity

AS / NZS and IEC Breaking and Making Capacities		AR325S	AR332S	AR316H	AR320H	AR325H*	AR332H*
Breaking Capacity kA [5)] (ICS = ICU) [kA sym rms] to AS / NZS and IEC	690V AC	65	65	85	85	85	85
	550V AC	65	65	85	85	85	85
	500V AC	85	85	85	85	85	85
	440V AC	85	85	100	100	100	100
	415V AC	85	85	100	100	100	100
Making Capacity (kA peak) to AS / NZS and IEC	690V AC	143	143	187	187	187	187
	550V AC	143	143	187	187	187	187
	500V AC	187	187	187	187	187	187
	440V AC	187	187	220	220	220	220
	415V AC	187	187	220	220	220	220

Physical

Number of Operating Cycles		AR325S	AR332S	AR316H	AR320H	AR325H*	AR332H*
Mechanical Life	with maintance	20000	20000	25000	25000	20000	20000
	without maintance	10000	10000	12000	12000	10000	10000
Electrical Life	460V AC	7000	7000	10000	10000	7000	7000
	690V AC (without maintenance)	5000	5000	7000	7000	5000	5000
Outline Dimensions: ACB + Carriage	a	460 / 580	460 / 580	460 / 580	460 / 580	460 / 580	460 / 580
	b	460	460	460	460	460	460
	c	345	345	345	345	345	345
	d	40	40	40	40	40	40



Standards

Based Standards	
AS/NZS 60947-2	Australian / New Zealand Standard
IEC 60947-2	International Electrotechnical Commission
EN60947-2	European Standard
JIS C8372	Japanese Industrial Standard
NEMA PUB NO.SG3	National Electrical Manufacturers Association
ANSI C37.13	American National Standard Institute

Certification and Authorisation	
ASTA, UK	ASTA Certification Services
NK, Japan	Nippon Kaiji Kyokai
LR, UK	Lloyd's Register of Shipping
ABS, USA	American Bureau of Shipping
GL, Germany	Germanischer Lloyd
BV, France	Bureau Veritas

Environmental

Standard Environment	The standard environment for ACBs is as follows:
Ambient Temperature	– 5°C to + 40°C. See following pages for ACB temperature ratings and busbar sizing for different temperatures
Relative Humidity	45% to 85%
Altitude	Below 2000m. A derating factor applies for higher elevations
Atmosphere	Excessive water vapor, oil vapor, smoke, dust, or corrosive gases must not exist. Sudden change in temperature, condensation, or icing must not occur. Otherwise, refer NHP for its range of climate control products
Vibration	TemPower 2 ACBs are designed to withstand electromagnetic and mechanical vibrations in accordance to IEC 68-2-6. (2-13.2Hz with amplitude of +/- 1 mm; 13.2 to 100Hz with an acceleration of 0.7g)
Low and High Temperatures	NHP can also supply environmental control solutions for switchboards – low and high temperature conditioning

Installation Types

Fixed Type	Yes
Draw-out Type	Yes

Temperature Ratings

Based Standard	JIS C 8201-2-1 Ann.1 Ann.2, IEC60947-2, EN60947-2, AS3947.2		
Type	**Terminal Arrangement**		
	Horizontal Terminals	**Vertical Terminals**	**Front Connections**
AR325S	2430	2500	2500
AR332S	2790	3200	3150
AR316H	1600	1600	-
AR320H	2000	2000	-
AR325H	2430	2500	-
AR332H	2790	3200	-

Notes
1) Contact NHP for details.

If different types of terminal arrangement are used for line and load sides refer to the ratings for the horizontal terminals.

Front connection cannot be specified with the different types of terminal arrangement for line and load sides.

General Guidelines

When a circuit breaker operates in an ambient temperature higher than the standard 40°C, the current carrying capacity of the circuit breaker may require a level of derating.

The degree to which circuit breaker derating is necessary depends upon the size and arrangement of busbars, ACB tag connection orientation, the size of the switchboard compartment where the ACB is mounted, the switchboard enclosure size, the degree of the enclosure ventilation, as well as other environmental factors.

The following tables can be used as a general guide to rating AR ACBs when the ambient temperature around the circuit breaker and its connections is known. It is possible however that varying conditions or the addition of other heat producing devices or even obstructions within the enclosure may require additional derating or an increased level of ventilation.

The values presented in the following tables are based upon test results and theoretical extrapolation. These tables are only intended to provide guidance and in no way substitute proven industrial design practices or temperature rise tests.

For When the Temperature Inside a Switchboard is Known

Standard Fault Series

Based Standards	Ambient Temperature (°C)	Type	AR325S	AR332S
		Connecting bar sizes	**2 x 50 x 6.3**	**2 x 80 x 6.3**
JIS C 8201-2-1 Ann.1 Ann. 2 IEC60947-2 EN 60947-2 AS3947.2	40 (Standard Ambient Temperature)		2500	3200
	45		2500	3200
	50		2500	3200
	55		2500	2990
	60		2400	2850
NEMA, SG-3 ANSI C37.13	40 (Standard Ambient Temperature)		2500	3200
	45		2500	3010
	50		2440	2860
	55		2300	2690
	60		2150	2520

Notes Standard Fault Series
- The values are applicable for both Draw-out and Fixed type.
- The values of AR332S are for vertical terminals on both line and load side.
- Above figures are subject to the design of the enclosure and rating of busbar.

High Fault Series

AR316H	AR320H	AR325H	AR332H
2 x 80 x 6.3	**2 x 100 x 6.3**	**3 x 100 x 6.3**	**3 x 100 x 6.3**
1600	2000	2500	3200
1600	2000	2500	3200
1600	2000	2500	3200
1600	2000	2500	2990
1600	2000	2400	2850
1600	2000	2500	3200
1600	2000	2500	3010
1600	2000	2440	2860
1600	1950	2300	2960
1550	1830	2150	2520

Notes High Fault Series
- The values are for vertical terminals on both line and load side.

TemPower 2 Busbar Connection Sizing

The temperatures shown represent the °C ambient temperature inside a switchboard where the ACB is installed.

- Busbars are to be of high conducting copper
- The maximum permissible busbar temperature is 100°C
- Spacers must be used where multiple busbars are connected For example, 6.3 mm spacers for 6.3 mm busbars and 10 mm spacers for 10 mm busbars

Example of a typical selection situation:

- Draw out ACB
- Horizontal connections
- 50°C ambient temperature
- Service current to be 1600 A

Solution:

Refer to the table for horizontal connections. By looking at the 50°C column and 1600A row, the ACB required would need to be an AR316H 1600A ACB, with 3 x 63 mm by 6.3 mm or 2 x 50 mm by 10 mm busbars connected.

Horizontal Connections for a Draw Out ACB

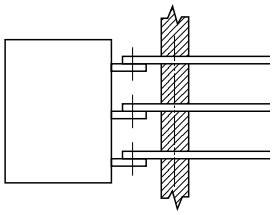
Standard Series	40°C			50°C			60°C		
	ACB	6.3 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar
1600	AR316H	3 - 50 X 6.3	2 - 50 X 10	AR316H	3 - 63 X 6.3	2 - 50 X 10	AR316H	4 - 63 X 6.3	2 - 63 X 10
2000	AR320H	4 - 63 X 6.3	3 - 63 X 6.3	AR320H	5 - 63 X 6.3	3 - 63 X 10	AR320H	-	3 - 80 X 10
2200	AR325S / H	4 - 80 X 6.3	3 - 63 X 10	AR325S / H	4 - 80 X 6.3	3 - 80 X 10	AR325S / H	-	3 - 80 X 10
2500	AR325S / H	-	3 - 80 X 10	AR325S / H	-	4 - 80 X 10	AR325S / H	-	4 - 80 X 10
2800	AR325S / H	-	4 - 80 X 10	-	-	-	-	-	-

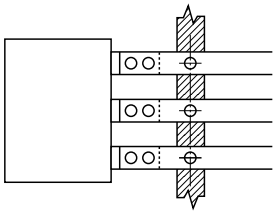
Vertical Connections for a Draw Out ACB

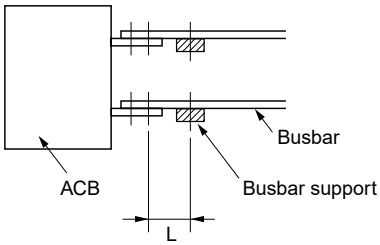
Max. Service Amps	40°C			50°C			60°C		
	ACB	3.6 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar
1600	AR316H	2 - 80 X 6.3	1 - 80 X 10	AR316H	2 - 80 X 6.3	1 - 100 X 10	AR316H	2 - 100 X 6.3	2 - 63 X 10
2000	AR320H	2 - 100 X 6.3	2 - 63 X 10	AR320H	2 - 125 X 6.3	2 - 80 X 10	AR320H	3 - 100 X 6.3	2 - 80 X 10
2200	AR325S / H	2 - 125 X 6.3	2 - 63 X 10	AR325S / H	2 - 125 X 6.3	2 - 63 X 10	AR325S / H	3 - 100 X 6.3	2 - 80 X 10
2500	AR325S / H	2 - 125 X 6.3	2 - 80 X 10	AR325S / H	3 - 100 X 6.3	2 - 100 X 10	AR325S / H	3 - 100 X 6.3	2 - 100 X 10
2800	AR332S / H	3 - 100 X 6.3	2 - 100 X 10	AR332S / H	3 - 100 X 6.3	2 - 100 X 10	AR332S / H	3 - 125 X 6.3	3 - 100 X 10
3000	AR332S / H	3 - 125 X 6.3	3 - 80 X 10	AR332S / H	4 - 125 X 6.3	3 - 100 X 10	AR332S / H	4 - 125 X 6.3	3 - 100 X 10
3200	AR332S / H	4 - 125 X 6.3	3 - 100 X 10	AR332S / H	4 - 160 X 6.3	4 - 100 X 10	AR332S / H	4 - 125 X 6.3	4 - 100 X 10

Technical Data – Busbar Connection Supports

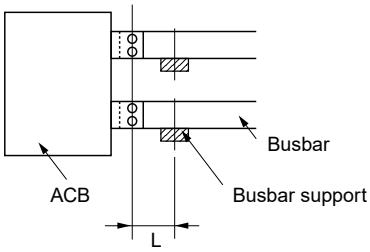
The busbars to the ACB should be firmly supported near the ACB terminal. Fault current flow through the busbars can develop significant electromagnetic force between the busbars, and the support must be strong enough to withstand such forces. The ACB terminals should not be relied upon as a busbar support, as in addition to potential electrical forces, the weight may also cause damage to the ACB terminals and mouldings.



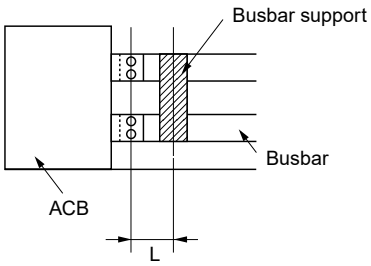




Horizontal terminals



Vertical terminals



Vertical terminals

Horizontal Terminals

Vertical Terminals

Front Terminals

Short Circuit Current (kA)		30	50	65	80	100	120
Distance L (mm)	AR3 type	350	300	250	150	150	100

Technical Data – Dielectric Strength, Internal Resistance, Power Consumption

Dielectric Strength

Circuit			Withstand Voltage (at 50 / 60Hz)		Rated Impulse Withstand Voltage U_{imp}
Main Circuit			Between terminals, terminal group to earth	AC 3500V for 1 minute	12kV
Control Circuits	Auxiliary switches	For general service	terminal group to earth	AC 2500V for 1 minute	6kV
		For microload	terminal group to earth	AC 2000V for 1 minute	4kV
	Position switches		terminal group to earth	AC 2000V for 1 minute	4kV
	Trip Unit		terminal group to earth	AC 2000V for 1 minute	4kV
	Power supply for undervoltage / reverse power trip function		terminal group to earth	AC 2500V for 1 minute	6kV
Other Accessories			terminal group to earth	AC 2000V for 1 minute	4kV

Notes
The values shown above are those measured on phase connections and cannot be applied to control terminals on the ACB.

Internal Resistance and Power Loss

	Standard Series		High Fault Series			
Type	**AR325S**	**AR332S**	**AR316H**	**AR320H**	**AR325H**	**AR332H**
Rated Current (A)	2500	3200	1600	2000	2500	3200
DC Internal Resistance Per Pole (mΩ)	0.014	0.014	0.014	0.014	0.014	0.014
DC Power Consumption for 3 poles (W)[1)]	263	430	108	168	263	430
AC Power Consumption for 3 poles (W)	600	780	310	430	600	780

Notes
1) Above figures are based on the calculation of 3 x I2R. For more information please contact NHP.

4000 A (AR4) Frame Size 3

The Terasaki 'TemPower 2 AR' series of Air Circuit Breakers (ACBs) are intended for both industrial and commercial applications.

AR440SB

AR440S

Key Features of the Terasaki TemPower 2 Range

Highest Levels of Performance

Unique Breaking Contact Design

TemPower 2 is the world's first Double Break ACB, having two breaking contacts per phase, allowing the short time withstand rating (I_{cw} 1 second) to equal to the service short circuit breaking capacity (I_{cs}) ensuring short circuit selectivity.

Rapid Fault Clearance

The TemPower 2 clears short-circuit faults in less that 30 ms* which minimises thermal and mechanical stress on busbars and reduces arc flash energy during a fault.

Highest Levels of Protection and Safety

Flexible LSI Protection Curve Characteristics

TemPower 2 is the only ACB that offers trip units with time-current characteristics to comply with three different standards and super fine level setting adjustment.

3C Temperature Condition Monitoring and Fire Hazard Prevention System

TemPower 2 has a breakthrough self-monitoring temperature system for checking the condition of the main contacts and conductive path using integrated thermistors.

Early-make-late-break Neutral (N) design

4-pole models have a fully rated, early-make-late-break Neutral (N) design which eliminates the risk of abnormal line to neutral voltages, which may damage sensitive electronic equipment (i.e. Hospital etc).

*30 ms figure applicable for all models except 5000/6300 A frame size

Highest Levels of Reliability

Operational Endurance

Double Break contacts increase service life. Endurance ratings are the best available and exceed the requirements of AS/NZS 60 947-2

Reduced Time to Repair and Easy Maintenance

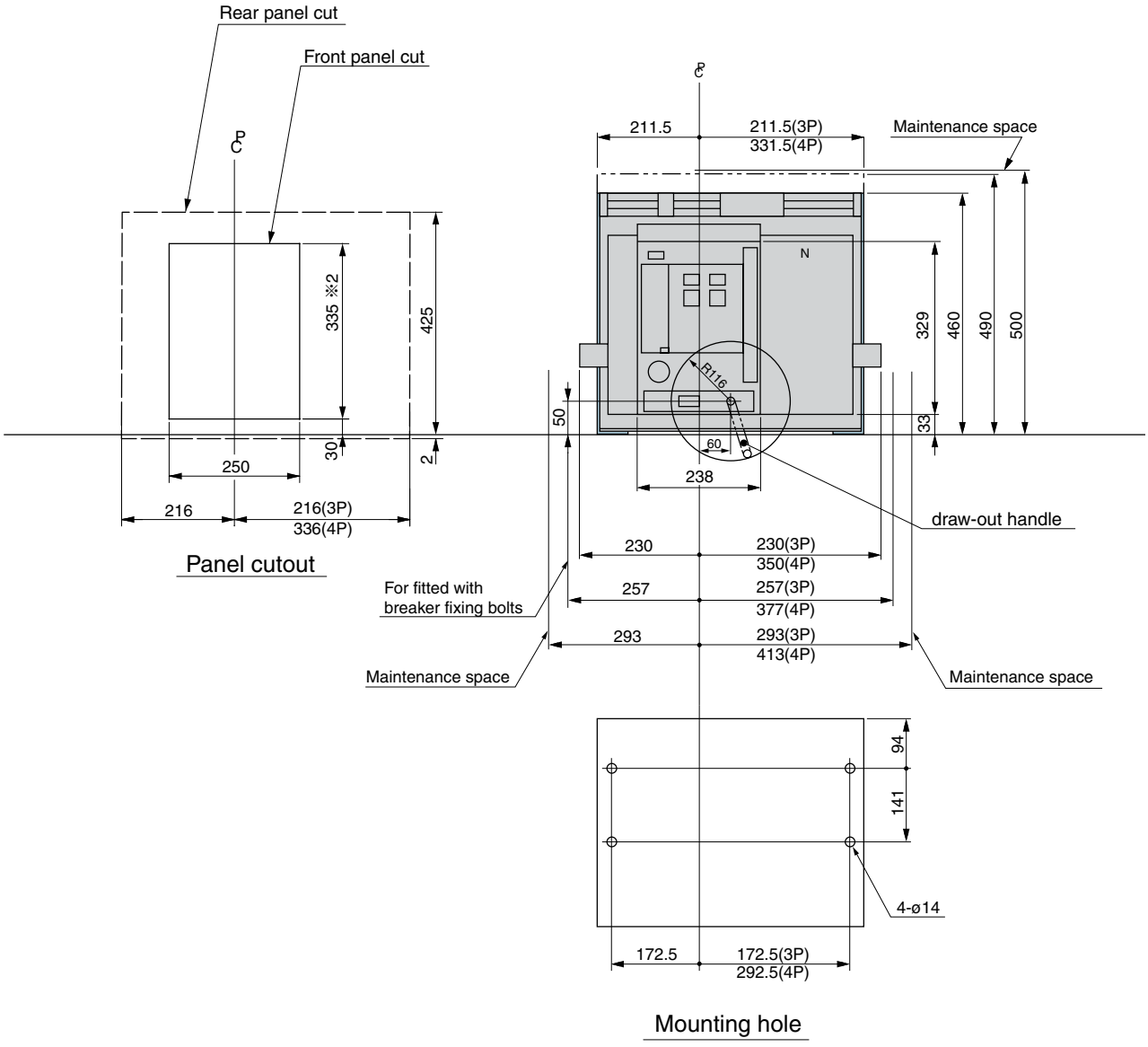
The modular Double Break contact construction allows on-site replacement of each contact set in minimal time.

Contact clusters are uniquely located on the ACB body, all serviceable parts are available for inspection, dramatically reducing power down time.

General	The Terasaki AR4 ACB in frame size 3 comes in a fully body width type as standard. A compact design called the AR4SB is also available as a special order from Japan. The AR4 is 'standard type' rated for 100kA I_{cu} at 440V AC.	
Nominal Current Ratings	4000A	
Number of Poles	3 or 4	
Short Circuit Ratings	**Standard Type**	100kA @ 440V AC
		75kA @ 690V AC
	High Capacity Type	120kA @ 440V AC
		75kA @ 690V AC
Connection Type	Withdrawable as standard, fixed type is not available	
Terminal Configurations	Vertical / Vertical only	

Detailed Dimensions - Draw-out Type

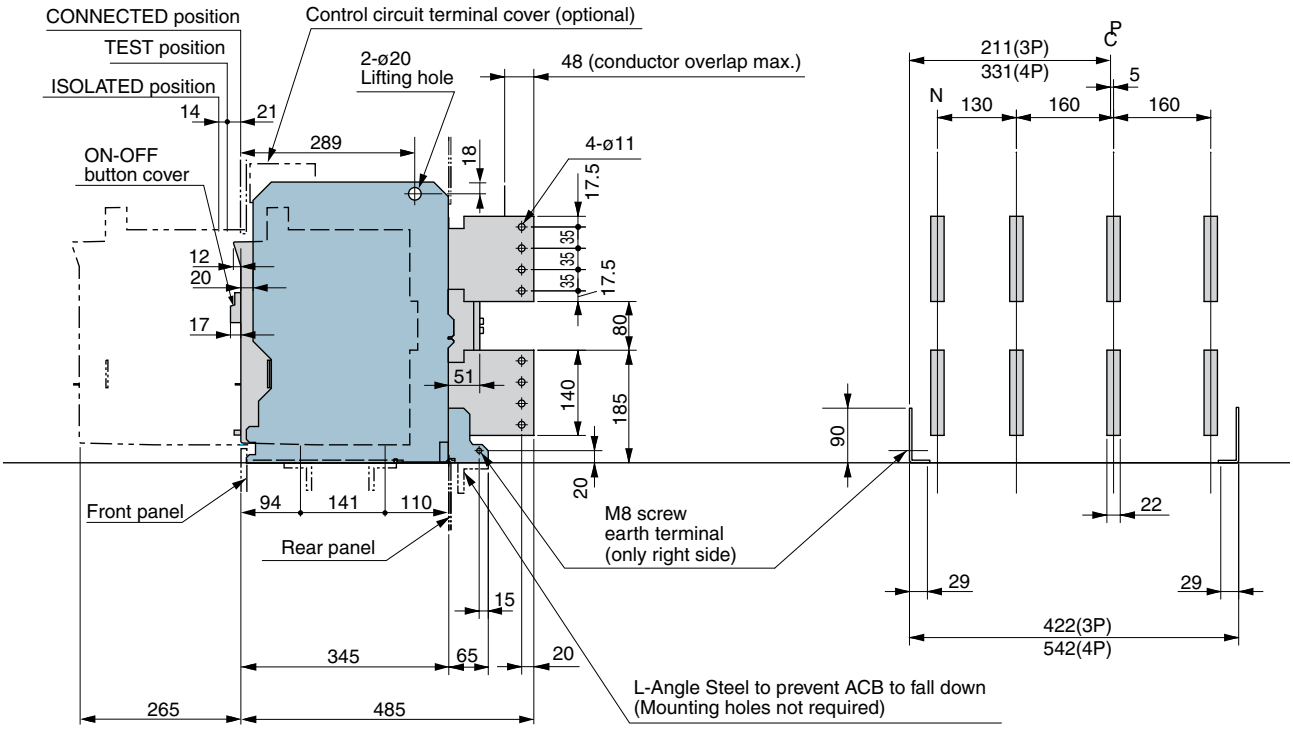
Type AR440SB



Notes

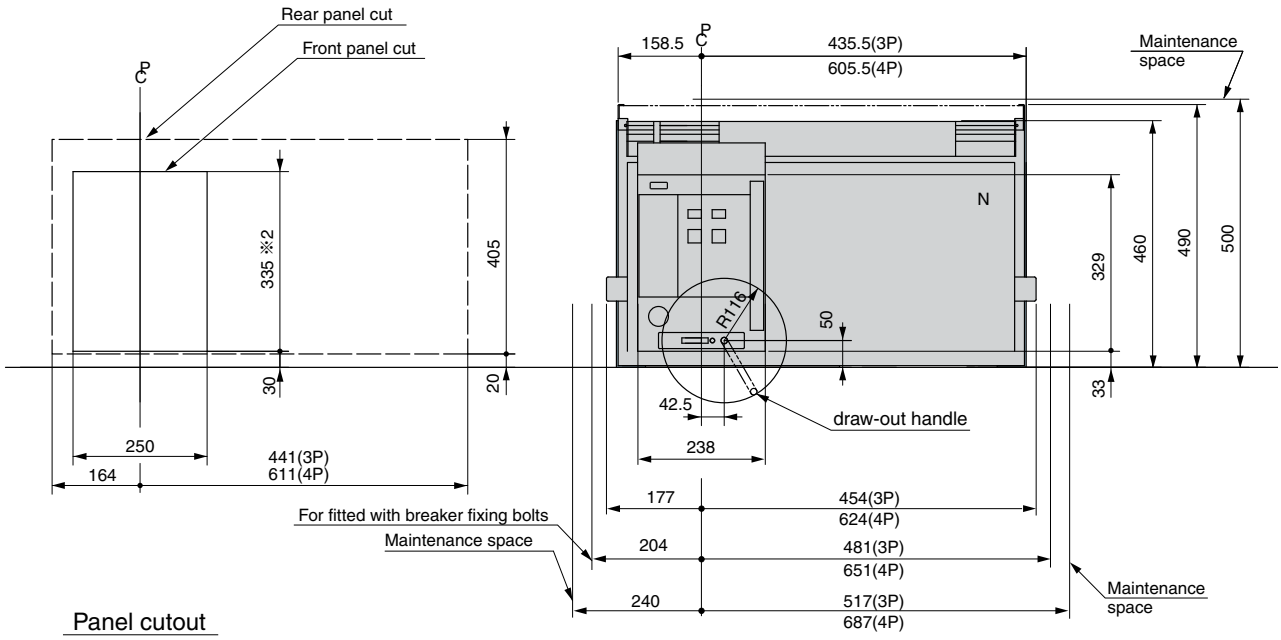
※ 2: Panel cut should be 339 mm not 335 mm when the door flange is used.

- N represents the neutral pole of 4-pole ACBs.


CONNECTED position
TEST position
ISOLATED position
Control circuit terminal cover (optional)
2-ø20
Lifting hole
48 (conductor overlap max.)
4-ø11
ON-OFF
button cover
14
21
289
18
17.5
35
35
35
17.5
12
20
17
80
51
140
185
20
90
Front panel
94
141
110
Rear panel
M8 screw
earth terminal
(only right side)
15
345
65
20
265
485
L-Angle Steel to prevent ACB to fall down
(Mounting holes not required)
211(3P)
331(4P)
P
C
5
N
130
160
160
22
29
29
422(3P)
542(4P)

Detailed Dimensions - Draw-Out Type

Type AR440S, AR420H (3 poles only), AR440H (3 poles only)

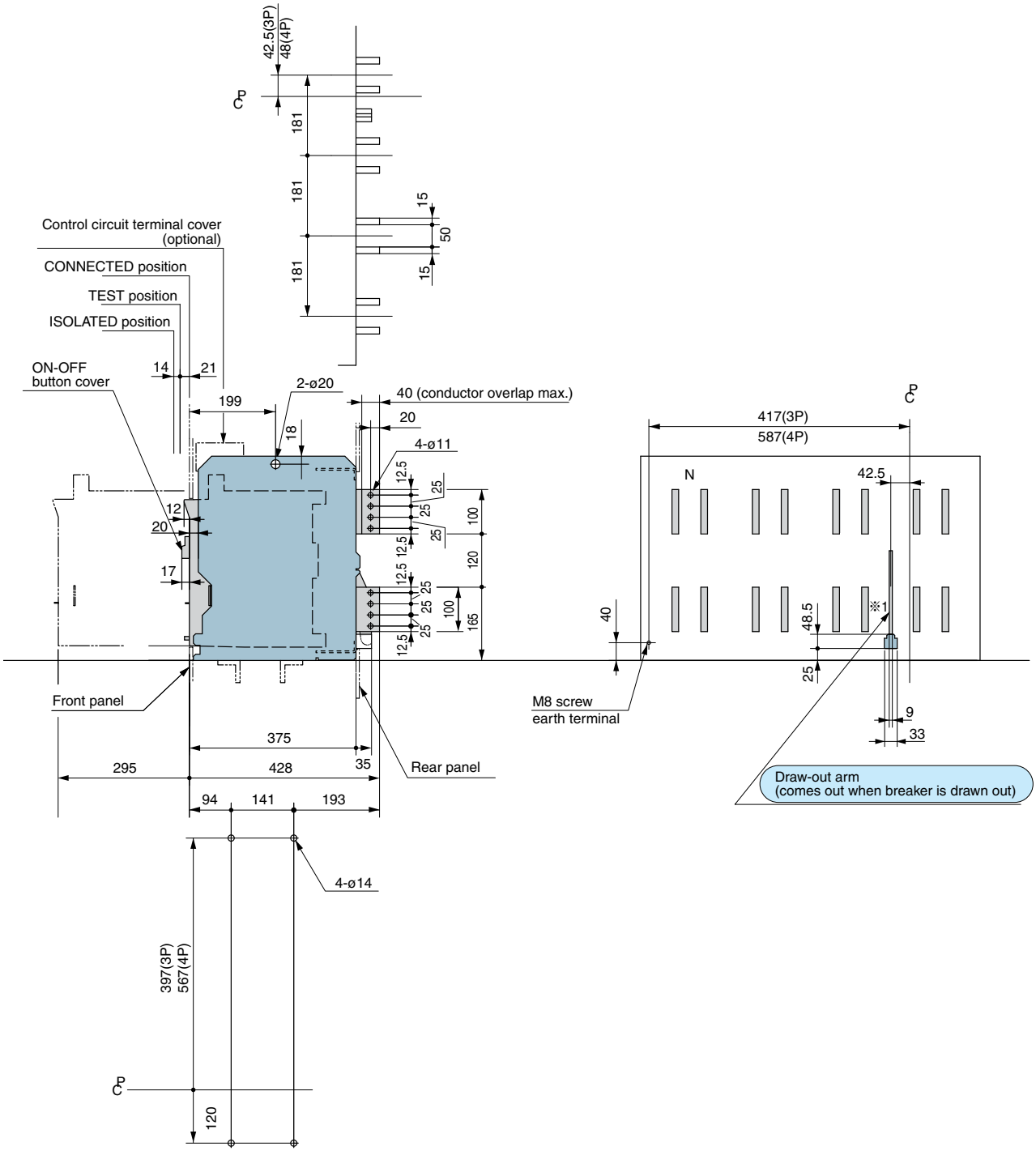


Notes

※ 1: Conductors including connecting bolts should be separated min. 7 mm from Draw-out arm.

※ 2: Panel cut should be 339 mm not 335 mm when the door flange is used.

- N represents the neutral pole of 4-pole ACBs.
- AR420H and AR440H are 3 poles only.


42.5(3P)
48(4P)
181
181
181
15
50
15
Control circuit terminal cover
(optional)
CONNECTED position
TEST position
ISOLATED position
ON-OFF
button cover
14
21
199
2-ø20
40 (conductor overlap max.)
20
4-ø11
18
12
20
17
12.5
25
25
25
100
120
12.5
25
25
25
100
165
12.5
25
Front panel
375
295
428
35
Rear panel
94
141
193
4-ø14
397(3P)
567(4P)
120
417(3P)
587(4P)
N
42.5
40
48.5
※1
25
M8 screw
earth terminal
9
33
Draw-out arm
(comes out when breaker is drawn out)

Ratings

AR-S Standard Break / AR-H High Break TemPower 2		AR440S	AR420H	AR440H
Rated Current (I_N) 1) 2)	A	4000	2000	4000
Number of Poles 3) 4)		3 or 4	3 or 4	3 or 4
Current Transformer Ratings (I_{ct})	A	4000	2000	4000
Insulation Voltage (U_i) (50 / 60 Hz)	V AC	1000	1000	1000
Operational Voltage (U_e) (50 / 60 Hz)	V AC	690	690	690
Impulse Voltage (Uimp)	kV	12	12	12
Rated Short Time Withstand (I_{CW})	1 sec	100	100	100
	3 sec	85	85	85
Total Breaking Time	Sec	0.03	0.03	0.03
Motor Charging Time (Max)	Sec	10	10	10
Closing Time (Max)	Sec	0.08	0.08	0.08
Latching Current	kA	100	100	100

Short Circuit Capacity

AS / NZS and IEC Breaking and Making Capacities		AR440S	AR420H	AR440H
Breaking Capacity kA 5) (ICS = ICU) [kA sym rms] to AS / NZS and IEC	690V AC	75	75	75
	550V AC	75	75	75
	500V AC	90	90	90
	440V AC	100	120	120
	415V AC	100	120	120
Making Capacity (kA peak) to AS / NZS and IEC	690V AC	165	165	165
	550V AC	165	165	165
	500V AC	198	198	198
	440V AC	220	264	264
	415V AC	220	264	264

Notes

1) Values in open air at 45ºC. Refer chart at rear of catalogue for other temperature ratings.

2) Values for AR208S, AR212S, AR216S types with horizontal terminals. Values for others, including all AR-H types, have vertical terminals (see Horizontal options).

3) For 2 pole ACBs use outside poles of 3 pole ACB.

4) 4 Pole ACBs without Neutral phase protection cannot be applied to “IT” type earthing systems, which do not include a neutral.

5) Please contact NHP for DC application ACBs. AGR Trip Units cannot be used with DC currents.

6) NEMA / ANSI rated AR ACBs are not UL Certified. NEMA / ANSI ratings are shown for markets outside of North America, or for marine use, using NEMA ratings.

