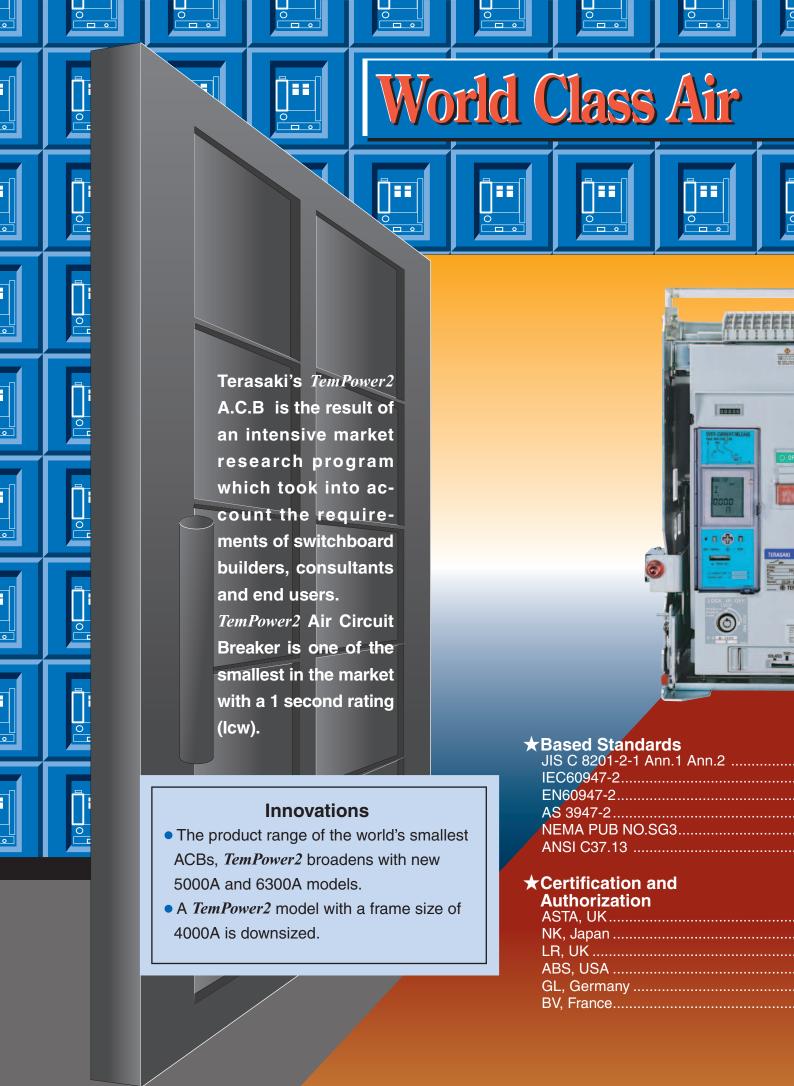


Innovations 2018



TemPowerACB Double Breaker

- Two Steps Ahead









.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

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1 Features

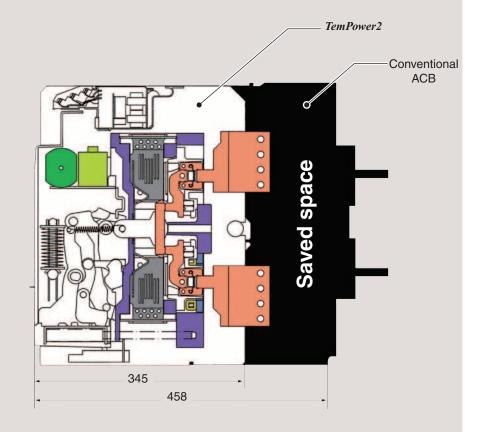
The ultimate in compactness and operational capability



 I_{cw} , 1s = I_{cs} 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 (I_{cw}, 1sec) is equal to the service short-circuit breaking capacity (I_{cs}) 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.

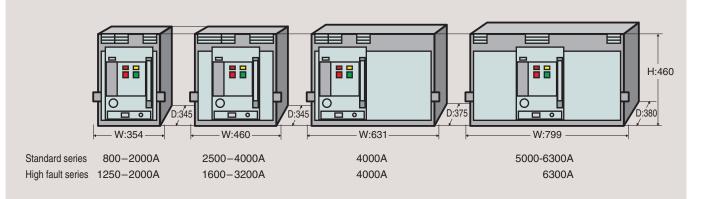


Terasaki's core business belief is commitment to our customers and the progressive innovation of the *TemPower2* AR ACB. With this in mind we are introducing our new **AR440SB** (**Compact**) **4000A ACB** and new **AR6 - 5000A and 6300A ACB**. With the introduction of these new ACBs there will be a solution from 800A to 6300A all with the same front cover dimension and standardized accessories throughout the range.

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.

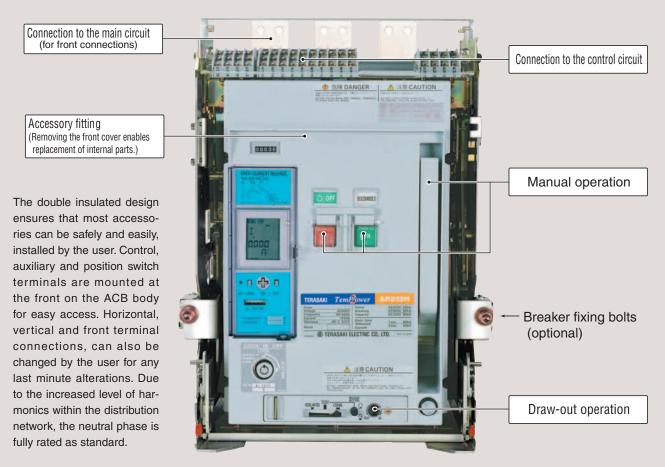






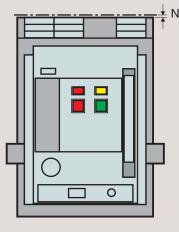
Increased accessibility from the front

It enhances ease of installation, operation, and maintenance.





No extra arc space required, vertical stacking permitted



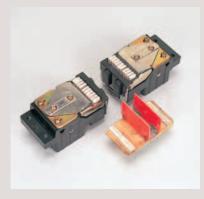
No extra arc space required

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.



: Not possible on AR6

1 Features

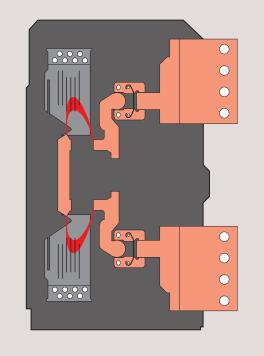
A high performance and reliability



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.



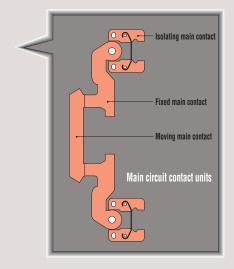
: Except AR6



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.



: Except AR6



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

- Long time delay
- Short time delay
- Instantaneous

At Terasaki our protection relays have 'LSI' characteristics as standard.

This provides an adjustable time delay on overload (L) and also the l²t 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 inter-

locking is available to provide zero time delay selectivity.

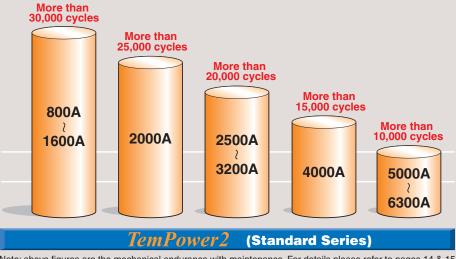
As the rated breaking capacity is identical to the rated short-time withstand current full selectivity can be achieved.

| Type and rated current | | AR208S AR212S AR216S | 1250A | AR212H AR216H AR220H | | AR325S AR332S | | AR316H AR320H AR325H | | AR440SB 4000A AR440S 4000A | AR650S 5000A AR663S 6300A | AR663H 5000A 6300A |
|---|--|----------------------------|-------|----------------------------|-------|------------------|----|----------------------------|----|-------------------------------|------------------------------|-----------------------|
| Performance | | AR220S | 2000A | | 2000A | | | AR332H | | | | |
| breaking | breaking current With ST delay trip function | | κA | 801 | κA | 851 | κA | 100 | kA | 100kA | 120kA | 135kA |
| 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.



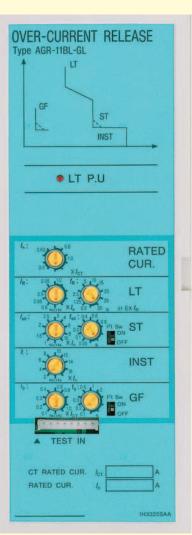
Note: above figures are the mechanical endurance with maintenance. For details please refer to pages 14 & 15.

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.

Backlit LCD optional



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 28-29



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 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.



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

The AGR-31B OCR comes standard with the backlit LCD display. It can monitor and indicate phase currents, voltages, power, energy, power factor, frequency, and more. For features refer page 27. The backlit LCD is optional for AGR-21B and AGR-22B.



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.

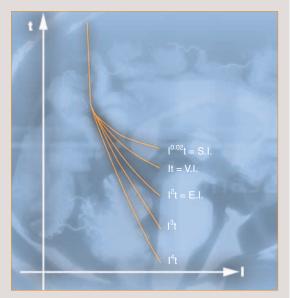
- S.I. Standard Inverse
- V.I. Very Inverse
- E.I. Extremely Inverse

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.)

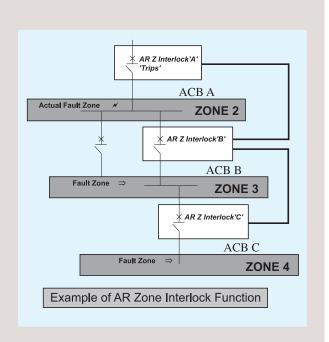


Zone Interlocking

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.







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.



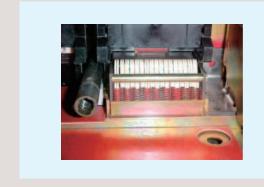


Earthing Device

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 42



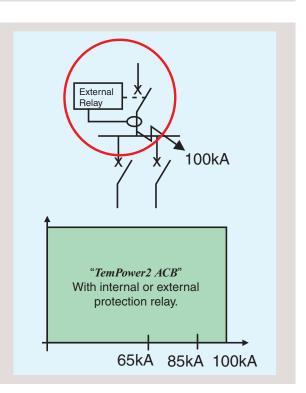


Protection relay performance

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.

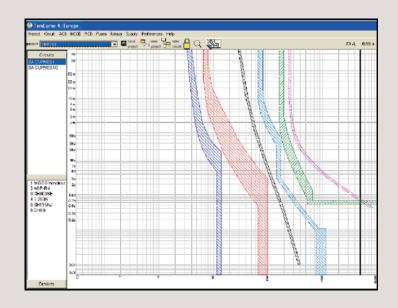


T Features



Tem Curve

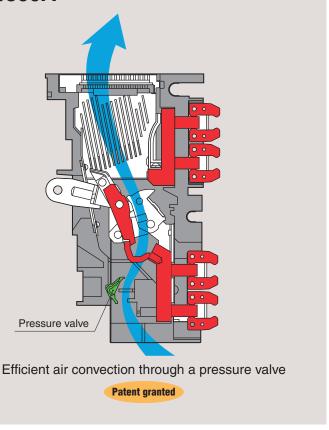
TemCurve Selectivity Analysis Software is shaped around the extensive range of Terasaki circuit breakers, but also includes a large number of complimentary protective devices such as High and Low Voltage Fuses to BS88/IEC60269, IDMT Relays to BS142/IEC60255. As a result, TemCurve can assist in protection device grading from the transformer primary to the point of final distribution, giving the facility to produce overcurrent and earth fault studies.





Maximum rated current of 6300A

The AR6 air circuit breaker interrupts the current at two points on the line side while dissipating heat from contacts or terminals by efficient air convection through a pressure valve.







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 an optional 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 | The tripping coil is always monitored for |
|------------------|--|
| monitoring | 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 | Phase current I_1 , I_2 , I_3 , I_N , I_g and max current lmax are measured and transmitted. |
|----------------------|--|
| Line-to-line voltage | V ₁₂ , V ₂₃ and V ₃₁ are measured. |
| Active power | Three-phase power and the reverse power are measured. |
| Demand active power | Active power demand (over time) and historical max. power are recorded. |
| Accumulated power | Accumulated power is measured. |
| Power factor | Circuit power factor is measured. |
| Frequency | Frequency is measured. |

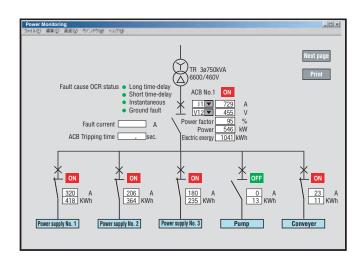
Note) Above is for type AGR-31 OCR.

Type AGR-21 and AGR-22 measure only phase current.

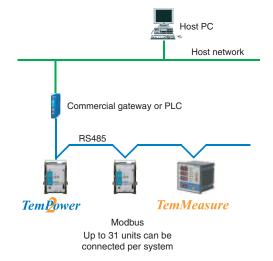
Network interface I/O specifications

| 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 – 31 |

On-screen PC monitor

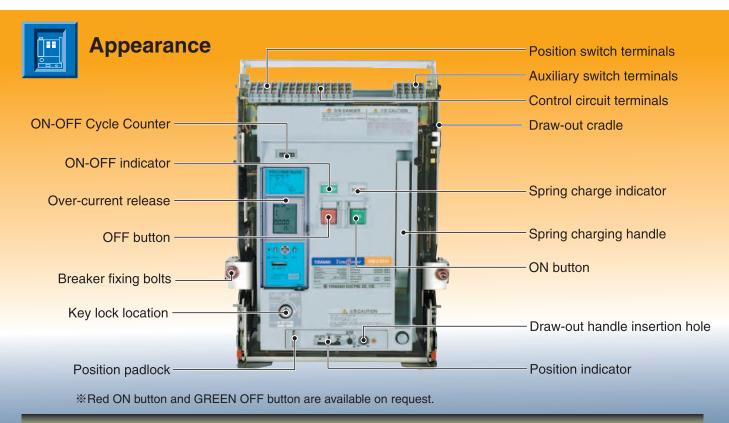


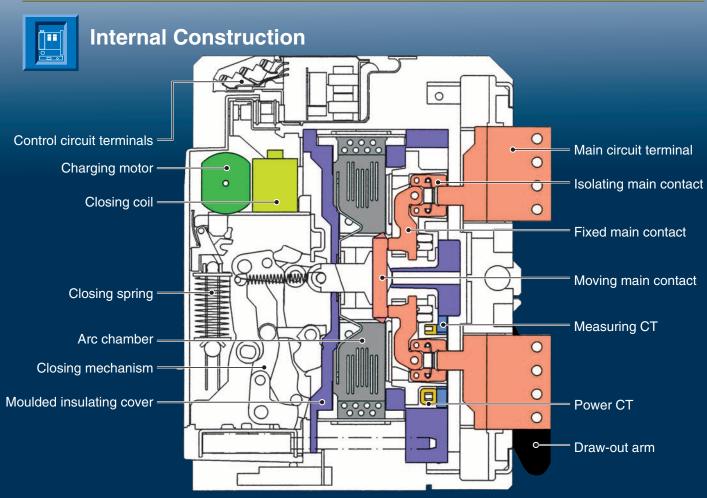
Communication network













| RATED CURRENT (may) (A) 38/32, EC, EN, AS 8800 1250 1250 1540 1600 1600 2000 20 20 20 20 20 20 | Series | | | Standard | Stan | dard | High | fault | Stand | dard | High t | ault | High | fault | Stand | dard | High | fault |
|--|-------------------------------------|------------------------------|-------------------------|---------------------------------|------|-----------------------------|-------|-----------------------------|-------|-----------------------------|---------------|------|-------|----------------------|-------|-----------------------------|-------|-----------------------------|
| RATED CUBRENT OF OVER-CUBRENT BELASE Mol | AMPERE RATING(A) | | 800 | 1250 |) | 1250 | | 1600 | | 1600 | | 1600 | 1600 | | | 2000 | | |
| MEMA_ANSI Marine Mo 1250 1250 1250 1600 1600 1600 200 20 NUMBER OF POLES | | | AR208S | AR2 | 12S | AR2 | 12H | AR21 | 16S | AR21 | 6H | AR31 | 16H | AR22 | 20S | AR22 | :0H | |
| MEMA_ANSI Marine Mo 1250 1250 1250 1600 1600 1600 200 20 NUMBER OF POLES | RATED CURRENT (max) [In](A) | JIS12 | , IEC, EN, AS | 800 | 1250 |) | 1250 |) | 1600 | | 1600 | | 1600 | - | 2000 | | 2000 | |
| NEUTRAL POLE AMPERES FRAME (A) NUMBER OF POLES 3 (1) 3 (4) | | NEM | IA, ANSI | 800 | 1250 |) | 1250 |) | 1540 | | 1600 | | 1600 | | 2000 | | 2000 | |
| NUMBER OF POLES 3 | | | | 800 | 1250 |) | 1250 |) | 1600 | | 1600 | | 1600 | | 2000 | | 2000 | |
| RATED PRIMARY CURRENT OF OVER-CURRENT 200 400 800 1000 800 1000 800 1000 800 1000 1 | JEUTRAL POLE AMPERES FRA | ME (A | .) | 800 | 1250 |) | 1250 |) | 1600 | | 1600 | | 1600 | | 2000 | | 2000 | |
| RELEASE | JUMBER OF POLES | | (3) (4) | 3 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 |
| - for general feeder circuit use Free general feeder general feeder general ge | ATED PRIMARY CURRENT OF | OVER- | -CURRENT | 200 | 400 | | 200 | | 400 | | 1600 | | 200 | | 400 | | 2000 | |
| + For general feeder circuit use 800 1000 1000 1000 1250 1600 16 | RELEASE [I _{CT}](A) | | | 400 | 800 | | 400 | | 800 | | | | 400 | | 800 | | | |
| RATED CURRENT OF OVER-CURRENT RELEASE (A) 1005 5200 2005 5400 1005 5200 2005 5400 1005 5200 2005 5400 1005 5200 2005 5400 1005 1005 | for general feeder circuit use | | | 800 | 1000 |) | 800 | | 1000 | | | | 800 | | 1000 | | | |
| ## AC PATED CURRENT RELEASE (A) ## 100.5 (£.520) ## 200.5 (£.540) ## 200. | | | | | 1250 |) | 1000 |) | 1250 | | | | 1250 | | 1250 | | | |
| RATED CURRENT OF OVER-CURRENT RELEASE(A) | | | | | | | 1250 |) | 1600 | | | | 1600 | | 1600 | | | |
| For generator protection use 200-C, 5400 400-C, 540 | | | | | | | | | | | | | | | 2000 | | | |
| | ATED CURRENT OF OVER-CURR | ENT R | ELEASE(A) | 100≦ <i>I</i> _n ≦200 | 200≦ | I _n ≦400 | 100≦ | <i>I</i> _n ≦200 | 200≦ | <i>I</i> _n ≦400 | 800≦ <i>I</i> | | 100≦ | / _n ≦200 | 200≦ | <i>I</i> _n ≦400 | 1000≦ | <i>I</i> _n ≦2000 |
| 630 < 1250 | for generator protection use | | | 200< I _n ≤400 | 400< | <i>I</i> _n ≦800 | 200< | <i>I</i> _n ≦400 | 400< | <i>I</i> n≦800 | | | 200< | / _n ≦400 | 400< | <i>I</i> _n ≦800 | | |
| AC RATED INSULATION VOLTAGE [U] V. 50/80Hz AC RATED INSULATION | /n] is generator rated current. | | | 400< I _n ≦800 | 500< | <i>I</i> _n ≦1000 | 400< | <i>I</i> _n ≦800 | 500< | <i>I</i> _n ≦1000 | | | 400< | / _n ≦800 | 500< | <i>I</i> _n ≦1000 | | |
| AC RATED INSULATION VOLTAGE [U](V. 50/60Hz) RATED OPERATIONAL VOLTAGE [U](V. 50/60Hz) 690 690 690 690 690 690 690 690 690 690 | | | | | 630< | <i>I</i> _n ≦1250 | 500< | <i>I</i> _n ≦1000 | 630< | <i>I</i> _n ≦1250 | | | 630< | / _n ≦1250 | 630< | <i>I</i> _n ≦1250 | | |
| RATED INSULATION VOLTAGE | | | | | | | 630< | <i>I</i> _n ≦1250 | 800< | <i>I</i> _n ≦1600 | | | 800< | / _n ≦1600 | 800< | <i>I</i> _n ≦1600 | | |
| RATED OPERATIONAL VOLTAGE | | | | | | | | | | | | | | | 1000< | <i>I</i> _n ≤2000 | | |
| AC ARTED BREAKING CAP kA sym ms MAKING CAP kA peak JIS12, IEC, EN, AS AC 690V 65/143 (6) 65/143 (6) 80/176 65/143 (6) 65/143 | C RATED INSULATION VOLTAG | E [<i>U</i> _i](| V. 50/60Hz) | 1000 | 1000 |) | 1000 |) | 1000 | | 1000 | | 1000 | | 1000 | | 1000 | |
| JS128_ EC, EN, AS | RATED OPERATIONAL VOLTAGE | [<i>U</i> _e](\ | V. 50/60Hz) | 690 | 690 | | 690 | | 690 | | 690 | | 690 | | 690 | | 690 | |
| | C RATED BREAKING CAP [kA sym rms]/M | AKING (| CAP [kA peak] | - | | | | | | | | | | | | | | |
| NEMA AC 635V 508V 508T 508T 508T 508T 508T 508T 508T 508T | IS12, IEC, EN, AS | AC | 690V | 50/105 ⑤ | 50/1 | 05 ⑤ | 55/12 | 21 | 50/10 |)5 (5) | 55/12 | 1 | 85/18 | 37 | 50/10 | 05 (5) | 55/12 | :1 |
| SOB | $I_{\rm cs} = I_{\rm cu}$ | | 440V | 65/143 ⑥ | 65/1 | 43 ⑥ | 80/17 | 76 | 65/14 | 13 ⑥ | 80/17 | 6 | 100/2 | 220 | 65/14 | 13 ⑥ | 80/17 | 6 |
| Type | IEMA | AC | 635V | 42/96.6 | 42/9 | 6.6 | 42/96 | 6.6 | 42/96 | 6.6 | 42/96 | .6 | 50/11 | 5 | 42/96 | 6.6 | 42/96 | .6 |
| Type | NSI | | 508V | 50/115 | 50/1 | 15 | 55/12 | 27 | 50/11 | 15 | 55/12 | 7 | 80/18 | 34 | 50/11 | 15 | 55/12 | 7 |
| NK | | | 254V | 65/149.5 | 65/1 | 49.5 | 80/18 | 34 | 65/14 | 19.5 | 80/18 | 4 | 100/2 | 230 | 65/14 | 19.5 | 80/18 | 4 |
| LR, AB, | 78 | DC | 250V | 40/40 | 40/4 | 0 | 40/40 |) | 40/40 |) | 40/40 | | 40/40 |) | 40/40 |) | 40/40 | |
| CL, AB, | IK 9 | AC | 690V | 50/115 | 50/1 | 15 | 55/12 | 28 | 50/11 | 15 | 55/12 | 8 | 85/20 |)1 | 50/11 | 15 | 55/12 | 8 |
| GL, BV 450V 65/153 (6) | | | 450V | 65/153 ⑥ | 65/1 | 53 ⑥ | 80/18 | 36 | 65/15 | 53 ⑥ | 80/18 | 6 | 100/2 | 233 | 65/15 | 53 ⑥ | 80/18 | 6 |
| REVERSE CONNECTED RATED IMPULSE WITHSTAND VOLTAGE [\$U_{mp}\$](kV)\$ RATED IMPULSE WITHSTAND 1s 65 65 80 65 80 100 65 80 CURRENT[\$w_{mp}\$](kV)\$ RATED SHORT TIME WITHSTAND 1s 65 65 85 80 65 80 100 65 80 CURRENT[\$w_{mp}\$](kV)\$ RATED SHORT TIME WITHSTAND 1s 65 65 85 80 65 80 100 65 80 ELATCHING CURRENT (kA) 65 65 65 65 65 65 65 65 65 65 65 65 65 | R, AB, 9 | AC | 690V | 50/115 | 50/1 | 15 | 55/12 | 28 | 50/11 | 15 | 55/12 | 8 | 85/20 |)1 | 50/11 | 15 | 55/12 | 8 |
| RATED IMPULSE WITHSTAND VOLTAGE [Ump](kV) 12 12 12 12 12 12 12 1 | àL, BV | | 450V | 65/153 ⑥ | 65/1 | 53 ⑥ | 80/18 | 36 | 65/15 | 53 ⑥ | 80/18 | 6 | 100/2 | 233 | 65/15 | 53 ⑥ | 80/18 | 6 |
| RATED SHORT TIME WITHSTAND IS CURRENT[I _{ow}][kA rms] 38 50 50 50 55 50 55 75 50 55 75 50 55 75 50 55 75 50 55 75 50 55 75 50 55 75 50 55 75 50 55 75 50 55 50 55 75 50 55 75 50 55 50 55 75 50 55 55 | REVERSE CONNECTED | | | 15) | 15 | | 15 | | 15 | | 15 | | 15 | | 15 | | 15 | |
| CURRENT[(_w)[(kA rms] | ATED IMPULSE WITHSTAND VC | LTAGE | [U _{imp}](kV) | 12 | 12 | | 12 | | 12 | | 12 | | 12 | | 12 | | 12 | |
| LATCHING CURRENT (kA) | RATED SHORT TIME WITHSTAN | D | 1s | 65 | 65 | | 80 | | 65 | | 80 | | 100 | | 65 | | 80 | |
| TOTAL BREAKING TIME (s) CLOSING OPERATION TIME SPRING CHARGING TIME (s) max. 10 10 10 10 10 10 10 10 10 10 10 10 10 1 | CURRENT[I _{cw}][kA rms] | | 3s | 50 | 50 | | 55 | | 50 | | 55 | | 75 | | 50 | | 55 | |
| CLOSING OPERATION TIME SPRING CHARGING TIME (s) max. 10 10 10 10 10 10 10 10 10 10 CLOSE TIME (s) max. No. of operating cycles Mechanical life with maintenance without maintenance a C460V 12000 15000 15000 15000 15000 15000 12000 12000 12000 12000 12000 12000 12000 12000 10000 | ATCHING CURRENT (kA) | | | 65 | 65 | | 65 | | 65 | | 65 | | 85 | | 65 | | 65 | |
| SPRING CHARGING TIME (s) max. | OTAL BREAKING TIME (s) | | | 0.03 | 0.03 | | 0.03 | | 0.03 | | 0.03 | | 0.03 | | 0.03 | | 0.03 | |
| No. of operating cycles No. of operating | LOSING OPERATION TIME | | | | | | | | | | | | | | | | | |
| No. of operating cycles Mechanical life with maintenance without maintenance 15000 | PRING CHARGING TIME (s) ma | ιX. | | 10 | 10 | | 10 | | 10 | | 10 | | 10 | | 10 | | 10 | |
| Mechanical life with maintenance without maintenance and a company of the company o | LOSE TIME (s) max. | | | 0.08 | 0.08 | | 0.08 | | 0.08 | | 0.08 | | 0.08 | | 0.08 | | 0.08 | |
| without maintenance 15000 15000 15000 15000 15000 15000 12000 | lo. of operating cycles | | | | | | | | | | | | | | | | | |
| Electrical life without maintenance AC460V AC690V 10000 12000 12000 12000 10 | Mechanical life with maintena | nce | | 30000 | 3000 | 00 | 3000 | 0 | 3000 | 0 | 30000 |) | 2500 | 0 | 2500 | 0 | 30000 |) |
| AC690V 10000 10000 10000 10000 10000 7000 | without mainte | enance | 9 | 15000 | 1500 | 00 | 1500 | 0 | 1500 | 0 | 15000 |) | 1200 | 0 | 1200 | 0 | 15000 |) |
| Draw-Out Body (kg) 10 | Electrical life without mainte | ∍nance | AC460V | 12000 | 1200 | 00 | 1200 | 0 | 1200 | 0 | 12000 |) | 1000 | 0 | 1000 | 0 | 1200 |) |
| Draw-Out Chassis (kg) (i) 28 35 28 35 33 42 30 38 33 42 49 57 33 42 35 35 38 35 38 33 42 49 57 33 42 35 38 37 49 76 90 79 94 105 125 79 94 75 79 94 75 79 94 75 79 94 75 79 94 75 79 94 75 79 94 75 79 94 75 79 94 75 75 79 94 75 79 94 75 75 79 94 75 75 79 94 75 7 | | | AC690V | 10000 | 1000 | 00 | 1000 | 0 | 1000 | 0 | 10000 |) | 7000 | | 7000 | | 10000 |) |
| Total Draw-Out Weight (kg) 10 73 86 79 94 76 90 79 94 105 125 79 94 75 125 75 125 75 125 75 75 75 75 75 75 75 75 75 75 75 75 75 | Praw-Out Body (kg) | | 11) | 45 51 | 45 | 51 | 46 | 52 | 46 | 52 | 46 | 52 | 56 | 68 | 46 | 52 | 46 | 52 |
| FIXED TYPE a b 460 460 460 460 460 460 460 | raw-Out Chassis (kg) | | 11) | 28 35 | 28 | 35 | 33 | 42 | 30 | 38 | 33 | 42 | 49 | 57 | 33 | 42 | 33 | 42 |
| OUTLINE DIMENSION (mm) FIXED TYPE a 360 445 360 445 360 445 360 445 360 445 466 586 360 445 360 445 460 460 460 460 460 460 460 460 460 460 | otal Draw-Out Weight (kg) | | 11) | 73 86 | 73 | 86 | 79 | 94 | 76 | 90 | 79 | 94 | 105 | 125 | 79 | 94 | 79 | 94 |
| A 360 445 360 460 460 460 460 460 460 460 460 460 4 | ixed (kg) | | 11) | 53 59 | 53 | 59 | 54 | 60 | 54 | 60 | 54 | 60 | 80 | 92 | 54 | 60 | 54 | 60 |
| DRAW-OUT TYPE 10 b 460 460 460 460 460 460 460 460 460 460 | OUTLINE DIMENSION (mm) | | | | | | | | | | | | | | | | | |
| DRAW-OUT TYPE 10 C 290 200 200 200 200 200 200 200 200 200 200 200 | IXED TYPE | , | а | 360 445 | 360 | 445 | 360 | 445 | 360 | 445 | 360 | 445 | 466 | 586 | 360 | 445 | 360 | 445 |
| DRAW-OUT TYPE (i) a a b 460 460 460 460 460 460 460 | Ь | | b | 460 | 460 | | 460 | | 460 | | 460 | | 460 | | 460 | | 460 | |
| DRAW-OUT TYPE ① a 354 439 354 439 354 439 354 439 354 439 354 439 354 439 360 580 354 439 35 b 460 460 460 460 460 460 460 460 460 460 | | | С | 290 | 290 | | 290 | | 290 | | 290 | | 290 | | 290 | | 290 | |
| TYPE (1) b 460 460 460 460 460 460 460 460 460 345 345 345 345 345 345 345 | a | d | d | 75 | 75 | | 75 | | 75 | | 75 | | 75 | | 75 | | 75 | |
| C 345 345 345 345 345 345 345 345 345 | PRAW-OUT | 1 | a | 354 439 | 354 | 439 | 354 | 439 | 354 | 439 | 354 | 439 | 460 | 580 | 354 | 439 | 354 | 439 |
| | YPE 10 b | 5 | b | 460 | 460 | | 460 | | 460 | | 460 | | 460 | | 460 | | 460 | |
| | <u> </u> | 1 | С | 345 | 345 | | 345 | | 345 | | 345 | | 345 | | 345 | | 345 | |
| a d 40 40 40 40 40 40 40 40 40 | a | ld_ | d | 40 | 40 | | 40 | | 40 | | 40 | | 40 | | 40 | | 40 | |

