IS-2 Insulation Resistance Monitor User's Manual

 Precautions	Precautions in safety

・The handling of this product shall be carried out persons who have sufficient knowledge and skill to correctly use this.
・Connect all wiring's without any wrong connection after sufficiently identifying this connection diagram.
・Tighten screws surely. Slackening of screws may cause to generate heat and burning.
・Do not use this at any value exceeding the rated specification. It may cause a failure and an accident.
・Do not touch to the live part. Always cut out the circuit when maintained and inspected it.

TOYO KEIKI CO.,LTD.

IS-2 Insulation Resistance Monitor User's Manual

1. General

The IS-2 insulation resistance monitor is designed to measure, and check whether there is any lowering in, the insulation resistance between an AC power feeder and the ground. If the insulation resistance gets lower than the specified level (to be selected from the twelve points between 0.01 MΩ and 1.5 MΩ by the small dip rotary switch), the monitor's load detection relay is activated to give an alarm. The monitor is provided with a green LED indicator to show whether the auxiliary power supply is on or off.

Caution for safety purposes

This manual uses three levels of caution for safety purposes, i.e., "Danger", "Caution", and "Request":


Danger : Operating the monitor improperly could cause a dangerous state that can result in the loss of life or a serious injury.


Caution : Operating the monitor improverly could cause a dangerous state that can result in a medium or slight bodily injury or a physical damage.

Request : Describes the instructions/guidelines necessary to ensure safety in using the monitor.

Listed below is the important safety-related cautions given in the text.


Danger

(Danger of electric shock)
Do not touch the charger.
To prevent electric shock, make sure that the circuit be disconnected when doing maintenance or inspection work.


Caution

Do not use the monitor outside the rated specifications. Otherwise, dielectric breakdown can occur, causing a ground fault/short-circuit with the possible danger of fire.

2. Principle of operation

Figure 1 gives a block diagram of the monitor and Figure 2 illustrates its measurement equivalent circuit.

In Figure 1, Rx represents the insulation resistance (grounding resistance) between the power feeder and ground. With this monitor, the fixed voltage of the builtin DC power supply (Eo) is applied to the insulation resistance Rx. The magnitude of its leak current (Ix) is compared and detected to drive the load relay circuit to give an alarm.