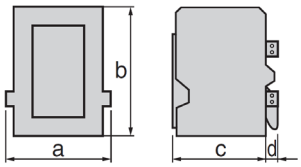
- When the INST trip function is set to NON, the MCR function should be enabled, otherwise, the breaking capacity equals the latching current.

i) = Available indent delivery only.

* AR-H High Fault series ACB’s are available on an INDENT delivery basis. Refer NHP for delivery.

Physical

Number of Operating Cycles		AR440S	AR420H	AR440H
Mechanical Life	with maintance	15000	15000	10000
	without maintance	8000	8000	8000
Electrical Life	460V AC	3000	3000	3000
	690V AC (without maintenance)	2500	2500	2500
Outline Dimensions: ACB + Carriage	a	631 / 801	631	631
	b	460	460	460
	c	375	375	375
	d	53	53	53



Standards

Based Standards	
AS/NZS 60947-2	Australian / New Zealand Standard
IEC 60947-2	International Electrotechnical Commission
EN60947-2	European Standard
JIS C8372	Japanese Industrial Standard
NEMA PUB NO.SG3	National Electrical Manufacturers Association
ANSI C37.13	American National Standard Institute

Certification and Authorisation	
ASTA, UK	ASTA Certification Services
NK, Japan	Nippon Kaiji Kyokai
LR, UK	Lloyd's Register of Shipping
ABS, USA	American Bureau of Shipping
GL, Germany	Germanischer Lloyd
BV, France	Bureau Veritas

Environmental

Standard Environment	The standard environment for ACBs is as follows:
Ambient Temperature	– 5°C to + 40°C. See following pages for ACB temperature ratings and busbar sizing for different temperatures
Relative Humidity	45% to 85%
Altitude	Below 2000m. A derating factor applies for higher elevations
Atmosphere	Excessive water vapor, oil vapor, smoke, dust, or corrosive gases must not exist. Sudden change in temperature, condensation, or icing must not occur. Otherwise, refer NHP for its range of climate control products
Vibration	TemPower 2 ACBs are designed to withstand electromagnetic and mechanical vibrations in accordance to IEC 68-2-6. (2-13.2Hz with amplitude of +/- 1 mm; 13.2 to 100Hz with an acceleration of 0.7g)
Low and High Temperatures	NHP can also supply environmental control solutions for switchboards – low and high temperature conditioning

Installation Types

Fixed Type	No
Draw-out Type	Yes

Temperature Ratings

Based Standard	JIS C 8201-2-1 Ann.1 Ann.2, IEC60947-2, EN60947-2, AS3947.2		
Type	**Terminal Arrangement**		
	Horizontal Terminals	**Vertical Terminals**	**Front Connections**
AR440S	-	4000	-

Notes
1) Contact NHP for details.

If different types of terminal arrangement are used for line and load sides refer to the ratings for the horizontal terminals.

Front connection cannot be specified with the different types of terminal arrangement for line and load sides.

General Guidelines

When a circuit breaker operates in an ambient temperature higher than the standard 40°C, the current carrying capacity of the circuit breaker may require a level of derating.

The degree to which circuit breaker derating is necessary depends upon the size and arrangement of busbars, ACB tag connection orientation, the size of the switchboard compartment where the ACB is mounted, the switchboard enclosure size, the degree of the enclosure ventilation, as well as other environmental factors.

The following tables can be used as a general guide to rating AR ACBs when the ambient temperature around the circuit breaker and its connections is known. It is possible however that varying conditions or the addition of other heat producing devices or even obstructions within the enclosure may require additional derating or an increased level of ventilation.

The values presented in the following tables are based upon test results and theoretical extrapolation. These tables are only intended to provide guidance and in no way substitute proven industrial design practices or temperature rise tests.

For When the Temperature Inside a Switchboard is Known

Standard Fault Series

Based Standards	Ambient Temperature (°C)	Type	AR440SB	AR440S
		Connecting bar sizes	**2 x 50 x 6.3**	**2 x 80 x 6.3**
JIS C 8201-2-1 Ann.1 Ann. 2 IEC60947-2 EN 60947-2 AS3947.2	40 (Standard Ambient Temperature)		4000	4000
	45		4000	4000
	50		3940	4000
	55		3820	3940
	60		3690	3760
NEMA, SG-3 ANSI C37.13	40 (Standard Ambient Temperature)		3310	3700
	45		3200	3580
	50		3100	3470
	55		2980	3350
	60		2870	3140

Notes Standard Fault Series
- The values are applicable for Draw-out type.
- The values of AR440SB and AR440S are for vertical terminals on both line and load side.
- Above figures are subject to the design of the enclosure and rating of busbar.

High Fault Series

AR420H	AR440H
2 x 80 x 6.3	**2 x 100 x 6.3**
2000	4000
2000	4000
2000	4000
2000	3940
2000	3760
2000	3700
2000	3580
2000	3470
2000	3350
2000	3140

Notes High Fault Series
- The values are for vertical terminals on both line and load side.
- Above figures are subject to the design of the enclosure and rating of busbar.

TemPower 2 Busbar Connection Sizing

The temperatures shown represent the °C ambient temperature inside a switchboard where the ACB is installed.

- Busbars are to be of high conducting copper
- The maximum permissible busbar temperature is 100°C
- Spacers must be used where multiple busbars are connected For example, 6.3 mm spacers for 6.3 mm busbars and 10 mm spacers for 10 mm busbars

Example of a typical selection situation:

- Draw out ACB
- Vertical connections
- 50°C ambient temperature
- Service current to be 3600 A

Solution:

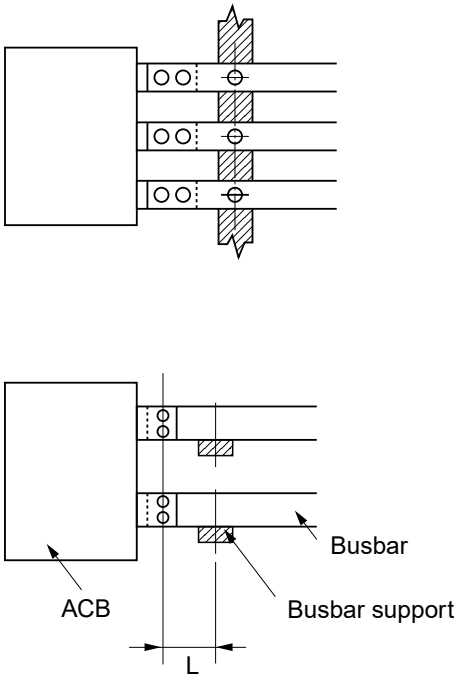
Refer to the table for horizontal connections. By looking at the 50°C column and 3600A row, the ACB required would need to be an AR440S 3600A ACB, with 4 x 160 mm by 6.3 mm or 4 x 100 mm by 10 mm busbars connected.

Vertical Connections for a Draw Out ACB

Max. Service Amps	40°C			50°C			60°C		
	ACB	3.6 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar
3600	AR440S	4 - 160 X 6.3	4 - 100 X 10	AR440S	4 - 160 X 6.3	4 - 100 X 10	AR440S	4 - 160 X 6.3	4 - 100 X 10
4000	AR440S	4 - 160 X 6.3	4 - 100 X 10	AR440S	4 - 160 X 6.3	4 - 200 X 10	AR440S	-	-

Technical Data – Busbar Connection Supports

The busbars to the ACB should be firmly supported near the ACB terminal. Fault current flow through the busbars can develop significant electromagnetic force between the busbars, and the support must be strong enough to withstand such forces. The ACB terminals should not be relied upon as a busbar support, as in addition to potential electrical forces, the weight may also cause damage to the ACB terminals and mouldings.



Vertical terminals

Vertical Terminals

Short Circuit Current (kA)		30	50	65	80	100	120
Distance L (mm)	AR4 type	350	300	250	150	150	100

Technical Data – Dielectric Strength, Internal Resistance, Power Consumption

Dielectric Strength

Circuit			Withstand Voltage (at 50 / 60 Hz)		Rated Impulse Withstand Voltage Uimp
Main Circuit			Between terminals, terminal group to earth	AC 3500V for 1 minute	12kV
Control Circuits	Auxiliary switches	For general service	terminal group to earth	AC 2500V for 1 minute	6kV
		For microload	terminal group to earth	AC 2000V for 1 minute	4kV
	Position switches		terminal group to earth	AC 2000V for 1 minute	4kV
	Trip Unit		terminal group to earth	AC 2000V for 1 minute	4kV
	Power supply for undervoltage / reverse power trip function		terminal group to earth	AC 2500V for 1 minute	6kV
Other Accessories			terminal group to earth	AC 2000V for 1 minute	4kV

Notes
The values shown above are those measured on phase connections and cannot be applied to control terminals on the ACB.

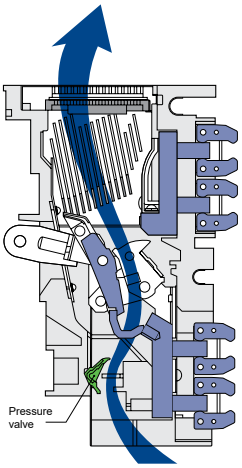
Internal Resistance and Power Loss

	Standard Series
Type	**AR440S**
Rated Current (A)	4000
DC Internal Resistance Per Pole (mΩ)	0.014
DC Power Consumption for 3 poles (W)[1)]	672
AC Power Consumption for 3 poles (W)	1060

Notes
1) Above figures are based on the calculation of 3 x I2R. For more information please contact NHP.

5000 A-6300 A (AR6) Frame Size 4

The 'TemPower 2 AR6' (5000 A and 6300 A) has a unique contact design that interrupts the current at two points on the line side of the ACB, while dissipating heat from essential components such as the main contacts and terminals by efficient air convection through a pressure value.



Key Features of the Terasaki TemPower 2 Range

Highest Levels of Performance

Unique Breaking Contact Design

TemPower 2 is the world's first Double Break ACB, having two breaking contacts per phase, allowing the short time withstand rating (I_{cw} 1 second) to equal to the service short circuit breaking capacity (I_{cs}) ensuring short circuit selectivity.

Highest Levels of Protection and Safety

Flexible LSI Protection Curve Characteristics

TemPower 2 is the only ACB that offers trip units with time-current characteristics to comply with three different standards and super fine level setting adjustment.

3C Temperature Condition Monitoring and Fire Hazard Prevention System

TemPower 2 has a breakthrough self-monitoring temperature system for checking the condition of the main contacts and conductive path using integrated thermistors.

Early-make-late-break Neutral (N) design

4-pole models have a fully rated, early-make-late-break Neutral (N) design which eliminates the risk of abnormal line to neutral voltages, which may damage sensitive electronic equipment (ie. Hospital etc).

Highest Levels of Reliability

Operational Endurance

Double Break contacts increase service life. Endurance ratings are the best available and exceed the requirements of AS/NZS 60 947-2

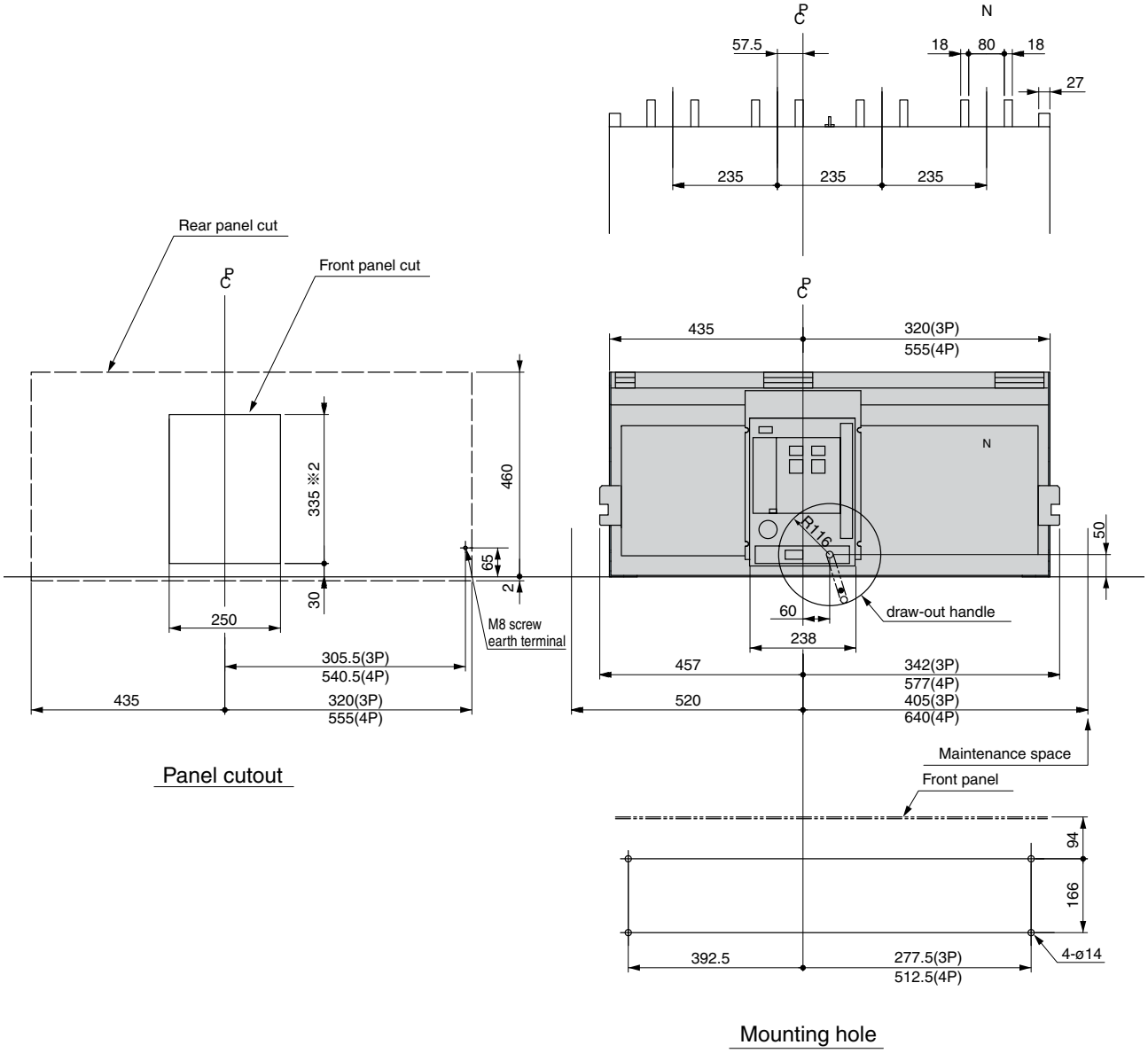
Reduced Time to Repair and Easy Maintenance

Contact clusters are uniquely located on the ACB body, all serviceable parts are available for inspection, dramatically reducing power down time.

General	The Terasaki AR6 ACB in frame size 4 comes in a fully body width type as standard. The AR6 'standard type' is rated for 120kA Icu at 440V AC.	
Nominal Current Ratings	5000A, 6300A	
Number of Poles	3 or 4	
Short Circuit Ratings	**Standard Type**	120kA @ 440V AC
		85kA @ 690V AC
	High Capacity Type	135kA @ 440V AC
		85kA @ 690V AC
Connection Type	Withdrawable as standard, fixed type is not available	
Terminal Configurations	Vertical / Vertical only	

Detailed Dimensions - Draw-Out Type

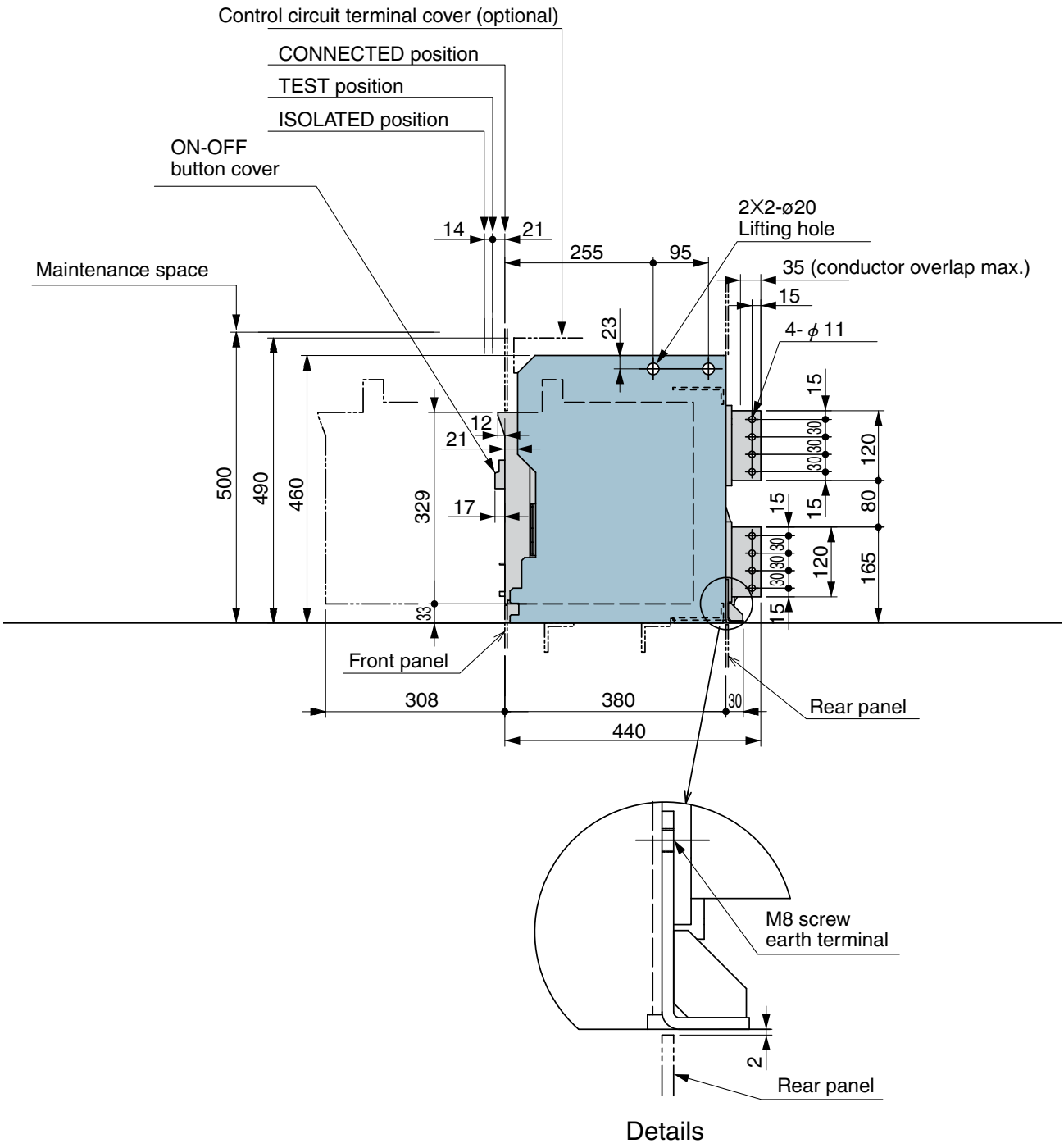
Type AR650S, AR663S, AR663H



Notes

※ 2: Panel cut should be 339 mm not 335 mm when the door flange is used.

- N represents the neutral pole of 4-pole ACBs.


Control circuit terminal cover (optional)
CONNECTED position
TEST position
ISOLATED position
ON-OFF
button cover
Maintenance space
14
21
255
95
2X2-ø20
Lifting hole
35 (conductor overlap max.)
15
4- ϕ 11
23
12
21
17
329
500
490
460
33
15
30
30
30
120
15
15
80
30
30
30
120
165
15
Front panel
308
380
30
440
Rear panel
M8 screw
earth terminal
2
Rear panel

Details

Ratings

AR-S Standard Break / AR-H High Break TemPower 2		AR650S	AR663S	AR663H*
Rated Current (I_N) [1) 2)]	A	5000	6300	6300
Number of Poles [3) 4)]		3 or 4	3 or 4	3 or 4
Current Transformer Ratings (I_{ct})	A	5000	6300	6300
Insulation Voltage (U_i) (50 / 60 Hz)	V AC	1000	1000	1000
Operational Voltage (U_e) (50 / 60 Hz)	V AC	690	690	690
Impulse Voltage (Uimp)	kV	12	12	12
Rated Short Time Withstand (I_{CW})	1 sec	120	120	135
	3 sec	85	85	85
Total Breaking Time	Sec	0.05	0.05	0.05
Motor Charging Time (Max)	Sec	10	10	10
Closing Time (Max)	Sec	0.08	0.08	0.08
Latching Current	kA	120	120	120

Short Circuit Capacity

AS / NZS and IEC Breaking and Making Capacities		AR650S	AR663S	AR663H*
Breaking Capacity kA [5)] (ICS = ICU) [kA sym rms] to AS / NZS and IEC	690 V AC	85	85	85
	550 V AC	100	100	85
	500 V AC	120	120	135
	440 V AC	120	120	135
	415 V AC	120	120	135
Making Capacity (kA peak) to AS / NZS and IEC	690 V AC	187	187	187
	550 V AC	230	230	187
	500 V AC	264	264	297
	440 V AC	264	264	297
	415 V AC	264	264	297

Notes

1) Values in open air at 45ºC. Refer chart at rear of catalogue for other temperature ratings.
2) Values for AR208S, AR212S, AR216S types with horizontal terminals. Values for others, including all AR-H types, have vertical terminals (see Horizontal options).
3) For 2 pole ACBs use outside poles of 3 pole ACB.
4) 4 Pole ACBs without Neutral phase protection cannot be applied to “IT” type earthing systems, which do not include a neutral.
5) Please contact NHP for DC application ACBs. AGR Trip Units cannot be used with DC currents.
6) NEMA / ANSI rated AR ACBs are not UL Certified. NEMA / ANSI ratings are shown for markets outside of North America, or for marine use, using NEMA ratings.

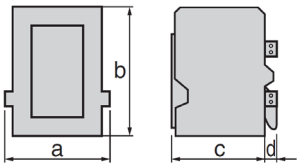
- When the INST trip function is set to NON, the MCR function should be enabled, otherwise, the breaking capacity equals the latching current.

i) = Available indent delivery only.

* AR-H High Fault series ACB’s are available on an INDENT delivery basis. Refer NHP for delivery.

Physical

Number of Operating Cycles		AR650S	AR663S	AR663H*
Mechanical Life	with maintance	10000	10000	10000
	without maintance	5000	5000	5000
Electrical Life	460V AC	1000	1000	1000
	690V AC (without maintenance)	500	500	500
Outline Dimensions: ACB + Carriage	a	799 / 1034	799 / 1034	799 / 1034
	b	460	460	460
	c	380	380	380
	d	60	60	60



Standards

Based Standards	
AS/NZS 60947-2	Australian / New Zealand Standard
IEC 60947-2	International Electrotechnical Commission
EN60947-2	European Standard
JIS C8372	Japanese Industrial Standard
NEMA PUB NO.SG3	National Electrical Manufacturers Association
ANSI C37.13	American National Standard Institute

Certification and Authorisation	
ASTA, UK	ASTA Certification Services
NK, Japan	Nippon Kaiji Kyokai
LR, UK	Lloyd's Register of Shipping
ABS, USA	American Bureau of Shipping
GL, Germany	Germanischer Lloyd
BV, France	Bureau Veritas

Environmental

Standard Environment	The standard environment for ACBs is as follows:
Ambient Temperature	– 5°C to + 40°C. See following pages for ACB temperature ratings and busbar sizing for different temperatures
Relative Humidity	45% to 85%
Altitude	Below 2000m. A derating factor applies for higher elevations
Atmosphere	Excessive water vapor, oil vapor, smoke, dust, or corrosive gases must not exist. Sudden change in temperature, condensation, or icing must not occur. Otherwise, refer NHP for its range of climate control products
Vibration	TemPower 2 ACBs are designed to withstand electromagnetic and mechanical vibrations in accordance to IEC 68-2-6. (2-13.2Hz with amplitude of +/- 1 mm; 13.2 to 100Hz with an acceleration of 0.7g)
Low and High Temperatures	NHP can also supply environmental control solutions for switchboards – low and high temperature conditioning

Installation Types

Fixed Type	No
Draw-out Type	Yes

Temperature Ratings

Based Standard	JIS C 8201-2-1 Ann.1 Ann.2, IEC60947-2, EN60947-2, AS3947.2		
Type	Terminal Arrangement		
	Horizontal Terminals	Vertical Terminals	Front Connections
AR650S	-	5000	-

Notes
1) Contact NHP for details.

If different types of terminal arrangement are used for line and load sides refer to the ratings for the horizontal terminals.

Front connection cannot be specified with the different types of terminal arrangement for line and load sides.

General Guidelines

When a circuit breaker operates in an ambient temperature higher than the standard 40°C, the current carrying capacity of the circuit breaker may require a level of derating.

The degree to which circuit breaker derating is necessary depends upon the size and arrangement of busbars, ACB tag connection orientation, the size of the switchboard compartment where the ACB is mounted, the switchboard enclosure size, the degree of the enclosure ventilation, as well as other environmental factors.

The following tables can be used as a general guide to rating AR ACBs when the ambient temperature around the circuit breaker and its connections is known. It is possible however that varying conditions or the addition of other heat producing devices or even obstructions within the enclosure may require additional derating or an increased level of ventilation.

The values presented in the following tables are based upon test results and theoretical extrapolation. These tables are only intended to provide guidance and in no way substitute proven industrial design practices or temperature rise tests.

For When the Temperature Inside a Switchboard is Known

Standard Fault Series | **High Fault Series**

Based Standards	Ambient Temperature (°C)	Type	AR650S	AR663S	AR663H
		Connecting bar sizes	2 x 50 x 6.3	2 x 80 x 6.3	2 x 80 x 6.3
JIS C 8201-2-1 Ann.1 Ann. 2 IEC60947-2 EN 60947-2 AS3947.2	40 (Standard Ambient Temperature)		5000	6300	6300
	45		5000	6300	6300
	50		4950	6000	6000
	55		4710	5680	5680
	60		4450	5370	5370
NEMA, SG-3 ANSI C37.13	40 (Standard Ambient Temperature)		4700	5680	5680
	45		4450	5370	5370
	50		4180	5050	5050
	55		3900	4710	4710
	60		6310	4350	4350

Notes Standard Fault Series
- The values are applicable for Draw-out type.
- The values of AR650S and AR663S are for vertical terminals on both line and load side.
- Above figures are subject to the design of the enclosure and rating of busbar.

Notes High Fault Series
- The values are for vertical terminals on both line and load side.

TemPower 2 Busbar Connection Sizing

The temperatures shown represent the °C ambient temperature inside a switchboard where the ACB is installed.

- Busbars are to be of high conducting copper
- The maximum permissible busbar temperature is 100°C
- Spacers must be used where multiple busbars are connected For example, 6.3 mm spacers for 6.3 mm busbars and 10 mm spacers for 10 mm busbars

Example of a typical selection situation:

- Draw out ACB
- Vertical connections
- 50°C ambient temperature
- Service current to be 5000A

Solution:

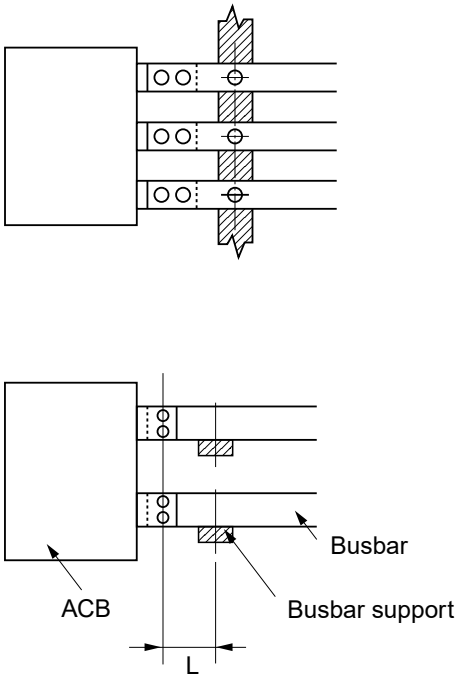
Refer to the table for horizontal connections. By looking at the 50°C column and 5000A row, the ACB required would need to be an AR650S 5000A ACB, with 4 x 200 mm by 10 mm busbars connected.

Vertical Connections for a Draw Out ACB

Max. Service Amps	40°C			50°C			60°C		
	ACB	3.6 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar	ACB	6.3 mm Bar	10 mm Bar
5000	AR650S	-	3 - 200 X 10	AR650S	-	4 - 200 X 10	AR650S	-	-
6300	AR663S	-	4 - 200 X 10	AR663S	-	-	AR663S	-	-

Technical Data – Busbar Connection Supports

The busbars to the ACB should be firmly supported near the ACB terminal. Fault current flow through the busbars can develop significant electromagnetic force between the busbars, and the support must be strong enough to withstand such forces. The ACB terminals should not be relied upon as a busbar support, as in addition to potential electrical forces, the weight may also cause damage to the ACB terminals and mouldings.



Vertical terminals

Vertical Terminals

Short Circuit Current (kA)		30	50	65	80	100	120
Distance L (mm)	AR6 type	350	300	250	150	150	100

Technical Data – Dielectric Strength, Internal Resistance, Power Consumption

Dielectric Strength

Circuit			Withstand Voltage (at 50 / 60Hz)		Rated Impulse Withstand Voltage U_{imp}
Main Circuit			Between terminals, terminal group to earth	AC 3500V for 1 minute	12kV
Control Circuits	Auxiliary switches	For general service	terminal group to earth	AC 2500V for 1 minute	6kV
		For microload	terminal group to earth	AC 2000V for 1 minute	4kV
	Position switches		terminal group to earth	AC 2000V for 1 minute	4kV
	Trip Unit		terminal group to earth	AC 2000V for 1 minute	4kV
	Power supply for undervoltage / reverse power trip function		terminal group to earth	AC 2500V for 1 minute	6kV
Other Accessories			terminal group to earth	AC 2000V for 1 minute	4kV

Notes
The values shown above are those measured on phase connections and cannot be applied to control terminals on the ACB.

Internal Resistance and Power Loss

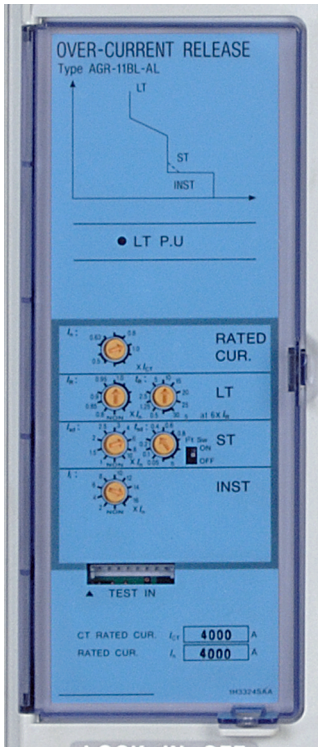
	Standard Series	
Type	**AR650S**	**AR663S**
Rated Current (A)	5000	6300
DC Internal Resistance Per Pole (mΩ)	0.012	0.010
DC Power Consumption for 3 poles (W)[1)]	900	1190
AC Power Consumption for 3 poles (W)	1620	1910

Notes
1) Above figures are based on the calculation of 3 x I2R. For more information please contact NHP.

Trip Units

TemPower 2 offers trip units with time/ current characteristics to comply with three different standards and super fine level setting adjustment:

- L Type IEC 60947-2 (low voltage circuit breakers) and R Type IEC 60 255-3 (electrical relays)
- S Type Lloyds Register of Shipping (for marine generator protection).



AGR-11B

Basic Trip Unit with adjustment dials TemPro AGR11

AGR-21C

Standard trip unit with LCD Ammeter display TemPro PLUS

AGR-31C

Advaned Trip Unit with LCD "Analyser" TemPro PREMIER

AR ACB – TemPro PLUS and TemPro PREMIER Metering Trip Units

Featuring a wide range of standard features and specialised options, the Terasaki TemPro / AGR Plus and Premier overcurrent release range is suitable for commercial, industrial and marine applications. These metering Trip Unit types are divided into two performance ranges; the TemPro PLUS and TemPro PREMIER.