- 1): Values in open air at 40°C (45°C for marine applications).
- 2: Values of AR208S, AR212S, AR216S for draw-out type with horizontal terminals, Values of the other ACBs for draw-out type with vertical terminals.
- ③: For 2 pole ACBs use outside poles of 3 pole ACB.
- (4): 4poles ACBs without Neutral phases protection can not apply IT earthing system.
- (a): Cannot apply IT earthing system, i.e., insulated from earth.
 (b): For 500V AC.
- Tel GOCRs can not be used for DC. Please contact TERASAKI for DC application.
- (8): A special version of the breaker is available to use above 250V DC. Applicable to only draw-out ACBs. Contact Terasaki for details.
- (9): Applicable to only 3 pole ACBs.

- 10: For vertical terminals or horizontal terminals.
- 1: These weights are based on normal specifications with the OCR and standard accessories.
- ①: Comply with JIS C 8201-2-1 Ann.1 Ann.2
- 3: Values for ACBs with INST. 100/220kA for ACBs with MCR.
- (4): Can apply IT system with special specification. Contact TERASAKI for the detail.
- (3): Available as standard. When ordering ACB with reverse power trip function OCRs (AGR-22B or AGR-31B) that this function needs information of normal or reverse connection.
- : Contact TERASAKI for the ratings.

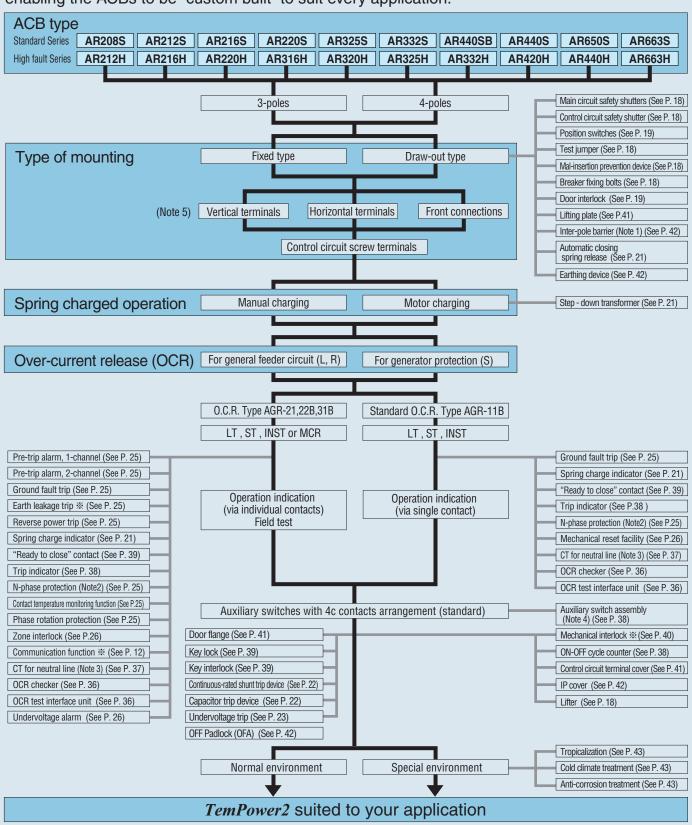
Note: When the INST trip function is set to NON, the MCR function should be enabled, otherwise, the rated breaking capacity is reduced to the rated latching current.



| High fault | High fault | Standard | High fault | Standard | High fault | Standard | Standard | High fault | Standard | Standard | High fault | |
|-----------------------------------|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--|--|
| 2000 | 2000 | 2500 | 2500 | 3200 | 3200 | 4000 | 4000 | 4000 | 5000 | 6300 | 6300 | |
| 2000 | AR420H | AR325S | AR325H | AR332S | AR332H | AR440SB | AR440S | AR440H | AR650S | AR663S | AR663H | |
| 2000 | 2000 | 2500 2500 | 2500 2500 | 3200 3200 | 3200 3200 | 4000 3310 | 4000 3700 | 4000 3700 | 5000 4700 | 6300 5680 | 6300 5680 | |
| 2000 | 2000 | 2500 | 2500 | 3200 | 3200 | 4000 | 4000 | 4000 | 5000 | 6300 | 6300 | |
| 2000 | 2000 | 2500 | 2500 | 3200 | 3200 | 4000 | 4000 | 4000 | 5000 | 6300 | 6300 | |
| 3 4 | 3 | 3 4 | 3 4 | 3 4 | 3 4 | 3 4 | 3 4 | 3 | 3 4 | 3 4 | 3 4 | |
| 2000 | 800 | 2500 | 2500 | 3200 | 3200 | 4000 | 4000 | 4000 | 5000 | 6300 | 5000 | |
| 2000 | 2000 | 2300 | 2300 | 0200 | 3200 | 4000 | 4000 | 4000 | 3000 | 0300 | 6300 | |
| 1000≦ <i>I</i> _n ≦2000 | 400≦ <i>I</i> _n ≦800 1000≦ <i>I</i> _n ≦2000 | 1250≦ <i>I</i> _n ≦2500 | 1250≦ <i>I</i> _n ≦2500 | 1600≦ <i>I</i> _n ≦3200 | 1600≦ <i>I</i> _n ≦3200 | 2000≦ <i>I</i> _n ≦4000 | 2000≦ <i>I</i> _n ≦4000 | 2000≦ <i>I</i> _n ≦4000 | 2500≦ <i>I</i> _n ≦5000 | 3150≦ <i>I</i> _n ≦6300 | 2500≦ <i>I</i> _n ≦5000 3150≦ <i>I</i> _n ≦6300 | |
| | | | | | | | | | | | | |
| 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |
| 690 | 690 | 690 | 690 | 690 | 690 | 690 | 690 | 690 | 690 | 690 | 690 | |
| 85/187 | 75/165 ⑤ | 65/143 ⑤ | 85/187 | 65/143 ⑤ | 85/187 | 85/187 | 75/165 ⑤ | 75/165 ⑤ | 85/187 14 | 85/187 ⑤ | 85/187 ⑤ | |
| 100/220 | 120/264 13 | 85/187 ⑥ | 100/220 | 85/187 ⑥ | 100/220 | 100/220 | 100/220 | 120/264 13 | 120/264 | 120/264 | 135/297 | |
| 50/115 | 65/149.5 | 50/115 | 50/115 | 50/115 | 50/115 | 50/115 | 65/149.5 | 65/149.5 | 65/149.5 | 65/149.5 | 65/149.5 | |
| 80/184 | 75/172.5 | 65/149.5 | 80/184 | 65/149.5 | 80/184 | 80/184 | 75/172.5 | | 80/184 | 80/184 | 80/184 | |
| 100/230 | 120/276 | 85/195.5 | 100/230 | 85/195.5 | 100/230 | 100/230 | 100/230 | 120/276 | 100/230 | 100/230 | 100/230 | |
| 40/40 | 40/40 | 40/40 | 40/40 | 40/40 | 40/40 | 40/40 | 40/40 | 40/40 | 40/40 | 40/40 | 40/40 | |
| 85/201 | 75/179 | 65/153 | 85/201 | 65/153 | 85/201 | | | 75/179 | 85/201 | 85/201 | | |
| 100/233 | 120/287 | 85/201 ⑥ | 100/233 | 85/201 ⑥ | 100/233 | _ | 100/245 | 120/287 | 120/287 | 120/287 | 138/322 | |
| 85/201 | 75/179 | 65/153 | 85/201 | 65/153 | 85/201 | 85/198 | 75/179 | 75/179 | 85/201 | 85/201 | 85/201 | |
| 100/233 | 120/287 | 85/201 ⑥ | 100/233 | 85/201 ⑥ | 100/233 | 100/233 | 100/245 | 120/287 | 120/287 | 120/287 | 138/322 | |
| 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | |
| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | |
| 100 | 100 | 85 | 100 | 85 | 100 | 100 | 100 | 100 | 120 | 120 | 135 | |
| 75 | 85 | 65 | 75 | 65 | 75 | 75 | 85 | 85 | 85 | 85 | 85 | |
| 85 | 100 | 85 | 85 | 85 | 85 | 85 | 100 | 100 | 120 | 120 | 120 | |
| 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.05 | 0.05 | 0.05 | |
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.1 | 0.1 | 0.1 | |
| 25000 | 15000 | 20000 | 20000 | 20000 | 20000 | 15000 | 15000 | 15000 | 10000 | 10000 | 10000 | |
| 12000 | 8000 | 10000 | 10000 | 10000 | 10000 | 8000 | 8000 | 8000 | 5000 | 5000 | 5000 | |
| 10000 | 3000 | 7000 | 7000 | 7000 | 7000 | 3000 | 3000 | 3000 | 1000 | 1000 | 1000 | |
| 7000 | 2500 | 5000 | 5000 | 5000 | 5000 | 2500 | 2500 | 2500 | 500 | 500 | 500 | |
| 56 68 | 71 | 56 68 | 56 68 | 56 68 | 56 68 | 58 71 | 71 92 | 71 | 125 160 | 140 180 | 140 180 | |
| 49 57 | 76 | 49 57 | 49 57 | 49 57 | 49 57 | 68 87 | 68 84 | 76 | 75 100 | 80 105 | 80 105 | |
| 105 125 | 147 | 105 125 | 105 125 | 105 125 | 105 125 | 126 158 | 139 176 | 147 | 200 260 | 220 285 | 220 285 | |
| 80 92 | | 80 92 | 80 92 | 80 92 | 80 92 | | | | | | | |
| 466 586 | | 466 586 | 466 586 | 466 586 | 466 586 | | | | | | | |
| 460 | | 460 | 460 300 | 460 | 460 | | | | | | | |
| 290 | | 290 | 290 | 290 | 290 | | | | | | | |
| 75 | | 75 | 75 | 75 | 75 | | | | | | | |
| 460 580 | 631 | 460 580 | 460 580 | 460 580 | 460 580 | 460 580 | 631 801 | 631 | 799 1034 | 799 1034 | 799 1034 | |
| 460 | 460 | 460 | 460 | 460 | 460 | 460 | 460 | 460 | 460 | 460 | 460 | |
| 345 | 375 | 345 | 345 | 345 | 345 | 345 | 375 | 375 | 380 | 380 | 380 | |
| 40 | 53 | 40 | 40 | 40 | 40 | 140 | 53 | 53 | 60 | 60 | 60 | |
| | | | | | | . 10 | | | | | | |

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: 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.



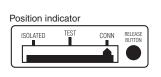
Types of Mounting

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").

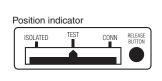






Both the main and control circuits are connected for normal service.

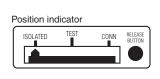
2 TEST position

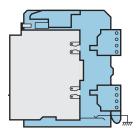




The main circuit is isolated and the control circuits are connected. This position permits operation tests without the need for opening the switchboard panel door.

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

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

Terminal arrangements

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.

Note: The max. rated current $[I_n]$ may be reduced depending on the main circuit terminal arrangement. For more information see page 70.

| Туре | Vertical terminals | Horizontal terminals | Front connections |
|--|--------------------|----------------------|-------------------|
| AR208S, AR212S, AR216S | 0 | 0 | 0 |
| AR220S, AR325S, AR332S | 0 | 0 | 0 |
| AR212H, AR216H, AR220H, AR316H, AR320H, AR325H, AR332H | 0 | • | _ |
| AR440SB, AR440S, AR650S, AR663S, AR420H, AR440H, AR663H | 0 | _ | _ |

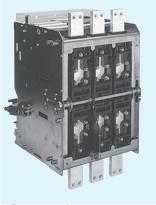
- ©: Standard. This configuration used unless otherwise specified.
- O: Optional standard. Specify when ordering.
- •: "yes" or "available". —: "no" or "not available".



▲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.



▲Screw terminals

• M4 screw terminals are standard.

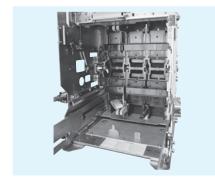
2 Accessories for Draw-out Type

*: Standard equipment

Main circuit safety shutters

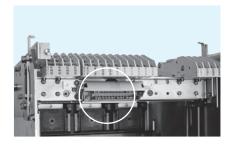
The main circuit safety shutters automatically conceal the main circuit contacts on the draw-out cradle when the ACB is drawn out.

- 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.



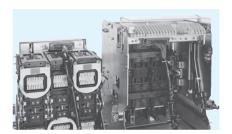
Control circuit safety shutter

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.



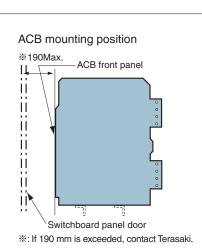
Position padlock lever *

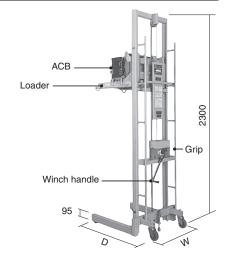
Using the position padlock lever prevents the breaker body from inadvertently being drawn out. The position padlock lever in the pulled-out position locks the breaker body in the CONNECTED, TEST, or ISOLATED position. Up to three padlocks (with Ø6 hasp) can be installed.



Lifter

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





| Type of | Weight | D | W | Applicable |
|---------|--------|------|------|--------------------|
| Lifter | (kg) | (mm) | (mm) | ACBs |
| AWR-1B | 92 | 887 | 710 | AR2, AR3, AR440SB |
| AWR-2B | 110 | 912 | 1150 | AR2, AR3, AR4, AR6 |

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

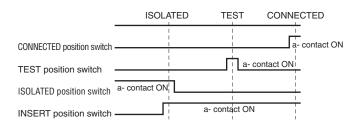
The position switch operates to give an indication of the breaker position: CONNECTED, TEST, ISOLATED, and INSERT. There are two contact arrangements: 2c and 4c.

Connections to the switches are made via screw type terminals.

The following table lists the available types of the switches.

| Type | Number of | Contact arrangeme | | | nent |
|-----------|-----------|-------------------|----------|------|------|
| | contacts | INSERT | ISOLATED | TEST | CONN |
| ALR-0110P | | 0 | 1 | 1 | 0 |
| ALR-0101P | | 0 | 1 | 0 | 1 |
| ALR-0011P | - 00 | 0 | 0 | 1 | 1 |
| ALR-0200P | 2c | 0 | 2 | 0 | 0 |
| ALR-0020P | | 0 | 0 | 2 | 0 |
| ALR-0002P | | 0 | 0 | 0 | 2 |
| ALR-1111P | _ | 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 | 4c | 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

| Resistive load (A) | Inductive load (A) (COS \emptyset = 0.6, L/R = 0.07) |
|--------------------|--|
| / 11 | 6 |
| 0.3 | 0.3 |
| 0.6 | 0.6 |
| 6 | 5 |
| 10 | 6 |
| | / 11 0.3 0.6 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 ACR is in the ISOLATED position, the interlock is released and the switchb

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).

2: Door interlock cannot be fitted with Door flange or IP cover.

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.
- ON signal should be given to the ACB on and over 200ms after OFF signal.

Opening the ACB

For opening the ACB remotely, specify the shunt trip device (See page 22) or the undervoltage trip (See page 23).

