

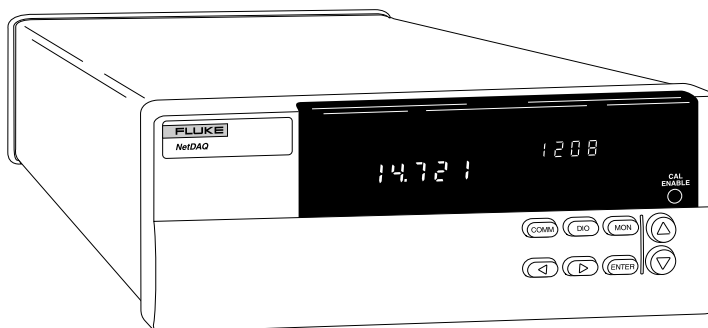
## NetDAQ® Series Models 2640A and 2645A

### 2640A

- 100, 50, 6 readings/second
- 18 bit A/D resolves 0.3  $\mu$ V and .02°C
- 300V maximum measurement input
- Built-in signal conditioning
- Real time on-board clock
- -20 to 60°C (-4 to 140°F) operating temperature

### 2645A

- 1000, 200, 48 readings/second
- 16 bit A/D resolves 3  $\mu$ V and 0.2°C
- 50V maximum measurement input
- Built-in signal conditioning
- Real time on-board clock
- -20 to 60°C (-4 to 140°F) operating temperature



## NetDAQ Series

### Channel capacity

**Analog inputs:** 20

**Computed channels:** 10

**Digital I/O and alarm outputs:** 8 total

**Totalizer:** 1

### Math functions

In addition to its 20 analog input channels, each NetDAQ unit supports 10 computed channels. Calculations include: addition, subtraction, multiplication, division, log, natural log, exponent, square root, absolute value, integer function, and average.

### Measurement speed (2640A)

**Slow:** 6 readings/second nominal

**Medium:** 41 (50 Hz), 48 (60 Hz) readings/second nominal

**Fast:** 143 readings/second nominal (5 readings/second for VAC nominal, 140 readings/second on 300 $\Omega$  range, 37 readings/second on 3 M $\Omega$  range)

**Measurement speed (2645A)**

**Slow:** 45 (50 Hz), 54 (60 Hz) readings/second nominal

**Medium:** 200 readings/second nominal

**Fast:** 1000 readings/second nominal (5 readings/second for VAC nominal, 370 readings/second on 300 $\Omega$  range, 44 readings/second on 3 M $\Omega$  range)

### Measurement speed (2645A)

**Slow:** 45 (50 Hz), 54 (60 Hz) readings/second nominal

**Medium:** 200 readings/second nominal

**Fast:** 1000 readings/second nominal (5 readings/second for VAC nominal, 370 readings/second on 300 $\Omega$  range, 44 readings/second on 3 M $\Omega$  range)

### Analog to digital converter

**2640A:** Multi-slope type, linear to 18 bits

**2645A:** Multi-slope type, linear to 16 bits

**Common mode rejection**

**2640A:**

AC:  $\geq 120$  dB (50/60 Hz,  $\pm 0.1\%$  max 1k $\Omega$  source imbalance)

DC:  $\geq 120$  dB

**2645A:**

AC:  $\geq 100$  dB (50/60 Hz,  $\pm 0.1\%$  max 1k $\Omega$  source imbalance)

