

FERVE F-1880

Contenido

TÍTULO

PÁGINA

1. INSTRUCCIONES GENERALES

1.1 Medidas de seguridad

1.1.1 Preliminares

1.1.2 Durante el uso

1.2 Símbolos

1.3 Instrucciones

2. DESCRIPCIÓN

2.1 Familiarización con el instrumento

2.2 Display LCD

2.3 Teclado

3. DESCRIPCIÓN de FUNCIONES

3.1 Funciones generales

3.1.1 Modo DATA HOLD (Retención de lectura)

3.1.2 Modo de selección de escala manual y modo automático

3.1.3 Ahorro de batería

3.1.4 Modo de medida relativo

3.1.5 Medida de verdadero valor eficaz

3.2 Funciones de medición

3.2.1 Medida de tensiones CA y CC

3.2.2 Medida de resistencia

3.2.3 Test de diodo

3.2.4 Test de continuidad

3.2.5 Medida de capacidad

3.2.6 Medida de frecuencia

3.2.7 Medida de temperatura

3.2.8 Medida de intensidad

3.2.9 PC Link

4. ESPECIFICACIONES TÉCNICAS

4.1 Especificaciones generales

4.2 Especificaciones de medida

4.2.1 Tensión

4.2.2 Frecuencia

4.2.3 Resistencia

4.2.4 Test de diodo

4.2.5 Test de continuidad

4.2.6 Capacidad

4.2.7 Temperatura

4.2.8 Intensidad

5. MANTENIMIENTO

5.1 Mantenimiento general

5.2 Substitución del fusible

5.3 Substitución de la batería

6. ACCESORIOS

MULTÍMETRO DIGITAL DE 6000 CUENTAS

MANUAL DEL USUARIO

1. INSTRUCCIONES GENERALES

Este instrumento cumple las normativas de sobretensión IEC 61010-1: 2001, CAT III 1000V y CAT VI 600V. Véanse las especificaciones.

Para obtener las mejores prestaciones de este instrumento, lea atentamente este manual de usuario y respete las detalladas medidas de seguridad.

Los símbolos internacionales usados en el multímetro y en este manual se detallan en el capítulo 1.2.

1.1 Medidas de seguridad

1.1.1 Preliminares

* Ante el incremento de la posibilidad de altas sobretensiones transitorias en los sistemas de potencia actuales, se establecen normativas de seguridad más exigentes en los equipos de medida eléctricos. Los transitorios en los sistemas eléctricos (red de distribución, circuitos de alimentación principal o circuitos derivados) provocan una serie de incidentes que pueden resultar en serios daños personales. Para protegerle de estos transitorios, la seguridad debe estar incorporada en los equipos de test.

Categorías de sobretensión.

En breve

Ejemplos

CAT I Electrónica

- Equipos electrónicos protegidos.
- Equipos conectados a circuitos de alimentación en los cuales existen medidas para limitar las sobretensiones transitorias a un nivel suficientemente bajo.
- Cualquier fuente de alta tensión y baja energía derivada de un transformador de alta relación de bobinado, tal como la sección de alta tensión de una copiadora.

CAT II Cargas monofásicas en interior de envoltura.

- Aparatos, herramientas portátiles y otras cargas domésticas y similares.
- Tomas de corriente y circuitos largos.
- Tomas de corriente a más de 10 metros de fuentes tipo CAT III.
- Tomas de corriente a más de 20 metros de fuentes tipo CAT IV.

CAT III Acoplamiento a red trifásica, cualquier cable en el exterior.

- Equipos en instalaciones fijas, tales como conmutadores y motores polifásicos.
- Tendidos y alimentaciones en plantas industriales.
- Líneas de alimentación y circuitos secundarios cortos, cuadros de distribución.
- Sistemas de iluminación en grandes edificios.
- Tomas de corriente con conexiones cortas hasta el cuadro de distribución.

CAT IV Conexiones a redes trifásicas, cualquier cableado exterior.

- Hace referencia al "origen de la instalación", por ejemplo, el punto donde se conecta la acometida de baja tensión a la red eléctrica.
- Contadores eléctricos anteriores a los equipos de protección.
- Exteriores y entrada de servicio, tendidos entre postes y edificios, circuitos entre contadores y cuadros de distribución.
- Línea aérea hasta edificios aislados, línea subterránea hasta una bomba de pozo.

* Al usar el multímetro el usuario debe cumplir todas las normas de seguridad relativas a :

-protección ante los peligros de la corriente eléctrica.

-protección del multímetro ante su uso indebido.

* Para su seguridad use únicamente las puntas de prueba suministradas con el instrumento. Compruebe que se hallan en buen estado antes de su uso.

1.1.2 Durante el uso

* Si el medidor se usa cerca de equipos generadores de ruido eléctrico tenga en cuenta que el display puede volverse inestable o indicar mediciones con un alto grado de error.

* No use el medidor o las puntas de prueba si parecen dañados.

* Use únicamente el medidor tal como se especifica en este manual, de lo contrario la protección proporcionada por el medidor puede resultar inefectiva.

* Tome precauciones extremas cuando trabaje cerca de conductores no aislados o barras de bus.

* No utilice el medidor en ambientes explosivos de gas, vapores o polvo.

* Verifique el funcionamiento del multímetro midiendo una tensión conocida. No use el medidor si funciona de modo anormal. La protección puede resultar inefectiva. En caso de duda, lleve el instrumento al servicio técnico.

* Use los terminales, funciones y escala adecuados a su medición.

* Cuando desconozca el rango del valor a medir compruebe que la escala seleccionada en el medidor sea la más alta disponible, o, cuando sea posible, elija el modo de rango automático.

* Para evitar dañar el instrumento, no exceda los límites máximos de los valores de medida que aparecen en las tablas de especificaciones técnicas.

* Cuando el multímetro se halle conectado a circuitos de medida, no toque los terminales no usados.

* Tenga precaución al trabajar con tensiones superiores a los 60 Vcc o 30 Vca rms. Tales tensiones suponen un riesgo de shock.

* Al usar las puntas de prueba mantenga sus dedos por detrás de las protecciones.

* Al hacer las conexiones conecte la punta de prueba del común antes que la punta de prueba del positivo. Al desconectar, siga el orden inverso.

* Antes de cambiar de función desconecte las puntas de prueba del circuito bajo test.

* En todas las funciones de corriente continua, ya sean en modo de escala manual o automático, verifique la presencia de tensiones alternas usando primero la función de corriente alterna. Evitará así el peligro de shock resultante

de una posible lectura errónea. Seleccione a continuación un escala de corriente continua igual o mayor que la escala de alterna.

- * Desconecte la alimentación del circuito y descargue todos los condensadores de alta tensión antes de realizar mediciones de resistencia, continuidad, diodos o capacidad.

- * Nunca realice medidas de resistencia o continuidad en circuitos bajo tensión.

- * Al medir intensidad de corriente compruebe el fusible del medidor y desconecte la alimentación del circuito antes de conectar el medidor al circuito.

- * Recuerde que en trabajos de reparación de TV o al realizar mediciones en fuentes de alimentación conmutadas, los pulsos de alta tensión presentes en los puntos de test pueden dañar el multímetro. El uso de un filtro TV atenuará ese tipo de pulsos.

- * Para alimentar el medidor use una sola pila 6F22 , instalada correctamente en el compartimiento de pila del instrumento.

- * Sustituya la pila tan pronto como aparezca el indicador de batería baja (*). Con la pila baja, el medidor puede producir falsas lecturas que podrían conducir a riesgo de shock eléctrico y daños personales.

- * No mida tensiones por encima de 1000V en instalaciones de Categoría III, o 600V en instalaciones de Categoría IV .

- * En el modo REL se visualiza el símbolo "REL" . Debe operar con precaución puesto que pueden estar presentes tensiones peligrosas.

- * No utilice el medidor con su carcasa o parte de ella abierta.

1.2 Símbolos:

Símbolos usados en este manual y en el instrumento:

- * Precaución: consulte el manual de instrucciones. Un uso incorrecto puede dañar el instrumento o sus componentes.

- * AC (Corriente Alterna o CA en castellano)

- * DC (Corriente Continua o CC en castellano)

- * AC o DC

- * Tierra

- * Aislamiento doble

- * Fusible

- * Cumple las normativas de la Unión Europea

1.3 Instrucciones

- * Desconecte las puntas de prueba del medidor antes de abrir la caja del instrumento o la tapa de la pila.

- * Al reparar el medidor use únicamente componentes de repuesto según las especificaciones.

- * Antes de abrir el instrumento desconéctelo siempre de cualquier fuente de tensión eléctrica y asegúrese de no estar cargado de electricidad estática, que podría destruir componentes internos.

- * Cualquier ajuste, mantenimiento o reparación llevado a cabo con el medidor en tensión debe ser llevado a cabo solamente por personal convenientemente cualificado, después de haber tenido en cuenta las instrucciones de este manual.

- * Una "persona cualificada" es alguien familiarizado con la instalación, construcción y operación del equipo y de los riesgos que ello comporta. Está

entrenado y autorizado para activar y desactivar circuitos y equipos de acuerdo con las prácticas establecidas.

* Cuando abra el instrumento, recuerde que algunos condensadores internos pueden mantener un potencial peligroso, incluso estando el aparato apagado.

* Si se observan defectos o anomalías, ponga el instrumento fuera de servicio y asegúrese de que no se pueda utilizar hasta que haya sido comprobado.

* Si el medidor no va a ser utilizado durante un largo tiempo, retire la pila y no guarde el medidor a alta temperatura o a alta humedad ambiente.

2. DESCRIPCIÓN

2.1 Familiarizándose con el instrumento.

El panel frontal se muestra en la Figura 2-1, y consta de los siguientes elementos:

1. Display LCD

Muestra los resultados de las medidas y otros símbolos.

2. Teclado

Teclas de funciones de medida.

3. Conmutador rotativo

Usado en la selección de funciones de medida.

4. *

Terminal de entrada de la punta de prueba roja para medidas de voltaje, resistencia, capacidad, frecuencia, temperatura, diodo y continuidad.

5. uA/mA

Terminal de entrada de la punta de prueba roja para medidas de μA , mA.

6. A

Terminal de entrada de la punta de prueba roja para medidas de 6A, 10A.

7. COM

Terminal de entrada de la punta de prueba negra (referencia o común).

2.2 Display LCD

La pantalla LCD se muestra en la Figura 2-2, y el significado de cada uno de sus símbolos en la Tabla 1:

Nº

Símbolo

Significado

1 * Indica lecturas negativas

2 * Indicador de tensión o intensidad CA

3 * Indicador de tensión o intensidad CC ,

4 AUTO El medidor está en el modo de escala automático, en el que el medidor selecciona automáticamente el rango con la mejor resolución.

5 PC-LINK El medidor está en modo de transmisión de datos.

6 H El medidor está en modo Data Hold (retención de lectura).

7 REL El medidor está en modo de Medida Relativa.

8 MAX Muestra el valor máximo.

9 MIN Muestra el valor mínimo.

10 * Indicación de bajo nivel de pila.

11 * El medidor se halla en modo test de continuidad.

12 * El medidor se halla en modo test de diodo.

13 * Unidades de medida.

14 * Este símbolo indica que la entrada sobrepasa la escala seleccionada.