Operation power supply

| Rated voltage | Applicable volt | age range (V) | Oper | Operation power supply ratings | | | | | |
|---------------|-------------------------|--------------------------|---------------------------------|--------------------------------|------------------------------------|--|--|--|--|
| (V) | 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 | (140161) | 7 | 1.1 | 0.29 | | | | |
| | | | 7 | | | | | | |
| AC 110 | 94–121 | | / | 1.1 | 0.25 | | | | |
| AC 120 | 102–132 | | 7 | 1.1 | 0.22 | | | | |
| AC 200 | 170–220 | | 4 | 0.7 | 0.15 | | | | |
| AC 220 | 187–242 | | 4 | 0.7 | 0.13 | | | | |
| AC 240 | 204–264 | | 4 | 0.7 | 0.11 | | | | |
| DC 24 | 18–26 | | 14 | 4 | 1.04 | | | | |
| DC 48 | 36–53 | | 10 | 1.6 | 0.51 | | | | |
| DC 100 | 75–110 | | 6 | 0.8 | 0.25 | | | | |
| DC 110 | 82-121 | | 6 | 0.8 | 0.22 | | | | |
| DC 125 | 93–138 | | 6 | 0.8 | 0.21 | | | | |
| DC 200 | 150-220 | | 4 | 0.5 | 0.13 | | | | |
| DC 220 | 165–242 | | 4 | 0.5 | 0.12 | | | | |

Note 1: For the ratings refer to the shunt trip device of page 22.

^{*} Split circuit for motor and closing coil available on request.



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.

■ Normal contacts for general service

| Voltage (V) | | Switch contact ratings | | | | | | | |
|-------------|--------|------------------------|----------------|--|--|--|--|--|--|
| νοπαί | ge (v) | Resistive load | Inductive load | | | | | | |
| AC | 250 | 3 | 3 | | | | | | |
| | 250 | 0.1 | 0.1 | | | | | | |
| DC | 125 | 0.5 | 0.5 | | | | | | |
| | 30 | 3 | 2 | | | | | | |

Minimum applicable load is DC24V 10mA.

■ Gold contacts for microload

| Voltage (V) | | Switch con | tact ratings |
|-------------|--------|----------------|----------------|
| voltaç | je (v) | Resistive load | Inductive load |
| AC | 250 | 0.1 | 0.1 |
| DC | 30 | 0.1 | 0.1 |

Minimum applicable load is DC24V 1mA.

Step-down transformer (external)

able as options.

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 avail-

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



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, by fitting a special continuously rated shunt trip to the side plate of a ACB chassis will allow an undervoltage trip to be used in conjunction with a continuously rated shunt trip. A mechanical interlock can not be fitted with this combination.
- * Instantaneously rated shunt trip also available with special specification. This shunt trip can be fitted with undervoltage trip to the same ACB.
- * Instantaneously rated shunt trip device can be used to monitor the break of the shunt trip circuit.
- * Special double opening and closing coils are available.

For more information contact TERASAKI.

Shunt Trip Rating (Continuously rated type)

| Туре | Rated voltage (V) | Operational voltage (V) | Max. excitation current (A) | Opening time (max.) (ms) |
|--------|-------------------------|-------------------------------|-----------------------------|--------------------------------|
| | AC100 | AC70-110 | 0.29 | |
| | AC110 | AC77-121 | 0.25 | _ |
| | AC120 | AC84-132 | 0.22 | |
| | AC200 | AC140-220 | 0.15 | _ |
| | AC220 | AC154-242 | 0.13 | _ |
| | AC240 | AC168-264 | 0.11 | |
| AVR-1C | DC24 | DC16.8-26.4 | 1.04 | 50% |
| | DC30 | DC21-33 | 0.85 | _ |
| | DC48 | DC33.6-52.8 | 0.51 | _ |
| | DC100 | DC70-110 | 0.25 | _ |
| | DC110 | DC77-121 | 0.22 | _ |
| | DC125 | DC87.5-137.5 | 0.21 | _ |
| | DC200 | DC140-220 | 0.13 | |
| | DC220 | DC154-242 | 0.12 | _ |

※For AR6, the opening time is 60msec.

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.

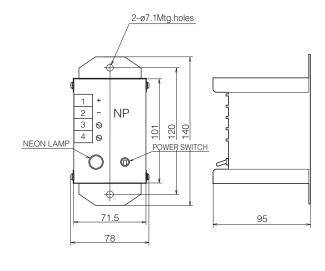
When the continuously-rated shunt trip is used with a capacitor trip device, "a" contact of auxiliary switch of ACB should be inserted in series, otherwise internal damage may occur.

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

| Туре | 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 |

PB (OPEN) or Control Circuit OCRy etc. 1 2 3 \odot \odot SHT В Α \odot POWER SUPPLY AC100V~120V CAPACITOR TRIP 20 <u>*1</u> Auxiliary Switch - - - User Wiring

Outline Dimensions



%1: Use Auxiliary Switch for capacitor trip



Undervoltage trip device (UVT)

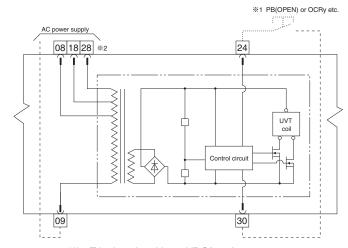
The undervoltage trip device (UVT) trips the ACB when the control voltage drops below the opening voltage. When the control voltage is restored to the pick-up voltage, the ACB can be closed. The pick-up voltage is fixed to 85% of the rated voltage.

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 (below 200ms.) to the ACB when the control voltage drops below the opening voltage. Type AUR-ICD provides a delayed trip to the ACB when the control voltage remains below the opening voltage for at least 500 ms. **

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

%Time-delay trip over 1 sec. or 3 sec. is available as special specification. Undervoltage trip control circuit (for AC)



It takes max. 1.5sec. for UVT coil to be adsorbed after the rated voltage is applied to the undervoltage trip device. Therefore, for the closing command, the closing signal should be applied on and over 1.5sec. after the rated voltage is applied.

Ratings

| Type of UVT | Rated | dVoltage Openin | | Pick-up | Coil Excitation | Power Consu | mption (VA) |
|----------------|--------|-----------------|-------------|---------------|-----------------|-------------|-------------|
| Control Device | 50/601 | Hz (V) | Voltage (V) | Voltage (V) | Current (A) | Normal | Reset |
| AUR-1CS | AC | 100 | 35 – 70 | 85 or less | | | |
| AUR-1CD | | 110 | 38.5 - 77 | 93.5 or less | | | |
| | | 120 | 42 – 84 | 102 or less | | | |
| | | 200 | 70 – 140 | 170 or less | | | |
| | | 220 | 77 – 154 | 187 or less | | | |
| | | 240 | 84 – 168 | 204 or less | | | |
| | | 380 | 133 – 266 | 323 or less | | | |
| | | 400%3 | 140 – 280 | 340 or less | 0.1 | 8 | 10 |
| | | 415 | 145 – 290 | 352 or less | | | |
| | | 440 | 154 – 308 | 374 or less | | | |
| | | 450%3 | 157.5 – 315 | 382.5 or less | | | |
| | | 480%3 | 168 – 336 | 408 or less | | | |
| | DC | 24 %3 | 8.4 – 16.8 | 20.4 or less | | | |
| | | 48 %3 | 16.8 – 33.6 | 40.8 or less | | | |
| | | 100 %3 %4 | 35 – 70 | 85 or less | | | |

^{※3:} Special specification.

^{%4:} Not possible to fit with Instantaneously rated shunt trip.

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. (Backlit L.C.D. optional)

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.

An AGR-11B over-current mechanical reset facility is available for special application. For more information contact TERASAKI.

Protective functions

1) Adjustable long time-delay trip function LT

RMS sensing is used to accurately read through distorted waveforms.

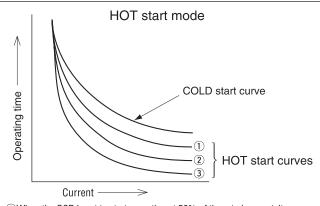
In addition to the standard L and S-characteristics, the R-characteristic is available in five types for long time-delay trip. The R-characteristic can be used to give selectivity with e.g. fuses. (See page 8).

■ 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.

Note: In the standard shipmemt mode, COLD start mode is selected.



- 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.
- When 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

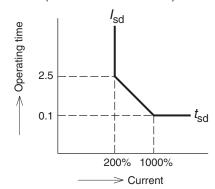
The ST delay trip function has a "definite time delay characteristic" and a "ramp characteristic". These characteristics are selectable.

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)



3 Adjustable 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 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 Adjustable 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.

5 Ground 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 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 page 37).

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.

6N-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. For AGR-11B, 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 time-delay 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.

7 Earth leakage trip function **ELT**

(For AGR-31B only.)

In conjunction with 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 and 0.5A (Medium sensitivity) or 1, 2, 3, 5 and 10A (Low sensitivity). This function needs the control power.

- Note 1: Contact Terasaki for outline dimension of ACBs fitted with ZCT.
- Note 2: For details on specifications of the external ZCT, contact Terasaki.
- Note 3: 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 4: Contact TERASAKI for applicable models.

®Reverse 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 stepdown power transformer is needed. When ordering the ACB, state the step-down ratio of the transformer you will use. **

9 Contact 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.

10Phase 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 $[I_n]$.

4 Specifications

11)Undervoltage alarm function UVA

(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 stepdown 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 23), 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.

13 Mechanical reset facility (For the AGR-11B only)

When the circuit breaker is tripped by the overcurrent tripping relay, the button pops up. Eliminate the cause for the accident and then reset the button by pressing it. Otherwise, the ACB cannot be turned ON. For further details, contact us.

*: Special version without step-down transformer

This version is specially applicable in the main-circuit voltage range from 250 to 690 VAC using the built-in register circuit board without requiring a step-down transformer. To request the version without a step-down transformer, specify your main circuit voltage.

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.

For AGR-11B

• 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.

For AGR-21B, 22B, 31B

- If the ST trip pickup current function is set to NON, INST trip pickup current function can not be set to NON, and MCR can not be selected.
- If the INST trip pickup current function is set to NON or if MCR is selected, ST trip pickup current function can not be set to NON.

For AR663H, even if MCR is selected, 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 [In] 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).



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) X: Auto-reset △: status indication —: Not applicable

| Protective characteristic | L/R-char | acteristic | S-characteristic | | |
|---|----------|------------|------------------|------------|--|
| Function | LCD | Contact | LCD | Contact | |
| LT · NP | 0 | 0 | 0 | X (Note 2) | |
| ST | 0 | (Note 5) | 0 | V (Note 2 | |
| INST/MCR | 0 | (Note 5) | 0 | ^ and 5) | |
| GF (Ground fault) or ELT (Earth leakage) | 0 | 0 | _ | _ | |
| OH (Contact temperature monitoring) | 0 | 0 | 0 | 0 | |
| (Note 3) NS (Reverse phase) | 0 | 0 | _ | | |
| REF (Line side GF) | 0 | 0 | _ | _ | |
| Trip indication ※1 | Δ | Δ | Δ | Δ | |
| RPT (Reverse power trip) | _ | _ | 0 | X (Note 2) | |
| PTA (Pretrip alarm) | × | × | X | × | |
| PTA2 (Pretrip alarm) | × | × | X | × | |
| (Note 4) UV (Undervoltage alarm) | 0 | Δ | 0 | Δ | |
| Spring charge indication | Δ | Δ | Δ | Δ | |
| System alarm | 0 | 0 | 0 | 0 | |

Note 1: To reset the motion indication, press the button on the front of OCR.

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 Contact ratings for Operation indication

| Volt | 000 | | Curre | ent (A) | | | |
|------|------------|----------------|----------------|-----------------------|----------------|--|--|
| | age | 1 Single | contact | 2 Individual contacts | | | |
| () | /) | Resistive load | Inductive load | Resistive load | Inductive load | | |
| AC | 250 | 3 3 | | 0.5 | 0.2 | | |
| | 250 | 0.3 | 0.15 | 0.27 | 0.04 | | |
| DC | 125 | 0.5 | 0.25 | 0.5 | 0.2 | | |
| | 30 | 3 | 3 | 2 | 0.7 | | |

Note: See page 38 for the contact ratings of Trip indicator.
See page 21 for the contact ratings of Spring charge indicator.

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 IN, Ig
- Line voltage (V) of V₁₂, V₂₃, V₃₁ and their max. peak voltage (or, Phase voltage (V) of V_{1N}, V_{2N}, V_{3N} and their peak voltage)
- Active power (W/ kW)
- Demand active power max. (W/kW)
- Power factor (cos Ø)
- Electric energy (Wh/ 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.

Note 2: Special version without requiring step-down transformer is applicable in the main-circuit voltage range from 250 to 690 VAC using the built-in register circuit board. To request the version without a step-down transformer, specify your main circuit voltage.

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 Relay | | | | PRO | TECTIO | V | | | FUNC | TIONS | | |
|----------------------|--------------------------------|----------------------|------|-------------------------|---------|---------------|--------------|------------------|-----------------------|-------------------|------------------------|------------|--------------------|---|
| 1 | | | St | tandard | Protect | ion | Ground | Fault ④ | N-Phase | Indic | cation an | d Monitor | ing | |
| | ection eteristic | Over-current release | Long | Long Short Time Time | | aneous/ CR | Unrestricted | Restricted | N-phase Protection | Indication | | Monitoring | | 1 |
| | | (OCR) | | | | | LIDEE | DEE@ | | Single Contact | Individual Contacts | Ammeter | Energy Analyser | 1 |
| Stan | ndard | Protection Relays | LT | ST | INST | MCR | UREF | REF ² | NP | | o o maiorio | | 7 | |
| Dial Type | _ | AGR-11BL-AL | | | • | | | | 0 | • | | | | |
| | For general feeder circuits | AGR-11BL-GL | | | • | | • | | 0 | • | | | | |
| Standard LCD Type | For general feeder circuits | AGR-21BL-PS | • | | • | • | | | 0 | | • | • | | |
| 1 | | AGR-21BL-PG | • | | • | • | • | 0 | 0 | | • | • | | |
| | cialis | ed Protection Relays | | | | | | | | | | | | |
| Type | 255-3 | AGR-21BR-PS | • | | • | • | | | 0 | | • | • | | |
| CCD | IEC 60255-3 | AGR-21BR-PG | | | • | • | • | 0 | 0 | | • | • | | |
| Standard LCD Type | or generator protection | AGR-21BS-PS | | | • | • | | | | | • | • | | |
| Stan | For ger prote | AGR-22BS-PR | | | • | • | | | | | • | • | | |
| | For general feeder circuits | AGR-31BL-PS | | | • | • | | | 0 | | • | | • | |
| Туре | For ge feeder o | AGR-31BL-PG | | | • | • | • | 0 | 0 | | • | | • | |
| CCD | 255-3 | AGR-31BR-PS | | | • | • | | | 0 | | • | | • | |
| Enhanced LCD Type | IEC 60255-3 | AGR-31BR-PG | | | • | • | • | 0 | 0 | | • | | • | |
| Enha | or generator protection | AGR-31BS-PS | | | • | • | | | | | • | | • | |
| | For gen protec | 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: Not available if CT rated primary current [I_{CT}] is 200A or less.
- \bigcirc : Available up to 3,200A rated current [I_n].
- 6 : Over AC 250V, a step down VT is required.

For full operational information see pages 24 to 27

Note: When a protection function of AGR-11B OCRs with singlecontact indication is activated, the corresponding operation LED indicator is ON momentarily or OFF. But the LED indicator is kept ON when the protection function is checked with the optional OCR checker.



| | | | | SPECIA | AL APPLI | CATION | NS | | | | | |
|-------------|-----------|------------------|------------|-----------------|----------|--------|------|------------|------------|-----------|-------|-----------------|
| Contact | Zone | Earth | Reverse | Phase | Under | Pre- | Trip | Spring | Trip | Commu- | Field | Control |
| Temperature | Interlock | Leakage | Power | Rotation | Voltage | Ala | | Charge | Indication | -nication | Test | Power |
| Monitoring | _ | Protection | Protection | Protection | Alarm | | 3 | Indication | | _ | | |
| OH ② | Z | ELT ⁵ | RPT6 | NS ^② | UVA3 | PTA | PTA2 | 3 | 2 | С | | |
| | | | | | | | | 0 | 0 | | | Not Required |
| | | | | | | | | 0 | 0 | | | Not Required |
| | | | | 0 | | • | | 0 | 0 | 0 | • | Required |
| | | | | 0 | | • | | 0 | 0 | 0 | • | Required |
| | | | | 0 | | | | 0 | 0 | 0 | | Required |
| | | | | | | | | | | | | T toquilou |
| | | | | 0 | | • | | 0 | 0 | 0 | • | Required |
| | | | | | | • | | 0 | 0 | 0 | • | Required |
| 0 | 0 | | • | | 0 | • | 0 | 0 | 0 | 0 | | Required |
| 0 | 0 | 0 | | 0 | 0 | • | | 0 | 0 | 0 | • | Required |
| 0 | 0 | | | 0 | 0 | • | | 0 | 0 | 0 | • | Required |
| 0 | 0 | 0 | | 0 | 0 | • | | 0 | 0 | 0 | • | Required |
| 0 | 0 | | | 0 | 0 | • | | 0 | 0 | 0 | • | Required |
| 0 | 0 | | | | 0 | | 0 | 0 | 0 | 0 | • | Required |
| 0 | 0 | | • | | 0 | • | 0 | 0 | 0 | 0 | • | Required |

| If the control power is not supplied or is lost, each function ope | erates 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 | Is inoperative. |
| 2-channel PTA | |
| 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 | Will display without backlit. |
| Field test facility | Is inoperative. |

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

Setting range of protection functions

Protection functions

Adjustable long time-delay trip characteristics

Pick-up current [IR] (A)

Time-delay [t_R] (s)

Time-delay setting tolerance (%)

Adjustable short time-delay trip characteristics

Pick-up current $[I_{sd}]$ (A)

Current setting tolerance (%)

Time-delay [t_{sd}] (ms) Relay time

Resettable time (ms)

Max. total clearing time (ms)

Adjustable instantaneous trip characteristics

INST or MCR (For AGR-11B, INST only)

 $\overline{\text{Pick-up current}}[I_i]$ (A)

Current setting tolerance (%)

Adjustable pre-trip alarm characteristics PTA

Pick-up current [IP1] (A)

Current setting tolerance (%)

Time-delay [t_{P1}] (s)

Time-delay setting tolerance (%)

Adjustable ground fault trip characteristics

Pick-up current [Ig] (A)

Current setting tolerance (%)

Time-delay [tg] (ms) Relay time

Resettable time (ms)

Max. total clearing time (ms)

Ground fault trip characteristics on line side

(AGR-21B, 31B only)

Pick-up current [IREF] (A)

current setting tolerance (%)

Time-delay (s)

N-phase protection characteristics

NP

Pick-up current [IN] (A)

Time-delay [t_N] (s)

Time-delay setting tolerance (%)

Phase rotation protection characteristics

(AGR-21B, 31B only)

Pick-up current [I_{NS}] (A)

current setting tolerance (%)

Time-delay [t_{NS}] (s)

Time-delay setting tolerance (%)

Adjustable earth leakage trip characteristics

ELT (AGR-31B only)

Pick-up current $[I_{\Delta R}]$ (A)

Current setting tolerance

Time-delay [$t_{\Delta R}$] (ms) Relay time

Resettable time (ms)

Max. total clearing time (ms)

Undervoltage alarm characteristics

UV (AGR-31B only) Recovery setting voltage (V)

Recovery voltage setting tolerance (%)

Setting voltage (V)

Voltage setting tolerance (%)

Time-delay (s)

Time-delay setting tolerance (%)

Control power

Setting range

 $I_n \times (0.8 - 0.85 - 0.9 - 0.95 - 1.0 - NON)$; 6 graduations

• Non tripping when load current \leq ([I_R]×1.05). • Tripping when ([I_R]×1.05) < load current \leq ([I_R]×1.2)

(0.5 - 1.25 - 2.5 - 5 - 10 - 15 - 20 - 25 - 30) at 600% of [I_R]; 9 graduations

±15% +150ms - 0ms

 $[I_n] \times (1 - 1.5 - 2 - 2.5 - 3 - 4 - 6 - 8 - 10 - NON)$; 10 graduations

| -10/0 | | | | | | |
|-------|-----|-----|------------|-----|-----|-----------------|
| 50 | 100 | 200 | <u>400</u> | 600 | 800 | ; 6 graduations |
| 25 | 75 | 175 | 375 | 575 | 775 | |
| 120 | 170 | 270 | 470 | 670 | 870 | |

 $[I_n] \times (2-4-6-8-10-12-14-\underline{16}-NON)$; 9 graduations

 $[I_n] \times (0.75 - 0.8 - 0.85 - 0.9 - 0.95 - 1.0)$; 6 graduations

(5-10-15-20-40-60-80-120-160-200) at $[I_{P1}]$ or more; 10 graduations

±15% +100ms - 0ms

Note: Set $[I_g]$ to 1200A or less.

 $I_{CT} \times (0.1 - 0.2 - 0.3 - 0.4 - 0.6 - 0.8 - 1.0 - NON)$; 8 graduations

| ±20% | | | | | | |
|------|-----|-----|-----|------|------|-----------------|
| 100 | 200 | 300 | 500 | 1000 | 2000 | ; 6 graduations |
| 75 | 175 | 275 | 475 | 975 | 1975 | |
| 170 | 270 | 370 | 570 | 1070 | 2070 | |
| • | | | | | | |

 $[I_{CT}] \times (0.1 - 0.2 - 0.3 - 0.4 - 0.6 - 0.8 - 1.0 - NON)$; 8 graduations

±20%

Inst

 $[I_{CT}] \times (0.4 - 0.5 - 0.63 - 0.8 - 1.0)$; Factory set to a user-specified value for AGR-11BL.

