

ZRJ Series Intelligent Thermal Instrument Calibration System

Based on powerful software and hardware platforms, ZRJ series intelligent thermal instrument calibration systems can be configured into different intelligent temperature metering standard devices and their combinations according to varying requirements to carry out automatic verification / calibration operations of various primary and secondary contact temperature measurement instruments.

Considering that ZRJ series products are characteristic of an integration of software, hardware, engineering and services, complex influencing factors on measurement results, long-term customer service needs, a wide geographical distribution, and other features, the Company includes innovation, standardization, minimized uncertainty, continuous improvement, and other scientific concepts and principles in the process of product development, production and services. Having been tested by the market for more than two decades, this series of products have long maintained a domestic leading position in terms of hardware and software level, product quality, after-sales services, market volume, etc., and have been widely praised by customers. The products have been playing an important role for a long time in many fields including high-temperature measurement of aerospace materials.

Basic Functions

● Verification / Calibration Functions

Functions	Graduation	Grade	Remarks
Standard thermocouple	S, R, B	Grade I, II	Standard thermocouple
Working thermocouple	S, R, short S, short R	Grade I, II	Working noble metal thermocouple
	B	Grade II, III	
	K, N, E, J, T, WRe, EA-2, etc.	Grade I, II, III	Working base metal thermocouple, sheathed thermocouples
Industrial resistance thermometer	Pt100, Pt10, Cu100, Cu50, PtX (x=500, 1000...), CuX	AA, A, B, C and multiple or fraction of B	Two-wire, three-wire and four-wire
Temperature transmitter	0-10mA, 4-20mA, 1-5V and etc.		With thermocouple, thermal resistance, etc.
Secondary temperature instrument	Moving coil step-indication controllers associated for measuring temperature, digital Temperature indicators and controllers, Records of industrial-process measurement		
Expansion thermometer	Standard Mercury-in-glass Thermometer, liquid-in-glass thermometer for working, bimetallic thermometer, pressure thermometer		

● Mixed Verification and Grouped Verification

By extending the scanner module, the ZRJ series products can realize the group

control and verification of thermocouples and resistance thermometers. It is possible to realize the mixed verification of base metal thermocouples in the same furnace. In addition, ZRJ series products can also realize grouped verification of resistance thermometers, low temperature thermocouples, low temperature integrated temperature transmitters, and other temperature measurement instruments to be verified in the thermostatic bath. Up to ten groups can be handled in a batch and 100 pieces for each batch of verification, which greatly improves the efficiency of the verification personnel.

- **Software / Hardware Protection Functions**

ZRJ series products have realized the comprehensive protection functions to the system through comprehensive hardware and software design. The power-off protection function can prevent data loss caused by power failure or other reasons during the verification process. When restarting the verification program, continued verification can be selected without having to start from the beginning. The over-temperature protection function makes full use of the timer triggering principle inside the ZRJ-03 scanner to ensure that when the scanner detects abnormality of the computer, it will stop sending the driving pulse to the SSR, thereby stopping the power supply to the thermocouple verification furnace, avoiding overheating and damage of the verification furnace. Each model equipped with intelligent instrument temperature control is protected with the intelligent instrument over-temperature protection function.

- **Auxiliary Testing Functions**

"JJF 1098-2003 Calibration Specification for Auto-measuring System of Thermocouples and Resistance Thermometers" are followed for automatic repeatability test, comparison test, temperature uniformity automatic test of the thermocouple verification furnace and thermostatic bath.

Advanced Functions

- **Software Platform with Excellent Functions**

The software features of the ZRJ series verification systems have unparalleled comprehensive advantages. It is not only a tool software that can verify or calibrate according to existing specifications, but also a software platform composed of a number of powerful thermos-metering professional software. Its professionalism, ease of use, and operability can represent the current highest standards in the industry, and provide a significant convenience to the routine verification and calibration of customers.

- **Professional and Enriched Report Generation Functions**

The software automatically generates Chinese and English verification records, supports digital signatures, provides users with professional reports, tables and Verification certificates or calibration certificates can be in a standard format or a custom format. According to the customer's request, the raw data of record forms and certificates can be exported to Excel.

The software contains professional certificate output programs in Word format. Users can quickly input existing Word-format template files, customize certificate output options, customize template number, customize Word-format template files to achieve quickly output of a variety of certificate files in Word format without modifying source programs.

