Togami

INSTRUCTION MANUAL

Super LINE CHECKER

Model: TLC-C-Y1

- This instruction manual describes the operation and maintenance for the correct and safe use of Super LINE CHECKER. Please thoroughly read and understand the information contained in this instruction manual before operating Super LINE CHECKER.
- After reading, keep this instruction manual for future reference.

Instruction Manual
No.00977

Togami Electric Mfg.Co.,Ltd.

Contents

1. Safety precautions

- In order to prevent accident and injury, the following points should always be observed. Please be proficient in the knowledge of product, safety information, and precautions before operating Super LINE CHECKER.
  After reading, please keep this instruction manual at hand and refer to it when necessary.
- Safety precaution levels are classified as “DANGER” and “CAUTION”.

⚠ DANGER	If operation is incorrect, a dangerous situation may occur, resulting in death or serious injury.
⚠ CAUTION	If operation is incorrect, a dangerous situation may occur, resulting in moderate impairment or minor injury or physical damage to the equipment.

⚠ DANGER

- To avoid electric shock, always wear rubber insulated gloves when performing detection and connecting each unit.
- Electric shock, damage, heat, and fire hazard: Never use this equipment in the circuit of 528V or more.
- Electric shock hazard: Never bring the receiver into contact with high voltage energized wire or cable.
- Electric shock hazard: Never clamp the clamp sensor on high voltage energized wire or cable. Never clamp on the bare conductors of any circuits.
- Electric shock, damage, heat, and fire hazard: Even in case of earth leakage point detection without power, circuit voltage is applied intermittently to the secondary circuit of the breaker which is connected to the transmitter. Be sure to confirm the safety of secondary circuit before detection.
- Electric shock and short-circuit hazard: After detection, confirm the detected circuit is de-energized by using a voltage detector to proceed the work.
- Electric shock, damage, heat, and fire hazard: Never disassemble or modify the equipment.
- Electric shock, damage, heat, and fire hazard: Never connect the battery clip cord to an energized circuit.
- Electric shock and damage hazard: Never use this equipment in or around water.

⚠ CAUTION

- ○ Electric shock hazard: Equipment should be operated only by the qualified personnel, e.g., licensed electrical worker or electrician.
- ○ Electric shock and short-circuit hazard: Connect transmitter and connecting cord before the cord is connected to the energized circuit.
- ○ Electric shock and short-circuit hazard: Ensure the connection of connecting cord to the energized circuit.
- ○ Damage and short-circuit hazard: Pull or insert by the plug of 200V cord rather than by the cord.
- ○ Misdetection hazard: The receiver has an auto power-off function built-in. If the receiver is left unoperated or does not receive the signal for 10 minutes, the power turns off automatically. Never confound this function with the condition without response.
- ○ Damage hazard: Remove the battery and store the equipment if it is not used over a long period of time.

2. Product overview

Super LINE CHECKER is designed for detecting the wiring of energized and de-energized lines.

- ・Circuit breaker detection
- ・In-wall wiring detection
- ・Buried wiring detection
- ・De-energized cable detection
- ・Earth leakage point detection
- ・Electricity meter miswiring detection

Super LINE CHECKER consists of transmitter, receiver, and various optional units. It is widely used in the facilities ranging from the general electric to nuclear plant.

3. Operating precautions

■Transmitter

○ This transmitter operated by circuit voltage consumes current. The detectable area of a circuit is from the transmitter connection point to the secondary side of power transformer. Load side detection of the distribution panel can not be conducted by Super LINE CHECKER. (For load detection, use LOAD CHECKER of our product lineup.)

○ If the transmitter is connected to the secondary side of an inverter, the detectable area is from the transmitter connection point to the inverter itself. Detection of the primary side of the inverter can not be conducted. To detect the inverter breaker, connect the transmitter to the primary side of the inverter prior to detection.

- Depending on the inverter type, the detection of the secondary circuit can not be conducted.
- If the transmitter is connected to the secondary side of the inverter, the circuit voltage on the transmitter may not be indicated correctly.

○ If the transmitter is dropped, check whether there is any damage to the case and abnormal operation prior to use.

○ For earth leakage point detection, if the earth leakage circuit breaker or the earth leakage relay (set value of 200mA or less) is located in the power side of the transmitter connection point, be aware of the breaker trip or the alarm activation. (Detection signal current is equal to the earth leakage current which is 200mA for the maximum.)

■Receiver

○ The applicable circuit is the one that the judgment LEDs of receiver blink regularly with the maximum number. Circuit with irregular blink and a few blinking LEDs is not applicable.

Note

- If the setting of receiver is [Wire-Low] or [Breaker-Low], the circuit of which the largest number of LEDs blinks is the applicable circuit. Please note that all 10 LEDs do not always blink.
- Although the receiver has the noise-cut function built-in, in case of a noncontact detection and a sudden noise breakout more than an acceptable level, the LEDs stop blinking temporarily. If it is difficult to judge, detect with clamp sensor. Noise cut level of the detection with clamp sensor is higher than that of the noncontact detection.
- Clamp at least 3 seconds or more for the accurate detection when using clamp sensor.

○ The circuit with noise over the permitted level may not be detectable. In such a case, stop using the noise generator.

○ In some cases of breaker detection inside the distribution panel, LEDs may blink on other breakers than the applicable breaker. In such cases, it is recommended to use the optional signal leakage prevention unit to prevent or reduce the unfavorable display and operation.

- To use the clamp sensor, confirm that the clamp is closed certainly. Incompletely-closed clamp causes improper indication on the receiver.
- If the Battery-LED blinks, exchange the battery as soon as possible.
- To prevent the damage by battery leakage, remove the battery when the equipment is not used for a long period of time.
- If the receiver is dropped, check whether there is any damage to the case and abnormal operation prior to use.

■Clamp sensor

- Each clamp sensor shall be used within the applicable voltage and current range.
- Never use the clamp sensor with the wire thicker than applicable size. Never open the clamp opening forcedly.
- If the clamp sensor is dropped, check whether there is any damage to the case and abnormal operation prior to use.

■Signal leakage prevention unit (Option)

- When the unit is fixed on the steel surface, such as the circuit breaker enclosure, by magnets, confirm that the unit is fixed certainly.
- Built-in fuse shall melt down and break when the signal leakage prevention unit is connected to the secondary circuit of inverter.
  Never connect the signal leakage prevention unit to the secondary circuit of inverter.
  (The signal leakage prevention unit is used for the detection in the distribution panel having the branch circuits. In case of detection in a circuit having an inverter and a motor in pairs like the secondary circuit of inverter, the signal leakage prevention unit is not necessary.)
- Confirm that the circuit switch is turned off prior to removing the clip from the circuit. For safety, never remove the connection before or shortly after the switch is turned off.

■Common

- Note that the detection may not be conducted when load current of the detecting circuit is 500A or more.
- Note that the detection may not be conducted when the static capacitor or UPS, uninterruptible power system, is connected to the detecting circuit.
- Storage temperature range shall be -20°C to 50°C; however, 50°C is temporary storage only. The maximum temperature for prolonged storage is 40°C.
  Use in the temperature outside this range may cause shortening of service life, leakage, heat generation, and explosion of battery.
- To prevent potential damage, never wipe the case or connecting code with organic solvent.

4. Product components

Upon arrival of this equipment, please check its appearance for damage. If any damage or lack of component is found, please contact our distributor.

Contents of standard set and options are:

Name	Model	Quantity
Standard set	TLC-C-Y1	-
Transmitter	TLC-C-TY1	1
Receiver	TLC-C-RY1	1
Clamp sensor (M) (internal diameter φ24)	TLC-C-F1Y1	1
Cord with 200V plug	TLC-C-F4Y2	1
Cord with battery clip	TLC-C-F5Y1	1
Clip cord	TLC-C-F6Y1	1
Carrying case	TLC-C-CY1	1
9V manganese battery	-	1
Instruction manual	-	1
Options		
Clamp sensor (LL) (internal diameter φ68)	TLC-C-F7Y1	-
Clamp sensor (L) (internal diameter φ40)	TLC-C-F2Y1	-
Clamp sensor (S) (internal diameter φ8)	TLC-C-F3Y1	-
Signal leakage prevention unit	SBU-A-5K (*5K = 5kHz)	-

5. Specifications

5.1 Transmitter

Applicable voltage range	AC 50/60 Hz and DC: 12-528V
Type	Current consumption
Signal frequency	5kHz
Signal current	200mAp
Signal time	30ms
Signal cycle	500ms
Operation indication	LED (yellow)
Voltage indication	LED (red) (100V/200V/400V)
Dimensions	112(H) × 82 (W) × 30(D)mm
Weight	About 111g

5.2 Receiver

Detection theory	Detecting the magnetic field generated by the signal current
Detection frequency	5kHz
Built-in sensor	2 coil sensors (coils for wire detection and breaker detection)
External sensor	Clamp sensor (plug connecting type)
Judgment criterion	10 LEDs (red) blink (receiving level indication) and alarm sound
Sensitivity selection	5 mode selection (Clamp, Wire, Breaker, Route, and E. Leakage) and Low/High sensitivity selection (common to each mode)
Condition of earth leakage detection	Ground fault resistance = 2kΩ or less Earth capacitance = 0.01μF or less