• Non tripping when load current \leq ([/N]×1.05). • Tripping when ([/N]×1.05) < load current \leq ([/N]×1.2)

Tripping at 600% of $[I_N]$ with LT time-delay $[t_R]$

±15% +150ms - 0ms

 $[I_n] \times (0.2 - 0.3 - 0.4 - 0.5 - 0.6 - 0.7 - 0.8 - 0.9 - 1.0)$; 9 graduations

 $\overline{(0.4-0.8-1.2-1.6-2-2.4-2.8-3.2-3.6-\underline{4})}$ at 150% of [I_{NS}]; 10 graduations

±20% +150ms - 0ms

 $0.2 - 0.3 - \underline{0.5}$ (Medium sensitivity) or $1 - 2 - 3 - \underline{5} - \underline{10}$ (Low sensitivity)

| Mon ope | iale below i | $_{0}$ $_{0}$ $_{0}$ $_{1}$ | Operate be | tweeli 70 /o | and 100 /6 C | ν [⁄ΔRJ· | |
|---------|--------------|-----------------------------|------------|--------------|--------------|----------------------|--|
| 100 | 150 | 300 | 500 | 800 | 1500 | 3000 ; 7 graduations | |
| 50 | 100 | 250 | 450 | 750 | 1450 | 2950 | |
| 250 | 300 | 450 | 650 | 950 | 1650 | 3150 | |

 $[V_n] \times (0.8 - 0.85 - 0.9 - 0.95)$; 4 graduations

±5%

 $[V_n] \times (0.4 - 0.6 - 0.8)$; 3 graduations

±5%

0.1 - 0.5 - 1 - 2 - 5 - 10 - 15 - 20 - 30 - 36; 10 graduations

±15% +100ms-0ms

AC100 - 120V DC100 - 125V AC200 – 240V Common DC48V Common Common DC200 - 250V

Power consumption: 5 VA

__: Default setting

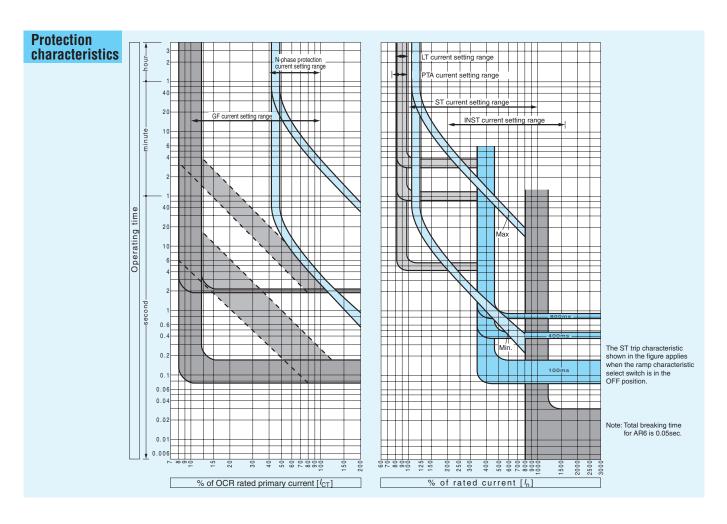
TemPower

■ Values of $[I_{CT}]$ and $[I_n]$

| Type | Applicable | Ra | ted curre | nt [I _n](A | () |
|-------|--------------------|--------------------|--------------------|------------------------|--------------------|
| | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] |
| | (A) | ×0.5 | ×0.63 | ×0.8 | <u>×1.0</u> |
| AR208 | S 200 | 100 | 125 | 160 | 200 |
| | 400 | 200 | 250 | 320 | 400 |
| | 800 | 400 | 500 | 630 | 800 |
| AR212 | S 400 | 200 | 250 | 320 | 400 |
| | 800 | 400 | 500 | 630 | 800 |
| | 1000 | 500 | 630 | 800 | 1000 |
| | 1250 | 630 | 800 | 1000 | 1250 |
| AR216 | S 400 | 200 | 250 | 320 | 400 |
| | 800 | 400 | 500 | 630 | 800 |
| | 1000 | 500 | 630 | 800 | 1000 |
| | 1250 | 630 | 800 | 1000 | 1250 |
| | 1600 | 800 | 1000 | 1250 | 1600 |

| Туре | Applicable Rated current [In](A) | | | | | |
|--------|----------------------------------|--------------------|--------------------|--------------------|--------------------|--|
| | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] | |
| | (A) | ×0.5 | ×0.63 | X0.8 | <u>×1.0</u> | |
| AR220S | 400 | 200 | 250 | 320 | 400 | |
| | 800 | 400 | 500 | 630 | 800 | |
| | 1000 | 500 | 630 | 800 | 1000 | |
| | 1250 | 630 | 800 | 1000 | 1250 | |
| | 1600 | 800 | 1000 | 1250 | 1600 | |
| | 2000 | 1000 | 1250 | 1600 | 2000 | |
| AR325S | 2500 | 1250 | 1600 | 2000 | 2500 | |
| AR332S | 3200 | 1600 | 2000 | 2500 | 3200 | |
| AR440S | B 4000 | 2000 | 2500 | 3200 | 4000 | |
| AR440S | 4000 | 2000 | 2500 | 3200 | 4000 | |
| AR650S | 5000 | 2500 | 3200 | 4000 | 5000 | |
| AR663S | 6300 | 3200 | 4000 | 5000 | 6300 | |
| | | | | | | |

| Type A | pplicable | Ra | ted curre | nt [/ _n](A) |) |
|--------|--------------------|--------------------|--------------------|-------------------------|--------------------|
| | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] |
| | (A) | ×0.5 | ×0.63 | ×0.8 | X1.0 |
| AR212H | 200 | 100 | 125 | 160 | 200 |
| | 400 | 200 | 250 | 320 | 400 |
| | 800 | 400 | 500 | 630 | 800 |
| | 1000 | 500 | 630 | 800 | 1000 |
| | 1250 | 630 | 800 | 1000 | 1250 |
| AR216H | 1600 | 800 | 1000 | 1250 | 1600 |
| AR220H | 2000 | 1000 | 1250 | 1600 | 2000 |
| AR316H | 200 | 100 | 125 | 160 | 200 |
| | 400 | 200 | 250 | 320 | 400 |
| | 800 | 400 | 500 | 630 | 800 |
| | 1250 | 630 | 800 | 1000 | 1250 |
| | 1600 | 800 | 1000 | 1250 | 1600 |
| AR320H | 2000 | 1000 | 1250 | 1600 | 2000 |
| AR325H | 2500 | 1250 | 1600 | 2000 | 2500 |
| AR332H | 3200 | 1600 | 2000 | 2500 | 3200 |
| AR420H | 800 | 400 | 500 | 630 | 800 |
| | 2000 | 1000 | 1250 | 1600 | 2000 |
| AR440H | 4000 | 2000 | 2500 | 3200 | 4000 |
| AR663H | 5000 | 2500 | 3200 | 4000 | 5000 |
| | 6300 | 3200 | 4000 | 5000 | 6300 |



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

Setting range of protection functions

| Pro | tection | functions |
|-----|---------|-----------|
| | | |

Adjustable long time-delay trip characteristics

Pick-up current [I_R] (A)

Current setting tolerance (%)

 $\overline{\text{Time-delay } [t_{R}] (s)}$

Time-delay setting tolerance (%)

Adjustable short time-delay trip characteristics

Pick-up current [I_{sd}] (A)

Current setting tolerance (%)

Time-delay [t_{sd}] (ms) Relay time

Resettable time (ms)

Max. total clearing time (ms)

Adjustable instantaneous trip characteristics

INST or MCR

Pick-up current [Ii] (A)

Current setting tolerance (%)

Adjustable pre-trip alarm characteristics

Pick-up current [IP1] (A)

Current setting tolerance (%)

Time-delay [t_{P1}] (s)

Time-delay setting tolerance (%)

Adjustable ground fault trip characteristics

Pick-up current [/g] (A)

Current setting tolerance (%)

Time-delay $[^tg]$ (ms) Relay time

Resettable time (ms)

Max. total clearing time (ms)

Ground fault trip characteristics on line side

Pick-up current [I_{REF}] (A)

current setting tolerance (%)

Time-delay (s)

■ N-phase protection characteristics

NP

Pick-up current [IN] (A)

Current setting tolerance (%)

Time-delay [t_N] (s)

Time-delay setting tolerance (%)

■ Phase rotation protection characteristics

Pick-up current [I_{NS}] (A)

current setting tolerance (%)

 $\overline{\text{Time-delay}} [t_{NS}] (s)$

Time-delay setting tolerance (%)

Adjustable earth leakage trip characteristics

(AGR-31B only)

Pick-up current $[I_{\Delta R}]$ (A)

Current setting tolerance

Time-delay [$t_{\Delta R}$] (ms) Relay time

Resettable time (ms)

Max. total clearing time (ms)

Undervoltage alarm characteristics

UV (AGR-31B only) Recovery setting voltage (V)

Recovery voltage setting tolerance (%)

Setting voltage (V)

Voltage setting tolerance (%)

Time-delay (s)

Time-delay setting tolerance (%)

Control power

Setting range

Select one from among I0.02t, It, I2t, I3t, and I4t on LCD.

 $[I_n] \times (0.8 - 0.85 - 0.9 - 0.95 - 1.0 - NON)$; 6 graduations

 $(1-2-3-4-\underline{5}-6.3-6.8-10)$ at 300% of [I_R]; 8 graduations

±20% +150ms - 0ms

 $[I_n] \times (1 - 1.5 - 2 - 2.5 - 3 - 4 - 6 - 8 - 10 - NON)$; 10 graduations

±15%

50 100 200 <u>400</u> 600 800 ; 6 graduations 25 75 175 775 375 575 120 170 270 470 670 870

 $[I_n] \times (2-4-6-8-10-12-14-16-NON)$; 9 graduations

 $[I_n] \times (0.75 - 0.8 - 0.85 - 0.9 - 0.95 - 1.0)$; 6 graduations

 $(5-10-15-20-40-60-80-\underline{120}-160-200)$ at $[I_{P1}]$ or more; 10 graduations

±15% +100ms - 0ms

Note: Set $[I_g]$ to 1200A or less.

 $[I_{CT}] \times (0.1 - \underline{0.2} - 0.3 - 0.4 - 0.6 - 0.8 - 1.0 - NON)$; 8 graduations

±20%

| 100 | 200 | 300 | 500 | 1000 | 2000 | ; 6 graduations | |
|-----|-----|-----|-----|------|------|-----------------|--|
| 75 | 175 | 275 | 475 | 975 | 1975 | | |
| 170 | 270 | 370 | 570 | 1070 | 2070 | | |
| | | | | | | | |

 $[I_{CT}] \times (0.1 - 0.2 - 0.3 - 0.4 - 0.6 - 0.8 - 1.0 - NON)$; 8 graduations

±20%

Inst

 $[I_{CT}] \times (0.4 - 0.5 - 0.63 - 0.8 - 1.0)$; Factory set to a user-specified value for AGR-11BR.

Tripping at 300% of $[I_N]$ with LT time-delay $[t_R]$

±20% +150ms - 0ms

 $[I_n] \times (0.2 - 0.3 - 0.4 - 0.5 - 0.6 - 0.7 - 0.8 - 0.9 - 1.0)$; 9 graduations

(0.4 - 0.8 - 1.2 - 1.6 - 2 - 2.4 - 2.8 - 3.2 - 3.6 - 4) at 150% of [I_{NS}]; 10 graduations

±20% +150ms - 0ms

0.2 - 0.3 - 0.5 (Medium sensitivity) or 1 - 2 - 3 - 5 - 10 (Low sensitivity)

Non operate below 70% of $[I_{\Lambda R}]$, Operate between 70% and 100% of $[I_{\Lambda R}]$.

| 100 | 150 | 300 | 500 | 800 | 1500 | 3000 ; 7 graduations |
|-----|-----|-----|-----|-----|------|----------------------|
| 50 | 100 | 250 | 450 | 750 | 1450 | 2950 |
| 250 | 300 | 450 | 650 | 950 | 1650 | 3150 |

 $[V_n] \times (0.8 - 0.85 - 0.9 - 0.95)$; 4 graduations

±5%

 $[V_n] \times (0.4 - 0.6 - 0.8)$; 3 graduations

±5%

0.1 - 0.5 - 1 - 2 - 5 - 10 - 15 - 20 - 30 - 36; 10 graduations

±15% +100ms-0ms

AC100 - 120V DC100 - 125V AC200 – 240V Common

Common DC200 - 250V

Common DC48V

Power consumption: 5 VA

__: Default setting

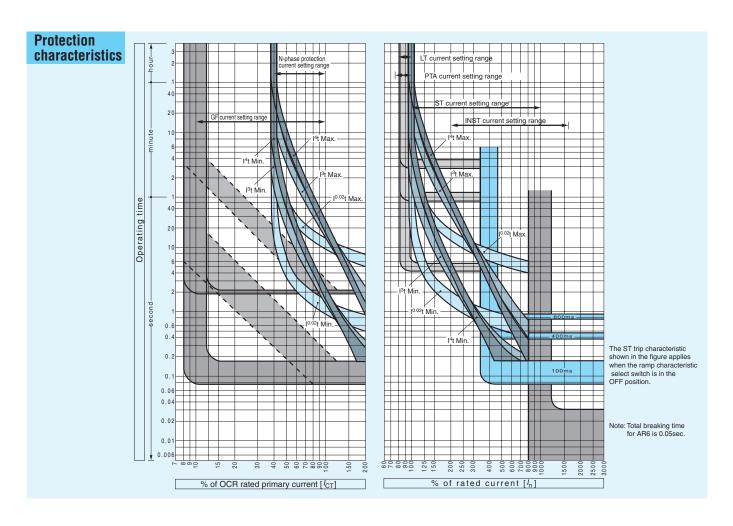
TemPower

■ Values of $[I_{CT}]$ and $[I_n]$

| AR208S 200 100 125 160 200 400 800 400 500 630 800 100 125 630 800 100 125 630 800 1000 125 630 800 1000 125 630 800 1000 1250 630 800 1000 1250 630 800 1000 1250 630 800 1000 1250 630 800 1000 1250 630 800 1000 1250 630 800 800 800 800 800 800 800 800 800 8 | | | /!- | F 112 | | |
|---|--------|------------|------|---------------|------------------------|--------------------|
| AR208S 200 100 125 160 200 400 800 400 500 630 800 100 125 630 800 100 125 630 800 1000 125 630 800 1000 125 630 800 1000 1250 630 800 1000 1250 630 800 1000 1250 630 800 1000 1250 630 800 1000 1250 630 800 1000 1250 630 800 800 800 800 800 800 800 800 800 8 | Type | Applicable | Ra | ited curre | nt [/ _n](A | .) |
| AR208S | | | | | | [/ _{CT}] |
| 400 200 250 320 400 800 400 500 630 800 AR212S 400 200 250 320 400 800 400 500 630 800 1000 1000 500 630 800 1000 1250 AR216S 400 200 250 320 400 800 400 500 630 800 | | (A) | ×0.5 | \times 0.63 | ×0.8 | <u>×1.0</u> |
| 800 400 500 630 800 AR212S 400 200 250 320 400 800 400 500 630 800 1000 1000 500 630 800 1000 1250 AR216S 400 200 250 320 400 800 400 500 630 800 | AR2085 | 200 | 100 | 125 | 160 | 200 |
| AR212S | | 400 | 200 | 250 | 320 | 400 |
| 800 400 500 630 800 1000 500 630 800 1000 1250 630 800 1000 1250 AR216S 400 200 250 320 400 800 400 500 630 800 | | 800 | 400 | 500 | 630 | 800 |
| 1000 500 630 800 1000 1250 630 800 1000 1250 AR216S 400 200 250 320 400 800 400 500 630 800 | AR212S | 400 | 200 | 250 | 320 | 400 |
| AR216S 400 250 800 1000 1250 800 200 250 320 400 800 400 500 630 800 | | 800 | 400 | 500 | 630 | 800 |
| AR216S 400 200 250 320 400 800 400 500 630 800 | | 1000 | 500 | 630 | 800 | 1000 |
| 800 400 500 630 800 | | 1250 | 630 | 800 | 1000 | 1250 |
| | AR216S | 400 | 200 | 250 | 320 | 400 |
| 1000 500 600 900 1000 | | 800 | 400 | 500 | 630 | 800 |
| 1000 500 630 800 1000 | | 1000 | 500 | 630 | 800 | 1000 |
| 1250 630 800 1000 1250 | | 1250 | 630 | 800 | 1000 | 1250 |
| 1600 800 1000 1250 1600 | | 1600 | 800 | 1000 | 1250 | 1600 |

| Туре | Applicable | Rated current [In](A) | | | | | |
|--------|---------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------------|--|--|
| | [/ _{CT}] (A) | [/ _{CT}] ×0.5 | [/ _{CT}] ×0.63 | [/ _{CT}] ×0.8 | [/ _{CT}] <u>×1.0</u> | | |
| AR2205 | S 400 | 200 | 250 | 320 | 400 | | |
| | 800 | 400 | 500 | 630 | 800 | | |
| | 1000 | 500 | 630 | 800 | 1000 | | |
| | 1250 | 630 | 800 | 1000 | 1250 | | |
| | 1600 | 800 | 1000 | 1250 | 1600 | | |
| | 2000 | 1000 | 1250 | 1600 | 2000 | | |
| AR3255 | 2500 | 1250 | 1600 | 2000 | 2500 | | |
| AR3325 | 3200 | 1600 | 2000 | 2500 | 3200 | | |
| AR4405 | SB 4000 | 2000 | 2500 | 3200 | 4000 | | |
| AR4405 | 4000 | 2000 | 2500 | 3200 | 4000 | | |
| AR6505 | 5000 | 2500 | 3200 | 4000 | 5000 | | |
| AR6635 | 6300 | 3200 | 4000 | 5000 | 6300 | | |
| | | | | | | | |

| Type | Аp | plicable | Ra | ted curre | nt [<i>I</i> _n](A) |) |
|--------|----|--------------------|--------------------|--------------------|---------------------------------|--------------------|
| | | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] | [/ _{CT}] |
| | | (A) | ×0.5 | ×0.63 | ×0.8 | X1.0 |
| AR212H | Н | 200 | 100 | 125 | 160 | 200 |
| | | 400 | 200 | 250 | 320 | 400 |
| | | 800 | 400 | 500 | 630 | 800 |
| | | 1000 | 500 | 630 | 800 | 1000 |
| | | 1250 | 630 | 800 | 1000 | 1250 |
| AR216H | Η | 1600 | 800 | 1000 | 1250 | 1600 |
| AR220H | Η | 2000 | 1000 | 1250 | 1600 | 2000 |
| AR316H | Η | 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 | Η | 2000 | 1000 | 1250 | 1600 | 2000 |
| AR325H | Η | 2500 | 1250 | 1600 | 2000 | 2500 |
| AR332H | Η | 3200 | 1600 | 2000 | 2500 | 3200 |
| AR420H | Η | 800 | 400 | 500 | 630 | 800 |
| | | 2000 | 1000 | 1250 | 1600 | 2000 |
| AR440H | Н | 4000 | 2000 | 2500 | 3200 | 4000 |
| AR663H | Н | 5000 | 2500 | 3200 | 4000 | 5000 |
| | | 6300 | 3200 | 4000 | 5000 | 6300 |
| | | | | | | |



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

Setting range of protection functions

| Protec | tion f | functions |
|--------|--------|-----------|
| | | anonono |

Adjustable long time-delay trip characteristics

Pick-up current [I_R] (A)

Current setting tolerance (%)

Time-delay $[t_R]$ (s)

Time-delay setting tolerance (%)

Adjustable short time-delay trip characteristics

Pick-up current $[I_{sd}]$ (A)

Current setting tolerance (%)

Time-delay [t_{sd}] (ms) Relay time

Resettable time (ms)

Max. total clearing time (ms)

Adjustable instantaneous trip characteristics

INST or MCR

Pick-up current [Ii] (A) Current setting tolerance (%)

Adjustable pre-trip alarm characteristics

Pick-up current [IP1] (A)

Current setting tolerance (%)

Time-delay [t_{P1}] (s)

Time-delay setting tolerance (%)

PTA 2 (AGR-22B, 31B only)

Pick-up current [IP2] (A)

Current setting tolerance (%)

Time-delay $[t_{P2}]$ (s)

Time-delay setting tolerance (%)

Adjustable reverse power trip characteristics

RPT (AGR-22B, 31B only)

Pick-up power [P_R] (kW) Power setting tolerance (%)

Time-delay [time] (s)

Time-delay setting tolerance (%)

Undervoltage alarm characteristics

UV (AGR-22B, 31B only)

Recovery setting voltage (V)

Recovery voltage setting tolerance (%)

Setting voltage (V)

Voltage setting tolerance (%)

Time-delay (s)

Time-delay setting tolerance (%)

Control power

Setting range

 $[I_n] \times (0.8 - 1.0 - 1.05 - 1.1 - 1.15 - NON)$; 6 graduations

(15 - 20 - 25 - 30 - 40 - 50 - 60) at 120% of $[I_R]$; 7 graduations

±15% +150ms - 0ms

 $[I_n] \times (2 - 2.5 - 2.7 - 3 - 3.5 - 4 - 4.5 - 5 - NON)$; 9 graduations

±10%

100 200 300 400 600 800 ; 6 graduations 75 175 275 375 575 775 170 270 370 470 670 870

 $I_n \times (2 - 4 - 6 - 8 - 10 - 12 - 14 - 16 - NON)$; 9 graduations

 $[I_n] \times (0.75 - 0.8 - 0.85 - 0.9 - 0.95 - 1.0 - 1.05)$; 7 graduations

(10 - 15 - 20 - 25 - 30) at 120% of $[I_{P1}]$; 5 graduations

±15% +100ms - 0ms

 $[I_n] \times (0.75 - 0.8 - 0.85 - 0.9 - 0.95 - 1.0 - 1.05)$; 7 graduations

±5%

1.5 [t_{P1}] at 120% of [l_{P2}]

±15% +100ms - 0ms

Rated power $[P_n] \times (0.04 - 0.05 - 0.06 - 0.07 - 0.08 - 0.09 - 0.1 - NON)$; 8 graduations

DC48V Common

+0 - 20%

(2.5 - 5 - 7.5 - 10 - 12.5 - 15 - 17.5 - 20) at 100% of $[P_R]$; 8 graduations

±20%

 $[V_n] \times (0.8 - 0.85 - 0.9 - 0.95)$; 4 graduations

 $[V_n] \times (0.4 - 0.6 - 0.8)$; 3 graduations

0.1 - 0.5 - 1 - 2 - 5 - 10 - 15 - 20 - 30 - 36; 10 graduations

±15% +100ms-0ms

AC200 – 240V Common AC100 - 120V DC100 - 125V

DC200 – 250V Common

Power consumption: 5 VA

[:] Default setting

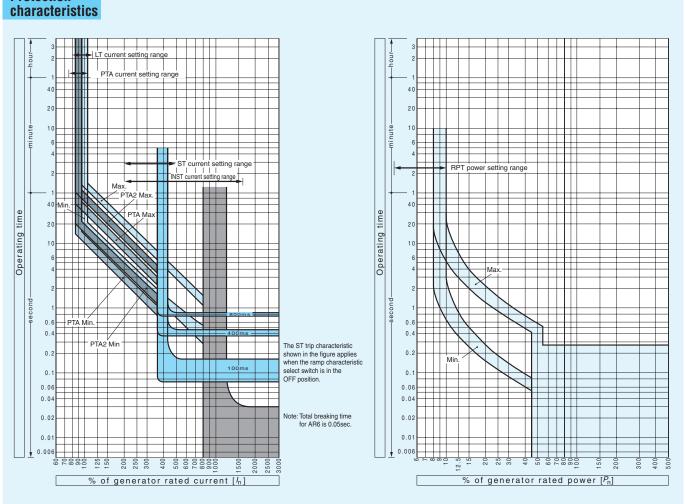


Applicable range of generator rated current $[I_n]$

| | | - 11- |
|---------|-------------------------------|-------------------------------------|
| Туре | OCR rated primary | Applicable range of generator |
| | current [I _{CT}](A) | rated current [In] (A) |
| AR208S | 200 | 100≦[/ _n]≦200 |
| | 400 | 200<[/ _n]≦400 |
| | 800 | 400<[/ _n]≦800 |
| AR212S | 400 | 200≦[<i>l</i> _n]≦400 |
| | 800 | 400<[/ _n]≦800 |
| | 1000 | 500<[<i>l</i> _n]≦1000 |
| | 1250 | 630<[<i>l</i> _n]≦1250 |
| AR216S | 400 | 200≦[<i>l</i> _n]≦400 |
| | 800 | 400<[/ _n]≦800 |
| | 1000 | 500<[/ _n]≦1000 |
| | 1250 | 630<[/ _n]≦1250 |
| | 1600 | 800≦[<i>I</i> _n]≦1600 |
| AR220S | 400 | 200≦[<i>l</i> _n]≦400 |
| | 800 | 400<[/ _n]≦800 |
| | 1000 | 500<[/ _n]≦1000 |
| | 1250 | 630<[/ _n]≦1250 |
| | 1600 | 800≦[/ _n]≦1600 |
| | 2000 | 1250≦[<i>I</i> _n]≦2000 |
| AR325S | 2500 | 1250≦[<i>I</i> _n]≦2500 |
| AR332S | 3200 | 1600≦[<i>I</i> _n]≦3200 |
| AR440S | 4000 | 2000≦[/ _n]≦4000 |
| AR440SB | 4000 | 2000≦[<i>I</i> _n]≦4000 |
| AR440S | 4000 | 2000≦[<i>I</i> _n]≦4000 |
| AR650S | 5000 | 2500≦[<i>I</i> _n]≦5000 |
| AR663S | 6300 | 3200≦[<i>I</i> _n]≦6300 |
| | | |

| Туре | OCR rated primary current [I _{CT}](A) | Applicable range of generator rated current $[I_n]$ (A) |
|--------|---|---|
| AR212H | 200 | 100≦[<i>l</i> _n]≦200 |
| | 400 | 200<[/ _n]≦400 |
| | 800 | 400<[I _n]≦800 |
| | 1000 | 500<[I _n]≦1000 |
| | 1250 | 630<[<i>l</i> _n]≦1250 |
| AR216H | 1600 | 800≦[/ _n]≦1600 |
| AR220H | 2000 | 1000≦[<i>I</i> _n]≦2000 |
| AR316H | 200 | 100≦[<i>l</i> _n]≦200 |
| | 400 | 200<[<i>I</i> _n]≦400 |
| | 800 | 400<[<i>I</i> _n]≦800 |
| | 1250 | 630<[<i>I</i> _n]≦1250 |
| | 1600 | 800<[/ _n]≦1600 |
| AR320H | 2000 | 1000≦[<i>l</i> _n]≦2000 |
| AR325H | 2500 | 1250≦[<i>I</i> _n]≦2500 |
| AR332H | 3200 | 1600≦[<i>l</i> _n]≦3200 |
| AR420H | 800 | 400≦[<i>l</i> _n]≦800 |
| | 2000 | 1000≦[<i>I</i> _n]≦2000 |
| AR440H | 4000 | 2000≦[<i>I</i> _n]≦4000 |
| AR663H | 5000 | 2500≦[<i>I</i> _n]≦5000 |
| | 6300 | 3200≦[<i>l</i> _n]≦6300 |

Protection



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



■ Measurement output

- Long time delay trip pickup current
- Long time delay trip pickup time
- Short time delay trip pickup current
- Short time delay trip pickup time
- Instantaneous trip pickup current
- MCR trip pickup current
- Ground fault trip pickup current
- Ground fault trip pickup time
- N-phase protection trip pickup current
- N-phase protection trip pickup time
- · Pre-trip alarm pickup current
- Pre-trip alarm pickup time

For the checking of Reverse power protection, use the following OCR test interface unit, ANU-2.