- Professional Uncertainty Assessment Functions

Professional uncertainty assessment analysis software is provided: According to "JJF1059.1-2012 Evaluation and Expression of Uncertainty in Measurement" and related data on source of uncertainty from the inspected devices, input of regulations, specifications and standards, the assessment software can automatically calculate the uncertainty value, degree of freedom (thermal resistance) and extended uncertainty of all standards, and generate an uncertainty component summary table and a very professional Word-format uncertainty assessment report (report format conforms to current national regulations / specifications).

After the verification of working thermocouples and resistance thermometers is completed, the actual expansion uncertainty data of the verification results of the verification points can be automatically calculated and reflected in the verification record and verification certificate, and the software can automatically draw out the uncertainty summary table of all verification points.

- Free Mobile APP for Professional ITS-90 Thermometric Scale Conversion (Android version)

Thermometric scale conversion of general thermocouple and industrial thermal resistance is achieved. The standard platinum resistance can realize the mutual conversion of temperature and electric quantity, and at the same time calculate dW/dt and dR/dt . The standard thermocouple can calculate the potential value of a, b, c and centigrade points according to certificate values; dry- wet bulb humidity conversion; temperature unit, pressure unit conversion, etc.

- Database Management Functions

The ZRJ series has a professional internal database that enables automatic data storage. After the verification is completed, the system automatically stores the information to be inspected, certificate data, and standard information, and the verification process information is also stored in the database as an OLE object to form verification records. The query function in the database allows searching qualified records by single or combined conditions, views or prints their verification records or certificates. Its statistical function can sort out the required records by one or combined conditions, view and print statistical reports or detailed reports. If the automatically generated verification record file is lost, the file can be restored by the recovery function of the database.

- Fast Backup and Recovery Function

This function enables fast backup and recovery of the software settings and parameters of the entire set of verification system.

Executive Standards

- Executed and Cited Regulations and Specifications

Codes of regulations and specifications	Names of regulations and specifications	Codes of regulations and specifications	Names of regulations and specifications
JJG 75-1995	Verification Regulation of Standard Platinum-10% Rhodium / Platinum	JJF 1176-2007	Calibration Calibration specification for Tungsten-Rhenium

	Thermocouple		Thermocouples
JJF 1637-2017	Calibration Specification for Base Metal Thermocouples	JJF 1183-2007	Calibration Specification for Temperature Transmitters
JJG 617-1996	Verification Regulation of Digital Temperature Indicators and Controllers	JJF 1184-2007	Testing skills Specification of Temperature Uniformity in Thermocouple Calibration Furnaces
JJG 186-1997	Verification Regulation of Moving Coil Indicators and Step-indication Controllers Associated for Measuring Temperature	JJG 229-2010	Verification Regulation of Industry Platinum Copper Resistance Thermometers
JJG 668-1997	Verification Regulation of the Working Platinum-10% Rhodium / Platinum and Platinum-13% Rhodium / Platinum Thermocouple with Short Length	JJG 1030-2011	Verification Regulation of Liquid-in-glass Thermometers for Working
JJG 368-2000	Verification Specification for Working Copper / Copper-Nickel Thermocouple	JJF 1262-2010	Calibration Specification for Sheathed Thermocouples
JJF 1098-2003	Calibration Specification for Auto-measuring System of Thermocouples and Resistance Thermometers	JJG 141-2013	Verification Regulation of Working Nobel Metal Thermocouples
JJG 74-2005	Verification Regulation of Recorders for Industrial-Process Measurement	AMS2750E	AEROSPACE MATERIAL SPECIFICATION (R) Pyrometry (Aerospace Materials Code High temperature measurement)

- Implemented Product Standards

The production and manufacturing process of ZRJ series follow enterprise standard Q/0900 TPR001-2017 «ZRJ Intelligent Thermal Instrument Calibration System».

The standardized product design brings ZRJ series products an excellent compatibility, which can ensure that the latest version of the software supports all ZRJ series products of PANRAN from 2003 to the present and all ZRJ-03 products by the original Taian Intelligent Instrument and Meter Factory before the restructuring.

- **Minimized Uncertainty**

Minimizing the uncertainty of the test devices at reasonable cost and improving the credibility of the measurement results is an eternal pursuit of PANRAN. For this reason, our company is committed to analysis and research on the main factors that form the uncertainty, and taking effective measures to reduce them to a minimum, so that a number of measurement indicators are superior to national regulations, and satisfactory to the relevant requirements of AMS2750E "Aerospace Materials Specifications - High Temperature Measurement".

