U-Series Air Circuit Breakers

Instruction Manual



Type covered in this manual

- UAN Type : UAN06, UAN08, UAN10, UAN12, UAN16, UAN20, UAN25, UAN32, UAN40, UAN50
- UAS Type : UAS06, UAS08, UAS10, UAS12, UAS16, UAS20, UAS25, UAS32

Notice

- Read this instruction manual carefully before using this Air Circuit Breaker.
- This instruction manual does not include all information regarding installation and maintenance.
- For further information, please contact Hyundai Heavy Industries (HHI) or your local dealer.



For Operational Safety of Air Circuit Breakers

Safety Practices

This instruction manual applies only to U-Series air circuit breakers (ACB) regarding installation and maintenance procedures. Installing and maintaining these products improperly may result in serious personal injury, property damage, or even death. Therefore this instruction manual must be read and understood at any step in unpacking, assembly, operation, and maintenance of the breaker. Only qualified persons who are familiar with installing and maintaining circuit breakers are permitted to work on breakers, and this instruction manual should be accessible to those persons at any time.

Signal Words

Signal words used in this instruction manual are divided by DANGER, WARNING, and CAUTION depending on the situation.



Indicates an imminently hazardous point that, if ignored, a serious accident causing death or severe injury could occur. This is the most dangerous point.



Indicates a potentially hazardous point that, if ignored, a serious accident causing death or severe injury could occur.



Indicates a potentially hazardous point that, if ignored, minor or moderate injury could occur. This signal reminds operators to work safely.

Transportation Precaution



Never lift the ACB over an area where there are people. Naver stand under the ACB.

OCR Field Test Precautions



- OCR field tests and setting changes must be performed by qualified personnel.
- After completion of OCR tests, make sure to return the original values.
- Failure to do may cause a fire or burnout.

Operation Precautions



- Never touch live terminal parts. There is a risk of electric shock.
- Do not leave the ACB in the draw-out position. Dropping the ACB cause serious injury.



- If the ACB trips open automatically, remove the cause before closing the ACB.
- Otherwise, a fire could occur.
- For the ACB with the fixing block, be sure to loosen the block screws before drawing out the ACB. Otherwise, damage to the ACB may occur.

Installation Precautions



- Installation work must be performed by qualified personnel.
- Prior to commencing any installation work, open an upstream circuit breaker to shut off all sources of power. Otherwise, electric shock may occur.
- Tighten terminal bolt up securely to the specified torque. Otherwise, a fire may occur.
- Fix the draw-out cradle of the ACB firmly on a flat level surface using mounting screws. Otherwise, draw-out operation may cause the ACB to fall.
- To ensure adequate arc space (insulation distance), avoid blocking the arc gas vents of the ACB. Otherwise a burn may result from high temperature arc gas.
- Do not place the ACB in such as an area that is subject to high temperature, high humidity, dusty air, corrosive gas, vibration and shock, or other unusual conditions.

Mounting in such area could cause a fire, non-tripping, or malfunction.

- Install the ACB to prevent dust, concrete powder, iron powder, and rainwater from entering the unit. These materials could cause a fire or non-tripping.
- For the ACB with four poles, connect the neutral wire of a 3-phase, 4-wire cable to the N-phase pole (on the right end).

Otherwise, an overcurrent may cause non-tripping resulting a fire.

Maintenance and Inspection Precautions



- ACB maintenance, inspection and/or parts replacement must be performed by qualified personnel.
- Prior to commencing any work on the ACB, open an upstream breaker or the like to isolate all sources of power/voltage from both the primary and auxiliary circuits.
 Otherwise, electric shock may result.
- Prior to commencing ACB internal inspection, make sure that the ACB is open and the closing spring is released. Otherwise, fingers or tools could be pinched in the internal mechanism, resulting injury.
- Retighten the terminal screws periodically to the specified torque. Otherwise, a fire could result.
- Be sure to reinstall the arc chamber if removed. Failure to do so or incorrect installation of the arc chamber may result in a fire or burn.
- Do not touch ACB live parts (contacts in particular), or structural parts close to a live part immediately after opening the ACB to stop supplying power.

Otherwise, remaining heat may cause burn or residual charged voltage may cause electric shock.

Do not bring your hand or face close to the arc gas vent of the arc chute while the ACB is closed.
 Otherwise, a burn may result from high-temperature arc gas blowing out of the arc gas vent when the ACB trips open.

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01 Receiving and Handling

Upon receipt of your breaker, check the following first.

HHI air circuit breakers are completely assembled, inspected and tested both electrically and mechanically at the factory, then shipped in fully guaranteed condition in construction and operation.

1.1 Storage

While it is recommended that the breaker be used as soon as you have received it. If it is necessary to store the ACB, note the followings.

- 1) Store the breaker in a dry indoor location to prevent condensation due to sudden changes in ambient temperature, which is quite harmful to the breaker insulation.
- Store the breaker in a clean place free of corrosive gases, dirt, dust and salinity (NaCl). In particular, a mixture of cement dust and moisture may cause corrosion damage to metal parts of the ACB. Fully protect the breaker from such mixtures.
- 3) Place the breaker on a flat, level surface in its normal position.
- 4) Do not place the breaker directly on the floor.
- 5) Do not stack up ACBs.

1.2 Transportation

When transporting the breaker, follow these instructions.

- 1) When lifting up the breaker, suspend wire rope from lifting lug and take care to ensure that the wire ropes do not touch the arc chute and protection relay. When lifting up the breaker, be sure to lift it up slowly.
- 2) Lower the breaker onto a flat surface.
- 3) Avoid impacts and shocks to the breaker during transportation.

1.3 Installation

1) Ambient temperature : from -5 °C to +40 °C (24 hours average temperature should not exceed 35 °C).

- 2) Altitude : Less than 2,000 m
- 3) In case of special environment application

(1) Derating table for the altitude over 2,000 m

Altitude	≤2,000 m	3,000 m	4,000 m	5,000 m
Rated voltage	690 V	590 V	520 V	460 V
Rated current	100 %	99 %	96 %	94 %

(2) Derating table for ambient temperature over 40 $^\circ\text{C}$

Ambient Temperature	≤40 °C	50 °C	60 °C
Rated current	100 %	95 %	90 %

01 Receiving and Handling

(3) Clearance requirements

Minimum Space Distance	А	В
Insulate parts	150 mm	30 mm
Metal parts	150 mm	50 mm

* - In case of arc shield application, ignore "A" size.

- In case of mechanical interlock application, it needs extra space over "B" size.







03 Operation

Air circuit breakers are available either manual charging type or motor charging type.

3.1 Manual Charging Type

In the manual charging type, both charging the closing springs and open-close control of the breaker should be done manually. The breaker is able to close only when the closing spring is charged.

Do not force down the charging handle after completion of charging. It may cause a malfunction.

1) Spring charging operation

Follow the procedure given below to charge the closing springs.

- Pump the charging handle (Fig. 2. ①) about five times.
- When closing springs are fully charged, a metallic click will be heard and no more pumping of the charging handle will be possible. Check that the spring charged indicator now shows [[www]] (Fig. 2. (2)).

2) Closing operation

Check the instruction before closing the breaker.

- Closing spring should be charged.
- Position lock release button should be in original position (Fig. 3. ①).

• Specified voltage should be applied to the under-voltage trip device option. See the description of the under-voltage trip device for the procedure in detail.

Upon satisfactory confirmation of the above three items, press the closing button (Fig. 3. 2). Then, closing springs are discharged and the breaker is closed. The close/open indicator indicates [] and spring charged indicator shows [][[]. 3. (3).

3) Opening operation

Press the open button (Fig. 3. ④), close/open indicator indicates 「O」 (Fig. 3. ⑤).

Fig. 2

Fig. 3





3.2 Motor Charging Type

In this type, a motor-operated mechanism automatically charges the closing springs. Means for remote electrical close-open control of the breaker are also fitted (see page 50-51 wiring circuit). Manual operation is also possible (manual operation procedures are described in the 3.1 section manual charging type).

