

# TemPower 2 Air Circuit Breaker

Safety, Performance, Protection, Reliability.

POWER DISTRIBUTION AND PROTECTION





## Introduction to Power Systems Protection and Air Circuit Breakers

In today's industrial and business environment it is essential to be able to rely on a continuous power supply. Modern buildings and industrial complexes have critical loads such as essential lighting, computers and continuously operating industrial equipment. Continual power supply is vital for these functions, therefore main switchboard circuit breakers with high mechanical durability and superior short circuit performance is critical.

The design of the Terasaki TemPower 2 Air Circuit Breaker is based on a unique 'double break' modular contact mechanism, which provides full selectivity to the full system fault level guaranteeing the continuity of the power supply and improving the safety for operators.

Locally stocked and technically supported within Australia and New Zealand, NHP have both off the shelf and customised Terasaki TemPower 2 Air Circuit Breakers to meet most technical and cost requirements.

### A Reliable , World Class Air Circuit Breaker Solution for your 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



NHP's Air Circuit Breaker manufacturing facility, Laverton Victoria.

### Why NHP?

While our customers' challenges may be complex, their ultimate goal is simple: run a profitable, safe and sustainable operation.

At NHP we're solely committed to servicing the needs of our customers. With close to 50 years of experience in the electrical and engineering industry. Our specialist teams work collaboratively to design and deliver solutions to maximise the success of your project.

We bring together internationally recognised power distribution and protection products with local knowledge and expertise to deliver best practice services from concept design through to installation and after-sales service, including project management.

A partnership with NHP will provide you with:

- Access to an extensive local stock holding
- A seamless combination of local technical support backed by around the clock service
- A specialist team of professionally qualified project management, design and engineering professionals
- A premium level of customer service and attention to detail no matter how big or small your project.

To find out how NHP can help you provide a more profitable, safer, sustainable operation call us on 1300 NHP NHP (1300 647 647).

## 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 breakthrough '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.



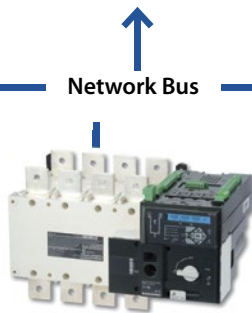
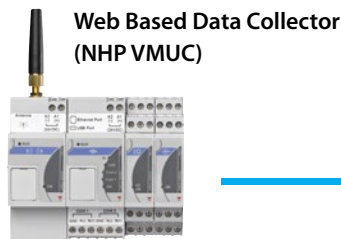
## Communications

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)

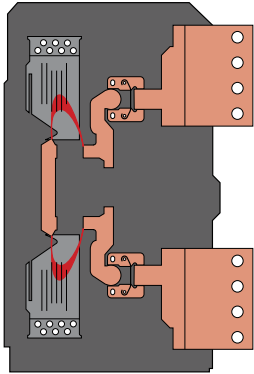
### Example Architecture

#### TemPower 2 Communication Options

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



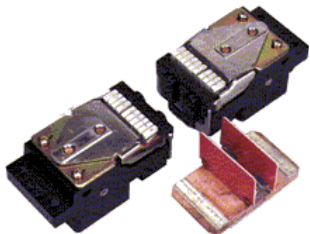
Field Devices



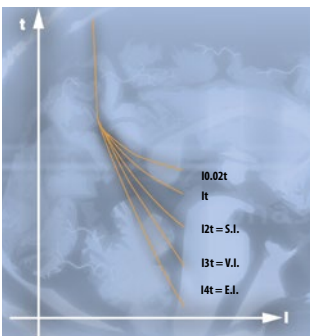
30ms fault clearance



Body mount clusters



Modular contact system



Flexible protection curves



Temperature Monitoring

## 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. The unique pole structure leads to the short time withstand rating (Icw 1 second) is equal to the service short circuit breaking capacity (Ics) for all models ensuring short circuit selectivity.

#### Double Quick Opening

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

#### Protection Relay performance

- The TemPower 2 suffers no loss in performance when used as a switch disconnecter and tripped through an external protection relay due to its high short time withstand Icw ratings.

#### Packing Density

- Increase switchboard packing density using the smallest withdrawable 1 sec rated ACB on the market while maintaining low temperature rise.

