

SECTION 6 SPECIFICATIONS

General

POWER SUPPLY

Voltage	: 100/120/220/240V $\pm$ 10%
Line Frequency	: 48Hz to 62Hz
Consumption	: 370 VA normal 660 VA full power
Fuses 220/240V	: 3.15A
100/120V	: 6.25A

MECHANICAL

Dimensions	: Height 178mm (7") Width 455mm (17.9") Depth 564mm (22.2")
------------	---

Weight	: 35kg (77lb)
--------	---------------

SAFETY	: The 4700 has been designed to meet BSI 4743, IEC 348 and UL 1244 specifications
---------------	---

PEAK TERMINAL VOLTAGES

Guard to Ground	: 920V
Lo to Guard	: 920V
Lo to Ground	: 920V
Hi to Guard	: 1556V
Hi to Ground	: 1556V

Rear Panel Digital Inputs-	
to Hi	1556V
to Lo	920V
to Guard	920V
to Ground	0V to +5V

N.B.

Digital Common is internally connected to Ground

ENVIRONMENTAL CONDITIONS

Operating temperature	: 0°C to +50°C
-----------------------	----------------

CAUTION.

Above 30°C on 1kV Range: maximum output power is derated

Storage Temperature	: -40°C to +70°C
---------------------	------------------

Maximum Relative Humidity	: 75% at 40°C Non-Condensing
---------------------------	---------------------------------

Warm-up Time	: One hour to meet all specifications
--------------	---------------------------------------

OPERATING INDICATIONS

Indication	: Symbols lit on displays and illuminated keys
------------	--

Scale Lengths

Output Display	: 7½ Digits maximum
----------------	---------------------

Frequency Display	: 3 Digits plus store location
-------------------	--------------------------------

Mode Display	: 7½ Digits maximum
--------------	---------------------

TAO
LAB
USE ONLY

DC VOLTAGE (Standard to 200V, Option 10 to 1100V)

Accuracy

46.4°F - 55.4°F
91.4°F - 100.4°F

Range	Stability 24 hour ± (ppm OUTPUT + ppmFS) (1) (2)	Accuracy Relative to Calibration Standards ± (ppm OUTPUT + ppmFS) (2)			Calibration Uncertainty (ppm) (3)	Temperature Coefficient (±ppm OUTPUT/°C) 8°C - 13°C 33°C - 38°C	Output Resistance	Output Compliance
		24 hour 23°C ± 1°C	90 days 23°C ± 1°C	1 year 23°C ± 10°C				
100.00μV to 100.00000mV	1.2+0.6μV	3+0.8μV	6+0.8μV	15+1.0μV	10+1μV	2.0	100Ω	-
1.0000000V	1.0+0.5	2+0.8	6+0.8	15+1.0	7	1.5	<0.1mΩ	25mA
10.000000V	0.6+0.1	1+0.5	4+0.5	15+1.0	5	1.0	<0.1mΩ	25mA
100.00000V	1.0+0.3	2+1.0	6+1.0	15+1.0	9	1.5	<1mΩ	25mA
1000.0000V(4)	1.0+0.2	3+0.5	6+0.5	15+1.0	12	2.0	<10mΩ	25mA

Noise (5)

Bandwidth Range	2.5kHz (RMS)	Average Over 1 Line Period (pk-to-pk)	Average Over 10 Line Periods (pk-to-pk)	DC - 2Hz (Typical Null Detector) (pk-to-pk)
100μV - 100mV	4μV	0.2μV	0.5μV	0.1μV
1V	4μV	2μV	0.5μV	0.5μV
10V	10μV	5μV	2μV	2μV
100V	120μV	50μV	25μV	25μV
1000V	2.5mV	600μV	200μV	150μV

Notes:

- (1) For same conditions between 18°C and 28°C
- (2) FS=2xRange
- (3) Factory calibration uncertainty using automated calibration equipment. Datron can provide better traceability. Contact factory for details.
- (4) Requires Option 10.
- (5) For 10kHz-wide band, multiply 2.5kHz figures by 2. For RMS, divide pk-to-pk figures by 6.