- 1) Spring charging operation
- Supply the specified control power voltage to the charging motor circuit.
- As soon as the closing springs are discharged, the charging motor is turned on to charge the closing springs.
- The charging motor is automatically stopped after the closing springs are fully charged. Then, charged/discharged indicator show charged sign, 「IMM -]」 (Fig. 2. ②).
 Spring charging time is different according to control power and type of breaker. This is normally within a range of 3 to 10 seconds.

A CAUTION

The permissible control voltage range for the charging motor is from 85 % to 110 % but 100 % of rated voltage is more recommended to be supplied.

Failure to follow this instruction will result damage in charging motor.

A CAUTION

It is strongly recommended to supply the control power at the rated voltage. Dielectric withstand test in motor, AC/DC 100-220 V : 1,500 V 1 min, DC 24, 48 V : 500 V 1 min. The motor jack should be disconnected before dielectric withstand test.

2) Closing operation

Before closing the breaker, check the followings.

- Closing springs are charged.
- Position lock release button should be in original position.
- Under voltage trip device (UVT) is supplying rated voltage.

Upon satisfactory confirmation of the above items, press the PB (Close) button (page 50-51).

This energizes LRC (latch release coil, Fig. 9. ④) which in turn release the closing springs and close the breaker. Close/Open indicator indicates [1] (Fig. 3. ③).

Charged/Discharged indicator indicates [www] (Fig. 3. ③).

When closing springs are discharged, the charging motor immediately turn to charge closing springs.

A CAUTION

Even when no. 2) is not satisfied, the breaker will not be placed in a closed state. Be sure to perform closing operation according no. 2).

3) Opening operation

The shunt trip device (SHT) or under voltage trip device (UVT) is used for remote electrical opening operation. Press the open button (PB open, page 50-51). This opens the breaker via the SHT or UVT.

A CAUTION

When close-open operations are repeated with the charging motor ON, limit the number of successive close-open cycles to 10 times. If the open-close cycle is repeated more than 10 times, allow a cooling period of at least 10 minutes between the 10th cycle and the 11th cycle.

Repeating open-close cycle more than 10 times consecutively may damage of charging motor.

04 Draw-out Mechanism

In order to test the breaker and exchange parts easily, the breaker body is drawn-in/out from draw-out cradle, the breaker can be fixed in one among three of draw-out cradle.

The breaker can be moved to TEST or ISOLATED position when the panel door is closed.

Caution of operation

- Open the breaker before working with the draw-out mechanism.
- Loosen the screws of the fixing blocks before drawing out the breaker body.
- Push the position lock release button (Fig. 1. (18)), insert draw-in/out handle into the insertion hole (Fig. 1. (19)).
- When you try to move the breaker body to the CONNECTED position, the operating force will increase. Torque of operating force is about 25 kgf.
- Operate draw-in/out handle totally in inserted state.
- Rotate draw-in/out handle until the handle is locked automatically at each ISOLATED, TEST, and CONNECTED position. At each locked position, stop turning the draw-out handle.

Failure to follow this instruction can result in equiptment damage or malfunction.

▲ CAUTION

During the breaker body move from ISOLATED to CONNECTED position, or from CONNECTED to ISOLATED position, do not rotate the handle by releasing position locking.

CONNECTED position



ISOLATED position



TEST position



REMOVED position



4.1 Draw-out Operation

The draw-in/out handle is used to move the breaker body to one of the three positions (CONNECTED, TEST, ISOLATED).

A CAUTION

When the fixing blocks (Fig. 4. 2) option) are fitted, loosen the right and left screws of the fixing blocks before drawing-out operation.

1) Moving from CONNECTED position to TEST position

- When the fixing blocks are fitted, loosen and free right and left screws.
- Check that the breaker is open. If it is closed, push open button (Fig. 4. ④) to open breaker.
- When the position lock release button is completely pushed in, connect draw-in/out handle to shaft fully.
 If it is not completely pushed in or not inserted, the body doesn't move and indicator doesn't rotate.
 The position indicator is rotated while the breaker body drawn out.

A CAUTION

When the main circuit is disconnected as the breaker body is being drawn out, the breaker body will be slightly pushed forward by the spring action of the primary disconnect contacts with a "banging" sound.

While the loudness of this sound may vary, the sound itself is perfectly normal and does not affect breaker performance.

Fig. 4



A CAUTION

When position lock release button (Fig. 4. ⑤) is pushed, the breaker will not close. In order to test operation, must move to the right position (CONNECTED, TEST, ISOLATED), and position lock release button (Fig. 4. ⑥) should be pushed out.

DANGER

When breaker body is drawn out to the TEST position or ISOLATED position, a metallic sound "click" will be heard, and the draw-in/out handle operation is automatically locked. At this time, do not attempt to compulsively rotate the handle.

04 Draw-out Mechanism

2) Moving from TEST position to ISOLATED position

In order to move from TEST to ISOLATED, push position lock release button (Fig. 4. (5)) shortly after handle locking is released, and turn the draw-in/out handle in a counterclockwise direction.

A CAUTION

If it is approaching ISOLATED position, draw-in/out handle (Fig. 4. ①) will be automatically locked. Do not attempt to compulsively rotate the handle.

3) Removing body from ISOLATED position

For maintenance, inspection, or exchanging parts, the breaker in the ISOLATED position should be drawn out from the draw-out cradle. If the breaker is charged, the breaker should release the closing springs, by using the manual close and open button.

• When the breaker is drawn-out perfectly, the breaker body is stopped by rail end stoppers (Fig. 5. ④). To release the stoppers, pull down the body lock (Fig. 5. ④) and take out the body slowly.

A CAUTION

This operation should be done slowly.

Apply wire rope to the lifting lug and lift the body upward after releasing stoppers.

A CAUTION

Don't leave the breaker in REMOVED position. When the breaker is drawn out, the center of gravity is changed. The draw-out cradle should be fixed in advance in the PNL.

Fig. 5



4.2 Draw-in Operation

In order to push back the breaker body to CONNECTED position, follow steps below.

- Check that the breaker is open. Also, check draw-in/out indicator shows isolated.
- Check charged/discharged indicator.
 Indicator shows discharged []
- Lift up the breaker body or use a special lifter. Push in the breaker body until the body side rails are locked by the cradle side plate.

A CAUTION

Never enter under the breaker. The breaker may fall and cause serious injury. Do not push hard the breaker.

- With position lock release button (Fig. 4. ⑤) pushed, connect drawing in/out handle to the shaft.
- Then, when position lock release button (Fig. 4. ⑤) is pushed, it maintains self holding and allows draw-in/out handle (Fig. 4. ①) operation.
- To move the breaker to CONNECTED or TEST position, rotate draw-in/out handle in a clockwise direction.
 With the breaker moving, if position indicator is accessing TEST position, position release button (Fig. 4. (5)) is automatically pushed out and it locked draw-in/out handle.
- When the handle is locked, do not rotate excessively. This may cause damage to the breaker.
- In the TEST position, with the handle stick, PUSH position release button (Fig. 4. (5)) again and release draw-in/out handles.
- With position lock release button pushed, it maintains self holding, rotate draw-in/out handle in a clockwise direction again.
- Main circuit connection starts just before CONNECTED position, draw-in/out handle operation will become heavy.
 But continue the rotating by adding force until, position indicator (Fig. 4. ⁽⁶⁾) of the breaker shows CONNECTED and, position release button (Fig. 4. ⁽⁵⁾) is automatically pushed out to lock the draw-in/out handle.
 Then, remove draw-in/out handle and fix it on the right side of draw-out cradle.
- In CONNECTED position, do not operate draw-in/out handle in a clockwise direction. This may cause damage to the breaker.
- When the breaker fixing block is fitted, tighten left and right fixing screw by draw-in/out handle.
- In order to control the breaker electrically, you should connect all circuit according to the diagram on page 44-45.

05 Periodic Inspection and Parts Replacement

Period of periodic inspection

It is most appropriate that the user works out his or her own inspection plan for the breakers according to the switching frequency, the value of normal breaking and making currents, the magnitude of the fault current interrupted, service conditions, and environmental conditions.