TemPro PLUS (Type AGR-21C)

Featuring a backlit liquid crystal display (LCD) for easy visual identification and a soft rubber key activated scrolling menu system the TemPro PLUS can display[1]:

- Phase currents I1, I2, I3 (accuracy + 2.5%)
- Fault current value
- Tripping delay time
- The maximum phase current
- Cause of fault (LTD, STD, INST, GF[2])

Providing adjustable LSI and GF[3] protection featuring MODBUS communications plus a built-in current meter as standard, the TemPro PLUS is perfect for basic and mid range applications.

TemPro PREMIER (Type AGR-31C)

The TemPro PREMIER is an advanced Trip Unit that offers the same LCD appearance and protective functions as the TemPro PLUS. In addition to the current meter measurements listed above the TemPro PREMIER has an inbuilt energy analyser which indicates:

- Phase currents I1, I2, I3 (accuracy + 1.5%)
- Line voltages (V) V12, V23, V31[4]
- Phase voltage (V) V1N, V2N, V3N (accuracy + 1.0%)
- Active power (kW) (accuracy + 2.5%)
- Demanded active power (kW)
- Electric energy (kWh) (accuracy + 3.0%)
- Power factor (cos ø) (accuracy + 2.5%)
- Frequency (Hz) (accuracy + 0.5Hz)
- Fault current value
- Tripping delay time
- The maximum phase current
- Cause of fault (LTD, STD, INST, GF[2])

Furthermore, the TemPro PREMIER is available with a range of optional features that make it ideal for use in specialised applications.

Field test facility

AGR-21C / /31C Trip Units are equipped with a field test function to verify the long time delay, short time delay, instantaneous and ground fault trip features without the need for tripping of the ACB.

AGR-21C

Standard Trip Unit with Ammeter display TemPro PLUS

AGR-31C

Advaned Trip Unit with LCD "Analyser" TemPro PREMIER

Notes

1) Trip variables can be viewed after an event via the LCD providing control power is constantly available.
2) LTD-Long time delay trip, STD-Short time delay trip, INST-Instantaneous trip, GF-Unrestricted ground fault (not available for 'S' curve model Trip Unit).
3) This function provides ground fault protection to TN-C or TN-S power distribution systems on the load side.
4) Line voltage and phase voltage cannot be displayed at the same time.

Trip Unit control voltage: Confirm the terminal connections to match the indicated control voltage. Refer to Trip Unit wiring diagrams in this section for terminal designation.

Trip Unit type:
TemPro PLUS (AGR-21C)
or
TemPro Premier (AGR-31C)

Trip Unit protection curve: Can be “L” general feeder protection, “R” IEC 60255 conforming multiple curves, or “S“ generator protection types. The curve type must be specified at the time of ordering

Unrestricted Ground fault:
If coloured in black it means this function is available. It does not indicate if the function is on or off, confirm this by checking the Trip Unit GF setting (SET 2).

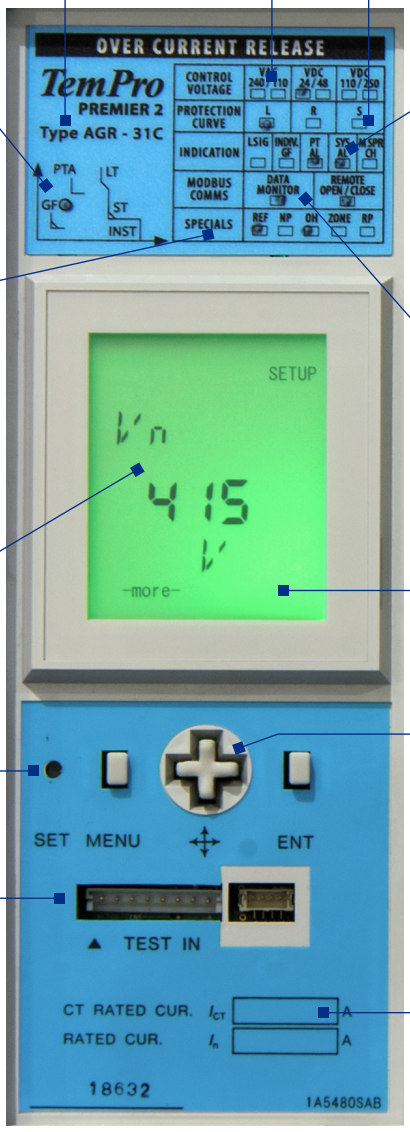
Alarm contact indication:
Standard trip contact indicator is LSI+GF. This is a single contact indicator. Other contact indicators such as individual GF, pre-trip alarm, system alarm and motor spring charge is available on special request.

Special functions: Must be requested at time of ordering.

REF: Restricted earth fault
NP: Neutral phase protection
OH: Contact temperature alarm
Zone: Zone interlocking
RP: Reverse power

Modbus and signaling options:

Data Monitor: Interrogate
Variables Remote open: The ACB can trip / open via a Modbus command.



Inbuilt current meter for TemPro PLUS or inbuilt energy analyser for TemPro PREMIER

Backlit LCD for easy viewing. The LCD flashes on and off when alarm / trip event occurs

Soft runner keys for menu navigation

Setting adjustment confirmation button

Test port for secondary injection test. Requires ANU-1 Trip Unit checker

Easy identification of the CT rated current and the set rated current

The power of selectivity.
Be selective with your protection release

Protection

Application Protection Curves

L curve

Standard protection curve, is designed for general feeder applications and will achieve most selectivity and protection requirements.

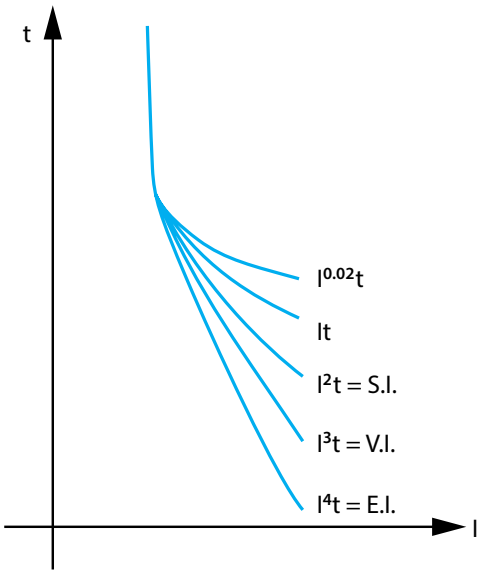
R curve

The high selectivity curve Trip Unit includes 3 curve characteristics to IEC60255 (S.I., V.I., E.I.) and is used when selectivity can not be achieved with other system protective devices (ie. fuses or other relays).

S.I. (standard inverse)
V.I. (very inverse)
E.I (extremely inverse)

S curve

Generator protection specifically designed for generator and marine applications.



Above: R curve Trip Unit with 5 curve options including S.I., V.I. and E.I. for Selectivity applications

Selectivity

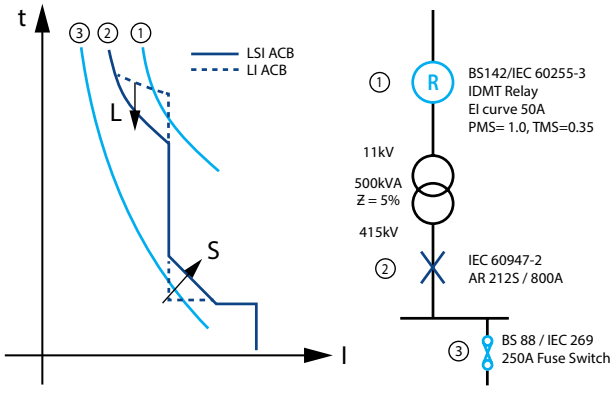
Terasaki are so serious about selectivity that all TemPro overcurrent release units have adjustable 'LSI' characteristics as standard. This provides an adjustable time delay on overload (L) and also the I^2t ramp characteristic (S).

As shown, these are essential to provide selectivity when grading with other protective devices such as downstream MCCBs, fuses and upstream relays.

The standard 'LSI' curve provides more than five million combinations of unique time current characteristics. Zone selective interlocking is also available to provide zero time delay selectivity.

TemPower 2 is the only ACB that offers trip units with time-current characteristics to comply with three different standards and super fine level setting adjustment:

- L Type IEC 60947-2 (low voltage circuit breakers) and R Type IEC 60 255-3 (electrical relays)
- S Type Lloyds Register of Shipping (for marine generator protection).



L = Long Time Delay
S = Short Time Delay
I = Instantaneous

AR Air Circuit Breaker – Trip Unit release specification

TemPro application protection curves

The TemPro PLUS and TemPro PREMIER Trip Unit range is available in three model variations:

- Standard protection curve, or 'L' type – designed for general feeder applications and will achieve most selectivity and protection requirements.
- High selectivity curve or 'R' type - offers 3 curve characteristics to IEC60255 and is used when selectivity cannot be achieved with other system protective devices (i.e. fuses or other relays).
- Generator protection curve or 'S' type. – Specifically designed for generator and marine applications.

It is recommended that all general feeder circuits be protected by the 'L' type unless the results of a selectivity study indicate that an 'R' type is required to discriminate with another system protective device. The application curve type must be specified at the time of order.

TemPro AGR11 includes adjustable LSI - Long Time Delay, Short Time Delay, INSTANTANEOUS as standard.

TemPro PLUS and TemPro PREMIER have adjustable LSIG - Long Time Delay, Short Time Delay, Instantaneous and GF as standard.

This provides an adjustable time delay on overload and also the I^2t ramp characteristic which is essential to provide selectivity when grading with other protective devices such as downstream fuses and upstream relays. The standard 'LSI' curve PLUS and PREMIER versions provide more than five million combinations of unique time current characteristics.

Main Features at a Glance

Trip Unit Type	Catalogue No.	Application Protection Curve[1]	LCD Monitoring	Basic Protection[2]		Single Contact and Indicator LTD, STD, INST, GF	Modbus (Only Data Monitoring)	RPT[4]	Control Power[3]
				LTD STD INST	GF				
TemPro AGR11	AGR-11B-AL	L	✘	✔	✘	✔ *	✘	✘	Required
TemPro PLUS	AGR-21C-L-PG	L	Current (A)	✔	✔	✔	✔	✘	Required
	AGR-21C-R-PG	R	Current (A)	✔	✔	✔	✔	✘	Required
	AGR-21C-S-PS	S	Current (A)	✔	✘	✔	✔	✘	Required
TemPro PREMIER	AGR-31C-L-PG	L	Amps + Energy	✔	✔	✔	✔	✘	Required
	AGR-31C-R-PG	R	Amps + Energy	✔	✔	✔	✔	✘	Required
	AGR-31C-S-PS	S	Amps + Energy	✔	✔	✔	✔	Option	Required

Notes

1) L / R / S refers to the application protection curve - specify at time of ordering.
2) LTD-Long Time Delay trip, STD-Short Time Delay trip, INST-Instantaneous trip, GF-Unrestricted Ground Fault, (load side GF)
3) Trip variables can be viewed after an event via the LCD providing control power is constantly available. The Trip Unit does not require control power to operate as a protective device, however it is recommended, as control power is essential for many of the specialised Trip Unit features and for the Trip Unit display itself, for setting purposes.
4) RPT- Reverse power trip. AGR-31CS-PS becomes AGR-31CS-PR with RPT.

* contact NHP

Specifications: AR ACBs with AGR21C and AGR31C Trip Units

AGR-21C – L and AGR31 C – L L characteristic for general feeder (general power distribution and transformer protection)

AGR-21C – R and AGR31 C – R R characteristic for general feeder (3 characteristics conforming to IEC60255)

AGR-21C – S and AGR31 C – S S characteristic for generator protection

Application		Setting / Opt	For General Feeder – Power Distribution				Generator Protection	
Trip Unit characteristic curve			L		R		S	
Trip Unit OCR type designation			AGR21C-L	AGR31C-L	AGR21C-R	AGR31C-R	AGR 21C-S	AGR31C-S
Trip Unit suffix of type designation			PG	PG	PG	PG	PS	PS
Protective Functions	Long time delay trip	LT	✔	✔	✔	✔	✔	✔
	Short time delay trip	ST	✔	✔	✔	✔	✔	✔
	Instantaneous trip 1 (standard fault setting)	INST1 / MCR	✔	✔	✔	✔	✔	✔
	Instantaneous trip 2 (low, maintenance mode etc)	INST2 / MCR	✔	✔	✔	✔	✔	✔
	Ground fault trip	GF 3)	✔	✔	✔	✔	–	✔
	Selectivity (Discrimination) curves to IEC 60255-3		–	–	✔	✔	–	–
	Reverse power trip	RPT	–	☐	–	☐	☐	☐
	N-phase protection	NP	☐	☐	☐	☐	–	–
	Negative-phase sequence protection	NS	☐	☐	☐	☐	–	–
	Line side ground fault protection	REF	☐	☐	☐	☐	–	–
	3C Over temperature monitoring and alarm	OH	–	☐	–	☐	–	☐
	Zone interlocking	Z	☐	☐	–	☐	☐	☐
	Under/Over Frequency Protection	UFOF	–	☐	–	☐	–	☐
Alarm Function	Pre-trip alarm	PTA	✔	✔	✔	✔	✔	✔
	Pre-trip alarm 2	PTA2	–	–	–	–	☐	☐
	Undervoltage alarm	UV	–	☐	–	☐	–	☐
	Over Voltage Alarm	OV	–	☐	–	☐	–	☐
Protection Characteristic	COLD / HOT (thermal memory) (LT)		✔	✔	–	–	–	–
	I2t ON / OFF (ST)		✔	✔	✔	✔	✔	✔
	INST / MCR (Instantaneous trip)		✔	✔	✔	✔	✔	✔
	I0.02t or It or I2T or I3t or I4t (LT)		–	–	✔	✔	–	–
	I2t ON / OFF (FG)		✔	✔	✔	✔	–	–
	Polarity NOR / REV (RPT)		–	✔	–	✔	–	✔
Operation Indication	LCD indication display		✔	✔	✔	✔	✔	✔
	Trip output contact (single relay contact output)		✔	✔	✔	✔	✔	✔

Symbol Key ✔ = Standard feature / or enabled as standard ☐ = Optional non standard special – = Not applicable

Application		Setting / Opt	For General Feeder – Power Distribution				Generator Protection	
Trip Unit characteristic curve			L		R		S	
Trip Unit OCR type designation			AGR21C-L	AGR31C-L	AGR21C-R	AGR31C-R	AGR 21C-S	AGR31C-S
Trip Unit suffix of type designation			PG	PG	PG	PG	PS	PS
Measurement and Event Indication	Integral LCD display		✔	✔	✔	✔	✔	✔
	Backlit display		✔	✔	✔	✔	✔	✔
	Present current (switchable between respective phase current phase max. and current)		✔	✔	✔	✔	✔	✔
	Maximum phase current		✔	✔	✔	✔	✔	✔
	Demand power		–	✔	–	✔	–	✔
	Line voltage Electrical Power Reactive Power Electrical energy, active and reactive Power factor Demand electrical power Frequency		–	✔	–	✔	–	✔
	Harmonic current	H	–	✔	–	✔	–	✔
	3C Over temperature monitoring and alarm	OH	–	☐	–	☐	–	☐
	Trip event log (last trip event)		✔	✔	✔	✔	✔	✔
	Alarm event log (last alarm event)		✔	✔	✔	✔	✔	✔
Miscellaneous								
Communication Function (Modbus RTU RS-485 standard)			✔	✔	✔	✔	✔	✔
Communication gateway options (Accessory module: Profibus, DeviceNet, Ethernet, Modbus)			☐	☐	☐	☐	☐	☐
External panel / door mount indication display (T2ED)			☐	☐	☐	☐	☐	☐
Control power supply			Specify voltage at the time of ordering					

Symbol Key ✔ = Standard feature / or enabled as standard ☐ = Optional non standard special – = Not applicable

TemPro Trip Units can be 'optioned up' with specialised application functions to suit customer requirements. Please indicate which special application functions are required at the time of order as all are factory installed.

Standard feature	Description	Application curve		
		L	R	S
LTD trip	Adjustable overload protection area trip	✔	✔	✔
STD trip	Adjustable short circuit protection area trip (with intentional delay)	✔	✔	✔
INST trip	Adjustable short circuit protection area trip (with NO intentional delay)	✔	✔	✔
GF trip[1)]	Adjustable unrestricted earth fault protection (GF) (requires external 4th CT for 3 pole model) See GF info on page 10 "Custom ACB Ordering"	✔	✔	✘
Single alarm contact indicator	As standard the single contact alarm indicator is available that indicates when the LTD trip, STD trip, INST/MCR trip or the GF trip function is activated.	✔	✔	✔
Modbus I/F [1)]	MODBUS communication interface allows monitoring of available data variables. ACB control is non-standard, refer to communications page.	✔	✔	✔
Backlit LCD with current meter (TemPro PLUS only)	Displays phase currents I_1, I_2, I_3 and I_{GF}, fault current values, tripping time delay, the maximum phase current and cause of fault (LTD, STD, INST, GF)	✔	✔	✔
Backlit LCD with current meter and energy analyser (TemPro PREMIER only)	Displays phase currents I_1, I_2, I_3 and I_{GF}, fault current values, tripping time delay, the maximum phase current and cause of fault (LTD, STD, INST, GF), Line voltages (V) V_{12}, V_{23}, V_{31}, Phase voltage (V) V_{1N}, V_{2N}, V_{3N}, Active power (kW), Demanded active power (kW), Electric energy (kWh), Power factor (cos Ø), Frequency (Hz)	✔	✔	✔
System alarm [1)]	Activates if an internal fault exists within the Trip Unit. System alarm can be monitored remotely via the MODBUS communications interface.	✔	✔	✔
PTA Pre-Trip Alarm [1)]	Activates if the monitored load current reaches the user set indication threshold. Useful for load shedding applications. This alarm is available via the MODBUS interface only. No Trip Unit display indication when switched OFF.	✔	✔	✔
NP Neutral phase protection 4 pole ACBs only	In 3-phase, 4-wire systems that contain harmonic distortion, the 3rd harmonic may cause large currents to flow through the neutral conductor. The N-phase protection function (NP) is available on 4 pole ACBs and prevents the neutral conductor from sustaining damage or burnout due to these large currents. The NP trip pickup current can be set between 40 % and 100 % of the Trip Unit rated primary current for L and R-characteristics. This protection function is not available for special 'generator protection' 'S' type Trip Units, and is available on an INDENT basis.	✔	✔	✘
REF Restricted Earth Fault [1)]	Restricted earth fault protection (GF) (requires external 5th CT for 4P ACB)	✔	✔	✘
Z Zone Interlocking (not AGR11 / AGR21C-S)	The Zone-Selective interlock (ZSI) feature allows tripping of an ACB nearest to a fault point in the shortest operating time, irrespective of the short time delay trip time setting, which minimizes thermal and mechanical damage to the overall power distribution system. ZSI ACBs cannot be fitted with a UVT.	✔	✔	✔
NS Phase rotation protection	This function detects the negative-phase current occurring due to reverse phase or phase loss and prevents burnout of a motor or damage to equipment.	✔	✔	✘

Standard feature	Description	Application curve		
		L	R	S
OH Contact over heat protection (TemPro PREMIER only)	Continuous monitoring of the contact temperature provides valuable input for preventative and predictive maintenance programs. This optional function uses thermistors to monitor the temperature of the ACBs main contacts, and surrounding area. An Trip Unit alarm indicates when the temperature exceeds a set point which is usually set at 155°C, though this point can be set by NHP for lower temperatures if needed. The temperature set point cannot be changed by the user. When the preset temperature is reached, the AGR31 Trip Unit will indicate on its display that the “OH” alarm has been activated. A volt free contact output is also available to signal an outside device. The same OH alarm can be sent by Modbus communications. It should be noted that the OH feature is just one component within the “3C” temperature monitoring system. 3C can also include separate temperature devices that will monitor different parts of a switchboard, external to an AC B. The 3C temperature monitors can indicate varying temperatures and display this data via comms.	✔	✔	✔
UV Undervoltage alarm function (TemPro PREMIER only)	This function monitors the phase voltages across 3 phases, and gives an alarm on the LCD display. The alarm is activated when the main circuit voltage drops below the setting voltage (selectable from 40%, 60% or 80% of the rated main circuit voltage [Vn]), and is deactivated when the main circuit voltage rises to the recovery setting voltage (selectable from 80%, 85%, 90% or 95% of the rated main circuit voltage [Vn]). Note 1: A relay alarm output is also available on request. Note 2: The UV alarm can be sent by Modbus for external signalling, to enable control via an external device. Note 3: The undervoltage alarm function is disabled unless the main circuit voltage has once risen to the recovery setting voltage or higher	✔	✔	✘
RP Reverse power trip function (TemPro PREMIER only)	The RPT function protects 3-phase generators running in parallel against reverse power. The RPT pickup current can be set in seven levels: 4% thru 10% of the generator rated power.	✔	✔	✔

Note: All special application functions are available on an indent basis. For further information on special application functions contact NHP.

Trip Unit Loss of control power – Low ICT phase current 415 - 690 VAC Phase and DC voltage

Loss of Trip Unit control power (sustained loss)

If the control power is not supplied or is lost, each function operates as follows:

Function	Operation (if power is lost or not supplied)[1)]
LT, ST, INST, RPT	Operates normally
GF	Operates normally
	However, when the CT rated primary current (I_{CT}) is less than 800A and the GF pick-up current is set to 10%, GF becomes inoperative
MCR	Operates as INST
PTA	1-channel PTA is inoperative. (has a 40ms operation)
Alarm contact output from Trip Unit	Inoperative
LCD/ COMMUNICATIONS	No display when no other power source is available. Cannot program ACB. Communications are disabled
Field test facility and MODBUS	Inoperative

1) A loss of power won't immediately cause the ACB to trip. The various functions will behave as outlined in the table above.

1 cycle loss of 50 Hz power to Trip Unit (momentary loss)

If there is an interruption to the supply power to the Trip Unit of 1 cycle of 50Hz or less, the Trip Unit's basic operation will be unaffected.

However, if the ACB Trip Unit's communications feature is being used communicate with external devices, there may be a momentary interruption, but this can be common in many systems. If during the one cycle of 50Hz signal loss, some important data is being transmitted, then that data may be not be communicated, though after that normal signals will recommence. Depending on the user application / system and what is being communicated, this short interruption may not be an issue.

Low I_{CT} Phase Currents

The ACB trip unit will function normally and the display will read correctly when ICT is above approximately 10% of the value of ICT.

ICT is defined as being the ampere rating of the current CTs that each ACB is fitted with. For example, a 2000 A ACB, rated for 2000A use, will be fitted with 2000A CTs. The minimum operating current for the ACB must be approximately 200A (~ 10%) to ensure the ACBs Trip Unit functions correctly. If the ICT drops below ~ 10%, the display may not read amps, volts and other data correctly. Functions such as comms, GF etc may also not function correctly.

The value of 10% is approximate, that is because depending on the Trip Unit function, some require slightly less than 10%, some more than 10%.

If an ACB Trip Unit is failing to read correctly, one of the first things to verify is that the ICT is adequate to ensure correct ACB operation.

415 V AC and 690 V AC Systems

TemPro Plus (AGR21) and Premier (AGR31) ACBs can be used for 400 – 450V AC, or 460 – 700V AC 3 phase or 3 phase + neutral systems.

ACBs with TemPro Plus (AGR21) Trip Units

The Trip Unit auxiliary control voltage options are: 24V – 250V DC or 100V – 250VAC, which is wired by the user. Phase voltages ranging from 415V to 690VAC are sensed by the Trip Unit directly from the power CTs and Rogowski coils that are mounted within the ACB body on each phase. ACBs fitted with AGR21 Trip Units will function as standard with 415V – 690V AC mains voltages. No user wiring is required.

ACBs with TemPro Premier (AGR31) Trip Units

The Trip Unit auxiliary control voltage options are: 24V – 250V DC or 100V – 250V AC, which is wired by the user.

As AGR31 Trip Units have energy monitoring, they must be supplied with a 3P or 3P+N reference voltage. The Trip Units have phase voltage connection terminals numbered; 13, 23, 04, 14, at the top of each ACB carriage. These terminals then feed the voltages to a 3 phase (+N) internal resistor card, which lowers the voltages from 415V to 120V, or 690V to 120V, and then internally feeds this voltage to the Trip Unit.

Each specific voltage range of 400 to 450V AC or 460 to 700V AC has a unique resistor card, and the Trip Unit also needs specific voltage programming.

ACBs with AGR31 Trip Units must be initially set up by NHP, and the mains voltage must be specified to NHP at the time or ordering.

Higher AC voltages and DC voltages

Contact NHP for AR ACBs for 1000V AC and any DC voltage use up to 800VDC.

Specifications: AR ACBs with AGR21C and AGR31C Over Current Releases

Protective / Alarm Function		Trip Unit Characteristic Curve	AGR "C" Series AGR21 C and AGR31 C
Long Time Delay Trip (LTD)	I_R	L, R	(80% to 100%) x I_n in 1% step
		S	(80% to 115%) x I_n in 1% steps
	t_R	L	(0.5 to 30.0) sec in 0.01 sec steps
		R	(1.0 to 10.0) sec in 0.01 sec steps
		S	(15.0 to 60.0) sec in 0.01 sec steps
Short Time Delay Trip (STD)	I_{sd}	L, R	(100% to 1000%) x I_n in 1% steps
		S	(200% to 500%) x I_n in 1% steps
	t_{sd}	L, R	(0.05 to 0.8) sec in 0.01 sec steps
		S	(0.1 to 0.8) sec in 0.01 sec steps
Instantaneous Trip (INST)	$I_{nst}1$	L, R, S	(200% to 1600%) x I_n in 1% steps
	$I_{nst}2$	L, R, S	(200% to 1600%) x I_n in 1% steps
Pre-Trip Alarm (PTA)	I_{P1}	L, R	(75% to 100%) x I_n in 1% steps
		S	(75% to 105%) x I_n in 1% steps
	t_{P1}	L, R	(5.0 to 200.0) sec in 0.10 sec steps
		S	(10.0 to 30.0) sec in 0.10 sec steps
Ground Fault Trip (GF)	I_R	L, R	(10% to 100%) x I_{CT} in 1% steps
		S	(10% to 100%) x I_{CT} in 1% steps
	t_R	L, R	(0.1 to 2.0) sec in 0.1 sec steps
		S	(0.1 to 2.0) sec in 0.1 sec steps
Reverse Power Trip (RPT)	P_R	L, R	(4.0% to 10.0%) x P_n in 1% steps
		S	(4.0% to 10.0%) x P_n in 1% steps
	t_{RP}	L, R	(2.5 to 20.0) sec in 0.1 sec steps
		S	(2.5 to 20.0) sec in 0.1 sec steps
Over Voltage Alarm (OV)	V_{OV}	L, R, S	(105% to 150%) x V_n by 1% step
	t_{OV}	L, R, S	(0.1 to 5.0) sec in 0.10 sec steps
Under and Over Frequency Protection (UFOF)	F_{uf}	L, R, S	(80% to 105%) x F_n in 1% steps
	t_{uf}	L, R, S	(0.1 to 10.0) sec in 0.10 sec steps
	F_{of}	L, R, S	(95% to 140%) x F_n in 1% steps
	t_{of}	L, R, S	(0.1 to 10.0) sec in 0.10 sec steps

Specifications: AGR-11B

Protective / Alarm Function		Trip Unit Characteristic Curve	AGR "C" Series AGR21 C and AGR31 C
Long Time Delay Trip (LTD)	I_R	L, R	(80% to 100%) x I_n in 1% step
		S	(80% to 115%) x I_n in 1% steps
	t_R	L	(0.5 to 30.0) sec in 0.01 sec steps
		R	(1.0 to 10.0) sec in 0.01 sec steps
		S	(15.0 to 60.0) sec in 0.01 sec steps
Short Time Delay Trip (STD)	I_{sd}	L, R	(100% to 1000%) x I_n in 1% steps
		S	(200% to 500%) x I_n in 1% steps
	t_{sd}	L, R	(0.05 to 0.8) sec in 0.01 sec steps
		S	(0.1 to 0.8) sec in 0.01 sec steps
Instantaneous Trip (INST)	$I_{nst}1$	L, R, S	(200% to 1600%) x I_n in 1% steps
	$I_{nst}2$	L, R, S	(200% to 1600%) x I_n in 1% steps

Loss of Trip Unit control power (sustained loss)

1. Indication via a single contact within the Trip Unit
(TemPro AGR11, TemPro Plus AGR21, TemPro Premier AGR31)

When the LT, ST, INST or GF trip function is activated, an output is generated via a N/O contact.2)

2. Indication of cause of trip
(TemPro Plus AGR21, TemPro Premier AGR31)

When the LT trip, ST trip, INST/MCR trip, GF trip, RPT, NS, REF, UV, OV, PTA, PTA2, OH, NS, REF, RPT, OF or UF functions are activated, the Trip Unit display will indicate each individual operation. Cause of trip can also be communicated from the ACB via Modbus communications. Control power is required.

3. System Alarm
(TemPro Plus AGR21, TemPro Premier AGR31)

The Trip Unit also has a self-diagnostic “system alarm” feature that monitors the internal tripping circuits. If detecting any fault in the circuits, the system turns on the system alarm indicator. Control power is needed.

- System Alarm will indicate on the Trip Unit display, if other indication alarms fail.
- If the MHT fails to activate, when the Trip Unit gives a trip signal (System Alarm 1)
- If an Trip Unit trip signal fails to trip the ACB for other reasons (System Alarm 2)
- If the Trip Unit does not initiate a trip operation when it should etc (System Alarm 2)
- System alarm can be communicated via MODbus communications, via memory map command address number 40102 / 101.