OCR test interface unit, type ANU-2

OCR test interface unit ANU-2 is a testing tool designed for checking the functionality of type AGR OCR (overcurrent release). Using this tool in conjunction with a commercial constant-current generator allows easy on-site testing of the OCR. The reverse power trip function of the OCR can also be tested using the tool. OCR test interface unit ANU-2 is a device that converts current into voltage. In addition to the unit, a constant-current generator is needed to test the OCR. Use a generator with a continuous rating of 5A (50/60Hz) and a short-time rating of 50A (50/60 Hz) for 10 seconds (500 VA).



■ Ratings and Specifications

| Power supply | Input | External power supply (through power cable with AC adapter) 100 to 240 VAC (50/60 Hz) |
|--------------------|--------|---|
| | Output | 9 VDC |
| Power consumption | | 7VA |
| Outline dimensions | | W160×H90×D220 (mm) |
| Mass of main unit | | 2kg |

■ Measurement output

- Long time delay trip pickup current
- Short time delay trip pickup current
- Instantaneous trip pickup current *1
- Instantaneous trip operation
- MCR trip pickup current *1
- Ground fault trip pickup current
- N-phase protection trip pickup current
- Pre-trip alarm pickup current *2
- Reverse power protection trip pickup current *4
- Long time delay trip pickup time (simplified testing) *3
- Reverse power protection trip pickup time (simplified testing) *3 *4
- Pre-trip alarm pickup time (simplified testing) *3

■ Accessories

- Power cable with AC adaptor (2m)
- Plug adaptor
- Signal cable (3m)
- Operation manual

- *2 Not applicable for types AGR-11 or AGR-11B.
- *3 A stopwatch is required for measurement.
- *4 Applicable for types AGR-22BS-PR and AGR-31BS-PR only.

^{*1} Can be measured only when the input current does not exceed 50 A.



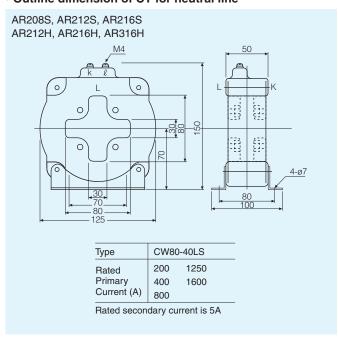
Current transformer for neutral line (separate type)

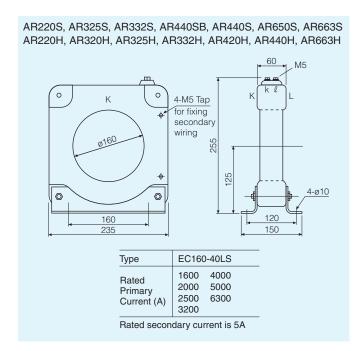
When using a 3-pole ACB with the ground fault protection function to protect a 3-phase, 4-wire system against ground fault, install an appropriate current transformer (CT) to the neutral line of the system.

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





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. Two current transformers are required for 3 pole restricted earth fault ACBs.

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 in-



Auxiliary switches

spection.

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.

| Туре | Normal contacts for general service | Gold contacts 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)

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

Auxiliary switch ratings

| <u></u> | | | | | |
|------------|---------------------|--|--------------------|--|----------------------|
| Category | For general service | | For microload *** | | |
| Voltage | Resistive load (A) | Inductive AC: $\cos \emptyset \ge 0.3$ load (A) DC: L/R ≤ 0.01 | Resistive load (A) | Inductive AC: $\cos \emptyset \ge 0.6$ load (A) DC: L/R ≤ 0.007 | Min. applicable load |
| AC100-250V | 5 | 5 | 0.1 | 0.1 | |
| AC251-500V | 5 | 5 | _ | _ | DC5V 1mA |
| DC30V | 1 | 1 | 0.1 | 0.1 | DOSV IIIIA |
| DC125-250V | 1 | 1 | _ | _ | |

Note 1: The chattering of b-contacts due to ON-OFF operation of the ACB lasts for less than 30 ms.

Trip Indicator

Trip Indicator closes (ON) when the air circuit breaker is tripped by overcurrent release, shunt trip device, undervoltage trip device or manual operation of OFF button. The table summarizes when the trip indicator operates (ON) and when it is reset (OFF). Use a suitable self-hold circuit as necessary for continuous trip alarm indication.

| Breker Tripped by | Operation of Trip Indicator | | |
|---|---|--|--|
| breker inpped by | Closing Springs Charged | Closing Spring Discharged | |
| Over-current Trip (OCR) | Switch is ON for minimum 40ms, then reset to OFF. | Switch is remains ON until closing springs are charged. | |
| Shunt trip | Switch remains ON until reset to OFF. | Switch remains ON until closing springs springs are charged after rest to OFF. | |
| Undervoltage trip Remote Opening Undervoltage Condition | Switch remains ON until undervoltage coil is pick-up voltage. | Switch remains ON until closing springs are charged after undervoltage condition has restored to normal. | |
| Manual Opening by PUSH-TO-OPEN button | Switch remains ON until PUSH-TO-OPEN button is released. | Switch remains ON until closing springs are charged after PUSH-TO-OPEN botton is released. | |

■ Normal contacts for general service

| Voltage (V) | | Switch contact ratings | | |
|-------------|---------------|------------------------|----------------|--|
| volta | <i>ye</i> (v) | Resistive load | Inductive load | |
| AC | 250 | 3 | 3 | |
| | 250 | 0.1 | 0.1 | |
| DC | 125 | 0.5 | 0.5 | |
| | 30 | 3 | 2 | |

Minimum applicable load is DC24V 10mA.

■ Gold contacts for microload

| Voltage (V) | | Switch contact ratings | |
|-------------|--------|------------------------|----------------|
| voltaç | ge (v) | Resistive load | Inductive load |
| AC 250 | | 0.1 | 0.1 |
| DC | 30 | 0.1 | 0.1 |

Minimum applicable load is DC24V 1mA.

[%] Suited to electronic circuits

Note 2: Do not supply different voltages to contacts of a switch.



"Ready to close" contact (special specification)

The "ready to close" contact indicates that the ACB is in a ready to close status.

This contact operates when the followings are valid.

- * ON-OFF indicator shows "OFF". (The ACB is in OFF position)
- * Spring charge indicator shows "charged".
- * Undervoltage trip is energised.
- * Shunt trip is not energised.
- * ACB is in the connected or test position.
- * Key lock and Key interlock are off.
- * Mechanical interlock is off.

■ Normal contacts for general service

| Voltage (V) | | Switch contact ratings | |
|-------------|--------|------------------------|----------------|
| volta | ge (v) | Resistive load | Inductive load |
| AC | 250 | 3 | 3 |
| | 250 | 0.1 | 0.1 |
| DC | 125 | 0.5 | 0.5 |
| | 30 | 3 | 2 |

Minimum applicable load is DC24V 10mA.

■ Gold contacts for microload

| Voltac | 70 (\/) | Switch contact ratings | |
|--------|---------|------------------------|----------------|
| Volta | ge (v) | Resistive load | Inductive load |
| AC 250 | | 0.1 | 0.1 |
| DC 30 | | 0.1 | 0.1 |

Minimum applicable load is DC24V 1mA.

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).

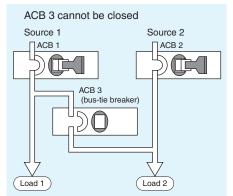
ACBs can be supplied with a cylinder lock or type FS-2 Castell lock (with an angular movement 90° clockwise to trap key).

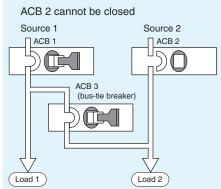
A double Castell interlocking facility suitable for applications such as UPS systems is available as a special specification contact Terasaki Electric Europe, UK.

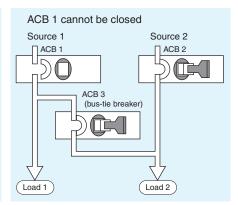
Facility or full option including locks are available, please specify.

For other lock types contact Terasaki Electric Europe, UK.

Example: Interlock for prevention of parallel feeding from two sources







Mechanical interlock (Contact TERASAKI for details)

Mechanical interlocks for interlocking 2 or 3 ACBs in either horizontal or vertical arrangements are available.

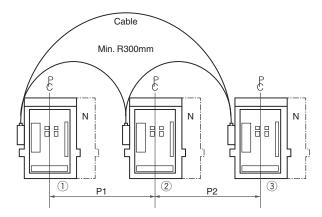
Interlocking is possible between any frame size within the *TemPower2* range.

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) | | | |
|--------------------------------|--------|--|---|-----------------------------------|-------------------------|
| Rig | ht ACB | AR208S~AR220S AR212H~AR220H | AR325S~AR332S AR316H~AR332H AR440SB | AR440S AR420H~AR440H (3P only) | AR650S~AR663S AR663H |
| Left ACB | | 3P, 4P | 3P, 4P | 3P, 4P | 3P, 4P |
| AR208S~AR220S | 3P | 600, 700, 800 | 600, 700, 800 | 600, 700, 800 | 800, 1000, 1100 |
| AR212H~AR220H | 4P | 600, 700, 800, 900 | 700, 800, 900 | 600, 700, 800, 900 | 900, 1000, 1100 |
| AR325S~AR332S AR316H~AR332H | 3P | 600, 700, 800, 900 | 700, 800, 900 | 600, 700, 800, 900 | 900, 1000, 1100 |
| AR440SB | 4P | 700, 800, 900, 1000 | 800, 900, 1000 | 700, 800, 900, 1000 | 1000, 1100, 1200 |
| AR440S | 3P | 800, 900, 1000, 1100 | 900, 1000, 1100 | 800, 900, 1000, 1100 | 1100, 1200, 1300 |
| AR420H~AR440H (3P only) | 4P | 1000, 1100, 1200, 1300 | 1000, 1100, 1200, 1300 | 1000, 1100, 1200, 1300 | 1300, 1400 |
| AR650S~AR663S | 3P | 700, 800, 900, 1000 | 800, 900, 1000 | 700, 800, 900, 1000 | 1000, 1100, 1200 |
| AR663H | 4P | 1000, 1100, 1200 | 1000, 1100, 1200 | 1000, 1100, 1200 | 1200, 1300, 1400 |



To order, P1 pitch same as P2 pitch. When P1 is different from P2 then we available as special specification, 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: <u>700</u> mm P2: <u>800</u> mm

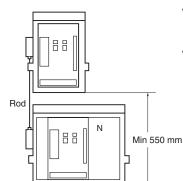
ACB ①: Type AR212H 3 poles ACB ②: Type AR332H 3 poles ACB ③: Type AR216H 3 poles

2 Vertical Type

Minimum pitch (550mm) is possible.

Specify the reguired pitch when ordering.

Maximum is 1200mm.



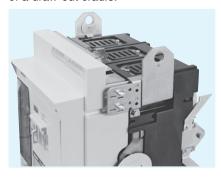
Types and Operations

| Type | 0 | perati | on | Remark |
|---------------|-----|--------|-----|---|
| Туре | Br1 | Br2 | Br3 | Heman |
| Type C | ON | OFF | | |
| 1 Br1 Br2 | OFF | ON | | One of two breakers can be turned on. |
| | OFF | OFF | | |
| Type B | ON | ON | OFF | |
| | ON | OFF | ON | |
| Br1 Br2 Br3 | OFF | ON | ON | One or two of three breakers |
| | ON | OFF | OFF | can be turned on. |
| | OFF | ON | OFF | |
| | OFF | OFF | ON | |
| | OFF | OFF | OFF | |
| Type D | ON | OFF | OFF | |
| 3 Br1 Br2 Br3 | OFF | ON | OFF | One of three breakers can |
| | OFF | OFF | ON | be turned on. |
| | OFF | OFF | OFF | |
| Type A | ON | OFF | ON | |
| Br1 Br2 Br3 | ON | OFF | OFF | |
| 4 | OFF | ON | OFF | Br2 is interlocked with both Br1 and Br3. |
| | OFF | OFF | ON | |
| | OFF | OFF | OFF | |

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

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 *

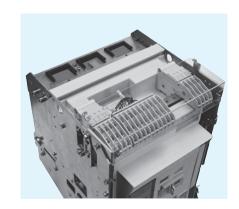
: Standard equipment

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.



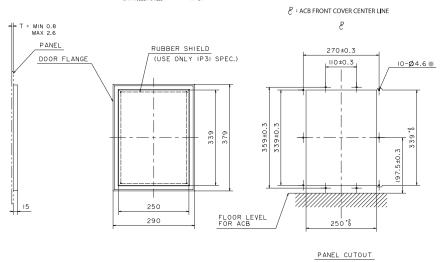
Door flange

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.

Note: Door flange can not be fitted with IP cover.



STANDARD — IP20 WITH RUBBER SHIELD — IP31



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

4 Specifications

OFF padlock (OFA)

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.



Compatible with IEC61439-2 Form 4

All the models of TemPower2, except for Model AR440SB, comply as standard with Form 4 specified in IEC61439-2.

The AR440SB can be customized to comply with Form 4.

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.

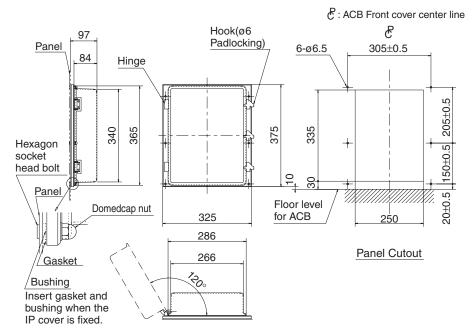
Note: UVT function can not be applied to the earthing device. Earthing device is not avilable for AR6.

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 Min. permissible storage

temperature –20°C

Max. permissible storage temperature +60°C

No condensation

Min. permissible operating

temperature -5°C

Max. permissible operating

temperature +40°C

(45°C for marine applications) The average temperature for 24 hours must not exceed 35°C.

Relative humidity Below 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 oc-

cur.

Vibration The TemPower 2 ACB is designed

to withstand electromagnetic and mechanical vibrations in accordance to IEC 68-2-6. (2-13.2 Hz with amplitude of +/- 1mm; 13.2 to 100Hz with an acceleration of 0.7g).

Special environment

Tropicalization (Fungus and moisture treatment)

Specify this treatment when the ACB is used under hightemperature 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

Max. permissible storage temperature +60°C Min. permissible operating temperature -25°C Max. permissible operating temperature +40°C

No condensation

Anti-corrosion treatment

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

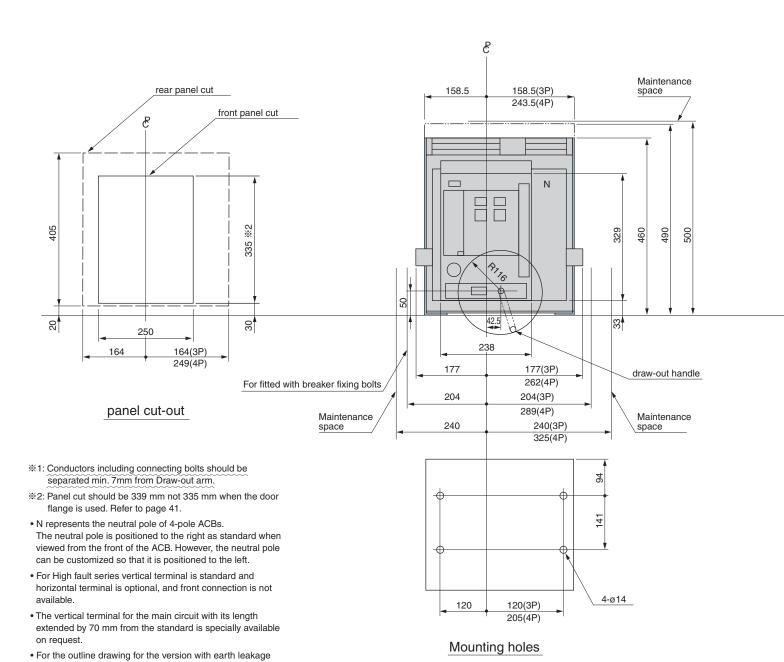
Contact Terasaki for details.

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

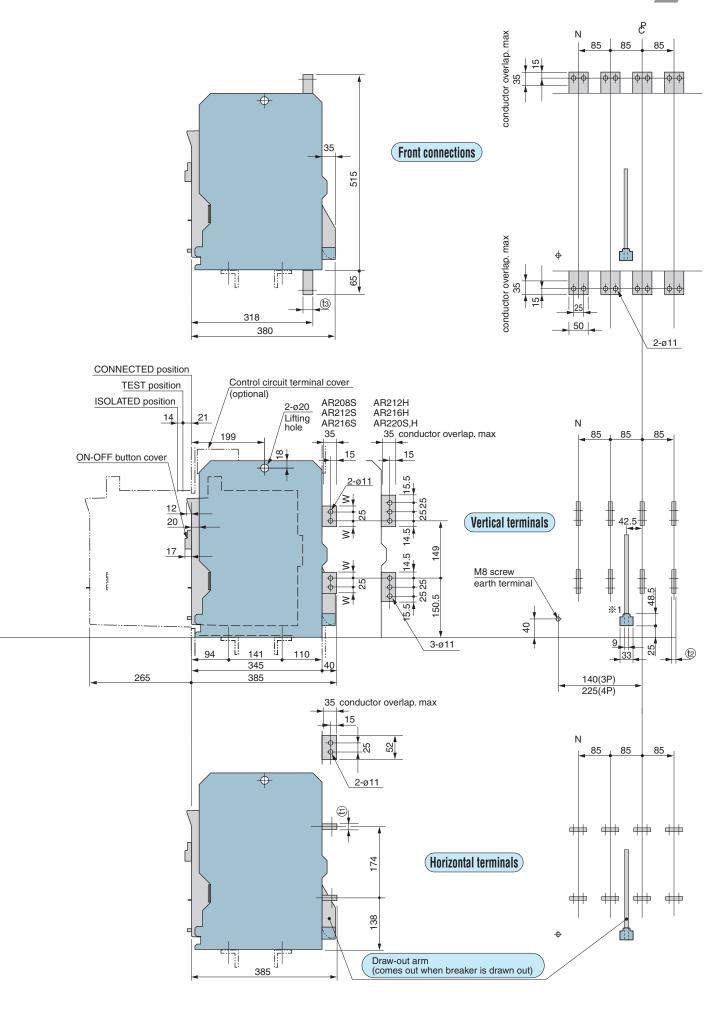
P: ACB Front cover center line

Terminal size

| Type | (tı) | (<u>t</u> 2) | (t 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 | | |

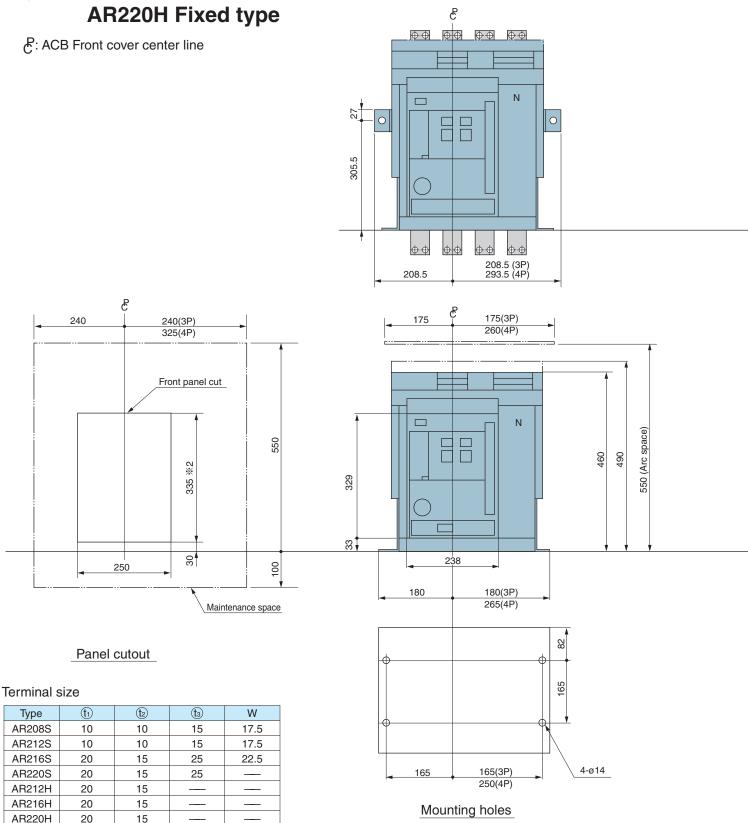


tripping, contact us.



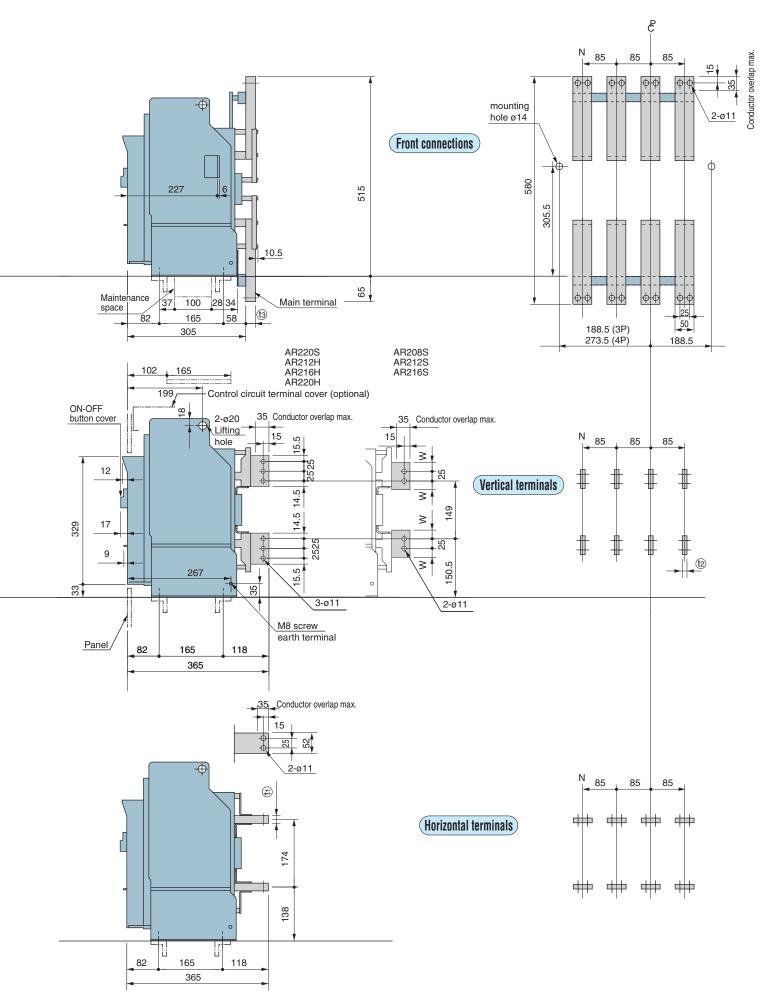
5 Outline Dimensions

• Types: AR208S, AR212S, AR216S, AR220S, AR212H, AR216H,



^{※2:} Panel cut should be 339 mm not 335 mm when the door flange is used. Refer to page 41.

