

Thermocouple Range Table

Sensor Type	Range/Display	Accuracy (±)*	Resolution
Iron-Constantan J	-336 to +2193°F -204 to +1200°C 68 to 1473 K	0.5°F 0.3°C 0.3 K	0.1°F 0.1°C 0.1 K
Chromel®- Alumel® K	-299 to +2503°F -184 to +1373°C 88 to 1646 K	0.6°F 0.3°C 0.3 K	0.1°F 0.1°C 0.1 K
Copper- Constantan T	-373 to +753°F -225 to +400°C 48 to 674 K	0.4°F 0.2°C 0.2 K	0.1°F 0.1°C 0.1 K
Chromel- Constantan E	-358 to +1835°F -217 to +1001°C 56 to 1275 K	0.6°F 0.3°C 0.3 K	0.1°F 0.1°C 0.1 K
Platinum- Platinum 13%, Rhodium R	+32 to +3219°F 0 to +1770°C 273 to 2043 K	1.2°F (above 79.0°F) 0.7°C (above 26.0°C) 0.7 K (above 299.2 K)	0.1°F 0.1°C 0.1 K
Platinum- Platinum 10%, Rhodium S	+32 to +3216°F 0 to +1769°C 273 to 2042 K	1.2°F (above 79.0°F) 0.7°C (above 26.0°C) 0.7 K (above 299.2 K)	0.1°F 0.1°C 0.1 K
Platinum 30%, Rhodium- Platinum 6%, Rhodium B	+899 to +3309°F +481 to +1820°C 755 to 2094 K	2.0°F 1.1°C 1.1 K	0.1°F 0.1°C 0.1 K
Nicrosil-Nisil N	32 to +2301°F 0 to +1260°C 273 to 1534 K	0.5°F 0.3°C 0.3 K	0.1°F 0.1°C 0.1 K
Tungsten 5%, Rhenium- Tungsten 26%, Rhenium C	-10 to +4200°F -23 to +2315°C 249 to 2589 K	1.1°F 0.6°C 0.6 K	0.1°F 0.1°C 0.1 K
Tungsten- Tungsten 26%, Rhenium G	+295 to +4206°F +146 to +2318°C 419 to 2592 K	1.1°F 0.6°C 0.6 K	0.1°F 0.1°C 0.1 K
Tungsten 3%, Rhenium- Tungsten 25%, Rhenium D	-8 to +4203°F -22 to +2317°C 250 to 2590 K	1.1°F 0.6°C 0.6 K	0.1°F 0.1°C 0.1 K
Chromel- Gold 0.07%, Atomic Iron CGI	-460 to +44°F -273 to +7°C 0 to 280 K	0.4°F 0.2°C 0.2 K	0.1°F 0.1°C 0.1 K
Iron Constantan DIN FeCon	-330 to +1654°F -201 to +901°C 71 to 1174 K	0.9°F 0.2°C 0.5 K	0.1°F 0.1°C 0.1 K
Copper-Constantan DIN CuCon	-331 to +1114°F -201 to +601°C 71 to 874 K	0.9°F 0.5°C 0.5 K	0.1°F 0.1°C 0.1 K

Strain-Gage Range Table

Sensor Type	Range/Display	Accuracy (±)*	Resolution
	-15 mV to +100 mV	0.01%	1 µV per count
	-30 mV to +200 mV	0.01%	2 µV per count
	-75 mV to +500 mV	0.01%	5 µV per count
	-150 mV to +1 V	0.01%	5 µV per count

RTD Range Table

Sensor Type	Range/Display	Accuracy (±)*	Resolution
Platinum 100 Ω @ 0°C 3- or 4-wire α =0.00385 DIN 43670 curve	-332 to +1571°F -202 to +855°C 70 to 1128 K	0.2°F 0.1°C 0.1 K	0.1°F 0.1°C 0.1 K
Platinum 100 Ω @ 0°C 3- or 4-wire α =0.00392	-401 to +1572°F -240 to +855°C 32 to 1128 K	0.2°F 0.1°C 0.1 K	0.1°F 0.1°C 0.1 K
Platinum 200 Ω @ 0°C 3- or 4-wire α =0.00392	-330 to +1566°F -201 to +852°C 72 to 1125 K	0.2°F 0.1°C 0.1 K	0.1°F 0.1°C 0.1 K
Platinum 1000 Ω @ 0°C 3- or 4-wire α =0.00375 Hycal Ultra 7 curve	-330 to +1025°F -204 to +1200°C 68 to 1473 K	0.2°F 0.1°C 0.1 K	0.1°F 0.1°C 0.1 K
Copper 10 Ω @ 25°C 3- or 4-wire per Minco table 16-9	-337 to +507°F -205 to +264°C 68 to 537 K	0.8°F 0.4°C 0.4 K	0.1°F 0.1°C 0.1 K
Nickel 120 Ω @ 0°C 3- or 4-wire per Minco table 7-120	-112 to +608°F -80 to +320°C 192 to 593 K	0.4°F 0.2°C 0.2 K	0.1°F 0.1°C 0.1 K