DC:  $\geq 100$  dB

### Normal mode rejection

50 dB @ 50/60 Hz,  $\pm 0.1\%$

### Common mode voltage maximum

**2640A:** 300 VDC or VAC rms (channels 1,11); 150 VDC or VAC rms (all other channels)

**2645A:** 50 VDC or 30 VAC rms (all channels)

## Measurement accuracy

### Model 2640A

Thermocouples <sup>9, 10</sup>		Accuracy <sup>1,6</sup> , 3σ, ± °C				
		18 to 28°C			-10 to 60°C	
		90 Day	1 Year		1 Year	
Type	Temp (°C)	Slow	Slow	Fast	Slow	Fast
J	-100°C to 80°C	0.45	0.5	0.8	0.6	0.8
	80°C to 230°C	0.35	0.5	0.7	0.6	0.8
	230°C to 760°C	0.4	0.5	0.7	0.8	0.9
K	-100°C to -25°C	0.55	0.6	0.9	0.7	1.0
	-25°C to 120°C	0.4	0.5	0.8	0.6	0.9
	120°C to 800°C	0.5	0.65	0.9	1.0	1.2
	800°C to 1372°C	0.7	1.0	1.3	1.6	1.9
N	-100°C to -25°C	0.65	0.75	1.2	0.8	1.3
	-25°C to 120°C	0.55	0.6	1.0	0.7	1.1
	120°C to 1000°C	0.45	0.6	0.9	1.0	1.2
	1000°C to 1300°C	0.55	0.75	1.0	1.2	1.5
E	-100°C to -25°C	0.45	0.5	0.8	0.6	0.8
	-25°C to 20°C	0.35	0.4	0.6	0.5	0.7
	20°C to 600°C	0.3	0.4	0.6	0.5	0.8
	600°C to 1000°C	0.4	0.5	0.7	0.9	1.0
T	-100°C to 0°C	0.6	0.65	1.0	0.7	1.1
	0°C to 150°C	0.4	0.5	0.8	0.6	0.9
	150°C to 400°C	0.3	0.4	0.6	0.6	0.8
R	250°C to 600°C	0.9	1.0	2.1	1.2	2.2
	600°C to 1500°C	0.8	0.9	1.8	1.3	2.0
	1500°C to 1767°C	0.85	0.85	1.9	1.7	2.5
S	250°C to 1000°C	0.95	1.1	2.3	1.3	2.4
	1000°C to 1400°C	0.8	1.0	1.9	1.4	2.3
	1400°C to 1767°C	1.0	1.3	2.2	1.8	2.8
B	600°C to 900°C	1.2	1.4	3.1	1.5	3.2
	900°C to 1200°C	0.9	1.0	2.2	1.2	2.4
	1200°C to 1820°C	0.75	1.0	1.9	1.3	2.2
C	0°C to 150°C	0.8	0.9	1.6	1.0	1.7
	150°C to 650°C	0.65	0.75	1.4	1.0	1.5
	650°C to 1000°C	0.65	0.85	1.4	1.2	1.8
	1000°C to 1800°C	1.0	1.3	2.1	2.1	2.8
	1800°C to 2316°C	1.6	2.1	3.2	3.4	4.6

### Model 2645A

Thermocouples <sup>9, 10</sup>		Accuracy <sup>1,6</sup> , 3σ, ± °C				
		18 to 28°C			-10 to 60°C	
		90 Day	1 Year		1 Year	
Type	Temp (°C)	Slow	Slow	Fast	Slow	Fast
J	-100°C to 80°C	0.8	0.9	1.6	0.9	1.7
	80°C to 230°C	0.7	0.8	1.4	0.9	1.5
	230°C to 760°C	0.7	0.8	1.3	1.0	1.5
K	-100°C to -25°C	1.0	1.1	2.0	1.2	2.1
	-25°C to 120°C	0.8	0.9	1.7	1.0	1.8
	120°C to 1000°C	0.9	1.1	1.8	1.5	2.2
	1000°C to 1372°C	1.2	1.5	2.3	2.0	2.9
N	-100°C to -25°C	1.4	1.5	2.8	1.5	2.9
	-25°C to 120°C	1.1	1.3	2.3	1.3	2.4
	120°C to 1000°C	1.0	1.1	2.0	1.2	2.1
	1000°C to 1300°C	1.0	1.2	1.9	1.6	2.4
E	-100°C to -25°C	0.8	0.9	1.5	1.0	1.6
	-25°C to 20°C	0.7	0.7	1.2	0.8	1.3
	20°C to 600°C	0.6	0.7	1.1	0.8	1.2
	600°C to 1000°C	0.6	0.8	1.2	1.1	1.5
T	-100°C to 0°C	1.1	1.2	2.2	1.3	2.3
	0°C to 150°C	0.9	1.0	1.7	1.0	1.8
	150°C to 400°C	0.7	0.8	1.4	0.8	1.5
R	250°C to 600°C	2.4	2.7	5.6	2.8	5.7
	600°C to 1500°C	2.0	2.3	4.6	2.4	4.8
	1500°C to 1767°C	2.0	2.3	4.5	2.8	5.1
S	250°C to 1000°C	2.6	2.8	5.9	2.9	6.0
	1000°C to 1400°C	2.0	2.3	4.6	2.6	5.0
	1400°C to 1767°C	2.3	2.7	5.3	3.3	5.9
B	600°C to 1200°C	3.6	3.9	8.5	4.0	8.6
	1200°C to 1550°C	2.1	2.4	5.0	2.6	5.2
	1550°C to 1820°C	2.0	2.3	4.7	2.7	5.0
C	0°C to 150°C	1.9	2.0	4.0	2.1	4.2
	150°C to 650°C	1.6	1.7	3.5	1.8	3.6
	650°C to 1000°C	1.4	1.7	3.2	2.0	3.5
	1000°C to 1800°C	2.0	2.5	4.5	3.2	5.3
	1800°C to 2316°C	3.1	3.8	6.8	5.1	8.1