2.3 Teclado

2.3.1 SELECT

1 * posición

Conmuta entre medida de resistencia, test de diodo y test de continuidad.

2. En las posiciones A, mA o μ A

Conmuta entre corriente cc y ca.

3. Opción de encendido.

Deshabilita la función de apagado automático.

2.3.2 HOLD

Presiónelo para entrar y salir del modo Data Hold (modo retención). Si lo mantiene presionado durante 2 segundos, se activa la retro-iluminación; si repite el proceso, la retro-iluminación se apagará.

2.3.3 ESCALA

En *

1. Presione RANGE para activar el modo de rango manual.

2. Presione RANGE para ir saltando entre los diferentes escalas disponibles para la función seleccionada.

3. La presión mantenida en RANGE durante 2 segundos activa de nuevo el rango automático.

2.3.4 *.

Pulse * para entrar y salir del modo de medición relativa. (Excepto Hz / Duty)

2.3.5 Hz %

En *

1. Pulse para iniciar la medida de frecuencia.

2. Pulse de nuevo para iniciar la medida de ciclo de trabajo (modo duty).

3. Pulse otra vez para abandonar el modo de medida de frecuencia.

4. Mantenga pulsada esta tecla mientras enciende el medidor para activar el modo de transmisión de datos.

2.3.6 MAX/MIN

Esta tecla permite la medida de valores máximos y mínimos.

1. Púlsela para activar el modo Max/Min.

2. Púlsela otra vez; el LCD mostrará el Valor Máximo.

3. Púlsela de nuevo; el LCD mostrará el Valor Mínimo.

4. Manténgala presionada durante 2 segundos, el medidor volverá al modo de medida normal , excepto en los modos HZ/Duty y capacidad.

3. DESCRIPCIÓN DE FUNCIONES

3.1 Funciones generales

3.1.1 Modo DATA HOLD (Retención de datos)

El modo Data Hold detiene la actualización continua del display. Si se activa la función Data Hold en modo Rango Automático el medidor pasará a modo Rango Manual, pero el rango de fondo de escala permanecerá inalterado. Puede desactivarse la función Data Hold cambiando el modo de medida, pulsando la tecla RANGE o la tecla * de nuevo.

Para entrar y salir del modo Data Hold :

1. Presione la tecla * (Pulsación corta). Congela el display en el valor actual. Se visualiza el símbolo H.
2. Una segunda pulsación corta devuelve el medidor al modo normal.

3.1.2 Modos de rango manual y automático.

El medidor tiene la opción de rango manual y la de rango automático.

* En el modo de rango automático, el medidor selecciona la mejor escala para la entrada detectada. Esto le permite cambiar los puntos de prueba sin tener que reajustar el escala.

* En el modo de rango manual, usted selecciona la escala. Esto le permite anular el rango automático y bloquear el medidor en una escala específica.

* El medidor cambia por defecto al modo de ajuste automático en las funciones de medición que tengan más de un escala. Cuando el medidor está en el modo de rango automático se visualiza AUTO

Para entrar y salir del modo de rango manual:

1. Pulse la tecla RANGE. El medidor entra en el modo de rango manual. AUTO se apaga. Cada pulsación de la tecla RANGE incrementará el rango de escala. Cuando se alcanza la escala más alta, el medidor pasa a la escala más baja.
2. Para salir del modo manual, pulse y mantenga pulsada la tecla RANGE durante dos segundos. El medidor vuelve al modo de rango automático y aparece el indicador AUTO.

3.1.3 Ahorro de batería.

El medidor entra en el "modo de reposo" y apaga la pantalla si el medidor está encendido pero no se utiliza durante 30 minutos. Pulse la tecla * o gire el selector giratorio para reactivar el medidor. Para desactivar el modo de reposo, mantenga pulsada la tecla SELECT al encender el medidor.

3.1.4 Modo de medida relativa

El medidor mostrará mediciones relativas en todas las funciones excepto la medición de frecuencia.

Para entrar y salir del modo de medición relativa:

1. Con el medidor en la función deseada, sitúe las puntas de prueba en los puntos de test del circuito que servirán de base para las mediciones posteriores.
2. Pulse * para guardar el valor de medición y activar el modo de medición relativa. Se muestra la diferencia entre el valor de referencia y la lectura posterior.
3. Pulse la tecla * durante más de 2 segundos para devolver el medidor al modo de operación normal.

3.1.5 Medidas de valor eficaz (RMS).

Los valores medidos por un instrumento capaz de lecturas de valor eficaz de tensiones o corrientes CA son valores de media cuadrática o RMS. Un medidor de gama baja solo puede medir el valor medio CA.

3.2 Funciones de medida.

3.2.1 Medida de tensiones CA y CC.

Para evitar descargas eléctricas y / o daños en el equipo, no intente tomar ninguna medición de voltaje que pudiera exceder 1.000 Vcc o 1.000 Vca rms.

Para evitar descargas eléctricas y / o daños en el equipo, no aplique más de 1.000 Vcc o 1.000 Vca rms entre el terminal común y la tierra de referencia.

Los escalas de medida de tensión del multímetro son 600,0 mV, 6,000V, 60,00V, 600,0 V y 1.000 V.

Para medir voltaje CA o CC (conectar el medidor como se muestra en la Figura 3-1):

1. Coloque el interruptor giratorio en la escala DCV, ACV o DCmV.
2. Conecte los cables de prueba negro y rojo a los terminales COM y V, respectivamente.
3. Conecte las puntas de prueba al circuito que se esté midiendo.
4. Lea el valor del display. Al realizar una medición DCV se indicará la polaridad de la conexión del cable de prueba rojo.

NOTA:

Especialmente en la escala de 600 mV pueden aparecer inestabilidades en la lectura, incluso sin tener conectados los terminales de prueba.

Para una mayor precisión en la medición de la desviación de continua (CC) de una tensión alterna (CA), mida el voltaje CA primero. Compruebe la escala de tensión de corriente alterna y, a continuación, seleccione manualmente una escala de tensión de corriente continua igual o mayor que el rango de corriente alterna. Esto mejora la exactitud de la medición de CC, al asegurar que los circuitos de protección de entrada no estén activados.

Tensión CC

Figura 3-1 Medición de tensión CA y CC

3.2 2 Medidas de Resistencia

Para evitar descargas eléctricas y / o daños en el instrumento, desconecte la alimentación del circuito y descargue todos los condensadores de alta tensión antes de medir la resistencia.

Los escalas de medida de resistencia del multímetro son 600.0Ω, 6.000kΩ, 60.00kΩ, 600.0kΩ, 6.000mΩ y 60.00MΩ.

Para medir la resistencia (configure el multímetro como se muestra en la figura 3-2):

1. Fije el selector giratorio en el rango *.
2. Conecte los cables de prueba negro y rojo a los terminales COM y VΩ respectivamente.
3. Conecte las puntas de prueba al circuito a medir y lea el valor indicado.

Algunos consejos al medir valores de resistencia:

- El valor medido de una resistencia en un circuito es a menudo diferente del valor nominal de la resistencia. Esto se debe a que la corriente de prueba del medidor fluye a través de todos los caminos posibles entre las puntas de las sondas.

- Con el fin de garantizar la máxima precisión en la medición de resistencias de bajo valor, puentee las puntas de prueba antes de la medición y memorice la resistencia de los cables de prueba. Reste después este valor de la medición real posterior.
- La función de medición de resistencia puede producir suficiente tensión como para polarizar un diodo de silicio o uniones de transistores, haciéndolos conductores. Para evitar esto, no utilice la escala 60MΩ para mediciones de resistencias insertadas en circuito.
- En la escala de 60MΩ, el medidor puede tardar unos segundos en estabilizar la lectura. Esto es normal en medidas de valores resistivos muy altos.
- Cuando la entrada se halla desconectada, es decir, en circuito abierto, el símbolo "OL" indicará la condición de fuera de rango.

Figura 3-2 Medición de resistencia

3.2.3 Test de polarización directa de diodos.

Para evitar descargas eléctricas y / o daños en el instrumento, desconecte la alimentación del circuito y descargue todos los condensadores de alta tensión antes de comprobar diodos.

Para probar un diodo en un circuito (configure el multímetro como se muestra en la Figura 3-3):

1. Fije el selector giratorio en el rango *.
2. Pulse la tecla SELECT una vez para activar la función Prueba de Diodos.
3. Conecte los cables de prueba negro y rojo a los terminales COM y VΩ respectivamente.
4. Para lecturas de polarización directa en cualquier componente semiconductor, coloque la punta de prueba roja en el ánodo del componente y la punta de prueba negra en el cátodo del mismo.
5. El medidor mostrará la tensión de polarización directa aproximada del diodo. En un circuito, un diodo en buen estado (Si) debe producir una lectura de polarización directa de 0,5 V a 0,8 V; sin embargo, la lectura de polarización inversa puede variar dependiendo de la resistencia de los otros caminos entre las puntas de las sondas.

Figura 3-3 Prueba de un diodo

3.2.4 Test de continuidad

Para evitar descargas eléctricas y / o daños en el instrumento, desconecte la alimentación del circuito y descargue todos los condensadores de alta tensión antes de realizar un test de continuidad.

Para la prueba de continuidad (configure el multímetro como se muestra en la Figura 3-4):

1. Fije el selector giratorio en el rango *.
2. Pulse la tecla SELECT dos veces para activar Test de continuidad.
3. Conecte los cables de prueba negro y rojo a los terminales COM y Ω respectivamente.
4. Conecte las puntas de prueba a la resistencia en el circuito que se está

probando.

5. Cuando la resistencia del circuito sea inferior a 40Ω , un zumbido continuo lo indicará.

NOTA:

- El test de continuidad está dirigido a comprobar el estado de cortocircuito/circuito abierto de un circuito.

Figura 3-4 Test de continuidad.

3.2.5 Medida de capacidad.

Para evitar descargas eléctricas y / o daños en el instrumento, desconecte la alimentación del circuito y descargue todos los condensadores de alta tensión antes de realizar una medida de capacidad.

Use la medición de tensión cc para confirmar que el condensador se halla descargado.

Los escalas de medida de capacidad del multímetro son 60,00nF, 600,0nF, 6,000μF, 60,00μF y 300,0μF.

Para medir la capacidad (configure el multímetro como se muestra en la Figura 3-5):

1. Fije el selector giratorio en el rango *.
2. Conecte los cables de prueba negro y rojo a los terminales COM y *, respectivamente (también puede utilizar cables de prueba de condensadores).
3. Conecte las puntas de prueba al condensador a medir y lea el valor indicado.

Algunas sugerencias para medir la capacidad:

- El medidor puede tardar unos segundos (> 30 segundos en el escala 300,0μF) para estabilizar la lectura. Esto es normal en medidas de altas capacidades.
- Para mejorar la precisión en las mediciones de menos de 60nF, reste la capacidad residual del multímetro y los cables de prueba.
- Por debajo de 600pF, la precisión de las mediciones no se especifica.

Figura 3-5 Medición de capacidad

3.2.6 Medidas de Frecuencia y Ciclo de Trabajo.

No realice mediciones de frecuencia en voltajes altos (> 1000V) para evitar el riesgo de descargas eléctricas y / o daños en el instrumento.