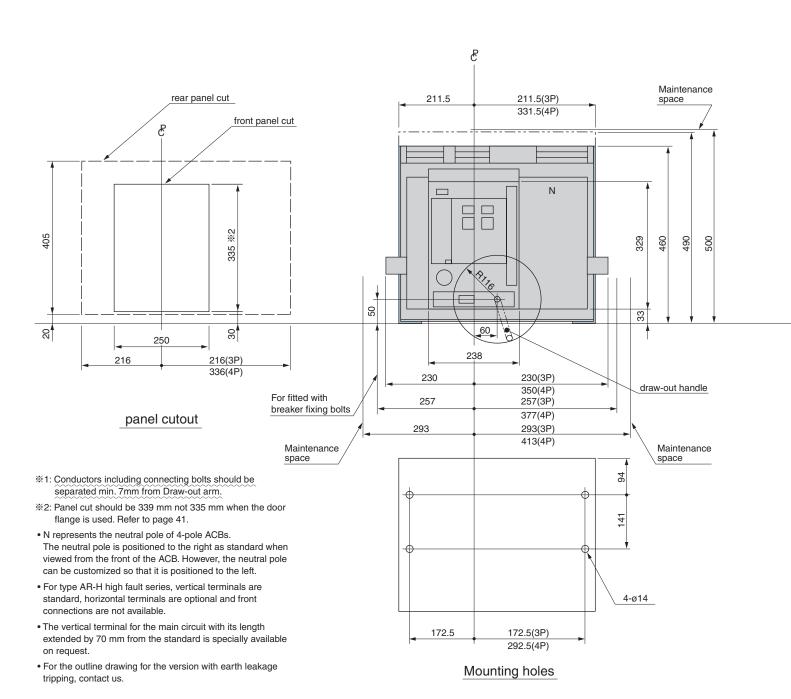
- N represents the neutral pole of 4-pole ACBs.
 The neutral pole is positioned to the right as standard when viewed from the front of the ACB. However, the neutral pole can be customized so that it is positioned to the left.
- For type AR-H high fault series, vertical terminals are standard, horizontal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

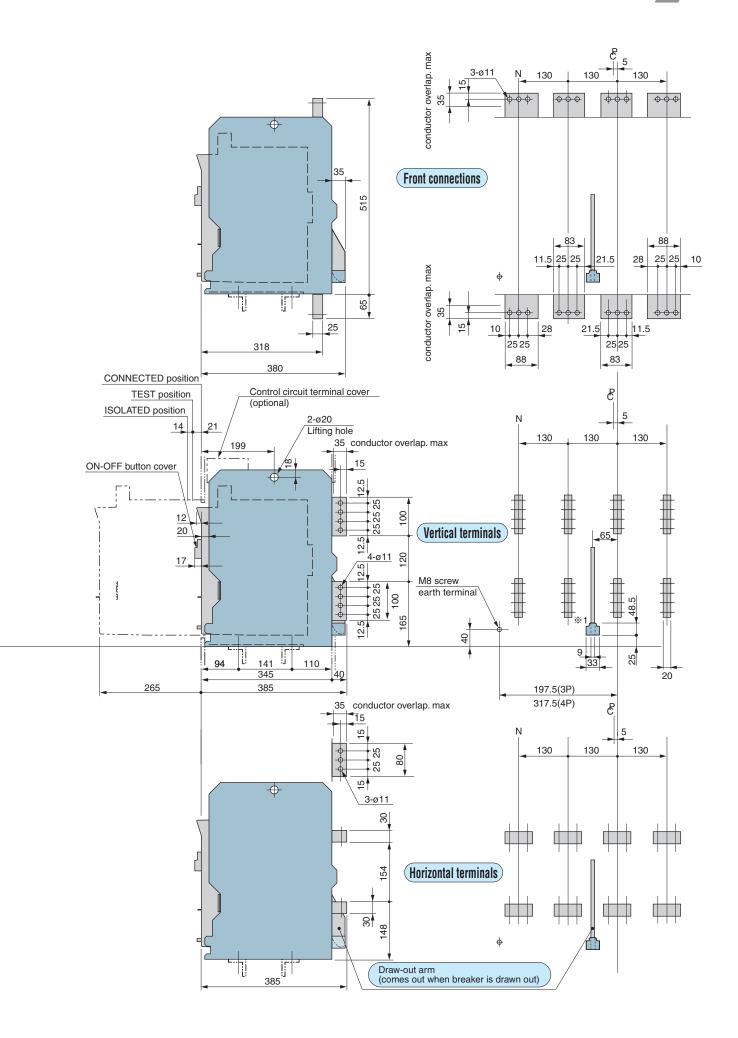


5 Outline Dimensions

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

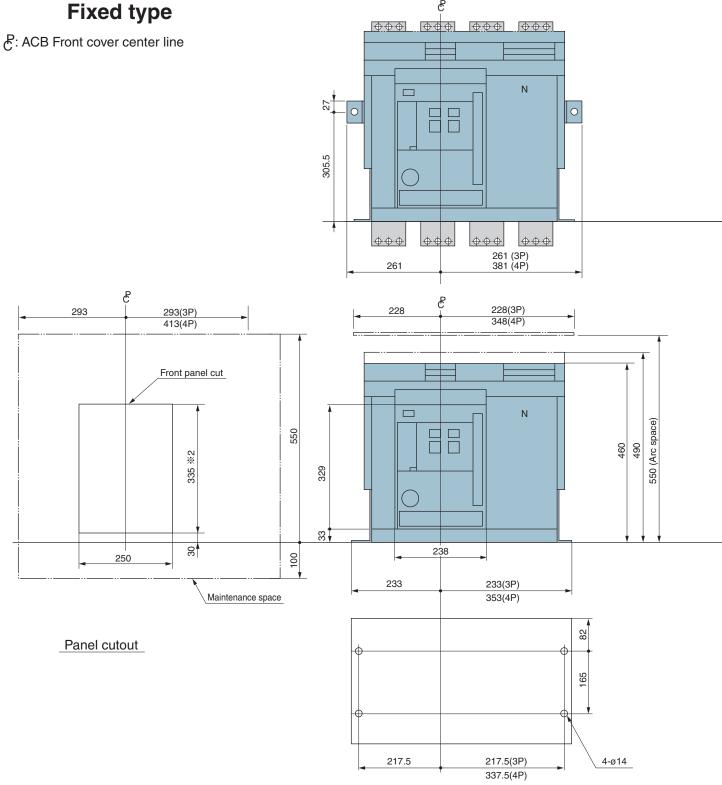
P: ACB Front cover center line





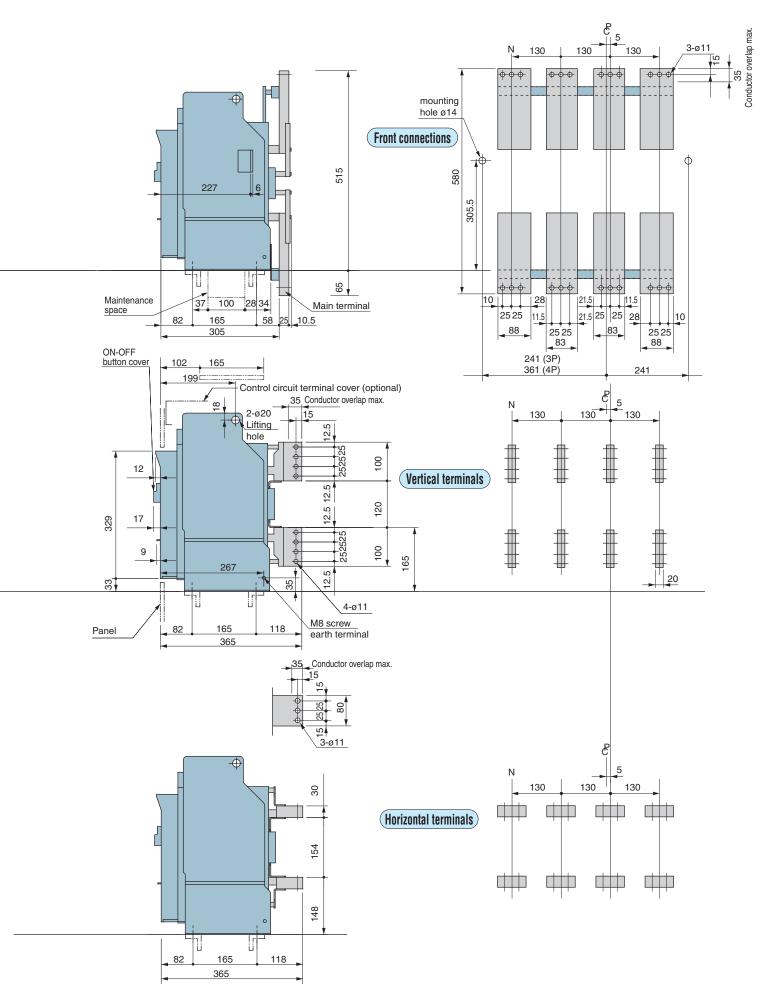
5 Outline Dimensions

•Types: AR325S, AR332S, AR316H, AR320H, AR325H, AR332H



- %2: Panel cut should be 339 mm not 335 mm when the door flange is used. Refer to page 41.
- N represents the neutral pole of 4-pole ACBs.
 The neutral pole is positioned to the right as standard when viewed from the front of the ACB. However, the neutral pole can be customized so that it is positioned to the left.
- For type AR-H high fault series, vertical terminals are standard, horizontal terminals are optional and front connections are not available.
- For the outline drawing for the version with earth leakage tripping, contact us.

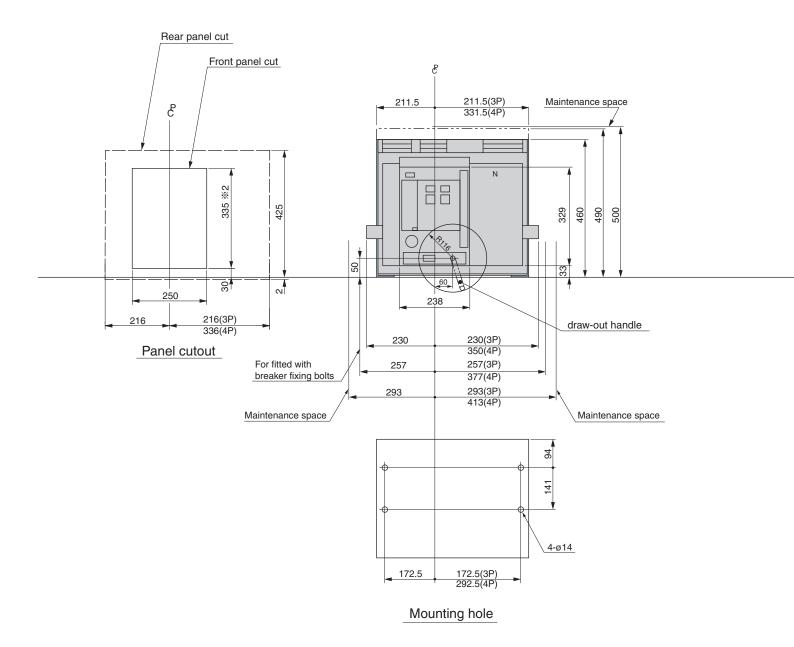
Mounting holes



5 Outline Dimensions

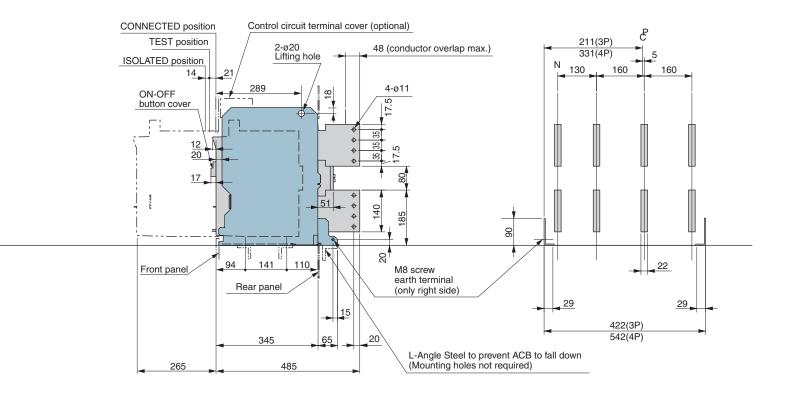
Types: AR440SB Draw-out type

P: ACB Front cover center line



[&]amp;2: Panel cut should be 339 mm not 335 mm when the door flange is used. Refer to page 41.

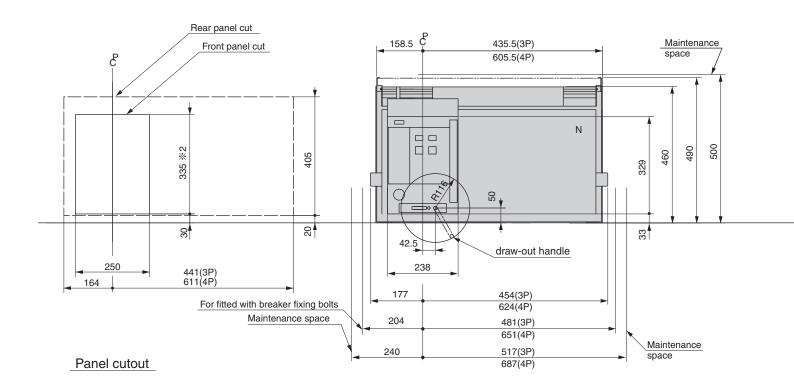
[•] N represents the neutral pole of 4-pole ACBs.



5 Outline Dimensions

•Types: AR440S, AR420H (3 poles only), AR440H (3 poles only) Draw-out type

P: ACB Front cover center line

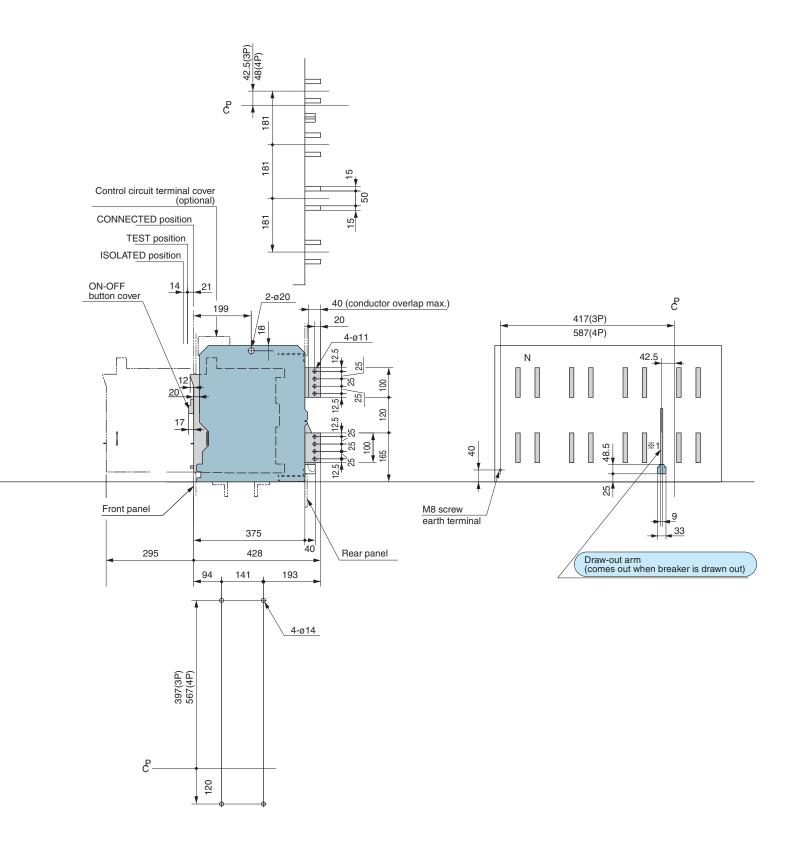


^{**1:} Conductors including connecting bolts should be separated min. 7mm from Draw-out arm.

^{%2}: Panel cut should be 339 mm not 335 mm when the door flange is used. Refer to page 41.

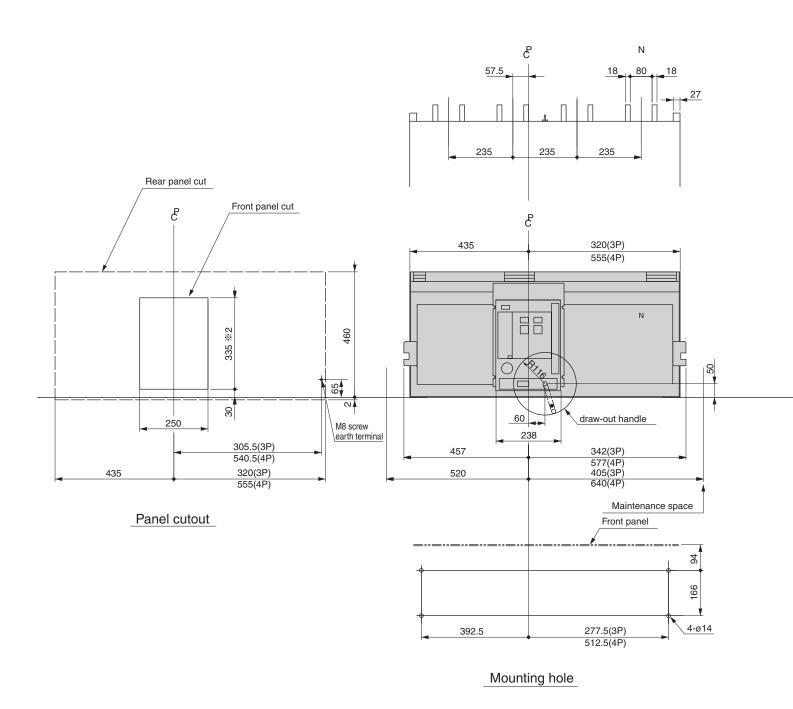
[•] N represents the neutral pole of 4-pole ACBs.

[•] AR420H and AR440H are 3 poles only.



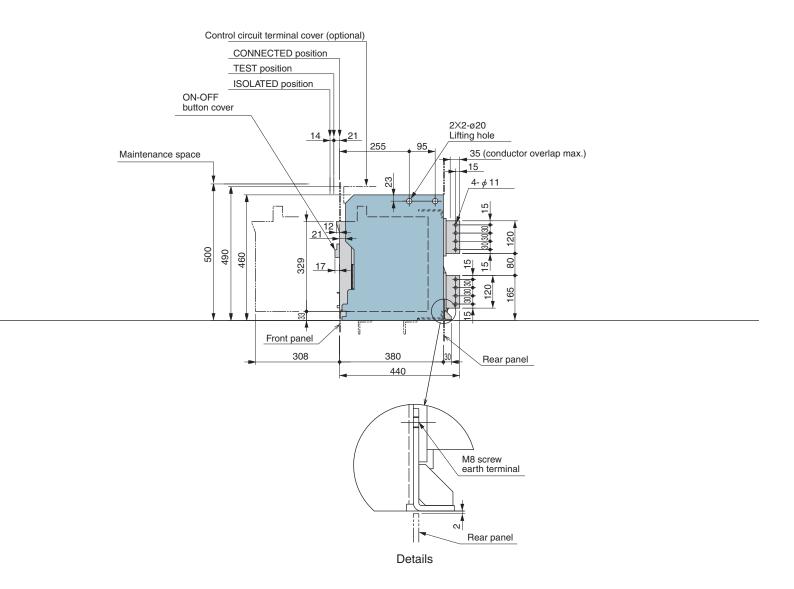
• Types: AR650S, AR663S AR663H Draw-out type

P: ACB Front cover center line



[&]amp;2: Panel cut should be 339 mm not 335 mm when the door flange is used. Refer to page 41.

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



6 Connection

Conductors connection area

Connect conductors to the main circuit terminals in the conductor connection.

Insulation distance of conductor connection area and earth metal is more than 12.5mm.

Types AR208S, AR212S, AR216S, AR220S, AR212H, AR220H

■ Vertical terminals 3P

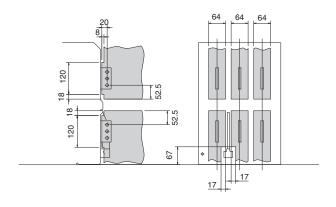
Right side view

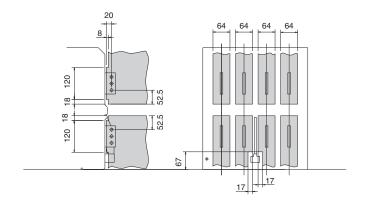
Back view

■ Vertical terminals 4P

Right side view

Back view





■ Horizontal terminals 3P

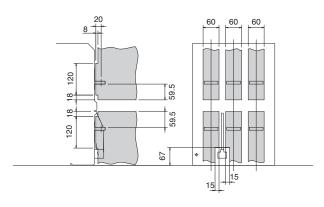
Right side view

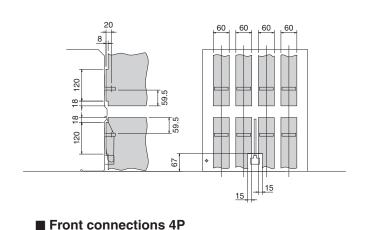
Back view

■ Horizontal terminals 4P

Right side view

Back view





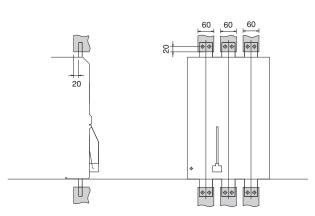
■ Front connections 3P

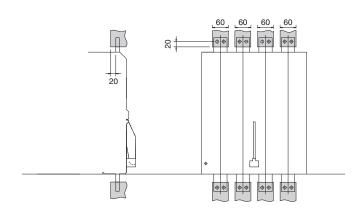
Right side view

Back view

Right side view

Back view



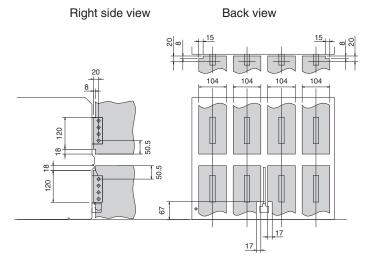


• Types AR325S, AR332S, AR316H, AR320H, AR325H, AR332H

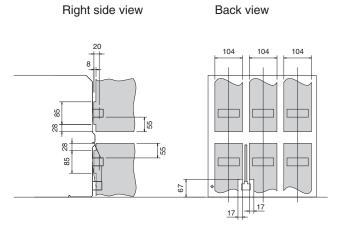
■ Vertical terminals 3P

Right side view Back view 50.5 29

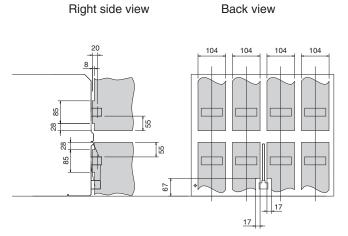
■ Vertical terminals 4P



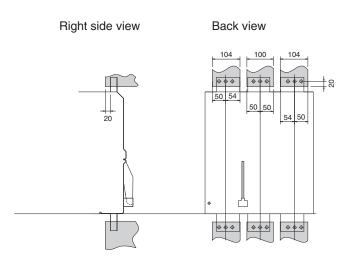
■ Horizontal terminals 3P



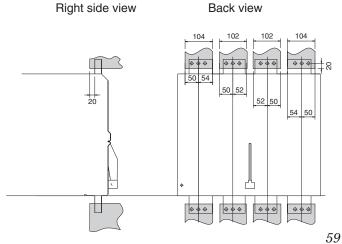
■ Horizontal terminals 4P



■ Front connections 3P



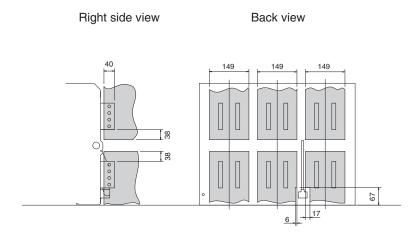
■ Front connections 4P



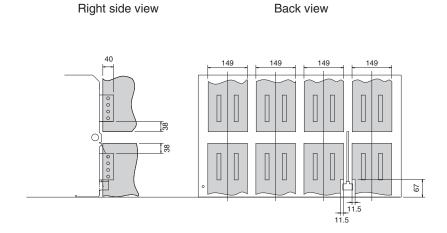


• Types AR440S, AR420H, AR440H

■ Vertical terminals 3P



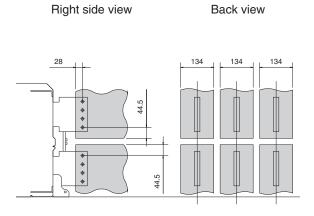
■ Vertical terminals 4P



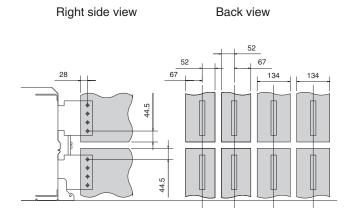


• Type AR440SB

■ Vertical terminals 3P



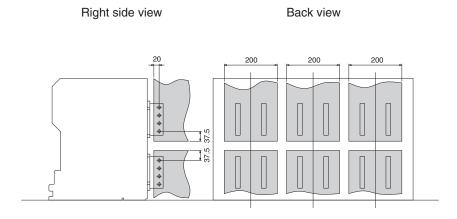
■ Vertical terminals 4P



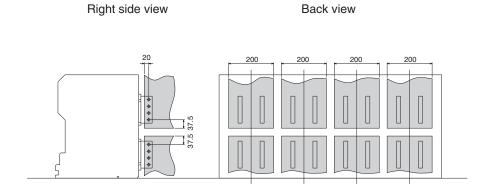


• Types AR650S, AR663S, AR663H

■ Vertical terminals 3P



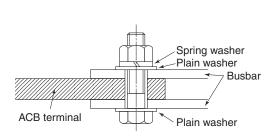
■ Vertical terminals 4P

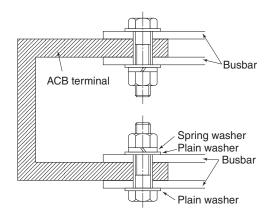




2 Busbars connection

When two busbars are connected to a terminal stud of the ACB, sandwich the terminal stud between the two busbars to utilize both surfaces of the terminal. A spring and plain washer must be used in conjunction with the busbar bolt and nut as below.