AGR21C and AGR31C special functions

Trip Unit Protective Characteristic	AGR21C L / R			AGR21C S			AGR31C L / R			AGR31C S		
Function	**Trip Unit display**	**Contact Output**	**Modbus output**	**Trip Unit display**	**Contact Output**	**Modbus output**	**Trip Unit display**	**Contact Output**	**Modbus output**	**Trip Unit display**	**Contact Output**	**Modbus output**
LT, NP, ST	●	●	✔	●	●	✔	●	●	✔	●	●	✔
INST / MCR	●	●	✔	●	●	✔	●	●	✔	●	●	✔
GF Ground Fault	●	●	✔	-	-	-	●	●	✔	●	●	✔
OH Contact Temperature Alarm	-	-	-	-	-	-	●	●	✔	●	●	✔
NS Reverse Phase Protection	●	●	✔	-	-	-	●	●	✔	-	-	-
REF Line side GF	-	-	-	-	-	-	●	●	✔	-	-	-
RPT Reverse Power Trip	-	-	-	-	-	-	●	●	✔	●	●	✔
PTA Pre Trip Alarm	✘	-	✔	✘	-	✔	✘	●	✔	✘	-	✔
System Alarm	●	-	✔	●	-	✔	●	-	✔	●	-	✔
UV Under Voltage Alarm	●	-	✔	-	-	-	●	-	✔	●	-	✔
OV Over Voltage Alarm	-	-	-	-	-	-	●	-	✔	●	-	✔
OF / UF Over / Under frequency Alarm	-	-	-	-	-	-	●	-	✔	●	-	✔

Operation Indication Key ● = Self Holding Circuit ✘ = Auto Reset ▲ = Status Indication - = Not Available ✔ = Standard

Contact Ratings for Operation Indication (by a single trip contact, item 1 above)

		Current (A)	
		Single contact	
Voltage (V)		**Resistive load**	**Inductive load**
AC	250	0.5	0.2
DC	250	0.27	0.04
	125	0.5	0.2
	30	2	0.7

L Curve Trip Unit Setting: TemPro PLUS (AGR-11B-AL)

Setting Item	Symbol	Setting Range											
Rated Current	I_n	CT rated primary current can be set to [I_{CT}] x 0.5 or 0.63 or 0.8 or 1.0											
		CT size (A)	200	400	800	1000	1250	1600	2000	2500	3200	4000	5000	6300
	Rated current [I_N] (A)	[I_{CT}] x 1.0	200	400	800	1000	1250	1600	2000	2500	3200	4000	5000	6300
		[I_{CT}] x 0.8	160	320	630	800	1000	1250	1600	2000	2500	3200	4000	5040
		[I_{CT}] x 0.63	125	250	500	630	800	1000	1250	1600	2000	2500	3150	3969
		[I_{CT}] x 0.5	100	200	400	500	625	800	1000	1250	1600	2000	2500	3150

Trip Unit Function		Symbol	Min	Max	Setting increments	Setting Tolerances and other data
LT Long Time Delay Trip	Pick-up current x [I_n]	I_R	0.80	1.0	0.8 - 0.85 - 0.9 - 0.95 - 1.0	Non tripping below [I_R] x 1.05 Tripping above [I_R] x 1.2 t_R setting at 600 % of IR t_R tolerance: ± 15 %, 0 - 150 ms
	Time-delay (s)	t_R	0.50	30.0	0.5 -1.25 -2.5 -5 -10 -15 -20 -25 -30	
	COLD/HOT	-	COLD / HOT			
	Mode selection	-	TRIP / NON			
ST Short Time Delay Trip	Pick-up current x [I_n]		1.0	10.0	1 - 1.5 - 2 - 2.5 – 3 – 4 – 6 – 8 - 10	I_{sd} tolerance: ± 15 %
	Time-delay (s)	I_{sd}	0.05	0.80	0.05 - 0.1 - 0.2 - 0.4 - 0.6 - 0.8	
	RAMP I^2t	t_{sd}	OFF / ON			
	Mode selection	I^2t t_{sd}	TRIP / NON (if OFF INST cannot be OFF)			
INST Instantaneous Trip INST / MCR	Pick-up current x [I_n]		2.0	16.0	2 - 4 - 6 - 8 - 10 - 12 - 14 -16	I_i tolerance: ± 20 %
	INST	I_i	INST			
	Mode selection	-	TRIP / NON (if OFF STD cannot be OFF)			

L Curve Trip Unit Setting: TemPro PLUS (AGR-21C-L)

Setting Item		Symbol	Setting Range									
Rated Current		I_n	CT rated primary current [I_{CT}] × (0.5 - 0.63 - 0.8 - 1.0) (A)									
			Applied [I_{CT}] (A)	200	400	800	1000	1250	1600	2000	2500	3200	4000
			Rated Current [I_n] (A) [I_{CT}] x 0.5	100	200	400	500	630	800	1000	1250	1600	2000
			[I_{CT}] x 0.63	125	250	500	630	800	1000	1250	1600	2000	2500
			[I_{CT}] x 0.8	160	320	630	800	1000	1250	1600	2000	2500	3200
			[I_{CT}] x 1.0	200	400	800	1000	1250	1600	2000	2500	3200	4000
LT Long Time Delay Trip	Mode Select		**Trip** / OFF									
	Pickup Current (continuous)	I_R	[I_n] × (80% to 100%) (A) in steps of 1%									
	Trip Timing	t_R	(0.5 to 30.0) (sec) at 600% of [I_R], in steps of 0.01 sec, Tolerance: ± 15%, +0.15s – 0s									
	COLD/HOT	-	**COLD** / HOT									
ST Short Time Delay Trip	Mode Select		**Trip** / OFF									
	Pickup Current	I_{sd}	[I_n] × (100% to 1000%) (A), in steps of 1%, Tolerance: ± 15%									
	Trip Timing	t_{sd}	Relaying time	(0.05 to 0.8) (sec) in steps of 0.01 sec.								
	I^2t Mode	I^2t t_{sd}	**OFF** / ON									
INST Instantaneous Trip INST / MCR	Mode Select		**Trip** / OFF									
	Pickup Current	Ii	[I_n] × (200% to 1600%) (A), in steps of 1%, Tolerance: ± 20%									
	INST1 or INST2 / MCR	-	INST1 or INST2 / MCR									
GF Ground Fault Trip	Pickup Current	I_g	[I_{CT}] × (10% to 100%) (A), in steps of 1%, Tolerance: ± 20%									
	Trip Timing	t_g	Relaying time (ms)	(0.1 to 2.0) (sec) in steps of 0.1 sec.								
	I^2t Mode	I^2t t_g	**OFF** / ON									
	Mode	-	**TRIP** / AL / OFF									
PTA Pre-Trip Alarm	Current Setting	I_{P1}	[I_n] × (75% to 100%) (A), in steps of 1%, Tolerance: ± 7.5%									
	Time Setting	t_{P1}	(5.0 to 200.0) (sec) at not less than [I_{P1}], in steps of 0.1 sec, Tolerance: ± 15%, +0.1s – 0s									
	Mode	-	**AL** / OFF									

Options on Request

NP N-phase Protection Trip	Pickup Current (continuous)	I_N	[I_{CT}] × (40% to 100%) in steps of 1% • Non tripping at not more than [I_N] × 1.05, Tripping at more than [I_N] × 1.05 and not more than [I_N] × 1.2
	Trip Timing	t_R	Depends on the long time delay trip pickup timing. Activated at 600% of [I_N]
	COLD / HOT	-	Depends on the long time delay trip mode (COLD / HOT)
NS Negative-Phase Sequence Protection	Current Setting	I_{NS}	[I_n] × (20% to 100%) (A), in steps of 1%, Tolerance: ± 10%
	Time Setting	t_{NS}	(0.4 to 4.0) (sec) at 150% of [I_{NS}], in steps of 0.1 sec, Tolerance: ± 20%, +0.15 s – 0s
	Mode	-	**TRIP** / AL / OFF
Z Zone Interlock	Current Setting	-	Interlock with short time delay trip pickup current
	Time Setting	-	50 ms. or less

L Curve Trip Unit Setting: TemPro PREMIER (AGR-31C-L)

Setting Item		Symbol	Setting Range									
Rated Current		I_n	CT rated primary current [I_{CT}] × (0.5 - 0.63 - 0.8 - 1.0) (A)									
			Applied [I_{CT}] (A)	200	400	800	1000	1250	1600	2000	2500	3200	4000
			Rated Current [I_n] (A) [I_{CT}] x 0.5	100	200	400	500	630	800	1000	1250	1600	2000
			[I_{CT}] x 0.63	125	250	500	630	800	1000	1250	1600	2000	2500
			[I_{CT}] x 0.8	160	320	630	800	1000	1250	1600	2000	2500	3200
			[I_{CT}] x 1.0	200	400	800	1000	1250	1600	2000	2500	3200	4000
LT Long Time Delay Trip	Mode Select		**Trip** / OFF									
	Pickup Current (continuous)	I_R	[I_n] × (80% to 100%) (A) in steps of 1%									
	Trip Timing	t_R	(0.5 to 30.0) (sec) at 600% of [I_R], in steps of 0.01 sec, Tolerance: ± 15%, +0.15s – 0s									
	COLD/HOT	-	**COLD** / HOT									
ST Short Time Delay Trip	Mode Select		**Trip** / OFF									
	Pickup Current	I_{sd}	[I_n] × (100% to 1000%) (A), in steps of 1%, Tolerance: ± 15%									
	Trip Timing	t_{sd}	Relaying time	(0.05 to 0.8) (sec) in steps of 0.01 sec.								
	I^2t Mode	I^2t t_{sd}	**OFF** / ON									
INST Instantaneous Trip INST / MCR	Mode Select		**Trip** / OFF									
	Pickup Current	Ii	[I_n] × (200% to 1600%) (A), in steps of 1%, Tolerance: ± 20%									
	INST1 or INST2 / MCR	-	INST1 or INST2 / MCR									
GF Ground Fault Trip	Pickup Current	I_g	[I_{CT}] × (10% to 100%) (A), in steps of 1%, Tolerance: ± 20%									
	trip timing	t_g	Relaying time (ms)	(0.1 to 2.0) (sec) in steps of 0.1 sec.								
	I^2t Mode	I^2t t_g	**OFF** / ON									
	Mode	-	**TRIP** / AL / OFF									
PTA Pre-Trip Alarm	Current Setting	I_{P1}	[I_n] × (75% to 100%) (A), in steps of 1%, Tolerance: ± 7.5%									
	Time Setting	t_{P1}	(5.0 to 200.0) (sec) at not less than [I_{P1}], in steps of 0.1 sec, Tolerance: ± 15%, +0.1s – 0s									
	Mode	-	**AL** / OFF									
UV Undervoltage Alarm	Voltage Setting	-	[V_n] × (40% to 80%) (V), in steps of 1%, Tolerance: ± 5%									
	Time Setting	-	(0.1 to 36) (sec) at voltage setting or less, in steps of 0.1 sec, Tolerance: ± 15%, +0.1s – 0s									
	Recovery Voltage Setting	-	[V_n] × (80% to 95%) (V), in steps of 1%, Tolerance: ± 5%									
	Mode	-	**AL** / OFF									
OV Over Voltage Alarm	Mode	-	[V_n] × (105% to 150%) (V), in steps of 1%, Tolerance: ± 5%									
	Time Setting	-	(0.1 to 5.0) (sec) at voltage setting or less, in steps of 0.1 sec, Tolerance: ± 15%, +0.1s – 0s									
UFOF Under / Over Frequency Protection	Voltage Setting	F_{uf}	[F_n] × (1% to 99%) (V), in steps of 1%									
	Time Setting	t_{uf}	(0.1 to 10) (sec) in steps of 0.1 sec.									
	Voltage Setting	F_{of}	[F_n] × (100% to 199%) (V), in steps of 1%									
	Time Setting	t_{of}	(0.1 to 10) (sec) in steps of 0.1 sec.									
	Mode	-	**TRIP** / AL / OFF									

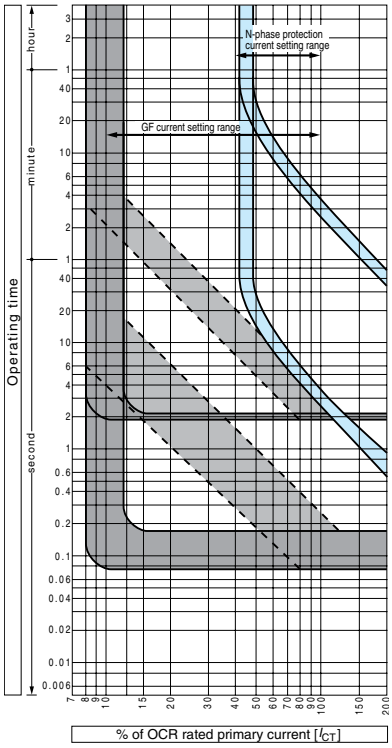
Setting Item		Symbol	Setting Range
Options on Request			
NP N-Phase Protection Trip	Pickup Current (continuous)	I_N	$[I_{CT}]$ × (40% to 100%) in steps of 1% • Non tripping at not more than $[I_N]$ × 1.05, Tripping at more than $[I_N]$ × 1.05 and not more than $[I_N]$ × 1.2
	Trip Timing	t_R	Depends on the long time delay trip pickup timing. Activated at 600% of [IN].
	COLD / HOT	-	Depends on the long time delay trip mode (COLD / HOT)
NS Negative-phase Sequence protection	Current Setting	I_{NS}	$[I_n]$ × (20% to 100%) (A), in steps of 1%, Tolerance: ± 10%
	Time Setting	t_{NS}	(0.4 to 4.0) (sec) at 150% of $[I_{NS}]$, in steps of 0.1 sec, Tolerance: ± 20%, +0.15 s – 0s
	Mode	-	**TRIP** / AL / OFF
REF Line Side Ground Fault Protection	Current Setting	I_{REF}	$[I_{CT}]$ × (10 % to 100%) (A), in steps of 1%, Tolerance: ± 20%
		I_{REFB}	$[I_{CT}]$ × (10 % to 100%) (A), in steps of 1%, Tolerance: ± 20%
	Time Setting	-	Instantaneous
	Mode	-	**TRIP** / AL / OFF
OH Contact Overheat Monitoring	Temperature Setting	-	155°C
	Time Setting	-	Instantaneous
	Mode	-	**TRIP** / AL / OFF
Z Zone Interlock	Current Setting	-	Interlock with short time delay trip pickup current
	Time Setting	-	50 ms. or less
RPT Reverse Power Trip	Power Setting	P_R	$[P_n]$ × (4% to 100%) (kW),) in steps of 1%, Tolerance +0% -20%
	Time Setting	-	(2.5 to 20.0) (sec) at 100% of $[P_R]$, in steps of 0.01 sec, Tolerance: ± 20%, +0.15s – 0s
	Polarity	-	**NOR** / REV
	Mode	-	**TRIP** / AL / OFF

L Curve Trip Unit Setting: TemPro AGR11, TemPro PLUS (AGR-21C-L), TemPro PREMIER (AGR-31C-L)

Ampere sensing coils available for AGR-21C-L and AGR-31C-L

Type	CT Amps	Rated current [I_n] (A)			
	[I_{CT}] (A)	[I_{CT}] x 0.5	[I_{CT}] x 0.63	[I_{CT}] x 0.8	[I_{CT}] x 1.0
AR208S	200	100	125	160	200
	400	200	250	320	400
	800	400	500	630	800
AR212S	400	200	250	320	400
	800	400	500	630	800
	1000	500	630	800	1000
	1250	630	800	1000	1250
AR216S	400	200	250	320	400
	800	400	500	630	800
	1000	500	630	800	1000
	1250	630	800	1000	1250
	1600	800	1000	1250	1600
AR220S	400	200	200	250	400
	800	400	400	500	800
	1000	500	500	630	1000
	1250	630	630	800	1250
	1600	800	800	1000	1600
	2000	1000	1250	1600	2000
AR325S	2500	1250	1600	2000	2500
AR332S	3200	1600	2000	2500	3200
AR440SB	4000	2000	2500	3200	4000
AR440S	4000	2000	2500	3200	4000
AR650S	5000	2500	3200	4000	5000
AR663S	6300	3200	4000	5000	6300
AR212H	200	100	125	160	200
	400	200	250	320	400
	800	400	500	630	800
	1000	500	630	800	1000
	1250	630	800	1000	1250
AR216H	1600	800	1000	1250	1600
AR220H	2000	1000	1250	1600	2000
AR316H	200	100	125	160	200
	400	200	250	320	400
	800	400	500	630	800
	1250	630	800	1000	1250
	1600	800	1000	1250	1600
AR320H	2000	1000	1250	1600	2000
AR325H	2500	1250	1600	2000	2500
AR332H	3200	1600	2000	2500	3200
AR420H	800	400	500	630	800
	2000	1000	1250	1600	2000
AR440H	4000	2000	2500	3200	4000
AR663H	5000	2500	3200	4000	5000
	6300	6300	4000	5000	6300

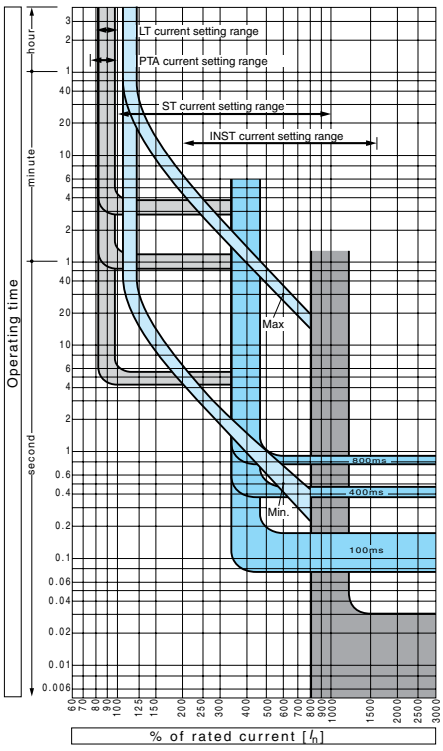
Protection characteristics L characteristic Trip Units



The ST trip characteristic shown in the curve applies when the ramp characteristic select switch is in the OFF position.

Note: Total breaking time for AR6 is 0.05 sec.

Note: I_n value is not a straight calculation. Refer to tables above for possible I_n values.



R Curve Trip Unit Setting: TemPro PLUS (AGR-21C-R)

Setting Item		Symbol	Setting Range									
Rated Current		I_n	CT rated primary current [I_{CT}] × (0.5 - 0.63 - 0.8 - 1.0) (A)									
			Applied [I_{CT}] (A)	200	400	800	1000	1250	1600	2000	2500	3200	4000
			Rated Current [I_n] (A) [I_{CT}] x 0.5	100	200	400	500	630	800	1000	1250	1600	2000
			[I_{CT}] x 0.63	125	250	500	630	800	1000	1250	1600	2000	2500
			[I_{CT}] x 0.8	160	320	630	800	1000	1250	1600	2000	2500	3200
			[I_{CT}] x 1.0	200	400	800	1000	1250	1600	2000	2500	3200	4000
LT Long Time Delay Trip	Mode Select		**Trip** / OFF									
	Pickup Current (continuous)	I_R	[I_n] × (80% to 100%) (A) in steps of 1%, Tolerance ± 5%									
	Trip Timing	t_R	(1.0 to 10.0) (sec) at 300% of [I_R], in steps of 0.01 sec, Tolerance: ± 20%, +0.15s – 0s									
	Protection Type	-	SIT: $I^{0.02}t$, VIT: I_t, EIT: I^2t, 3IT: I^3t, 4IT: I^4t									
ST Short Time Delay Trip	Mode Select		**Trip** / OFF									
	Pickup Current	I_{sd}	[I_n] × (100% to 1000%) (A), in steps of 1%, Tolerance: ± 15% Short time delay trip (ST)									
	Trip Timing	t_{sd}	Relaying time	(0.05 to 0.8) (sec) in steps of 0.01 sec.								
	I^2t Mode	$I^2t\ t_{sd}$	**OFF** / ON									
INST Instantaneous Trip INST / MCR	Mode Select		**Trip** / OFF									
	Pickup Current	Ii	[I_n] × (200% to 1600%) (A), in steps of 1%, Tolerance: ± 20%									
	INST1 or INST2 / MCR	-	INST1 or INST2 / MCR									
GF Ground Fault Trip	Pickup Current	I_g	[I_{CT}] × (10% to 100%) (A), in steps of 1%, Tolerance: ± 20%									
	Trip Timing	t_g	Relaying time (ms)	(0.1 to 2.0) (sec) in steps of 0.01 sec.								
	I^2t Mode	$I^2t\ t_g$	**OFF** / ON									
	Mode	-	**Trip** / OFF									
PTA Pre-Trip Alarm	Current Setting	I_{P1}	[I_n] × (75% to 100%) (A), in steps of 1%, Tolerance: ± 7.5%									
	Time Setting	t_{P1}	(5.0 to 200.0) (sec) at not less than [I_{P1}], in steps of 0.1 sec, Tolerance: ± 15%, +0.1s – 0s									
	Mode	-	**AL** / OFF									

Options on Request

NP N-Phase Protection Trip	Pickup Current (continuous)	I_N	[I_{CT}] × (40% to 100%) in steps of 1%
	Trip Timing	t_R	Depends on the long time delay trip pickup timing. Activated at 300% of [I_N].
NS Negative-Phase Sequence Protection	Current Setting	I_{NS}	[I_n] × (20% to 100%) (A), in steps of 1%, Tolerance: ± 10%
	Time Setting	t_{NS}	(0.4 to 4.0) (sec) at 150% of [I_{NS}], in steps of 0.1 sec, Tolerance: ± 20%, +0.15 s – 0s
	Mode	-	**TRIP** / AL / OFF
Z Zone Interlock	Current Setting	-	Interlock with short time delay trip pickup current
	Time Setting	-	50 ms or less

R Curve Trip Unit Setting: TemPro PREMIER (AGR-31C-R)

Setting Item		Symbol	Setting Range
Rated Current		I_n	CT rated primary current [I_{CT}] × (0.5 - 0.63 - 0.8 - 1.0) (A)
			Applied [I_{CT}] (A): 200 400 800 1000 1250 1600 2000 2500 3200 4000
			Rated Current [I_n] (A): [I_{CT}] x 0.5: 100 200 400 500 630 800 1000 1250 1600 2000
			[I_{CT}] x 0.63: 125 250 500 630 800 1000 1250 1600 2000 2500
			[I_{CT}] x 0.8: 160 320 630 800 1000 1250 1600 2000 2500 3200
			[I_{CT}] x 1.0: 200 400 800 1000 1250 1600 2000 2500 3200 4000
LT Long Time Delay Trip	Mode Select		**Trip** / OFF
	Pickup Current (continuous)	I_R	[I_n] × (80% to 100%) (A) in steps of 1%, Tolerance ± 5%
	Trip Timing	t_R	(1.0 to 10.0) (sec) at 300% of [I_R], in steps of 0.01 sec, Tolerance: ± 20%, +0.15s – 0s
	Protection Type	-	SIT: $I^{0.02}t$, VIT: It, EIT: I^2t, 3IT: I^3t, 4IT: I^4t
ST Short Time Delay Trip	Mode Select		**Trip** / OFF
	Pickup Current	I_{sd}	[I_n] × (100% to 1000%) (A), in steps of 1%, Tolerance: ± 15% Short time delay trip (ST)
	Trip Timing	t_{sd}	Relaying time: (0.05 to 0.8) (sec) in steps of 0.01 sec.
	I^2t Mode	I^2t t_{sd}	**OFF** / ON
INST Instantaneous Trip INST / MCR	Mode Select		**Trip** / OFF
	Pickup Current	*Ii*	[I_n] × (200% to 1600%) (A), in steps of 1%, Tolerance: ± 20%
	INST1 or INST2 / MCR	-	INST1 or INST2 / MCR
GF Ground Fault Trip	Pickup Current	I_g	[I_{CT}] × (10% to 100%) (A), in steps of 1%, Tolerance: ± 20%
	Trip Timing	t_g	Relaying time (ms): (0.1 to 2.0) (sec) in steps of 0.1 sec.
	I^2t Mode	I^2t t_g	**OFF** / ON
	Mode	-	**Trip** / OFF
PTA Pre-Trip Alarm	Current Setting	I_{P1}	[I_n] × (75% to 100%) (A), in steps of 1%, Tolerance: ± 7.5%
	Time Setting	t_{P1}	(5.0 to 200.0) (sec) at not less than [I_{P1}], in steps of 0.1 sec, Tolerance: ± 15%, + 0.1s – 0s
	Mode	-	**AL** / OFF
UV Undervoltage Alarm	Voltage Setting	-	[V_n] × (40% to 80%) (V), in steps of 1%, Tolerance: ± 5%
	Time Setting	-	(0.1 to 36) (sec) at voltage setting or less, in steps of 0.1 sec, Tolerance: ± 15%, +0.1s – 0s
	Recovery Voltage Setting	-	[V_n] × (80% to 95%) (V), in steps of 1%, Tolerance: ± 5%
	Mode	-	**AL** / OFF
OV Over voltage Alarm	Voltage Setting	-	[V_n] × (105% to 150%) (V), in steps of 1%, Tolerance: ± 5%
	Time Setting	-	(0.1 to 5.0) (sec) at voltage setting or less, in steps of 0.1 sec, Tolerance: ± 15%, +0.1s – 0s
UFOF Under / Over Frequency Protection	Voltage Setting	F_{uf}	[F_n] × (1% to 99%) (V), in steps of 1%
	Time Setting	t_{uf}	(0.1 to 10) (sec) in steps of 0.1 sec.
	Voltage Setting	F_{of}	[F_n] × (100% to 199%) (V), in steps of 1%
	Time Setting	t_{of}	(0.1 to 10) (sec) in steps of 0.1 sec.
	Mode	-	**TRIP** / AL / OFF

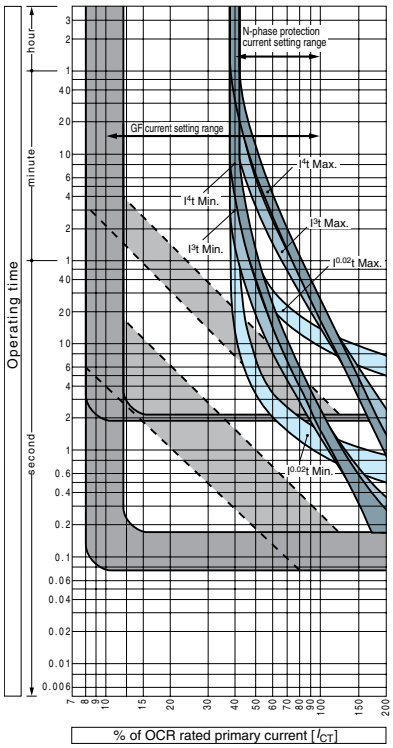
Setting Item		Symbol	Setting Range
Options on Request			
NP N-Phase Protection Trip	Pickup Current (continuous)	I_N	$[I_{CT}]$ × (40% to 100%) in steps of 1%
	Trip Timing	t_R	Depends on the long time delay trip pickup timing. Activated at 300% of $[I_N]$.
NS Negative-Phase Sequence Protection	Current Setting	I_{NS}	$[I_n]$ × (20% to 100%) (A), in steps of 1%, Tolerance: ± 10%
	Time Setting	t_{NS}	(0.4 to 4.0) (sec) at 150% of $[I_{NS}]$, in steps of 0.1 sec, Tolerance: ± 20%, +0.15 s – 0 s
	Mode	-	**TRIP** / AL / OFF
REF Line Side Ground Fault Protection	Current setting	I_{REF}	$[I_{CT}]$ × (10 % to 100%) (A), in steps of 1%, Tolerance: ± 20%
		I_{REFB}	$[I_{CT}]$ × (10 % to 150%) (A), in steps of 1%, Tolerance: ± 20%
	Time Setting	-	Instantaneous
	Mode	-	**TRIP** / AL / OFF
OH Contact Overheat Monitoring	Temperature Setting	-	155°C
	Time Setting	-	Instantaneous
	Mode	-	**TRIP** / AL / OFF
Z Zone Interlock	Current Setting	-	Interlock with short time delay trip pickup current
	Time Setting	-	50 ms. or less
RPT Reverse Power Trip	Power Setting	P_R	[Pn] × (4% to 100%) (kW), in steps of 1%, Tolerance +0% -20%
	Time Setting	-	(2.5 to 20.0) (sec) at 100% of [PR], in steps of 0.01 sec, Tolerance: ±20%, +0.15s – 0s
	Polarity	-	**NOR** / REV
	Mode	-	**TRIP** / AL / OFF

R Curve Trip Unit Setting: TemPro PLUS (AGR-21C-R), TemPro PREMIER (AGR-31C-R)

Ampere sensing coils available for AGR-21C-R and AGR-31C-R

Type	CT Amps	Rated current [I_n] (A)			
	[I_{CT}]	[I_{CT}]	[I_{CT}]	[I_{CT}]	[I_{CT}]
	(A)	x 0.5	x 0.63	x 0.8	x 1.0
AR208S	200	100	125	160	200
	400	200	250	320	400
	800	400	500	630	800
AR212S	400	200	250	320	400
	800	400	500	630	800
	1000	500	630	800	1000
	1250	630	800	1000	1250
AR216S	400	200	250	320	400
	800	400	500	630	800
	1000	500	630	800	1000
	1250	630	800	1000	1250
	1600	800	1000	1250	1600
AR220S	400	200	200	250	400
	800	400	400	500	800
	1000	500	500	630	1000
	1250	630	630	800	1250
	1600	800	800	1000	1600
	2000	1000	1250	1600	2000
AR325S	2500	1250	1600	2000	2500
AR332S	3200	1600	2000	2500	3200
AR440SB	4000	2000	2500	3200	4000
AR440S	4000	2000	2500	3200	4000
AR650S	5000	2500	3200	4000	5000
AR663S	6300	3200	4000	5000	6300
AR212H	200	100	125	160	200
	400	200	250	320	400
	800	400	500	630	800
	1000	500	630	800	1000
	1250	630	800	1000	1250
AR216H	1600	800	1000	1250	1600
AR220H	2000	1000	1250	1600	2000
AR316H	200	100	125	160	200
	400	200	250	320	400
	800	400	500	630	800
	1250	630	800	1000	1250
	1600	800	1000	1250	1600
AR320H	2000	1000	1250	1600	2000
AR325H	2500	1250	1600	2000	2500
AR332H	3200	1600	2000	2500	3200
AR420H	800	400	500	630	800
	2000	1000	1250	1600	2000
AR440H	4000	2000	2500	3200	4000
AR663H	5000	2500	3200	4000	5000
	6300	6300	4000	5000	6300

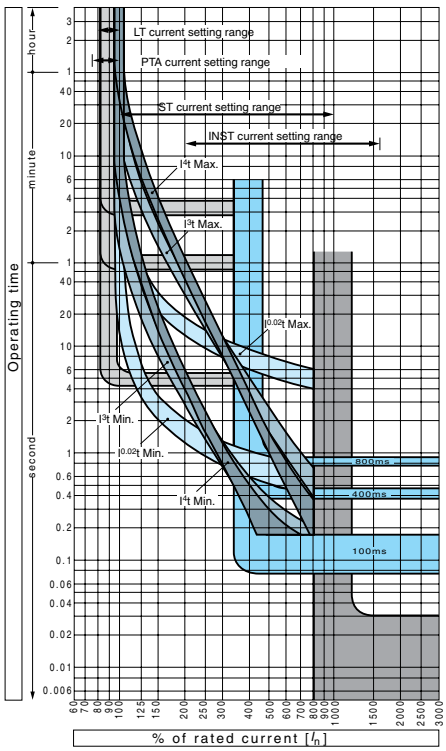
Protection characteristics R characteristic Trip Units



The ST trip characteristic shown in the curve applies when the ramp characteristic select switch is in the OFF position.

Note: Total breaking time for AR6 is 0.05 sec.

Note: I_n value is not a straight calculation. Refer to tables above for possible I_n values.