El multímetro puede medir la frecuencia o el ciclo de trabajo al hacer una medición ya sea de tensión CA o intensidad CA.

Para medir la frecuencia o el ciclo de trabajo:

1. Con el medidor en la función deseada (voltaje CA o corriente CA), pulse la tecla Hz%.
2. Lea la frecuencia de la señal de CA en la pantalla.
3. Para realizar una medición del ciclo de trabajo, pulse la tecla Hz% de nuevo.

4. Lea el porcentaje del ciclo de trabajo en la pantalla.
5. Coloque el interruptor giratorio en la escala Hz.
6. Inserte los cables negro y rojo en el terminal COM y Hz respectivamente.
7. Conecte las puntas de prueba en paralelo con el circuito a medir. Y no toque ningún conductor eléctrico.
8. En el modo de medición de frecuencia, presione Hz% una vez : entrará en el modo de medición de ciclo de trabajo. Pulsando de nuevo volverá al modo de medición de frecuencia.
9. Lea el resultado en la pantalla.

NOTA:

En ambientes ruidosos es preferible usar cables apantallados para medir señales de bajo nivel.

3.2.7 Medida de temperatura

Para evitar descargas eléctricas y / o daños en el equipo, no aplique más de 250 Vcc o 220 Vca rms entre el terminal C °y el terminal COM.

Para evitar descargas eléctricas, no utilice este instrumento cuando los voltajes en la superficie a medir sobrepasen los 60 Vcc o 24 Vca rms.

Para evitar daños o quemaduras no haga mediciones de temperatura en hornos de microondas.

Para medir la temperatura:

1. Ajuste el interruptor giratorio al rango °C y la pantalla mostrará la temperatura ambiente actual.
2. Inserte un termopar tipo 'K' entre el terminal COM y el °C (o puede usar un zócalo multifunción). Tenga cuidado en respetar la polaridad correcta.
3. Toque el objeto con la sonda termopar para realizar la medición.
4. La lectura de la pantalla se estabilizará al cabo de cierto tiempo.

3.2.8 Medidas de intensidad

Para evitar daños al medidor o lesiones personales si se funde el fusible, no intente una medición de corriente en un circuito en el que el potencial de circuito abierto respecto a tierra sea superior a 1000V.

Para evitar daños al multímetro, revise el fusible del medidor antes de continuar. Utilice los terminales adecuados a la función de medida, y el rango apropiado para las mediciones. Nunca coloque las sondas en paralelo con un circuito o componente cuando los cables de prueba estén conectados a los terminales de corriente.

Los escalas de corriente del medidor son 600,0μA, 6000μA, 60,00mA, 600,0mA, 6,000A y 10,00A.

Para medir la corriente (configure el multímetro como se muestra en la Figura 3-6):

1. Desconecte la alimentación del circuito. Descargue todos los condensadores de alta tensión.
2. Ajuste el interruptor giratorio al rango μA, mA o A.
3. Presione la tecla SELECT para seleccionar el modo de medición CA o CC.

4. Conecte el cable de prueba negro al terminal COM y el rojo al terminal mA (para un máximo de 600 mA). Para medir hasta un máximo de 10 A, mueva el cable rojo al terminal A.
5. Abra el circuito cuya intensidad quiera medir.
Toque con la sonda negra el lado más negativo del circuito abierto y con la sonda roja el lado más positivo. (La inversión de los conductores provocará una lectura negativa, pero no dañará el medidor.)
6. Conecte la alimentación al circuito y luego lea la pantalla. Asegúrese de anotar la unidad de medida del lado derecho de la pantalla (μ A, mA o A). Si sólo aparece el símbolo "OL" estaremos fuera de rango y deberemos seleccionar la escala superior.
7. Desconecte la alimentación del circuito y descargue todos los condensadores de alta tensión. Retire el medidor y devuelva el circuito a su funcionamiento normal.

Figura 3-6 Medición de corriente

3.2.9 PC Link El medidor posee la función de transmisión de datos en serie. Puede conectarse con un PC mediante interfaz USB, por lo que los datos de medición pueden registrarse, analizarse, procesarse e imprimirse en el PC. Antes de usar esta función, debe instalar el software PC-Link y el controlador USB en su PC.

Pulse la tecla Hz% mientras enciende el medidor. El medidor entrará en el modo PC-Link, el símbolo "PC-LINK" aparecerá en la pantalla LCD y la función de transmisión de datos en serie estará activa.

PC-LINK MANUAL DE INSTRUCCIONES DEL SOFTWARE

1. Asegúrese de que tanto el controlador USB como los archivos de software del CD adjunto se hallan instalados correctamente antes de cualquier medición.
2. Con el medidor apagado, mantenga pulsada la tecla Hz% y luego encienda el medidor. El símbolo "PC-LINK" aparecerá en la pantalla indicando que la función de transmisión de datos en serie está activa. (Para desactivar la función de apagado automático, mantenga pulsada tanto la tecla SELECT como la tecla Hz% al encender el medidor.)

NOTA: Si desea habilitar la función de transmisión de datos serie durante la medición, apague el medidor y luego siga a partir del paso 2.

3. Conecte el puerto óptico del medidor y el puerto USB de la computadora mediante el cable USB.
4. Ejecute el software PC-LINK y haga clic en el menú SET. Seleccione "SYSTEM SET". A continuación, seleccione el puerto COM correcto en "Serial Port Select". Para saber el puerto COM correcto, debemos entrar en el Administrador de Dispositivos de Windows, siguiendo estos pasos:
 - Haga clic derecho en el icono Mi PC en el escritorio de Windows y, a continuación, haga clic en Propiedades.
 - Haga clic en la pestaña Hardware y luego en Administrador de dispositivos.
 - Desplácese por la lista de dispositivos instalados hasta que encuentre el elemento "Puertos" (COM y LPT). Haga clic en el signo más (+) junto a la entrada para ver los puertos instalados. Si no se han producido errores, aparecerá la Sunplus-to-USB con el puerto serie COM (COM x). COM x es el puerto que nos interesa siendo x el número concreto del puerto.

5. Seleccione la frecuencia de muestreo predeterminada o seleccione otra frecuencia de muestreo deseada.
6. Ahora pulse el botón Start del programa PC-LINK para medir y visualizar los datos sincrónicos o gráficos de la interfaz del programa.
7. Para desactivar la función de transmisión de datos en serie, apague el medidor.
8. Para más información sobre el programa PC-LINK, consulte el tema de ayuda incluido en el software o entre en nuestra página web:
www.mastech.com.cn

4. ESPECIFICACIONES TÉCNICAS

4.1 Especificaciones generales

Condiciones ambientales:

1000V CAT III y CAT IV 600 V

Grado de contaminación: 2

Altitud < 2000 m

Temperatura de funcionamiento: 0 a 40 °C, 32 ° F-122 ° F (<80% RH, <10°C sin condensación)

Temperatura de almacenamiento: -10 a 60 ° C, 14 ° F-140 ° F (<70% de humedad relativa, sin pila)

Coeficiente de temperatura: 0,1 x (precisión especificada) / ° C (<18 ° C o > 28 ° C)

Tensión Max entre terminales y tierra: 1000V CA rms o CC 1000V.

Fusible de protección: μ A y mA: F 0.63A/1000V Ø10.3x38; A: F 10A/1000V Ø 10.3x38.

Frecuencia de muestreo: 3 veces / seg para los datos digitales.

Visualización: 3 5/6 dígitos en pantalla LCD. Indicación automática de funciones y símbolos.

Selección de rango: automática y manual.

Indicación de rango excedido: el LCD muestra "OL".

Indicador de batería baja: el símbolo "*" aparece cuando la batería está en niveles bajos.

Indicación de la polaridad: se muestra automáticamente el símbolo "-".

Fuente de alimentación: 9V

Tipo de batería: 6F22.

Dimensiones: 190 (L) x90 (W) x40 (H) mm.

Peso: 500 g. Aprox. (batería incluida).

4.2 Especificaciones de medición.

La precisión especificada es válida para un período de un año después de la calibración, a temperaturas de funcionamiento de 18 °C a 28 °C, con una humedad relativa menor del 80%.

Las especificaciones de precisión toman la forma: $\pm$ I: (% de lectura + número de dígitos menos significativos)

4.2.1 Tensión

Vcc:

Rango

Resolución

Precisión

Vac:

Rango

Resolución

Precisión

Las precisiones anteriores pueden ser garantizados entre el 5% % y el 100% del fondo de escala..

La medida de verdadero valor eficaz o RMS tiene un valor residual inferior a 10 conteos cuando los conductores de prueba están cortocircuitados, pero eso no va a afectar a la precisión de la medición.

1. Rango de frecuencia de ACV: 40Hz-400Hz.

2. Respuesta de ACV: Medio, calibrado en rms de la onda sinusoidal.

3. Protección de sobrecarga: 1000V 1000V CC o CA rms.

4. Impedancia de entrada (nominal): voltaje de CC:> 10MΩ; voltaje de CA:> 10MΩ

4.2.2 Frecuencia

Frecuencia Lógica (1Hz-1MHz)

Rango

Resolución

Precisión

Frecuencia lineal (6HZ-10KHZ)

Rango

Resolución

Precisión

Las precisiones arriba indicadas se puede garantizar en un rango del 10% - 100% del fondo de escala.

4.2.3 Resistencia

Rango

Resolución

Precisión

4.2.4 Prueba de diodos

Rango

Resolución

Condiciones de prueba

Corriente de polarización directa de aproximadamente 1 mA Invertida

Tensión de corriente continua de aproximadamente 1,5 V

4.2.5 Prueba de continuidad

Rango

Resolución

Condiciones de prueba

Tensión de circuito abierto: aprox. 0.5V

Descripción: Señal acústica indicadora $\leq 40\Omega$

4.2.6 Capacidad

Rango

Resolución

Precisión

4.2.7 Temperatura

Rango

Resolución

Precisión

Nota: La especificación de la temperatura no incluye errores del termopar.

4.2.8 Corriente

Rango

Resolución

Precisión

Las precisiones anteriores pueden ser garantizados para medidas de entre el 5% % y el 100% del fondo de escala..

La medida de verdadero valor eficaz o RMS tiene un valor residual inferior a 10 conteos cuando los conductores de prueba están cortocircuitados, pero eso no afecta a la precisión de la medición.

1. Rango de frecuencia de CA: 40Hz-400Hz

2. Protección ante sobrecargas: fusible F 10A/1000V para 10A

Protección ante sobrecargas: fusible F 0.63A/1000V para escalasde μA y mA.

3. Máxima corriente de entrada: 600mA CC o 600mA CA rms para escalas de μA y mA, 10A CC o 10A AC rms para los rangos de 10A.

4. Para las mediciones > 6 A, 4 minutos máximo en continuo de cada 10 minutos de medición, por encima de 10 A no especificado.

5. MANTENIMIENTO

Esta sección proporciona información sobre el mantenimiento básico, e incluye instrucciones para la sustitución de fusibles y batería.

No intente reparar el medidor a menos que esté cualificado para hacerlo y disponga de la información relativa a la calibración, pruebas de funcionamiento, y reparación.

5.1 Mantenimiento general.

Para evitar descargas eléctricas o daños al multímetro, evite la entrada de agua dentro del medidor. Retire los cables de prueba y cualquier señal de entrada antes de abrir el mismo.

