TERASAKI
Innovators in Protection Technology

Innovations 2006

TemPowerACB

Double Breaker

- Two Steps Ahead

World Class Air

Terasaki's *TemPower2* A.C.B is the result of an intensive market research program which took into account the requirements of switchboard builders, consultants and end users.
TemPower2 Air Circuit Breaker is one of the smallest in the market with a 1 second rating (Icw).

Innovations

New design built-in UVT that eliminates the need for the controller to be mounted on the side of the ACB.

New Protection Relay range the AGR-B. The new AGR-B range will have an improved LCD display, which will include additional features such as an Ammeter, Zone Interlocking and Multi/Power Meter capabilities. This will also mean some changes to previous closing circuit configurations.

★Based Standards

JIS C8372 .....
IEC60947-2 .....
EN60947-2 .....
AS 3947-2 .....
NEMA PUB NO.SG3 .....
ANSI C37.13 .....

★Certification and Authorization

ASTA, UK .....
NK, Japan .....
LR, UK .....
ABS, USA .....
GL, Germany .....
BV, France .....

Circuit Breakers

Contents

..... Japanese Industrial Standard
..... International Electrotechnical Commission
..... European Standard
..... Australian Standard
..... National Electrical Manufacturers Association
..... American National Standard Institute

..... ASTA Certification Services
..... Nippon Kaiji Kyokai
..... Lloyd's Register of Shipping
..... American Bureau of Shipping
..... Germanischer Lloyd
..... Bureau Veritas

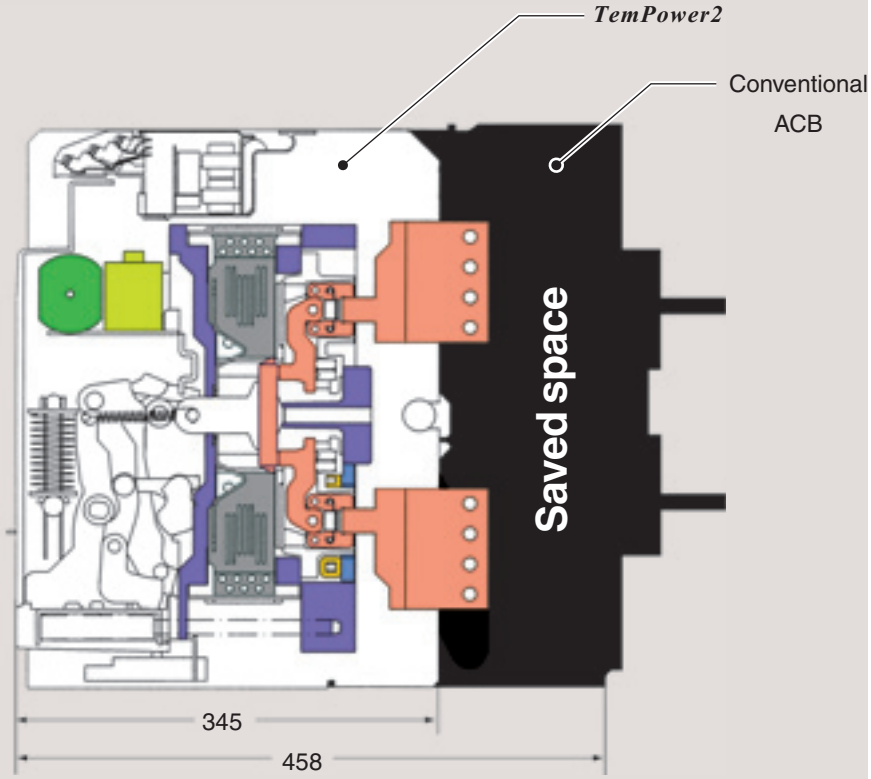
1 Features

The ultimate in compactness and operational capability

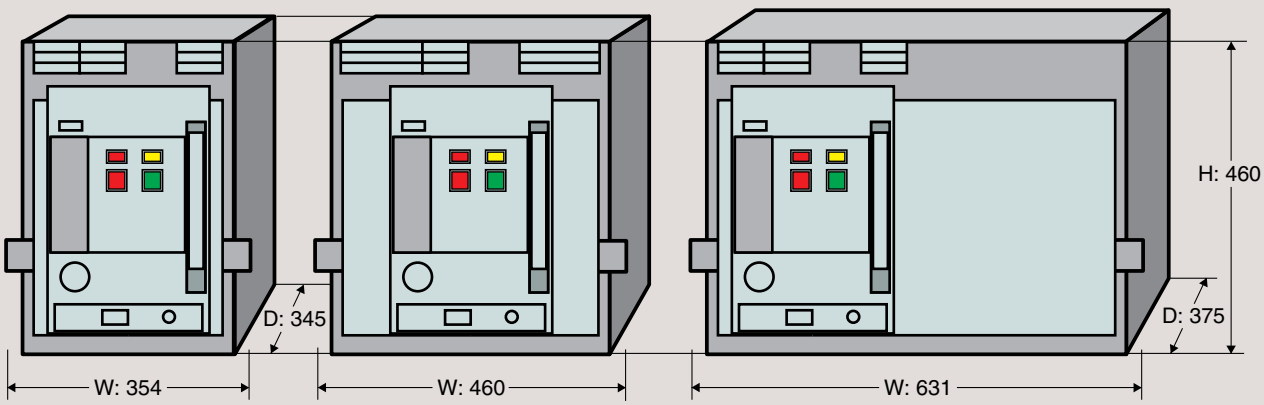
Icw,1s = Ics for all *Tempower2* ACBs.

TemPower2 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 (Icw, 1sec) is equal to the service short-circuit breaking capacity (Ics) for all models. Full selectivity is guaranteed up to the full system fault level. ***TemPower2*** ACBs have the world's smallest depth resulting in space saving in switchboards.

More than twenty design patents have been registered for the ***TemPower2*** ACB.



The height and depth dimensions are identical in all sizes up to 3200A. There are two common widths or frame size, from 800-2000A and from 2500-3200A for the standard series. The panel cutout size is the same for all types of ***TemPower2***, which makes it easy to arrange the ACBs in switchboards.
Maximum power from minimum volume was central to the design specification. With a depth of 290mm for the fixed type and 345mm for draw-out, it is one of the smallest ACBs in the world.
ACBs with front connections are available off-the-shelf.
Front connections are especially suitable for smaller-depth switchboards.



Standard series 800-2000A
High fault series 1250-2000A

2500-3200A
1600-3200A

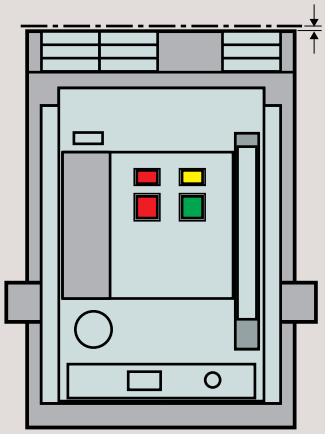
4000A

Increased accessibility from the front

It enhances ease of installation, operation, and maintenance.

The double insulated design ensures that most accessories can be safely and easily, installed by the user. Control, auxiliary and position switch terminals are mounted at the front on the ACB body for easy access. Horizontal, vertical and front terminal connections, can also be changed by the user for any last minute alterations. Due to the increased level of harmonics within the distribution network, the neutral phase is fully rated as standard.

No extra arc space required, vertical stacking permitted



The *TemPower2* ACB dissipates all arc energy within its unique *"DoubleBreak"* arc chamber. The internal energy dissipation within the ACB allows the clearance distance of the ACB to nearby earthed metal to be zero. This will assist in minimizing switchboard height and costs.

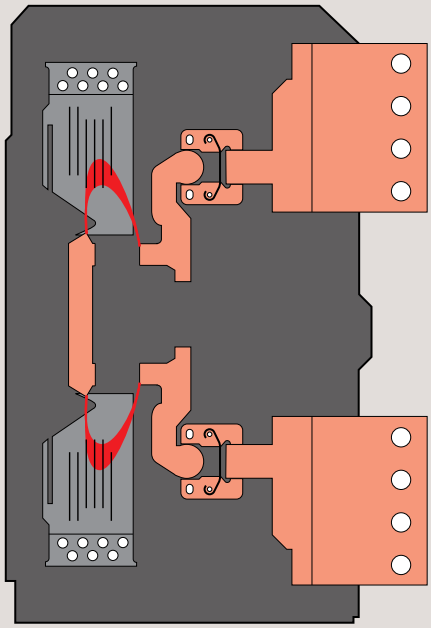
Replacement of the main contacts

The fixed and moving main contacts can easily be replaced in the field, thus prolonging the life on the circuit breaker. Changing each pole takes around 15 minutes.

1 Features
A high performance and reliability

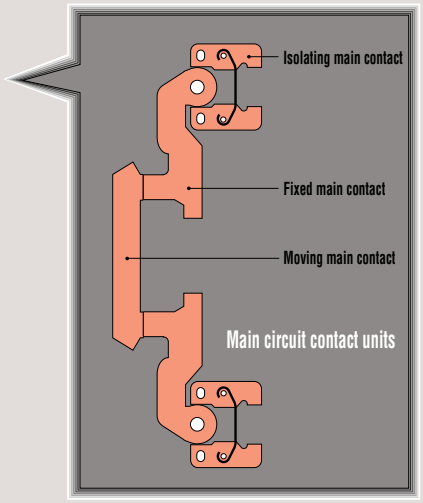
Very fast interruption by *"DoubleBreak"* system

The unique ***"DoubleBreak"*** main contact system ensures extremely fast interruption of short circuit currents and substantially reduces main contact wear. The internally symmetrical ***"DoubleBreak"*** structure means the moving contact is isolated from the supply voltage even when the ACB is reverse connected. The neutral pole of all ***TemPower2*** ACBs are of early make/late break design. This eliminates the risk of abnormal line to neutral voltages, which may damage sensitive electronic equipment.
"***DoubleBreak***" contacts increase service life - Electrical and mechanical endurance ratings are the best available, and exceed the requirements of IEC 60947-2.



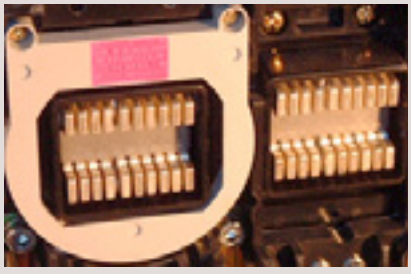
No clamp screws used for the main circuit contact units

There are no clamp screws or flexible leads in the main circuit contact units.
This substantially enhances the durability of the main circuit contact units and improves the reliability in ON-OFF operation.



Easy Maintenance

The unique design of ***TemPower2*** incorporates its isolating clusters and main contacts on the ACB body. Allowing for quick easy maintenance of the main electrical contact points and for maintenance to be completed without having to isolate the switchboard.



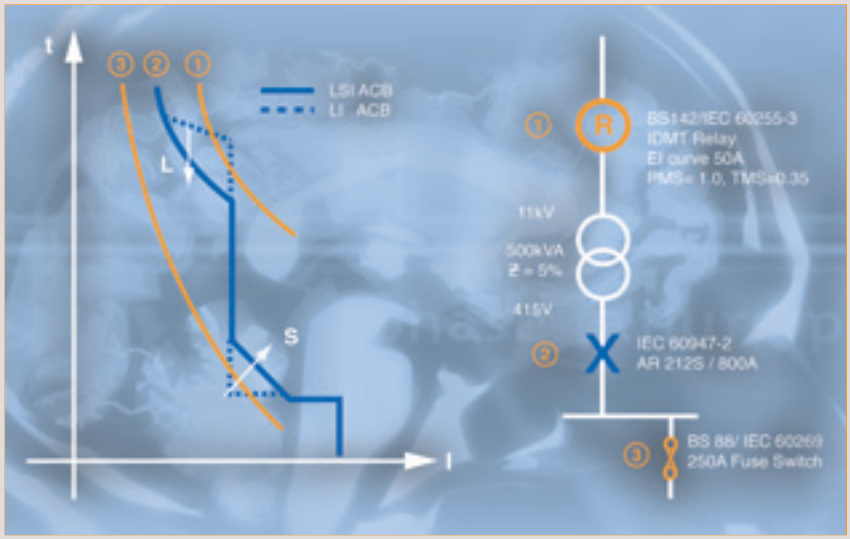
Enhanced selectivity

L Long time delay
S Short time delay
I Instantaneous

At Terasaki our protection relays have '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 fuses and upstream relays.



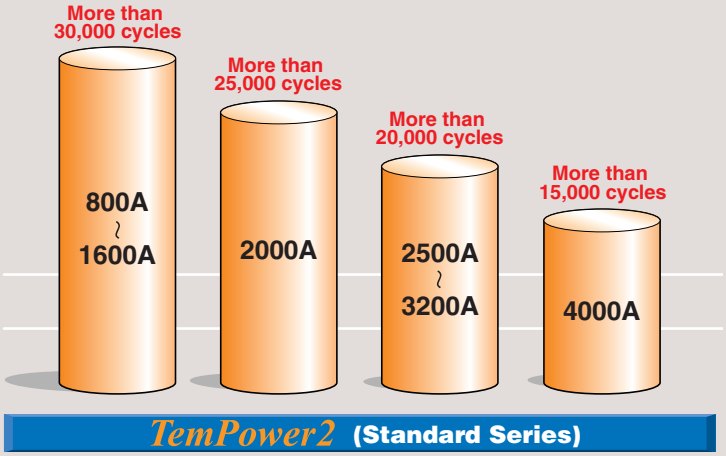
The standard 'LSI' curve provides more than five million combinations of unique time current characteristics.
Zone selective interlocking is available to provide zero time delay selectivity.

As the rated breaking capacity is identical to the rated short-time withstand current full selectivity can be achieved.

Performance \ Type and rated current	AR208S 800A AR212S 1250A AR216S 1600A AR220S 2000A	AR212H 1250A AR216H 1600A AR220H 2000A	AR325S 2500A AR332S 3200A	AR316H 1600A AR320H 2000A AR325H 2500A AR332H 3200A	AR440S 4000A
Rated breaking current (at AC440V) — With INST trip function	65kA	80kA	85kA	100kA	100kA
Rated breaking current (at AC440V) — With ST delay trip function (Without INST trip/MCR functions)					
Rated short-time withstand current (for 1 sec.)					

A substantial improvement in life cycles

The *TemPower2* series has achieved very high life cycles compared with our competitors.



TemPower2 **(Standard Series)**

Note: above figures are the mechanical endurance with maintenance. For details please refer to pages 14 & 15.

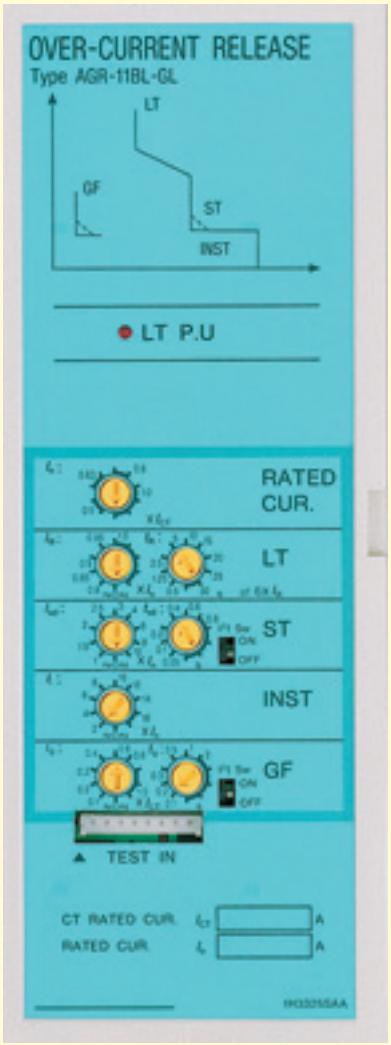
AH6 ACB Range

5000Amp (Icw, 1 sec 100kA - Ics 120kA) and 6300Amp (Icw, 1 sec 120kA - Ics 120kA) 3 and 4 Pole ACBs. Catalogue Ref. – 04-I52E

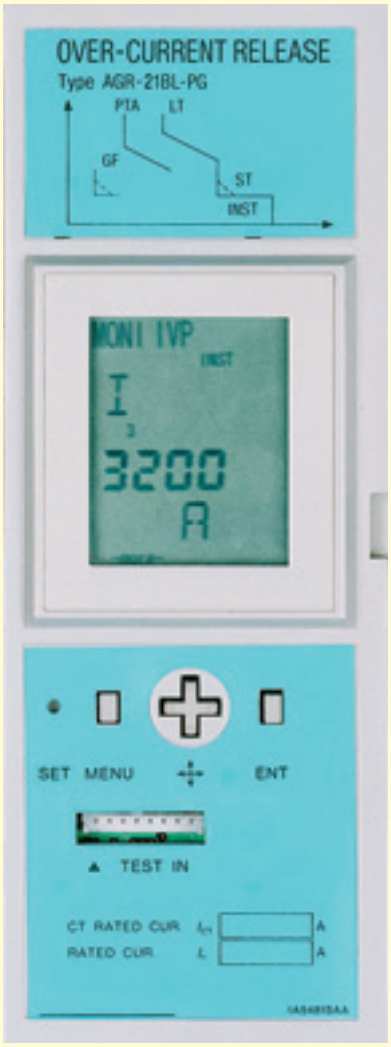
1 Features

TemPower2 provides positive protection for electric power systems.

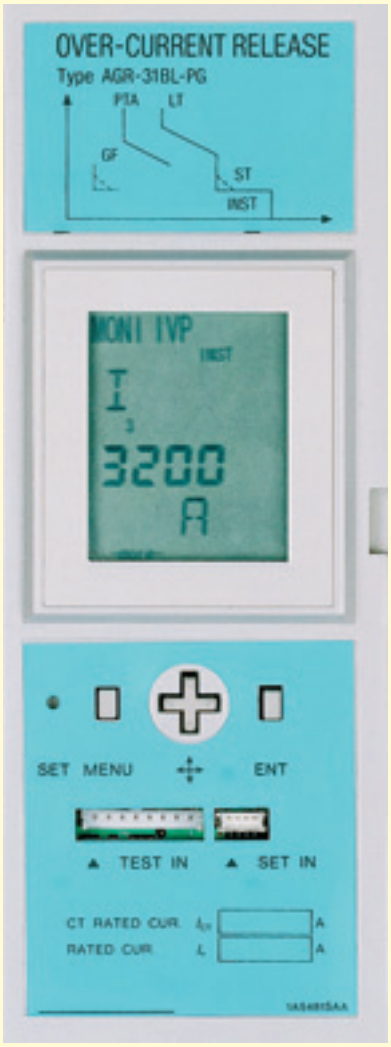
The *TemPower2* series is equipped with an RMS sensing over-current release (OCR) having a wide range of protection functions and capabilities.



Standard OCR with adjustment dial Type AGR-11B.



Standard OCR with LCD-'Ammeter' Type AGR-21B,22B.



Enhanced OCR with LCD- 'Analyser' Type AGR-31B.

Backlit LCD installed

Overload protection

Adjustable from 40–100% of rated current. True r.m.s detection up to the 19th harmonic, a distant vision for the competition who rarely see past the 7th. Neutral protection for all those Triple-N harmonics, such as 3rd, 9th and 15th. Also in case we forgot to mention, a **"thermal memory"** ia available on the AGR21B/31B.

Reverse power trip function

(S-characteristic)

This feature provides additional protection when paralleling generators. The AGR22B/31B OCR for generator protection with the reverse power trip function, negates the need for installation and wiring in an external reverse power relay. This feature is available using an AGR OCR with a generator "S" type characteristic only.

For general feeder circuits (L-characteristic)
For general feeder circuits (R-characteristic)
For generator protection (S-characteristic)

FOR FULL DETAILS REFER TO THE FEATURES TABLE PAGE 30-31

Two channel pre-trip alarm function (optional)

This function can be used to monitor and switch on additional power backup to feed critical circuits. For example, the function can be set so that when a pre-trip alarm is activated, an emergency generator starts to ensure a constant supply. This feature is only available on some AGR22B/31B OCR models with a generator “S” characteristic.

N-phase protection function (optional)

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 prevents the neutral conductor from sustaining damage or burnout due to these large currents. Available in all OCRs except for generator “S” characteristic types.

Ground fault trip function

This function eliminates external relays to provide a ground fault protection to TN-C or TN-S power distribution systems on the load side. Ground fault protection on the line side is also available as an option.

Earth leakage trip function

Used in conjunction with an externally mounted Zero phase Current Transformer (ZCT), this function provides protection against leakage to earth of very small levels of current. Trip or alarm indication, and contact output is available to enhance the level of system protection.

Phase rotation protection function

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.

External display (optional)

Soon to be available

If the ACB is installed in the switchboard so that overcurrent release (OCR) indications are hidden to the operator, the use of this large external display allows the operator to monitor the indications. Out of phase currents, line voltages (or phase voltages), power and power factor, up to 4 outputs can be read as current signals (converted to 4 - 20 mA DC) on the external display.

Advanced L.C.D. display, Over Current Relay

The AGR-31B OCR comes standard with an LCD display. It can monitor and indicate phase currents, voltages, power, energy, power factor, frequency, and more. For features refer page 29.

Remote Communications Protocols (optional)

Data communications via Modbus, an open network, are supported.

Energy Measurement

I, V, kW, MWh, kVar, cosø, frequency

Intelligent Fault Analysis

Status, fault type, fault size, tripping time, fault history

Maintenance Information

Trip circuit supervision, contact temperature monitoring.

For details please refer to page 12.

For other protocols please contact terasaki.

Contact temperature monitoring function (optional)

This function monitors the temperature of the ACBs main contacts. An alarm indicates when the temperature exceeds 155°C. Continuous monitoring of the contact temperature provides valuable input for preventative and predictive maintenance programs.

1 Features

Optimum protective coordination

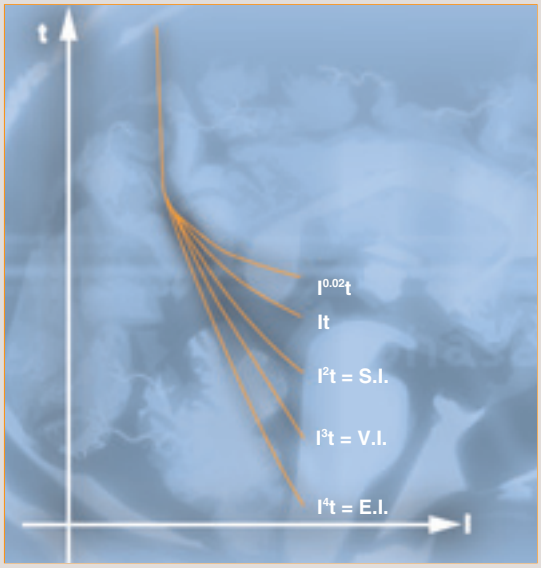
Why use a separate panel mounted protection relay when you can have all the benefits of I.D.M.T. protection integral to the ACB?

TemPower2 is available with a choice of flexible protection curves to assist in selectivity applications.

S.I. Standard Inverse
V.I. Very Inverse
E.I. Extremely Inverse

All these curves are user definable and comply with IEC 60255-3. Standard transformer and generator protection characteristics are also available.

AGR-L Industrial & transformer protection
AGR-S Generator protection
AGR-R Characteristics to IEC 60255-3



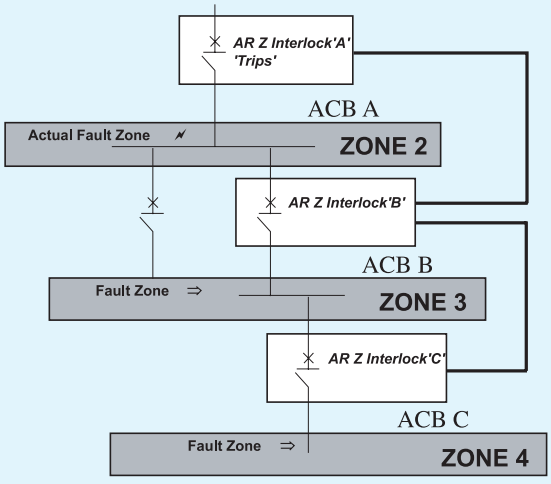
Inverse Definite Minimum Time (I.D.M.T.)

Zone Interlocking

In conventional discrimination systems, short time delays are used to allow a short-circuit current to be tripped by the circuit breaker nearest the fault. The disadvantage of this type of system is during a fault; considerable thermal and mechanical stresses are placed on the entire system. With the *TemPower2* Z Interlock system the breaker nearest the fault irrespective of the short time delay setting will trip first.

Example of operation:

If a fault occurs in Zone 2, only AR Z Interlock 'A' will sense any fault current fault, a no fault signal will be sent by AR Z Interlock 'B' & 'C', consequently AR Z Interlock 'A' trips the ACB immediately, overriding its short time delay.



Example of AR Zone Interlock Function

Double opening and closing coils

Double Opening and Closing Coils provides extended control system redundancy to an ACB. Double coils allow designers to implement back-up tripping and closing systems. It provides the end user with ultimate reliability on critical UPS circuits connected to critical loads.

Earthing Device

The unique design of ***TemPower2 ACBs*** allows for the earthing of either the busbar (line) or the circuit (load) of a low voltage system. Thus allowing system flexibility.

Some other manufactures only offer one option either, busbar or circuit earthing.

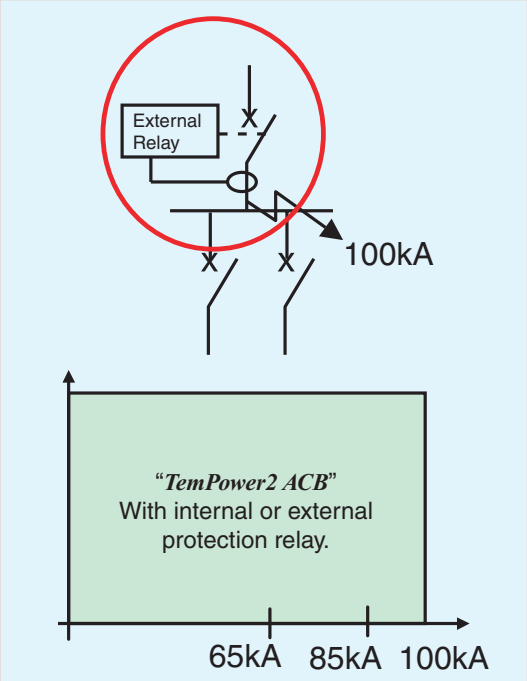
For full details refer to page 44

Protection relay performance

Ensure that the ACB you specify suffers no loss of performance when tripped by an external protection relay!

The ***TemPower2 ACB*** suffers no loss in performance when tripped through an external protection relay.

Some competitor's ACBs have reduced breaking performance when an external protection relay is used.



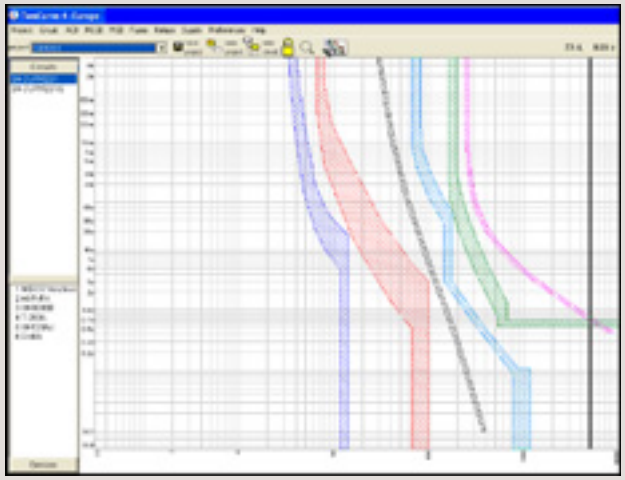
1 Features

Double Neutrals

System harmonics, in the face of increasing triple-N harmonic currents Terasaki have launched a range of ACBs with double neutrals from 800 – 6300Amps – The 'AR-DN'. Terasaki have the widest range of double rated neutral ACBs on the global market.

TemCurve

TemCurve Selectivity Analysis Software is shaped around the extensive range of Terasaki circuit breakers, but also includes a large number of complimentary protective devices such as High and Low Voltage Fuses to BS88/IEC269, IDMT Relays to BS142/IEC255. As a result, ***TemCurve*** can assist in protection device grading from the transformer primary to the point of final distribution, giving the facility to produce overcurrent and earth fault studies.



Meeting customer requirements

TemPower2 **provides solutions to satisfy customer needs.**

SWITCHBOARD BUILDER

- Compact size for high packing density
- No extra arc space required for clearance
- Low temperature dissipation
- Built in trip supervision circuit
- Fully rated neutral as standard
- Terminal connections and accessories are field changeable
- Uniform panel cut out size

CONSULTANT

- Time Current Characteristics to IEC 60255-3
- Standard, Very and Extremely Inverse curves available
- Restricted and Unrestricted ground fault protection in one relay
- LSI characteristic curves as standard
- True r.m.s. protection
- Integral reverse power protection and load shedding relay

END USER

- Self checking protection relay and tripping coil
- Built in relay tester available on AGR21B/22B/31B can check on line without tripping the ACB
- Contact temperature monitoring
- Fault diagnosis - type of fault, magnitude, tripping time & trip history
- High making capacity for operator safety
- Communication via B.M.S. or S.C.A.D.A. system
- Main contacts can be changed within around 15 minutes per pole

1 Features

Communication facility added to *TemPower2*

TemPower2 is equipped with a communication interface unit that allows data exchange with a host PC via a Modbus open network. Data communicated includes measurements, fault log, maintenance information, ON/OFF status, settings, and control (ON/OFF/RESET) signals.

Fault log

Cause	Whichever trip functions, LTD, STD, INST, or GF is activated is then transmitted.
Fault current	The fault current at which the breaker tripped open is transmitted.
Trip pickup time	The trip pickup time is transmitted.