DC Voltage Range Table

Sensor Type	Range/Display**	Accuracy (±)*	Resolution
DC mV	-15.000 to +99.999 mV	0.01%	0.001 mV
DC mV	-150.00 to +999.99 mV	0.01%	0.01 mV
DC Volts	-1.5000 to +9.9999 V	0.01%	0.0001 V
DC Volts	-15.000 to +99.999 V	0.01%	0.001 V

Scaled DC Range Table

Sensor Type	Range/Display**	Accuracy (±)*	Resolution
4 to 20 mA	0 to 100%	0.01%	0.01%
10 to 50 mA	0 to 100%	0.01%	0.01%

Thermistor Range Table

Sensor Type	Range/Display	Accuracy (±)*	Resolution
YSI 400 2252 Ω @ 25°C 2-wire	-42 to +221°F -41 to +105°C 231 to 458 K	0.4°F 0.2°C 0.2 K	0.02°F 0.01°C 0.01 K
YSI 700 3-wire	+31 to +213°F 0 to +100°C 272 to 373 K	0.4°F 0.2°C 0.2 K	0.01°F 0.01°C 0.01 K

* Accuracy percentage is of full scale reading, ±1 digit.

** If the Scaling and Offset option is ordered with Scaled DC or DC Voltage types, any input from 0 to 50 mA or -15 to +100 V, can be rescaled within -10000 to +99999 display counts.

Ordering Guide

Model	Description
610	Digital indicator for use with temperature, voltage or current loop inputs, single width/two option slots
612	Digital indicator for use with temperature, voltage or current loop inputs, double width/five option slots
620	Digital indicator for use with strain-gage transducers and external excitation supply, single width/two option slots
621	Digital indicator for use with strain-gage transducers, includes built-in excitation supply for up to two 350Ω transducers, single width/one option slot
622	Digital indicator for use with strain-gage transducers, includes high power built-in excitation supply for up to eight 350Ω transducers, double width/four option slots

Code	Line Voltage
-1	Set for 90-132 Vac power, 48-400 Hz.
-2	Set for 190-262 Vac power, 48-400 Hz.

Code	Input Range
-1	T/C ranges: K, J, T, E, R, S, B, N, C, G, D, CGI, Fe Con (DIN), CuCO _n (DIN)
-2	Vdc ranges: -15 to 100mV, -150 to 1000mV, -1.5 to 10V and -15 to 100V
-4	Current ranges: 4–20mA and 10–50mA = 0–100%
-5	RTD ranges (3 or 4-wire): Pt100/200/1000, Cu10, Ni120
-6	Thermistor range card: YSI 400 2-wire, YSI 700 3-wire
-8	Strain-gage (621, 622 only)

Code	Options
-20	6 inputs of 2-wire sensors
-21	3 inputs of 3/4-wire RTD sensors
-22	Delta input, 2-wire sensors
-23	Delta input, 3/4-wire sensors
-04	Math: max/min/average/rate of change
-03	Alarms: dual limits (up to 2 per instrument)
-06*	Analog output, current: 4-20mA
-05*	Analog output, voltage: 0-10 Vdc
-01	Scaling and offset: user configurable
-07	Serial output: RS232C or 20mA current loop
-08	IEEE-488 Interface (requires two option slots)
-10*	DC power: isolated instrument power (9–16 Vdc)
-11*	DC power: isolated instrument power (8–32 Vdc)
-31	Scan option

* Only one available per instrument.

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Doric 600

Series Laboratory Precision Digital Panel Indicators



When it comes to ruggedness, reliability and laboratory accuracy, the Doric 600 Series of multifunction digital panel meters is your ideal answer to your most demanding process and test measurement applications.