Limpie periódicamente la carcasa con un paño húmedo y detergente suave. No utilice abrasivos ni disolventes.

La suciedad o humedad en los terminales puede afectar a las lecturas.

Para limpiar los terminales:

Apague el medidor y retire todos los cables de prueba.

Sacuda cualquier suciedad que pueda haber en los terminales.

Moje un bastoncillo de algodón nuevo con un agente de limpieza y lubricación (como el WD-40).

Mueva el bastoncillo alrededor de cada terminal. El agente engrasador aísla los terminales de la contaminación debida a la humedad.

5.2 Substitución de los fusibles.

Antes de reemplazar el fusible, desconecte los cables de prueba y / o los conectores de cualquier circuito bajo prueba. Para evitar daños o lesiones reemplace el fusible únicamente por componentes de las características especificadas.

1. Coloque el interruptor giratorio en la posición OFF.
2. Desconecte los cables de prueba y / o cualquier conexión de los terminales.
3. Utilice un destornillador para aflojar los cuatro tornillos de la cubierta trasera.
4. Extraiga la cubierta posterior del medidor.
5. Retire el fusible liberando un extremo y deslizando el fusible hasta sacarlo de su soporte.
6. Instale el repuesto de las siguientes características : F 0.63A/1000V Ø10.3x38 y F 10A/1000V Ø10.3x38
7. Vuelva a colocar la cubierta trasera y apriete los tornillos.

5.3 Substitución de la batería

Para evitar lecturas falsas, que podrían tener como consecuencia descargas eléctricas o lesiones personales, reemplace la batería tan pronto como aparezca el indicador de batería baja "*".

Antes de sustituir la batería, desconecte los cables de prueba y / o las conexiones de cualquier circuito bajo prueba y apague el medidor.

1. Coloque el interruptor giratorio en la posición OFF.
2. Desconecte los cables de prueba y / o las conexiones de los terminales.
3. Utilice un destornillador para desbloquear los dos tornillos de la tapa de la batería.
4. Saque la tapa de la batería del medidor.
5. Extraiga la batería usada.
6. Reemplácela por una nueva pila de 9V (6F22).
7. Vuelva a colocar la tapa y apriete los tornillos.

6. ACCESORIOS

Suministrados junto al multímetro:

- Manual del usuario (Cant. 1)
- Cables de prueba (Cant. 1)
- Termopar tipo "K" (Cant. 1)
- Zócalo multi-función (Cant. 1)
- Cable USB (Cant. 1)
- CD del software PC-Link (Cant. 1)

Si hay algunos cambios en los accesorios, consulte el producto real como referencia.

FERVE F-1880

Contents

TITLE

PAGE

1. GENERAL INSTRUCTIONS

1.1 Precaution safety measures

1.1.1 Preliminary

1.1.2 During use

1.2 Symbols

1.3 Instructions

2. DESCRIPTION

2.1 Instrument Familiarization

2.2 LCD Display

2.3 Key pad

3. FUNCTION DESCRIPTION

3.1 General Functions

3.1.1 DATA HOLD mode

3.1.2 Manual ranging and Auto range mode

3.1.3 Battery saver

3.1.4 Relative measurement mode

3.1.5 True RMS measurement

3.2 Measurement Functions

3.2.1 AC and DC Voltage measurement

3.2.2 Resistance measurement

3.2.3 Diode Test

3.2.4 Continuity Check

3.2.5 Capacitance measurement

3.2.6 Frequency measurement

3.2.7 Temperature measurement

3.2.8 Current measurement

3.2.9 PC Link

4. TECHNICAL SPECIFICATIONS

4.1 General specifications

4.2 Measurement specifications

4.2.1 Voltage

4.2.2 Frequency

4.2.3 Resistance

4.2.4 Diode Test

4.2.5 Continuity Check

4.2.6 Capacitance

4.2.7 Temperature

4.2.8 Current

5. MAINTENANCE

5.1 General maintenance

5.2 Fuse replacement

5.3 Battery replacement

6. ACCESSORIES

6000 COUNTS DIGITAL MULTIMETER USER'S MANUAL

1. GENERAL INSTRUCTIONS

This instrument complies with IEC 61010-1: 2001, CAT III 1000V and CAT VI 600V over voltage standards. See specifications.

To get the best service from this instrument, read carefully this user's manual and respect the detailed safety precautions.

International symbols used on the Meter and in this manual are explained in chapter 1.2.

1.1 Precautions safety measures

1.1.1 Preliminary

* As the possibilities of high transient over voltages occurred in today's power systems increase, more stringent safety standards are set for the electrical test equipment. Transients on electrical systems(power grid, feeder or branch circuits) will trigger a series of incidents that may result in serious personal injury. To protect you against transients, safety must be built into the test equipment.

Over voltage category

In brief

Examples

CAT I Electronic

- Protected electronic equipment.
- Equipment connected to (source) circuits in which measures are taken to limit transient over voltages to an appropriately low level.
- Any high-voltage, low-energy source derived from a high winding resistance transformer, such as the high-voltage section of a copier.

CAT II Single-phase receptacle connected loads

- Appliance, portable tools, and other household and similar loads.
- Outlet and long branch circuits.
- Outlets at more than 10 meters from CAT III source.
- Outlets at more that 20 meters from CAT IV source.

CAT III Three-phase at utility connection, any outdoor conductors

- Equipment in fixed installations, such as switch gear and poly phase motors.
- Bus and feeder in industrial plants.
- Feeders and short branch circuits, distribution panel devices.
- Lighting systems in lager buildings.
- Appliance outlets with short connections to service entrance.

CAT IV Three-phase at utility connection, any outdoor conductors

- Refers to the "origin of installation"; i.e., where low-voltage connection is made to utility power.
- Electricity meters, primary over current protection equipment.
- Outside and service entrance, service drop from pole to building, run between meter and panel.
- Overhead line to detached building , underground line to well pump.

* When using this multimeter, the user must observe all normal safety rules concerning:

-protection against the dangers of electric current.

-protection of the multimeter against misuse.

* For your own safety, only use the test probes supplied with the instrument, Before use, check that they are in good condition.

1.1.2 During use

* If the meter is used near noise generating equipment, be aware that display may become unstable or indicate large errors.

* Do not use the meter or test leads if they look damaged.

* Use the meter only as specified in this manual; otherwise, the protection provided by the meter may be impaired.

* Use extreme caution when working around bare conductors or bus bars.

* Do not operate the meter around explosive gas, vapour, or dust.

* Verify a Meter's operation by measuring a known voltage. Do not use the Meter if it operates abnormally. Protection may be impaired. When in doubt, have the Meter serviced.

* Uses the proper terminals, function, and range for your measurements.

* When the range of the value to be measured is unknown, check that the range initially set on the multi meter is the highest possible or, wherever possible, choose the auto ranging mode.

* To avoid damages to the instrument, do not exceed the maximum limits of the input values shown in the technical specification tables.

* When the multimeter is linked to measurement circuits, do not touch unused terminals.

* Caution when working with voltages above 60Vdc or 30Vac rms. Such voltages pose a shock hazard.

* When using the probes, keep your fingers behind the finger guards.

* When making connections, connect the common test lead before connecting the live test lead; when disconnecting, disconnect the live test lead before disconnecting the common test lead.

* Before changing functions, disconnect the test leads from the circuit under test.

* For all dc functions, including manual or auto-ranging, to avoid the risk of shock due to possible improper reading, verify the presence of any ac voltages by first using the ac function. Then select a dc voltage range equal to or greater than the ac range.

* Disconnect circuits power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.

* Never perform resistance or continuity measurements on live circuits.

- * Before measuring current, check the meter's fuse and turn off power to the circuit before connecting the meter to the circuit.
- * In TV repair work, or when carrying out measurements on power switching circuits, remember that high amplitude voltage pulses at the test points can damage the multimeter. Use of a TV filter will attenuate any such pulses.
- * Use just one 6F22 battery, properly installed in the Meter's battery case, to power the Meter.
- * Replace the battery as soon as the battery indicator (*) appears. With a low battery, the Meter might produce false readings that can lead to electric shock and personal injury.
- * Do not measure voltages above 1000V in Category III, or 600V in Category IV installations.
- * When in REL mode, the "REL" symbol is displayed. Caution must be used because hazardous voltage may be present.
- * Do not operate the Meter with the case (or part of the case) removed.

1.2 Symbols:

Symbols used in this manual and on the instrument:

- * Caution: refer to the instruction manual. Incorrect use may result in damage to the device or its components.
- * AC (Alternating Current)
- * DC (Direct Current)
- * AC or DC
- * Earth ground
- * Double insulated
- * Fuse
- * Conforms to European Union directives

1.3 Instructions

- * Remove test leads from the Meter before opening the Meter case or battery cover.
- * When servicing the Meter, use only specified replacement parts-
- * Before opening up the instrument, always disconnect from all sources of electric current and make sure you are not charged with static electricity, which may destroy internal components.
- * Any adjustment, maintenance or repair work carried out on the meter while it is live should be carried out only by appropriately qualified personnel, after having taken into account the instructions in this present manual.
- * A "qualified person" is someone who is familiar with the installation, construction and operation of the equipment and the hazards involved. He is trained and authorized to energize and de-energize circuits and equipment in accordance with established practices.
- * When the instrument is opened up, remember that some internal capacitors can retain a dangerous potential even after the instrument is switched off.
- * If any faults or abnormalities are observed, take the instrument out of service and ensure that it cannot be used until it has been checked out.
- * If the meter is not going to be used for a long time, take out the battery and do not store the meter in high temperature or high humidity environment.

2. DESCRIPTION

2.1 Instrument Familiarization

The front panel is shown as in Figure 2-1, explanation being as follows:

1. LCD display

Used for displaying the measuring results and various symbols.

2. Keypad

Measurement function keys.

3. Rotary switch

Used for selecting measurement functions.

4. *

Terminal receiving the red test lead for voltage, resistance, capacitance, frequency, temperature, diode and continuity measurements.

5. $\mu\text{A}/\text{mA}$

Terminal receiving the red test lead for μA , mA measurements.

6. A

Terminal receiving the red test lead for 6A, 10A measurements.

7. COM

Terminal receiving the black test lead as a common reference.

2.2 LCD Display

LCD screen is shown as in Figure 2-2, with its every symbol's meaning shown as in the Table 1:

Nº

Symbol

Meaning

1 * Indicates negative readings

2 * Indicator for AC voltage or current

3 * Indicator for DC voltage or current ,

4 AUTO The meter is in the Autorange mode in which the meter automatically selects the range with the best resolution.

5 PC-LINK The Meter is in the data transmission mode.

6 H The meter is in Data Hold mode.

7 REL The meter is in Relative Measurement mode.

8 MAX Display maximum data

9 MIN Display minimum data

10 * Low battery indication

11 * The meter is in Continuity Check mode.

12 * The meter is in Diode Test mode.

13 * Measurement units.

14 * This symbol means that the input is too large for the selected range.

2.3 Keypad

2.3.1 SELECT

1 * position

Switches between Resistance measurement, Diode Test and Continuity check.

2. At A mA μA position

Switches between dc and ac current.

3. Power-up Option

Disables automatic power-off feature.