### Highest Levels of Reliability

#### Operational Endurance

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

#### Double Opening and Closing Coils

- Extend control system redundancy to an ACB. TemPower 2 can have double coils fitted which allow designers to implement back-up tripping and closing systems.

#### Reduced Time to Repair and Easy Maintenance

- The modular **Double Break** contact construction allows on-site replacement of each contact set in about 15 minutes per pole. \*\*
- Contact clusters are uniquely located on the ACB body, all serviceable parts are available for inspection once the body is racked out, dramatically reducing power down time.
- Trip Units feature an alarm which signals any internal functional faults or tripping coil health issue.

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

#### 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. The status and wear of the contacts is determined by temperature measurement using integrated thermistors.

#### Zone Interlocking

- During a fault; considerable thermal and mechanical stresses are placed on the switchboard. With the TemPower 2 Zone Interlocking system, the breaker nearest the fault will trip first with the minimum short time delay, reducing the let through energy (I<sup>2</sup>T).

#### 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)

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

\*\* Main contacts to be maintained and replaced by a certified Terasaki Technician.



## Key Benefits of the Terasaki TemPower 2 Range

### Switchboard Builders

- Compact size for high packing density and zero arc space required for clearance which facilitates optimal utilisation of sheet metal while minimising manufacturing costs. Only Terasaki can offer  $I_{cw} = 100 \text{ kA} / 1 \text{ second}$  in a small 3200 A frame size.
- Minimal derating at high ambient temperatures reduces the need to 'oversize' the ACB rating in arduous environments, saving switchgear costs.
- Uniform panel cut out size which supports repetitive production of panel doors, saving labour cost and resulting in a clean, consistent look.
- Vertical, horizontal and front terminal connections are available enabling the most efficient switchboard busbar arrangement, reducing both material and labour costs.
- Easy front access to control, auxiliary and position switch terminals which allows for efficient installation of control wiring.
- High  $I_{cu}$ ,  $I_{cs}$  and  $I_{cw}$  performance allows for optimum switchboard design (ie busbar supports etc), reducing both material and labour costs.
- Integrated protection and energy management functions, resulting in less external specialised protection and metering relays, reducing material costs and space requirements.
- Local NHP ACB experts, upskilling your staff and boosting their confidence while handling the product.
- Assembled by NHP in Australia, allowing for very fast delivery and local technical support.



### Consultants and Specifiers

- Super fast 30ms fault clearance times optimize let through energy  $I^2T$  calculations.
- Satisfying power utility requirements by ensuring minimal impact on supply during a short circuit.
- Approvals and test: IEC 60947, AS/NZS 60947-2 and ASTA certified, insuring compliance to standards.
- Electronic trip units with time current protection characteristics to IEC 60947-2, IEC 60255-3 and Marine generator requirements, ensuring ease of grading during protection studies.
- Integrated protection (ie reverse power, over voltage etc) and energy management functions (including harmonic analysis), resulting in a simplified engineering design.
- High  $I_{cu}$ ,  $I_{cs}$  and  $I_{cw}$  performance results in no loss in performance when tripped through an external protection relay, assuring high level of selectivity for the network.
- Add an extra dimension for the switchboard protection by using the breakthrough 3C overheating system.



### End Users

- Reduced risk of fire, down time and production loss thanks to the high endurance performance and breakthrough 3C overheat protection technology. Insurance costs can potentially be reduced.
- Easy on-site maintenance with built in relay tester and modular 'body mount' contact and cluster design, minimising power disruption and production stoppages.
- Super fast 30ms fault clearance times reduce let through energy ( $I^2T$ ) and potential arc flash during a fault, improving the safety of the switchroom environment for electrical workers.
- Wide variety of industrial communication protocols available allowing for integration into to B.M.S. or S.C.A.D.A systems facilitating energy management and general operational reporting.
- Product servicing and extended warranty available from NHP, Australia and New Zealand's only Terasaki trained and certified ACB technicians.