Other Specifications

Output	True bipolar output capable of delivering 1100V with respect to Output Lo.
Overrange	100% on 100μV to 100V ranges, 10% on 1000V range (1100V).
Voltage Sensing	Selectable remote or local voltage sensing on 1V to 1000V ranges.
Guarding	Selectable remote or local guard connection. Max Guard to Ground voltage of 650V rms (2.5kV flash test).
Common Mode Rejection	140dB at DC to 400Hz.
Settling Time	To 1ppm of step size < 5s. To 10ppm of step size < 1s. To 100ppm of step size < 100ms.



DANGER

HIGH VOLTAGE



**THIS INSTRUMENT IS CAPABLE
OF DELIVERING
A LETHAL ELECTRIC SHOCK!**



FRONT or REAR
terminals carry the
Full Output Voltage.

THIS CAN KILL!



Guard terminal is
sensitive to over-
voltage

**It can damage
your instrument!**

Unless **you** are **sure** that
it is **safe** to do so,
DO NOT TOUCH the
I+ I- Hi or Lo leads
and **terminals**

DANGER

AC VOLTAGE (Basic to 200V, Option 10 to 1100V)

Accuracy

Range	Frequency (Hz)	Stability 24 hour $\pm$ (ppm OUTPUT +ppm FS) (1) (2)	Accuracy Relative to Calibration Standards $\pm$ (ppm OUTPUT + ppm FS) (2)		
			24 hour 23°C $\pm$ 1°C	90 days 23°C $\pm$ 1°C	1 year 23°C $\pm$ 10°C
1.0000mV to 100.0000mV	10-31 32-33k 30k-100k 100k-330k 300k-1M	120+10+10 μ V 60+10+10 μ V 60+10+10 μ V 160+20+10 μ V 260+20+10 μ V	200+60+10 μ V 160+40+10 μ V 600+60+10 μ V 0.2%+0.02%+20 μ V 0.6%+0.2%+30 μ V	250+60+10 μ V 200+40+10 μ V 600+60+10 μ V 0.2%+0.02%+20 μ V 0.6%+0.2%+30 μ V	340+60+10 μ V 240+60+10 μ V 700+60+10 μ V 0.2%+0.02%+20 μ V 0.6%+0.2%+30 μ V
1.000000V and 10.00000V	10-31 32-33k 30k-100k 100k-330k 300k-1M	80+20 40+10 40+10 100+20 240+20	180+40 100+20 180+30 500+200 0.3%+0.1%	200+40 120+20 200+30 600+200 0.4%+0.1%	280+60 180+40 300+40 1000+200 0.6%+0.1%
100.0000V	10-31 32-33k 30k-100k	80+20 40+10 40+10	180+40 100+20 220+40	200+40 120+20 250+40	280+60 180+40 320+40
1000.000V (6)	45-330 300-10k 10k-33k	100+20 60+20 100+30	180+50 120+50 220+50	200+50 150+50 250+50	360+50 280+50 360+50

Notes:

- (1) For same conditions between 18°C and 28°C.
- (2) FS=2x Range.
- (3) Factory calibration uncertainty using automated calibration equipment. Datron can provide better traceability. Contact factory for details.
- (4) Estimated, not fully traceable.
- (5) Predominantly second harmonic (negligible error on mean sensing instruments).
- (6) Requires Option 10.
- (7) For Frequency Range or Output Range changes, Function changes, OFF/ON changes, and Frequency changes between 31 and 32Hz: the Settling Times are doubled.
 - In remote operation via the IEEE 488 Interface, hardware switching occurs under the control of 'H' (Frequency) codes. Any transfer (up or down) between the undermentioned frequencies must be regarded as a frequency range change. Settling Time should be allowed as for 'Other Specifications.'