2.3.2 HOLD

Press it to enter and exit the Data Hold mode. Press it and hold 2 seconds, backlight on; if press it and hold for 2 seconds again, backlight off.

2.3.3 RANGE

At *

1. Press RANGE to enter the manual ranging mode.
2. Press RANGE to step through the ranges available for the selected function.
3. Press and hold RANGE for 2 seconds to return to autoranging.

2.3.4 *.

Press * to enter and exit the Relative measurement mode. (Except Hz/Duty)

2.3.5 Hz %

At *

1. Press it to start the frequency counter.
2. Press it again to enter duty (load factor) mode.
3. Press it again to exit the frequency counter mode.
4. Hold down this key while turning the meter on to enter the data transmission mode.

2.3.6 MAX/MIN

This key is for measuring maximum value and minimum value.

1. Press it to enter Max/Min mode.
2. Press it again; the LCD will display the Maximum Value.
3. Press it again; the LCD will display the Minimum Value.
4. Press and hold it for two seconds, the meter will return to normal measurement state. (Except Hz/Duty and Capacitance)

3. FUNCTION DESCRIPTION

3.1 General Functions

3.1.1 DATA HOLD mode

Data Hold mode makes the meter stop updating the display. Enabling Data Hold function in autorange mode makes the meter switch to Manual ranging mode, but the full-scale range remains the same. Data Hold function can be cancelled by changing the measurement mode, pressing RANGE key, or push * key again.

To enter and exit the Data Hold mode:

1. Press * key (short press). Fixes the display on the current value, H is displayed.
2. A second short press returns the meter to normal mode.

3.1.2 Manual ranging and Autorange mode

The Meter has both manual ranging and autorange options.

* In the autorange mode, the Meter selects the best range for the input detected. This allows you to switch test points without having to reset the range.

* In the manual ranging mode, you select the range. This allows you to override autorange and lock the meter in a specific range.

* The Meter defaults to the autorange mode in measurement functions that have more than one range. When the Meter is in the autorange mode, AUTO is displayed.

To enter and exit the manual range mode:

1. Press RANGE key. The Meter enters the manual ranging mode. AUTO turns off. Each presses of RANGE key increments the range. When the highest range is reached, the Meter wraps to the lowest range.

2. To exit the manual ranging mode, press and hold down RANGE key for two seconds. The Meter returns to the autorange mode and AUTO is displayed.

3.1.3 Battery Saver

The Meter enters the "sleep mode" and blanks the display if the Meter is on but not used for 30 minutes. Press the * key or rotate the rotary switch to wake the meter up. To disable the Sleep mode, hold down the SELECT key while turning the meter on.

3.1.4 Relative measurement mode

The Meter will display relative measurement in all functions except frequency. To enter and exit the relative measurement mode:

1. With the Meter in the desired function, touch the test leads to the circuit on which you want future measurement to be based.
2. Press * key to store the measured value and activate the relative measurement mode. The difference between the reference value and subsequent reading is displayed.
3. Press * key for more than 2 seconds to return the Meter to normal operation.

3.1.5 TRUE RMS measurement

All the measurement values of the true RMS meter on the AC voltage and AC current are true root-mean-square values. The basic meter can only measure the AC average value.

3.2 Measurement Functions

3.2.1 AC and DC Voltage measurement

To avoid electrical shock and/or damage to the instrument, do not attempt to take any voltage measurement that might exceeds 1000Vdc or 1000Vac rms.

To avoid electrical shock and/or damage to the instrument, do not apply more than 1000Vdc or 1000Vac rms between the common terminal and the earth round.

The Meter's voltage ranges are 600.0mV, 6.000V, 60.00V, 600.0V and 1000V. To measure ac or dc voltage (set up and connect the Meter as shown in Figure 3-1):

1. Set rotary switch to the DCV, ACV or DCmV range.
2. Connect the black and red test leads to the COM and V terminals respectively.
3. Connect the test leads to the circuit being measured
4. Read the displayed value. The polarity of red test lead connection will be Indicated when making a DCV measurement.

NOTE:

Unstable display may occur especially at 600mV range, even though you do not put test leads into input terminals.

For better accuracy when measuring the dc offset of an ac voltage, measure the ac voltage first. Note the ac voltage range, then manually select a dc voltage range equal to or higher than the ac range. This improves the accuracy of the dc measurement by ensuring that the input protection circuits are not activated.

DC Voltage

Figure 3-1 Measuring AC and DC Voltage

3.2.2 Resistance measurement

To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before measuring resistance.

The Meter's resistance ranges are 600.0 Ω , 6.000k Ω , 60.00k Ω , 600.0k Ω , 6.000m Ω and 60.00M Ω .

To measure resistance (set up the Meter as shown in figure 3-2):

1. Set the rotary switch to * range.
2. Connect the black and red test leads to the COM and V Ω terminals respectively.
3. Connect the test leads to the circuit being measured and read the displayed value.

Some tips for measuring resistance:

- The measured value of a resistor in a circuit is often different from the resistor's rated value. This is because the Meter's test current flows through all possible paths between the probe tips.
- In order to ensure the best accuracy in measurement of low resistance, short the test leads before measurement and memory the test probe resistance in mind. This necessary to subtract for the resistance of the test leads.
- The resistance function can produce enough voltage to forward-bias silicon diode or transistor junctions, causing them to conduct. To avoid this, do not use the 60M Ω range for in-circuit resistance measurements.
- On 60M Ω range, the meter may take a few seconds to stabilize reading. This is normal for high resistance measuring.
- When the input is not connected, i.e. at open circuit, the figure "OL" will be displayed for the overrange condition.

Figure 3-2 Measuring Resistance

3.2.3 Diode Test Forward Bias

To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before testing diodes.

To test a diode out of a circuit (set up the Meter as shown in Figure 3-3):

1. Set the rotary switch to * range.
 2. Press the SELECT key once to activate Diode Test.
 3. Connect the black and red test leads to the COM and V Ω terminals respectively.
 4. For forward-bias readings on any semiconductor component, place the red test lead on the component's anode and place the black test lead on the component's cathode.
 5. The meter will show the approx. forward voltage of the diode.
- In a circuit, a good diode (Si) should still produce a forward bias reading of 0.5V to 0.8V; however, the reverse-bias reading can vary depending on the resistance of other pathways between the probe tips.

Figure 3-3 Testing a Diode

3.2.4 Continuity Check

To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before testing for continuity.

To test for continuity (set up the Meter as shown in Figure 3-4):

1. Set the rotary switch to * range.
2. Press the SELECT key twice to activate Continuity Check.
3. Connect the black and red test leads to the COM and Ω terminals respectively.
4. Connect the test leads to the resistance in the circuit being measured.
5. When the test lead to the circuit is below 40Ω , a continuous OFF beeping will indicate it.

NOTE:

- Continuity test is available to check open/short of the circuit.

Figure 3-4 Checking the Continuity

3.2.5 Capacitance measurement

To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before measuring capacitance. Use the dc voltage function to confirm that the capacitor is discharged.

The Meter's capacitance ranges are 60.00nF, 600.0nF, 6.000 μ F, 60.00 μ F and 300.0 μ F.

To measure capacitance (set up the Meter as shown in Figure 3-5):

1. Set the rotary switch to * range.
2. Connect the black and red test leads to the COM and * terminals respectively (or you can use capacitor test lead).
3. Connect the test leads to the capacitor being measured and read the displayed value.

Some tips for measuring capacitance:

- The meter may take a few seconds (>30 seconds in 300.0 μ F range) to stabilize reading. This is normal for high capacitance measuring.
- To improve the accuracy of measurements less than 60nF, subtract the residual capacitance of the Meter and leads.
- Below 600pF, the accuracy of measurements is unspecified.

Figure 3-5 Measuring Capacitance

3.2.6 Frequency and Duty Cycle measurement

Do not measure Frequency on high voltage (>1000V) to avoid electrical shock hazard and/or damage to the instrument.

The Meter can measure Frequency or Duty Cycle while making either an AC Voltage or AC Current measurement.

To measure frequency or Duty Cycle:

1. With the meter in the desired function (AC Voltage or AC Current), press the Hz % key.
2. Read the frequency of the AC signal on the display.
3. To make a duty cycle measurement, press the Hz % key again.
4. Read the percent of duty cycle on the display.
5. Set the rotary switch to the Hz range.
6. Insert the black and red test leads into the COM and Hz input terminals.
7. Connect the test leads tip in parallel with the circuit to be measured. And don't touch any electrical conductors.
8. At frequency measuring status, press Hz % one time then meter enters duty cycle measuring status, press it again then return to frequency measuring status.
9. Read the result directly from the display.

NOTE:

In noisy environment, it is preferable to use shield cable for measuring small signal

3.2.7 Temperature measurement

To avoid electrical shock and/or damage to the instrument, do not apply more than 250Vdc or 220Vac rms between the °C terminal and the COM terminal.

To avoid electrical shock, do not use this instrument when voltages at the measurement surface exceed 60v dc or 24v rms. Ac.

To avoid damage or burns. Do not make temperature measurement in microwave ovens.

To measure temperature:

1. Set the rotary switch to °C range and the LCD will show the current environment temperature.
2. Insert 'K' type thermocouples into the COM terminal and °C terminal (or you can insert it by using Multi Function Socket), Taking care to observe the correct polarity.
3. Touch the object with the thermocouple probe for measurement.
4. Read the stable reading from LCD.

3.2.8 Current measurement

To avoid damage to the meter or Injury if the fuse blows, never attempt an in-circuit current measurement where the open-circuit potential to earth is greater than 1000V.

To avoid damage to the meter, check the meter's fuse before proceeding. Use the proper terminals function, and range for your measurement. Never place the probes in parallel with a circuit or component when the leads are plugged into the current terminals.

The meters current ranges are 600.0 μ A, 6000 μ A, 60.00mA, 600.0mA, 6.000A and 10.00A.

To measure current (set up the Meter as shown in Figure 3-6):

1. Turn off power to the circuit. Discharge all high voltage capacitors.
2. Set the rotary switch to the μ A, mA or A range.
3. Press the SELECT key to select DCA or ACA measuring mode.
4. Connect the black test lead to the COM terminal and the red test leads to the mA terminal for a maximum of 600mA. For a maximum of 10A, move the red test lead to the A terminal.

5. Break the circuit path to be tested.

Touch the black probe to the more negative side of the break; touch the red probe to the more positive side of the break. (Reversing the leads will give a negative reading, but will not damage the Meter.)

6. Turn on power to the circuit; then read the display. Be sure to note the measurement units at the right side of the display (μ A, mA or A). When only the figure "OL" displayed, it indicates over range situation and the higher range has to be selected.

7. Turn off power to the circuit and discharge all high voltage capacitors.

Remove the Meter and restore the circuit to normal operation.

Figure 3-6 Measuring Current

3.2.9 PC Link The meter has serial data output function. It can be connected with PC by USB interface, so the measured data can be recorded, analyzed, processed and printed by PC. Before use this function, you need install the PC-Link software and USB driver in your PC.

Press the Hz% key while turn on the meter, the meter enter PC-Link mode, the symbol "PC-LINK" will appear on LCD, and the serial data output function is active.