Offering full five-digit resolution, three-character engineering unit display and powerful front-panel programming capability, the versatile Series 600 will quickly become the instrument of choice wherever and whenever precision measurements are required.

The 600 Series accommodate thermocouple, RTD or thermistor-based temperature measurements, and DC voltage and current measurements, with or without engineering-unit scaling. Temperature can be measured from -460 to +4206°F, -273 to +2318°C, or 0 to 2592°K, all with 0.1° resolution. DC voltage up to 100 volts can be measured to 1 μ V. Process voltage and current loops

can easily be scaled from the front panel using up to 99999 display counts.

The 600 Series are offered in field-expandable single input and multiple input configurations. Single-wide models can accommodate up to six thermocouple or voltage inputs, or three RTD or thermistor inputs. Double-wide models can accept up to 24 thermocouple or voltage inputs, or 12 RTD or thermistor inputs.

In addition, there are specific Series 600 models for strain gage based mechanical measurements. Measurements of weight (load cells), pressure, torque, thrust and force can be performed with 0.01% precision. Up to eight 350 Ω bridges, with built-in excitation supply is available. Dual engineering units (e.g., lbs and Kg) are standard.

Input option card slots can be used for expansion of the total number of inputs as described, or for special features such as differential measurements, scaling and offset, or math functions (maximum, minimum, rate of change, or timed average value of measurements).

Option cards may also be specified for analog output (4-20 mA or 0-10 Vdc). Output options are fully isolated. An Alarm option card provides for two alarm limits and relay outputs.

With so much power and precision, the 600 Series are the right choice when you can't afford to be wrong.

Key Features

- Highest Accuracy to 0.01%
- Full 5-Digit (99999 Counts) Resolution and 3-Character Engineering Units Display
- Large, Easy-To-Read 0.8" Red LED Display
- 12 Plug-in Options
- Sensitivity to 1 μ V per Count
- Solid Die-Cast Aluminum Case
- Simple Front Panel Programming for Input Types:
 - Thermocouples: J, K, T, E, R, S, B, N, C, G, D, CGI, FeCon, CuCon types
 - RTDs: Platinum, Copper, and Nickel types
 - Thermistors: YSI 400 and YSI 700 types
 - DC Voltage: -15.000 mVdc to +99.999 Vdc and 4 to 50 mA range
 - Strain-Gage: -15 mV to +1 V range

Temperature Measurement

The Doric 600 Series temperature indicator is designed to measure one or, with the multi-input option, as many as 24 input points. All 14 types of thermocouples, six types of RTD and both thermistor types can be accommodated by simply specifying thermocouple, RTD or thermistor type range cards. The single-wide unit, Model 610, can accommodate up to

two option cards, while up to five option cards can be added to the double-wide unit, Model 612. Typical accuracy is within 0.1° for thermocouple and RTD sensors, and 0.01° to 0.02° for thermistor inputs.

Specific sensor types and temperature scales of °F, °C, or Kelvins are keypad-selectable from the front panel.



Typical single-wide and double-wide units are shown above.

DC and Scaled DC Measurement

The 600 Series can be used to provide precision measurement and display of current loop and DC voltages.

Functioning as a digital voltmeter, the front panel keypad allows for easy switching between 100 mV, 1 V, 10 V, and 100 V ranges. The optional scaling and offset card allows for rescaling and displaying of measurements, changing of engineering units, and/or repositioning of the decimal point location (e.g., 1-5 Vdc input can be displayed as 200.0 to 750.0 PSI).

For current loop measurements, 4-20 mA or 10-50 mA is prescaled and can be displayed as 0.00 to 100.00%. The optional scaling card allows for rescaling and displaying of measurements anywhere within +99999 counts, changing of engineering units, and/or repositioning of the decimal point location (e.g., 4-20 mA can be displayed as 0.00 to 560.0 GPM).

Laboratory measurements are made possible with the display of 99999 counts, 0.01% accuracy and 1-digit repeatability.

Strain-Gage Measurement

The 600 Series of digital strain-gage indicators are equally compatible with lower output bonded foil type transducers as they are with high output semiconductor type transducers (up to 1000 mV). Each instrument allows selection from one of four full scale voltage ranges to optimize sensitivity.

The measuring technique used is the unique voltage-to-frequency conversion, dual slope method with a true, four-wire ratio measurement. This method assures very accurate and stable readings even in the noisiest of environments, possibly caused by fluctuating excitation power, and allows use of indicators with floating or grounded transducers.