## TemPower 2 Body Technical Specification

AR-S TemPower 2 -STANDARD		AR208S	AR212S	AR216S	AR220S	AR325S	AR332S	AR440S	AR650S	AR663S	
Rated current (In) <sup>1)2)</sup>	(A)	800	1250	1600	2000	2500	3200	4000	5000	6300	
Number of poles <sup>3)4)</sup>		3 & 4	3 & 4	3 & 4	3 & 4	3 & 4	3 & 4	3 & 4	3 & 4	3 & 4	
Current transformer ratings (Ict)	(A)	200i	200i	200i	200i	200i	200i	4000	5000	6300	
		400i	400i	400i	400i	400i	400i				
		800i	800i	800i	800i	800i	800i	800i			
					1600	1600	1600	1600			
				2000	2000	2000	2500	3200			
Insulation voltage (Ui) (V 50/60 Hz)	(V AC)	1000	1000	1000	1000	1000	1000	1000	1000	1000	
Operational voltage (Ue) (V 50/60 Hz)	(V AC)	690	690	690	690	690	690	690	690	690	
Impulse voltage (Uimp)	(kV)	12	12	12	12	12	12	12	12	12	
Breaking capacity kA IEC, AS <sup>5)7)</sup> (Ics = Icu) [kA sym rms]	690 V	50	50	50	50	65	65	75	85	85	
	440 V	65 <sup>6)</sup>	65 <sup>6)</sup>	65 <sup>6)</sup>	65 <sup>6)</sup>	85 <sup>6)</sup>	85 <sup>6)</sup>	100	120	120	
Making capacity (kA peak) IEC, AS	690 V	105	105	105	105	143	143	165	187	187	
	440 V	143	143	143	143	187	187	220	264	264	
Rated short time withstand (Icw)	1 Sec	65	65	65	65	85	85	100	120	120	
	3 Sec	50	50	50	50	65	65	85	85	85	
Total breaking time	Sec	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.05	0.05	
Motor charging time (max)	Sec	10	10	10	10	10	10	10	10	10	
Closing time (max)	Sec	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	
Latching current	(kA)	65	65	65	65	85	85	100	120	120	

### Notes:

1. Values in open air at 50°C up to 4000A.
2. Values for AR208S, AR212S, AR216S draw-out types with horizontal terminals. Values for drawout types with vertical terminals.
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.
5. Contact NHP for details.
6. For 500 V AC.
7. Please contact NHP for DC applications.

i = Available indent delivery only.



## TemPower 2 Body Technical Specification

AR-H TemPower 2-HIGH kA		AR216H	AR220H	AR316H	AR320H	AR325H	AR332H	AR663H
Rated current (In) <sup>1) 2)</sup>	(A)	1600	2000	1600	2000	2500	3200	6300
Number of poles <sup>3) 4)</sup>		3 & 4	3 & 4	3 & 4	3 & 4	3 & 4	3 & 4	3 & 4
Current transformer ratings (Ict)	(A)	200i	200i	200i	200i	200i	200i	5000
		400i	400i	400i	400i	400i	400i	6300
		800i	800i	800i	800i	800i	800i	
		1250	1250	1250	1250	1250	1250	
		1600	1600	1600	1600	1600	1600	
			2000		2000	2000	2000	
						2500	2500	
							3200	
AC Insulation voltage (Ui)	(V AC)	1000	1000	1000	1000	1000	1000	1000
Operational voltage	(V AC)	690	690	690	690	690	690	690
Impulse voltage (Uimp)	(kV)	12	12	12	12	12	12	12
Breaking capacity kA IEC, AS <sup>5) 7)</sup> (Ics = Icu) [kA sym rms]	690 V	55	55	85	85	85	85	85
	440 V	80	80	100	100	100	100	135
Making capacity (kA peak) IEC, AS	690 V	121	121	187	187	187	187	187
	440 V	176	176	220	220	220	220	297
Rated short time	1 Sec	80	80	100	100	100	100	125
withstand (Icw)	3 Sec	55	55	75	75	75	75	85
Total breaking time	Sec	0.03	0.03	0.03	0.03	0.03	0.03	0.05
Motor charging time	Sec	10	10	10	10	10	10	10
Closing time (max)	Sec	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Latching current	(kA)	65	65	85	85	85	85	85