S Curve Trip Unit Setting: TemPro PLUS (AGR-21C-S)

Trip Unit Function		Symbol	Min	Max	Setting increments	Setting Tolerances and other data
LT Long Time Delay Trip	Pick-up current x [I_n]	I_R	0.80	1.15	0.01	t_R operates at 120 % of I_R I_R tolerance: ± 5 % t_R tolerance: ± 15 %, 0 - 150 ms
	Time-delay (s)	t_R	15	60	0.01	
	Mode selection	-	TRIP / OFF			
ST Short Time Delay Trip	Pick-up current x [I_n]	I_{sd}	2.0	5.0	0.01	I_{sd} tolerance: ± 10 %
	Time-delay (s)	t_{sd}	0.1	0.8	0.01	
	RAMP I^2t	-	OFF / ON			
	Mode selection	-	TRIP / OFF (if OFF INST cannot be OFF)			
INST Instantaneous Trip INST / MCR	Pick-up current x [I_n]	I_i	2.0	16.0	0.01	I_i tolerance: ± 20 %
	INST/MCR	-	INST/MCR			
	Mode selection	-	TRIP / OFF (if OFF STD cannot be OFF)			
PTA Pre Trip Alarm	Pick-up current x [I_n]	I_{P1}	0.75	1.05	0.01	t_{P1} operates at 120 % of I_{P1} I_{P1} tolerance: ± 5 % t_{P1} tolerance: ± 15 %, 0 - 100 ms
	Time-delay (s)	t_{P1}	10.0	30.0	0.10	
	Mode selection	-	ALARM / OFF			

S Curve Trip Unit Setting: TemPro PREMIER (AGR-31C-S)

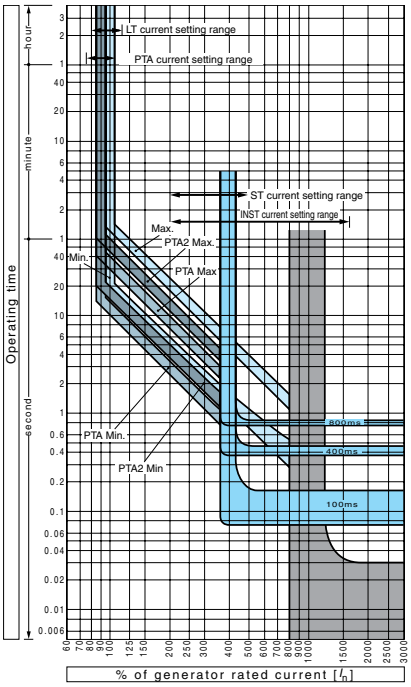
Trip Unit Function		Symbol	Min	Max	Setting increments	Setting Tolerances and other data
LT Long Time Delay Trip	Pick-up current x [I_n]	I_R	0.80	1.15	0.01	t_R operates at 120 % of I_R I_R tolerance: ± 5 % t_R tolerance: ± 15 %, 0 - 150 ms
	Time-delay (s)	t_R	15	60	0.01	
	Mode selection	-	TRIP / OFF			
ST Short Time Delay Trip	Pick-up current x [I_n]	I_{sd}	2.0	5.0	0.01	I_{sd} tolerance: ± 10 %
	Time-delay (s)	t_{sd}	0.1	0.8	0.01	
	RAMP I^2t	-	OFF / ON			
	Mode selection	-	TRIP / OFF (if OFF INST cannot be OFF)			
INST Instantaneous Trip INST / MCR	Pick-up current x [I_n]	I_i	2.0	16.0	0.01	I_i tolerance: ± 20 %
	INST/MCR	-	INST/MCR			
	Mode selection	-	TRIP / OFF (if OFF STD cannot be OFF)			
GF Ground fault trip	Pick-up current x [I_{CT}]	I_g	0.10	1.0	0.01	I_g tolerance: ± 20 %
	Time-delay (s)	t_G	0.10	2.0	0.01	
	RAMP I^2t	-	OFF/ON			
	Mode selection	-	TRIP / ALARM / OFF			
PTA Pre Trip Alarm	Pick-up current x [I_n]	I_{P1}	0.75	1.05	0.01	t_{P1} operates at 120 % of I_{P1} I_{P1} tolerance: ± 5 % t_{P1} tolerance: ± 15 %, 0 - 100 ms
	Time-delay (s)	t_{P1}	10.0	30.0	0.10	
	Mode selection	-	ALARM / OFF			
UV Under Voltage Alarm	Recovery Level x [V_n]	VUVP	0.80	0.95	0.01	Recovery Voltage tolerance ± 5 % t_{UVD} tolerance: ± 15 %, 0 - 100 ms
	Alarm Level x [V_n]	VUVD	0.40	0.80	0.01	
	Time-delay (s)	tUVD	0.10	36.0	0.10	
	Mode selection	-	ALARM / OFF			
OV Over Voltage Alarm	Alarm Level x [V_n]	V_{OV}	1.05	1.50	0.01	V_{OV} tolerance: ± 5 % t_{OV} tolerance: ± 15 %, 0 -100 ms
	Time-delay (s)	t_{OV}	0.10	5.0	0.10	
UFOF Under Frequency Over Frequency Protection	Pick-up Level x [F_N]	F_{UF}	0.80	1.05	0.01	F_N is the ACB set frequency which is 50 Hz in A-NZ. Voltage pick up level is defined as ([F_N] x [F_{UF}]) or ([F_N] x [F_{OF}])
	Time-delay (s)	t_{UF}	0.10	10.0	0.10	
	Pick-up Level x [F_N]	F_{OF}	0.95	1.40	0.01	
	Time-delay (s)	t_{OF}	0.10	10.0	0.10	
	Mode	-	TRIP / ALARM / OFF			
OPTIONS on request						
PTA2	Pick-up current x [I_n]	I_{P2}	0.75	1.05	0.01	t_{P2} operates at 120 % of I_{P2} I_{P2} tolerance: ± 5 % t_{P2} tolerance: ± 15 %, 0 - 100 ms
	Time-delay (s)	t_{P2}	1.5 x t_{P1} at 120% of I_{P2}, and t_{P1} setting			
	Mode selection	-	ALARM / OFF			
OH	Temperature setting	-	155 °C			-
	Time setting	-	Instantaneous			
	Mode	-	TRIP / ALARM / OFF			
Z	Current setting	-	Same as short time delay trip pickup current			-
	Time setting	-	50 ms or less			
RP	Power setting (kW)	P_R	4.0	100	0.01	P_R Tolerance: 0 % to -20 %

S Curve Trip Unit Setting: TemPro PLUS (AGR-21C-S), TemPro PREMIER (AGR-31C-S)

Ampere sensing coils available for AGR-21C-S and AGR-31C-S

Type	Trip Unit rated primary current	Applicable range of generator rated current
	$[I_{CT}]$ (A)	$[I_n]$ (A)
AR208S	200	$100 \le [I_n] \le 200$
	400	$200 \le [I_n] \le 400$
	800	$400 \le [I_n] \le 800$
AR212S	400	$200 \le [I_n] \le 400$
	800	$400 \le [I_n] \le 800$
	1250	$630 \le [I_n] \le 1250$
AR216S	400	$200 \le [I_n] \le 400$
	800	$400 \le [I_n] \le 800$
	1250	$630 \le [I_n] \le 1250$
	1600	$800 \le [I_n] \le 1600$
AR220S	400	$200 \le [I_n] \le 400$
	800	$400 \le [I_n] \le 800$
	1250	$630 \le [I_n] \le 1250$
	1600	$800 \le [I_n] \le 1600$
	2000	$1000 \le [I_n] \le 2000$
AR325S	2500	$1250 \le [I_n] \le 2500$
AR332S	3200	$1600 \le [I_n] \le 3200$
AR440SB	4000	$2000 \le [I_n] \le 4000$
AR440S	4000	$2000 \le [I_n] \le 4000$
AR650S	2000	$1000 \le [I_n] \le 2000$
AR663S	6300	$3200 \le [I_n] \le 6300$
AR212H	200	$100 \le [I_n] \le 200$
	400	$200 \le [I_n] \le 400$
	800	$400 \le [I_n] \le 800$
	1250	$630 \le [I_n] \le 1250$
AR216H	1600	$800 \le [I_n] \le 1600$
AR220H	2000	$1000 \le [I_n] \le 2000$
AR316H	200	$100 \le [I_n] \le 200$
	400	$200 \le [I_n] \le 400$
	800	$400 \le [I_n] \le 800$
	1250	$630 \le [I_n] \le 1250$
	1600	$800 \le [I_n] \le 1600$
AR320H	2000	$1000 \le [I_n] \le 2000$
AR325H	2500	$1250 \le [I_n] \le 2500$
AR332H	3200	$1600 \le [I_n] \le 3200$

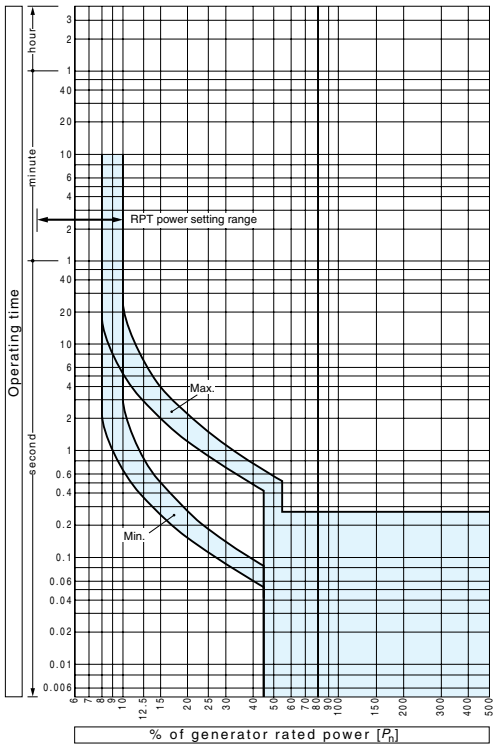
Protection characteristics S characteristic Trip Units



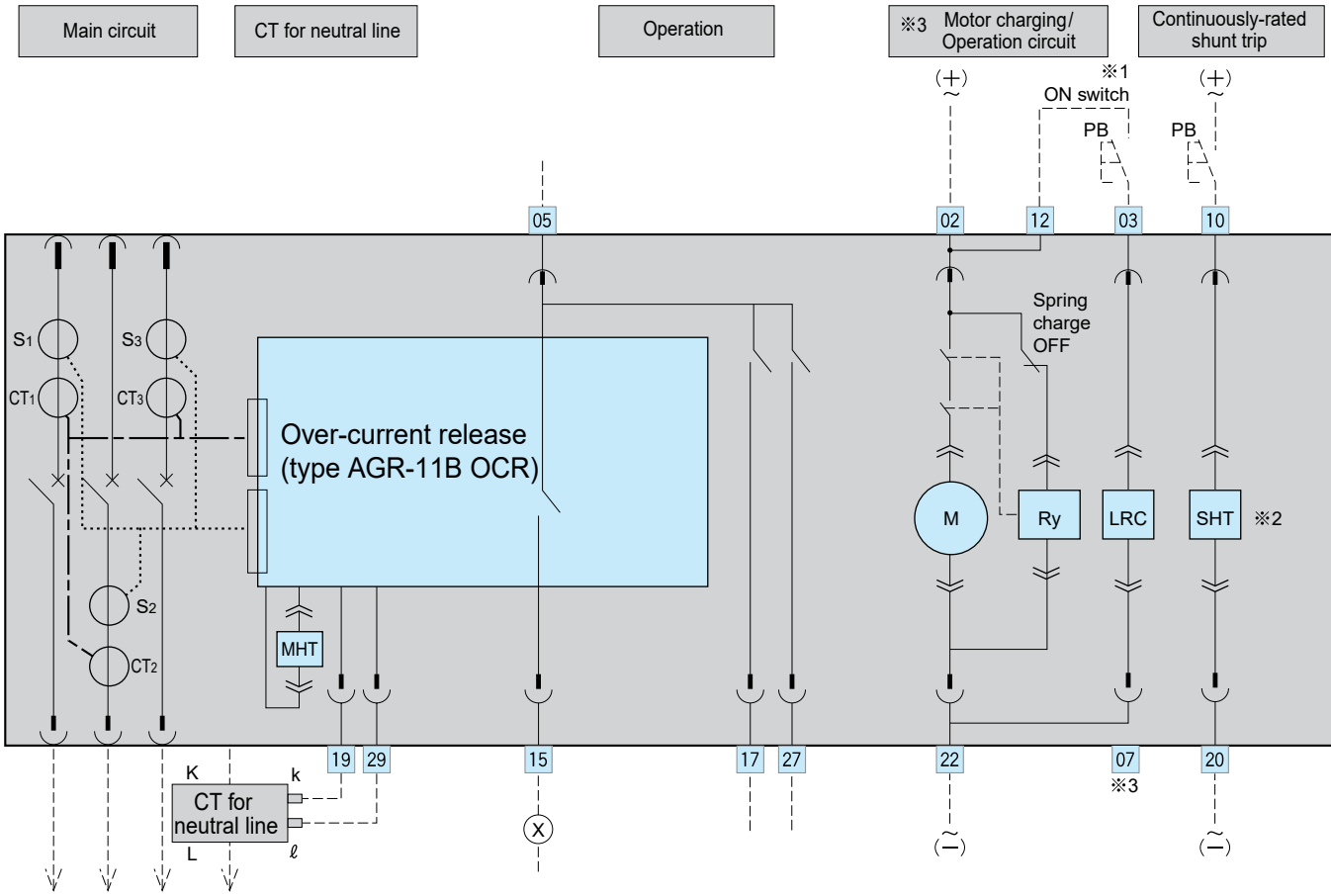
The ST trip characteristic shown in the curve applies when the ramp characteristic select switch is in the OFF position.

Note: Total breaking time for AR6 is 0.05 sec.

Note: I_n value is not a straight calculation. Refer to tables above for possible I_n values.



Connection – AGR11B



Terminal Description

02 22	Control power supply AC 100 - 240 V, DC 100 - 250 V, DC 24 V, DC 48 V
12	Operation switch, common
03	ON switchv
05	Operation indication terminal, common
15	Trip Unit indication or single-contact trip indication (40ms signal)
17	Trip indication (not ready indication)
27	Spring charge indicator
10 20	Continuously-rated shunt trip
19	Separate CT for neutral line (k)
29	Separate CT for neutral line (ℓ)
08 18 28	UVT power supply
09	UVT power supply common

Symbols for Accessories

CT1 - CT3	Power CTs
S1 - S3	Current sensors
M	Charging motor
LRC	Latch release coil
MHT	Magnetic Hold Trigger
	Isolating terminal connector (for draw-out type)
	Manual connector
	User wiring
	Relay or indicator lamp

※ 1: Do not series connect a normally open auxiliary contact switch to ON switch contact, otherwise, ACB pumping may occur.
※ 2: Refer previous pages the circuit diagram of the continuously-rated shunt trip device with a capacitor trip device.
※ 3: For motor split circuit, terminals 02 22 and 03 , 07 are used for charging and closing operation respectively. (Please specify when ordering)
※ 4: Refer to previous pages on UVT wiring (short pulse only)
※ 5: Only one of terminals 08 , 18 , 28 must be used as this is a single phase UVT.
※ 6: Do not use these terminals for other circuits when both instantaneously rated shunt trip and UVT are fitted. These terminals are used by Terasaki as the anti burnout SW for the instantaneously rated shunt trip.

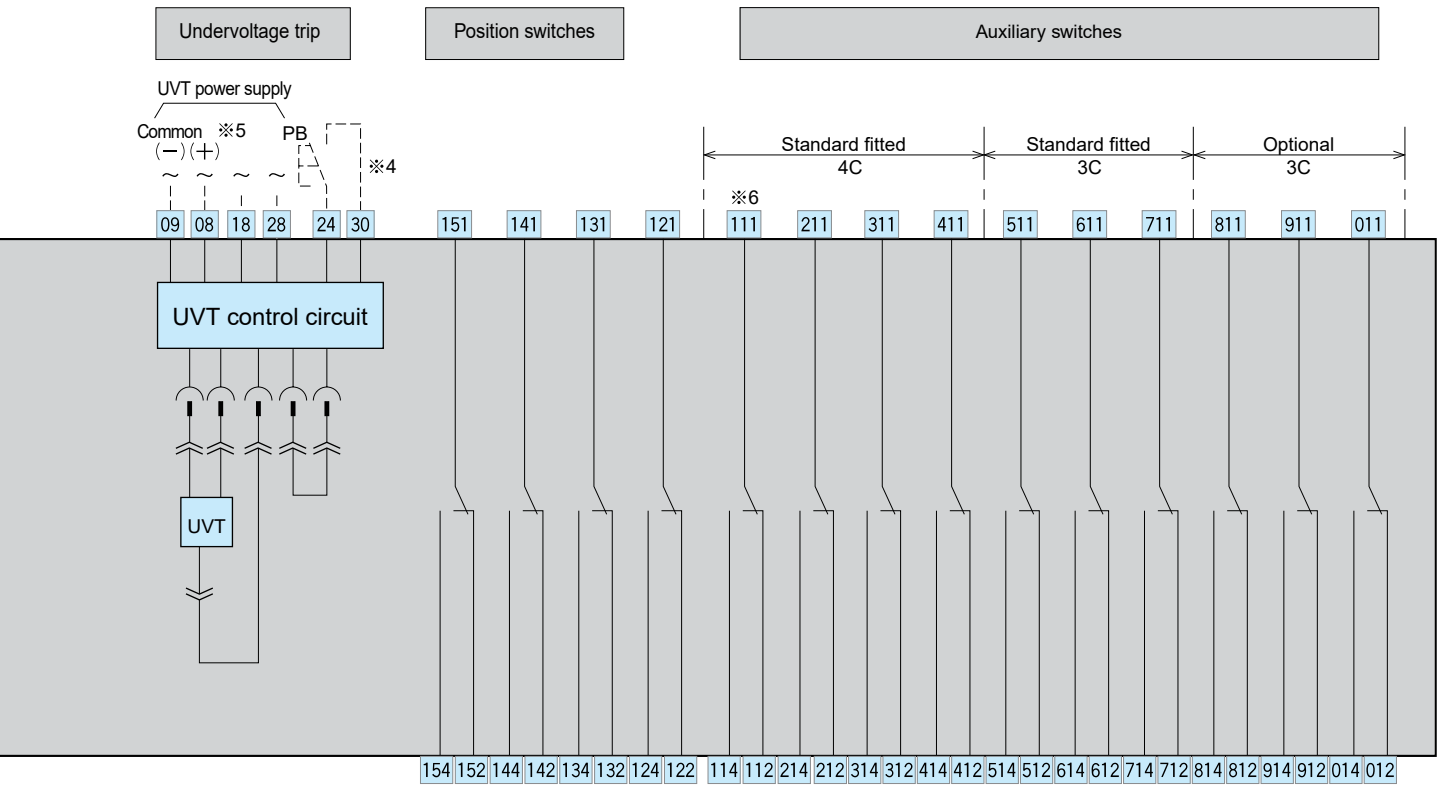
Note: In case of a UVT and a Shunt fitted together or Double opening or closing coil, use an aux. switch to prevent burnout. Contact NHP for wiring or pre-ordering of an ACB.

UVT Power Supply

Term. No.	AC 100 V Unit	AC 200 V Unit	AC 400 V Unit	AC 450 V Unit
08 — 09	100 V	200 V	380 V	450 V
08 — 09	110 V	220 V	415 V	480 V
08 — 09	120 V	240 V	440 V	400 V

Term. No.	DC 24 V Unit	DC 48 V Unit	DC 100 V Unit	DC 110 V Unit
08 — 09	24 V	48 V	100 V	110 V

UVT NOTE: The UVT is either 100 - 120 V AC, 200 - 240 V AC or 400 - 480 V AC, not all three!



Designation of Terminals for Auxiliary and Position Switches

* * *

- 1: Common
  - 2: b-contact (normally open)
  - 4: a-contact (normally closed)
- 1: Auxiliary switch
  - 2: Position switch (for CONNECTED)
  - 3: Position switch (for TEST)
  - 4: Position switch (for ISOLATED)
  - 5: Position switch (for INSERT)
- 1 - 0: Switch numbers
- A, B, C: Auxiliary switches for microload

CONNECTED position	121 -124 ON
	121 - 122 OFF
TEST position	131 - 134 ON
	131 - 132 OFF
ISOLATED position	141 - 144 ON
	141 - 142 OFF
INSERT position	151 - 154 ON
	151 - 152 OFF

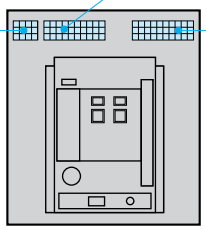
Position switches

Top	151	141	131	121
Middle	154	144	134	124
Bottom	152	142	132	122

Top	131	121
Middle	134	124
Bottom	132	122

Operation/control circuits

01	02	03	04	05	06	07	08	09	10	
11	12	13	14	15	16	17	18	19	20	
21	22	23	24	25	26	27	28	29	30	



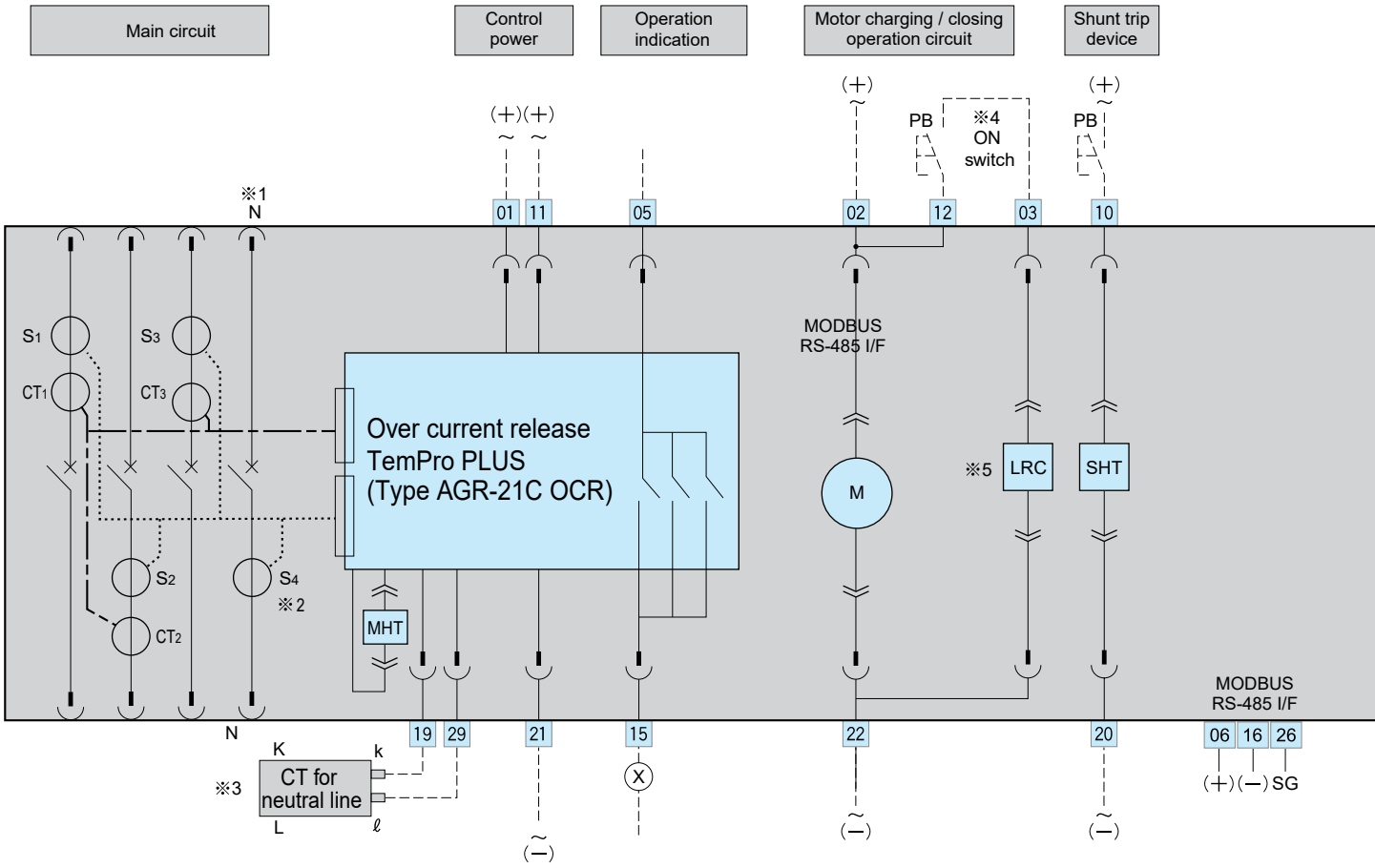
Auxiliary switches

Terminal arrangement up to 10c

111	211	311	411	511	611	711	811	911	011	
114	214	314	414	514	614	714	814	914	014	
112	212	312	412	512	612	712	812	912	012	

ACBs

Connection – AGR21C



Terminal Description

01 21	Control power supply AC 200 - 240 V, DC 200 - 250 V, DC 48 V
01 11	Control power supply AC 100 - 120 V
11 21	Control power supply AC 100 - 125 V, DC 24 V
02 22	Motor / LRC power supply AC 100 - 240 V, DC 100 - 250 V, DC 24 V, DC 48 V
10 20	Continuously-rated shunt trip
08 18 28	Single phase UVT power supply only. No. 3 phase connection!
03	ON switch
05	Operation indication terminal, common
15	LT, ST, INST, GF trip indication
06 16 26	MODB US RS-485 (+TX, -RX, SG)
19	Separate CT for neutral line (k)
29	Separate CT for neutral line (ℓ)
09	UVT power supply common
24	Used with terminal 30 for remote ACB opening ※6

Main Circuit Input Voltage (Required)

13	'R' Line Voltage (RED PHASE)
23	'S' Line Voltage (WHITE PHASE)
04	'T' Line Voltage (BLUE PHASE)
14	'N' - Neutral

Symbols for Accessories

CT1 - CT3	Power CTs
S1 - S3	Current sensors
M	Charging motor
LRC	Latch release coil
MHT	Magnetic Hold Trigger
	Isolating terminal connector (for draw-out type)
	Manual connector
	User wiring
	Relay or indicator lamp

※ 1: For 4 pole ACBs.
※ 2: For 4 pole ACBs equiped with N-phase protection and / or Ground Fault trip functions.
※ 3: Used for 3-pole ACB's with Ground Fault trip function to be installed in a 3-phase, 4-wire circuit. N-phase CT is polarity sensitive. Refer ACB user manual for external CT orientation installation information.
※ 4: Do not connect an ON switch in series with a Normally Open auxiliary contact, as this may cause ACB pumping to occur.
※ 5: When the LRC and motor voltages are different (a SPLIT VOLTAGE), please specify this at time of of ordering. In this case, terminals 02 and 22 are used for the motor and terminals 03 and 07 will be used for the LRC.
※ 6: When using a UVT for remote ACB opening, refer to ACB user manual section "3.0 Tripping options" for details rated shunt trip.
※ 7: Only one of terminals 08 , 18 , 28 must be used as this is a single phase UVT.

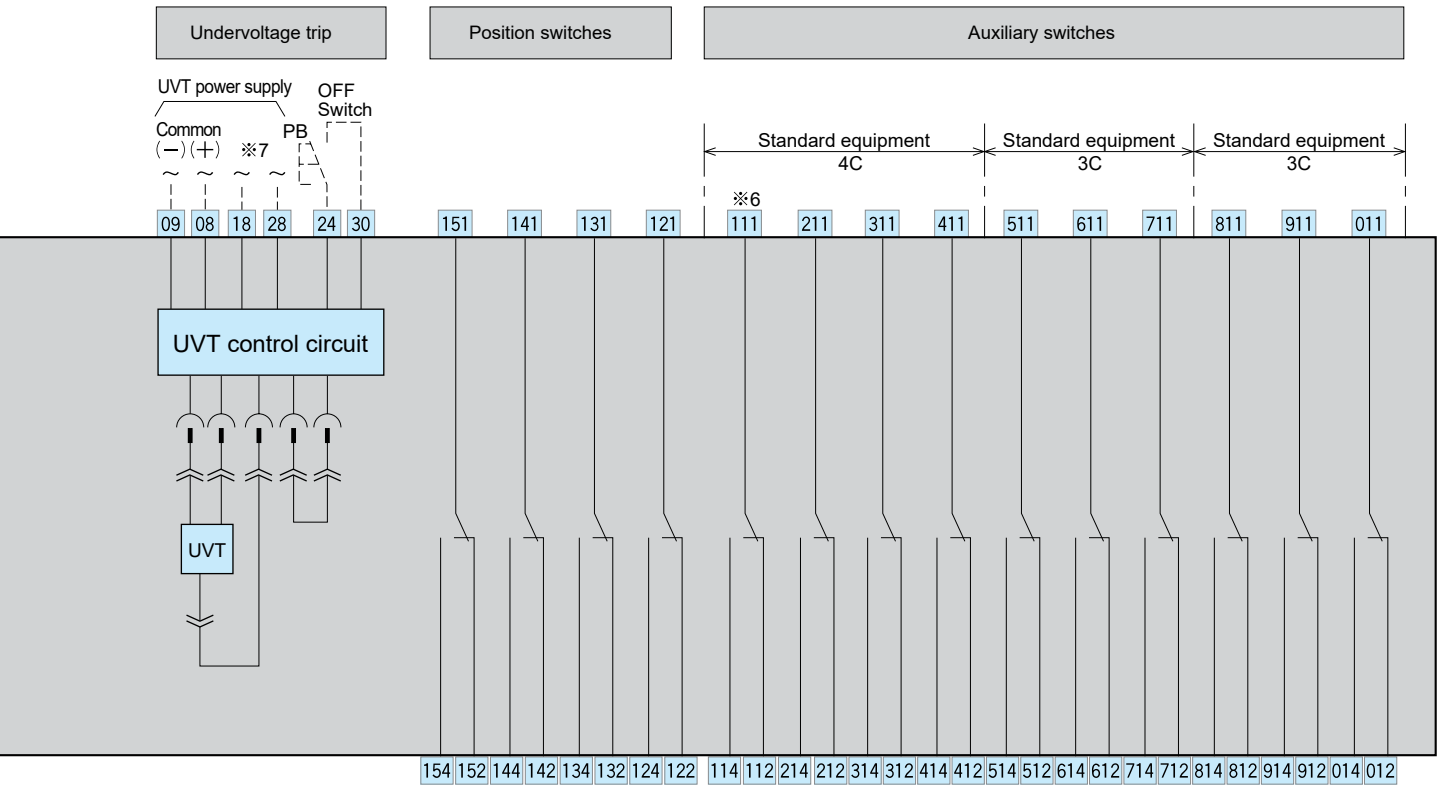
Note: In case of a UVT and a Shunt fitted together or Double opening or closing coil, use an aux. switch to prevent burnout. Contact NHP for wiring or pre-ordering of an ACB.

UVT Power Supply

Term. No.	AC 100 V Unit	AC 200 V Unit	AC 400 V Unit
08 — 09	100 V	200 V	380 V
08 — 09	110 V	220 V	415 V
08 — 09	120 V	240 V	440 V

Term. No.	DC 24 V Unit	DC 48 V Unit	DC 100 V Unit
08 — 09	24 V	48 V	100 V

UVT NOTE: The UVT is either AC 100 V, AC 200 V or AC 400 V, not all three!



All external pushbuttons and connections made to the above terminals are to be made and supplied by the user

Designation of Terminals for Auxiliary and Position Switches

* * *

- 1: Common
  2: b-contact (normally open)
  4: a-contact (normally closed)
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- 1 - 0: Switch numbers
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TEST position	131 - 134 ON
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INSERT position	151 - 154 ON
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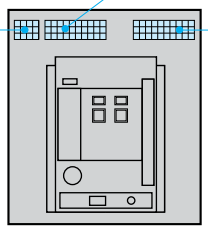
Position Switches

Top	151	141	131	121
Middle	154	144	134	124
Bottom	152	142	132	122

Top	131	121
Middle	134	124
Bottom	132	122

Operation / Control Circuits

01	02	03	04	05	06	07	08	09	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

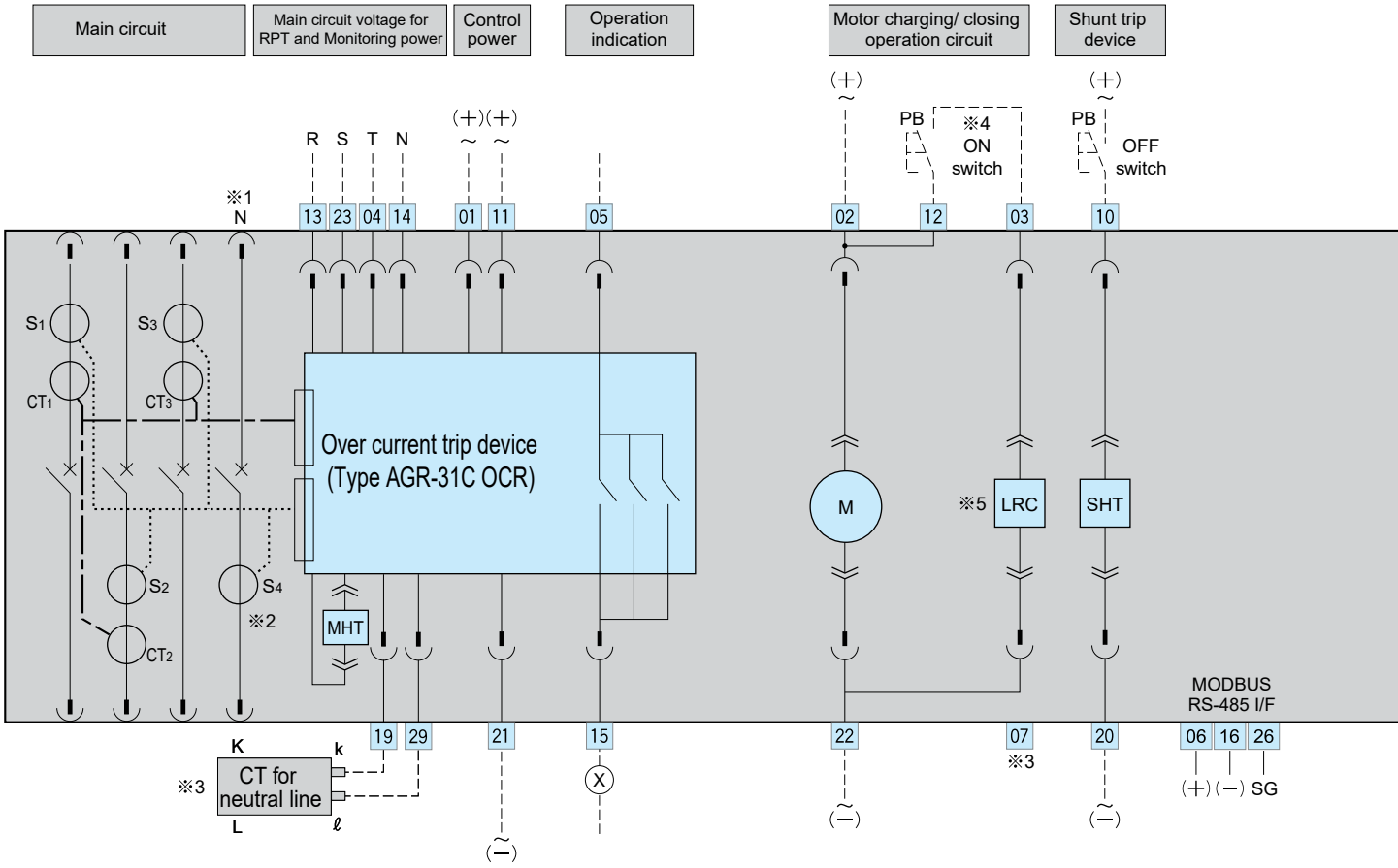


Auxiliary Switches

(4C + 3C + 3C terminal connections)

111	211	311	411	511	611	711	811	911	011
114	214	314	414	514	614	714	814	914	014
112	212	312	412	512	612	712	812	912	012

Connection – AGR31C



Terminal Description

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01 11	Control power supply AC 100 - 120 V
11 21	Control power supply DC 100 - 125 V, DC 24 V
02 22	Motor / LRC power supply AC 100 - 240 V, DC 100 - 250 V, DC 24 V, DC 48 V
10 20	Shunt trip
08 18 28	Single phase UVT power supply, NO 3 phase connection
03	ON switch (MUST HAVE LRC INSTALLED TO WORK)
05	Operation indication terminal, common
15	LT, ST, INST, GF trip indication (AND RPT on 'S' type Trip Unit)
06 16 26	MODB US RS-485 (+TX -RX,SG)
19	Separate CT for neutral line (k)
29	Separate CT for neutral line (ℓ)
09	UVT power supply common
24	Used with terminal 30 for remote ACB opening ※6

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M	Charging motor
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MHT	Magnetic Hold Trigger
	Isolating terminal connector (for draw-out type)
	Manual connector
	User wiring
	Relay or indicator lamp

※ 1: For 4 pole ACBs.
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※ 7: Only one of terminals 08 , 18 , 28 must be used as this is a single phase UVT.