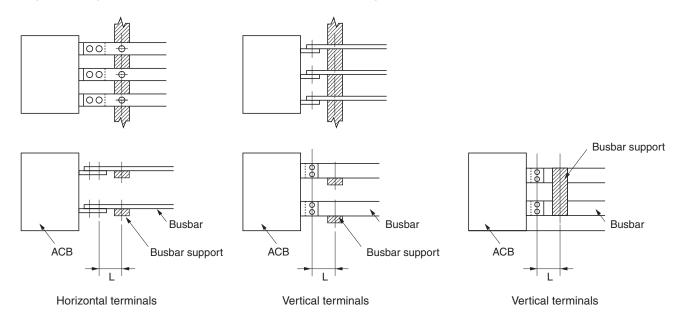


In case of 1 terminal per pole

In case of 2 terminals per pole

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. The support must be strong enough to withstand such forces and ensure the enough insulating distance. The ACB should not be relied on as a single support.

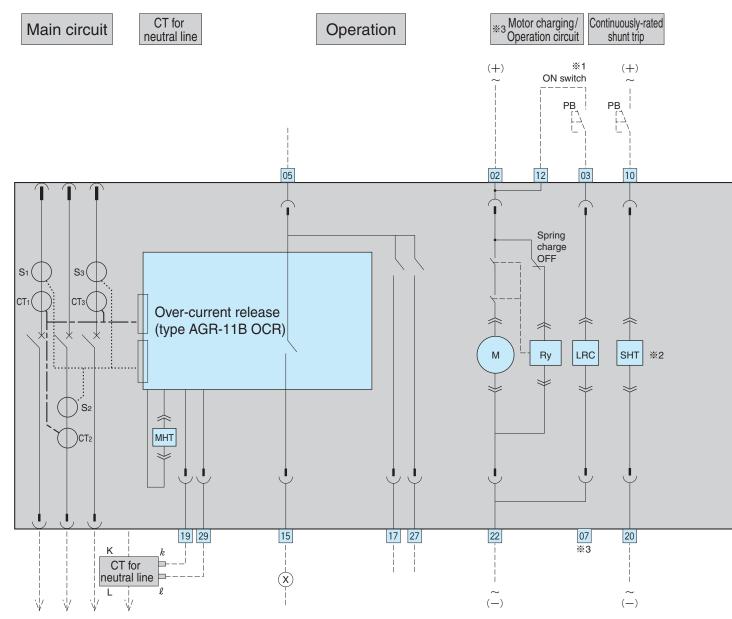


The maximum distance of the connection point of ACB to the first busbar support

| S | Short-circuit current (kA) | | 50 | 65 | 80 | 100 | 120 | 135 |
|--------------------|----------------------------|-----|-----|-----|-----|-----|-----|-----|
| | AR2 | 300 | 250 | 150 | 150 | _ | _ | _ |
| D: 1 | AR3 | 350 | 300 | 250 | 150 | 150 | _ | _ |
| Distance L (mm) | AR440SB | 350 | 300 | 250 | 150 | 100 | _ | _ |
| _ () | AR440S, AR420H, AR440H | 350 | 300 | 250 | 150 | 150 | 100 | _ |
| | AR6 | 350 | 300 | 250 | 150 | 150 | 150 | 150 |



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 OCR trip indication or single-contact trip indication (40ms signal)

UVT power supply

09 100V

- 09

- 09

unit

110V

120V

DC 24V

unit

No.

28 - 09

Term.

No

AC 200V

unit

200V

220V

240V

DC 48V

unit

AC 400V

unit

380V

415V

440V

DC 100V

unit

AC 450V

unit

450V

480V

400V

DC 110V

unit

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

09UVT power supply common

· Do not exceed specified voltages

Symbols for accessories

CT1 - CT3 : Power CTs S1 - S3 : Current sensors M : Charging motor LRC : Latch release coil : Magnetic Hold Trigger MHT Isolating terminal connector

(for draw-out type) Manual connector

User wiring

--X-- Relay or indicator lamp

%1: Do not connect "b" contact of auxiliary switch to ON switch in

series, otherwise, pumping may occur.

*2: See page 22 for the circuit diagram of the continuously-rated shunt trip device with capacitor trip device.

*3: For motor split circuit, terminals 2, 2 and 3, 7 are used for

charging and closing operation respectively.
(Please specify when ordering)

*44: Refer to page 23 (short pulse only)

*55: Only one of terminals

86,

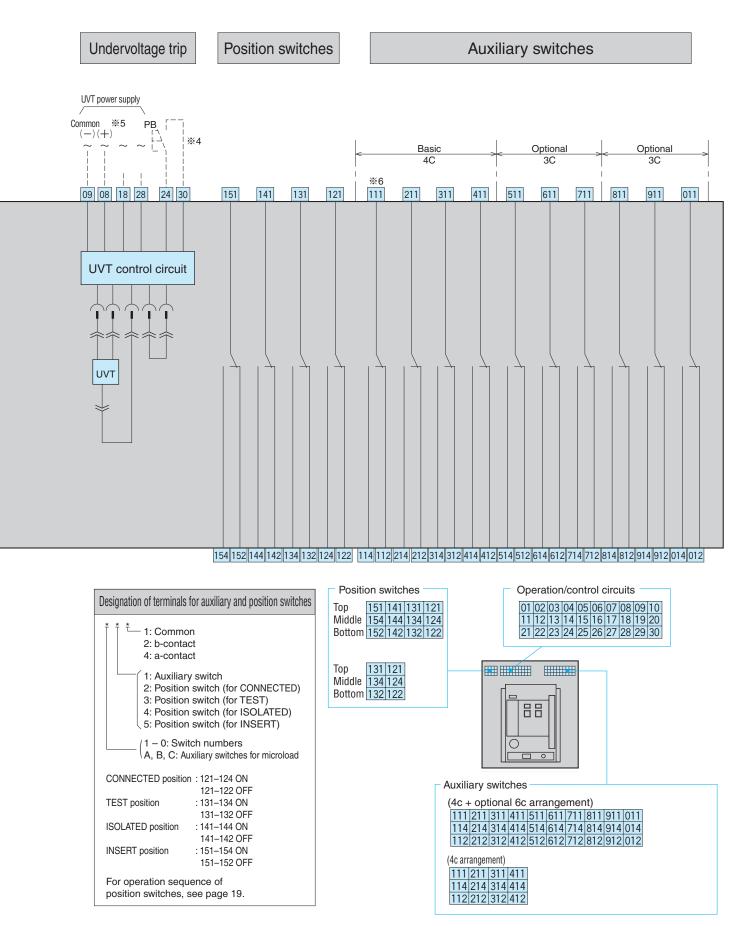
18,

28 must be used as this is a single phase UVT.

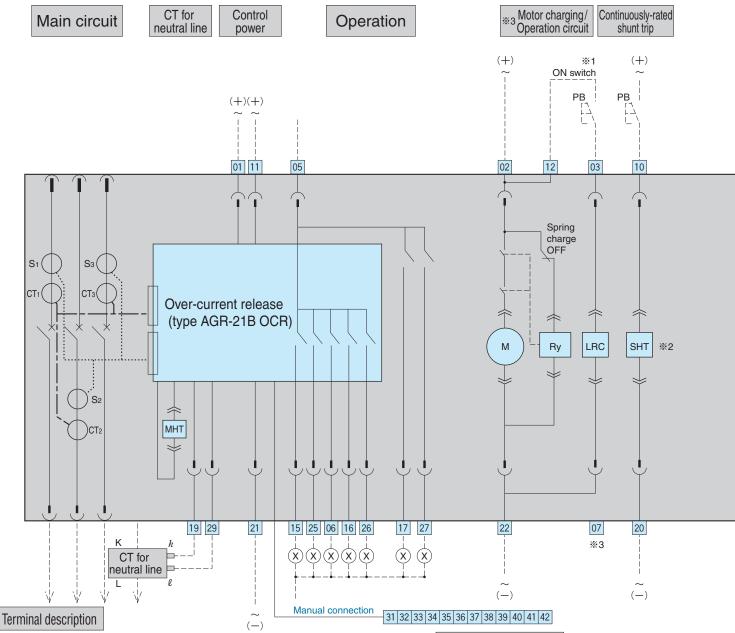
%6: Do not use these terminals for other circuits when both instantaneously rated shunt trip and UVT are fitted. These terminals are used by Terasaki as the anti-burnout SW for the instantaneously rated shunt trip.

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





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 DC100 - 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 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 Communication line (-)

42 Communication line (+)

32 Communication line (common)

Do not exceed specified voltages **UVT** power supply

| Term. No. | AC 100V unit | AC 200V unit | AC 400V unit | AC 450V unit |
|--------------|-----------------|-----------------|-----------------|-----------------|
| 08 — 09 | 100V | 200V | 380V | 450V |
| 18 - 09 | 110V | 220V | 415V | 480V |
| 28 — 09 | 120V | 240V | 440V | 400V |

| Term. | DC 24V | DC 48V | DC 100V | DC 110V |
|---------|--------|--------|---------|---------|
| No. | unit | unit | unit | unit |
| 08 — 09 | 24V | 48V | 100V | 110V |

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

--X-- Relay or indicator lamp

*1: Do not connect "b" contact of auxiliary switch to ON switch in series, otherwise, pumping may occur.
*2: See page 22 for the circuit diagram of the continuously-rated shunt trip device with capacitor trip

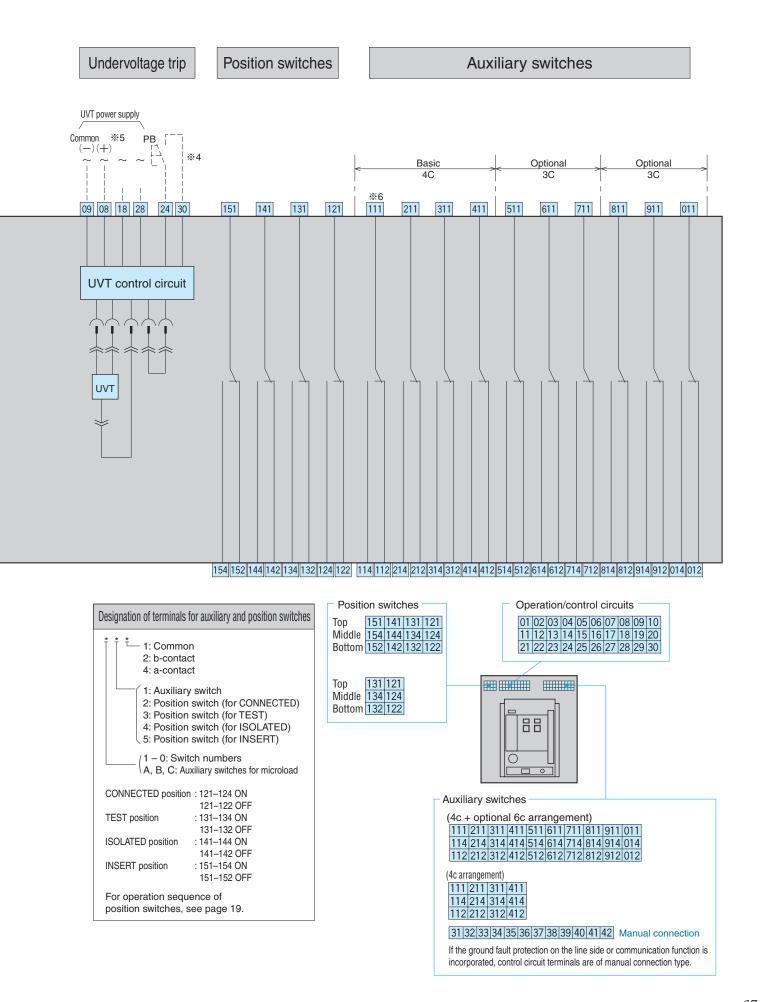
device.

3: For motor split circuit, terminals 2, 2 and 3, 7 are

**8: For motor split circuit, terminals @2, @2 and @3, @7 are used for charging and closing operation respectively. (Please specify when ordering)
**4: Refer to page 23 (short pulse only)
**5: Only one of terminals @3, [18, 28] must be used as this is a single phase UVT.
**6: Do not use these terminals for other circuits when both instantaneously rated shunt trip and UVT are fitted. These terminals are used by Terasaki as the antiburnout SW for the instantaneously rated shunt trip.
Note: In case of a LVT and a Shunt fitted together or compared to the control of the cont

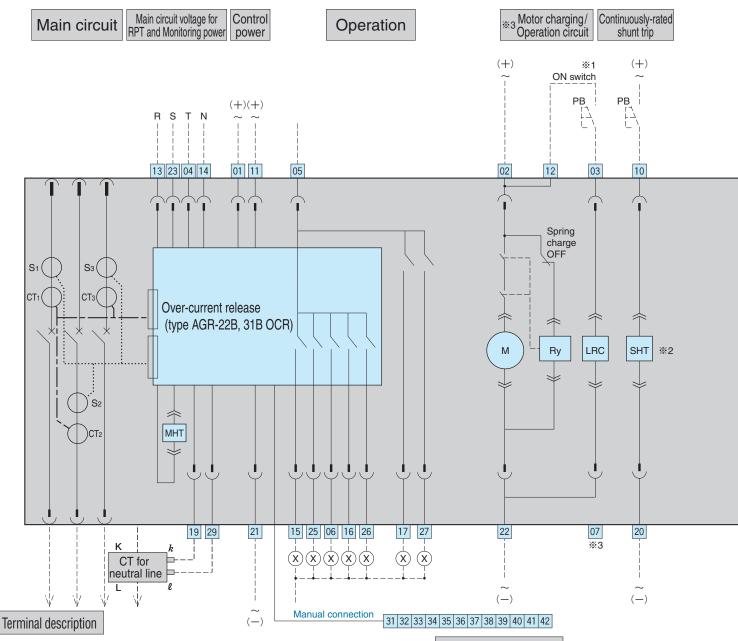
Note: In case of a UVT and a Shunt fitted together or Double opening or closing coil, use an aux. switch to prevent burnout. Contact TERASAKI for wiring.







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 DC100 - 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 or RPT trip indication or ELT trip indication

26 System alarm indication

17 REF, OH, 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 Communication line (-)

42 Communication line (+)

32 Communication line (common)

· Do not exceed specified voltages

UVT power supply

| Term. No. | AC 100V unit | AC 200V unit | AC 400V unit | AC 450V unit |
|--------------|-----------------|-----------------|-----------------|-----------------|
| 08 — 09 | 100V | 200V | 380V | 450V |
| 18 — 09 | 110V | 220V | 415V | 480V |
| 28 — 09 | 120V | 240V | 440V | 400V |
| | | | | |

| Term. | DC 24V | DC 48V | DC 100V | DC 110V |
|---------|--------|--------|---------|---------|
| No. | unit | unit | unit | unit |
| 08 — 09 | 24V | 48V | 100V | 110V |

Symbols for accessories

CT1 - CT3 : Power CTs S1 - S3 : Current sensors Μ : Charging motor LRC : Latch release coil MHT : Magnetic Hold Trigger

Isolating terminal connector (for draw-out type)

Manual connector User wiring

--X-- Relay or indicator lamp

*1: Do not connect "b" contact of auxiliary switch to ON switch in series, otherwise, pumping may occur.*2: See page 22 for the circuit diagram of the

continuously-rated shunt trip device with capacitor trip

**3: For motor split circuit, terminals 02, 22 and 03, 07 are used for charging and closing operation respectively. (Please specify when ordering)

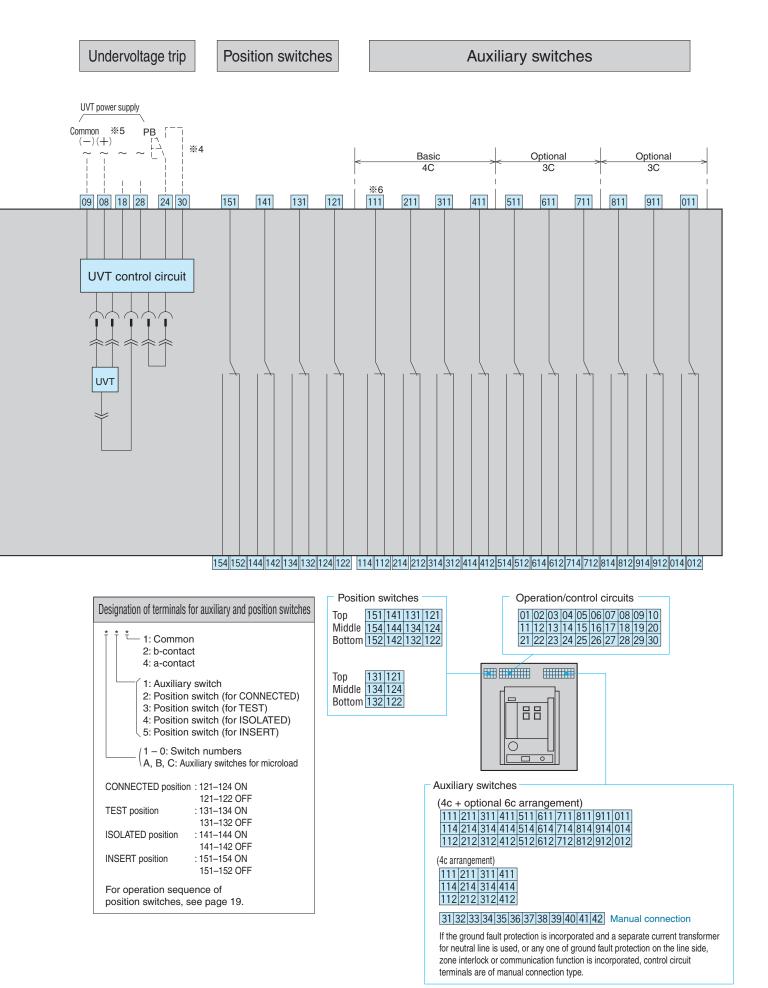
*4: Refer to page 23 (short pulse only)
*5: Only one of terminals ®, B, & must be used as this is a single phase UVT.

uns is a single phase OVI.

Do not use these terminals for other circuits when both instantaneously rated shunt trip and UVT are fitted. These terminals are used by Terasaki as the antiburnout SW for the instantaneously rated shunt trip.

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





Dielectric strength

| Circuit | | | Withstand voltage (at 50/60 H | Rated Impulse withstand voltage <i>U</i> imp | | |
|-----------|--|-----------------------|--|---|------|--|
| Main cire | cuit | | Between terminals, terminal group to earth | AC3500V for 1 minute | 12kV | |
| S | Auxiliary switches Position switches | For general service | Terminal group to earth | AC2500V for 1 minute | 6kV | |
| cuit | | For microload | Terminal group to earth | AC2000V for 1 minute | 4kV | |
| | Position switches | | Terminal group to earth | AC2000V for 1 minute | 4kV | |
| ıtrol | Over-current release | (OCR) | Terminal group to earth | AC2000V for 1 minute | 4kV | |
| Control | Power supply for und reverse power trip fu | lervoltage/ nction | Terminal group to earth | AC2500V for 1 minute | 6kV | |
| Other ac | Other accessories | | Terminal group to earth AC2000V for 1 minute | | | |

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

| Туре | AR208S | AR212S | AR216S | AR220S | AR325S | AR332S | AR440SB | AR440S | AR650S | AR663S |
|--------------------------------------|--------|--------|--------|--------|--------|--------|---------|--------|--------|--------|
| Rated current (A) | 800 | 1250 | 1600 | 2000 | 2500 | 3200 | 4000 | 4000 | 5000 | 6300 |
| DC internal resistance per pole (mΩ) | 0.033 | 0.033 | 0.028 | 0.024 | 0.014 | 0.014 | 0.017 | 0.014 | 0.012 | 0.010 |
| Power consumption for 3 poles (W) | 64 | 155 | 215 | 288 | 263 | 430 | 816 | 672 | 900 | 1190 |

• High fault Series

| Туре | AR212H | AR216H | AR220H | AR316H | AR320H | AR325H | AR332H | AR420H | AR440H | AR663H |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Rated current (A) | 1250 | 1600 | 2000 | 1600 | 2000 | 2500 | 3200 | 2000 | 4000 | 6300 |
| DC internal resistance per pole (m Ω) | 0.024 | 0.024 | 0.024 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.010 |
| Power consumption for 3 poles (W) | 113 | 184 | 288 | 108 | 168 | 263 | 430 | 168 | 672 | 1190 |

Note: Above figures are based on the calculation of 3I²R. For more information please contact TERASAKI.