It is recommended to perform a simplified inspection once every 6 months and a full inspection once every 12 months. To perform an periodic inspection, draw out to ISOLATED position or move out of draw-out cradle.

Mechanical durability life of the breaker

The following table shows the mechanical durability of the breaker.

When accumulated counting number of switching cycles excees those shown, we recommend you check the breaker. For renewal or thorought inspection, please contact us.

Frame Size	Below 3,200 AF	Above 4,000 AF
No. of switching cycle	20,000	10,000

Frequency of inspection

Frequency of inspection is considered with service condition and switching numbers, breaking/making current value, but it is recommended to perform a simplified inspection once every 6 months and a full inspection once every 12 months.

Inspection by switching numbers

Switching Conditions of ACD	Inspection Interval Based on Switching Cycles			
Switching Conditions of ACB	Below 1,000 AF	1,250-2,500 AF	Above 3,200 AF	
Switching operation in the state of nearly no-carrying current	1,000	1,000	1,000	
Switching operation in the rated current region	500	500	100	
Switching operation in overload region (about 2-3 times the rated current)	25	25	10	
Switching operation in current interruption region	each time	each time	each time	

Draw out the breaker to the ISOLATED position or remove the breaker body from the draw-out cradle for inspection or parts replacement purposes.

Make sure that residual heat of terminal should be cooled down before performing inspection work. **Unless it may cause burn.**

5.1 Arc Chamber

Check each arc chamber during the periodic inspection and also, after a fault current take place. A cracked arc chamber cover or de-ionized grid side plate, or a heavy, hard-to-remove molten contact or de-ionized pieces inside of the arc chamber, requires replacement of the arc chamber unit.

1) Periodic inspection

Inspection Item	Method / Criteria	
Dirt, dust, foreign matter	Check visually. Inside must be clean, free of foreign matter and dust. Blow off foreign matter and dust with a jet of compressed air.	
Cracks	Check visually. There should be no cracks or other damage.	

2) Removal and mounting

Loosen the two-mounting screws on the arc chamber cover until they are free. Remove the arc chamber cover and nut. To mount the arc chamber, set nut and arc chamber in position and tighten with two-mounting screws on the arc chamber cover.

A CAUTION

Do not perform on-off operation with the nut installed after removing arc chamber, or it may slip into contact unit.

To mount the arc chamber, check square nut, place the arc chamber in position and tighten fixing screw (dish M6).

Fig. 6



05 Periodic Inspection and Parts Replacement

5.2 Contact Unit

Contact unit are visible and accessible when the arc chamber is removed. Check the contact unit during a periodic inspection and after a short-circuit fault current take place.

Fig. 7



1) Periodic inspection

(1) Arcing contact

Inspection Item	Method / Criteria
Contact tip surface	 Check visually. Melting mark in the contact point tip surface is not a problem because it is a normal phenomenon by close-open arc. Remove dirt, dust, grease, etc. When the arcing contact is melted less than 33 % original thickness, it should be replaced. For replacements, please contact us.

(2) Main contact

If contact surface is badly worn or become rough, you should clean the surface in case of periodic inspection.

A CAUTION

When scrubbing contact trips' surface, pay attention to not let dust fall into the breaker mechanism. After dressing, be sure to wipe and clean contact trips.

5.3 Operating Mechanism

Fig. 8



1) Periodic maintenance

Check the operating mechanism in detail as much as possible.

If there are parts that seem to be checked or hard to check, please contact us.

Inspection Item Method / Criteria	
Operation	Open and close breaker through manual control to check the mechanical parts for normal operation (every six months).
Lubrication Add a small amount of grease to each of the pins, shafts and their bearings (every six Avoid excessive oiling to prevent the accumulation of dirt and dust.	
Screws, bolts and springs	Check screws and bolts on each part for signs of loosening. Tighten them if loose. Check each spring for proper engagement and damage. Correct problem through repair or replacement (every six months).
Dirt and dust	Latching parts should be free of dirt and dust. Wipe them with a clean cloth (every six months).

05 Periodic Inspection and Parts Replacement

5.4 Internal Accessories

Loosen the two front cover mounting screws and open the front cover (Fig. 1. 2) to check internal accessories.

A CAUTION

Do not place your fingers or a tool in the gap between close/open and charged/discharged indicator (Fig. 9. (6, @)) since this gap is closed when the breaker is closed.

Do not attempt to put hand or a tool into the breaker when closing springs are charged.

Be sure to discharge the closing springs prior to internal inspection.

Do not operate the on-off operation arbitrarity (qualified personnel only).

Fig. 9



1) Shunt trip device (SHT)

Rated Voltage		Coil Resistence
	110	40 \mathcal{Q} \pm 5 %
ACIDC	220	68 \mathcal{Q} \pm 5 %
٨٢	380	120 <i>Q</i> ± 5 %
AC	440	120 <i>Q</i> ± 5 %
	24	12 <i>Q</i> ± 5 %
DC	48	22 <i>Q</i> ± 5 %

(1) Periodic inspection (Fig. 21. reference)

Inspection Items	Methods / Criteria / Dispositions	
Operation	 Push the moving core of SHT with a pointed tool, such as a screwdriver trip, then, slowly release the core. The result is acceptable if the core returns lightly. Push in the moving core slowly after closing the breaker. The result is acceptable if breaker trips open. The result is acceptable, if the breaker trips open at less than 70 % of the rated voltage after closing the breaker. 	
Coil	- Measure the coil resistance with an ohmmeter. If it is much lower than the value shown in table or there is no continuity, replace the coil.	
Terminals and mounting screws	- Check terminals and mounting screws. Tighten them if loose.	

Fig. 10. Shunt trip equipment mounting



(2) Replacement of SHT (Fig. 10)

- Remove the two pin terminal from the control jack terminals (Fig. 10. 2).
- Remove the one support mount screws (Fig. 10. ③) and take out LRC-UVT-SHT support.
- Remove the coil mount screws (Fig. 13. ③).
- A new coil is properly assembled, and during attaching it. The trip-rod and shunt moving core position is shown as in Fig. 10. 6, 2.
- After checking the light movement of the moving core of new SHT, mount it in the breaker as it was.
- Connect the two pin terminal to the control jack terminals, and test the ACB and trip lever both electrically and mechanically for normal operation (number 7, 8).

05 Periodic Inspection and Parts Replacement

- 2) Undervoltage trip device (UVT)
- UVT coil uses only DC rating.
- The under-voltage trip device includes instantaneous trip type and time delay trip type having 0.5 sec, 1 sec, 1.5 sec and 3 sec time delay characteristics.

(1) General view of undervoltage trip coil & controller (time delay trip type)

Fig. 11. UVT coil & UVT controller (only time delay type applied)



(2) Periodic inspection

Inspection Items	Methods / Criteria / Dispositions		
Operation	 The breaker can not be closed when the UVT is de-energized. Because of this, if the breaker can be closed at more than 85 % of the rated voltage, moving core becomes pick-up, the result is acceptable. If the breaker can be tripped from 35 % to 70 % of the rated voltage after closing the breaker, the result is acceptable. 		
Coil resistance	- Measure the coil resistance with an ohmmeter. If the	Coil resistance (Q)	
Conresistance	in the right or there is no continuity, replace the UVT coil. $118 \ Q \pm 5 \ \%$		
erminals and mounting screws - Check terminals and mounting screws for loosening. Retighten them if loose.			

(3) Replacement of UVT controller

When it is necessary to replace the UVT controller, replace the whole UVT controller unit.

- Remove the UVT wire at the wire terminal (Fig. 11. 1).
- Remove UVT mounting bolt (2-M6x10) (Fig. 11. ④).
- Take out the UVT controller.
- Install new UVT controller as it was on the breaker with UVT mounting bolt (Fig. 11. ④).
- Connect the wire terminals with fasten terminals at the same time.
- Test the UVT both electrically and mechanically.

When inspecting the performance, rated voltage should be supplied unless ACB will not operate.