## Off the Shelf 'Standard Configuration TemPower 2 ACBs' and Customer Build ACBs

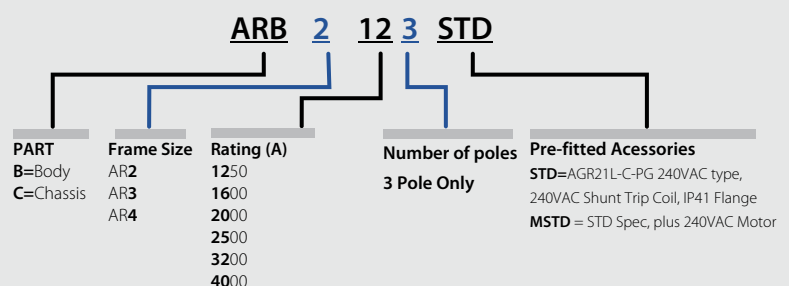
TemPower 2 ACBs can be ordered as either a basic 'pre-built standard' off the shelf item or as a workshop custom built item.

Standard ACBs are kept on the shelf in a 'pre-built' 3 pole configuration providing fast customer delivery. The ACB body (withdrawable part) and chassis (fixed part) are ordered separately according to the required chassis terminal configuration. For the full list of off the shelf stocked ACB part numbers including motorised and non auto versions refer to the current NHP Price List catalogue.

Example: ARB2123STD = Standard Body part (no motor) ARC2123STD = Standard Chassis to suit the standard body. Note the standard 'STD' Chassis part number can be used with both 'STD' and 'MSTD' standard body part numbers.

Custom built Terasaki TemPower 2 ACBs are locally assembled by NHP along with many variations and options available to suit specific end user applications including 4 pole models. Contact NHP for further details on ordering a customer built Terasaki TemPower 2 ACB.

### Standard Configure Off the Shelf TemPower 2 ACB Part Number Constructure



## TemPower 2 Chassis Technical Specification

### AR-S Standard series

Ampere rating (A)	ACB type	ACB mounting method	Horizontal terminals	Vertical terminals	Front connect terminals
800 A	AR208S	Draw-out	√	√	√
1250 A	AR212S	Draw-out	√	√	√
1600 A	AR216S	Draw-out	√	√	√
2000 A	AR220S	Draw-out	√	√	√
2500 A	AR325S	Draw-out	√	√	√
3200 A	AR332S	Draw-out	√	√	√
4000 A	AR440S	Draw-out	X	√	X

### AR-H High kA series

Ampere rating (A)	ACB type	ACB mounting method	Horizontal terminals	Vertical terminals	Front connect terminals
1600 A	AR216H	Draw-out	√	√	X
2000 A	AR220H	Draw-out	√	√	X
1600 A	AR316H	Draw-out	√	√	X
2000 A	AR320H	Draw-out	√	√	X
2500 A	AR325H	Draw-out	√	√	X
3200 A	AR332H	Draw-out	√	√	X

### AR650 / AR663

Ampere rating (A)	ACB type	ACB mounting method	Horizontal terminals	Vertical terminals	Front connect terminals
5000 A	AR650	Draw-out	X	√	X
6300 A	AR663	Draw-out	X	√	X