Power	9V battery (manganese or alkaline)
Battery life	About 8 hours (manganese battery, 20°C, continuous receive)
Battery life display	Battery-LED (blue) (Battery remaining: lighting=40% or more, blinking=40% or less, extinction=0%)
Auto power off	Auto power off after 10 minutes of non-operation
Auto power off alarm sound	1.5 sec (ON) → 5 sec (OFF) → 1.5 sec (ON) → 5 sec (OFF) → 3 sec (ON) → Power off
Applicable clamp sensor	Clamp sensor (M) (internal diameter φ24) (standard) Clamp sensor (LL) (internal diameter φ68) (option) Clamp sensor (L) (internal diameter φ40) (option) Clamp sensor (S) (internal diameter φ8) (option)
Dimensions	193(H) × 51(W) × 33(D)mm
Weight	About 135g (including a battery)

5.3 Clamp sensor (M)

Applicable voltage range	AC 50/60Hz and DC: max. 528V
Applicable current	AC 50/60Hz and DC: 100A
Internal diameter of clamp	φ24
Applicable clamping point	Insulating coating of LV insulated conductor (Never clamp the bare conductors.)
Length of signal cable	About 90cm
Dimensions	100(L) × 60(W) × 26(D)mm
Weight	About 81g

Applicable range of clamp sensor

Type	Applicable current	Internal diameter	Maximum applicable cable (600V)		
			Type	Nominal (mm^2)	Finished dimensions (mm)
Clamp sensor (M)	AC 50/60Hz DC100A	φ24	IV (single)	200	23
			CV (single)	150	22
			CV (triplex)	22	22
			CVT	22	Not applicable due to 25mm
Clamp sensor (S)	AC 50/60Hz DC 30A	φ8	IV (single)	14	7.6
			CV (single)	3.5	7.0
Clamp sensor (L)	AC 50/60Hz DC 300A	φ40	IV (single)	500	35
			CV (single)	500	39
			CV (triplex)	100	40
			CVT	60	34
Clamp sensor (LL)	AC 50/60Hz DC 500A	φ68	IV (single)	500	35
			CV (single)	1000	52
			CV (triplex)	325	65
			CVT	325	66

* For energized line, clamp sensor can only clamp the insulated part of low voltage insulated conductor. Never clamp the bare wire/conductor.

5.4 Detectable distance

Max. 5km

* The sum of earth resistance shall be 200Ω or less when using the earth return circuit.

5.5 Options

■ Signal leakage prevention unit

Applicable voltage range	AC 50/60Hz: 0-460V, DC: 0-110V
Maximum rated current	Max. 3.7A/circuit
Number of circuits	2 circuits
Applicable signal frequency	1 circuit: 5kHz, 2 circuits: 5kHz
Length of lead	About 1m
Dimensions	88(H) × 130(W) × 170(D)mm
Weight	About 985g

■ Clamp sensor (S)

Applicable voltage range	AC 50/60Hz and DC: max. 528V
Applicable current	AC 50/60Hz and DC: 30A
Internal diameter of clamp	φ8
Applicable clamping point	Insulated coating of LV insulated wire (Never clamp the bare conductor.)
Length of signal cable	About 90cm
Dimensions	153(L) × 18(W) × 23(D)mm
Weight	About 66g

■ Clamp sensor (L)

Applicable voltage range	AC 50/60Hz and DC: max 528V
Applicable current	AC 50/60Hz and DC: 300A
Internal diameter of clamp	φ40
Applicable clamping point	Insulated coating of LV insulated wire (Never clamp the bare conductor.)
Length of signal cable	About 90cm
Dimensions	128(L) × 81(W) × 36(D)mm
Weight	About 187g

■ Clamp sensor (LL)

Applicable voltage range	AC 50/60Hz and DC: max 528V
Applicable current	AC 50/60Hz and DC: 500A
Internal diameter of clamp	φ 68
Applicable clamping point	Insulated coating of LV insulated wire (Never clamp the bare conductor.)
Length of signal cable	About 90cm
Dimensions	186(L) × 129(W) × 53(D)mm
Weight	About 400g

5.6 Service conditions

Operation temperature range: -10°C to 40°C

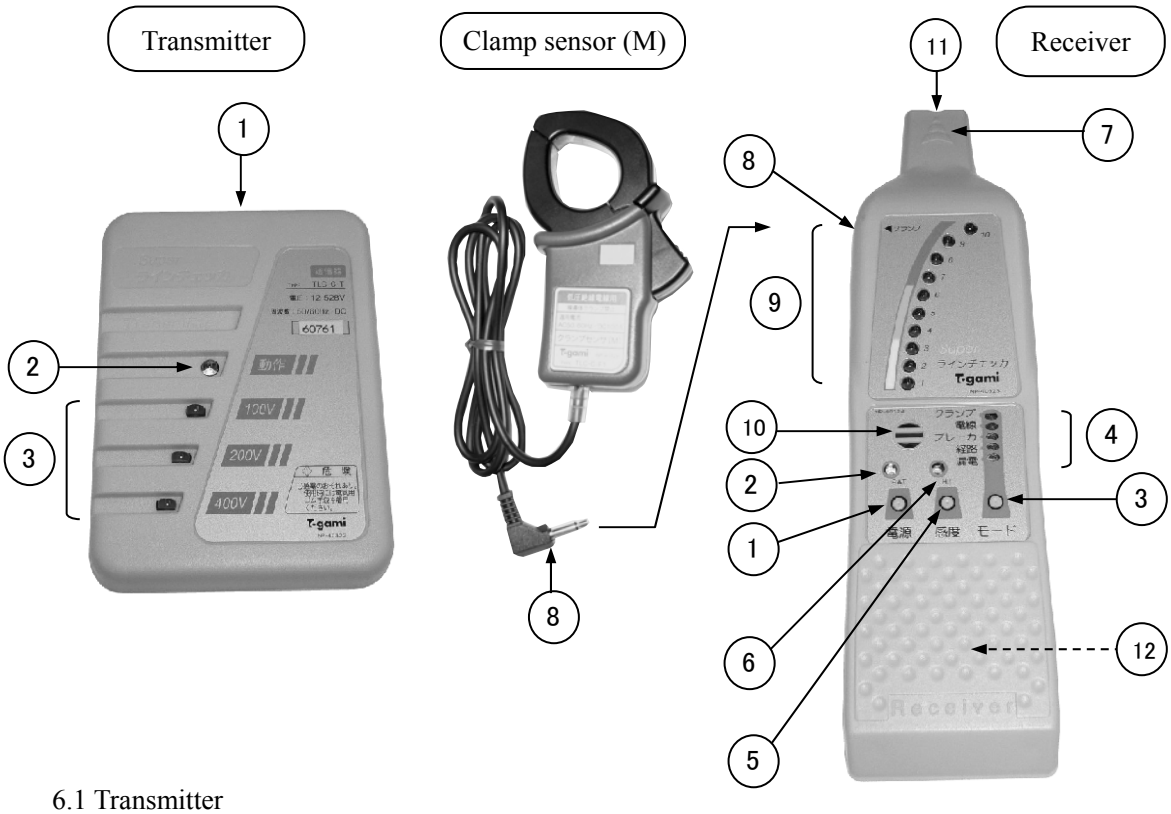
Operation humidity range: Relative humidity of 95% or less (no condensation)

Storage temperature range: -20°C to 50°C

*50°C shall be the temporary temperature for 8 hours or less. Maximum prolonged storage temperature shall be 40°C.

*Never leave Super LINE CHECKER in a car during the summer.

6. Part names and functions



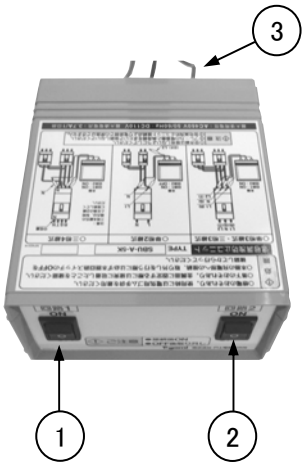
6.1 Transmitter

No.	Name	Function
1	Power receptacle	For connection of the 200V plug cord or clip cord
2	Operation LED	Blinking during operation and signal current flowing
3	Circuit voltage LEDs	Indicating the circuit voltage

6.2 Receiver & 6.3 Clamp sensor (M)

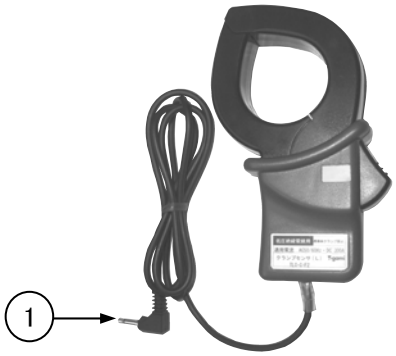
No.	Name	Function
1	Power switch	Switch for ON-OFF operation
2	Power LED/ Battery-LED	Battery remaining: lighting=40% or more, blinking=40% or less, extinction=0%
3	Mode selector	Selecting the detection mode: Wire →Breaker →Route →E. Leakage →Clamp (Default is Wire.) Set a mode of detection point. Refer to page 11.
4	Mode LEDs	Indicating the selected mode
5	Sensitivity selector	Selecting the sensitivity: Low →High (Default is Low.) Set a sensitivity of detection point. Refer to page 11.
6	Sensitivity LED	Indicating the selected sensitivity (lighting= High, extinction= Low)
7	Internal sensor	Sensor for noncontact detection
8	External sensor connector & receptacle	Connecting clamp sensor and receiver *Clamp sensor can be used only when the “Clamp” mode is selected.
9	Judgment LEDs	Indicating the received detection signal
10	Alarm	Electronic alarm sounds when turning the power on, receiving signal, and warning the auto power-off.
11	Direction guide	Guiding the direction of detecting wire. *Place the receiver on the wire along the groove of direction guide.
12	Battery	Installing a 9V battery

Signal leakage prevention unit (Option)



Clamp sensor (S) (Option)

Clamp sensor (L) (Option)



Clamp sensor (LL) (Option)

6.4 Options

■Signal leakage prevention unit

No.	Name	Function
1	Circuit 1 switch	Turning on when the circuit 1 is used
2	Circuit 2 switch	Turning on when the circuit 2 is used
3	Lead wire	Connecting to the detecting circuit Ensure connection/removal of the lead after the circuit switch is turned off.