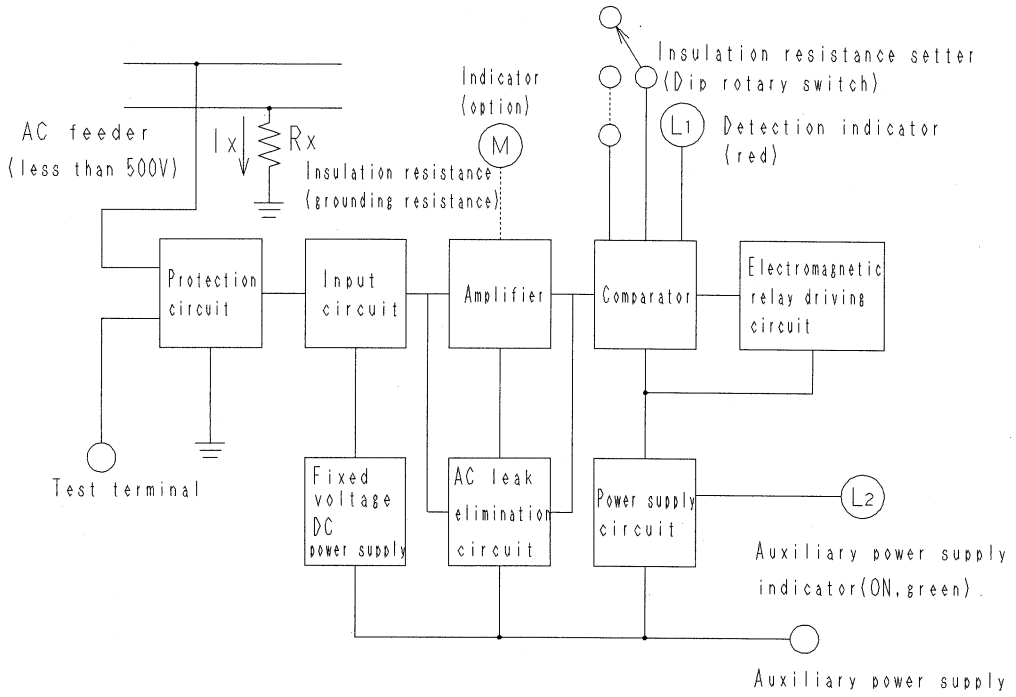


Figure1. Block diagram of Insulation Resistance Monitor

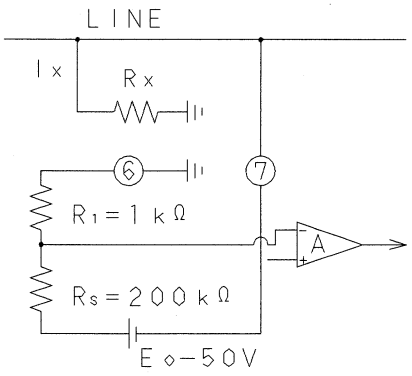


Figure2.

In Figure 2, Rx is the insulation resistance and Ix is the leak current. In the measurement input circuit, Rx(=200 kΩ) and Ri(=1 kΩ)are connected to the reference voltage Eo(=50 V). The grounding resistance Rx is serially connected to this circuit.
When measuring the grounding resistance, the following relationship holds:(Equation)

$$Ix = \frac{Eo}{(R1+RS)+Rx} = \frac{50(V)}{(0.201+Rx)M\Omega} \ (\mu A)$$

This becomes the leak current with respect to Rx.(When Rx = 0Ω due to short-circuit, Ix equals 250 μA) The setting operation and optional MΩ indicator (FS = 1mA) are driven by amplifying, comparing an detecting the voltage drop Rx × Ix (V).

The AC element (500 V or less) of the AC feeder, superimposed with the DC element Eo, is applied to the insulation resistance (grounding resistance) meter Rx. This means that Ix contains the AC leak portion, which is eliminated by means of a feedback circuit. Therefore, only the DC leak element is applied to the comparator, which compares it with the fixed reference voltage (selectable by using the dip rotary switch)for detection.

The insulation resistance can be set by selecting any one of the following:
0.01, 0.02, 0.03, 0.05, 0.1, 0.2, 0.3, 0.5, 0.7, 0.9, 1 and 1.5 MΩ.

Insulation resistance setting is made by dip rotary switch in front of the insulation resistance monitor. Relation insulation resistance setting value and rotating arrow position of the dip rotary switch is shown in Table 1.

Table 1

Insulation resistance setting value SET	Arrow position	
	SW1	SW2
0.01 MΩ	1	. OFF
0.02 MΩ	2	
0.03 MΩ	3	
0.05 MΩ	4	
0.1 MΩ	5	
0.2 MΩ	6	
0.3 MΩ	. OFF	1
0.5 MΩ		2
0.7 MΩ		3
0.9 MΩ		4
1 MΩ		5
1.5 MΩ		6

The precision of the detecting operation with respect to the set value is as shown in Table 2.

Table 2.

0.1～1.5 MΩ ± 5%	Ambient temperature 3℃～45℃
0.05 MΩ or less ±10%	
0.1～1.5 MΩ ±10%	Ambient temperature -10℃～3℃, 45℃～60℃
0.05 MΩ or less ±20%	

3. Insulation resistance indicator

This monitor can use an optional insertion resistance indicator, which indicates the insulation resistance in proportion to the leak current Ix. If the indicator is unnecessary, you can use the monitor without connecting it to the indicator output terminal. Leaving the indicator terminal open will not affect the monitor's operation.

The indicator scale is ∞-5-0.2-0MΩ.

Since the output for the indicator (FS DC 1mA) gives a fixed current for the load resistance between 0 and 2 kΩ, there can arise no problem even if a long cable is used to connect the indicator and the insulation resistance monitor, adding to its resistance.

