Digital Multimeters

TR2114H

- ■ **Temperature Measurement with 0.1°C Resolution Using Thermocouples and Resistor Bulb**
- ■ **1 μV Resolution for DC Voltage Measurement and 10 m Ω Resolution for Resistance Measurement**
- ■ **Multi-Channel Input (Up to 40 Channels) (With Accessories)**
- ■ **High Sampling Rate of 20 Samples/s**
- ■ **Diverse Calculation Functions**
- ■ **GPIB Full Remote Control**
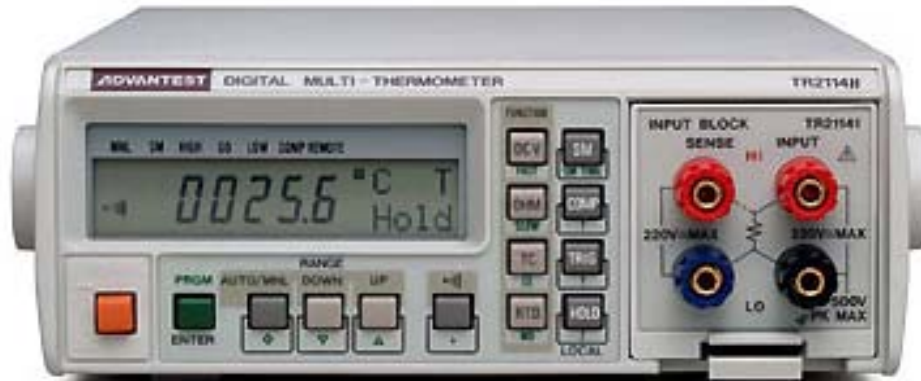
TR2114H

Digital Multi-Thermometers

The TR2114H are unique instruments intended to be flexibly used for all kind of experiments and tests in such fields as semiconductors, plant engineering and new materials. It is designed to cover a wide range of applications for a variety of users.

■ Three Measurement Functions - Temperature, Voltage and Resistance

The TR2114H accommodate a wide variety of sensors, enabling measurement of temperature using either thermocouples or resistor bulbs in addition to voltage and resistance measurement functions. This combination of functions is extremely powerful in applications such as temperature testing of equipment and in plant maintenance, in which both physical and electrical quantity measurements are required. All temperature measurements are made with 0.1°C resolution and capable of cryogenic temperature measurement with a resolution of 0.1 K, using a Chromel-Au (Fe) or normal silver-Au (Fe) sensor.
Voltage and resistance measurements are also made with high resolution - 1 μV and 10 mΩ, respectively.

■ Ideal for Multi-Channel Measurement

With the use of plug-ins for the input section, TR21142 Input Block makes it possible to make normal or differential measurement of temperature, DC voltage and resistance with respect to two channels (2-wire systems). TR21143 Input Block and TR19001 Auto Channel Selector may be used together to enable automatic data measurement for up to 40 channels (or 20 channels for 3- or 4-wire systems), thus allowing TR2114H to be used as a simplified data logger.

■ High Sampling Rate of Up to 20 Samples/s

The TR2114H is provided with a high-speed sampling capability for use in automated data acquisition systems. For thermocouple temperature and voltage measurements, sampling is made at 15 to 20 samples/s. For platinum resistor bulb measurements, the sampling rate is 7 to 10 samples/s, thus allowing high-speed data capture and ensuring the simultaneity of multi-point measurement.

■ GPIB with Full Remote Control

Data output and control units are available - TR13206/A GPIB Adaptor Unit. The use of the TR13206 allows full remote control of all functions and ranges.

■ Diverse Measuring Functions Capable of Calculation of Measurement Results

Provided with a standard comparator which allows comparison of upper and lower limits, the TR2114H when used together with TR19001 Auto Channel Selector, makes it possible to make GO/NO-GO judgment for up to 40 electronic components. TR2114H with the % deviation calculation function can read resistance and other measured values directly using % deviation.

Multi-Thermometers for Automatic Measurement Systems

TR2114H

─── **Specifications** ───

DC Voltage Measurement
Maximum Display: ±19999

Range	20 mV	200 mV	2000 mV	20 V	200 V
Resolution	1 µV	10 µV	100 µV	1 mV	10 mV
Accuracy	±0.045% ±5 d	±0.045% ±2 d		±0.05% ±2 d	
Temperature coefficient	±0.005% ±0.8 d	±0.005% ±0.2 d			
Input impedance	1000 MΩ or more			10 MΩ ±1%	
Maximum allowable applied voltage	220 VDC, 220 Vrms AC, continuous				
Noise rejection ratio	Effective common-mode noise rejection ratio with an unbalanced resistance of 1 kΩ: 120 dB or greater for DC, 120 dB or greater for 50/60 Hz ±0.1% AC, Normal-mode noise rejection ratio (NMRR): Approx. 60 dB for 50/60 Hz ±0.1% AC				

Accuracy: Guaranteed for six months at a temperature of +23℃ ±5℃ and a relative humidity of 85% or less. Expressed as % of reading ± digits.