Maintenance information

Tripping circuit monitoring	The tripping coil is always monitored for disconnection. If the breaker is not open within approx. 300 ms of a trip signal delivered from the OCR, an alarm signal is generated.

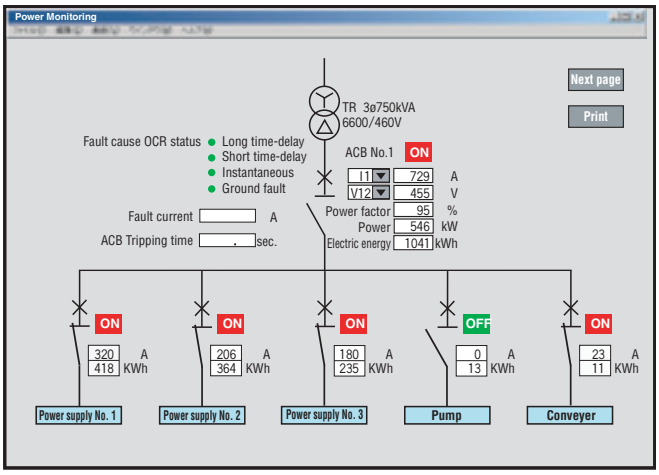
Data measurement

Phase current	The phase current I_1, I_2, I_3, I_N, I_g and max current Imax are measured and transmitted.
Line-to-line voltage	V_{12}, V_{23} and V_{31} are measured.
Active power	The three-phase power, reverse power and max power are measured.
Demand active power	The demand active power is measured.
Accumulated power	The accumulated power is measured.
Power factor	The circuit power factor is measured.
Frequency	The frequency is measured.

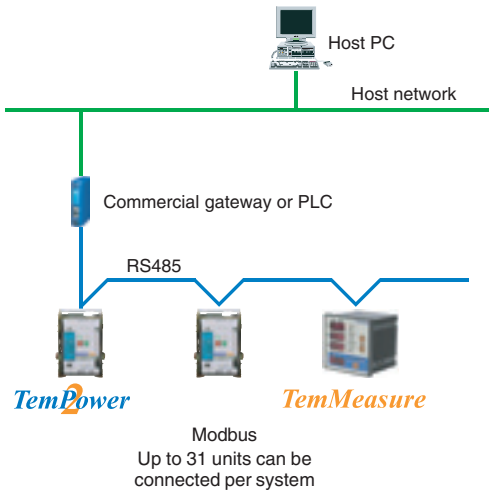
Network interface I/O specifications

Item	Modbus
Transmission standard	RS-485
Transmission method	Two-wire half-duplex
Topology	Multi-drop bus
Transmission rate	19.2 kbps max
Transmission distance	1.2 km max (at 19.2 kbps)
Data format	Modbus-RTU or ASCII
Max number of nodes	1 - 32

On-screen PC monitor



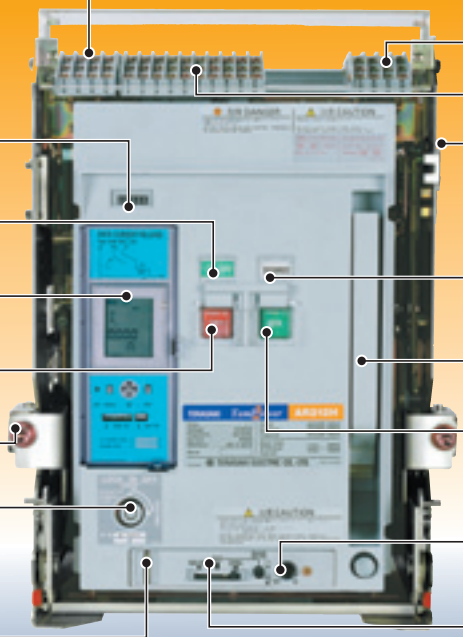
Communication network



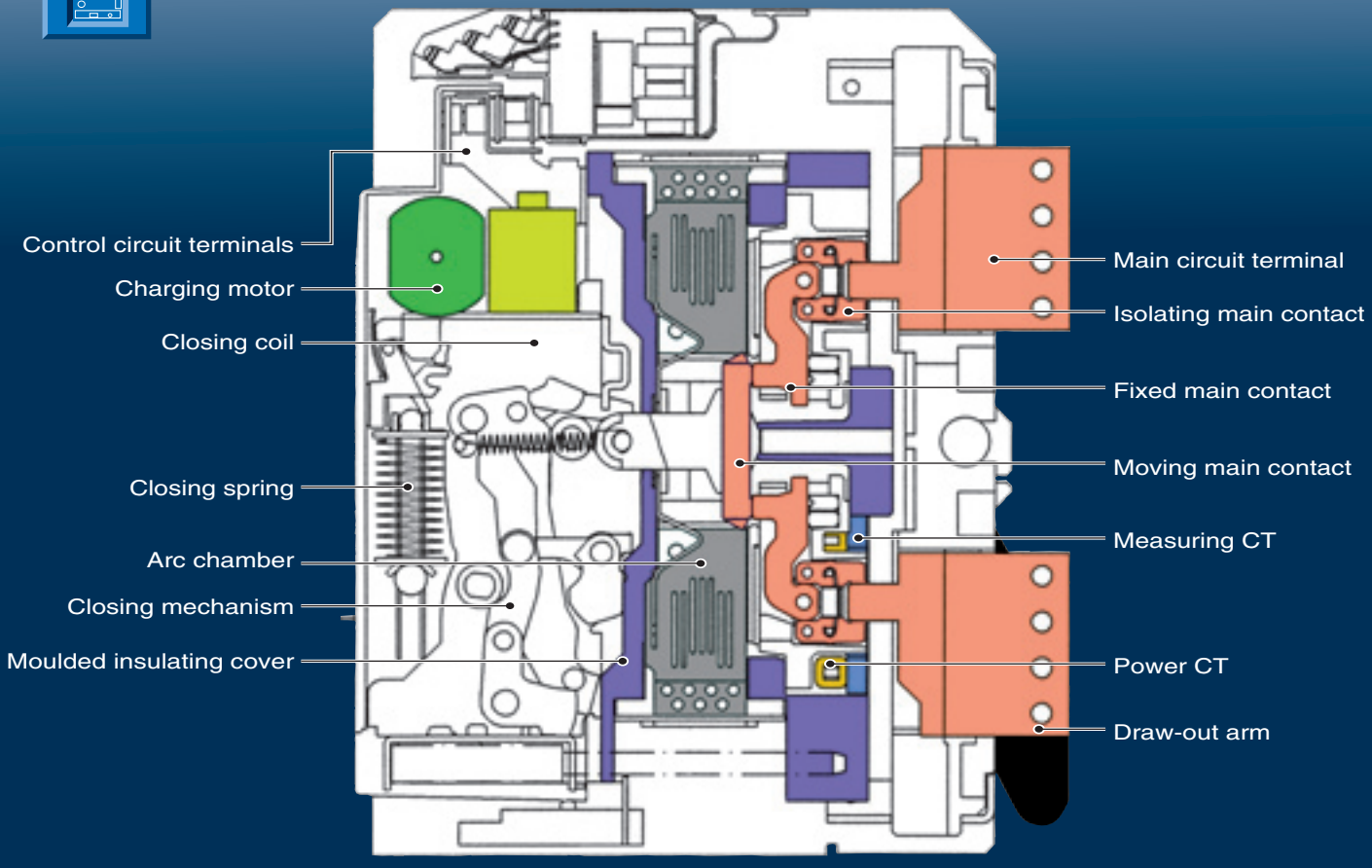
2 Appearance and Internal Construction

TemPower

Appearance

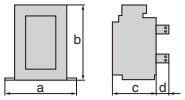
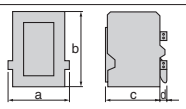


Internal Construction



3 Ratings

Standard Series

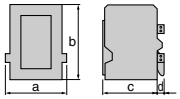
AMPERE RATING(A)			800		1250		1600		2000		2500		3200		4000			
TYPE			**AR208S**		**AR212S**		**AR216S**		**AR220S**		**AR325S**		**AR332S**		**AR440S**			
RATED CURRENT (max) [I_n](A)		IEC, EN, AS	800		1250		1600		2000		2500		3200		4000			
① ②		JIS	800		1250		1600		2000		2500		3200		3700			
		NEMA, ANSI	800		1250		1540		2000		2500		3200		3700			
		Marine	800		1250		1600		2000		2500		3200		4000			
NEUTRAL POLE AMPERES FRAME (A)			800		1250		1600		2000		2500		3200		4000			
NUMBER OF POLES		③	3	4	3	4	3	4	3	4	3	4	3	4	3	4		
RATED PRIMARY CURRENT OF OVER–CURRENT RELEASE [I_{CT}](A)			200		400		400		400		2500		3200		4000			
			400		800		800		800									
• for general feeder circuit use			800		1250		1250		1250									
							1600		1600									
									2000									
RATED CURRENT OF OVER–CURRENT RELEASE (A)			100≦I_n≦200		200≦I_n≦400		200≦I_n≦400		200≦I_n≦400		1250≦I_n≦2500		1600≦I_n≦3200		2000≦I_n≦4000			
• for generator protection use			200<I_n≦400		400<I_n≦800		400<I_n≦800		400<I_n≦800									
[I_n] is generator rated current.			400<I_n≦800		630<I_n≦1250		630<I_n≦1250		630<I_n≦1250									
							800<I_n≦1600		800<I_n≦1600									
									1000<I_n≦2000									
AC RATED INSULATION VOLTAGE [U_i](V. 50/60Hz) ④			1000		1000		1000		1000		1000		1000		1000			
RATED OPERATIONAL VOLTAGE [U_e](V. 50/60Hz) ⑤			690		690		690		690		690		690		690			
AC RATED BREAKING CAP [kA sym rms]/MAKING CAP [kA peak]																		
IEC,EN,AS		AC 690V ⑥	50/105		50/105		50/105		50/105		65/143		65/143		75/165			
[I_{cs} = I_{cu}]		440V	65/143 ⑦		65/143 ⑦		65/143 ⑦		65/143 ⑦		85/187 ⑦		85/187 ⑦		100/220			
NEMA		AC 600V	42/96.6		42/96.6		42/96.6		42/96.6		50/115		50/115		65/149.5			
ANSI		480V	50/115		50/115		50/115		50/115		65/149.5		65/149.5		75/172.5			
		240V	65/149.5		65/149.5		65/149.5		65/149.5		85/195.5		85/195.5		100/230			
JIS		AC 550V	50/105		50/105		50/105		50/105		65/143		65/143		75/165			
		460V	65/143		65/143		65/143		65/143		85/195.5		85/195.5		100/230			
		220V	65/143		65/143		65/143		65/143		85/195.5		85/195.5		100/230			
⑧		DC 600V ⑨	40/40		40/40		40/40		40/40		40/40		40/40		40/40			
		250V	40/40		40/40		40/40		40/40		40/40		40/40		40/40			
NK ⑩		AC 690V	50/115		50/115		50/115		50/115		65/153		65/153		75/179			
		450V	65/153 ⑦		65/153 ⑦		65/153 ⑦		65/153 ⑦		85/201 ⑦		85/201 ⑦		100/245			
LR, AB, ⑩		AC 690V	50/115		50/115		50/115		50/115		65/153		65/153		75/179			
GL, BV		450V	65/153 ⑦		65/153 ⑦		65/153 ⑦		65/153 ⑦		85/201 ⑦		85/201 ⑦		100/245			
RATED IMPULSE WITHSTAND VOLTAGE [U_{imp}](kV)			12		12		12		12		12		12		12			
RATED SHORT TIME WITHSTAND		1s	65		65		65		65		85		85		100			
CURRENT[I_{cw}][kA rms]		3s	50		50		50		50		65		65		85			
LATCHING CURRENT (kA)			65		65		65		65		85		85		100			
TOTAL BREAKING TIME (s)			0.03		0.03		0.03		0.03		0.03		0.03		0.03			
CLOSING OPERATION TIME																		
SPRING CHARGING TIME (s) max.			10		10		10		10		10		10		10			
CLOSE TIME (s) max.			0.08		0.08		0.08		0.08		0.08		0.08		0.08			
No. of operating cycles																		
Mechanical life	with maintenance		30000		30000		30000		25000		20000		20000		15000			
	without maintenance		15000		15000		15000		12000		10000		10000		8000			
Electrical life	without maintenance	AC460V	12000		12000		12000		10000		7000		7000		5000			
		AC690V	10000		10000		10000		7000		5000		5000		2500			
WEIGHT (kg) draw-out type		⑫	73	86	73	86	76	90	79	94	105	125	105	125	139	176		
OUTLINE DIMENSION (mm)																		
FIXED TYPE 		a	360	445	360	445	360	445	360	445	466	586	466	586	—	—		
		b	460		460		460		460		460		460		—			
		c	290		290		290		290		290		290		—			
		d	75		75		75		75		75		75		—			
DRAW-OUT TYPE ⑪ 		a	354	439	354	439	354	439	354	439	460	580	460	580	631	801		
		b	460		460		460		460		460		460		460			
		c	345		345		345		345		345		345		375			
		d	40		40		40		40		40		40		53			

※1 : AH6 Range, 5000-6300A

① : Values in open air at 40°C (45°C for marine applications).
② : Values of AR208S ~ 216S for draw-out type with horizontal terminals, Values of AR220S ~ 440S for draw-out type with vertical terminals.
③ : For 2 pole ACBs use outside poles of 3 pole ACB.
④ : Rated insulation voltage depends on applied standard: 1000V AC according to IEC 60947-2.
⑤ : Rated operational voltage depends on applied standard: 690V according to IEC 60947-2.
⑥ : Cannot apply IT earthing system, ie, insulated from earth.
⑦ : For 500V AC.
⑧ : Please contact TERASAKI for DC application.
⑨ : 3 poles in series should be applied for 600V DC.
⑩ : Applicable to only 3 pole ACBs.
⑪ : For vertical terminals or horizontal terminals.
⑫ : For more information see page 62.

※1 : AH6 Range, 5000Amp (Icw, I sec 100kA - Ics 120kA) and 6300Amp (Icw, I sec 120kA - Ics 120kA) 3 and 4 Pole ACBs. Catalogue Ref. – 04-I52E.

High Fault Series

AMPERE RATING(A)				1250		1600		2000		1600		2000		2500		3200								
TYPE				**AR212H**		**AR216H**		**AR220H**		**AR316H**		**AR320H**		**AR325H**		**AR332H**								
RATED CURRENT (max) [I_n](A)		IEC, EN, AS		1250		1600		2000		1600		2000		2500		3200								
① ②		JIS		1250		1600		2000		1600		2000		2500		3200								
		NEMA, ANSI		1250		1600		2000		1600		2000		2500		3200								
		Marine		1250		1600		2000		1600		2000		2500		3200								
NEUTRAL POLE AMPERES FRAME (A)				1250		1600		2000		1600		2000		2500		3200								
NUMBER OF POLES			③ ④	3	4	3	4	3	4	3	4	3	4	3	4	3	4							
RATED PRIMARY CURRENT OF OVER–CURRENT RELEASE [I_{CT}](A) • for general feeder circuit use				200 400 800 1250		1600		2000		200 400 800 1250 1600		2000		2500		3200								
RATED CURRENT OF OVER–CURRENT RELEASE (A) • for generator protection use [I_n] is generator rated current.				100≦I_n≦200 200<I_n≦400 400<I_n≦800 630<I_n≦1250		800≦I_n≦1600		1000≦I_n≦2000		100≦I_n≦200 200<I_n≦400 400<I_n≦800 630<I_n≦1250 800<I_n≦1600		1000≦I_n≦2000		1250≦I_n≦2500		1600≦I_n≦3200								
AC RATED INSULATION VOLTAGE [U_i](V. 50/60Hz) ⑤				1000		1000		1000		1000		1000		1000		1000								
RATED OPERATIONAL VOLTAGE [U_e](V. 50/60Hz) ⑥				690		690		690		690		690		690		690								
AC RATED BREAKING CAP [kA sym rms]/MAKING CAP [kA peak]※2																								
IEC,EN,AS		AC	690V ⑦	55/121		55/121		55/121		85/187		85/187		85/187		85/187								
[I_{cs} = I_{cu}]			440V	80/176		80/176		80/176		100/220		100/220		100/220		100/220								
NEMA		AC	600V	42/96.6		42/96.6		42/96.6		50/115		50/115		50/115		50/115								
ANSI			480V	65/149.5		65/149.5		65/149.5		80/184		80/184		80/184		80/184								
			240V	80/184		80/184		80/184		100/230		100/230		100/230		100/230								
JIS		AC	550V	55/121		55/121		55/121		85/196		85/196		85/196		85/196								
			460V	80/176		80/176		80/176		100/230		100/230		100/230		100/230								
			220V	80/176		80/176		80/176		100/230		100/230		100/230		100/230								
	⑧	DC	600V ⑨	40/40		40/40		40/40		40/40		40/40		40/40		40/40								
			250V	40/40		40/40		40/40		40/40		40/40		40/40		40/40								
NK	⑩ ⑪	AC	690V	55/128		55/128		55/128		85/201		85/201		85/201		85/201								
			450V	80/186		80/186		80/186		100/233		100/233		100/233		100/233								
LR, AB,	⑩ ⑪	AC	690V	55/128		55/128		55/128		85/201		85/201		85/201		85/201								
GL, BV			450V	80/186		80/186		80/186		100/233		100/233		100/233		100/233								
RATED IMPULSE WITHSTAND VOLTAGE [U_{imp}](kV)				12		12		12		12		12		12		12								
RATED SHORT TIME WITHSTAND			1s	80		80		80		100		100		100		100								
CURRENT[I_{cw}][kA rms]			3s	55		55		55		75		75		75		75								
LATCHING CURRENT (kA)				65		65		65		85		85		85		85								
TOTAL BREAKING TIME (s)				0.03		0.03		0.03		0.03		0.03		0.03		0.03								
CLOSING OPERATION TIME																								
SPRING CHARGING TIME (s) max.				10		10		10		10		10		10		10								
CLOSE TIME (s) max.				0.08		0.08		0.08		0.08		0.08		0.08		0.08								
No. of operating cycles																								
Mechanical life	with maintenance			30000		30000		30000		25000		20000		20000		20000								
	without maintenance			15000		15000		15000		12000		10000		10000		10000								
Electrical life	without maintenance		AC460V	12000		12000		12000		10000		7000		7000		7000								
			AC690V	10000		10000		10000		7000		5000		5000		5000								
WEIGHT (kg) draw-out type			⑬	79	94	79	94	79	94	105	125	105	125	105	125	105	125							
OUTLINE DIMENSION (mm)																								
DRAW-OUT TYPE ⑫ 			a	354	439	354	439	354	439	460	580	460	580	460	580	460	580							
			b	460		460		460		460		460		460		460								
			c	345		345		345		345		345		345		345								
			d	40		40		40		40		40		40		40								

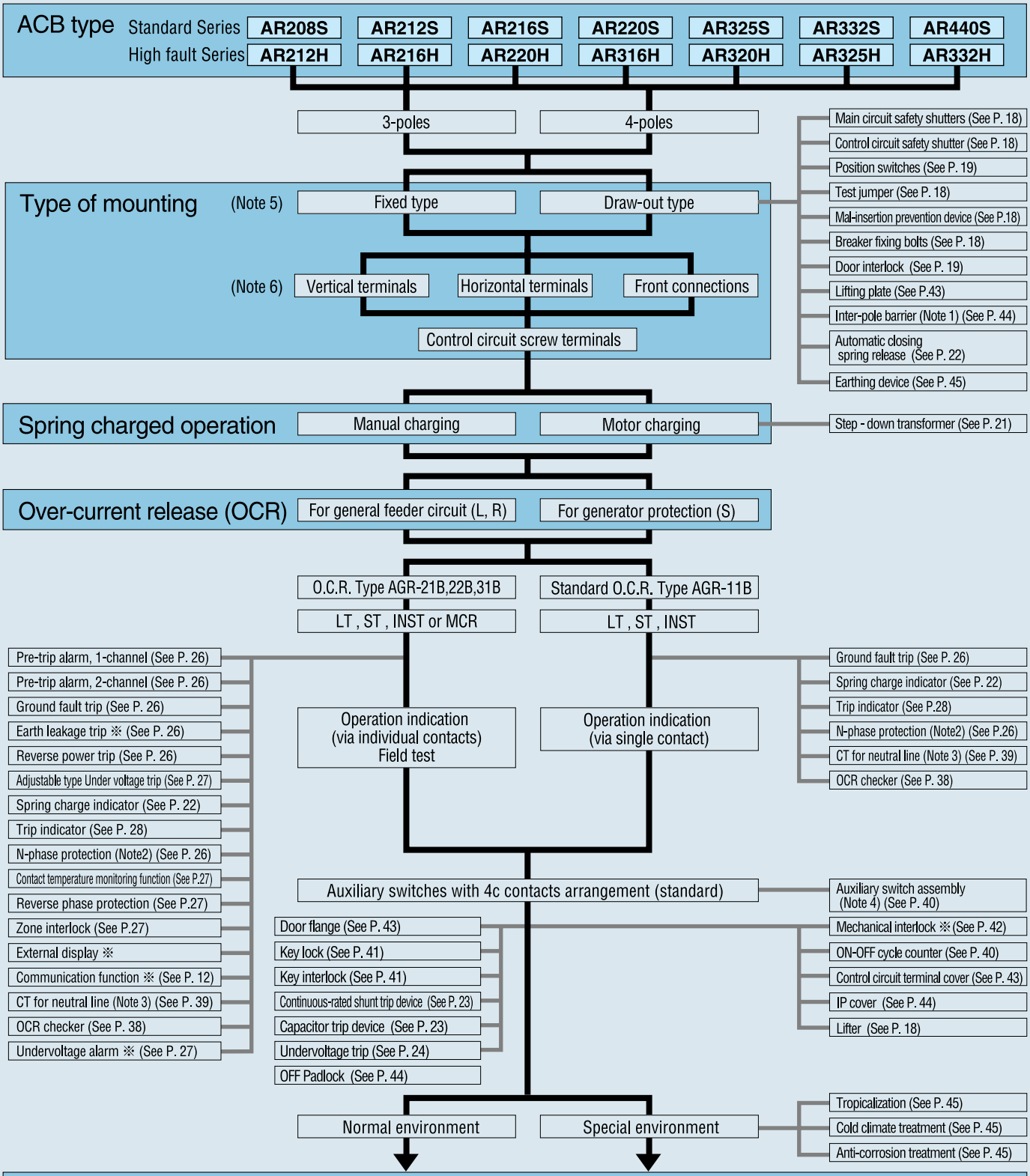
※1 : AH6 Range, 5000 -6300A

① : Values in open air at 40°C (45°C for marine applications).
② : Values for draw-out type with vertical terminals.
③ : For 2 pole ACBs use outside poles of 3 pole ACB.
④ : 4 pole ACBs without Neutral phase protection can not be applied to IT earthing systems.
⑤ : Rated insulation voltage depends on applied standard: 1000V according to IEC 60947-2.
⑥ : Rated operational voltage depends on applied standard: 690V according to IEC 60947-2.
⑦ : Contact TERASAKI for details.
⑧ : Please contact TERASAKI for DC application.
⑨ : 3 poles in series should be applied for 600V DC.
⑩ : Will apply soon.
⑪ : Applicable to only 3 pole ACBs.
⑫ : For vertical terminals.
⑬ : For more information see page 62.

※1 : AH6 Range, 5000Amp (Icw, I sec 100kA - Ics 120kA) and 6300Amp (Icw, I sec 120kA - Ics 120kA) 3 and 4 Pole ACBs. Catalogue Ref. – 04-I52E.
※2 : When the ACB is used without Instantaneous trip function MCR should be set to work. The rated breaking capacity will reduce to the level of the latching current without MCR function.

4 Specifications

TemPower2 series ACBs have an extensive range of accessories available, enabling the ACBs to be “custom built” to suit every application.



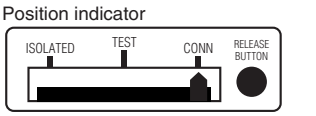
Note 1: Not applicable to ACBs equipped with front connections.
Note 2: Applicable to 4-pole ACBs.
Note 3: Required for ground fault protection for 3-poles ACB on 3-phase, 4-wire systems.
Note 4: Microload switch assembly with 3c arrangement available.
Note 5: Fixed type is not available for High fault series.
Note 6: Vertical terminal is standard and horizontal terminal is optional for High fault series. Front connection is not available for High fault series.
※: Contact Terasaki for details.

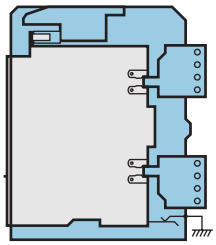
1 Types of Mounting

Draw-out type

This type of ACB consists of a breaker body and a draw-out cradle. The breaker body can be moved within or removed from the draw-out cradle that is fixed in the switchboard.
There are four breaker body positions: CONNECTED, TEST, ISOLATED, and WITHDRAWN. The switchboard panel door can be kept closed in the CONNECTED, TEST, and ISOLATED positions ("shut-in three positions").

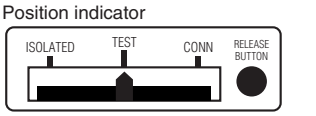
1 CONNECTED position

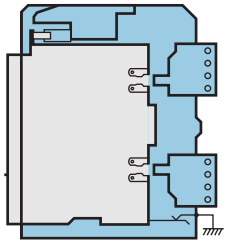




Both the main and control circuits are connected for normal service.

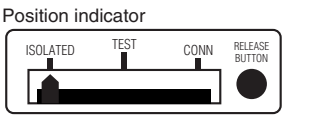
2 TEST position

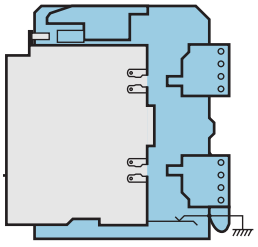




The main circuit is isolated and the control circuits are connected. This position permits operation tests without the need for opening the switchboard panel door.

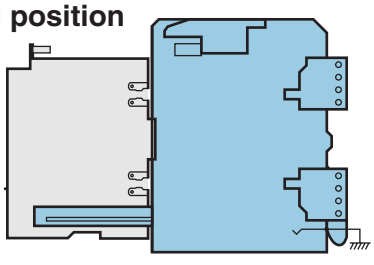
3 ISOLATED position





Both the main and control circuits are isolated.
The switchboard panel door does not need to be opened.

4 WITHDRAWN position



The breaker body is fully withdrawn from the draw-out cradle.

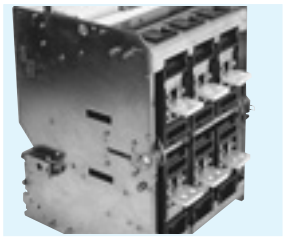
Fixed type (standard series only)

This type of ACB has no draw-out cradle and is designed to be directly mounted in the switchboard.

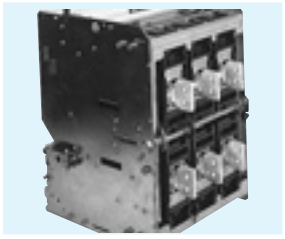
Connection methods

■ Main circuit terminals

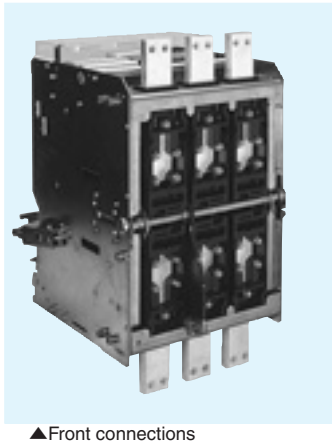
Three(3) types of main circuit terminal arrangements are available: vertical terminals, horizontal terminals, and front connections. Different types of terminal arrangements can be specified for the line and load sides. Unless otherwise specified by the user, horizontal terminals are given to types AR208S, AR212S and AR216S ACBs on both the line and load sides, and vertical terminals to AR220S, AR235S, AR332S and AR 440S. For AR440S, only vertical terminals available. For High fault series, vertical terminals are standard and horizontal terminals are optional, and front connections are not available.



▲Horizontal terminals



▲Vertical terminals



▲Front connections

■ Control circuit terminals

Control circuit terminals are front located to allow easy wiring/access.

- The terminal blocks (for auxiliary switches, position switches, and control circuits) are positioned on the top of the ACB front panel and can be accessed from the front for wiring.
- M4 screw terminals are standard.

▲Screw terminals

4 Specifications

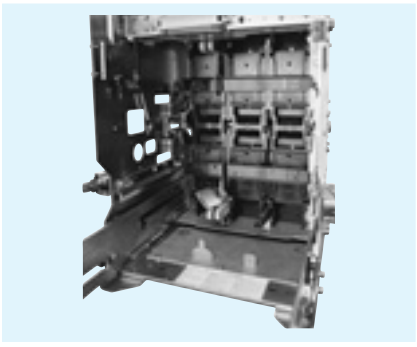
2 Accessories for Draw-out Type

※: Standard equipment

Main circuit safety shutters

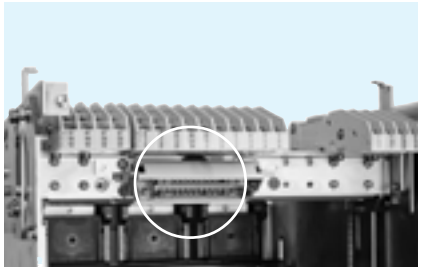
The main circuit safety shutters automatically conceal the main circuit contacts on the draw-out cradle when the ACB is drawn out.

- The top and bottom shutters operate independently and can be separately padlocked in the closed position.
- Up to three padlocks (with ø6 hasp) can be installed on each side using padlocking unit. (Padlock not supplied)
- In the closed position, the shutters are locked to the extent that they cannot be easily unlocked by hand. They can be unlocked and held open if required for the purpose of inspection or maintenance.



