

F18

Precision Thermometer



AUTOMATIC SYSTEMS
LABORATORIES



TYPICAL APPLICATIONS

- Primary Thermometer Calibration
- Research
- Oceanography
- Aerospace
- Power
- Thermometer manufacturers

F18 PRECISION THERMOMETRY BRIDGE

In world class metrology, the most important consideration is the quality of the fundamental measurement. ASL's F18 AC bridge technology represents the peak of performance in resistance thermometer measurement and exploits the inherent advantages of AC bridge technology to maintain repeatable measurements of the highest precision under practical operating conditions.

AC bridge technology will always out-perform measurements made using DC technology with slow current reversal. These benefits are inherent to the fundamental physics of electrical measurement rather than their implementation.

MAIN FEATURES

- Accuracy $<\pm 0.1\text{ppm}$ ($\pm 25\mu\text{K}$) ♦
- Resolution 0.003ppm ($0.75\mu\text{K}$) ♦
- Linearity $<\pm 0.01\text{ppm}$
- Stability $<0.02\text{ppm}/\text{year}$
- Fast measurement time (2 seconds balance)
- Differential and absolute measurement
- Warm up time <30 seconds
- Traceable to International Standards

♦ e.g. 25.5Ω SPRT referenced to a 25Ω reference resistor

A FEW FACTS

The Model F18 is designed specifically for resistance thermometry to provide you with the best possible accuracy. The 25 Hz or 75 Hz operating frequency provides fast, continuous measurement with high immunity to thermal emfs and supply frequency noise sources. Practical measurements involve cables, connectors and imperfect operating environments, the F18 achieves its full specification under a wide range of real operating conditions. For example, you can add cable probe extensions and extra terminal junctions without concern for thermal emfs generated by the temperature gradients in your laboratory. Design features such as the unique input guard ensure that you really can obtain the specified accuracy of 0.1 ppm over the range of 0.2Ω to 390Ω . This equates to a temperature measurement accuracy of $25\mu\text{K}$ for a 25.5Ω SPRT referenced to a 25Ω reference resistor.

Like to know more about AC and why AC measurement then see the data sheet "Why is AC better than DC ?"

The F18 includes a wide range of features specifically tailored for temperature metrology. These include programmable excitation current, $\sqrt{2}$ current, analogue outputs, selectable source impedance, gain and filter bandwidth. Manual or automatic bridge balancing together with manual or automatic control (IEEE interface) of the instrument ensure that the F18 can provide solutions in a wide range of measurement applications.



A TRUE PEDIGREE

National standards laboratories around the world require the best instrumentation for their work. The majority of these organisations use ASL's top of the range Models F900 or F18 to set the temperature standard in their country, these include 22 out of the 22 members of the international C.C.T. (Consultative Committee of Thermometry).

FEATURES

Bandwidth	Selectable: 0.5, 0.1 or 0.02 Hz.
External Standard	AC/DC standard resistor or resistance thermometer.
Sensor current	0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50mA or $\times \sqrt{2}$ any value.
Sensor current frequency	User selectable frequencies: 25 or 75 Hz with 50 Hz supply 30 or 90 Hz with 60 Hz supply Phase locked to supply frequency.
Bridge balancing modes	<u>Automatic</u> : via full self balance algorithm. <u>Manual</u> : via front panel switches (to 0.1ppm) and analogue meter (interpolated to 0.01ppm).
Self check modes	<u>Zero</u> : verifies bridge zero accuracy. <u>Unity</u> : verifies bridge slope accuracy.
Lead connections	True four wire connections for resistance thermometer (R_t) and standard resistor (R_s). Accuracy is unaffected by series lead resistance, permitting measurements with long cables (100 metres for 25.5 Ω SPRT referenced to a 25 Ω reference resistor)).
Quadrature balance	Eliminates effects of thermometer, resistor and cable reactance.
Active input guard	Eliminates effects of leakage from any terminal to ground.
Analogue output	<u>Null balance</u> : $\pm 10V$ (unfiltered). <u>Programmable</u> : 0 - 10V (3 scale ranges).

ACCESSORIES

SB148	10 channel auto/manual multiplexer, with individual preset "keep warm" current.
SB148/01	As SB148, with 4 individual "keep warm" currents per channel.
SB158	Driver/interface for up to 2 x SB148 or SB148/01 multiplexers (Specify RS232 or IEEE).
SB158/01	Driver/interface for up to 6 x SB148 or SB148/01 multiplexers (Specify RS232 or IEEE).
AS1 System	F18 complete with SB148 and SB158 multiplexer in 19"/16U cabinet complete with power distribution and cutout.
AS2 System	As AS1 system, but with SB148/01 multiplexer.
RW1, 10, 25, 100, 300	"Wilkins" AC/DC standard resistor. Values: 1, 10, 25, 100 and 300 Ω .
RWTE1, RWTE2	Thermal enclosure for 1 off or 2 off RW resistors.
FA-1	Co-axial cable set with BNC connectors at both ends to use with FA-3 adaptor.
FA-2	Co-axial cable set with BNC connectors at one end for reference resistor.
FA-3	4 terminal to 2 x BNC connector, adaptor box.
F/ACC	FA-1, FA-2 and FA-3 cable set.



SPECIFICATION

Accuracy $\leq \pm 0.1 \text{ ppm}$ This is equivalent to a temperature of $\pm 25 \mu\text{K}$ for a 25.5Ω SPRT at 0°C referenced to a 25Ω standard resistor, or $\pm 100 \mu\text{K}$ for a 25.5Ω SPRT using a 100Ω standard resistor ($\kappa = 2$).

Resolution

	Ratio Resolution	Standard Resistor	SPRT	Temperature Resolution
IEEE	0.003ppm	100Ω 25Ω	25.5Ω 25.5Ω	3μK 0.75μK
Front Panel	0.1ppm	100Ω 25Ω	25.5Ω 25.5Ω	0.1μK 25μK

Linearity $\leq \pm 0.01 \text{ ppm}$.

Stability $< 0.02 \text{ ppm/year}$.

Measurement time 20 seconds for full balance.
2 seconds for incremental balance.

Warm up time < 30 seconds

Thermometers $R_{0.01}$ of 100Ω , 25.5Ω , 2.5Ω , 0.25Ω and any intermediate value.

Standard resistor range 1Ω to 300Ω AC/DC resistance.

Measurement range 0 to 1.299 999 99 ratio of two resistors, R_t to R_s , via IEEE-488 interface and 1.299 999 9 via front panel LED display using any value of R_s between 1Ω and 300Ω . e.g. 0 to $129.999\ 999 \Omega$ in $1 \mu\Omega$ steps ($R_s = 100 \Omega$).

Differential measurements between two external resistors or SPRTs can be made. e.g. an SPRT on each R_t and R_s input.

Operating conditions 10°C to 29°C (50°F to 85°F), 10 to 90% RH.

Power requirements 240, 220, 120, 100 VAC ($\pm 10\%$) selectable on rear panel, 50 or 60 Hz, 250VA max

Specifications are subject to change without prior notice.



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