A CAUTION

Recheck the wire terminal before suppling power. Incorrect wiring may cause coil burning.

3) Latch release coil (LRC) Coil resistance is same with SHT.

(1) General view of latch release coil (LRC)

Fig. 12



(2) Periodic inspection

Inspection Items	Methods / Criteria / Dispositions
Operation	 Push the moving core with a pointed tool, such as a screwdriver tip, then, slowly release the core. The result is acceptable if the core returns lightly. Charge the closing springs and push the moving core. The result is acceptable if the closing springs are discharged. If the breaker can be closed at 85 % of the rated voltage, the result is acceptable.
Coil resistance	- Measure the coil resistance with an ohmmeter. If resistance was much lower than the value shown in table.1 (page 19) or there is no continuity, replace the LRC.
Terminals and mounting screws	- Check terminals and mounting screws for loosening. Tighten them if they are loose.

(3) Replacement of LRC (unit replacement)

- Remove the pin terminal from the control jack terminals (Fig. 10. ④).
- Remove support mounting screw (Fig. 13. 2) M4, and take out the LRC-UVT-SHT support.
- Remove coil mounting screw (Fig. 13. 2)).
- After checking the movement of the new LRC moving core, mount it in the breaker as it was.
- Connect the pin terminal to the control jack terminals (Fig. 10. ④).
- Test the device both electrically and mechanically for normal operation in the same manner described in periodic inspection table.

▲ CAUTION

Take care when checking on/off operation by using mechanism manual button. **Fingers may be pinched during operation.**

Fig. 13



05 Periodic Inspection and Parts Replacement

4) Auxiliary switch unit

(1) General view of auxiliary switch unit, connection circuit

Fig. 14. Aux, switch general view



Fig. 15. Aux. switch connection circuit

1		1	
<u></u>	<u> </u>	\longrightarrow	09
	<u> </u>	\longrightarrow	84
55 → (€	<u> </u>	 \longrightarrow	92
<u> </u>	<u> </u>	\longrightarrow	54
5 - ((<u>→</u> \	\longrightarrow	75
64		\longrightarrow	20
4	I	\longrightarrow	48
45		\longrightarrow	46
		\longrightarrow	7 47
4			4.
I		I	

(2) Periodic inspection

Inspection Items	Methods / Criteria / Dispositions
Operation	 Take the breaker body out of the cradle. Connect the ohmmeter or alarm (buzzer) to each switch element. Check that a-contact is ON and b-contact is OFF when breaker is CLOSED, and that a-contact is OFF and b-contact is ON when breaker is OPEN.
Contact surface	- If contact is excessively worn or rough, replace whole switch unit.
Terminals and mounting screws	- Check terminals and mounting screws. Tighten them if loose.

(3) Replacement of auxiliary switch unit (Fig. 17)

The auxiliary switch unit is an assembly of 10 circuits (5 a-contacts and 5 b-contacts).

Replace the whole switch unit even if there is a partial defect.

- Remove the auxiliary switch assembly bolt (1-M6 wrench bolt) (Fig. 14. ①).
- Change wire circuit.
- Tighten the auxiliary switch assembly bolt (1-M6 wrench bolt).
- Conduct periodic inspection mentioned in (2) above and make sure if the switch operates normally.

A CAUTION

Replaced terminal must be properly connected before operating.

5) Motor unit

(1) Motor unit general view

Fig. 16



(2) Operation check

Open and close the breaker through electrical control to check the relay for normal operation. Do this in the following procedure.

• After checking front-cover, with the push-button switch ON, close the breaker.

• Normal operation is when the breaker is closed, the motor is rotating and the charged/discharged indicator displays [].

(3) Replacement of motor control unit

- Open the ACB.
- Draw-out the breaker body out of draw-out cradle.
- Remove front cover.
- Remove both motor cables (1, 2 terminal) and control jack terminal.
- Release motor fixing bolt (2-M6 wrench bolt, Fig. 17. 1).
- Remove motor from the breaker.
- Remove motor connection terminal (Fig. 17. 2).
- After checking new motor unit, replace, and follow steps 4-7 in reverse.
- Charging motor is originally placed position of the breaker.
- Attach front cover.
- Check the operation according to operation check (2).

A CAUTION

Replaced line terminal must be properly connected before operation.

Fig. 17



6) Direction of ACB position padlock device

- Purpose: Position padlock device is designed for locking ACB body at three positions (ISOLATED, TEST, CONNECTED) by a shackle.
- Usage: At any position, pull out position padlock plate and attach the shackle (user supplied).

DANGER

Do not draw out ACB when it is in the service states. Since main circuit is live, draw-out operation will cause fatal accident. Check the breaker is opened before operating draw-in/out.

06 Protection Relay - UPR

Fig. 18



UPR is a CPU loaded, high-reliability, multifunctional protection relay for U-Series ACB.

This protection relay is classified into types UPR-1L, 2L (for general feed circuits) and type UPR-1S, 2S (for generator protection).

Refer to the following protective function combination table.

Protective function combination table

Dirotestine Function		Indication	Control	UPR Multifunction	Protective Device
Protective Function		Contact	Supply	For General Feeder Circuits	For General Protection
AL AS AI	AG —	IU		- UPR-LN	-
AL AS AI AP MCR	- AG	CP/I	Needed -	- UPR-LA	-
AL AS AI AP MCR	- AG	elt — Cp/I —	Needed —	UPR-LAG	-
AL AS AI AP	AG —	elt — Cp/I —	Needed —	UPR-LAZ	-
AL AS AI AP MCR	- AG	CP/I	Needed	- UPR-LP	-
AL AS AI AP MCR	AG	CP/I	– Needed –	- UPR-LH	-
AL AS AI MCR		IU			UPR-SN
AL AS AI AP MCR		CP/I	Needed		UPR-SA
AL AS AI AP MCR		CP/I	Needed		UPR-SP
Type UPR-LA, LAG, LAZ, LP, LH, SA, SP OCR is	LCD display	r type.			
IU Contact for opera	ation indica	ation	AS Instan	taneous trip	
CP/I Tripped LED indic	cator and c	ontact	Al Groun	id fault trip	
AL Long time delay	trip		AG Functi	ion is an option	
AP Pre-trip alarm			MCR* Makin	g current release (o	option)
ELT Short time delay	trip		* The function of	heck is provided in U	PR protection rela

06 Protection Relay - UPR

6.1 Rated Current

Туре	Rated Current [In]
UPR-L type	 Rated current [In] can be adjusted to 50 %, 63 %, 70 %, 80 %, 90 %, and 100 % of the rated primary CT current [In]. On the UPR nameplate, rated current [In] is marked. Rated current [In] can be selected by sliding the base current setting select switch, which can be set to the predetermined scale.
UPR-S type	 A proper CT is selected according to the rated current [IGEN] of generator. Rated current [In] is adjusted to be equal to the rated current value [IGEN] of generator by the rotary switch inside UPR-S. Accordingly, the rated current value [IGEN] of generator corresponds to rated current [In]. On the UPR nameplate, rated current [In] is marked.