Control circuit safety shutter

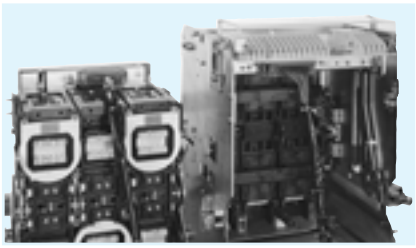
The control circuit safety shutter covers the control circuit contacts, ensuring safety.



Test jumper

The test jumper is a plug-in type, and allows ON-OFF tests on all the *TemPower2* series ACBs with the breaker body drawn out from the draw-out cradle.

The standard jumper cable is 5 m long.



Breaker fixing bolts

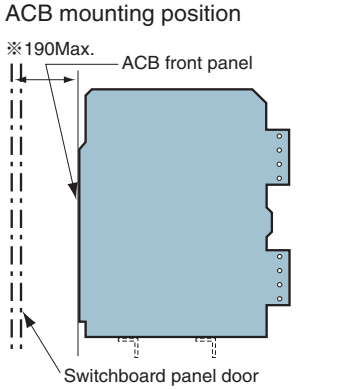
The breaker fixing bolts hold the breaker body securely to the draw-out cradle in position. Use them if the ACB is subject to strong vibration.

Position padlock lever ※

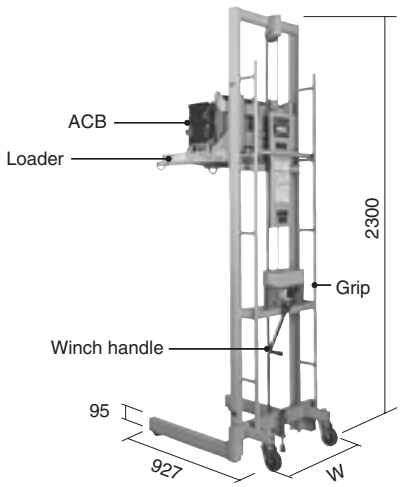
Using the position padlock lever prevents the breaker body from inadvertently being drawn out. The position padlock lever in the pulled-out position locks the breaker body in the CONNECTED, TEST, or ISOLATED position. Up to three padlocks (with ø6 hasp) can be installed.

Lifter

A special lifter is available to allow easy and safe transportation or installation of the ACB. A drop prevention mechanism is standard.



※: If 190 mm is exceeded, contact Terasaki.



Contact Terasaki for products with CE marking.

Type of Lifter	Weight (kg)	W (mm)	Applicable ACBs
AWR-1	110	700	AR2, AR3
AWR-2	120	890	AR2, AR3, AR4

Mal-insertion prevention device

Interchangeability exists within the *TemPower2* series of ACBs. Because of this feature, there is a possibility for an ACB of a different specification being placed into the draw-out cradle. Using the mal-insertion prevention device eliminates such a possibility.

This device is capable of distinguishing nine different breaker bodies.

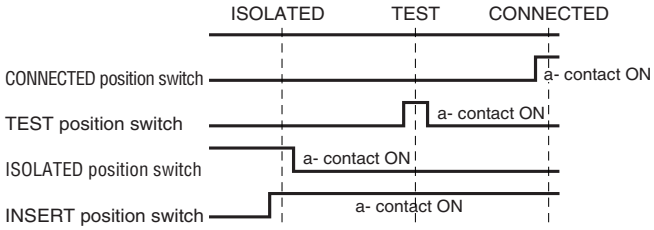
Please specify the Code 1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, 3C for each ACB.

Position switches

The position switch operates to give an indication of the breaker position: CONNECTED, TEST, ISOLATED, and INSERT.
There are two contact arrangements: 2c and 4c.
Connections to the switches are made via screw type terminals.
The following table lists the available types of the switches.

Type	Number of contacts	Contact arrangement			
		INSERT	ISOLATED	TEST	CONN
ALR-0110P	2c	0	1	1	0
ALR-0101P		0	1	0	1
ALR-0011P		0	0	1	1
ALR-0200P		0	2	0	0
ALR-0020P		0	0	2	0
ALR-0002P		0	0	0	2
ALR-1111P	4c	1	1	1	1
ALR-1210P		1	2	1	0
ALR-1201P		1	2	0	1
ALR-0211P		0	2	1	1
ALR-1120P		1	1	2	0
ALR-1021P		1	0	2	1
ALR-0121P		0	1	2	1
ALR-1102P		1	1	0	2
ALR-1012P		1	0	1	2
ALR-0112P		0	1	1	2
ALR-0220P		0	2	2	0
ALR-0202P		0	2	0	2
ALR-0022P		0	0	2	2
ALR-1030P		1	0	3	0
ALR-0130P		0	1	3	0
ALR-0031P		0	0	3	1
ALR-1003P		1	0	0	3
ALR-0103P		0	1	0	3
ALR-0013P		0	0	1	3
ALR-0040P		0	0	4	0
ALR-0004P		0	0	0	4

Position switch operation sequence



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

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

Door interlock

The door interlock prevents the switchboard door from being opened unless the breaker body is in the ISOLATED position.
When the draw-out handle is removed while the ACB is in the ISOLATED position, the interlock is released and the switchboard door can be opened.
The breaker body cannot be inserted unless the switchboard door is closed.
Contact Terasaki for details.

Note 1: When the door interlock is installed, the standard draw-out handle cannot be stored in the switchboard. A storage draw-out handle is available as an option. The storage draw-out handle can be housed flush with the front surface of the ACB. (The storage handle will incur extra cost).
Note 2: Contact TERASAKI for the details for fitting Door interlock with IP55 cover.

4 Specifications

3 Spring Charged 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

Turning on “remote” ON switch enables the ACB to be remotely closed.

- Anti-pumping mechanism
  Even if the ON switch is kept on, ACB closing operation is performed only once.
  To close 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 is ignored.

■ Opening the ACB

For opening the ACB remotely, specify the shunt trip device (See P. 23) or the undervoltage trip (See P. 24).

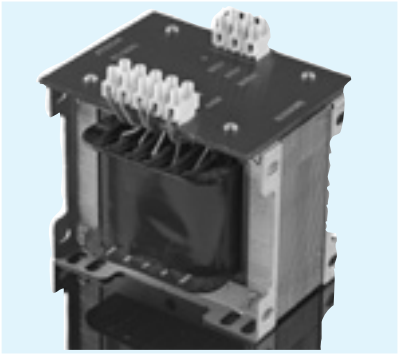
■ Operation power supply

Rated voltage (V)	Applicable voltage range (V)		Operation power supply ratings		
	CHARGE/ ON operation	OFF operation (Note1)	Motor inrush current (peak) (A)	Motor steady-state current (A)	Closing command current (peak) (A)
AC 100	85-110		7	1.1	0.48
AC 110	94-121		7	1.1	0.39
AC 120	102-132		7	1.1	0.37
AC 200	170-220		4	0.7	0.24
AC 220	187-242		4	0.7	0.19
AC 240	204-264		4	0.7	0.18
DC 24	20-26		14	4	1.65
DC 48	41-53		10	1.6	0.86
DC 100	85-110		6	0.8	0.39
DC 110	94-121		6	0.8	0.37
DC 125	106-138		6	0.8	0.31
DC 200	170-220		4	0.5	0.19
DC 220	187-242		4	0.5	0.18

Note 1: For the ratings refer to the shunt trip device of page 23.

Step-down transformer (external)

The maximum rated control voltage applicable to the operation power supply is AC240V. For higher voltages, a step-down transformer is needed.
The following step-down transformers are available as options.



Rated control voltage	Transformer		
	Type	Capacity	Voltage ratio
AC410-470V	TSE-30M	300VA	450/220V
AC350-395V	TSE-30M	300VA	380/220V

4 Specifications

4 Accessories for Spring Charged Operation

Automatic closing spring release

This device allows the charged closing springs to be automatically released when the ACB is drawn out.
ANSI or NEMA-compliant ACBs require this option.

Spring charge indicator

This switch can be used to indicate that the closing springs have been fully charged.
For contact ratings of the switch, see table 3-1 on page 28.

5 Trip Devices

Continuously-rated shunt trip device

The continuous-rated shunt trip device allows the ACB to be opened when an external protection relay against overcurrent or reverse power is activated.
Because of its continuous rating, the device can also be used to provide an electrical interlock to the ACB.
Continuously rated shunt trip and undervoltage trip can not be fitted to the same ACB. However, Instantaneously rated shunt trip can be used together with undervoltage trip with special specification. Special double opening and closing coils are available, contact TERASAKI for details.

Shunt Trip Rating (Continuously rated type)

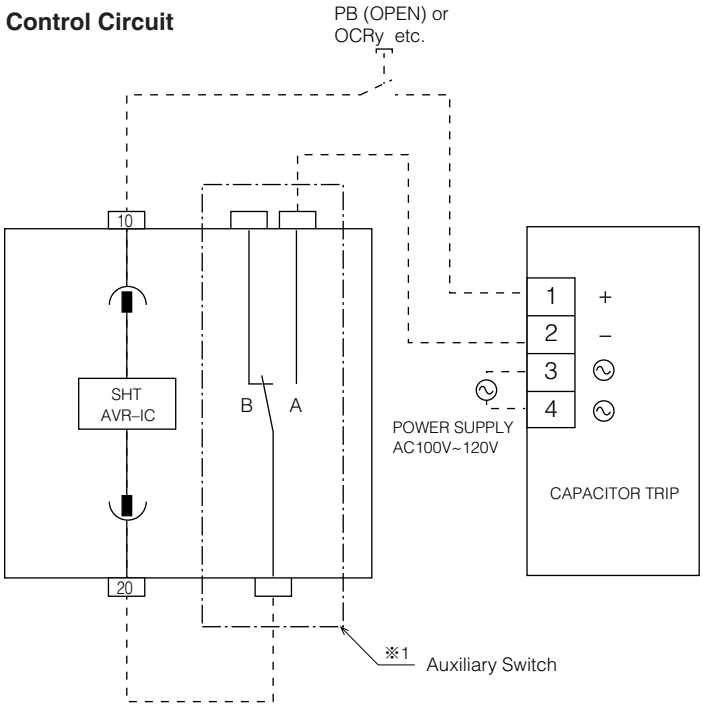
Type	Rated voltage (V)	Operational voltage (V)	Peak excitation current (A)	Steady–state current (A)	Opening time (max.) (ms)
AVR–1C	AC100	AC70–110	0.48	0.32	40
	AC110	AC77–121	0.39	0.26	
	AC120	AC84–132	0.37	0.24	
	AC200	AC140–220	0.24	0.16	
	AC220	AC154–242	0.19	0.13	
	AC240	AC168–264	0.18	0.12	
	DC24	DC16.8–26.4	1.65	1.1	
	DC48	DC33.6–52.8	0.86	0.57	
	DC100	DC70–110	0.39	0.26	
	DC110	DC77–121	0.37	0.25	
	DC125	DC87.5–137.5	0.31	0.21	
	DC200	DC140–220	0.19	0.13	
	DC220	DC154–242	0.18	0.12	

Capacitor trip device

In conjunction with the continuously-rated 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	AC100-120V
Operational Voltage	Rated Voltage X 70 to 110%
Rated frequecy	50/60Hz
Rated Voltage of Shunt Trip Used	DC48V
Power Consumption	100VA

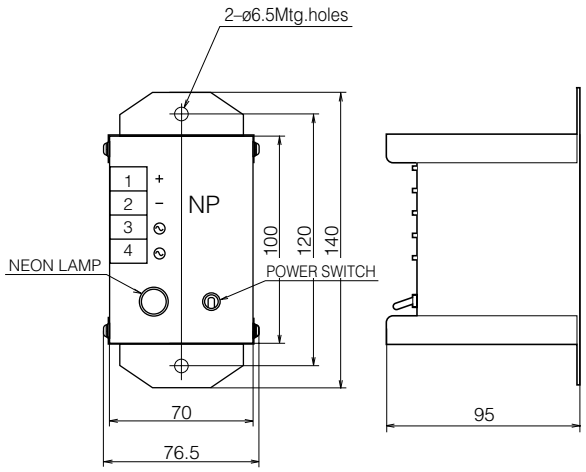
• Control Circuit



- - - - - - - - User Wiring

※1: Use Auxiliary Switch for capacitor trip

• Outline Dimensions



4 Specifications

Undervoltage trip device (UVT)

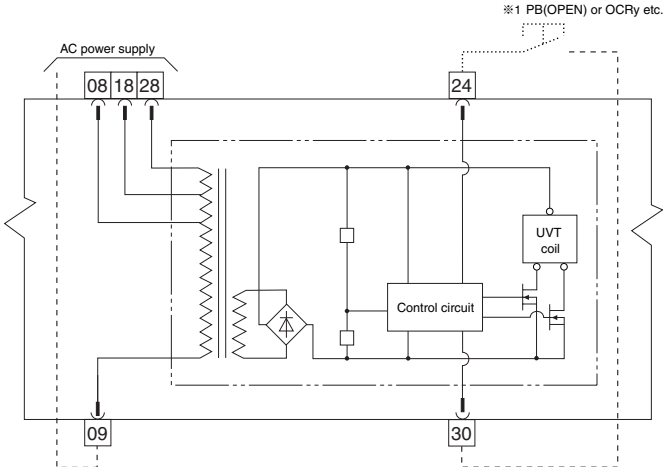
The undervoltage trip device (UVT) trips the ACB when the control voltage drops below the opening voltage. When the control voltage is restored to the pick-up voltage, the ACB can be closed. The pick-up voltage is fixed to 85% of the rated voltage.

The UVT consists of a tripping mechanism and an undervoltage trip control device. The trip control device is available in two types: AUR-ICS and AUR-ICD.

Type AUR-ICS provides an instantaneous trip 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 500 ms.

Adding a pushbutton switch (with normally opened contacts) between terminals 24 and 30 allows the ACB to be tripped remotely.

Undervoltage trip control circuit (for AC)



※1 Tripping signal is 48 VDC/5 mA.
Apply tripping signal for at least 80 ms. If a constant tripping signal is applied a n/o auxiliary switch must be used in series with the PB.

• Ratings

Type of UVT Control Device	Rated Voltage 50/60Hz (V)		Opening Voltage (V)	Pick-up Voltage (V)	Coil Excitation Current (A)	Power Consumption (VA)	
						Normal	Reset
AUR-1CS	AC	100	35 – 70	85	0.1	8	10
AUR-1CD		110	38.5 – 77	93.5			
		120	42 – 84	102			
		200	70 – 140	170			
		220	77 – 154	187			
		240	84 – 168	204			
		380	133 – 266	323			
		415	145 – 290	352			
		440	154 – 308	374			
	DC	24 ※ 2	8.4 – 16.8	20.4			
		48 ※ 2	16.8 – 33.6	40.8			
		100 ※ 2	35 – 70	85			

※2: Soon to be available. Contact TERASAKI for the details.

6 Over-current Releases (OCRs)

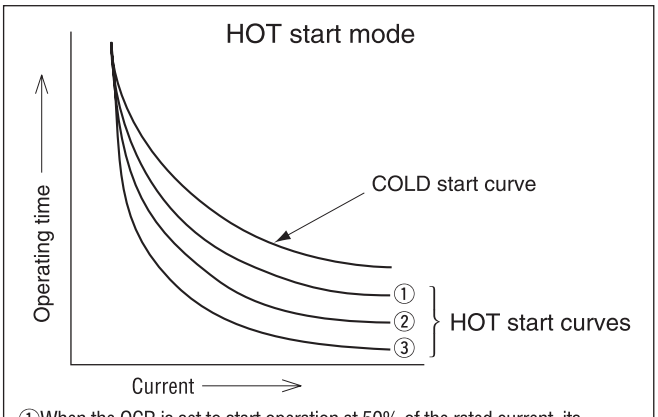
The AGR series of over-current releases (OCRs) featuring high reliability and multiple protection capabilities is available for *TemPower2*. Controlled by an internal 16-bit microprocessor, the OCR provides reliable protection against overcurrent.
The OCR range is divided into three groups: L-characteristic, R-characteristic (both for general feeder) and S-characteristic (for generator protection).
Each group consists of:
Type AGR-11B: Standard OCR with adjustment dial
Type AGR-21B,22B: Standard OCR with L.C.D.
Type AGR-31B: Enhanced OCR with backlit L.C.D.
Optional protection functions of the OCR include those against ground fault, earth leakage, undervoltage and reverse power.
Pre-trip alarm function can also be installed.

Protective functions

①Adjustable long time-delay trip function LT

RMS sensing is used to accurately read through distorted waveforms.
In addition to the standard L and S-characteristics, the R-characteristic is available in five types for long time-delay trip.
The R-characteristic can be used to give selectivity with e.g. fuses. (See P. 8).

■ HOT start mode (applicable to L-characteristic of AGR-21B,31B)
HOT or COLD start mode is user-selectable.
In HOT start mode, the OCR operates faster than in COLD start mode in response to an overload. The HOT start mode gives protection, taking account of the behavior of loads under heat stress.

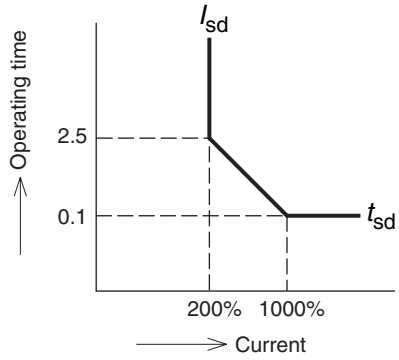


①When the OCR is set to start operation at 50% of the rated current, its operating time in HOT start mode is approx. 80% of that in COLD start mode.
②When the OCR is set to start operation at 75% of the rated current, its operating time in HOT start mode is approx. 60% of that in COLD start mode.
③When the OCR is set to start operation at 100% of the rated current, its operating time in HOT start mode is approx. 20% of that in COLD start mode.

②Adjustable short time-delay trip function ST

The ST delay trip function has a “definite time delay characteristic” and a “ramp characteristic”. These characteristics are switch-selectable.
The ramp characteristic provides close selectivity with downstream circuit breakers or fuses.
The group AGR-L and AGR-R OCRs come in operation with the definite time characteristic when the load current reaches 1000% or more of the rated current [I_n] (500% or more of the rated current [I_n] for AGR-S).
The ST trip function is factory set to the definite time characteristic.

Ramp characteristic curve
(“L” or “R” characteristic)



③Adjustable instantaneous trip function INST/MCR

The INST trip function trips the ACB when the short circuit current exceeds the pickup current setting, irrespective of the state of the ACB.
The making current release (MCR) trips the ACB when the short circuit current exceeds the pickup current setting during closing operation. After the ACB is closed, the MCR is locked and kept inoperative.
The INST and MCR are switch-selectable for AGR-21B, 22B and 31B. (AGR-11B is INST only , MCR is not selectable)
Note) The MCR needs the control power. If the control power is lost, the MCR provides the INST trip function only.

4 Specifications

④Adjustable pre-trip alarm function PTA

The pre-trip alarm function provides an alarm signal via the alarm contact (1a-contact) when the load current exceeding a predetermined value lasts for a predetermined time. A 2-channel pre-trip alarm function is available for S-characteristic. This function can be used to adjust feeding to loads according to their priority.
The pre-trip alarm is automatically reset when the load current drops to the predetermined value.
Note that this function needs the control power.

⑤Ground fault trip function GF

The peak value sensing is used (the residual current of each phase is detected).
The GF pickup current can be set between 10% and 100% of the CT rated primary current [I_{CT}]. Not available if CT primary current [I_{CT}] is 200A or less.

<Ramp characteristic is added>
The ramp and definite time characteristics are switch selectable. The GF trip function comes into operation with the definite time characteristic when the load current reaches 100% or more of the CT rated primary current [I_{CT}].
The GF trip function is factory set to the definite time characteristic.

When using a 3-pole ACB in a 3-phase, 4-wire system, be sure to use an optional CT for neutral line (see P. 39).

Note 1: The GF trip function comes usually with operation indications. If you need nothing but ground fault indication without a ground fault tripping operation, specify at the time of ordering.

Note 2: Restricted and unrestricted ground fault protection REF is available as option. This enables protection against ground fault on the line side of the ACB.

⑥Earth leakage trip function ELT Soon to be available

(For AGR-31B only.)

In conjunction with an external Zero phase Current Transformer (ZCT), the ELT function provides protection against earth leakage.
The ELT pickup current can be set at 0.2, 0.3, 0.5 and 1A (Medium sensitivity) or 3 and 5A (Low sensitivity).
This function needs the control power.

Note 1: For details on specifications of the external ZCT, contact Terasaki.

Note 2: The ELT function comes usually with operation indications. If you need nothing but earth leakage indications without earth leakage tripping operation, specify at the time of ordering.

Note 3: The ELT function is available up to 2500A rated current [I_n]

⑦Reverse power trip function RPT

(For AGR-22B and AGR-31B 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. If the rated main circuit voltage exceeds 250 VAC, a step-down power transformer is needed. When ordering the ACB, state the step-down ratio of the transformer you will use.

⑧N-phase protection function NP

This NP function is available on 4-pole ACBs and prevents the neutral conductor from suffering damage or burnout due to overcurrent.
The NP trip pickup current can be set between 40% and 100% of the OCR rated primary current for L and R-characteristics or of the generator rated current for S-characteristic.
It is factory set to a value specified at the time of ordering.

Note 1: The NP trip function comes usually with operation indications. The NP trip pickup current setting is shared by the LT trip function.

Note 2: The HOT start mode is available for AGR-21B and AGR-31B. The operating time for the NP trip function is linked to that for the LT trip function.

⑨Contact temperature monitoring function OH

(For AGR-22B and AGR-31B only.)

The HEAT function prevents the ACB from suffering damage due to overheat.
It monitors the temperature of the ACB main contacts, and gives an alarm on the LCD and an output signal via the alarm contact (1a-contact) when the temperature exceeds 155°C.
The alarm can be manually reset when the temperature drops to a normal temperature.
If you want to set the threshold temperature to a lower value, contact Terasaki.
This function needs the control power.
Note 1: "Alarm" or "Trip" can be selected.

⑩ Phase rotation protection function NS

(For AGR-21B and AGR-31B only)
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. The protection setpoint ranges from 20% to 100% of the main circuit rated current [I_n].

⑪Undervoltage alarm function UV

(For AGR-22B and AGR-31B only.)
This function monitors the main circuit voltage, and gives an alarm on the LCD and an output signal via an alarm contact when the voltage drops below the setting voltage.
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]).
If the rated main circuit voltage exceeds 250 VAC, a step-down power transformer is needed. When ordering the ACB, state the step-down ratio of the transformer you will use.

Note 1: The undervoltage alarm function is disabled unless the main circuit voltage has once risen to the recovery setting voltage or higher.
Note 2: If the undervoltage alarm function is used in conjunction with the undervoltage trip device (see page 24), an alarm may occur after the ACB trips open depending on the alarm setting voltage.

⑫Zone interlock Z

(For AGR-22B and AGR-31B only)
The zone-selective interlock capability permits tripping of the ACB upstream of and nearest to a fault point in the shortest operating time, irrespective of the short time delay trip time setting, and minimizes thermal and mechanical damage to the power distribution line.

NON setting and fail-safe feature

1 NON setting

Setting a trip pickup current function to NON allows you to render the corresponding protection function inoperative.
Functions having the NON option include LT, ST, INST/MCR, and GF.
Appropriate NON setting will be a useful means for optimum selectivity.

2 Fail-safe feature

The OCR has a fail-safe mechanism in case protection functions are improperly set to NON.

- If the ST and INST trip pickup current functions are both set to NON, the fail-safe mechanism will activate the INST trip function to trip the ACB when a fault current equal to or more than 16 times the rated current [I_n] flows through the ACB.
- If the ST and MCR trip pickup current functions are both set to NON, the fail safe mechanism will activate the ST delay trip function to trip the ACB when a fault current equal to or more than 10 times (5 times for generator protection) the rated current [I_n] flows through the ACB.

Field test facility

Type AGR-21B/22B/31B OCRs 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.
To check type AGR-11B, use the type ANU-1 OCR checker (optional).

4 Specifications

Operation indication function

1 Indication via single contact (AGR-11B)

When the LT, ST, INST or GF trip function is activated, an output is generated via 1a-contact.
The 1a-contact will turn off after 40 ms or more.
A self-hold circuit is needed.

2 Indication via individual contacts (AGR-21B, 22B, 31B)

When the LT trip, ST trip, INST/MCR trip, GF trip, ELT, RPT,NS, REF, UVT, pre-trip alarm, or contact temperature monitoring function is activated, LCD will indicate their operation individually and output is generated via the corresponding contact.
The OCR also has a self-diagnostic feature that monitors the internal tripping circuits. If detecting any fault in the circuits, this feature turns on the system alarm indicator. The control power is needed.

Operation indications
○: Self-hold (Note 1)
×: Auto-reset
△: status indication
—: Not applicable

Protective characteristic		L/R-characteristic		S-characteristic	
Function		LCD	Contact	LCD	Contact
LT・NP		○	○	○	× (Note 2)
ST		○	○ (Note 5)	○	× (Note 2 and 5)
INST/MCR		○		○	
GF (Ground fault) or ELT (Earth leakage)		○	○	—	—
(Note 3)	OH (Contact temperature monitoring)	○	○	○	○
	NS (Reverse phase)	○	○	—	—
	REF (Line side GF)	○	○	—	—
	Trip indication ※1	△	△	△	△
RPT (Reverse power trip)		—	—	○	× (Note 2)
PTA (Pretrip alarm)		×	×	×	×
(Note 4)	PTA2 (Pretrip alarm)	×	×	×	×
	UV (Undervoltage alarm)	○	△	○	△
	Spring charge indication	△	△	△	△
System alarm		○	○	○	○

Note 1: To reset the motion indication, press the reset button.
Note 2: The contact will turn off after 500 ms or more. Use a self-hold circuit.
Note 3: Only one function can be selected from OH, NS, REF or trip indication. Selection of two or more functions involves manual connection of their control circuits (custom configuration). Contact Terasaki for details.
Note 4: Only one function can be selected from PTA2, UV or spring charge indication. Selection of two or more functions involves manual connection of their control circuits (custom configuration). Contact Terasaki for details.
Note 5: Motion indication contacts are commonly used for ST and INST/MCR.
※1: A switch is used to indicate the ACB has been tripped. This switch is activated whenever the off button, the overcurrent trip device, shunt trip device or undervoltage trip device is activated.

3 - 1 Contact ratings of Trip indicator and Spring charge indicator

Voltage (V)		Switch contact ratings (A)	
		Resistive load	Inductive load
AC	250	3	3
DC	250	0.1	0.1
	125	0.5	0.5
	30	3	3

3 - 2 Contact ratings for other contacts

Voltage (V)		Current (A)			
		1 Single contact		2 Individual contacts	
		Resistive load	Inductive load	Resistive load	Inductive load
AC	250	8	3	0.5	0.2
DC	250	0.3	0.15	0.27	0.04
	125	0.5	0.25	0.5	0.2
	30	5	3	2	0.7

OCR with advanced L.C.D. display, type AGR-31B (contact Terasaki for details)

1 Monitoring various data on L.C.D.

OCR can monitor,

- Phase current (A) of I_1, I_2, I_3 and their max. peak current
- Current (A) of I_N, I_g
- Line voltage (V) of V_{12}, V_{23}, V_{31} and their max. peak voltage (or, Phase voltage (V) of V_{1N}, V_{2N}, V_{3N} and their peak voltage)
- Active power max. (kW)
- Demand active power max. (kW)
- Power factor (cos ø)
- Electric energy (kWh/ MWh/ GWh)
- Frequency (Hz)
- Trip history

  Fault current is monitored, and the operation cause is indicated on LCD and via individual contacts.

Note 1: The supply voltage to the OCR for indicating the main circuit voltage or power must not exceed 250 VAC. If the main circuit voltage exceeds 250 VAC, a step-down power transformer is needed. When ordering the ACB, state the step-down ratio of the transformer you will use.

2 Gives the system alarm with number on the LCD for the following abnormal function.

- Trip function fail
- MHT circuit break

4 Specifications

OCR Specifications

Protection characteristic		*Protection Relay* Over-current release (OCR)	PROTECTION						FUNCTIONS				
			Standard Protection			Ground Fault		N-Phase	Indication and Monitoring				
			Long Time	Short Time	Instant--aneous	Unrestricted	Restricted	N-phase Protection	Indication		Monitoring		
									Single Contact	Individual Contacts	Ammeter	Energy Analyser	
			L	S	I	UREF	REF②	NP					
Standard Protection Relays													
Dial Type	For general feeder circuits	**AGR-11BL-AL**	●			------	------	○	●	------	------	------	
		AGR-11BL-GL	●			●	------	○	●	------	------	------	
Standard LCD Type	For general feeder circuits	**AGR-21BL-PS**	●			------	------	○	------	●	●	------	
		AGR-21BL-PG	●			●	○	○	------	●	●	------	
Specialised Protection Relays													
Standard LCD Type	IEC 60255-3 ①	AGR-21BR-PS	●			------	------	○	------	●	●	------	
		AGR-21BR-PG	●			●	○	○	------	●	●	------	
	For generator protection	AGR-21BS-PS	●			------	------	------	------	●	●	------	
		AGR-22BS-PR	●			------	------	------	------	●	●	------	
Enhanced LCD Type	For general feeder circuits	AGR-31BL-PS ④	●			------	------	○	------	●	------	●	
		AGR-31BL-PG	●			●	○	○	------	●	------	●	
	IEC 60255-3 ①	AGR-31BR-PS ④	●			------	------	○	------	●	------	●	
		AGR-31BR-PG	●			●	○	○	------	●	------	●	
	For generator protection	AGR-31BS-PS	●			------	------	------	------	●	------	●	
		AGR-31BS-PR	●			------	------	------	------	●	------	●	

● : Available as standard
○ : Available as option
— : Not available

① : Standard Inverse, Very Inverse, Extremely Inverse Curves

② : Only one function can be selected from OH, NS, REF or trip indication. Selection of two or more functions involves manual connection of their control circuits (special specification). Contact Terasaki for details.