√=Standard X=Optional



Front Connect



Horizontal Connect



Vertical Connect



## TemPower 2 Electronic Trip Unit Technical Specification

Trip Unit type fitted		AGR-21C			AGR-31C		
Feature		Ammeter display			Energy metering display		
Protection Curve Type		L	R	S	L	R	S
Application		General	High Selectivity	Generator	General	High Selectivity	Generator
Protective function	Fine (1%) Adjustable LSI protection	A	√	√	√	√	√
	Ground fault trip	GF	√	√	-	√	√
	High Selectivity Curves to IEC60255		-	√	-	-	√
	Under voltage	UV	-	-	-	√	√
	Over Voltage	OV	-	-	-	√	√
	Under Frequency	UF	-	-	-	√	√
	Over Frequency	OF	-	-	-	√	√
Alarm function	Pre-trip alarm <sup>1)2)</sup>	PTA	√	√	√	√	√
Protection characteristic	HOT/COLD - thermal memory (LT) <sup>3)</sup>	-	√	√	√	√	√
	I <sup>2</sup> t ON / OFF (ST) <sup>4)</sup>	-	√	√	√	√	√
Integral display	Integral LCD display	-	√	√	√	√	√
	Backlit display <sup>1)</sup>	-	√	√	√	√	√
Measurement/event indication	Current	-	√	√	√	√	√
	Line voltage	-	-	-	-	√	√
	Electrical power	-	-	-	-	√	√
	Electrical energy	-	-	-	-	√	√
	Power factor	-	-	-	-	√	√
	Demand electrical power	-	-	-	-	√	√
	Harmonic current	H	-	-	-	√	√
	Trip event log (last 10 trips) <sup>1)5)</sup>	-	√	√	√	√	√
Alarm event log (last 10 alarms) <sup>1)5)</sup>	-	√	√	√	√	√	
Miscellaneous	Modbus RTU RS-485 comms <sup>1)</sup>	C	√	√	√	√	√
	External display meter option	I	√	√	√	√	√
	Test function (internal Trip Unit function) <sup>1)6)</sup>	-	√	√	√	√	√
	Test function using ANU1 Trip Unit checker <sup>6)</sup>	-	√	√	√	√	√
	Trip output contact (single contact output)	Y	√	√	√	√	√
Optional Protections	N-phase protection <sup>7)</sup>	NP	○	○	-	○	○
	Zone Interlock	Z	○	○	-	○	○
	Restricted Earth Fault	REF	-	-	-	○	○
	3C Over Temperature Alarm	OH	-	-	-	○	○
	Reverse Power	RP	-	-	-	○	○
	Phase rotation protection (sequence) <sup>8)</sup>	NS	○	○	-	○	○

√=Standard ○=Optional

### Notes

- Control power supply is required. Feature disabled when control power is lost.
- The pretrip alarm capability provides an alarm on the LCD when it is detected that the current value exceeds the current setting for longer than the time setting, thereby preventing the breaker from tripping due to a gradual increase in load current.
- In HOT mode, the Trip Unit is actuated in shorter time than in COLD mode when an overload occurs.
- I<sup>2</sup>t ON avoids intersection of characteristic curves of the breaker and e.g., a downstream breaker or fuse. This improves selectivity flexibility.
- Logs the last 10 TRIP and ALARM event, and displays the cause, value and operating time of the event.
- Using an ANU1 Trip Unit checker, or the Trip Unit internal test function, field testing is possible to check LSI+GF trip functions.
- Provides overcurrent protection for the neutral conductor in a 4 wire circuit.
- Detects negative-phase current due to reversal of phase sequence or phase loss, preventing damage to loads.



