

## LOW FREQUENCY C & tan $\delta$ METER

# DAC-LFM-3



Model DAC-LFM-3 is designed to measure tan  $\delta$  and capacitance of test samples by making use of a built-in very-low frequency power source.

Measurement of tan  $\delta$  and electrostatic capacity using a very-low frequency of 0.1 Hz or 0.01 Hz provides accurate results for test samples that are large in electrostatic capacity, such as power cables.

This instrument can be used for various applications at low cost, such as, Precise moisture content control for the purpose of quality assurance of oil-filled cables and mineral insulated cables, failure point identification of optical fiber submarine cables, and insulation diagnosis of commercial frequency power cables.

### Applications

- Drying process control of oil-filled or mineral insulated cables
- Failure point identification of optical fiber submarine cables
- Insulation diagnosis of commercial frequency power cables

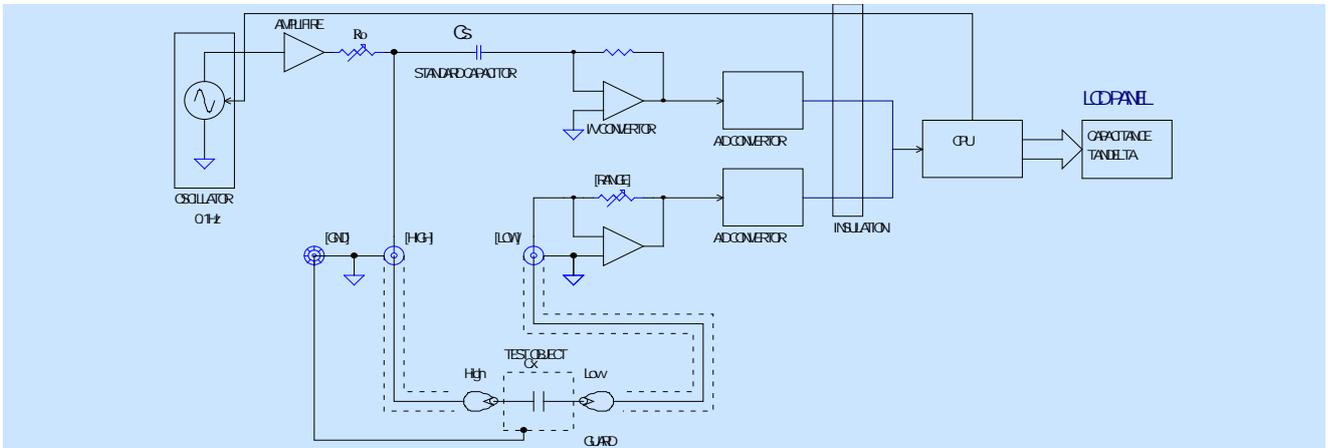
### Features

- Full digital processing using a 32-bit MPU
- Comfortable operation with a TFT LCD and a touch keyboard
- Built-in very-low frequency power source
- Compact and lightweight
- USB interface equipped standard

# DAC-LFM-3 LOW FREQUENCY C & tan δ METER

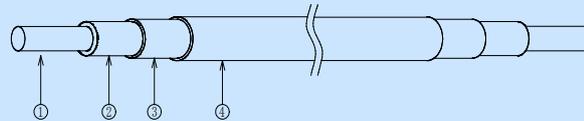
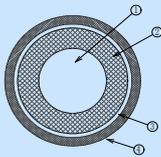
## Principals

The following schematic diagram shows the measuring circuit of Model DAC-LFM-3.



The low frequency signal generated at the oscillator is power-amplified to supply the reference voltage  $E$ . The standard capacitor  $C_s$  detects the reference current  $I_s = j\omega C_s E$ . Analog values of the reference current flowing through the  $C_s$  and the current flowing through the test object  $C_x$  are multiplied after they are converted into digital data. Finally, parameter analysis of the corresponding equivalent circuit is performed to obtain the true values of  $\tan \delta$  and electrostatic capacitance.