③ : Only one function can be selected from PTA2, UV or spring charge indication. Selection of two or more functions involves manual connection of their control circuits (special specification). Contact Terasaki for details.

④ : Soon to be available. Contact TERASAKI for details.

For full operational information see pages 25 to 29

SPECIAL APPLICATIONS

Contact Temperature Monitoring **OH** (2)	Zone Interlock **Z**	Earth Leakage Protection **ELT**	Reverse Power Protection **RPT**	Phase Rotation Protection **NS** (2)	Under Voltage Alarm **UV** (3)	Pre-Trip Alarm **PTA**	Pre-Trip Alarm (3) **PTA2**	Spring Charge Indication (3)	Trip Indication (2)	Commu--nication **C**	External Display (4)	Field Test	Control Power
------	------	------	------	------	------	------	------	○	○	------	------	------	Not Required
------	------	------	------	------	------	------	------	○	○	------	------	------	Not Required
------	------	------	------	○	------	●	------	○	○	○	------	●	Required
------	------	------	------	○	------	●	------	○	○	○	------	●	Required
------	------	------	------	○	------	●	------	○	○	○	------	●	Required
------	------	------	------	○	------	●	------	○	○	○	------	●	Required
------	------	------	------	------	------	●	------	○	○	○	------	●	Required
○	○	------	●	------	○	●	○	○	○	○	○	●	Required
○	○	●	------	○	○	●	------	○	○	○	○	●	Required
○	○	------	------	○	○	●	------	○	○	○	○	●	Required
○	○	●	------	○	○	●	------	○	○	○	○	●	Required
○	○	------	------	○	○	●	------	○	○	○	○	●	Required
○	○	------	------	------	○	●	○	○	○	○	○	●	Required
○	○	------	●	------	○	●	○	○	○	○	○	●	Required

If the control power is not supplied or is lost, each function operates as follows:	
LT, ST, INST, RPT	Operates normally.
GF	Operates normally When the CT rated primary current [I_{CT}] is less than 800A and the GF pick-up current is set to 10 %, the GF becomes inoperative.
MCR	Operates as INST.
PTA 1-channel PTA 2-channel PTA	Is inoperative.
ELT	Is inoperative.
LED indicator on OCRs with single-contact indication	Is on momentarily or off.
Contact output from OCRs with single-contact indication	Turns off after 40 ms or more.
Contact output from OCRs with individual contact indication	Is inoperative.
LCD	No display
Field test facility	Is inoperative.

4 Specifications

L-characteristic for general feeder circuits (Type AGR-11BL, 21BL, 31BL)

Setting range of protection functions

Protection functions	Setting range
■ Adjustable long time-delay trip characteristics LT	
Pick-up current [I_R] (A)	[I_n]×(0.8 – 0.85 – 0.9 – 0.95 – 1.0 – NON) ; 6 graduations • Non tripping when load current ≦ ([I_R]×1.05). • Tripping when ([I_R]×1.05) < load current ≦ ([I_R]×1.2)
Time-delay [t_R] (s)	(0.5 – 1.25 – 2.5 – 5 – 10 – 15 – 20 – 25 – 30) at 600% of [I_R]; 9 graduations
Time-delay setting tolerance (%)	±15% +150ms – 0ms
■ Adjustable short time-delay trip characteristics ST	
Pick-up current [I_{sd}] (A)	[I_n]×(1 – 1.5 – 2 – 2.5 – 3 – 4 – 6 – 8 – 10 – NON) ; 10 graduations
Current setting tolerance (%)	±15%
Time-delay [t_{sd}] (ms) Relay time	50 / 100 / 200 / 400 / 600 / 800 ; 6 graduations
Resettable time (ms)	25 / 75 / 175 / 375 / 575 / 775
Max. total clearing time (ms)	120 / 170 / 270 / 470 / 670 / 870
■ Adjustable instantaneous trip characteristics INST or MCR (For AGR-11B, INST only)	
Pick-up current [I_i] (A)	[I_n]×(2 – 4 – 6 – 8 – 10 – 12 – 14 – 16 – NON) ; 9 graduations
Current setting tolerance (%)	±20%
■ Adjustable pre-trip alarm characteristics PTA	
Pick-up current [I_{P1}] (A)	[I_n]×(0.75 – 0.8 – 0.85 – 0.9 – 0.95 – 1.0) ; 6 graduations
Current setting tolerance (%)	±7.5%
Time-delay [t_{P1}] (s)	(5 – 10 – 15 – 20 – 40 – 60 – 80 – 120 – 160 – 200) at [I_{P1}] or more; 10 graduations
Time-delay setting tolerance (%)	±15% +100ms – 0ms
■ Adjustable ground fault trip characteristics GF	Note: Set [I_g] to 1200A or less.
Pick-up current [I_g] (A)	[I_{CT}]×(0.1 – 0.2 – 0.3 – 0.4 – 0.6 – 0.8 – 1.0 – NON) ; 8 graduations
Current setting tolerance (%)	±20%
Time-delay [t_g] (ms) Relay time	100 / 200 / 300 / 500 / 1000 / 2000 ; 6 graduations
Resettable time (ms)	75 / 175 / 275 / 475 / 975 / 1975
Max. total clearing time (ms)	170 / 270 / 370 / 570 / 1070 / 2070
Ground fault trip characteristics on line side REF (AGR-21B, 31B only)	
Pick-up current [I_{REF}] (A)	[I_{CT}]×(0.1 – 0.2 – 0.3 – 0.4 – 0.6 – 0.8 – 1.0 – NON) ; 8 graduations
current setting tolerance (%)	±20%
Time-delay (s)	Inst
■ N-phase protection characteristics NP	
Pick-up current [I_N] (A)	[I_{CT}]×(0.4 – 0.5 – 0.63 – 0.8 – 1.0) ; Factory set to a user-specified value. • Non tripping when load current ≦ ([I_N]×1.05). • Tripping when ([I_N]×1.05) < load current ≦ ([I_N]×1.2)
Time-delay [t_N] (s)	Tripping at 600% of [I_N] with LT time-delay [t_R]
Time-delay setting tolerance (%)	±15% +150ms – 0ms
■ Reverse phase protection characteristics NS (AGR-21B, 31B only)	
Pick-up current [I_{NS}] (A)	[I_n]×(0.2 – 0.3 – 0.4 – 0.5 – 0.6 – 0.7 – 0.8 – 0.9 – 1.0) ; 9 graduations
current setting tolerance (%)	±10%
Time-delay [t_{NS}] (s)	0.4 – 0.8 – 1.2 – 1.6 – 2 – 2.4 – 2.8 – 3.2 – 3.6 – 4 ; 10 graduations
Time-delay setting tolerance (%)	±20% +150ms – 0ms
■ Adjustable earth leakage trip characteristics ELT (AGR-31B only)	
Pick-up current [$I_{\Delta R}$] (A)	0.2 – 0.3 – 0.5 – 1 (Medium sensitivity) or 3 – 5 (Low sensitivity)
Current setting tolerance	Non operate below 50% of [I_R], Operate between 50% and 100% of [I_R].
Time-delay [$t_{\Delta R}$] (ms) Relay time	100 / 200 / 300 / 500 / 1000 / 2000 ; 6 graduations
Resettable time (ms)	50 / 150 / 250 / 450 / 950 / 1950
Max. total clearing time (ms)	250 / 350 / 450 / 600 / 1150 / 2150
■ Undervoltage alarm characteristics UV (AGR-31B only)	
Recovery setting voltage (V)	[V_n]×(0.8 – 0.85 – 0.9 – 0.95) ; 4 graduations
Setting voltage (V)	[V_n]×(0.4 – 0.6 – 0.8) ; 3 graduations
Time-delay (s)	0.1 – 0.5 – 1 – 2 – 5 – 10 – 15 – 20 – 30 – 36 ; 10 graduations
■ Control power	AC100 – 120V / AC200 – 240V Common ; DC100 – 125V / DC200 – 250V Common ; DC24V / DC48V Common Power consumption: 5 VA

__ : Default setting

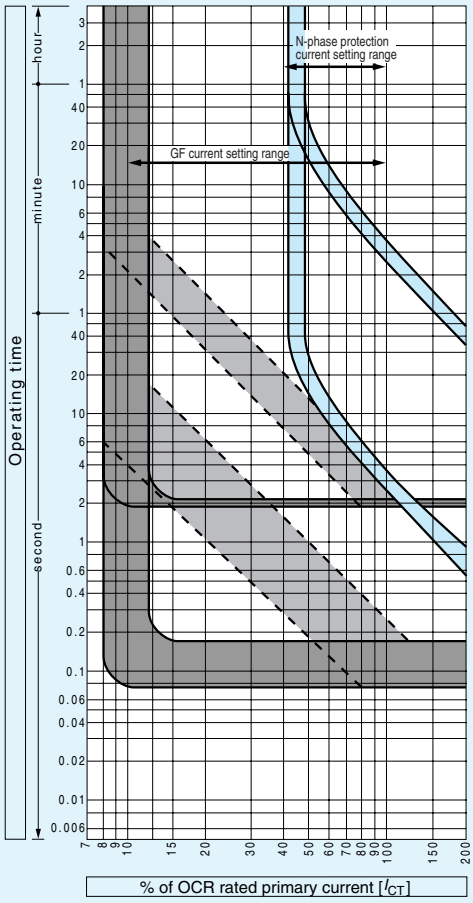
■Values of [I_{CT}] and [I_n]

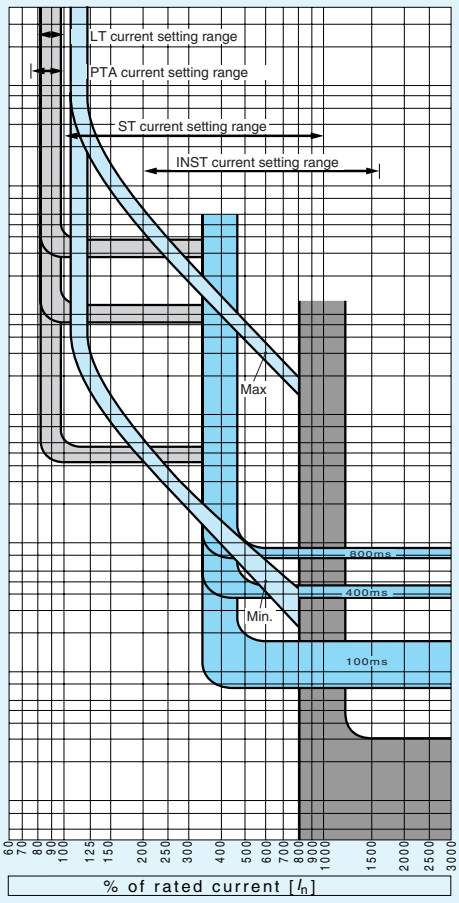
Type	Applicable [I_{CT}] (A)	Rated current [I_n](A) [I_{CT}] ×0.5	[I_{CT}] ×0.63	[I_{CT}] ×0.8	[I_{CT}] ×1.0
AR208S	**200**	100	125	160	200
	400	200	250	320	400
	800	400	500	630	800
AR212S	**400**	200	250	320	400
	800	400	500	630	800
	1250	630	800	1000	1250
AR216S	**400**	200	250	320	400
	800	400	500	630	800
	1250	630	800	1000	1250
	1600	800	1000	1250	1600

Type	Applicable [I_{CT}] (A)	Rated current [I_n](A) [I_{CT}] ×0.5	[I_{CT}] ×0.63	[I_{CT}] ×0.8	[I_{CT}] ×1.0
AR220S	**400**	200	250	320	400
	800	400	500	630	800
	1250	630	800	1000	1250
	1600	800	1000	1250	1600
	2000	1000	1250	1600	2000
AR325S	**2500**	1250	1600	2000	2500
AR332S	**3200**	1600	2000	2500	3200
AR440S	**4000**	2000	2500	3200	4000

Type	Applicable [I_{CT}] (A)	Rated current [I_n](A) [I_{CT}] ×0.5	[I_{CT}] ×0.63	[I_{CT}] ×0.8	[I_{CT}] ×1.0
AR212H	**200**	100	125	160	200
	400	200	250	320	400
	800	400	500	630	800
	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

Protection characteristics





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

4 Specifications

R-characteristic for general feeder circuits (Type AGR-21BR, 31BR)

Setting range of protection functions

Protection functions	Setting range
■ Adjustable long time-delay trip characteristics LT	Select one from among $I^{0.02}t$, It, I^2t, I^3t, and I^4t on LCD.
Pick-up current [I_R] (A)	[I_n]×(0.8 – 0.85 – 0.9 – 0.95 – 1.0 – NON) ; 6 graduations
Current setting tolerance (%)	±5%
Time-delay [t_R] (s)	(1 – 2 – 3 – 4 – 5 – 6.3 – 6.8 – 10) at 300% of [I_R]; 8 graduations
Time-delay setting tolerance (%)	±20% +150ms – 0ms
■ Adjustable short time-delay trip characteristics ST	
Pick-up current [I_{sd}] (A)	[I_n]×(1 – 1.5 – 2 – 2.5 – 3 – 4 – 6 – 8 – 10 – NON) ; 10 graduations
Current setting tolerance (%)	±15%
Time-delay [t_{sd}] (ms) Relay time	50 / 100 / 200 / 400 / 600 / 800 ; 6 graduations
Resettable time (ms)	25 / 75 / 175 / 375 / 575 / 775
Max. total clearing time (ms)	120 / 170 / 270 / 470 / 670 / 870
■ Adjustable instantaneous trip characteristics INST or MCR	
Pick-up current [I_i] (A)	[I_n]×(2 – 4 – 6 – 8 – 10 – 12 – 14 – 16 – NON) ; 9 graduations
Current setting tolerance (%)	±20%
■ Adjustable pre-trip alarm characteristics PTA	
Pick-up current [I_{P1}] (A)	[I_n]×(0.75 – 0.8 – 0.85 – 0.9 – 0.95 – 1.0) ; 6 graduations
Current setting tolerance (%)	±7.5%
Time-delay [t_{P1}] (s)	(5 – 10 – 15 – 20 – 40 – 60 – 80 – 120 – 160 – 200) at [I_{P1}] or more; 10 graduations
Time-delay setting tolerance (%)	±15% +100ms – 0ms
■ Adjustable ground fault trip characteristics GF	Note: Set [I_g] to 1200A or less.
Pick-up current [I_g] (A)	[I_{CT}]×(0.1 – 0.2 – 0.3 – 0.4 – 0.6 – 0.8 – 1.0 – NON) ; 8 graduations
Current setting tolerance (%)	±20%
Time-delay [t_g] (ms) Relay time	100 / 200 / 300 / 500 / 1000 / 2000 ; 6 graduations
Resettable time (ms)	75 / 175 / 275 / 475 / 975 / 1975
Max. total clearing time (ms)	170 / 270 / 370 / 570 / 1070 / 2070
Ground fault trip characteristics on line side REF	
Pick-up current [I_{REF}] (A)	[I_{CT}]×(0.1 – 0.2 – 0.3 – 0.4 – 0.6 – 0.8 – 1.0 – NON) ; 8 graduations
current setting tolerance (%)	±20%
Time-delay (s)	Inst
■ N-phase protection characteristics NP	
Pick-up current [I_N] (A)	[I_{CT}]×(0.4 – 0.5 – 0.63 – 0.8 – 1.0) ; Factory set to a user-specified value. • Non tripping when load current ≦ ([I_N]×1.05). • Tripping when ([I_N]×1.05) < load current ≦ ([I_N]×1.2)
Time-delay [t_N] (s)	Tripping at 300% of [I_N] with LT time-delay [t_R]
Time-delay setting tolerance (%)	±20% +150ms – 0ms
■ Reverse phase protection characteristics NS	
Pick-up current [I_{NS}] (A)	[I_n]×(0.2 – 0.3 – 0.4 – 0.5 – 0.6 – 0.7 – 0.8 – 0.9 – 1.0) ; 9 graduations
current setting tolerance (%)	±10%
Time-delay [t_{NS}] (s)	0.4 – 0.8 – 1.2 – 1.6 – 2 – 2.4 – 2.8 – 3.2 – 3.6 – 4 ; 10 graduations
Time-delay setting tolerance (%)	±20% +150ms – 0ms
■ Adjustable earth leakage trip characteristics ELT (AGR-31B only)	
Pick-up current [$I_{\Delta R}$] (A)	0.2 – 0.3 – 0.5 – 1 (Medium sensitivity) or 3 – 5 (Low sensitivity)
Current setting tolerance	Non operate below 50% of [I_R], Operate between 50% and 100% of [I_R].
Time-delay [$t_{\Delta R}$] (ms) Relay time	100 / 200 / 300 / 500 / 1000 / 2000 ; 6 graduations
Resettable time (ms)	50 / 150 / 250 / 450 / 950 / 1950
Max. total clearing time (ms)	250 / 350 / 450 / 600 / 1150 / 2150
■ Undervoltage alarm characteristics UV (AGR-31B only)	
Recovery setting voltage (V)	[V_n]×(0.8 – 0.85 – 0.9 – 0.95) ; 4 graduations
Setting voltage (V)	[V_n]×(0.4 – 0.6 – 0.8) ; 3 graduations
Time-delay (s)	0.1 – 0.5 – 1 – 2 – 5 – 10 – 15 – 20 – 30 – 36 ; 10 graduations
■ Control power	AC100 – 120V / AC200 – 240V Common ; DC100 – 125V / DC200 – 250V Common ; DC24V / DC48V Common
	Power consumption: 5 VA

__ : Default setting

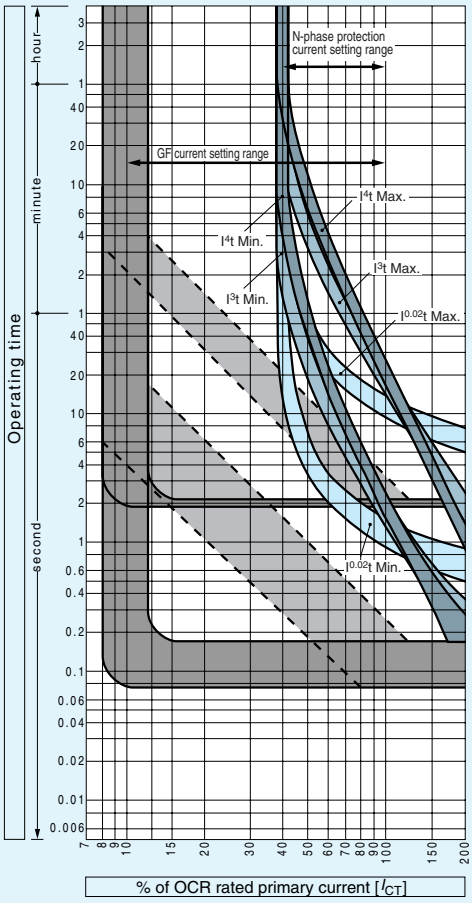
■Values of [I_{CT}] and [I_n]

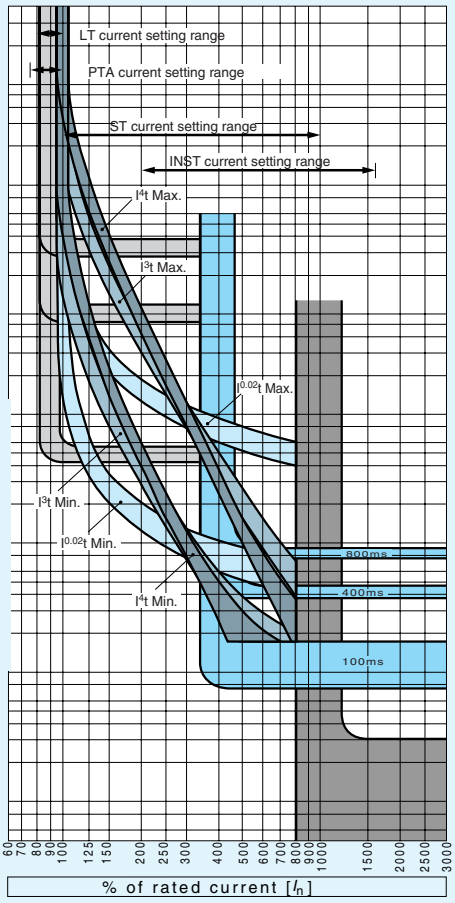
Type	Applicable [I_{CT}] (A)	Rated current [I_n](A) [I_{CT}] ×0.5	[I_{CT}] ×0.63	[I_{CT}] ×0.8	[I_{CT}] ×1.0
AR208S	**200**	100	125	160	200
	400	200	250	320	400
	800	400	500	630	800
AR212S	**400**	200	250	320	400
	800	400	500	630	800
	1250	630	800	1000	1250
AR216S	**400**	200	250	320	400
	800	400	500	630	800
	1250	630	800	1000	1250
	1600	800	1000	1250	1600

Type	Applicable [I_{CT}] (A)	Rated current [I_n](A) [I_{CT}] ×0.5	[I_{CT}] ×0.63	[I_{CT}] ×0.8	[I_{CT}] ×1.0
AR220S	**400**	200	250	320	400
	800	400	500	630	800
	1250	630	800	1000	1250
	1600	800	1000	1250	1600
	2000	1000	1250	1600	2000
AR325S	**2500**	1250	1600	2000	2500
AR332S	**3200**	1600	2000	2500	3200
AR440S	**4000**	2000	2500	3200	4000

Type	Applicable [I_{CT}] (A)	Rated current [I_n](A) [I_{CT}] ×0.5	[I_{CT}] ×0.63	[I_{CT}] ×0.8	[I_{CT}] ×1.0
AR212H	**200**	100	125	160	200
	400	200	250	320	400
	800	400	500	630	800
	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

Protection characteristics





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

4 Specifications

S-characteristic for generator protection (Type AGR-21BS, 22BS, 31BS)

Setting range of protection functions

Protection functions	Setting range
■ Adjustable long time-delay trip characteristics LT	
Pick-up current [I_R] (A)	[I_n]×(0.8 – 1.0 – 1.05 – 1.1 – 1.15 – NON) ; 6 graduations
Current setting tolerance (%)	±5%
Time-delay [t_R] (s)	(15 – 20 – 25 – 30 – 40 – 50 – 60) at 120% of [I_R]; 7 graduations
Time-delay setting tolerance (%)	±15% +150ms – 0ms
■ Adjustable short time-delay trip characteristics ST	
Pick-up current [I_{sd}] (A)	[I_n]×(2 – 2.5 – 2.7 – 3 – 3.5 – 4 – 4.5 – 5 – NON) ; 9 graduations
Current setting tolerance (%)	±10%
Time-delay [t_{sd}] (ms) Relay time	100 / 200 / 300 / 400 / 600 / 800 ; 6 graduations
Resettable time (ms)	75 / 175 / 275 / 375 / 575 / 775
Max. total clearing time (ms)	170 / 270 / 370 / 470 / 670 / 870
■ Adjustable instantaneous trip characteristics INST or MCR	
Pick-up current [I_i] (A)	[I_n]×(2 – 4 – 6 – 8 – 10 – 12 – 14 – 16 – NON) ; 9 graduations
Current setting tolerance (%)	±20%
■ Adjustable pre-trip alarm characteristics PTA	
Pick-up current [I_{P1}] (A)	[I_n]×(0.75 – 0.8 – 0.85 – 0.9 – 0.95 – 1.0 – 1.05) ; 7 graduations
Current setting tolerance (%)	±5%
Time-delay [t_{P1}] (s)	(10 – 15 – 20 – 25 – 30) at 120% of [I_{P1}]; 5 graduations
Time-delay setting tolerance (%)	±15% +100ms – 0ms
PTA 2 (AGR-22B,31B only)	
Pick-up current [I_{P2}] (A)	[I_n]×(0.75 – 0.8 – 0.85 – 0.9 – 0.95 – 1.0 – 1.05) ; 7 graduations
Current setting tolerance (%)	±5%
Time-delay [t_{P2}] (s)	1.5 [t_{P1}] at 120% of [I_{P2}]
Time-delay setting tolerance (%)	±15% +100ms – 0ms
■ Adjustable reverse power trip characteristics RPT (AGR-22B,31B only)	
Pick-up power [P_R] (kW)	Rated power [P_n]×(0.04 – 0.05 – 0.06 – 0.07 – 0.08 – 0.09 – 0.1 – NON) ; 8 graduations
Power setting tolerance (%)	+0 – 20%
Time-delay [time] (s)	(2.5 – 5 – 7.5 – 10 – 12.5 – 15 – 17.5 – 20) at 100% of [P_R]; 8 graduations
Time-delay setting tolerance (%)	±20%
■ Undervoltage alarm characteristics UV (AGR-31B only)	
Recovery setting voltage (V)	[V_n]×(0.8 – 0.85 – 0.9 – 0.95) ; 4 graduations
Setting voltage (V)	[V_n]×(0.4 – 0.6 – 0.8) ; 3 graduations
Time-delay (s)	0.1 – 0.5 – 1 – 2 – 5 – 10 – 15 – 20 – 30 – 36 ; 10 graduations
■ Control power	AC100 – 120V / AC200 – 240V Common ; DC100 – 125V / DC200 – 250V Common ; DC24V / DC48V Common
	Power consumption: 5 VA

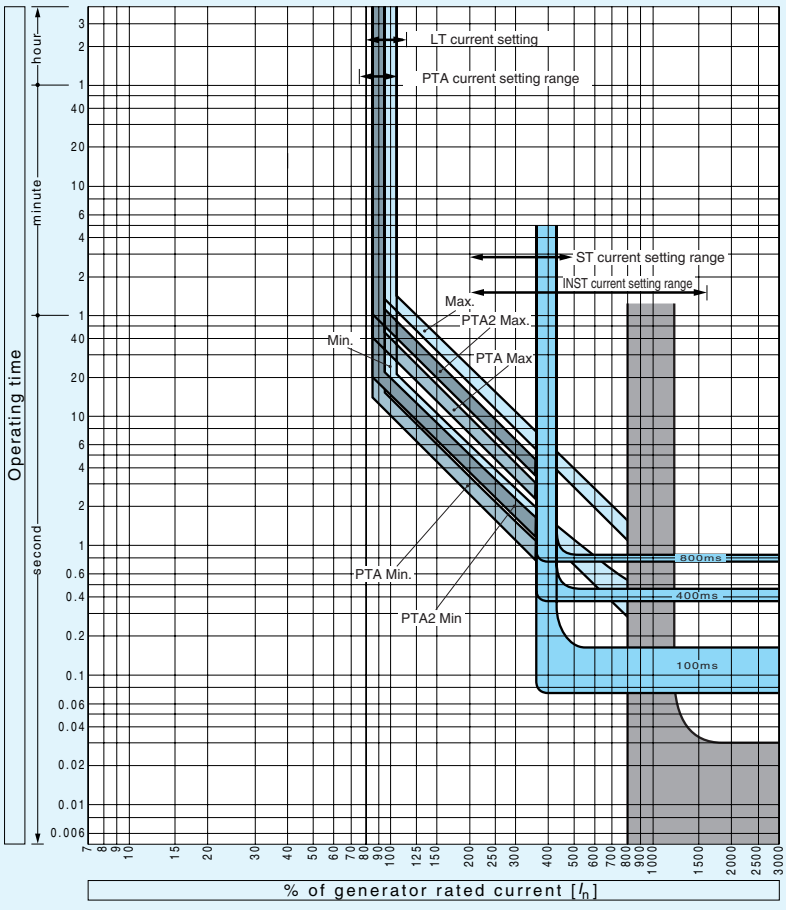
__ : Default setting

Applicable range of generator rated current [I_n]

Type	OCR rated primary current [I_{CT}](A)	Applicable range of generator rated current [I_n] (A)
AR208S	200	100≦[I_n]≦200
	400	200<[I_n]≦400
	800	400<[I_n]≦800
AR212S	400	200≦[I_n]≦400
	800	400<[I_n]≦800
	1250	630<[I_n]≦1250
AR216S	400	200≦[I_n]≦400
	800	400<[I_n]≦800
	1250	630<[I_n]≦1250
	1600	800≦[I_n]≦1600
AR220S	400	200≦[I_n]≦400
	800	400<[I_n]≦800
	1250	630<[I_n]≦1250
	1600	800≦[I_n]≦1600
	2000	1250≦[I_n]≦2000
AR325S	2500	1250≦[I_n]≦2500
AR332S	3200	1600≦[I_n]≦3200
AR440S	4000	2000≦[I_n]≦4000

Type	OCR rated primary current [I_{CT}](A)	Applicable range of generator rated current [I_n] (A)
AR212H	200	100≦[I_n]≦200
	400	200<[I_n]≦400
	800	400<[I_n]≦800
	1250	630<[I_n]≦1250
AR216H	1600	800≦[I_n]≦1600
AR220H	2000	1000≦[I_n]≦2000
AR316H	200	100≦[I_n]≦200
	400	200<[I_n]≦400
	800	400<[I_n]≦800
	1250	630<[I_n]≦1250
	1600	800<[I_n]≦1600
AR320H	2000	1000≦[I_n]≦2000
AR325H	2500	1250≦[I_n]≦2500
AR332H	3200	1600≦[I_n]≦3200

Protection characteristics



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

4 Specifications

7 Other Accessories

OCR checker, type ANU-1

The OCR checker allows easy checking of the long time-delay trip, short time-delay trip, instantaneous trip, ground fault trip functions and the pre-trip alarm function of the OCR in the field.