### Model 2640A

DC Voltage		Accuracy <sup>1</sup> , 3σ, ±(%input + V) 18 to 28°C		
Range	Resolution	90 Day	1 Year	
		Slow	Slow	Fast
90 mV	.3 μV	0.01%+7 μV	0.013%+8 μV	0.013%+18 μV
300 mV	1 μV	0.01%+15 μV	0.013%+17 μV	0.013%+35 μV
3V	10 μV	0.01%+1 mV	0.013%+.15 mV	0.013%+.2 mV
30V	100 μV	0.01%+1.5 mV	0.013%+1.7 mV	0.026%+3.5 mV
150/300V	1 mV	0.01%+15 mV	0.013%+17 mV	0.052%+35 mV
Resistance		Accuracy <sup>1,3</sup> (4-wire), 3σ, ±(% input+Ω)		
300Ω	1 mΩ	0.015%+20 mΩ	0.02%+30 mΩ	0.02%+120 mΩ
3 kΩ	10 mΩ	0.02%+.3Ω	0.02%+.5Ω	0.02%+1.2Ω
30 kΩ	100 mΩ	0.03%+3Ω	0.03%+5Ω	0.04%+15Ω
300 kΩ	1Ω	0.1%+40Ω	0.1%+60Ω	0.2%+150Ω
3 MΩ	10Ω	0.25%+800Ω	0.25%+1 kΩ	0.5%+1.5 kΩ

### Model 2645A

DC Voltage		Accuracy <sup>1</sup> , 3σ, ±(%input + V) 18 to 28°C		
Range	Resolution	90 Day	1 Year	
		Slow	Slow	Fast
90 mV	3 μV	0.01%+20 μV	0.013%+23 μV	0.013%+50 μV
300 mV	10 μV	0.01%+40 μV	0.013%+49 μV	0.013%+93 μV
3V	100 μV	0.01%+.3 mV	0.013%+.38 mV	0.013%+.64 mV
30V	1 mV	0.01%+4 mV	0.013%+4.9 mV	0.026%+9.5 mV
150/300V	10 mV	0.01%+30 mV	0.013%+40 mV	0.052%+64 mV
Resistance		Accuracy <sup>1,4</sup> (4-wire), 3σ, ±(% input+Ω)		
300Ω	10 mΩ	0.02%+60 mΩ	0.02%+.1Ω	.02%+.2Ω
3 kΩ	100 mΩ	0.02%+6Ω	0.02%+1Ω	.02%+3Ω
30 kΩ	1Ω	0.02%+6Ω	0.02%+10Ω	.02%+300Ω
300 kΩ	10Ω	0.5%+80Ω	0.5%+150Ω	1.0%+3 kΩ
3 MΩ	100Ω	1.3%+1 kΩ	1.3%+2 kΩ	2.0%+200 kΩ

## Measurement accuracy cont.

Model 2640A

AC Voltage				
Range	Resolution	Frequency	Accuracy <sup>1,2,3</sup> , $3\sigma$ , $\pm$ (% input+counts)	
			Slow	Fast
300mV	1 $\mu$ V	20 Hz-50 Hz 50 Hz-20 kHz 20 kHz-50 kHz 50 kHz-100 kHz	3.0%+25 0.4%+25 2.0%+30 5.0%+50	6.0%+50 1.0%+50 3.0%+50 5.0%+100
3V	100 $\mu$ V	Same frequencies, similar accuracies as above		
30V	1 mV	Same frequencies, similar accuracies as above		
150/300V	10mV	Same frequencies, similar accuracies as above		
RTD (Pt 100)		Accuracy <sup>1,5</sup> , $3\sigma$ , $\pm$ °C (4-wire)		
Temperature °C	Resolution °C	90 Day, 18 to 28°C	1 Year, 18 to 28°C	
	Slow	Slow	Slow	
-200°C	0.003	0.06	0.09	
0°C	0.003	0.09	0.13	
100°C	0.003	0.10	0.16	
300°C	0.003	0.14	0.21	
600°C	0.003	0.19	0.30	
Frequency Measurement Accuracy <sup>1,8</sup> , -20 to 60°C				
Range	Resolution		Accuracy, $3\sigma$ , $\pm$ (% input +Hz)	
	Slow	Fast	Slow	Fast
15 Hz-900 Hz	0.01 Hz	0.1 Hz	0.05%+0.02 Hz	0.05%+0.2 Hz
900 Hz-9 kHz	0.1 Hz	1 Hz	0.05%+0.1 Hz	0.05%+1 Hz
9 kHz-90 kHz	1 Hz	10 Hz	0.05%+1 Hz	0.05%+10 Hz
90 kHz-900 kHz	10 Hz	100 Hz	0.05%+10 Hz	0.05%+100 Hz
1 MHz	100 Hz	1 kHz	0.05%+100 Hz	0.05%+1 kHz
Frequency Measurement Sensitivity (sine wave)				
Frequency	Minimum Signal		Maximum Signal	
15 Hz - 200 Hz	100 mV rms		150/300V rms	
200 Hz - 70 kHz	100 mV rms		30V rms	
70kHz - 100 kHz	100 mV rms		20V rms	
100 kHz - 200 kHz	150 mV rms		10V rms	
200 kHz - 300 kHz	150 mV rms		7V rms	
300 kHz - 1 MHz	linearly increasing from 150 mV rms at 300 kHz to 2V rms at 1 MHz		linearly decreasing from 7V rms at 300 kHz to 2V rms at 1 MHz	