■Clamp sensor (S)

No.	Name	Function
1	External sensor connector	Connecting to the external sensor receptacle of receiver
2	Sliding lever	Sliding the lever to clamp the line After the line is clamped, be sure to place its position back.

■Clamp sensor (L)

No.	Name	Function
1	External sensor connector	Connecting to the external sensor receptacle of receiver

■Clamp sensor (LL)

No.	Name	Function
1	External sensor connector	Connecting to the external sensor receptacle of receiver

6.5 Characteristics of receiver (Selection and characteristics of sensitivity)

Mode and sensitivity selection

Select the Mode and the Sensitivity correctly for an accurate detection.

Mode	Sensitivity	Point to place the receiver
Clamp	Low	Energized line and breaker connecting line
	High	De-energized line with battery
Wire	Low	Thin wire and breaker connecting wire *Mainly wire of 100mm² or less
	High	Thick wire and surface of 1P breaker
Breaker	Low	Surface of a breaker
	High	Surface of a breaker (High sensitivity)
Route E. Leak	Low	Shallow buried line (close from the detection point/receiver)
	High	Deep buried line (far from the detection point/receiver)

* Breaker mode is exclusive to the detection of 2P and 3P breaker and can not apply to other detections. [The direction of the sensor coil for breaker mode is different from the other modes.]
* When detecting 1P breaker, select the mode “Wire” and the sensitivity “High” because “Breaker” mode is not suitable.

Characteristics of sensitivity (Direction guide)

The judgment LEDs blink the most when the receiver is placed as shown in the Figure 1.

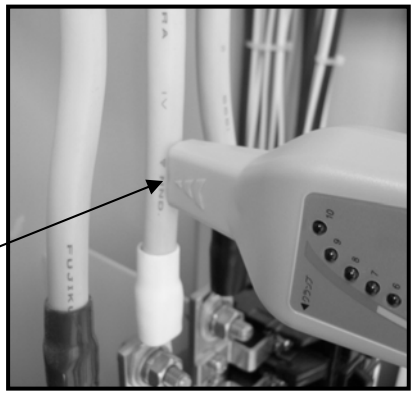
The receiver does not respond when it is placed as shown in the Figure 2.

When detecting the in-wall or underground wire, rotate the receiver and confirm the direction of the buried wire by checking the number of LEDs blinking. Proceed the detection along the direction guide (groove).

Place the receiver on the wire along the direction guide.

Figure 1

Sensitivity: good



The receiver does not respond when the direction guide (groove) of receiver is not at the right angle with the line.

Figure 2

Sensitivity: bad

7. Usage

7.1 Circuit voltage check

1. [Figure 3] Connect the transmitter to the terminal to check the voltage. One of the circuit voltage LEDs blinks.
2. Check the indicated voltage of blinking LED.
   Range of circuit voltage

Blinking LED	AC	DC
100V	75V±5%	67V±5%
200V	150V±5%	134V±5%
400V	300V±5%	268V±5%

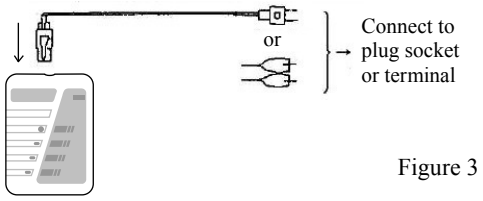


Figure 3

If any circuit voltage LED does not blink while the operation LED blinks, it is possible that the circuit voltage is less than the range or the circuit is damaged.

7.2 Energized breaker detection

1. Connecting transmitter
   [Figure 4] Connect the transmitter to the plug socket or terminal to be repaired or inspected.
   The operation LED and one of the circuit voltage LEDs blink.
   (If the operation LED does not blink, voltage is not applied to the circuit. Detect the line with "De-energized line detection" specified in the page 19.)

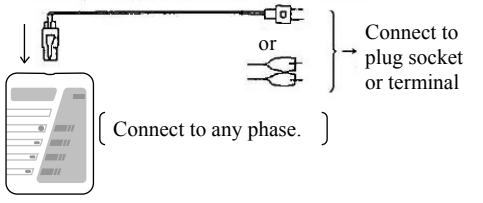


Figure 4

Sensitivity setting

The sensitivity of receiver can be set by the mode selector and sensitivity selector depending on the detection point.

Ensure sensitivity settings as explained in this manual.

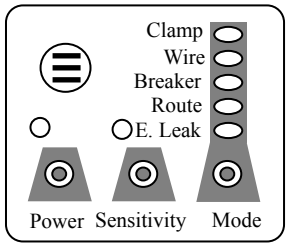


Figure 5

2. Detection of distribution panel

Detection area	Mode	Sensitivity
Distribution panel	Route or E. Leak	Low or High

[Figure 6] Place the receiver on the door gaps of distribution panels which possibly have breakers.

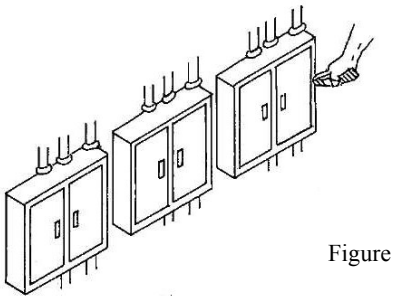


Figure 6

3. Detecting breaker (detection on the breaker surface) [Figure 7 & 8]

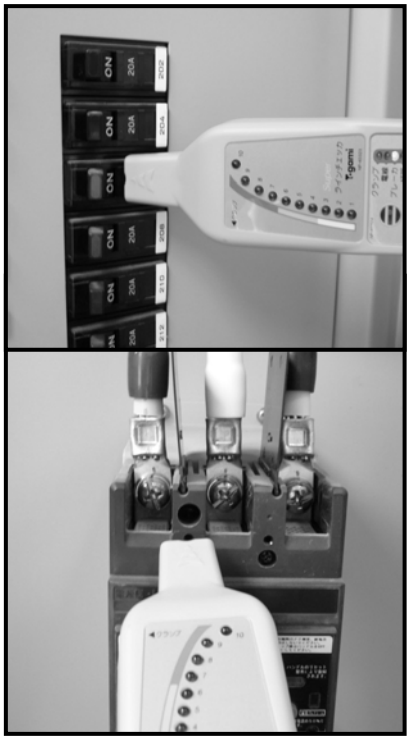
Detection area	Mode	Sensitivity
1P breaker	Cable	High
2P 3P breaker	Breaker	Low or High

(1) Open the door of the distribution panel and place the top of receiver on each breaker handle of the power side one after another over the protective cover.
(2) The breaker with the maximum LEDs blinking and continuous alarm sound is the detected breaker.

Caution

- Place the receiver vertically to the breaker.
- If a protection cover is made of steel, the number of maximum blinking LEDs may be one or two. If possible, remove the protection cover and place the receiver on the breaker connection wire as shown in Figure 9.
- The receiver may show the slight response to both side of the nearest breakers when 1P breaker is installed close to each other. It is recommended to detect as explained in the clause 4 below.

Figure 7



* If the detecting breaker is 2P or 3P, place the receiver between two phases.

Figure 8

4. Detecting breaker with connection wires [Fig. 9]
Conduct this detection if breaker can not be detected with the method explained in the clause 3.

Detection area	Mode	Sensitivity
Wire 100mm^2 or less	Cable	Low
Wire 100mm^2 or more		High

(1) Remove a protection cover and place the direction guide of receiver on each wire connected to the breaker one after another.
(2) The wire with the maximum LEDs blinking and continuous alarm sound is the applicable breaker.

Caution

- The receiver has the noise cut function built-in, but if a sudden noise which is higher than an acceptable level breaks out, the LEDs temporarily stop blinking.
- The breaker with the maximum LEDs blinking is the detected breaker. (Note that all 10 LEDs do not always blink.)
- The signal is intermittent electronic alarm sounds.

Figure 9

* Canceling the magnetic flux on the cable prevents the receiver from responding. Be sure to place the receiver on the single wire near the breaker as shown in Figure 9.

♦ If the receiver slightly respond near the detecting wire (most of the time, both side of the nearest wires), use Clamp Sensor for more accurate detection.

⇨ Refer to page 14: Usage of Clamp Sensor

♦ If nearly same numbers of LEDs blink at several breakers or wires, use optional signal leakage prevention unit for more accurate detection.

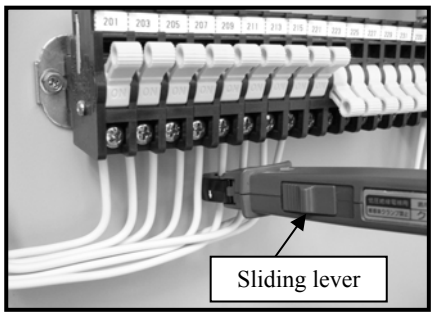
⇨ Refer to page 14: Usage of Signal Leakage Prevention Unit

Usage of clamp sensor

If the receiver slightly shows the response to other breakers, mostly next to the applicable breaker, use clamp sensor for an accurate detection.

