The impedance measurement can be performed using AC impedance method.
Impedance of cells of up to 20V can be measured in the range of 10 mHz to 10 kHz.
Two ranges of the constant current mode in 5A and 0.5A are available for the load rating.
Load current setting resolutions of 0.1 mA (in 5 A range) and 0.01 mA (in 0.5 A range).
Capable of 0 V operating voltage, equipped built-in electronic load
with maximum power consumption of 60 W (applied to the single cell testing).
Application software included as a standard accessory.
External control of the load current, various protection functions are equipped.
Equipped with GPIB, RS232C and USB interfaces as standard.
The measuring instrument and the electronic load are integrated in one single device!

Possible to acquire the Tafel plot and the Cole-cole plot of the micro fuel cell (such as cellular phones, laptop computers, and electric power-assisted bicycles, etc.)

The impedance meter KFM2005 is designed for testing of the fuel cell with the small current (5 A or less), and not only the current-voltage characteristic test, the KFM2005 can easily measure the impedance of a fuel cell using the AC impedance method, and the Cole-Cole plot. Using the measurement data of the Cole-cole plot, it is possible to calculate the circuit constant of the approximate equivalent circuit of the fuel cell. The built-in DC load (60 W) is capable to operate from 0 V, and it can perform the test for the fuel cell up to 20 V and 5 A.

Fuel Cell Impedance meter

KFM2005

- Application software included as a standard accessory
- Equipped with GPIB, RS232C and USB interfaces as standard.

The impedance measurement using AC impedance method
- Frequency range: 10 mHz to 10 kHz
- Frequency resolution: 14 points/decade
- Impedance measurement range: 100 mΩ, 300 mΩ, 1 Ω, 3 Ω
- Measurement alternated current range: 16.5 mA range, 50 mA range
  The selected range of measurement AC current can be set for 10 % to 100 % of the rated value in 0.1 % step.
  The impedance measurement can be measured by the dummy rated voltage which varies automatically for the measured AC current to become at 5mVpp of the detected terminal voltage of the DUT.

The built-in DC load (60 W) is capable to operate from 0 V
- Not only for stack cell, it can also apply for single cell testing
- Operating mode: Constant Current
- Current range: 0.5 A range, 5 A range
- Current setting resolution: 0.01 mA(0.5 A range), 0.1 mA(5 A range)
- Input voltage range: 0 V to 20 V
- Maximum input power: 60 W

Useful application software is included
It is possible to start immediate testing for the measurement of Cole-Cole Plot, I-V characteristics, and Constant Current characteristics simply by entering the parameters and acquiring the test data easily.

Various controls by external control functions
The KFM2005 allows you to control not only from the panel or through the communication interface but also using external signals from the control terminal.
- Controlling the load current using an external voltage
  0.5 A range : 0 V to 10 V at 0 A to 0.5 A
  5 A range : 0 V to 10 V at 0 A to 5 A
- Turning the load current on/off
- Switching the load current range
- Voltage monitor output : outputs 10 V at 20 V of the sensing input voltage
- Current monitor output : outputs 10 V at 5 A of the load current
- Alarm output : occurred when abnormal state is detected such as OHP, Over Load, OCP.
- Status output of the LOAD ON/OFF
  (output of the ON/OFF status of the load device)

External control by Interfaces
Equipped with GPIB, RS232C and USB interfaces as standard.

Various protection functions
The protection function of UVP / OVP / OPP / OHP / OCP / OPEN are equipped as standard.

For the secondary or the primary battery testing
The impedance can be measured in the range of 10 mHz to 10 kHz.

[Software Requirements] CPU: Pentium IV 1 GHz or higher
Memory: 512 MB or more
Windows 2000 (SP4+Update Roll up1), Windows XP (SP2 or later with intel x86), Windows Vista (Intel x86, x64) / USB interface
The data acquisition of each characteristic test is possible by the application software included as a standard accessory. Each test data can be created in the text file in the TAB (Tab separated value) format.

● **Cole-Cole plot**
  The impedance measurement is used by the AC impedance measurement method. The AC impedance measurement method applies alternate current-induced vibration to the DUT (fuel cell), calculates the complex impedance from the amplitude of the resulting voltage and current and the phase difference, and then plots the impedance in a complex coordinate system.

● **Current-voltage characteristic measurement testing (I-V characteristics)**
  Measures the cell voltage (contact point of the sensing terminal) to the load current, and displays the Tafel plot.
  The maximum resolution can be adjusted in 0.1 mA steps in the range of 0 A to 5 A. The software reads voltages with the specified resolution. The measurement can be repeated any number of times including infinitely. Even while the load current is passing through, it is also possible to measure the internal resistance (the impedance value of the single frequency measured by the AC impedance measurement method).