AGR-21C



AGR-31C

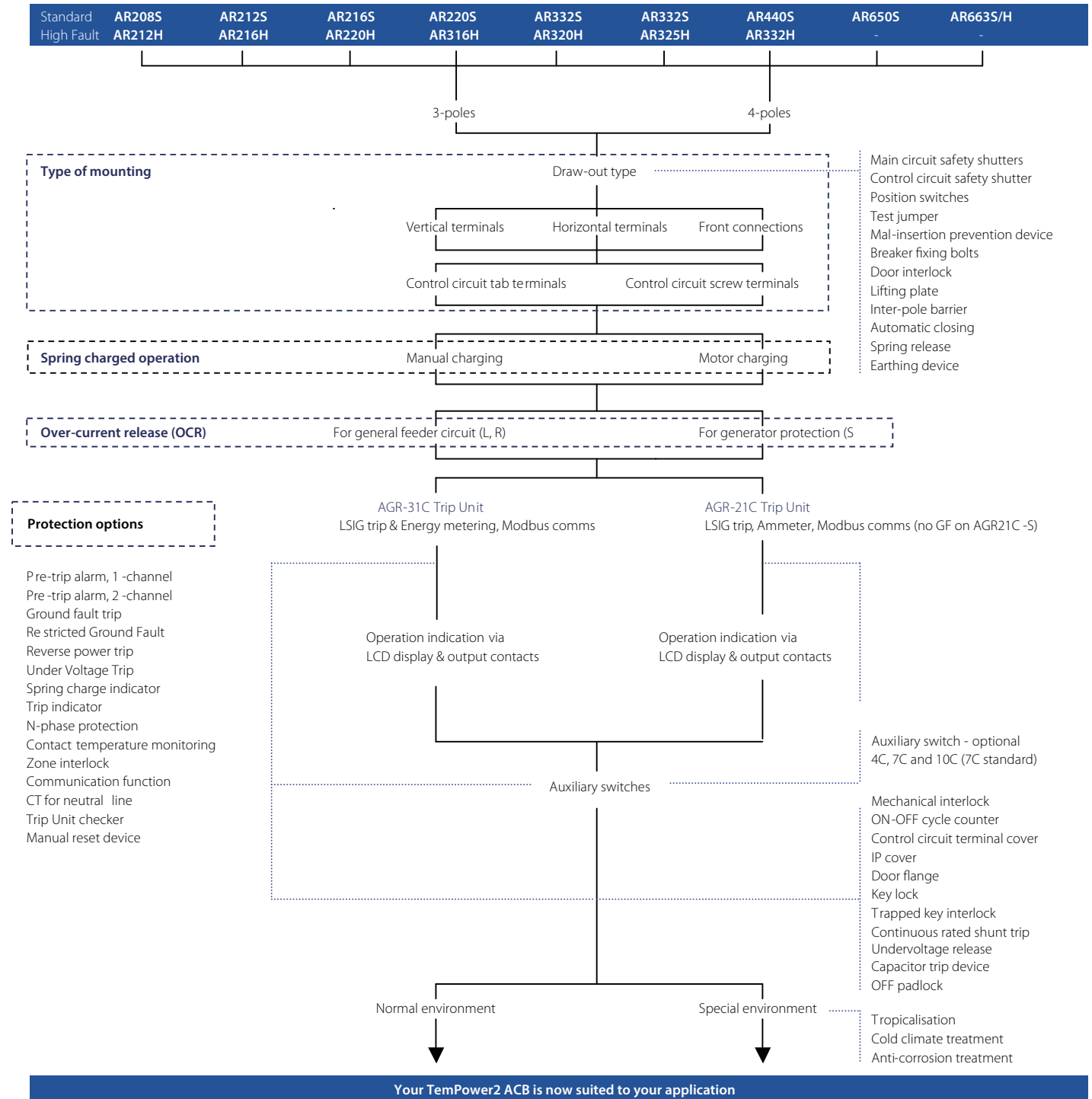
Measurement / Integral meter event indication		AGR-21C	AGR-31C
Load current	Present value for each phase	√	√
	Present max value	√	√
Line voltage	Present value of each line voltage	-	√
	Present maximum value	-	√
	Present phase voltage value for each phase	-	√
Harmonic current	Present value of 3rd - 19th harmonic current per phase	-	√
	Present active power	-	√
Electrical power	Present reactive power	-	√
	Present apparent power	-	√
	Demand active power	-	√
Demand Electric power	Demand reactive power	-	√
	Demand apparent power	-	√
	Maximum demand value of active power	-	√
	Active electrical energy	-	√
Electrical energy	Reactive electrical energy	-	√
	Apparent electrical energy	-	√
	Power factor	Present value	-
Trip event log <sup>1)2)</sup>	Fault current	√	√
	Indication of cause	√	√
Alarm event log <sup>1)2)</sup>	Cause of alarm, Indication of operated value	√	√

Notes:

- Control power supply is required. Feature disabled when control power is lost.
- Logs the last 10 TRIP and ALARM event, and displays the cause, value and operating time of the event.

## TemPower 2 Selection Guide

TemPower 2 ACBs have an extensive range of accessories available, enabling the ACBs to be “custom built” to suit the application



**Your TemPower2 ACB is now suited to your application**

Contact NHP for full details on how to order a custom built, factory tested TemPower 2 ACB.

## AUSTRALIA

[nhp.com.au](http://nhp.com.au)

SALES 1300 NHP NHP

[sales@nhp.com.au](mailto:sales@nhp.com.au)

## NEW ZEALAND

[nhp-nz.com](http://nhp-nz.com)

SALES 0800 NHP NHP

[sales@nhp-nz.com](mailto:sales@nhp-nz.com)



**NHP Electrical Engineering Products**  
A.B.N. 84 004 304 812

NTERTMP2ACB  
© Copyright NHP 2017



For more information, scan to download  
the NHP eCatalogues App offering exclusive  
video content, catalogues and literature