## Cross Section of oil field cable

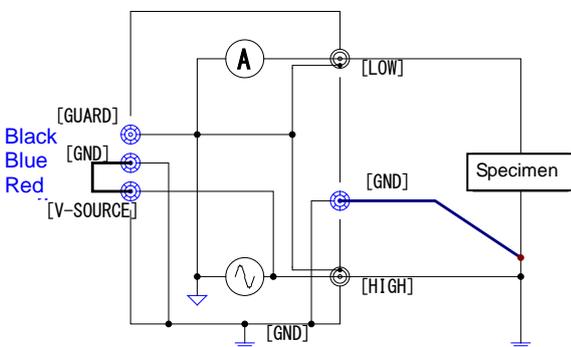


- (1) Central conductor
- (2) Insulator
- (3) Shielded conductor
- (4) Sheath

In general, the insulator (2) is considered as dielectric, and measure the electrostatic capacitance and  $\tan \delta$  between the central conductor (1) and the shielded conductor (3). Measurement is possible by making either connection: connect (1) to HIGH terminal and (3) to LOW terminal, or connect (1) to LOW terminal and (3) to HIGH terminal.

## Connecting Diagrams

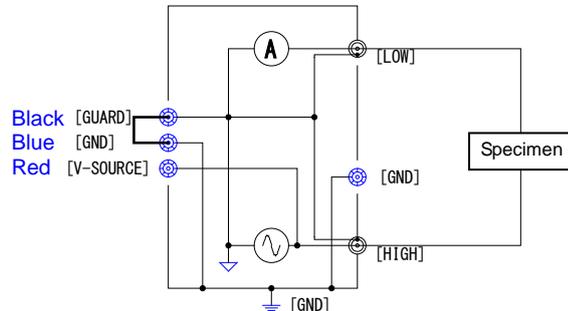
[Measurement of grounded specimens]



Short circuit "GND" and "V-SOURCE" terminals for measurement of grounded specimens.

Note: The instrument must be grounded.

[Measurement of ungrounded specimens]



Short circuit "GND" and "GUARD" terminals for measurement of ungrounded specimens.

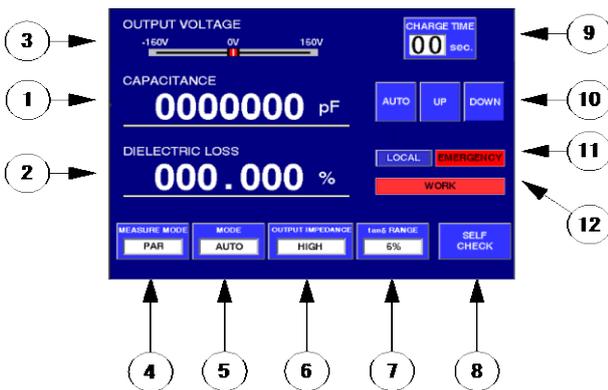
Note: The instrument must be grounded.

## Measuring Method

A TFT LCD along with a touch keyboard assures comfortable operation of Model DAC-LFM-3.

On the operation screen, you can see all the information necessary for measurement, and you can readily follow the progress of measurement operation.

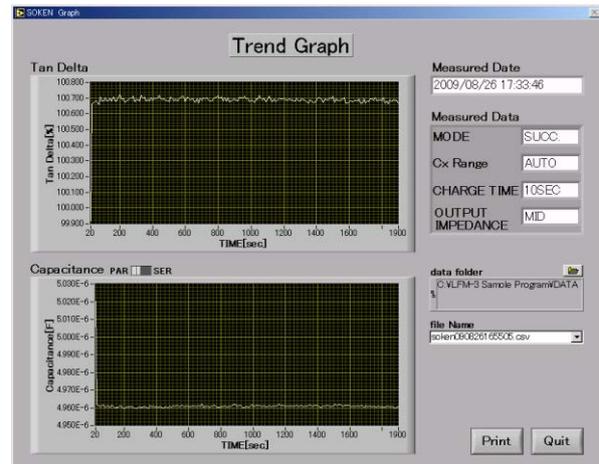
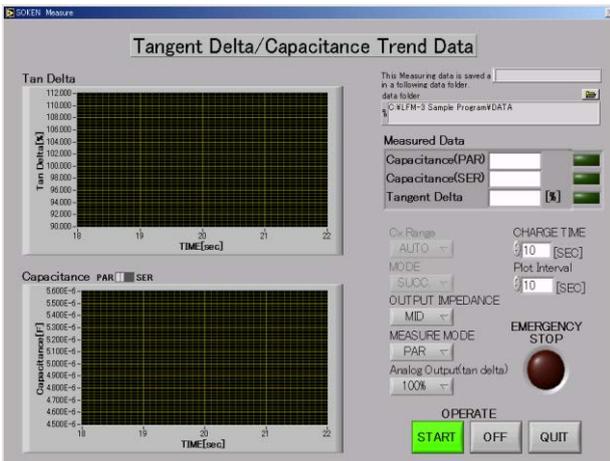
When you touch an operation parameter on the screen, a corresponding pop-up window appears, on which you can readily specify a desired data setup.