Three alphanumeric LEDs display engineering unit labels (PSI, KG, LBS) or they can be assigned to display dead zeros. Dual engineering units can be set to toggle from the front panel.

Digital scaling is standard on all strain-gage indicators. Drift-free scaling is settable to precise engineering units and decimal location using the front panel keypad.

System calibration can be accomplished using a 3-point "live" load, like actual weight on a scale, or via electronic instrument calibration using a DC voltage source.

To reduce settling indications on the display or option outputs, the display may be rounded to count by 1, 2, 5, 10 or 100 counts via a simple program menu selection.

Auto zero (tare) may be accomplished at any time by the auto zero menu command or while the process is running.

Options and Accessories

Multiple Inputs

This option allows for monitoring up to 24 inputs. The first multiple input card provides five additional channels of thermocouple or voltage, or two channels of RTD or thermistor inputs. Additional cards provide six additional channels of thermocouple or voltage, or three channels of RTD or thermistor inputs. Model 610 can only accept one multiple input card and while up to four cards can be added to the Model 612.

Usage: *Use with Model 610 and 612. Cannot be used with current loop or strain-gage models.*

Differential Measurement

This card provides an additional input channel and the capability to display the difference between the two channels. This function can be combined with other options to provide expanded capabilities – maximum, minimum and average deltas when used with match capability; scaled analog output of differentials when used with analog output, and alarm points based on differential limits.

Usage:
*Cannot be used with current loop or strain-gage models.
Cannot be used with the multiple input option card simultaneously.*

Scaling and Offset

This option provides wide range user-scaling of the display to process units. Inputs can be offset or rescaled to display engineering units to ± 99999 counts. In addition, alphanumeric labels or dead zeros can be assigned to the displayed units. (i.e. 4-20 mA could be scaled to display "0.00-255.00 PSI", "LBS", "KG", "GPM", etc.).

Unlike other instruments, entering formulas or performing computations is not required. Once the upper and lower input and output values are entered, the 600 Series does the rest by adjusting the optimum slope and offset automatically.

Usage:
*Use with voltage and current loop versions of Model 610 and 612.
Cannot be used with Model 620G, 621G, or 622G.*

Math Expressions

The Math Expressions option provides display of maximum, minimum, rate of change or the timed average value of measurements. Front panel keys allow for easy switching between viewing of math value and actual measured value.

Usage:
Use with all models.

Alarms

This option card provides two alarms with separate limits and relays. Up to two cards per unit may be specified. Any combination of high, low or \pm values can be used to trigger the alarm from either actual or math-processed input. Trigger delay and a settable deadband are included as standard.

Usage:
Use with all models.

DC Power

The 600 Series can be configured to operate with 12 or 24 Vdc power when this option is specified.

Usage:
Cannot be used with Model 622G.

Analog Output

This option provides two fully isolated linearized analog outputs that can be used for output to recorders or other analog input instruments. Both output types, 4-20 mA or 0-10 Vdc can be fully scaled. Output can be assigned to direct measurements or to math values.

Usage:
Use with all models.

Serial Digital Output

This option provides RS232C or 20 mA interface, allowing for information to be displayed in serial ASCII format. User-selectable transmission rates from 300 to 9600 bps, line feed and carriage return are included.

Usage:
Use with all models.

IEEE-488 Digital Output

This option allows for integration with IEEE-488 bus based measurement or analytical systems. Main indicator and other options can be programmed via the IEEE-488 bus.

Usage:
Use with all models.

Rack Adapter Plate

This accessory provides an option for mounting of one or more 600 Series instruments in a standard 19" rack.

Usage:
Use with all models.

Field Installation

All upgrades to accessories and options can be field-installed. Please consult VAS Engineering for more information.

Custom Configurations

With your help, our engineers can build a digital panel indicator that meets your specification requirements. Please consult VAS Engineering for more information.

Powerful Front Panel

Just about everything can be done from the front panel — even calibration. Simple display instructions provide an easy guide for every step of the way. Changes such as sensor type selection, °F or °C, alarm setpoints or math option resets can be made from the front panel.

Isolated Outputs

All output options are fully isolated keeping unwanted ground loops from affecting the instrument's measuring system. This further maintains the instrument's high accuracy and can only increase confidence in the displayed value.