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UVT Power Supply

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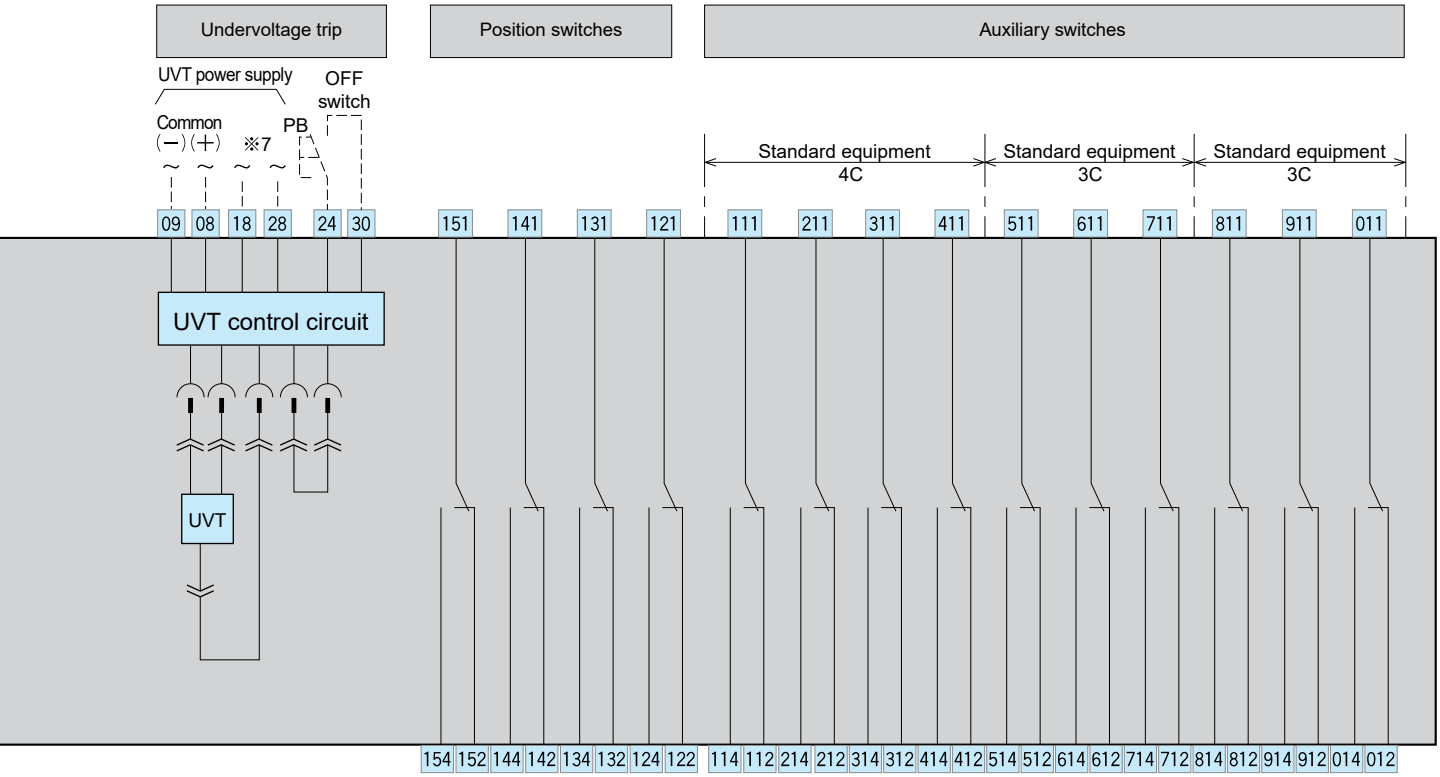
28 — 09	120 V	240 V	440 V

Term. No.	DC 24 V Unit	DC 48 V Unit	DC 100 V Unit
08 — 09	24 V	48 V	100 V

UVT NOTE: The UVT is either AC 100 V, AC 200 V or AC 400 V, not all three!



All external pushbuttons and connections made to the above terminals are to be made and supplied by the user

Designation of Terminals for Auxiliary and Position Switches

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- 1: Common
- 2: b-contact (normally open)
- 4: a-contact (normally closed)

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- 3: Position switch (for TEST)
- 4: Position switch (for ISOLATED)
- 5: Position switch (for INSERT)

- 1 - 0: Switch numbers
- A, B, C: Auxiliary switches for microload

CONNECTED position	121 -124 ON
	121 - 122 OFF
TEST position	131 - 134 ON
	131 - 132 OFF
ISOLATED position	141 - 144 ON
	141 - 142 OFF
INSERT position	151 - 154 ON
	151 - 152 OFF

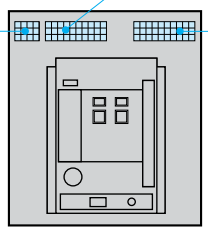
Position switches

Top	151	141	131	121
Middle	154	144	134	124
Bottom	152	142	132	122

Top	131	121
Middle	134	124
Bottom	132	122

Operation/control circuits

01	02	03	04	05	06	07	08	09	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30



Auxiliary switches

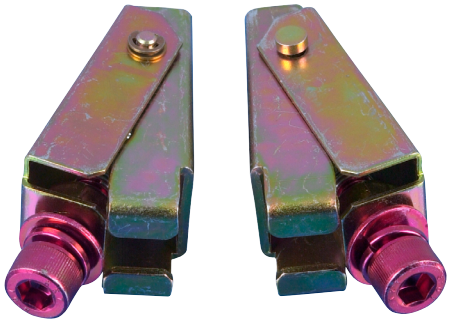
(4C + 3C + 3C terminal connections)

111	211	311	411	511	611	711	811	911	011
114	214	314	414	514	614	714	814	914	014
112	212	312	412	512	612	712	812	912	012

Customer Fit Accessories

Fixing Bolts for ACB

Holds the breaker firmly inside the carriage.



Item Description	Catalogue No.
Suits AR2, AR3, AR4 ACBs	AR234VIBRATBOLTS
Suits AR6 ACBs	AR6VIBRATBOLTS

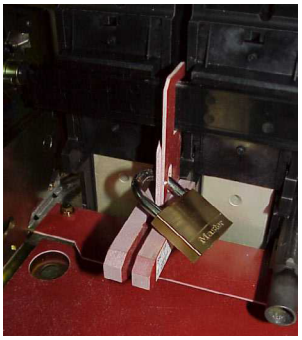
Lifting Lugs

AR ACB Body Lifting Plates

Item Description	Catalogue No.
Size 2/3/4 800 - 4000AF	AR234ACBLIFTLUGS
Size 6 5000 - 6300AF	AR6ACBLIFTLUGS

Padlock Main Safety Shutters

Allows shutters to be padlocked



Item Description	Catalogue No.
Suits 3/4P AR2, AR3 ACBs	AR23SHUTPADLOCK
Suits 3/4P AR4 ACBs	AR4SHUTPADLOCK
Suits 3P AR6 ACBs	AR6SHUTPADLOCK3P
Suits 3P AR6 ACBs	AR6SHUTPADLOCK4P

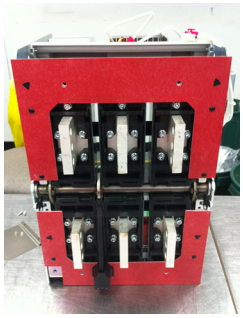
Interpole Barrier

For 4P version, use part numbers ending in 4P

Item Description	Catalogue No.
Suits 3P AR2 ACB	AR2INTPOLEBAR3P
Suits 3P AR3 ACB	AR3INTPOLEBAR3P
Suits 3P AR4 ACB	AR4INTPOLEBAR3P
Suits 3P AR6 ACB	AR6INTPOLEBAR3P

Rear Insulation Barrier

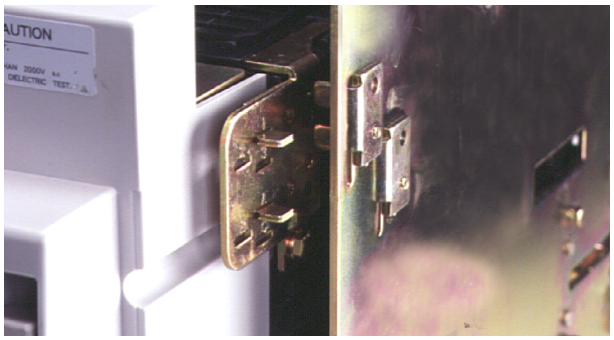
Rear insulation plates which add an additional barrier over the ACB rear



Item Description	Catalogue No.
Suits 3P AR2 ACB	AR23CBI2
Suits 4P AR2 ACB	AR24CBI2
Suits 3P AR3 ACB	AR33CBI2
Suits 4P AR3 ACB	AR34CBI2

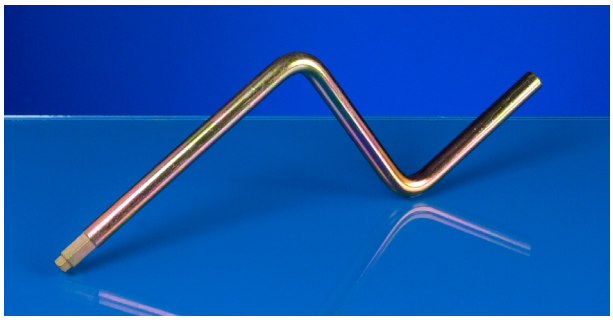
Incorrect Insertion Device

Prevents ACB and carriage mix up.
Order body kit and carriage kit.



Item Description	Catalogue No.
Suits AR2, AR3, AR4 ACBs	AR234MALINDEV
Suits AR6 ACBs	AR6MALINDEV

Spare Handles for Drawout ACBs



Item Description	Catalogue No.
External Racking Handle	AREXTERNLHANDLE
Internal Racking Handle that stores within the ACB, storage sheath sold seperately and NHP Service fit only.	ARINTERNLHANDLE

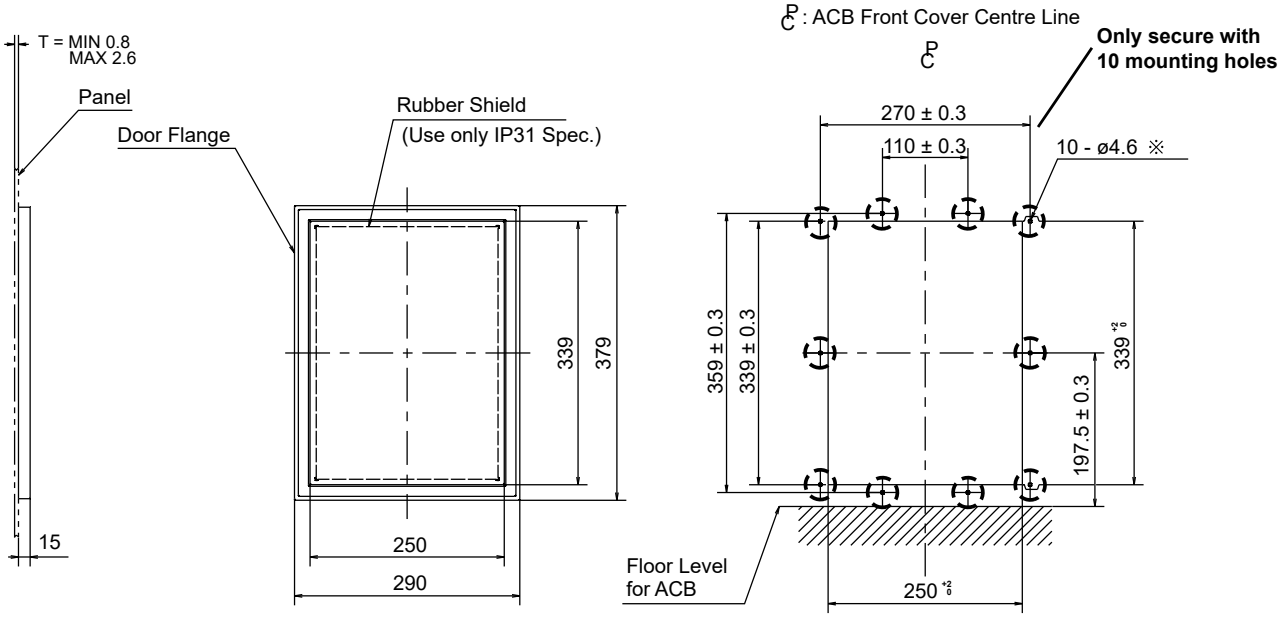
Circuit Breakers > ACBs > Customer Fit Accessories <

IP 41 Door Flange

A door flange can be used as a decoration panel that covers the cutout on the switchboard panel, and provides IP 41 protection with the gasket fitted. Only drill the 10 holes indicated below to achieve IP 41.

Item Description	Catalogue No.
AR ACB Door Flange IP41	ARDOORFLANGEIP41

Dimensions

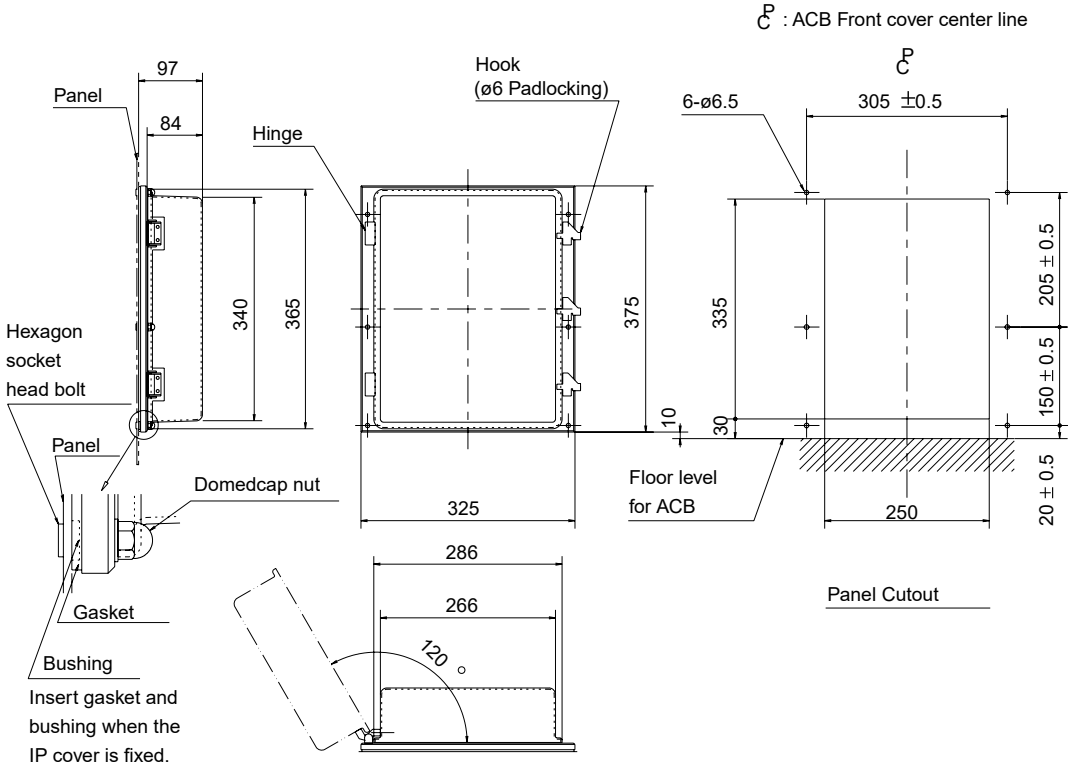


IP 55 Door Cover

An IP cover provides an IP 55 grade of protection as defined in IEC 60529, even if the breaker body is in the ISOLATED position, the IP cover can still be fitted on the ACB.

Item Description	Catalogue No.
AR ACB IP55 Lockable Escutcheon Door Cover	ARDOORCOVERIP55

Dimensions



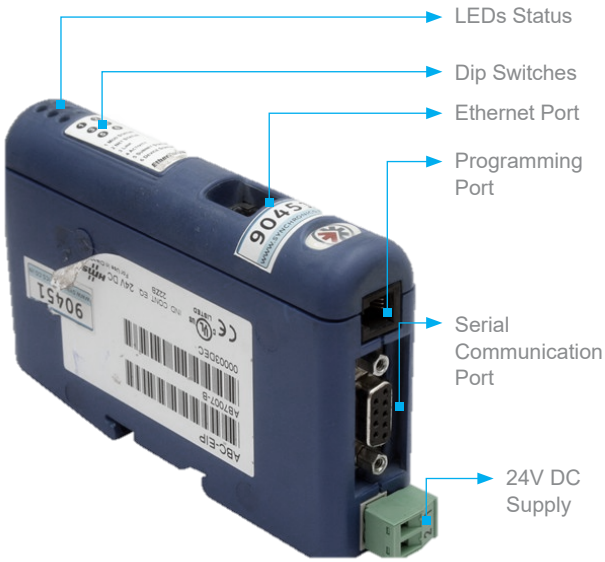
Communications Gateways - Anybus

NHP Anybus modules can connect non-networked devices to any major fieldbus or industrial Ethernet. The module performs an intelligent conversion between the serial protocols (Modbus RTU) of Terasaki Air Circuit Breakers to Ethernet / TCP. All data between the fieldbus and the serial network is stored in an internal memory buffer inside the Anybus module. The data exchanged between the PLC on the fieldbus / Ethernet and the ACB is then made using the input and output areas of the internal memory within the Anybus module.

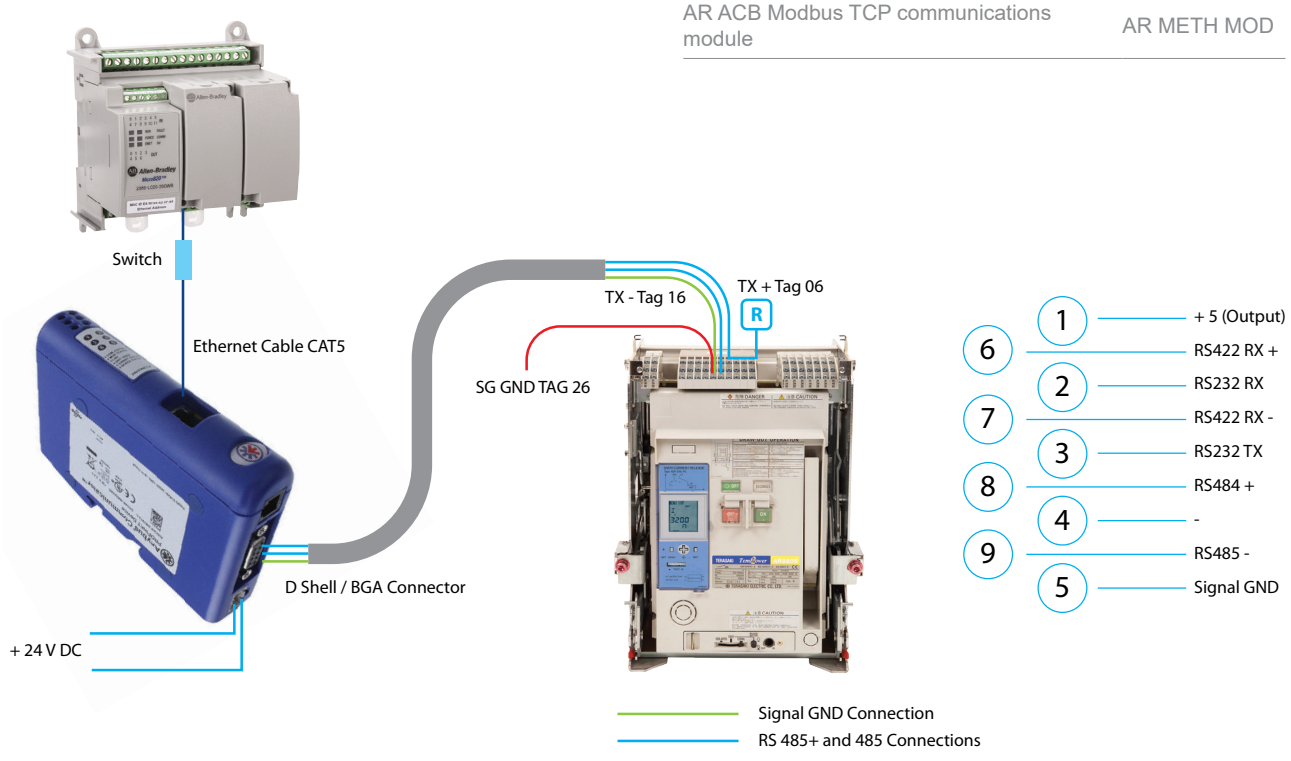
Features

- ✔ Gateways are available with Profibus, DeviceNet, Ethernet or Modbus TCP communications
- ✔ Anybus gateways are pre-configured with the AR Air Circuit Breakers Trip Unit memory map.
- ✔ The gateway allows the Modbus registers in the Trip Unit to be read from and written to via an Ethernet / IP class 1 connection (implicit data transfer).
- ✔ The gateway allows the ACB to be opened/closed via communications by mapping to the open and close Modbus registers in the Trip Unit. This is only possible if the non-standard on / off via communications option has been installed in the ACB at the time of ordering.

Module Layout



Type	Catalogue No.
AR ACB Profibus communications module	AR PROFI MOD
AR ACB DeviceNet communications module	AR DEVNT MOD
AR ACB Ethernet communications module	AR ETHIP MOD
AR ACB Modbus TCP communications module	AR METH MOD



T2ED Circuit Breaker External Display

A door flange can be used as a decoration panel that covers the cutout on the switchboard panel, and provides IP 41 protection with the gasket fitted.

Features

- ✔ For TemBreak PRO B_SE MCCBs rated 16A to 1000A or any TemPower AR ACB
- ✔ Works as a master / slave meter
- ✔ The T2ED display is the master, the MCCB / ACB, the slave
- ✔ A single meter is used with each MCCB / ACB
- ✔ Up to 31 meters can be daisy chain connected

Item Description	Catalogue No.
External Switchboard Door Digital Display (Suits both TemBreak Pro B Type MCCBs and AR ACBs)	T2ED00D02NNA

Outline Dimensions and IP Rating

Outline Dimensions	H 96 × W 96 × D 50 mm
IP Rating	IP65 Panel mounted

Control Supply Details

Operating Voltage Range	18V to 31.2 V DC
Ampere Consumption at 24V DC	50mA

Communication Specifications

	COM 0	COM 2
Communications Standard	RS485 (Master)	RS485 (Slave)
Communications Mode	2 wire, half duplex	
Data Format	Modbus - RTU	
Topology	Multi-drop bus	
Transmission Address	1 (Fixed)	1 – 127 (Selectable)
Transmission Rate (bps)	19200 (Fixed)	4800 / 9600 / 19200 / 38400 (Selectable)
Parity	EVEN (Fixed)	EVEN / ODD / NONE (Selectable)
Transmission Distance	1.2 km max (at 19.2 kbps)	
Maximum No. of Nodes	1 to 31	

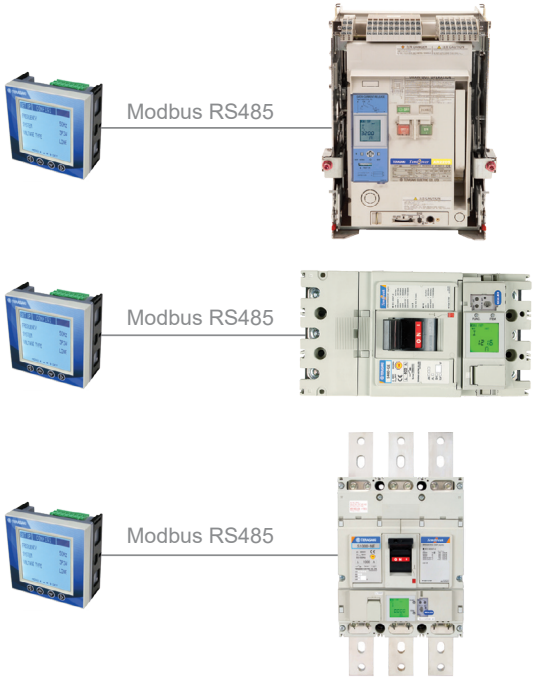
LCD Display

Number of Dots	160 × 160 pixels
Active Area	55.985 × 55.985 mm
Dot Size	0.335 × 0.335 mm
Dot Pitch	0.35 × 0.35 mm
Type of LCD	FSTN
Backlight	White

External Meter and Building Management System Communications Options

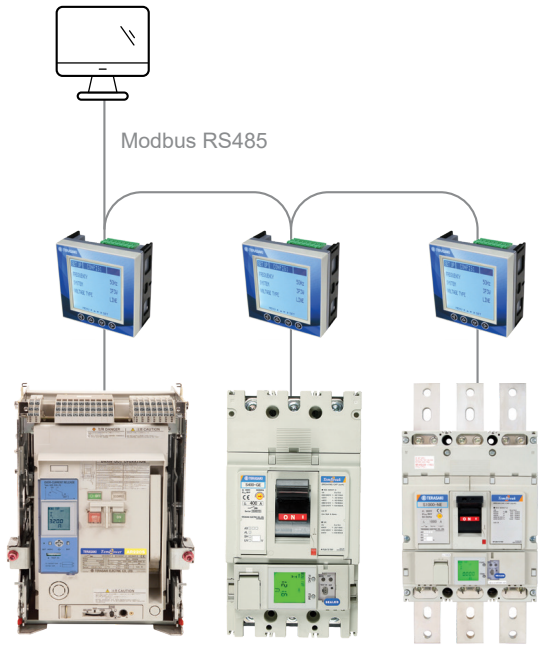
Monitoring Application 1

- One T2ED display required for each MCCB or ACB
- Modbus RS485 standard between each MCCB/ACB and T2ED display
- T2ED external displays can be daisy chain connected
- Refer following pages for T2ED wiring
- For TemBreak PRO B_SE MCCBs rated 16 A to 1000 A or any TemPower AR ACB

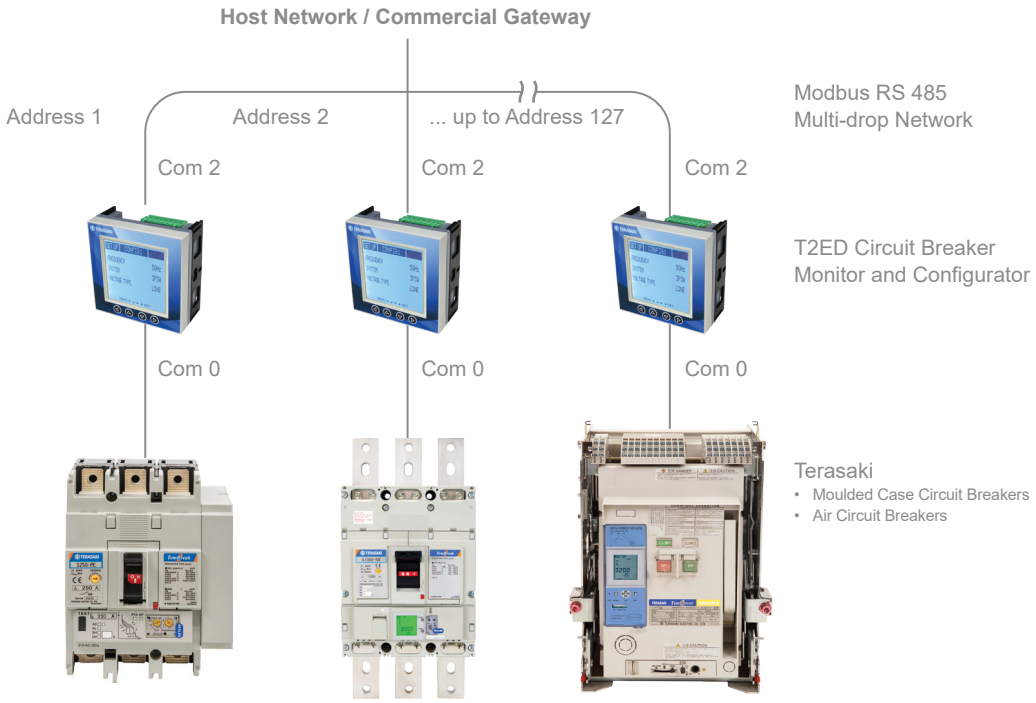


Monitoring, and Remote Control (Applications 1 and 2)

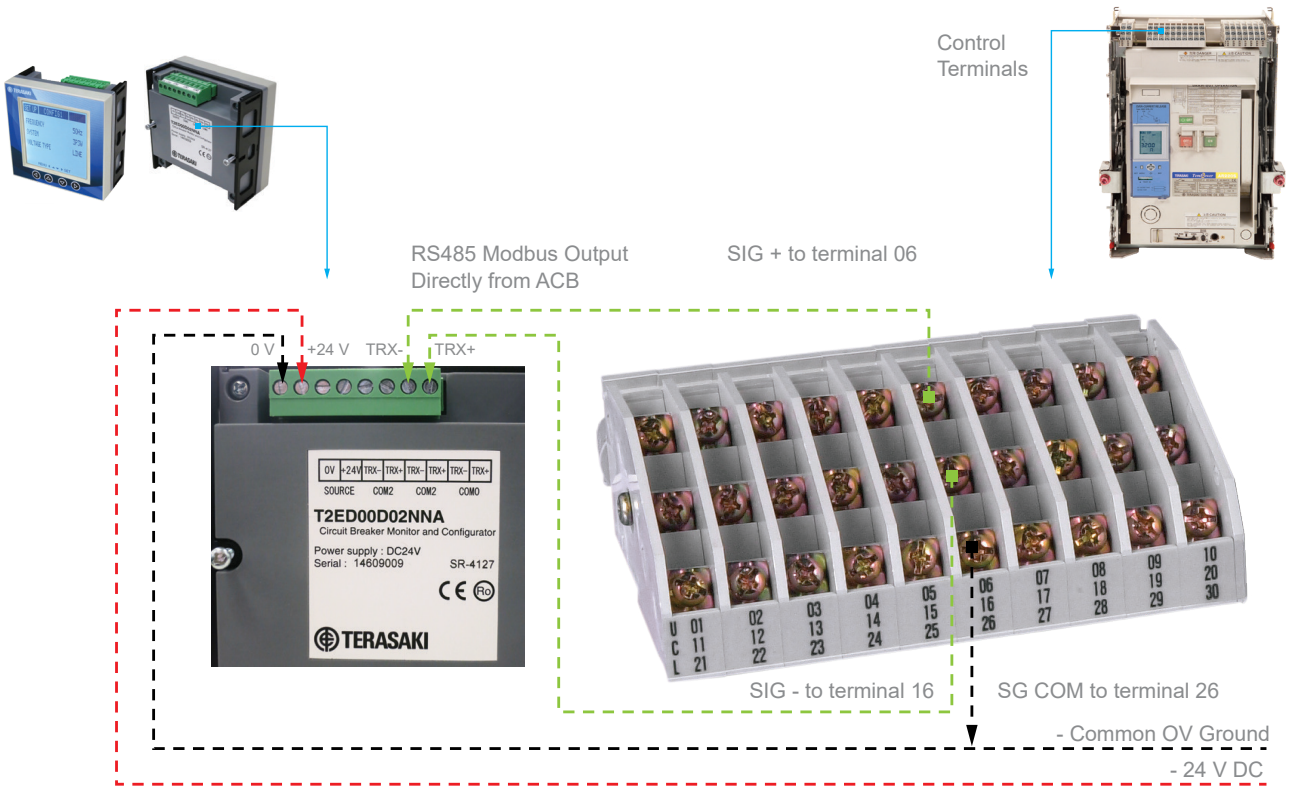
- Each MCCB or ACB has Modbus RS485 output as standard
- Communications can be daisy chain connected
- T2ED external display option
- Applications include building / energy management systems
- Connection to peripheral devices such as touch screens, PLCs, PCs etc.