- **Low Potential Scanning Switch**

Through the special made low-temperature potential switch, terminal, lead and strict assembly according to the process specifications, the overall parasitic potential of the low-potential scanning switch is not more than $0.2\mu\text{V}$, ensuring a good consistency, long-term stability and reliability among the channels. The shunted reversing switch can eliminate the effects of stray parasitic potential on the measured results during resistance thermometer measurement.

- **Professional Supporting Temperature Source and High-precision Constant Temperature Adjustment Scheme**

The temperature uniformity and temperature stability of the temperature source in the thermocouple verification is the largest source of uncertainty in the thermocouple verification assembly except the main standard, and extreme emphasis shall be placed on it. Through the use of self-developed series of temperature sources, including series of thermocouples verification furnaces with a temperature field width of 60mm~100mm or even wider, and their supporting equal temperature blocks, heat pipe thermostatic bath, zero-point dry-well, etc., the measurement uncertainty component introduced by the temperature field is minimized.

Different from other similar products, ZRJ series products can use standard sensor for temperature control, using the system's own high-precision digital meter and the standard thermocouple with certificate value correction and traceability, and through the professional optimization of the thermostat software algorithm by the computer, fine thermostat adjustment of the thermocouple assay furnace is performed to minimize, linearize and visualize furnace temperature fluctuations.

- **Integrated Terminal Block**

Starting from the terminal, the dedicated integrated terminal block convert the two-wire, three-wire and four-wire measured resistance thermometers into a

four-wire connection method. The length of the external lead of the assembly, the resistance size, the temperature environment changes, etc. have no influences on the measurement of the measured resistance, greatly reducing the uncertainty of the resistance measurement, and significantly improving the measurement repeatability.

- Data Revision and Traceability

The verification regulation and data revision rules are strictly followed in data processing to ensure traceability of verification/calibration results.

- Professional Data Analysis Function

Based on a powerful software platform, the ZRJ system can perform statistics on the data in the verification process, analyze and provide data analysis reports, including temperature deviations and fluctuation level, invisible faults of thermoelectric equipment power supply lines, electromagnetic interference, dynamic/static adaptation of temperature adjustment parameters, measurement repeatability, parasitic potential of device, parasitic potential of measured thermal resistance, expansion uncertainty of measurement results, etc. Data analysis results can help the user to grasp the overall situation of the device operation in a timely manner, and to make necessary adjustment so that the system stays in a controlled state for a long time.

Measurement Specification

All key technical indicators of the ZRJ series calibration system are better than the regulations or specifications, leaving sufficient margin for future upgrades.

Difference between scanning switch parasitic potential and parasitic potential of each channel	$\leq 0.2\mu\text{V}$
Data collection difference among channels	$\leq 0.5\mu\text{V}$, $1.0\text{m}\Omega$
Measurement repeatability	$\leq 0.1\mu\text{V}$, $3.0\text{m}\Omega$
Thermocouple verification constant temperature performance	Constant temperature $\leq 0.5^\circ\text{C}/6\text{min}$, measurement $\leq 0.1^\circ\text{C}/\text{min}$
Resistance thermometer verification constant temperature performance	Constant temperature $\leq 0.02^\circ\text{C}/10\text{min}$, measurement $\leq 0.01^\circ\text{C}/\text{min}$
Verification of measurement data processing results (manual calculation for error verification)	$\leq 0.1\mu\text{V}$, $0.1\text{m}\Omega$

Product Model

- ZRJ-03 Intelligent Thermal Instrument Calibration System

Applicable objects: Metrology colleges, scientific research departments, calibration laboratories, enterprises and public institutions for which it is necessary to establish grade I or grade II standard thermocouple metering standard devices, grade II standard platinum resistance thermometer metering standard device, and to carry out working thermocouple, industrial resistance thermometer and other temperature instrument verification / calibration.

Main functions: Basic configurations in ZRJ series products, mainly used for automatic verification / calibration of various working thermocouples, industrial resistance thermometers, and temperature transmitters. The scanner switch includes 6 verified channels , and the precision temperature controller of the assay furnace is achieved with high-precision thermostat adjustment software algorithms.

Extended functions: Configured with a corresponding temperature meter calibrator (such as PR231, PR233), it may carry out automatic verification of temperature secondary instruments. Other extended verification / calibration items include glass liquid thermometers, bimetallic Thermometers, pressure thermometers, etc.

Supporting software: 1602, 1603, 1604, 1610, 1612.

- ZRJ-03A Standard Thermocouple Automatic Calibration System

Applicable objects: Metrology institutes, military engineering stations and large corporate metering centers for standard thermocouple verification.