Detection area	Mode	Sensitivity
Breaker wire or Neutral line	Clamp	Low

(1) Clamp the breaker wire or neutral line with the clamp sensor.



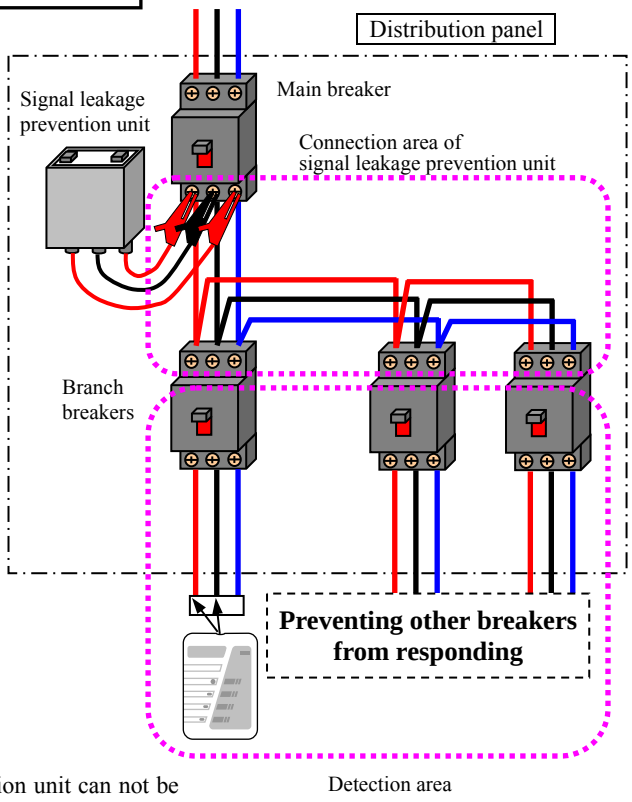
Caution

- Noise cut level of clamp mode is higher than that of the other modes. Clamp at least 3 seconds or more to detect.
- Slide the sliding lever to clamp the wire with the optional clamp sensor(S). Return the slide lever surely after clamping

Usage of signal leakage prevention unit

If nearly the same numbers of LEDs blink at several breakers or wires, use optional Signal Leakage Prevention Unit to prevent or reduce false responses.

(1) Turn off the circuit switch 1 and 2 of the unit.
(2) Connect the lead from the unit to between secondary side of the main breaker and primary side of the branch circuit breaker.
* For more detailed connection, refer to the nameplate on the unit.
(3) Turn on the circuit switch 1 and 2.
(4) Detect the breaker or wire.
(5) After completing the detection, turn off the circuit switch 1 and 2, and then remove the lead.



Caution

- Maximum current flowing through per circuit is 3.7A when the signal leakage prevention unit is connected. Please be aware of tripping if the breaker has small capacity.
- There may be no use effect depending on the circuit.
- Power side of the signal leakage prevention unit can not be detected. The receiver does not show any response.
- After completing the detection, remove the unit promptly and never leave the unit to be connected for long time.

7.3 Buried energized wire detection (wiring route)

For detecting buried energized line, when the transmitter is connected directly to the terminal or plug socket, the directions of each signal current flow would be opposite, which makes the response of receiver weakened due to cancelling the magnetic fluxes.
Detection of the buried live wire shall be conducted as indicated below.

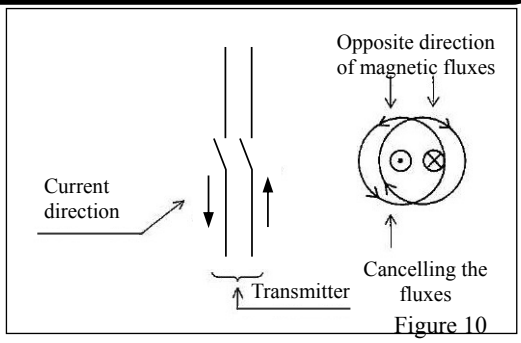
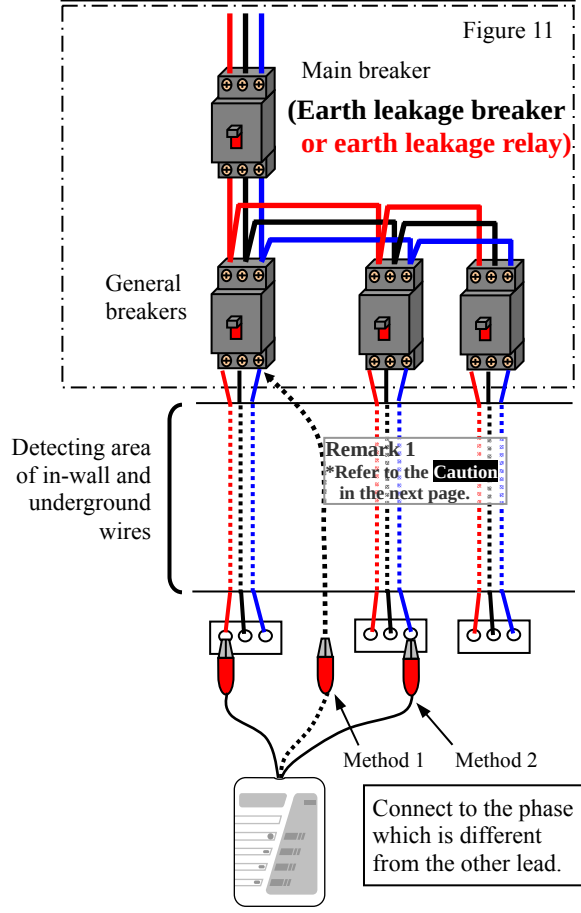


Figure 10

・Detection of the circuit with earth leakage circuit breaker or earth leakage relay whose setting value shall be 200mA or less
・Detection of the uncertain circuit whether the circuit has any earth leakage breaker or relay

Figure 11

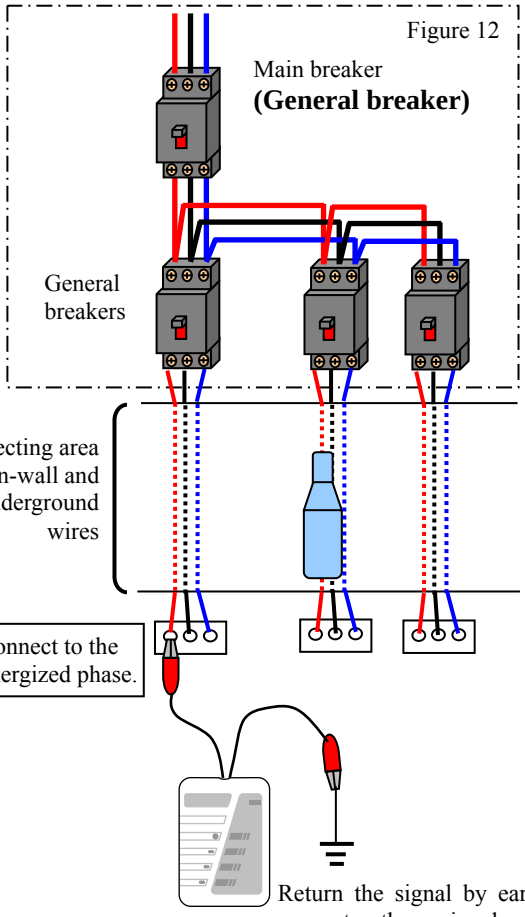


Connect the transmitter by either the method 1 or 2 shown in the Figure 11 above to return the signal by a different route in order to prevent the signal from flowing in the detecting route.

・Detection of the circuit without earth leakage circuit breaker

* If there is any earth leakage circuit breaker, it may trip accidentally.

Figure 12



Return the signal by earth to prevent the signal from flowing in the detecting route.

Caution

- Unearthed circuit can not be detected.
- Connect the transmitter to the earthing terminal which is 100Ω or less.
- Method 1 and 2 shown in the Figure 11 can be applied for the circuit detection without earth leakage breaker.

1. Route detection of in-wall wire

Detection area	Mode	Sensitivity
Wall	Route	Low or High

1.1 Detection of the circuit with earth leakage circuit breaker or relay whose setting value is 200mA or less and detection of the uncertain circuit whether the circuit has any earth leakage circuit breaker or relay

(1) Connect the clip cord to the transmitter.

(2) Connect one of the clips of clip cord to the detecting terminal (or plug socket terminal, etc.).

(3) Connect another clip to the terminal (or plug socket terminal, etc.) in another route.
If the operation LED and the circuit voltage LEDs do not blink, connect the clip to another phase.

(4) Figure 13 is an example of in-wall wire route detection.
Move the receiver around the plug sockets on the wall. (1)

(5) If the receiver shows responses, move it along the wall as observing the reaction. (2)
If the receiver does not show any response as tracing the line, rotate the receiver 90 degree right and left at where the signal disappears, and search the route direction.

(6) Figure 14 shows the condition of the judgment LEDs. Buried line is at the midpoint of the blinking LED range.

1.2 Detection of the circuit without earth leakage breaker

(1) Connect the clip cord to the transmitter.

(2) Connect one of the clips of clip cord to the energized phase of the detecting terminal (or plug socket terminal, etc.).

(3) Connect another clip to the earthing terminal which is 100Ω or less.
If none of LEDs on the transmitter blinks, the earthing may not be perfect.

(4) Detect in the same procedure as mentioned in the clause 1.1 above.