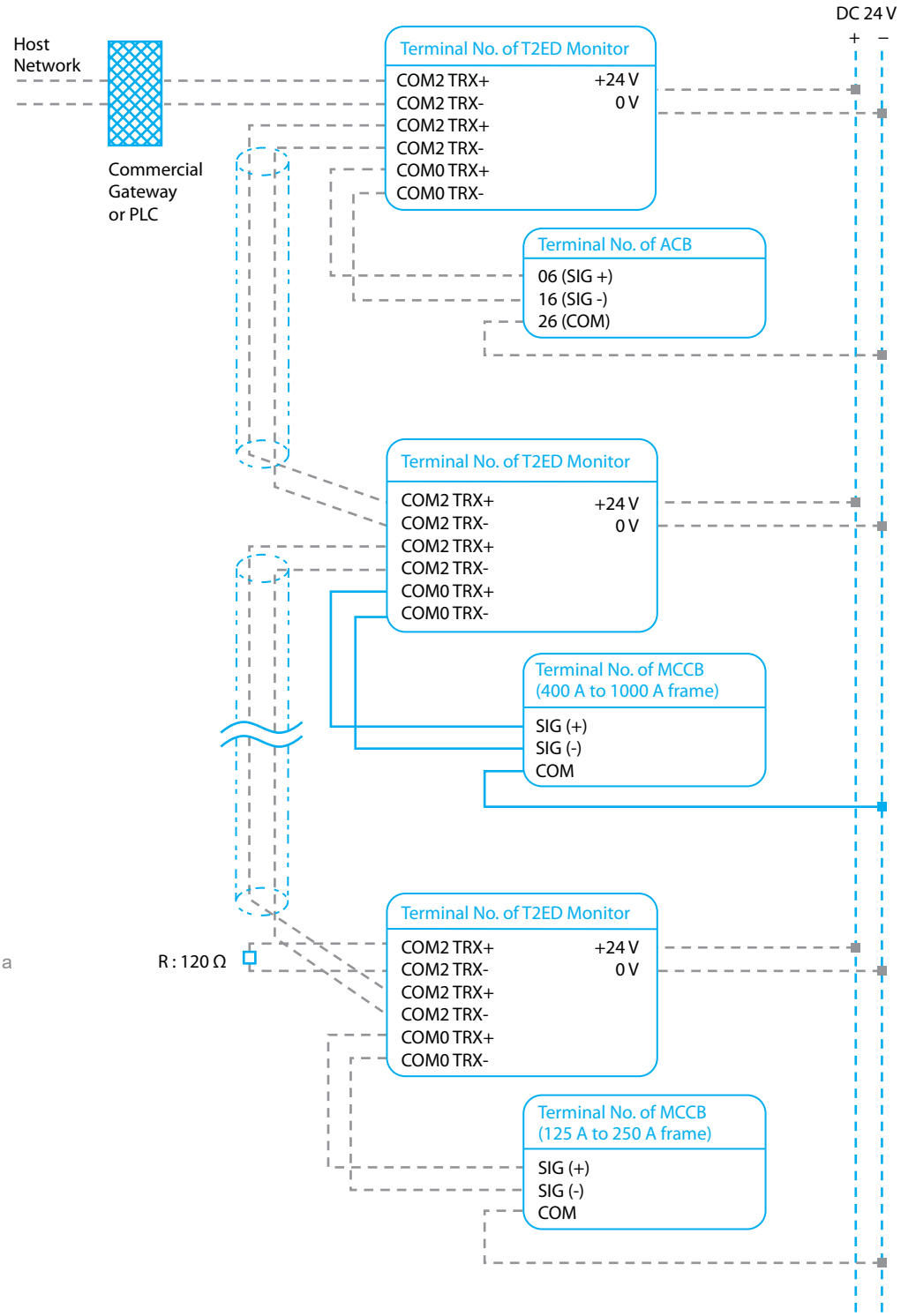
T2ED Installation Examples



ACB Connection Diagram - Single T2ED External Display Meter Connection to TemPower 2, AR ACB



T2ED User Connection



R: Install a terminator between "TRX +ve" and "TRX – ve" for COM2 furthest from the gateway

Customer Wiring

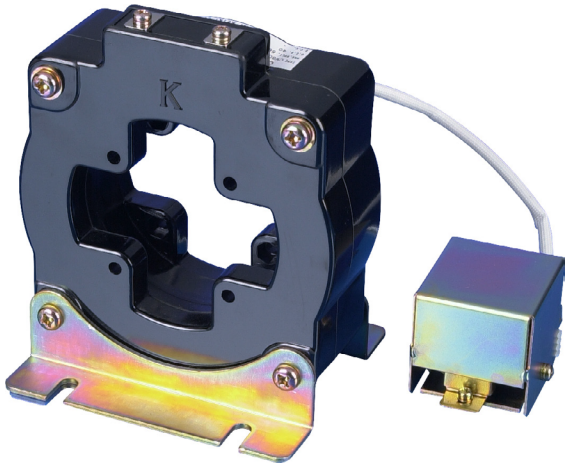
Wiring from MCCB

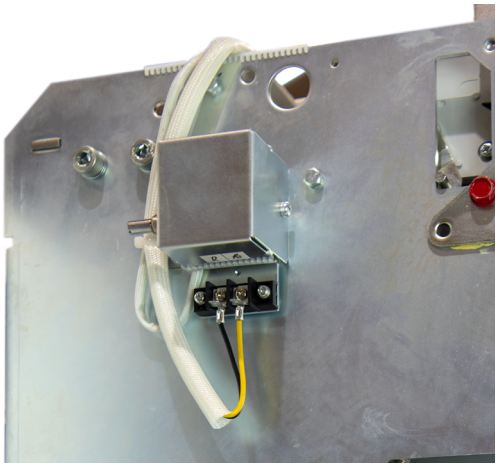
Ground Fault 4th Neutral CT

The external ground fault 4th CT is required to be fitted to a switchboard neutral bar when the ground fault protection function used.

The 4th CT is wired to the transducer terminals K and L on the ACB carriage. The transducer reduces the output of the CT to signal size that it sent to the ACB Trip Unit.

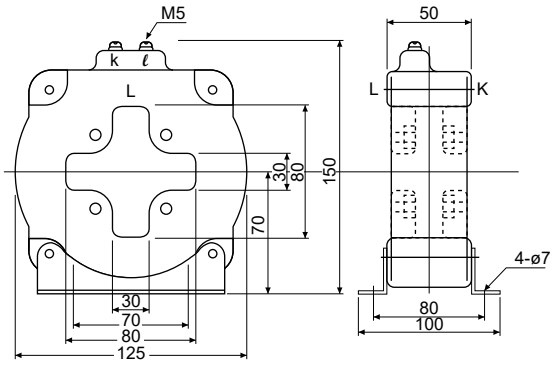
The CTs are Class 1.0 type with a 5A secondary.





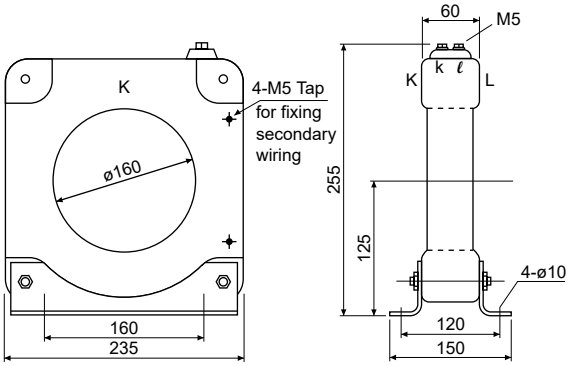
Dimensions

ACB Types – AR208S, AR212S, AR216S, AR212H, AR 216H, AR 316H



Type	CW80-40LS
Rated primary current (A)	200A, 400A, 800A, 1250A, 1600A
Rated secondary current is 5A	

ACB Types – AR220S, AR325S, AR332A, AR440S, AR650S, AR663S, AR220H, AR320H, AR325H, AR332H, AR440H, AR650H, AR663H



Type	EC160-40LS
Rated primary current (A)	1600A, 2000A, 2500A, 3200A, 4000A, 5000A, 6300A
Rated secondary current is 5A	

Ground Fault 4th Neutral CT

Rated Primary Curent	Suits ACB Type	4th CT Catalogue No.
1250A	ARB2123STD	XCW0840LS13
1600A	ARB2163STD	XCW0840LS16
2000A	ARB2203STD	XEC1640LS20
2500A	ARB3253STD	XEC1640LS25
3200A	ARB3323STD	XEC1640LS32
4000A	ARB4403STD	XEC1640LS40
5000A	AR650S	XEC1640LS50
6300A	AR663S	XEC1640LS63

Factory Fit Accessories

The TEMPOWER 2 AR ACB has two methods of remote tripping of the main contacts:

- Shunt trip coil
- Undervoltage Trip (UVT) Device

Shunt Trip Coil

The shunt trip coil is available in three varieties:

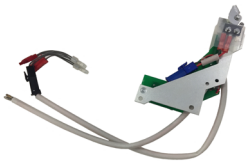
- Single Shunt – Short time rated (STR) and should be wired in series with a N/C auxiliary contact.
- Single Shunt – Which is continuously rated (CR)
- Double Shunt – Which is short time rated and should be wired in series with a N/C auxiliary contact.

Shunt trips and Under Voltage Trips are available in different voltages and are factory fit accessories / NHP service site visit. Below is a basic list of shunt coils, for voltages not shown on this list please contact your NHP representative.

Under Voltage Coil

Single phase under voltage or voltage loss detection

Remote Tripping Devices



Rated Voltage	Single Shunt Coil (CR)	Double Shunt Coil	Single coil short time rated shunt trip	Under Voltage Trip
AC 110V	✔	✘	✔	✔
AC 220V	✔	✘	✔	✔
AC 240V	✔	✔	✔	✔
AC 415V	✘	✘	✘	✔
DC 24V	✔	✔	✔	✔
DC 48V	✔	✘	✔	✔
DC 100V	✔	✘	✘	✔
DC 110V	✔	✔	✘	✔

Continuously rated shunt trip and undervoltage trip can not be fitted to the same ACB. However, the STR shunt trip can be used together with an undervoltage trip.

Shunt Trip – AVR-1C Single Coil Type

Single coil shunt trip coils are designed to remotely trip the ACB, are continuously rated.

The coils are available in different voltages and are factory fit accessories or via NHP site-service.

Shunt Trips and UVTs Installed in the Same ACB

An AVR-1C shunt trip and undervoltage trip cannot be fitted at the same time into an ACB. For applications where a shunt and UVT are both required, a N/O pushbutton or relay contact should be wired between control terminals 24 and 30 to remotely open the ACB main contacts. This is the recommended method of remotely opening the ACB because it uses the UVT's fail safe coil to 'trip' the main contacts. Alternatively a single shunt (STR) can be fitted together with the UVT coil.

Refer following pages for further details on this.

Rated Voltages Stocked By NHP	Single Shunt Coil (CR) Continuously Rated
110V AC	✔
240V AC	✔
24V DC	✔
48V DC	✔
110V DC	✔

Shunt Trip Data - Continuously rated, showing all available voltages

Rated Voltage (V)[2]	Operational Voltage Range (V)[3]	Maximum Excitation Current (A)	Maximum Opening Time (ms)
100V AC	70 – 110V AC	0.29	
110V AC	77 – 121V AC	0.25	
120V AC	84 – 132V AC	0.22	
200V AC	140 – 220V AC	0.15	
220V AC	154 – 242V AC	0.13	
240V AC	168 – 264V AC	0.11	
24V DC	16.8 – 26.4V DC	1.04	
30VDC	21 – 33V DC	0.85	50[1]
48V DC	33.6 - 52.8V DC	0.51	
100V DC	70 – 110V DC	0.25	
110V DC	77 – 121V DC	0.22	
125V DC	87.5 – 137.5V DC	0.21	
200V DC	140 – 220V DC	0.13	
220V DC	154 – 242VDC	0.12	

Notes

1) For AR6 the opening time is 60 msec.
2) For voltages not shown on this list please contact your NHP representative.
3) Operational voltage can be different to Trip Unit auxiliary control voltage.

Shunt Trip – AVR - 1CD Double Coil Type

Double (2) coil Shunt trips are available to add increased redundancy to an ACB's shunt tripping capability. If one coil fails, the other can function.

- Double shunts are short time rated and need to be series wired with a N/C aux contact.

Shunt coils are available in a range of different voltages, and are factory fit accessories or via NHP site-service. Below is list of voltages available. For voltages not shown contact your NHP representative. 240V AC and 24V DC are standard available voltages.

Other Information:

- Double shunt coils can be installed in ACBs that are Non-Auto, and those using TemPro PLUS and TemPro Premier AGR31 Trip Units
- Double shunts require a special wiring loom to be fitted during manufacture
- Double coil shunt trips and undervoltage trips or latch release coils cannot be fitted to the same ACB
- A special shunt trip controller that trips the ACBs MHT (Magnetic Holding Trigger) can be installed along with an undervoltage trip. See “ACBs with a shunt and UVT” on the following pages
- The double shunt operational voltage can be different to Trip Unit auxiliary control voltage

Available Voltages Types	Double Shunt Coil (AVR-1CD)
240V AC	NHP Factory Fit / Site-service
24V DC	NHP Factory Fit / Site-service

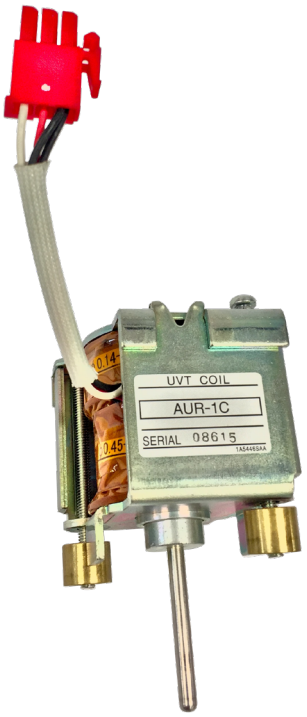
Under Voltage Trip – Type AUR-1C

Under Voltage Trip (UVT) Accessory – For Remote Tripping an ACB

The Under Voltage Trip accessory (UVT) monitors a single phase and trips the ACB when the control voltage drops below its opening voltage threshold. When the control voltage is restored to the pick-up voltage, the ACB can be closed. The pick-up voltage is fixed to 85 % of the rated voltage. The UVT device is available in an instantaneous (standard type) or a 500 ms time delay version. **Note: AGR31 Trip Units have 3 phase UV alarms – refer to note A below.*

The UVT consists of a standard 24 V DC coil which acts as a tripping mechanism inside the ACB, and an undervoltage trip control device for different control voltages, which is mounted on at the top of the ACB carriage. The trip control device is available in two types: AUR-ICS and AUR-ICD. Type AUR-ICS provides an instantaneous trip (below 200ms) to the ACB when the control voltage drops below the opening voltage. Type AUR-ICD provides a delayed trip to the ACB when the control voltage remains below the opening voltage for at least 500ms. A time-delay trip of 1 to 3 seconds is available as a special specification.

An option with an ACB UVT, is to use it as a shunt trip. To shunt trip the ACB, a N/O pushbutton or relay contact can be wired between control terminals 24 and 30 to remotely open the ACB main contacts. This is the recommended method of remotely opening the ACB in this instance because it uses the UVT's fail safe coil to 'trip' the main contacts.



Note A
AGR31 TemPro Premier Trip Units have a 3 phase Under Voltage Alarm feature. A UV alarm signal can be sent by Modbus communications to signal an external device. Further UV alarm details are in Trip Unit specifications on previous pages.

Type of UVT Control Device	Rated Voltage 50 / 60Hz	Operational Voltage (V)[2]	Pick-Up Voltage (V)	Coil Excitation Current (A)	Power Consumption (VA)	
					Normal	Reset
AUR-1CS (Instantaneous) **AUR-1CD** (Time Delay)	100V AC	35 – 70	85	0.1	8	10
	110V AC	38.5 – 77	93.5			
	120V AC	42 – 84	102			
	200V AC	70 – 140	170			
	220V AC	77 – 154	187			
	240V AC	84 – 168	204			
	380V AC	133 – 266	323			
	415V AC	133 – 266	352			
	440V AC	154 – 308	374			
	24V DC[1]	8.4 – 16.8	20.4			
	48V DC[1]	16.8 – 33.6	40.8			
	100V DC[1]	35 – 70	85			

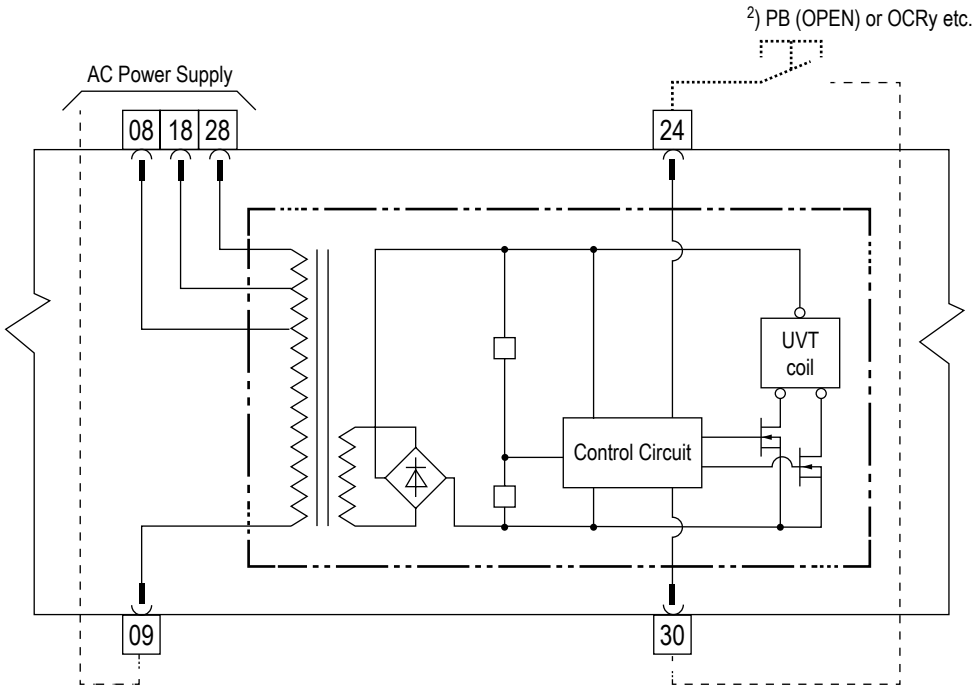
Notes
1) Special configuration, please contact NHP for these voltages.
2) Operational voltage can be different to trip unit auxiliary contol voltage.

Under Voltage Trip Control Circuit (For AC Voltages) Monitoring a Single Phase[1)]

It takes a maximum of 1.5 seconds for the UVT coil to be respond after the rated voltage is applied to the undervoltage trip device. Therefore, for the closing command, the closing signal should be applied for over 1.5 seconds after the rated voltage is applied.

If a separate shunt trip facility is required, which does not use UVT trip terminals 24 and 30 as described above, a special shunt controller can be used to shunt the ACB's MHT (Magnetic Holding Trigger). Refer to ACBs with a shunt and UVT for more information.

Wiring Diagram

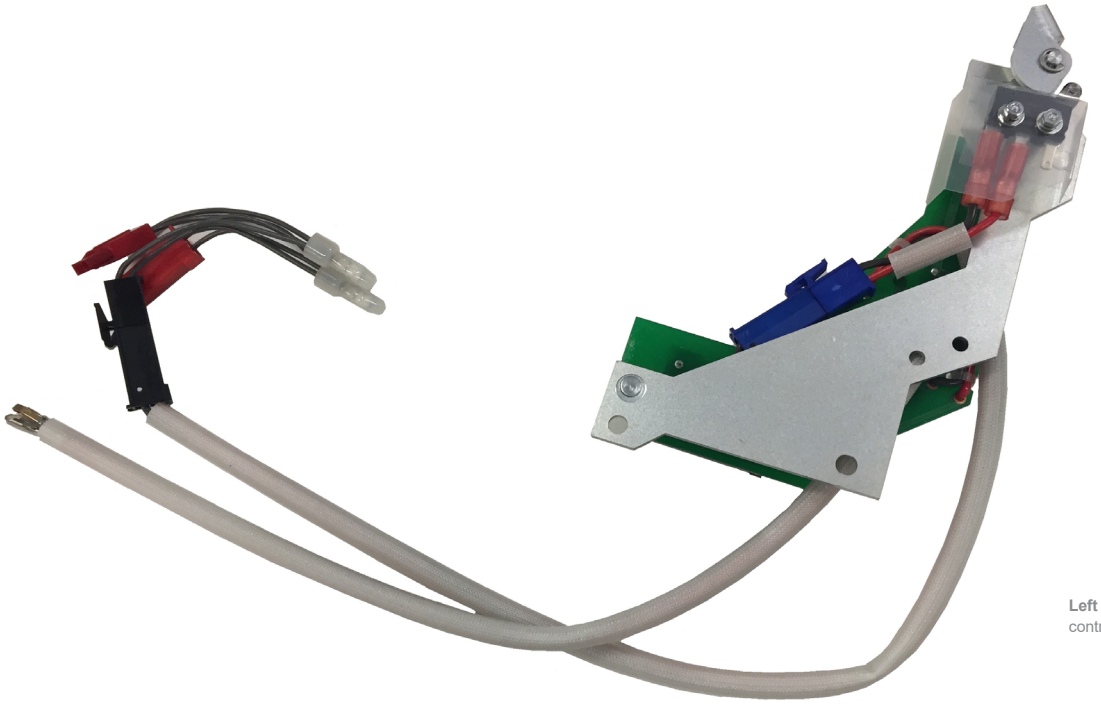


Notes

1) For DC voltage UVTs use terminal 09 as the (–) terminal and 08 as the (+) terminal.
2) Tripping signal is 48 V DC / 5mA. Apply tripping signal for at least 80 ms. Push button and wiring to be supplied by user.

Single Coil - Short Time Rated (STR) Shunt Trip

The single coil short time rated shunt can be used to provide an alternative means of shunt tripping the ACB, where a standard AVR-1C shunt trip coil may or may not also be installed. Applications for this method can be where a user wants additional redundancy, or where they need to have a second independent shunt trip circuit. It should be noted that where a standard AVR- 1C shunt is also installed, a UVT cannot be installed.



Left – Internal Shunt Trip controller type

Applications

- When an ACB has a UVT (Under Voltage Trip) fitted, and a shunt trip is also required
- When a second independent shunt circuit is required, where a standard shunt coil is already installed

Function and Operation

- The design is short time rated, but since the internal circuit includes a N/C cut off switch it cannot be continuously energised even if a trip signal is maintained
- **Auxiliary Voltage:** The STR shunt tip coil is wired independently of the ACB Trip Unit, and this allows the control voltage of the shunt trip to be different to the Trip Unit auxiliary control voltage
- After the energisation the STR shunt coil, the trip / opening operation time for AR2 - 4 ACBs is approximately 50 ms, and 60ms for AR6
- The total arcing clearance time can vary between 50 and 70ms

Available Voltages Types	STR Shunt Trip
110V AC	✔
220V AC	✘
240V AC	✔
24V DC	✔
48V DC	✔
100V DC	✘
110V DC	✘

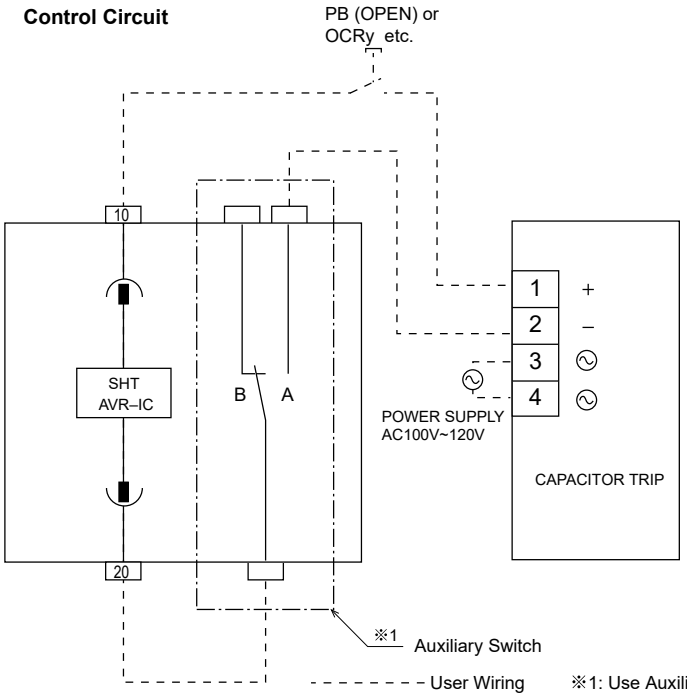
Tripping Options

Capacitor Trip Device

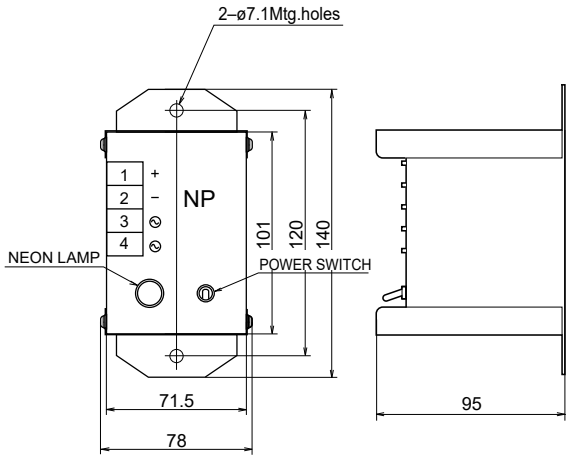
In conjunction with a continuously-rated 48 V DC shunt trip device, the capacitor trip device can be used to trip the ACB within a limited period of 30 sec. if a large voltage drop occurs due to an AC power failure or short-circuit. When the continuously-rated shunt trip is used with a capacitor trip device, “a” contact of auxiliary switch of ACB should be inserted in series, otherwise internal damage may occur.

Type	AQR-1
Rated Voltage	AC 100-120V
Operational Voltage	Rated Voltage x 70 to 110%
Rated frequecy	50 / 60Hz
Rated Voltage of Shunt Trip Used	DC 48V
Power Consumption	100VA

Control Circuit



Outline Dimensions



Notes

1) Use Auxiliary Switch for capacitor trip.

--- User wiring

It is not possible to test the capacitor trip device when the test jumper is used.

Carriage Mounted Shunt Trip Device

Left – ACB carriage side mounted shunt trip

Features

- ✔ Continuously rated
- ✔ No series N/C contact required
- ✔ 50 ms trip time (standard shunts 50 ms)
- ✔ **Voltages available:**
  - **AC:** 100, 110 120, 200, 220, 240
  - **DC:** 24, 48, 110, 125, 200, 220, 250
- ✔ Wiring: the side mount shunt trips have 2 screw terminals: 49 and 50
- ✔ When this type of shunt is used, a mechanical interlock cannot be used
- ✔ The shunt operational voltage can be different to Trip Unit auxiliary control voltage

How It Works

This is a special shunt trip assembly that is mounted to the left side of an ACB carriage using a modified continuously rated shunt trip coil, which activates the ACB's mechanical interlock trip lever to trip the ACB.

Two Continuously Rated Shunt Trips

The carriage mount shunt trip is mainly used in addition to a standard continuously rated Internal shunt, where a second completely separate continuously rated shunt trip coil is required.

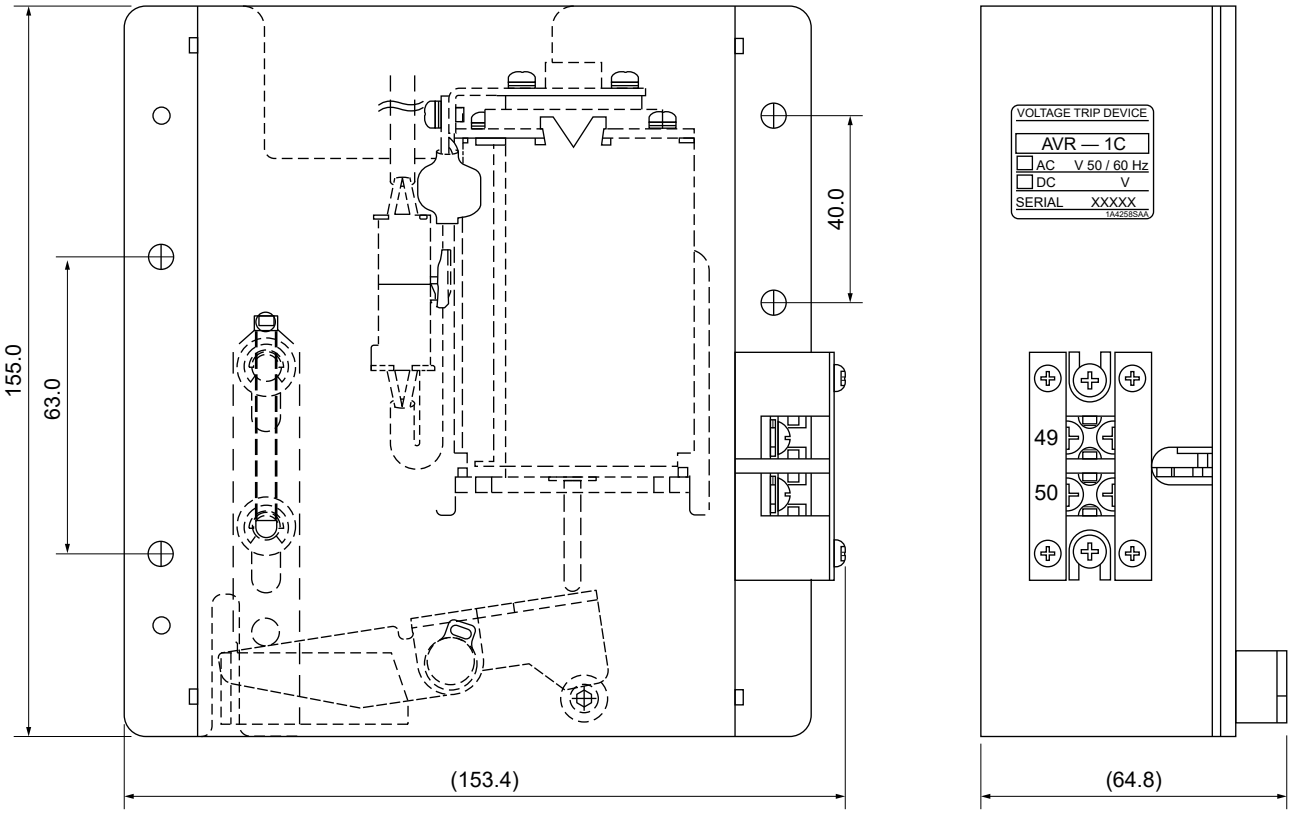
Alternative to a Double Shunt Coil

The carriage mount shunt trip when used with an internal continuously rated shunt trip, is also an alternative to the internally mounted Dual Shunt trip coil which has 2 short time rated coils within the same coil bobbin assembly, which are short time rated and require a N/C anti-burnout contact for each coil.