- (1) [CAPACITANCE]: Electrostatic capacitance, 6 digits of full scale
- (2) [DIELECTRIC LOSS (%): Tan  $\delta$ , 6 digits of full scale
- (3) [OUTPUT VOLTAGE (V): Output voltage on scale bar
- (4) [MEASURE MODE]: Selection of measuring equivalent circuit
- (5) [MODE]: Selection of measuring mode
- (6) [OUTPUT IMPEDANCE]: Selection of output impedance
- (7) [tan  $\delta$  RANGE]: Selection of analog data output range
- (8) [SELF CHECK]: Self Test
- (9) [CHARGE TIME]: Selection and display of charging time
- (10) Selection of measuring electrostatic capacitance range
- (11) [LOCAL / REMORT]: Interface condition
- (12) [WORK]: Displayed in red when the testing voltage is turned on.

## Option Software

With this optional software, you can display time-series data of tan $\delta$  and electrostatic capacitance.



Note: This sample program uses VISA (Virtual Instrument Software Architecture) for the transmission of messages to and from the measuring instrument. VISA is a registered trademark of National Instruments Corporation.

OS: Windows 2000, XP, Vista 32 bits  
 Driver: USB Serial Converter from FTDI (Future Technology Devices International Ltd.)

# DAC-LFM-3 LOW FREQUENCY C & tan $\delta$ METER

## Specifications

Measurement items:	C (electrostatic capacitance) and D (tan $\delta$ ) (1) Electrostatic capacitance: 100.00 pF - 100.000 $\mu$ F Manual and automatic selection of capacitance range (2) Tan $\delta$ : 0.010% - 999.999%
Measuring frequency:	0.1 Hz $\pm$ 3%, Stability: $\pm$ 500 ppm/ $^{\circ}$ C
Measuring time:	Within 30 s, excluding charging time
Measuring voltage:	100 Vrms $\pm$ 10%, Stability: $\pm$ 0.1%/ $^{\circ}$ C, Output current: Maximum 20 mA
Measuring mode:	Manual selection between parallel equivalent circuit and series equivalent circuit
Measurement terminals:	Two-terminal configuration (HIGH and LOW); TXA104-BR terminals plus a grounding terminal (GND)
Output impedance:	LOW: 10 k $\Omega$ $\pm$ 5% MID: 50 k $\Omega$ $\pm$ 5% HIGH: 100 k $\Omega$ $\pm$ 5%
Output voltage display:	LCD bar graph, Indicating range: $\pm$ 150 VDC
Charging time setting:	0 - 99 s in increments of 1 s on the LCD screen
External analog output:	Electrostatic capacitance and dielectric loss
External interface:	USB
Driving power source:	(100 - 240 VAC) $\pm$ 10%, 50/60 Hz
Power consumption:	Maximum 125 VA, standard about 60 VA
Operating environment:	Operating temperature range; 10 $^{\circ}$ C - 40 $^{\circ}$ C Operating relative humidity range; 0% - 80% (at 35 $^{\circ}$ C or lower)
Dimensions:	200 (H) $\times$ 430 (W) $\times$ 450 (D) mm, excluding projections
Mass:	About 15 kg

Specifications are subject to change for improvements without prior notice.

2015/03/16