6.2 Protective Functions and Setting Ranges

Protective	• Function	Current Setting Range		Time Setting Range	
LTD trip (Ir.Tr)	Type UPR-L	Ir 0.85 0.85 0.85 0.85 0.9 0.95 0.95 0.95 0.95 0.95 0.95 0.95	 The scale is marked as magnification of [In]. Current setting range is 10 steps (Non, 0.8, 0.83, 0.85, 0.88, 0.9, 0.93, 0.95, 0.98, 1.0) times of [In]. When [Ir] is set to NON the protective function, it does not operate. The breaker is not tripped at less than 105 %, and tripped at more than 120 % of [Ir] setting. 	Tr 25 125 05 30 20 25 10 15 20 20 25 5 10 15 20 20 5 5 10 15 20 20 5 5 10 15 20 20 5 5 10 15 20 20 5 5 10 15 20 20 5 10 15 20 20 20 15 15 20 20 15 15 20 20 15 15 20 20 15 15 20 20 15 15 20 20 15 15 20 20 15 20 20 15 15 20 20 20 15 15 20 20 20 20 20 20 20 20 20 20	 The setting dial is scaled in a few seconds, which is the operating time at 600 % of [I_r] setting. Time setting range is 10 steps of 0.5, 1.25, 2, 2.5, 5, 10, 15, 20, 25, and 30 seconds. The breaker is tripped at the range from -15 % to +15 % of time setting range.
(r, r) Ty UF	Type UPR-S	Ir 1.05 0.9 0.7 NON 1.25 1.1 1.2 1.2 1.2 1.2 1.2 1.2 1.2 1.2 1.2	 The scale is marked as magnification of [In]. Current setting range is eight steps (NON, 0.7, 0.8, 0.9, 1.0, 1.05, 1.1, 1.15, 1.2, 1.25) of [In]. When [Ir] is set to NON the protective function, it does not operate. 	Tr 25 30 15 10 50 50 50 50 50 50 50 50 50 50 50 50 50	 The setting dial is scaled in a few seconds, which is the operating time of current flow at 120 % of [l_r] setting. Time setting range is nine steps of 10, 15, 20, 25, 30, 35, 40, 50, and 60 seconds (error extent is 5 %).
Type UPR-L INST trip (I) Type UPR-S	Ii	 The scale is marked as magnification of [In]. Current setting range is nine steps (NON, 2, 3, 4, 6, 8, 10, 12, 15) of [In]. When [II] is set to NON the protective function, it does not operate. 	- Time catting is		
	3 2 NON x In	 The scale is marked as magnification of [In]. Current setting range is nine steps (NON, 2, 3, 4, 6, 8, 10, 12, 15) of [In]. When [II] is set to NON the protective function, it does not operate. 	nine setting is	unnecessary.	

Protective Function Current Setting Range			Time Setting Range		
STD trip (Isa, Tsa)	Type UPR-L	\mathbf{I}_{sd}	 The scale is marked as magnification of [In]. Setting dial is scaled in multiples of [In]. There are ten discrete setting positions: NON, 1, 1.5, 2, 2.5, 3, 4, 6, 8, 10 times [In]. When [Isd] and [I] are set at NON, the device is operated at 1,000 % of [In] setting as a fail-safe function by [Tsd] setting. 	Tsd 2000 100 50 ms	 Setting dial is scaled in milliseconds, which is the operating time at current flow higher than [Isd] 120 % setting. There are six discrete 50, 100, 200, 300, 400, 500 milliseconds.
	Type UPR-S	Isd 25 1.5 NON x In	 The scale is marked as magnification of [In]. Setting dial is scaled in multiples of [In]. There are nine discrete setting positions: NON, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5 times [Io]. When [Iso] and [Ii] are set at NON, the device is operated at 500 % of [In] setting as a fail-safe function. 	Tsd 300 100 50 ms	 Setting dial is scaled in milliseconds, which is the operating time at current flow higher than [Ist] 120 % setting. There are six discrete setting positions: 50, 100, 200, 300, 400, 500 milliseconds.
GFT (lg)	Type UPR-L	Ig 0.3 0.2 0.1 NON x Ict	 The scale is marked as magnification of UPR rated primary current [lar]. The current setting range is 10 steps (NON, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 1.0 times of [lar]). 	Tg 300 400 50 ms	 Setting dial is marked as relay operation time. The mark is milliseconds. The current setting range is six steps (50, 100, 200, 300, 400, 500 milliseconds).
ELT (I⊿t)	Type UPR-L	I∠n (A)	 The scale is marked as magnification of UPR rated primary current [ZCT]. The current setting range is six steps (NON, 0.5, 0.8, 1, 2, 3, 5 A of [ZCT]). 	∠t (ms) Alarm	 If setting primary current is applying an electric current, two modes of alarm and trip are established. Alarm setting range is five steps (140, 230, 350, 800, 950 milliseconds). Trip setting range is five steps (60, 140, 230, 350, 800 milliseconds).
Pre-alarm	Type UPR-L	Ip 0.75 0.65 0.6 NON 0.85 0.9 0.95 0.9 0.95 0.95 0.95 0.95 0.95	 The scale is marked as magnification of UPR rated primary current [ln]. The current setting range is 10 steps methods (NON, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0 times of [ln]). 	$T_{P} \xrightarrow{20}_{15} \underbrace{40}_{5} \underbrace{40}_{120} \underbrace$	 Setting dial is marked as relay operating time. The mark is seconds. The current setting range is 10 steps (5, 10, 15, 20, 40, 60, 80, 120, 160, 200 seconds).
(IP)	Type UPR-S	Ip 0.85 0.75 0.7 0.75 0.7 0.7 0.75 0.7 1.0 1.05 0.7 1.0 1.05 0.7 1.0 1.05 0.7 1.0 0.0 0.7 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	 The scale is marked as magnification of UPR rated primary current [In]. The current setting range is 10 steps methods (NON, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0, 1.05, 1.1 times of [In]). 	Tp 15 + 10 + 10 + 10 + 10 + 10 + 10 + 10 +	- At 120 % of [I _P], nine steps are available (1, 5, 10, 15, 20, 25, 30, 35, 40 seconds).

06 Protection Relay - UPR

1) Method of changing protective function settings

The settings of type UPR protection relay can be changed easily by dial operation. This section describes the basic procedures for setting the protective device. For setting details of individual protective functions see page 26-27.

(1) Basic procedures

 \bullet To release the UPR safety cover attached to the front of the ACB, insert a flat-head screwdriver at (1).

• Adjust setting switches with a small flat-head screwdriver.

UPR is composed of two setting switch.

Fig. 19





Rotary step switches

Rotate the dial until the arrow points to the desired position. The setting is the same within the scale range denoted by a bold line.



Slide switches

Slide the switch knob up/down to turn on/off.

• After adjustment, check a set point by using a test function and tester of UPR checker (optional item).

A CAUTION

Do not apply excessive force to the switches. The switches should be turned lightly or slid with the screwdriver.

• Return the transparent UPR cover (Fig. 19. ①) to its original position.

(2) The setting of slide switch

• Ig²t ON/OFF

GFT time characteristic is divided into definite time and inverse time, it can be selected.

lg²t ON/OFF



• Isd²t ON/OFF

STD time characteristic is divided into definite time and inverse time, it can be selected.

Isd²t ON/OFF



• INST/MCR

Instantaneous characteristic can be selected INST or MCR. When MCR is selected, must be sure to observe, following condition: Estimated short-circuit current ≤ Rated breaking current (without INST).

** MCR is a protective function which instantaneously trips open the breaker only when a fault current exceeding STD current setting value is applied at making operation of the breaker. After making operation, MCR function is not working.

MCR ON/OFF



6.3 Operation Indication Functions

The operation indication function includes IU contact for tripped indication (whole indication).

1) IU contact for tripped indication (whole indication) (UPR-L, UPR-S)

- This contact output is one contact operating even when of LTD, STD, INST, or GFT operates.
- The contact output (Fig. 1. (3)) is transmitted between the terminals (2) and (3) of disconnecting device for control circuit.
- Rating of contact for tripped indication.

Rated Voltage	AC 250 V	DC 30 V	DC 125 V	DC 250 V
Rated current (resistive load)	8 A	5 A	0.5 A	0.3 A
Rated current (inductive load)	3 A	3 A	0.25 A	0.15 A

06 Protection Relay - UPR

- 2) CP/I LED light and contact for tripped indication (type UPR-LA, LAG, LAZ, LP, LH, SA, SP)
- Control power is required for tripped indication. Supply the following power between terminals (1) and (2) of control circuit disconnecting device (Fig. 1. (2)).
 - AC 100-125 V / 10 VA or AC 200-250 V / 10 VA
 - DC 100–125 V / 10 W or DC 200–250 V / 10 W or DC 240 V / 10 W
- When LTD, STD or GFT operates, the LED lights for tripped indication (Fig. 18. 2), 3), (4) light up individually.
- At the same time, the contact signal ON is outputted individually between terminals 20–20 of control circuit disconnecting device (Fig. 1. (1)).