Caution

- If the main and branch breakers are earth leakage breakers, bypass the secondary side of the branch breaker whose line is detecting (see Figure 11). In such case, bypass wiring has to be placed at least 5m away from the area of buried wire.
- Detectable depth is about 1m.

2. Detection of underground buried wire

Detection area	Mode	Sensitivity
Ground surface	Route or E. Leak	High or Low

The underground buried wire can be detected as the same procedure shown in the in-wall wire detection above.

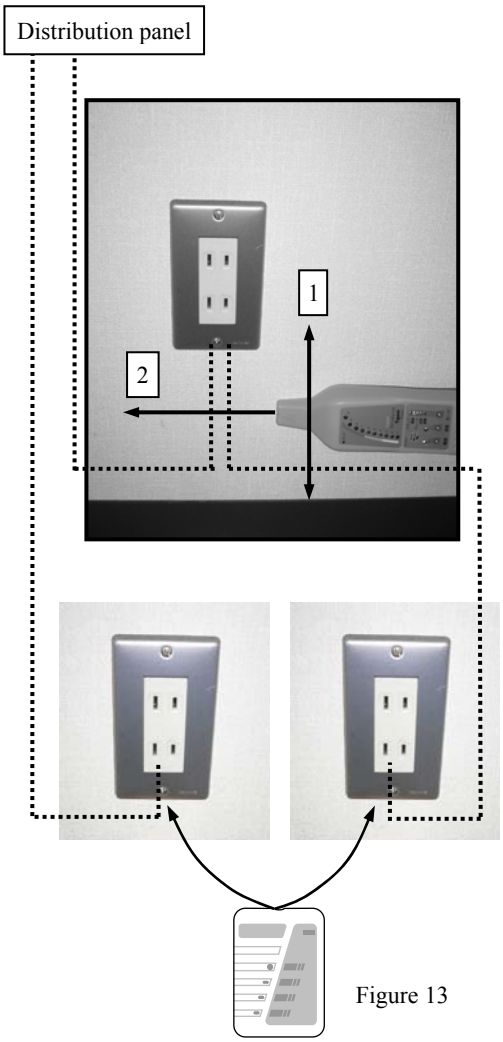


Figure 13

Number of blinking LEDs

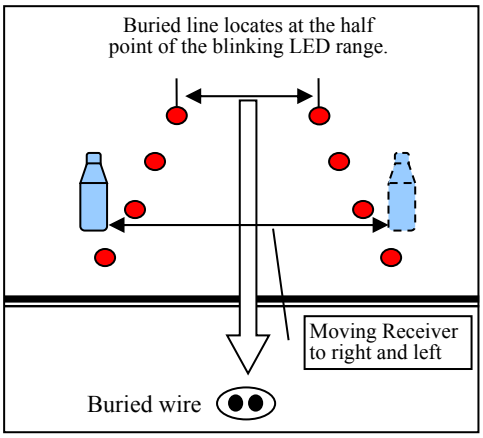


Figure 14

7.4 Energized cable detection (in the cable rack or cable trench)

When detecting the buried energized cable which has identified its breakers and cable terminals, if the transmitter is connected directly to the terminal, the signal current flowing the wires are opposite and cancelled the magnetic fluxes, which weakens the response of receiver. Detect the buried energized cable in the procedure as shown below.

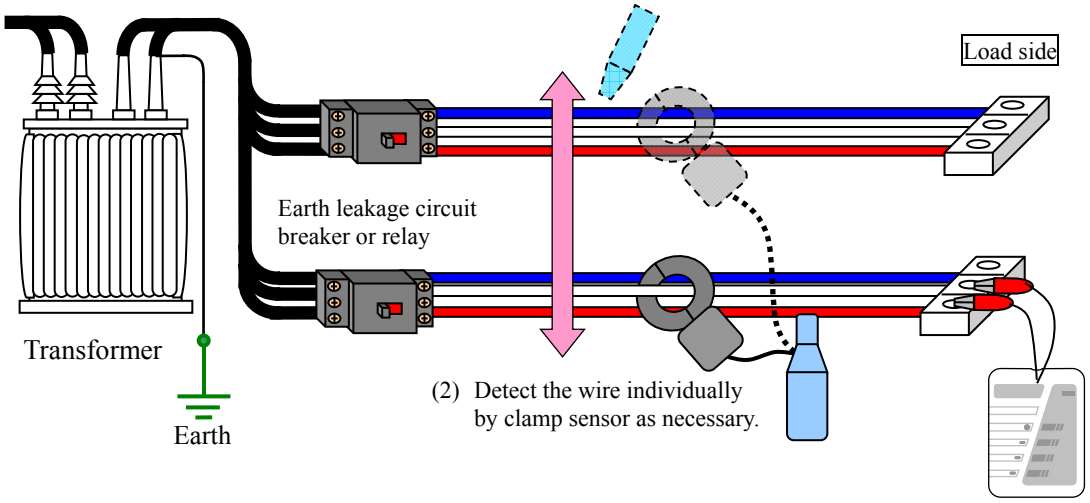
Detection area	Mode	Sensitivity
Cable rack and Surface of wire in cable trench	Wire	Low or High
	Clamp	Low

- **Detection of the circuit with earth leakage circuit breaker or earth leakage relay whose setting value shall be 200mA or less**
- **Detection of the uncertain circuit whether the circuit has any earth leakage circuit breaker or relay**

IV wire	Connect as Figure 15 because each wire can be clamped.

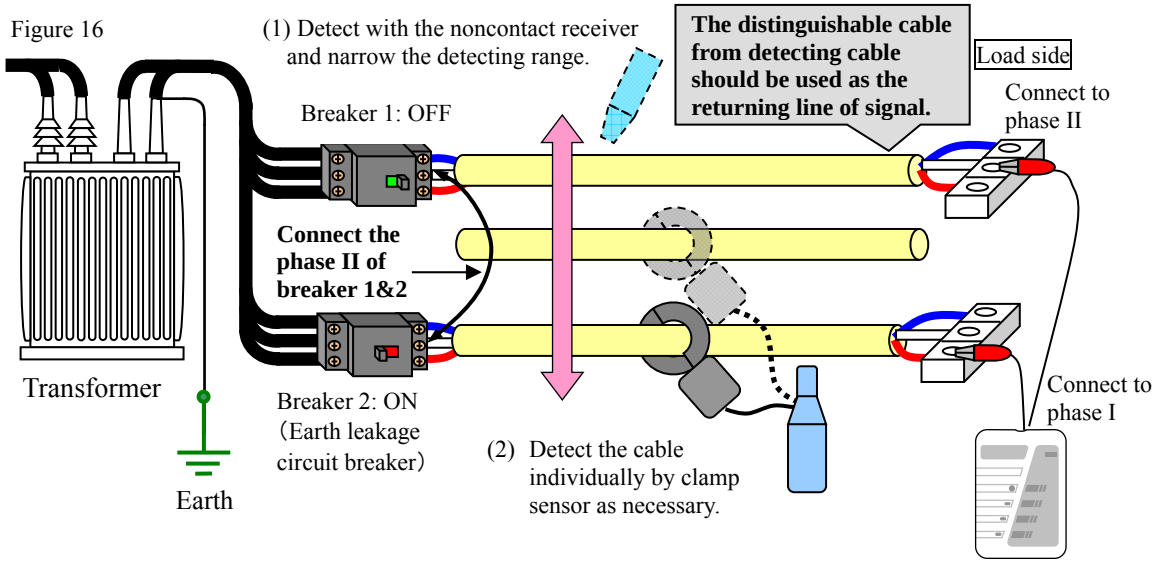
(1) Detect with the noncontact receiver and narrow the detecting range.
*Receiver shows the response to the signal because the wires may not be placed perfectly parallel.

Figure 15



CV/CVT cable	Connect as Figure 16 when another cable can be used for the returning line.

Figure 16

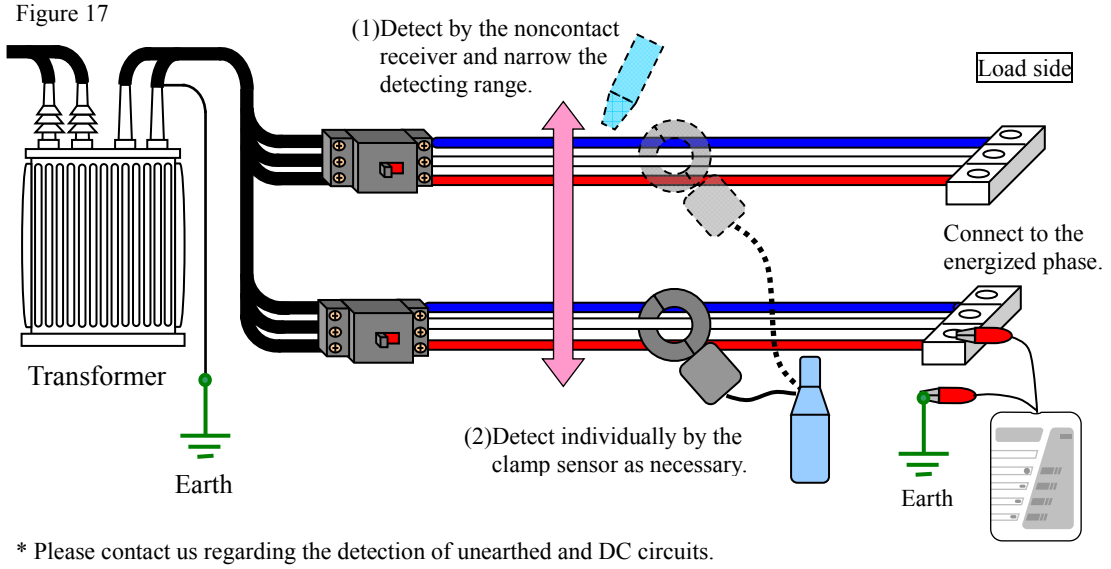


·Detection of the circuit without earth leakage circuit breaker

* If there is the earth leakage circuit breaker, it may trip accidentally.