PC-LINK SOFT OPERATING MANUAL

1. Make sure the two Install USB driver and Install software files in the attached CD successfully installed before any measurement.
2. Keep the meter in "OFF" status, pressing the Hz% key while turn on the meter and the symbol "PC-LINK" will appear on the LCD if the serial data output function is active. (To disable the auto power off function, hold down the SELECT key and Hz% key while turning the meter on.)

NOTE: If we want to enable the serial data output function during measuring, we have to turn off the meter first, then operate according to step2.

3. Connect the meter's OPTICAL PORT and computer USB port with the USB line.

4. Run the PC-LINK software, click the SET menu. Select the System Set. Then select the proper COM port in the Serial Port Select. As for the proper COM port, we can view it in the Device Manager by following these steps:

- Right-click the My Computer icon on the Windows desktop, and then click Properties.
 - Click the Hardware tab and then click Device Manager.
 - Scroll through the list of installed devices till you locate the Ports (Com and LPT) entry. Click the plus (+) beside this entry to view the installed ports, If no errors occur, the Sunplus USB to Serial COM Port (COM x) will appear, COM x is just the proper port, here x is a specific number.
5. Select the default sampling rate or you can select other desired sampling rate.
6. Now press the Start in the PC-LINK SOFT to measure and view the synchronic data or graph in the software interface.
7. To disable the serial data output function, switch the meter to OFF location first.
8. More information about the PC-LINK SOFT, please refer to the Help topic including in the software or enter our website: www.mastech.com.cn

4. TECHNICAL SPECIFICATIONS

4.1 General specifications

Environment conditions:

1000V CAT III and 600V CAT IV

Pollution degree: 2

Altitude < 2000m

Operating temperature: 0-40°C, 32°F-122°F(<80% RH, <10°C non-condensing)

Storage temperature: -10-60 °C, 14°F-140°F(<70% RH, battery removed)

Temperature Coefficient: 0.1x(specified accuracy) / °C (<18°C or >28°C)

MAX. Voltage between terminals and earth ground: 1000V AC rms or 1000V DC.

Fuse Protection: μ A and mA: F 0.63A/1000V $\varnothing$ 10.3x38; A: F 10A/1000V $\varnothing$ 10.3x38.

Sample Rate: 3 times/sec for digital data.

Display: 3 5/6 digits LCD display. Automatic indication of functions and symbols.

Range selection: automatic and manual.

Over Range indication: LCD will display "OL".

Low battery indication: The "*" is displayed when the battery is under the proper operation range.

Polarity indication: "-" displayed automatically.

Power source: 9V

Battery type: 6F22.

Dimensions: 190(L)x90(W)x40(H) mm.

Weight: 500g. Approx. (battery included).

4.2 Measurement specifications

Accuracy is specified for one year after calibration, at operating temperatures of 18°C to 28°C, with relative humidity at less than 80%.

Accuracy specifications take the form of: $\pm$ (% of Reading + Number of Least Significant Digits)

4.2.1 Voltage

DCV:

Range

Resolution

accuracy

ACV:

Range

Resolution

accuracy

Above accuracies can be guaranteed within 5%-100% of the full range.

The true RMS meter has residual value within 10 counts when the test leads are shorten, but that will not affect the accuracy of measurement.

1. Frequency Range for ACV: 40Hz-400Hz.

2. Response for ACV: Average, calibrated in rms of sine wave.

3. Overload Protection: 1000V dc or 1000V ac rms.

4. Input Impedance (Nominal): DC voltage: $>10M\Omega$; AC voltage: $>10M\Omega$

4.2.2 Frequency

Logic frequency (1Hz-1MHz)

Range

Resolution

Accuracy

Linear frequency (6HZ-10KHZ)

Range

Resolution

Accuracy

Above accuracies can be guaranteed within 10%-100% of the full range.

4.2.3 Resistance

Range

Resolution

Accuracy

4.2.4 Diode Test

Range

Resolution

Test condition

Forward DC current approximately 1mA Reversed

DC voltage approximately 1.5V

4.2.5 Continuity check

Range

Resolution

Test condition

Open circuit voltage: approx. 0.5V

Description: Continuity beeper $\leq 40\Omega$

4.2.6 Capacitance

Range

Resolution

Accuracy

4.2.7 Temperature

Range

Resolution

Accuracy

Note: The specification of temperature don't include thermocouple errors.

4.2.8 Current

Range

Resolution

Accuracy

Above accuracies can be guaranteed within 5%-100% of the full range.

The true RMS meter has residual value within 10 counts when the test leads are shorten, but that will not affect the accuracy of measurement.

1. Frequency Range for ACA: 40Hz-400Hz

2. Overload protection: F 10A/1000V fuse for 10A

Overload protection: F 0.63A/1000V fuse for μ A and mA ranges.

3. Maximum input current: 600mA dc or 600mA ac rms for μ A and mA ranges, 10A dc or 10A ac rms for 10A ranges.

4. For measurements>6A, 4 minutes maximum ON to measure 10 minutes OFF; Above 10A unspecified.

5. MAINTENANCE

This section provides basic maintenance information, including fuse and battery replacement instructions.

Do not attempt to repair or service your Meter unless you are qualified to do so and have the relevant calibration, performance test, and service information.

5.1 General Maintenance

To avoid electrical shock or damage to the meter, do not get water inside the case. Remove the test leads and any input signals before opening the case.

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents.

Dirt or moisture in the terminals can affect readings.

To clean the terminals:

Turn the meter off and remove all test leads.

Shake out any dirt that may be in the terminals.

Soak a new swab with a cleaning and oiling agent (such as WD-40).

Work the swab around in each terminal. The oiling agent insulates the terminals from moisture-related contamination.

5.2 Fuse replacement

Before replacing the fuse, disconnect test leads and/or any connectors from any circuit under test. To prevent damage or injury replace the fuse only with specified ratings.

1. Set rotary switch to the OFF position.
2. Disconnect test leads and/or any connectors from the terminals.
3. Use a screwdriver to unlock the four screws on the rear cover.
4. Take out the rear cover from the meter.
5. Remove the fuse by gently prying one end loose, then sliding the fuse out of its bracket.
6. Install the replacement fuses only with specified ratings: F 0.63A/1000V Ø10.3x38 and F 10A/1000V Ø10.3x38
7. Rejoin the rear cover and tighten the screws.

5.3 Battery replacement

To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator "*" appears.

Before replacing the battery, disconnect test leads and/or any connectors from any circuit under test, turn the meter off and remove test leads from the input terminals.

1. Set rotary switch to the OFF position.
2. Disconnect test leads and/or any connectors from the terminals.
3. Use a screwdriver to unlock the two screws on the battery cover.
4. Take out the battery cover from the meter.
5. Remove the used battery.
6. Replace with one new 9V battery (6F22).
7. Rejoin the battery cover and tighten the screws.

6. ACCESSORIES

Delivered with the multimeter:

- User's manual (One piece)
- Test leads (One piece)
- "K" type Thermocouple (One piece)
- Multi-function socket (One piece)
- USB line (One piece)
- PC-Link software CD (One piece)

If there are some changes in accessories, please refer to the real product as standard.

FERVE F-1880

Contents

TITLE

PAGE

1. GENERAL INSTRUCTIONS

1.1 Precaution safety measures

1.1.1 Preliminary

1.1.2 During use

1.2 Symbols

1.3 Instructions

2. DESCRIPTION

2.1 Instrument Familiarization

2.2 LCD Display

2.3 Key pad

3. FUNCTION DESCRIPTION

3.1 General Functions

3.1.1 DATA HOLD mode

3.1.2 Manual ranging and Auto range mode

3.1.3 Battery saver

3.1.4 Relative measurement mode

3.1.5 True RMS measurement

3.2 Measurement Functions

3.2.1 AC and DC Voltage measurement

3.2.2 Resistance measurement

3.2.3 Diode Test

3.2.4 Continuity Check

3.2.5 Capacitance measurement

3.2.6 Frequency measurement

3.2.7 Temperature measurement

3.2.8 Current measurement

3.2.9 PC Link

4. TECHNICAL SPECIFICATIONS

4.1 General specifications

4.2 Measurement specifications

4.2.1 Voltage

4.2.2 Frequency

4.2.3 Resistance

4.2.4 Diode Test

4.2.5 Continuity Check

4.2.6 Capacitance

4.2.7 Temperature

4.2.8 Current

5. MAINTENANCE

5.1 General maintenance

5.2 Fuse replacement

5.3 Battery replacement

6. ACCESSORIES

6000 COUNTS DIGITAL MULTIMETER USER'S MANUAL

1. GENERAL INSTRUCTIONS

This instrument complies with IEC 61010-1: 2001, CAT III 1000V and CAT VI 600V over voltage standards. See specifications.

To get the best service from this instrument, read carefully this user's manual and respect the detailed safety precautions.

International symbols used on the Meter and in this manual are explained in chapter 1.2.

1.1 Precautions safety measures

1.1.1 Preliminary

* As the possibilities of high transient over voltages occurred in today's power systems increase, more stringent safety standards are set for the electrical test equipment. Transients on electrical systems(power grid, feeder or branch circuits) will trigger a series of incidents that may result in serious personal injury. To protect you against transients, safety must be built into the test equipment.

Over voltage category

In brief

Examples

CAT I Electronic

- Protected electronic equipment.
- Equipment connected to (source) circuits in which measures are taken to limit transient over voltages to an appropriately low level.
- Any high-voltage, low-energy source derived from a high winding resistance transformer, such as the high-voltage section of a copier.

CAT II Single-phase receptacle connected loads

- Appliance, portable tools, and other household and similar loads.
- Outlet and long branch circuits.
- Outlets at more than 10 meters from CAT III source.
- Outlets at more that 20 meters from CAT IV source.

CAT III Three-phase at utility connection, any outdoor conductors

- Equipment in fixed installations, such as switch gear and poly phase motors.
- Bus and feeder in industrial plants.
- Feeders and short branch circuits, distribution panel devices.
- Lighting systems in lager buildings.
- Appliance outlets with short connections to service entrance.

CAT IV Three-phase at utility connection, any outdoor conductors

- Refers to the "origin of installation"; i.e., where low-voltage connection is made to utility power.
- Electricity meters, primary over current protection equipment.
- Outside and service entrance, service drop from pole to building, run between meter and panel.
- Overhead line to detached building , underground line to well pump.

* When using this multimeter, the user must observe all normal safety rules concerning:

-protection against the dangers of electric current.

-protection of the multimeter against misuse.

* For your own safety, only use the test probes supplied with the instrument, Before use, check that they are in good condition.

1.1.2 During use

* If the meter is used near noise generating equipment, be aware that display may become unstable or indicate large errors.

* Do not use the meter or test leads if they look damaged.

* Use the meter only as specified in this manual; otherwise, the protection provided by the meter may be impaired.

* Use extreme caution when working around bare conductors or bus bars.

* Do not operate the meter around explosive gas, vapour, or dust.

* Verify a Meter's operation by measuring a known voltage. Do not use the Meter if it operates abnormally. Protection may be impaired. When in doubt, have the Meter serviced.

* Uses the proper terminals, function, and range for your measurements.

* When the range of the value to be measured is unknown, check that the range initially set on the multi meter is the highest possible or, wherever possible, choose the auto ranging mode.

* To avoid damages to the instrument, do not exceed the maximum limits of the input values shown in the technical specification tables.

* When the multimeter is linked to measurement circuits, do not touch unused terminals.