31-32Hz	33.0-33.1kHz
300-301Hz	330-331kHz
3.00-3.01kHz	

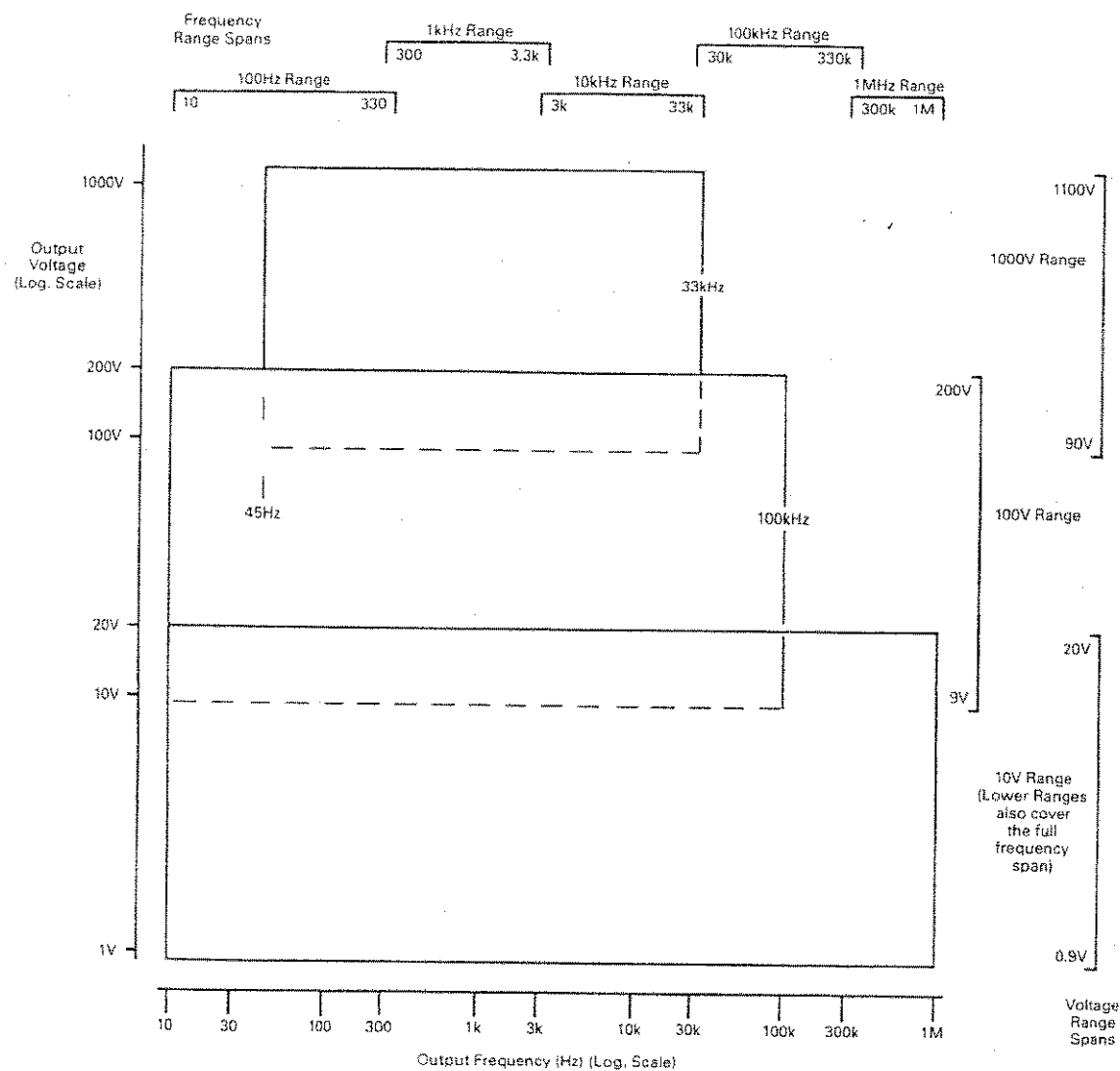
- For settling to 10ppm of Step Size, multiply all times by 1.5.

Calibration Uncertainty (ppm) (3)	Temperature Coefficient ($\pm$ ppm/OUTPUT/°C) 8°C - 13°C 33°C - 38°C	Total Harmonic Distortion (%) (5)	Output Impedance at Zero to Full Load Regulation	Output Compliance
110+12 μ V 250+10 μ V 560+11 μ V 800+12 μ V (4) 1300+12 μ V (4)	10 10 10 40 100	0.1 0.04 0.1 0.3 1.0	30 Ω at all frequencies	—
160 130 170 450 1150	6 6 6 20 100	0.1 0.04 0.1 0.3 1.0	Typically 0.001% FS to 33kHz increasing to 0.3% FS at 1MHz (2)	1V Range: 25mA 10V Range: 60mA
160 130 200 (4)	6 6 10	0.1 0.04 0.2	Typically 0.002% FS to 33kHz increasing to 0.02% FS at 100kHz (2)	120mA
190 170 250	10 10 10	0.2 0.1 0.1	Typically 0.002% FS to 33kHz (2)	<3.3kHz, 15mA >3.3kHz, 65mA