Doric 600 Series General Specifications

Repeatability:	±1 digit
Stability With Temperature:	Zero: 0.5 $\mu\text{V}/^\circ\text{C}$; Span: 0.005% rdg/ $^\circ\text{C}$; Reference junction: automatic built-in: 0.018 $^\circ/\text{°}$ for 0-50 $^\circ\text{C}$; J, K, T, E, N, C, G, D, CGI, FeCon and CuCon thermocouples, 0.03 $^\circ/\text{°}$ for R, S and B thermocouples
Stability With Time:	Zero: no measurable drift with time; Span (thermocouple, RTD and thermistor ranges): <1 $^\circ$ per year; Span (voltage, current and strain-gage ranges): 0.1% of reading per year
Noise Rejection:	NMRR: ≥ 60 dB @ 50/60 Hz, ± 0.1 Hz CMRR: ≥ 120 dB @ 50/60 Hz, ± 0.1 Hz
Overload Protection:	Power lead to ground: 1500 Vdc or Vac RMS; Input to ground: 270 Vdc or Vac RMS; Across inputs: 270 Vdc or Vac RMS continuous; 4-20 mA range: 80 mA; 10-50 mA range: 200 mA
Input Impedance:	Thermocouples: 22 M Ω (with 20 nA of break detect current) RTDs: I ₁ to V _{inLo} , 10 M Ω ; I ₂ to V _{inLo} , 12.4 k Ω , depending on range, V _{inHi} to V _{inLo} , 500M Ω Thermistors: I ₁ to V _{inHi} , 3.2 k Ω ; I ₁ to I ₂ , 9.45 k Ω Voltage: 10 M Ω to 500 M Ω depending on range Current: <15 Ω Strain-Gage: 10 M Ω to 500 M Ω depending on range
Environmental Ranges:	Operating: 0 to 50 $^\circ\text{C}$; Storage: -40 to +65 $^\circ\text{C}$; Humidity: $\leq 90\%$ RH noncondensing
Input Connections:	Sensors: screw terminal blocks; multi-input: quick-connect; AC power: plug-in; DC power: screw terminal blocks
Display:	8-digits, 14-segment alphanumeric LEDs, 13.7 mm (0.54") H standard; One negative "-" LED at left of LED array
Alarm Options:	Two alarm settings per alarm option, up to two alarm options per instrument; Form C relay output, 1 A @ 120 Vac reset auto, manual, remote and override selectable alarm delay and deadband
Multiple Input Options:	Thermocouple: ± 10 μV to ± 70 μV depending on thermocouple type and measurement point; RTD: ± 10 m Ω Cu10, ± 50 m Ω all others; current loop and thermistor: no effect
Point Update Rate:	2 readings per second; 1 reading per second for R, S, B, C, G, D and CGI thermocouples
Linearization, Temperature Inputs:	100% digital, using variable length, second-order, polynomial segments
Program Storage:	EEROM
Case Construction:	Metal, black anodized, extruded aluminum
Reliability:	40,000 hours MTBF
Installation:	Panel mounting from front, secured at sides by rail clamps supplied with each indicator
Weight:	Single wide: 4 lbs. (1800 g) Double wide: 6 lbs. (2800 g)
Power:	AC power: 90-132 Vac, 48 Hz to 400 Hz; 190-262 Vac, 48 Hz to 400 Hz; 8.0 W typical (without options) detachable six-foot power cord is supplied; two supplied with Model 622
Excitation Supply:	Model 621: 5, 10 and 15 V, switch selectable, isolated; will drive two parallel 350 Ω strain-gages at 15 V (90 mA) Model 622: 5, 10, 15 and 20 V, switch selectable, isolated; will drive eight parallel 350 Ω strain-gages at 15 V (350 mA)
Size:	Single wide (Models 610, 620, 621): case: 2.63"H x 5.34"W x 9.87"D (6.7 cm x 13.6 cm x 25.0 cm) bezel: 2.84"H x 5.67"W (7.2 cm x 14.4 cm) panel cutout: 2.68"H x 5.44"W (6.8 cm x 13.8 cm) Double wide (Models 612, 622): case: 2.63"H x 10.69"W x 9.87"D (6.7 cm x 27.2 cm x 25.0 cm) bezel: 2.84"H x 11.01"W (7.2 cm x 28.0 cm) panel cutout: 2.68"H x 10.79"W (6.8 cm x 27.4 cm)