Digital I0r Leakage　Current　Clamp Tester

I0r Leakage Current

Model MCL-400IR

About I0r Leakage Current

Recently, the leakage current clamp meter is widely used for insulation control of low voltage circuit as the supplementary method of the insulation resistance measurement.

The control of leakage current has the advantages to enable the prediction of insulation condition in the electric power line without having to shut off power.

The leakage current (I0) include the capacitive leakage current(I0c) originated in the capacitance and the resistive leakage current (I0r) originated in the insulation resistance each related to the ground.

It is considered that the measurement of resistive leakage current(I0r) is very useful and effective method for the insulation control of low voltage circuit.
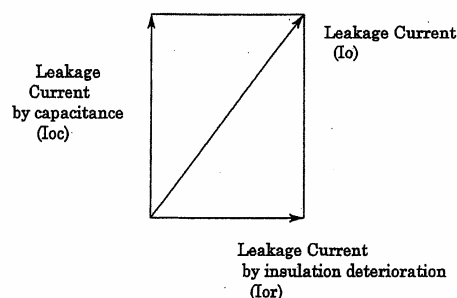
However, it was difficult to measure the resistive leakage current (I0r)only with traditional leakage current clamp meter.

MCL-400IR new digital clamp tester enabled the measurements of the resistive leakage current(I0r) without voltage input(phase detection).

Current waveform with harmonics
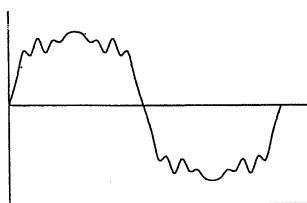
Vector of leakage current

Leakage Current by capacitance (Ioc)

Leakage Current (Io)

Leakage Current by insulation deterioration (Ior)

SPECIFICATIONS

Measuring function	: Load current, leakage current ($I0$)
	Resistive leakage current ($I0r$)
	Harmonics current & voltage
	(Fundamental, 3rd,5th,7th,11th&13th)
	AC Voltage
CT opening capability	: ϕ 40mm
Influence of external magnetic field	: Less than 5mA (nearby 100A conductor)
Withstanding voltage	: AC 2200V,1minute
Measuring Range	: AC 0-40mA, 400mA, 4A, 40A, 300A,
	AC 0～500V
Input Frequency	: 45-65Hz
Measuring method	: Dual slope integration mode
AC conversion	: Average sensing rms reading
Display	: 3.5 digit LCD, max. reading of 4000
Sampling	: 2 times/sec., 1 time/6 sec. for Ior
	measurement
Over range indication	: "OL" mark on LCD
Low battery indication	: "Battery mark" on LCD
Data hold indication	: "DH" mark on LCD
Auto power off function	: Approx.10 minutes later after final key
	operation
Power supply	: 1.5V ("AAA" sixe, um-4)x3
	or AC adaptor (Option)
Power consumption	: Approx. 8mA (approx.60 hours continuous)
Limitation of circuit voltage	: Less than AC 500V
Operating temperature	: 0℃~40℃, ＜80%RH（w/o condensation）
Storage temperature	: -10℃~60℃, ＜70%RH（w/o condensation）
Size & weight	: 70(W)x223(H)x34(D)mm
	: Approx. 440g including batteries

Measuring Ranges and Accuracy

Measuring Function	Range	Resolution	Accuracy
AC Current	40mA	0.01mA	±1.0%rdg±8dgt
	400mA	0.1mA	
	4A	0.001A	
	40A	0.01A	
	300A	0.1A	±1.0%rdg±1%FS
AC Voltage	500V	0.1V	±1.0%rdg±8dgt

Accuracy for Harmonics Current and Voltage

Fundamental, 3rd, 5th, 7th : 1%rdg±5dgt±AC current & voltage accuracy
11th and 13th Harmonics　 : 2%rdg±5dgt±AC current & voltage accuracy
(Min. fundamental input current : more than 2% of each current)

Measuring Principle for I0r Leakage Current

It is observed that the load connected to the low voltage side of the transformer generates the harmonics in the current flow in the power line. And it is observed 5th and 7th harmonics current causes the phenomenon of voltage drop at the high voltage side of the transformer.

This voltage drop at high voltage side added the drops of other related power line generates the terminal voltage with harmonics at low voltage side.

Thus, 5th and 7th harmonics current is generated at the low voltage side by the influence of high voltage side, and it is considered the ratio of these 5th and 7th harmonics current is always constant.

Consequently, the ratio of 5th and 7th harmonics flowing into earth line is changed proportionally according to the ratio of capacitive component and resistive component in the circuit.

On the other hand, when the long line is used, it is observed that the fundamental current component into earth line is increased proportionally and the ratio of 5th and 7th harmonics current is also changed due to the increase of capacitance and inductance of the circuit.

By above fact ,the calculation factor can be obtained by the measured ratio of 5th and 7th harmonics current and fundamental current component into earth line.

Thus, the resistive leakage current(I0r) can be obtained by the computation of the calculation factor and compensation factor of the circuit.

And it is reported that the satisfactory test result was observed from our many practical field tests in Japan.