Design Considerations

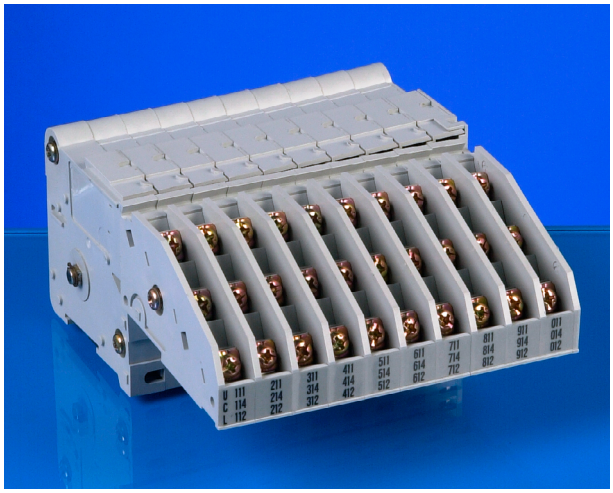
The side mount shunt is enclosed in a metal housing along with interlocking system components. The additional width to the ACB is approximately 50 mm on the left side of the ACB carriage.

Dimensions


155.0
63.0
40.0
(153.4)
VOLTAGE TRIP DEVICE
AVR — 1C
AC V 50 / 60 Hz
DC V
SERIAL XXXXX
1A4258SAA
49
50
(64.8)

Auxiliary Switches

The auxiliary switches operate during the ACB ON/OFF operation. Connections to the switches are made via screw terminals as standard, with a spade connection types and indent option. The auxiliary switches for draw-out type ACBs operate in the CONNECTED and TEST positions. Auxiliary switches for ACBs operate in the CONNECTED position only. Auxiliary switches have change-over contacts, with a Common – N/O / N/C arrangement, and are available for general service and for micro-loads.[3)]



Type	Normal Contacts for General Service	Gold Tipped Contacts for Micro-Loads[2)]
11601CAB	7C	-
21603CAB	10C	-
31607CAB	7C	3C

Auxiliary Switch Ratings

Category	For General Service		For Micro Loads[2)]		
Voltage	Resistive Load (A)	Inductive Load (A) AC: cos ø^ 0.3 DC: L/R % 0.01	Resistive Load (A)	Inductive Load (A) AC: cos ø^ 0.6 DC: L/R % 0.007	Min Applicable Load
100 – 250V AC	5	5	0.1	0.1	DC 5 V 1mA
251 – 500V AC	5	5	-	-	
30V DC	1	1	0.1	0.1	
125 – 250V DC	1	1	-	-	

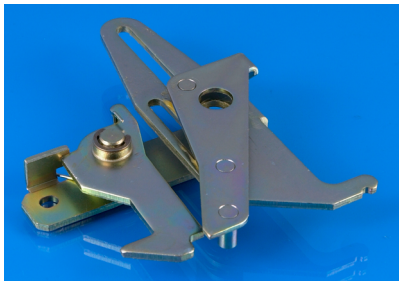
Notes

1) From approx. 2007 the standard auxiliary switch contact types were changed from 4C to 7C. (Form C: Change-over, single gap, three terminals).
2) Suited for electronic circuits.
3) As the auxiliary contacts are changeover (C/O) types with a Common and N/O and N/C contacts, do not supply different voltages to the N/O and N/C contacts.

Capacitor Trip Device

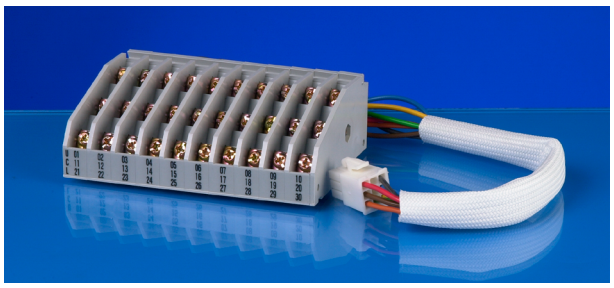
Item Description	NHP Service, Special order
Used along with a shunt trip to trip an ACB during a power loss	NHP Service fit

Door Interlock



Item Description	NHP Service, Special order
Prevents enclosure door being opened unless ACB is isolated	NHP Service fit

Spring Charge Indicator (Simple)



Item Description	NHP Service, Special order
Spring charge status allowing ACB closure	NHP Service fit

Cycle Counter

Item Description	NHP Service, Special order
A 5 digit counter showing the ACB's ON-OFF cycles	NHP Service fit

Earthing Device

Refer NHP for details

Item Description	NHP Service, Special order
Converts the ACB from normal service to an earthing device	NHP Service fit

Storage Draw Out Handle

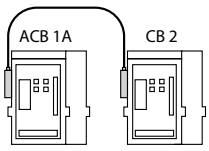
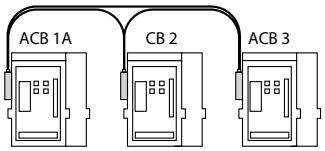
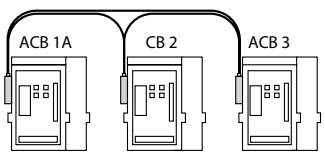
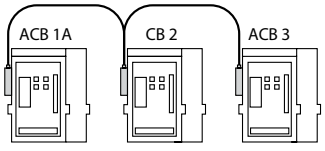
Item Description	NHP Service, Special order
Draw-out handle that is stored inside the ACB body	NHP Service fit

Mechanical Interlock - 2 or 3 Way Horizontal

Cable Interlocking - Horizontal, Vertical Or Diagonal Types and Operations

There are four variations of the mechanical interlock. They are type A, type B, type C and type D. The table below describes how the ACBs operate in relation to each other depending on the type of interlock that has been supplied. Cable quantities are also indicated. Carriage mounting hardware is type specific. For example the hardware supplied for a 'type C' interlock is only suitable for use in a two way system. The hardware supplied for a 'type B' interlock is only suitable for that particular type, it can not be used for a 'type A' system. Contact NHP for further info.

Item Description	NHP Service, Special order
2 and 3 way horizontal cable interlock	Body mech. NHP fit, carriage parts and cable user fit

Type	Operation			Remark
	ACB 1	ACB 2	ACB 3	
	ON	OFF	–	Type C Cable Qty = 2 One of two breakers can be turned on
	OFF	ON	–	
	OFF	OFF	–	
	ON	ON	OFF	Type B Cable Qty = 6 One or two of three breakers can be turned on
	ON	OFF	ON	
	OFF	ON	ON	
	ON	OFF	OFF	
	OFF	ON	OFF	
	OFF	OFF	ON	
	OFF	OFF	OFF	
	ON	OFF	OFF	Type D Cable Qty = 6 One of three breakers can be turned on
	OFF	ON	OFF	
	OFF	OFF	ON	
	OFF	OFF	OFF	
	ON	OFF	ON	Type A Cable Qty = 4 Br2 is interlocked with both Br1 and Br3
	ON	OFF	OFF	
	OFF	ON	OFF	
	OFF	OFF	ON	
	OFF	OFF	OFF	

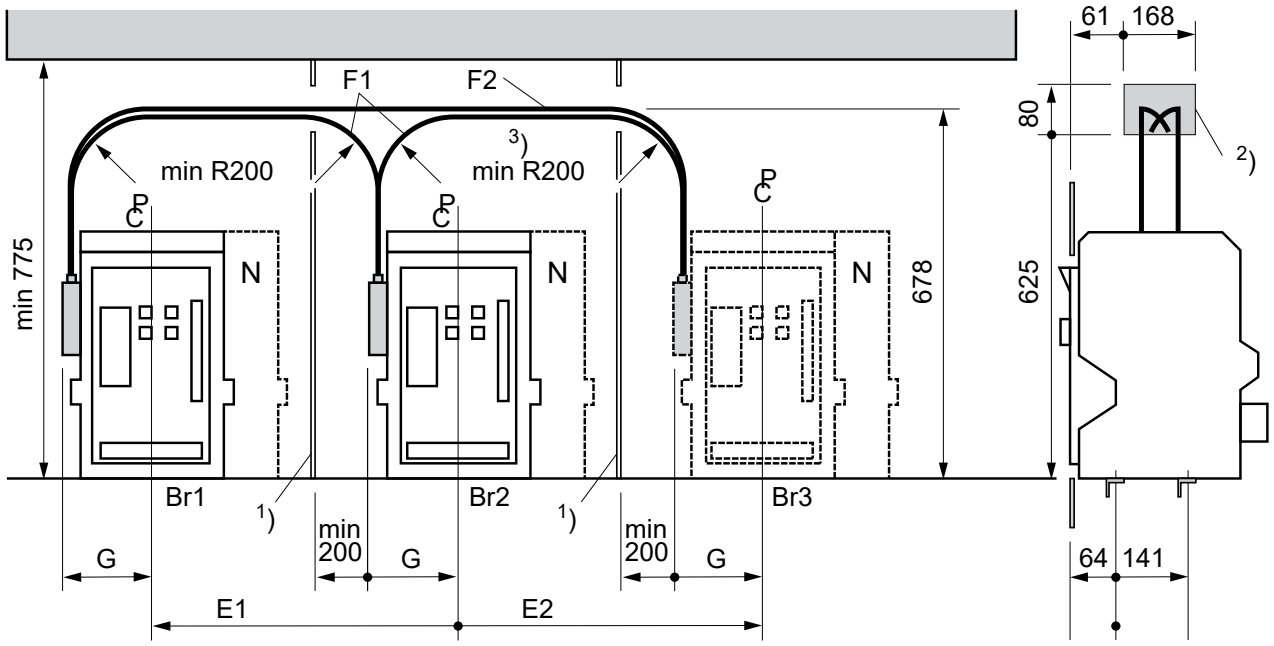
- Interlock is enabled in the CONNECTED position. When the ACB body is in the TEST, ISOLATED or DRAW-OUT position, interlock is disabled.
- If all of two or three breakers receive a closing (on) signal, they all will turn off. This case, however, involves momentary continuity between the main circuit and the auxiliary switch 'A' contact in all the breakers.
- The body of a draw-out type breaker, as long as it is off (open), can be drawn out or inserted, irrespective of the state of other breakers. (Do not draw out or insert a breaker body during cable installation, adjustment or operation check).

Cable Specification and Installation

The interlock cable supplied is available in a 2.5 M or a 4.0 M length. These cables have a multi-strand flexible inner core that can be cut to length. The cable length must be specified at the time of order.

Cable Installation Recommendation

When fitting interlock cables the below dimensions and clearances are recommended for a successful installation.



G = AR2, AR4: 200.5 (mm)
AR3: 253 (mm)
AR6: 477 (mm)
Unit in: mm

Notes
1) Partition (not supplied)
2) Space for interlock cables
3) This is the recommended bend radius

Spring Charged Operation: Manual Racking, Motor Charging, LRC Operation

Manual Charging Type

For this type of ACB, the closing springs are charged by means of the spring charging handle. ON/OFF operation of the ACB is performed by means of ON/OFF buttons on the ACB.

Charging the closing springs

Pumping the spring charging handle by hand charges the closing springs.

Closing the ACB

Pressing the ON button on the ACB closes the ACB.

Opening the ACB

Pressing the OFF button on the ACB opens the ACB. The ACB cannot be closed as long as the OFF button is pressed.

Motor Charging Type

For this type of ACB, the closing springs are charged by means of a motor. ON/OFF operation of the ACB can be performed remotely. A manual charging mechanism is also fitted to facilitate inspection or maintenance work.

Charging the closing springs

A motor is used to charge the closing springs. When the closing springs are released to close the ACB, they are automatically charged again by the motor for the next ON operation.

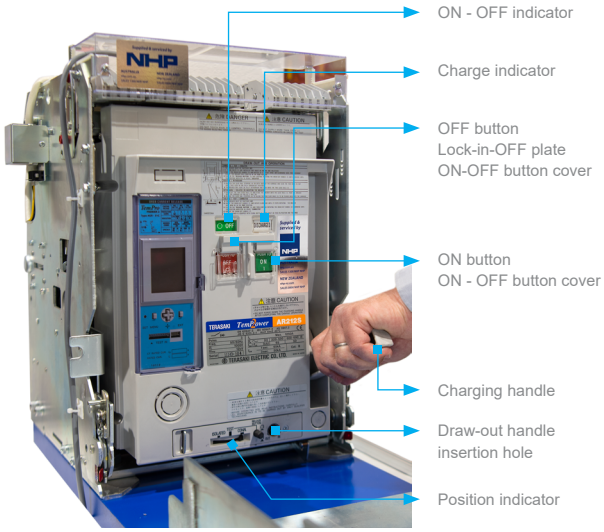
Closing the ACB (ON operation)

Turning on “remote” ON switch enables the ACB to be remotely closed by activating the internal Latch Release Coil (LRC).

- The ACB includes an Anti-pumping mechanism. Even if the ON switch is kept on, ACB closing operation is performed only once via the LRC. To close (switch ON) the ACB again, remove the ON signal, to reset the anti-pumping mechanism and then reapply the ON signal.
- If ON and OFF signals are simultaneously given to the ACB, the ON signal will be ignored, for safety reasons.
- The LRC which switches the ACB ON, is continuously rated, though it is advisable that it not be continually energised. Ideally the coil should be de-energised after closing an ACB, as this will prolong the service life of this critical coil.

Opening the ACB

For opening the ACB remotely, specify the Shunt Trip device.



Motor Data, Spring Charged Operation, LRC Closing Data

Item Description	NHP Service, Special order
Motor used to remotely charge / close the ACB (specify voltage)	NHP Service fit

Operation Power Supply

Rated Voltage (V)[2]	Applicable Voltage Range		Operation Power Supply Ratings		
	CHARGE / ON Operation (V)	OFF Operation	Motor Inrush Current (Peak) (A)	Motor Steady State Current (A)	LRC[1] Closing Command Current (Peak) (A)
100V AC	85 – 110	Refer shunt trip ratings page for OFF operation data	7	1.1	0.29
110V AC	94 – 121		7	1.1	0.25
120V AC	102 – 132		7	1.1	0.22
200V AC	170 – 220		4	0.7	0.15
220V AC	187 – 242		4	0.7	0.13
240V AC	204 – 264		4	0.7	0.11
24V DC	18 – 26		14	4	1.04
30V DC	21 - 33		12	2.5	0.85
48V DC	36 – 53		10	1.6	0.51
100V DC	75 – 110		6	0.8	0.25
110V DC	82 – 121		6	0.8	0.22
125V DC	93 – 138		6	0.8	0.21
200V DC	150 – 220		4	0.5	0.13
220V DC	165 – 242		4	0.5	0.12

Notes

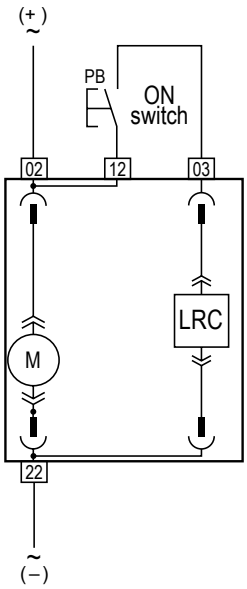
1) The above LRC closing command current is the current draw by the Latch Release Coil.
2) Refer NHP for 415V AC motor options.

Split Voltage Specification

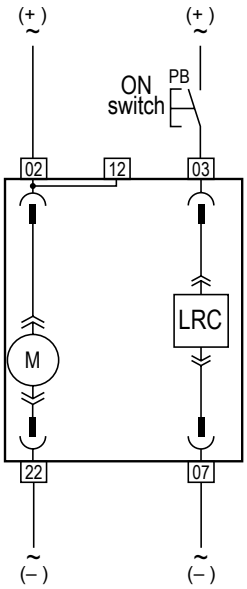
The motor control circuit can be manufactured for two methods of operation. The standard motor control circuit configuration requires that the motor and LRC (closing coil) voltage be common due to the shared wiring to terminal 22.

When the motor and LRC are required to be different voltages (e.g. 240V AC motor, 24V DC LRC) the ACB must be manufactured as a 'split voltage' configuration. This must be specified at time of order. When configured for a split voltage, the LRC is energised via terminals 03 and 07.

Standard Motor + LRC Charging / Closing Operation



Split Voltage Motor + LRC Charging / Closing Operation



Spring Charge Indicator

An indication switch can be used to indicate that the closing springs have been fully charged. See ordering form last page.

Normal Contacts for General Service

Voltage (V)		Switch Contact Ratings	
		Resistive Load	Inductive Load
AC	250	3	3
	250	0.1	0.1
DC	125	0.5	0.5
	30	3	2

Gold Contacts for Microload

Voltage (V)		Switch Contact Ratings	
		Resistive Load	Inductive Load
AC	250	0.1	0.1
DC	30	0.1	0.1

Position Switches

A position switch operates to give an indication of the ACB body position within the carriage: CONNECTED, TEST, ISOLATED, or INSERT [1].

- There are two contact arrangements: 2c and 4c
- Connections to the switches are made via screw type terminals
- The following table lists the possible configurations of the position switches. Contact NHP for any other configuration requirement

Number of Contacts	Contact Arrangement			
	INSERT [1]	ISOLATED	TEST	CONN
2c	0	1	1	0
	0	1	0	1
	0	0	1	1
	0	2	0	0
	0	0	2	0
	0	0	0	2
4c	1	1	1	1
	1	2	1	0
	1	2	0	1
	0	2	1	1
	1	1	2	0
	1	0	2	1
	0	1	2	1
	1	1	0	2
	1	0	1	2
	0	1	1	2
	0	2	2	0
	0	2	0	2
	0	0	2	2
	1	0	3	0
	0	1	3	0
	0	0	3	1
	1	0	0	3
	0	1	0	3
	0	0	1	3
	0	0	4	0
	0	0	0	4

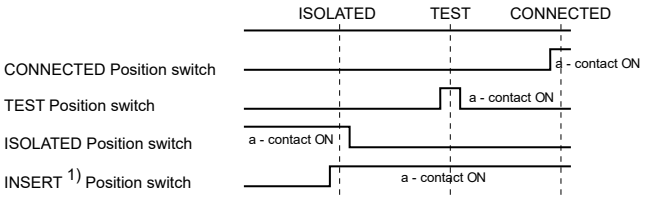
Notes

1) The INSERT Position contact is unavailable if a Pre-trip alarm or spring charge contact is INSTALLED with a UVT

Position Switch Ratings

Voltage	Resistive Load (A)	Inductive Load (A) (COS ø = 0.6, L/R = 0.07)
AC 100 - 250V	11	6
DC 250V	0.3	0.3
DC 125V	0.6	0.6
DC 30V	6	5
DC 8V	10	6

Position Switch Operation Sequence



INSERT [1] position means the breaker body is in any position between ISOLATED and CONNECTED.

Trapped Key Interlock

The key lock is available in the lock-in OFF type that locks the ACB in the open (OFF) position. When the ACB is fitted with a key lock, an operator cannot operate the ACB unless using a matched key. The ACB's OFF button also self-retracts, preventing the ACB ON button from closing the ACB to ON.

Key Interlock

The key interlock is a system of interlocking between 2 or 3 ACBs, each fitted with a key lock of lock-in OFF type. Key exchange boxes can be used for additional numbers or types of key codes.

- A key must be inserted to release the lock before the ACB can be closed
- Rotating the key clockwise locks OFF the ACB. Anti-clockwise rotation releases the lockout
- The ACB must be opened and locked in the OFF position before the key can be removed

By utilising the lock-in OFF type key lock feature, and then a limited number of keys by default provides an effective and reliable interlock system. Using the same keys also allows interlocking between an ACB and other devices (such as a switchboard door). ACBs can be supplied, using our range of stocked NHP / Allen-Bradley ProSafe trapped key interlocks. Other brands such as Fortress CL, Castell or Ronis locks can also be supplied on request.

Figure 1
Key in OFF, ACB OFF button retracted

Figure 2
Trapped key lock with ACB cover fitted

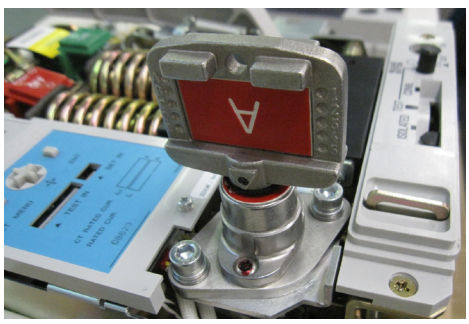


Figure 3
Allen-Bradley ProSafe trapped key lock fitted with the ACB cover removed

Trapped Key Interlock Specification

Applies to Rockwell / AB ProSafe, Fortress CL or Castell

Mounting	Left hand mount
Construction	Stainless Steel
Movement	90° clockwise rotation
Rear Spindle Size	9.5 mm square x 22 mm
Coding	Specified at the time of ordering

Applies to Ronis

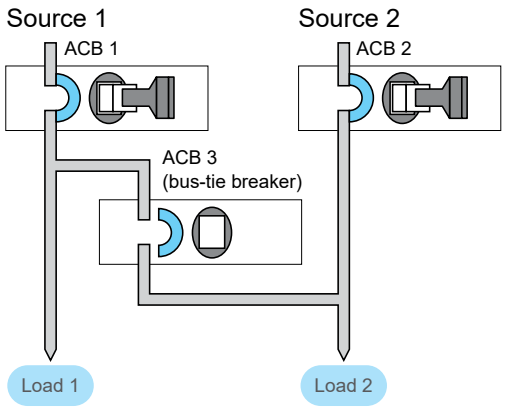
Type	SRO-1104
Description	Basic cam lock
Movement	Right rotation to trap key (clockwise 90° movement)
Coding	Specified at the time of ordering

ORDERING a Trapped Key Interlock Mechanism Built Into an ACB

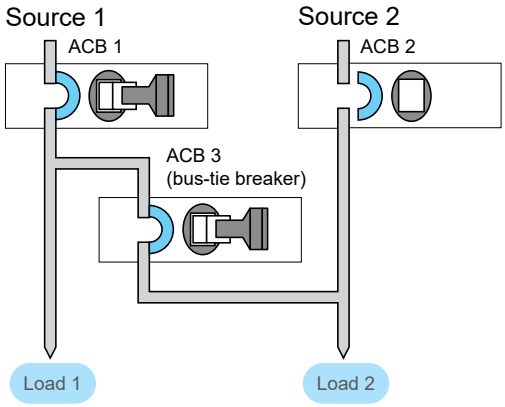
Since 2012, standard stocked AR ACBs have been supplied with trapped key interlock mounting hardware installed as standard. This allows a user to purchase a trapped key and fit it. The ACB's front plastic cover also includes a mounting hole with a knock-out for the trapped key lock.

When ordering customer specified "custom built" ACBs it should be noted that these do not include trapped key lock mounting hardware as standard, though this can be specified at the time of ordering. Existing ACBs that do not have the mounting hardware installed will need NHP service for on-site fitting.

ACB 3 Cannot Be Closed



ACB 2 Cannot Be Closed



ACB 1 Cannot Be Closed

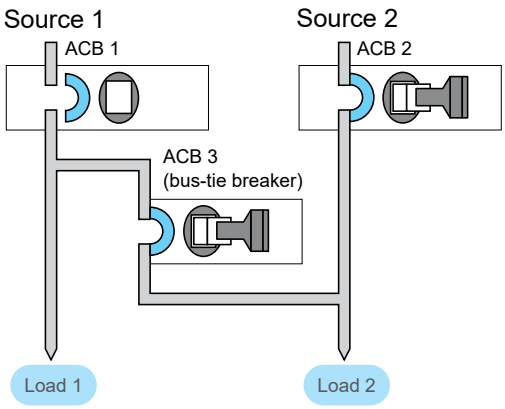
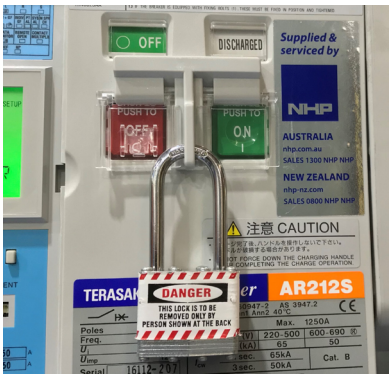


Figure 4
Interlock for prevention of parallel feeding from two sources

Padlocking On Off Pushbutton

An ON-OFF button cover prevents inadvertent or unauthorised operation of the ACB ON or OFF button. It can be locked with up to three padlocks with ø 6 mm hasp. Padlocks are not supplied. Button covers are supplied fitted to ACBs as standard.

The padlock facility for the ACB's pushbuttons, is intended to prevent unauthorised operation of the buttons. The buttons are not padlockable in the OFF only. The cover only prevents access to the buttons when padlocked. The ACB can still be switched ON from a remote location via electrical control.



Padlocking Off

This option fits in the same position as where a trapped key is fitted. This optional feature permits the ACB to be padlocked in the OFF position. A maximum of three padlocks with a ø 6 mm hasp can be fitted. Padlocking is possible only when the ACB's ON-OFF indicator shows OFF. When the ACB is padlocked in the OFF position, both the ACB's manual and electrical closing operations become inoperative, though charging of the closing spring by manually operating the charging lever or by the motor is still possible.

The OFF padlock is installed in the same position on the front of the breakers that is occupied by a ProSafe, Fortress or Castell lock, and does not replace the "position padlock" which is standard on TemPower 2 ACBs.

This is an accessory fitted to the same hole space that a trapped key fits. It is a lever that pulls out, and allows a padlock to be installed. It prevents the ACB from being switched ON.

To operate the OFF padlock facility, the RED OFF pushbutton must be first depressed, which then allows the metal padlock lever on the OFF Padlock facility, to be drawn out. Once a padlock is installed, the RED OFF pushbutton remains in the depressed position. The ACB cannot be switched ON. The ACB also cannot be switched ON electrically, as the LRC is electrically isolated.

Description	NHP Service, Special Order
Allows the ACB to be padlocked in the OFF position	NHP Service fit

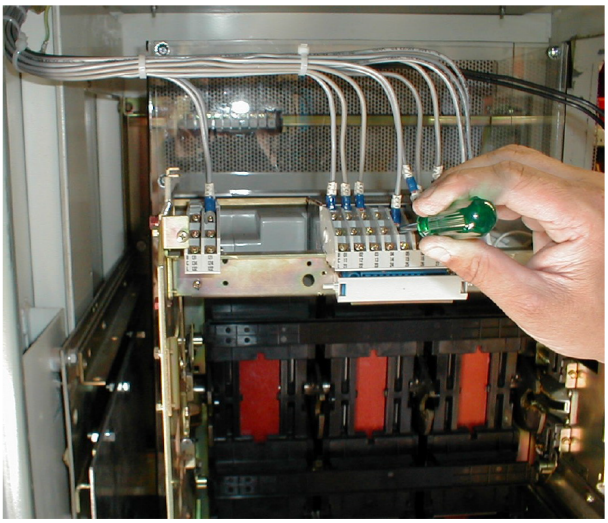
Padlocking Position

This padlocks the body relative to the carriage position. Rack the ACB out to the test or isolated position, and use the padlock position lock towards the bottom of the ACB to lock it in TEST or ISOLATED – or CONNECTED.

The ACB's position padlock lever prevents the breaker body from being accidentally drawn out. When the position padlock lever is in the pulled-out position, it can lock the breaker body in any one of the CONNECTED, TEST, or ISOLATED positions the user chooses. Up to three padlocks with a ø 6 mm hasp can be installed.

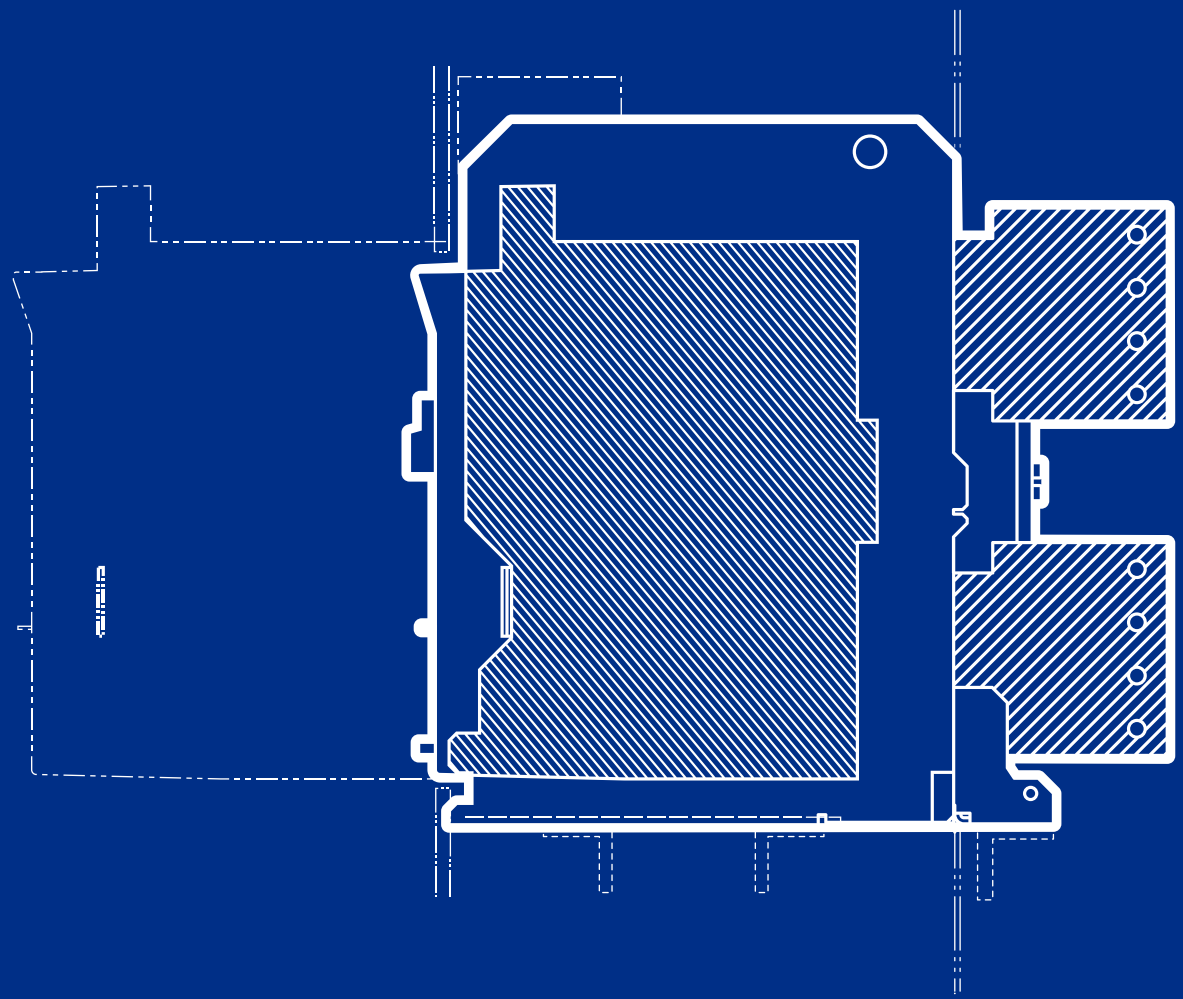
Retrofit Kits

When replacing an old obsolete air circuit breaker it is almost always necessary to modify the existing busbar alignment, mounting position and door cut-out. Retrofit kits and installation kits provide a cost effective third party solution that allows you to install a completely new Terasaki AR Air Circuit Breaker into many of the popular older brands cubical with minor re-work and down time.



Item Description	Catalogue No.
Retrofit Kit	Contact NHP

Notes



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