The max. rated current $[I_n]$ depends on the main circuit terminal arrangement

Ambient temperature 40 °C

| - положения | Ambient temperature 40 0 | | | | | | | | | | |
|-------------------|---|-----------------------|-------------------|---------------------------|-----------------------|-------------------|--|--|--|--|--|
| Based Standard | JIS C 8201-2 IEC60947-2, AS3947.2 | | | ANSI C37.13 NEMA, SG-3 | | | | | | | |
| | Terr | minal arrangen | nent | Terminal arrangement | | | | | | | |
| Туре | Horizontal terminals | Vertical terminals | Front connections | Horizontal terminals | Vertical terminals | Front connections | | | | | |
| AR208S | 800 | 800 | 800 | 800 | 800 | 800 | | | | | |
| AR212S | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | | | | | |
| AR216S | 1600 | 1600 | 1600 | 1540 | 1600 | 1570 | | | | | |
| AR220S | 2000 | 2000 | 2000 | 1670 | 2000 | 1830 | | | | | |
| AR325S | 2430 | 2500 | 2500 | 2230 | 2500 | 2430 | | | | | |
| AR332S | 2790 | 3200 | 3150 | 2700 | 3200 | 2890 | | | | | |
| AR440SB | _ | 4000 | _ | _ | 3310 | _ | | | | | |
| AR440S | _ | 4000 | _ | _ | 3700 | _ | | | | | |
| AR650S | _ | 5000 | _ | _ | 4700 | _ | | | | | |
| AR663S | | 6300 | _ | _ | 5680 | _ | | | | | |
| AR212H | 1250 | 1250 | _ | 1250 | 1250 | _ | | | | | |
| AR216H | 1600 | 1600 | _ | 1540 | 1600 | _ | | | | | |
| AR220H | 2000 | 2000 | _ | 1670 | 2000 | _ | | | | | |
| AR316H | 1600 | 1600 | _ | 1600 | 1600 | _ | | | | | |
| AR320H | 2000 | 2000 | _ | 2000 | 2000 | _ | | | | | |
| AR325H | 2430 | 2500 | _ | 2230 | 2500 | _ | | | | | |
| AR332H | 2790 | 3200 | | 2700 | 3200 | | | | | | |
| AR420H | _ | 2000 | _ | | * | | | | | | |
| AR440H | | 4000 | | _ | 3700 | _ | | | | | |
| AR663H | _ | 6300 | _ | _ | 5680 | _ | | | | | |

Note 1: If different type of terminal arrangement are used for line and load sides refer to the ratings for the horizontal terminals.

Note 2: Front connection can not be specified with the different types of terminal arrangement for line and load sides.

^{*:} Contact TERASAKI for the details.



Derating

Standard Series

| | Ambient | Туре | AR208S | AR212S | AR216S | AR220S | AR325S | AR332S | AR440SB | AR440S | AR650S | AR663S |
|---------------------------|---------------------|-------------------------|---------|---------|----------|----------|-----------|-----------|-----------|----------|-----------|-----------|
| Standards | temperature (°C) | Connecting bar sizes | 2×50×5t | 2×80×5t | 2X100X5t | 3×100×5t | 2X100X10t | 3×100×10t | 4X150X10t | 4×150×6t | 3×200×10t | 4X200X10t |
| JIS C 8201-2-1 Ann.1 | - (| ard ambient erature) | 800 | 1250 | 1600 | 2000 | 2500 | 3200 | 4000 | 4000 | 5000 | 6300 |
| IEC60947-2 | 45 | | 800 | 1250 | 1600 | 2000 | 2500 | 3200 | 4000 | 4000 | 5000 | 6300 |
| EN 60947-2 AS3947.2 | 50 | | 800 | 1250 | 1600 | 2000 | 2500 | 3200 | 3940 | 4000 | 4950 | 6000 |
| A00947.2 | 55 | | 800 | 1200 | 1540 | 1820 | 2500 | 2990 | 3820 | 3940 | 4710 | 5680 |
| | 60 | | 800 | 1150 | 1460 | 1740 | 2400 | 2850 | 3690 | 3760 | 4450 | 5370 |
| NEMA, SG-3 ANSI C37.13 | - (| ard ambient erature) | 800 | 1250 | 1540 | 2000 | 2500 | 3200 | 3310 | 3700 | 4700 | 5680 |
| | 45 | | 800 | 1190 | 1470 | 1960 | 2500 | 3010 | 3200 | 3580 | 4450 | 5370 |
| | 50 | | 800 | 1130 | 1390 | 1860 | 2440 | 2860 | 3100 | 3470 | 4180 | 5050 |
| | 55 | | 790 | 1070 | 1310 | 1750 | 2300 | 2690 | 2980 | 3350 | 3900 | 4710 |
| | 60 | | 740 | 1000 | 1230 | 1640 | 2150 | 2520 | 2870 | 3140 | 3610 | 4350 |

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, AR440SB, AR440S, AR650S and AR663S are for vertical terminals on both line and load side. Above figures are subject to the design of the enclosure and rating of busbar.

High fault Series

| | Ambient | Туре | AR212H | AR216H | AR220H | AR316H | AR320H | AR325H | AR332H | AR420H | AR440H | AR663H |
|---------------------------|---------------------|-------------------------|---------|----------|----------|----------|----------|-----------|-----------|----------|----------|-----------|
| | temperature (°C) | Connecting bar sizes | 2×80×5t | 2×100×5t | 3×100×5t | 2×100×5t | 3×100×5t | 2×100×10t | 3×100×10t | 3×100×5t | 4×150×6t | 4×200×10t |
| Ann.1 IEC60947-2 | (| ard ambient erature) | 1250 | 1600 | 2000 | 1600 | 2000 | 2500 | 3200 | 2000 | 4000 | 6300 |
| | 45 | | 1250 | 1600 | 2000 | 1600 | 2000 | 2500 | 3200 | 2000 | 4000 | 6300 |
| | 50 | | 1250 | 1600 | 2000 | 1600 | 2000 | 2500 | 3200 | 2000 | 4000 | 6000 |
| | 55 | | 1250 | 1600 | 1820 | 1600 | 2000 | 2500 | 2990 | 2000 | 3940 | 5680 |
| | 60 | | 1250 | 1550 | 1740 | 1600 | 2000 | 2400 | 2850 | 2000 | 3760 | 5370 |
| NEMA, SG-3 ANSI C37.13 | , | ard ambient erature) | 1250 | 1600 | 2000 | 1600 | 2000 | 2500 | 3200 | 2000 | 3700 | 5680 |
| | 45 | | 1250 | 1600 | 1960 | 1600 | 2000 | 2500 | 3010 | 2000 | 3580 | 5370 |
| | 50 | 50 | | 1600 | 1860 | 1600 | 2000 | 2440 | 2860 | 2000 | 3470 | 5050 |
| | 55 | | 1250 | 1510 | 1750 | 1600 | 1950 | 2300 | 2690 | 2000 | 3350 | 4710 |
| | 60 | | 1240 | 1420 | 1640 | 1550 | 1830 | 2150 | 2520 | 2000 | 3140 | 4350 |

Note: The values are applicable for both Draw-out type and Fixed type.

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.

8 Technical 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.

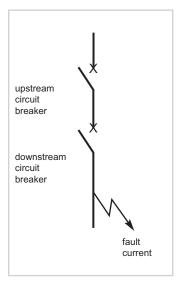
Total discrimination

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 (I_s).

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 73

Note: Discrimination would be total whether the TemPower2 ACB had an integral or external protection relay because I_{CW} (1s) = I_{CS} Most other ACBs have I_{CW} (1s) < I_{CS} .



Discrimination Table

Upsream: TemPower2 ACB with or without Integral Protection Relay

Downstream: TemBreak2 MCCB

Upstream ACB

| Upstream ACB | | | | | | | | | | | | | | | | | | | |
|---------------|--|--|---------------------------------|---|---|--------------------------------------|---|--------------------------------------|--------------------------------------|--------------------------------------|---------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---|--------------------------------------|--------------------------------------|---------------------------------|--------------------------------------|
| Frame | | | 800A | 125 | 60A | | 1600A | | | 2000A | | 250 | 00A | 320 | 00A | 4000A | 5000A | 630 | |
| | Model | | AR208S | AR212S | AR212H | AR216S | AR216H | AR316H | AR220S | AR220H | AR320H | AR325S | AR325H | AR332S | AR332H | AR440SB | AR650S | AR663S | AR663H |
| | | Breaking Capacity | 65kA | 65kA | 80kA | 65kA | 80kA | 100kA | 65kA | 80kA | 100A | 85kA | 100kA | 85kA | 100kA | 100kA | 120kA | 120kA | 135kA |
| 125A | E125NJ S125NJ S125GJ H125NJ L125NJ | 25kA 36kA 65kA 125kA 200kA | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T | T T T T |
| 160A/ 250A | \$160NJ \$160GJ E250NJ \$250NJ \$250GJ \$250PE H250NJ L250NJ | 36kA 65kA 25kA 36kA 65kA 70kA 125kA 200KA | T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T T | T T T T T | T T T T T T |
| 400A/ 630A | E400NJ S400CJ S400NJ S400NE S400GJ S400GE S400PJ S400PE H400NJ H400NE E630NE S630CE S630GE | 25kA 36kA 50kA 70kA 70kA 85kA 85kA 125kA 125kA 36kA 50kA | T T T T T T T | T T T T T T T T T | T T T T T T T T T | T T T T T T T T | T T T T T T T T T | T T T T T T T T | T T T T T T T T | T T T T T T T T | T T T T T T T | T T T T T T T T | T T T T T T T T | T T T T T T T T | T T T T T T T T T | T T T T T T T T | T T T T T T T T | T T T T T T T | T T T T T T T T |
| 800A | \$800-CJ \$800-NJ \$800-RJ \$800-RE \$800-RE H800-NE L800-NE | 36kA 50kA 70kA 50kA 70kA 125kA 200kA | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T | T T T T T |
| 1000A | S1000-SE S1000-NE | 50kA 70kA | - | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T |
| 1250A | S1250-SE S1250-NE S1250-GE | 50kA 70kA 100kA | - | T T T | T T T | T T T | T T T | T T T | T T T | T T T | T T T | T T T | T T T | T T T | T T T | T T T | T T T | T T T | T T T |
| 1600A | S1600-SE S1600-NE | 50kA 100kA | - | - | - | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T | T T |

Notes: 1. All ACB's have Ii set at NON, MCR ON.

T= Total Selectivity

^{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 $400\mathrm{V}$ AC.

Discrimination with 'T' type fuses

The following table should be used as a guide when selecting Terasaki *TemPower2* Air Circuit Breakers and fuses (BS88/IEC60269) which are immediately downstream from a transformer.

In and IR are set to the full rated current of the transformer, and tR, 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 tR, 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 | Туре | AR208S | AR212S | AR212S | AR212S | AR216S | AR220S | AR325S | AR332S |
| | C.T. (A) | 800 | 1250 | 1250 | 1250 | 1600 | 2000 | 2500 | 3200 |
| | 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 |
| SETTINGS | tR (sec) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| (AGR-L) | sd | 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).

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.

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



Accessories For Dual Supply Changeover Systems

Tem Transfer 2 Automatic Changeover Controller

TemTransfer 2 is fully configurable Automatic Changeover Controller (ACC) for use in standby power applications. The module will monitor the voltage and frequency of the incoming AC mains (utility) supply and in the event of a failure will issue a start command to the generator control system.

The controller (ACC) is designed to monitor the incoming AC mains supply (1 or 3 phases) for under/over voltage and under/over frequency. Should any of the parameters fall out of limit, the module will issue a command to the generating set controller. Once the generator set is available and producing an output within limits, *TemTransfer 2* will control the transfer device and switch the load from the mains (utility) to the generating set.

When the mains (utility) supply returns to within limits, the module will command a return to the mains (utility) supply and shut down the generator after a suitable cooling run. Various timing sequences are available to prevent nuisance starting or unnecessary supply breaks.



Tem Transfer 2 Product Features

TemTransfer 2's back-lit LCD shows system status and indicates any system warnings via a 4 line text display. Red and green LEDs indicate the operational status of the network. The module can be easily configured by using TemTransfer 2 Configuration Suite PC Software, via an interface kit (optional).

- Back-lit LCD with 4 line text display
- Real time clock
- PC / Front panel configuration
- Volt-free relays
- Configurable timers

- 5 configurable outputs
- 10 configurable inputs
- Event loa
- · Auto start inhibit
- Load inhibit

Supporting many different topologies, configurable timers, volt-free digital inputs and outputs make the *TemTransfer 2* controller a fully flexible solution to suit a wide variety of applications.



Fixed and Drawout Pattern ACB's AR208 to AR663 (800A to 6300A)

| COMPANY NAME: | EMAIL ADDRESS: | | | | | | | | | | | |
|---|--|--|------------|--|---------------|------------------------------|----------------|--------------------------|-----------|---------|-----------------|--|
| CONTACT NAME: | ORDER NUMBER: | | | | | | | | | | | |
| TELEPHONE NUMBER: | | | QUANTITY: | | | | | | | | | |
| FAX NUMBER: | DELIVE | DELIVERY TIME REQUEST : | | | | | | | | | | |
| 1.TemPower 2 ACB: Enter yo | er to the catalogue for ratings and specfications) | | | | | | | | | | | |
| TERASAKI ACB TYPE | | , | AR | | | FOR EX | AMPLE - | AR | 325 | | | |
| ENTER CIRCUIT BREAKER TYPE - T | ype S, H or SB | | | | | 'H' TYPES AND 'SB' T | ARE ONLY | AVAILABLE IE 4000A AC | ON 1250A | ГО 3200 | DA ACBS | |
| ENTER RATED CURRENT - Amps | | | | | | 7 | | 1000,1710 | .5 | | | |
| ENTER SENSOR KIT RATING - Ict | | | | | | ONLY ENT | ER A VALU | IE IF DIFFER | RENT FROM | RATE |) CURRENT | |
| ENTER NUMBER OF POLES | → | | | ONLY ENTER A VALUE IF DIFFERENT FROM RATED CURRE | | | | | | | | |
| 2.Type of Mounting, Connect | tions and Shutters: Tick require | es. | | | | | | | | | | |
| Fixed Pattern. | Not available on AR4 & AR6 ACBs | | Drawout | Pattern. | | |] | | | | | |
| | | | Diamout | | | | J | | | ı | | |
| T 0 " | Horizontal Vertical Front | | | | | Control Circ | | l Cover | | | | |
| Top - Connections. Bottom - Connections. | | | | | | Main Circuit Control Circ | | | | l | | |
| Bottom - Connections. | For AR4 & AR6 ACBs only vertical connections are availal | ble | | | | Control Circ | uit Shutters | | | J | | |
| 3.AGR - Protection Relay and | d Protection Options: Tick requ | uired bo | oxes. | | | | | | | | | |
| Non Automatic. | Go to Section 4 - Indication | | | | | | | | | | | |
| | AGR-11B | | AGR-2 | 21/22B | | | AGF | R-31B | | 1 | | |
| | Economy Protection - Dial | S | tandard Pr | | .CD | En | | otection - L | CD | | | |
| Protection Functions | AGR-11BL | AGR-21BL | AGR-21BR | AGR-21BS | AGR-22BS | AGR-31BL | AGR-31BR | AGR-31BS | | | | |
| AL | | | | | | | | | | | | |
| PS | | | | | | | | | | 1 | | |
| GL | | | | | | | | | | | | |
| GS | | | | | | | | | | l | | |
| PG | | | | | | | | | | l | | |
| PR | | | | | | | | | | l | | |
| Protection Options | | | | | | | | | | | | |
| N-Phase Protection -NP. | | <u> </u> | | | | | | | | l | | |
| S1-Contact Temperature Monitoring - OH. | | | | | N2 | N2 | N2 | N2 | | l | | |
| S1-Trip Indicator. | | N2 | N2 | | N2 | N2 | N2 | N2 | | | | |
| S1-Phase Rotation Protection - NS. | | N2 | N2 | | | N2 | N2 | | | l | | |
| S1-Restricted Ground Fault - REF. N4 | | N2 | N2 | | | N2 | N2 | | | | | |
| S2-Second Pre -Trip Alarm - PTA2. | | | | | N3 | | | N3 | | 1 | | |
| S2-Undervoltage Alarm - UVA. | | | | | N3 | N3 | N3 | N3 | | 1 | | |
| S2-Spring Charge Indicator. | | | | | N3 | N3 | N3 | N3 | | l | | |
| Zone Interlock - Z. | | | | | | | | | | l | | |
| Communication - C. | | | | | | | | | | | | |
| Earth Leakage - ELT. | | | | | | | | | | 1 | | |
| Please specify control voltage | AC100-120V AC200-240V | DC24V | | DC48V | | DC100-25V | | DC200-250V | | | | |
| Example of AGR Protection Relay Descripti | on_ | | | For AGR-31B please state system voltage - Volts | | | | | | | | |
| | ACD CARL D | 1 | | Consife a | anavatav full | lood oursent | (In) if applie | abla | | Λ | (DO T D-1) | |
| | AGR -21BL -P S | J | | Specify g | enerator iuii | load current | (іп) іі аррііс | able - | | Amps | (BS Type Relay) | |
| RELAY KEY Protection Relay Family. | | Back lit LCD for AGR-21B, 22B (option) | | | | | | | | | | |
| Protection Relay Group. | | | | Baok iit E | 02 101 71011 | 2.0, 220 (0) | 5.1.0.1.) | | | I | | |
| Protection Function and Indication. | | | | NOTES: | | | | | | | | |
| A = LSI PROTECTION. (as standard on all protect | N1 - Soon to be available. | | | | | | | | | | | |
| G = A + UNRESTRICTED GROUND FAULT PROT | N2 - Only one function can be selected from section S1. | | | | | | | | | | | |
| P = A + PRE TRIP ALARM. | tion contact operation | | | | | | | | | | | |
| R = A + REVERSE POWER. | contact indicator. | | | N4 - Restric | ted Ground Fa | ult only availab | le with PG fun | ction. | | | | |
| AGR BL Type Protection Relay - INDUST AGR BR Type Protection Relay - CHARA AGR BS Type Protection Relay - GENER | ACTERISTICS TO IEC 60255-3 | | | | | | | | | | | |
| | | | | ı | | | | | | | | |



Fixed and Drawout Pattern ACB's AR208 to AR663 (800A to 6300A)

| 4.Indication Accessories: Tick required boxes. | | | | | | | | | | | | |
|---|------------|------------------------------|-----------------------------|--------------------|----------------|---------------|--------------|---------|--|-------|-----------|--|
| 4AB Auxiliary Switches | | 1 | | | | | | | | | | |
| 7AB Auxiliary Switches | | | | | | | | | | | | |
| 10AB Auxiliary Switches | | | | | | | | | | | | |
| | Insert | Isolated | Test | Conn | 1 | | | | | | | |
| 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 | | | | | | | |
| | | 1 | | (0) 0 | | | | | | 1 | | |
| Trip Indication Switch Normal Gold Spring Charge Switch Normal Gold | | _ | Ope | n/Close Cy | cie Counter | | | | <u></u> | J | | |
| Ready to Close Switch Normal Gold | | _ | | | | | | | | | | |
| | | | | | | | | | | | | |
| 5.Electrical Operation Accessories: Tick required be | oxes. | | | | | | | | | | | |
| Double Closing Coil 24V DC & 240V AC Only (Short Rated) | | | Cap | acitor Shur | nt Trip 110 A | .C (Not Avail | able with U\ | /T) | |] | | |
| Double Shunt Trip Coil 24V DC &240 V AC Only (Short Rated) | | | | | | | | | | | | |
| Split Circuit** (For Motor and Closing Coil) | | **Sp | low. | | | | | | | | | |
| AC - Control Voltage | AC100 | AC110 | AC120 | AC200 | AC220 | AC230 | AC240 | AC380 | AC400 | AC415 | AC440 | |
| Shunt Trip Continuously Rated (Short Rated with UVT) | | | | | | | | | | | | |
| Motor Operator and Closing coil | | | | | | | | | | | | |
| Closing Coil (Split Circuit)** | | | | | | | | | | | | |
| Motor Operator (Split Circuit)** Undervoltage Trip Device - Instantaneous | | | | | | | | | | | | |
| Undervoltage Trip Device - Tinstantaneous Undervoltage Trip Device - Time-Delay | | | | | | | | | | | | |
| | DC24 | DC30 | DC48 | DC100 | DC110 | DC125 | DC200 | DC220 | DC250 | 1 | | |
| DC - Control Voltage Shunt Trip Continuously Rated (Short Rated with UVT) | DC24 | DC30 | DC46 | DC 100 | DCTTO | DC 125 | DC200 | DC220 | DC250 | | | |
| Motor Operator and Closing coil | | | | | | | 1 | 1 | | 1 | | |
| Closing Coil (Split Circuit)** | | | | | | | | | | 1 | | |
| Motor Operator (Split Circuit)** | | | | | | | | | | | | |
| Undervoltage Trip Device - Instantaneous | | | | | | | | | |] | | |
| 6.External Accessories: Tick required boxes. | | | | | | | | | | | | |
| | | 1 | | IDEE T | | | | | | 1 | | |
| Door Flange IP20 Door Flange IP31 | | _ | | Fixing Bloo | sparent Cov | er | | | - | ł | | |
| Standard Drawout Handle | | _ | | Test Jump | | | | | | 1 | | |
| Storage Drawout Handle | | Auto-Discharge | | | | | | | | | | |
| Mal-insertion Prevention Device (Insert Code in Box) | | Lifting Plates | | | | | | | | | | |
| InterPole Barriers (Not Applicable for Front Connections) | | OCR Checker ANU-1 | | | | | | | | | | |
| Step Down Transformer (P380-440V/S220V) | | OCR test interfaceunit ANU-2 | | | | | | | | | | |
| Tropicalisation Treatment | | _ | Main Shutter Padlock Device | | | | | | | | | |
| Anti-Corrosion Treatment Cold Climate Treatment | | _ | | IP3X Chas | sis Protection | on | | | <u></u> | J | | |
| Test Report (Enter Number of Copies in Box) | | Lifter Loader AWR-1B Fo | | | | | | | | | 3 & 440SB | |
| | | 1 | | For AR 2, 3, 4 & 6 | | | | | | | | |
| 7.Locking and Interlocking Systems: Tick required | hoves | | | | | | | | | • | | |
| | | | | | , | | | | | | | |
| Horizontal Mechanical Interlock for three ACBs, Gen. ACB Interlocked with outer | ACBs | | Type A (4) | | | | | | | | | |
| Horizontal Mechanical Interlock for three ACBs, one or two from three Horizontal Mechanical Interlock for two ACBs, one from two | Type B (2) | | | | | | | | | | | |
| Horizontal Mechanical Interlock for two ACBs, one from two Horizontal Mechanical Interlock for three ACBs, one from three | | | Type C (1) Type D (3) | | ł | | | | | | | |
| Tionzonial Wednamed Interior for the CASS, one from three | | | 1, pc 2 (c) | | J | | | | | | | |
| Type A - Indicate position of Gen. ACB | Left | Cent | Right | | | | | | | | | |
| All Types - Pitch 'P1'(1st & 2nd), 'P2' (2nd & 3rd) | | mm P2= | | mm | | | | | | | | |
| Vertical Mechanical Interlock for two ACBs, one from two | | | 1 | | | | | | | | | |
| Enter Vertical Pole Pitch 'P' Between ACBs | P= | | mm | | | | | | | | | |
| Door Interlock | | | 1 | Storage dr | awout hand | e is recomm | ended. | | | | | |
| | | | _ | g | | | | | | | | |
| 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 | | | 1 1100 | One box | | | | | | | | |
| Castell Lock (Lock in Off) and Key (Factory fitted-European market only) | | | 1 | | | Enter Caste | II symbol re | quired. | | | | |
| Castell Lock (Lock in On) and Key (Factory fitted-European market only) | | |] _ | | | Enter Caste | ll symbol re | quired. | | | | |
| 8.Earthing Devices: Tick required boxes. | | | | | | | | | | | | |
| | 01 : /5 | | - 0 | | г | 1 | | | | | | |
| Body (Portable Part) | Chassis (F | ermanent F | Part) | | |] | | | | | | |
| Earthing Device Note: | | | | | | | | | | | | |
| Not available with front connections. | | | | | | | | | | | | |
| Not recommended with a UVT, as manual disconnection is required. | | | | | | | | | | | | |
| For Customer Notes or References. | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |



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