<sup>1</sup> Total instrument accuracy for the indicated time period and ambient temperature range. Includes A/D errors, linearization conformity, initial calibration error, isothermality errors, reference junction conformity and power line voltage effects within the range from 107VAC to 264VAC.

<sup>2</sup> Sine wave inputs >2000 counts (slow), >200 counts (fast). Accuracies for crest factor  $\leq 2.0$ .

<sup>3</sup> For two-wire measurements add 5 $\Omega$  to basic accuracy (does not include lead-wire resistances).

<sup>4</sup> For two-wire measurements add 700-1000 $\Omega$  to basic accuracy (does not include lead-wire resistances). Ohms varies due to the resistance of the solid state switches.

<sup>5</sup> DIN/IEC 751 only, assumes no lead-wire resistance errors.

Model 2645A

AC Voltage				
Range	Resolution	Frequency	Accuracy <sup>1,2,3</sup> , $3\sigma$ , $\pm$ (% input+counts)	
			Slow	Fast
300mV	10 $\mu$ V	20 Hz-50 Hz 50 Hz-20 kHz 20 kHz-50 kHz 50 kHz-100 kHz	3.0%+25 0.4%+25 2.0%+30 5.0%+50	6.0%+50 1.0%+50 3.0%+50 5.0%+100
3V	100 $\mu$ V	Same frequencies, similar accuracies as above		
30V	1 mV	Same frequencies, similar accuracies as above		
RTD (Pt 100)		Accuracy <sup>1,5</sup> , $3\sigma$ , $\pm$ °C (4-wire)		
Temperature °C	Resolution °C	90 Day, 18 to 28°C	1 Year, 18 to 28°C	
	Slow	Slow	Slow	
-200°C	0.03	0.16	0.25	
0°C	0.03	0.20	0.31	
100°C	0.03	0.23	0.34	
300°C	0.03	0.30	0.41	
600°C	0.03	0.53	0.63	
Frequency Measurement Accuracy <sup>1,8</sup> , -20 to 60°C				
Range	Resolution		Accuracy, $3\sigma$ , $\pm$ (% input +Hz)	
	Slow	Fast	Slow	Fast
15 Hz-900 Hz	0.01 Hz	0.1 Hz	0.05%+0.02 Hz	0.05%+0.2 Hz
900 Hz-9 kHz	0.1 Hz	1 Hz	0.05%+0.1 Hz	0.05%+1 Hz
9 kHz-90 kHz	1 Hz	10 Hz	0.05%+1 Hz	0.05%+10 Hz
90 kHz-900 kHz	10 Hz	100 Hz	0.05%+10 Hz	0.05%+100 Hz
1 MHz	100 Hz	1 kHz	0.05%+100 Hz	0.05%+1 kHz
Frequency Measurement Sensitivity (sine wave)				
Frequency	Minimum Signal		Maximum Signal	
15 Hz - 200 Hz	100 mV rms		30V rms	
200 Hz - 70 kHz	100 mV rms		30V rms	
70kHz - 100 kHz	100 mV rms		20V rms	
100 kHz - 200 kHz	150 mV rms		10V rms	
200 kHz - 300 kHz	150 mV rms		7V rms	
300 kHz - 1 MHz	linearly increasing from 150 mV rms at 300 kHz to 2V rms at 1 MHz		linearly decreasing from 7V rms at 300 kHz to 2V rms at 1 MHz	

<sup>6</sup> Resolution is 0.02°C or 0.04°F over the useful range of base metal thermocouples (J, K, T, E, N) and 0.1°C or 0.2°F resolution for types R, S, B, and C with slow scan.