Temperature coefficient: Applies to 0℃ to +18℃ and +28℃ to +50℃. Expressed as (±% of reading ± digits)/℃.

Resistance Measurement
Maximum display: 19999

Range	200 Ω	2000 Ω	20 k Ω	200 k Ω	2000 k Ω
Resolution	10 mΩ	100 mΩ	1 Ω	10 Ω	100 Ω
Measured applied current	1 mA		100 µA	10 µA	1 µA
Measured voltage	0.2 V	2 V			
Measurement accuracy	±0.04% ±14 d* ±0.04% ±2 d	±0.04% ±2 d			0.1% ±6 d
Temperature coefficient	±0.004% ±0.1 d				
Open-circuit voltage	5 V max. (Between Hi and Lo terminals)				
Lead configuration	2-wire, 3-wire and 4-wire				
Allowable lead resistance	10 Ω max. (3-wire and 4-wire)				
Maximum allowable applied voltage	120 VDC, 220 Vrms AC, continuous				

* For 2-wire input (but not including measurement wire resistance)

Accuracy: Guaranteed for six months at a temperature of +23℃ ±5℃ and a relative humidity of 85% or less. Expressed as % of reading ± digits.

Temperature coefficient: Applies to 0℃ to +18℃ and +28℃ to +50℃. Expressed as (±% of reading ± digits)/℃.

Thermocouple Temperature Measurement
Ranges, resolutions and accuracy:

Thermocouple type	Range*	Resolution	Accuracy**
T(CC)	-270 to -250℃	0.1℃	±0.06% of rdg. ±2.7℃
	-250 to -180℃		±0.06% of rdg. ±1.0℃
	-180 to +400℃		±0.06% of rdg. ±0.3℃
J(IC)	-210 to 0℃	0.1℃	±0.06% of rdg. ±0.4℃
	0 to +1200℃		±0.06% of rdg. ±0.3℃
E(CRC)	-270 to -250℃	0.1℃	±0.06% of rdg. ±1.4℃
	-250 to -200℃		±0.06% of rdg. ±0.5℃
	-200 to +1000℃		±0.06% of rdg. ±0.3℃
K(CA)	-270 to -250℃	0.1℃	±0.06% of rdg. ±2.4℃
	-250 to -200℃		±0.06% of rdg. ±0.6℃
	-200 to +1372℃		±0.06% of rdg. ±0.3℃
S(PR10)	-50 to 0℃	0.1℃	±0.06% of rdg. ±2.0℃
	0 to +1769℃		±0.06% of rdg. ±0.8℃
R(PR13)	-50 to 0℃	0.1℃	±0.06% of rdg. ±2.0℃
	0 to +350℃		±0.06% of rdg. ±1.0℃
	+350 to +1769℃		±0.06% of rdg. ±0.6℃
B(PR30)	+100 to +500℃	0.1℃	±0.06% of rdg. ±3.0℃
	+500 to +1820℃		±0.06% of rdg. ±0.8℃
Chromel-Au (Fe)	4K to 280K (-268 to +7℃)	0.1K	±0.06% of rdg. ±0.4℃
Normal silver-Au (Fe)	4K to 40K (-268to -233℃)	0.1K	±0.06% of rdg. ±0.4℃

* Calibration of T, J, E, K, S, R and B is performed, conforming to JIS C1602-1981.

Chromel-Au (Fe) (chromel vs Au-0.07 at % Fe) and normal silver-Au (Fe) (normal silver vs Au-0.07 at % Fe) conform to the NBS tables.

** Does not include the accuracy of reference junction compensation.

Measurement accuracy: Guaranteed for six months at a temperature of +23℃ ±5℃ and a relative humidity of 85% or less.

Linearization: Digital compensating system
Input impedance: 1000 M Ω or higher
Maximum allowable applied voltage: 220 VDC, 220 Vrms AC, continuous
Measurement units: Can be selected from ℃, ℉, or K.
Reference contact compensation:
    Internal: Transistor compensation of the input terminal temperature
      Compensation accuracy (added to the measurement accuracy when internal compensation is used)
        TR21141 (Binding post type): ±1.0℃
        TR21142 (Screw terminals, 2 ch input): ±0.5℃
        TR21143 + TR19001: ±1.0℃
    External: Freezing point of water: 0℃ (273.2K)
      Boiling point of nitrogen: -195.9℃ (77.3K)
      Boiling point of helium: -269.0℃ (4.2K)
      User-selected temperature: T℃

Temperature Measurement by Resistance Bulb
Resistance bulb: Pt 100, JPt 100 (conforming to JIS C1604-1989)
Measurement range: -200℃ to +649℃
Resolution: 0.1℃
Measurement accuracy: ±0.06% of rdg. ±0.2℃ (except for 2-wire) (Guaranteed for six months at a temperature of +23℃ ±5℃ and a relative humidity of 85% of less.)
Measurement current: 1 mA
Lead configuration: 2-wire, 3-wire, 4-wire
Allowable lead resistance: 10 Ω or less (3-wire and 4-wire)
Linearization: Digital compensating system
Maximum allowable applied voltage: 120 VDC, 220 Vrms AC, continuous
Measurement units: Can be selected from ℃, ℉, or K.
Calculation Functions

Scaling: $R = \dfrac{X - Y}{Y}$

% deviation: $R = \dfrac{X - Y}{Y} \times 100$ (%)

R: Calculation result
X: Measured value
Y: Constant (numerical value set from the panel; may be measured value)
Z: Constant (numerical value set from the panel; may be measured value)

Comparator: R (Hi): X > Y
  R (Lo): X < Z
  R (Go): Y ≥ X ≥ Z
  Hi, Lo, and Go display and beeper sounds for Hi, Lo, Go and Hi and Lo conditions.