● Ratings and specifications

Power supply	• AC100–110V, 50/60Hz or AC100–240V, 50/60Hz with type C plug • 4×AA alkaline cells
Power consumption	7VA
Dimensions	101 (W) × 195 (H) × 44 (D) mm
Weight	400 g

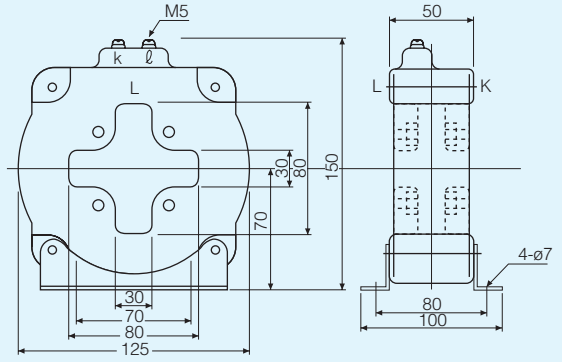
Contact Terasaki for how to check the reverse power trip function.

Current transformer for neutral line (separate type)

When using a 3-pole ACB with the ground fault protection function to protect a 3-phase, 4-wire system against ground fault, install an appropriate current transformer (CT) to the neutral line of the system.
TERASAKI can provide this neutral line CT as an option.
For the 4-pole ACB, a measuring CT instead of the neutral line CT is already built into the neutral phase of the ACB when the ground fault protection is fitted.

• Outline dimension of CT for neutral line

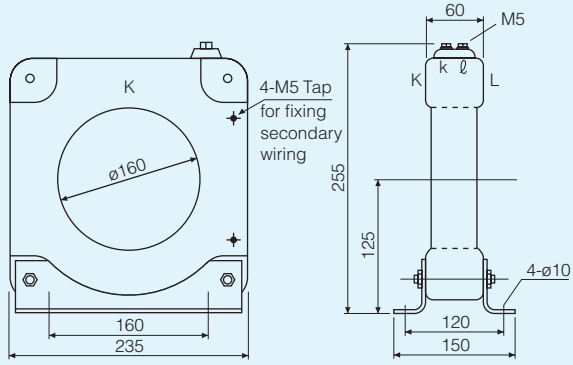
AR208S, AR212S, AR216S
AR212H, AR216H, AR316H



Type	CW80-40LS	
Rated Primary Current (A)	200	1250
	400	1600
	800	

Rated secondary current is 5A

AR220S, AR325S, AR332S, AR440S
AR220H, AR320H, AR325H, AR332H



Type	EC160-40LS	
Rated Primary Current (A)	1600	3200
	2000	4000
	2500	

Rated secondary current is 5A

The over-current trip device of *TemPower2* provides a ground fault protection on the line side (optional) as well as on the load side as shown above. When the ACB is used for protection of a 3-pole, 4-wire system, select the same current transformer for the neutral line shown above.

4 Specifications

ON–OFF cycle counter

The ON-OFF cycle counter is a mechanical 5-digit readout that shows the number of ON-OFF cycles of the ACB.
Counter readings serve as a guide for maintenance or inspection.

Auxiliary switches

The auxiliary switches operate during the ACB ON/OFF operation.
Connections to the switches are made via screw terminals.
The auxiliary switches for draw-out type ACBs operate in the CONNECTED and TEST positions.
The auxiliary switches for ACBs conforming to classification society's rules operate in the CONNECTED position only.
The auxiliary switches have change-over contacts and are available for general service and for microload.

Type	For general service	For microload ※※
※AXR-004	4c	—
AXR-007	7c	—
AXR-304	4c	3c
AXR-010	10c	—
AXR-307	7c	3c

※The standard contact arrangement of the auxiliary switches is 4c.
(Form c: Change-over, single gap, three terminals)

※※Suited to electronic circuits

Note: 4c is the maximum arrangement when any one of the ground fault protection on the line side, zone interlock, external display, or communication function is incorporated or in the case of type AGR-31B OCR with the ground fault trip function incorporated.

Auxiliary switch ratings

Category	For general service		For microload ※※		
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
AC100-250V	5	5	0.1	0.1	DC5V 1mA
AC251-500V	5	5	—	—	
DC30V	1	1	0.1	0.1	
DC125-250V	1	1	—	—	

Note 1: The chattering of b-contacts due to ON-OFF operation of the ACB lasts for less than 20 ms.
Note 2: Do not supply different voltages to contacts of a switch.

Key lock

The key lock is available in two types: the lock-in ON type that locks the ACB in the closed position, and the lock-in OFF type that locks the ACB in the open position.

When the ACB is fitted with a key lock, the operator cannot operate the ACB unless using a matched key.

Key interlock

The key interlock is a system of interlocking between ACBs, each fitted with a key lock of lock-in OFF type.

- A key must be inserted to release the lock before the ACB can be closed.
- The ACB must be opened and locked in the OFF position before the key can be removed.

By utilizing 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).

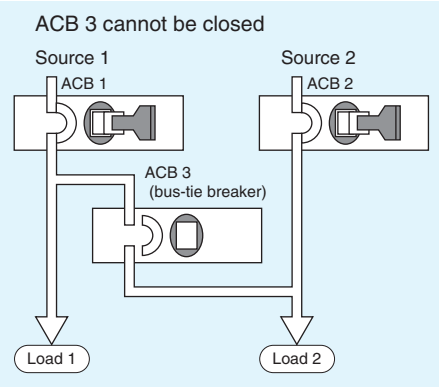
ACBs can be supplied with a cylinder lock or type FS-2 Castell lock (with an angular movement 90° clockwise to trap key).

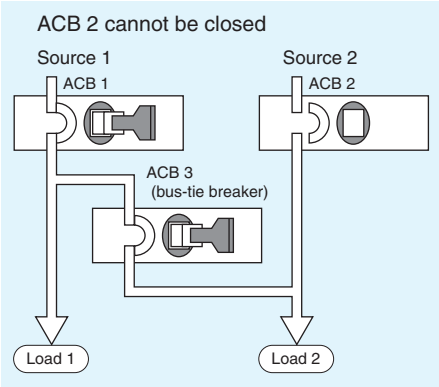
A double Castell interlocking facility suitable for applications such as UPS systems is available as a special specification contact Terasaki.

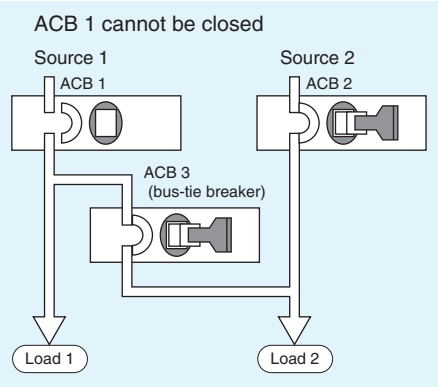
Facility or full option including locks are available, please specify.

For other lock types contact Terasaki.

Example: Interlock for prevention of parallel feeding from two sources







4 Specifications

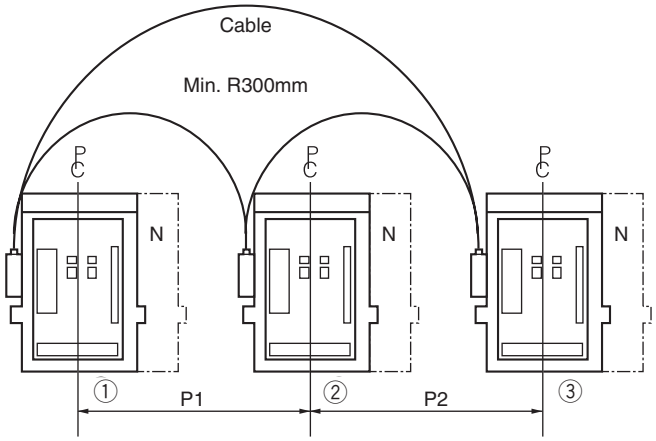
Mechanical interlock (Contact TERASAKI for details)

Mechanical interlocks for interlocking 2 or 3 ACBs in either horizontal (Draw-out type and Fixed type) or vertical (Draw-out type only) arrangements are available.
Interlocking is possible between any frame size within the *TemPower2* range.
In conjunction with an electrical interlock, it will enhance safety and reliability of power distribution systems.

1 Horizontal type

This table shows the standard pitch between left side ACB ① and right side ACB ②, or between left side ACB ② and right side ACB ③.

		Pitch of ACB P (mm) (PC line to PC line)		
Right ACB / Left ACB		AR208S～AR220S AR212H～AR220H	AR325S～AR332S AR316H～AR332H	AR440S
		3P, 4P	3P, 4P	3P, 4P
AR208S～AR220S AR212H～AR220H	3P	600, 700	600, 700, 800	600, 700
	4P	600, 700, 800	700, 800, 900	600, 700, 800
AR325S～AR332S AR316H～AR332H	3P	600, 700, 800	700, 800, 900	600, 700, 800
	4P	700, 800, 900	800, 900, 1000	700, 800, 900
AR440S	3P	800, 900, 1000	900, 1000, 1100	800, 900, 1000
	4P	1000, 1100, 1200	1000, 1100, 1200	1000, 1100, 1200



To order, select the required pitch for P1 and P2 from the above table, and specify the type and number of poles for each ACB.

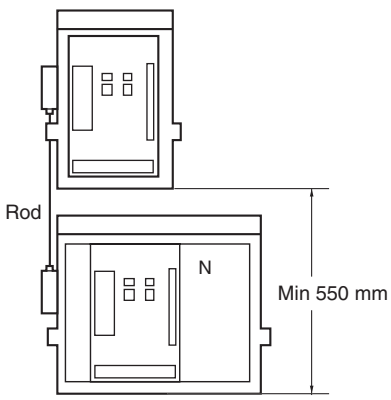
Example,

P1: 700 mm
P2: 800 mm
ACB ①: Type AR212H 3 poles
ACB ②: Type AR332H 3 poles
ACB ③: Type AR216H 3 poles

Type A Horizontal Mechanical Interlock for three ACBs, Gen.ACB Interlock with outer ACBs
Type B Horizontal Mechanical Interlock for three ACBs, two from three
Type C Horizontal Mechanical Interlock for two ACBs, one from two
Type D Horizontal Mechanical Interlock for three ACBs, one from three

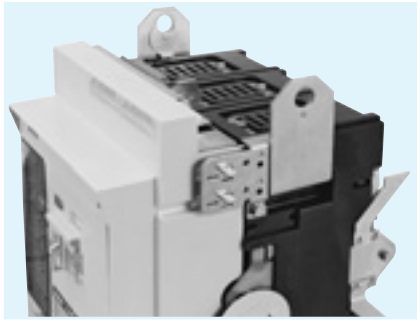
2 Vertical Type

Minimum pitch (550mm) is possible.
Specify the reguired pitch when ordering.
Maximum is 1200mm.
Contact TERASAKI for the details of vertical type with 3 ACBs.



Lifting plate

Lifting plates are detachable tools that can be used to lift a breaker body out of a draw-out cradle.



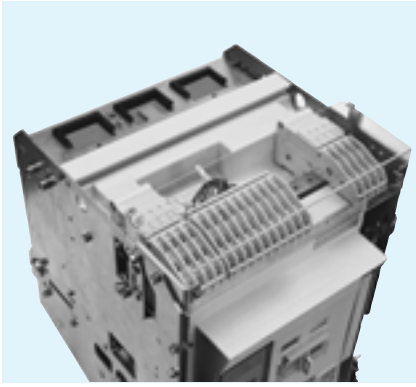
ON-OFF button cover ※

※: Standard equipment

An ON-OFF button cover prevents inadvertent or unauthorized operation of the ON or OFF button. It can be locked with up to three padlocks with ø6 hasp. Padlocks are not supplied.

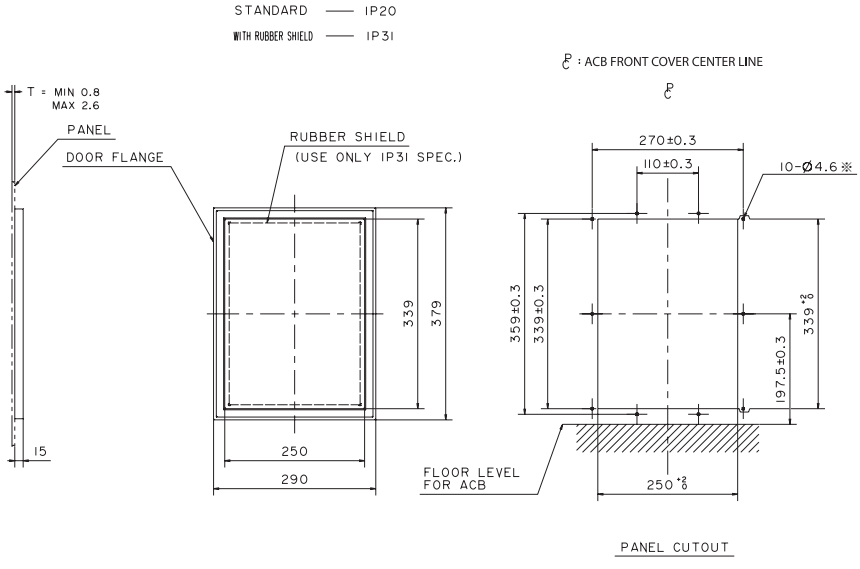
Control circuit terminal cover

A control circuit terminal cover protects the terminal blocks for auxiliary switches, position switches, and control circuits from being accidentally touched, thus enhancing safety.



Door flange

A door flange can be used as a decoration panel that covers the cutout on the switchboard panel, and provides IP20 protection. For IP31 protection please specify the door flange with a gasket.



※ : Mount IP20 door flange through 6 mounting holes and IP31 door flange through 10 mounting holes.

4 Specifications

OFF padlock

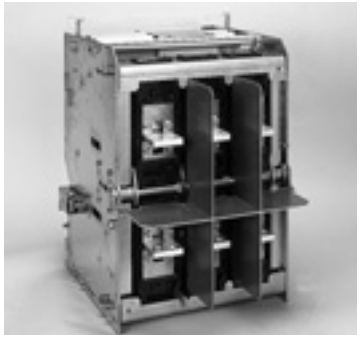
Permits the ACB to be padlocked in the OFF position. Max. three padlocks with ø6 hasp can be fitted. Padlocking is possible only when ON-OFF indicator shows OFF. When the ACB is padlocked in the OFF position both manual and electrial closing become inoperative, but the charging of the closing spring by manual or motor is still possible.

Note1: OFF padlock facility cannot be fitted with key lock or key interlock.

Inter-pole barrier

An inter-pole barrier prevents a possible short-circuit due to foreign objects entering between the poles of the main circuit terminals or between the line and load ends, thus enhancing operational reliability of the ACB.

This barrier can be applied to the draw-out type ACB with vertical terminals or horizontal terminals.



Earthing device

There is a growing demand in L.V. distribution for greater protection against electric shock particularly during periods when maintenance work is being carried out on the main busbars or cables. A safe and economical way to meet this requirement is to apply system earthing via the normal service breaker. Earthing devices on ***TemPower2*** ACBs comprises; Permanent parts which are factory fitted by Terasaki and are mounted on the ACB chassis and body to enable the ACB to receive the portable parts. Portable parts are supplied in loose kit form and are fitted on to the ACB body by the customer's engineer.

This converts the ACB from a normal service device to an earthing device.

When the ACB is converted to the earthing device mode, the over-current release and the other electrical tripping devices are automatically disabled to prevent the remote opening of the ACB.

It is recommended that the ON-OFF operating buttons be padlocked to prevent manual opening of the ACB when used in the earthing mode.

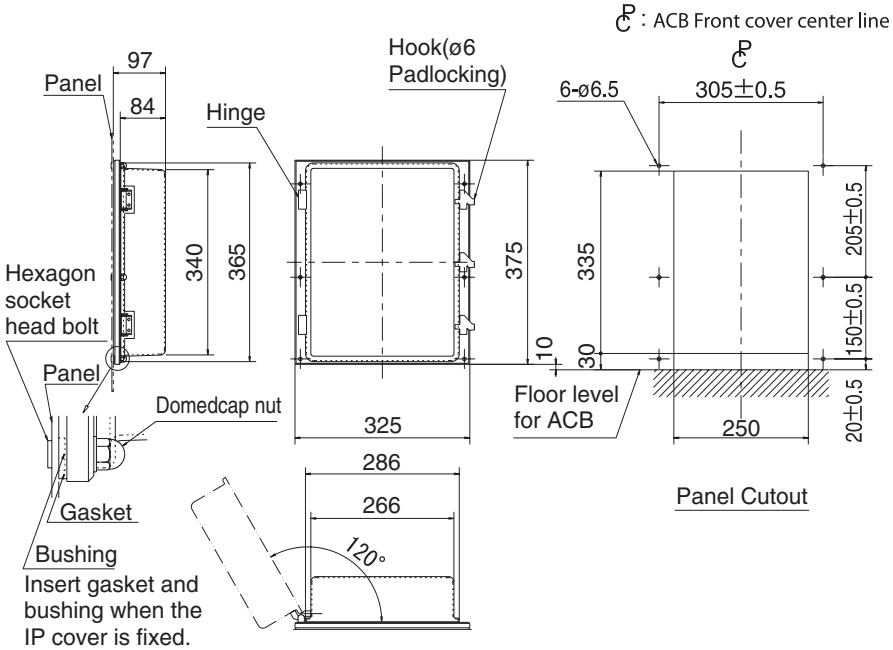
UVT function can not be applied to the earthing device.

For further information contact Terasaki for details.

IP cover

An IP cover provides an IP55 grade of protection as defined in IEC 60529.

Even if the breaker body is on the ISOLATED position, IP cover can still be fitted on the ACB.



8 Operation Environments

Standard environment

The standard environment for ACBs is as follows:

Ambient temperature	–5°C to +40°C The average temperature for 24 hours must not exceed 35°C.
Relative humidity	45% to 85%
Attitude	Below 2000 m
Atmosphere	Excessive water vapor, oil vapor, smoke, dust, or corrosive gases must not exist. Sudden change in temperature, condensation, or icing must not occur.

Special environment

Tropicalization (Fungus and moisture treatment)

Specify this treatment when the ACB is used under high-temperature and high-humidity conditions.

Conditions: Max. permissible ambient temperature 60°C
Max. permissible humidity 95% rel.
No condensation

Cold climate treatment

Specify this treatment when the ACB is used in cold areas.

Conditions: Min. permissible storage temperature –40°C
Min. permissible operating temperature –25°C
No condensation

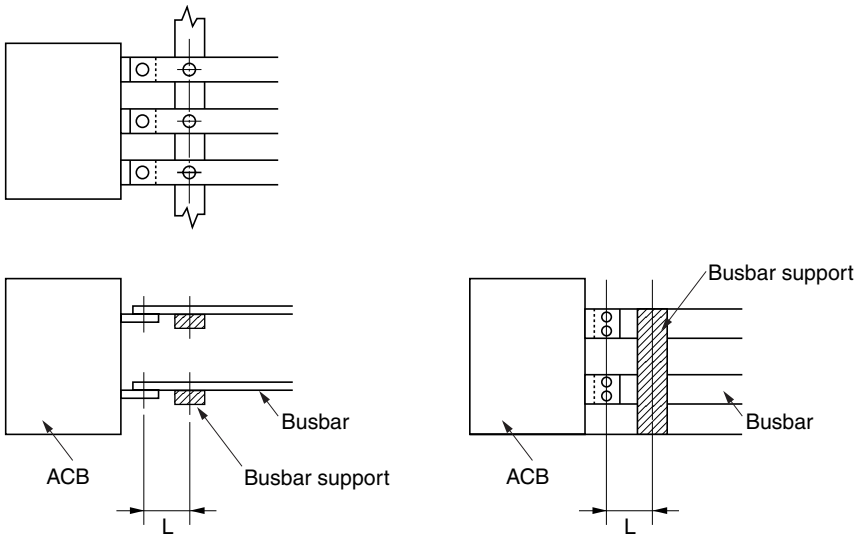
Anti-corrosion treatment

Specify this treatment when the ACB is used in a corrosive atmosphere.

Contact Terasaki for details.

Recommendation for Busbars connection

The busbars to the ACB should be firmly supported near the ACB terminal. Fault currents flow through the busbars developing a large electromagnetic force between the busbars, and the support must be strong enough to withstand such forces. The ACB should not be relied on as a single support.



The maximum distance of the connection point of ACB to the first busbar support

Short-circuit current (kA)		30	50	65	80	100
Distance L (mm)	Type AR2	300	250	150	150	—
	Type AR3,AR4	350	300	250	150	150

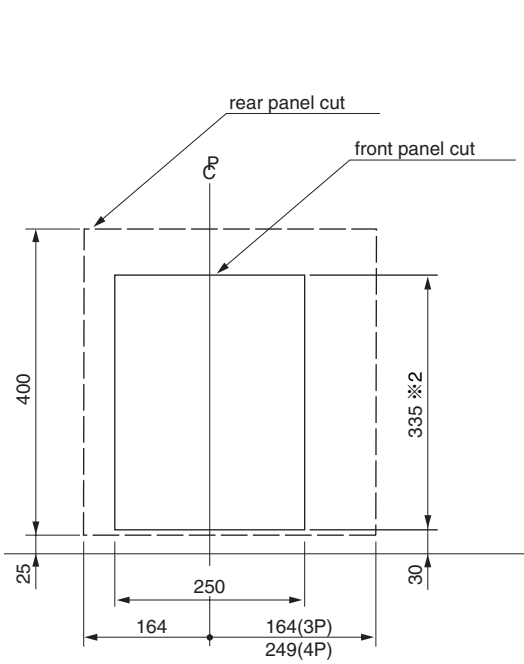
5 Outline Dimensions

• Type AR208S, AR212S, AR216S, AR220S, AR212H, AR216H, AR220H Draw-out type

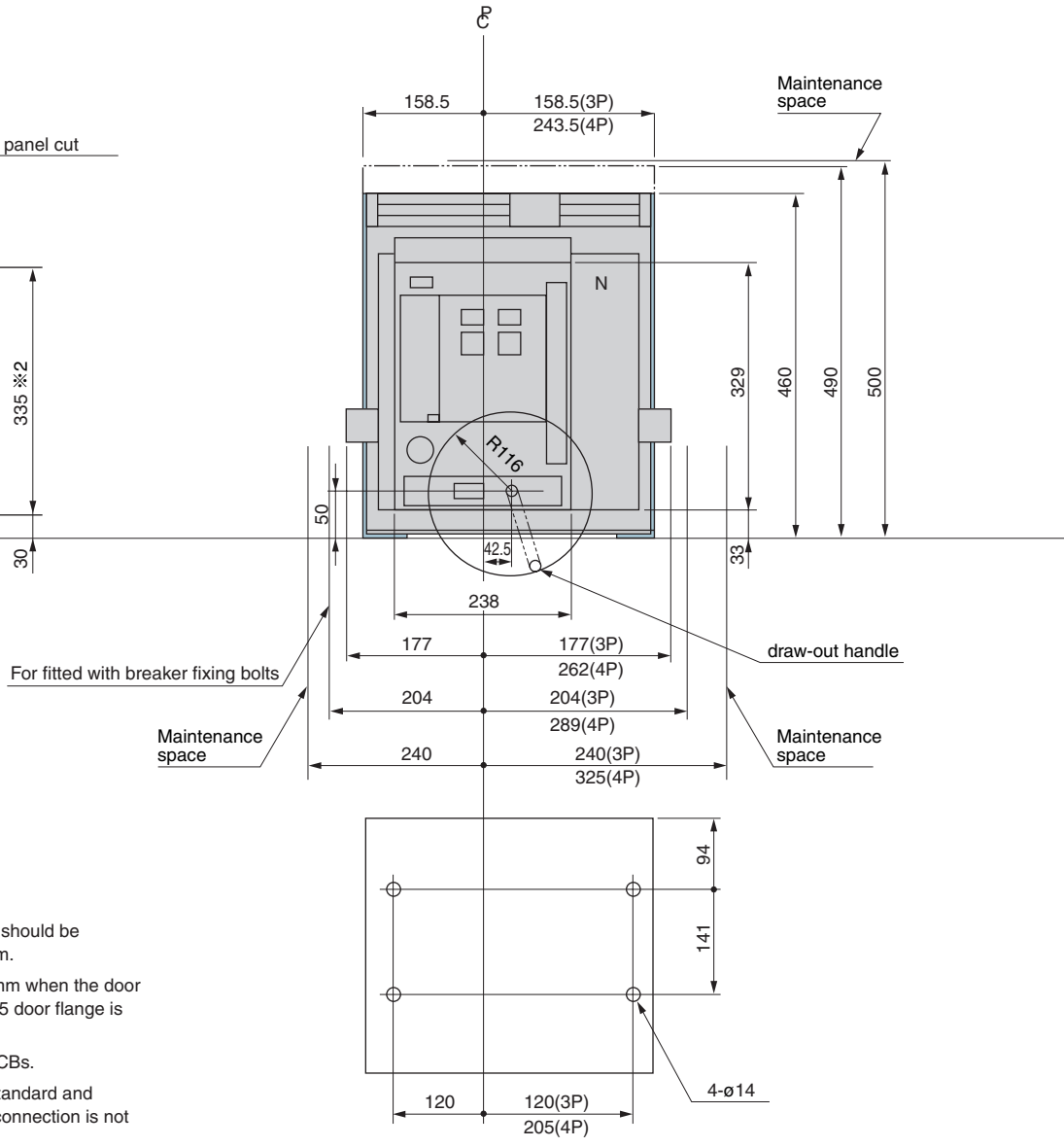
℄: ACB Front cover center line

Terminal size

Type	ⓣ1	ⓣ2	ⓣ3	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	——	——



panel cut-out

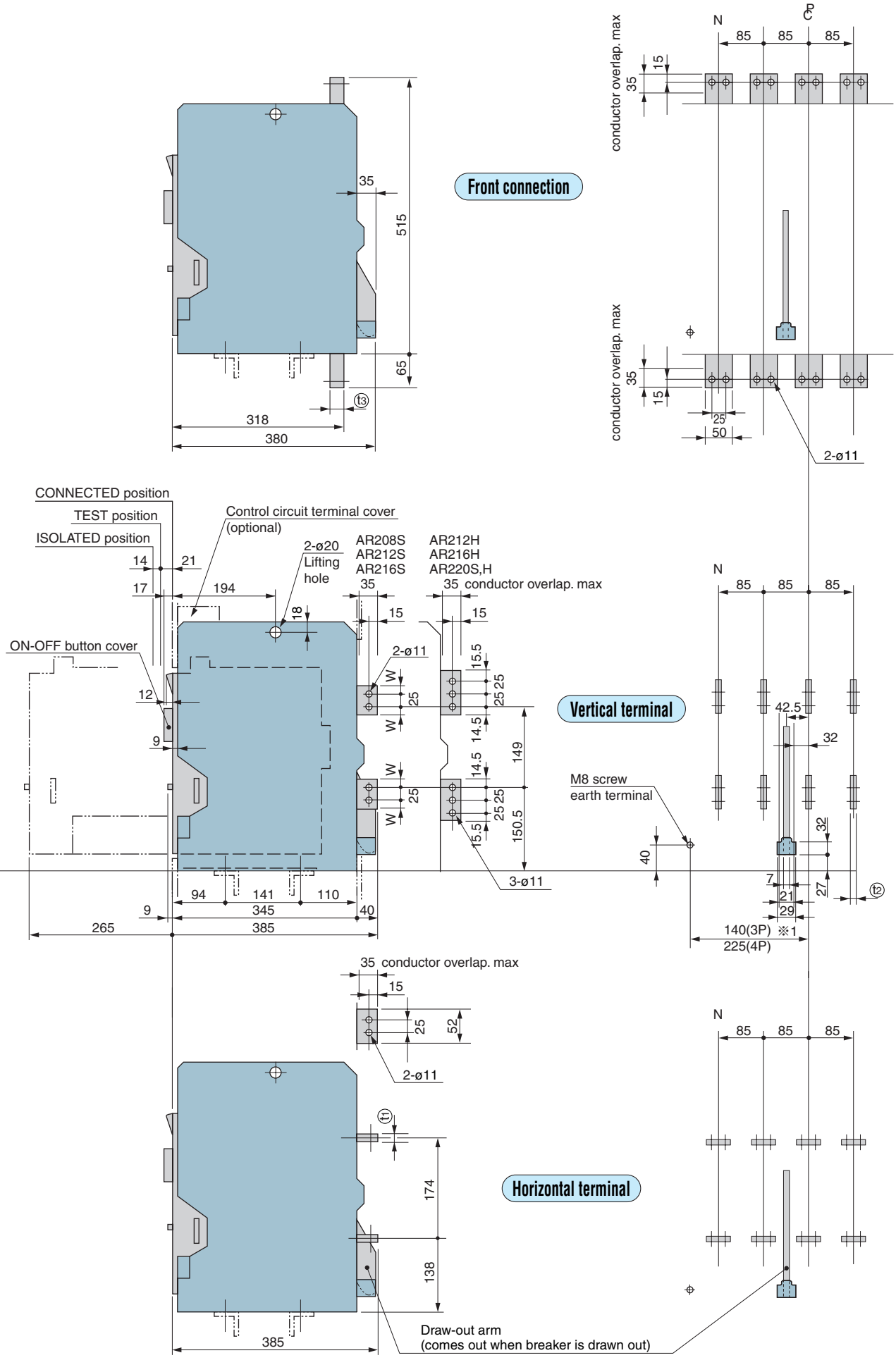


Mounting holes

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

※2: Panel cut should be 339 mm not 335 mm when the door flange is used. Refer to page 43. If IP55 door flange is used see page 44.