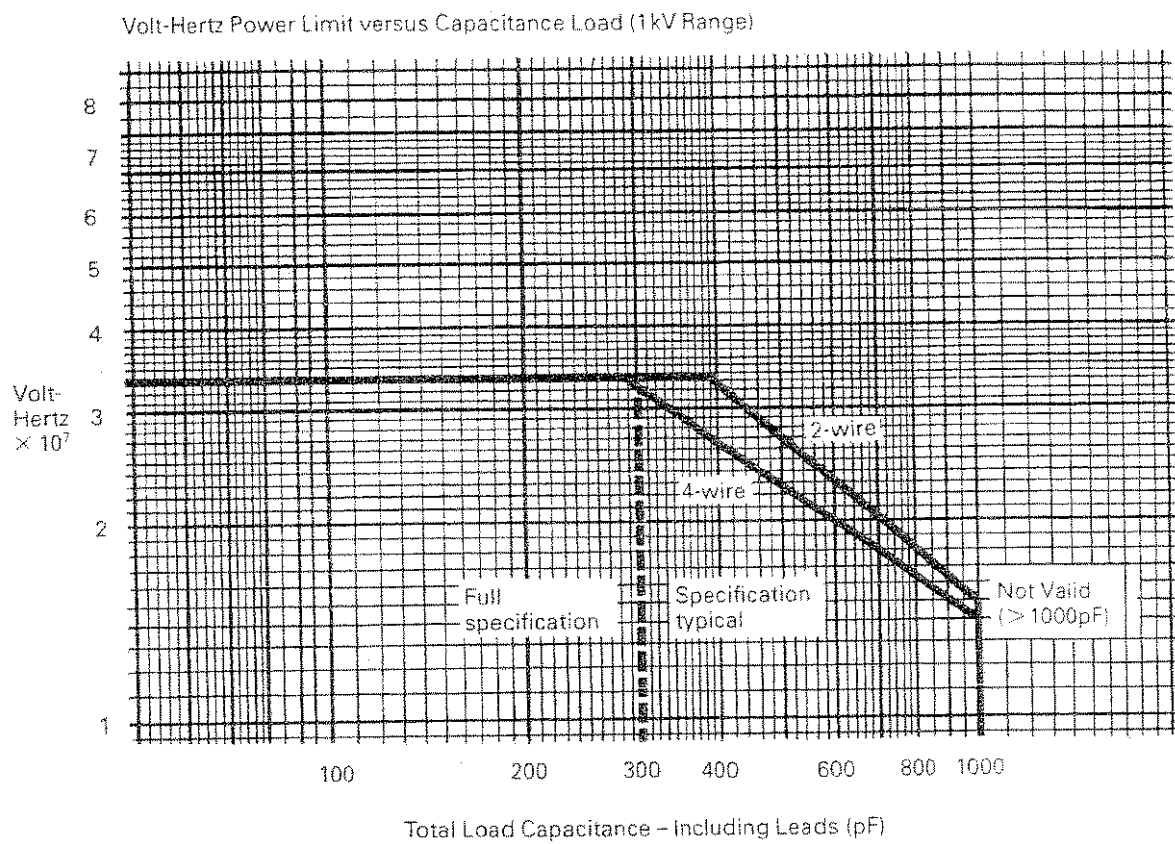
Other Specifications

Scale Length	9% to 200% of Range, 1mV to 100V ranges. 9% to 110% of range, 1000V range (1100V).
Voltage Sensing	Selectable remote or local voltage sensing on 1V to 1000V ranges.
Guarding	Selectable remote or local guard connection. Maximum Guard to Ground voltage 650V RMS (2.5kV flash test).
Common Mode Rejection	140dB at DC to 400Hz.
Settling Time (7)	To 100ppm of step size (double for range changes); 10 - 32Hz < 10s. 32 - 330Hz < 3s. > 330Hz < 1s.
Frequency Accuracy	< 100ppm, typically < 10ppm.
Maximum Load Capacitance	1V to 100V ranges: 1000pF. 1000V range: 300pF.