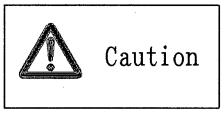
(Internal resistance of the indicator is not more than 500 Ω. In addition,if wire with the cross section of 0.75 mm² is used,the cable(loop) resistance becomees 20 Ω when the transmission distance (between the insulation resistance monitor and the indicator) is 400 m.)

4. Auxiliary power supply

To operate the insulation resistance monitor requires an auxiliary power supply.
There are two types of auxiliary power supply:

AC 50/60 Hz, 100 V system (rated voltage 100-115 V)
AC 50/60 Hz, 200 V system (rated voltage 200-230 V)

Turning the auxiliary power supply on causes the auxiliary power supply indicator (green LED) of the insulation resistance monitor to come oil.
The auxiliary power supply is insulated from the detection circuit via a transformer with a withstanding voltage of AC 2.5 kV (50/60 Hz) for one minute.
This can prevent any interference between the two.
The auxiliary power supply allows the voltage to change between 80 and 126.5 V for the 100 V system and between 160 and 253 V for the 200 V system. It can be used in a wide range of voltage fluctuation.



Do not use the monitor outside the rated specifications. Otherwise,dielectric breakdown can occur, causing a ground fault/short-circuit with the possible danger of fire.

5. Wiring

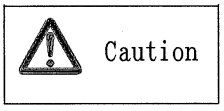
Wire the monitor as illustrated in attached chart 1.

Request: Ensure that the monitor is wired properly. Wrong wring may cause fire.

Explanation of terminals

1, 2	Output terminals for the optional indicator. If the indicator is unnecessary, these terminals are not used.
3, 4, 5	Contact output terminals for the load relay
6	Grounding terminal To be connected to the ground or cabinet earth.
7	Detection terminal To be connected to the 1, 2 or 3 phase of the AC feeder.
8	Test terminal To be used to test the grounding resistance monitor for detection operation by connecting a dummy resistance between 6 and 8.
9, 10	Auxiliary power supply terminal

(Danger of electric shock)
Do not touch the charger.
To prevent electric shock, make sure that the circuit be disconnected when doing maintenance or inspection work.



Do not use the monitor outside the rated specifications. Otherwise, dielectric breakdown can occur, causing a ground fault/short-circuit with the possible danger of fire.

6. Testing of the insulation resistance monitor for detection operation

The insulation resistance monitor is provided with a detection operation test terminal, making it possible to test its detection operation by connecting an outside equivalent insulation resistance (dummy resistance).

If the insulation resistance monitor starts detection operation, the detection operation indicator (LED) comes on.

Connect a dummy resistance Ro (should be lower than the set level) between terminals 8 and 6. If the detection indicator comes on, the insulation resistance monitor can be judged as normally operational.

In this case, if a power feeder is connected between terminals 6 and 7 and there is a grounding resistance Rx between the feeder and the ground, the detection operation point is to detect the parallel combined resistance of Rx and Ro, which is lower than Rx alone. But the detection point is made the set level if detection operation testing is done by removing the connection of the feeder from terminal 7 and inserting a dummy resistance between terminals 6 and 8.

(Note) Terminals 7 and 8 are connected inside the insulation resistance monitor.

Terminal 7 becomes the same as one of the feeder phases (500 V or lower) with a high voltage applied to the ground. Be careful not to cause an electric shock, short circuit, etc.

(Danger of electric shock)
Do prevent electric shock, make sure that the circuit be disconnected when doing maintenance or inspection work.

H-500 Attached chart1

MARK	NO	DATE	DESCRIPTION	BY
3RD. ANGLE PROJECTION				
SCALE 1/2	DIM IN mm			
CLASSIFICATION 3300				
TYPE IS-2				
TITLE INSULATION RESISTANCE MONITOR CONNECTION DIAGRAM				
APPROVED	K. Yokoi			
CHECKED	H. Yoshida			
DRAWN	Y. Fukuyama			
DESIGNED	K. Yokoi			
DATE July 29, 1999				
TOYO KEIKI CO.,LTD.				
DRAWING NO. H-500 Attached chart1				