Operation signal contact terminal (UPR-2L-GS)

2-21 : LTD contact terminal	29-29 : STD/INST contact terminal
2 → 2 → 2 → 2 → 2 → 2 → 2 → 2 → 2 → 2 →	⑳-⑳ : GFR/ELT contact terminal

- The LTD, STD and GFT tripped indications remain ON until the reset button (Fig. 18. 11) is depressed. Pressing the reset button for more than one second resets the ON state.
- LED light and contacts for Pre-trip alarm operation indication
 - The PTA pickup indication LED light (Fig. 18. (1)) flickers at more than pickup current value [IP].
 - At the same time, the contact signal ON is outputted between terminals 20-23 of control circuit.
 - The operation indication is automatically reset if the current of less than $[{\sf I}_{{\sf P}}]$ is reached.
- * Push the reset button (Fig. 18. 🛈).

If the abnormality is temporary, such as noise, the LED will turn off. At that time, the control function returns to normal. If the LED does not go off after pushing the reset button, some abnormality may occur. In this case, immediately contact to HHI.

• Rating of contact for tripped indication

Rated Voltage	AC 250 V	DC 220 V
Rated current (resistive load)	125 VA (MAX 2 A)	60 W (MAX 2 A)
Rated current (inductive load)	20 VA (MAX 2 A)	10 W (MAX 2 A)

6.4 Field Test

1) Function check method

• A simple check of operation for type UPR protection relay can be made with a test switch.

For function check of each protective function, draw out the breaker to the ISOLATED position, or take it out from the draw-out cradle. If making function check in the TEST position, confirm that there is no influence on the sequence.

• Function check of the ground fault trip function is not possible (for ground fault trip function, portable UPR checker can be possible).

2) Necessity for function check

- Stop watch.
- A flat-head screwdriver
- Control power supply: Use marking plate of type UPR multifunction protective device if test in the test position checks function, check whether control power supply (19) to (20) of control circuit short device (Fig. 1. (20)).

3) Protective function check

Protective Function	Type UPR-L (for general feeder circuit) / Type UPR-S (for generator protection)
LTD	Isd 25 15 15 15 10 10 10 10 10 10 10 10 10 10
	 rated current, each dial should be in "NON" position using a flat-head screwdriver . Push the "LOW" test switch (Fig. 18. ①) (current flow of 6 times the rated current [In] in type UPR-L, and 1.2 times the rated current in type UPR-S), and at the same time, measure the tripping time with a stopwatch. Also, hold the test switch until the breaker is tripped. After tripping, release the test SW. Push the RESET button to OFF (neutral) automatically. Read the tripped time. in case of type UPR-L, by flowing current (6 times of [In], 1.2 times of [In]), If it is nearly equal to the operation time, at the current of 6 times [In] for UPR-L and 1.2 times [In] for UPR-S, it is normal. After the LCD test, short time delay and instantaneous time setting should be reset to original setting value by flat head screwdriver. In case of pre-trip alarm device, until the breaker is tripped, an alarm signal occur.
STD	1. Close the breaker. 2. Instantaneous time trip setting current dial should set to NON position using a flat-head screw-driver. I_i $I_$
	 4. After tripping, release the test switch. Push the RESET button to OFF (neutral) automatically. Return the STD pickup current setting dial to the original set value with a flat-head screwdriver.
INST	 Close the breaker. Push the test switch (Fig. 18. ⁽¹⁾) to [HI] current flow of more than 15 times the base current [In]. If the breaker is tripped momentarily, it is normal. After tripping, release the test switch. Push the RESET button to OFF (neutral) automatically.

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6.5 Characteristic Check

Protective	e Function	Type UPR-L (for general feeder circuit) / Type UPR-S (for generator protection)
		 Close the breaker. Increase test voltage gradually from zero, pre-alarm trip, indicator LED (Fig. 18. ①), will flicker near the long time setting current value. Increase test voltage gradually until the long-time trip pick-up signal LED (Fig. 18. ②) turns on. At this moment, the test voltage of type UPR-1L should be within 1.05-1.2 times of secondary voltage converted from [Ir] current. In case of type UPR-1S, the test voltage should be within ±20 % of secondary voltage.
	Pick-up current	LED display
LTD		4. Reduce the test voltage to zero.** LCD display is not available for type UPR-L and UPR-S.
	Trip time	1. Close the breaker. 2. In case of type UPR-L, when short time and instantaneous time setting current value are lower than 6 times of rated current, each dial using a flat-bladed screwdriver should set NON position. $I_{sd} = I_{sd} = I_{sd}$
		 Type UPR-L and type UPR-S flow 6 times and 1.2 times current of setting value separately. And at the same time, measure trip deadline as stopwatch or portable UPR checker. The breaker is tripped in a range of ±15 %, it is normal. Reduce the test voltage to zero. In case of operation of [2], short time delay and instantaneous time setting dial should be reset original setting value with a flat-head screwdriver.

Protective	Function	Type UPR-L (for general feeder circuit) / Type UPR-S (for generator protection)
	Trip	1. Close the breaker. 2. Set long time and instantaneous time trip setting current dial to non using a flat-head screw-driver. $I_{r} = I_{0,25} = I_{0$
	setting current	0.8 NON 1.0 2 NON X In
Short time delay trip		 3. Supply test voltage within ±15 % of secondary voltage converted from [Isd] setting current for type UPR-L. If the breaker trips, it is normal. In case of type UPR-S, test voltage is within ±10 % of secondary voltage. 4. Reduce the test voltage to zero.
delay trip characteristic check		 Close the breaker. Set the test equipment output to 1.2 times the secondary current levels converted from the set value [Isd] current. Apply test voltage. At the same time, start the trip delay measurement with a stopwatch. If the breaker is tripped, reduce the test voltage to zero. Read the trip time. If the trip time is within the range of resettable time (ms) and maximum total clearing time (ms) shown in the table below, it is normal.
	Trip time	
		Time setting [T_sd] (ms) Six step system 50 100 200 300 400 500 Resettable time (ms) 35 60 150 240 330 400 Max. total clearing time (ms) 120 170 270 380 480 580
INST	Trip setting current	 Close the breaker. If the breaker doesn't trip at the test voltage of -20 % of secondary voltage converted from [li] setting current and trips at +20 % of secondary voltage, it is normal.

Protection Relay - UPR

Protective	Function	Type UPR-L (for general feeder circuit) / Type UPR-S (for generator protection)										
Pre trip alarm	Pick-up current	 Close the breaker. Increase the test voltage up to the position in which the pre-alarm indicator LED (Fig. 18. ①) flickers. If the current value at that time is within the range of 7.5 % (UPR-L) and 5 % (UPR-S) of secondary voltage levels converted from the set value [IP] current, it is normal. The property of provide the set voltage to zero. 3. Reduce the test voltage to zero.										
	Trip time	 Supply the specified control power. Apply the test voltage of 1.1 times (UPR-L) and 1.2 times of (UPR-S) of secondary voltage levels converted from the set value [I_P] current. At the same time, start the time measurement with a stopwatch. If the time at which an alarm signals is outputed across COM-PTA terminals is within the range of 20 % (UPR-L) and 15 % (UPR-S) of the set value [T_P] second, it is normal. Reduce of the test voltage to zero. 										
	Trip setting current	 Close the breaker. Apply the test voltage within the range of 20 % of secondary voltage levels converted from the set value [IG] current: If the breaker is tripped, it is normal. Reduce the test voltage to zero. 										
GFT	Trip time	 Close the breaker. Set the test equipment output to 120 % of the secondary voltage levels converted from the set value [I_{c1}] current. Apply the test voltage. At the same time, start the trip delay measurement with a stopwatch. If the breaker is tripped, reduce the test equipment output to zero. Read the trip time. If the trip time value is within the range of resettable time (ms) and maximum total clearing time (ms) shown in the table below, it is normal. Time setting [T ₉] (ms) Six step system <u>50</u> 100 200 300 400 500 <u>Resettable time (ms)</u> <u>35</u> 60 150 240 330 400 <u>Max. total clearing time (ms)</u> <u>120</u> 170 270 380 480 580										
	NON	 Set when switchboard system does not needs neutral pole protection. It is only possible with control power supply type of OCR. It is impossible with UPR-LN, SN type of OCR. 										
Neutral protection	50n (@0.5 ln)	 It operates at 50 % of In value. LTD current of neutral pole is same as 50 % of Ir setting value. STD current of neutral pole is same as 50 % of Isd setting value. INST operates at 100 % of Is setting value. It is impossible with UPR-LN, SN type of OCR. 										
	100n (@ l _n)	 It operates at 100 % of In value. LTD current of neutral pole is same as 100 % of Ir setting value. STD current of neutral pole is same as 100 % of Isd setting value. INST operates at 100 % of I setting value. For UPR-LN, SN type of OCR. It is basically set as 100 % 										