● **Constant Current characteristic (for aging test)**
  The rise or fall time can be set to a maximum of 999 seconds.
  Measures the change of cell voltage at constant load current.
  The logging interval can be extended from 1 s to 86,400 s.
  Even while the load current is passing through, it is also possible to measure the internal resistance (the impedance value of the single frequency measured by the AC impedance measurement method).
Specifications

Impedance Measurement Section

- **Measurement frequency**: 10 mHz to 10 kHz
- **Frequency resolution**: 1.00, 1.26, 1.58, 2.00, 2.51, 3.00, 3.16, 4.00, 5.00, 6.00, 6.30, 7.00, 8.00, 9.00 sequence with a resolution of 14 points/decade
- **Measurement range** 1: 16.5 mΩ range: 300 mΩ, 1 Ω, 3 Ω, or AUTO
- **Measurement range** 2: 50 mΩ range: 100 mΩ, 300 mΩ, 1 Ω, or AUTO
- **Measurement alternated current** 1: 16.5 mΩ range: 6 mArms ±0.01 %
- **Measurement alternated current** 2: 50 mΩ range: 18 mArms ±0.01 %
- **OFF**: Mechanically opens the AC current source
- **50 mA range**: 100 mΩ, 300 mΩ, 1 Ω, or AUTO

Voltage measurement resolution ...

- **DC Voltage and Current Measurement Section**
  - ± (4 % of |Z| reading + 0.5 % of range + 2 mΩ/Variable ratio)
  - ± (3 % of |Z| reading + 0.5 % of range + 1.5 mΩ/Variable ratio)
  - ± (2 % of |Z| reading + 0.5 % of range + 1 mΩ/Variable ratio)
  - ± (1 % of |Z| reading + 0.1 % of range + 0.5 mΩ/Variable ratio)

- **Measurement accuracy** 2, 3
- **Select and display 4 items among R, Z, |Z|, θ, voltage, and current**
- **All ranges**: -180.00 deg to 180.00 deg
- **100 μA to approx. 16 Ω**
- **300 mΩ range**: 0.0 mΩ to 999.9 mΩ
- **1.000 Ω to approx. 5.25 A**
- **Maximum load current**: 5 A
- **Current setting resolution** 1: 5 A range: ±(0.5 % of set *6 + 2.5 mA)
- **Current setting resolution** 2: 5 A range: ±0.5 % of set *6 +8.0 mA
- **Output accuracy** 1: ±0.2 V (5 V) or ±2 % (50 V)
- **Output accuracy** 2: ±2.5 % (50 V) or ±5 % (100 V)

DC Voltage and Current Measurement Section

- **Voltage range**: Auto switching between 2 V and 20 V
- **Voltage measurement resolution**: 2 V range: 100 μV
- **Voltage measurement accuracy**: ±(0.2 % of rdg + 8 digit)
- **Current measurement resolution**: 100 μA
- **Current measurement accuracy**: ±1 % with respect to 5 A

- **Monitor output**: Voltage monitor: Outputs 10 V with respect to a sensing input voltage of 20 V
- **Voltage monitor accuracy**: ±0.05 V
- **Current monitor**: Outputs 10 V with respect to a load current of 5 A

Electronic Load Section

- **Operation mode**: Constant current
- **Range**: 0.5 A or 5 A
- **Maximum load current**: 5 A
- **Input voltage range**: 0 V to 20 V
- **Maximum input power**: 60 W
- **Current setting resolution**: 0.5 A range: 0.01 mA
- **Current setting accuracy** 1: ±0.1 mA
- **Current setting accuracy** 2: ±0.5 % of set *6 +0.5 mA
- **Measurement accuracy** 1: ±0.5 % of set *6 +8.25 mA
- **Measurement accuracy** 2: ±0.5 % of set *6 +2.5 mA
- **External control**

Protection Function

- **Overvoltage protection (OVP)**: Cuts off the load when a voltage greater than or equal to 21 V is applied to the sensing terminal
- **Undervoltage protection (UVF)**: Cuts off the load if the sensing terminal falls below the preset voltage. Setting range: -2 V to 20 V
- **Overheat protection (OHP)**: Cuts off the load when the load device reaches an abnormal temperature. OHP LED lights.
- **Load regulation (LP)**: CP (constant power) trips and OVER LOAD LED lights with a power greater than or equal to 63 W
- **Overcurrent protection (OCP)**: Cuts off the load when a load current greater than or equal to 5.25 A flows.

Communication Interface

- **RS232C, GPIB, USB**

General

- **Display**: 240 × 64 dot LCD, with CCFL backlight, contrast adjustable
- **Installation location**: 2000 m or less
- **Storage temperature range**: -10 °C to 60 °C (14 °F to 140 °F)
- **Storage humidity range**: 90 % rh or less (no condensation)
- **Operating temperature range**: 0 °C to 40 °C (32 °F to 104 °F)
- **Operating humidity range**: 20 % to 85 % rh or less (no condensation)
- **Line voltage range**: 85 VAC to 132 VAC, 180 VAC to 250 VAC
- **Line frequency range**: 45 Hz to 65 Hz
- **Overload protection**: Up to 600 VA
- **Weight**: 9.5 kg (20.9 lb)

Accessories

- **Power cord**: 1, Spare fuse: 1 *8 (250 VAC, 6.3 A), Sensing wire: 1 (AWG24, 2-core shielded wire 1.8 m), Lead wire: 1 pair (AWG18 red and white twisted pair 1.5 m), CD-ROM, User’s manual: 1

Options

- **Rack mount bracket**: KRB2-TOS, KRB100-TOS

Miscellaneous

- **Although every effort has been made to provide the information as accurate as possible for this catalogue, certain details have unavoidably been omitted due to limitations in space.**
- **If you find any misprints or errors in this catalogue, it would be appreciated if you would inform us.**
- **Please contact our distributors to confirm specifications, price, accessories or anything that may be unclear when placing an order or concluding a purchasing agreement.**

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Printed in Japan