* Caution when working with voltages above 60Vdc or 30Vac rms. Such voltages pose a shock hazard.

* When using the probes, keep your fingers behind the finger guards.

* When making connections, connect the common test lead before connecting the live test lead; when disconnecting, disconnect the live test lead before disconnecting the common test lead.

* Before changing functions, disconnect the test leads from the circuit under test.

* For all dc functions, including manual or auto-ranging, to avoid the risk of shock due to possible improper reading, verify the presence of any ac voltages by first using the ac function. Then select a dc voltage range equal to or greater than the ac range.

* Disconnect circuits power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.

* Never perform resistance or continuity measurements on live circuits.

- * Before measuring current, check the meter's fuse and turn off power to the circuit before connecting the meter to the circuit.
- * In TV repair work, or when carrying out measurements on power switching circuits, remember that high amplitude voltage pulses at the test points can damage the multimeter. Use of a TV filter will attenuate any such pulses.
- * Use just one 6F22 battery, properly installed in the Meter's battery case, to power the Meter.
- * Replace the battery as soon as the battery indicator (*) appears. With a low battery, the Meter might produce false readings that can lead to electric shock and personal injury.
- * Do not measure voltages above 1000V in Category III, or 600V in Category IV installations.
- * When in REL mode, the "REL" symbol is displayed. Caution must be used because hazardous voltage may be present.
- * Do not operate the Meter with the case (or part of the case) removed.

1.2 Symbols:

Symbols used in this manual and on the instrument:

- * Caution: refer to the instruction manual. Incorrect use may result in damage to the device or its components.
- * AC (Alternating Current)
- * DC (Direct Current)
- * AC or DC
- * Earth ground
- * Double insulated
- * Fuse
- * Conforms to European Union directives

1.3 Instructions

- * Remove test leads from the Meter before opening the Meter case or battery cover.
- * When servicing the Meter, use only specified replacement parts-
- * Before opening up the instrument, always disconnect from all sources of electric current and make sure you are not charged with static electricity, which may destroy internal components.
- * Any adjustment, maintenance or repair work carried out on the meter while it is live should be carried out only by appropriately qualified personnel, after having taken into account the instructions in this present manual.
- * A "qualified person" is someone who is familiar with the installation, construction and operation of the equipment and the hazards involved. He is trained and authorized to energize and de-energize circuits and equipment in accordance with established practices.
- * When the instrument is opened up, remember that some internal capacitors can retain a dangerous potential even after the instrument is switched off.
- * If any faults or abnormalities are observed, take the instrument out of service and ensure that it cannot be used until it has been checked out.
- * If the meter is not going to be used for a long time, take out the battery and do not store the meter in high temperature or high humidity environment.

2. DESCRIPTION

2.1 Instrument Familiarization

The front panel is shown as in Figure 2-1, explanation being as follows:

1. LCD display

Used for displaying the measuring results and various symbols.

2. Keypad

Measurement function keys.

3. Rotary switch

Used for selecting measurement functions.

4. *

Terminal receiving the red test lead for voltage, resistance, capacitance, frequency, temperature, diode and continuity measurements.

5. $\mu\text{A}/\text{mA}$

Terminal receiving the red test lead for μA , mA measurements.

6. A

Terminal receiving the red test lead for 6A, 10A measurements.

7. COM

Terminal receiving the black test lead as a common reference.

2.2 LCD Display

LCD screen is shown as in Figure 2-2, with its every symbol's meaning shown as in the Table 1:

Nº

Symbol

Meaning

1 * Indicates negative readings

2 * Indicator for AC voltage or current

3 * Indicator for DC voltage or current ,

4 AUTO The meter is in the Autorange mode in which the meter automatically selects the range with the best resolution.

5 PC-LINK The Meter is in the data transmission mode.

6 H The meter is in Data Hold mode.

7 REL The meter is in Relative Measurement mode.

8 MAX Display maximum data

9 MIN Display minimum data

10 * Low battery indication

11 * The meter is in Continuity Check mode.

12 * The meter is in Diode Test mode.

13 * Measurement units.

14 * This symbol means that the input is too large for the selected range.

2.3 Keypad

2.3.1 SELECT

1 * position

Switches between Resistance measurement, Diode Test and Continuity check.

2. At A mA μA position

Switches between dc and ac current.

3. Power-up Option

Disables automatic power-off feature.

2.3.2 HOLD

Press it to enter and exit the Data Hold mode. Press it and hold 2 seconds, backlight on; if press it and hold for 2 seconds again, backlight off.

2.3.3 RANGE

At *

1. Press RANGE to enter the manual ranging mode.
2. Press RANGE to step through the ranges available for the selected function.
3. Press and hold RANGE for 2 seconds to return to autoranging.

2.3.4 *.

Press * to enter and exit the Relative measurement mode. (Except Hz/Duty)

2.3.5 Hz %

At *

1. Press it to start the frequency counter.
2. Press it again to enter duty (load factor) mode.
3. Press it again to exit the frequency counter mode.
4. Hold down this key while turning the meter on to enter the data transmission mode.

2.3.6 MAX/MIN

This key is for measuring maximum value and minimum value.

1. Press it to enter Max/Min mode.
2. Press it again; the LCD will display the Maximum Value.
3. Press it again; the LCD will display the Minimum Value.
4. Press and hold it for two seconds, the meter will return to normal measurement state. (Except Hz/Duty and Capacitance)

3. FUNCTION DESCRIPTION

3.1 General Functions

3.1.1 DATA HOLD mode

Data Hold mode makes the meter stop updating the display. Enabling Data Hold function in autorange mode makes the meter switch to Manual ranging mode, but the full-scale range remains the same. Data Hold function can be cancelled by changing the measurement mode, pressing RANGE key, or push * key again.

To enter and exit the Data Hold mode:

1. Press * key (short press). Fixes the display on the current value, H is displayed.
2. A second short press returns the meter to normal mode.

3.1.2 Manual ranging and Autorange mode

The Meter has both manual ranging and autorange options.

* In the autorange mode, the Meter selects the best range for the input detected. This allows you to switch test points without having to reset the range.

* In the manual ranging mode, you select the range. This allows you to override autorange and lock the meter in a specific range.

* The Meter defaults to the autorange mode in measurement functions that have more than one range. When the Meter is in the autorange mode, AUTO is displayed.

To enter and exit the manual range mode:

1. Press RANGE key. The Meter enters the manual ranging mode. AUTO turns off. Each presses of RANGE key increments the range. When the highest range is reached, the Meter wraps to the lowest range.

2. To exit the manual ranging mode, press and hold down RANGE key for two seconds. The Meter returns to the autorange mode and AUTO is displayed.

3.1.3 Battery Saver

The Meter enters the "sleep mode" and blanks the display if the Meter is on but not used for 30 minutes. Press the * key or rotate the rotary switch to wake the meter up. To disable the Sleep mode, hold down the SELECT key while turning the meter on.

3.1.4 Relative measurement mode

The Meter will display relative measurement in all functions except frequency. To enter and exit the relative measurement mode:

1. With the Meter in the desired function, touch the test leads to the circuit on which you want future measurement to be based.
2. Press * key to store the measured value and activate the relative measurement mode. The difference between the reference value and subsequent reading is displayed.
3. Press * key for more than 2 seconds to return the Meter to normal operation.

3.1.5 TRUE RMS measurement

All the measurement values of the true RMS meter on the AC voltage and AC current are true root-mean-square values. The basic meter can only measure the AC average value.

3.2 Measurement Functions

3.2.1 AC and DC Voltage measurement

To avoid electrical shock and/or damage to the instrument, do not attempt to take any voltage measurement that might exceeds 1000Vdc or 1000Vac rms.

To avoid electrical shock and/or damage to the instrument, do not apply more than 1000Vdc or 1000Vac rms between the common terminal and the earth round.

The Meter's voltage ranges are 600.0mV, 6.000V, 60.00V, 600.0V and 1000V. To measure ac or dc voltage (set up and connect the Meter as shown in Figure 3-1):

1. Set rotary switch to the DCV, ACV or DCmV range.
2. Connect the black and red test leads to the COM and V terminals respectively.
3. Connect the test leads to the circuit being measured
4. Read the displayed value. The polarity of red test lead connection will be Indicated when making a DCV measurement.

NOTE:

Unstable display may occur especially at 600mV range, even though you do not put test leads into input terminals.

For better accuracy when measuring the dc offset of an ac voltage, measure the ac voltage first. Note the ac voltage range, then manually select a dc voltage range equal to or higher than the ac range. This improves the accuracy of the dc measurement by ensuring that the input protection circuits are not activated.

DC Voltage

Figure 3-1 Measuring AC and DC Voltage

3.2.2 Resistance measurement

To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before measuring resistance.

The Meter's resistance ranges are 600.0 Ω , 6.000k Ω , 60.00k Ω , 600.0k Ω , 6.000m Ω and 60.00M Ω .

To measure resistance (set up the Meter as shown in figure 3-2):

1. Set the rotary switch to * range.
2. Connect the black and red test leads to the COM and V Ω terminals respectively.
3. Connect the test leads to the circuit being measured and read the displayed value.

Some tips for measuring resistance:

- The measured value of a resistor in a circuit is often different from the resistor's rated value. This is because the Meter's test current flows through all possible paths between the probe tips.
- In order to ensure the best accuracy in measurement of low resistance, short the test leads before measurement and memory the test probe resistance in mind. This necessary to subtract for the resistance of the test leads.
- The resistance function can produce enough voltage to forward-bias silicon diode or transistor junctions, causing them to conduct. To avoid this, do not use the 60M Ω range for in-circuit resistance measurements.
- On 60M Ω range, the meter may take a few seconds to stabilize reading. This is normal for high resistance measuring.
- When the input is not connected, i.e. at open circuit, the figure "OL" will be displayed for the overrange condition.

Figure 3-2 Measuring Resistance

3.2.3 Diode Test Forward Bias

To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before testing diodes.

To test a diode out of a circuit (set up the Meter as shown in Figure 3-3):

1. Set the rotary switch to * range.
 2. Press the SELECT key once to activate Diode Test.
 3. Connect the black and red test leads to the COM and V Ω terminals respectively.
 4. For forward-bias readings on any semiconductor component, place the red test lead on the component's anode and place the black test lead on the component's cathode.
 5. The meter will show the approx. forward voltage of the diode.
- In a circuit, a good diode (Si) should still produce a forward bias reading of 0.5V to 0.8V; however, the reverse-bias reading can vary depending on the resistance of other pathways between the probe tips.

Figure 3-3 Testing a Diode

3.2.4 Continuity Check

To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before testing for continuity.

To test for continuity (set up the Meter as shown in Figure 3-4):

1. Set the rotary switch to * range.
2. Press the SELECT key twice to activate Continuity Check.
3. Connect the black and red test leads to the COM and Ω terminals respectively.
4. Connect the test leads to the resistance in the circuit being measured.
5. When the test lead to the circuit is below 40Ω , a continuous OFF beeping will indicate it.

NOTE:

- Continuity test is available to check open/short of the circuit.

Figure 3-4 Checking the Continuity

3.2.5 Capacitance measurement

To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before measuring capacitance. Use the dc voltage function to confirm that the capacitor is discharged.