VOLTAGE/FREQUENCY CONSTRAINTS



CAPACITIVE LOADING CONSTRAINTS



DC CURRENT (Option 20)

Accuracy

Range	Stability 24 hour $\pm$ (ppm OUTPUT + ppmFS) (1) (2)	Accuracy Relative to Calibration Standards $\pm$ (ppm OUTPUT + ppmFS) (2)			Calibration Uncertainty ($\pm$ ppm) (3)	Temperature Coefficient ($\pm$ ppm OUTPUT/°C) 8°C – 13°C 33°C – 38°C	Output Resistance	Output Compliance
		24 hour 23°C $\pm$ 1°C	90 days 23°C $\pm$ 1°C	1 year 23°C $\pm$ 10°C				
100.0000 μ A	7+5	10+10	50+10	100+10	35	12	>2G Ω	3V
1.000000mA	7+5	10+7	40+7	100+10	33	12	>2G Ω	3V
10.00000mA	7+5	10+7	40+7	100+10	33	12	>200M Ω	3V
100.0000mA	7+5	10+7	40+7	100+10	33	12	>20M Ω	3V
1.000000A (4)	15+10	20+15	100+15	200+20	80	30	>1M Ω	3V

Noise

2.5kHz (RMS)	Bandwidth	
	Average Over 1 Line Period (pk-to-pk)	Average Over 10 Line Periods (pk-to-pk)
5nA	6nA	2nA
5nA	6nA	2nA
50nA	30nA	20nA
1 μ A	500nA	400nA
25 μ A	30 μ A	20 μ A

Notes:

- (1) For same conditions between 18°C and 28°C.
- (2) FS=2xRange.
- (3) Factory calibration uncertainty using automated calibration equipment.
Datron can provide better traceability. Contact factory for details.
- (4) Typical above 1A.

Other Specifications

Output	True bipolar output capable of delivering $\pm$ 2A.
Overrange	100% on all ranges.
Settling Time	1s to full specification.
Local Sense Only, all ranges	
Max. reactive loads	100nF, 1mH (<1 μ s).



DANGER

HIGH VOLTAGE



**THIS INSTRUMENT IS CAPABLE
OF DELIVERING
A LETHAL ELECTRIC SHOCK!**



FRONT or REAR
terminals carry the
Full Output Voltage.

THIS CAN KILL!



Guard terminal is
sensitive to over-
voltage

**It can damage
your instrument!**

Unless **you** are **sure** that
it is **safe** to do so,
DO NOT TOUCH the
I+ I- Hi or Lo leads
and **terminals**

DANGER

AC CURRENT (Option 20)

Accuracy

Range	Frequency (Hz)	Stability 24 hour $\pm$ (ppm OUTPUT +ppm FS) (1) (2)	Accuracy Relative to Calibration Standards $\pm$ (ppm OUTPUT + ppm FS) (2)		
			24 hour 23°C + 1°C	90 days 23°C + 1°C	1 year 23°C + 10°C
100.0000 μ A	10 - 1k	50 + 20	400 + 80	400 + 80	500 + 100
	1k - 5k	70 + 30	550 + 100 (7)	550 + 100 (7)	650 + 160 (7)
1.000000mA	10 - 1k	50 + 20	200 + 80	220 + 80	350 + 100
	1k - 5k	50 + 20	350 + 80	350 + 80	450 + 100
10.000000mA	10 - 1k	50 + 20	200 + 80	220 + 80	350 + 100
	1k - 5k	50 + 20	350 + 80	350 + 80	450 + 100
100.0000mA	10 - 1k	50 + 20	200 + 80	220 + 80	350 + 100
	1k - 5k	50 + 20	350 + 80	350 + 80	450 + 100
1.000000A(4)	10 - 1k	50 + 20	400 + 80	400 + 80	500 + 100
	1k - 5k	70 + 30	550 + 100 (7)	550 + 100 (7)	650 + 160 (7)

Notes:

- (1) For same conditions between 18°C and 28°C.
- (2) FS=2x Range.
- (3) Factory calibration uncertainty using automated calibration equipment. Datron can provide better traceability. Contact factory for details.
- (4) Typical above 1 A.
- (5) Predominantly second harmonic (negligible error on mean sensing instruments).
- (6) For Frequency Range or Output Range changes, Function changes, OFF ON changes, and Frequency changes between 31 and 32Hz: the Settling Times are doubled.
 - In remote operation via the IEEE 488 Interface, hardware switching occurs under the control of 'H' (Frequency) codes. Any transfer (up or down) between the undermentioned frequencies must be regarded as a frequency range change. Settling Time should be allowed as for Other Specifications.