Main functions: Automatic verification of grade I and grade II standard Platinum-10% Rhodium/Platinum thermocouples, completely compatible with ZRJ-03 functions.

Supporting software: 1601, 1602, 1603, 1604, 1610, 1612.

- ZRJ-03B Intelligent Thermal Instrument Calibration System

Applicable object: Applicable objects: Metrology colleges, scientific research departments, calibration laboratories, enterprises and public institutions for which it is necessary to establish grade I or grade II standard thermocouple metering standard devices, grade II standard platinum resistance thermometer metering standard device, and to carry out working thermocouple, industrial resistance thermometer and other temperature instrument verification / calibration.

Main functions: The scanning switch is a 10 measured channels, and other functions are the same with ZRJ-03.

Supporting software: 1602, 1603, 1604, 1610, 1612.

- ZRJ-03C Intelligent Thermal Instrument Calibration System

Applicable objects: Military and special industry verification micro-thermocouples.

Main functions: The scan switch includes 24 verified channels, which can / calibrate 24 micro-thermocouples at one time.

Supporting software: 1602.

- ZRJ-04 Double Furnace Thermocouple (Resistance Thermometer) Automatic Calibration System

Applicable objects: Enterprises that verify a lot of thermocouples / resistance thermometers or thermocouple manufacturers.

Main functions: The system can control two verification furnaces at the same time, complete the automatic verification of two sets of thermocouples or the verification of a single set of resistance thermometer, which can meet the requirements of verifying a large number of thermocouples and resistance thermometers in a short time. The scanning switch includes 20 verified channels,

and the verification furnace temperature is precisely controlled with an intelligent meter.

Supporting software: 1608, 1609.

- ZRJ-05 Group-furnace Thermocouple (Resistance Thermometer) Automatic Calibration System

Applicable objects: Thermocouple, resistance thermometer manufacturers, large and medium-sized enterprises with a considerable amount of verification.

Main functions: It can control 1-10 verification furnaces for automatic verification of thermocouples, and can carry out the verification of resistance thermometers, low temperature thermocouples and integrated temperature transmitters (with batch verification function, up to 10 batches). The system adds a hierarchical low-potential scanning switch and a scanning control system to the structure. Each verification furnace adopts RS485 bus intelligent meters and SSR for temperature control, and its temperature settings, PID parameter settings, etc. can be remotely controlled, and centrally controlled with a computer. During the verification process, the system automatically completes the continuous verification of each temperature point of each verification furnace under the control of the computer. The special resistance thermometer group verification software and the integrated terminal block can realize the group verification of the resistance thermometers. The system automatically records and displays the temperature control data, which can not only display the temperature control parameters of each verification furnace, but also display the working status and temperature control parameters of different verification furnaces in detail, automatically draw the temperature control curve, and automatically realize the digital acquisition, processing, transfer, storage and document management and automatic generation of verification certificates.

Supporting software: 1608, 1609.

ZRJ-06 Simultaneous Calibration of Working Thermocouple and Industrial Resistance Thermometers

Applicable objects: Metrology colleges, scientific research departments, calibration laboratories, enterprises and public institutions for which it is necessary to establish grade I or grade II standard thermocouple measurement standard devices, grade II standard platinum resistance thermometer measurement standard device, and to carry out working thermocouple, industrial resistance thermometer and other temperature instrument verification / calibration.

Main functions: The system can achieve verification / calibration of working thermocouples and industrial resistance thermometers at the same time, the maximum efficiency of digital multimeters. Thermocouple scanning switch: 10 channels; the verification furnace use intelligent instruments for temperature control; resistance thermometer scanning switch: 10 channels;

Supporting software: 1602, 1603, 1621.

Professional Technical Support

PANRAN has professional technical service teams and after-sales service teams to provide customers with high-quality, long-term technical support and services.

- Customization

Different users have different requirements for the thermal instrument calibration system. Based on the professional technical service team, PANRAN can provide users with professional accessories, specification, software functions, ERP data access, report output and other customized services in a short time.

- After Sales Service

The thermal instrument calibration system integrates hardware, software and engineering, and puts forward professional and long-term requirements for the after sales service quality. PANRAN is committed to providing customers with high-level consulting, on-site commissioning, maintenance and other services. The company can provide relevant software and hardware upgrade services in a timely manner according to the latest release and revised regulations and specifications of the country, eliminate problems of encountered by customers in operation in a timely and effective manner, and ensure that the equipment used by the customer is in the best working condition for a long time.