Averaging*: R (Ave.): $R = \sum X / Y = X$
Maximum*: R (Max.)
Minimum*: R (Min.)
  Maximum, minimum and average of Y measurements

*Y=1 to 100: display, data output and analog output for each measurement.
*Y ≥ 101: after setting the current running maximum and minimum values, average value are output.

Input Terminals
Standards: TR21141 Input Block
  Binding posts, 2-wire/4-wire configuration, voltage, resistance, thermocouple temperature, temperature measurement by resistance bulb
Accessories (Optional)
  TR21142 Input Block: Flat-screw (M4) binding posts, 2-wire/2-channel measurement, differential measurement function
  TR21143 Input Block: For use in connection to TR19001 Auto Channel Selector
General Specifications

Digital Multimeters

Digital Multi-Thermometer for Automatic Measurement Systems

TR2114H (Continued From Previous Page)

Measurement system: Integration system

Input type: Floating

Display: 5-digit decimal 7-segment LCD (with units and other functions displayed using 5×7 dot matrix characters)

Over input display: "OVER" indicator is displayed if the input level exceeds the limit.

Low battery indicator: If AC or battery voltage drops below the driving voltage, "BATT" indicator is displayed.

Range switching: Automatic and Manual

Autoranging occurs at a display of "20000" (up-ranging) and a display of "1799" (down-ranging).

Measurement rate:

FAST: 15 to 20 times/s (when measuring DC voltage and thermocouple temperature)

7 to 10 times/s (when measuring resistance and temperature by resistance bulb)

SLOW: 1/2, 1/5, 1/10, 1/20, 1/50 or 1/100 of the value of the FAST mode can be selected.

Withstanding voltage: 500 V (DC and AC peak) between the Lo terminal and case and between the Lo terminal and the AC power line

Filter function: Digital smoothing system allows the number of smoothings to be set to 1 to 100.

Beeper function: A piezoelectric element generates an intermittent beep (may be turned on/off) which sounds at key input, when an overflow condition exists and for the comparator function.

Analog output: D-A Converter output isolated from the measurement system is available at a rear-panel jack.

Output data: Measured value, calculated value and recorder calibration outputs (0 V, 1 V)

Converted digits: 3 digits, 000 to 999 (0 V to 0.999 V)

Digit selection: 19999 19999 19999 19999

Output offset:

Offset setting to 50% is possible.

Offset output (500 to 0 V, 000 to 0.5 V, 499 to 0.999 V)

Polarity selection: Absolute value (ABSOLUTE) or signed value (NORMAL)

Conversion accuracy: ±0.3% of full scale

(Guaranteed for six months at a temperature of +23°C ±5°C and a relative humidity of 85% or less.)

Output impedance: 0.5 Ω or less (up to 100 μA)

Connector: Earphone jack

Remote control: Possible using TR13206A GPIB Adaptor

Operating environment: Temperature 0 to +50°C (except 0°C to +40°C for TR15802 Battery Unit), Relative humidity 85% or less

Storage environment: Temperature -25°C to +70°C

Power requirements:

AC power: 100 VAC ±10%, 50/60 Hz

AC Line voltage: Specified at time of ordering

Power consumption:

4 VA max. (main unit only)

Option No.	Std.	31	32	42	43	44
Line voltage (V)	100	115	120	220	230	240
Line variation (%)	±10	±10	±10	±10	+8, -10	+4, -10

5 VA max. (with accessories)

Dimensions: Approx. 190 (W) × 70 (H) × 260 (D) mm

Mass: 2 kg max. (including main input and input block)

Accessories

Item	Model	Remarks
Power cable	AO1402	1
Input cable	AO1007	1 (Used for DC voltage and 2-wire resistance measurement)
Connecting cable	AO1204	1(for analog output)
Thermocouple (T)	TR1101-100	

Accessories (Optional)

TR21142	Input Block
TR21143	Input Block
TR19001	Auto Channel Selector
TR13206A	GPIB Adaptor Unit
A01006	Input Cable (for 4-wire resistance measurement)
A02423	EIA Rack Mount Set
TR1101 Series	Sheath-Type Thermocouple
TR1102 Series	Sheath-Type Thermocouple
TR1105/1106	Thermocouples for Ultra Low Temperature
TR1107A Series	Probe-Type Thermocouple
TR1104 Series	Platinum Resistance Bulb
TR1108 Series	Surface Temperature Sensors
TR1111	Terminal Adaptor
TR7021	Automatic Reference Cold Contact Compensator

**TR1111
Terminal Adaptor**