31 - 32Hz	33.0 - 33.1kHz
300 - 301Hz	330 - 331kHz
3.00 - 3.01kHz	

- For settling to 10ppm of Step Size, multiply all times by 1.5.
- (7) Assumes similar load time constant to that at calibration.

	Calibration Uncertainty (ppm) (3)	Temperature Coefficient ($\pm$ ppm OUTPUT $^{\circ}$ C 3 $^{\circ}$ C - 13 $^{\circ}$ C 33 $^{\circ}$ C - 43 $^{\circ}$ C)	Total Harmonic Distortion (%) (5)	Typical Output Impedance	Output Compliance
	400	20	0.2	100M Ω *	3V rms
	900	40	0.5		
	255	20	0.2	30M Ω	3V rms
	255	20	0.2		
	255	20	0.2	3M Ω	3V rms
	255	20	0.2		
	255	20	0.2	300k Ω	3V rms
	255	20	0.2		
	290	40	0.2	30k Ω **	3V rms
	440	40	1.0		

* Typical effective output capacitance = 200pF } Negligible on other Ranges
 ** Typical effective output capacitance = 0.5 μ F }

Other Specifications

Scale Length 9% to 200% of range, all ranges.
 Settling Time (6) To 100ppm of step size (double for range changes):
 10-32Hz < 10s
 32-330Hz < 3s
 > 330Hz < 1s
 Frequency Accuracy < $\pm$ 100ppm, typically 10ppm.
 Maximum Load Capacitance 10nF (< 1 μ s).
 Maximum Load Inductance 1mH (< 1 μ s).
 Local Sense Only, all ranges.

RESISTANCE (Option 20)

Accuracy (2-wire or 4-wire sense)

Range (1)	Stability 24 hour $\pm$ (ppm OUTPUT +ppmFS) (1)(2)	* Accuracy Relative to Calibration Standards $\pm$ (ppm OUTPUT +ppmFS) (2)			Calibration Uncertainty (ppm) (3)	Temperature Coefficient ($\pm$ ppm OUTPUT $^{\circ}$ C) 8 $^{\circ}$ C ~ 13 $^{\circ}$ C 33 $^{\circ}$ C ~ 38 $^{\circ}$ C	Specified Current (Is)	Maximum Current (Im)	Additional uncertainty for Is $\leq$ I<Im (ppm)
		24 hour 23 $^{\circ}$ C $\pm$ 1 $^{\circ}$ C	90 days 23 $^{\circ}$ C $\pm$ 1 $^{\circ}$ C	1 year 23 $^{\circ}$ C $\pm$ 10 $^{\circ}$ C					
10.00000011	6	8	20	50	25	6	10mA	100mA	(10x10 $^{-1}$)1
100.0000011	2.5	3	6	20	10	2	10mA	25mA	(8.5x10 $^{-1}$)1
1.0000000k	2.5	3	6	20	10	2	1mA	10mA	(8.5x10 $^{-1}$)1
10.000000k	2.5	3	6	20	10	2	100 μ A	2.5mA	(8.5x10 $^{-1}$)1
100.00000k	2.5	3	6	25	20	2	100 μ A	1mA	(8.5x10 $^{-1}$)1
1.0000000M	6	8	20	50	40	6	10 μ A	100 μ A	(10x10 $^{-1}$)1
10.000000M	15	20	50	100	65	10	1 μ A	10 μ A	(15x10 $^{-1}$)1
100.00000M	30	40	100	400	200	20	1 μ A	10 μ A	(15x10 $^{-1}$)1

* 2-wire Sense 24 Hrs and 90 days stability } 4-wire values $\pm$ 0.1(1)
 90 days accuracy }
 1 year accuracy } 4-wire values $\pm$ 0.2(1)

Notes:

- (1) Range figures are nominal, actual calibrated values are displayed.
- (2) FS=2xRange.
- (3) Factory calibration uncertainty using automated calibration equipment.
 Datron can provide better traceability. Contact factory for details.

Other Specifications

Connection	Selectable 2 or 4-wire connection to resistors. 2-wire displayed value includes internal lead resistance.
Guarding	Selectable remote or local guard connection.
Protection	All resistors fuse protected to max applied voltage of 120V RMS.