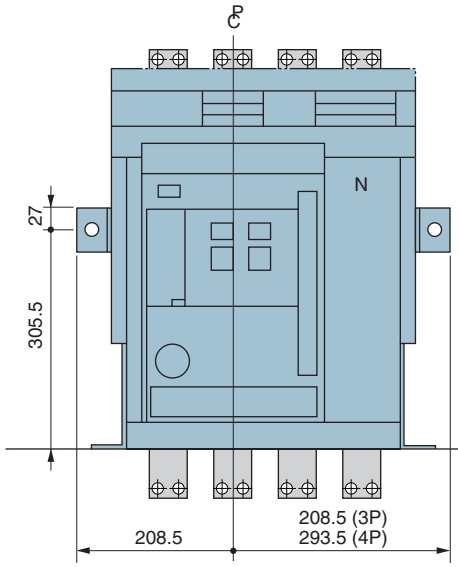
- N represents the neutral pole of 4-pole ACBs.
- For High fault series vertical terminal is standard and horizontal terminal is optional, and front connection is not available.

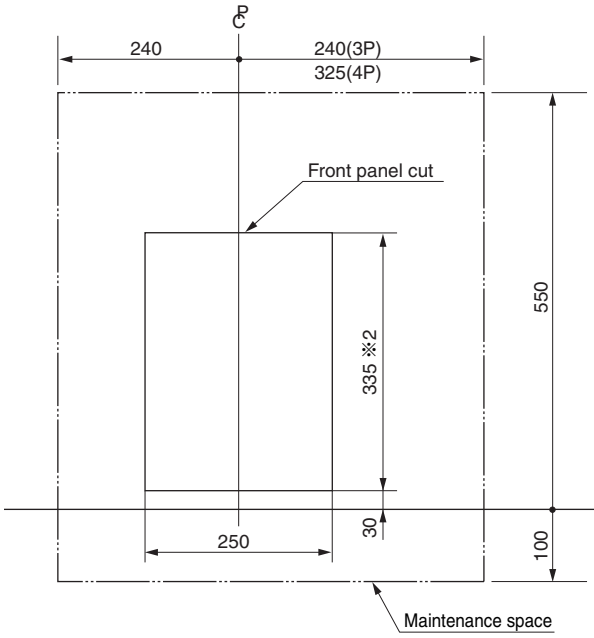

Front connection
N
P
C
85
85
85
conductor overlap. max
35
15
515
65
35
t3
318
380
25
50
2-ø11
CONNECTED position
TEST position
ISOLATED position
Control circuit terminal cover
(optional)
2-ø20
Lifting
hole
AR208S
AR212S
AR216S
AR212H
AR216H
AR220S,H
35 conductor overlap. max
14
21
17
194
18
ON-OFF button cover
12
9
2-ø11
W
25
15.5
14.5
149
150.5
3-ø11
94
141
110
345
265
385
40
Vertical terminal
M8 screw
earth terminal
42.5
32
40
7
21
29
27
t2
140(3P) ※1
225(4P)
52
t1
174
138
Horizontal terminal
Draw-out arm
(comes out when breaker is drawn out)

5 Outline Dimensions

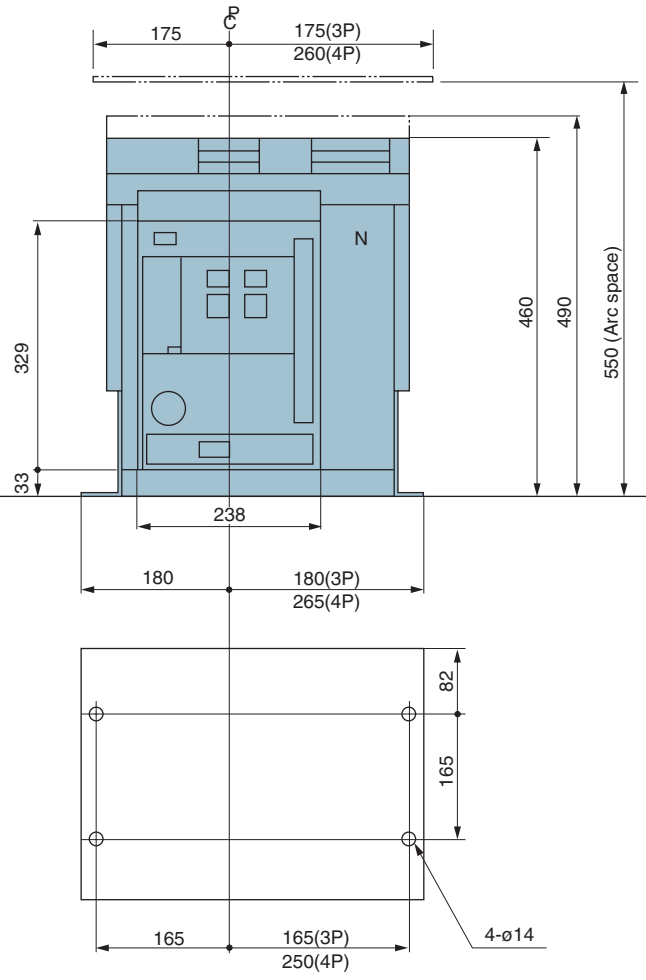
•Types: AR208S, AR212S, AR216S, AR220S Fixed type

℄: ACB Front cover center line





Panel cutout



Mounting holes

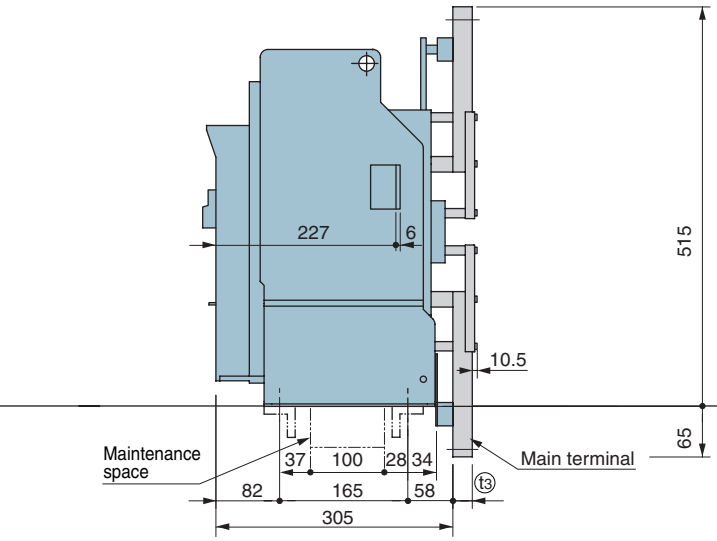
Terminal size

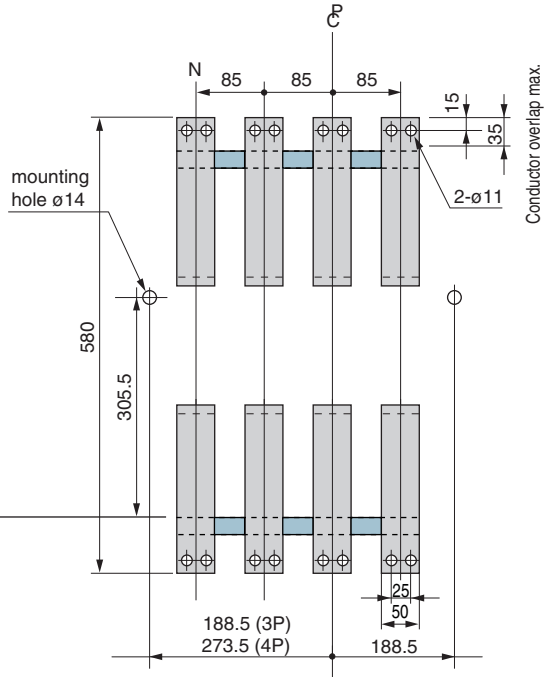
Type	ⓣ1	ⓣ2	ⓣ3	W
AR208S	10	10	15	17.5
AR212S	10	10	15	17.5
AR216S	20	15	25	22.5
AR220S	20	15	25	——

※2: Panel cut should be 339 mm not 335 mm when the door flange is used. Refer to page 43. If IP55 door flange is used see page 44.

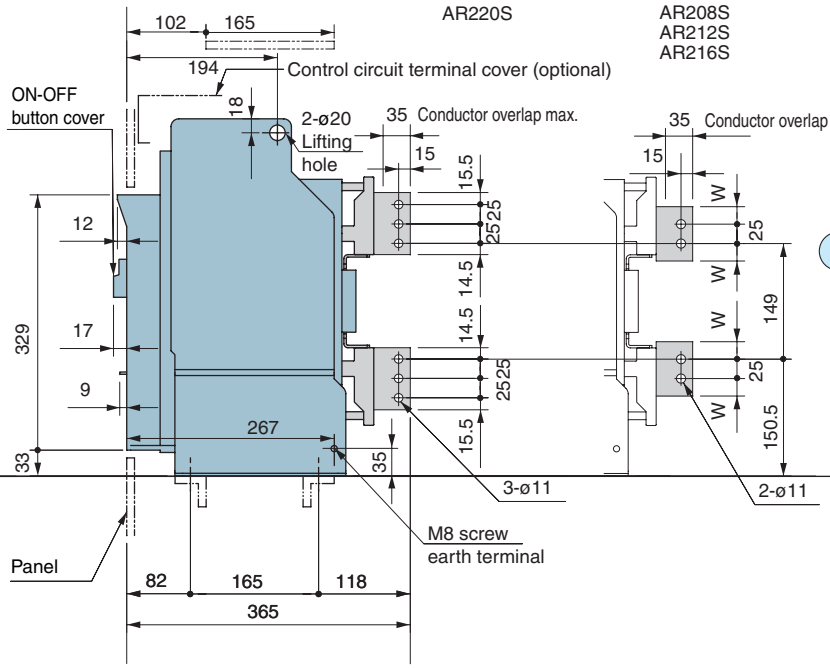
• N represents the neutral pole of 4-pole ACBs.

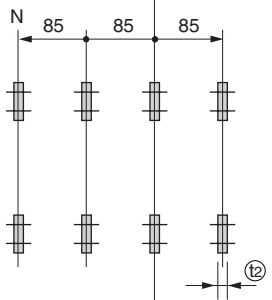
Front connections



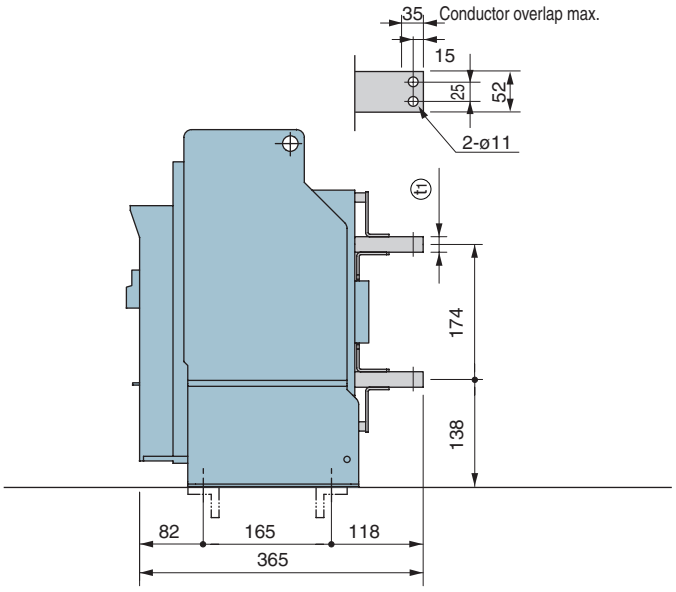


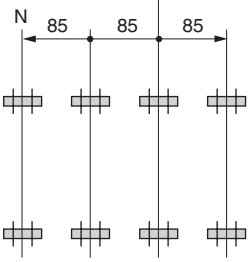
Vertical terminals





Horizontal terminals

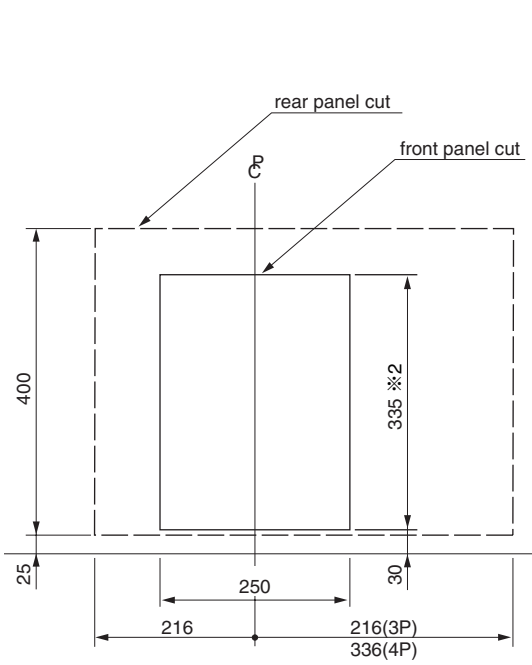




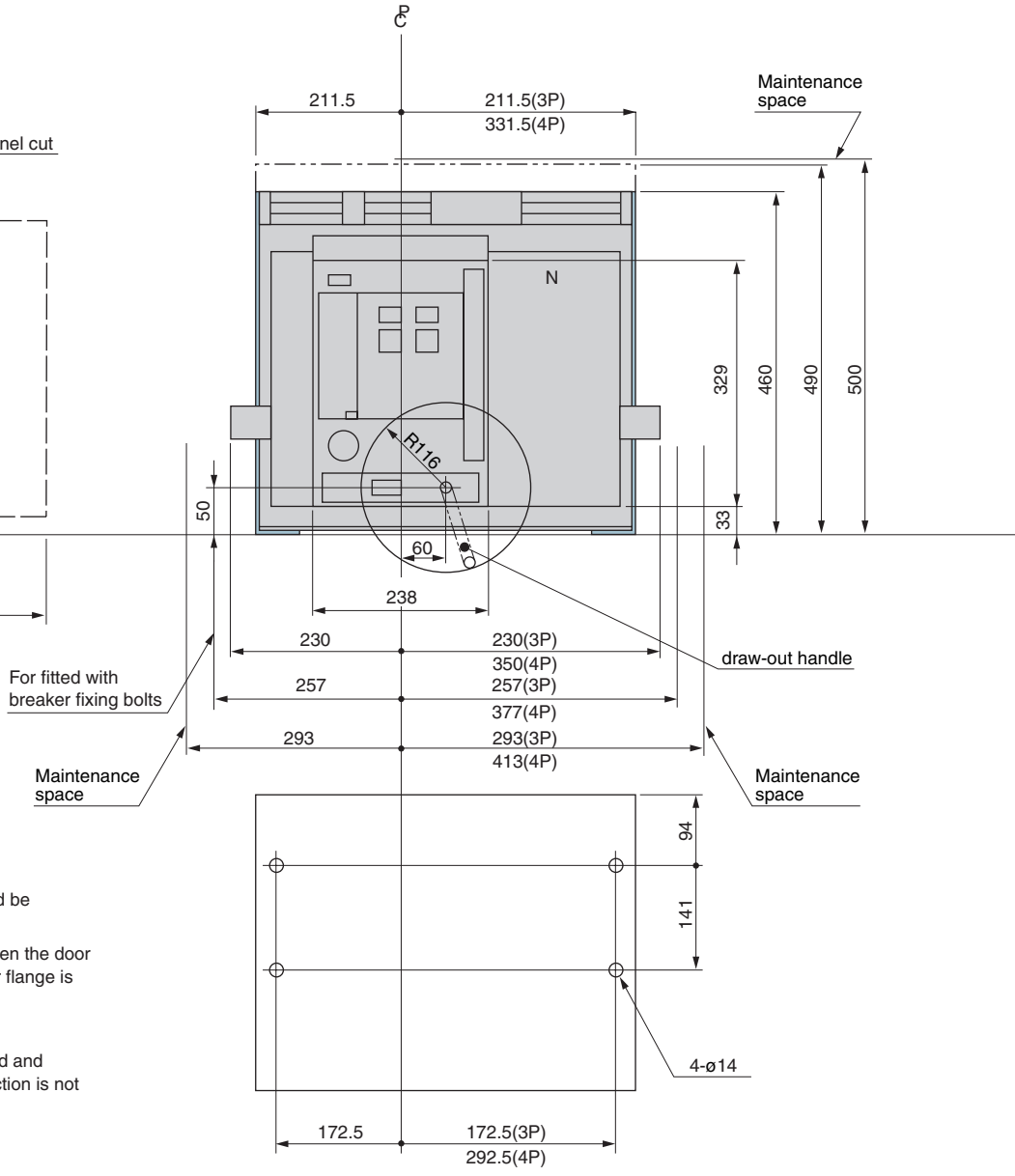
5 Outline Dimensions

• Type AR325S, AR332S, AR316H, AR320H, AR325H, AR332H Draw-out type

℄: ACB Front cover center line



panel cutout

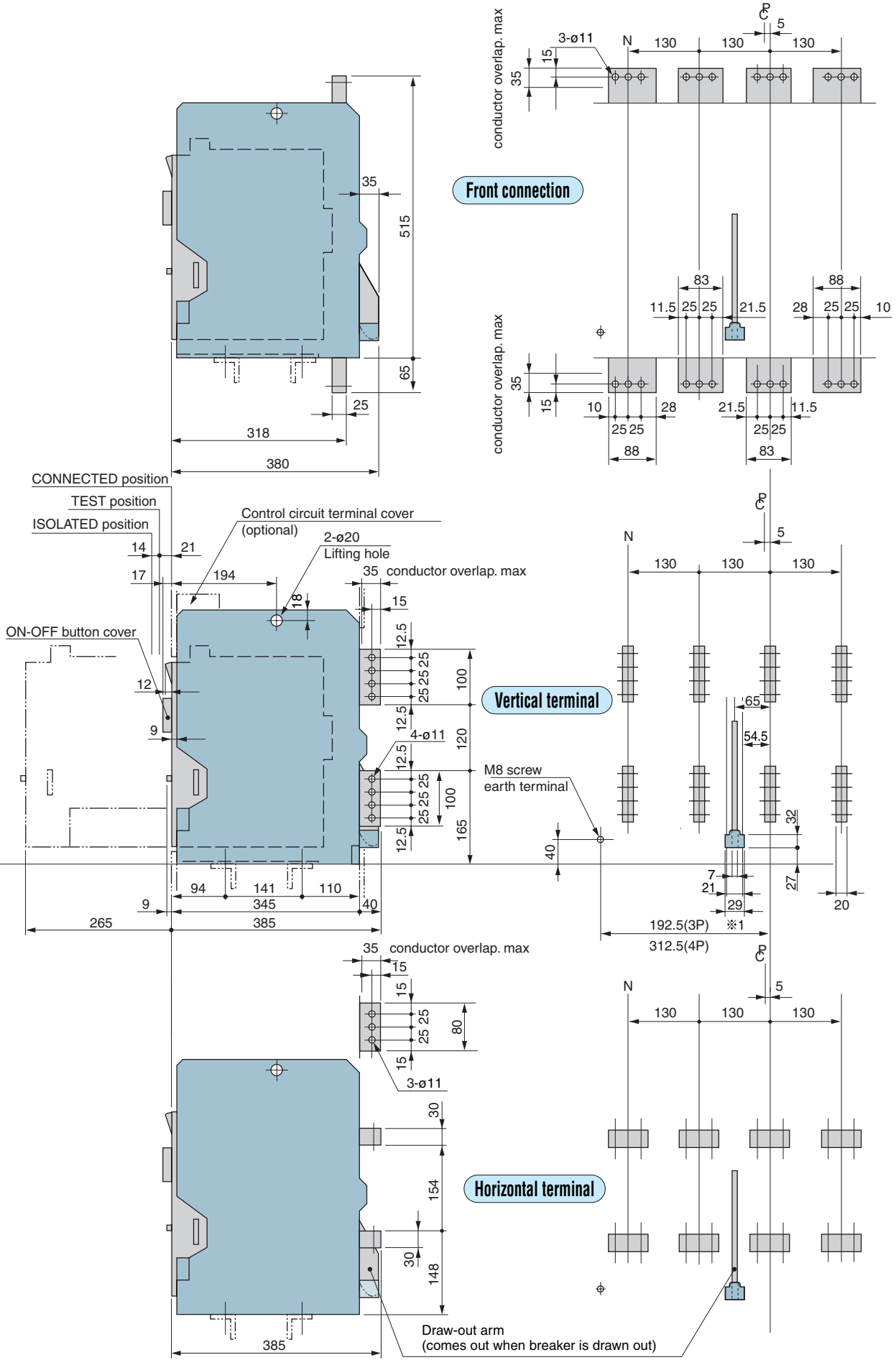


Mounting holes

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

※2: Panel cut should be 339 mm not 335 mm when the door flange is used. Refer to page 43. If IP55 door flange is used see page 44.

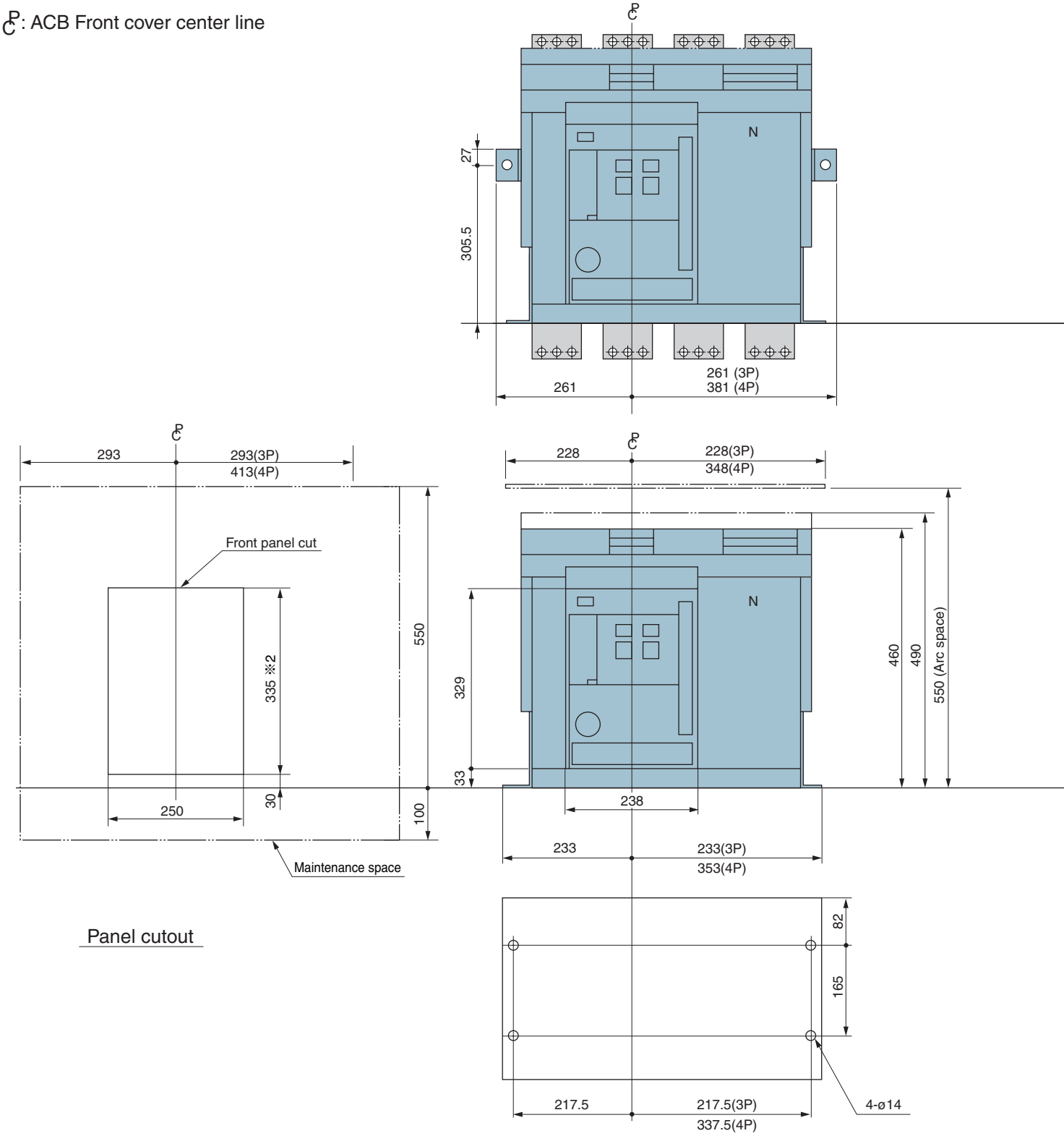
- N represents the neutral pole of 4-pole ACBs.
- For High fault series vertical terminal is standard and horizontal terminal is optional, and front connection is not available.


Front connection
conductor overlap. max
3-ø11
P
C
N
5
130
130
130
15
35
83
88
11.5
25
25
21.5
28
25
25
10
10
28
21.5
11.5
25 25
25 25
88
83
515
65
25
318
380
CONNECTED position
TEST position
ISOLATED position
Control circuit terminal cover
(optional)
2-ø20
Lifting hole
35 conductor overlap. max
14
21
17
194
18
15
12.5
25 25 25
100
ON-OFF button cover
12
9
4-ø11
120
165
94
141
110
345
9
40
265
385
Vertical terminal
M8 screw
earth terminal
65
54.5
32
40
7
21
29
27
20
192.5(3P) ※1
312.5(4P)
80
30
154
148
Horizontal terminal
Draw-out arm
(comes out when breaker is drawn out)

5 Outline Dimensions

•Types: AR325S, AR332S Fixed type

℄: ACB Front cover center line



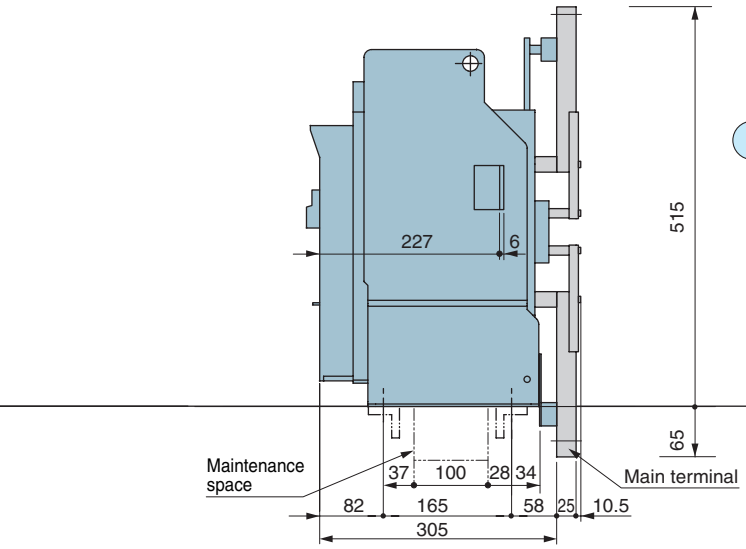
Panel cutout

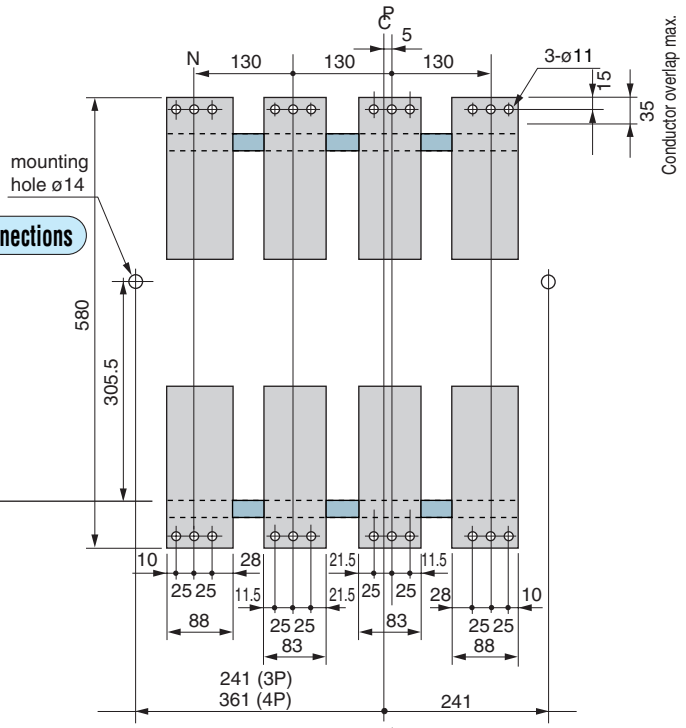
Mounting holes

※2: Panel cut should be 339 mm not 335 mm when the door flange is used. Refer to page 43. If IP55 door flange is used see page 44.

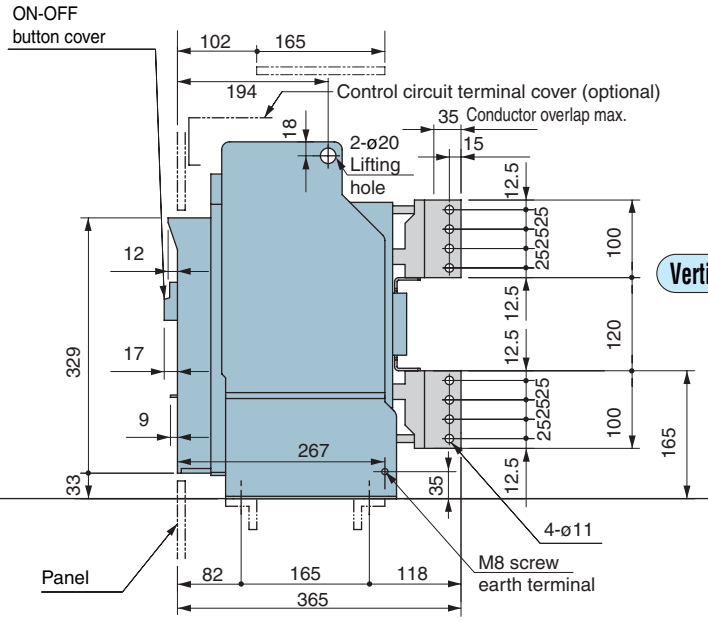
• N represents the neutral pole of 4-pole ACBs.