IV wire	Connect as Figure 17 because each wire can be clamped. (Connection of Figure 15 is also possible.)

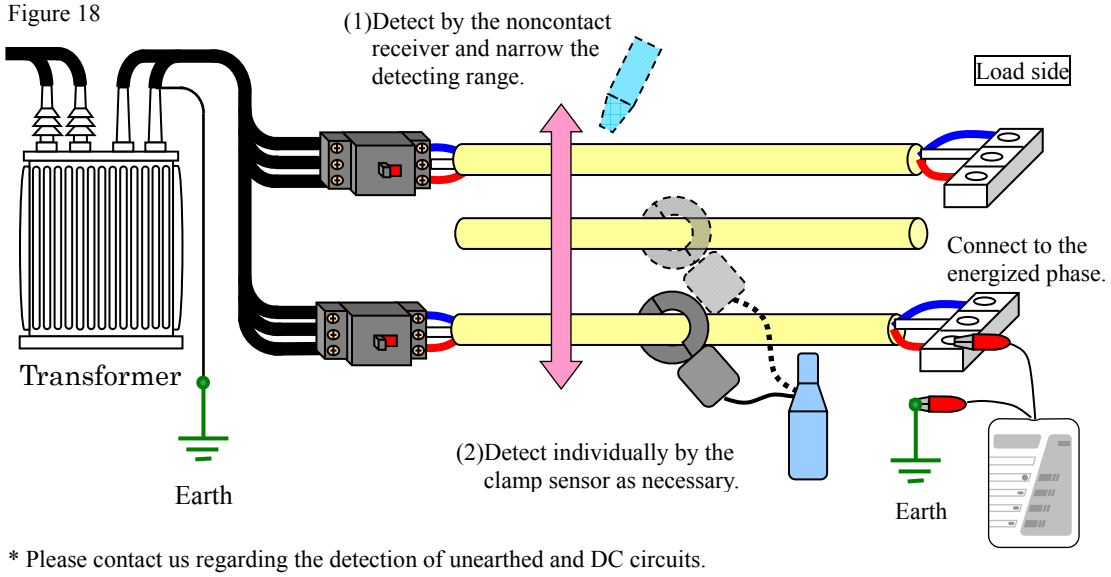
Figure 17



* Please contact us regarding the detection of unearthed and DC circuits.

CV/CVT cable	Connect as Figure 18 when another cable can be used for the returning line.

Figure 18



* Please contact us regarding the detection of unearthed and DC circuits.

7.5 De-energized cable detection (wiring route)

Detection area	Mode	Sensitivity
Wall surface	Route	Low or High
Ground surface	Route or E. Leak	Low or High

(1) Turn off the breakers.
(2) Connect one of the phases at secondary side of a breaker to the earthing terminal.
(3) Connect the clip cords to the transmitter.
(4) Connect two 9V alkaline batteries to one of the clip cords from the transmitter.

*In-wall and underground wires
*Able to trace conduit and metallic pipe
*Depth of detection: about 1m

(5) Connect one of the clips which has not been connected to the batteries to the detecting terminal or plug socket, etc.
(6) Connect another clip which has been connected to the batteries to the earthing terminal.
(7) Check whether the operation LED on transmitter blinks. If not, check whether the appropriate phase has been connected.
(8) Detect with the receiver.
Detect the wires, etc. by moving the receiver right and left as checking the response.

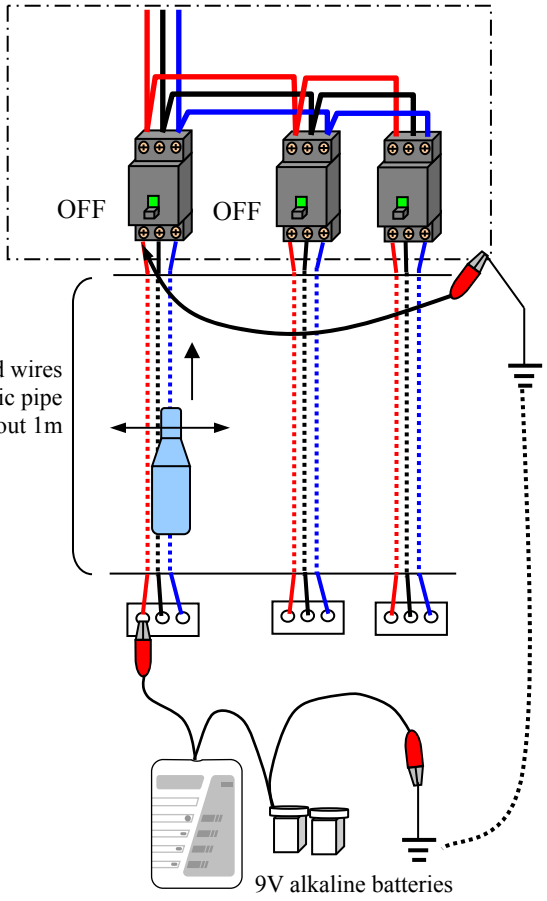


Figure 19

Caution

- Connect to the earthing terminal of 100Ω or less.
- Earthings of the transmitter should be apart from the buried line not less than 5m when the underground wire or cable is detected.

Note

- When a breaker is detected at de-energized state, connect the transmitter, and then place the receiver to the connecting wire which is earthed as indicated in the Figure 19.
  If the receiver does not show any response, the connected breaker is not the applicable breaker, so connect the earth connection wire to other breaker. In such a case, make sure to connect the earth connection wire to the phase which is connected to the transmitter.

Detection area	Mode	Sensitivity
Earth connection wire	Wire	Low or High

Number of blinking LEDs for judgment

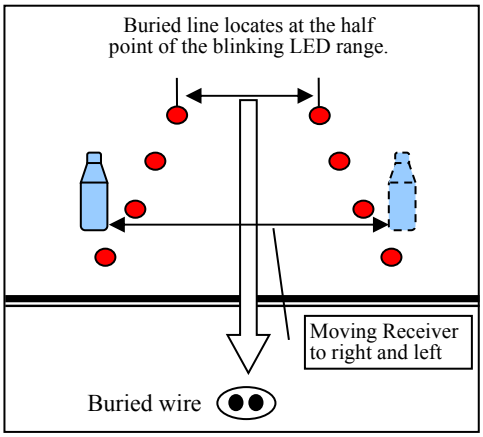


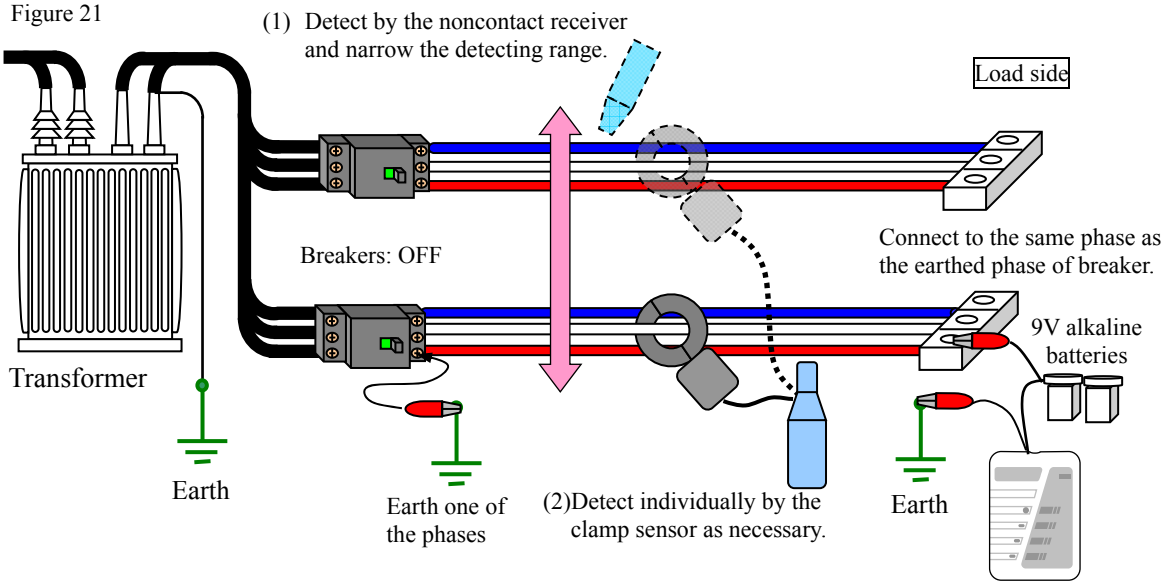
Figure 20

7.6 De-energized cable detection (in cable rack or cable trench)

Detection area	Mode	Sensitivity
Cable rack and surface of wire in cable trench	Cable	Low or High
	Clamp	Low