6.6 Operating Manual for UPR-LA, LAG, LAZ, LP, LH, SA, SP Type

1) Simplicity test methods

LTD test



For LTD simplicity test, control

source of UPR (AC/DC 110-220 V)





If you push continually low button,

with PTA/LTD LED flickering, it starts



After time delay, LTD LED turning on, at the same time, LTD ground point is printed. ACB is open.



In order to remove printed ground point, after pushing reset button, all output LED is turned on and off. Also, the print contact point is removed.

STD/INST test

is approved.





perception



For STD/INST simplicity test, control source of UPR (AC/DC 110-220 V) is approved.

In case of STD/INST, if you push hi button, INST LED and ground point is printed. In case of INST/ NON, STD ground point is printed.



STD/INST accident signal and ground point is printed. ACB is open.



In order to remove printed ground point, after pushing reset button, all output LED is turned on and off. Also, the print contact point is removed.

2) The beginning screen

The beginning screen



If control source is applied, each phase load-current is automatically displayed in regular sequence of R-S-T-N. Under the rated 2 %, it marks "0".

In case of pickup setting switch change



In case of time setting switch change



In case of setting switch adjustment, setting value is automatically displayed and after turning on back light, it is automatically turned off.

06 Protection Relay - UPR

3) Data check method



• List button (🗐) - In case of pushing 1 time: Shows maximum current.



š

This mode shows phase with maximum current.

• List button (🗐) - In case of pushing 2 times: Voltage confirmation (E type only)



ENTER





Push list button twice.



Using movement button, you can confirm voltage.

For E type, pushing list button twice shows measured voltage value. When it is 3P type, it shows phase-to-phase voltage only. And when it is 4P type, it shows both phase-to-phase voltage and phase voltage. By pushing movement button you can check voltage value which you want.

• List button (🗐) - In case of pushing 3 times: Power confirmation (E type only)



For E type, pushing list buttom 3 times shows measured power value. Each value shows each total for P, Q, S, PF in sequence. In case of negative PF value, positive value will be shown marked with R (reverse).

• List button (🔳) - In case of pushing 4 times: Energy



This mode shows active energy value. Energy is shown in two screens. When there is remaining value, arrow will shown and you can move by movement button.

• List button (🗐) - In case of pushing 5 times: Fault confirmation



This is list checking accident record. The accident is stored in 10 data at this point in time, F001 is the newest. In case of data number exceeds, it is automatically deleted from the older data. Accidental contents, type-phase load current and accident occurrence time are stored, and you can confirm it by movement button. Time information is shown in year, month, day, hour, minute in sequence. After choose data with movement button and then push enter button, you can check saved data.

• List button (🗐) - In case of pushing 6 times: Set information confirmation.



This mode can check pickup setting value and time setting value per each item. You can check each menu by movement button in regular sequence of LTD > STD > INST > PTA > GFT > ELT. Each menu shows its pickup setting value, delayed time value moving by button.

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• List button (🗐) - In case of pushing 7 times: Frequency confirmation



• List button ((■) + Movement button () - In case of pushing both for 3 seconds : Neutral protection setting







This is N phase protection. N phase protection can be set as 100 %, 50 %, non of In value. Once you push enter button, figures flash, it turns into setting mode. Use hi/low button during this setting mode and then press enter button when you finished setting.

• Movement button (🕨) - In case of pushing it 1 time: Baud rate setting









Flashing

This is communicational parameters setting mode. Pressing enter button at each screen make figures flashing, turning into setting mode. Using hi/low button to adjust value, and press the enter button when you finished setting.
Communication protocol : Modbus-RTU
Data bit: 8 bit
Parity: non
Stop bit: 1

Modbus address can be set between 1-240, and basically set as 1. Baud rate can be set as 9,600/19,200/38,400 and basically set as 38,400. Swap is transmitting function which able to transmit data byte more than word. Ex) $0 \times 1234 \ge 0 \times 3412$

ENTER

• Movement button (🕨) - In case of pushing it twice: Setting in (SA type only)



Flashing

This is only for the SA type of OCR.

For the marine type you can set the in value. Pressing the enter button, figures flash, it turns into setting mode. Using hi/low button to adjust value, and press the enter button when you finished setting. Setting value is available for 50-100 % of lct, with 1 A unit.

• Movement button (🕨) - In case of pushing it twice : Demand time setting (P type only)



• Movement button (🕑) - In case of pushing it 3 times: Network setting.



This is setting mode of network type. It is restricted by type of OCR 3-pole/4-pole. ** Network setting criteria is determined by type of ACB.

ACB CT	OCR type	Network
3	3-poles	3P3W, 3P4W
4	4-poles	4P4W

* In case of 3P ACB but with 4 wire connection, you have to set network as 3P4W.

When you press enter button, figures are flashing, it turns into setting mode. Using hi/low button to adjust value, and press the enter button when you finished setting.

• Movement button (🕑) - In case of pushing it 4 times: Power factor sign convention setting (P type only)



This is setting mode regarding power factor sign convention according to IEC and IEEE. Signs are determined from the active power and reactive power flow.

Pressing enter button, figures are flashing, it turns into setting mode. Using hi/low button to adjust value, and press the enter button when you finished setting. Basic setting is IEC convention.

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• Movement button (🕑) - In case of pushing it 5, 6, 7 times: Time setting



• Movement button (🕑) - In case of pushing it 8 times: OCR version confirmation



This mode shows version of your OCR.

• Movement button (🕑) - In case of pushing it 9 times: OCR model number confirmation



This mode shows model number of your OCR.

4) Flow-current test of the main circuit

(1) Temperature test

If rated current flowed current to a 3-poles series connection and 1-phase source, the breaker functioning GFT will work and trip the ACB.

This is 2-poles among 3-poles in the same direction, pick-up circuit inside UPR protection relay flows unbalanced current as a vector. Therefore, in the temperature test in 1-pole source system, before test, separate NHT connection cable to prevent from GFT trip.

(2) Overcurrent trip test

Turn the GFT function knob to NON and execute LTD test.

To test relay setting with single phase source, ACB with GFT function will trip by GFT because of load unbalance.

- GFT function in a circuit breaker is in the single-phase type.

In the breaker functioning GFT, in case that the current in the 1-phase is approved by approving load unbalance GTF operates.

07 Insulation Resistance Test and Dielectric Withstand Test

The insulation resistance test and dielectric withstand test for main circuit and control circuit are performed as follows:

7.1 Main Circuit

- Dielectric withstand voltage performance is AC 3,500 V for one minute.
- Use a DC 500 V insulation resistance tester (megger) (over 300 ohm).

7.2 Control Circuit (to earth)

• Dielectric withstand voltage performance is AC 1,500 V for one minute.

For DC 24 V rating of motor charging and closing operation circuits, its characteristic is AC 500 V for one minute (control circuit terminals ①, ②, ③).

For DC rating of the following control circuits, withstand voltage test is impossible.

- Control circuit terminals (9) and (10) of undervoltage trip device (UVT).

- The terminals (19) and (20) of UPR protection relay.

• Use DC 500 V insulation resistance tester (megger) for insulation resistance test.