<sup>7</sup> Resolution is 0.2°C or 0.4°F over the useful range of base metal thermocouples (J, K, T, E, N) and 1.0°C or 2.0°F resolution for types R, S, B, and C with slow scan.

<sup>8</sup> Accuracy for both slow and fast scan speeds.

<sup>9</sup> Open thermocouple detection is performed on each thermocouple channel unless defeated by computer command.

<sup>10</sup> When NetDAQ is mounted on its side, using the Y2642 adapter or other means, thermocouples at the ends of the input connector module may have an additional  $\pm 0.25^\circ\text{C}$  error.

**Totalizing inputs**

DC coupled, non-isolated, max +30V, min -4V

**Max count:** 4,294,967,295

**Minimum signal:** 2V peak

**Threshold:** 1.4V

**Rate:** 0-5 kHz (debounce off)

**Hysteresis:** 500 mV

**Input debouncing:** None or 1.66 ms

**Digital inputs**

**Threshold:** 1.4V

**Hysteresis:** 500 mV

**Maximum input:** +30V, min -4V; non-isolated

**Digital/master alarm outputs**

The open collector output lines are non-isolated, TTL compatible with the following logic levels:

**Logical "zero" output:**

- 0.8V max |out = -1.0 mA (1 LSTTL load equivalent)
- 1.8V max |out = -20 mA
- 3.25V max |out = -50 mA

**Logical "one" output:**

- Output voltage depends on external load
- 3.8V min |out = 0.05 mA (1 LSTTL load equivalent)

**Alarm associations**

Each Digital I/O may be randomly assigned as a digital input, status output, or alarm output (associated with any input channel or channels)

**Trigger input**

**Minimum pulse:** 5  $\mu$ s

**Minimum latency:** 2 ms

**Repeatability:** 1 ms

**Input "High":** 2.0V min, 7.0V max

**Input "Low":** -0.6V min, 0.8V max non-isolated, contact closure and TTL compatible

**Clock**

Accurate to within 1 minute/month for 0°C to 50°C range

**Power**

107 to 264 VAC, 50 or 60 Hz (<15W), or 9 to 16 VDC (<6W) (if both sources are applied simultaneously, the greater of AC or DC is used.), at 120 VAC the equivalent DC voltage ~ 14.5V

**Temperature, humidity (non-condensing)**

**Operating:** -20°C to 28°C,  $\leq$ 90% RH; 28°C to 40°C,  $\leq$ 75% RH; 40°C to 60°C,  $\leq$ 50% RH

**Storage:** -40°C to 70°C, 5% to 95% RH

**Altitude**

**Operating:** 2000m

**Storage:** 12,200m

**Electromagnetic interference (EMI)**

FCC-15B Class B Equipment, Vfg. 243, European Norms EN50081-1 and EN50082-1, CE. When shielded cables are used.

**Safety**

Complies with applicable sections of the IEC 1010-1, ANSI/ISA-S82.01-1994, CSA-C22.2 No. 1010.1-92. Overvoltage Category II

**Weight**

3.7 kg

**Size**

9.3 cm H, 21.6 cm W, 36.2 cm D

**Battery life**

10 years minimum for real time clock (from date of manufacture)

**Interfaces**

**Ethernet:** Conforms to IEEE 802.3 Ethernet standard, compatible with 10Base2 and 10BaseT standards, uses TCP/IP protocol

**RS-232C:** For calibration only. The optional NetDAQ Service Manual provides step-by-step calibration instructions.

**Data buffer memory**

- Stored with each scan: time stamp, all defined analog input channels, the status of the eight digital I/O, and the totalizer count.
- The number of stored scans varies with the number of channels configured. The following table shows the scan size and time it takes to fill the data buffer memory.

# of channels configured	# of scans stored	Time to fill the 2640A's buffer (100 rps)	Time to fill the 2645A's buffer (1,000 rps)
1	6,400	48 sec (118 rps)	14 sec (427 rps)
2	5,688	77 sec (131 rps)	17 sec (628 rps)
5	4,266	133 sec (142 rps)	23 sec (886 rps)
10	3,011	183 sec (145 rps)	29 sec (1019 rps)
20	1,896	227 sec (147 rps)	33 sec (1102 rps)