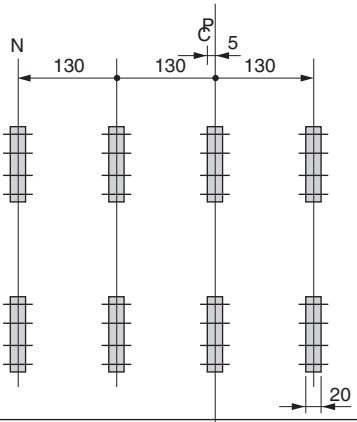
Front connections

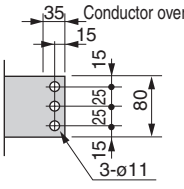




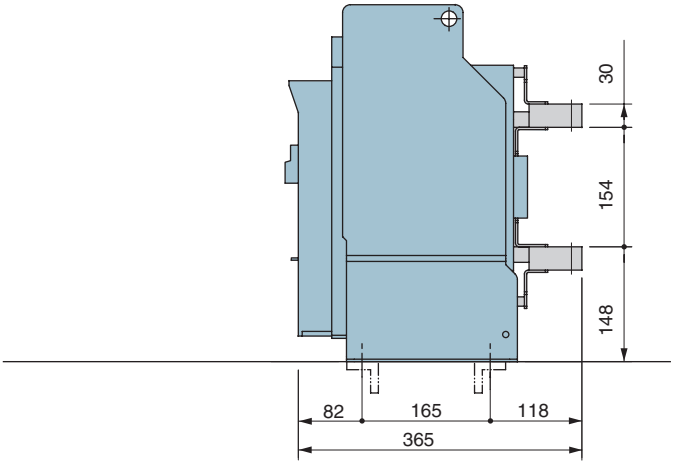
Vertical terminals

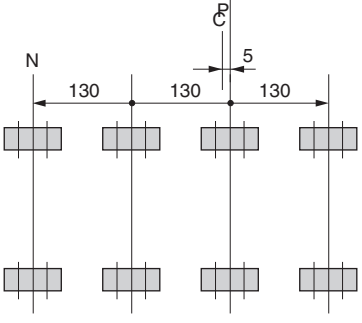






Horizontal terminals

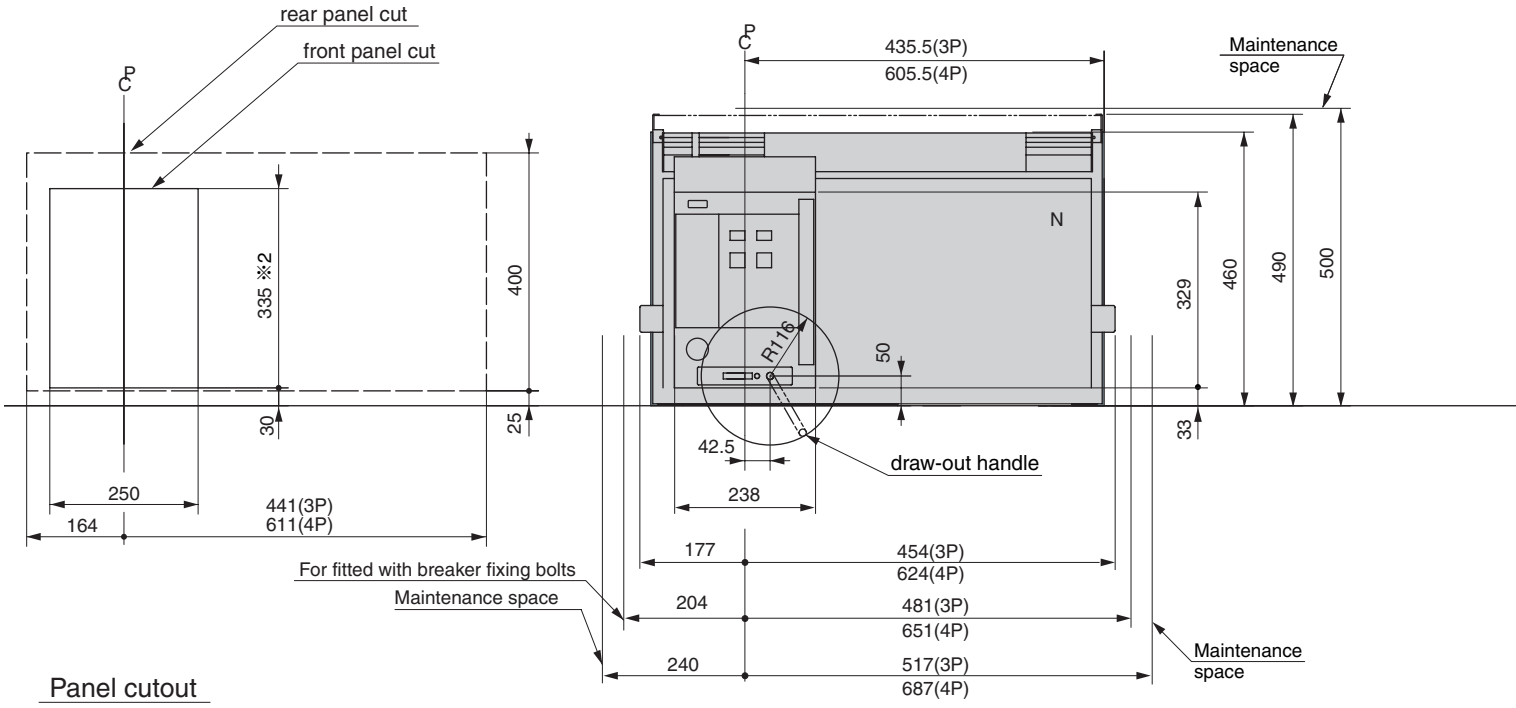




5 Outline Dimensions

•Types: AR440S Draw-out type

P: ACB Front cover center line

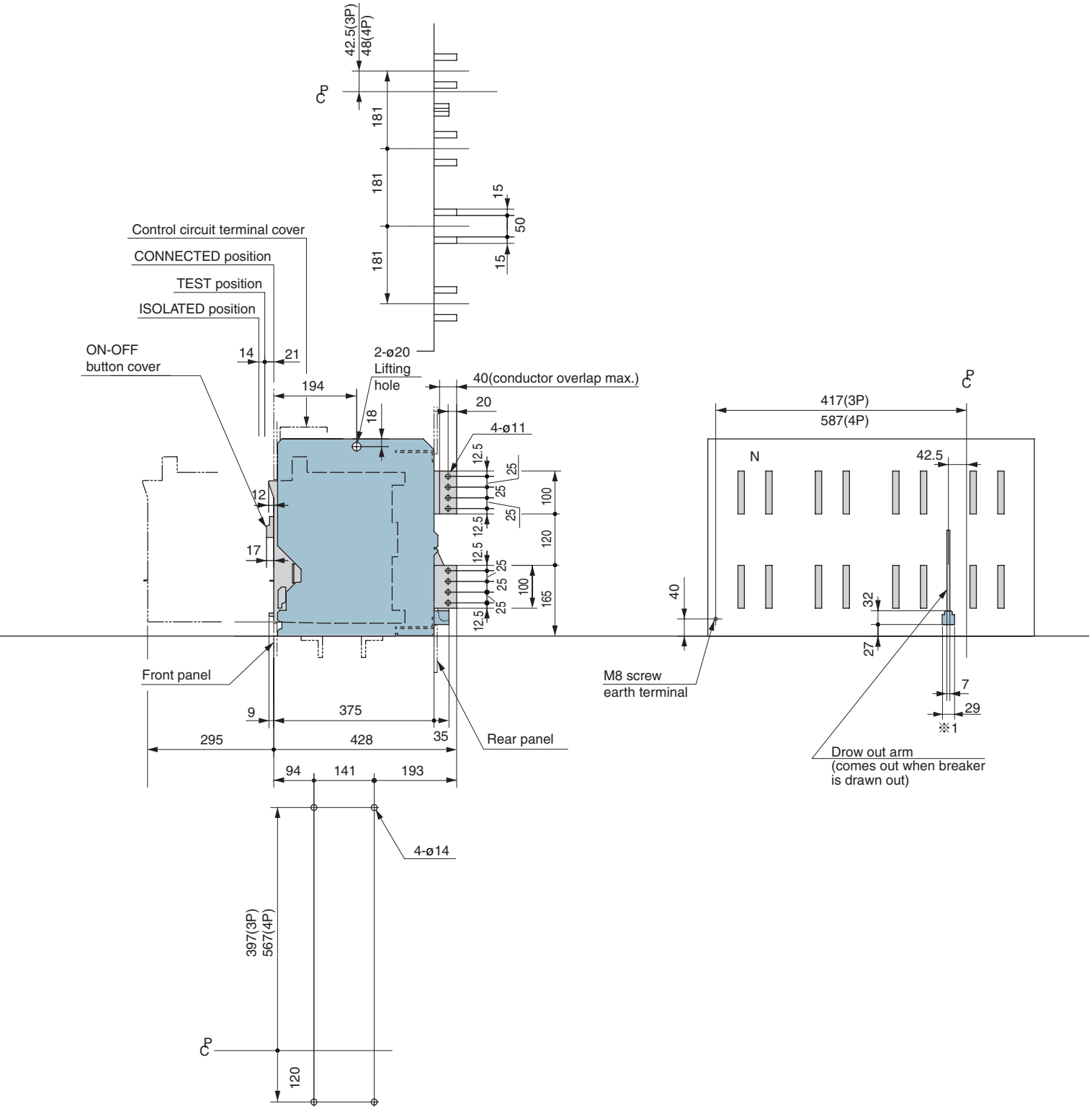


Panel cutout

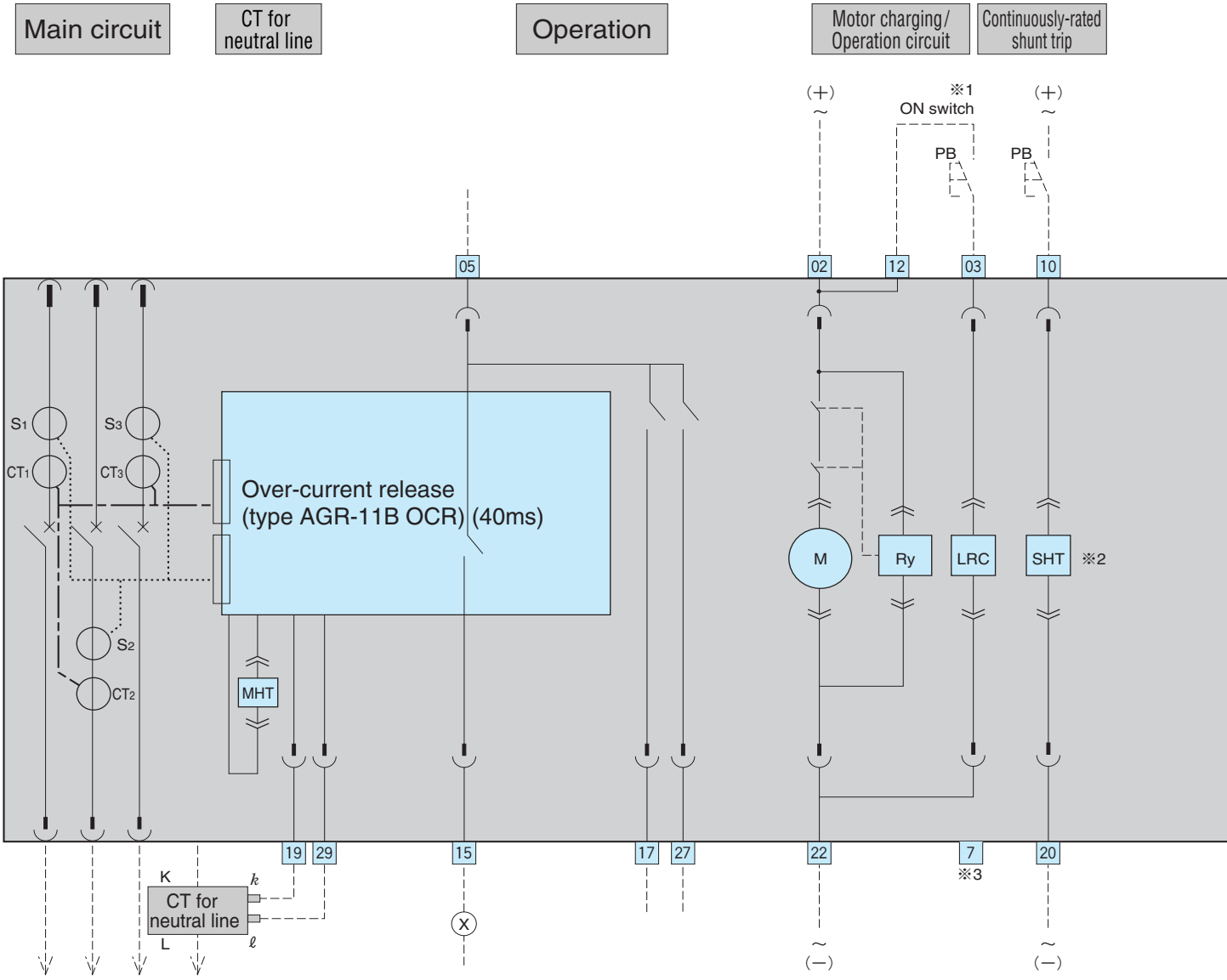
※1: Conductors including connecting bolts should be separated min-7mm from Draw-out arm.

※2: Panel cut should be 339 mm not 335 mm when the door flange is used. Refer to page 43. If IP55 door flange is used see page 44.

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


42.5(3P)
48(4P)
181
181
181
15
50
15
Control circuit terminal cover
CONNECTED position
TEST position
ISOLATED position
ON-OFF
button cover
14
21
2-ø20
Lifting
hole
194
18
40(conductor overlap max.)
20
4-ø11
12.5
25
25
25
100
12.5
120
12.5
25
25
25
100
165
12.5
25
12
17
Front panel
9
375
295
428
35
Rear panel
94
141
193
4-ø14
397(3P)
567(4P)
120
417(3P)
587(4P)
N
42.5
40
32
27
M8 screw
earth terminal
7
29
※1
Drow out arm
(comes out when breaker
is drawn out)

6 Circuit Diagram (with AGR-11B OCR)



Terminal description

Check OCR voltage before connecting.

02 22 Control power supply AC100 - 240V, DC100 - 250V, DC24V, DC48V

12 Operation switch, common

03 ON switch

05 Operation indication terminal, common

15 LT trip 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

• Do not exceed specified voltages

UVT power supply

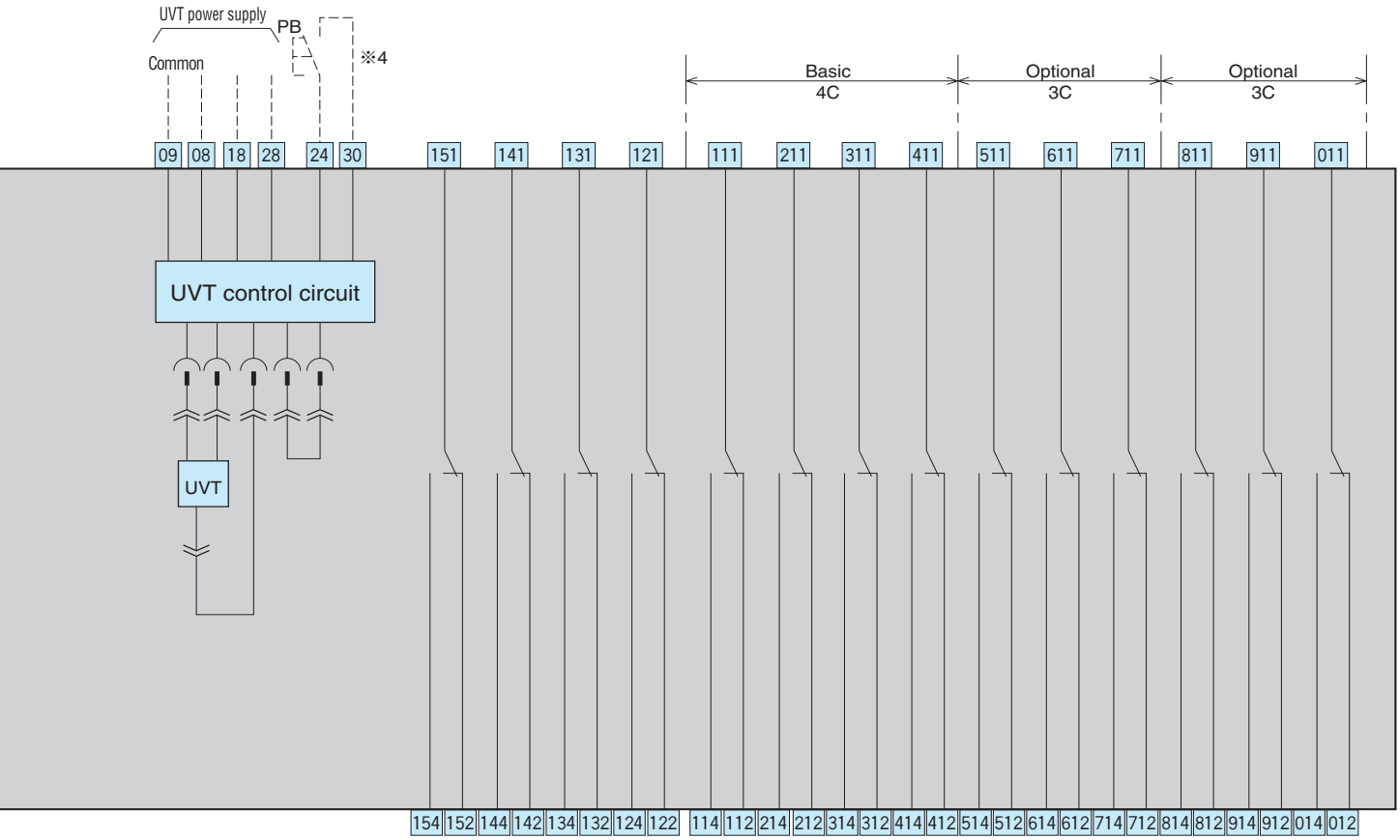
Term. No.	AC 100V unit	AC 200V unit	AC 400V unit
08 — 09	100V	200V	380V
18 — 09	110V	220V	415V
28 — 09	120V	240V	440V

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 connect "b"contact of auxiliary switch to ON switch in series, otherwise, pumping may occur.
※2: See P. 23 for the circuit diagram of the continuously-rated shunt trip device with 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 page 24 (short pulse only)

Undervoltage trip	Position switches	Auxiliary switches



Designation of terminals for auxiliary and position switches

* * *
- 1: Common
- 2: b-contact
- 4: a-contact

*
- 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

For operation sequence of position switches, see page 19.

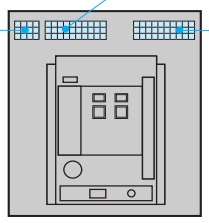
Position switches

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

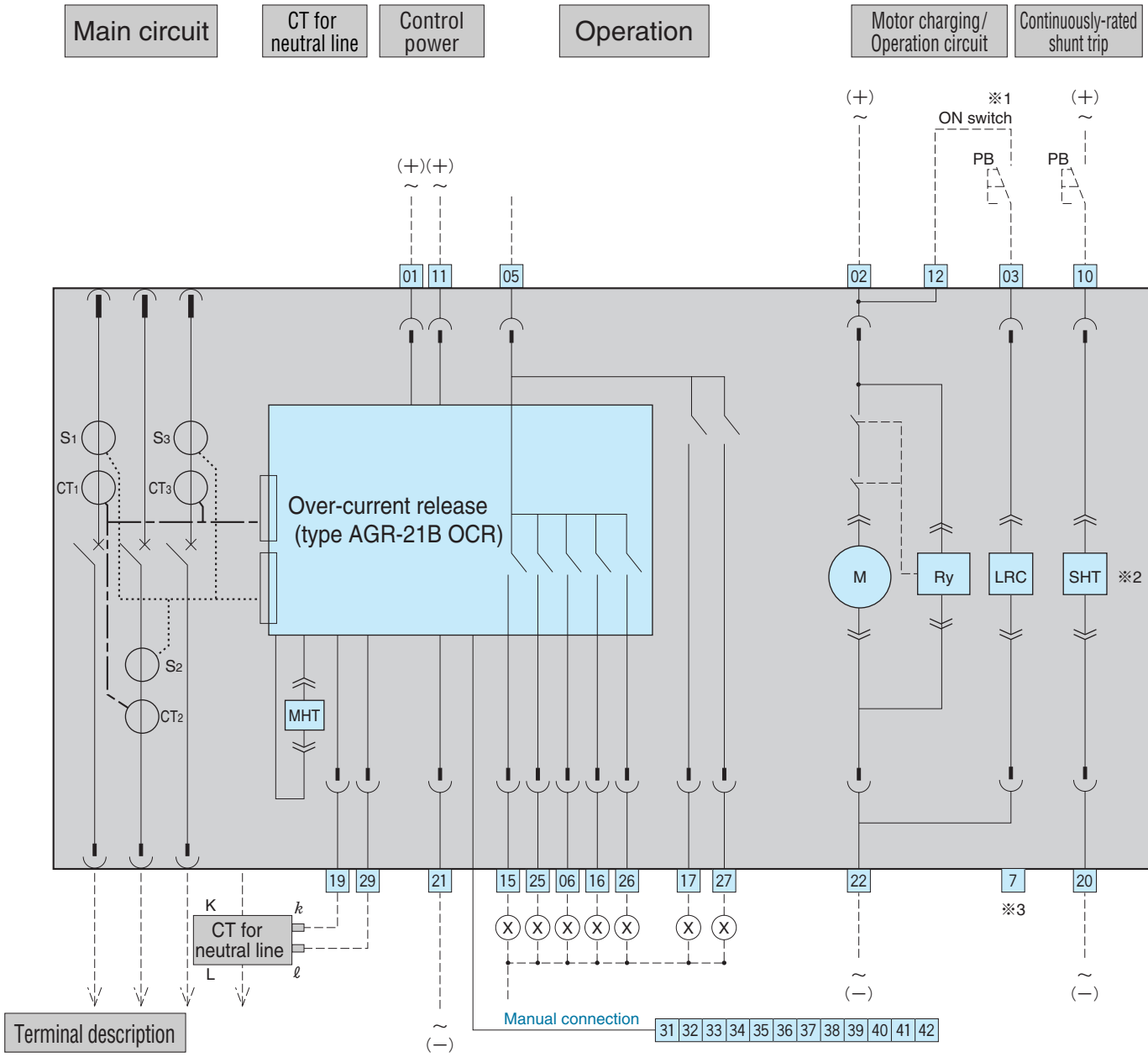
(4c + optional 6c arrangement)

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	

(4c arrangement)

111	211	311	411
114	214	314	414
112	212	312	412

6 Circuit Diagram (with AGR-21B OCR)



Check OCR voltage before connecting.

01 21 Control power supply AC200 - 240V, DC200 - 250V, DC48V

01 11 Control power supply AC100 - 120V

11 21 Control power supply AC100 - 125V, DC24V

02 22 Control power supply AC100 - 240V, DC100 - 250V, DC24V, DC48V

12 Operation switch, common

03 ON switch

05 Operation indication terminal, common

15 LT trip indication

25 ST, INST trip indication

06 PTA indication

16 GF trip indication

26 System alarm indication

17 REF, NS or trip indication

27 PTA2, UV or spring charge indication

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

35 Separate CT for REF (k)

36 Separate CT for REF (ℓ)

41, 42 Communication line

• Do not exceed specified voltages

UVT power supply

Term. No.	AC 100V unit	AC 200V unit	AC 400V unit
08 — 09	100V	200V	380V
18 — 09	110V	220V	415V
28 — 09	120V	240V	440V

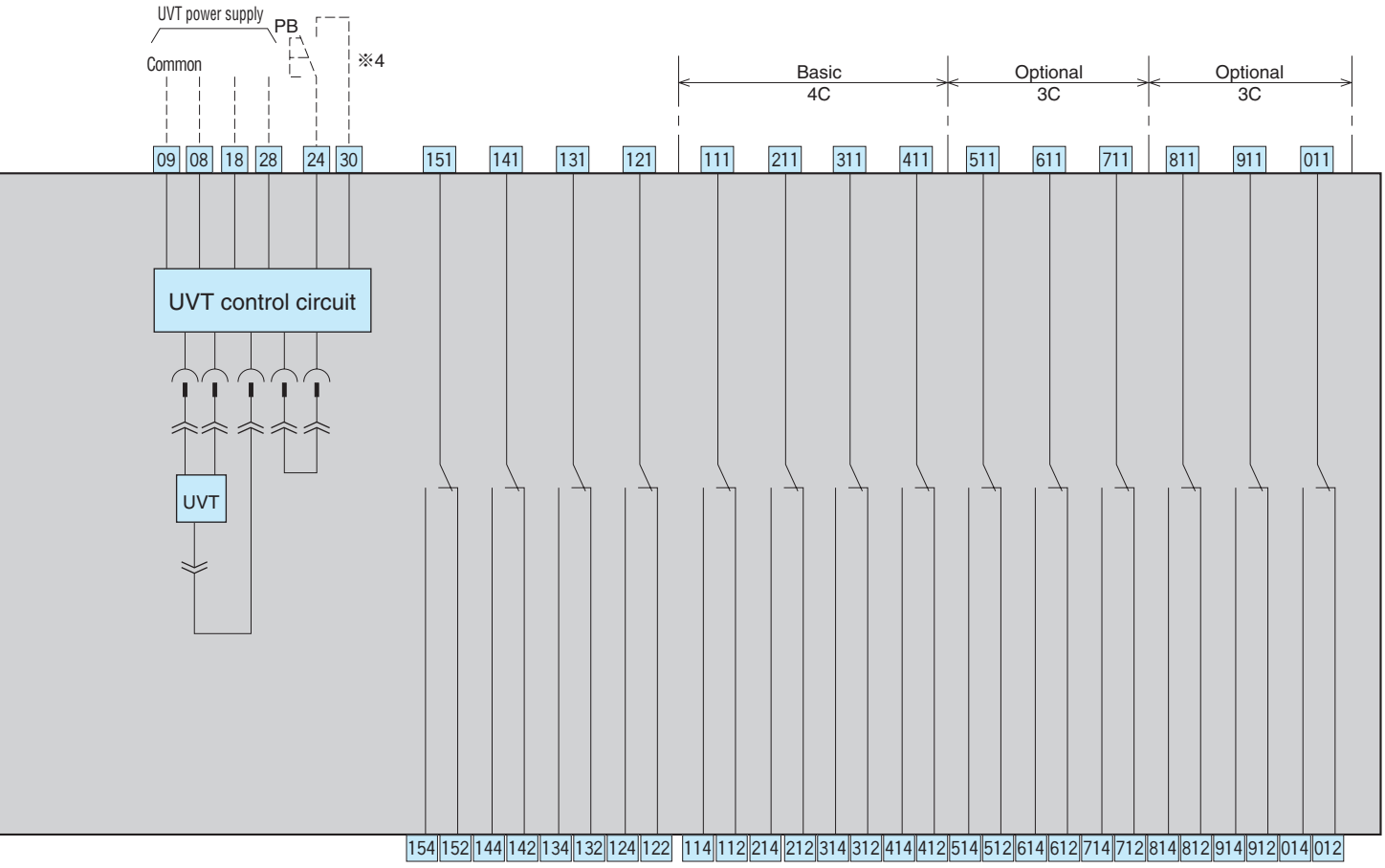
Symbols for accessories

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 connect "b"contact of auxiliary switch to ON switch in series, otherwise, pumping may occur.
※2: See P. 23 for the circuit diagram of the continuously-rated shunt trip device with 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 page 24 (short pulse only)

Undervoltage trip | Position switches | Auxiliary switches



Designation of terminals for auxiliary and position switches

* * *
- 1: Common
- 2: b-contact
- 4: a-contact

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

For operation sequence of position switches, see page 19.