IV wire

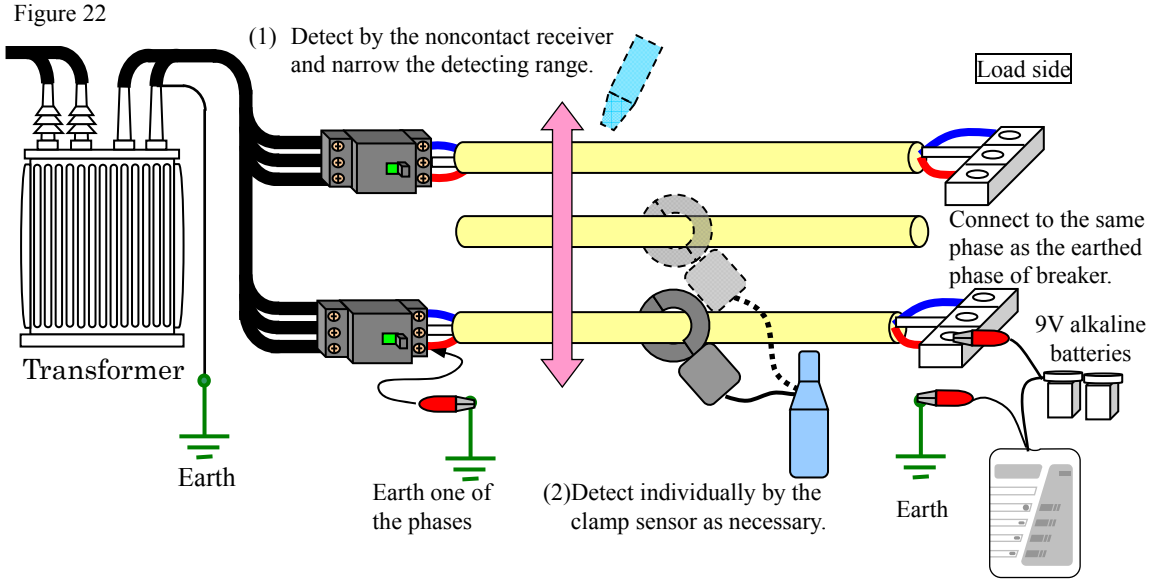
Figure 21



Caution Connect to the earthing terminal of 100Ω or less.

CV/CVT cable

Figure 22



Caution Connect to the earthing terminal of 100Ω or less.

7.7 Earth leakage point detection

Method to detect the earth leakage point of de-energized circuit:

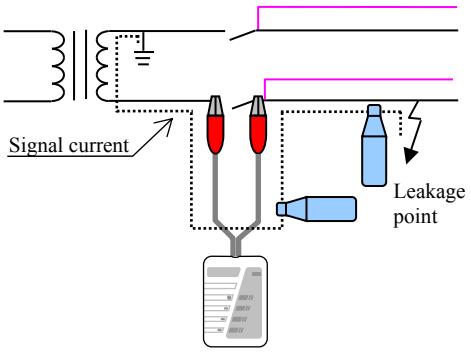
Detection area	Mode	Sensitivity
Surface of wall and ground	E. Leak or Route	Low or High
Surface of wire	Wire	Low or High

(1) Turn off the breaker or the earth leakage circuit breaker.
(2) Connect the transmitter to each phase of the earth leakage circuit breaker, and then connect the transmitter to the phase that the operation LED blinks as shown in the Figure 23 and 24.
If the leakage current is between 50mA and 80mA, tracing is possible, but operation LED does not blink.
To judge whether the phase has earth leakage, select the mode "Wire" and sensitivity "High", and place the receiver on one of the transmitter leads.
The phase with blinking LEDs has the earth leakage.

Caution Please thoroughly read the following.

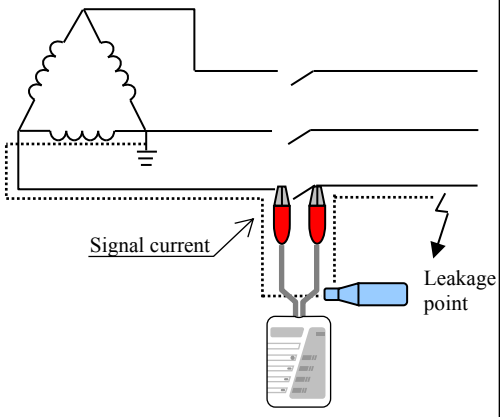
- Although the breaker is turned off, voltage is possibly applied to the load side of breaker when the transmitter is connected. Please connect the transmitter after confirming safety.
- In cases of Figure 23 and 24, the earth leakage circuit breaker may trip when the breaker is located at the power side of transmitter connection point; the alarm may be activated when the earth leakage relay whose setting value is 200mA or less is located at the power side of transmitter connection point.
- Detectable earth resistance is 2kΩ or less, and earth capacitance is 0.01μF or less.
- When detecting the earth leakage point of the earthed phase, change the connection of the clip to the energized phase from the primary side of breaker. (another phase than the same phase as load side)

(3) When detecting the earth leakage point of buried line, find a point that the receiver shows response as moving the receiver right and left on the wall or ground as shown in the Figure 26.
The point that the signal weakens or disappears is the earth leakage point.
(4) When detecting the earth leakage of equipments, detect with the terminal wire and earthing wire as shown in the Figure 26. If the receiver shows response at the earthing wire, the leakage point is inside the equipment.



Single-phase circuit case

Figure 23



3-phase circuit case

Figure 24

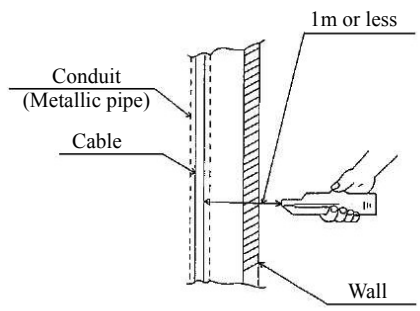
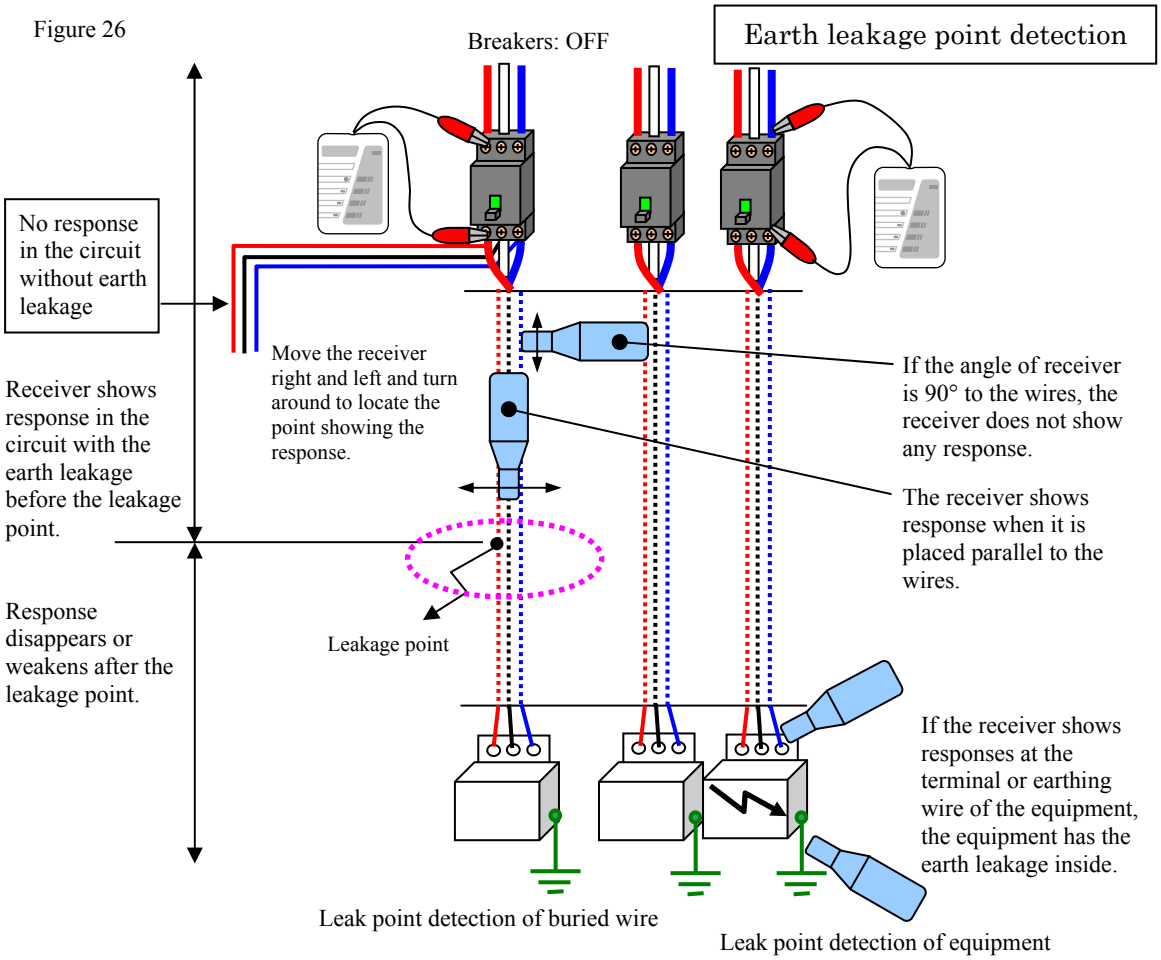


Figure 25

Figure 26



Points

- Start the detection at the point where the receiver can be placed directly, such as joint of wire, earthing wire, etc. The receiver shows responses in the section between the transmitter to the earth leakage point, and the responses disappear after the leakage point.
- It is important to detect with the suitable settings. Select the "Wire" and "Low/High" when placing the receiver on the wire directly and "Route" and "Low" when detecting the in-wall wiring within 30cm. "E. Leak" mode is too sensitive to detect the leakage point correctly.
  * "E. Leak" mode is used when the receiver, or the surface of wall, and wire is apart more than 30cm.