Troubleshooting Points

No	Troublo	Pheno	menon	Expected Causes	Corrective Actions
NO.	Trouble	Machine	Electrical	Expected Causes	Corrective Actions
				1. Mechanism badness	1. Contact HHI
				2. Whether it is charging by handle mechanism	2. Contact HHI
				3. Is close rod returned ?	3. Close rod returning check
				4. Whether inertia latch is jamming or not ?	4. Inertia latch movement check.
				5. Is ACB placed in proper position (ISO-TEST-CON) ?	5. Move to proper position
		×	×	6. Is UPR manual reset button pull out ?	6. Push back UPR manual reset button
				7. Is UVT coil applied proper voltage ?	7. UVT source check
1	Close fault			8. Is position lock button handle cover pushed in ?	8. Handle cover comeback . Push draw in/out handle and adjust position confirm button returning
				9. The breaker caught interlock ?	9. Interlock dissolution
				10. Is trip latch turned down ?	10. Trip latch returning
		~	0	1. Is close rod returned ?	1. Close rod returning
			0	2. Is trip latch turned down ?	2. Trip latch returning
				1. Is proper voltage applied to CC coil ?	1. CC coil voltage check
				2. Is CC coil operates normally ?	2. Coil replacement
		0	×	3. Is CC coil stroke in proper position ?	3. Stroke check
				4. Is UVT coil applied proper voltage ?	4. UVT source check
				5. Is over current relay reset ?	5. Reset OCR
		~	×	1. Whether any interlock system exist ?	1. Contact HHI
				2. Whether trip latch exists bur ?	2. Contact HHI
2	Open fault			1. Whether proper voltage applied to TC coil ?	1. TC coil voltage check
		0	×	2. Whether TC coil exists mechanical interference	2. After voltage is applied, check core movement
				3. Whether proper voltage applied to UVT coil ?	3. UVT coil voltage check
		×	×	1. Whether handle mechanism cam operates normally ?	1. Contact HHI
3	Charging fault			1. Whether proper voltage applied to motor ?	1. Voltage check (85-110 % of rated voltage)
		0	×	2. Whether motor control unit is damaged	2. Motor output voltage check
				3. Whether motor ratchet (M/B) is proper	3. Part check

09 Appendix

9.1 Neutral CT and UPR Protection Relay Connection Methods

In case of using 3-poles ACB with 3-phase 4-lines, both switchboard neutral pole and neutral pole CT are attached.

1) Neutral CT rating and specification

Frame	ACB	CT Rating (V)
A	UAN06/UAS06 UAN08/UAS08 UAN10/UAS10 UAN12/UAS12 UAN16/UAS16 UAN20	320/0.2 640/0.2 800/0.2 1,000/0.2 1,250/0.2 1,600/0.2 2,000/0.2
В	UAN20/UAS20 UAN25/UAS25 UAN32/UAS32 UAN40	2,000/0.2 2,500/0.2 3,200/0.2 4,000/0.2
С	UAN32 UAN40 UAN50	3,200/0.2 4,000/0.2 5,000/0.2
D	UAN40 UAN50	4,000/0.2 5,000/0.2

* The neutral pole CT class: Class 1.0

2) Connection

Connect CT (the dotted line is tied up the user side) with attention of polarity.

Connection diagram for natural CT of 3-poles ACB



A CAUTION

When the CT polarity is connected reversely, ground fault protection function may cause a malfunction. (ACB is set with K polarity, please assemble NCT as K polarity)

09 Appendix

9.2 Ground Protection Method

1) Grounded neutral Y-Y transformer

(1) In case of 3-poles ACB with 3-phase 4-lines

The neutral pole CT connects neutral pole terminals.

When remaining current of CT exceeds setting value, ACB is tripped to GFT.

As the ratio of the neutral poles lowers, apply HHI NCT (only for UPR optional).

lg	la×(0.1-0.2-0.3-0.4-0.5-0.6-0.7-0.8-1.0- Non) 10 steps
Pickup Current Adjustment	$I_{\rm CT} \times {\rm from}$ 0.1 to 1.0 type-step temporarily adjustment
Tolerance	±20 %
Trip Time (ms)	50-100-200-300-400-500 msec

(2) In case of using 4-poles ACB with 3-phase 4-lines

The neutral pole is equipped with CT in 4-poles ACB, CT sense remaining current not ground but vector sum of CT of 4GE by ground.

In case of $I_a + I_b + I_c + I_n = 0$, Non Trip In case of $I_a + I_b + I_c + I_n \neq 0$, Trip



(3) In case of using 3-poles ACB with 3-phase 3-lines, the operating principles is the same

```
In case of I_a + I_b + I_c = 0, Non Trip
In case of I_a + I_b + I_c \neq 0, Trip
```



2) Insulated system Y- \triangle transformer

At isolated-neutral system, the grounded current is very small.

HHI UPR protection relay can not detect small grounded current at this system can not applied. If you need GFT function at this system, please select UPR with ELT (option) and ZCT.

9.3 Closing and Trip Operation Cycle



09 Appendix

9.4 Wiring Circuit for UPR Protection Relay

UPR-LN



UPR-LA







UPR-LP/LH



09 Appendix

UPR-SN



UPR-SA







09 Appendix

9.5 Wiring Circuit for ACB



Symbol description

СТ	Current transformer
L	LTD terminal
PT	PTA (pre-trip alarm) terminal
G	Ground fault terminal
S/I	STD/INST terminal
Ac	Common terminal
NCT	Neutral current transformer
ZI	Zone selective input
ZO	Zone selective output
A/C	MCR input terminal
Tp / Tn	MHT input source
М	Charging motor
	Close coil (close)
ТС	Trip coil (open)
UVT	Under voltade trip coil
СТ	Magnetic hold trigger
S0 / S2	UPR protection relay source power

Terminal description

1 2	Charging motor (M) source power
3 4	Closing coil (CC) source power
7 8	Open coil (TC) source power
9 10	UVT coil terminal
15 16	Charge complete contact
19 20	OCR source power
22 21	LTD contact
22 23	PTA/TEMP contact
22 24	STD/INST contact
22 26	GFT/ELT contact
29 30	NCT input terminal
31 - 34	ZSI
41 - 60	AUX. contact
61 - 93	Position switch
— Manufactur	er's wiring

---- User's wiring

 $\prec \leftarrow$ Disconnecting device (draw out type)



Control jack lay-out

M 1

	OCR												Operating							Auxiliary switch										
PO	W co	OCI	R Con S/I	tact P/T	G/E ELT	N-CT	Z	SI	CON	1 Tei	mp	V Ir	nput	t N	л со	: т	CU	IVT	СНА	1a	2a	3a	4a	5a	1b	2b	3b	4b	5	b
19)	21	23	3	27	29	31	33	35	37	39	VR	VT	- 1	3	-	7	9	15	41	43	45	47	49	51	53	55	57	5	9
20	22	2	4	26	5 28	3 3	0 3	32 3	34	36 3	88 4	10 \	VS	VN	2	4	8	1(0 1	6 4	42 4	4	46 4	48	50 5	2 5	4	56	58	60
	OCR Protection relay													Ope	ratir	ng ci	rcui	it —				— A	uxilia	ny sv	/itch					

		OCR																					
	POW OCR Contact COM ELT N-CT ZSI COM Temp V Input																						
	1	19 21 23 2					7	2	9	31		33		35		37		39		V	VR \		Т
20)	22 24 26			6	2	8	3	0 3		2	3	4 3		6 3		8	4(.0 V.		S	V	

_	UPR	Protection	relay	_
	· · · ·	1 1000001011		

_																							
	С)perat	ing										A	uxili	iary s	witc	h						
	CC	TC	U١	/Т	CHA		1a 2a 3a 4a 5a 1b 2b 3b 4b 5b																
	3	7	g)	15		4	1	43	4	5	4	7	49		51	5	3	55	5	57	' <u> </u>	59
2	2	4	8	10) 1	6		42		44	4	6	48	3	50	5	2	54		56	5	58	6

- Operating circuit -

- Auxiliary switch -



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