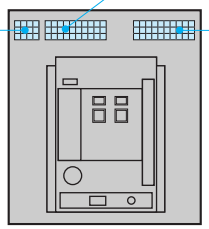
Position switches

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 + optional 6c arrangement)

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

(4c arrangement)

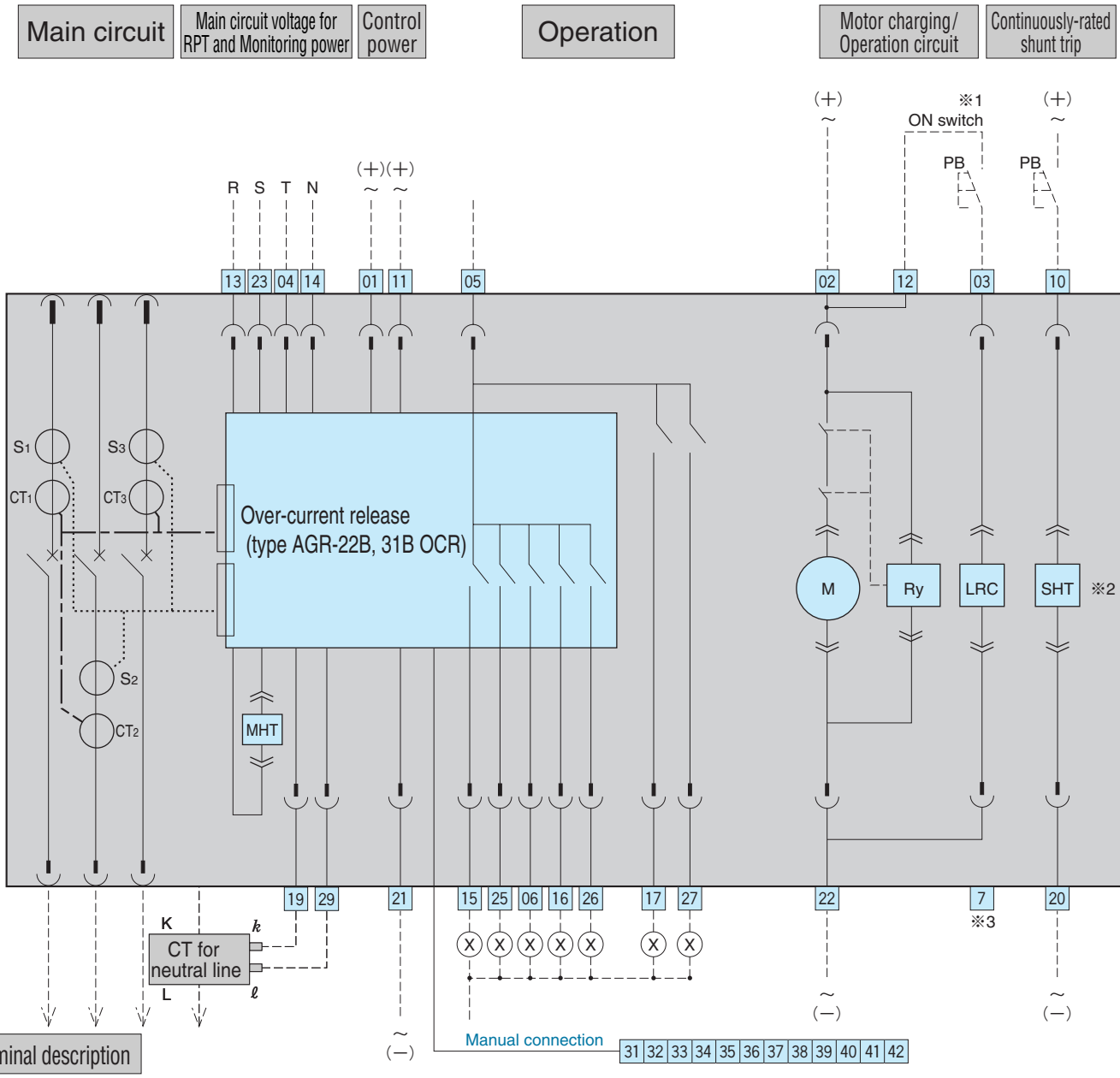
111	211	311	411
114	214	314	414
112	212	312	412

31	32	33	34	35	36	37	38	39	40	41	42

Manual connection

If the ground fault protection on the line side or communication function is incorporated, control circuit terminals are of manual connection type.

6 Circuit Diagram (with AGR-22B, 31B OCR)



Check OCR voltage before connecting.

01 21 Control power supply AC200 - 240V, DC200 - 250V, DC48V

01 11 Control power supply AC100 - 120V

11 21 Control power supply AC100 - 125V, DC24V

02 22 Control power supply AC100 - 240V, DC100 - 250V, DC24V, DC48V

12 Operation switch, common

03 ON switch

05 Operation indication terminal, common

15 LT trip indication

25 ST, INST trip indication

06 PTA indication

16 GF trip indication

26 System alarm indication

17 REF, NS or trip indication

27 PTA2, UV or spring charge indication

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

35 Separate CT for REF (k)

36 Separate CT for REF (ℓ)

41, 42 Communication line

• Do not exceed specified voltages

UVT power supply

Term. No.	AC 100V unit	AC 200V unit	AC 400V unit
08 — 09	100V	200V	380V
18 — 09	110V	220V	415V
28 — 09	120V	240V	440V

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

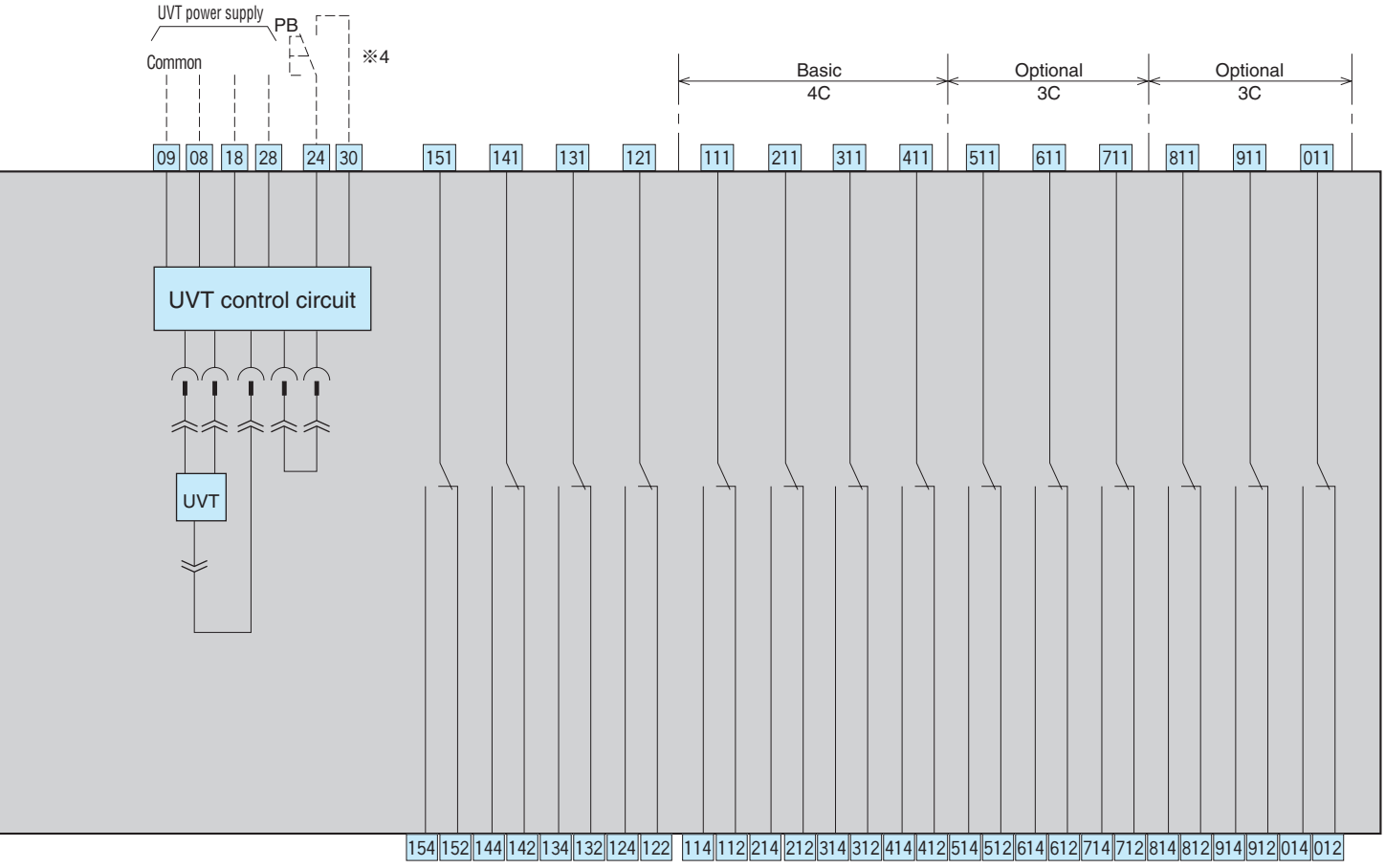
※1: Do not connect "b"contact of auxiliary switch to ON switch in series, otherwise, pumping may occur.

※2: See P. 23 for the circuit diagram of the continuously-rated shunt trip device with 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 page 24 (short pulse only)

Undervoltage trip | Position switches | Auxiliary switches



Designation of terminals for auxiliary and position switches

* * *
- 1: Common
- 2: b-contact
- 4: a-contact

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

For operation sequence of position switches, see page 19.

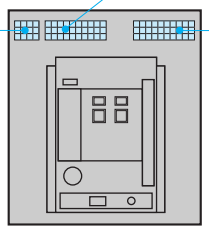
Position switches

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 + optional 6c arrangement)

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

(4c arrangement)

111	211	311	411
114	214	314	414
112	212	312	412

31	32	33	34	35	36	37	38	39	40	41	42

Manual connection

If the ground fault protection is incorporated and a separate current transformer for neutral line is used, or any one of ground fault protection on the line side, zone interlock, external display or communication function is incorporated, control circuit terminals are of manual connection type.

7 Technical Data

Dielectric strength

Circuit			Withstand voltage (at 50/60 Hz)		Rated Impulse withstand voltage U_{imp}
Main circuit			Between terminals, terminal group to earth	AC3500V for 1 minute	12kV
Control circuits	Auxiliary switches	For general service	Terminal group to earth	AC2500V for 1 minute	6kV
		For microload	Terminal group to earth	AC2000V for 1 minute	4kV
	Position switches		Terminal group to earth	AC2000V for 1 minute	4kV
	Over-current release (OCR)		Terminal group to earth	AC2000V for 1 minute	4kV
	Power supply for undervoltage/ reverse power trip function		Terminal group to earth	AC2500V for 1 minute	6kV
Other accessories			Terminal group to earth	AC2000V for 1 minute	4kV

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

Internal resistance and power consumption

• Standard Series

Type	AR208S	AR212S	AR216S	AR220S	AR325S	AR332S	AR440S
Rated current (A)	800	1250	1600	2000	2500	3200	4000
DC internal resistance per pole (mΩ)	0.033	0.033	0.028	0.024	0.014	0.014	0.014
AC power consumption for 3 poles (W)	200	350	350	490	600	780	1060

• High fault Series

Type	AR212H	AR216H	AR220H	AR316H	AR320H	AR325H	AR332H
Rated current (A)	1250	1600	2000	1600	2000	2500	3200
DC internal resistance per pole (mΩ)	0.024	0.024	0.024	0.014	0.014	0.014	0.014
AC power consumption for 3 poles (W)	260	350	490	310	430	600	780

Weight

Type	AR208S~212S		AR216S		AR220S AR212H~220H		AR325S~332S AR316H~332H		AR440S	
	3P	4P	3P	4P	3P	4P	3P	4P	3P	4P
Draw-Out Body (Kg)	45	51	46	52	46	52	56	68	71	92
Draw-Out Chassis (Kg)	28	35	30	38	33	42	49	57	68	84
Total Draw-Out Weight (Kg)	73	86	76	90	79	94	105	125	139	176
Fixed (Kg)	53	59	54	60	54	60	80	92		

Note: The above weights are based on normal specifications with the OCR and standard accessories

Derating

• Standard Series

Based Standards	Ambient temperature (°C)	Type	AR208S	AR212S	AR216S	AR220S	AR325S	AR332S	AR440S
		Connecting bar sizes	2×50×5t	2×80×5t	2×100×5t	3×100×5t	2×100×10t	3×100×10t	4×150×6t
IEC60947-2 EN 60947-2 AS3947.2	40 (Standard ambient temperature)		800	1250	1600	2000	2500	3200	4000
	45		800	1250	1600	2000	2500	3200	4000
	50		800	1250	1600	2000	2500	3200	4000
	55		800	1200	1540	1820	2500	2990	3940
	60		800	1150	1460	1740	2400	2850	3760
NEMA, SG-3 ANSI C37.13	40 (Standard ambient temperature)		800	1250	1540	2000	2500	3200	3700
	45		800	1190	1470	1960	2500	3010	3580
	50		800	1130	1390	1860	2440	2860	3470
	55		790	1070	1310	1750	2300	2690	3350
	60		740	1000	1230	1640	2150	2520	3140
JIS C8372	40 (Standard ambient temperature)		800	1250	1600	2000	2500	3200	3700
	45		800	1250	1600	1900	2500	2900	3580
	50		800	1190	1540	1820	2500	2800	3470
	55		800	1130	1460	1740	2400	2710	3350
	60		800	1080	1390	1650	2280	2610	3230

Note: The values are applicable for both Draw-out type and Fixed type.
The values of AR208S, AR212S and AR216S are for horizontal terminals on both line and load side.
The values of AR220S, AR325S, AR332S 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

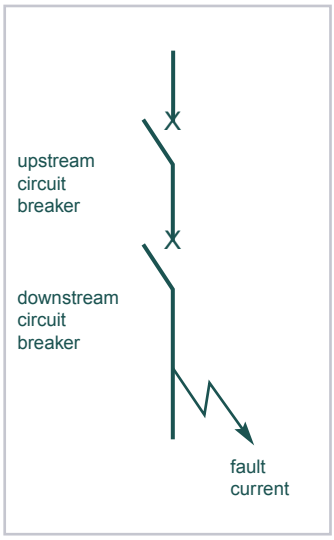
Based Standards	Ambient temperature (°C)	Type	AR212H	AR216H	AR220H	AR316H	AR320H	AR325H	AR332H
		Connecting bar sizes	2×80×5t	2×100×5t	3×100×5t	2×100×5t	3×100×5t	2×100×10t	3×100×10t
IEC60947-2 EN 60947-2 AS3947.2	40 (Standard ambient temperature)		1250	1600	2000	1600	2000	2500	3200
	45		1250	1600	2000	1600	2000	2500	3200
	50		1250	1600	2000	1600	2000	2500	3200
	55		1250	1600	1820	1600	2000	2500	2990
	60		1250	1550	1740	1600	2000	2400	2850
NEMA, SG-3 ANSI C37.13	40 (Standard ambient temperature)		※	1600	2000	※	※	2500	3200
	45		※	1600	1960	※	※	2500	3010
	50		※	1600	1860	※	※	2440	2860
	55		※	1510	1750	※	※	2300	2690
	60		※	1420	1640	※	※	2150	2520
JIS C8372	40 (Standard ambient temperature)		1250	1600	2000	1600	2000	2500	3200
	45		1250	1600	1900	1600	2000	2500	2900
	50		1250	1600	1820	1600	2000	2500	2800
	55		1250	1550	1740	1600	2000	2400	2710
	60		1250	1480	1650	1600	1900	2280	2610

Note: 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.
※: Contact Terasaki for details.

7 Application Data

What Is Discrimination?

Discrimination, also called selectivity, is the co-ordination of protective devices such that a fault is cleared by the protective device installed immediately upstream of the fault, and by that device alone.



Total discrimination

Discrimination is said to be total if the downstream circuit breaker opens and the upstream circuit breaker remains closed. This ensures maximum availability of the system.

Partial discrimination

Discrimination is partial if the above condition is not fulfiled up to the prospective short-circuit current, but to a lesser value, termed the selectivity limit current (Is).

Above this value both circuit breakers could open, resulting in loss of selectivity

How To Read The Discrimination Tables

Boxes containing the letter “T” indicate total discrimination between the relevant upstream and downstream circuit-breakers. Total discrimination applies for all fault levels up to the breaking capacity of the upstream or the downstream circuit breaker, whichever is the lesser.

For the other boxes, discrimination is either partial or there is no discrimination.

Worked Examples

Q (1) A main switchboard requires a 1600A ACB feeding a 400A MCCB.The fault level is 65kA. What combination of protective devices would provide total discrimination?

A (1) A ***TemPower2 ACB*** AR216S feeding a ***TemBreak2*** S400GJ would provide total discrimination up to 65kA. See page 65

Note: Discrimination would be total whether the ***TemPower2 ACB*** had an integral or external protection relay because Icw (1s) = Ics. Most other ACBs have Icw(1s) < Ics.

Discrimination Table

Upsream: ***TemPower2 ACB*** with or without Integral Protection Relay

Downstream: ***TemBreak2 MCCB***

Upstream ACB

Downstream MCCB																	
Frame			800A		1250A		1600A		2000A		2500A		3200A		4000A	5000A	6300A
	Model		AR208S	AR208H	AR212S	AR212H	AR216S	AR216H	AR220S	AR220H	AR325S	AR325H	AR332S	AR332H	AR440S	AH50C	AH60C
		Breaking Capacity	65kA	80kA	65kA	80kA	65kA	80kA	65kA	80kA	85kA	100kA	85kA	100kA	100kA	100kA	120kA
125A	E125NJ	25kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S125NJ	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S125GJ	65kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	H125NJ	125kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	L125NJ	200kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
160A/ 250A	S160NJ	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S160GJ	65kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	E250NJ	25kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S250NJ	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S250GJ	65kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S250PE	70kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	H250NJ	125kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	L250NJ	200KA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
400A/ 630A	E400NJ	25kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400CJ	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400NJ	50kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400NE	50kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400GJ	70kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400GE	70kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	H400NJ	125kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	H400NE	125kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	E630NE	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S630CE	50kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S630GE	70kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
800A	XS800NJ	65kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	XH800SE	65kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	XH800PJ	100kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	XS800SE	50kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
1250A/ 1600A	XS1250SE	65kA	-	-	T	T	T	T	T	T	T	T	T	T	T	T	T
	XS1600SE	85kA	-	-	-	-	T	T	T	T	T	T	T	T	T	T	T

Notes: 1. All ACB's have I_i set at NON, MCR ON.
2. Assuming ACB time settings are greater than MCCB.
3. The above table is in accordance with IEC 60947-2, Annex A.
4. External relay can be used - Contact Terasaki for further details.
5. All values shown at 400V AC.

T= Total Selectivity

7 Application Data

Discrimination with 'T' type fuses

The following table should be used as a guide when selecting Terasaki *Tempower2* Air Circuit Breakers and fuses (BS88/ IEC269) which are immediately downstream from a transformer.

In and I_R are set to the full rated current of the transformer, and t_R, Isd and tsd are at standard transformer settings. Listed are the maximum fuse ratings that can be used when downstream from a given ACB at these settings.

Also included are the maximum fuse ratings that can be used downstream when t_R, Isd and tsd are at their maximum settings.

All information listed is based on a transformer secondary voltage of 415V.

TRANSFORMER	kVA	500	630	750	800	1000	1250	1600	2000
	F.L.C. (A)	696	876	1043	1113	1391	1739	2226	2782
TemPower2	Type	***AR208S***	***AR212S***	***AR212S***	***AR212S***	***AR216S***	***AR220S***	***AR325S***	***AR332S***
	C.T. (A)	800	1250	1250	1250	1600	2000	2500	3200
SETTINGS **(AGR-L)**	In	1	0.8	1	1	1	1	1	1
	I_R	0.9	0.9	0.85	0.9	0.9	0.9	0.9	0.9
	t_R (sec)	20	20	20	20	20	20	20	20
	Isd	6	6	6	6	6	6	6	6
	tsd (mcec)	400	400	400	400	400	400	400	400
Max.fuse rating with standard ACB settings	Note:1 (Amps)	355	400	500	500	500	630	800	1000
Max.fuse rating with maximum ACB settings	(Amps)	450	500	670	710	800	1000	1250	1250 Note:2

> The above 'In' settings are based on 100% of Rated Current (Ict).

> Table Reference : I_R - Long Time Delay Pickup Current, t_R - Long Time Delay Time Setting, Isd - Short Time Delay Pickup Current, tsd - Short Time Delay Time Setting.

Notes:

Note:1 It is possible to increase the maximum fuse rating by utilising the 'ramp' facility on the on the *TemPower2* Protection Relay (AGR).

Note:2 Information on fuses above 1250A rating was not available.

Note:3 All ACBs have Ii (Instantanious) set to NON. (MCR can be set to ON)

Please note the above table is meant only for guidance, individual installations should have a specific discrimination study undertaken.

Accessories For Dual Supply Changeover Systems Accessories

TemTransfer Automatic Changeover Controller

The ***TemTransfer*** is a fully configurable Automatic Changeover Controller (ACC). It is designed to monitor the incoming AC mains supply (1 or 3 phases) for under/over voltage and under/over frequency. Should these fall out of limits, the module will issue a start command to the generating set controller. Once the set is available and producing an output within limits the ACC will control the transfer devices and switch the load from the mains to the generating set. Should the mains supply return to within limits the module will command a return to the mains supply and shut down the generator after a suitable cooling run. Various timing sequences are used to prevent nuisance starting and supply breaks.

TemTransfer is compatible with ***TemPower2 ACB***s, ***TemBreak2 MCCB***s and ***TemContact*** contactors.

Terasaki can supply ***TemTransfer*** pre-configured to specification, or unconfigured with an optional interface kit.

Configuration is by PC based software and the interface kit using an FCC68 socket on the rear of the module. This allows rapid and secure configuration of the module. The FCC68 socket also provides full real-time diagnostics on the status of the ACC, its inputs and outputs.

Configuration and connection options allow for a wide range of higher functions such as *'Auto start inhibit', 'Manual restore to mains', 'Load inhibit'*(both mains and gen-set)*, 'Lamp test', Push-button transfer control, External mains or Gen-set failure inputs,* etc. The four position key-switch allows for mode selection:-

- Auto Mode
- Auto mode with manual return to Mains
- Run generator off load
- Run generator on load

A clear mimic diagram with 'International' symbols and LEDs provide clear indication of supply availability and load switching status. Further LED indication is provided for 'Start delay in progress' and 'Mains return timer active'. Two user configurable LED's are provided to allow the user to display specific states (defaulted to indicate that the closing procedure of the Mains or Generator circuit breaker has been started).

Five user configurable relays are provided to allow control of contactors, different circuit breaker types and engine control modules and alarm systems.

The controller features a self seeking power supply which will utilise power from the Mains AC supply or the Generator AC supply. A DC supply to the module is not essential for basic operation, though some 'higher' functions require it (such as system diagnostics).

The module is mounted in a robust plastic case, connection to the module is via plug and socket connectors.

8 TemPower Order Form

COMPANY NAME:	**EMAIL ADDRESS:**
CONTACT NAME:	**ORDER NUMBER:**
TELEPHONE NUMBER:	**QUANTITY:**
FAX NUMBER:	**DELIVERY TIME REQUEST :**

1.TemPower 2 ACB: Enter the desired rating of ACB in the appropriate box. (Refer to catalogue for ratings)

Air Circuit Breaker	800A		1250A		1600A		2000A		2500A		3200A		4000A	
No of Poles	3P	4P	3P	4P	3P	4P	3P	4P	3P	4P	3P	4P	3P	4P
AR-S	AR208S		AR212S		AR216S		AR220S		AR325S		AR332S		AR440S	
Enter rated current in Amps (Ict)														
AR - 2H	---		AR212H		AR216H		AR220H		----		-----		-----	
Enter rated current in Amps (Ict)	---	---							---	---	---	---	---	---
AR - 3H	---		---		AR316H		AR320H		AR325H		AR332H		-----	
Enter rated current in Amps (Ict)	---	---	---	---									---	---

2.Type of Mounting, Connections and Shutters: Tick required boxes.

Fixed Pattern. ☐ Drawout Pattern. ☐

	Horizontal	Vertical	Front
Top - Connections.			
Bottom - Connections.			

Control Circuit Terminal Cover ☐
Main Circuit Shutters ☐
Control Circuit Shutters ☐

3.AGR - Protection Relay and Protection Options: Tick required boxes.

Non Automatic. ☐ **Go to Section 4 - Internal Accessories.**

Protection Functions	**AGR 11B** Standard Protection - Dial	**AGR 21/22B** Standard Protection - LCD				**AGR 31B** Enhanced Protection - LCD			
	AGR-11BL	AGR-21BL	AGR-21BR	AGR-21BS	AGR-22BS	AGR-31BL	AGR-31BR	AGR-31BS	----
AL		---	---	---	---	---	---	---	---
PS	---				---	N1	N1		---
GL		---	---	---	---	---	---	---	---
PG	---			---	---			---	---
PR	---	---	---	---		---	---		---
Protection Options									
N-Phase Protection -NP.				---	---			---	---
S1-Contact Temperature Monitoring - OH.	---	---	---	---	N2	N2	N2	N2	---
S1-Trip Indicator.		N2	N2		N2	N2	N2	N2	---
S1-Reverse Phase Protection - NS.	---	N2	N2	---	---	N2	N2	---	---
S1-Restricted Ground Fault - REF. **N4**	---	N2	N2	---	---	N2	N2	---	---
S2-Second Pre -Trip Alarm - PTA2.	---	---	---	---	N3	---	---	N3	---
S2-Undervoltage Alarm - UV.	---	---	---	---	N3	N3	N3	N3	---
S2-Spring Charge Indicator.					N3	N3	N3	N3	---
Zone Interlock - Z.	---	---	---	---					---
Communication - C.	---								---
External Display.	---	---	---	---	N1	N1	N1	N1	---
Earth Leakage - ELT.	---	---	---	---	---	N1	N1	---	---

Please specify control voltage: AC100 -120V ☐ AC200 - 240V ☐ DC24V ☐ DC48V ☐ DC100 -125V ☐ DC200 - 250V ☐

Example of AGR Description

AGR	- 21BL	- P	S

KEY:
Protection Relay Family.
Protection Relay Group.
Protection Function and Indication.
A = LSI PROTECTION.
G = A + UNRESTRICTED GROUND FAULT PROTECTION.
P = A + PRE TRIP ALARM.
R = A + REVERSE POWER.

All AGR-B Protection Relays have individual operation contact indicators except the AGR-11B, which has a single operation contact indicator.

Specify generator full load current (In) if applicable - _____ Amps

NOTES:
N1 - Soon to be available.
N2 - Only one function can be selected from section **S1.**
N3 - Only one function can be selected from section **S2.**
N4 - Restricted Ground Fault only available with PG function.

4.Internal Accessories: Tick required boxes.

4AB Auxiliary Switches	☐	*For Marine Application 4AB Auxiliary Switches	☐
7AB Auxiliary Switches (Refer to Page 40)	☐	7AB Auxiliary Switches (Refer to Page 40)	☐
10AB Auxiliary Switches (Refer to Page 40)	☐	10AB Auxiliary Switches (Refer to Page 40)	☐
4AB Standard + 3AB Gold (Refer to Page 40)	☐	4AB Standard + 3AB Gold (Refer to Page 40)	☐
7AB Standard + 3AB Gold (Refer to Page 40)	☐	7AB Standard + 3AB Gold (Refer to Page 40)	☐

	Insert	Isolated	Test	Conn	
2 Position Switches (Write a '0', '1' or a '2', total 2)					= Total 2.
4 Position Switches (Write a '0', '1' or a '2', total 4)					= Total 4.

Non-Auto Trip Indication Switch-Normal (Not Ready to Close)	☐	Non-Auto Trip Indication Switch-Gold (Not Ready to Close)	☐
Non-Auto Spring Charge Switch-Normal	☐	Non-Auto Spring Charge Switch-Gold	☐
Capacitor Shunt Trip 110 AC (Not Available with Fixed Type UVT)	☐	Open/Close Cycle Counter	☐
Double Closing Coil 24V DC Only (Short Rated)	☐		
Double Shunt Trip Coil 24V DC Only (Short Rated)	☐	*Marine Application - Auxiliary switch only operates in the connected position.	
Split Circuit** (For Motor and Closing Coil)	☐	**Split Circuit - Voltages for the motor and closing coil must be indicated below.	

AC - Control Voltage	AC100	AC110	AC120	AC200	AC220	AC230	AC240	AC380	AC400	AC415	AC440
Shunt Trip Continuously Rated (Short Rated with Fixed Type UVT)								—	—	—	—
Motor Operator and Closing coil	—		—	—							
Closing Coil (Split Circuit)**	—		—	—							
Motor Operator (Split Circuit)**	—		—	—							
Undervoltage Trip Device - Instantaneous	—		—	—							
Undervoltage Trip Device - Time-Delay	—		—	—							

DC - Control Voltage	DC24	DC30	DC48	DC100	DC110	DC125	DC200	DC220	DC250
Shunt Trip Continuously Rated (Short Rated with Fixed Type UVT)									
Motor Operator and Closing coil		—		—			—		—
Closing Coil (Split Circuit)**		—		—			—		—
Motor Operator (Split Circuit)**		—		—			—		—
Undervoltage Trip Device - Instantaneous	N1	—	N1	—	N1	—	—	—	—

See page 2 of 2 for External Accessories, Locking/Interlocking Systems and Earthing devices.

5.External Accessories: Tick required boxes.

Door Flange IP20		IP55 Transparent Cover	
Door Flange IP31		Fixing Blocks	
Standard Drawout Handle		Test Jumper	
Storage Drawout Handle		Auto-Discharge	
Insertion Prevention Device (Insert Code in Box)		Lifting Plates	
InterPole Barriers (Not Applicable for Front Connections)		OCR Checker	
Step Down Transformer For Motor Use (P380-440V/S220V)		Main Shutter Padlock Device	
Tropicalisation Treatment			
Anti-Corrosion Treatment			
Cold Climate Treatment		Lifter Loader AWR-1	For AR 2 & 3
Test Report (Enter Number of Copies in Box)		AWR-2	For AR 2, 3 & 4

6.Locking and Interlocking Systems: Tick required boxes.

Horizontal Mechanical Interlock for three ACBs, Gen. ACB Interlocked with outer ACBs	Type A
Horizontal Mechanical Interlock for three ACBs, two from three	Type B
Horizontal Mechanical Interlock for two ACBs, one from two	Type C
Horizontal Mechanical Interlock for three ACBs, one from three	Type D

Type A - Indicate position of Gen. ACB — Left | Cent | Right

All Types - Pitch 'P1'(1st & 2nd), 'P2' (2nd & 3rd) — P1= mm P2= mm

Vertical Mechanical Interlock for two ACBs, one from two

Enter Vertical Pole Pitch 'P' Between ACBs — P= mm

Door Interlock — Indicate type of drawout handle required Section 5 – External Accessories.

Cylinder lock (Lock in Off) and key

Cylinder lock (Lock in On) and key

Lock in Off Padlock Facility

Castell Fitting (Lock in Off) - Facility only — Tick One Box

Castell Fitting (Lock in On) - Facility only

Castell Lock (Lock in Off) and Key (Factory fitted) — Enter Castell symbol required.

Castell Lock (Lock in On) and Key (Factory fitted) — Enter Castell symbol required.

7.Earthing Devices: Tick required boxes.

Body (Portable) Chassis (Permanent)

Earthing Device Note:

Not available with front connections.

Not recommend with a UVT, as manual disconnection is required.

For Customer Notes or References.

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