Note

- If the wire has several leakage points or leakage from the overall insulating coating, the leakage point may not be identified.
- If the wire has leakage in the metallic pipe or case, the signal flows through the pipe or case. As a result, the receiver may not be able to indicate the leakage point exactly.
- If the depth of buried wire differs from point to point and gets deeper, the response of the receiver weakens. In such cases, take layout drawing and on-site situation into consideration collectively to determine whether the point is the earth leakage point or the point where the buried line deepens because the response on the receiver is similar in both cases by decreasing the number of blinking LEDs.

7.8 Electricity meter miswiring detection

Miswiring detection of single-phase, three-wire electricity meter (*Note 1)

Detection area	Mode	Sensitivity
Clamping 3 connection wires of power side terminal of meter	Clamp	Low or High

*Three-phase, three-wire meter can be also checked as well.

(1) Procedure of miswiring check

Miswiring within the own meter	Miswiring with other meter	Miswiring under unspecified condition
⇩	⇩	⇩
(2)	(2)	(5)
⇩	⇩	⇩
(3)	(4)	(3) or (4)

(2) Checking whether miswired or not

* If miswiring is detected only at the neutral phase, miswiring can be checked by connecting the transmitter to 1L-2L.

Transmitter connecting phase	Criterion
1L-2L and 2L-3L	Miswiring if receiver responds

* Conduct the procedure (3) below when miswired phase needs to be identified.

(3) Identification of miswired phase

Change the connections of the transmitter three times, and judge the miswired phase from the patterns of responses. (○ : response, × : no response)

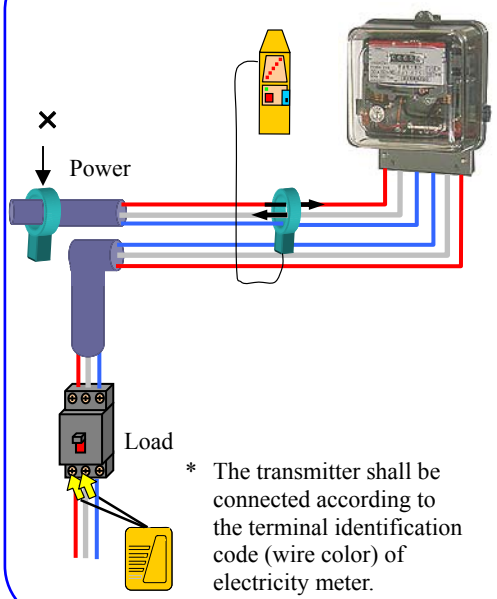
Pattern	Connecting phases of transmitter (Note 2)	Result	Judgment
1	1L-2L	○	・Connected 1S-1L in reverse or ・Connected 2S-2L and 3S-3L in reverse
	2L-3L	×	
	3L-1L	○	
2	1L-2L	○	・Connected C2S-2L in reverse or ・Connected 3S-3L and 1S-1L in reverse
	2L-3L	○	
	3L-1L	×	
3	1L-2L	×	・Connected 3S-3L in reverse or ・Connected 1S-1L and 2S-2L in reverse
	2L-3L	○	
	3L-1L	○	

(Note 1) This can be applied only to a case of power-load reverse connection of a same phase and excludes a miswiring which two wires are crossed at the power side or the load side.

(Note 2) The transmitter shall be connected based on the terminal code of electricity meter. Connect the transmitter based on the color of wire which is connected to the electricity meter load side terminal.

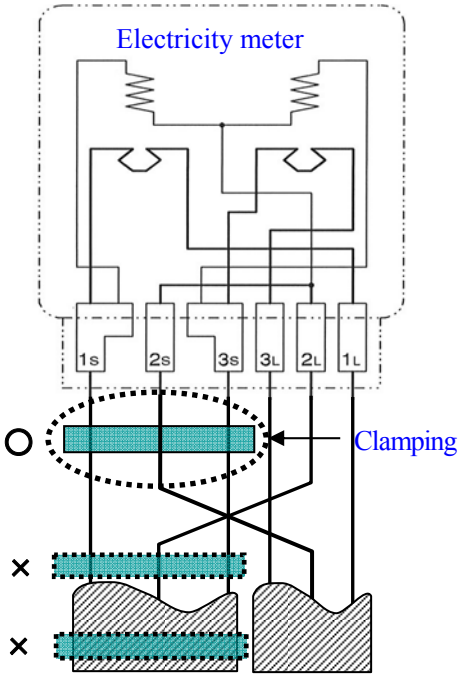
(Note 3) Clamping other than the connected wires on the electricity meter power side terminal can not detect the miswiring correctly.

Transmitter connection and clamp position



* The transmitter shall be connected according to the terminal identification code (wire color) of electricity meter.

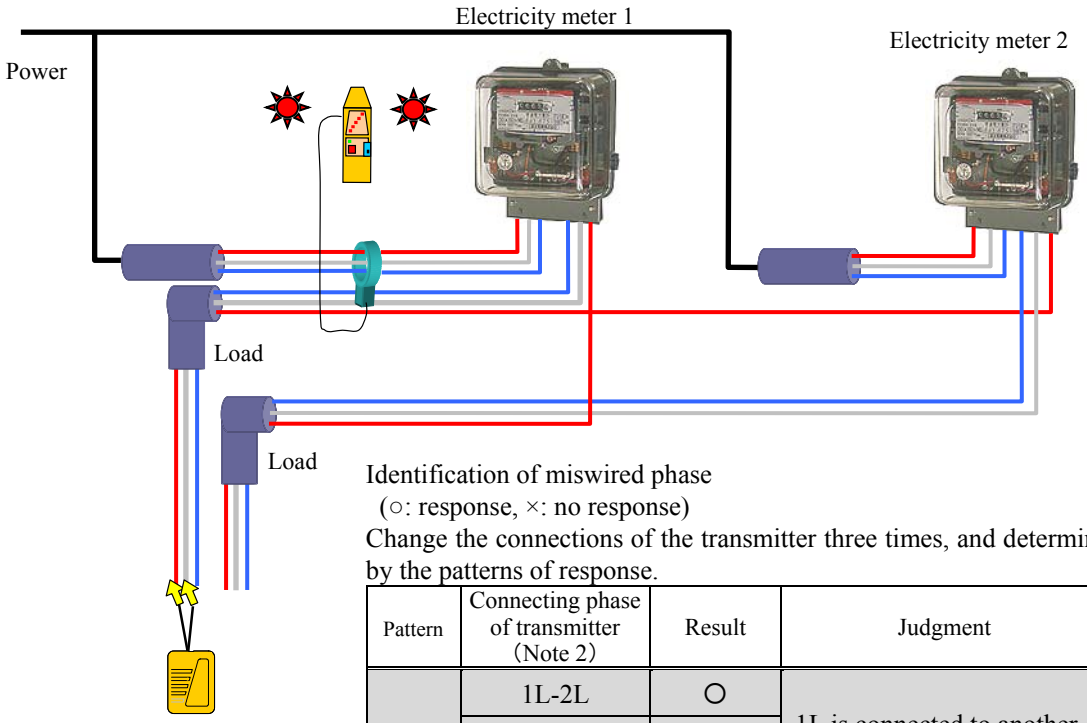
Mounting point of clamp



* Above diagram is an example of neutral phase miswiring.

* Clamp close to the meter terminals because 3 power connection wires should be clamped. (Note 3)

(4) Detection when one of the wires of load side is connected from another electricity meter (The following diagram is an example of 1L phase miswiring.)



Identification of miswired phase
(○: response, ×: no response)
Change the connections of the transmitter three times, and determine by the patterns of response.

Pattern	Connecting phase of transmitter (Note 2)	Result	Judgment
1	1L-2L	○	1L is connected to another electricity meter
	2L-3L	×	
	3L-1L	○	
2	1L-2L	○	2L is connected to another electricity meter
	2L-3L	○	
	3L-1L	×	
3	1L-2L	×	3L is connected to another electricity meter
	2L-3L	○	
	3L-1L	○	

* Detection of the electricity meter 2 can be conducted as same as above procedure.

(5) Judgment whether miswiring is within own electricity meter or connection to another meter
Conduct the procedure with the following steps and judge from the result.

Step1	Step2	Step3	Step4	
Transmitter connecting phase	Detection result of clamping 3 power lines of electricity meter	Detection with receiver of all electricity meter connection wire * With the responded condition in step 2	Result	Judgment
Each phase of 1L-2L, 2L-3L, and 3L-1L	Responded	(1) Set the mode of receiver "Wire" & "Low". (2) Place receiver on the connection wire of the electricity meter to detect.	Receiver shows response in 4 of 6 wires	Miswiring within the own electricity mater
			Receiver shows response in 2 of 6 wires	Miswiring to another electricity mater
	Non-responded	* Normal connection. Wire detection by the receiver is not necessary.		

8. Warranty period

The warranty period of this product shall be one year after the date of delivery to a location designated by the customer.

9. Warranty coverage

Togami will repair or replace the product free of charge, provided that such degradation is determined to be due to defects in materials or workmanship under normal operation within the warranty period.

However, warranty coverage does not apply when:

(1) the failure is caused by user's negligence and force majeure, and

(2) the failure is caused by the modification and service by anyone other than Togami or an authorized personnel.

This warranty is limited to coverage of only the dlivered product itself and does not extend to the compensation for consequential damage that has occurred by the product supplied itself.

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