The Meter's capacitance ranges are 60.00nF, 600.0nF, 6.000 μ F, 60.00 μ F and 300.0 μ F.

To measure capacitance (set up the Meter as shown in Figure 3-5):

1. Set the rotary switch to * range.
2. Connect the black and red test leads to the COM and * terminals respectively (or you can use capacitor test lead).
3. Connect the test leads to the capacitor being measured and read the displayed value.

Some tips for measuring capacitance:

- The meter may take a few seconds (>30 seconds in 300.0uF range) to stabilize reading. This is normal for high capacitance measuring.
- To improve the accuracy of measurements less than 60nF, subtract the residual capacitance of the Meter and leads.
- Below 600pF, the accuracy of measurements is unspecified.

Figure 3-5 Measuring Capacitance

3.2.6 Frequency and Duty Cycle measurement

Do not measure Frequency on high voltage (>1000V) to avoid electrical shock hazard and/or damage to the instrument.

The Meter can measure Frequency or Duty Cycle while making either an AC Voltage or AC Current measurement.

To measure frequency or Duty Cycle:

1. With the meter in the desired function (AC Voltage or AC Current), press the Hz % key.
2. Read the frequency of the AC signal on the display.
3. To make a duty cycle measurement, press the Hz % key again.
4. Read the percent of duty cycle on the display.
5. Set the rotary switch to the Hz range.
6. Insert the black and red test leads into the COM and Hz input terminals.
7. Connect the test leads tip in parallel with the circuit to be measured. And don't touch any electrical conductors.
8. At frequency measuring status, press Hz % one time then meter enters duty cycle measuring status, press it again then return to frequency measuring status.
9. Read the result directly from the display.

NOTE:

In noisy environment, it is preferable to use shield cable for measuring small signal

3.2.7 Temperature measurement

To avoid electrical shock and/or damage to the instrument, do not apply more than 250Vdc or 220Vac rms between the °C terminal and the COM terminal.

To avoid electrical shock, do not use this instrument when voltages at the measurement surface exceed 60v dc or 24v rms. Ac.

To avoid damage or burns. Do not make temperature measurement in microwave ovens.

To measure temperature:

1. Set the rotary switch to °C range and the LCD will show the current environment temperature.
2. Insert 'K' type thermocouples into the COM terminal and °C terminal (or you can insert it by using Multi Function Socket), Taking care to observe the correct polarity.
3. Touch the object with the thermocouple probe for measurement.
4. Read the stable reading from LCD.

3.2.8 Current measurement

To avoid damage to the meter or Injury if the fuse blows, never attempt an in-circuit current measurement where the open-circuit potential to earth is greater than 1000V.

To avoid damage to the meter, check the meter's fuse before proceeding. Use the proper terminals function, and range for your measurement. Never place the probes in parallel with a circuit or component when the leads are plugged into the current terminals.

The meters current ranges are 600.0 μ A, 6000 μ A, 60.00mA, 600.0mA, 6.000A and 10.00A.

To measure current (set up the Meter as shown in Figure 3-6):

1. Turn off power to the circuit. Discharge all high voltage capacitors.
2. Set the rotary switch to the μ A, mA or A range.
3. Press the SELECT key to select DCA or ACA measuring mode.
4. Connect the black test lead to the COM terminal and the red test leads to the mA terminal for a maximum of 600mA. For a maximum of 10A, move the red test lead to the A terminal.

5. Break the circuit path to be tested.

Touch the black probe to the more negative side of the break; touch the red probe to the more positive side of the break. (Reversing the leads will give a negative reading, but will not damage the Meter.)

6. Turn on power to the circuit; then read the display. Be sure to note the measurement units at the right side of the display (μ A, mA or A). When only the figure "OL" displayed, it indicates over range situation and the higher range has to be selected.

7. Turn off power to the circuit and discharge all high voltage capacitors.

Remove the Meter and restore the circuit to normal operation.

Figure 3-6 Measuring Current

3.2.9 PC Link The meter has serial data output function. It can be connected with PC by USB interface, so the measured data can be recorded, analyzed, processed and printed by PC. Before use this function, you need install the PC-Link software and USB driver in your PC.

Press the Hz% key while turn on the meter, the meter enter PC-Link mode, the symbol "PC-LINK" will appear on LCD, and the serial data output function is active.

PC-LINK SOFT OPERATING MANUAL

1. Make sure the two Install USB driver and Install software files in the attached CD successfully installed before any measurement.
2. Keep the meter in "OFF" status, pressing the Hz% key while turn on the meter and the symbol "PC-LINK" will appear on the LCD if the serial data output function is active. (To disable the auto power off function, hold down the SELECT key and Hz% key while turning the meter on.)

NOTE: If we want to enable the serial data output function during measuring, we have to turn off the meter first, then operate according to step2.

3. Connect the meter's OPTICAL PORT and computer USB port with the USB line.

4. Run the PC-LINK software, click the SET menu. Select the System Set. Then select the proper COM port in the Serial Port Select. As for the proper COM port, we can view it in the Device Manager by following these steps:

- Right-click the My Computer icon on the Windows desktop, and then click Properties.
 - Click the Hardware tab and then click Device Manager.
 - Scroll through the list of installed devices till you locate the Ports (Com and LPT) entry. Click the plus (+) beside this entry to view the installed ports, If no errors occur, the Sunplus USB to Serial COM Port (COM x) will appear, COM x is just the proper port, here x is a specific number.
5. Select the default sampling rate or you can select other desired sampling rate.
6. Now press the Start in the PC-LINK SOFT to measure and view the synchronic data or graph in the software interface.
7. To disable the serial data output function, switch the meter to OFF location first.
8. More information about the PC-LINK SOFT, please refer to the Help topic including in the software or enter our website: www.mastech.com.cn

4. TECHNICAL SPECIFICATIONS

4.1 General specifications

Environment conditions:

1000V CAT III and 600V CAT IV

Pollution degree: 2

Altitude < 2000m

Operating temperature: 0-40°C, 32°F-122°F(<80% RH, <10°C non-condensing)

Storage temperature: -10-60 °C, 14°F-140°F(<70% RH, battery removed)

Temperature Coefficient: 0.1x(specified accuracy) / °C (<18°C or >28°C)

MAX. Voltage between terminals and earth ground: 1000V AC rms or 1000V DC.

Fuse Protection: μ A and mA: F 0.63A/1000V $\varnothing$ 10.3x38; A: F 10A/1000V $\varnothing$ 10.3x38.

Sample Rate: 3 times/sec for digital data.

Display: 3 5/6 digits LCD display. Automatic indication of functions and symbols.

Range selection: automatic and manual.

Over Range indication: LCD will display "OL".

Low battery indication: The "*" is displayed when the battery is under the proper operation range.

Polarity indication: "-" displayed automatically.

Power source: 9V

Battery type: 6F22.

Dimensions: 190(L)x90(W)x40(H) mm.

Weight: 500g. Approx. (battery included).

4.2 Measurement specifications

Accuracy is specified for one year after calibration, at operating temperatures of 18°C to 28°C, with relative humidity at less than 80%.

Accuracy specifications take the form of: $\pm$ (% of Reading + Number of Least Significant Digits)

4.2.1 Voltage

DCV:

Range

Resolution

accuracy

ACV:

Range

Resolution

accuracy

Above accuracies can be guaranteed within 5%-100% of the full range.

The true RMS meter has residual value within 10 counts when the test leads are shorten, but that will not affect the accuracy of measurement.

1. Frequency Range for ACV: 40Hz-400Hz.

2. Response for ACV: Average, calibrated in rms of sine wave.

3. Overload Protection: 1000V dc or 1000V ac rms.

4. Input Impedance (Nominal): DC voltage: $>10M\Omega$; AC voltage: $>10M\Omega$

4.2.2 Frequency

Logic frequency (1Hz-1MHz)

Range

Resolution

Accuracy

Linear frequency (6HZ-10KHZ)

Range

Resolution

Accuracy

Above accuracies can be guaranteed within 10%-100% of the full range.

4.2.3 Resistance

Range

Resolution

Accuracy

4.2.4 Diode Test

Range

Resolution

Test condition

Forward DC current approximately 1mA Reversed

DC voltage approximately 1.5V

4.2.5 Continuity check

Range

Resolution

Test condition

Open circuit voltage: approx. 0.5V

Description: Continuity beeper $\leq 40\Omega$

4.2.6 Capacitance

Range

Resolution

Accuracy

4.2.7 Temperature

Range

Resolution

Accuracy

Note: The specification of temperature don't include thermocouple errors.

4.2.8 Current

Range

Resolution

Accuracy

Above accuracies can be guaranteed within 5%-100% of the full range.

The true RMS meter has residual value within 10 counts when the test leads are shorten, but that will not affect the accuracy of measurement.

1. Frequency Range for ACA: 40Hz-400Hz

2. Overload protection: F 10A/1000V fuse for 10A

Overload protection: F 0.63A/1000V fuse for μ A and mA ranges.

3. Maximum input current: 600mA dc or 600mA ac rms for μ A and mA ranges, 10A dc or 10A ac rms for 10A ranges.

4. For measurements>6A, 4 minutes maximum ON to measure 10 minutes OFF; Above 10A unspecified.

5. MAINTENANCE

This section provides basic maintenance information, including fuse and battery replacement instructions.

Do not attempt to repair or service your Meter unless you are qualified to do so and have the relevant calibration, performance test, and service information.

5.1 General Maintenance

To avoid electrical shock or damage to the meter, do not get water inside the case. Remove the test leads and any input signals before opening the case.

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents.

Dirt or moisture in the terminals can affect readings.

To clean the terminals:

Turn the meter off and remove all test leads.

Shake out any dirt that may be in the terminals.

Soak a new swab with a cleaning and oiling agent (such as WD-40).

Work the swab around in each terminal. The oiling agent insulates the terminals from moisture-related contamination.

5.2 Fuse replacement

Before replacing the fuse, disconnect test leads and/or any connectors from any circuit under test. To prevent damage or injury replace the fuse only with specified ratings.

1. Set rotary switch to the OFF position.
2. Disconnect test leads and/or any connectors from the terminals.
3. Use a screwdriver to unlock the four screws on the rear cover.
4. Take out the rear cover from the meter.
5. Remove the fuse by gently prying one end loose, then sliding the fuse out of its bracket.
6. Install the replacement fuses only with specified ratings: F 0.63A/1000V Ø10.3x38 and F 10A/1000V Ø10.3x38
7. Rejoin the rear cover and tighten the screws.

5.3 Battery replacement

To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator "*" appears.

Before replacing the battery, disconnect test leads and/or any connectors from any circuit under test, turn the meter off and remove test leads from the input terminals.

1. Set rotary switch to the OFF position.
2. Disconnect test leads and/or any connectors from the terminals.
3. Use a screwdriver to unlock the two screws on the battery cover.
4. Take out the battery cover from the meter.
5. Remove the used battery.
6. Replace with one new 9V battery (6F22).
7. Rejoin the battery cover and tighten the screws.

6. ACCESSORIES

Delivered with the multimeter:

- User's manual (One piece)
- Test leads (One piece)
- "K" type Thermocouple (One piece)
- Multi-function socket (One piece)
- USB line (One piece)
- PC-Link software CD (One piece)

If there are some changes in accessories, please refer to the real product as standard.